Human Health and Ecological Risk Assessment and Risk Management Plan

Central Park, 171 Bay Street North, Hamilton, Ontario

City of Hamilton

Environment & Geoscience

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The hydraulic gradients and groundwater flow directions reported in 2018 are generally consistent with the results from previous investigations.

3.3 Contaminants of Concern

3.3.1 Preliminary Screening of COCs

Soil and groundwater analytical results from the Phase II ESAs completed between 2013 and 2018 in support of the RA are tabulated in Table 1 to Table 4 of the report.

Primary screening of chemical analytical data was completed and the preliminary screening tables for soil and groundwater is provided in Table 1 to Table 4. A brief summary is provided in this section. The COC exposure concentrations were identified based on the following:

- The maximum concentrations plus 20% for all COCs (to account for uncertainty in the lateral and vertical delineation of the RA Property, 1.2x maximum concentrations for the identified COCs were used for the evaluation of potential risk in this RA) that were detected were compared to the generic MECP Table 3 and 5 soil SCS for shallow and stratified soil, respectively, Table 7 and 5 groundwater SCS for shallow and deep groundwater, respectively;
- The maximum reportable detection limits (RDLs) were used for chemical screening of soil COCs that were not detected and the maximum RDLs in the most recent groundwater sampling event for groundwater COCs that were not detected; and
- For vinyl chloride, the exposure concentration was estimated by accounting for potential degradation of its parent compounds, as per MECP (MOE, 2011b) guidance. The exposure point concentration (EPC) for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, ½ of RDLs (if RDL satisfies generic SCS) were used or if any of the product or VC are detected, 1.2 maximum detected concentrations were used for the estimation of VC if the parents compounds were not detected.

Some of the generic SCS and component values applied for the COC screening were developed with the consideration of source depletion. Per MECP standard rationale (MOE, 2011b), these SCSs should not be used in situations where there is a continuous source of the contaminant. It is acknowledged that petroleum hydrocarbon free-products is present at the RA Property, i.e., free products may act as a continuous source for inhalation of indoor air sourced through vapour intrusion sourced from soil. Further discussion is provided in Section 4.1.2. Detailed calculation of site-specific criteria for these SCS based on infinite source was outside the scope of this risk assessment.

MECP (MOE, 2011a) generic SCS used to complete preliminary screening of Site COCs included the following:

- Surface soil: Table 3 Full Depth Generic SCS, non-potable groundwater condition, residential/parkland/institution land use, coarse textured soils;
- Subsurface soil: Table 5 Stratified Generic SCS, non-potable groundwater condition, residential/parkland/institution land use, coarse textured soils;
- Shallow Groundwater (<3 m bgs): Table 7 generic SCS, non-potable groundwater condition, residential/parkland/institution land use, coarse textured soils; and
- Groundwater (>3 m bgs): Table 5 Stratified Generic SCS, non-potable groundwater condition, residential/parkland/institution land use, coarse textured soils.

Surface Soil:

- Exposure to electrical conductivity (EC), sodium adsorption ratio (SAR), and hot water soluble (HWS) boron are not evaluated for the human receptors as the standards for these parameters are based on protection of ecological receptors. Both EC and SAR exceeded the MECP generic SCS. As such, EC, SAR, and HWS boron were retained for further evaluation for ecological health, but not the human health risk assessment;
- Weak Acid Digestion (WAD) Cyanide includes both free cyanide (CN-) and weak metal cyanide complexes. MECP cyanide (CN-) SCS was used as the criteria for cyanide (WAD) as cyanide (WAD) can be interpreted as the worst-case scenario of all CN-. Based on the screening, cyanide (WAD) was retained as a COC for further evaluation;
- Two (2) soil samples from the same borehole, out of seventy-six (76) surface soil samples analyzed for pH, had pH value outside of the surface soil pH range (i.e., 5-9) per MECP (MOE, 2011b). These two (2) PH values are not considered characteristic of soil PH across the RA Property and are not expected to affect the interpretation of site conditions as part of the RA. As such, the RA Property is not considered an environmentally sensitive area and the MECP (MOE, 2011b) Table 1 generic SCS do not apply to the RA Property. Given the localized nature of the pH samples outside of the range, the effect of pH on COCs in surface soil was considered negligible. As such, pH will not be carried forward as COC for further evaluation;
- The following parameters were analyzed for the purpose of calculation of other parameters, or to evaluate COC transport in the RA and were not directly considered COCs: fraction of organic carbon, soluble sodium, soluble calcium, soluble magnesium and total organic carbon. As such, these parameters were not retained as COCs for further evaluation;
- For VOCs, a total of seventeen (17) soil samples were analyzed for VOCs and were below detection limits for most VOCs, with the exception of six (6) parameters – BTEX, hexane, and styrene. Furthermore, one (1) sample (i.e., BH-19-17 at 0.8-1.4 m bgs) had elevated RDLs for some VOCs which exceeded the generic MECP (MOE, 2011b) SCS as a result of increased dilution employed by the laboratory. Therefore, these elevated RDLs for some VOCs, due to interferences as a result of high analyte concentrations of certain COCs, were not retained for further secondary screening;
- There are no MECP SCS for different PCB arochlors. As such, total PCBs was considered in the risk assessment and individual arochlors were not considered in the RA; and
- The surface soil COCs that have been retained for further secondary screening are listed in Table 1.

Subsurface Soil:

- There are no MECP (MOE, 2011b) Table 5 generic SCS for EC, SAR and boron (HWS), these parameters are only relevant to ecological health and on-Site terrestrial ecological receptors would not come in direct contact with subsurface soil (> 1.5 m bgs). Further discussion is provided in Section 5.1.1.1. As such EC, SAR, and boron (HWS) were not retained for further evaluation. For parameters in subsurface soil within the general chemistry category, Cyanide (CN-) was retained as a COC for further evaluation;
- Parameters such as fraction of organic carbon, soluble sodium, soluble calcium, soluble magnesium and total organic carbon were not retained as COCs for further evaluation. Fraction of organic carbon and total organic carbon were analysed to evaluate chemical fate and transport within the RA. Soluble sodium, soluble calcium and soluble magnesium were analysed to calculate SAR, which is evaluated in the RA;
- The maximum pH is within the MECP pH range, the RA Property is not considered an environmentally sensitive area and the effect of pH on other COCs in subsoil was not considered further;

- For VOCs, all parameters were below detection limits with the exception of trichloroethylene (TCE), BTEX, hexane, and styrene. TCE is one of the parent compound of VC, as such the exposure concentration of VC was determined using the equation: max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%. BTEX, TCE and VC were retained for further secondary screening;
- All analysed PAHs exceeded the generic MECP SCS and were retained for further evaluation; and
- The subsurface soil COCs that have been retained for further secondary screening are listed in Table 2.

Groundwater (> 3 m bgs):

- The maximum measured concentrations plus 20% of all COCs in groundwater at depths greater than 3 m bgs were compared to the generic MECP Table 5 stratified SCS;
- TCE was detected and therefore VC was calculated using the same formula provided previously for soil based on parent compound degradation. As such, the exposure concentration of TCE and VC exceeded the generic SCS and were retained for further evaluation; and
- The groundwater (>3 m bgs) COCs that have been retained for further secondary screening are listed in Table 3.

Shallow Groundwater (< 3 m bgs):

- For all COCs in groundwater at depth less than 3 m bgs, the maximum measured concentrations plus 20% were compared to the generic MECP Table 7 shallow groundwater SCS;
- For VOCs, TCE was detected and therefore VC was calculated using the same formula provided previously based on parent compound degradation. As such, the exposure concentration of TCE and VC exceeded the generic SCS and were retained for further evaluation; and
- The shallow groundwater (<3 m bgs) COCs that have been retained for further secondary screening are listed in Table 4.

Based on the preliminary screening of COCs at the RA Property, and associated media, the COC inventory consists of the following:

- Surface soil (<1.5 m bgs): cyanide (WAD), EC, SAR, inorganics/metals (included antimony, arsenic, barium, boron (HWS), cadmium, copper, lead, mercury, nickel, selenium, zinc), VOCs (included benzene, toluene, ethylbenzene, xylenes, hexane (n), styrene), PHCs F1 F4, PAHs (included acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, 1 ,2 methylnaphthalene, naphthalene, phenanthrene, pyrene), and total PCBs;
- Subsurface soil (>1.5 m bgs): cyanide (CN-), inorganics/metals (included arsenic, lead, mercury), VOCs (included benzene, toluene, ethylbenzene, xylenes, trichloroethylene, vinyl chloride), PHCs F1-F4, PAHs (equivalent PAHs as retained from surface soil screening);
- Groundwater (full-depth): zinc, PHC F1-F3, benzene, trichloroethylene, vinyl chloride, PAHs (included acenaphthene, acenaphthylene, anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, indeno[1,2,3 cd]pyrene, naphthalene);
- Groundwater (shallow): mercury, PHC F1-F4, VOCs (included benzene, toluene, ethylbenzene, xylenes, styrene, trichloroethylene, vinyl chloride), PAHs (included acenaphthene, acenaphthylene, anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, fluorene, indeno[1,2,3-cd]pyrene, naphthalene, and pyrene)

3.3.2 Distribution and Delineation of COCs

Based on the findings of the Phase II ESA and supplemental subsurface investigations, delineation of the COCs are considered sufficient for the purposes of this RA. The locations of impacts associated with these COCs are shown on Figures 8 to 18 and the interpreted vertical extents are depicted in cross-sections shown on Figures 19 to 22. Where lateral delineation of impacts within site boundaries was not determined it was interpreted that impacts may extend to and beyond the property limit. Investigations targeted areas of anticipated worst-case contamination in order to derive maximum concentrations for COCs. Sampling locations were also selected to provide lateral and vertical coverage of the RA Property for contaminants without distinct sources (such as the application of road salt as well as heterogeneous fill/waste materials buried across the RA Property).

COCs in surficial soil are generally undelineated and were interpreted to extend to the property boundary for one or more of VOCs, PHCs F1-F4, PCBs, metals and inorganics and PAHs. This is consistent with an interpreted source of poor quality fill used in backfilling the RA Property so while sporadic areas sampled across the RA Property have concentrations of COCs below the applicable it is inferred that shallow surficial soil to a depth of approximately 1.5 m bgs is impacted across the RA Property, up to the property boundary.

Subsurface soil impacts by one of more of BTEX and PHCs F1-F4 are present within the central portion of Site, extending from the property boundary at Railway Street and extending north towards the property boundary at Caroline Street North but impacts are generally delineated to the east, west, and south within the property boundaries as shown in Figure 9.

Vertical delineation of BTEX and PHCs F1-F4 is generally achieved in boreholes throughout the RA Property, with the exception of borehole locations BH-06-17, BH-17-17, BH18-25 and BH18-28. However, vertical delineation is achieved at sample locations in the vicinity of these boreholes, where investigations were completed to greater depth.

Subsurface soil impacts for metals and inorganics is generally distributed along the central and western portion of the RA Property north of Caroline Street south, west of Railway Street and up to the northern property boundary at Caroline Street north (Figure 11). Vertical delineation of metals and inorganics is generally achieved in boreholes and test pits throughout the RA Property, with the exception of locations TP-2, BH-06-17, BH-17-17, BH-111, BH-112, BH115, BH18-06, BH18-08, BH18-16, BH18-18, BH18-23, BH18-25, BH18-28 and BH18-29. However, vertical delineation is achieved at sample locations in the vicinity of these boreholes, where investigations were completed to greater depth.

Subsurface soil impacts for PAHs is generally distributed along the central portion of the RA Property and extends toward the western property boundary in some areas. An additional area of impact is present in the eastern portion of the RA Property extending to Bay Street North and the northern property boundary in that area. Vertical delineation of PAHs is generally achieved in boreholes and test pits throughout the RA Property, with the exception of locations TP-1, TP-2, BH-103, BH-104, BH-105, BH-109, BH-112, BH-115, BH-117, BH-17-17, BH18-04, BH18-06, BH18-07, BH18-25, BH18-27, BH18-28 and BH18-29. However, vertical delineation is achieved at sample locations in the vicinity of these boreholes, where investigations were completed to greater depth.

Subsurface soil impact for TCE is limited to BH-18-17 at 2.3 to 2.9 m bgs (Figure 9). TCE is not vertically delineated at this location. Horizontal delineation of TCE at the RA Property is generally achieved. TCE and other VOCs were below detection limits in boreholes at the area where groundwater TCE plume is

identified (i.e., BH18-03 and BH-204). Groundwater impacts of benzene and PHCs F2 and F3 in the eastern portion of the RA Property are located east of Railway Street and extend to the southern property boundary delineated laterally to the east and north by monitoring wells on-site. Impacts in the north-central area of the RA Property extend to the northern and eastern property boundaries and are delineated laterally to the south and west within the property boundaries. Vertical delineation is achieved at MW-116, MW-201, MW-202 and MW18-02 in the north-central area. In the eastern portion of the RA Property, MW-203 provides vertical delineation.

Groundwater impacts of metals and inorganics is limited to the eastern portion of the RA Property along Bay Street. Vertical delineation in the immediate vicinity of MW-203 is not apparent. However, downgradient location MW-202 shows both lateral and vertical delineation.

Groundwater impacts of PAHs are located in the north-central portion of the RA Property extending to the northern property boundary. Vertical delineation is achieved at MW-116, MW-201 and MW18-02.

Concentrations of VOCs in groundwater is laterally delineated and isolated to the central and central western portions of the RA Property. Vertical delineation of VOCs is achieved MW18-03 and BH 204.

3.3.3 Additional Considerations

3.3.3.1 Soil Vapour Investigations

No enclosed buildings are proposed for the RA Property. To assess potential soil vapour risk at adjacent properties, soil vapor probes were installed in boreholes BH18-19 to BH18-23 near the property boundaries at three (3) locations (designated as SVP18 01 to SV18-03) and at one (1) suspected worst-case location (designated as SVP18-04) in the vicinity of known soil and groundwater impacts, and suspected trace NAPL. Soil vapour analytical results are summarized in Table 5. Soil vapour contaminants of concern included benzene and ethylene dibromide, and hexachlorobutadiene.

Generic Site Condition Standards for evaluation of soil vapour have not been developed by the MECP; however, soil vapour screening levels, considered to be protective of potential risks via the vapour intrusion pathway can be derived using the MECP (MOECC, 2016a) Modified Generic Risk Assessment (MGRA) Model by dividing the health based indoor air criteria (HBIAC) by a default attenuation factor of 0.02. The current RA completed at the RA Property details the approach to developing site specific soil vapour screening levels (Section 4.4.4.2). The soil vapour results are presented in Table 5 and are compared against the attenuated HBIAC for residential and commercial settings.

3.3.3.2 Down-gradient Off-Site Migration of Groundwater and Vapour Migration to Indoor Air

There are off-Site residential properties located northwest and west, and commercial properties located northeast immediately adjacent to the RA Property. Occupants of these off-Site locations have the potential to be exposed to volatile COC in indoor air via volatilization of vapours from groundwater migrating from the RA Property. In the absence of soil vapour data, this potential risk was evaluated indirectly.

In order to indirectly assess the potential exposure of the off-Site residents and commercial workers to the volatile groundwater COCs exposure via vapour intrusion was evaluated based on an evaluation of the depth to groundwater and the concentration of VOCs in monitoring wells located upgradient of the off-Site properties. This evaluation conservatively assumes that the off-Site groundwater quality is the same as the groundwater quality at nearby, upgradient, on-Site, monitoring wells. There were a total of twenty one monitoring wells considered as upgradient monitoring wells relevant to groundwater migration from the

RA Property to residential areas to the northwest and west and a total of ten (10) monitoring wells considered relative to groundwater migration to the commercial area to the northeast. The lists of monitoring wells for residential and/or commercial scenarios are provided in Table 6.

The depth to groundwater in monitoring wells at the property boundary were evaluated in order to determine the approximate groundwater depth at the adjacent off-Site areas. This depth to groundwater was in the identification of groundwater COCs for further quantitative evaluation.

It was determined that the depth to groundwater in the monitoring wells located at the boundary between the RA Property and the immediately adjacent residential area to the northwest are shallower than 3 m bgs (based on MW-115 at 2.5m bgs and MW-09-17 at 1.7 m bgs). The depth to groundwater in the monitoring wells located immediately adjacent to the commercial property to the northeast are deeper than 3 m bgs (based on MW18-23 and MW18-14 at 4.4 m bgs and 4.2 m bgs, respectively). As such, the groundwater COCs measured in the twenty one (21) monitoring wells for the evaluation of off-Site residential indoor air inhalation pathway were assessed under shallow groundwater condition; whereas the groundwater COCs measured in the ten (1) monitoring wells for the evaluation of off-Site commercial indoor air inhalation pathway were assessed under deep groundwater condition. The groundwater concentrations in these upgradient wells were compared the Table 7 (residential) and Table 5 (commercial) SCS as appropriate. The detailed preliminary screening of groundwater volatile/semi-volatile COCs based on residential and commercial scenario are provided in Table 7 and Table 8, respectively.

Based on the preliminary screening of groundwater COCs for the evaluation of off-Site indoor air inhalation pathway, the COC inventory consists of the following:

- Residential land use scenario: mercury, PHC F1-F4, benzene, ethylbenzene, styrene, toluene, xylenes, trichloroethylene, vinyl chloride, and PAHs included acenaphthene, acenaphthylene, anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, and pyrene.
- Commercial land use scenario: PHC F1-F3, benzene, PAHs included acenaphthene, acenaphthylene, anthracene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, and naphthalene.

These retained COCs were further assessed via secondary screening using pathway specific component values and detail of secondary screening of COCs is provided in Section 4.1.2.

4 Human Health Risk Assessment (HHRA)

4.1 Problem Formulation

Problem formulation is the first step in the human health risk assessment process. It comprises the identification of the COCs at the RA Property, the receptors that may be exposed to those chemicals, and the pathways of exposure. The conceptual risk model is developed during the problem formulation stage.

4.1.1 Human Health Conceptual Site Model

The RA Property is currently used for urban parkland purposes. There is currently a small building at RA Property but there no enclosed buildings as part of the redeveloped park. The RA Property is immediately surrounded by residential dwellings in south, west, and east directions (i.e., off-Site) and a commercial building to the north and northeast. The nearest surface water body is Lake Ontario located 560 m north of the RA Property (Hamilton Harbour, Lake Ontario). On-Site human receptors include Park Visitors (infant to adult life stages), surface and subsurface workers (adults). Off-Site human receptors consist of residents (infant to adult life stages) and office workers (adults).

The soil at depth between the surface and 1.5 m bgs is considered surface soil (or referred to as “shallow” soil in this RA) while soil at depths greater than 1.5 m bgs (and up to the depth investigated, i.e., 17.4 m bgs) is considered subsurface soil. Where groundwater is encountered at 3 m bgs or shallower, groundwater at these locations are considered shallow groundwater while areas where the apparent groundwater surface is encountered from >3 m bgs, groundwater at these locations is considered deep groundwater in this RA. Specifically, locations where the shallowest seasonal apparent groundwater surface is identified to occur at < 3 m bgs, that area is considered shallow groundwater and locations where the shallowest seasonal apparent groundwater surface is identified to occur at >3 m bgs, these areas are considered representative of deep groundwater. This depth distinction is included in the RA based on the MECP (MOE, 2011b) generic SCS derivation assumption that groundwater occurs at 3 m bgs and therefore this RA considers areas with apparent groundwater surface depths <3 m bgs to be shallow (Figure 6).

In the absence of risk management measures, the complete exposure pathways for on-site Park Visitors are incidental ingestion of surface soil, dermal contact with surface soil, inhalation of volatile COCs in outdoor air; the Park Visitors would not have direct contact with impacted subsurface soil (i.e. > 1.5 m bgs) and groundwater, consistent with MECP (MOE, 2011b) rationale, as COCs in subsurface soil are considered too deep for Park Visitor receptor direct contact. COC exposure to an on-site surface worker, consisting of a Long-Term Outdoor Worker (e.g. a worker cutting the grass), is evaluated for incidental ingestion of surface soil, dermal contact with surface soil and inhalation of volatile COCs in outdoor air derived from surface soil. Exposure for subsurface workers (e.g. a worker installing or repairing utilities at the RA Property) is evaluated for inhalation of vapours in a trench, incidental ingestion of soil, dermal contact with soil, inhalation of soil particulates, incidental ingestion of groundwater, and dermal contact with groundwater. Potential exposure pathways for off-Site residential receptors would be related to off-Site migration of groundwater to the residential area and include indoor inhalation of vapours arising from groundwater. The potential COC exposure to off-Site Commercial Workers via inhalation of indoor air through vapour intrusion as a result of groundwater off-Site migration is also considered in the RA. The off-Site residential receptor and off-Site Commercial Workers could also be potentially exposed to dust in outdoor air while excavation activities are occurring.

Exposures are evaluated in the absence of risk management measures and the results of the assessment are used to evaluate the potential requirements for risk management. The human health conceptual Site model in the absence of risk management measures is shown on Appendix A.

The potential cumulative cancer risk for benzo[a]pyrene (B[a]P) Total Potency Equivalents (TPE) based on sum of all the carcinogenic PAHs was not evaluated as the purpose of the current RA is to provide SSTLs. As such, all PAHs were evaluated individually.

Based on the receptor groups two different land use scenarios, and exposure scenarios were used for the selection of exposure pathways to be quantitatively evaluated in the RA. In summary, receptors and exposure pathways to be considered further through secondary screening in the human health risk assessment consist of the following:

On-Site:

- Park Visitors (Residential/Parkland/Institution Land use – composite lifetime receptor and toddler)
  - Surface soil direct contact (S1 incidental ingestion and dermal contact); and
  - Inhalation of volatile COCs in outdoor air originating from shallow soil and groundwater.

- Long-Term Outdoor Worker (Industrial/Commercial/Community Land use – adult)
  - Surface soil direct contact (S2 incidental ingestion and dermal contact).

- Subsurface Worker (Industrial/Commercial/Community Land use – adult)
  - Surface and subsurface soil direct contact (S3 incidental ingestion and dermal contact and inhalation of particulates);
  - Direct contact with groundwater (GW1 ingestion and dermal contact); and
  - Inhalation of trench air (GW2 commercial indoor air inhalation and S-IA commercial) COCs originating from groundwater and soil.

Off-Site:

- Off-Site Resident (Residential/Parkland/Institution Land use – composite lifetime receptor and toddler)
  - Inhalation of particulates (surface and subsurface soil) during excavation activities; and
  - Inhalation of indoor air (GW2 residential) COCs originating from groundwater.

- Off-Site Commercial Office Worker (Industrial/Commercial/Community Land use – adult)
  - Inhalation of indoor air (GW2 commercial) COCs originating from groundwater; and
  - inhalation of particulates (surface and subsurface soil) during excavation activities.

4.1.2 Secondary Screening of COCs for Human Health

The COCs identified in Section 3.3 are screened in the HHRA by comparison of 1.2x the maximum COC concentration) with the components of the MECP SCSs protective of human health. Table 9 to Table 12 present the COC screening concentrations in soil and groundwater used in the risk assessment. The summary of the secondary screening results is described below.

4.1.2.1 Surface Soil

Cyanide, metals (with exception of mercury), PHC F3, and PHC F4 do not have Soil to Indoor Air (S-IA) and Soil to Outdoor Air (S-OA) component values as these COCs are considered insufficiently volatile to be present in the vapour phase. Therefore, they will not be retained for quantitative assessment for inhalation of indoor, outdoor air, and trench air exposure pathways for human receptors. As discussed earlier, PHC NAPL is present at the RA Property and the maximum concentrations of PHC F2 and F3 exceed the free phase thresholds. For secondary screening, some component values such as S-IA were derived with the consideration of source depletion. As there will not be a building constructed at the RA Property in the future site redevelopment, indoor air inhalation pathway is not operable for human receptors identified at the RA Property. The use of S-IA for secondary screening in this RA was for the purpose of identifying COCs that are relevant for inhalation of trench air pathway for subsurface workers. This approach is considered conservative as indoor air screening criteria were derived based on assumptions of vapour intrusion into indoor air space without further mixing within enclosed space while trench air COC concentrations will be diluted by the surrounding ambient air in open space. Furthermore, the potential exposure of subsurface workers to free products will be minimized through the implementation of a site-specific health and safety plan as discussed in later sections.

A number of PAHs (anthracene, benzo(g,h,i)perylene, fluorene, 1-,2-methylnaphthalene, and phenanthrene) do not have S-IA and S-OA component values identified by the MECP. It is noted that soil direct contact (incidental ingestion and dermal contact) with PAHs is the main risk driver among the operable pathways used to develop the MECP standards (MOE, 2011b), therefore the potential risk to on-Site human receptors from exposure to the aforementioned PAHs via inhalation of vapour is considered relatively insignificant compared to the direct contact soil exposure. As a result, these PAHs were not carried forward for quantitative assessment of the inhalation of indoor and outdoor air exposure pathways.

Furthermore, phenanthrene does not have human health risk based component values available from the MECP. Due to the structural similarity between anthracene and phenanthrene, anthracene is considered an appropriate surrogate for phenanthrene toxicity. It is not anticipated that the slight structural difference between the two compounds would significantly affect uptake, biodegradation or the (unknown) mechanism of toxicity. As such, the soil direct contact component values (S1, S2, and S3) for anthracene were used as screening values for phenanthrene. The phenanthrene exposure concentrations were less than the anthracene component value concentrations, therefore, phenanthrene was not retained further for quantitative assessment for Park Visitors, Long Term Outdoor Workers, and Subsurface Workers via soil direct contact exposure pathways.

The surface soil COCs that have been retained for further quantitative assessment are listed in Table 9.

4.1.2.2 Subsurface Soil

Cyanide, arsenic, lead, PHC F3, and PHC F4 do not have Soil to Indoor Air (S-IA) and Soil to Outdoor Air (S-OA) component values as these COCs are considered insufficiently volatile to be present in the vapour phase. Therefore, they will not be retained for quantitative assessment of the inhalation of indoor air and outdoor air exposure pathways for human receptors. As discussed earlier, PHC NAPL is present at the RA Property and the maximum concentrations of PHC F2 to F4 exceed their respective free phase thresholds.

A number of PAHs (anthracene, benzo(g,h,i)perylene, fluorene, 1-,2-methylnaphthalene, and phenanthrene) do not have S-IA and S-OA component values identified by the MECP. It is noted that soil

direct contact (incidental ingestion and dermal contact) with PAHs is the main risk driver among the soil associated operable pathways. The potential risk for on-site human receptors from the exposure to the above PAHs via inhalation of vapour is considered insignificant compared to the direct soil exposure. Therefore, these PAHs were not carried forward for quantitative assessment for the inhalation of indoor and outdoor air pathways. Furthermore, phenanthrene does not have component values available. Due to the structural similarity between anthracene and phenanthrene, anthracene is considered an appropriate surrogate for phenanthrene toxicity. It is not anticipated that the slight structural difference between the two compounds would significantly affect uptake, biodegradation or the (unknown) mechanism of toxicity. As such, the Soil Contact component values S1 and S3 for anthracene were used for phenanthrene. Phenanthrene was not retained further for quantitative assessment for subsurface workers via soil contact pathways as the exposure concentration (1.2x maximum concentration) was below S3 direct contact component value. In addition, the exposure concentration was below the S1 direct contact component value, which was used as a screening method for the protection of the general public (i.e., bystanders) from exposure to phenanthrene and other PAHs via inhalation of soil particulates as a result of soil excavation. Therefore, phenanthrene will not be retained for quantitative assessment.

The subsurface soil COCs that have been retained for further quantitative assessment are listed in Table 10.

4.1.2.3 Groundwater (shallow, < 3 m bgs)

For all COCs, the 1.2x maximum measured concentrations were used as screening concentrations. For the COCs that have maximum concentrations below detection limits, the reportable detection limits (RDLs) were used as the screening concentration. The COCs that exceeded their respective component value concentration applicable to groundwater ingestion (GW1) were carried forward for further quantitative assessment for the protection of Subsurface Workers via direct contact with groundwater (incidental ingestion and dermal contact with groundwater). The COCs that exceeded the industrial/commercial/community (I/C/C) land use GW2 component value concentrations were carried forward for quantitative assessment in the RA to evaluate risk to Subsurface Workers via inhalation of trench air (as a result of excavation activity) following migration of volatile COC vapours from groundwater. It is noted that the groundwater COCs in shallow groundwater exceeded GW1 component values are recorded at higher or the same maximum concentrations compared to groundwater at depth greater than 3 m bgs. As such, the retained shallow groundwater COCs for further quantitative assessment for the protection of Subsurface Workers via direct contact with groundwater (incidental ingestion and dermal contact with groundwater) are considered also protective of Subsurface Workers who might be exposed to groundwater at depth greater than 3 m bgs. The shallow groundwater COCs that have been retained for further quantitative assessment are listed in Table 11.

4.1.2.4 Groundwater (deep, > 3 m bgs)

The COCs that exceeded the industrial/commercial/community (I/C/C) GW2 component value concentrations under land use were carried forward in the RA to quantitatively assess of the risk to Subsurface Workers via inhalation of trench air (as a result of excavation activity) following migration of volatile COC vapours from groundwater. As discussed above, the quantitative assessment of direct contact with shallow groundwater (GW1) pathway for Subsurface Workers is considered protective of Subsurface Workers from the exposure to deeper groundwater COCs. As such, direct contact with deep groundwater pathway for Subsurface Workers is not evaluated separately in this risk assessment.

The deep groundwater COCs that have been retained for further quantitative assessment are listed in Table 12.

4.1.2.5 Secondary Screening of GW COCs for Off-Site Indoor Air Inhalation

The groundwater COCs retained as a result of preliminary screening for the protection of downgradient off-Site inhalation of indoor air were further screened using the MECP GW2 I/C/C land use or residential/parkland/institutional (R/P/I) land use component values. The COCs that exceeded the R/P/I or I/C/C GW2 component value concentrations were carried forward to quantitatively assess the risk to off-Site residents or commercial office workers, respectively, via inhalation of indoor air COCs migrating from groundwater. The secondary screening of groundwater COCs for the off-Site indoor air inhalation exposure pathway are listed in Table 13 (R/P/I GW2 component value screening) and 14 (I/C/C GW2 component value screening).

There are no GW2 component values available from the MECP for two (2) PAHs (anthracene and benzo(g,h,i)perylene), therefore these PAH were evaluated qualitatively. For these PAHs, groundwater direct contact (incidental ingestion and dermal contact) with PAHs is considered the main risk driver among the groundwater associated operable pathways, based on the component values provided by the MECP (MOE, 2011b). The potential risk for human receptors through exposure to these PAHs in groundwater via inhalation of indoor air is considered relatively minor compared to the direct groundwater exposure (i.e. ingestion). The MECP direct contact (GW1) component value for anthracene and benzo(g,h,i)perylene are 890 µg/L and 1 µg/L, respectively. The 1.2x maximum concentration of anthracene and benzo(g,h,i)perylene at the RA Property are below their respective GW1 component value concentrations, therefore inhalation exposure will not be evaluated in the RA for these PAHs.

4.1.3 Risk Assessment Objectives

The objectives of the HHRA are to:

- Evaluate the human health risks associated exposure to impacted soil and groundwater;
- Calculate Risk-Based Concentrations (RBCs) protective of the human receptors;
- Identify Site Specific Target Levels (SSTLs) for COC which are considered to pose a potentially unacceptable health risk; and
- Develop a risk management plan to limit exposures to the COCs in areas which may pose a potentially unacceptable health risk, if necessary.

Proposed Use of the RA Property: The RA Property will be used for parkland purposes and it is assumed that no buildings will be present on the RA Property. Furthermore, the RA Property is immediately surrounded by residential land use to the northwest, south, east, and west, and commercial land use to the north and northeast.

Receptors and Exposure Pathways to be assessed in the Human Health Risk Assessment: In the absence of risk management measures, complete exposure pathways exist for the following receptors:

Park Visitor (composite lifetime receptor and toddler) – The future Park Visitor may come into direct contact with surface soil and may inhale vapours outdoors arising from surface soil and/or groundwater.

Off-Site Resident (composite lifetime receptor and toddler) – The Off-Site Residents may inhale COC vapours indoors arising from groundwater which has migrated off-Site, may inhale soil particulates as a result of excavation activities on the RA Property.

Off-Site Commercial Worker (adult) – The Off-Site Commercial Worker may inhale COC vapours indoors arising from groundwater that migrates off-Site to the commercial property and the receptor may also inhale soil particulates as a result of excavation activities being conducted on-Site.

Long-Term Outdoor Worker (adult) – The Long-Term Outdoor Worker may have direct contact (incidental ingestion, dermal contact) with surface soil.

Subsurface Worker (adult) – The Subsurface Worker may be involved in construction or maintenance of underground utilities. The receptor may come in direct contact with surface and subsurface soil (incidental ingestion of soil, dermal contact with soil, and inhalation of particulates), direct contact with groundwater (incidental ingestion of groundwater and dermal contact with groundwater) and may inhale vapours in a trench which arise from full depth soil and/or groundwater.

Qualitative or Quantitative Assessment of Risk: Both qualitative and quantitative approaches are used in the HHRA, as described below. COC exposures are quantified in Section 4.2. Prior to the exposure assessment, the COCs were screened against components of the generic MECP (MOE, 2011b) SCSs (Section 4.1.2) to identify the exposure pathways requiring further evaluation in the HHRA.

Type of Approach Used for the Human Health Risk Assessment: This report follows the general format for risk assessments specified in O. Reg. 153/04 Schedule C, as amended. The risk assessment uses calculations based on formulas available in MECP rationale document (MOE, 2011b) which details the derivation of the generic MECP SCSs; for formulas that are not available in MECP (MOE, 2011b), US EPA RA guidance and ASTM 2004 were also used, as described in Section 4.2.

Sufficiency of Data and Associated Uncertainty: As discussed in Section 3.1.1.1, a number of environmental investigations including Phase I Environmental Site Assessments (ESA) and Phase II ESA investigations have been conducted at the RA Property since 1993, during which samples of soil and groundwater were submitted for analysis. The review of previous investigations determined that soil and groundwater data collected since 2013 were appropriate for the use for the current risk assessment. The Phase II ESAs investigated the APECs and PCOCs identified in the Phase I ESA. The previously identified Site APECs were investigated to the extents possible and maximum COC concentrations were likely identified based on the PCOCs previously identified. However, the current RA has been completed for due diligence purpose and to support the future redevelopment of the RA Property given that there is no change in future land use (i.e., parkland). As such, the lateral and vertical extents of COC impact at the RA property has not been fully delineated given the relatively large size of the RA Property. In order to account for the uncertainty in the lateral and vertical delineation of the RA Property, 1.2x maximum concentrations for the identified COCs were used for the evaluation of potential risk in this RA.

In general, samples were collected and handled in accordance with recommended sampling protocols (MOE, 2011b). A QA/QC program was implemented during each of the two (2) Phase II ESAs completed by SNC-Lavalin. As part of the QA/QC program, sampling protocols included minimizing sample handling, submitting field QA/QC samples using dedicated non-contaminating sampling equipment, using sample specific identification and labelling procedures and using chain of custody records. Field QC samples included blind field duplicate soil samples, blind duplicate groundwater samples, blind field blank water samples prepared using de-ionized water supplied by the laboratory, trip blank water samples and trip spike water samples, also prepared by the laboratory. Laboratory QA/QC measures included analysis of laboratory blank, spiked blank, duplicate and matrix spike samples. The data available are considered sufficient to meet the stated objectives of the RA: to evaluate the risks to the human and ecological

receptors associated with the identified COCs in soil and groundwater, and to determine whether risk management measures are required.

4.2 Exposure Assessment

The exposure assessment consists of the following evaluation steps: characterization of the potentially exposed receptors, identification of the pathways of exposure, and estimation of COC exposure to the receptors.

4.2.1 Receptor Characteristics

Generic assumptions regarding receptor characteristics, generally consistent with those used to derive the MECP SCSs, were applied in this RA. Unless stated otherwise, all values are obtained from MECP (MOE, 2011b). For all receptors, exposure to developmental toxicants (i.e., trichloroethylene and ethylbenzene) is evaluated using adult female receptor characteristics and exposure is not pro-rated, consistent with the MECP SCS derivation approach. As discussed earlier, based on the future re-development of the RA Property and continual use as an urban park, the on-Site human receptors considered in the HHRA comprised of Park Visitors, Subsurface Workers, and Long-Term Outdoor Workers; whereas off-Site human receptors comprised of off-Site Residents and off-Site Commercial Workers. Homeless individuals may be present at the RA Property on an intermittent basis. COC exposure risk to homeless individuals is indirectly evaluated through the Park Visitor risk evaluation in consideration that the Park Visitor is considered to be exposed to the RA Property seven (7) days per week during the frost-free period of the year which is expected to represent an exposure period longer than would be experience by a homeless individual on an intermittent basis.

Subsurface worker air inhalation rates were adopted from the MECP. in the absence of available data from the MECP air inhalation rates, all other receptors were obtained from Table 3 of Health Canada (HC, 2012). The HC (2012) inhalation rates are based on the values compiled by Allan et al. (2008; 2009), and are considered sufficiently conservative for the purposes of the RA.

4.2.1.1 Park Visitor (composite lifetime receptor and toddler)

The Park Visitor may come into direct contact with surface soil and may inhale vapours outdoors arising from soil and/or groundwater. Lifetime exposure for a Park Visitor is evaluated by considering all life stages based on five age classes: adult, teen, child, toddler, and infant. As the RA Property is and continues to be an urban park, the exposure frequency applied in the pathway evaluation is generally similar to what MECP recommended for residents under the generic residential land use scenario (MOE, 2011b) with the exceptions discussed as follows:

- Based on the geographical location of Hamilton a frost-free exposure frequency of 45 weeks/year (MOECC, 2016a) is used in the exposure assessment instead of the generic (MOE, 2011b) 39 weeks per year; and
- To evaluate inhalation of outdoor air, the hours per day that a Park Visitor is assumed to spend at the RA Property is assumed to be 1.5 hours/day based on Health Canada (HC) Preliminary Quantitative Risk Assessment (PQRA) guidance (HC, 2012).

4.2.1.2 Off-Site Resident (composite lifetime receptor and toddler)

The off-Site residents may inhale vapours indoors arising from groundwater that migrate off-Site and may inhale soil particulates as a result of excavation activities. For indoor air inhalation of a carcinogenic COC,

lifetime exposure for an off-Site resident is evaluated by considering five age classes: adult, teen, child, toddler, and infant, consistent with the MECP (MOE, 2011b) generic SCS derivation approach. Risk associated with exposure to non-carcinogenic COCs is assessed based on toddler receptor characteristics since a toddler is considered to represent the critical receptor when exposed to this class of COCs. The exposure frequency applied in the inhalation of indoor air pathway evaluation is same as that recommended by the MECP (MOE, 2011b) according to the residential land use scenario; while exposure frequency applied when evaluating inhalation of soil particulates in this RA, a route of exposure not considered in the MECP generic SCS applicable to a resident, incorporates the following:

› The lifetime exposure experienced by an off-Site Resident through particulate inhalation is evaluated for an adult only as the exposure to soil COCs via particulate inhalation only occur for 1.5 years per MECP (MOE, 2011b) for any generic excavation activity; the hours that an off-Site Resident spends outdoors and would therefore be exposed to soil particulates through inhalation is assumed to be 1.5 hours/day based on HC (2012).

4.2.1.3 Off-Site Commercial Worker (adult)

The Off-Site Commercial Worker may inhale vapours indoors arising from groundwater that migrates off-Site and may also inhale soil particulates outdoors as a result of excavation activities that may take place at the RA Property.

Consistent with MECP MOE (2011b) assumptions regarding indoor worker exposure, risk associated with exposure to non-carcinogenic and carcinogenic COCs is assessed based on adult receptor characteristics. The exposure frequency applied in the inhalation of indoor air pathway evaluation is equivalent to what the MECP recommends (MOE, 2011b) for a commercial indoor worker under the commercial/industrial land use scenario. The particulate inhalation pathway is not evaluated separately for the protection of an off-Site Commercial Office Worker in the RA, as the exposure frequency for this receptor is anticipated to be much shorter in duration compared to off-Site residents. As such, it is assumed that the evaluation of potential risk to off-Site residents from the exposure to the listed COCs via inhalation of particulates is protective of the Off-Site Commercial Office workers.

4.2.1.4 Long-Term Outdoor Worker (adult)

The Long-Term Outdoor Worker is assumed to be involved in regular park maintenance activities following the re-development phase of the park. The exposure characteristics for a Long-Term Outdoor Worker from the MECP MOE (2011b) outdoor worker (long-term) generic characteristics, with the exception that the weeks/year (wks/yr) exposed to the RA Property is longer than the 39 wks/yr generic assumption and in this case is 45 wks/yr based on MOECC (2016a). Consistent with MECP MOE (2011b) assumptions regarding long term outdoor worker exposure, risk associated with exposure to non-carcinogenic and carcinogenic COCs is assessed based on adult receptor characteristics.

4.2.1.5 Subsurface Worker (adult)

The subsurface worker may be responsible for construction or maintenance of underground utilities. They may come in direct contact with surface and subsurface soil (incidental ingestion of soil, dermal contact with soil, and inhalation of particulates), direct contact with groundwater (incidental ingestion of groundwater and dermal contact with groundwater) and may inhale trench vapours arising from soil and/or groundwater.

The exposure characteristics for a Subsurface Worker were obtained from the MECP MOE (2011b) subsurface worker generic characteristics, with the exception of water intake rate and days/year of Site

exposure. Consistent with the MECP's definition of exposure periods for a subsurface worker, an adult worker is assumed to spend 9.8 hours a day, five days per week for 45 weeks of the year (based on MOECC, 2016a) onsite over a period of 1.5 years, as provided by MECP MOE (2011b). The Exposure period of 45 weeks/years represents the duration over which outside temperatures are above 0ºC per the MGRA model guidance (MOECC, 2016b).

Incidental ingestion rates related to exposure to groundwater which may be encountered in an open excavation are not available from the MECP (MOE, 2011b and MOECC, 2016a), as such, two (2) incidental surface water ingestion rates were considered for application in the HHERA. These rates comprise the following:

- 0.02 L/day as provided by US EPA Region IV (US EPA, 2018), which is recommended by US EPA Region IX for derivation of preliminary remediation goals. This rate is also used in the Virginia Department of Environmental Quality (VDEQ) construction/utility worker exposure scenario (VDEQ, undated) and intended to account for splashing and hand-to-mouth contact with groundwater; and
- An incidental surface water ingestion rate of 0.05 L/d was obtained from US EPA (1989a) as referenced in US EPA (US EPA, 1989b and MADEP, 1995). This rate is also recommended for use by ATSDR (2005) and MECP (MOE, 2006) as an incidental surface water ingestion rate for a swimmer.

In consideration that the surface water ingestion potential for a recreational swimmer is likely higher than that of a subsurface worker exposed to groundwater, and that Dufour et al., (2006) identified a lower adult pool water consumption volume of 16 mL for a swimmer (37 mL for non-adult), based on the worst-case scenario, 0.05 L/d is considered sufficiently conservative to apply as an incidental groundwater ingestion rate to a Subsurface Worker.

4.2.1.6 Receptor Characteristic Summary

Exposure factors for each receptor to be quantitatively evaluated in the HHRA are summarized below. Most receptor characteristics and exposure terms are referenced in MECP (MOE, 2011b) with the exception of frost-free days and inhalation rates, which are referenced in MGRA user guidance (MOECC, 2016a) and Health Canada PQRA guidance (HC, 2012).

Table 4.1 Summary of Receptor Characteristics

Receptor	Characteristic
Park Visitor	Body Weight (BW) – Toddler – 16.5 kg Body Weight (BW) – Composite – 62.4 kg [a] Body Weight (BW) – Female Adult – 63.1 kg Exposure Duration (ED) – Toddler – 4.5 yrs Exposure Duration (ED) – Composite – 76 yrs Exposure Duration (ED) – Female Adult – 56 Averaging Period (AP) (non-carcinogens) – Toddler – 4.5 yrs Averaging Period (AP) (carcinogens) – Composite – 76 yrs [b] Averaging Period (AP) (Developmental non-carcinogens) – Female Adult – 56 yrs Outdoor Exposure Frequency (EF) (Inhalation and soil direct contact) – All Life stages – 45 wks/yr (MOECC, 2016b) Outdoor Exposure Frequency (EF) (Inhalation and soil direct contact) – Female Adult – 52 wks/yr Outdoor Exposure Frequency (EF) (Inhalation and soil direct contact) – All – 7 d/wk Outdoor Exposure Frequency (EF) (inhalation) – All – 1.5 hr/d (HC, 2012)

Receptor	Characteristic
Off-Site Resident	Body Weight (BW) – Toddler – 16.5 kg Body Weight (BW) – Composite – 62.4 kg [a] Body Weight (BW) – Female Adult – 63.1 kg Inhalation rate (IR) – Toddler – 8.3 m^3/day (HC, 2012) Inhalation rate (IR) – Adult—16.6 m^3/day (HC, 2012) Exposure Duration (ED) – Toddler – 4.5 yrs Exposure Duration (ED) – Composite – 76 yrs Exposure Duration (ED) – Female Adult – 56 yrs Exposure Duration (ED) Particulate Inhalation – Toddler and Adult – 1.5 yrs Averaging Period (AP) (Non-carcinogens) – Toddler – 4.5 yrs Averaging Period (AP) (Carcinogens) – Composite – 76 yrs Averaging Period (AP) (Developmental non-carcinogens) – Female Adult – 56 yrs Indoor Exposure Frequency (EF) (Indoor Air Inhalation) – Toddler – 50 wks/yr Indoor Exposure Frequency (EF) (Indoor Air Inhalation) – Composite – 50 wks/yr Indoor Exposure Frequency (EF) (Indoor Air Inhalation) – Female Adult – 52 wks/yr Outdoor Exposure Frequency (EF) (Particulate Inhalation) – All – 45 wks/yr (MOECC, 2016a) Indoor Exposure Frequency (EF) (Inhalation) – All – 7 d/wk Indoor Exposure Frequency (EF) (Inhalation) – Toddler – 24 hr/d Indoor Exposure Frequency (EF) (Inhalation) – Composite – 22.5 hr/d [a] Indoor Exposure Frequency (EF) (Inhalation) – Female Adult – 24 hr/d [a] Outdoor Exposure Frequency (EF) (Particulate Inhalation) – All – 1.5 hr/d (HC, 2012)
Subsurface Worker	Body Weight (BW) – Adult – 70.7 kg Body Weight (BW) – Female Adult – 63.1 kg Inhalation rate (IR) – Adult – 1.4 m^3/hr Incidental Water Intake Rate (SWIR) – Adult – 0.05 L/d Exposure Duration (ED) – Adult – 1.5 yr Exposure Duration (ED) – Female Adult – 1.5 yr Averaging Period (AP) (Non-carcinogens) – Adult – 1.5 yr Averaging Period (AP) (Non-carcinogens) – Female Adult – 1.5 yr Averaging Period (AP) (Carcinogens) – Adult – 56 yr Exposure Frequency (EF) (Inhalation) – Adult – 45 wks/yr Exposure Frequency (EF) (Inhalation) – Female – 52 wks/yr Exposure Frequency (EF) (Inhalation) – Adult – 5 d/wk Exposure Frequency (EF) (Inhalation) – Female – 7 d/wk Exposure Frequency (EF) (Inhalation) – Adult – 9.8 hr/d Exposure Frequency (EF) (Inhalation) – Female – 24 hr/d
Long-Term Outdoor Worker	Body Weight (BW) – Adult – 70.7 kg Body Weight (BW) – Female Adult – 63.1 kg Exposure Duration (ED) – Adult – 56 yr Exposure Duration (ED) – Female Adult – 56 yr Averaging Period (AP) (Non-carcinogens) – Adult – 56 yr Averaging Period (AP) (Developmental non-carcinogens) – Female Adult – 56 yr Averaging Period (AP) (Carcinogens) – Adult – 56 yr Exposure Frequency (EF) (Soil Direct Contact) – Adult – 45 wks/yr (MOECC, 2016a) Exposure Frequency (EF) (Soil Direct Contact) – Female – 52 wks/yr Exposure Frequency (EF) (Soil Direct Contact) – Adult – 5 d/wk Exposure Frequency (EF) (Soil Direct Contact) – Female – 7 d/wk
Off-Site Commercial Indoor Worker	Body Weight (BW) – Adult – 70.7 kg Body Weight (BW) – Female Adult – 63.1 kg Exposure Duration (ED) – Adult – 56 yr [C] Exposure Duration (ED) – Female Adult – 56 yr Averaging Period (AP) (Non-carcinogens) – Adult – 56 yr [C] Averaging Period (AP) (Developmental non-carcinogens) – Female Adult – 56 yr

Receptor	Characteristic
	Averaging Period (AP) (Carcinogens) – Adult – 56 yr [C] Exposure Frequency (EF) (Inhalation) – Female – 24 hr/d Exposure Frequency (EF) (inhalation) – Adult – 9.8 hr/d

a – Calculated based on substituting life stage exposure factors from MECP (MOE, 2011b) for skin surface area.
b – Sum of life stage exposure durations in MECP (MOE, 2011b Table 2.10).
c – Off-Site receptor exposure characteristics are equivalent to an indoor receptor with the exception of outdoor exposure specified.

4.2.2 Pathway Analysis

The following exposure pathways and COCs are quantitatively evaluated in this RA:

- Soil direct contact (S1 and S2) – All COCs retained following secondary screening of surface soil COCs, except n-hexane, were evaluated with respect to incidental direct contact with soil for Park Visitors (S1) and Long-Term Outdoor Workers (S2). Consistent with MECP's (MOECC, 2016a) approach in development of the SCSs, n-hexane is not evaluated for ingestion (and dermal contact) exposures due to the lack of an available oral toxicological reference value.
- Soil direct contact (S3) – All COCs retained following secondary screening of surface and subsurface soil COCs were evaluated with respect to incidental direct contact with soil for Subsurface Workers.
- Soil vapour inhalation exposure during excavation (S-Trench) – All volatile soil COCs retained after secondary screening are evaluated for potential exposure to the Subsurface Worker via inhalation of vapours during work in a trench;
- Groundwater vapour inhalation exposure during excavation (GW-Trench) – All volatile groundwater COCs retained after secondary screening are evaluated for potential exposure to the Subsurface Worker via inhalation of vapours during work in a trench;
- Inhalation of particulates in outdoor air – All COCs retained following secondary screening of surface and subsurface soil, except n-hexane, were evaluated with respect to inhalation of soil particulates (PM10) for off-Site Residents during Site re-development activities;
- Incidental groundwater ingestion (GW1) and dermal contact with groundwater – all groundwater COCs retained following secondary screening, are evaluated for incidental groundwater ingestion and dermal contact by a Subsurface Worker during work in a trench;
- Groundwater vapour migration to indoor air (GW2) - All volatile groundwater COCs retained after secondary screening were evaluated for migration of vapours into indoor air at off-Site areas where the vapours may be inhaled by off-Site Residents and off-Site Commercial Workers; and
- Outdoor air inhalation – All volatile surface soil and groundwater COCs retained after secondary screening were evaluated with respect to outdoor air inhalation for Park Visitor.

The following exposure pathways are qualitatively evaluated in this RA:

- The particulate inhalation pathway was not evaluated separately for the protection of the off-Site Commercial Worker as the exposure frequency for this receptor is anticipated to be much lower and the duration much shorter compared to off-Site Residents. As such, it is assumed that the evaluation of potential risk for off-Site Residents from the exposure to the listed COCs via inhalation of particulates is protective of the off-Site Commercial Office workers; and
- Soil leaching to potable groundwater (S-GW1) – this pathway was not evaluated as the RA Property and surroundings within 300 m of the RA Property are municipally serviced. Additionally, groundwater concentrations of COCs were directly measured in groundwater samples collected at the RA

Property, therefore where drinking water screening criteria have been utilized for secondary screening (e.g. to identify COCs related to incidental groundwater ingestion by a Subsurface Worker), groundwater data have been exclusively used for screening.

Several exposure pathways were considered incomplete for one or more receptors:

- The particulate inhalation pathway was not evaluated for Park Visitors. The presence of on-Site airborne particulates is anticipated to be associated with the RA Property re-development construction activities. This receptor group is not anticipated to be present during RA Property construction activities. As such, this pathway is considered incomplete for Park Visitors;
- The particulate inhalation pathway was not evaluated for the protection of the Long-Term Outdoor Worker as this receptor group is anticipated to perform regular park maintenance work after the RA Property re-development construction is completed. The presence of on-Site airborne particulates is anticipated to be associated only with the RA Property re-development construction activities. As such, this pathway is considered incomplete for Long-Term Outdoor Worker;
- Incidental direct contact with on-Site surface soil was not evaluated for an off-Site Resident and an off-Site Commercial Worker. If an off-Site Resident or an off-Site Commercial Worker visits the RA Property, the exposure scenario for these two receptors via incidental direct contact with surface soil would be the same as for a Park Visitor and they are evaluated as a Park Visitor;
- Soil to indoor air (S-IA) - There will be no buildings on the RA Property after Site re-development, therefore, indoor air inhalation of volatile COCs in soil and groundwater is not considered a complete exposure pathway for any Site receptors at the RA Property;
- Ingestion of vegetation - It is the understanding of SNC-Lavalin that the City may install community gardens in the re-developed park. Indirect exposure to soil COCs via ingestion of vegetation was not evaluated as it is anticipated that the vegetables will be grown on raised planting beds with imported clean potting soil and a separation textile installed at the base of the raised bed, therefore, it is assumed that there is no direct contact between the plants in the raised bed gardens and impacted soil present at the RA Property;
- Ingestion of groundwater and dermal contact with groundwater:
  - Incidental direct contact with groundwater at areas where the groundwater table is at a depth greater than 3 m bgs (i.e., deep groundwater) by Subsurface Worker – Due to the depth to groundwater at 3 m bgs or deeper in some areas of the RA Property, a Subsurface Worker would not directly contact groundwater in a hypothetical trench within those areas; and
  - Ingestion of groundwater and dermal contact with groundwater by a Park Visitor and Long-Term Outdoor Worker – Due to the minimum depth to groundwater (>1.76 m bgs), a Park Visitor and Long-Term Worker would not have contact with groundwater.
- Outdoor air inhalation – Outdoor air inhalation was not considered for Long-Term Outdoor Workers, consistent with MECP rationale guidance (MOE, 2011b) that only a direct contact with soil (i.e., incidental ingestion and dermal contact with surface soil) component value was derived for the protection of Long-Term Outdoor Workers; and
- Groundwater odour – Groundwater COCs were not evaluated for odour in groundwater for all receptors as the objective of the current risk assessment is to assess potential health risk from the exposure to soil and groundwater COCs. Aesthetic effects, such as odour, were not considered in the RA.

In summary, the following exposure pathways are quantitatively evaluated in this HHRA:

Table 4.2 Human Health Exposure Pathway Evaluated in the Quantitative Assessment

Source Medium	Park Visitor	Subsurface Worker	Long-Term Outdoor Worker	Off-Site Resident	Off-Site Commercial Worker
Soil	› Incidental dermal contact › Incidental ingestion › Outdoor air inhalation of volatile COCs	› Incidental dermal contact › Incidental ingestion › Inhalation of soil particulates › Trench air inhalation of volatile COCs	› Dermal contact › Incidental Ingestion	› Inhalation of soil particulates	› Inhalation of soil particulates (indirectly evaluated through the evaluation for off-Site Resident)
Groundwater	› Outdoor air inhalation of volatile COCs	› Incidental dermal contact › Incidental ingestion › Trench air inhalation of volatile COCs	› None	› Indoor air inhalation of volatile COCs	› Indoor air inhalation of volatile COCs

4.2.3 Exposure Estimates

A quantitative assessment was completed to calculate exposure to COCs by identified human receptors for each of the complete exposure pathways identified in Section 4.2.2. Receptor exposure characteristics, including frequency and duration of exposure, are summarized in Section 4.2.1.

4.2.3.1 Exposure Point Concentrations

1.2 times the maximum measured concentrations of COCs in soil and groundwater were used as EPCs for evaluating exposure pathways relating to direct contact and as source concentrations to identify final EPCs which are influenced by fate and transport processes prior to exposure. Direct contact EPCs for soil exposure are identified in Table 9 and Table 10 for surface soil and subsurface soil, respectively; direct contact EPCs for groundwater exposure are identified in Table 11 and Table 12 for shallow groundwater and deep groundwater, respectively. Soil direct contact EPCs for pathways S1 for Park Visitors and S2 for Long-Term Outdoor Worker were provided in Appendix A, Table A-1 and Table A-2, respectively. Soil direct contact EPCs based on surface soil and subsoil COCs for the S3 pathway for Subsurface Workers are provided in Appendix A, Table A-3 and Table A-4, respectively.

Soil vapour analytical results were used to serve as additional line of evidence in evaluating exposure. However, measured soil vapour concentrations were not used in the exposure assessment calculations since soil vapour samples were collected from soil vapour probes located near property boundaries in the vicinity of expected off-site receptors, with only one situated in the vicinity of worst-case impacts. Additionally, there are only four (4) soil vapour samples, and therefore are not considered representative of overall Site soil vapour quality. Further qualitative assessment of the soil vapour sample data is provided in Section 4.4.4.

4.2.3.1.1 Exposure Point Concentrations for Soil COCs in Airborne Particulates

The concentration of a soil COC in airborne particulates from a soil source is calculated as the product of the soil COC concentration and the concentration in air of particulate matter that is less than or equal to

10 micrometers (µm) in aerodynamic size (PM10), which is considered to be 100 $\mu g_{soil}/m^3$ based on MECP (MOE, 2011b) and particulate fraction of PM10 (FPM_{inh}) that is inhalable, which is considered to be 0.6 (MOE, 2011b, Table 2.30). It is generally assumed that the concentration of the COCs in airborne particulates is the same as the concentration of the COCs in soil (MOE, 2011b). As such, the exposure point concentration for soil COCs in airborne particulates for inhalation of soil particulates (dust) for Off-site Residents is provided in Appendix A, Table A-5. The evaluation of inhalation of soil particulates (dust) for Subsurface Workers is part of the soil direct contact (S3) pathway, as such, the exposure point concentration for soil COCs in airborne particulates for Subsurface Workers is provided in Appendix A, Table A-3 and A-4.

4.2.3.1.2 Exposure Point Concentrations for Volatile COCs in Indoor Air

The Johnson and Ettinger (1991) model is widely used for assessing chemical vapour intrusion into enclosed spaces. The MECP used the algorithms from the Johnson and Ettinger model for calculation of the generic GW2 component values (MOE, 2011b). The US EPA and many individual States in the US also use this model to evaluate indoor air exposure from soil vapour. The model has undergone extensive peer review and development and has generally been recognized as appropriate, if not conservative, for evaluating the vapour intrusion pathway. This one-dimensional model is applicable for evaluating indoor air concentrations of volatile compounds that have originated from soil or groundwater and migrated indoors by advection and diffusion. The model treats the building as a single compartment and requires additional partitioning models to estimate soil vapour concentrations from groundwater or soil concentrations. The most widely used version of the model is the US EPA spreadsheet implementation of the model. The US EPA (2004, revised in September 2017 to improve ease of use, transparency and interpretability) spreadsheet (2004 version 3.1) was utilized to calculate indoor air concentrations of volatile COCs, based on an infinite groundwater source, which were retained for evaluation after chemical screening. Indoor air EPCs were calculated based on the shallowest observed depth to groundwater at the RA Property using monitoring wells situated hydraulically upgradient (or across gradient) of the residential and commercial off-Site points of reception.

Based upon wells listed below for the evaluation of residential indoor air, the shallowest depth to groundwater is 1.7 m bgs and conceivably within approximately 0.16 m of the underside of a generic basement floor slab, therefore the indoor air EPC was calculated using the generic MECP residential subslab attenuation factor of 0.02 (MOE, 2011b Section 7.6.4). The groundwater monitoring wells used to establish the residential indoor air EPCs consisted of the following:

- MW-102;
- MW-103;
- MW-115;
- MW-09-17;
- MW17-17;
- MW18-01;
- MW18-02;
- MW18-08;
- MW18-09;
- MW18-17;
- MW18-23;
- MW18-24;
- MW18-28; and
- MW18-29.

Based on monitoring wells locations for the evaluation of commercial indoor air, the shallowest depth to groundwater is 2.6 mbgs, therefore for a slab on grade commercial structure, the indoor air EPC has been calculated using US EPA J&E model (2004) based on MECP (MOE, 2011b) generic commercial building characteristics and coarse textured soil properties. The groundwater monitoring wells used to establish the commercial indoor air EPC consisted of the following:

- MW18-14;
- MW18-23;
- MW18-25;
- MW18-26;
- MW18-27;
- MW18-30; and
- MW-104.

Table 4.3 Summary of Building and Subsurface Characteristics

Parameter	Input	Reference
Average Soil Temperature	15°C	MOE (2011b Section 7.2.6.4 and p303)
Depth below grade to bottom of enclosed space floor	11.25 cm	MOE (2011b Section 7.2.6) – Commercial/Industrial
Depth below grade to top of contamination	260 cm	Site specific
Depth below grade to water table	260 cm	Shallowest observed Site groundwater depth
Thickness of stratum A	11.25 cm	MOECC (2016a) and MOE (2011b Section 7.2.6)
Thickness of stratum B	30 cm	MOECC (2016a) and MOE (2011b Section 7.2.6)
Thickness of stratum C	218.75 cm	Based on depth to top of contamination, less stratum A and B thickness
Soil vapour permeability	1.78×10^{-7} cm^2	MOE (2011b Section 7.3.4) – Coarse Soil, Commercial/Industrial
Average vapour flow rate into building	9.8 L/min	MOE (2011b Section 7.3.4) – Coarse Soil, Commercial/Industrial
Floor thickness	11.25 cm	MOE (2011b Section 7.2.6) - Commercial/Industrial
Soil-building pressure differential	40 g/cm-s^2	MOE (2011b Section 7.2.6.2) - Residential
Enclosed space length	2000 cm	MOE (2011b Section 7.2.6) - Commercial/Industrial
Enclosed space width	1500 cm	MOE (2011b Section 7.2.6) - Commercial/Industrial
Enclosed space height	300 cm	MOE (2011b Section 7.2.6) - Commercial/Industrial
Floor-wall crack width (cm)	0.1 cm	MOE (2011b Section 7.2.6)
Indoor air exchange rate	1 per hour	MOE (2011b Section 7.2.6) – Commercial/Industrial

Stratum A, B and C soil properties represent coarse textured soil properties identified in MECP (MOE, 2011b) as the results of site investigations at the RA Property identified the soil as coarse textured. Chemical properties were obtained from MECP (MOECC, 2016a).

Indoor air PHC modelling required conversion of PHC F1 and F2 super fraction concentrations to aliphatic and aromatic sub fractions, comprising PHC F1 and F2, as PHC physico-chemical properties are associated with these sub fractions. Groundwater PHC F1 and F2 aliphatic and aromatic sub fraction

EPCs were calculated from groundwater apportionments provided in CCME (2008 - Table 3.7) and MECP (MOE, 2011b p382). Aliphatic and aromatic COC sub fraction EPCs are summarized in Table 4.4.

Table 4.4 Summary of Groundwater PHC Sub fraction EPCs

COC	Media	Sub fraction Apportionment	Reference	Concentration
F1 Aliphatic C_6-C_8 F1 Aliphatic >C_8-C_{10} F1 Aromatic C_8-C_{10}	Groundwater Groundwater Groundwater	0.605 0.063 0.332	MECP MOE (2011b) MECP MOE (2011b) MECP MOE (2011b)	2613.6 µg/L 272.16 µg/L 1434.2 µg/L
F2 Aliphatic >C_{10}-C_{12} F2 Aliphatic >C_{12}-C_{16} F2 Aromatic >C_{10}-C_{12} F2 Aromatic >C_{12}-C_{16}	Groundwater Groundwater Groundwater Groundwater	0.024 0.002 0.603 0.371	MECP MOE (2011b) MECP MOE (2011b) MECP MOE (2011b) MECP MOE (2011b)	976.32 µg/L 81.36 µg/L 24530 µg/L 15092 µg/L

Table 4.5 Summary of Residential Indoor Air EPC Modelling - Groundwater

COC	Calculated Indoor Air Concentration without Bio attenuation (mg/m^3)
Benzene Toluene Ethylbenzene Xylene Mixture	9.32E+01 2.80E-02 3.90E-03 1.27E-02
F1 Aliphatic C6-C8 F1 Aliphatic >C8-C10 F1 Aromatic C8-C10	2.61E+00 4.35E-01 1.38E-02
F2 Aliphatic >C10-C12 F2 Aliphatic >C12-C16 F2 Aromatic >C10-C12 F2 Aromatic >C12-C16	2.34E+00 8.46E-01 6.87E-02 1.60E-02
Styrene Trichloroethylene Vinyl Chloride	4.84E-04 1.16E-04 4.29E-05
Acenaphthene Acenaphthylene Fluorene Naphthalene	1.15E-04 7.51E-06 2.37E-05 9.89E-03
Mercury	1.13E-04

As discussed earlier in Section 4.1.2.5, the only retained groundwater COCs for commercial indoor air inhalation is benzene. Although the transport distance from the groundwater source associated with the

off-Site commercial buildings is in excess of 1 m, a generic bio-attenuation factor (MOE, 2011b p337) has not been applied to the calculated indoor air EPC for benzene. This approach is intended to allow for a conservative estimate of the commercial indoor air EPC. Modelling results are summarized below.

Table 4.6 Summary of Commercial Indoor Air EPC Modelling - Groundwater

COC	Calculated Indoor Air Concentration without Bio attenuation (mg/m^3)	Bio attenuation Factor	Final Indoor Air Concentration (mg/m^3)
Benzene	0.375	1	0.375

US EPA (2004) model result output files are provided in Appendix A, Table A-6. Indoor air EPCs and prorated exposure COC concentrations applicable to the adjacent residential land use scenario, assuming the presence of shallow groundwater, is provided in Appendix A, Table A-7. The modeling spreadsheets for the prorated exposure concentration based on the commercial land use scenario is provided in Appendix A, Table A-8.

4.2.3.1.3 Exposure Point Concentrations in Trench Air from Surface and Subsurface Soil Volatile COCs

The concentration of a volatile COC in trench air is calculated using a volatilization factor (VF). The procedures for estimating air concentrations of a soil derived volatile are as follows (ASTM, 2004):

$$C_{trench-air} = C_{soil} \times VF$$ Equation 4-1

where:

VF = COC specific volatilization factor from soil to air [(mg/m^3-air)/(mg/kg-soil)] or (kg/m^3);
Csoil = COC concentration in soil (mg/kg); and
Ctrench-air = COC concentration in air (mg/m^3).

The soil-to-trench air VF is used to define the relationship between the concentration of the contaminant in soil and the flux of the volatilized contaminant to trench air. Trench air COC concentrations arising from surface soil (<1.5 m bgs) were calculated using a surface soil to outdoor air model (ASTM, 2004) (Equation 4-2). Trench air COC concentrations arising from subsurface soil (≥ 1.5 m bgs) COCs were calculated using a subsurface soil to outdoor air model (ASTM, 2004) (Equation 4-3). The surface and subsurface soil to trench air volatilization factors ($VF_{s.amb}$) are calculated using the following equations (ASTM, 2004):

$$VF_{s,amb} = \frac{\rho_b}{DF_{amb}} \sqrt{\frac{4 \times DF_{eff.vad} \times H_{eff}}{\pi \times \tau \times 31536000 \frac{s}{y} \times K_d \times \rho_b}}$$ Equation 4-2 – Surface Soil

$$VF_{s.amb} = \frac{1}{\left[(1+\frac{DF_{amb} \times L_s}{D_{eff.vad}}) \times \frac{K_{sw}}{H_{eff}}\right]} \times CF$$ Equation 4-3 – Subsurface Soil

and,

$$K_{sw} = \frac{\left[\theta_w + (f_{OC} \times K_{OC} \times \rho_b) + (H_{eff} \times \theta_a)\right]}{\rho_b}$$ Equation 4-4

and,

$$H_{eff} = \frac{H_1}{R \times T} \times CF$$ Equation 4-5

where:

$$D_{eff.vad} = \left(D_{ia} \times \frac{\theta_a^{3.33}}{\theta_t^2} + D_{iw} \times \frac{1}{H_{eff}} \times \frac{\theta_w^{3.33}}{\theta_t^2} \right)$$ Equation 4-6

$$DF_{amb} = \left(\frac{V \times LS \times DH}{A} \right)$$ Equation 4-7

$VF_{s.amb}$ = COC specific volatilization factor from surface or subsurface soil to trench air [(mg/m^3-air)/(mg/kg-soil)] or (kg/m^3);
$D_{eff.vad}$ = COC effective diffusion coefficient (cm^2/s);
DF_{amb} = COC dispersion factor in air (cm/s);
τ = Averaging time for vapour flux = receptor exposure duration (seconds).
ρ_b = Soil dry bulk density (g/cm^3);
D_{ia} = Chemical specific diffusivity in air (cm^2/s);
D_{iw} = Chemical specific diffusivity in water (cm^2/s);
H_1 = Henry's Law constant (atm-m^3/mol);
H_{eff} = Effective Henry's Law Constant (cm^3 water/cm^3 air);
R = Ideal gas law constant (0.08206 atm-L/g-mol-K);
T = Ambient temperature (K);
K_{sw} = Soil to pore water partition coefficient (cm^3 water/g soil);
θ_w = Volumetric water content in vadose zone soil (cm^3-H_2O/g-soil);
θ_a = Volumetric air content in vadose zone soil (cm^3-air/g-soil);
θ_t = Impacted zone total soil porosity (cm^3/cm^3-soil);
f_{OC} = Fraction organic carbon in soil (g-OC/g-soil);
K_{OC} = Chemical specific organic carbon partition coefficient (cm^3/g);
CF = Conversion factor (cm^3-kg/m^3-g) or (L/m^3) = 10^3
A = Length wise cross-sectional area of the trench (m^2);
LS = Width of the contaminated area (cm);
V = Wind speed in the mixing zone – trench (cm/s);
DH = Diffusion height (cm); and

L_s = Depth to subsurface soil contamination (cm).

The wind speed in the mixing zone will be less than the generic MECP (MOE, 2011b) outdoor wind speed of 410 cm/sec due to mixing occurring below grade. MECP (MOECC, 2016a) identifies a generic trench air exchange rate (ACR) of 5/hour. This ACR was converted to a trench wind velocity based on a 13 m long, 1 m wide and 2 m deep trench (MOE, 2011b) requiring 5 ACR per hour (130 m^3/hr) and assuming ventilation air enters the trench along the length (i.e. the 13 m face) of the trench.

$$V = \frac{ACR \times Trench_{vol}}{3600 \times A}$$ Equation 4-8

where:

V = Wind speed in the mixing zone of the trench (cm/s);
ACR = Trench air exchange rate with ambient air (hr^{-1});
A = Length wise cross-sectional area of the trench (m^2); and
$Trench_{vol}$ = Volume of the trench (m^3);

This conversion of ambient air wind velocity to a trench air velocity based on an ACR of 5/hr treats the trench as a rectangular duct with air flow occurring along length of the trench. The final calculated wind speed in the mixing zone is 0.0014 m/sec.

Soil temperature is assumed to be equivalent to the MECP (MOE, 2011b) soil temperature of 15° C (288.15 K). The source area (A) represents the area of all trench walls and floor through which vapour diffusion occurs. L_s is based on the separation distance between the trench floor (2 m bgs) and the delineated upper depth range of soil COCs which is 0.5 m bgs based on shallowest depth of the surface soil impact identified at 0.8 m bgs. Soil COCs are vertically delineated, therefore a finite source or mass limited volatilization factor ($VF_{s.amb-fs}$) (ASTM, 2004) can be also be calculated.

$$VF_{s.amb-fs} = \frac{d_s \times \rho_b \times C_1}{\left(\frac{V \times LS \times DH}{A}\right) \times \tau \times 31536000\,\text{sec}/\,yr}$$ Equation 4-9

where:

$VF_{s.amb-fs}$ = COC specific volatilization factor from subsurface soil to trench air [(mg/m^3-air)/(mg/kg-soil)] or (kg/m^3);
d_s = Depth to impacted surface soil layer; and
τ = Averaging time for vapour flux = receptor exposure duration (years).

The final surface soil to trench air $VF_{s.amb}$ is the minimum of either $VF_{s.amb}$ or $VF_{s.amb-fs}$ (ASTM, 2004). τ is calculated from subsurface worker exposure factors obtained from MECP (MOE, 2011b). COC physico-chemical properties were obtained from MECP (MOECC, 2016a). The surface and subsurface soil to trench air $VF_{s.amb}$ for each COC, including inputs and equations are provided in Appendix A, Table A-9. Trench air concentrations of COC EPCs from a surface and subsurface soil source are summarized Appendix A, Table A-10.

4.2.3.1.4 Exposure Point Concentrations for Surface Soil Volatile COCs in Outdoor Air

The concentration of a volatile COC in outdoor air is calculated using a volatilization factor (VF). The procedures for estimating air concentrations of a surface soil derived volatile are as follows (US EPA, 1996):

$$C_{outdoor-air} = C_{soil} \times VF$$ Equation 4-10

where:

VF = COC specific volatilization factor from soil to air [(mg/m^3-air)/(mg/kg-soil)] or (kg/m^3);
C_{soil} = COC concentration in surface soil (mg/kg); and
C_{air} = COC concentration in air (mg/m^3).

The soil-to-outdoor air VF is used to define the relationship between the concentration of the contaminant in soil and the flux of the volatilized contaminant to outdoor air. Only surface soil volatile COCs were considered for outdoor air volatilization per MECP (MOE, 2011b), as sub-surface soil do not have outdoor air component values. Outdoor air COC concentrations arising from surface soil (<1.5 m bgs) were calculated using a surface soil to outdoor air model (ASTM, 2004) (Equation 4-2). The surface soil to outdoor air volatilization factors ($VF_{s.amb}$) are calculated using the following equations (ASTM, 2004):

$$VF_{s.amb} = \frac{\rho_b}{DF_{amb}} \sqrt{\frac{4 \times DF_{eff.vad} \times H_{eff}}{\pi \times \tau \times 31536000 \frac{s}{y} \times K_d \times \rho_b}}$$ Equation 4-11 – Surface Soil

and,

$$K_{sw} = \frac{\left[\theta_w + \left(f_{OC} \times K_{OC} \times \rho_b\right) + \left(H_{eff} \times \theta_a\right)\right]}{\rho_b}$$ Equation 4-12

and,

$$H_{eff} = \frac{H_1}{R \times T} \times CF$$ Equation 4-13

where:

$$D_{eff.vad} = \left(D_{ia} \times \frac{\theta_a^{3.33}}{\theta_t^2} + D_{iw} \times \frac{1}{H_{eff}} \times \frac{\theta_w^{3.33}}{\theta_t^2} \right)$$ Equation 4-14

$$DF_{amb} = \left(\frac{V \times LS \times DH}{A} \right)$$ Equation 4-15

$VF_{s.amb}$ = COC specific volatilization factor from surface soil to outdoor air [(mg/m^3-air)/(mg/kg-soil)] or (kg/m^3);
$D_{eff.vad}$ = COC effective diffusion coefficient (cm^2/s);

DF_{amb} = COC dispersion factor in air (cm/s);
τ = Averaging time for vapour flux = receptor exposure duration (year).
ρ_b = Soil dry bulk density (g/cm^3);
D_{ia} = Chemical specific diffusivity in air (cm^2/s);
D_{iw} = Chemical specific diffusivity in water (cm^2/s);
H_1 = Henry's Law constant (atm-m^3/mol);
H_{eff} = Effective Henry's Law Constant (cm^3 water/cm^3 air);
R = Ideal gas law constant (0.08206 atm-L/g-mol-K);
T = Ambient temperature (K);
K_{sw} = Soil to pore water partition coefficient (cm^3 water/g soil);
θ_w = Volumetric water content in vadose zone soil (cm^3-H_2O/g-soil);
θ_a = Volumetric air content in vadose zone soil (cm^3-air/g-soil);
θ_t = Impacted zone total soil porosity (cm^3/cm^3-soil);
f_{OC} = Fraction organic carbon in soil (g-OC/g-soil);
K_{OC} = Chemical specific organic carbon partition coefficient (cm^3/g);
CF = Conversion factor (cm^3-kg/m^3-g) or (L/m^3) = 10^3
A = Source zone area (assumed to be the area of the RA Property) (cm^2);
LS = Length of longest side of contaminated area (assumed to be the area of the RA Property (cm);
V = Wind speed in the breathing zone (cm/s);
DH = Diffusion height (cm); and

The wind speed in the breathing zone above ground surface will be the generic MECP (MOE, 2011b) outdoor wind speed of 410 cm/sec as the mixing occur above grade. Soil temperature is assumed to be equivalent to the MECP (MOE, 2011b) soil temperature of 15^o C (288.15 K). The source area (A) is assumed to be the area of the entire Site based on a conservative approach. Soil COCs are vertically delineated, therefore a finite source or mass limited volatilization factor ($VF_{s.amb-fs}$) (ASTM, 2004) can be also be calculated.

$$VF_{s.amb-fs} = \frac{d_s \times \rho_b}{\left(\frac{V \times LS \times DH}{A}\right) \times \tau}$$ Equation 4-16

where:

$VF_{s.amb-fs}$ = COC specific volatilization factor from subsurface soil to trench air [(mg/m^3-air)/(mg/kg-soil)] or (kg/m^3);
d_s = Depth of impacted surface soil layer; and
τ = Averaging time for vapour flux = receptor exposure duration (seconds).

The final surface and subsurface soil to trench air $VF_{s.amb}$ is the minimum of either $VF_{s.amb}$ or $VF_{s.amb-fs}$ (ASTM, 2004). τ is calculated from subsurface worker exposure factors obtained from MECP (MOE, 2011b). COC physico-chemical properties were obtained from MECP (MOECC, 2016a). The surface and soil to outdoor air $VF_{s.amb}$ for each COC, including inputs and equations are provided in Appendix A, Table A-11. Trench air concentrations of COC EPCs from a surface and subsurface soil source are summarized Appendix A, Table A-12.

4.2.3.1.5 Exposure Point Concentrations for Groundwater Volatile COCs in Trench Air

The concentration of a volatile COC in trench air from a groundwater source is calculated using a volatilization factor (VF) as follows:

$$C_{air} = C_{gw} \times VF \times CF$$ Equation 4-17

where:

VF = COC specific volatilization factor from groundwater to air (cm^3/cm^3);
CF = Conversion factor (L/m^3) = 1000;
C_{gw} = COC concentration in groundwater (µg/L); and
C_{air} = COC concentration in air ($\mu g/m^3$).

The groundwater-to-trench air VF is used to define the relationship between the concentration of the contaminant in groundwater and the flux of the volatilized contaminant to trench air. Trench air COC concentrations were calculated using a groundwater to outdoor air model (ASTM, 2004). The groundwater to trench air volatilization factor ($VF_{gw.amb}$) is calculated using the following equation (ASTM, 2004):

$$VF_{gw.amb} = \frac{1}{\left[\left(1 + \frac{DF_{amb} \times L_{gw} \times CF}{D_{eff.ws}}\right) \times \frac{1}{H_{eff}}\right]}$$ Equation 4-18

and,

$$D_{eff.ws} = \frac{L_{gw}}{\left(\frac{h_v - h_{cap}}{D_{eff.vad}}\right) \times CF + \left(\frac{h_{cap}}{D_{eff.cap}}\right) \times CF}$$ Equation 4-19

and based on rearrangement and modification of the ASTM (2004) L_{gw} definition,

$$L_{gw} = h_v - h_{cap} - h_{trench}$$ Equation 4-20

where:

$$DF_{amb} = \left(\frac{V \times LS \times DH}{A}\right)$$ Equation 4-21

$VF_{gw.amb}$ = COC specific volatilization factor from groundwater to trench air (cm^3/cm^3);
$D_{eff.vad}$ = COC effective diffusion coefficient (cm^2/s);
DF_{amb} = COC dispersion factor in air (cm/s);
CF = Conversion factor (cm/m) = 100
h_{cap} = Thickness of the capillary fringe which is based on the measured depth to groundwater (cm);
h_v = Thickness of the vadose zone (cm);
H_{eff} = Effective Henry's Law Constant (cm^3 water/cm^3 air); and
L_{gw} = Depth to groundwater below the trench floor (cm).

The wind speed in the mixing zone will be less than the generic MECP (MOE, 2011b) outdoor wind speed of 410 cm/sec due to mixing occurring below grade. MECP (MOECC, 2016a) identifies a generic trench air exchange rate (ACR) of 5/hour. This ACR was converted to a trench wind velocity based on a 13 m long, 1 m wide and 2 m deep trench (MOE, 2016a) requiring 5 ACR per hour (130 m^3/hr) and assuming ventilation air enters the trench along the short axis (i.e. the 13 m face) of the trench.

$$V = \frac{ACR \times Trench_{vol}}{3600 \times A}$$ Equation 4-22

where:

V = Wind speed in the mixing zone of the trench (cm/s);
ACR = Trench air exchange rate with ambient air (hr^{-1});
A = Length wise cross sectional area of the trench (m^2); and
$Trench_{vol}$ = Volume of the trench (m^3);

This conversion of ambient air wind velocity to a trench air velocity based on an ACR of 5/hr treats the trench as a rectangular duct with air flow occurring along the short axis of the trench. The final calculated wind speed in the mixing zone is 0.0014 m/sec.

The depth to groundwater definition from ASTM (2004) was rearranged since vadose zone thickness is not directly measured. Depth to groundwater is measured from monitoring wells and the observed depth to groundwater does not reflect the upper boundary of the capillary fringe (i.e. the lower boundary of the vadose zone) since water in the capillary fringe is held by matric suction and is not fully draining, therefore ASTM (2004) h_v is equivalent to h_v-h_{cap} in this assessment. The vadose zone thickness for L_{gw} calculation represents the shallowest measured depth to groundwater from 2018 observations minus the depth of a trench (200 cm). The height of the capillary fringe (h_{cap}) is assumed to be 0.1705 m (17.05 cm) based on the coarse textured soil capillary fringe height from MECP (MOECC, 2016a – as defined by Lcz in the MGRA model). ASTM (2004) define $D_{eff.vad}$ as being equivalent to $D_{eff.cap}$ for calculation purposes, but with differing volumetric water and air contents. The MECP (MOECC, 2016a) capillary zone water content at 0.25 and the air content at 0.12 (MOECC, 2016a), respectively as Qacz and Qwcz terms in the "Physical Transport" tab) and the vadose zone water content at 0.12 and air content at 0.24 (MOECC 2016a nC-qwC and qaC terms and "SoilGas_Tier2" tab). These volumetric contents have been adopted in this assessment. The calculation of $D_{eff.vad}$, DF_{amb} and H_{eff} have been defined previously. Temperature (T) is assumed to be equivalent to the MECP (MOE, 2011b) soil temperature of 15° C (288.15 K). COC physico-chemical properties were obtained from MECP (MOECC, 2016a). The groundwater to trench air $VF_{gw.amb}$ for each COC, including inputs and equations are provided in Appendix A, Table A-13. Trench air COC EPCs from a groundwater source are summarized Appendix A, Table A-10.

4.2.3.1.6 Exposure Point Concentrations for Groundwater Volatile COCs in Outdoor Air

The concentration of a volatile COC in outdoor air from a groundwater source is calculated using a volatilization factor (VF) as follows:

$$C_{air} = C_{gw} \times VF \times CF$$ Equation 4-23

where:

VF = COC specific volatilization factor from groundwater to air (cm^3/cm^3);
CF = Conversion factor (L/m^3) = 1000;
C_{gw} = COC concentration in groundwater (µg/L); and
C_{air} = COC concentration in air ($\mu g/m^3$).

The groundwater-to-outdoor air VF is used to define the relationship between the concentration of the contaminant in groundwater and the flux of the volatilized contaminant to ambient air. Outdoor air COC concentrations were calculated using a groundwater to outdoor air model (ASTM, 2004). The groundwater to outdoor air volatilization factor ($VF_{gw.amb}$) is calculated using the following equation (ASTM, 2004):

$$VF_{gw.amb} = \frac{1}{\left[\left(1+\frac{DF_{amb}\times L_{gw}\times CF}{D_{eff.ws}}\right)\times\frac{1}{H_{eff}}\right]}$$ Equation 4-24

and,

$$D_{eff.ws} = \frac{L_{gw}}{\left(\frac{h_v - h_{cap}}{D_{eff.vad}}\right)\times CF + \left(\frac{h_{cap}}{D_{eff.cap}}\right)\times CF}$$ Equation 4-25

and based on rearrangement and modification of the ASTM (2004) L_{gw} definition,

$$L_{gw} = h_v - h_{cap}$$ Equation 4-26

where:

$$DF_{amb} = \left(\frac{V\times LS\times DH}{A}\right)$$

$VF_{gw.amb}$ = COC specific volatilization factor from groundwater to outdoor air (cm^3/cm^3);
$D_{eff.vad}$ = COC effective diffusion coefficient (cm^2/s);
DF_{amb} = COC dispersion factor in air (cm/s);
CF = Conversion Factor (cm/m) = 100
h_{cap} = Thickness of the capillary fringe which is based on the measured depth to groundwater (cm);
h_v = Thickness of the vadose zone (cm);
H_{eff} = Effective Henry's Law Constant (cm^3 water/cm^3 air);
L_{gw} = Depth to groundwater below the ground surface (cm);
A = Source zone area (assumed to be the area of the RA Property) (cm^2);
LS = Length of longest side of contaminated area (assumed to be the length of the RA Property (cm); and
V = Wind speed in the breathing zone (cm/s);

The wind speed in the breathing zone above ground surface will be the generic MECP (MOE, 2011b) outdoor wind speed of 410 cm/sec as the mixing occur above grade. Soil temperature is assumed to be equivalent to the MECP (MOE, 2011b) soil temperature of 15° C (288.15 K). The source area (A) is assumed to be the area of the entire Site based on a conservative approach. It is assumed that the maximum concentrations of soil COCs were identified based on previous Site assessments, therefore a finite source or mass limited volatilization factor ($VF_{s.amb-fs}$) (ASTM, 2004) can be also be calculated.

The depth to groundwater definition from ASTM (2004) was rearranged since vadose zone thickness is not directly measured. Depth to groundwater is measured from monitoring wells and the observed depth to groundwater does not reflect the upper boundary of the capillary fringe (i.e. the lower boundary of the vadose zone) since water in the capillary fringe is held by matric suction and is not fully draining, therefore ASTM (2004) h_v is equivalent to h_v-h_{cap} in this assessment. The vadose zone thickness for L_{gw} calculation represents the shallowest measured depth to groundwater from 2018 observations. The height of the capillary fringe (h_{cap}) is assumed to be 0.1705 m (17.05 cm) based on the coarse textured soil capillary fringe height from MECP (MOECC, 2016a – as defined by Lcz in the MGRA model). ASTM (2004) define $D_{eff.vad}$ as being equivalent to $D_{eff.cap}$ for calculation purposes, but with differing volumetric water and air contents. The MECP (MOECC, 2016a) capillary zone water content at 0.25 and the air content at 0.12 (MOECC, 2016), respectively as Qacz and Qwcz terms in the “Physical Transport” tab) and the vadose zone water content at 0.12 and air content at 0.24 (MOECC 2016a nC-qwC and qaC terms and “SoilGas_Tier2” tab,). These volumetric contents have been adopted in this assessment. The calculation of $D_{eff.vad}$, DF_{amb} and H_{eff} have been defined previously. Temperature (T) is assumed to be equivalent to the MECP (MOECC, 2016a) soil temperature of 15° C (288.15 K). COC physico-chemical properties were obtained from MECP (MOECC, 2016a). The groundwater to outdoor air VFgw.amb for each COC identified in shallow and deep groundwater, including inputs and formulas are provided in Appendix A, Table A-14. Outdoor air concentrations of COC EPCs from shallow and deep groundwater are summarized in Appendix A, Table A-12.

4.2.3.2 Receptor Exposure Estimates

Exposure estimates based on the previously presented surface and subsurface soil and groundwater EPCs are summarized in the following sub-sections.

4.2.3.2.1 Soil Ingestion Contact Exposure

Average daily COC dose from incidental soil ingestion exposure is calculated by using the following equation with the 1.2x the maximum soil concentration (C_S) and the MECP (MOE, 2011b) residential (equivalent to Park Visitor), Long-Term Outdoor Worker, and Subsurface Worker exposure factors as follows:

$$ADSIR = \frac{C_S \times SIR \times RAF_{oral} \times EF_b \times EF_c \times ED}{BW \times AP_{NC} \times C}$$ Equation 4-27

$$LADSIR = \frac{C_S \times RAF_{oral} \times EF_b \times EF_c}{AP_C \times C} \times \sum_n^i \frac{SIR_i \times ED_i}{BW_i}$$ Equation 4-28

where:

ADSIR = Average daily dose for a non-carcinogenic COC in soil through incidental ingestion (mg/kg/day);
LADSIR = Lifetime average daily dose for a carcinogenic COC in soil through incidental ingestion (mg/kg/day);

C_S = Soil COC EPC (mg/kg);
SIR_i = Soil ingestion rate for receptor at each life stage *i* (kg/day);
RAF_{oral} = Oral relative absorption factor (unitless);
BW = Receptor body weight (kg);
C = Conversion Factor (day/year);
ED_i = Exposure duration for receptor at each life stage *i* (years);
EF_b = Exposure frequency (days/week);
EF_c = Exposure frequency (weeks/year);
AP_c = Averaging time for carcinogens (years) (= life expectancy); and
AP_{nc} = Averaging time for non-carcinogens (exposure duration) (years).

Lifetime exposure to carcinogenic COCs through soil ingestion for a Park Visitor, is evaluated by considering five age classes: adult, teen, child, toddler and infant. The amortization is the sum of the products of exposure terms for each life stages such as soil ingestion rate, exposure duration, and body weight. Incidental soil ingestion exposure estimates from soil COCs are provided in Appendix A, Table A-1 to A-4.

4.2.3.2.2 Soil Dermal Contact Exposure

Average daily COC dose through soil dermal contact exposure is calculated using the following equation with 1.2x the maximum subsurface and/or surface soil (dependent upon receptor) COC concentration (C_S) and the MECP (MOE, 2011b) residential (equivalent to a Park Visitor), Long-Term Outdoor Worker and Subsurface Worker exposure factors as follows:

$$ADDCR = \frac{C_S \times SSA \times SA \times RAF_{derm} \times EF_b \times EF_c \times ED}{BW \times AP_{NC} \times C}$$ Equation 4-29

$$LADDCR = \frac{C_S \times RAF_{derm} \times EF_b \times EF_c}{AP_C \times C} \times \sum_i \frac{SSAi \times SAi \times EDi}{BWi}$$ Equation 4-30

where:

ADDCR = Average daily dose for a non-carcinogenic COC in soil through dermal contact (mg/kg/day);
LADDCR = Lifetime average daily dose for a carcinogenic COC in soil through dermal contact (mg/kg/day);
C_S = Soil COC EPC (mg/kg);
SSA_i = Average skin surface area exposed for receptor at each life stage *i* (m^2);
SA_i = Soil adherence factor for receptor at each life stage *i* (soil loading rate on exposed skin) (kg/m^2-day)
RAF_{dermal} = Dermal relative absorption factor (unitless);
BW_i = Receptor body weight for receptor at each life stage *i* (kg);
C = Conversion Factor (day/year);
ED_i = Exposure duration for receptor at each life stage *i* (years);
EF_b = Exposure frequency (days/week);
EF_c = Exposure frequency (weeks/year);
AP_c = Averaging time for carcinogens (years) (= life expectancy); and
AP_{nc} = Averaging time for non-carcinogens (exposure duration) (years).

Lifetime dermal exposure to carcinogenic COCs for a Park Visitor is evaluated by considering five age classes: adult, teen, child, toddler, and infant. The amortization is the sum of the products of exposure terms for each life stages such as average skin surface area, soil adherence factor (loading rate), exposure duration, and body weight. Soil dermal contact exposure estimates to soil COCs are provided in Appendix A, Table A-1 to Table A-4.

4.2.3.2.3 Soil Particulate Inhalation Exposure

Soil particulate inhalation exposure to surface and subsurface soil COCs is calculated using the following equation with the 1.2x maximum soil COC concentrations (C_S) and the receptor exposure factors as follows:

For carcinogenic and non-carcinogenic COCs,

$$(L)ADSIE = \frac{(C_S \times [PM_{10}] \times FPM_{inh} \times IR \times EF_a \times EF_b \times EF_c \times ED \times BW_{assumed} \times RAF_i)}{BW \times AP \times IR_{assumed} \times C}$$ Equation 4-31

where:

(L)ADSIE = (Lifetime) Average Daily Soil Inhalation Exposure, through particulate inhalation (mg/m^3);
C_S = Soil COC concentration (mg/kg);
[PM_{10}] = Concentration in air of dust particles ≤ 10 µm in diameter (kg$_{soil}$/m^3);
FPM_{inh} = Fraction of PM_{10} that is deposited in lungs (0.6 based on MOE, 2011b) (unitless)
$IR_{Assumed}$ = Assumed inhalation rate in the development of inhalation TRV (m^3/day)
IR = Inhalation rate the receptor during the exposure period (m^3/day)
$BW_{Assumed}$ = Assumed body weight in development of the inhalation TRV (kg)
BW = Body weight of the receptor (kg);
RAF_i = Inhalation relative absorption factor for receptor at each life stage *i* (unitless)
EF_a = Exposure frequency (hours/day);
EF_b =Exposure frequency (days/week);
EF_c = Exposure frequency (weeks/year);
ED = Exposure duration (years);
AP = Carcinogenic COC averaging period (= life expectancy) or Non-carcinogenic COC exposure averaging period (years); and
C = Conversion factor (hours/year).

Receptor exposure estimates to soil COCs through particulate inhalation is provided in Appendix A, Table A-5.

4.2.3.2.4 Indoor Air Inhalation Exposure – Groundwater COC Source

Indoor air exposure to volatile groundwater COCs is calculated from the product of the indoor air COC concentrations ($C_{indoorair-soil}$) and the MECP (MOE, 2011b) residential or commercial receptor prorating factors (PRF) obtained from MECP (MOE, 2011b) Table 2.31 and 2.32 as follows:

$$EC_{indoorair-soil} = C_{indoorair-soil} \times PRF$$ Equation 4-32

where:

$EC_{indoorair-soil}$ = Average indoor air COC exposure concentration (mg/m^3);
$C_{indoorair-soil}$ = Calculated indoor air COC concentration (mg/m^3); and
PRF = Residential or Commercial receptor prorating factor (unitless).

The residential PRFs provided in MECP (MOE, 2011b) are 0.96 (non-cancer residential indoor air prorating or NCRIAP), 1.0 (non-cancer residential indoor air developmental prorating or $NCRIAP_D$) and 0.90 (cancer residential indoor air prorating or CRIAP). The commercial PRFs provided in MECP (MOE, 2011b) are 0.28 (non-cancer industrial/commercial indoor air prorating or NCICIAP), 1.0 (non-cancer industrial/commercial indoor air developmental prorating or $NCICIAP_D$), and 0.28 (cancer industrial/commercial indoor air prorating or CICIAP). Residential and commercial receptor indoor air exposure estimates to volatile COCs originating from groundwater are provided in Appendix A, Table A-7 and Table A-8, respectively.

4.2.3.2.5 Trench Air Exposure to Volatile COCs in Soil and Groundwater

Trench air exposure to volatile surface soil, subsurface soil and groundwater COCs is calculated using the following equation with the modelled trench air COC concentrations (C_{tr-air}) and the MECP (MOE, 2011b) subsurface worker exposure factors as follows:

$$CEC_{tr-air} = \frac{C_{tr-air} \times EF_a \times EF_b \times EF_c \times ED}{AP_c \times C}$$ Equation 4-33

for non-carcinogenic COC, and for carcinogenic COC as follows:

$$NCEC_{ts-air} = \frac{C_{tr-air} \times EF_a \times EF_b \times EF_c \times ED}{AP_{nc} \times C}$$ Equation 4-34

where:

(N)CEC$_{tr-air}$ = Non-carcinogenic or carcinogenic COC exposure in trench air (mg/m^3);
C$_{tr-air}$ = Calculated trench air COC concentration from a soil or groundwater source (mg/m^3);
EF$_a$ = Exposure frequency (hours/day);
EF$_b$ =Exposure frequency (days/week);
EF$_c$ = Exposure frequency (weeks/year);
ED = Exposure duration (years);
AP$_c$ = Carcinogenic COC averaging period (= life expectancy) (years)
AP$_{nc}$ = Non-carcinogenic COC exposure averaging period (years);
C = Conversion factor (hours/yr).

Subsurface worker trench air exposure estimates to volatile COCs from soil and groundwater are provided in Appendix A, Table A-10 and Table A-13, respectively.

4.2.3.2.6 Outdoor Air Exposure to Volatile COCs in Soil and Groundwater

Outdoor air exposure to volatile surface soil and groundwater COCs is calculated using the following equation with the outdoor air COC concentrations (C_{OA}) and the MECP (MOE, 2011b) residential (equivalent to a Park Visitor), exposure factors as follows:

$$CEC_{OA} = \frac{C_{OA} \times EF_a \times EF_b \times EF_c \times ED}{AP_c \times C}$$ Equation 4-35

for non-carcinogenic COC, and for carcinogenic COC as follows:

$$NCEC_{OA} = \frac{C_{OA} \times EF_a \times EF_b \times EF_c \times ED}{AP_{nc} \times C}$$ Equation 4-36

where:

(N)CEC$_{OA}$ = Non-carcinogenic or carcinogenic COC exposure in outdoor air (mg/m^3);
C$_{OA}$ = Calculated outdoor air COC concentration from a soil or groundwater source (mg/m^3);
EF$_a$ = Exposure frequency (hours/day);
EF$_b$ =Exposure frequency (days/week);
EF$_c$ = Exposure frequency (weeks/year);
ED = Exposure duration (years);
AP$_c$ = Carcinogenic COC averaging period (= life expectancy) (years)

AP_{nc} = Non-carcinogenic COC exposure averaging period (years);
C = Conversion factor (hours/yr).

Park Visitors outdoor air exposure estimates to volatile COCs from soil and groundwater are provided in Appendix A, Table A-12.

4.2.3.2.7 Groundwater Ingestion Exposure

Average daily dose from groundwater COCs through incidental groundwater ingestion exposure is calculated using the following equations with the 1.2x maximum groundwater COC concentrations (C_{GW}) and the MECP (MOE, 2011b) Subsurface Worker exposure factors as follows:

for a carcinogenic COC,

$$NCDWEF = \frac{C_{GW} \times DW_{IR} \times RAF_{oral} \times EF_b \times EF_c \times ED}{BW \times AP_{nc} \times C}$$ Equation 4-37

and for a carcinogenic COC,

$$CDWEF = \frac{C_{GW} \times DW_{IR} \times RAF_{oral} \times EF_b \times EF_c \times ED}{BW \times AP_c \times C}$$ Equation 4-38

where:

NCDWEF = Average daily dose of a non-carcinogenic COC through incidental groundwater ingestion (mg/kg/day);
CDWEF = Lifetime average daily dose of a carcinogenic COC through incidental groundwater ingestion (mg/kg/day);
C_{GW} = Groundwater COC exposure point concentration (mg/L);
DW_{IR} = Incidental groundwater ingestion rate (L/day);
BW = Receptor body weight (kg);
ED = Exposure duration (years);
EF_b = Exposure frequency (days/week);
EF_c = Exposure frequency (weeks/year);
C = Conversion factor (days/year);
AP_c = Averaging time for carcinogens (years) (= life expectancy); and
AP_{nc} = Averaging time for non-carcinogens (exposure duration) (years).

Incidental ingestion exposure estimates from COCs in groundwater are provided in Appendix A, Table A-16.

4.2.3.2.8 Groundwater Dermal Contact

The concentration of the COC on the skin surface drives the diffusive transfer process through the skin. The transfer of a chemical substance through the skin can be described by two measurements:

- The lag-time (time taken from initial contact with the skin until the material enters the blood supply); and,
- The flux (the steady state diffusion rate of the material when the lag-time is complete).

The dermal adsorbed (DA) flux is measured in units of mass per unit area per contact event (mg/cm^2-event) (Equation 4-39). DA is directly proportional to the concentration gradient and the rate is regulated

by the chemical specific skin permeability constant (K_p). DA is calculated differently for inorganic compounds compared to organic compounds. DA is calculated for inorganic compounds as follows (US EPA, 2004b):

$$DA_{event} = K_p \times C_{GW} \times t_{event} \times CF \qquad \text{Equation 4-39}$$

where:

DA_{event} = Absorbed dose (mg.cm^{-2} per event);
K_p = Dermal permeability coefficient of compound in water (cm/hr);
t_{event} = Event duration (hr/event);
C_{GW} = Contaminant concentration in groundwater (µg/L); and
CF = Conversion factor (mg/µg multiplied by L/cm^3) = 1x10^{-6}
K_p values for inorganic COC were obtained from US EPA (2004b). Equation 4-39 was modified from US EPA, 2004b) to accommodate the event duration for dermal exposure.

Estimation of DA for organic compounds depends in part on whether the exposure event duration is longer than, or less than, the time required to reach a steady state transfer across the skin. The DA was estimated for organic compounds based on US EPA (2004b). The event duration (t_{event}) used in the groundwater dermal COC uptake calculations assumes a single daily 2 hour contact event. This duration assumes that the Subsurface Worker may be working with groundwater (e.g. installing and operating an excavation dewatering pump) and as a result, the worker would be wetted for a period of time until the workers gloves and clothing would dry passively. The groundwater dermal exposure period assumes a water contact and dry time of 2 hours per day.

The equation to calculate DA for a steady state ($t_{event} > 2.4\ \tau_{event}$) organic COC diffusion process is as follows (US EPA, 2004b, Eqn. 3.3):

$$DA = FA \times K_p \times C_{GW} \left[\frac{t_{event}}{1+B} + 2\tau_{event} \left(\frac{1+3B+3B^2}{(1+B)^2} \right) \right] \qquad \text{Equation 4-40}$$

where:

FA = fraction absorbed (unitless);
τ_{event} = Lag time per event (hr/event); and,
B = Ratio of permeability coefficient through stratum corneum relative to across the viable epidermis (unitless).

The fraction of COC absorbed is assumed to be 100% (FA=1) and is therefore conservative and does not account for desquamation loss of the COC or COC metabolization in the skin. Lag time (τ_{event}) is chemical specific (function of COC molecular weight) and calculated as follows (US EPA, 2004b Eqn. A.4):

$$\tau_{event} = \frac{l_{sc}^2}{6 \times \left[\frac{10^{(-2.80-0.0056 \times MW)}}{l_{sc}} \right]} \qquad \text{Equation 4-41}$$

Or it can be simplified to be

$$\tau_{event} = 0.105 \times 10^{(0.0056 x MW)}$$

where:

l_{sc} = Apparent stratum corneum thickness (10^{-3} cm from US EPA, 2004b)); and,
MW = COC molecular weight (g/mole).

The ratio of a COC permeability coefficient through stratum corneum relative to across the viable epidermis (B) is calculated as follows (US EPA, 2004b Eqn. A.1):

$$B = K_p \frac{\sqrt{MW}}{2.6}$$ Equation 4-42

For non-steady state conditions (t_{event} < 2.4 τ_{event}), DA for organic COCs is calculated from (US EPA, 2004b, Eqn. 3.2):

$$DA = 2FA \times K_p \times C_{GW} \sqrt{\frac{6\tau_{event} \times t_{event}}{\pi}}$$ Equation 4-43

For organic compounds, K_p is calculated from the COCs molecular weight (MW) and octanol-water partition coefficient (K_{ow}) as follows (US EPA, 2004b, modified from Eqn. 3.8):

$$K_p = 10^{(-2.80 + 0.66 \log K_{ow} - 0.0056 MW)}$$ Equation 4-44

A number of organic chemicals possess MW and K_{ow} that are beyond the effective prediction domain (EPD) of Equation 4-44. The COCs with MW and K_{ow} beyond the EPD are identified in Appendix A, Table 15 (noted as being calculated as steady or non-steady state "qualified"). In the absence of an alternative method of K_p estimation for these parameters, a preliminary estimate of K_p is obtained using Equation 4-44 (US EPA, 2004b). The permeability coefficients for a number of inorganics, such as mercury ($1X10^{-3}$), are provided in the US EPA document (US EPA, 2004b).

For carcinogenic COCs, daily dermal absorbed exposure dose is calculated as follows:

$$CGWDC = \frac{DA_{event} \times SSA \times EF_{event} \times EF_b \times EF_c \times ED}{BW \times AP_{NC} \times C}$$ Equation 4-45

and for non-carcinogens:

$$NCGWDC = \frac{DA_{event} \times SSA \times EF_{event} \times EF_b \times EF_c \times ED}{BW \times AP_C \times C}$$ Equation 4-46

where:

NCGWDC or CGWDC = Non-carcinogenic or carcinogenic chronic daily dermal absorbed from water exposure concentration (mg/kg/day);
DA_{event} = Absorbed dose from water (mg/cm^2 per day);
EF_{event} = Event frequency (events/day)

EF_b = Exposure frequency (days/year);
EF_c =Exposure frequency (weeks/year)
ED = Exposure duration (years);
SSA = Exposed skin surface area (cm^2);
BW = Receptor body weight (kg);
C = Conversion factor (days/year);
AP_c = Averaging time for carcinogens (years) (= life expectancy); and
AP_{nc} = Averaging time for non-carcinogens (exposure duration) (years).

SA represents the exposed skin surface area of 3400 cm^2 for adult industrial-commercial worker based on head, hands and forearms (MOE, 2011b). For developmental toxicants, SA represents the adult female surface area of 3090 cm^2 (MOE, 2011b) for equivalent body parts. Estimates of DA_{event} for chemical intakes through groundwater dermal contact are provided in Appendix A, Table A-15; whereas the groundwater dermal contact exposure estimates are provided in Appendix A, Table A-16.

4.2.4 Exposure Uncertainty

Characterization of Chemical Variability at the RA Property – Despite the number of soil samples collected and analyzed at a Site, soil samples represent small aliquots of material from a much larger volume of Site material. Additionally, groundwater quality varies both spatially and temporally. As a result, there is inherent uncertainty with regard to the chemical variability at the RA Property. The evaluations completed consist of multiple groundwater quality characterization events and soil quality investigations intended to both characterize hotspots and extents of COC impact. Based on the large area of the RA Property, the soil impact was not fully delineated laterally though the hotspots were likely identified based on historical information. As a result, it is considered that the available data adequately characterizes COC variability at the RA Property and suitably identifies maximum COC concentrations considering that the risk assessment was conducted by increasing the maximum measured COC concentrations by 20%.

Reasonable Maximum Exposure – The exposure assessment is based on 1.2x the maximum COC concentrations as a conservative approach for defining a reasonable maximum exposure concentration. Humans are rarely exposed to maximum Site COC concentrations and exposure is typically integrated over an exposure unit of the RA Property. As a result, exposure is considered to be potentially overestimated and not representative of long term average exposure due to the conservative risk assessment approach utilized in this assessment.

Receptor Exposure Characteristics – It is expected that receptors who may be exposed to COCs will exhibit variability in both their physical exposure factors (body weight, inhalation rate, ingestion rate, etc.) and the degree to which they interact with COC impacted media (length of time, etc.). The assumptions utilized in the exposure assessment are consistent with MECP (MOE 2011b) generic SCS assumptions, which are considered conservative. Therefore, it is anticipated that COC exposure may be overestimated.

4.3 Toxicity Assessment

The toxicity assessment is typically conducted in two stages: the hazard assessment and the dose response assessment. In the hazard assessment, the potential adverse human health effects due to exposure to the COCs are described. In the dose response assessment, quantitative information, which establishes a relationship between the magnitude of exposure and the potential for adverse health effects, is reviewed in order to select TRVs. For this RA, the TRVs selected by the MECP are used where available and are summarized in Appendix A, Table A-17

4.3.1 Nature of Toxicity (Hazard Assessment)

The potential adverse human health effects for each COC, including the potential carcinogenicity, are identified in Appendix A, Table A-17. All TRVs were obtained from MECP (MOECC, 2016a) with the exception of lead. There is a potential for some groups of chemicals to produce similar toxic effects. However, in general, there is not sufficient information in the literature to determine whether the result of exposure to mixtures of these chemicals may result in additive, synergistic, or antagonistic effects. Consistent with the derivation of the MECP SCS, exposure to aliphatic and aromatic subtractions comprising PHC F1 or PHC F2 are considered to result in additive effects. In the case of lead, the oral TRV used in the RA is based on a 1 point IQ decrement (such a decrease is only measurable at the population rather than the individual level); based on the rationale provided in Wilson and Richardson (2012), use of an HQ of 1.0 is acceptable for the assessment of lead contaminated soils. Therefore, an HQ of 1.0 was used for the assessment of soil consumption exposure to lead at the RA Property due to the rationale and methodology used in the derivation of the oral TRV (Wilson and Richardson, 2012).

4.3.2 Dose Response Assessment

Threshold chemicals are chemicals for which a safe level of exposure (one which does not produce adverse health effects when exposed daily over a lifetime) can be defined. Exposure to chemicals via ingestion is usually evaluated using a reference dose (RfD), while exposure via inhalation is evaluated using a reference concentration (RfC). The reference dose may be derived from a no observed adverse effect level (NOAEL), lowest observed adverse effect level (LOAEL), or a benchmark dose, with uncertainty factors generally applied to reflect limitations of the data used. The MECP requires that Site exposure not exceed 20% of the RfD or RfC (MOE, 2011). This allows the receptors to be exposed to contamination from other sources without potentially exceeding the RfD or RfC. For PHCs, the MECP uses an allowable fraction of 50% (MOE, 2011b). An allocation factor of 100% is applicable to lead, as discussed in Section 4.3.1. The following COCs are evaluated as threshold chemicals: toluene, xylenes, ethylbenzene, PHCs F1 – F3 fractions, styrene, PAHs consisting of acenaphthylene, fluoranthene, 1- and 2-methylnaphthalene, naphthalene, pyrene; metals consisting of antimony, arsenic, cadmium, copper, lead, zinc, and PCB.

Non-threshold chemicals are believed to present a risk of adverse health effects at any dose. In Canada, this class of chemicals is currently restricted to mutagens and genotoxic carcinogens. For chemicals considered carcinogenic, any dose is believed to present some risk and a slope factor, which represents the risk per unit dose of chemical, is derived by regulatory agencies. The relationship between the risk of adverse health effects and dose is termed an inhalation unit risk factor or, for ingestion, a slope factor. The MECP requires that an incremental lifetime cancer risk of 1×10^{-6} be used in risk assessments (MOE, 2011b). The following COCs are evaluated as non-threshold chemicals: benzene, trichloroethylene, vinyl chloride, PAHs consisting of acenaphthylene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[ghi]perylene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, indeno[1,2,3-cd]pyrene and pyrene.

The reference doses and reference concentrations for each of the COCs are summarized in Appendix A, Table A-17.

4.3.3 Toxicity Assessment Uncertainty

Toxicity reference values are developed on the basis of mammalian and/or human studies and incorporate uncertainty, safety or modifying factors in TRV development in order that the final TRV is considered conservative. The TRVs represent an estimate (with uncertainty spanning perhaps an order of

magnitude) of a daily oral exposure of a chemical to the human population (including sensitive subpopulations) that is likely to be without risk of deleterious non-cancer effects during a lifetime. The TRVs have been selected from MECP (MOE 2011b) which represent MECP Standards Development Branch-reviewed TRVs (MOE, 2011b p46) and are considered to represent the most toxicologically defensible TRVs for each compound. As such, the TRVs utilized in this risk assessment are considered to represent the best available or current science. The MECP evaluation is therefore expected to reduce TRV uncertainty as low as reasonably possible.

4.4 Risk Characterization

Risk characterization combines the results of the exposure assessment with those of the toxicity assessment to yield an evaluation of the potential human health effects associated with exposure to COCs in soil, soil particulates, indoor air, groundwater, trench air, and outdoor air at the RA Property. All risk characterization calculations are provided in Appendix A, Table A-18 to A-25.

4.4.1 Interpretation of Health Risks

Non-cancer hazards are evaluated by comparing the predicted exposure level to the reference dose (RfD) or reference concentration (RfC). The ratio, called the Hazard Quotient (HQ), is given by Equation 4.22:

$$HQ = \frac{DOSE}{RfD} or \frac{EC}{RfC}$$ Equation 4-47

where:

HQ = Hazard quotient (dimensionless);
DOSE = COC dose (e.g. ADD) calculated in Section 4.2.3.2 (mg/kg/day);
EC = COC inhalation exposure calculated in Section 4.2.3.2 (mg/m^3);
RfD = Reference dose - the dose believed not to cause an adverse effect by ingestion (mg/kg/day); and
RfC = Reference concentration - the concentration believed not to cause an adverse effect through inhalation (mg/m^3).

For each receptor and complete exposure pathway for non-carcinogenic COCs, the calculated HQ was compared to the MECP target HQ of 0.2 for non-carcinogens with the exception of PHCs which are compared to a target HQ of 0.5 (MOE, 2011b). Those exposure pathways exhibiting HQs below the MECP target values are considered to pose acceptable risk. If an exposure pathway yields an HQ in excess of the MECP target, risk management measures or further remediation are required to reduce the risk to acceptable levels.

Cancer risks would be evaluated for carcinogenic COCs using Equation 4.23:

$$ELCR = DOSE \times CSForEC \times IUR$$ Equation 4-48

where:

ELCR = Excess lifetime cancer risk (dimensionless)
DOSE = COC dose or exposure calculated in Section 4.2.3.2 (mg/kg/day)

IE = COC inhalation exposure calculated in Section 4.2.3.2 (mg/m^3)
CSF = Cancer slope factor $(mg/kg/day)^{-1}$
IUR = Inhalation unit risk $(mg/m^3)^{-1}$

Risks identified in relation to maximum COC concentration exposure for each of the pathway and receptor combinations are described in Section 4.4.2.

4.4.2 Quantitative Interpretation of Health Risks

Non-cancer health hazards were calculated based on intake assumptions previously outlined in this report. Intake parameters were selected in anticipation that the combination of all parameters would result in a conservative estimate of the reasonable maximum exposure that could be experienced by the modelled receptor for a particular exposure pathway. Health risks are assessed for each receptor-exposure pathway combination in the CSM.

Human Health Risks in Absence of Risk Management Measures

Risk estimates are summarized for Park Visitors, Long-term Outdoor Workers, Subsurface Workers, Off-Site Residents, and Off-Site Commercial Worker and provided in Appendix A, Table A-22 to A-25.

1.2X of the maximum measured COC concentrations in groundwater and soil present potentially unacceptable human health risks for the following exposure pathways:

- Park Visitor
  - Surface Soil Direct Contact (ingestion and dermal contact) – benzene, PHC F2-F3, PAHs (acenaphthylene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[ghi]perylene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, indeno[1,2,3-cd]pyrene, 1- and 2-Methylnaphthalene, pyrene), metals (antimony, arsenic, cadmium, copper, lead, and zinc)
  - Outdoor Air Inhalation from a Surface Soil Source – benzene
  - Outdoor Air Inhalation from Groundwater Source – None.
- Long-Term Outdoor Worker
  - Surface Soil Direct Contact (ingestion and dermal contact) – benzene, PAHs (acenaphthylene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[ghi]perylene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, indeno[1,2,3-cd]pyrene, and pyrene), metals (antimony, arsenic, cadmium, copper, lead, and zinc)
- Subsurface Worker
  - Surface Soil Direct Contact (ingestion and dermal contact and inhalation of particulates) – PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, and dibenz[a,h]anthracene) and metals (antimony, arsenic, cadmium, copper, lead, and zinc)
  - Subsurface Soil Direct Contact (ingestion and dermal contact and inhalation of particulates) – PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenz[a,h]anthracene, fluoranthene, indeno[1,2,3-cd]pyrene, and 1-2-methylnaphthalene), metals (arsenic and lead)
  - Trench Vapour Inhalation from a Surface Soil Source – benzene, toluene, xylenes, PHC F1 and F2, styrene, PAHs (acenaphthylene, naphthalene) and mercury
  - Trench Vapour Inhalation from a Subsurface Soil Source – benzene, ethylbenzene, xylenes, PHC F1 and F2, trichloroethylene, vinyl chloride, naphthalene, and mercury

- Trench Vapour Inhalation for a Groundwater Source: None.
- Incidental Direct Contact with Shallow Groundwater (ingestion and dermal contact) – Benzene, PHC F2 and F3, PAHs (acenaphthene, acenaphthylene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, indeno[1,2,3-cd]pyrene, naphthalene)

- Off-Site Residents
  - Soil Particulate Inhalation from a Surface and Subsurface Soil Source: None.
  - Indoor Air Inhalation of Volatile COCs from a Groundwater Source – benzene, toluene, ethylbenzene, xylenes, PHC F1 and F2, styrene, trichloroethylene, and vinyl chloride, PAHs (acenaphthene, acenaphthylene, fluorene, and naphthalene), and mercury

- Off-Site Commercial Office Worker
  - Soil Particulate Inhalation from a Surface and Subsurface Soil Source: None (using Off-Site Residents exposure as surrogate).
    Indoor Air Inhalation from a Groundwater Source – benzene

4.4.2.1 Development of Human Health Risk Based Concentrations (RBC)

The RBCs for groundwater and soil were developed to be protective of human health according to each of the assessed exposure scenarios. The objective of the current HHRA is to develop site-specific human health risk-based concentrations (RBC) based on the identified potential risks from all pathways evaluated on media basis.

Based on the results of the quantitative human health risk assessment, soil and groundwater RBCs for each COC and receptors/exposure pathway combination were identified as follows:

$$RBC_{x-y} = EPC_x \times \frac{T\arg etRisk_x}{CalculatedRisk_{x-y}}$$ Equation 4-49

where:

RBC_{x-y} = Human health RBC in soil or groundwater calculated for COC x and human receptor y (mg/kg or µg/L);

EPC_x = 1.2 x the maximum Site soil or groundwater concentration for COC x (mg/kg or µg/L);

Target $Risk_{x-y}$ = Target risk level for COC x (unitless); and

Calculated $Risk_{x-y}$ = Calculated risk level for chemical x and receptor y (unitless).

The RBC for soil derived from the dust inhalation pathway protective of off-Site Residents and Subsurface Workers was derived from exposure concentration of soil dust which is product of the concentration of PM_{10} [100 $\mu g_{soil}/m^3$] based on MECP and FPM_{inh} [0.6 unitless] (MOE, 2011b, Table 2.30).

$$EPC_{dust} = EPC_{Soil} \times PM_{10} \times FPM$$ Equation 4-50

$$RBC_{Soil} = \frac{EPC_{soil} \times PM_{10} \times FPM \times \frac{T\arg etRisk_x}{CalculatedRisk_{x-y}}}{PM_{10} \times FPM_{inh}}$$ Equation 4-51

$$RBC_{Soil} = EPC_{soil} \times \frac{T\arg etRisk_x}{CalculatedRisk_{x-y}}$$ Equation 4-52

Where,

RBC_{Soil} = Human health RBC in soil calculated for COC x and human receptor y (mg/kg);

EPC_{dust} = 1.2 x the maximum Site soil dust concentration for COC x (mg/m^3);

EPC_{soil} = 1.2 x the maximum Site soil dust concentration for COC x (mg/kg);

FPM_{inh} = Fraction of PM_{10} that is deposited in lungs

PM_{10} = Concentration in air of dust particles ≤ 10 µm in diameter

Target $Risk_{x-y}$ = Target risk level for COC x (unitless); and

Calculated $Risk_{x-y}$ = Calculated risk level for chemical x and receptor y (unitless).
Based on the Equation 4-50 to 4-52, RBC_{soil} was calculated directly based on exposure to soil COCs.

The indoor air based groundwater RBCs protective of COC inhalation applicable to Off-Site Residents and Off-Site Commercial Office Workers were calculated based on the indoor air RBC which was then converted to a groundwater RBC by dividing the indoor air RBC by the product of the groundwater to indoor air COC attenuation factor (0.02 for a residential building and 0.004 for a commercial building) and the COC Henry's Law Constant (chemical specific) shown as follows:

$$RBC_{GW} = \frac{RBC_{IA}}{\alpha \times H'}$$ Equation 4-53

where:

RBC_{GW} = Human health RBC calculated for groundwater COCs applicable to Off-Site Residents or Off-Site Commercial Office Workers (µg/L);

α = sub-slab vapour attenuation coefficient – residential (0.02) or commercial (0.004) (unitless); and,

RBC_{IA} = Human health RBC calculated for indoor air COCs applicable to Off-Site Residents or Off-Site Commercial Workers mg/m^3 = µg/L.

The outdoor air based soil and groundwater RBCs protective of COC inhalation applicable to Park Visitors is calculated from the outdoor air RBC, then converted to a soil or groundwater RBC by dividing the indoor air RBC by the volatilization factors previously calculated, shown as follows:

$$RBC_{GWorSoil} = \frac{RBC_{OA}}{VF}$$ Equation 4-54

where:

RBC_{OA} = Human health RBC calculated for outdoor air COCs applicable to Park Visitors through outdoor air inhalation (mg/m^3 = µg/L)

$RBC_{GW\ or\ Soil}$ = Human health RBC calculated for groundwater or soil COCs applicable to Park Visitors through outdoor air inhalation (mg/kg or µg/L);

VF = Volatization factor from groundwater (cm^3/cm^3 or unitless) or soil to ambient air (g/cm^3); and

The trench air based soil and groundwater RBCs protective of COC inhalation applicable to Subsurface Worker is calculated from the trench air RBC, then converted to a soil or groundwater RBC by dividing the trench air RBC by the volatilization factors previously calculated, shown as follows:

$$RBC_{GWorSoil} = \frac{RBC_{tr-air}}{VF}$$ Equation 4-55

where:

$RBC_{tr\text{-}air}$ = Human health RBC calculated for trench air COCs applicable to Subsurface Workers exposed through trench air inhalation (mg/m^3 = µg/L)

$RBC_{GW\ or\ Soil}$ = Human health RBC calculated for groundwater or soil COC applicable to Subsurface Workers through trench air inhalation (mg/kg or µg/L);

VF = volatization factor from groundwater (cm^3/cm^3 or unitless) or soil to trench air (kg/m^3).

The final RBC for each COC in surface soil is selected from the lowest of the RBCs calculated based on the pathway specific RBCs for incidental soil contact, soil to outdoor air, and inhalation of particulate pathways. The final RBC for surface soil is applicable and protective of Park Visitor, Long-Term Outdoor Worker, off-Site Resident, and off-Site Commercial Worker. For the exposure to subsurface soil for these four(4) receptor groups, only inhalation of soil particulates pathway arising from subsurface soil is operable and applicable to off-Site Resident and off-Site Commercial Worker, there was no potential unacceptable risk identified, and therefore no RBCs for subsurface soil were calculated. The surface soil RBCs are provided in Appendix A, Table A-26.

As shown in Section 4.2.3.2, the potential risk associated with the outdoor air inhalation exposure pathway is dependent on the calculated COPC volatilization factor from surface soil (or subsurface soil) to outdoor air, and the volatilization factor calculation is influenced by the input value for the dimensions and depth of soil impact. Due to the limited surface soil concentration dataset and resulting limitations in the horizontal and vertical delineation of benzene impacts in surface soil, factors used to calculate the potential risk to Park Visitors from exposure to benzene in surface soil via inhalation of outdoor air is based on the maximum surface soil benzene concentration identified in one (1) soil sample (SS-2 with benzene concentration of 141 µg/g at BH-19-17 at 0.8 to 1.4 m bgs) interpolated to be present over a large portion of the RA Property, and over the full depth interval of 1.5 m for surface soil. As such, the estimated potential risk is likely over estimated and the subsequent RBC (9.77 µg/g) is considered conservative. In order to refine the estimated potential outdoor air inhalation risk, the following RBCs are derived based on proposed RMMs (as described in Section 7.3.2):

- Option 1: no capping would be required, if a RBC of 9.77 µg/g is to be achieved as the maximum concentration in surface soil (≤ 1.5 m bgs) throughout the entire RA Property;
- Option 2: a 1.0 m cap would be required, if a RBC of 29.3 µg/g is to be achieved as the maximum concentration in surface soil (≤1.5 m bgs) throughout the entire RA Property; and
- Option 3: a minimum thickness 1.45 m cap would be required, if the currently identified benzene impact (x1.2) in surface soil (169 µg/g) is to remain in place.

The uncertainty associated with the outdoor air risk evaluation is further discussed in Section 4.4.6.

The RBCs for groundwater (along the property boundary) protective of inhalation of indoor air for off-Site Residents and Commercial Office Workers are provided in Appendix A, Table A-27.

The RBC for groundwater based on outdoor air inhalation for on-Site Park Visitors was not calculated as there were no potential risks identified.

The final RBC for each COC applicable to Subsurface Workers exposed to surface and subsurface soil was selected from the lowest RBC calculated for each exposure pathway (incidental direct contact with surface and subsurface soil and inhalation of particulates and vapour COC in trench air from a soil source). The final groundwater RBC applicable to Subsurface Workers was derived from the lowest RBC calculated for each applicable exposure pathway where potentially unacceptable risk was identified (incidental direct contact with groundwater). The Subsurface Worker RBCs applicable to soil and groundwater are provided in Appendix A, Table A-28.

4.4.2.2 Proposed Human Health Risk Management Measures

Risk management measures (RMMs) are presented in the Risk Management Plan (RMP) provided as Section 7 of the RA. Proposed RMMs to mitigate the human health risks identified above include:

- Localized remediation of benzene impact in surface soil (at BH-19-17).
- A fill cap (minimum 1 m thickness) or hard cap to mitigate direct exposure to soil and direct contact for Park Visitors and long term outdoor workers.
- If the identified benzene impact in surface soil (at BH-19-17) remains in place, a fill cap (minimum 1.5 m thickness) is required to mitigate indirect exposure to surface soil benzene via inhalation of outdoor air for Park Visitors.
- A soil management plan, health and safety plan and management and handling of contaminated groundwater plan to be implemented to mitigate risks from exposure to groundwater, surface soil or subsurface soil, including trench vapour inhalation for Subsurface Workers.
- An engineered groundwater mitigation system to mitigate risks to off-site residential and commercial properties through indoor air inhalation from a groundwater source.

Implementation of the soil management plan noted above will also restrict disturbance and relocation of remaining impacted subsurface soil when excavation occurs (as necessitated by the adoption of a stratified soil approach at the RA Property).

Given the assumptions and receptors considered in the RA, administrative controls also apply to the RA Property and are described further in Section 7.4. These include restrictions for groundwater use, buildings and growing of plants/vegetation for human consumption at the property as well as requirements for fencing during re-development work.

4.4.3 Qualitative Interpretation of Health Risks

COCs consisting of SAR, EC, and boron (HWS) in surface soil were not evaluated for human exposure as the SCSs for these COCs are based on protection of ecological receptors. Metals, with the exception of mercury, cyanide, and PHC F3 and F4, inhalation of indoor and outdoor air were not evaluated as these COCs are considered insufficiently volatile and do not pose potential health risks to receptors through inhalation of indoor/outdoor air. A number of PAHs (anthracene, benzo(g,h,i)perylene, fluorene, 1-,2-methylnaphthalene, and phenanthrene) do not have S-IA and S-OA component values identified by MECP. It is noted that soil direct contact (incidental ingestion and dermal contact) with PAHs is the main risk driver among the operable pathways used to develop the MECP standards (MOE, 2011b). The potential risk for on-site human receptors from the exposure to the above PAHs via inhalation of vapour is considered relatively minor compared to direct soil exposure. Therefore, these PAHs were not carried forward for quantitative assessment for the inhalation of indoor and outdoor air pathways. Soil n-hexane was not evaluated quantitatively with respect to incidental direct contact with soil for Park Visitors and Long-Term Outdoor Workers. Consistent with MECP's approach in development of the SCSs, n-hexane is not evaluated for ingestion (and dermal contact) exposures due to the lack of an available oral toxicological reference value.

4.4.4 Special Considerations

Neither the RA Property nor the surrounding area is considered environmentally sensitive and thus no special considerations are required.

4.4.5 Interpretation of Off-Site Health Risks

The RA Property was assessed as parkland property without any enclosed building present following redevelopment. Off-Site land use is not considered more sensitive (i.e. residential) and only indirect exposure to volatile groundwater COCs was evaluated for off-Site residents via inhalation of indoor air through groundwater migration off-Site.

Migration of groundwater COCs from the RA Property to off-Site properties is considered to represent the principal pathway of concern that may expose off-Site receptors to Site COCs. Given that close proximity between the off-Site residential/commercial buildings and the RA Property, the screening of the groundwater COCs based on GW2 was applied to identify the volatile groundwater COCs for the potential off-Site indoor air inhalation risk for off-Site receptors. To provide an additional line of evidence, soil vapour samples were also collected at four (4) locations along the RA Property boundary immediately upgradient from the off-Site residential/commercial buildings.

4.4.5.1 Soil Vapour

The depth of soil vapour sampling is 1.5 m bgs. Based on the shallowest depth of soil vapour sampling being within the hypothetical MECP (MOE 2011b) subslab gravel crush depth range, soil vapour screening criteria were calculated as follows:

- The soil vapour criteria were derived by dividing the MECP (MOECC, 2016a) residential health based indoor air criteria by generic residential and commercial sub-slab attenuation factor of 0.02 and 0.004, respectively.
- Measured soil vapour concentrations were then compared to the derived soil vapour criteria.

As shown in Table 5, for all chemicals, the maximum measured soil vapour concentrations do not exceed their respective residential and commercial soil vapour screening criteria with the exception of benzene,

ethylene dibromide, and hexachlorobutadiene. The maximum measured soil vapour benzene concentration of 83 µg/m^3 (SVP18-04 measured on October 22, 2018) exceeded the residential sub-slab vapour criteria of 25.3 µg/m^3 (residential land use Health Based Indoor Air Criteria adjusted with an attenuation factor of 0.02), which is also the same as the calculated risk-based soil vapour concentration. However, the maximum attenuated indoor air concentration based on the measured soil vapour concentrations is significantly lower than the maximum calculated indoor air concentration (9.32 x 10^4 µg/m^3) based on on-Site groundwater concentrations. Therefore, the previously estimated potential unacceptable risk based on the groundwater concentration of benzene were overestimated and conservative. The potential risk for off-Site Residents and off-Site Commercial Workers through indirect exposure to groundwater volatile COCs via inhalation of indoor air was further estimated based on the measure soil vapour concentrations and potential unacceptable risk were also identified. As such, the calculated risk-based soil vapour concentration was derived, and risk management measure was recommended, see detailed discussion in Section 7.

The maximum measured soil vapour concentrations of ethylene dibromide of 0.77µg/m^3 and hexachlorobutadiene of 5.3 µg/m^3 represent detection limits that exceeded the attenuated residential soil vapour concentrations, which were derived from residential land use Health Based Indoor Air Criteria provided in MECP MGRA model spreadsheet (MOECC, 2016a), using the residential attenuation factor of 0.02 (MOE, 2011b) to allow for direct comparison. The detection limit of ethylene dibromide also exceeded the attenuated commercial soil vapour criteria derived from commercial land use Health Based Indoor Air Criteria provided in MECP (MOECC, 2016a), using the commercial attenuation factor of 0.004 in this RA. It is noted that ethylene dibromide is a typical additive to gasoline and gasoline storage/handling is not a potentially contaminating activity at or adjacent to the property. As such, ethylene dibromide is not considered to be a COC for the RA Property. Ethylene dibromide was analyzed in groundwater samples and was not detected in all analyzed samples, and therefore was not considered a COC in groundwater and the elevated soil vapour ethylene dibromide RDL is therefore not considered a soil vapour COC. Hexachlorobutadiene was not analyzed in groundwater and not considered very soluble in water and it strongly binds to soil particles. Though the RDL for hexachlorobutadiene exceeded the attenuated residential soil vapour criteria from MECP MGRA model spreadsheet (MOECC, 2016a), it is considered unlikely the hexachlorobutadiene would migrate downgradient through groundwater and volatilize into enclosed basement space through vapour intrusion. As such, hexachlorobutadiene was not further assessed as an indoor air COC in this HHRA.

The HQs calculated using the measured soil vapour concentrations of benzene resulted in exceedance of targeted non-carcinogenic and carcinogenic risk limits for residential land use situation (Appendix A, Table A-29); therefore, soil vapour benzene exposure is considered to represent a potentially unacceptable risk to an off-Site resident. Risk management measures are recommended and provided Section 7.

4.4.6 Discussion of Uncertainty

4.4.6.1 Effect of Uncertainties in the Characterization of Chemical Variability at the RA Property

The site assessments completed consist of multiple groundwater quality characterization events conducted at the RA Property and soil quality investigations intended to both characterize hotspots and extents of COC impact. The extents of groundwater and soil impact are not considered fully delineated on the RA Property, although the assessment has been completed based on the maximum identified COC concentrations multiplied by 1.2, therefore the assessment has been conducted based on 120% of the observed maximum COC concentrations in part to account for limitations of COC characterization at the

RA Property. As a result, it is considered that the available data adequately characterizes COC variability at the RA Property and suitably identifies maximum COC concentrations.

4.4.6.2 Effect of Uncertainty in the Reasonable Maximum Exposure Estimate

The exposure assessment and the HH-RBCs are based on 1.2x the maximum COC concentrations. Humans are rarely exposed to maximum Site COC concentrations and exposure is typically integrated over an exposure unit of the RA Property. As a result, exposure is considered to be potentially overestimated and not representative of long term average exposure due to the conservative approach utilized in this assessment. The HH-RBC identified in this risk assessment is therefore unlikely to result in an unacceptable risk with risk management measures in place.

4.4.6.3 Effect of Uncertainty in the Off-Site Indoor Air Inhalation Exposure Evaluation

The residential indoor air inhalation modelling conservatively assumes that COC biodegradation does not occur based on the depth to groundwater at the hydraulic downgradient Site property limits in close proximity to the residences relative to the assumed depth of a residential basement. This assumption should not overestimate potential risk considering that, based on Site groundwater elevation observations, the soil vapour vertical transport distance would be significantly less than 1 m. There is the potential though that Site property limit groundwater quality in close proximity to the residences is not representative of groundwater quality below the residences since the residences are situated oblique to the direction of Site groundwater transport. As a result, residential indoor air inhalation risk may be over or under-estimated, depending on off-Site groundwater quality.

The screening of groundwater COCs based on the MECP GW2 component values was applied to identify the volatile groundwater COCs that may result in potential off-Site indoor air inhalation risks to off-Site residential and commercial receptors. This screening process is considered conservative as Site data were evaluated as opposed to data collected at off-Site areas.

4.4.6.4 Effect of Uncertainty in the Outdoor Air Inhalation Risk Evaluation

The maximum measured site concentration for benzene (141 µg/g at BH-19-17) in surface soil is significantly higher than the benzene concentrations measured in the rest of the soil samples. The, 95%UCLM concentration across the RA Property was calculated to be 25.44 µg/g, with the majority of the samples being below detection limits. As such, the use of 1.2x of the maximum measured concentration of benzene is considered very conservative and likely leads to the overestimation of potential outdoor air inhalation risk associated with benzene in surface soil. Furthermore, the vertical thickness of the benzene contamination zone in surface soil was assumed to be 1.5 m, as this benzene exceedance was not vertically delineated. The maximum measured benzene concentration in surface soil was measured at between 0.8 and 1.4 m bgs, while beyond this depth range, the benzene concentration in surface soil (≤1.5 mbgs) and subsurface soil (≥1.5 m bgs) at this location is unknown. As discussed earlier, horizontal delineation of surface soil benzene impact is also limited. As a conservative approach, the size of the entire RA Property was used to calculate the surface soil to outdoor air volatilization factor. In summary, outdoor air exposure risk is evaluated based on the 1.2x maximum benzene concentration applied to a depth range from ground surface to 1.5 m bgs across the entire RA Property. It is acknowledged that such approach likely leads to the overestimation of potential outdoor air inhalation risk. Additional horizontal and vertical delineation with respect to benzene in surface and subsurface soil would allow for further refinement of the potential outdoor air inhalation risk characterization. This refinement would permit modification of RMM recommendations which is anticipated to result in a potential cost reduction. Nonetheless, based on the available data set, the conservative risk evaluation is provided herein, and a

RMM (fill cap of minimum 1.5 m thickness) has been proposed in Section 7.3.2 to address the potential outdoor inhalation risk with the recommendation to further delineate the area of elevated benzene impact in the vicinity of BH-19-17 in order to limit the area where this RMM should apply.

4.4.6.5 Effect of Uncertainty in the Receptor Exposure Characteristics

It is expected that receptors who may be exposed to Site COCs will exhibit variability in both their physical exposure factors (body weight, inhalation rate, ingestion rate, etc.) and the degree to which they interact with COC impacted media (length of time, etc.). The assumptions utilized in the exposure assessment are consistent with MECP (MOE, 2011b) generic SCS assumptions, which are considered conservative. Therefore, it is anticipated that COC exposure may be overestimated.

4.4.6.6 Effect of Uncertainty in the Toxicity Reference Values

The TRVs have been selected from MECP (MOE, 2011b). They have been reviewed and accepted by MECP Standards Development Branch (MOE, 2011b p46) and are considered to represent the most toxicologically defensible TRVs for each compound. As such, the TRVs utilized in this risk assessment are considered to represent the best available or current science. The MECP evaluation is therefore expected to reduce TRV uncertainty as low as reasonably possible.

5 Ecological Risk Assessment (ERA)

5.1 Problem Formulation

The problem formulation represents the first step in the ecological risk assessment (ERA) process. This step comprises the identification of the COCs, the current and proposed use of the RA Property, and the receptors that may be exposed to the COCs (the valued ecosystem components (VECs). The conceptual risk model is developed during the problem formulation stage.

5.1.1 Ecological Conceptual Site Model

The RA Property is currently a City owned urban park. Current surrounding land use in the immediate vicinity of the RA Property is residential to the south, east and west; is commercial to the north and northeast. The nearest surface water body is located 560 m north of the RA Property.

The RA Property has an irregular shape, measuring approximately 26,250 m^2 (2.6 ha) in area, and consists of open grassed areas with some paved pedestrian pathways. The northern part of the RA Property predominantly consists of an open grassed area. The western portion of the RA Property slopes down to the east, and the eastern portion of the RA Property slopes down to the west, with an overall decrease in elevation from south to north. The regional direction of local shallow groundwater flow is towards Hamilton Harbour (Lake Ontario), located approximately 560 m north of the RA Property. Surface drainage infiltrates through the grassed ground surface or is directed to one of the several catch basins throughout the park.

Possible ecological receptors on and in the vicinity of the RA Property include plants, soil invertebrates, mammals and avian species. Mammals and avian species may be exposed to COCs in surface soil through incidental soil ingestion and ingestion of impacted food items. Soil invertebrates may be exposed to surface soil COCs through direct contact, including ingestion. Terrestrial plants may be exposed to surface soil COCs through direct root contact and root uptake. Aquatic receptors in the downgradient off-Site water body – Lake Ontario could also be exposed to the COCs via leaching from soil to groundwater and migration of groundwater to surface water; however, the potential exposure is considered minimal given the separation distance is 560 m between the RA Property and Lake Ontario.

A search of the National Heritage Information Center (NHIC) online database was conducted to identify species at risk (SAR) within a 1 km^2 area which includes the RA Property. The NHIC database identified the five (5) species as endangered or threatened within approximately 1 km of the RA Property. Species for which the most recent observed date is later than 30 years ago and the species at risk status in Ontario (SARO) designated as “threatened” and “endangered” were considered. Since there is no surface water body located at the RA Property, aquatic species are not considered.

Table 5.1 Provincial Species at Risk Potentially Present at the RA Property

Scientific Name	Common Name	Taxonomic Group	Provincial Rank (S-Rank)	SARO Status	Date Last Observed
Uvularia perfoliata	Perfoliate Bellwort	Plant	S1S2	NA	1962/05/14
Chimaphila maculata	Spotted Wintergreen	Plant	S2	Endangered	1886/07/01

Scientific Name	Common Name	Taxonomic Group	Provincial Rank (S-Rank)	SARO Status	Date Last Observed
Colinus virginianus	Northern Bobwhite	Bird	S1	Endangered	1904
Falco peregrinus	Peregrine Falcon	Bird	S3B	Special Concern	2008/07/09
Sphodros niger	Black Purseweb Spider	Arthropod	S3	NA	2012/05/24
Nicrophorus americanus	American Burying Beetle	Arthropod	SH	Extirpated	1970
Hirundo rustica	Barn Swallow	Bird	S4B	Threatened	2017/05/28

SARO Species at Risk in Ontario per O.Reg.230/08.
S1 Extremely rare in Ontario; usually 5 or fewer occurrences in the province or very few remaining individuals; often especially vulnerable to extirpation.
S2 Very rare in Ontario; usually between 5 and 20 occurrences in the province or with many individuals in fewer occurrences; often susceptible to extirpation.
S3 Rare to uncommon in Ontario; usually between 20 and 100 occurrences in the province; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.
S4 Common and apparently secure in Ontario; usually with more than 100 occurrences in the province.
SH Historically known from Ontario, but not verified recently (typically not recorded in the province in the last 20 years); however suitable habitat is thought to be still present in the province and there is reasonable expectation that the species may be rediscovered.
B Breeding migrants/vagrants.

Based on the last observed date recorded and the SARO status, only the Barn Swallow is considered SAR for the current RA Property. They build mud nests under the eaves of barns and stables, on structures near playing fields, or under bridges. There is currently a small maintenance building at the RA Property. As such, Barn Swallows are potentially present at the RA Property. It is recommended that a species at risk survey with the focus on Barn Swallows be conducted prior to the redevelopment of the park. If Barn Swallows are identified to be present at the park, specific measures should be implemented in order to protect Barn Swallows and its habitat.

No provincial parks or conservation reserves, life science or earth science areas of natural and scientific interest (ANSIs) or provincially-significant wetlands were identified within 1 km in radius of the RA Property.

According to the City's official plan, no environmentally significant lands are located within the 1km in radius from the RA Property. Also, the area of 1km in radius from the RA Property is not located within an area designated as an escarpment natural area or an escarpment protection area by the Niagara Escarpment Plan, or within an area designated as a natural core area or natural linkage area by the Oak Ridges Moraine Conservation Plan.

The COCs in subsurface soil are present at a depth of 1.5 m or more and exposure of all on-Site VECs to the COCs via inhalation, direct contact, and ingestion would be incomplete provided that subsurface soil is not brought to the ground surface (the stratified soil approach is a risk management measure further described in Section 7). Mammalian and avian receptors are not expected to directly contact subsurface soil (> 1.5 m bgs) consistent with assumptions provided in MECP rationale guidance document (MOE, 2011b) As such, the ERA is limited to an assessment of risk to terrestrial receptors from exposure to surface soil.

5.1.2 Secondary Screening of COCs for Ecological Health

5.1.2.1 Surface Soil

The following parameters do not have soil direct contact component values for plant & soil organism or mammals & birds for screening against ecological component values:

- No plant & soil organism or mammals & birds component values ecological component values: hexane (n), acenaphthylene, dibenzo(a,h)anthracene, fluorene, and 1,2-methylnaphthalene;
- No plant & soil organism component values: acenaphthene, pyrene; and,
- No mammals & birds component values: PHC F1-F4, styrene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, and indeno[1,2,3-cd]pyrene.

EC, SAR, and boron (HWS) are only relevant to plant toxicity and therefore were not carried forward for further evaluation for the protection of mammals and birds. As such, EC, SAR, and boron (HWS) were carried forward only for quantitative assessment for the protection of plants.

Hexane (n) does not have an available ecological component value from the MECP. A soil and food ingestion pathway guideline is available for the protection of mammals and birds from CCME, and the 1.2x maximum concentration of 6.7 µg/g hexane (n) is below the CCME ecological soil and food ingestion guideline. As a result, hexane (n) was not carried forward for quantitative assessment for the protection of mammals and birds. A plant and soil organism component value is not available for hexane (n), therefore risk to plants and soil organisms from hexane (n) exposure is not evaluated in the ERA, although it is noted that an unpublished study indicated 0% earthworm mortality at a hexane(n) exposure concentration of 210 µg/g (CCME, 2011). The 1.2x maximum concentration of hexane (n) at the RA Property is 6.7 µg/g and below the previously identified no observed effects level, therefore acute toxicity experienced by soil invertebrates may be considered unlikely.

There are no component values protective of mammals and birds for PHC F1-F4. As such, PHCs F1-F4 were not carried forward for quantitative assessment for the protection of mammals and birds. The potential health risk to PHCs F1-F4 for mammals and birds cannot be evaluated and remains an uncertainty in this RA.

There is no component value protective of mammals and birds for styrene from MECP. Styrene is a derivative of benzene structurally. As such, the mammals and birds component value for benzene was used for styrene. The 1.2x maximum concentration of styrene was below the mammals and birds component value for benzene, as such, styrene was not carried forward for further evaluation for the protection of mammals and birds. However, it was carried forward for further evaluation for the protection of plants and soil organisms.

CCME Canadian Soil Quality Guidelines (CCME, 2010) were used to identify the available pathway criteria for the above PAHs. As such, soil and food ingestion pathway criteria protective of mammals and birds were used for benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, and fluorene. In addition, US EPA Ecological Soil Screening Levels (Eco-SSL) derived for low molecular weight (LMW) (i.e., three rings or less) and high molecular weight (HMW) (i.e., four rings or more) PAHs for soil invertebrates and mammalian wildlife (US EPA, 2007) were also used as the component values for the additional PAHs that do not have the ecological component values from MECP. Based on the number of rings of the PAHs, acenaphthene and acenaphthylene fluorene, and 1,2-methylnaphthalene

are LMW-PAHs, whereas dibenzo(a,h)anthracene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, pyrene, and indeno[1,2,3-cd]pyrene are LMW-PAHs. Eco-SSLs protective of soil invertebrates for LMW and HWM are 29 and 18 µg/g (dry weight), respectively. Eco-SSLs protective of mammals for LWM and HWM are 100 and 1.1 µg/g, respectively. No Eco-SSLs available for plants or birds.

There is a potential for leaching of COCs to groundwater and migration of groundwater to off-Site surface water where aquatic receptors may be exposed to the COCs via ingestion and direct contact (refer to Table 5.3). The potential risk for downgradient aquatic receptors from the indirect exposure to COCs in soil leaching into groundwater was not evaluated using S-GW3 component values, instead, COCs in groundwater were directly used to compare to GW3 component values as discussed in the section below.

The ministry has developed a “modified ecological protection (MEP)” option, which is intended to promote brownfield redevelopment and preserve existing and potential future ecological habitat. MEP is a greener alternative to completely removing ecological habitat to ensure no ecological species are present or exposed to contamination. Based on the current site condition of the RA Property, there are existing vegetation present at the RA Property such as trees, it is determined that MEP is appropriate for use at the RA Property in order to preserve the existing habitat where vegetation are present. As such, for the secondary screening of COCs at the RA Property, the maximum soil concentration were compared to 1.9x the plant and soil organism component value, and to 1000x of the mammals and birds component values.

The surface soil COCs that have been retained for further quantitative assessment are listed in Table 15.

5.1.2.2 Groundwater

The COCs in groundwater are present at a depth of 1.7 m or more and exposure of all on-Site VECs to the COCs via, direct contact, and ingestion would be incomplete provided that groundwater is not exposed during subsurface work. Consistent with MECP (MOE, 2011b), the ecological direct contact pathway is considered incomplete at depths in excess of 1.5 m, therefore direct contact exposure to groundwater is not evaluated in the ERA. The assessment of potential risk from exposure to groundwater COCs is limited to hydraulic downgradient aquatic receptors via migration of groundwater to off-Site surface water.

The COCs in both shallow and deep groundwater were compared to site specific GW3 component value based on the distance of 560m between the RA property and the closest surface water body (i.e., Lake Ontario). For shallow groundwater, PHC F2, acenaphthylene, and anthracene exceeded the site specific GW3 and therefore were carried forward for further evaluation for aquatic life. For deep groundwater, PHC F2 exceeded the site specific GW3 and therefore was carried forward for further evaluation for aquatic life.

There are not GW3 component values available for PHC F3 and F4 as they are considered low solubility and strongly bound to solid particles. Therefore, they are not carried forward for further evaluation.

The shallow and deep groundwater COCs that have been retained for further quantitative assessment are listed in Table 16 and Table 17, respectively.

The ecological conceptual Site model is presented in Appendix B.

5.1.3 Risk Assessment Objectives

The objectives of the ERA are to:

- Evaluate the risks to the VECs associated with exposure to the impacted soil and groundwater;
- Calculate RBCs protective of the VECs; and
- Develop a risk management plan protective of the VECs.

Proposed Use of Subject Property: The RA Property will be used for parkland purposes and it is assumed that no buildings will be constructed at the park. It is understood that the parkland property will include community vegetable gardens, proposed to be constructed on a raised bed and provide habitat for specific VECs. Raised bed soil or growing material should not be in contact with surface soil at the RA Property and growing material should be sourced from commercial or otherwise approved suppliers. Soil at the RA Property should not be used in raised beds.

Receptors and Exposure Pathways to be assessed by the ERA: In the absence of risk management measures with the exception of applying MEP, complete exposure pathways exist for the following receptors:

Site Plants and soil invertebrates – these receptors may be in direct contact with impacted surface soil.

Off-Site aquatic receptors – these receptors may be in contact with the COCs as a result of migration of groundwater from the RA Property.

Degree of Protection: The assessment endpoints will consist of survival, growth and reproduction (in addition to physical appearance for plants, where applicable) and will be quantified based on measurement endpoints consistent with the MECP (MOE 2011b) ecological TRVs. For plants and invertebrates, the MECP measurement endpoints generally consist of the 25th percentile of the ranked effects data for each COC or alternatively the lowest observed effect concentration or median effects level. For off-Site aquatic life, the MECP measurement endpoints typically represent lowest observable effects levels based on the MECP (MOE 2011a) aquatic protection values.

Qualitative or Quantitative Assessment of Risk: Both qualitative and quantitative approaches are used in the ERA. Exposures are quantified in Section 5.3. Prior to the exposure assessment, the COCs are secondarily screened to identify the exposure pathways requiring further evaluation.

Secondary Screening of COCs: The identified COCs are screened in the ERA by comparison of maximum measured Site concentrations plus 20% with the components of the SCSs protective of ecological receptors, as discussed in detail above. This screening process eliminates the need to quantify exposures to some COCs via certain exposure pathways. Tables 5.2 and 5.3 present the maximum measured concentrations of each COC retained after primary screening in soil and groundwater, respectively, compared with the ecological components of the SCSs. The results of this comparison are summarized below.

Surface Soil - Exposure to EC, SAR, and boron (HWS) are evaluated only for plants and soil invertebrates. Exposure to cyanide (WAD) is evaluated for plants and soil invertebrates. Metals such antimony, arsenic, cadmium, copper, lead, zinc are evaluated for plants and soil invertebrates. For volatiles, benzene, xylenes, styrene, and PHC F1-F4 are evaluated for plants and soil invertebrates.

Subsurface Soil – As discussed in the Section of Secondary Screening of COCs above, on-site terrestrial ecological receptors would not come in direct contact with subsurface soil. The exposure for downgradient off-Site aquatic life was evaluated based on the comparison between groundwater COCs and GW3 component values.

Groundwater – As discussed in the Section of Secondary Screening of COCs above, site specific GW3 were calculated based on the distance of 560 m between the RA property boundary and the closest surface water body (i.e., Lake Ontario). PHC F2 fraction, acenaphthylene and anthracene are the COC for which the 1.2x maximum measured concentration exceeds the component for protection of aquatic receptors via migration of groundwater to surface water (GW3) for shallow groundwater condition (< 3 m bgs); PHC F2 is the only COC with 1.2 x maximum concentration exceeded the site specific GW3 component value based on deep groundwater scenario.

Type of Approach Used for the ERA: This report follows the general format for risk assessments specified in O. Reg. 153/04 Schedule C, as amended. The risk assessment uses the calculations based on formulas available in MOE rationale guidance; for formulas that are not available in MOE rationale guidance, US EPA RA guidance is also used, as described in Section 4.2. The RA utilizes the MOE's MGRA model (MOE, 2011c) to complete off-Site exposure calculations and to derive site specific GW3 component values and RBCs, and for calculations using Modified Ecological Protection (MEP).

Sufficiency of Data and Associated Uncertainty:

The RA is based on data collected during all studies completed between 2013 and 2018 at the RA Property. The 2018 supplemental Phase II ESA was conducted to support investigations carried out between 2013 and 2017, during which samples of soil, groundwater and soil vapour were submitted for analysis. The Phase II ESA investigated the APECs and PCOCs identified in the Phase I ESA. In general, the results of this investigation were consistent with the findings of the previous investigations completed at the RA Property. As such, the sampling program on which this RA is based is considered to adequately characterize the RA Property. Maximum concentrations of COCs are identified in Section 5.1.2 and delineation of COCs are discussed in Section 3.

In general, samples were collected and handled in accordance with recommended sampling protocols (MOE, 2011b). The QA/QC programs implemented during soil and groundwater sampling activities completed during previous investigations are considered suitable. As part of the QA/QC programs, sampling protocols included minimizing sample handling, submitting field QA/QC samples using dedicated non-contaminating sampling equipment, using sample specific identification and labelling procedures and using chain of custody records. Field QC samples included blind field duplicate soil samples, blind duplicate groundwater samples, blind field blank water samples prepared using de-ionized water supplied by the laboratory and trip blank water samples prepared by the laboratory. Laboratory QA/QC measures included analysis of laboratory blank, spiked blank, duplicate and matrix spike samples. The data available are considered sufficient to meet the stated objectives of the ERA: to evaluate the risks to the VECs associated with the identified COCs in soil and groundwater and to determine whether risk management measures are required.

5.1.4 Receptor Characterization

Receptors requiring evaluation in the ERA would consist of those considered to be valued ecosystem components (VEC). Special consideration should be given to species which are considered threatened or endangered. The CCME (1996) provides the following guidance for identification of VECs.

VECs are resources or environmental features that:

- Are important to human populations;
- Have economic and/or social significance;
- Have intrinsic ecological significance; and/or
- Serve as a baseline from which impacts of development can be evaluated, including changes in management or regulatory policies.

Additional VEC selection decision criteria may also be considered to consist of the following:

- Indigenous to the area and would be potentially exposed to the RA Property contaminants;
- Most likely to receive the greatest exposure to contaminants due to their habitat, behavioral traits, and home range;
- Representative of various levels in the trophic web (e.g., carnivore, herbivore, insectivore); and
- Potentially at risk because they have been classified as being rare or endangered.

VECs at the RA Property include those receptors which have an intrinsic, economic or social value and include both on-Site terrestrial and off-Site aquatic organisms.

5.1.5 Ecological Receptors

A receptor of concern (ROC) is any non-human individual, species, population, community, habitat or ecosystem that is potentially exposed to the RA Property COCs (FCSAP, 2012a). As no MEP adjusted surface soil COC concentrations exceeded the MECP (MOE 2011b) mammal and bird component value concentrations (Table 27), the soil ERA is restricted to evaluation of risk to soil invertebrates and terrestrial plants. Additionally, shallow and deep groundwater possess COC concentrations exceeding the aquatic life protection component values and surface water is present approximately 560 m from the RA Property. As a result, the receptors to be evaluated in the ERA consist of the following:

- Terrestrial plants and soil invertebrates; and
- Freshwater aquatic life (e.g. algae, macrophytes, invertebrates and fish).

The available receptor information is discussed below.

5.1.5.1 Terrestrial Plants

Primary producers provide a critical food source and are the first link in the terrestrial food chain for higher trophic level consumers. In addition, vegetation provides habitat for wildlife. Terrestrial vegetation receptors that are included in this ERA include generic terrestrial plant categories such as grasses, shrubs and trees and crops, since there is a general lack of species-specific toxicity data. The selection of generic receptors is a typical assumption in ERAs. The MECP (MOE, 2005), for example, indicates that receptors may be described as a group rather than individual species.

5.1.5.2 Soil Invertebrates

Earthworms (i.e. *Eisenia foetida*) are plentiful in surface soil and one of the more important organisms responsible for the breakdown of organic litter material in soil. As decomposers/detritivores, they play a critical role in nutrient cycling. They also aid in soil aeration and infiltration by increasing macro and micro porosity. These organisms have wet surface membranes and are in contact with soil and ingest soil. They are therefore directly exposed to COCs. Their close relationship with soil makes them an important link between potentially impacted Sites and other wildlife species. Earthworms represent a valuable food

source for a variety of higher trophic level animals and, therefore, function to transfer COCs. In this ERA, surface soil COCs are not considered capable of biomagnification and therefore trophic transfer is not considered to require evaluation.

5.1.5.3 Measurement Receptors for Off-Site Surface Water Exposure

Aquatic habitat present approximately 560 m north of the RA Property, consisting of Hamilton Harbour. Hamilton Harbour is designated as a Great Lakes Area of Concern (AOC) through the U.S.-Canada Great Lakes Water Quality Agreement (Annex 1 of the 2012 Protocol) because available data indicate that water quality and environmental health in the Harbour are considered severely degraded as a result of human activities at the local level. As a result, the ERA will evaluate risk to aquatic life (as a community) from potential groundwater transport of Site COCs to surface water, but risk to higher forms of life (mammals and birds) will not be evaluated. The reason for this limitation is that certain life stages of aquatic life, or sessile organisms, may be exposed at the point of discharge of groundwater to surface water, but higher forms of life are more mobile and integrate exposure over a potentially wide area. This wider area could encompass other contaminated areas within the Hamilton Harbour.

Off-Site aquatic VECs consist of aquatic life, including fish, plants and invertebrates. These organisms either spend their entire lifecycle in contact with surface water, or in the case of emergent insects, a significant portion of their lifecycle and developmental period in contact with surface water and are therefore considered most at risk to COC effects. Aquatic receptors may be exposed to groundwater COCs in water, sediments, and sediment pore water following partitioning across cellular membranes (i.e. plant cell walls, gill membranes), ingestion of sediments, and consumption of contaminated prey. The off-Site surface water body evaluated in the ERA is located 560 m from the RA property. Therefore sediment (i.e. soil runoff from the RA Property) exposure risk analysis is not required. The plant, fish and benthic community of the surface water body in the potential groundwater discharge zone is not known in detail, although it is anticipated that all communities are present.

- Fish - Fish represent valued ecological components based on both social importance (recreational fishing) and ecological significance as a component of the aquatic food web. Fish may be exposed to COCs in surface water through uptake across gill membranes, or porewater across egg membranes during developmental periods. Fish are mobile and may integrate exposure over a wide area, including areas which may not be influenced by the RA Property.
- Aquatic Plants - Primary producers provide a critical food source and are the first link in the aquatic food chain for higher trophic level consumers. In addition, vegetation provides habitat for wildlife. Aquatic plants may uptake groundwater COCs through uptake across cell membranes from sediment pore water and in surface water. Aquatic plants are evaluated as a community in a similar manner as terrestrial plants in this ERA.
- Aquatic Invertebrates - The benthic community (molluscs, crustaceans, insects, etc.) represents a diverse and important food source for birds, fish, and other benthic and epibenthic invertebrates. The benthic community is potentially exposed to groundwater COCs through pore water and surface water contact and diffusion across gill membrane tissue.

5.1.5.4 Measurement Receptor Summary

Selected measurement receptors and the feeding/foraging guilds they are intended to protect are summarized below.

Table 5.2 Selected ERA Measurement Receptors

Community/Guild	Measurement Receptor
On-Site	
Soil Invertebrates (Terrestrial Community)	Non-specific invertebrates
Terrestrial Plants (Terrestrial Community)	Grass, shrubs, etc. (non-specific)
Off-Site	
Aquatic Life (Aquatic Community)	Aquatic Invertebrates, plants, fish

5.2 Exposure Assessment

The exposure assessment stage of the ERA involves the identification of exposure point concentrations for each COC and the estimation of intake or exposure experienced by the measurement receptors evaluated in the ERA. This assessment is conducted for all COC, receptors and exposure pathway combinations that are considered complete in the problem formulation stage of the ERA.

The principal steps of the exposure assessment consist of the following:

- Characterization/estimation of media exposure point concentrations: The concentrations of all COCs are determined through direct measurement or estimation in each media identified in the CSM of the problem formulation. As part of this step of the evaluation process, transport modeling may be required to identify exposure point concentrations (EPC) where exposure is indirect. Portions of this step are conducted in parallel with the exposure estimation step;
- Receptor characterization: Physical and behavioral characteristics of ecological receptors that influence intake rates (e.g. body weight, foraging range, media intake rates, hibernation/migration behavior, etc.) are identified; and,
- Exposure estimation: The exposure dose or media exposure is calculated for each receptor, chemical and exposure route.

For soil or freshwater community measurement receptors, the exposure level is equal to EPC for COC in these media, respectively. For mammal and avian receptors, the estimated exposure level is the estimated COC intake considering all significant exposure pathways, estimated as an average daily dose. These different exposure level estimates are used because TRVs (the measure of effect) for receptors in contact with soil, freshwater and sediment are based on the COC concentration in the medium, whereas TRVs for a mammalian or avian measurement receptor are often reported in terms of daily doses ingested (US EPA, 1999).

5.2.1 Pathway Analysis

The exposure assessment will evaluate the following exposure pathways and receptors:

- Direct contact with impacted surface soil by vegetation and soil invertebrates; and
- Direct contact exposure (ingestion, uptake across cell membranes) to aquatic life with impacted surface water due to migration of groundwater.

The shallowest depth to groundwater at the RA Property exceeds rooting and animal burrowing depths (1.5 m based on the ecological direct contact depth applicable in MOE, 2011b). Therefore, groundwater exposure to plants, invertebrates, mammals and avian receptors is considered incomplete. Although

receptors may be exposed to volatile COCs present in subsurface soil and groundwater following transport to ambient air, this route of exposure is considered insignificant and will not be evaluated in the ERA. In this ERA, groundwater and soil COCs are not considered capable of biomagnification (i.e. COCs do not represent high molecular weight halogenated organic compounds or organometallic compounds), therefore trophic transfer is not evaluated in the ERA.

5.2.2 Exposure Point Concentrations

The maximum measured concentrations of COCs in surface soil (Table 1), subsurface soil (Table 2), deep groundwater (Table 3), and shallow groundwater (Table 4) were used as exposure point concentrations for exposure pathways relating to direct contact and as source concentrations for indirect contact COC EPCs following fate and transport processes.

5.2.2.1 Terrestrial Plant and Soil Invertebrate Exposure Point Concentrations

The maximum surface soil COC concentrations represent the direct contact EPCs applicable to the terrestrial plant and soil invertebrate exposure analysis. EPCs are provided in Appendix B, Table B-1.

5.2.2.2 Exposure Point Concentrations in Off-Site Surface Water

Off-Site surface water EPCs were calculated based on a shallow and deep groundwater COC source following transport to surface water. RA Property groundwater COC concentrations modelled for transport to the off-Site surface water body are summarized in Appendix B, Table B-2 and represent 120% of the maximum RA Property groundwater COC concentrations.

Calculation of Surface Water Exposure Point Concentrations

Surface water EPC concentrations of COC were calculated from groundwater transport dilution factors developed using the Domenico and Robbins (1985) approximate 3-D analytical model assuming no vertical dispersion (therefore in effect the modelling is 2-D). This transport model is applied by the CCME (2006) and the MECP (MOE, 2011a) to calculate generic guideline dilution factors (CCME DF4 component) when setting certain guidelines or check values and is used by the MECP to identify the GW3 standards. The form of the transport equation utilized by the MECP and CCME (CCME, 2008) differ slightly in that there is no complimentary error function x direction term in the MECP equation and the decay constant is calculated differently by both agencies. The form of equation used in the ERA is the steady state model assuming an infinite source and first order COC decay (where applicable) presented in MECP (MOE, 2011a). The groundwater transport dilution factor (DF_{GW}) is calculated using the following equations (CCME, 2006):

$$DF_{GW} = \frac{4}{\exp(A) \times erfc(B) \times \left[erf(C) - erf(D)\right]}$$ Equation 5-1

where:

DF_{GW} = The groundwater transport dilution factor (dim);

exp = Exponential function;

erf = The error function; and

erfc = The complimentary error function.

A, B, C and D are dimensionless groups calculated as follows below:

$$A = \frac{x}{2D_x}\left\{1-\left(1+\frac{4L_sD_x}{v}\right)^{0.5}\right\}$$ Equation 5-2

$$B = \frac{x - vt\left(1+\frac{4L_sD_x}{v}\right)^{0.5}}{2\left(D_x vt\right)^{0.5}}$$ Equation 5-3

$$C = \frac{y+\frac{Y}{2}}{2\left(D_y x\right)^{0.5}}$$ Equation 5-4

$$D = \frac{y-\frac{Y}{2}}{2\left(D_y x\right)^{0.5}}$$ Equation 5-5

where:

x = Distance to source (m);

D_x = Dispersivity in the direction of groundwater flow;

D_y = Dispersivity perpendicular to the direction of groundwater flow;

Y = Source width (m);

y = Distance to receptor perpendicular to groundwater flow (m);

t = Time since contaminant release;

Ls = COC decay constant (yr^{-1}) and is calculated from (MOECC, 2016a):

$$Ls = \frac{0.693}{t_{0.5}}$$ Equation 5-6

MECP and CCME (e.g. CCME, 2008 p 143) incorporate different methods to calculate the saturated zone COC decay constant (Ls). The MECP method (MOE, 2011a equation 7.20 p331) has been used in this ERA.

where:

$t_{0.5}$ = COPEC half-life in saturated zone (yrs).

COC velocity (v) in groundwater during transport is calculated from:

$$v = \frac{V}{\theta_e R_s}$$ Equation 5-7

where:

V = Darcy velocity in groundwater (m/yr) = (K x i);

v = contaminant velocity (m/yr);

θ_e = Effective porosity (total porosity used as input); and,

R_s = COPEC retardation factor in the saturated zone. R_s is calculated from:

$$R_s = 1 + \frac{\rho_s \times (Koc \times f_{OC})}{\theta_t}$$ Equation 5-8

The distance to source (x) is equivalent to 560 m based on the direct downgradient distance from the RA Property to Hamilton Harbour (SNC-Lavalin, 2018). The source width (Y) of 200 m is the widest width of the RA Property perpendicular to the direction of groundwater flow, assuming a straight line flow direction from the RA Property to Hamilton Harbour. The distance to the receptor perpendicular to groundwater flow (y) is set at 0, therefore the receptor is located immediately downgradient. D_x is estimated based on 0.1x and Dy is estimated from 0.01x (MOE, 2011b; Gelhar et al. 1992). Darcy velocity is estimated from the RA Property geometric mean overburden hydraulic conductivity (6.9 x 10^{-7} m/sec) multiplied by the hydraulic gradient estimated from the distance to surface water and elevation of the groundwater surface and elevation of Lake Ontario. The assumed elevation of Lake Ontario is 74.77 m above mean sea level (masl) (Lake Ontario average for 2017 based on USACE, undated). The average groundwater elevation at the RA Property in 2018 was 87.91 masl, resulting in a hydraulic gradient of 0.023.

The time since contaminant release is set at 56,000 years (MOE, 2011b) based on a minimum 100 years of modelling time per 10 m of transport distance used to set generic standards as discussed in MECP (MOE 2011a, p329). The MECP derived the GW3 standard component based on a minimum modelling time of 300 years assuming a surface water feature 30 m distant from a generic site. The modelling time of 56,000 years in this ERA can be considered unrealistically long given the societal and geological changes that would be expected to occur over this time period. This ERA has conservatively evaluated COC transport over a 100 year/10 m transport period considering that with an infinite source, the model should realistically achieve steady state at the receiving water body distance over that time period.

Unlike assumed when MECP developed the generic standards (MOE, 2011a p305), COC biodegradation has been assumed to occur with COC transport model since it is considered unlikely that biodegradation would not occur for a hydrocarbon COC over a 56,000 year travel time covering 560 m. MECP handled the degradation component within the transport model by fixing the COC degradation half-life in the saturated zone at $1x10^{10}$ days, which effectively results in no degradation adjustment during transport. To conduct this ERA, COC degradation half-lives were obtained from HC (2008) for PAH and CCME (2008) for PHC.

DF_{GW} calculation details are provided in Appendix B, Table B-3 (shallow groundwater source) and Appendix B, Table B-4 (deep groundwater source). The groundwater concentration at the discharge distance (y) was then adjusted for receiving water body mixing based on a 10 times dilution factor consistent with the MECP (MOE 2011a) GW3 derivation assumption as follows:

$$C_{sw} = \left[\frac{C_{gw}}{DF_{GW}} \Big/ 10 \right]$$

Equation 5-9

where:

C_{sw} = Modelled concentration of the COC in surface water (µg/L); and,

Cgw = Concentration of the COC in the source groundwater (µg/L).

Surface water COC concentrations are presented in Appendix B, Table B-5.

5.2.3 Exposure Estimates

A quantitative exposure assessment was completed to calculate exposure to COCs by identified ERA receptors for each of the complete exposure pathways identified in Section 5.3.1. The objective of the ecological risk characterization is to estimate COC exposure levels or intakes for each measurement receptor, then estimate risk based on established benchmarks or toxicity reference values. For soil or the freshwater community measurement receptors (i.e. soil invertebrates, plants and aquatic life), the exposure level is the measured COC concentration in soil and modelled off-Site surface water respectively. For mammal and avian receptors, the estimated exposure level is the estimated COC intake, estimated as an average daily dose, although mammal and bird receptors were not screened into the ERA and therefore will not be quantitatively evaluated. These different exposure level estimates are used because the TRV (the measure of effect) for a soil community receptor is based on the COC concentration in the medium, whereas the TRV for a mammalian or avian measurement receptor is reported in terms of daily dose ingested (US EPA, 1999).

Since mammal and bird receptors do not require evaluation in the ERA, the level of soil COC exposure to soil organisms and terrestrial plants is equivalent to the EPCs identified in Appendix B, Table B-1 and the level of groundwater COC exposure to aquatic life is equivalent to the EPCs identified in Appendix B, Table B-3 (shallow groundwater source) and Appendix B, Table B-4 (deep groundwater source).

5.2.4 Exposure Uncertainty

Characterization of Chemical Variability at the RA Property – Despite the number of soil samples collected and analyzed at a RA Property, soil samples represent small aliquots of material from a much larger volume of Site material. Additionally, groundwater quality varies both spatially and temporally. As a result, there is inherent uncertainty with regard to the chemical variability at the RA Property. The evaluations completed consist of multiple groundwater quality characterization events and soil quality investigations intended to both characterize hotspots and extents of COC impact. As a result, it is considered that the available data reasonably characterizes COC variability at the RA Property and the risk evaluation is conducted based on 120% of the identified maximum COC concentrations.

Groundwater Transport and Off-Site Surface Water Exposure – The groundwater transport calculation assumes an infinite COC source when in fact the source is expected to be finite over the modelling period. As a result, it is anticipated that exposure to RA Property COCs in off-site surface water is not underestimated. Additionally, no downgradient groundwater quality data is available to calibrate the transport model output against observed groundwater quality data. This typically would result in potentially significant uncertainty in receiving waterbody concentration calculations, although in this case, an overestimate of exposure concentrations is not anticipated as a result of an infinite source assumption and the modelling time-period.

5.3 Hazard Assessment

The hazard assessment provides a description of the TRVs and adverse effects basis (where determined) for each COC to be quantitatively evaluated in the ERA.

5.3.1 Toxicity Reference Values

Toxicity reference values applicable to the soil invertebrate, terrestrial plant and freshwater aquatic life community were obtained from MECP (MOE, 2011b). The TRVs applied in this ERA are provided in MECP (MOE, 2011b) Appendix B.2 (soil organisms and plants) and Section 3.3 (aquatic life based on the aquatic protection values (APVs)).

5.3.2 Hazard Assessment Uncertainty

The surface soil toxicity reference values are based on effects to terrestrial plants. Based on the available supporting TRV documentation from MECP, it is not certain if plants, as opposed to soil invertebrates, represent the most sensitive receptors to the COCs. A similar situation exists for the APVs identified in MECP (MOE, 2011b). MECP (MOE, 2011b p147) identifies a general approach to APV identification, but the number of organisms and endpoints per chemical were not identified, therefore it is not possible to identify if the APV is protective of the range of aquatic life classes that may be present in the surface water body which may receive groundwater COCs from the RA Property.

That being stated, the TRVs have been selected from MECP (MOE, 2011b) which represent toxicity reference values reviewed and accepted for use generically at the majority of sites in Ontario according to the MECP. As such, the TRVs utilized in this risk assessment are considered to represent an acceptable point of evaluation for the identification of COC exposure related risk at the RA Property.

5.4 Risk Characterization

5.4.1 Interpretation of Ecological Risks

The following risks were quantitatively evaluated in the ERA:

- Surface soil exposure risk to terrestrial plants and soil invertebrates at the RA Property; and
- Surface water exposure risk to off-Site aquatic life following groundwater COC transport to surface water.

Ecological risks are characterized based on calculation of a dimensionless exposure ratio (ER) defined as:

$$ER = \frac{EPC}{TRV}$$ Equation 5-10

where:

EPC = The organism level of exposure based on the COC specific exposure point concentration (surface soil or surface water concentration) (µg/g, mS/cm or µg/L); and
TRV = Regulatory agency COC specific toxicity reference value (µg/g, mS/cm or µg/L).

An ER of less than 1 implies that a risk is slight and little, or no action is required. An ER of greater than 1 implies the risk is greater and action may be required. An ER target of 1 assumes exposure to the organism is entirely from the RA Property. The TRVs for plants/soil organisms and mammals/birds include a MEP adjustment. Though ER exceeded the targeted ER of 1 for a number of COCs, risk based concentrations for the protection of ecological receptors were not calculated, as the MEP adjusted component values were applied in the secondary screening of COCs for the protection of COCs, MEP adjusted component values were used to determine the ecological site specific target levels (E-SSTLs). The detailed E-SSTLs are provided in Appendix B, Table B-8 as well as in Section 6.2 below.

5.4.2 Quantitative Interpretation of Ecological Risks

Surface soil exposure ratios applicable to plants and soil organisms calculated from maximum Site concentration-based EPCs (120% of the maximum COC concentrations) are provided in Appendix B, Table B-6. COC ERs vary from 2.22 (PHC F4G) to 4937 (Electrical Conductivity) and exceed the target risk threshold of 1.0.

Surface water ERs applicable to off-Site aquatic life calculated from maximum RA Property groundwater concentration-based EPCs (120% of the maximum COC concentrations) and incorporating COC fate and transport considerations are provided in Appendix B, Table B-7. The maximum surface water ER is $2.8x10^{-5}$ (Shallow groundwater PHC F2) which does not exceed the target risk threshold of 1.0. As such, groundwater SSTLs were not calculated.

5.4.2.1 Development of Ecological Site Specific Target Levels (E-SSTLs) for Surface Soil

Based on the results of the qualitative and quantitative ecological health risk assessment, RA Property E-SSTLs for surface soil COCs which were quantitatively evaluated are identified in Appendix B, Table B-8 and further discussed in Section 6.2.

5.4.2.2 Proposed Ecological Risk Management Measures

The implementation of a shallow soil cap barrier RMM will not satisfy the E-SSTLs since MEP adjusted ecological component values were used in the ERA COC secondary screening, which is equivalent to the MECP numerical adjustment to account for a shallow soil cap barrier. In addition, the RA Property is used as parkland, while a shallow soil cap barrier would be applicable for industrial, commercial, or community land use properties as opposed to parkland per MECP. As such, a hard cap or fill cap barrier (1.0 metre or specified greater thickness) will be required to mitigate ecological risks. It is understood that the RA Property will undergo utility replacement and regrading as part of park redevelopment. Accordingly, areas at the property boundary or other locations where a grade adjustment of 1.0 m will be excessive, and where applicable RMM is required, will require a lowering of the current grade to accommodate a fill cap, or accept a hard cap as required. As a result, the following RMM are proposed:

- Excavate and dispose off-Site all soil within 1.0 m bgs of the final Site grade soil which exceeds the E-SSTLs (refer to Table 6.5); or
- Excavate and dispose off-Site all soil within 0.5 m bgs of the final Site grade soil which exceeds the MEP adjusted plant and soil organism component values (refer to Table 6.5). This approach would not be compliant with an MGRA model risk management approach (MOECC, 2016b), although the RA Property is being assessed and managed outside the Brownfields framework. A 0.5 m surface soil cap could be implemented as an ecological RMM if a geotextile barrier, which does not permit soil organism or root penetration, is installed at the base of the surface soil cap.

Any soil handling will be required to be done in accordance with a soil management plan. The soil management plan will include measures to prevent the relocation of soil existing at depth on the RA property to a shallower depth. Where soil is relocated, a soil management plan, prepared by Qualified Person is required to ensure relocated soil meets the appropriate depth specific SCS or SSTL. The Owner shall construct and/or maintain, under the supervision and direction of a Qualified Person, cap to cover the RA property.

5.4.3 Qualitative Interpretation of Ecological Risks

The following COCs were evaluated qualitatively as the RA Property maximum concentrations did not exceed ecological secondary screening component values.

5.4.3.1 Soil Leaching to Groundwater and Groundwater Discharge to Surface Water

A qualitative soil screening assessment was not completed for the soil leaching to groundwater and groundwater discharge to surface water (S-GW3) exposure pathway. This pathway was indirectly evaluated based on the GW3 exposure pathway since groundwater COC concentrations are directly measured at the RA Property.

5.4.3.2 Soil Direct Soil Contact by Mammals and Birds

A qualitative groundwater screening assessment is provided in Table 27. The maximum concentrations of Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Methylnaphthalene, 1- & 2-, Naphthalene, Phenanthrene, Pyrene and Total PCBs in surface soil did not exceed the applicable MECP (MOE 2011b) Table 3 MEP adjusted ecological component value protective of mammals and birds, therefore these soil COCs are not considered to represent a risk to these classes of animals.

5.4.3.3 Soil Direct Soil Contact by Soil Organisms and Plants

A qualitative groundwater screening assessment is provided in Table 27. The maximum concentrations of Dibenzo(a,h)anthracene, fluorene, Methylnaphthalene, 1- & 2-, Pyrene and Total PCBs in surface soil did not exceed the applicable MECP (MOECC 2016b) Table 3 MEP adjusted ecological component value, therefore these soil COCs are not considered to represent a risk to soil organisms and plants.

5.4.3.4 Groundwater Discharge to Surface Water

A qualitative groundwater screening assessment is provided in Table 28. The maximum concentrations of mercury, BTEX, PHC F1, styrene, trichloroethylene, vinyl chloride, Acenaphthene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Benzo(k)fluoranthene, Chrysene, Fluorene, Indeno(1,2,3-cd)pyrene, Naphthalene and Pyrene in groundwater did not exceed the applicable MECP (MOE, 2011b) Table 3 groundwater ecological component values and therefore these groundwater COCs are not considered to represent a risk to aquatic life.

5.4.3.5 Special Considerations

Neither the RA Property nor the surrounding area is considered environmentally sensitive and no special considerations are required.

5.4.3.6 Interpretation of Off-Site Ecological Risks

Soil standards proposed to protect ecological receptors at the RA Property are not considered likely to result in an exceedance of applicable off-Site generic full depth SCSs. Migration of groundwater COCs (GW3 pathway) from the RA Property to off-Site properties is considered to represent the principal pathway of concern that may expose off-Site receptors to RA Property COCs. As discussed in Section 5.5.2, the maximum calculated surface water ER does not exceed the target risk threshold of 1.0. It is concluded that groundwater COCs do not pose unacceptable risks to off site aquatic receptors.

5.5 Discussion of Uncertainty

5.5.1 Effect of Uncertainties in the Characterization of Chemical Variability at the RA Property

The evaluations completed consist of multiple groundwater quality characterization events and soil quality investigations intended to both characterize hotspots and extents of COC impact. The extents of groundwater and soil impact are not considered fully delineated on the RA Property, although the assessment has been completed based on the maximum identified COC concentrations multiplied by 1.2, therefore the assessment has been conducted based on 120% of the observed maximum COC concentrations in part to account for limitations of COC characterization at the RA Property. The secondary objective of the RA is to develop E-SSTLs. Therefore, uncertainty in characterization of chemical variability at the RA Property is not anticipated to unreasonably alter the final E-SSTLs due to the method by which SSTLs are derived.

5.5.2 Effect of Uncertainty in the Groundwater Transport and Off-Site Surface Water Exposure Evaluation

The transport model assumes an infinite COC source when in fact the source is finite, especially considering the modelling timeframe. As a result, it is anticipated that risk due to groundwater transport to surface water is not underestimated.

5.5.3 Effect of Uncertainty in the Level of Protection to Soil Organisms and Plants

The surface soil toxicity reference values are based on effects to soil organisms and plants and are considered to represent conservative and adequately protective benchmarks. As a result, it is anticipated that risk to soil organisms and plants is not potentially underestimated.

5.5.4 Effect of Uncertainty in the Toxicity Reference Values

The TRVs have been selected from MECP (MOE 2011b) which represent toxicity reference values reviewed and accepted for use generically at the majority of Sites in Ontario. As such, the TRVs utilized in this risk assessment are considered to represent acceptable point of evaluation for the identification of COC exposure risk at the RA Property and E-SSTLs are considered appropriate.

6 RA Conclusions and Recommendations

6.1 Recommended Site Specific Target Levels Protective of Human Health

Based on the results of the risk assessment, final human health SSTLs (HH-SSTLs) have been identified in Table 6.1 (Surface Soil), Table 6.2 (Groundwater Along the Property Boundary), Table 6.3 (Surface and Subsurface Soil Applicable to Trench Worker), and Table 6.4 (Groundwater Applicable to Trench Worker). Table 6.1 presents the lowest surface soil SSTLs based on four (4) operable exposure pathways associated with surface soil COCs for the human receptors including Park Visitors, Long-Term Outdoor Workers, Off-Site Residents, and Off-Site Commercial Workers evaluated in HHRA. Table 6.2 presents the groundwater SSTLs based on the inhalation of indoor air exposure pathway for Off-Site Residents and Off-Site Commercial Workers located at the hydraulic downgradient off-Site properties adjacent to the RA Property. Table 6.3 presents soil SSTLs for Subsurface Workers. The surface and subsurface soil SSTLs are based on the direct contact with soil exposure pathway and inhalation of trench air originating from surface soil and subsurface soil exposure pathways. Table 6.4 presents groundwater SSTLs for Subsurface Workers, groundwater SSTLs were based on inhalation of trench air originating from groundwater. The Human Health SSTLs represent the higher value between the calculated HH-RBCs identified in Section 4.4.2 and the MECP generic SCSs; MECP Free Phase threshold or ½ Solubility were also used to identify the HH-RBCs that were above the free phase threshold and ½ of solubility limit for soil and groundwater, respectively. As such, the final HH-SSTL was not identified at a concentration below the MECP SCS and/or above the free phase threshold or ½ of solubility limit. Table 6.3 recommended SSTLs were all based on MECP (MOE 2011a) Table 3 or Table 5 for surface soil and subsurface soil SCS as the calculated HH-RBCs are all below the MECP (MOE 2011a) Table 3 and Table 5 SCS. As such, free phase threshold values are not provided in Table 6.3.

Table 6.1 Final Surface Soil Site Specific Target Levels (SSTLs) Protective of Human Health (Park Visitors, Long-Term Outdoor Workers, Off-Site Residents, and Off-Site Commercial Workers)

COC	Site Maximum Concentration (µg/g)	Lowest Soil RBC (µg/g)	MOE Table 3 SCS (µg/g)	MOE Free Phase Threshold (µg/g)	Final HH-SSTLs Surface Soil (µg/g)
BTEX					
Benzene	169.2	8	0.21	5000	8
PHCs					
PHC F2	6588	2730	98	2700	2700
PHC F3	13560	5010	300	5800	5010
PHC F4	6204	5280	2800	6900	5280
PAHs					
Acenaphthylene	12	5.96	0.15	2900	6.0
Benz[a]anthracene	104.4	0.6	0.5	7600	0.6
Benzo[a]pyrene	76.8	0.06	0.3	7600	0.3
Benzo[b]fluoranthene	90	0.6	0.78	7600	0.8
Benzo[ghi]perylene	30	5.96	6.6	7600	6.6
Benzo[k]fluoranthene	43.2	0.6	0.78	7600	0.8
Chrysene	90	5.96	7	7700	7
Dibenz[a,h]anthracene	13.2	0.06	0.1	7600	0.1
Fluoranthene	324	5.96	0.69	7600	5.96
Indeno[1,2,3-cd]pyrene	34.8	0.6	0.38	7600	0.6

COC	Site Maximum Concentration (µg/g)	Lowest Soil RBC (µg/g)	MOE Table 3 SCS (µg/g)	MOE Free Phase Threshold (µg/g)	Final HH-SSTLs Surface Soil (µg/g)
Methlynaphthalene, 2-(1-)	74.4	62.34	0.99	3600	62.34
Pyrene	264	59.57	78	7700	78
Metals & Inorganics					
Antimony	63.12	6.51	7.5	8000	7.5
Arsenic	51.6	0.78	18	12000	18
Cadmium	54.96	0.6	1.2	18000	1.2
Copper	8880	519.21	140	NA	519
Lead	4920	4.18	120	24000	120
Zinc	49920	4884	340	15000	4884
PCBs					
Polychlorinated Biphenyls	1.92	0.31	0.35	5000	0.35

NA- Not Available

Table 6.2 Final Groundwater Human Health SSTLs Protective of Inhalation of Indoor Air at Off-Site Properties

COCs	Maximum Groundwater Concentration (µg/L)	RBC GW (µg/L)	MOE Table 7 GW SCS (µg/L)	MOE Free Phase Threshold	Final HH-SSTLs Groundwater (µg/L)
Residential Scenario					
VOCs					
Benzene	20520	0.11	0.5	900000	0.5
Toluene	5160	192	320	260000	320
Ethylbenzene	605	31	54	85000	54
Xylene Mixture	2352	27	72	53000	72
PHCs					
PHC F1	4320	3.48	420	1900	420
PHC F2	40680	5.87	150	150	150
VOCs					
Styrene	216	24.18	43	160000	43
Trichloroethylene	21	0.07	0.5	640000	0.5
Vinyl Chloride	3	0.01	0.5	4400000	0.5
PAHs					
Acenaphthene	775	6.79	17	2000	17
Acenaphthylene	73	0.99	1	8100	1
Naphthalene	27480	2.14	7	16000	7
Metals & Inorganics					
Mercury	12	0.002	0.1	30	0.1
Commercial Scenario					
Benzene	20520	23.6	44	900000	44

Table 6.3 Final Soil Human Health SSTLs for the Protection of Subsurface Workers

COCs	Maximum Soil Concentrations (µg/g)	Lowest RBC_{Soil} (µg/g)	MOE Generic SCS (µg/g)	Final Soil SSTLs (µg/g)
Surface Soil			**MOE Generic Table 3 SCS**	
BTEX				
Benzene	169	0.5	0.21	0.5
Toluene	246	82.6	68	82.6

COCs	Maximum Soil Concentrations (µg/g)	Lowest RBC_{Soil} (µg/g)	MOE Generic SCS (µg/g)	Final Soil SSTLs (µg/g)
Surface Soil			**MOE Generic Table 3 SCS**	
Xylene Mixture	403	11.6	26	26
PHCs				
PHC F1	1104	21.1	55	55
PHC F2	6588	19.6	98	98
VOCs				
Styrene	162	4.9	0.7	4.9
PAHs				
Acenaphthylene	99	6.5	7.9	7.9
Benz[a]anthracene	104	31.1	0.5	31.1
Benzo[a]pyrene	77	3.1	0.3	3.1
Benzo[b]fluoranthene	90	31.1	0.78	31.1
Benzo[k]fluoranthene	43	31.1	0.78	31.1
Dibenz[a,h]anthracene	13	3.1	0.1	3.1
Naphthalene	65	0.01	0.6	0.6
Metals & Inorganics				
Antimony	63	54.6	7.5	54.6
Arsenic	52	40.5	18	40.5
Cadmium	55	6.9	1.2	6.9
Copper	8880	4887	140	4887
Lead	4920	38.2	120	120
Zinc	49920	40961	340	40961
Mercury	7	0.01	0.27	0.27
Subsoil			**MOE Generic Table 5 SCS**	
BTEX				
Benzene	33	0.2	0.21	0.21
PHCs				
PHC F1	216	11.4	55	55
PHC F2	15840	65.5	98	98
VOCs				
Trichloroethylene	3	0.08	0.061	0.06
Vinyl Chloride	0.3	0.01	0.02	0.02
PAHs				
Benz[a]anthracene	240	31.1	0.96	31.1
Benzo[a]pyrene	120	3.1	0.3	3.1
Benzo[b]fluoranthene	180	31.1	0.96	31.1
Benzo[k]fluoranthene	95	31.1	0.96	31.1
Dibenz[a h]anthracene	14	3.1	0.1	3.1
Fluoranthene	792	311.3	9.6	311.3
Indeno[1 2 3-cd]pyrene	62	31.1	0.96	31.1
Methlynaphthalene, 2-(1-)	845	487	34	487
Naphthalene	3036	0.0016	0.65	0.65
Metals & Inorganics				
Arsenic	120	40.5	18	40.5
Mercury	49	0.06	0.27	0.27

Table 6.4 Final Groundwater Human Health SSTLs for the Protection of Subsurface Workers

COCs	Maximum Groundwater (µg/L)	Lowest RBC_{GW} (µg/L)	MOE Table 7 SCS	½ of Solubility	Final Shallow Groundwater SSTLs (µg/L)
BTEX					
Benzene	20500	469	0.5	900000	469
PHCs					
PHC F2	40680	334	150	150	150
PHC F3	2760	251	500	4.90E-08	251
PAHs					
Acenaphthene	775	571	17	2000	571
Acenaphthylene	73	55	1	81000	55
Benzo[a]pyrene	0.91	0.04	0.81	0.81	0.81
Benzo[b]fluoranthene	11.68	0.67	0.75	0.75	0.75
Benzo[k]fluoranthene	0.64	0.4	0.4	0.4	0.4
Indeno[1 2 3-cd]pyrene	0.56	0.2	0.2	0.095	0.2
Naphthalene	27500	917	7	16000	917

6.2 Recommended Site-Specific Target Levels Protective of Ecological Health

Based on the results of the qualitative and quantitative ecological health risk assessment, RA Property E-SSTLs for surface soil COCs for the protection of ecological receptors were identified in Table 6.5. The TRVs for plants/soil organisms and mammals/birds incorporated MEP adjustment factors of 1.9 and 1,000, respectively. Although the calculated ERs exceeded the targeted ER of 1 for a number of COCs in risk characterization, risk based concentrations for the protection of ecological receptors were not calculated, as the MEP adjusted component values were applied in the secondary screening of COCs and were used to determine the E-SSTLs. Table 6.5 presents the surface soil E-SSTLs represent the higher value between the MEP adjusted component values and the MECP generic SCSs; MECP Free Phase threshold were also used to identify the E-SSTLs that were above the free phase threshold for soil. As such, the final E-SSTL was not identified at a concentration below the MECP SCS and/or above the free phase threshold. No groundwater E-SSTLs were calculated as there is no unacceptable risk identified for downgradient surface water aquatic life.

Table 6.5 Ecological Site Specific Target Levels (E-SSTLs) - Surface Soil

Parameter	Units	Table 3 Generic SCS R/P/I GC [1]	Site Maximum Concentration	EPC (1.2xMaximum)	Ontario Soil Background (Table 1)	Plants& Soil Org. R/P/I_CG_NPG [2]	MEP (1.9x) is Applied	Mammals & Birds. R/P/I_CG_NPG [2]	MEP (1,000x) is Applied	MOE Free Phase Threshold (µg/g)	Final E-SSTL	RMM Required?
General Chemistry												
Cyanide (WAD)	µg/g	0.051	2.3	2.8	0.051	0.9	1.71	0.11	110	240000	1.7	YES
Electrical Conductivity	mS/cm	0.7	2880	3456	0.57	0.7	1.33	na	na	na	1.3	YES
Sodium Adsorption Ratio	None	5 [5]	109	130.8	2.4	5	9.5	na	na	na	9.5	YES
Total Metals												
Antimony	µg/g	7.5	52.6	63.1	1.3	20	38	25	25000	8000	38	YES
Arsenic	µg/g	18	43.0	51.6	18	20	38	51	51000	12000	38	YES
Boron (Hot Water Soluble)	µg/g	1.5	3.6	4.4	0.5	1.5	2.85	na	na	5000	3	YES
Cadmium	µg/g	1.2	45.8	55.0	1.2	12	22.8	1.9	1900	18000	23	YES
Copper	µg/g	140	7400	8880	92	140	266	770	770000	na	266	YES
Lead	µg/g	120	4100	4920	120	250	475	32	32000	24000	475	YES
Zinc	µg/g	340	41600	49920	290	400	760	340	340000	15000	760	YES
BTEX												
Benzene	µg/g	0.21	141	169	0.02	25	47.5	370	370000	5000.00	47.5	YES
Xylenes	µg/g	3.1	336	403	0.05	95	180.5	96	96000	2300	180.5	YES
PHCs												
PHC F1	µg/g	55	920	1104	25	210	399	na	na	1700	399	YES
PHC F2	µg/g	98	5490	6588	10	150	285	na	na	2700	285	YES
PHC F3	µg/g	300	11300	13560	240	300	570	na	na	5800	570	YES
PHC F4 (silica gel)	µg/g	2,800	5170	6204	120	2800	5320	na	na	6900	5320	YES
VOCs												
Styrene	µg/g	0.7	0.05	162	0.05	17	32.3	370[b]	370000	3500	32.3	YES
PAHs												
Anthracene	µg/g	0.67	100	120	0.16	2.5	4.75	38000	38000000	2700	4.8	YES
Benzo(a)anthracene	µg/g	0.5	87	104	0.36	0.5	0.95	6.2[e]	6200	7600	0.95	YES
Benzo(a)pyrene	µg/g	0.3	64	76.8	0.3	20	38	1600	1600000	7600	38	YES
Benzo(b)fluoranthene	µg/g	0.78	75	90	0.47	7.6	14.44	6.2[e]	6200	7600	14.4	YES
Benzo(g,h,i)perylene	µg/g	6.6	25	30	0.68	6.6	12.54	1.1[d]	1100	7600	12.5	YES
Benzo(k)fluoranthene	µg/g	0.78	36	43.2	0.48	7.6	14.44	6.2[e]	6200	7600	14.4	YES
Chrysene	µg/g	7	75	90	2.8	7	13.3	6.2[e]	6200	7700	13.3	YES
Fluoranthene	µg/g	0.69	270	324	0.56	50	95	0.69	690	7600	95	YES
Fluorene	µg/g	62	64	76.8	0.12	ncv	55.1[a]	15.4[f]	15400	2800	55.1	YES
Indeno(1,2,3-cd)pyrene	µg/g	0.38	29	34.8	0.23	0.38	0.722	1.1[d]	1100	7600	0.7	YES
Methylnaphthalene, 1- & 2-	µg/g	0.99 [3]	62	74.4	0.59	ncv	55.1[a]	100[c]	100000	3600	55.1	YES
Naphthalene	µg/g	0.6	54.2	65.0	0.09	0.6	1.14	380	380000	2800	1.1	YES
Phenanthrene	µg/g	6.2	310	372	0.69	6.2	11.78	2700	2700000	2300	11.8	YES
Pyrene	µg/g	78	220	264	1	ncv	34.2[b]	4700	4700000	7700	34.2	YES

All terms defined within the body of SNC-Lavalin's report.
µg/g - micrograms per gram, dry weight basis
ncv - No component value
ns - No MECP MOE (2011b) standard
na - Not applicable
mS/cm - milliSiemens per centimetre

[1] Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011b)

[2] Soil components for Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011b). Soil component values were selected for the protection of ecological health based on residential parkland land use, plant & soil organisms, mammals & birds, soil leaching to groundwater and migrating to surface water (S-GW3).

[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard. Individual isomer is not carried forward for evaluation as the methylnaphthalene, 1-,2- is retained for further evaluation.

[a] 29 µg/g is the US EPA (2007) Eco-SSL protective of soil invertebrates for LMW-PAHs that do not have Plants & Soil Org. component values from MOE, 2011b.

[b] 18 µg/g is the US EPA Eco-SSL (2007) protective of soil invertebrates for HMW-PAHs that do not have Plants & Soil Org. component values from MOE, 2011b.

[c] 100µg/g is the US EPA Eco-SSL protective of mammals for LMW-PAHs (acenaphthylene and 1,2-methylnaphthalene) that do not have Mammals & Birds component values from MOE, 2011b.

[d] 1.1µg/g is the US EPA Eco-SSL protective of mammals for HMW-PAHs (benzo(g,h,i)perylene, dibenzo(a,h)anthracene and indeno[1,2,3-cd]pyrene) that do not have Mammals & Birds component values from MOE, 2011b.

[e] 6.2 µg/g is the CCME soil and food ingestion (SQG) pathway guideline for the protection of mammals and birds for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene.

[f] 15.4 µg/g is the CCME soil and food ingestion (SQG) pathway guideline for the protection of mammals and birds for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene.

7 Risk Management Plan

7.1 Risks Identified by Risk Assessment

Risk modelling and analysis presented in Sections 4 and 5 identified potential unacceptable risks to human and ecological health. The RMMs discussed in the following sections are designed to mitigate potential unacceptable risks associated with the following exposure pathways, environmental media and contaminants:

- Park Visitor (public)
  - **Surface Soil Direct Contact (ingestion and dermal contact)** – benzene, PHC F2-F3, PAHs (acenaphthylene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[ghi]perylene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, indeno[1,2,3-cd]pyrene, 1- and 2-Methylnaphthalene, pyrene), metals (antimony, arsenic, cadmium, copper, lead, and zinc)
  - **Outdoor Air Inhalation from a Surface Soil Source** – benzene
- Long-Term Outdoor Worker (e.g. landscape or maintenance worker)
  - **Surface Soil Direct Contact (ingestion and dermal contact)** – benzene, PAHs (acenaphthylene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[ghi]perylene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, indeno[1,2,3-cd]pyrene, and pyrene), metals (antimony, arsenic, cadmium, copper, lead, and zinc)
- Subsurface Worker (e.g. landscape or maintenance worker)
  - **Surface Soil Direct Contact (ingestion and dermal contact and inhalation of particulates)** – PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, and dibenz[a,h]anthracene) and metals (antimony, arsenic, cadmium, copper, lead, and zinc)
  - **Subsurface Soil Direct Contact (ingestion and dermal contact and inhalation of particulates)** – PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenz[a,h]anthracene, fluoranthene, indeno[1,2,3-cd]pyrene, and 1-2-methylnaphthalene), metals (arsenic and lead)
  - **Trench Vapour Inhalation from a Surface Soil Source** – benzene, toluene, xylenes, PHC F1 and F2, styrene, PAHs (acenaphthylene, naphthalene) and mercury
  - **Trench Vapour Inhalation from a Subsurface Soil Source** – benzene, ethylbenzene, xylenes, PHC F1 and F2, trichloroethylene, vinyl chloride, naphthalene, and mercury
  - **Incidental Direct Contact with Shallow Groundwater (ingestion and dermal contact)** – Benzene, PHC F2 and F3, PAHs (acenaphthene, acenaphthylene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, indeno[1,2,3-cd]pyrene, naphthalene)
- Off-Site Residents (e.g. neighbouring residential property)
  - **Indoor Air Inhalation of Volatile COCs from a Groundwater Source** – benzene, toluene, ethylbenzene, xylenes, PHC F1 and F2, styrene, trichloroethylene, and vinyl chloride, PAHs (acenaphthene, acenaphthylene, fluorene, and naphthalene), and mercury
- Off-Site Commercial Office Worker (e.g. neighbouring commercial property)
  - **Indoor Air Inhalation from a Groundwater Source** – benzene

- Ecological Receptors
  - **Direct ecological contact with contaminated surface soil** – cyanide EC, SAR, antimony, arsenic, HWS boron, cadmium, copper, lead, zinc, benzene, xylenes, styrene, PHC F1-F4, and PAHs

The risk management measures proposed herein have been developed to be protective of potential future park visitor receptors, off-site commercial and residential receptors, subsurface workers as well as ecological receptors. As a key assumption of the risk assessment was the application of a stratified soil approach, stratified soil conditions must be maintained.

7.2 Areas Requiring Risk Management Measures

Areas where RMMs are required are defined where soil and/or groundwater quality exceeds the applicable SSTLs. Surface soil impacts posing risks are prevalent across the majority of the RA Property and due to the heterogeneous nature of subsurface conditions as a result of extensive presence of fill material, detailed delineation of the impacts was not completed, rather sufficient data were gathered including expected maximum concentrations of contaminants of concern. Figure 23 indicates locations where surface soil sample concentrations were greater than the HH-SSTLs protective of Park Visitors, Long-Term Outdoor Workers, Off-Site Residents, and Off-Site Commercial Workers evaluated in the HHRA.

The need for a RMM to address surface soil risks is primarily driven by the human health risks (e.g. surface soil concentrations exceeding the HH-SSTLs). There was only one sampling location (BH-01-17) where the shallow soil conditions met the HH-SSTLs but exceeded an E-SSTL based on an elevated sodium adsorption ratio (SAR) value. At all other surface soil locations where eco-risks are present, there are also human health risks present. As such, where a RMM will be applied to address the human health risk in surface soil, it will also address any ecological risk present.

Some isolated areas near the property boundaries have been identified (Figure 23) where data (primarily from metals analysis) may suggest acceptable risk conditions exist. In the absence of further sampling for additional COCs (including VOCs, PHCs, PAHs and PCBs) risk management measures should be applied in these areas. Nonetheless, these areas were identified for future discussion purposes as the City has expressed interest in possibly conserving existing trees and/or tapering the extent of a proposed soil cap RMM if the soil conditions allow. As there has been limited to no sampling for COCs other than metals/inorganics in the specified areas, if the City wishes to remove or reduce the RMM required in these areas sampling for additional COCs (including VOCs, PHCs, PAHs and PCBs) should be completed.

The outdoor inhalation risk to Park Visitors from benzene exposure in shallow soil is calculated from a single sampling location (SS-2 at BH-19-17 at 0.8 to 1.4 m bgs) associated with a benzene concentration that is significantly higher (141 µg/g) than concentrations for both surface and subsurface soil in the remainder of the RA Property (ranging from <0.0068 µg/g to 2.7 µg/g in surface soil and <0.0068 µg/g to 27.5 µg/g in subsurface soil). The material sampled at borehole BH-19-17 consisted of brown and dark brown silt, sand and gravel with coal and asphalt with a “sticky texture” (Englobe, 2018b). As the outdoor air risk is based on a single sample location with few samples nearby for delineation (notably L2-2, BH-4, BH-108, BH-110 and BH18-07; see Figure 8), the area requiring RMMs for this risk is broadly outlined in Figure 23 indicating minimum 1.5 m thickness fill cap requirement. Further delineation or confirmatory sampling is recommended prior to finalizing the cap design.

Figure 24 indicates all locations where subsurface soil sample concentrations were greater than the HH-SSTLs protective of subsurface workers. Subsurface soil impacts posing risks to subsurface workers are prevalent over the majority of the RA Property. Due to the heterogenous nature of the fill, it was considered unlikely that the limits of contamination could be reasonably determined and he surface soil impacts posing risks to subsurface workers are interpreted to extend over the majority of the RA Property. The RMMs discussed below to address risks to trench workers from surface and subsurface soil will therefore apply across the whole site area.

A summary of groundwater impacts posing risks to subsurface workers is presented in Figure 25. Impacted groundwater posing risks is located in the north central portion of the RA Property and at an isolated area in the eastern portion of the RA Property (MW-101). Significant trench work will be associated with the site re-development as the City is planning replacement of the existing sewers and water main which run through the RA Property from north to south (south of Caroline Street North) and east-west connecting to Harriet Street, Mill Street and Railway Street. The RMMs discussed below to address groundwater risks to subsurface workers will apply primarily in the northern section of the RA Property adjacent to the benzene/PHC/PAH groundwater impacts in shallow groundwater in that area.

The areas where groundwater concentrations exceed the HH-SSTLs protective of Inhalation of Indoor Air at off-site residential properties are shown in Figure 26. There are groundwater impacts in the north central portion of the RA Property with a variety of volatile parameters presenting risk to down gradient off site residential areas north of the RA Property (along Caroline Street North) and a second area with groundwater impacts in the west central portion of the RA Property based primarily on chlorinated solvent impacts (namely TCE) presenting risk to the off-site down-gradient residential area west of the RA Property (north of Harriet Street). Preliminary soil vapour data collected in 2018 from a single sampling event further suggests potential risk to off-site indoor air at the residential properties north and west of the RA Property based on elevated benzene concentrations in soil vapour samples (SVP18-01 and SVP18-03). The residential area to the west of Railway Street is situated up-gradient of groundwater impacts, however, given its proximity to the chlorinated solvent (TCE) impacted groundwater at monitoring wells MW18-04, MW18-05 and MW18-07, the potential for back-diffusion is being considered and there is potential for risks to these properties as well. Soil vapour data in the south portion of the RA Property (SVP18-02) did not indicate similar elevated benzene concentrations and accordingly a different risk profile is present there compared to other locations. The SVP18-02 soil vapour probe location was targeted for potential hydrocarbon and naphthalene risk evaluation, but as it was not situated near the TCE groundwater impacts located further north, the data does not serve to assess potential risks associated with TCE impacts located further north.

Additional soil vapour probe installation and sampling in the vicinity of the impacts could further evaluate the potential off-site risks by volatile contaminants in groundwater. However, based on the current data, RMMs will be required to address risks to the down-gradient residential properties to the north and east of the RA Property (Caroline Street North and Harriet Street) as well as the up gradient residential properties to the southeast (Railway Street). Pending further assessment of soil vapour at these locations, off-site groundwater conditions are unknown in the vicinity of Railway street and the potential for off-site impacts, upgradient to the RA Property, to contribute to measured on-site impacts cannot be ruled out.

The areas where groundwater concentrations exceed the HH-SSTLs protective of Inhalation of Indoor Air at off-site commercial properties are shown in Figure 27. Groundwater impacts are present in the north central portion of the RA Property with benzene concentrations presenting risk to the down gradient off site commercial property north of the RA Property (along Caroline Street North). The commercial property

immediately east of the northern portion of the RA Property (on Sheaffe Street) is situated cross-gradient of groundwater impacts. However, given its proximity to the benzene impacted groundwater at monitoring wells MW-104, MW18-26 and MW8-27, the potential for back-diffusion is being considered and there is potential for risk at this property as well. Similar to above, additional soil vapour probe installation and sampling in the vicinity of the impacts could further evaluate the potential risks of back-diffusion by volatile contaminants in groundwater. However, based on the current data, RMMs will be required to address risks to the down-gradient commercial property to the north (on Caroline Street North) as well as the cross-gradient commercial property to the east of the north portion of the RA Property (on Sheaffe Street).

With respect to cross-gradient and upgradient properties/receptors, given the historical industrial nature of the area off-site sources of contamination could be present. These sources could be contributing to some the contamination identified in the park and RMM that will reduce risk to the off-Site receptors from contamination in the park will not mitigate risks from off-Site sources.

7.3 Proposed Risk Management Measures

The following RMMs are proposed for the RMP:

- Install a cap to mitigate exposure to soil and direct contact for park visitors, long term outdoor workers, and ecological receptors and indirect risks to Park Visitors via outdoor air:
    - Option A – Install a 1.5 m fill cap across the area broadly delineated around BH-19-17
    - Option B – Completion of additional soil sampling to more closely delineate the area of the RA Property where the concentration of benzene exceeds 29.3 µg/g.
      Install a 1.5 m fill cap or hard cap in areas where benzene exceeds 29.3 µg/g and a 1 m fill cap or hard cap where benzene is less than 29.3 µg/g.
    - Option C - Remedial excavation of surface soil with concentrations of benzene greater than 29.3 µg/g and installation of a 1m fill cap or hard cap.
- A soil and groundwater management plan, health and safety plan will be implemented to mitigate risks from exposure to groundwater, surface soil or subsurface soil, including trench vapour inhalation for subsurface workers.
- An engineered groundwater mitigation system is proposed near portions of the north and west property boundaries of the RA Property to mitigate risks to off-site down-gradient residential and commercial properties through indoor air inhalation of volatile COC from a groundwater source.
- A vapour barrier is proposed along a portion of the east and south property boundaries to mitigate risks to off-site up-gradient/cross-gradient residential and commercial properties through indoor air inhalation from a groundwater source.
- Implementation of the soil management plan noted above will also restrict disturbance and relocation of remaining impacted subsurface soil when excavation occurs will ensure stratified conditions are maintained at the RA Property).

Currently the requirement for a 1.5m thickness cap described in Cap Option A is based on a single elevated benzene concentration and expected to result in an overly conservative and costly risk management measure. However, it is included in absence of additional data defining the limits of the benzene risk. As such Option A is not proposed as a preferred option.

The scope of the planned re-development of the RA Property includes utility replacement/construction and as such, trench blocks are to be installed during construction work as an additional risk management

measure to mitigate the potential for utility trenches to serve as preferential migration pathways for soil vapours and groundwater.

Given the assumptions and receptors considered in the RA, administrative controls also apply to the RA Property and are described further in Section 7.4. These include restrictions for groundwater use, buildings and growing of plants/vegetation for human consumption, as well as requirements for fencing during re-development work.

The RMM listed herein are proposed to reduce exposure to COCs in soil, groundwater and vapour to levels at which no unacceptable risks are anticipated and/or to render the exposure pathways inoperable.

7.3.1 Fill Cap or Soil Cap

The RA is being conducted for potential future parkland use and a preliminary re-development plan was made available to SNC-Lavalin. The fill cap or hard cap is required to be implemented during re development as part of the construction specifications. As described in Section 7.2, the fill cap or hard cap is required across the whole site area due to the extent of surface soil impacts. Details of the required inspection and maintenance program are described in Section 7.6.

The minimum cap requirements outlined below (and illustrated in Figure 28) are intended to meet the requirements of the MGRA model risk management approach (MOECC, 2016a). Consideration of alternate capping approaches from other jurisdictions which may address the human health direct contact and outdoor air risks and ecological risks associated with the surface soil was beyond the scope of the current RMP. Section 5.4.2.2 of the RA mentions an alternate cap option (0.5 m surface soil with geotextile barrier to restrict root penetration) to address the ecological risks however this cap would not necessarily address the identified human health risks.

In grassed and landscaped areas of the re-development and where the concentration of benzene in surface soil is less than 29.3 µg/g, a fill cap shall consist of a minimum thickness of 1.0 m of soil meeting the MECP Table 3 SCS for coarse textured soil in residential/parkland land use setting. A visual barrier, consisting of geotextile or other suitable material, should be placed between the soil cap and the underlying pre-existing soils. In grassed and landscaped areas, and where the concentration of benzene is greater than 29.3 µg/g the thickness of the fill cap shall be increased to 1.5 m. The limits of the area requiring a 1.5 m cap shall be determined by the completion of a supplemental surface soil sampling program. The sampling program shall be designed and supervised by a Qualified Person to delineate the area of the RA Property where the concentration of benzene in surface soil is greater than 29.3 µg/g. The Qualified Person shall document the delineation in a report.

If trees or shrubs with roots extending greater than 0.5 m into the soil are to be planted, their root balls must be placed in an excavation and surrounded on all sides by a soil layer no less than 0.5 m thick, MECP Table 3 SCS for coarse textured soil in residential/parkland land use setting.

In paved areas of the re-development, as a minimum the hard cap shall consist of a non-permeable surface such as asphalt paving, concrete sidewalk/pad, consisting of at least 150 mm of Granular “A” or equivalent material (meeting the MECP Table 3 SCS for coarse textured soil in residential/parkland land use setting) overlain by at least 75 mm of hot mix asphalt or concrete.

Areas of the re-development which will be used for play, which may have a rubber asphalt cover shall require a 0.5 m fill cap beneath the surfacing material. A geotextile marker layer shall be placed below the fill material.

Where the re-development design does not allow a grade adjustment of +1.0 m, a grade lowering would first be required to accommodate a fill cap, or accept a hard cap as required. If the existing grade is to be lowered before the cap is installed, the thickness of the cap must be proportionally increased from the minimum of 1 m by an amount equal to the lowering of the initial grade, to a maximum cap thickness of 1.5 m in order to maintain the stratified soil conditions assessed in the Risk Assessment. Excavated surface soils may be reused on-site provided they are also capped by the minimum 1.0 m fill cap or hard cap in accordance with the proposed soil management plan for the RA Property (with the exception of some site soils, as described in Section 7.3.2).

Figures documenting the installation of the cap should be prepared at the conclusion of the redevelopment program.

7.3.1.1 Remedial Excavation

Where the concentration of benzene exceeds 29.3 µg/g and a 1.5 m fill cap is not desirable, surface soil shall be remediated. Borehole BH-19-17 should be excavated and the excavation extended until concentrations of benzene in confirmation soil samples analysed from the floors and wells of the completed excavation are less than 29.3 µg/g. Confirmation samples should be collected at a frequency equal to or greater than that described in Table 3 of (Minimum Confirmation Sampling Requirements for Excavation) in O. Reg 153/04.

Following excavation, where benzene concentrations meet the RBC value of 29.3 µg/g, a 1 m fill cap would address any remaining potential outdoor air risk associated with benzene in soil. As described in 7.3.1, a 1.5 m of surface soil must be maintained over the subsurface soil.

Finally, any excavated surface soils in this area (with benzene concentrations exceeding the RBC value of 29.3 µg/g) may only be reused on-site provided they are capped by a minimum 1.5 m fill cap.

The excavation shall be supervised by a Qualified Person and the results of the excavation program documented.

7.3.2 Soil Management Plan

A soil management plan should be prepared for the Property and implemented during any activities potentially coming in contact with or exposing site soils. The SMP will be developed to minimize exposure to COCs and to ensure that soil placed on the RA Property (re-used or imported) meets appropriate depth-specific Table SCSs or SSTLs. This plan shall be developed and overseen by a Qualified Person as described under O. Reg. 153/04 and include, but not be limited to, the following components:

- Dust control measures and prevention of soils tracking by vehicles and personnel from the Property, including wetting of soil with potable water, reduced speeds for on-Site vehicles, tire washing stations and restricting work in high wind conditions.
- Management of excavated materials to minimize exposure to and migration of contaminated soil, including cleaning equipment, placement of materials for stockpiling on designated areas lined and covered with polyethylene sheeting, bermed and fenced to prevent access, runoff control to minimize contact and provisions for discharge to sanitary sewers or other approved treatment.
- The development and implementation of protocols for assessing soil excavated at, brought to or removed from the RA Property.
- Protocols and procedures to ensure the placement of excavated or imported soil meets the appropriate depth-specific standards.

- Storm water management measures to control the potential transport of COCs off-Site during on-Site construction/redevelopment activities. This shall include, but to not be limited to, silt fences and filter socks on catch-basins and utility covers as necessary.
- Characterization of excavated materials requiring off-site disposal, such that disposal as a waste will be in accordance with the provisions of O. Reg. 347, as amended, made under the Act.
- Record keeping including, but not to limited to, dates and duration of work, weather and Site conditions, location and depth of excavation and soil placement activities, dust control measures, stockpile management and drainage, all soil and groundwater characterization results, names of the Qualified Persons, contractors, haulers and receiving Sites for any excavated soils/materials or contaminated groundwater removed from the property and any complaints received relating to Site activities.

7.3.3 Groundwater Management Plan

A groundwater management plan should be developed and implemented to describe management handling and disposal requirements for groundwater encountered during excavation associated with re-development work (notably utility upgrades/replacements) or implementation/installation of any RMMs (e.g. the engineered groundwater mitigation system).

Based on details of the proposed work, an evaluation should be completed to determine if a Permit to Take Water may be required to handle the volumes of groundwater expected within the excavations. During rain events, run-off and rainfall should also be diverted away from any open excavations. Record keeping for groundwater management can be done in coordination with the SMP's record keeping requirements listed in Section 7.3.2.

7.3.4 Groundwater Mitigation System

An engineered system is recommended as an RMM to mitigate indoor air risks from groundwater to off-site down gradient residential and commercial receptors as well as control the potential for future migration of impacts. A mitigation system should be designed to intercept, collect and discharge groundwater to an acceptable sewer/receiver. Depending on the requirements of the receiver, treatment of the collected groundwater may be required prior to discharge.

Since mitigation is required along sections of the property boundaries, design options should consider a cut-off trench design (preferred over extraction well designs) as an effective way to capture impacts. A groundwater monitoring and sampling program and effluent sampling program will be required to demonstrate the performance of the engineered system and monitor ongoing groundwater conditions (see Section 7.6).

7.3.5 Groundwater and Vapour Barrier

Where potential risks to indoor air from groundwater impacts were identified at residential or commercial properties located up-gradient and cross-gradient to groundwater impacts, an engineered groundwater and vapour barrier is recommended as an RMM to isolate the groundwater impacts from receptors. Design options may include a grout curtain, impermeable barrier, or high density polyethylene (HDPE) wall installed within the upper portion of the seasonal low point of the saturated zone and extending in the unsaturated zone to near surface. Appropriate design consideration should be made for potential groundwater mounding up-gradient of the barrier with suitable relief and discharge conditions to prevent daylighting of groundwater at upgradient locations or impact utility or building foundations upgradient of potential barrier locations.

The requirement for the extent and location of this barrier may be adjusted based on further investigation as proposed previously. Additional soil vapour probe installation and sampling near the off-site residential and commercial buildings could be used to further evaluate the potential risks of back-diffusion by volatile contaminants in groundwater and update this RMM requirement.

This RMM would not mitigate any risks associated with off-Site sources of contamination.

7.3.6 Underground Services and Trench Blocks

Services shall be installed in trenches with aggregate and/or soil meeting the meeting the MECP Table 3 SCS for coarse textured soil in residential/parkland land use setting to a minimum depth 500 mm below and 500 mm laterally from the limits of the services (as illustrated in Figure 28). This RMM is meant to limit utility contact with contaminated soil and decrease a utility workers exposure to contaminated materials during potential future repair work. Trench fill material is to be installed into, and covered by, non-woven mesh geotextile to mitigate contact with existing site soils and limit migration of fines into granular trench backfill material.

Where a utility is to be installed in an area of heavy impact and potential free-phase contamination, additional mitigations should be proposed to decrease risks of residual contamination impacting or migrating along the utility. The following options are proposed:

- Over excavating of impacted soil and backfilling with clean material
- Installation of non-permeable liner, e.g. geosynthetic clay liner
- Consider rerouting of utility to mitigate contact with impacted site soil

Where existing or new services intersect groundwater, low permeability trench blocks should be installed across the trench channel (as illustrated in Figure 28). Trench blocks are proposed to be installed in utility trenches at intervals required to mitigate vapour migration and allow infiltration of groundwater which may accumulate in trench material, as well as mitigate migration of groundwater from un-impacted to impacted areas and off-site. Trench blocks are to be constructed of 750 mm compacted clay, installed directly into the surrounding soil material.

Additional details on locations and spacing of trench blocks in support of the City's planned utility upgrade project were provided in a Memorandum to the City dated December 4, 2018 (SNC Lavalin, 2018d).

7.4 Administrative Controls

7.4.1 Prohibit Installation of Potable Wells

Groundwater in or under the Property shall not be used as a source of potable water and no wells shall be installed on the RA Property for the purposes of obtaining potable water.

Since maintaining existing wells would interfere with construction works it is proposed that all existing monitoring wells be abandoned/decommissioned prior to the start of re-development construction. Wells should be decommissioned in accordance Ontario Regulation (O. Reg.) 903 by a licensed well contractor. A new, smaller network of fewer monitoring wells should be installed following completion of the re-development work (as described in Section 7.6).

7.4.2 Building Prohibition

No buildings shall be constructed on the RA Property.

7.4.3 Health and Safety Requirements

A site specific health and safety plan should be developed and implemented during all intrusive, below-grade construction activities potentially coming in contact with or exposing site soil or groundwater. The City should ensure that the health and safety plan consider the following:

- all relevant information concerning the presence of, human exposure to, and risk posed by, the COCs through dermal contact, soil or ground water ingestion and inhalation of soil particles or vapour that may be present at the Property including information in the RA;
- all relevant information, measures and procedures concerning protection of the persons from exposure to the COCs and the precautions to be taken when undertaking intrusive activities, including the supervision of workers, occupational hygiene requirements, use of personal protective equipment, provision of air flow augmentation in excavations or other areas or situations of minimal air ventilation, and other protective measures and procedures as appropriate;
- all relevant information concerning the presence and significance of the RMMs and requirements which are being, or have been, implemented at the Property; and,
- the procedures and timing for implementing emergency response and contingency measures and procedures, including contact information, in the event of a health and safety incident.

The health and safety plan should be prepared in accordance with applicable Ministry of Labour health and safety regulations, shall address any potential risks identified in the RA. Prior to initiation of any project (as defined in the Occupational Health and Safety Act, as amended), the local Ministry of Labour office shall be notified of the proposed activities and that the Property contains contaminated soil and ground water.

Implementation of the health and safety plan shall be overseen by persons qualified to review the provisions of the plan with respect to the proposed site work and conduct daily inspections. The Owner shall retain a copy of the plan.

Following implementation of the cap, the health and safety plan is only required when excavation will extend below the cap.

7.4.4 Site Fencing Requirements

Prior to site redevelopment, before any activities that have the potential to disturb soil are initiated, the site area shall be fenced off to secure the site from unauthorized access to prevent visitors/the public from contact with contamination. Gates should be secured with locks when construction personnel are not present. Evidence of entry of unauthorized personnel should be recorded, and if this is found to occur frequently, security personnel should be recruited to monitor the site during off-hours.

Following redevelopment, fencing is only required if excavation will occur below the soil cap (or as required for other purposes).

7.4.5 Restrictions on Plants/Vegetation for Human Consumption

The RA Property may not be used for growing of any vegetation/plants for human consumption. Any potential future growing of vegetation/plants for human consumption would require the plants to be grown in raised planting beds with imported clean potting soil and a separation textile installed at the base of the raised bed. Growing material should be sourced from commercial or otherwise approved suppliers. Soil at the RA Property should not be used in raised beds.

7.5 Duration of Risk Management Measures

The fill cap or hard cap shall be maintained indefinitely.

The soil and groundwater management plans, health and safety plan and site fencing shall be required for the RA Property during any activities potentially in contact with or exposing site soils and/or groundwater for as long as the COCs are present at the Property.

The groundwater mitigation and barrier systems and groundwater monitoring program shall continue to be carried out indefinitely or until it has been demonstrated that groundwater at the RA Property meets either the applicable generic SCSs or SSTLs.

All other RMMs shall be maintained indefinitely.

7.6 Requirements for Monitoring and Maintenance

7.6.1 Fill Cap or Hard Cap

An inspection and maintenance program should be prepared and implemented to ensure the continuing integrity of the fill cap or hard cap as long as the COCs are present on the Property. The inspection program should include, at a minimum, semi-annual (spring and fall) inspections of the cap integrity. And deficiencies should be repaired promptly to the original design specifications. Inspection, deficiencies and repairs should be recorded in a log book maintained by the City.

7.6.2 Groundwater Mitigation System

A monitoring and sampling program should be prepared and implemented to monitor the effectiveness of the engineered groundwater mitigation system. A monitoring well network should be established at the RA Property and at off site locations (if applicable) following installation of the groundwater recovery system. Performance monitoring for an engineered groundwater mitigation system would include measuring hydraulic heads and gradients, ground-water flow directions and rates, pumping rates, discharge volumes and effluent quality. These data should be evaluated to ensure compliance with discharge requirements to interpret effectiveness at mitigating groundwater migration and to identify whether enhancements are required. Groundwater samples should be completed from monitoring wells and analysed for COCs to effectiveness in mitigating migration.

8 Closure

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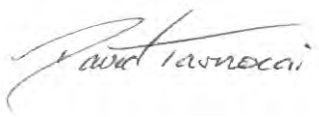

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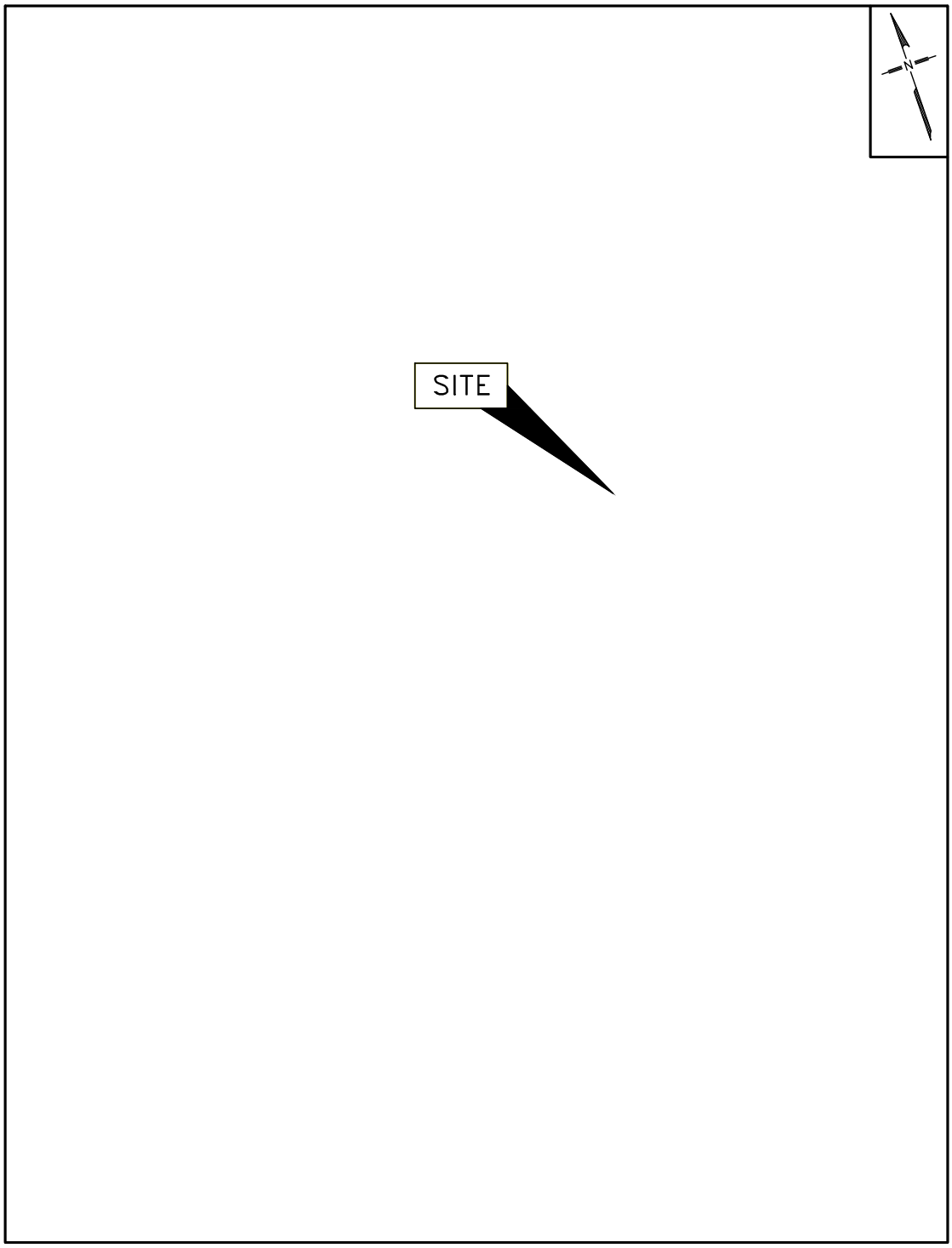
Figures



SOURCE(S):
1. SCHWERDT GRAPHIC ARTS LTD., (MapArt), 2007 EDITION

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SNC·LAVALIN

Client/Location: CITY OF HAMILTON CENTRAL PARK, HAMILTON, ON		Title: SITE LOCATION PLAN	
Project No: 648696	Filename: 007F01_655184	Date: NOVEMBER 2018	Dwg No: FIGURE 1
Drawn: AG	Verified: LB	Project Manager: LB	

FILENAME: P:\HAM\Central Park\655184\40_Execution\47_Wrkg_Vers\CAD_GIS\007 (2018 RA)\007F01_655184.dwg

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MW-09-17	
SCREENED INTERVAL: 1.2 – 4.2mbg	
SCREENED ELEVATIONS: 87.2 – 84.2m	
SAMPLE DATE	Zn
2018 09 11	< 10

MW-116	
SCREENED INTERVAL: 12.2 – 13.7mbg	
SCREENED ELEVATIONS: 75.0 – 73.5m	
SAMPLE DATE	Zn
2018 09 12	11

MW-115	
SCREENED INTERVAL: 2.7 – 5.8mbg	
SCREENED ELEVATIONS: 84.2 – 81.1m	
SAMPLE DATE	Zn
2013 10 11	< 5
2018 09 11	< 10

MW-201	
SCREENED INTERVAL: 15.5 – 17.0mbg	
SCREENED ELEVATIONS: 73.4 – 71.9m	
SAMPLE DATE	Zn
2016 08 15	11.4
2018 09 10	47

MW18-28	
SCREENED INTERVAL: 3.4 – 6.4mbg	
SCREENED ELEVATIONS: 86.8 – 83.8m	
SAMPLE DATE	Zn
2018 09 25	10

MW18-01	
SCREENED INTERVAL: 4.9 – 8.0mbg	
SCREENED ELEVATIONS: 88.4 – 85.4m	
SAMPLE DATE	Zn
2018 09 10	< 10

MW18-02	
SCREENED INTERVAL: 5.9 – 8.9mbg	
SCREENED ELEVATIONS: 84.2 – 81.2m	
SAMPLE DATE	Zn
2018 09 10	< 10

MW-103	
SCREENED INTERVAL: 7.0 – 10.1mbg	
SCREENED ELEVATIONS: 86.2 – 83.1m	
SAMPLE DATE	Zn
2013 10 11	< 5
2016 08 05	< 5
2016 08 05*	< 5
2018 09 11	< 10

MW-205	
SCREENED INTERVAL: 16.7 – 18.2mbg	
SCREENED ELEVATIONS: 75.1 – 73.6m	
SAMPLE DATE	Zn
2016 09 09	5.2
2018 09 11	20

MW-18-17	
SCREENED INTERVAL: 1.6 – 3.1mbg	
SCREENED ELEVATIONS: 89.4 – 87.9m	
SAMPLE DATE	Zn
2018 09 12	< 10

MW18-03	
SCREENED INTERVAL: 14.2 – 17.3mbg	
SCREENED ELEVATIONS: 79.1 – 76.1m	
SAMPLE DATE	Zn
2018 09 27	1.5

MW18-24	
SCREENED INTERVAL: 5.9 – 9.0mbg	
SCREENED ELEVATIONS: 85.2 – 82.2m	
SAMPLE DATE	Zn
2018 09 24	< 10

MW-204	
SCREENED INTERVAL: 16.8 – 18.3mbg	
SCREENED ELEVATIONS: 81.5 – 79.9m	
SAMPLE DATE	Zn
2016 08 15	< 5

MW-102	
SCREENED INTERVAL: 2.1 – 5.2mbg	
SCREENED ELEVATIONS: 90.1 – 87.1m	
SAMPLE DATE	Zn
2013 10 16	< 5
2016 08 04	42.5
2018 09 12	192

MW18-23	
SCREENED INTERVAL: 3.0 – 6.1mbg	
SCREENED ELEVATIONS: 87.7 – 84.7m	
SAMPLE DATE	Zn
2018 09 10	< 10

MW-104	
SCREENED INTERVAL: 4.6 – 7.6mbg	
SCREENED ELEVATIONS: 85.8 – 82.7m	
SAMPLE DATE	Zn
2013 10 11	< 5
2016 08 15	< 5
2018 09 10	< 10

MW-17-17	
SCREENED INTERVAL: 3.9 – 6.9mbg	
SCREENED ELEVATIONS: 86.5 – 83.5m	
SAMPLE DATE	Zn
2018 09 25	< 10

MW18-27	
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SCREENED ELEVATIONS: 89.4 – 86.4m	
SAMPLE DATE	Zn
2018 09 24	< 10

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SCREENED INTERVAL: 17.4 – 18.9mbg	
SCREENED ELEVATIONS: 72.7 – 71.2m	
SAMPLE DATE	Zn
2016 09 13	< 5

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SCREENED INTERVAL: 2.0 – 5.1mbg	
SCREENED ELEVATIONS: 91.5 – 88.4m	
SAMPLE DATE	Zn
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MW18-07	
SCREENED INTERVAL: 3.7 – 6.8mbg	
SCREENED ELEVATIONS: 88.2 – 85.1m	
SAMPLE DATE	Zn
2018 09 10	< 10

MW-01-17	
SCREENED INTERVAL: 2.2 – 5.2mbg	
SCREENED ELEVATIONS: 90.8 – 87.8m	
SAMPLE DATE	Zn
2018 09 11	< 10

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SCREENED ELEVATIONS: 78.3 – 76.8m	
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SCREENED ELEVATIONS: 90.7 – 87.7m	
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2016 08 04	7.1
2018 09 11	< 1.0

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SCREENED ELEVATIONS: 89.5 – 86.5m	
SAMPLE DATE	Zn
2018 09 10	< 10

MW18-09	
SCREENED INTERVAL: 5.0 – 8.1mbg	
SCREENED ELEVATIONS: 89.2 – 86.2m	
SAMPLE DATE	Zn
2018 09 07	< 10

MW18-08	
SCREENED INTERVAL: 4.9 – 8.0mbg	
SCREENED ELEVATIONS: 88.6 – 85.6m	
SAMPLE DATE	Zn
2018 09 07	< 10

MW18-16	
SCREENED INTERVAL: 4.0 – 7.1mbg	
SCREENED ELEVATIONS: 90.3 – 87.3m	
SAMPLE DATE	Zn
2018 09 07	< 10

LEGEND

- MONITORING WELL
- PHASE TWO STUDY AREA
- PROPERTY LINE
- INFRASTRUCTURE
- EXISTING BUILDING
- FENCE LINE
- LOCATION WHERE MOST RECENT GROUNDWATER SAMPLE MET STANDARDS FOR ALL PARAMETERS THAT WERE ANALYSED, SHOWN IN GREEN
- LOCATION WHERE MOST RECENT GROUNDWATER SAMPLE EXCEEDED STANDARDS FOR AT LEAST ONE PARAMETER THAT WAS ANALYSED, SHOWN IN RED
- GREEN — GREEN COLOURED CONCENTRATION MET THE STANDARD APPLICABLE AT THE TIME OF SAMPLING
- RED — EXCEEDANCES OF STANDARDS, APPLICABLE AT THE TIME OF SAMPLING, SHOWN IN RED AND UNDERLINED

NOTE(S):
1. SCALE AND SITE INFRASTRUCTURE LOCATIONS ARE APPROXIMATE
2. INFORMATION ON THIS FIGURE MAY BE LOST IF IT IS PRINTED, PHOTOCOPIED OR FAXED IN OTHER THAN ITS ORIGINAL SIZE AND COLOURS

PARAMETERS	ABBREVIATION	STANDARDS
ZINC	Zn	1100

STANDARDS:
- TABLE 3 (2011): FULL DEPTH GENERIC SITE CONDITION STANDARDS IN A NON-POTABLE GROUNDWATER CONDITION FOR ALL TYPES OF PROPERTY USE, COARSE TEXTURED SOILS (MOE, 2011)

GENERAL NOTES:
1. ALL CONCENTRATIONS IN MICROGRAMS/LITRE (µg/L)
2. '<' : LESS THAN ROUTINE REPORTABLE DETECTION LIMIT APPLICABLE AT THE TIME OF REPORTING
3. '*' : FIELD DUPLICATE OF PREVIOUSLY LISTED SAMPLE
4. 'VOC' : VOLATILE ORGANIC COMPOUNDS
5. '(D)' : INDICATES DEEPER SCREENED WELL
6. '(S)' : INDICATES WELL WITH SHALLOW WATER TABLE (DEPTH TO WATER TABLE <3mbg)
7. 'm' : METRES
8. '2018 09 11' : DATE FORMAT YYYY/MM/DD
9. RESULTS FROM SELECT WELLS (WHERE DEPTH TO WATER TABLE <3mbg) WERE ALSO COMPARED TO SHALLOW GROUNDWATER STANDARDS: TABLE 7 GENERIC SITE CONDITION STANDARDS FOR SHALLOW SOILS IN A NON-POTABLE GROUNDWATER CONDITION (MOE, 2011). ADDITIONAL CONTAMINANTS OF CONCERN IDENTIFIED THROUGH THAT SCREENING ARE DISCUSSED IN THE REPORT.

SCALE 1:1,000

0 20 40m

SNC·LAVALIN

Client/Location: CITY OF HAMILTON CENTRAL PARK, HAMILTON, ON	Title: GROUNDWATER ANALYTICAL RESULTS FOR SELECT METALS
Project No: 655184	Filename: 007F18_655184
Drawn: AG/DM	Verified: AM
Date: MARCH 2018	Dwg No: FIGURE 18
Project Manager: LB	

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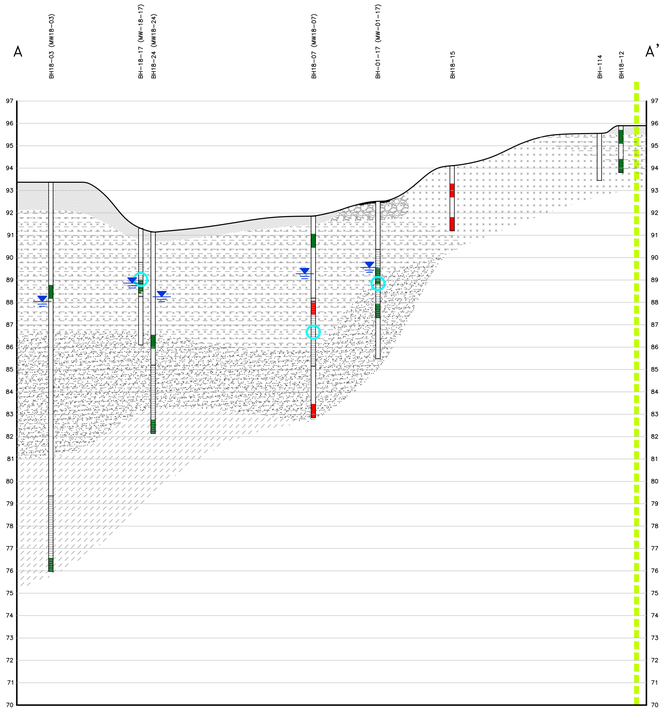

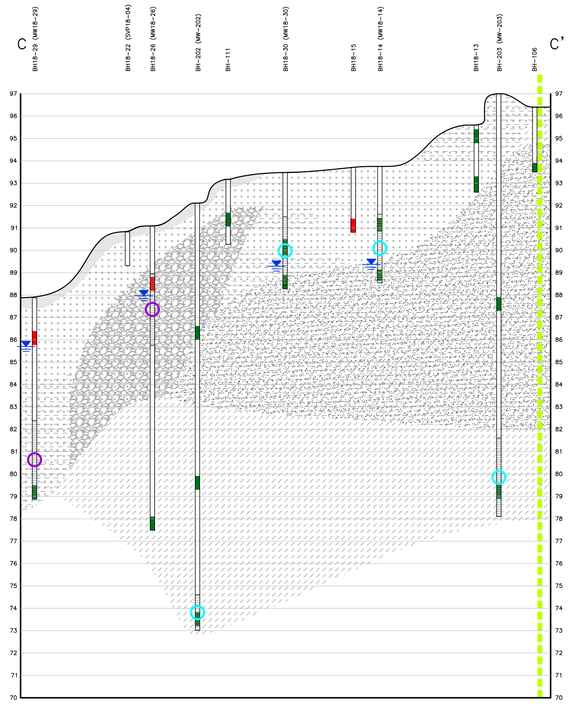

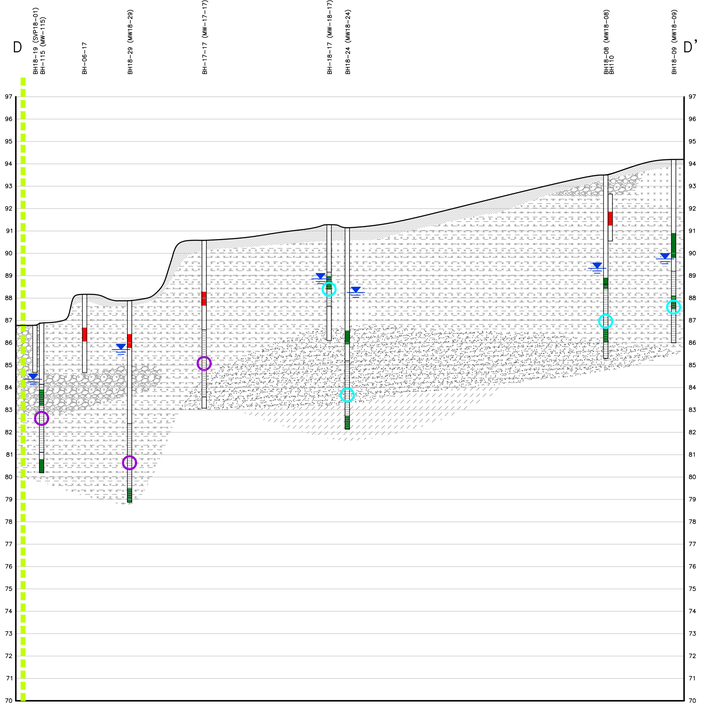

LEGEND

- ASPHALT
- TOPSOIL
- SAND FILL
- SAND AND GRAVEL FILL
- SITY SAND FILL
- NATIVE SILTY SAND
- CLAY
- SILTY CLAY
- ASH
- WOOD
- BRICK
- SITE AREA (ASSUMED)
- WATER LEVEL MEASURED SEPTEMBER 2018
- BOREHOLE/TEST PIT
- MONITORING WELL WITH SCREEN INTERVAL
- ANALYSED SAMPLE – SOIL SAMPLE ANALYSED MET THE STANDARD FOR ALL PARAMETERS ANALYSED
- ANALYSED SAMPLE – SOIL SAMPLE ANALYSED EXCEEDED THE STANDARD FOR AT LEAST ONE PARAMETER ANALYSED
- ANALYSED SAMPLE – GROUNDWATER SAMPLE ANALYSED MET THE STANDARD FOR ALL PARAMETERS ANALYSED
- ANALYSED SAMPLE – GROUNDWATER SAMPLE ANALYSED EXCEEDED THE STANDARD FOR AT LEAST ONE PARAMETER ANALYSED

SCALE 1:1,000

0 20 40m

NOTE(S):
1. SCALE AND SITE INFRASTRUCTURE LOCATIONS ARE APPROXIMATE
2. INFORMATION ON THIS FIGURE MAY BE LOST IF IT IS PRINTED, PHOTOCOPIED OR FAXED IN OTHER THAN ITS ORIGINAL SIZE AND COLOURS
3. "m" : METRES

SNC·LAVALIN

Client/Location: CITY OF HAMILTON
CENTRAL PARK,
HAMILTON, ON

Title: GENERALIZED GEOLOGICAL CROSS SECTIONS (A-A', B-B', C-C' AND D-D') WITH ANALYTICAL RESULTS FOR BTEX PHCs

Project No: 655184 | Filename: 007F19_655184 | Date: JANUARY 2019 | Dwg No: FIGURE 19

Drawn: AC | Verified: AM | Project Manager: LB

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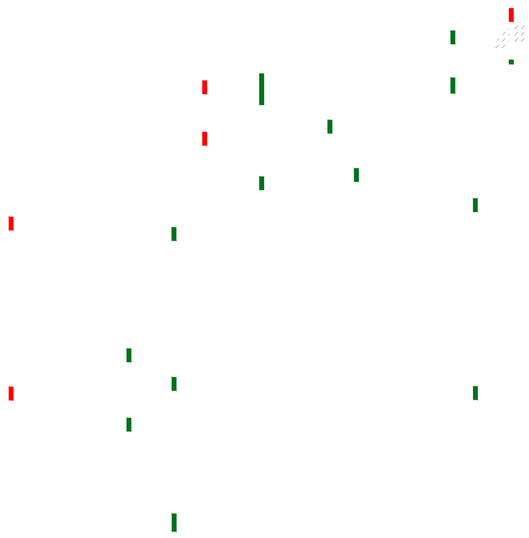

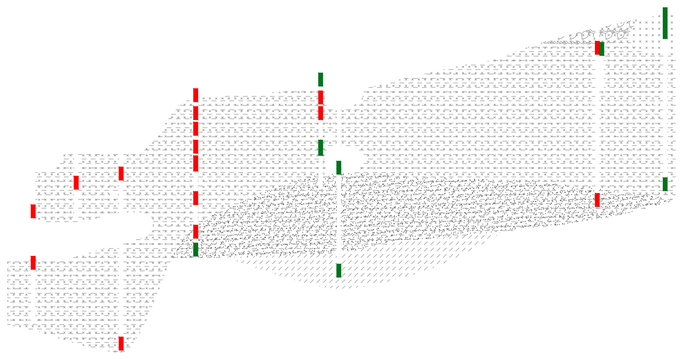

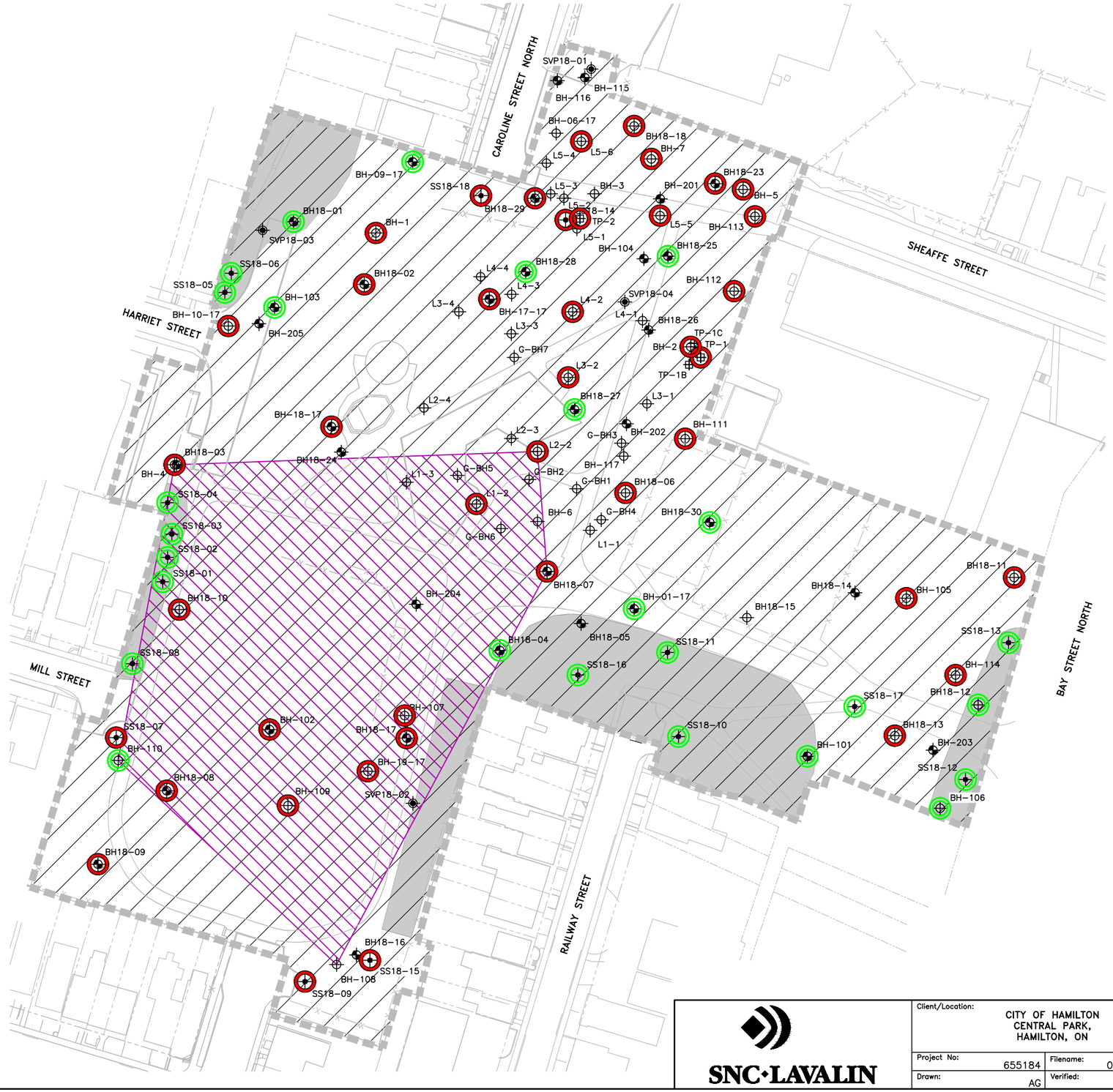

LEGEND

- SHALLOW SOIL SAMPLE
- BOREHOLE
- BOREHOLE/MONITORING WELL
- TEST PIT
- SOIL VAPOUR PROBE
- RA PROPERTY
- PROPERTY LINE
- INFRASTRUCTURE
- EXISTING BUILDING
- FENCE LINE
- RISK MANAGEMENT MEASURE (RMM) REQUIRED (FILL CAP OR HARD CAP)
- RISK MANAGEMENT MEASURE (RMM) REQUIRED – FILL CAP OR HARD CAP MINIMUM THICKNESS OF 1.5m
- ADDITIONAL SOIL SAMPLING REQUIRED TO EXCLUDE RICK MANAGEMENT MEASURE (RMM) REQUIREMENT IN TREED AREAS
- LOCATION WHERE ALL SOIL SAMPLES ANALYSED MET THE HH-SSTL FOR ALL PARAMETERS ANALYSED, SHOWN IN GREEN
- LOCATION WHERE AT LEAST ONE SOIL SAMPLE ANALYSED EXCEEDED THE HH-SSTL FOR AT LEAST ONE PARAMETER ANALYSED, SHOWN IN RED

HH-SSTL — HUMAN HEALTH-SITE SPECIFIC TARGET LEVEL PROTECTIVE OF PARK VISITORS, LONG-TERM OUTDOOR WORKERS, OFF-SITE RESIDENTS AND OFF-SITE COMMERCIAL WORKERS

RMM — RISK MANAGEMENT MEASURE

NOTE(S):
1. SCALE AND SITE INFRASTRUCTURE LOCATIONS ARE APPROXIMATE
2. INFORMATION ON THIS FIGURE MAY BE LOST IF IT IS PRINTED, PHOTOCOPIED OR FAXED IN OTHER THAN ITS ORIGINAL SIZE AND COLOURS

SCALE 1:1,000

0 20 40m

SNC·LAVALIN

Client/Location: CITY OF HAMILTON CENTRAL PARK, HAMILTON, ON		Title: SUMMARY OF SURFACE SOIL RESULTS EXCEEDING HUMAN HEALTH SSTLs	
Project No: 655184	Filename: 007F23_655184	Date: JUNE 2019	Dwg No: FIGURE 23
Drawn: AG	Verified: AM	Project Manager: LB	

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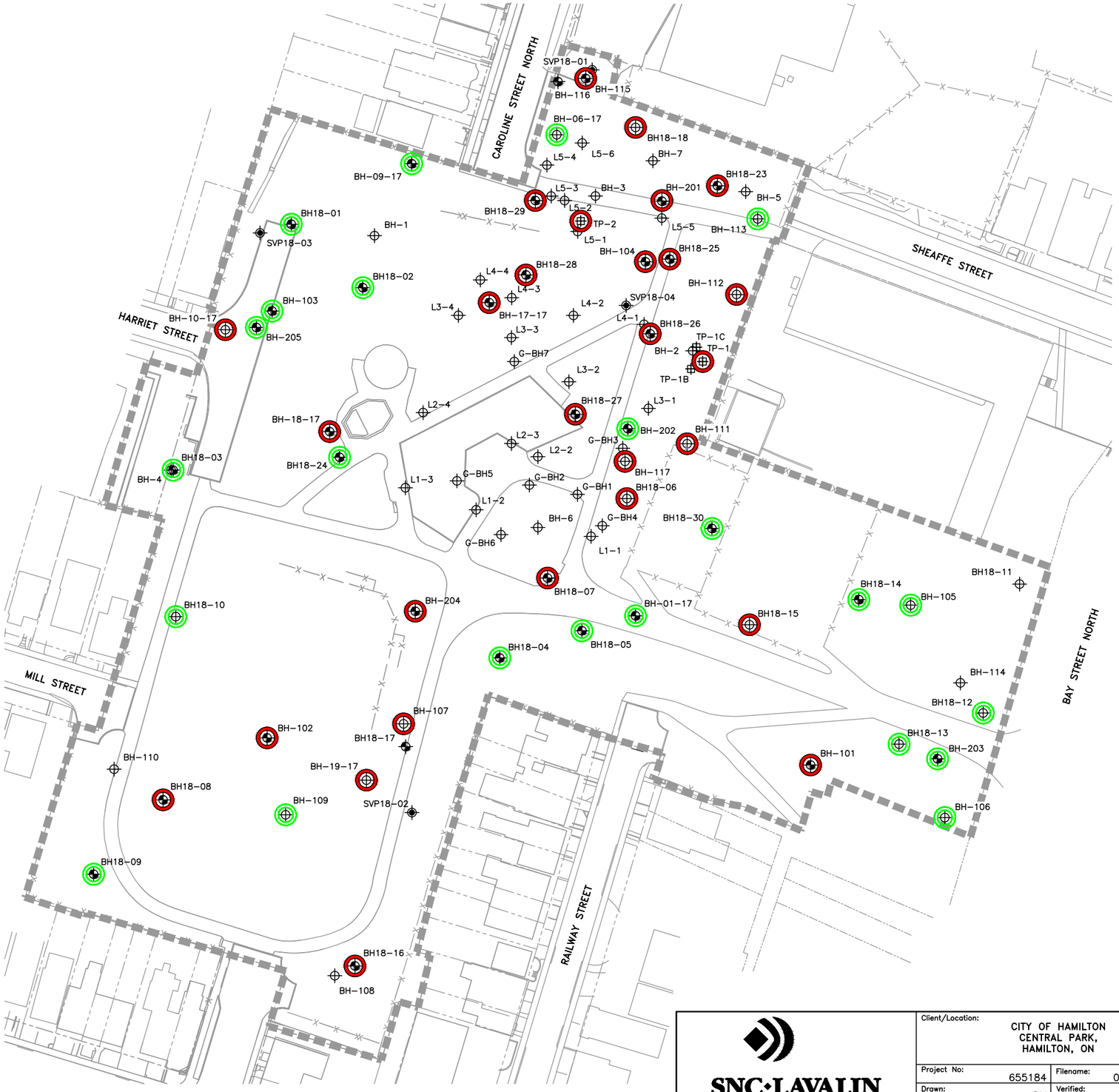

LEGEND

- MONITORING WELL
- RA PROPERTY
- PROPERTY LINE
- INFRASTRUCTURE
- EXISTING BUILDING
- FENCE LINE
- LOCATION WHERE ALL SOIL SAMPLES MET THE HH–SSTL FOR ALL PARAMETERS THAT WERE ANALYSED, SHOWN IN GREEN
- LOCATION WHERE AT LEAST ONE SOIL SAMPLE EXCEEDED THE HH–SSTL FOR AT LEAST ONE PARAMETER ANALYSED, SHOWN IN RED
- HH–SSTL: HUMAN HEALTH–SITE SPECIFIC TARGET LEVEL PROTECTIVE OF SUBSURFACE WORKERS

NOTE(S):
1. SCALE AND SITE INFRASTRUCTURE LOCATIONS ARE APPROXIMATE
2. INFORMATION ON THIS FIGURE MAY BE LOST IF IT IS PRINTED, PHOTOCOPIED OR FAXED IN OTHER THAN ITS ORIGINAL SIZE AND COLOURS

SNC·LAVALIN

Client/Location: CITY OF HAMILTON CENTRAL PARK, HAMILTON, ON		Title: SUMMARY OF SUBSURFACE SOIL RESULTS EXCEEDING HUMAN HEALTH SPECIFIC TARGET LEVEL (SUBSURFACE WORKERS)	
Project No: 655184	Filename: 007F24_655184	Date: MARCH 2019	Dwg No: FIGURE 24
Drawn: DM	Verified: AM	Project Manager: LB	

PAGE FORMAT: 11x17

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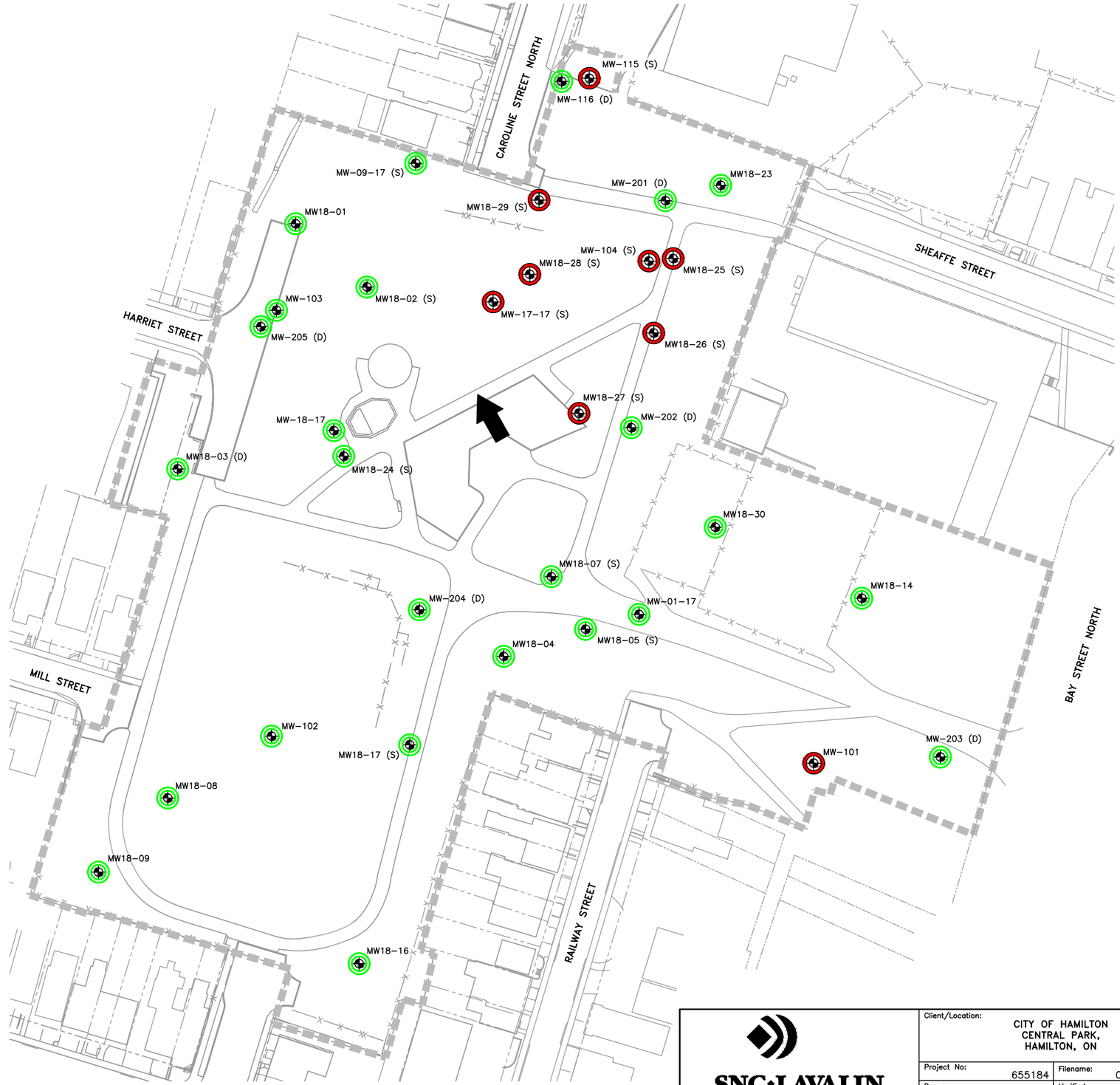

LEGEND

- MONITORING WELL
- RA PROPERTY
- PROPERTY LINE
- INFRASTRUCTURE
- EXISTING BUILDING
- FENCE LINE
- INTERPRETED SHALLOW HORIZONTAL GROUNDWATER FLOW
- LOCATION WHERE MOST RECENT GROUNDWATER SAMPLE MET HH-SSTL FOR ALL PARAMETERS THAT WERE ANALYSED, SHOWN IN GREEN
- LOCATION WHERE MOST RECENT GROUNDWATER SAMPLE EXCEEDED THE HH-SSTL FOR ONE OR MORE PARAMETERS ANALYSED, SHOWN IN RED
- (S) INDICATES SHALLOW WATER TABLE (DEPTH TO WATER TABLE <3mbg)
- (D) INDICATES DEEPER SCREENED WELL
- HH-SSTL HUMAN HEALTH-SITE SPECIFIC TARGET LEVEL PROTECTIVE OF SUBSURFACE WORKERS

NOTE(S):
1. SCALE AND SITE INFRASTRUCTURE LOCATIONS ARE APPROXIMATE
2. INFORMATION ON THIS FIGURE MAY BE LOST IF IT IS PRINTED, PHOTOCOPIED OR FAXED IN OTHER THAN ITS ORIGINAL SIZE AND COLOURS

SCALE 1:1,000
0 20 40m

SNC·LAVALIN

Client/Location: CITY OF HAMILTON CENTRAL PARK, HAMILTON, ON		Title: SUMMARY OF SUBSURFACE GROUNDWATER RESULTS EXCEEDING HUMAN HEALTH SPECIFIC TARGET LEVEL (SUBSURFACE WORKERS)	
Project No: 655184	Filename: 007F25_655184	Date: MARCH 2019	Dwg No: FIGURE 25
Drawn: DM	Verified: AM	Project Manager: LB	

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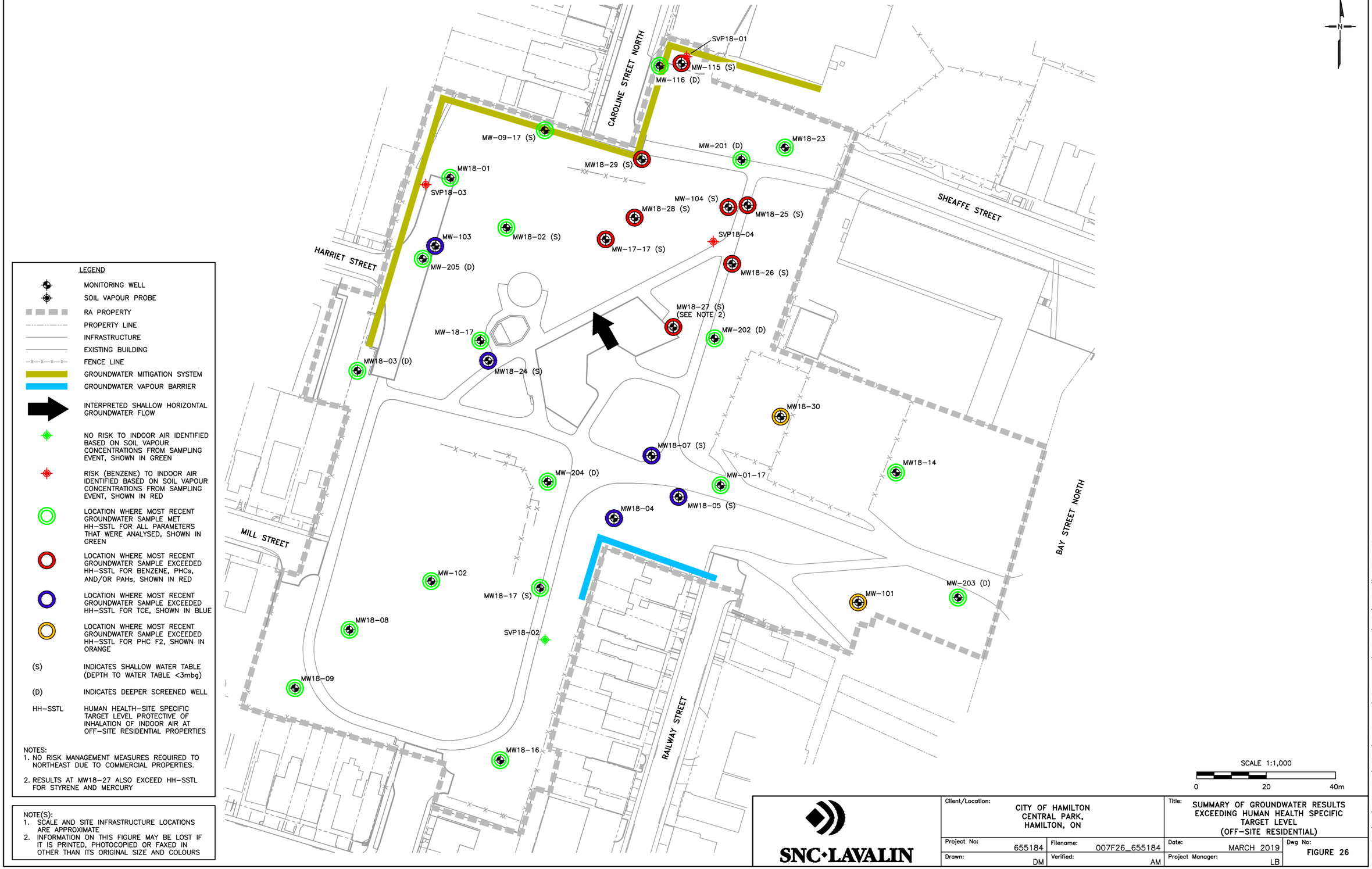

LEGEND

- MONITORING WELL
- SOIL VAPOUR PROBE
- RA PROPERTY
- PROPERTY LINE
- INFRASTRUCTURE
- EXISTING BUILDING
- FENCE LINE
- GROUNDWATER MITIGATION SYSTEM
- GROUNDWATER VAPOUR BARRIER
- INTERPRETED SHALLOW HORIZONTAL GROUNDWATER FLOW
- NO RISK TO INDOOR AIR IDENTIFIED BASED ON SOIL VAPOUR CONCENTRATIONS FROM SAMPLING EVENT, SHOWN IN GREEN
- RISK (BENZENE) TO INDOOR AIR IDENTIFIED BASED ON SOIL VAPOUR CONCENTRATIONS FROM SAMPLING EVENT, SHOWN IN RED
- LOCATION WHERE MOST RECENT GROUNDWATER SAMPLE MET HH-SSTL FOR ALL PARAMETERS THAT WERE ANALYSED, SHOWN IN GREEN
- LOCATION WHERE MOST RECENT GROUNDWATER SAMPLE EXCEEDED HH-SSTL FOR BENZENE, PHCs, AND/OR PAHs, SHOWN IN RED
- LOCATION WHERE MOST RECENT GROUNDWATER SAMPLE EXCEEDED HH-SSTL FOR TCE, SHOWN IN BLUE
- LOCATION WHERE MOST RECENT GROUNDWATER SAMPLE EXCEEDED HH-SSTL FOR PHC F2, SHOWN IN ORANGE

(S) INDICATES SHALLOW WATER TABLE (DEPTH TO WATER TABLE <3mbg)

(D) INDICATES DEEPER SCREENED WELL

HH-SSTL HUMAN HEALTH-SITE SPECIFIC TARGET LEVEL PROTECTIVE OF INHALATION OF INDOOR AIR AT OFF-SITE RESIDENTIAL PROPERTIES

NOTES:
1. NO RISK MANAGEMENT MEASURES REQUIRED TO NORTHEAST DUE TO COMMERCIAL PROPERTIES.
2. RESULTS AT MW18-27 ALSO EXCEED HH-SSTL FOR STYRENE AND MERCURY

NOTE(S):
1. SCALE AND SITE INFRASTRUCTURE LOCATIONS ARE APPROXIMATE
2. INFORMATION ON THIS FIGURE MAY BE LOST IF IT IS PRINTED, PHOTOCOPIED OR FAXED IN OTHER THAN ITS ORIGINAL SIZE AND COLOURS

SNC·LAVALIN

Client/Location: CITY OF HAMILTON CENTRAL PARK, HAMILTON, ON		Title: SUMMARY OF GROUNDWATER RESULTS EXCEEDING HUMAN HEALTH SPECIFIC TARGET LEVEL (OFF-SITE RESIDENTIAL)	
Project No: 655184	Filename: 007F26_655184	Date: MARCH 2019	Dwg No: FIGURE 26
Drawn: DM	Verified: AM	Project Manager: LB	

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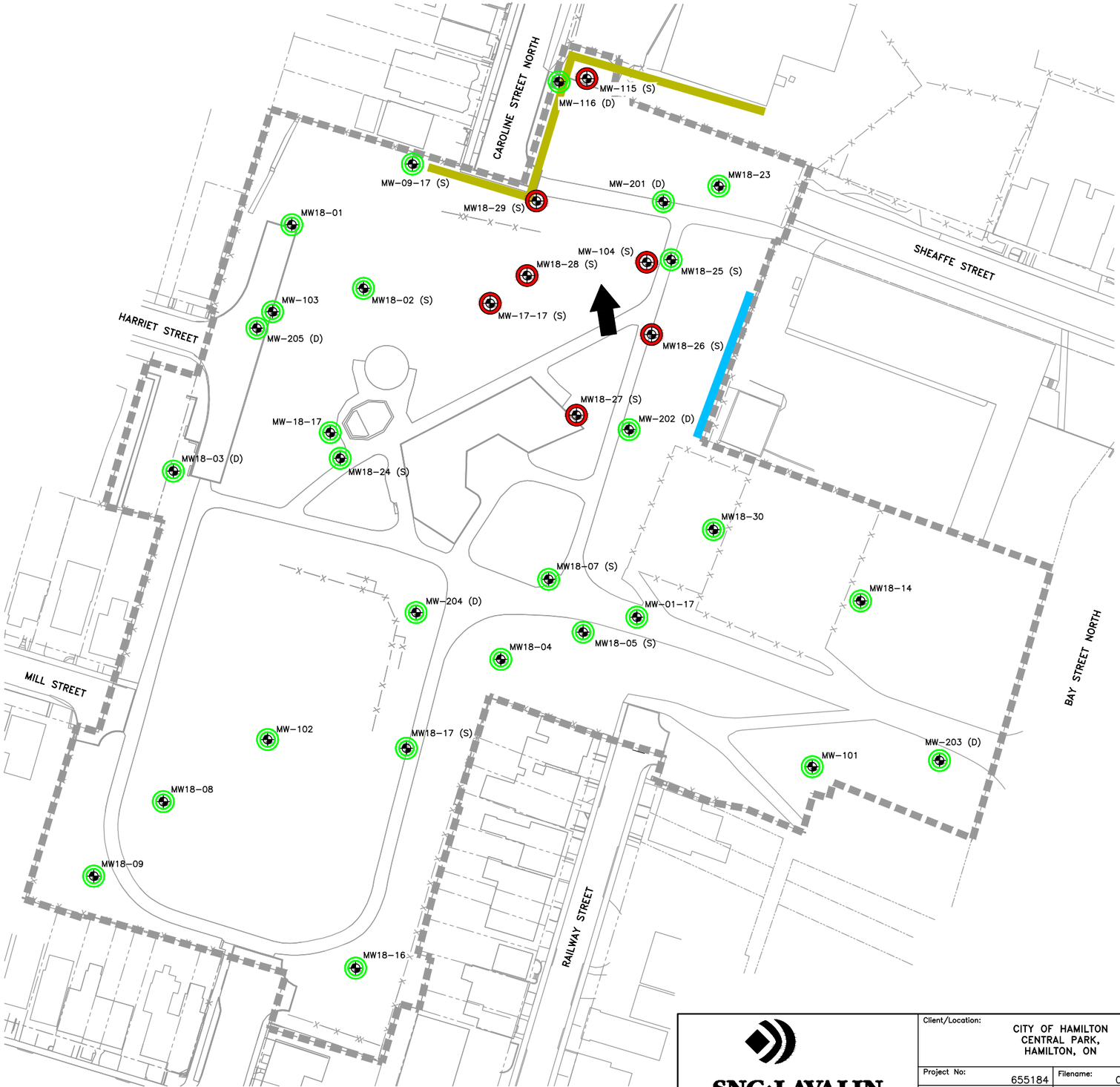

LEGEND

- MONITORING WELL
- RA PROPERTY
- PROPERTY LINE
- INFRASTRUCTURE
- EXISTING BUILDING
- FENCE LINE
- GROUNDWATER MITIGATION SYSTEM
- GROUNDWATER VAPOUR BARRIER
- INTERPRETED SHALLOW HORIZONTAL GROUNDWATER FLOW
- LOCATION WHERE MOST RECENT GROUNDWATER SAMPLE MET HH-SSTL FOR ALL PARAMETERS THAT WERE ANALYSED, SHOWN IN GREEN
- LOCATION WHERE MOST RECENT GROUNDWATER SAMPLE EXCEEDED HH-SSTL FOR BENZENE, SHOWN IN RED
- (S) INDICATES SHALLOW WATER TABLE (DEPTH TO WATER TABLE <3mbg)
- (D) INDICATES DEEPER SCREENED WELL
- HH-SSTL HUMAN HEALTH-SITE SPECIFIC TARGET LEVEL PROTECTIVE OF INHALATION OF INDOOR AIR AT OFF-SITE COMMERCIAL PROPERTIES

NOTE(S):
1. SCALE AND SITE INFRASTRUCTURE LOCATIONS ARE APPROXIMATE
2. INFORMATION ON THIS FIGURE MAY BE LOST IF IT IS PRINTED, PHOTOCOPIED OR FAXED IN OTHER THAN ITS ORIGINAL SIZE AND COLOURS

SNC·LAVALIN

Client/Location: CITY OF HAMILTON CENTRAL PARK, HAMILTON, ON		Title: SUMMARY OF GROUNDWATER RESULTS EXCEEDING HUMAN HEALTH SPECIFIC TARGET LEVEL (OFF-SITE COMMERCIAL)	
Project No: 655184	Filename: 007F27_655184	Date: MARCH 2019	Dwg No: FIGURE 27
Drawn: DM	Verified: AM	Project Manager: LB	

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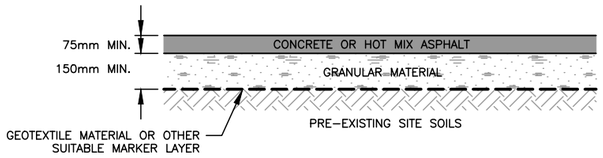
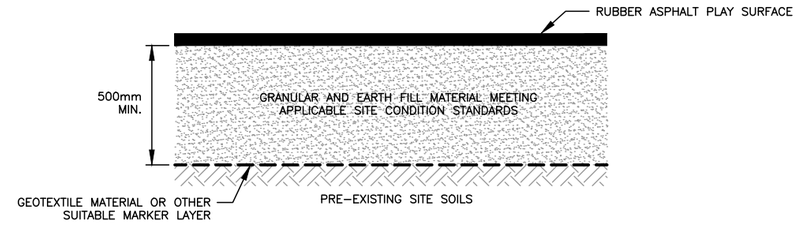
FILL CAP/HARD CAP

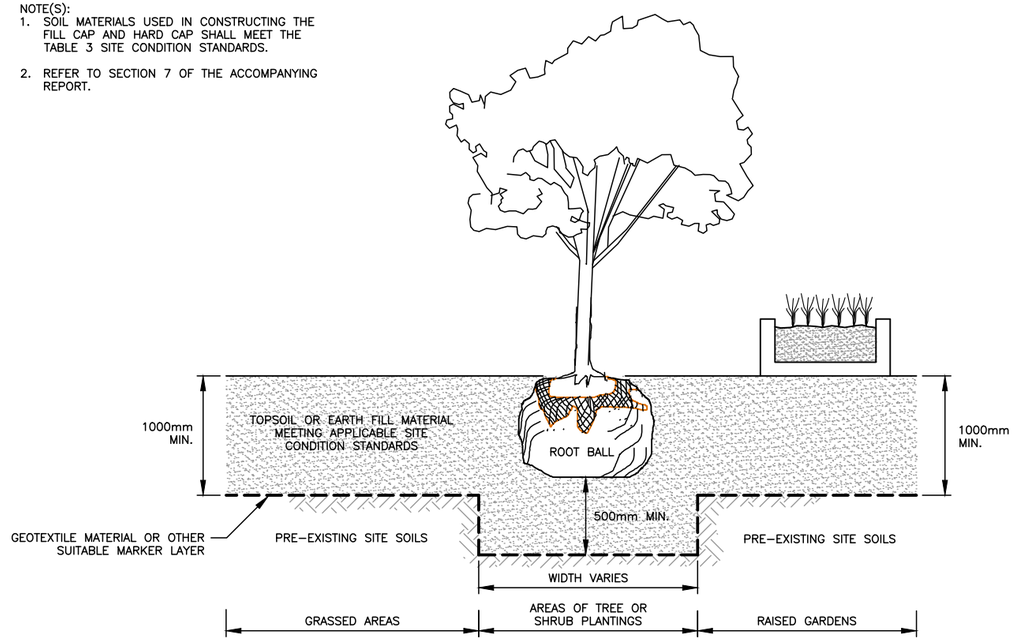


DETAIL 1 – WALKWAYS, ACCESS ROADS AND PAVED PARKING AREAS
NOT TO SCALE



DETAIL 2 – PLAY AREAS
NOT TO SCALE

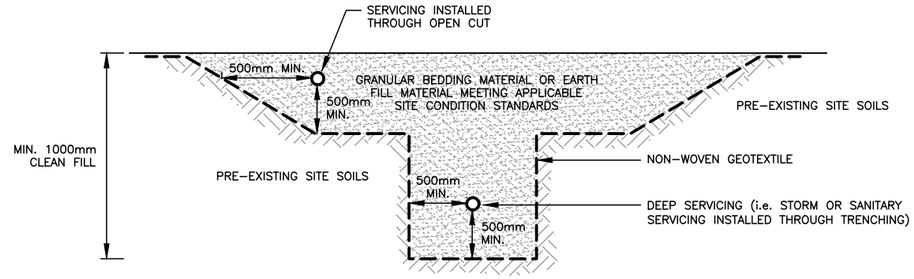
NOTE(S):
1. SOIL MATERIALS USED IN CONSTRUCTING THE FILL CAP AND HARD CAP SHALL MEET THE TABLE 3 SITE CONDITION STANDARDS.
2. REFER TO SECTION 7 OF THE ACCOMPANYING REPORT.



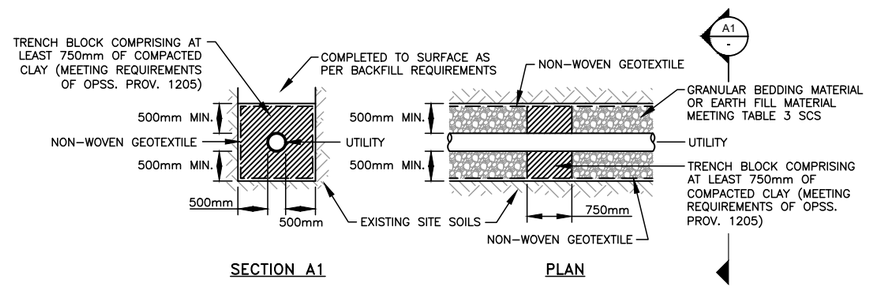
DETAIL 3 – LANDSCAPED AREAS
NOT TO SCALE

NOTE(S):
1. SCALE AND SITE INFRASTRUCTURE LOCATIONS ARE APPROXIMATE
2. INFORMATION ON THIS FIGURE MAY BE LOST IF IT IS PRINTED, PHOTOCOPIED OR FAXED IN OTHER THAN ITS ORIGINAL SIZE AND COLOURS

SITE SERVICES AND TRENCH BLOCKS



DETAIL 4 – SITE SERVICING
NOT TO SCALE



DETAIL 5 – TRENCH BLOCK
NOT TO SCALE

SNC·LAVALIN

Client/Location: CITY OF HAMILTON CENTRAL PARK, HAMILTON, ON		Title: CONCEPTUAL RISK MANAGEMENT MEASURES	
Project No: 655184	Filename: 007F28_655184	Date: JUNE 2019	Dwg No: FIGURE 28
Drawn: DM/AG	Verified: AM	Project Manager: LB	

FILENAME: P:\HAM\Central Park\655184\40_Execution\47_Wrkg_Vers\CAD_GIS\007 (2018 RA)\007F28_655184.dwg

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Tables

TABLE 2: Preliminary Screening of COCs In Surface Soil 2013-2018
Central Park, Hamilton, ON

			Sample Location	Table 3[1]	BH-1	BH-1	BH-2	BH-2	BH-4	BH-4	BH-5	BH-5	BH-6	BH-6	BH-7	BH-7	L-1-2	L-2-2	L-3-2
			Laboratory Sample ID	Standard	130524-1	130524-2	130524-3	130524-4	130524-5	130524-6	130524-7	130524-8	130524-10	130524-9	130524-11	130524-12	130524-13	130524-14	130524-15
			SNC-Lavalin Sample ID		130320_BH-1-1 0 - 1.0	BH-1-2	BH-2-1	BH-2-2	130320_BH-4-1 0 - 1.0	BH-4-2	130320_BH-5-1 0 - 1.0	BH-5-2	BH-6-2	BH-6-1	130320_BH-7-1 0 - 1.0	BH-7-2	L-1-2	L-2-2	L-3-2
			Sampling Date (yyyy/mm/dd)	R/P/I_CG_NPG Surface	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2013/03/20
			Depth Interval (mbgs)		0.0 - 1.0	1.2 - 2.0	0.0 - 1.0	1.2 - 2.0	0.0 - 1.0	1.2 - 2.0	0.0 - 1.0	1.2 - 2.0	1.2 - 2.0	0.0 - 1.0	0.0 - 1.0	1.2 - 2.0	0.1 - 0.6	0.2 - 0.9	0.1 - 0.9
			Field Screen (ppmv)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parameter	**RDL**	**Units**																	
General Chemistry																			
Cyanide (CN-)	0.04	µg/g		0.051	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g		0.051	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm		0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fraction of Organic Carbon	0.001	g/g		na	-	-		-	-	-	-	-	-	-	-	-	-	-	-
pH [2]	-	pH		9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium Adsorption Ratio [3]	-	None		5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Sodium	1	mg/L		na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Calcium	1	mg/L		na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Magnesium	1	mg/L		na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon	0.1	%		na	-	-		-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																			
Antimony	0.8	µg/g		7.5	1.1	< 0.8	< 0.8	1	2.5	< 0.8	**15.6**	< 0.8	2.2	< 0.8	1.2	< 0.8	1.5	1.6	1.3
Arsenic	0.2	µg/g		18	12	4	4	13	7	4	10	3	10	4	8	3	10	14	11
Barium	1	µg/g		390	107	27	61	174	97	27	92	34	108	52	142	25	111	100	87
Beryllium	0.5	µg/g		4	< 0.5	< 0.5	< 0.5	0.6	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Boron	5	µg/g		120	6	< 5	7	9	7	8	12	< 5	6	< 5	10	5	8	5	7
Boron (Hot Water Soluble)	0.1	µg/g		1.5	0.63	0.25	0.44	1.04	0.94	0.3	0.41	0.25	0.71	0.25	0.3	0.27	0.56	0.22	0.71
Cadmium	0.5	µg/g		1.2	0.7	< 0.5	0.7	1.2	0.6	< 0.5	0.7	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.7	0.5
Chromium (total)	1	µg/g		160	24	10	13	26	18	12	17	12	14	16	14	9	18	16	15
Chromium (VI)	0.2	µg/g		8	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Cobalt	1	µg/g		22	7.9	6.4	5.2	9.7	6.5	7.7	10.3	6.5	8.2	7.6	6.6	5.7	8.2	7	7.3
Copper	1	µg/g		140	75	23	18	130	51	27	97	24	**160**	23	48	19	112	122	**143**
Lead	1	µg/g		120	**224**	9	112	**338**	**176**	9	**593**	31	**676**	25	**180**	10	**396**	**312**	**255**
Mercury	0.005	µg/g		0.27	**0.52**	< 0.10	< 0.10	**2.69**	**0.29**	< 0.10	0.13	**0.3**	**2.3**	0.1	**1.83**	< 0.10	**4.03**	**3.64**	**3.26**
Molybdenum	0.5	µg/g		6.9	2.4	< 0.5	1.4	1.5	0.8	0.5	1.1	< 0.5	1.2	< 0.5	1.1	< 0.5	2.9	1.3	1.2
Nickel	1	µg/g		100	22	12	12	33	16	15	21	12	17	14	14	12	17	18	20
Selenium	0.4	µg/g		2.4	0.8	< 0.4	< 0.4	0.9	0.6	< 0.4	0.5	< 0.4	0.7	0.4	0.5	< 0.4	0.8	0.9	0.8
Silver	0.2	µg/g		20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.5	< 0.2	< 0.2
Thallium	0.4	µg/g		1	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Uranium	0.5	µg/g		23	< 0.5	< 0.5	0.8	0.5	0.6	< 0.5	0.6	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Vanadium	1	µg/g		86	17	15	26	29	21	19	25	18	22	22	21	15	23	22	26
Zinc	5	µg/g		340	205	37	319	**541**	241	43	279	50	**424**	78	119	32	260	**410**	315
Volatiles																			
Benzene	0.0068	µg/g		0.21	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Toluene	0.05	µg/g		2.3	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Ethylbenzene	0.018	µg/g		2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Xylenes	0.05	µg/g		3.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
m+p-Xylenes	0.03	µg/g		na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylenes	0.02	µg/g		na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexane (n)	0.05	µg/g		2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum Hydrocarbon (PHC) Fractions																			
PHC F1	5	µg/g		55	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PHC F2	10	µg/g		98	< 10	< 10	< 10	**480**	< 10	< 10	< 10	< 10	21	< 10	< 10	< 10	< 10	< 10	< 10
PHC F3	50	µg/g		300	**390**	< 50	< 50	**7,000**	< 50	< 50	**2,700**	< 50	**450**	< 50	< 50	< 50	**350**	100	< 50
PHC F4	50	µg/g		2,800	84	< 50	< 50	710	51	< 50	420	79	< 50	< 50	< 50	< 50	60	< 50	< 50
PHC F4 (silica gel)	250	µg/g		2,800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds																			
Bromodichloromethane	0.05	µg/g		13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform	0.05	µg/g		0.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromomethane	0.05	µg/g		0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	0.05	µg/g		0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	0.05	µg/g		2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	0.04	µg/g		0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	0.05	µg/g		9.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g		3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g		4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g		0.083	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorodifluoromethane	0.05	µg/g		16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,1-	0.02	µg/g		3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,2-	0.03	µg/g		0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethylene, 1,1-	0.05	µg/g		0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethylene, cis-1,2-	0.02	µg/g		3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethylene, trans-1,2-	0.05	µg/g		0.084	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloropropane, 1,2-	0.03	µg/g		0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloropropene, 1,3-	0.042	µg/g		0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylene Dibromide	0.04	µg/g		0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Ethyl Ketone	0.5	µg/g		16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Isobutyl Ketone	0.5	µg/g		1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl tert butyl ether (MTBE)	0.05	µg/g		0.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylene Chloride	0.05	µg/g		0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	0.05	µg/g		0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g		0.058	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g		0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethylene	0.05	µg/g		0.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,1-	0.05	µg/g		0.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,2-	0.04	µg/g		0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethylene	0.01	µg/g		0.061	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	0.05	µg/g		4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride [4]	0.02	µg/g		0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAHs																			
Acenaphthene L	0.05	µg/g		7.9	0.12	< 0.05	< 0.05	**33**	< 0.05	< 0.05	0.2	< 0.05	1.5	< 0.05	0.34	< 0.05	3.3	0.14	0.12
Acenaphthyler L	0.05	µg/g		0.15	**0.4**	< 0.05	< 0.05	**2.2**	< 0.05	< 0.05	< 0.05	< 0.05	**2.1**	< 0.05	**0.55**	< 0.05	**1.7**	0.15	0.14
Anthracene L	0.05	µg/g		0.67	**0.75**	< 0.05	0.13	**85**	0.07	< 0.05	0.41	0.06	**4.5**	< 0.05	**1.4**	0.05	**14**	0.33	0.2
Benzo(a)anthr H	0.05	µg/g		0.5	**2.4**	< 0.05	0.22	**73**	0.14	< 0.05	0.38	0.05	**7.1**	0.08	**4.6**	0.24	**50**	**1.2**	**0.87**
Benzo(a)pyren H	0.05	µg/g		0.3	**3.2**	< 0.05	0.39	**57**	0.22	< 0.05	**0.36**	0.05	**8.5**	0.11	**5.1**	0.24	**45**	**1.2**	**0.92**
Benzo(b)fluora H	0.05	µg/g		0.78	**3.4**	< 0.05	0.4	**75**	0.22	< 0.05	0.48	0.06	**9.9**	0.08	**7.2**	0.27	**33**	**1.3**	**1.1**
Benzo(g,h,i)pe H	0.05	µg/g		6.6	2	< 0.05	0.2	**25**	0.14	< 0.05	0.23	< 0.05	4.7	0.12	3	0.15	**14**	1	0.96
Benzo(k)fluora H	0.05	µg/g		0.78	**1.7**	< 0.05	0.27	**32**	0.12	< 0.05	0.24	< 0.05	**4.6**	0.07	**2.3**	0.14	**11**	0.6	0.44
Chrysene H	0.05	µg/g		7	2.9	< 0.05	0.23	**68**	0.2	< 0.05	0.41	0.05	7	0.08	4.4	0.27	**45**	1.2	0.86
Dibenzo(a,h)an H	0.05	µg/g		0.1	**0.56**	< 0.05	< 0.05	**7.3**	< 0.05	< 0.05	0.05	< 0.05	**1.2**	< 0.05	**0.89**	< 0.05	**4.1**	**0.3**	**0.21**
Fluoranthene H	0.05	µg/g		0.69	**5.4**	< 0.05	0.72	**220**	0.35	< 0.05	**1.2**	0.13	**16**	0.09	**9.4**	0.38	**89**	**2.5**	**1.8**
Fluorene L	0.05	µg/g		62	0.21	< 0.05	< 0.05	**64**	< 0.05	< 0.05	0.37	< 0.05	1.8	< 0.05	0.4	< 0.05	4.8	0.09	0.08
Indeno(1,2,3-c H	0.05	µg/g		0.38	**1.9**	< 0.05	0.18	**29**	0.12	< 0.05	0.24	< 0.05	**5**	0.08	**3.1**	0.12	**13**	**0.84**	**0.59**
Methylnaphthalene, 1-	0.03	µg/g		0.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	0.03	µg/g		0.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthal L	0.042	µg/g		0.99	0.18	< 0.05	< 0.05	**28**	< 0.05	< 0.05	0.37	< 0.05	**1.2**	< 0.05	0.12	< 0.05	0.91	< 0.05	< 0.05
Naphthalene L	0.013	µg/g		0.6	0.18	< 0.05	0.07	**52**	< 0.05	< 0.05	**2**	0.1	**3.3**	< 0.05	0.25	< 0.05	0.47	0.08	0.19
Phenanthrene L	0.046	µg/g		6.2	2.5	< 0.05	0.23	**260**	0.15	< 0.05	1.2	0.11	**13**	< 0.05	3.7	0.17	**44**	0.72	0.55
Pyrene H	0.05	µg/g		78	5.1	< 0.05	0.63	**160**	0.31	< 0.05	0.85	0.1	14	0.12	8.2	0.36	**79**	2.4	1.7
LMW PAH [7]	na	µg/g		na	4.34	na	0.43	524.2	0.22	na	4.55	0.27	27.4	na	6.76	0.22	69.18	1.51	1.28
HMW PAH [8]	na	µg/g		na	28.56	na	3.24	746.3	1.82	na	4.44	0.44	78	0.83	48.19	2.17	383.1	12.54	9.45
PCBs																			
Arochlor 1242	0.01	µg/g		na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g		na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g		na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g		na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/g		0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
> - SAR is incalculable du to Ca, Na and/or Mg below detection limit. Lowest possible SAR is reported as minimum value
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

Acenaphthylene	L
Anthracene	L
Benzo(a)anthracene	H
Benzo(a)pyrene	H
Benzo(b)fluoranthene	H
Benzo(g,h,i)perylene	H
Benzo(k)fluoranthene	H
Chrysene	H
Dibenzo(a,h)anthracene	H
Fluoranthene	H
Fluorene	L
Indeno(1,2,3-cd)pyrene	H
Methylnaphthalene, 1-	
Methylnaphthalene, 2-	
Methylnaphthalene, 1- & 2-	L
Naphthalene	L
Phenanthrene	L
Pyrene	H

[1] Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[7] Low Molecular Weight (LMW) PAH consisting of: Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Methylnaphthalenes, Naphthalene and Phenanthrene.

[8] High Molecular Weight (HMW) PAH consisting of: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene and Pyrene.

TABLE 2: Preliminary Screening of COCs In Surface Soil 2013-2018
Central Park, Hamilton, ON

			Sample Location	Table 3[1]	L-4-2	L-4-2	L-5-5	L-5-5	L-5-6	BH-01-17	BH-01-17	BH-01-17	BH-02-17	BH-02-17	BH-02-17	BH-03-17	BH-03-17	BH-04-17	BH-04-17	BH-05-17	BH-05-17	BH-05-17
			Laboratory Sample ID	Standard	130524-16	130524-17	130524-18	130524-19	130524-20	L2038490-1	L2038490-2	L2038490-3	L2040326-1	L2040326-2	L2040326-3	L2040326-6	L2040326-7	L2040324-1	L2040324-2	L2040324-5	L2040324-6	L2040324-7
			SNC-Lavalin Sample ID		L-4-2	L-4-2 Dup	L-5-5	L-5-5 Dup	L-5-6	BH-01-17 SS1	BH-01-17 SS2	BH-01D-17 SS2	BH-02-17 SS1	BH-02-17 SS2	BH-02D-17 SS2	BH-03-17 SS1	BH-03-17 SS2	BH-04-17 SS1	BH-04-17 SS2	BH-05-17 SS1	BH-05-17 SS2	BH-05D-17 SS2
			Sampling Date (yyyy/mm/dd)	R/P/I_CG_NPG Surface	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2017/12/15	2017/12/15	2017/12/15	2017/12/22	2017/12/22	2017/12/22	2017/12/22	2017/12/22	2017/12/22	2017/12/22	2017/12/22	2017/12/22	2017/12/22
			Depth Interval (mbgs)		0.1 - 1.3	0.1 - 1.3	0.1 - 1.3	0.1 - 1.3	0.1 - 1.2	0.1 - 0.6	0.8 - 1.4	0.8 - 1.4	0.2 - 0.8	0.9 - 1.5	0.9 - 1.5	0.2 - 0.8	0.9 - 1.5	0.1 - 0.7	0.8 - 1.4	0.1 - 0.7	0.8 - 1.4	0.8 - 1.4
			Field Screen (ppmv)		-	Duplicate of L-4-2	-	Duplicate of L-5-5	-	-	-	Duplicate of BH-01-17 SS2	-	-	Duplicate of BH-02-17 SS2	-	-	-	-	-	-	Duplicate of BH-05-17 SS2
Parameter	**RDL**	**Units**																			
General Chemistry																					
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	0.7	-	-	-	-	-	563	-	-	184	344	387	372	**741**	343	**973**	362	659	623
Fraction of Organic Carbon	0.001	g/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH [2]	-	pH	9	-	-	-	-	-	8.12	-	-	7.43	7.43	7.56	7.74	7.71	7.6	7.63	8.4	8.18	8.16
Sodium Adsorption Ratio [3]	-	None	5	-	-	-	-	-	**13.1**	-	-	0.79	2.89	4.42	**8.88**	**19**	2.73	**33>**	**9.3>**	**31.7**	**19>**
Soluble Sodium	1	mg/L	na	-	-	-	-	-	97.5	-	-	26.5	55.8	64.2	63	126	61.4	194	54.9	118	111
Soluble Calcium	1	mg/L	na	-	-	-	-	-	4.2	-	-	6.5	2.9	1.7	1.5	3.4	4.8	< 1.0	< 1.0	1.1	< 1.0
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	< 1.0	-	-	47.8	15.4	8.7	1.4	< 1.0	20.4	< 1.0	< 1.0	< 1.0	< 1.0
Total Organic Carbon	0.1	%	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																					
Antimony	0.8	µg/g	7.5	< 0.8	< 0.8	3.1	< 0.8	< 0.8	1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	0.2	µg/g	18	7	8	**23**	9	7	4.19	4.5	4.3	6.77	6.18	6.5	2.28	6.39	3.91	4.79	2.71	4.06	4.1
Barium	1	µg/g	390	100	100	197	120	59	43.8	25.5	27.1	31.8	22.8	25.1	41.7	28.9	23.6	21.1	19.1	41.2	40.3
Beryllium	0.5	µg/g	4	< 0.5	0.5	0.6	0.6	< 0.5	< 0.50	< 0.50	< 0.50	0.57	< 0.50	0.5	< 0.50	0.59	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Boron	5	µg/g	120	9	8	12	7	6	-	9.2	9.5	-	-	-	-	-	-	-	-	-	-
Boron (Hot Water Soluble)	0.1	µg/g	1.5	1.22	1.03	1.3	0.63	0.5	-	0.52	0.55	-	-	-	-	-	-	-	-	-	-
Cadmium	0.5	µg/g	1.2	0.5	< 0.5	1	< 0.5	< 0.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	**45.8**	< 0.50	< 0.50
Chromium (total)	1	µg/g	160	17	21	29	16	11	14.2	11.3	11.4	17.4	16.2	17.7	11.5	19.6	12.9	14.9	5.9	9.8	10.3
Chromium (VI)	0.2	µg/g	8	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	< 0.20	< 0.20	-	-	-	-	-	-	-	-	-	-
Cobalt	1	µg/g	22	6.8	9.4	7.2	6.5	5.8	7.6	6.4	6.1	8.9	8.1	8.8	4.6	9.2	6	8.8	2	5.7	6.2
Copper	1	µg/g	140	64	58	**264**	79	51	31.3	22.1	21.7	41.9	37.8	40.4	13.7	39.7	24.2	31.2	15.7	22.2	22.3
Lead	1	µg/g	120	**141**	**137**	**897**	**512**	**147**	48.5	6.8	6.7	10.7	9.7	10.5	8.5	12	9	9.3	60.1	17.5	11.3
Mercury	0.005	µg/g	0.27	**0.69**	**1.43**	**5.79**	**0.84**	**0.76**	0.128	0.0079	0.0066	0.0185	0.0188	0.0214	0.0317	0.0202	0.0339	0.0149	**0.592**	0.0408	0.0254
Molybdenum	0.5	µg/g	6.9	1	1.5	1.9	0.7	0.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.6	< 1.0	< 1.0
Nickel	1	µg/g	100	15	22	22	21	12	16	11.4	11	17.3	15.8	16.3	9.8	19.2	12.1	17	5.4	10.9	11.7
Selenium	0.4	µg/g	2.4	0.7	0.5	1.5	< 0.4	0.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Silver	0.2	µg/g	20	< 0.2	< 0.2	0.2	0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Thallium	0.4	µg/g	1	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	-	< 0.50	< 0.50	-	-	-	-	-	-	-	-	-	-
Uranium	0.5	µg/g	23	0.6	0.6	0.6	< 0.5	< 0.5	-	< 1.0	< 1.0	-	-	-	-	-	-	-	-	-	-
Vanadium	1	µg/g	86	20	28	26	27	17	25.4	27.2	27.9	31.4	30.2	35.2	22.1	34.7	23.4	25.8	8.2	19.4	20
Zinc	5	µg/g	340	259	223	**677**	**515**	111	57.2	34.1	32.3	51	48.7	49.8	37.3	50.4	43.6	47.4	**41,600**	55.1	38.8
Volatiles																					
Benzene	0.0068	µg/g	0.21	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	0.05	µg/g	2.3	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	0.018	µg/g	2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes	0.05	µg/g	3.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-	-	-	-	-	-	-	-	-	-
m+p-Xylenes	0.03	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylenes	0.02	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexane (n)	0.05	µg/g	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum Hydrocarbon (PHC) Fractions																					
PHC F1	5	µg/g	55	< 5	< 5	< 5	< 5	< 5	-	-	-	-	-	-	-	-	-	-	-	-	-
PHC F2	10	µg/g	98	< 10	< 10	**130**	33	12	-	-	-	-	-	-	-	-	-	-	-	-	-
PHC F3	50	µg/g	300	< 50	150	**1,100**	**1,200**	**440**	-	-	-	-	-	-	-	-	-	-	-	-	-
PHC F4	50	µg/g	2,800	< 50	< 50	160	300	96	-	-	-	-	-	-	-	-	-	-	-	-	-
PHC F4 (silica gel)	250	µg/g	2,800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds																					
Bromodichloromethane	0.05	µg/g	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform	0.05	µg/g	0.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromomethane	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	0.05	µg/g	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	0.05	µg/g	9.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorodifluoromethane	0.05	µg/g	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Ethyl Ketone	0.5	µg/g	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Isobutyl Ketone	0.5	µg/g	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylene Chloride	0.05	µg/g	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	0.05	µg/g	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethylene	0.05	µg/g	0.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethylene	0.01	µg/g	0.061	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	0.05	µg/g	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride [4]	0.02	µg/g	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAHs																					
Acenaphthene L	0.05	µg/g	7.9	0.13	0.1	4.4	**15**	0.06	-	< 0.050	-	-	-	-	-	-	-	-	-	-	-
Acenaphthyle L	0.05	µg/g	0.15	< 0.05	0.09	**1.2**	**10**	**0.19**	-	< 0.050	-	-	-	-	-	-	-	-	-	-	-
Anthracene L	0.05	µg/g	0.67	0.35	0.37	**21**	**100**	**0.86**	-	< 0.050	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthr H	0.05	µg/g	0.5	**0.72**	**0.91**	**8.1**	**87**	**2.3**	-	< 0.050	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrer H	0.05	µg/g	0.3	**0.59**	**0.94**	**8**	**64**	**1.8**	-	< 0.050	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluor H	0.05	µg/g	0.78	0.62	**1**	**15**	**70**	**1.8**	-	< 0.050	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)pe H	0.05	µg/g	6.6	0.41	0.63	3.2	**24**	0.86	-	< 0.050	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluor H	0.05	µg/g	0.78	0.31	0.46	**4.8**	**36**	0.78	-	< 0.050	-	-	-	-	-	-	-	-	-	-	-
Chrysene H	0.05	µg/g	7	0.7	0.92	**11**	**75**	2.1	-	< 0.050	-	-	-	-	-	-	-	-	-	-	-
Dibenzo(a,h)a H	0.05	µg/g	0.1	**0.12**	**0.19**	**1.5**	**11**	**0.31**	-	< 0.050	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene H	0.05	µg/g	0.69	**1.6**	**2.1**	**38**	**270**	**4.5**	-	< 0.050	-	-	-	-	-	-	-	-	-	-	-
Fluorene L	0.05	µg/g	62	0.12	0.13	1.1	55	0.25	-	< 0.050	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-c H	0.05	µg/g	0.38	0.3	**0.52**	**3**	**24**	**0.78**	-	< 0.050	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 1-	0.03	µg/g	0.99	-	-	-	-	-	-	< 0.030	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	0.03	µg/g	0.99	-	-	-	-	-	-	< 0.030	-	-	-	-	-	-	-	-	-	-	-
Methylnaphtha L	0.042	µg/g	0.99	< 0.05	< 0.05	0.38	**62**	0.09	-	< 0.042	-	-	-	-	-	-	-	-	-	-	-
Naphthalene L	0.013	µg/g	0.6	< 0.05	< 0.05	0.34	**23**	0.07	-	0.023	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene L	0.046	µg/g	6.2	1.4	1.2	4.5	**310**	3	-	< 0.046	-	-	-	-	-	-	-	-	-	-	-
Pyrene H	0.05	µg/g	78	1.5	1.9	27	**220**	3.7	-	< 0.050	-	-	-	-	-	-	-	-	-	-	-
LMW PAH [7]	na	µg/g	na	2	1.89	32.92	575	4.52	na	0.023	na	na	na	na	na	na	na	na	na	na	na
HMW PAH [8]	na	µg/g	na	6.87	9.57	119.6	881	18.93	na	na	na	na	na	na	na	na	na	na	na	na	na
PCBs																					
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/g	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
> - SAR is incalculable du to Ca, Na and/or Mg below detection limit. Lowest possible SAR is reported as minimum value
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[7] Low Molecular Weight (LMW) PAH consisting of: Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Methylnaphthalenes, Naphthalene and Phenanthrene.

[8] High Molecular Weight (HMW) PAH consisting of: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene and Pyrene.

TABLE 2: Preliminary Screening of COCs In Surface Soil 2013-2018
Central Park, Hamilton, ON

Sample Location			**Table 3[1]**	**BH-07-17**	**BH-07-17**	**BH-09-17**	**BH-09-17**	**BH-09-17**	**BH-10-17**	**BH-10-17**	**BH-11-17**	**BH-11-17**	**BH-11-17**	**BH-12-17**	**BH-13-17**	**BH-13-17**	**BH-14-17**	**BH-14-17**	**BH-15-17**	**BH-15-17**	**BH-16-17**	**BH-16-17**
Laboratory Sample ID			**Standard**	L2038807-1	L2038807-2	L2038487-1	L2038487-2	L2038487-3	L2038493-1	L2038493-2	L2038803-1	L2038803-2	L2038803-3	L2038803-10	L2038791-1	L2038791-2	L2038791-7	L2038791-8	L2040320-1	L2040320-2	L2040320-8	L2040320-9
SNC-Lavalin Sample ID				BH-07-17 SS1	BH-07-17 SS2	BH-09-17 SS1	BH-09-17 SS2	BH-09D-17 SS2	BH-10-17 SS2	BH-10D-17 SS2	BH-11-17 SS1	BH-11-17 SS2	BH-11D-17 SS2	BH-12-17 SS1	BH-13-17 SS1	BH-13-17 SS2	BH-14-17 SS1	BH-14-17 SS2	BH-15-17 SS1	BH-15-17 SS2	BH-16-17 SS1	BH-16-17 SS2
Sampling Date (yyyy/mm/dd)			**R/P/I_CG_NPG Surface**	2017/12/21	2017/12/21	2017/12/15	2017/12/15	2017/12/15	2017/12/15	2017/12/15	2017/12/21	2017/12/21	2017/12/21	2017/12/21	2017/12/21	2017/12/21	2017/12/21	2017/12/21	2017/12/22	2017/12/22	2017/12/22	2017/12/22
Depth Interval (mbgs)				0.1 - 0.6	0.8 - 1.4	0.0 - 0.6	0.8 - 1.4	0.8 - 1.4	0.8 - 1.4	0.8 - 1.4	0.1 - 0.6	0.8 - 1.4	0.8 - 1.4	0.8 - 1.2	0.1 - 0.6	0.8 - 1.2	0.1 - 0.6	0.8 - 1.2	0.1 - 0.6	0.8 - 1.4	0.1 - 0.7	0.8 - 1.4
Field Screen (ppmv)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
								Duplicate of BH-09-17 SS2		Duplicate of BH-10-17 SS2			Duplicate of BH-11-17 SS2									
Parameter	**RDL**	**Units**																				
General Chemistry																						
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	0.7	**771**	**1,750**	-	204	130	640	672	448	**871**	**1,110**	**1,090**	**2,360**	**1,560**	**883**	**1,300**	**2,880**	243	**871**	**898**
Fraction of Organic Carbon	0.001	g/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH [2]	-	pH	9	7.66	7.84	-	7.9	7.79	8.47	8.55	7.69	7.89	7.93	8.11	7.77	7.85	7.56	7.39	7.68	7.71	7.81	7.77
Sodium Adsorption Ratio [3]	-	None	5	**38.2**	**26.5**	-	1.58	0.54	**19.2**	**19**	**11.6**	**30>**	**40>**	**23.9**	**109**	**76.2**	**29>**	**69.7**	**20.8**	**6.27**	**9.98**	**45.7**
Soluble Sodium	1	mg/L	na	147	358	-	9.5	2.6	118	121	74.7	177	234	223	512	333	174	267	540	34.1	169	177
Soluble Calcium	1	mg/L	na	1.1	13.8	-	2.8	1.7	2.9	3.1	< 1.0	< 1.0	< 1.0	< 1.0	1.7	1.4	< 1.0	1.1	39.3	< 1.0	3.6	1.1
Soluble Magnesium	1	mg/L	na	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0	< 1.0	1.9	< 1.0	< 1.0	4	< 1.0	< 1.0	< 1.0	< 1.0	7.3	1.4	11.1	< 1.0
Total Organic Carbon	0.1	%	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																						
Antimony	0.8	µg/g	7.5	1.8	< 1.0	< 1.0	< 1.0	< 1.0	6.9	6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.9	< 1.0	1	< 1.0
Arsenic	0.2	µg/g	18	9.61	5.2	4.1	3.56	3.55	8.53	8.19	4.4	4.27	5.02	7.55	5.49	5.93	7.18	6.57	10.4	4.52	4.67	4.3
Barium	1	µg/g	390	67.7	37.5	36.9	23.1	26.3	120	140	35.8	29.4	30.7	32.9	52.4	48.2	22.5	23.7	169	27.5	36.5	26.8
Beryllium	0.5	µg/g	4	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.65	0.65	< 0.50	< 0.50	< 0.50	0.72	< 0.50	< 0.50	0.57	0.56	< 0.50	< 0.50	< 0.50	< 0.50
Boron	5	µg/g	120	-	-	8.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (Hot Water Soluble)	0.1	µg/g	1.5	-	-	0.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	0.5	µg/g	1.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	**1.24**	1.09	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	**1.24**	< 0.50	< 0.50	< 0.50
Chromium (total)	1	µg/g	160	11.6	11.9	10.8	9.6	9.8	23.9	25.3	12.3	13.7	13.6	20.2	11.2	11.2	15.8	17.1	17.2	10.1	11.6	11.2
Chromium (VI)	0.2	µg/g	8	-	-	< 0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	1	µg/g	22	5.6	7.8	6	5.2	5.2	8.6	7.8	7.2	7.4	7.8	12	5.8	5.9	8.5	9.6	6.5	6.4	6.4	7.1
Copper	1	µg/g	140	50.8	31.4	24.7	18.5	18.9	**234**	**275**	25.7	25.6	28.4	42.8	27.3	31.2	42.3	39	77.5	21	24.2	22.2
Lead	1	µg/g	120	**178**	8.6	28.4	5.7	5.9	**295**	**315**	9.2	10	13.5	15.3	76.4	**122**	10.9	10.9	**597**	7.8	20.7	7.1
Mercury	0.005	µg/g	0.27	**0.891**	0.0178	0.0631	0.0087	0.0071	**4.62**	**2.5**	0.035	0.0202	0.0335	0.0169	**0.678**	**0.817**	0.0237	0.0216	**0.904**	0.0567	0.098	0.0147
Molybdenum	0.5	µg/g	6.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.7	< 1.0	< 1.0	< 1.0
Nickel	1	µg/g	100	11.8	17	11.9	9.8	9.7	30.7	27.6	14.3	13.9	14.6	25.3	11.6	11	15.6	17	19.6	12.3	12.6	13.8
Selenium	0.4	µg/g	2.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Silver	0.2	µg/g	20	0.21	< 0.20	< 0.20	< 0.20	< 0.20	0.39	0.4	< 0.20	< 0.20	0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Thallium	0.4	µg/g	1	-	-	< 0.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	0.5	µg/g	23	-	-	< 1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	1	µg/g	86	22.6	20.3	20.4	21.4	24.7	30.5	28	24.4	27.2	25.7	30	24.6	23.1	30.9	31.2	26	20.1	21.7	18.9
Zinc	5	µg/g	340	147	43.9	113	28.5	27.3	245	277	37.9	39.2	45.2	68.1	121	93.2	46.9	48.4	**373**	34.3	84.5	34.4
Volatiles																						
Benzene	0.0068	µg/g	0.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.014	-	< 0.0068	-
Toluene	0.05	µg/g	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.080	-	< 0.080	-
Ethylbenzene	0.018	µg/g	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.018	-	< 0.018	-
Xylenes	0.05	µg/g	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	< 0.050	-
m+p-Xylenes	0.03	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.030	-	< 0.030	-
o-Xylenes	0.02	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.020	-	< 0.020	-
Hexane (n)	0.05	µg/g	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Petroleum Hydrocarbon (PHC) Fractions																						
PHC F1	5	µg/g	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 5.0	-	< 5.0	-
PHC F2	10	µg/g	98	< 10	-	-	-	-	-	-	-	-	-	-	34	-	-	-	< 20	-	< 10	-
PHC F3	50	µg/g	300	< 50	-	-	-	-	-	-	-	-	-	-	**650**	-	-	-	**630**	-	51	-
PHC F4	50	µg/g	2,800	< 50	-	-	-	-	-	-	-	-	-	-	700	-	-	-	1,240	-	< 50	-
PHC F4 (silica gel)	250	µg/g	2,800	-	-	-	-	-	-	-	-	-	-	-	2,110	-	-	-	**5,170**	-	-	-
Volatile Organic Compounds																						
Bromodichloromethane	0.05	µg/g	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Bromoform	0.05	µg/g	0.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Bromomethane	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Carbon Tetrachloride	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Chlorobenzene	0.05	µg/g	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Chloroform	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Dibromochloromethane	0.05	µg/g	9.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Dichlorodifluoromethane	0.05	µg/g	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.042	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Methyl Ethyl Ketone	0.5	µg/g	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.50	-	-	-
Methyl Isobutyl Ketone	0.5	µg/g	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.50	-	-	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Methylene Chloride	0.05	µg/g	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Styrene	0.05	µg/g	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Tetrachloroethylene	0.05	µg/g	0.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Trichloroethylene	0.01	µg/g	0.061	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.010	-	-	-
Trichlorofluoromethane	0.05	µg/g	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-
Vinyl Chloride [4]	0.02	µg/g	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.020	-	-	-
PAHs																						
Acenaphthene	L 0.05	µg/g	7.9	< 0.050	-	< 0.050	-	-	-	-	-	-	-	-	< 0.050	-	-	-	2.32	-	< 0.050	-
Acenaphthylen	L 0.05	µg/g	0.15	< 0.050	-	< 0.050	-	-	-	-	-	-	-	-	< 0.050	-	-	-	**4.64**	-	< 0.050	-
Anthracene	L 0.05	µg/g	0.67	< 0.050	-	< 0.050	-	-	-	-	-	-	-	-	< 0.050	-	-	-	**8.44**	-	< 0.050	-
Benzo(a)anthr	H 0.05	µg/g	0.5	0.119	-	< 0.050	-	-	-	-	-	-	-	-	0.102	-	-	-	**28.3**	-	0.267	-
Benzo(a)pyren	H 0.05	µg/g	0.3	0.13	-	< 0.050	-	-	-	-	-	-	-	-	0.146	-	-	-	**26.6**	-	0.259	-
Benzo(b)fluora	H 0.05	µg/g	0.78	0.245	-	0.054	-	-	-	-	-	-	-	-	0.207	-	-	-	**36.3**	-	0.375	-
Benzo(g,h,i)pe	H 0.05	µg/g	6.6	0.124	-	< 0.050	-	-	-	-	-	-	-	-	0.145	-	-	-	**19.7**	-	0.179	-
Benzo(k)fluora	H 0.05	µg/g	0.78	0.072	-	< 0.050	-	-	-	-	-	-	-	-	0.061	-	-	-	**12.3**	-	0.119	-
Chrysene	H 0.05	µg/g	7	0.165	-	< 0.050	-	-	-	-	-	-	-	-	0.129	-	-	-	**27.2**	-	0.265	-
Dibenzo(a,h)an	H 0.05	µg/g	0.1	< 0.050	-	< 0.050	-	-	-	-	-	-	-	-	< 0.050	-	-	-	**4.77**	-	< 0.050	-
Fluoranthene	H 0.05	µg/g	0.69	0.171	-	0.054	-	-	-	-	-	-	-	-	0.137	-	-	-	**57.9**	-	0.34	-
Fluorene	L 0.05	µg/g	62	< 0.050	-	< 0.050	-	-	-	-	-	-	-	-	< 0.050	-	-	-	2.01	-	< 0.050	-
Indeno(1,2,3-c	H 0.05	µg/g	0.38	0.128	-	< 0.050	-	-	-	-	-	-	-	-	0.11	-	-	-	**18.4**	-	0.179	-
Methylnaphthalene, 1-	0.03	µg/g	0.99	0.042	-	< 0.030	-	-	-	-	-	-	-	-	0.03	-	-	-	0.432	-	< 0.030	-
Methylnaphthalene, 2-	0.03	µg/g	0.99	0.054	-	< 0.030	-	-	-	-	-	-	-	-	0.036	-	-	-	0.583	-	< 0.030	-
Methylnaphtha	L 0.042	µg/g	0.99	0.096	-	< 0.042	-	-	-	-	-	-	-	-	0.067	-	-	-	**1.02**	-	< 0.042	-
Naphthalene	L 0.013	µg/g	0.6	0.045	-	< 0.013	-	-	-	-	-	-	-	-	0.027	-	-	-	**0.914**	-	0.025	-
Phenanthrene	L 0.046	µg/g	6.2	0.094	-	< 0.046	-	-	-	-	-	-	-	-	0.063	-	-	-	**21**	-	0.092	-
Pyrene	H 0.05	µg/g	78	0.173	-	< 0.050	-	-	-	-	-	-	-	-	0.189	-	-	-	48.3	-	0.312	-
LMW PAH [7]	na	µg/g	na	0.331	na	na	na	na	na	na	na	na	na	na	0.223	na	na	na	41.359	na	0.117	na
HMW PAH [8]	na	µg/g	na	1.327	na	0.108	na	na	na	na	na	na	na	na	1.226	na	na	na	279.77	na	2.295	na
PCBs																						
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/g	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
> - SAR is incalculable du to Ca, Na and/or Mg below detection limit. Lowest possible SAR is reported as minimum value
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[7] Low Molecular Weight (LMW) PAH consisting of: Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Methylnaphthalenes, Naphthalene and Phenanthrene.

[8] High Molecular Weight (HMW) PAH consisting of: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene and Pyrene.

TABLE 2: Preliminary Screening of COCs In Surface Soil 2013-2018
Central Park, Hamilton, ON

Parameter	RDL	Units	Table 3[1]	BH-17-17	BH-17-17	BH-17-17	BH-18-17	BH-18-17	BH-19-17	BH-19-17	BH-101	BH-102	BH-102	BH-103	BH-104	BH-105	BH-106	BH-106	BH-107	BH-108	BH-108	BH-109
Laboratory Sample ID			Standard	L2038487-7	L2038487-8	L2038487-9	L2038487-16	L2038487-17	L2038487-22	L2038487-23	4802099	4813331	4813334	4802069	4802230	4813367	4813346	4813347	4802079	4802080	4802081	4813370
SNC-Lavalin Sample ID				BH-17-17 SS1	BH-17D-17 SS1	BH-17-17 SS2	BH-18-17 SS1	BH-18-17 SS2	BH-19-17 SS1	BH-19-17 SS2	BH-101-1	BH-102-2b	BH-102-2bb	BH-103-2	BH-104-2	BH-105-1	BH-106-1	BH-106-2	BH-107-1	BH-108-1b	BH-108-2	BH-109-1
Sampling Date (yyyy/mm/dd)			R/P/I_CG_NPG Surface	2017/12/14	2017/12/14	2017/12/14	2017/12/15	2017/12/15	2017/12/14	2017/12/14	2013/10/01	2013/10/02	2013/10/02	2013/09/30	2013/09/30	2013/10/02	2013/10/02	2013/10/02	2013/09/30	2013/09/30	2013/09/30	2013/10/02
Depth Interval (mbgs)				0.0 - 0.6	0.0 - 0.6	0.8 - 1.4	0.0 - 0.6	0.8 - 1.4	0.0 - 0.6	0.8 - 1.4	0.0 - 0.6	0.9 - 1.4	0.9 - 1.4	0.8 - 1.4	0.8 - 1.4	0.0 - 0.6	0.0 - 0.6	0.8 - 1.4	0.0 - 0.6	0.4 - 0.6	0.8 - 1.4	0.0 - 0.6
Field Screen (ppmv)				-	Duplicate of BH-17-17 SS1	-	-	-	-	-	<25	<25	<25 Duplicate of BH-102-2b	25	25	<25	25% LEL	5	<25	<25	<25	<25
General Chemistry																						
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	< 0.04	< 0.04	< 0.04	< 0.04	-	< 0.04	< 0.04	-	< 0.04	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	0.7	522	622	370	-	176	327	-	161	580	639	385	-	187	163	-	173	-	-	-
Fraction of Organic Carbon	0.001	g/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH [2]	-	pH	9	8.99	**9.68**	**9.93**	-	7.62	7.74	-	7.72	8.16	8.28	8.27	-	8.31	7.97	-	7.75	-	-	-
Sodium Adsorption Ratio [3]	-	None	5	0.6	0.53	0.85	-	0.28	4.8	-	0.076	1.52	1.59	2.4	-	0.074	0.22	-	0.078	-	-	-
Soluble Sodium	1	mg/L	na	16.7	17.2	14.3	-	2.1	44.4	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Calcium	1	mg/L	na	52.5	72.2	18.3	-	4.4	6.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Magnesium	1	mg/L	na	3.9	4.4	1.8	-	< 1.0	< 1.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon	0.1	%	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																						
Antimony	0.8	µg/g	7.5	1.3	3.2	< 1.0	< 1.0	2.7	3.1	**52.6**	< 0.8	6.1	5.5	< 0.8	-	< 0.8	< 0.8	-	**12**	-	-	-
Arsenic	0.2	µg/g	18	8.94	12.1	0.87	5.3	9.25	7.57	17.6	6	12	12	8	-	6	14	-	9	-	-	-
Barium	1	µg/g	390	124	120	11.1	72	151	213	124	70	187	212	51	-	62	87	-	**645**	-	-	-
Beryllium	0.5	µg/g	4	0.6	0.57	< 0.50	0.52	< 0.50	1.01	< 0.50	0.5	0.6	0.5	< 0.5	-	< 0.5	0.6	-	< 0.5	-	-	-
Boron	5	µg/g	120	-	-	-	5.5	-	-	7.5	7	12	13	7	-	7	8	-	6	-	-	-
Boron (Hot Water Soluble)	0.1	µg/g	1.5	-	-	-	0.33	-	-	0.87	0.62	**1.72**	**1.72**	0.88	-	0.42	0.81	-	0.44	-	-	-
Cadmium	0.5	µg/g	1.2	0.53	0.57	< 0.50	< 0.50	0.56	**1.65**	< 0.50	< 0.5	**3.3**	**2.6**	< 0.5	-	< 0.5	< 0.5	-	**2.7**	-	-	-
Chromium (total)	1	µg/g	160	21.2	23	1.8	16.9	16.3	23.4	21.5	16	23	25	11	-	8	14	-	19	-	-	-
Chromium (VI)	0.2	µg/g	8	-	-	-	< 0.20	-	-	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	-	< 0.2	< 0.2	-	< 0.2	-	-	-
Cobalt	1	µg/g	22	8.9	8.8	< 1.0	8.7	6.5	7.2	5.1	8.4	7.3	7.4	6.4	-	5.1	6.7	-	6.9	-	-	-
Copper	1	µg/g	140	65.6	86.1	13.3	30.4	56	117	**157**	32	**180**	**177**	46	-	45	36	-	**264**	-	-	-
Lead	1	µg/g	120	**121**	**159**	31.9	21.8	**473**	**349**	**856**	46	**610**	**653**	55	-	105	96	-	**2,290**	-	-	-
Mercury	0.005	µg/g	0.27	**0.865**	**1.23**	0.097	0.0679	**0.412**	**1.12**	**0.832**	< 0.1	**3.36**	**2.87**	**2.47**	-	< 0.1	**0.59**	-	**0.53**	-	-	-
Molybdenum	0.5	µg/g	6.9	1	1.7	< 1.0	< 1.0	< 1.0	< 1.0	1.2	0.8	1.8	1.6	0.7	-	1.3	0.9	-	2	-	-	-
Nickel	1	µg/g	100	20.6	22.7	2.1	17.3	16.9	19.4	11.9	16	74	**109**	15	-	10	14	-	21	-	-	-
Selenium	0.4	µg/g	2.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.4	1.2	1.3	< 0.4	-	0.4	< 0.4	-	0.7	-	-	-
Silver	0.2	µg/g	20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.28	< 0.2	0.3	0.3	< 0.2	-	< 0.2	< 0.2	-	0.3	-	-	-
Thallium	0.4	µg/g	1	-	-	-	< 0.50	-	-	< 0.50	< 0.4	< 0.4	< 0.4	< 0.4	-	< 0.4	< 0.4	-	< 0.4	-	-	-
Uranium	0.5	µg/g	23	-	-	-	< 1.0	-	-	< 1.0	< 0.5	< 0.5	< 0.5	< 0.5	-	< 0.5	< 0.5	-	< 0.5	-	-	-
Vanadium	1	µg/g	86	30.4	30	2.7	26.6	26.1	26.1	53.2	25	19	19	19	-	12	20	-	18	-	-	-
Zinc	5	µg/g	340	220	228	29.9	81.7	214	**539**	89.2	99	**611**	**569**	90	-	133	155	-	**1,570**	-	-	-
Volatiles																						
Benzene	0.0068	µg/g	0.21	-	-	-	-	-	-	**141**	-	-	-	-	< 0.02	-	-	**0.99**	-	-	0.05	< 0.02
Toluene	0.05	µg/g	2.3	-	-	-	-	-	-	**205**	-	-	-	-	< 0.05	-	-	0.23	-	-	0.21	0.2
Ethylbenzene	0.018	µg/g	2	-	-	-	-	-	-	**11.3**	-	-	-	-	< 0.05	-	-	**21**	-	-	0.13	< 0.05
Xylenes	0.05	µg/g	3.1	-	-	-	-	-	-	**336**	-	-	-	-	< 0.05	-	-	**37**	-	-	0.2	0.34
m+p-Xylenes	0.03	µg/g	na	-	-	-	-	-	-	253	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylenes	0.02	µg/g	na	-	-	-	-	-	-	83.3	-	-	-	-	-	-	-	-	-	-	-	-
Hexane (n)	0.05	µg/g	2.8	-	-	-	-	-	-	**5.58**	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Petroleum Hydrocarbon (PHC) Fractions																						
PHC F1	5	µg/g	55	-	-	-	-	-	-	**920**	-	-	-	-	< 5	-	-	**830**	-	-	5	7
PHC F2	10	µg/g	98	-	-	-	-	-	-	**5,490**	-	-	-	-	15	< 10	-	60	-	-	< 10	< 10
PHC F3	50	µg/g	300	-	-	-	-	-	-	**11,300**	-	-	-	-	290	290	-	< 50	-	-	**2,600**	< 50
PHC F4	50	µg/g	2,800	-	-	-	-	-	-	1,680	-	-	-	-	< 50	130	-	150	-	-	2,300	< 50
PHC F4 (silica gel)	250	µg/g	2,800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds																						
Bromodichloromethane	0.05	µg/g	13	-	-	-	-	-	-	< 0.20	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Bromoform	0.05	µg/g	0.27	-	-	-	-	-	-	< 0.20	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Bromomethane	0.05	µg/g	0.05	-	-	-	-	-	-	< 0.20[1]	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Carbon Tetrachloride	0.05	µg/g	0.05	-	-	-	-	-	-	< 0.20[1]	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Chlorobenzene	0.05	µg/g	2.4	-	-	-	-	-	-	< 0.73	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Chloroform	0.04	µg/g	0.05	-	-	-	-	-	-	< 0.20[1]	-	-	-	-	< 0.04	-	-	< 0.04	-	-	< 0.04	< 0.04
Dibromochloromethane	0.05	µg/g	9.4	-	-	-	-	-	-	< 0.20	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	3.4	-	-	-	-	-	-	< 1.6	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	4.8	-	-	-	-	-	-	< 1.6	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	-	-	-	-	-	< 1.6[1]	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Dichlorodifluoromethane	0.05	µg/g	16	-	-	-	-	-	-	< 0.20	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	-	-	-	-	-	< 0.20	-	-	-	-	< 0.02	-	-	< 0.02	-	-	< 0.02	< 0.02
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	< 0.20[1]	-	-	-	-	< 0.03	-	-	< 0.03	-	-	< 0.03	< 0.03
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	-	-	-	-	-	< 0.20[1]	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	-	-	-	-	-	< 0.20	-	-	-	-	< 0.02	-	-	< 0.02	-	-	< 0.02	< 0.02
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	-	-	-	-	-	< 0.20[1]	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	< 0.20[1]	-	-	-	-	< 0.03	-	-	< 0.03	-	-	< 0.03	< 0.03
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	-	-	-	-	-	< 0.17[1]	-	-	-	-	< 0.04	-	-	< 0.04	-	-	< 0.04	< 0.04
Ethylene Dibromide	0.04	µg/g	0.05	-	-	-	-	-	-	< 0.20[1]	-	-	-	-	< 0.04	-	-	< 0.04	-	-	< 0.04	< 0.04
Methyl Ethyl Ketone	0.5	µg/g	16	-	-	-	-	-	-	< 2.0	-	-	-	-	< 0.5	-	-	< 0.5	-	-	< 0.5	< 0.5
Methyl Isobutyl Ketone	0.5	µg/g	1.7	-	-	-	-	-	-	< 2.0[1]	-	-	-	-	< 0.5	-	-	< 0.5	-	-	< 0.5	< 0.5
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	-	-	-	-	-	< 0.20	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Methylene Chloride	0.05	µg/g	0.1	-	-	-	-	-	-	< 0.20[1]	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Styrene	0.05	µg/g	0.7	-	-	-	-	-	-	**135**	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	-	-	-	-	-	< 0.20[1]	-	-	-	-	< 0.04	-	-	< 0.04	-	-	< 0.04	< 0.04
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	-	-	-	-	-	< 0.20[1]	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Tetrachloroethylene	0.05	µg/g	0.28	-	-	-	-	-	-	< 0.20	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	-	-	-	-	-	< 0.20	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	-	-	-	-	-	< 0.20[1]	-	-	-	-	< 0.04	-	-	< 0.04	-	-	< 0.04	< 0.04
Trichloroethylene	0.01	µg/g	0.061	-	-	-	-	-	-	< 0.040	-	-	-	-	< 0.03	-	-	< 0.03	-	-	< 0.03	< 0.03
Trichlorofluoromethane	0.05	µg/g	4	-	-	-	-	-	-	< 0.20	-	-	-	-	< 0.05	-	-	< 0.05	-	-	< 0.05	< 0.05
Vinyl Chloride [4]	0.02	µg/g	0.02	-	-	-	-	-	-	< 0.080[1]	-	-	-	-	< 0.02	-	-	< 0.02	-	-	< 0.02	< 0.02
PAHs																						
Acenaphthene	L	0.05	µg/g	7.9	-	-	-	< 0.050	-	-	1.25	-	-	-	-	0.07	0.12	-	< 0.05	-	-	0.13	0.09
Acenaphthylen	L	0.05	µg/g	0.15	-	-	-	< 0.050	-	-	**7.23**	-	-	-	-	0.09	0.09	-	< 0.05	-	-	**1**	**0.54**
Anthracene	L	0.05	µg/g	0.67	-	-	-	< 0.050	-	-	**15.1**	-	-	-	-	0.23	0.54	-	0.08	-	-	**2.1**	0.46
Benzo(a)anthr	H	0.05	µg/g	0.5	-	-	-	0.108	-	-	**13.3**	-	-	-	-	**0.83**	**1.2**	-	0.15	-	-	**4.4**	**1.8**
Benzo(a)pyren	H	0.05	µg/g	0.3	-	-	-	0.095	-	-	**7.98**	-	-	-	-	**0.78**	**1.1**	-	0.13	-	-	**3.1**	**2**
Benzo(b)fluora	H	0.05	µg/g	0.78	-	-	-	0.129	-	-	**10.2**	-	-	-	-	**1.3**	**1.4**	-	0.15	-	-	**4.7**	**1.7**
Benzo(g,h,i)pe	H	0.05	µg/g	6.6	-	-	-	0.065	-	-	4.34	-	-	-	-	0.38	0.46	-	0.06	-	-	1.4	0.9
Benzo(k)fluora	H	0.05	µg/g	0.78	-	-	-	< 0.050	-	-	**4.09**	-	-	-	-	0.31	0.6	-	0.1	-	-	**1.2**	**1.1**
Chrysene	H	0.05	µg/g	7	-	-	-	0.095	-	-	**12.5**	-	-	-	-	0.7	1.3	-	0.17	-	-	3.2	1.7
Dibenzo(a,h)an	H	0.05	µg/g	0.1	-	-	-	< 0.050	-	-	**1.48**	-	-	-	-	0.07	0.08	-	< 0.05	-	-	**0.32**	**0.19**
Fluoranthene	H	0.05	µg/g	0.69	-	-	-	0.194	-	-	**26.7**	-	-	-	-	**1.5**	**2.5**	-	0.43	-	-	**6**	**3.1**
Fluorene	L	0.05	µg/g	62	-	-	-	< 0.050	-	-	7.16	-	-	-	-	0.07	0.15	-	< 0.05	-	-	1.3	0.14
Indeno(1,2,3-c	H	0.05	µg/g	0.38	-	-	-	0.065	-	-	**4.97**	-	-	-	-	**0.4**	**0.65**	-	0.08	-	-	**1.2**	**1.3**
Methylnaphthalene, 1-		0.03	µg/g	0.99	-	-	-	< 0.030	-	-	**3.36**	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-		0.03	µg/g	0.99	-	-	-	< 0.030	-	-	**7.36**	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphtha	L	0.042	µg/g	0.99	-	-	-	< 0.042	-	-	**10.7**	-	-	-	-	0.29	< 0.05	-	0.47	-	-	**1.2**	0.36
Naphthalene	L	0.013	µg/g	0.6	-	-	-	0.016	-	-	**54.2**	-	-	-	-	0.54	< 0.05	-	0.22	-	-	**2.4**	0.33
Phenanthrene	L	0.046	µg/g	6.2	-	-	-	0.078	-	-	**27.4**	-	-	-	-	0.78	2	-	0.33	-	-	4.8	1.5
Pyrene	H	0.05	µg/g	78	-	-	-	0.16	-	-	19.8	-	-	-	-	1.4	2.1	-	0.35	-	-	5	3
LMW PAH [7]		na	µg/g	na	na	na	na	0.094	na	na	133.76	na	na	na	na	2.07	2.9	na	1.1	na	na	12.93	3.42
HMW PAH [8]		na	µg/g	na	na	na	na	0.911	na	na	105.36	na	na	na	na	7.67	11.39	na	1.62	na	na	30.52	16.79
PCBs																						
Arochlor 1242		0.01	µg/g	na	-	-	-	-	-	-	< 0.020	-	-	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	-
Arochlor 1248		0.01	µg/g	na	-	-	-	-	-	-	< 0.010	-	-	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	-
Arochlor 1254		0.01	µg/g	na	-	-	-	-	-	-	< 0.010	-	-	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	-
Arochlor 1260		0.01	µg/g	na	-	-	-	-	-	-	0.011	-	-	-	0.1	-	0.1	-	< 0.1	-	0.1	-	-
Total PCBs		0.1	µg/g	0.35	-	-	-	-	-	-	0.03	-	-	-	0.1	-	0.1	-	< 0.1	-	0.1	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
> - SAR is incalculable du to Ca, Na and/or Mg below detection limit. Lowest possible SAR is reported as minimum value
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[7] Low Molecular Weight (LMW) PAH consisting of: Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Methylnaphthalenes, Naphthalene and Phenanthrene.

[8] High Molecular Weight (HMW) PAH consisting of: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene and Pyrene.

TABLE 2: Preliminary Screening of COCs In Surface Soil 2013-2018
Central Park, Hamilton, ON

			Sample Location	Table 3[1]	BH-109	BH-109	BH-110	BH-110	BH-110	BH-111	BH-111	BH-112	BH-112	BH-113	BH-114	BH-114	BH18-01	BH18-02	BH18-03	BH18-03	BH18-03	BH18-04
			Laboratory Sample ID	Standard	4813371	4813372	4813375	4813376	4813380	4813388	4813392	4813404	4813405	4813417	4802077	4802078	L2156982-1	L2156982-11	L2161122-10	L2166311-3	L2166311-4	L2157466-1
			SNC-Lavalin Sample ID		BH-109-2	BH-109-22	BH-110-1	BH-110-2	BH-110-22	BH-111-1	BH-111-2	BH-112-1b	BH-112-2	BH-113-2	BH-114-1	BH-114-2	BH18-01-2	BH18-02-2	BH18-03-2	BH18-03-2	BH18-03-22	BH18-04-1/2
			Sampling Date (yyyy/mm/dd)	R/P/I_CG_NPG Surface	2013/10/02	2013/10/02	2013/10/02	2013/10/02	2013/10/02	2013/10/03	2013/10/03	2013/10/03	2013/10/03	2013/10/03	2013/09/30	2013/09/30	2018/08/29	2018/08/29	2018/09/06	2018/09/17	2018/09/17	2018/08/30
			Depth Interval (mbgs)		0.8 - 1.4	0.8 - 1.4	0.0 - 0.6	0.8 - 1.4	0.8 - 1.4	0.0 - 0.6	0.8 - 1.4	0.2 - 0.6	0.8 - 1.4	0.8 - 1.4	0.0 - 0.6	0.8 - 1.4	0.8 - 1.4	0.8 - 1.4	0.8 - 1.4	0.8 - 1.4	0.8 - 1.4	0.0 - 1.4
			Field Screen (ppmv)		<25	<25 Duplicate of BH-109-2	50	75	75 Duplicate of BH-110-2	<25	<25	25	25	75	<25	<25	<5	<5	<5	<5	<5 Duplicate of BH18-03-2	<5
Parameter	**RDL**	**Units**																			
General Chemistry																					
Cyanide (CN-)	0.04	µg/g	0.051	< 0.04	< 0.04	< 0.04	-	-	< 0.04	-	< 0.04	-	< 0.04	-	< 0.04	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	< 0.050	-	-	-	< 0.050
Electrical Conductivity	0.004	mS/cm	0.7	**701**	**965**	315	-	-	155	-	123	-	231	-	209	651	218	-	-	-	307
Fraction of Organic Carbon	0.001	g/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH [2]	-	pH	9	7.85	8.18	7.89	-	-	7.69	-	7.7	-	7.56	-	8.44	7.7	8.08	-	-	-	7.58
Sodium Adsorption Ratio [3]	-	None	5	0.798	0.53	0.43	-	-	0.051	-	0.139	-	1.58	-	0.171	**11**	0.28	-	-	-	0.13
Soluble Sodium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	153	3.7	-	-	-	2.3
Soluble Calcium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	5.3	9.1	-	-	-	18.3
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	5.6	2.4	-	-	-	2.8
Total Organic Carbon	0.1	%	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																					
Antimony	0.8	µg/g	7.5	2.7	2.1	< 0.8	-	-	**10.9**	-	< 0.8	-	< 0.8	-	< 0.8	< 1.0	**12.1**	-	-	-	4.2
Arsenic	0.2	µg/g	18	8	14	7	-	-	**30**	-	6	-	4	-	6	6.4	9.5	-	-	-	12.6
Barium	1	µg/g	390	97	85	46	-	-	202	-	32	-	290	-	75.6	103	-	-	-	135
Beryllium	0.5	µg/g	4	< 0.5	< 0.5	< 0.5	-	-	0.7	-	< 0.5	-	< 0.5	-	< 0.5	0.52	< 0.50	-	-	-	0.54
Boron	5	µg/g	120	8	7	< 5	-	-	12	-	7	-	< 5	-	9	11.2	9.5	-	-	-	14.6
Boron (Hot Water Soluble)	0.1	µg/g	1.5	**2.16**	**1.88**	0.48	-	-	0.62	-	0.23	-	0.14	-	0.85	0.87	0.52	-	-	-	0.44
Cadmium	0.5	µg/g	1.2	0.9	0.7	< 0.5	-	-	**1.6**	-	< 0.5	-	< 0.5	-	0.6	< 0.50	**1.23**	-	-	-	0.79
Chromium (total)	1	µg/g	160	12	11	10	-	-	14	-	10	-	12	-	17	22.2	23.1	-	-	-	18.5
Chromium (VI)	0.2	µg/g	8	< 0.2	< 0.2	< 0.2	-	-	< 0.2	-	< 0.2	-	< 0.2	-	< 0.2	< 0.20	0.45	-	-	-	< 0.20
Cobalt	1	µg/g	22	6.6	7.4	6.8	-	-	9.2	-	4.5	-	6.4	-	5.4	7.4	7.5	-	-	-	9.6
Copper	1	µg/g	140	73	76	33	-	-	**7,400**	-	36	-	24	-	37	50.7	**446**	-	-	-	**215**
Lead	1	µg/g	120	**195**	**187**	43	-	-	**1,730**	-	45	-	35	-	**221**	66	**727**	-	-	-	**427**
Mercury	0.005	µg/g	0.27	**0.53**	**0.29**	0.12	-	-	**3.74**	-	0.18	-	**0.54**	-	0.25	0.122	**0.774**	-	-	-	**0.932**
Molybdenum	0.5	µg/g	6.9	1.1	1.1	0.8	-	-	3.2	-	0.6	-	< 0.5	-	1	1.4	< 1.0	-	-	-	1.3
Nickel	1	µg/g	100	16	15	14	-	-	33	-	10	-	12	-	11	19	31	-	-	-	19.6
Selenium	0.4	µg/g	2.4	< 0.4	< 0.4	< 0.4	-	-	**2.7**	-	< 0.4	-	< 0.4	-	< 0.4	< 1.0	< 1.0	-	-	-	1
Silver	0.2	µg/g	20	< 0.2	0.3	< 0.2	-	-	3.5	-	< 0.2	-	< 0.2	-	< 0.2	< 0.20	0.54	-	-	-	0.3
Thallium	0.4	µg/g	1	< 0.4	< 0.4	< 0.4	-	-	< 0.4	-	< 0.4	-	< 0.4	-	< 0.4	< 0.50	< 0.50	-	-	-	< 0.50
Uranium	0.5	µg/g	23	< 0.5	0.5	< 0.5	-	-	< 0.5	-	< 0.5	-	< 0.5	-	< 0.5	< 1.0	< 1.0	-	-	-	< 1.0
Vanadium	1	µg/g	86	19	20	19	-	-	23	-	15	-	19	-	18	27.7	25.5	-	-	-	30.6
Zinc	5	µg/g	340	268	215	95	-	-	**5,640**	-	102	-	55	-	175	121	**427**	-	-	-	255
Volatiles																					
Benzene	0.0068	µg/g	0.21	-	-	-	< 0.02	< 0.02	-	**0.51**	-	0.11	< 0.02	-	-	-	-	-	-	-	-
Toluene	0.05	µg/g	2.3	-	-	-	0.1	0.17	-	0.3	-	0.34	< 0.05	-	-	-	-	-	-	-	-
Ethylbenzene	0.018	µg/g	2	-	-	-	< 0.05	0.08	-	< 0.05	-	0.08	< 0.05	-	-	-	-	-	-	-	-
Xylenes	0.05	µg/g	3.1	-	-	-	< 0.05	< 0.05	-	0.25	-	0.46	< 0.05	-	-	-	-	-	-	-	-
m+p-Xylenes	0.03	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylenes	0.02	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexane (n)	0.05	µg/g	2.8	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Petroleum Hydrocarbon (PHC) Fractions																					
PHC F1	5	µg/g	55	-	-	-	5	5	-	< 5	-	< 5	< 5	-	-	-	-	-	-	-	-
PHC F2	10	µg/g	98	-	-	-	< 10	< 10	-	< 10	-	**280**	< 10	-	-	-	-	-	-	-	-
PHC F3	50	µg/g	300	-	-	-	**750**	**870**	-	< 50	-	**7,100**	< 50	-	-	-	-	-	-	-	-
PHC F4	50	µg/g	2,800	-	-	-	230	280	-	< 50	-	1,400	< 50	-	-	-	-	-	-	-	-
PHC F4 (silica gel)	250	µg/g	2,800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds																					
Bromodichloromethane	0.05	µg/g	13	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Bromoform	0.05	µg/g	0.27	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Bromomethane	0.05	µg/g	0.05	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Carbon Tetrachloride	0.05	µg/g	0.05	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Chlorobenzene	0.05	µg/g	2.4	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Chloroform	0.04	µg/g	0.05	-	-	-	< 0.04	< 0.04	-	< 0.04	-	< 0.04	< 0.04	-	-	-	-	-	-	-	-
Dibromochloromethane	0.05	µg/g	9.4	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	3.4	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	4.8	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Dichlorodifluoromethane	0.05	µg/g	16	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	-	-	< 0.02	< 0.02	-	< 0.02	-	< 0.02	< 0.02	-	-	-	-	-	-	-	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	< 0.03	-	-	-	-	-	-	-	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	-	-	< 0.02	< 0.02	-	< 0.02	-	< 0.02	< 0.02	-	-	-	-	-	-	-	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	< 0.03	-	-	-	-	-	-	-	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	-	-	< 0.04	< 0.04	-	< 0.04	-	< 0.04	< 0.04	-	-	-	-	-	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	-	-	-	< 0.04	< 0.04	-	< 0.04	-	< 0.04	< 0.04	-	-	-	-	-	-	-	-
Methyl Ethyl Ketone	0.5	µg/g	16	-	-	-	< 0.5	< 0.5	-	< 0.5	-	< 0.5	< 0.5	-	-	-	-	-	-	-	-
Methyl Isobutyl Ketone	0.5	µg/g	1.7	-	-	-	< 0.5	< 0.5	-	< 0.5	-	< 0.5	< 0.5	-	-	-	-	-	-	-	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Methylene Chloride	0.05	µg/g	0.1	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Styrene	0.05	µg/g	0.7	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	-	-	< 0.04	< 0.04	-	< 0.04	-	< 0.04	< 0.04	-	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Tetrachloroethylene	0.05	µg/g	0.28	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	-	-	< 0.04	< 0.04	-	< 0.04	-	< 0.04	< 0.04	-	-	-	-	-	-	-	-
Trichloroethylene	0.01	µg/g	0.061	-	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	< 0.03	-	-	-	-	-	-	-	-
Trichlorofluoromethane	0.05	µg/g	4	-	-	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	< 0.05	-	-	-	-	-	-	-	-
Vinyl Chloride [4]	0.02	µg/g	0.02	-	-	-	< 0.02	< 0.02	-	< 0.02	-	< 0.02	< 0.02	-	-	-	-	-	-	-	-
PAHs																					
Acenaphthene L	0.05	µg/g	7.9	-	-	-	< 0.05	< 0.05	-	0.35	-	**10**	< 0.05	-	-	-	-	-	-	-	-
Acenaphthylei L	0.05	µg/g	0.15	-	-	-	< 0.05	0.06	-	**0.2**	-	**0.71**	< 0.05	-	-	-	-	-	-	-	-
Anthracene L	0.05	µg/g	0.67	-	-	-	0.13	0.42	-	**1.3**	-	**19**	< 0.05	-	-	-	-	-	-	-	-
Benzo(a)anthr H	0.05	µg/g	0.5	-	-	-	**1.5**	**11**	-	**2.2**	-	**18**	< 0.05	-	-	-	-	-	-	-	-
Benzo(a)pyren H	0.05	µg/g	0.3	-	-	-	**1.2**	**15**	-	**2**	-	**21**	< 0.05	-	-	-	-	-	-	-	-
Benzo(b)fluora H	0.05	µg/g	0.78	-	-	-	**3**	**22**	-	**2.3**	-	**36**	< 0.05	-	-	-	-	-	-	-	-
Benzo(g,h,i)pe H	0.05	µg/g	6.6	-	-	-	1.5	**7.5**	-	0.7	-	**7.9**	< 0.05	-	-	-	-	-	-	-	-
Benzo(k)fluora H	0.05	µg/g	0.78	-	-	-	**1.5**	**10**	-	**1.1**	-	**9.9**	< 0.05	-	-	-	-	-	-	-	-
Chrysene H	0.05	µg/g	7	-	-	-	2.6	**16**	-	2.1	-	**19**	< 0.05	-	-	-	-	-	-	-	-
Dibenzo(a,h)a H	0.05	µg/g	0.1	-	-	-	**0.36**	**2.3**	-	**0.15**	-	**2.2**	< 0.05	-	-	-	-	-	-	-	-
Fluoranthene H	0.05	µg/g	0.69	-	-	-	**2.9**	**13**	-	**4.8**	-	**95**	0.05	-	-	-	-	-	-	-	-
Fluorene L	0.05	µg/g	62	-	-	-	< 0.05	< 0.05	-	0.44	-	15	< 0.05	-	-	-	-	-	-	-	-
Indeno(1,2,3-c H	0.05	µg/g	0.38	-	-	-	**1.9**	**9**	-	**1**	-	**8.2**	< 0.05	-	-	-	-	-	-	-	-
Methylnaphthalene, 1-	0.03	µg/g	0.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	0.03	µg/g	0.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphtha L	0.042	µg/g	0.99	-	-	-	0.24	0.14	-	0.25	-	**3.8**	< 0.05	-	-	-	-	-	-	-	-
Naphthalene L	0.013	µg/g	0.6	-	-	-	0.11	0.07	-	0.33	-	**5.8**	< 0.05	-	-	-	-	-	-	-	-
Phenanthrene L	0.046	µg/g	6.2	-	-	-	0.9	2.1	-	4	-	**85**	< 0.05	-	-	-	-	-	-	-	-
Pyrene H	0.05	µg/g	78	-	-	-	2.5	12	-	4.2	-	70	< 0.05	-	-	-	-	-	-	-	-
LMW PAH [7]	na	µg/g	na	na	na	na	1.38	2.79	na	6.87	na	139.31	na	na	na	na	na	na	na	na	na
HMW PAH [8]	na	µg/g	na	na	na	na	18.96	117.8	na	20.55	na	287.2	0.05	na	na	na	na	na	na	na	na
PCBs																					
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	< 0.1	-	-	< 0.1	< 0.1	-	-	-	< 0.010	< 0.010	< 0.010	-
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	< 0.1	-	-	< 0.1	< 0.1	-	-	-	< 0.010	< 0.010	< 0.010	-
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	< 0.1	-	-	< 0.1	< 0.1	-	-	-	0.194	< 0.030	< 0.010	-
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	< 0.1	-	-	< 0.1	< 0.1	-	-	-	0.129	0.121	0.062	-
Total PCBs	0.1	µg/g	0.35	-	-	-	-	-	-	< 0.1	-	-	< 0.1	< 0.1	-	-	-	0.323	0.121	0.062	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
> - SAR is incalculable du to Ca, Na and/or Mg below detection limit. Lowest possible SAR is reported as minimum value
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[7] Low Molecular Weight (LMW) PAH consisting of: Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Methylnaphthalenes, Naphthalene and Phenanthrene.

[8] High Molecular Weight (HMW) PAH consisting of: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene and Pyrene.

TABLE 2: Preliminary Screening of COCs In Surface Soil 2013-2018
Central Park, Hamilton, ON

		Sample Location	**Table 3[1]**	**BH18-05**	**BH18-06**	**BH18-07**	**BH18-08**	**BH18-09**	**BH18-10**	**BH18-10**	**BH18-11**	**BH18-12**	**BH18-13**	**BH18-15**	**BH18-17**	**BH18-18**	**BH18-19**	**BH18-19**	**BH18-20**	**BH18-21**	**BH18-21**
		Laboratory Sample ID	**Standard**	L2157466-5	L2157467-2	L2157468-1	L2157468-5	L2159176-1	L2159639-1	L2159639-2	L2159639-6	L2159639-7	L2159639-9	L2159175-1	L2159176-9	L2160425-7	L2160425-1	L2160425-2	L2160425-3	L2161122-1	L2161122-2
		SNC-Lavalin Sample ID		BH18-05-2	BH18-06-2	BH18-07-2	BH18-08-2	BH18-09-1/2	BH18-10-1/2	BH18-100-1/2	BH18-11-1	BH18-12-1	BH18-13-1	BH18-15-2	BH18-17-2	BH18-18-1	BH18-19-2	BH18-19-22	BH18-20-2	BH18-21-1	BH18-21-2
		Sampling Date (yyyy/mm/dd)	**R/P/I_CG_NPG Surface**	2018/08/30	2018/08/30	2018/08/31	2018/08/31	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/05	2018/09/05	2018/09/05	2018/09/05	2018/09/06	2018/09/06
		Depth Interval (mbgs)		0.8 - 1.4	0.8 - 1.4	0.8 - 1.4	0.8 - 1.4	0.0 - 1.4	0.0 - 1.4	0.0 - 1.4	0.2 - 0.8	0.2 - 0.8	0.2 - 0.8	0.8 - 1.4	0.8 - 1.4	0.0 - 0.6	0.8 - 1.4	0.8 - 1.4	0.8 - 1.4	0.0 - 0.8	0.8 - 1.5
		Field Screen (ppmv)		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
										Duplicate of BH18-10-1/2								Duplicate of BH18-19-2			
Parameter	**RDL**	**Units**																			
General Chemistry																					
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	< 0.050	< 0.050	< 0.050	**0.096**	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	-	**2.33**	< 0.050	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	0.7	79.2	195	**1,210**	**1,300**	272	265	225	165	206	188	-	**1,390**	250	-	-	-	-	-
Fraction of Organic Carbon	0.001	g/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0288	0.0299	0.0109	0.0049	0.0037
pH [2]	-	pH	9	7.84	7.42	7.38	7.52	7.71	7.83	7.78	8.06	7.42	7.58	-	7.74	7.64	-	-	-	-	-
Sodium Adsorption Ratio [3]	-	None	5	<	<	**16.7**	0.21	2.88	0.24	0.2	0.19	0.25	0.14	-	1.78	0.3	-	-	-	-	-
Soluble Sodium	1	mg/L	na	< 1.0	< 1.0	216	12.6	22.3	3.8	2.4	1.6	3.2	1.5	-	95.6	3.7	-	-	-	-	-
Soluble Calcium	1	mg/L	na	1	7.8	10.3	210	4.6	8.7	5.2	5.3	9.8	6.9	-	196	9.3	-	-	-	-	-
Soluble Magnesium	1	mg/L	na	< 1.0	< 1.0	1.4	30.1	< 1.0	6.6	3.7	< 1.0	1.3	1.2	-	13.6	1.3	-	-	-	-	-
Total Organic Carbon	0.1	%	na	-	-	-	-	-	-	-	-	-	-	-	-	-	2.7	2.71	1.02	0.46	0.35
Total Metals																					
Antimony	0.8	µg/g	7.5	< 1.0	2	2.2	6	< 1.0	1.6	< 1.0	1.5	< 1.0	< 1.0	-	2.3	**13.9**	-	-	-	-	-
Arsenic	0.2	µg/g	18	< 1.0	**20.5**	5.1	8.1	5	16.7	7.3	7.9	5.6	6.1	-	12.8	15.1	-	-	-	-	-
Barium	1	µg/g	390	1.4	222	58	84.1	56.5	134	116	197	37.3	103	-	154	114	-	-	-	-	-
Beryllium	0.5	µg/g	4	< 0.50	1.16	0.51	< 0.50	< 0.50	0.82	0.7	0.91	< 0.50	0.6	-	0.73	< 0.50	-	-	-	-	-
Boron	5	µg/g	120	6.3	20.1	6	7	< 5.0	11.4	10.2	18	6	5.3	-	14	8.8	-	-	-	-	-
Boron (Hot Water Soluble)	0.1	µg/g	1.5	< 0.10	0.23	0.22	0.65	0.53	0.7	0.54	0.53	0.69	0.38	-	0.86	0.26	-	-	-	-	-
Cadmium	0.5	µg/g	1.2	< 0.50	**2.12**	< 0.50	**2.28**	< 0.50	0.78	< 0.50	0.58	< 0.50	< 0.50	-	0.53	0.62	-	-	-	-	-
Chromium (total)	1	µg/g	160	< 1.0	28.8	13.3	16.3	18.7	29.1	20	19.5	14.8	19.7	-	18	14	-	-	-	-	-
Chromium (VI)	0.2	µg/g	8	< 0.20	< 0.20	0.23	< 0.20	0.8	0.51	< 0.20	< 0.20	1.09	0.48	-	< 0.20	< 0.20	-	-	-	-	-
Cobalt	1	µg/g	22	< 1.0	13.2	6.7	7.5	6.8	8.6	7.2	7.2	7.4	9.4	-	6.6	8.4	-	-	-	-	-
Copper	1	µg/g	140	1.3	**303**	43	114	44.2	81.7	45.3	43	35.2	35.3	-	**197**	**325**	-	-	-	-	-
Lead	1	µg/g	120	< 1.0	**445**	**130**	**451**	80.9	**126**	82.9	**310**	18.3	63.7	-	**204**	**776**	-	-	-	-	-
Mercury	0.005	µg/g	0.27	0.0189	**1.64**	**0.482**	**0.366**	0.138	**0.286**	0.224	**0.602**	0.0552	0.106	-	**4.98**	**0.541**	-	-	-	-	-
Molybdenum	0.5	µg/g	6.9	< 1.0	2.3	< 1.0	1	< 1.0	1.4	< 1.0	< 1.0	< 1.0	< 1.0	-	1.2	2	-	-	-	-	-
Nickel	1	µg/g	100	< 1.0	32.1	14.8	21.7	17.2	21.2	18.7	17	14.8	20.1	-	21.9	19.1	-	-	-	-	-
Selenium	0.4	µg/g	2.4	< 1.0	1.7	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	< 1.0	< 1.0	-	-	-	-	-
Silver	0.2	µg/g	20	< 0.20	0.37	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.2	< 0.20	< 0.20	-	< 0.20	0.29	-	-	-	-	-
Thallium	0.4	µg/g	1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	-	-	-	-	-
Uranium	0.5	µg/g	23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	< 1.0	< 1.0	-	-	-	-	-
Vanadium	1	µg/g	86	< 1.0	43.6	20.9	25.7	24	31.8	26.4	25.1	26.5	28.9	-	27.3	25.9	-	-	-	-	-
Zinc	5	µg/g	340	< 5.0	**829**	112	252	117	339	145	243	69.6	121	-	253	329	-	-	-	-	-
Volatiles																					
Benzene	0.0068	µg/g	0.21	-	-	0.0364	-	-	-	-	< 0.0068	< 0.0068	< 0.0068	< 0.0068	-	-	-	-	-	-	-
Toluene	0.05	µg/g	2.3	-	-	< 0.080	-	-	-	-	< 0.080	< 0.080	< 0.080	< 0.080	-	-	-	-	-	-	-
Ethylbenzene	0.018	µg/g	2	-	-	< 0.018	-	-	-	-	< 0.018	< 0.018	< 0.018	< 0.018	-	-	-	-	-	-	-
Xylenes	0.05	µg/g	3.1	-	-	< 0.050	-	-	-	-	< 0.050	< 0.050	< 0.050	< 0.050	-	-	-	-	-	-	-
m+p-Xylenes	0.03	µg/g	na	-	-	< 0.030	-	-	-	-	< 0.030	< 0.030	< 0.030	< 0.030	-	-	-	-	-	-	-
o-Xylenes	0.02	µg/g	na	-	-	< 0.020	-	-	-	-	< 0.020	< 0.020	< 0.020	< 0.020	-	-	-	-	-	-	-
Hexane (n)	0.05	µg/g	2.8	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Petroleum Hydrocarbon (PHC) Fractions																					
PHC F1	5	µg/g	55	-	-	-	-	-	-	-	< 5.0	< 5.0	< 5.0	6.6	-	-	-	-	-	-	-
PHC F2	10	µg/g	98	-	-	-	-	-	-	-	< 10	< 10	14	**987**	-	-	-	-	-	-	-
PHC F3	50	µg/g	300	-	-	-	-	-	-	-	**382**	< 50	273	**3,870**	-	-	-	-	-	-	-
PHC F4	50	µg/g	2,800	-	-	-	-	-	-	-	429	< 50	242	134	-	-	-	-	-	-	-
PHC F4 (silica gel)	250	µg/g	2,800	-	-	-	-	-	-	-	2,720	-	990	-	-	-	-	-	-	-	-
Volatile Organic Compounds																					
Bromodichloromethane	0.05	µg/g	13	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Bromoform	0.05	µg/g	0.27	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Bromomethane	0.05	µg/g	0.05	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	0.05	µg/g	0.05	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	0.05	µg/g	2.4	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Chloroform	0.04	µg/g	0.05	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	0.05	µg/g	9.4	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	3.4	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	4.8	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Dichlorodifluoromethane	0.05	µg/g	16	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	-	< 0.042	-	-	-	-	< 0.042	-	-	-	-	-	-	-	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Methyl Ethyl Ketone	0.5	µg/g	16	-	-	< 0.50	-	-	-	-	< 0.50	-	-	-	-	-	-	-	-	-	-
Methyl Isobutyl Ketone	0.5	µg/g	1.7	-	-	< 0.50	-	-	-	-	< 0.50	-	-	-	-	-	-	-	-	-	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Methylene Chloride	0.05	µg/g	0.1	-	-	< 0.35[1]	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Styrene	0.05	µg/g	0.7	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Tetrachloroethylene	0.05	µg/g	0.28	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Trichloroethylene	0.01	µg/g	0.061	-	-	< 0.010	-	-	-	-	< 0.010	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	0.05	µg/g	4	-	-	< 0.050	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride [4]	0.02	µg/g	0.02	-	-	< 0.020	-	-	-	-	< 0.020	-	-	-	-	-	-	-	-	-	-
PAHs																					
Acenaphthene	L 0.05	µg/g	7.9	-	-	-	-	-	-	-	0.169	< 0.050	0.09	< 0.050	-	-	-	-	-	-	-
Acenaphthylei	L 0.05	µg/g	0.15	-	-	-	-	-	-	-	**0.183**	< 0.050	**0.42**	< 0.050	-	-	-	-	-	-	-
Anthracene	L 0.05	µg/g	0.67	-	-	-	-	-	-	-	0.422	< 0.050	0.441	< 0.050	-	-	-	-	-	-	-
Benzo(a)anthr	H 0.05	µg/g	0.5	-	-	-	-	-	-	-	**1.53**	< 0.050	**2.06**	< 0.050	-	-	-	-	-	-	-
Benzo(a)pyrer	H 0.05	µg/g	0.3	-	-	-	-	-	-	-	**1.55**	< 0.050	**2.01**	< 0.050	-	-	-	-	-	-	-
Benzo(b)fluora	H 0.05	µg/g	0.78	-	-	-	-	-	-	-	**1.85**	< 0.050	**2.35**	< 0.050	-	-	-	-	-	-	-
Benzo(g,h,i)pe	H 0.05	µg/g	6.6	-	-	-	-	-	-	-	1.25	< 0.050	1.42	< 0.050	-	-	-	-	-	-	-
Benzo(k)fluora	H 0.05	µg/g	0.78	-	-	-	-	-	-	-	0.773	< 0.050	**0.875**	< 0.050	-	-	-	-	-	-	-
Chrysene	H 0.05	µg/g	7	-	-	-	-	-	-	-	1.44	< 0.050	1.77	0.068	-	-	-	-	-	-	-
Dibenzo(a,h)an	H 0.05	µg/g	0.1	-	-	-	-	-	-	-	**0.362**	< 0.050	**0.426**	< 0.050	-	-	-	-	-	-	-
Fluoranthene	H 0.05	µg/g	0.69	-	-	-	-	-	-	-	**3.04**	< 0.050	**3.87**	< 0.050	-	-	-	-	-	-	-
Fluorene	L 0.05	µg/g	62	-	-	-	-	-	-	-	0.173	< 0.050	0.154	< 0.050	-	-	-	-	-	-	-
Indeno(1,2,3-c	H 0.05	µg/g	0.38	-	-	-	-	-	-	-	**1.21**	< 0.050	**1.56**	< 0.050	-	-	-	-	-	-	-
Methylnaphthalene, 1-	0.03	µg/g	0.99	-	-	-	-	-	-	-	0.095	< 0.030	0.194	< 0.030	-	-	-	-	-	-	-
Methylnaphthalene, 2-	0.03	µg/g	0.99	-	-	-	-	-	-	-	0.123	< 0.030	0.275	< 0.030	-	-	-	-	-	-	-
Methylnaphtha	L 0.042	µg/g	0.99	-	-	-	-	-	-	-	0.219	< 0.042	0.469	< 0.042	-	-	-	-	-	-	-
Naphthalene	L 0.013	µg/g	0.6	-	-	-	-	-	-	-	0.165	< 0.013	0.28	< 0.013	-	-	-	-	-	-	-
Phenanthrene	L 0.046	µg/g	6.2	-	-	-	-	-	-	-	1.77	< 0.046	1.65	< 0.046	-	-	-	-	-	-	-
Pyrene	H 0.05	µg/g	78	-	-	-	-	-	-	-	2.7	< 0.050	3.52	0.059	-	-	-	-	-	-	-
LMW PAH [7]	na	µg/g	na	na	na	na	na	na	na	na	3.319	na	3.973	na	na	na	na	na	na	na	na
HMW PAH [8]	na	µg/g	na	na	na	na	na	na	na	na	15.705	na	19.861	0.127	na	na	na	na	na	na	na
PCBs																					
Arochlor 1242	0.01	µg/g	na	< 0.010	-	-	< 0.030	< 0.010	-	-	-	-	-	-	< 0.60	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g	na	< 0.010	-	-	< 0.010	< 0.010	-	-	-	-	-	-	< 0.10	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g	na	< 0.010	-	-	< 0.15	< 0.70	-	-	-	-	-	-	< 0.010	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g	na	< 0.010	-	-	0.588	1.6	-	-	-	-	-	-	< 0.015	-	-	-	-	-	-
Total PCBs	0.1	µg/g	0.35	< 0.020	-	-	**0.588**	**1.6**	-	-	-	-	-	-	< 0.61[1]	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
> - SAR is incalculable du to Ca, Na and/or Mg below detection limit. Lowest possible SAR is reported as minimum value
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[7] Low Molecular Weight (LMW) PAH consisting of: Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Methylnaphthalenes, Naphthalene and Phenanthrene.

[8] High Molecular Weight (HMW) PAH consisting of: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene and Pyrene.

TABLE 2: Preliminary Screening of COCs In Surface Soil 2013-2018
Central Park, Hamilton, ON

			Sample Location	Table 3[1]	BH18-22	BH18-23	BH18-25	BH18-27	BH18-28	BH18-29	BH18-29	BH18-30	BH18-30	SS18-01	SS18-02	SS18-03	SS18-04	SS18-05	SS18-06	SS18-07	SS18-08
			Laboratory Sample ID	Standard	L2161122-3	L2161122-4	L2165098-4	L2165631-1	L2165631-7	L2165631-10	L2165631-11	L2165705-1	L2165705-2	L2166210-1	L2166210-2	L2166210-3	L2166210-4	L2166210-5	L2166210-6	L2170645-1	L2170645-2
			SNC-Lavalin Sample ID		BH18-22-2	BH18-23-2	BH18-25-2	BH18-27-2	BH18-28-2	BH18-29-2	BH18-29-22	BH18-30-1/2	BH18-30-1/22	SS18-01	SS18-02	SS18-03	SS18-04	SS18-05	SS18-06	SS18-07	SS18-08
			Sampling Date (yyyy/mm/dd)	R/P/I_CG_NPG	2018/09/06	2018/09/06	2018/09/12	2018/09/13	2018/09/14	2018/09/14	2018/09/14	2018/09/14	2018/09/14	2018/09/17	2018/09/17	2018/09/17	2018/09/17	2018/09/17	2018/09/17	2018/09/24	2018/09/24
			Depth Interval (mbgs)	Surface	0.8 - 1.5	0.8 - 1.4	0.8 - 1.4	0.8 - 1.4	0.8 - 1.4	0.8 - 1.4	0.8 - 1.4	0.0 - 1.4	0.0 - 1.4	0.0 - 0.2	0.0 - 0.2	0.0 - 0.2	0.0 - 0.2	0.0 - 0.2	0.0 - 0.2	0.0 - 0.2	0.0 - 0.2
			Field Screen (ppmv)		<5	<5	<5	<5	<5	<5	<5 Duplicate of BH18-29-2	<5	<5 Duplicate of BH18-30-1/2	-	-	-	-	-	-	-	-
Parameter	**RDL**	**Units**																			
General Chemistry																					
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	< 0.050	-	-	< 0.050	-	-	< 0.050	< 0.050	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	0.7	-	156	-	-	276	-	-	134	106	-	-	-	-	-	-	-	-	-
Fraction of Organic Carbon	0.001	g/g	na	0.0111	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH [2]	-	pH	9	-	7.44	-	-	8.07	-	-	7.99	8.35	-	-	-	-	-	-	-	-	-
Sodium Adsorption Ratio [3]	-	None	5	-	0.14	-	-	1.81	-	-	0.31	0.28	-	-	-	-	-	-	-	-	-
Soluble Sodium	1	mg/L	na	-	1.4	-	-	22.1	-	-	2	1.5	-	-	-	-	-	-	-	-	-
Soluble Calcium	1	mg/L	na	-	6.4	-	-	4.8	-	-	3.3	2.2	-	-	-	-	-	-	-	-	-
Soluble Magnesium	1	mg/L	na	-	1.1	-	-	3.9	-	-	< 1.0	< 1.0	-	-	-	-	-	-	-	-	-
Total Organic Carbon	0.1	%	na	1.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																					
Antimony	0.8	µg/g	7.5	-	1.3	< 1.0	1.5	< 1.0	1.5	**14.1**	< 1.0	< 1.0	< 1.0	< 1.0	1.2	1.1	< 1.0	< 1.0	< 1.0	1.2	
Arsenic	0.2	µg/g	18	-	10.6	5.9	7.5	5.8	**22.6**	**19.3**	4.2	3.6	5.6	6.6	7	4.6	5.6	4.4	4.6	6.7	
Barium	1	µg/g	390	-	94.1	90.8	82.9	83.8	138	247	55.2	42.6	77.3	56.2	79.7	63.9	55.3	61.9	107	84	
Beryllium	0.5	µg/g	4	-	< 0.50	1.05	< 0.50	0.7	0.6	0.66	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.55	
Boron	5	µg/g	120	-	8.5	30.3	11.3	9.9	14.2	14	9.8	10.4	12.4	7.8	12.4	12.3	6.1	8.3	10	12.8	
Boron (Hot Water Soluble)	0.1	µg/g	1.5	-	0.32	-	0.72	1.04	1.05	1.26	0.34	0.21	-	-	-	-	-	-	-	-	
Cadmium	0.5	µg/g	1.2	-	< 0.50	0.63	< 0.50	< 0.50	0.61	**1.62**	< 0.50	< 0.50	< 0.50	< 0.50	0.62	0.58	< 0.50	< 0.50	< 0.50	< 0.50	
Chromium (total)	1	µg/g	160	-	12.3	19.8	14.9	24	20.2	18.4	12.7	11.7	18.1	17.2	16.5	16.8	15.2	14.5	17.4	21	
Chromium (VI)	0.2	µg/g	8	-	0.39	-	-	0.56	-	-	< 0.20	< 0.20	-	-	-	-	-	-	-	-	
Cobalt	1	µg/g	22	-	6.2	9	6.7	8.4	8.9	8.8	7.3	7	6.6	6.1	6.1	6.2	6.2	6.6	5.3	7.1	
Copper	1	µg/g	140	-	70.9	26	62.3	40.2	133	**4,260**	22.8	21.1	46.8	36.6	57.2	53.2	28.1	38.1	39.1	43.2	
Lead	1	µg/g	120	-	**182**	74.1	**153**	114	**166**	**1,510**	7.5	7.3	92.9	63.1	100	89.2	52.1	55.1	**167**	69.4	
Mercury	0.005	µg/g	0.27	-	**1.63**	0.0598	**0.874**	0.184	0.0666	**1.79**	0.006	0.0074	0.218	0.109	0.257	0.26	0.103	0.108	**0.57**	0.169	
Molybdenum	0.5	µg/g	6.9	-	< 1.0	1.1	< 1.0	< 1.0	1.3	1.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Nickel	1	µg/g	100	-	11.8	22.1	14.8	21.9	19.6	29.7	14.6	14	16.2	13.9	15	14.8	12.5	15.8	12.5	16.3	
Selenium	0.4	µg/g	2.4	-	< 1.0	< 1.0	< 1.0	< 1.0	1.2	1.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Silver	0.2	µg/g	20	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	2.05	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.27	< 0.20	< 0.20	0.27	< 0.20	
Thallium	0.4	µg/g	1	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	
Uranium	0.5	µg/g	23	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Vanadium	1	µg/g	86	-	23.1	24.6	27.2	28.9	37.6	33.8	24.2	21.4	21.4	21	20.7	20.9	20.3	19.9	18.7	25.2	
Zinc	5	µg/g	340	-	154	226	237	165	337	**1,690**	39.1	36.2	195	142	206	189	108	132	169	162	
Volatiles																					
Benzene	0.0068	µg/g	0.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Toluene	0.05	µg/g	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ethylbenzene	0.018	µg/g	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Xylenes	0.05	µg/g	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
m+p-Xylenes	0.03	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
o-Xylenes	0.02	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Hexane (n)	0.05	µg/g	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Petroleum Hydrocarbon (PHC) Fractions																					
PHC F1	5	µg/g	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PHC F2	10	µg/g	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PHC F3	50	µg/g	300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PHC F4	50	µg/g	2,800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PHC F4 (silica gel)	250	µg/g	2,800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Volatile Organic Compounds																					
Bromodichloromethane	0.05	µg/g	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bromoform	0.05	µg/g	0.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bromomethane	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Carbon Tetrachloride	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chlorobenzene	0.05	µg/g	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chloroform	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dibromochloromethane	0.05	µg/g	9.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dichlorodifluoromethane	0.05	µg/g	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ethylene Dibromide	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Methyl Ethyl Ketone	0.5	µg/g	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Methyl Isobutyl Ketone	0.5	µg/g	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Methylene Chloride	0.05	µg/g	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Styrene	0.05	µg/g	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tetrachloroethylene	0.05	µg/g	0.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Trichloroethylene	0.01	µg/g	0.061	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Trichlorofluoromethane	0.05	µg/g	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Vinyl Chloride [4]	0.02	µg/g	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PAHs																					
Acenaphthene L	0.05	µg/g	7.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Acenaphthyle L	0.05	µg/g	0.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Anthracene L	0.05	µg/g	0.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(a)anthr H	0.05	µg/g	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(a)pyren H	0.05	µg/g	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(b)fluora H	0.05	µg/g	0.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(g,h,i)pe H	0.05	µg/g	6.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(k)fluora H	0.05	µg/g	0.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chrysene H	0.05	µg/g	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dibenzo(a,h)an H	0.05	µg/g	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Fluoranthene H	0.05	µg/g	0.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Fluorene L	0.05	µg/g	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Indeno(1,2,3-c H	0.05	µg/g	0.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Methylnaphthalene, 1-	0.03	µg/g	0.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Methylnaphthalene, 2-	0.03	µg/g	0.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Methylnaphtha L	0.042	µg/g	0.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Naphthalene L	0.013	µg/g	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Phenanthrene L	0.046	µg/g	6.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Pyrene H	0.05	µg/g	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
LMW PAH [7]	na	µg/g	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	
HMW PAH [8]	na	µg/g	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	
PCBs																					
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total PCBs	0.1	µg/g	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
> - SAR is incalculable du to Ca, Na and/or Mg below detection limit. Lowest possible SAR is reported as minimum value
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[7] Low Molecular Weight (LMW) PAH consisting of: Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Methylnaphthalenes, Naphthalene and Phenanthrene.

[8] High Molecular Weight (HMW) PAH consisting of: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene and Pyrene.

TABLE 2: Preliminary Screening of COCs In Surface Soil 2013-2018
Central Park, Hamilton, ON

Parameter	RDL	Units	Table 3[1]	SS18-09	SS18-10	SS18-11	SS18-12	SS18-13	SS18-14	SS18-15	SS18-16	SS18-17	SS18-18	Composite Topsoil	TP-1	TP-1	TP-2	TP-2	TP-2
Sample Location																			
Laboratory Sample ID			Standard	L2170645-3	L2170645-4	L2170645-5	L2170645-6	L2170645-7	L2170645-8	L2170645-9	L2170645-10	L2170645-11	L2170645-12	130524-21	4780015	4780034	4780066	4780091	4780095
SNC-Lavalin Sample ID				SS18-09	SS18-10	SS18-11	SS18-12	SS18-13	SS18-14	SS18-15	SS18-16	SS18-17	SS18-18	130320_Composite Topsoil	TP-1-1	TP-1-1A	TP-2-1	TP-2-2	TP-2-22
Sampling Date (yyyy/mm/dd)			R/P/I_CG_NPG Surface	2018/09/24	2018/09/24	2018/09/24	2018/09/24	2018/09/24	2018/09/24	2018/09/24	2018/09/24	2018/09/24	2018/09/24	2013/03/20	2013/09/24	2013/09/24	2013/09/25	2013/09/25	2013/09/25
Depth Interval (mbgs)				0.0 - 0.2	0.0 - 0.2	0.0 - 0.2	0.0 - 0.2	0.0 - 0.2	0.0 - 0.2	0.0 - 0.2	0.0 - 0.2	0.0 - 0.2	0.0 - 0.2		0.5	0.7	0.5	1.0	1.0
Field Screen (ppmv)				-	-	-	-	-	-	-	-	-	-	-	<25	<25	<25	50	50
																			Duplicate of TP-2-2
General Chemistry																			
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	< 0.050	< 0.050	< 0.050	< 0.050	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	0.7	-	-	-	-	-	-	224	173	202	219	-	240	**711**	478	513	530
Fraction of Organic Carbon	0.001	g/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH [2]	-	pH	9	-	-	-	-	-	-	7.23	6.95	6.83	7.36	-	8.51	8.42	7.3	7.13	7.07
Sodium Adsorption Ratio [3]	-	None	5	-	-	-	-	-	-	0.25	0.54	0.54	0.52	-	0.337	0.852	1.88	2.12	2.63
Soluble Sodium	1	mg/L	na	-	-	-	-	-	-	3.3	5.7	6.2	7.2	-	-	-	-	-	-
Soluble Calcium	1	mg/L	na	-	-	-	-	-	-	10.7	6.2	5.5	10.6	-	-	-	-	-	-
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	-	1.7	1.4	2.8	2.3	-	-	-	-	-	-
Total Organic Carbon	0.1	%	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																			
Antimony	0.8	µg/g	7.5	**24.3**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**8.3**	< 1.0	< 1.0	1.6	< 0.8	1.8	5.7	1.9	< 0.8	< 0.8
Arsenic	0.2	µg/g	18	5.4	4.1	5.6	5.1	6.1	7.2	5.5	3.6	5.7	6.2	5	12	**43**	12	7	9
Barium	1	µg/g	390	318	44.2	36.5	44.3	48.9	89.3	186	48.8	37.9	72.9	71	104	**405**	**910**	46	45
Beryllium	0.5	µg/g	4	0.8	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.56	< 0.50	< 0.50	< 0.50	< 0.5	0.6	0.6	0.7	< 0.5	0.5
Boron	5	µg/g	120	15.9	11.4	7.8	9.2	7.8	11.1	13.2	6.5	6.3	10.4	8	11	22	13	14	15
Boron (Hot Water Soluble)	0.1	µg/g	1.5	-	-	-	-	-	-	1.1	1.33	1.12	0.98	0.73	0.62	**3.63**	1.11	1.37	1.48
Cadmium	0.5	µg/g	1.2	**2.41**	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	**1.86**	< 0.50	< 0.50	< 0.50	< 0.5	1	**2.3**	1.1	< 0.5	< 0.5
Chromium (total)	1	µg/g	160	28.2	13	13.9	11.8	16.2	15	30.4	14.8	13.4	14.7	17	18	28	29	8	8
Chromium (VI)	0.2	µg/g	8	-	-	-	-	-	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Cobalt	1	µg/g	22	7.2	5	6.2	5	5.9	6	6.9	5	4.7	6.5	6.9	6.7	13.9	7.6	4.3	4.6
Copper	1	µg/g	140	**147**	46.7	30.5	27.7	24.7	79.9	117	32.4	20	77.4	43	91	**3,820**	**206**	32	33
Lead	1	µg/g	120	**587**	51.3	39.4	25.2	40	**145**	**342**	38.4	29	**131**	79	**256**	**4,100**	**664**	79	77
Mercury	0.005	µg/g	0.27	**0.511**	0.136	0.113	0.0811	0.112	**1.49**	**0.737**	0.197	0.0809	**0.732**	**0.36**	**1.68**	**0.71**	**1.89**	0.24	**0.35**
Molybdenum	0.5	µg/g	6.9	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0	< 1.0	0.9	1.5	3.1	1.8	0.5	0.7
Nickel	1	µg/g	100	23.1	11.8	12.5	10.6	12.5	14	19	10.6	10.1	16.7	15	40	32	24	6	7
Selenium	0.4	µg/g	2.4	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.6	< 0.4	1.7	1.6	0.9	1
Silver	0.2	µg/g	20	0.21	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.32	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	1.2	0.3	< 0.2	0.4
Thallium	0.4	µg/g	1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Uranium	0.5	µg/g	23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.6	0.5	0.6	< 0.5	< 0.5	< 0.5
Vanadium	1	µg/g	86	28.4	18.6	22.1	17.4	22.6	20.4	28.4	18	18.9	21.3	21	28	25	28	12	13
Zinc	5	µg/g	340	**700**	106	79.3	84.7	93.1	207	**515**	120	88.6	190	194	**440**	**5,340**	**1,500**	160	166
Volatiles																			
Benzene	0.0068	µg/g	0.21	-	-	-	-	-	-	-	-	-	-	< 0.02	< 0.02	-	< 0.02	**2.7**	**2.1**
Toluene	0.05	µg/g	2.3	-	-	-	-	-	-	-	-	-	-	< 0.08	< 0.05	-	< 0.05	0.19	0.17
Ethylbenzene	0.018	µg/g	2	-	-	-	-	-	-	-	-	-	-	< 0.05	< 0.05	-	< 0.05	0.5	0.49
Xylenes	0.05	µg/g	3.1	-	-	-	-	-	-	-	-	-	-	< 0.05	< 0.05	-	< 0.05	0.96	0.94
m+p-Xylenes	0.03	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylenes	0.02	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexane (n)	0.05	µg/g	2.8	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Petroleum Hydrocarbon (PHC) Fractions																			
PHC F1	5	µg/g	55	-	-	-	-	-	-	-	-	-	-	< 5	< 5	-	< 10	6	6
PHC F2	10	µg/g	98	-	-	-	-	-	-	-	-	-	-	< 10	32	-	< 20	19	19
PHC F3	50	µg/g	300	-	-	-	-	-	-	-	-	-	-	140	**710**	-	130	< 50	< 50
PHC F4	50	µg/g	2,800	-	-	-	-	-	-	-	-	-	-	< 50	120	-	< 100	< 50	< 50
PHC F4 (silica gel)	250	µg/g	2,800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds																			
Bromodichloromethane	0.05	µg/g	13	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Bromoform	0.05	µg/g	0.27	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Bromomethane	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Carbon Tetrachloride	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Chlorobenzene	0.05	µg/g	2.4	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Chloroform	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	< 0.04	-	< 0.04	< 0.04	< 0.04
Dibromochloromethane	0.05	µg/g	9.4	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	3.4	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	4.8	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Dichlorodifluoromethane	0.05	µg/g	16	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	-	-	-	-	-	-	-	-	-	-	< 0.02	-	< 0.02	< 0.02	< 0.02
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	< 0.03	-	< 0.03	< 0.03	< 0.03
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	-	-	-	-	-	-	-	-	-	-	< 0.02	-	< 0.02	< 0.02	< 0.02
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	< 0.03	-	< 0.03	< 0.03	< 0.03
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	< 0.04	-	< 0.04	< 0.04	< 0.04
Methyl Ethyl Ketone	0.5	µg/g	16	-	-	-	-	-	-	-	-	-	-	-	< 0.5	-	< 0.5	< 0.5	< 0.5
Methyl Isobutyl Ketone	0.5	µg/g	1.7	-	-	-	-	-	-	-	-	-	-	-	< 0.5	-	< 0.5	< 0.5	< 0.5
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Methylene Chloride	0.05	µg/g	0.1	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Styrene	0.05	µg/g	0.7	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	-	-	-	-	-	-	-	-	-	-	< 0.04	-	< 0.04	< 0.04	< 0.04
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Tetrachloroethylene	0.05	µg/g	0.28	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	< 0.04	-	< 0.04	< 0.04	< 0.04
Trichloroethylene	0.01	µg/g	0.061	-	-	-	-	-	-	-	-	-	-	-	< 0.03	-	< 0.03	< 0.03	< 0.03
Trichlorofluoromethane	0.05	µg/g	4	-	-	-	-	-	-	-	-	-	-	-	< 0.05	-	< 0.05	< 0.05	< 0.05
Vinyl Chloride [4]	0.02	µg/g	0.02	-	-	-	-	-	-	-	-	-	-	-	< 0.02	-	< 0.02	< 0.02	< 0.02
PAHs																			
Acenaphthene L	0.05	µg/g	7.9	-	-	-	-	-	-	-	-	-	-	0.5	4.9	-	1.7	**12**	**9.8**
Acenaphthyle L	0.05	µg/g	0.15	-	-	-	-	-	-	-	-	-	-	0.11	**2**	-	**1.7**	< 0.05	< 0.05
Anthracene L	0.05	µg/g	0.67	-	-	-	-	-	-	-	-	-	-	**0.86**	**18**	-	**4.3**	**0.71**	**0.89**
Benzo(a)anthr H	0.05	µg/g	0.5	-	-	-	-	-	-	-	-	-	-	**0.77**	**30**	-	**14**	**1.6**	**1.6**
Benzo(a)pyrer H	0.05	µg/g	0.3	-	-	-	-	-	-	-	-	-	-	**0.92**	**25**	-	**13**	**1.3**	**1.2**
Benzo(b)fluora H	0.05	µg/g	0.78	-	-	-	-	-	-	-	-	-	-	**1.1**	**35**	-	**18**	**1.7**	**1.6**
Benzo(g,h,i)pe H	0.05	µg/g	6.6	-	-	-	-	-	-	-	-	-	-	0.77	**13**	-	5.7	0.57	0.57
Benzo(k)fluora H	0.05	µg/g	0.78	-	-	-	-	-	-	-	-	-	-	0.46	**16**	-	**7**	0.58	0.6
Chrysene H	0.05	µg/g	7	-	-	-	-	-	-	-	-	-	-	0.83	**30**	-	**14**	1.7	1.7
Dibenzo(a,h)an H	0.05	µg/g	0.1	-	-	-	-	-	-	-	-	-	-	**0.18**	**0.63**	-	**1.2**	**0.15**	**0.14**
Fluoranthene H	0.05	µg/g	0.69	-	-	-	-	-	-	-	-	-	-	**2.2**	**70**	-	**34**	**3.1**	**2.8**
Fluorene L	0.05	µg/g	62	-	-	-	-	-	-	-	-	-	-	0.48	9.5	-	2.1	2.5	2.1
Indeno(1,2,3-c H	0.05	µg/g	0.38	-	-	-	-	-	-	-	-	-	-	**0.53**	**19**	-	**8**	**0.81**	**0.81**
Methylnaphthalene, 1-	0.03	µg/g	0.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	0.03	µg/g	0.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphtha L	0.042	µg/g	0.99	-	-	-	-	-	-	-	-	-	-	0.12	**1.8**	-	0.5	**4.9**	**3.6**
Naphthalene L	0.013	µg/g	0.6	-	-	-	-	-	-	-	-	-	-	0.47	**1.6**	-	0.59	**15**	**13**
Phenanthrene L	0.046	µg/g	6.2	-	-	-	-	-	-	-	-	-	-	1.4	**69**	-	**16**	2.3	2.5
Pyrene H	0.05	µg/g	78	-	-	-	-	-	-	-	-	-	-	1.8	67	-	29	2.3	2
LMW PAH [7]	na	µg/g	na	na	na	na	na	na	na	na	na	na	na	3.94	106.8	na	26.89	37.41	31.89
HMW PAH [8]	na	µg/g	na	na	na	na	na	na	na	na	na	na	na	9.56	305.63	na	143.9	13.81	13.02
PCBs																			
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	< 0.1	-	< 0.1	< 0.1	< 0.1
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	< 0.1	-	< 0.1	< 0.1	< 0.1
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	< 0.1	-	< 0.1	< 0.1	< 0.1
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	0.1	-	0.1	< 0.1	< 0.1
Total PCBs	0.1	µg/g	0.35	-	-	-	-	-	-	-	-	-	-	-	0.1	-	0.1	< 0.1	< 0.1

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
> - SAR is incalculable du to Ca, Na and/or Mg below detection limit. Lowest possible SAR is reported as minimum value
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[7] Low Molecular Weight (LMW) PAH consisting of: Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Methylnaphthalenes, Naphthalene and Phenanthrene.

[8] High Molecular Weight (HMW) PAH consisting of: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene and Pyrene.

TABLE 2: Preliminary Screening of COCs In Surface Soil 2013-2018
Central Park, Hamilton, ON

Sample Location			Table 3[1]	COCs	RDL(most updated)	Maximum RDL	Maximum (0 means no detects)	Maximum With RDL	Maximum x 1.2	Maximum Concentration Exceeded Generic Standard
Laboratory Sample ID			Standard							
SNC-Lavalin Sample ID			R/P/I_CG_NPG Surface							
Sampling Date (yyyy/mm/dd)										
Depth Interval (mbgs)										
Field Screen (ppmv)										
Parameter	**RDL**	**Units**								
General Chemistry				**General Chemistry**						
Cyanide (CN-)	0.04	µg/g	0.051	Cyanide (CN-)	0.04	0.04	0	0.04	0.048	No
Cyanide (WAD)	0.05	µg/g	0.051	Cyanide (WAD)	0.05	0.05	2.33	2.33	2.796	Yes
Electrical Conductivity	0.004	mS/cm	0.7	Electrical Conductivity	0.004	0.005	2880	2880	3456	Yes
Fraction of Organic Carbon	0.001	g/g	na	Fraction of Organic Carbon	0.001	0.001	0.03	0.03	0.04	No
pH [2]	-	pH	9	pH			9.93	9.93	11.916	No
Sodium Adsorption Ratio [3]	-	None	5	Sodium Adsorption Ratio			109	109	130.8	Yes
Soluble Sodium	1	mg/L	na	Soluble Sodium	1	1	540	540	648	No
Soluble Calcium	1	mg/L	na	Soluble Calcium	1	1	210	210	252	No
Soluble Magnesium	1	mg/L	na	Soluble Magnesium	1	1	47.8	47.8	57.36	No
Total Organic Carbon	0.1	%	na	Total Organic Carbon	0.1	0.1	2.71	2.71	3.252	No
Total Metals				**Total Metals**						
Antimony	0.8	µg/g	7.5	Antimony	1	1	52.6	52.6	63.12	Yes
Arsenic	0.2	µg/g	18	Arsenic	1	1	43	43	51.6	Yes
Barium	1	µg/g	390	Barium	1	1	910	910	1092	Yes
Beryllium	0.5	µg/g	4	Beryllium	0.5	0.5	1.16	1.16	1.392	No
Boron	5	µg/g	120	Boron	5	5	30.3	30.3	36.36	No
Boron (Hot Water Soluble)	0.1	µg/g	1.5	Boron (Hot Water Soluble)	0.1	0.1	3.63	3.63	4.356	Yes
Cadmium	0.5	µg/g	1.2	Cadmium	0.5	0.5	45.8	45.8	54.96	Yes
Chromium (total)	1	µg/g	160	Chromium (total)	1	1	30.4	30.4	36.48	No
Chromium (VI)	0.2	µg/g	8	Chromium (VI)	0.2	0.2	1.09	1.09	1.308	No
Cobalt	1	µg/g	22	Cobalt	1	1	13.9	13.9	16.68	No
Copper	1	µg/g	140	Copper	1	10	7400	7400	8880	Yes
Lead	1	µg/g	120	Lead	1	10	4100	4100	4920	Yes
Mercury	0.005	µg/g	0.27	Mercury	0.005	0.5	5.79	5.79	6.948	Yes
Molybdenum	0.5	µg/g	6.9	Molybdenum	1	1	3.2	3.2	3.84	No
Nickel	1	µg/g	100	Nickel	1	1	109	109	130.8	Yes
Selenium	0.4	µg/g	2.4	Selenium	1	1	2.7	2.7	3.24	Yes
Silver	0.2	µg/g	20	Silver	0.2	0.2	3.5	3.5	4.2	No
Thallium	0.4	µg/g	1	Thallium	0.5	0.5	0	0.5	0.6	No
Uranium	0.5	µg/g	23	Uranium	1	1	0.8	1	1.2	No
Vanadium	1	µg/g	86	Vanadium	1	1	53.2	53.2	63.84	No
Zinc	5	µg/g	340	Zinc	5	800	41600	41600	49920	Yes
Volatiles				**Volatiles**						
Benzene	0.0068	µg/g	0.21	Benzene	0.0068	0.22	141	141	169.2	Yes
Toluene	0.05	µg/g	2.3	Toluene	0.08	2.6	205	205	246	Yes
Ethylbenzene	0.018	µg/g	2	Ethylbenzene	0.018	0.072	21	21	25.2	Yes
Xylenes	0.05	µg/g	3.1	Xylenes	0.05	0.96	336	336	403.2	Yes
m+p-Xylenes	0.03	µg/g	na	m+p-Xylenes	0.03	0.96	253	253	303.6	No
o-Xylenes	0.02	µg/g	na	o-Xylenes	0.02	0.08	83.3	83.3	99.96	No
Hexane (n)	0.05	µg/g	2.8	Hexane (n)	0.05	0.2	5.58	5.58	6.696	Yes
Petroleum Hydrocarbon (PHC) Fractions				**Petroleum Hydrocarbon (PHC) Fractions**						
PHC F1	5	µg/g	55	PHC F1	5	5	920	920	1104	Yes
PHC F2	10	µg/g	98	PHC F2	10	50	5490	5490	6588	Yes
PHC F3	50	µg/g	300	PHC F3	50	500	11300	11300	13560	Yes
PHC F4	50	µg/g	2,800	PHC F4	50	500	2300	2300	2760	No
PHC F4 (silica gel)	250	µg/g	2,800	PHC F4 (silica gel)	250	250	5170	5170	6204	Yes
Volatile Organic Compounds				**Volatile Organic Compounds**						
Bromodichloromethane	0.05	µg/g	13	Bromodichloromethane	0.05	0.2	0	0.2	0.24	No
Bromoform	0.05	µg/g	0.27	Bromoform	0.05	0.2	0	0.2	0.24	No
Bromomethane	0.05	µg/g	0.05	Bromomethane	0.05	0.2	0	0.2	0.24	No
Carbon Tetrachloride	0.05	µg/g	0.05	Carbon Tetrachloride	0.05	0.2	0	0.2	0.24	No
Chlorobenzene	0.05	µg/g	2.4	Chlorobenzene	0.05	0.73	0	0.73	0.876	No
Chloroform	0.04	µg/g	0.05	Chloroform	0.05	0.2	0	0.2	0.24	No
Dibromochloromethane	0.05	µg/g	9.4	Dibromochloromethane	0.05	0.2	0	0.2	0.24	No
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	3.4	Dichlorobenzene, 1,2- (o-DCB)	0.05	1.6	0	1.6	1.92	No
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	4.8	Dichlorobenzene, 1,3- (m-DCB)	0.05	1.6	0	1.6	1.92	No
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	Dichlorobenzene, 1,4- (p-DCB)	0.05	1.6	0	1.6	1.92	No
Dichlorodifluoromethane	0.05	µg/g	16	Dichlorodifluoromethane	0.05	0.2	0	0.2	0.24	No
Dichloroethane, 1,1-	0.02	µg/g	3.5	Dichloroethane, 1,1-	0.05	0.2	0	0.2	0.24	No
Dichloroethane, 1,2-	0.03	µg/g	0.05	Dichloroethane, 1,2-	0.05	0.2	0	0.2	0.24	No
Dichloroethylene, 1,1-	0.05	µg/g	0.05	Dichloroethylene, 1,1-	0.05	0.2	0	0.2	0.24	No
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	Dichloroethylene, cis-1,2-	0.05	0.2	0	0.2	0.24	No
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	Dichloroethylene, trans-1,2-	0.05	0.2	0	0.2	0.24	No
Dichloropropane, 1,2-	0.03	µg/g	0.05	Dichloropropane, 1,2-	0.05	0.2	0	0.2	0.24	No
Dichloropropene, 1,3-	0.042	µg/g	0.05	Dichloropropene, 1,3-	0.042	0.17	0	0.17	0.204	No
Ethylene Dibromide	0.04	µg/g	0.05	Ethylene Dibromide	0.05	0.2	0	0.2	0.24	No
Methyl Ethyl Ketone	0.5	µg/g	16	Methyl Ethyl Ketone	0.5	2	0	2	2.4	No
Methyl Isobutyl Ketone	0.5	µg/g	1.7	Methyl Isobutyl Ketone	0.5	2	0	2	2.4	No
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	Methyl tert butyl ether (MTBE)	0.05	0.2	0	0.2	0.24	No
Methylene Chloride	0.05	µg/g	0.1	Methylene Chloride	0.05	0.35	0	0.35	0.42	No
Styrene	0.05	µg/g	0.7	Styrene	0.05	1.7	135	135	162	Yes
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	Tetrachloroethane, 1,1,1,2-	0.05	0.2	0	0.2	0.24	No
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	Tetrachloroethane, 1,1,2,2-	0.05	0.2	0	0.2	0.24	No
Tetrachloroethylene	0.05	µg/g	0.28	Tetrachloroethylene	0.05	0.2	0	0.2	0.24	No
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	Trichloroethane, 1,1,1-	0.05	0.2	0	0.2	0.24	No
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	Trichloroethane, 1,1,2-	0.05	0.2	0	0.2	0.24	No
Trichloroethylene	0.01	µg/g	0.061	Trichloroethylene	0.01	0.04	0	0.04	0.048	No
Trichlorofluoromethane	0.05	µg/g	4	Trichlorofluoromethane	0.05	0.2	0	0.2	0.24	No
Vinyl Chloride [4]	0.02	µg/g	0.02	Vinyl Chloride	0.02	0.08	0	0.08	0.096	No
PAHs				**PAHs**						
Acenaphthene L	0.05	µg/g	7.9	Acenaphthene	0.05	5	33	33	39.6	Yes
Acenaphthyle L	0.05	µg/g	0.15	Acenaphthylene	0.05	0.05	10	10	12	Yes
Anthracene L	0.05	µg/g	0.67	Anthracene	0.05	0.05	100	100	120	Yes
Benzo(a)anthr H	0.05	µg/g	0.5	Benzo(a)anthracene	0.05	0.05	87	87	104.4	Yes
Benzo(a)pyren H	0.05	µg/g	0.3	Benzo(a)pyrene	0.05	0.05	64	64	76.8	Yes
Benzo(b)fluora H	0.05	µg/g	0.78	Benzo(b)fluoranthene	0.05	0.05	75	75	90	Yes
Benzo(g,h,i)pe H	0.05	µg/g	6.6	Benzo(g,h,i)perylene	0.05	0.05	25	25	30	Yes
Benzo(k)fluora H	0.05	µg/g	0.78	Benzo(k)fluoranthene	0.05	0.05	36	36	43.2	Yes
Chrysene H	0.05	µg/g	7	Chrysene	0.05	0.05	75	75	90	Yes
Dibenzo(a,h)an H	0.05	µg/g	0.1	Dibenzo(a,h)anthracene	0.05	0.05	11	11	13.2	Yes
Fluoranthene H	0.05	µg/g	0.69	Fluoranthene	0.05	0.05	270	270	324	Yes
Fluorene L	0.05	µg/g	62	Fluorene	0.05	0.05	64	64	76.8	Yes
Indeno(1,2,3-c H	0.05	µg/g	0.38	Indeno(1,2,3-cd)pyrene	0.05	0.05	29	29	34.8	Yes
Methylnaphthalene, 1-	0.03	µg/g	0.99	Methylnaphthalene, 1-	0.03	3	3.36	3.36	4.032	Yes
Methylnaphthalene, 2-	0.03	µg/g	0.99	Methylnaphthalene, 2-	0.03	3	7.36	7.36	8.832	Yes
Methylnaphtha L	0.042	µg/g	0.99	Methylnaphthalene, 1- & 2-	0.042	3	62	62	74.4	Yes
Naphthalene L	0.013	µg/g	0.6	Naphthalene	0.013	2.6	54.2	54.2	65.04	Yes
Phenanthrene L	0.046	µg/g	6.2	Phenanthrene	0.046	4.6	310	310	372	Yes
Pyrene H	0.05	µg/g	78	Pyrene	0.05	5	220	220	264	Yes
LMW PAH [7]	na	µg/g	na	LMW PAH [7]	na	na	575	575	690	No
HMW PAH [8]	na	µg/g	na	HMW PAH [8]	na	na	881	881	1057.2	No
PCBs				**PCBs**						
Arochlor 1242	0.01	µg/g	na	Arochlor 1242	0.01	0.6	0	0.6	0.72	No
Arochlor 1248	0.01	µg/g	na	Arochlor 1248	0.01	0.3	0	0.3	0.36	No
Arochlor 1254	0.01	µg/g	na	Arochlor 1254	0.01	0.3	0.194	0.3	0.36	No
Arochlor 1260	0.01	µg/g	na	Arochlor 1260	0.01	0.3	1.6	1.6	1.92	No
Total PCBs	0.1	µg/g	0.35	Total PCBs		0.3	1.6	1.6	1.92	Yes

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
> - SAR is incalculable du to Ca, Na and/or Mg below detection limit. Lowest possible SAR is reported as minimum value
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[7] Low Molecular Weight (LMW) PAH consisting of: Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Methylnaphthalenes, Naphthalene and Phenanthrene.

[8] High Molecular Weight (HMW) PAH consisting of: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene and Pyrene.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013-2018**
Central Park, Hamilton, ON

Sample Location			Table 5[1]	BH-1	BH-2	BH-4	BH-5	BH-6	BH-7	BH-01-17	BH-01-17	BH-01-17
Laboratory Sample ID			Standard	130524-2	130524-4	130524-6	130524-8	130524-10	130524-12	L2038490-4	L2038490-5	L2038490-6
SNC-Lavalin Sample ID			RL/PL/IN CG	BH-1-2	BH-2-2	BH-4-2	BH-5-2	BH-6-2	BH-7-2	BH-01-17 SS3	BH-01-17 SS4	BH-01-17 SS5
Sampling Date (yyyy/mm/dd)			Subsurface	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2013/03/20	2017/12/15	2017/12/15	2017/12/15
				1.2 - 2.0	1.2 - 2.0	1.2 - 2.0	1.2 - 2.0	1.2 - 2.0	1.2 - 2.0	1.5 - 2.1	2.3 - 2.9	3.0 - 3.7
				-	-	-	-	-	-	-	-	-
Parameter	**RDL**	**Units**										
General Chemistry												
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	-	-	-	-	-	-	347	225	609
pH [2]	-	pH	11	-	-	-	-	-	-	7.8	7.92	7.77
Sodium Adsorption Ratio [3]	-	None	na	-	-	-	-	-	-	7.5>	3.1>	4.86
Soluble Sodium	1	mg/L	na	-	-	-	-	-	-	44.3	18	78.8
Soluble Calcium	1	mg/L	na	-	-	-	-	-	-	< 1.0	< 1.0	11.7
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	-	< 1.0	< 1.0	5
Total Metals												
Antimony	0.8	µg/g	63	< 0.8	1	< 0.8	< 0.8	2.2	< 0.8	< 1.0	< 1.0	< 1.0
Arsenic	0.2	µg/g	18	4	13	4	3	10	3	3.34	4.92	4.26
Barium	1	µg/g	7,700	27	174	27	34	108	25	46.8	69.7	52.7
Beryllium	0.5	µg/g	60	< 0.5	0.6	< 0.5	< 0.5	< 0.5	< 0.5	< 0.50	< 0.50	< 0.50
Boron	5	µg/g	5,000	< 5	9	8	< 5	6	5	-	-	-
Boron (Hot Water Soluble)	0.1	µg/g	na	0.25	1.04	0.3	0.25	0.71	0.27	-	-	-
Cadmium	0.5	µg/g	7.9	< 0.5	1.2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.50	< 0.50	< 0.50
Chromium (total)	1	µg/g	11,000	10	26	12	12	14	9	7.8	9.3	11.6
Chromium (VI)	0.2	µg/g	40	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-
Cobalt	1	µg/g	250	6.4	9.7	7.7	6.5	8.2	5.7	5.3	5.6	6.9
Copper	1	µg/g	5,600	23	130	27	24	160	19	22.9	27.8	22.6
Lead	1	µg/g	1,000	9	338	9	31	676	10	5.9	7.1	6.8
Mercury	0.005	µg/g	0.27	< 0.10	2.69	< 0.10	0.3	2.3	< 0.10	< 0.0050	0.0057	0.0062
Molybdenum	0.5	µg/g	1,200	< 0.5	1.5	0.5	< 0.5	1.2	< 0.5	< 1.0	< 1.0	< 1.0
Nickel	1	µg/g	510	12	33	15	12	17	12	9.8	10.8	12.8
Selenium	0.4	µg/g	1,200	< 0.4	0.9	< 0.4	< 0.4	0.7	< 0.4	< 1.0	< 1.0	< 1.0
Silver	0.2	µg/g	490	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20
Thallium	0.4	µg/g	3.3	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	-	-	-
Uranium	0.5	µg/g	300	< 0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	-	-	-
Vanadium	1	µg/g	160	15	29	19	18	22	15	16.2	22.4	23.6
Zinc	5	µg/g	15,000	37	541	43	50	424	32	25.7	28.9	35
Volatiles												
Benzene	0.0068	µg/g	0.21	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-	-	< 0.0068
Toluene	0.05	µg/g	6.2	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	-	-	< 0.080
Ethylbenzene	0.018	µg/g	2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	< 0.018
Xylenes	0.05	µg/g	3.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	< 0.050
m+p-Xylenes	0.03	µg/g	na	-	-	-	-	-	-	-	-	< 0.030
o-Xylenes	0.02	µg/g	na	-	-	-	-	-	-	-	-	< 0.020
Hexane (n)	0.05	µg/g	2.8	-	-	-	-	-	-	-	-	-
Petroleum Hydrocarbon (PHC) Fractions												
PHC F1	5	µg/g	55	< 5	< 5	< 5	< 5	< 5	< 5	-	-	< 5.0
PHC F2	10	µg/g	98	< 10	480	< 10	< 10	21	< 10	-	-	< 10
PHC F3	50	µg/g	5,800	< 50	7,000	< 50	< 50	450	< 50	-	-	< 50
PHC F4	50	µg/g	6,900	< 50	710	< 50	79	< 50	< 50	-	-	< 50
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds												
Bromodichloromethane	0.05	µg/g	18	-	-	-	-	-	-	-	-	-
Bromoform	0.05	µg/g	0.27	-	-	-	-	-	-	-	-	-
Bromomethane	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-
Chlorobenzene	0.05	µg/g	2.4	-	-	-	-	-	-	-	-	-
Chloroform	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-
Dibromochloromethane	0.05	µg/g	13	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	-	-	-	-	-	-	-	-
Dichlorodifluoromethane	0.05	µg/g	16	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	-	-	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	-	-	-	-	-	-	-	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	-	-	-	-	-	-	-	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	-	-	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	-	-	-	-	-	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-
Methyl Ethyl Ketone	0.5	µg/g	16	-	-	-	-	-	-	-	-	-
Methyl Isobutyl Ketone	0.5	µg/g	6.6	-	-	-	-	-	-	-	-	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	-	-	-	-	-	-	-	-
Methylene Chloride	0.05	µg/g	0.1	-	-	-	-	-	-	-	-	-
Styrene	0.05	µg/g	16	-	-	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	-	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-
Tetrachloroethylene	0.05	µg/g	0.28	-	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-
Trichloroethylene	0.01	µg/g	0.061	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	0.05	µg/g	4	-	-	-	-	-	-	-	-	-
Vinyl Chloride [4]	0.02	µg/g	0.02	-	-	-	-	-	-	-	-	-
PAHs												
Acenaphthene	0.05	µg/g	7.9	< 0.05	33	< 0.05	< 0.05	1.5	< 0.05	-	-	-
Acenaphthylene	0.05	µg/g	0.15	< 0.05	2.2	< 0.05	< 0.05	2.1	< 0.05	-	-	-
Anthracene	0.05	µg/g	0.67	< 0.05	85	< 0.05	0.06	4.5	0.05	-	-	-
Benzo(a)anthracene	0.05	µg/g	0.96	< 0.05	73	< 0.05	0.05	7.1	0.24	-	-	-
Benzo(a)pyrene	0.05	µg/g	0.3	< 0.05	57	< 0.05	0.05	8.5	0.24	-	-	-
Benzo(b)fluoranthene	0.05	µg/g	0.96	< 0.05	75	< 0.05	0.06	9.9	0.27	-	-	-
Benzo(g,h,i)perylene	0.05	µg/g	9.6	< 0.05	25	< 0.05	< 0.05	4.7	0.15	-	-	-
Benzo(k)fluoranthene	0.05	µg/g	0.96	< 0.05	32	< 0.05	< 0.05	4.6	0.14	-	-	-
Chrysene	0.05	µg/g	9.6	< 0.05	68	< 0.05	0.05	7	0.27	-	-	-
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	< 0.05	7.3	< 0.05	< 0.05	1.2	< 0.05	-	-	-
Fluoranthene	0.05	µg/g	9.6	< 0.05	220	< 0.05	0.13	16	0.38	-	-	-
Fluorene	0.05	µg/g	62	< 0.05	64	< 0.05	< 0.05	1.8	< 0.05	-	-	-
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	< 0.05	29	< 0.05	< 0.05	5	0.12	-	-	-
Methylnaphthalene, 1-	0.03	µg/g	34	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	0.03	µg/g	34	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	< 0.05	28	< 0.05	< 0.05	1.2	< 0.05	-	-	-
Naphthalene	0.013	µg/g	0.65	< 0.05	52	< 0.05	0.1	3.3	< 0.05	-	-	-
Phenanthrene	0.046	µg/g	270	< 0.05	260	< 0.05	0.11	13	0.17	-	-	-
Pyrene	0.05	µg/g	96	< 0.05	160	< 0.05	0.1	14	0.36	-	-	-
PCBs												
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/g	2.7	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location / Laboratory Sample ID / SNC-Lavalin Sample ID / Sampling Date (yyyy/mm/dd)	RDL	Units	Table 5[1] Standard RL/PL/IN CG Subsurface	BH-01-17 L2038490-7 BH-01-17 SS6 2017/12/15 4.6 - 5.2 -	BH-02-17 L2040326-4 BH-02-17 SS3 2017/12/22 1.5 - 2.1 -	BH-02-17 L2040326-5 BH-02-17 SS4 2017/12/22 2.3 - 2.9 -	BH-03-17 L2040326-8 BH-03-17 SS3 2017/12/22 1.5 - 2.1 -	BH-05-17 L2040324-8 BH-05-17 SS3 2017/12/22 1.5 - 2.1 -	BH-05-17 L2040324-9 BH-05-17 SS4 2017/12/22 2.3 - 2.9 -	BH-06-17 L2038495-1 BH-06-17 SS3 2017/12/19 1.5 - 2.1 -	BH-07-17 L2038807-3 BH-07-17 SS3 2017/12/21 1.5 - 2.1 -	BH-07-17 L2038807-4 BH-07-17 SS4 2017/12/21 2.3 - 2.9 -	BH-09-17 L2038487-4 BH-09-17 SS3 2017/12/15 1.5 - 2.1 -
General Chemistry													
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	-	535	242	437	685	574	-	1,030	697	352
pH [2]	-	pH	11	-	7.44	7.6	7.66	8.22	7.92	-	7.92	7.98	7.65
Sodium Adsorption Ratio [3]	-	None	na	-	16>	4.06	5.95	21>	17>	-	32.7	28.7	6.6
Soluble Sodium	1	mg/L	na	-	92.1	25.9	72.3	124	99.4	-	199	123	41
Soluble Calcium	1	mg/L	na	-	< 1.0	3.1	1.3	< 1.0	< 1.0	-	2.8	1.4	2.9
Soluble Magnesium	1	mg/L	na	-	< 1.0	< 1.0	6	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0
Total Metals													
Antimony	0.8	µg/g	63	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.7	< 1.0	< 1.0	< 1.0
Arsenic	0.2	µg/g	18	-	5.55	5.57	5.65	3.9	3.71	**27.6**	4.91	3.93	3.43
Barium	1	µg/g	7,700	-	36.1	22.4	41.3	40.4	40.1	265	67.7	24.5	22.9
Beryllium	0.5	µg/g	60	-	0.66	< 0.50	0.63	< 0.50	< 0.50	0.56	< 0.50	< 0.50	< 0.50
Boron	5	µg/g	5,000	-	-	-	-	-	-	7.9	-	-	-
Boron (Hot Water Soluble)	0.1	µg/g	na	-	-	-	-	-	-	-	-	-	-
Cadmium	0.5	µg/g	7.9	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chromium (total)	1	µg/g	11,000	-	18.6	11	19.3	9.8	9.4	14.7	16.9	8.2	9.2
Chromium (VI)	0.2	µg/g	40	-	-	-	-	-	-	-	-	-	-
Cobalt	1	µg/g	250	-	11.5	6.6	10.4	6.1	5.5	7.9	9.1	5.2	6.4
Copper	1	µg/g	5,600	-	35.5	24.7	30.2	21.8	20	157	35.6	24.8	19.1
Lead	1	µg/g	1,000	-	13	7.2	9.9	12.2	5.6	333	9.7	6.7	6
Mercury	0.005	µg/g	0.27	-	0.0181	0.0068	0.012	0.0302	0.0061	-	0.0151	0.0053	0.0065
Molybdenum	0.5	µg/g	1,200	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.1	1.1	< 1.0	< 1.0
Nickel	1	µg/g	510	-	22.9	11.9	21.1	11.6	10.4	18.9	18.8	10.9	11.8
Selenium	0.4	µg/g	1,200	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.4	< 1.0	< 1.0	< 1.0
Silver	0.2	µg/g	490	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Thallium	0.4	µg/g	3.3	-	-	-	-	-	-	< 0.50	-	-	-
Uranium	0.5	µg/g	300	-	-	-	-	-	-	< 1.0	-	-	-
Vanadium	1	µg/g	160	-	28.8	25.9	35.3	18.8	21.1	32.4	27.6	15.9	17
Zinc	5	µg/g	15,000	-	56	36.1	49.9	41	29.4	193	50.4	31.9	29.6
Volatiles													
Benzene	0.0068	µg/g	0.21	< 0.0068	-	-	-	-	-	< 0.0068	-	-	< 0.0068
Toluene	0.05	µg/g	6.2	< 0.080	-	-	-	-	-	< 0.080	-	-	< 0.080
Ethylbenzene	0.018	µg/g	2	< 0.018	-	-	-	-	-	< 0.018	-	-	< 0.018
Xylenes	0.05	µg/g	3.1	< 0.050	-	-	-	-	-	0.166	-	-	< 0.050
m+p-Xylenes	0.03	µg/g	na	< 0.030	-	-	-	-	-	0.108	-	-	< 0.030
o-Xylenes	0.02	µg/g	na	< 0.020	-	-	-	-	-	0.058	-	-	< 0.020
Hexane (n)	0.05	µg/g	2.8	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Petroleum Hydrocarbon (PHC) Fractions													
PHC F1	5	µg/g	55	-	-	-	-	-	-	< 5.0	-	-	< 5.0
PHC F2	10	µg/g	98	-	-	-	-	-	-	< 100[1]	-	-	< 10
PHC F3	50	µg/g	5,800	-	-	-	-	-	-	< 500	-	-	< 50
PHC F4	50	µg/g	6,900	-	-	-	-	-	-	2,170	-	-	< 50
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	**10,200**	-	-	-
Volatile Organic Compounds													
Bromodichloromethane	0.05	µg/g	18	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Bromoform	0.05	µg/g	0.27	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Bromomethane	0.05	µg/g	0.05	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Carbon Tetrachloride	0.05	µg/g	0.05	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Chlorobenzene	0.05	µg/g	2.4	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Chloroform	0.04	µg/g	0.05	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Dibromochloromethane	0.05	µg/g	13	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Dichlorodifluoromethane	0.05	µg/g	16	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Dichloroethane, 1,1-	0.02	µg/g	3.5	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Dichloroethane, 1,2-	0.03	µg/g	0.05	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Dichloroethylene, 1,1-	0.05	µg/g	0.05	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Dichloropropane, 1,2-	0.03	µg/g	0.05	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Dichloropropene, 1,3-	0.042	µg/g	0.05	< 0.042	-	-	-	-	-	< 0.042	-	-	< 0.042
Ethylene Dibromide	0.04	µg/g	0.05	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Methyl Ethyl Ketone	0.5	µg/g	16	< 0.50	-	-	-	-	-	< 0.50	-	-	< 0.50
Methyl Isobutyl Ketone	0.5	µg/g	6.6	< 0.50	-	-	-	-	-	< 0.50	-	-	< 0.50
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Methylene Chloride	0.05	µg/g	0.1	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Styrene	0.05	µg/g	16	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Tetrachloroethylene	0.05	µg/g	0.28	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Trichloroethylene	0.01	µg/g	0.061	< 0.010	-	-	-	-	-	< 0.010	-	-	< 0.010
Trichlorofluoromethane	0.05	µg/g	4	< 0.050	-	-	-	-	-	< 0.050	-	-	< 0.050
Vinyl Chloride [4]	0.02	µg/g	0.02	< 0.020	-	-	-	-	-	< 0.020	-	-	< 0.020
PAHs													
Acenaphthene	0.05	µg/g	7.9	-	-	-	-	-	-	< 0.050	-	-	-
Acenaphthylene	0.05	µg/g	0.15	-	-	-	-	-	-	< 0.050	-	-	-
Anthracene	0.05	µg/g	0.67	-	-	-	-	-	-	< 0.050	-	-	-
Benzo(a)anthracene	0.05	µg/g	0.96	-	-	-	-	-	-	< 0.050	-	-	-
Benzo(a)pyrene	0.05	µg/g	0.3	-	-	-	-	-	-	< 0.050	-	-	-
Benzo(b)fluoranthene	0.05	µg/g	0.96	-	-	-	-	-	-	< 0.050	-	-	-
Benzo(g,h,i)perylene	0.05	µg/g	9.6	-	-	-	-	-	-	< 0.050	-	-	-
Benzo(k)fluoranthene	0.05	µg/g	0.96	-	-	-	-	-	-	< 0.050	-	-	-
Chrysene	0.05	µg/g	9.6	-	-	-	-	-	-	< 0.050	-	-	-
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	-	-	-	-	-	-	< 0.050	-	-	-
Fluoranthene	0.05	µg/g	9.6	-	-	-	-	-	-	< 0.050	-	-	-
Fluorene	0.05	µg/g	62	-	-	-	-	-	-	< 0.050	-	-	-
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	-	-	-	-	-	-	< 0.050	-	-	-
Methylnaphthalene, 1-	0.03	µg/g	34	-	-	-	-	-	-	< 0.030	-	-	-
Methylnaphthalene, 2-	0.03	µg/g	34	-	-	-	-	-	-	< 0.030	-	-	-
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	-	-	-	-	-	-	< 0.042	-	-	-
Naphthalene	0.013	µg/g	0.65	-	-	-	-	-	-	< 0.013	-	-	-
Phenanthrene	0.046	µg/g	270	-	-	-	-	-	-	< 0.046	-	-	-
Pyrene	0.05	µg/g	96	-	-	-	-	-	-	< 0.050	-	-	-
PCBs													
Arochlor 1242	0.01	µg/g	na	< 0.010	-	-	-	-	-	< 0.10	-	-	-
Arochlor 1248	0.01	µg/g	na	< 0.010	-	-	-	-	-	< 0.10	-	-	-
Arochlor 1254	0.01	µg/g	na	< 0.010	-	-	-	-	-	< 0.10	-	-	-
Arochlor 1260	0.01	µg/g	na	< 0.010	-	-	-	-	-	< 0.10	-	-	-
Total PCBs	0.1	µg/g	2.7	< 0.020	-	-	-	-	-	< 0.20	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location / Laboratory Sample ID / SNC-Lavalin Sample ID / Sampling Date (yyyy/mm/dd)	RDL	Units	Table 5[1] Standard RL/PL/IN CG Subsurface	BH-10-17 L2038493-3 BH-10-17 SS3 2017/12/15 1.5 - 2.1 -	BH-10-17 L2038493-4 BH-10-17 SS4 2017/12/15 2.3 - 2.9 -	BH-10-17 L2038493-5 BH-10-17 SS5 2017/12/15 3.0 - 3.7 -	BH-10-17 L2038493-6 BH-10-17 SS6 2017/12/15 4.6 - 5.2 -	BH-10-17 L2038493-7 BH-10-17 SS7 2017/12/15 6.1 - 6.7 -	BH-11-17 L2038803-4 BH-11-17 SS3 2017/12/21 1.5 - 2.1 -	BH-11-17 L2038803-5 BH-11-17 SS4 2017/12/21 2.3 - 2.9 -	BH-11-17 L2038803-6 BH-11-17 SS5 2017/12/21 3.0 - 3.7 -	BH-11-17 L2038803-7 BH-11-17 SS6 2017/12/21 3.8 - 4.4 -	BH-11-17 L2038803-8 BH-11-17 SS7 2017/12/21 4.6 - 5.2 -
Parameter													
General Chemistry													
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	559	-	676	719	389	1,640	2,140	3,680	1,900	321
pH [2]	-	pH	11	7.77	-	7.79	7.35	7.22	7.92	7.78	7.77	7.47	7.33
Sodium Adsorption Ratio [3]	-	None	na	20.3	-	2.53	8.24	6.17	59>	79>	69.4	84.5	7.3>
Soluble Sodium	1	mg/L	na	101	-	61.4	117	51.1	352	465	790	413	43
Soluble Calcium	1	mg/L	na	1.9	-	34.9	11.6	5.2	< 1.0	< 1.0	7.9	1.8	< 1.0
Soluble Magnesium	1	mg/L	na	< 1.0	-	6	2.3	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0
Total Metals													
Antimony	0.8	µg/g	63	1.5	2.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	< 1.0	< 1.0
Arsenic	0.2	µg/g	18	10.9	16.9	4.69	4.3	3.51	4.86	4.55	13.6	2.87	3.46
Barium	1	µg/g	7,700	124	189	33.5	34.4	37.8	28.6	33.5	1,510	65.5	40.3
Beryllium	0.5	µg/g	60	< 0.50	0.79	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Boron	5	µg/g	5,000	-	12.7	-	-	-	-	-	-	-	-
Boron (Hot Water Soluble)	0.1	µg/g	na	-	0.81	-	-	-	-	-	-	-	-
Cadmium	0.5	µg/g	7.9	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.54	< 0.50	< 0.50
Chromium (total)	1	µg/g	11,000	19.2	19.9	13.4	14.2	14.8	12.7	13.8	29.2	10.6	13.5
Chromium (VI)	0.2	µg/g	40	-	0.85	-	-	-	-	-	-	-	-
Cobalt	1	µg/g	250	8	11.9	7.4	7.3	7.4	7.7	7.9	5.9	5.8	6.9
Copper	1	µg/g	5,600	47.2	55	27	25.5	27.5	28.2	28.3	33.8	16.2	14.6
Lead	1	µg/g	1,000	177	291	14.9	8.5	9.3	8.7	23.2	**1,690**	11	7.2
Mercury	0.005	µg/g	0.27	**0.599**	**0.581**	0.0567	0.0173	0.0165	0.0086	0.146	**39.6**	0.0639	0.0207
Molybdenum	0.5	µg/g	1,200	< 1.0	2.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Nickel	1	µg/g	510	17.4	23.3	14	13.8	13.8	14.6	14.3	10.8	9.1	11.7
Selenium	0.4	µg/g	1,200	< 1.0	4.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Silver	0.2	µg/g	490	< 0.20	0.3	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.82	< 0.20	< 0.20
Thallium	0.4	µg/g	3.3	-	< 0.50	-	-	-	-	-	-	-	-
Uranium	0.5	µg/g	300	-	< 1.0	-	-	-	-	-	-	-	-
Vanadium	1	µg/g	160	28.6	40.1	28.3	28.2	30.1	25	27.9	20.9	23.9	27.7
Zinc	5	µg/g	15,000	153	178	42	41.1	42.3	41.3	46.3	506	36.2	34.2
Volatiles													
Benzene	0.0068	µg/g	0.21	-	-	-	< 0.0068	-	-	-	-	-	-
Toluene	0.05	µg/g	6.2	-	-	-	< 0.080	-	-	-	-	-	-
Ethylbenzene	0.018	µg/g	2	-	-	-	< 0.018	-	-	-	-	-	-
Xylenes	0.05	µg/g	3.1	-	-	-	< 0.050	-	-	-	-	-	-
m+p-Xylenes	0.03	µg/g	na	-	-	-	< 0.030	-	-	-	-	-	-
o-Xylenes	0.02	µg/g	na	-	-	-	< 0.020	-	-	-	-	-	-
Hexane (n)	0.05	µg/g	2.8	-	-	-	< 0.050	-	-	-	-	-	-
Petroleum Hydrocarbon (PHC) Fractions													
PHC F1	5	µg/g	55	-	-	-	< 5.0	-	-	-	-	-	-
PHC F2	10	µg/g	98	-	-	-	< 10	-	-	-	< 10	-	-
PHC F3	50	µg/g	5,800	-	-	-	< 50	-	-	-	< 50	-	-
PHC F4	50	µg/g	6,900	-	-	-	< 50	-	-	-	< 50	-	-
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds													
Bromodichloromethane	0.05	µg/g	18	-	-	-	< 0.050	-	-	-	-	-	-
Bromoform	0.05	µg/g	0.27	-	-	-	< 0.050	-	-	-	-	-	-
Bromomethane	0.05	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Carbon Tetrachloride	0.05	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Chlorobenzene	0.05	µg/g	2.4	-	-	-	< 0.050	-	-	-	-	-	-
Chloroform	0.04	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Dibromochloromethane	0.05	µg/g	13	-	-	-	< 0.050	-	-	-	-	-	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	-	-	-	< 0.050	-	-	-	-	-	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	-	-	-	< 0.050	-	-	-	-	-	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	-	-	< 0.050	-	-	-	-	-	-
Dichlorodifluoromethane	0.05	µg/g	16	-	-	-	< 0.050	-	-	-	-	-	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	-	-	< 0.050	-	-	-	-	-	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	-	-	< 0.050	-	-	-	-	-	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	-	-	< 0.050	-	-	-	-	-	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	-	-	< 0.042	-	-	-	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Methyl Ethyl Ketone	0.5	µg/g	16	-	-	-	< 0.50	-	-	-	-	-	-
Methyl Isobutyl Ketone	0.5	µg/g	6.6	-	-	-	< 0.50	-	-	-	-	-	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	-	-	< 0.050	-	-	-	-	-	-
Methylene Chloride	0.05	µg/g	0.1	-	-	-	< 0.050	-	-	-	-	-	-
Styrene	0.05	µg/g	16	-	-	-	< 0.050	-	-	-	-	-	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	-	-	< 0.050	-	-	-	-	-	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Tetrachloroethylene	0.05	µg/g	0.28	-	-	-	< 0.050	-	-	-	-	-	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	-	-	< 0.050	-	-	-	-	-	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Trichloroethylene	0.01	µg/g	0.061	-	-	-	< 0.010	-	-	-	-	-	-
Trichlorofluoromethane	0.05	µg/g	4	-	-	-	< 0.050	-	-	-	-	-	-
Vinyl Chloride [4]	0.02	µg/g	0.02	-	-	-	< 0.020	-	-	-	-	-	-
PAHs													
Acenaphthene	0.05	µg/g	7.9	-	0.069	-	-	-	-	-	< 0.050	-	-
Acenaphthylene	0.05	µg/g	0.15	-	< 0.050	-	-	-	-	-	< 0.050	-	-
Anthracene	0.05	µg/g	0.67	-	0.107	-	-	-	-	-	< 0.050	-	-
Benzo(a)anthracene	0.05	µg/g	0.96	-	0.183	-	-	-	-	-	< 0.050	-	-
Benzo(a)pyrene	0.05	µg/g	0.3	-	0.13	-	-	-	-	-	< 0.050	-	-
Benzo(b)fluoranthene	0.05	µg/g	0.96	-	0.232	-	-	-	-	-	< 0.050	-	-
Benzo(g,h,i)perylene	0.05	µg/g	9.6	-	0.089	-	-	-	-	-	< 0.050	-	-
Benzo(k)fluoranthene	0.05	µg/g	0.96	-	0.062	-	-	-	-	-	< 0.050	-	-
Chrysene	0.05	µg/g	9.6	-	0.173	-	-	-	-	-	< 0.050	-	-
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	-	< 0.050	-	-	-	-	-	< 0.050	-	-
Fluoranthene	0.05	µg/g	9.6	-	0.378	-	-	-	-	-	< 0.050	-	-
Fluorene	0.05	µg/g	62	-	0.055	-	-	-	-	-	< 0.050	-	-
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	-	0.092	-	-	-	-	-	< 0.050	-	-
Methylnaphthalene, 1-	0.03	µg/g	34	-	< 0.030	-	-	-	-	-	< 0.030	-	-
Methylnaphthalene, 2-	0.03	µg/g	34	-	< 0.030	-	-	-	-	-	< 0.030	-	-
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	-	< 0.042	-	-	-	-	-	< 0.042	-	-
Naphthalene	0.013	µg/g	0.65	-	0.101	-	-	-	-	-	< 0.013	-	-
Phenanthrene	0.046	µg/g	270	-	0.247	-	-	-	-	-	< 0.046	-	-
Pyrene	0.05	µg/g	96	-	0.302	-	-	-	-	-	< 0.050	-	-
PCBs													
Arochlor 1242	0.01	µg/g	na	-	-	-	< 0.020	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g	na	-	-	-	< 0.010	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g	na	-	-	-	< 0.010	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g	na	-	-	-	< 0.010	-	-	-	-	-	-
Total PCBs	0.1	µg/g	2.7	-	-	-	< 0.020	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location / Laboratory Sample ID / SNC-Lavalin Sample ID / Sampling Date (yyyy/mm/dd)	RDL	Units	Table 5[1] Standard RL/PL/IN CG Subsurface	BH-11-17 L2038803-9 BH-11-17 SS8 2017/12/21 6.1 - 6.7 -	BH-12-17 L2038803-11 BH-12-17 SS2 2017/12/21 1.5 - 2.1 -	BH-12-17 L2038803-12 BH-12-17 SS3 2017/12/21 2.3 - 2.7 -	BH-13-17 L2038791-3 BH-13-17 SS3 2017/12/21 1.5 - 2.1 -	BH-13-17 L2038791-4 BH-13D-17 SS3 2017/12/21 1.5 - 2.1 - Duplicate of BH-13-17 SS3	BH-13-17 L2038791-5 BH-13-17 SS4 2017/12/21 2.3 - 2.9 -	BH-13-17 L2038791-6 BH-13-17 SS5 2017/12/21 3.0 - 3.7 -	BH-14-17 L2038791-10 BH-14-17 SS4 2017/12/21 2.3 - 2.9 -	BH-14-17 L2038791-9 BH-14-17 SS3 2017/12/21 1.5 - 2.1 -	BH-15-17 L2040320-3 BH-15-17 SS3 2017/12/22 1.5 - 2.1 -
General Chemistry													
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	157	1,200	574	1,530	1,680	1,130	420	305	493	674
pH [2]	-	pH	11	7.31	7.91	8.03	7.76	7.74	7.76	7.73	7.92	7.77	7.7
Sodium Adsorption Ratio [3]	-	None	na	1.6	43>	16>	52.1	52.3	24.1	10.1	6.5>	14>	28
Soluble Sodium	1	mg/L	na	7.1	253	93.5	324	356	225	59.9	38.4	80.1	122
Soluble Calcium	1	mg/L	na	1.5	< 1.0	< 1.0	2.9	3.5	4.8	2.7	< 1.0	< 1.0	1.4
Soluble Magnesium	1	mg/L	na	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	< 1.0	< 1.0
Total Metals													
Antimony	0.8	µg/g	63	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	0.2	µg/g	18	5.26	5.67	4.54	6.21	5.5	5	3.31	4.56	5.97	3.71
Barium	1	µg/g	7,700	90	23	28.6	57.4	57.7	50.7	25.9	33.4	33.3	29
Beryllium	0.5	µg/g	60	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Boron	5	µg/g	5,000	-	-	-	-	-	-	-	-	-	-
Boron (Hot Water Soluble)	0.1	µg/g	na	-	-	-	-	-	-	-	-	-	-
Cadmium	0.5	µg/g	7.9	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chromium (total)	1	µg/g	11,000	12.7	14.6	8	12.3	10.6	10.3	8.4	8	13	9.6
Chromium (VI)	0.2	µg/g	40	-	-	-	-	-	-	-	-	-	-
Cobalt	1	µg/g	250	6.2	9.2	5.1	5.9	5.1	5.4	5.5	5.3	9.1	6.4
Copper	1	µg/g	5,600	36.7	33.1	25.5	35.7	30.2	26.6	18.8	29.1	36	20.8
Lead	1	µg/g	1,000	8.6	9.1	5.9	84.1	107	57.6	5.4	5.7	6.8	7.6
Mercury	0.005	µg/g	0.27	0.0244	0.0094	< 0.0050	**0.665**	**0.859**	**0.865**	< 0.0050	0.0052	0.0075	0.0154
Molybdenum	0.5	µg/g	1,200	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Nickel	1	µg/g	510	15.3	17.8	10	11.2	9.1	10.7	11.1	10.4	18.4	11.8
Selenium	0.4	µg/g	1,200	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Silver	0.2	µg/g	490	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Thallium	0.4	µg/g	3.3	-	-	-	-	-	-	-	-	-	-
Uranium	0.5	µg/g	300	-	-	-	-	-	-	-	-	-	-
Vanadium	1	µg/g	160	21	26.2	19.3	24.6	20.8	20.3	14.4	16.8	21.8	19.1
Zinc	5	µg/g	15,000	40.4	46.9	27.7	161	107	57.5	27	30.4	44.3	37.5
Volatiles													
Benzene	0.0068	µg/g	0.21	-	-	-	-	-	-	-	-	-	< 0.0068
Toluene	0.05	µg/g	6.2	-	-	-	-	-	-	-	-	-	< 0.080
Ethylbenzene	0.018	µg/g	2	-	-	-	-	-	-	-	-	-	< 0.018
Xylenes	0.05	µg/g	3.1	-	-	-	-	-	-	-	-	-	< 0.050
m+p-Xylenes	0.03	µg/g	na	-	-	-	-	-	-	-	-	-	< 0.030
o-Xylenes	0.02	µg/g	na	-	-	-	-	-	-	-	-	-	< 0.020
Hexane (n)	0.05	µg/g	2.8	-	-	-	-	-	-	-	-	-	< 0.050
Petroleum Hydrocarbon (PHC) Fractions													
PHC F1	5	µg/g	55	-	-	-	-	-	-	-	-	-	< 5.0
PHC F2	10	µg/g	98	-	-	-	-	-	-	-	-	-	< 10
PHC F3	50	µg/g	5,800	-	-	-	-	-	-	-	-	-	< 50
PHC F4	50	µg/g	6,900	-	-	-	-	-	-	-	-	-	< 50
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds													
Bromodichloromethane	0.05	µg/g	18	-	-	-	-	-	-	-	-	-	< 0.050
Bromoform	0.05	µg/g	0.27	-	-	-	-	-	-	-	-	-	< 0.050
Bromomethane	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	< 0.050
Carbon Tetrachloride	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	< 0.050
Chlorobenzene	0.05	µg/g	2.4	-	-	-	-	-	-	-	-	-	< 0.050
Chloroform	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	< 0.050
Dibromochloromethane	0.05	µg/g	13	-	-	-	-	-	-	-	-	-	< 0.050
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	-	-	-	-	-	-	-	-	-	< 0.050
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	-	-	-	-	-	-	-	-	-	< 0.050
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	-	-	-	-	-	-	-	-	< 0.050
Dichlorodifluoromethane	0.05	µg/g	16	-	-	-	-	-	-	-	-	-	< 0.050
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	-	-	-	-	-	-	-	-	< 0.050
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	-	-	-	< 0.050
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	< 0.050
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	-	-	-	-	-	-	-	-	< 0.050
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	-	-	-	-	-	-	-	-	< 0.050
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	-	-	-	< 0.050
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	-	-	-	-	-	-	-	-	< 0.042
Ethylene Dibromide	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	< 0.050
Methyl Ethyl Ketone	0.5	µg/g	16	-	-	-	-	-	-	-	-	-	< 0.50
Methyl Isobutyl Ketone	0.5	µg/g	6.6	-	-	-	-	-	-	-	-	-	< 0.50
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	-	-	-	-	-	-	-	-	< 0.050
Methylene Chloride	0.05	µg/g	0.1	-	-	-	-	-	-	-	-	-	< 0.050
Styrene	0.05	µg/g	16	-	-	-	-	-	-	-	-	-	< 0.050
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	-	-	-	-	-	-	-	-	< 0.050
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	-	-	-	-	-	-	-	-	< 0.050
Tetrachloroethylene	0.05	µg/g	0.28	-	-	-	-	-	-	-	-	-	< 0.050
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	-	-	-	-	-	-	-	-	< 0.050
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	-	-	-	-	-	-	-	-	< 0.050
Trichloroethylene	0.01	µg/g	0.061	-	-	-	-	-	-	-	-	-	< 0.010
Trichlorofluoromethane	0.05	µg/g	4	-	-	-	-	-	-	-	-	-	< 0.050
Vinyl Chloride [4]	0.02	µg/g	0.02	-	-	-	-	-	-	-	-	-	< 0.020
PAHs													
Acenaphthene	0.05	µg/g	7.9	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	0.05	µg/g	0.15	-	-	-	-	-	-	-	-	-	-
Anthracene	0.05	µg/g	0.67	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	0.05	µg/g	0.96	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	0.05	µg/g	0.3	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	0.05	µg/g	0.96	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	0.05	µg/g	9.6	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	0.05	µg/g	0.96	-	-	-	-	-	-	-	-	-	-
Chrysene	0.05	µg/g	9.6	-	-	-	-	-	-	-	-	-	-
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	-	-	-	-	-	-	-	-	-	-
Fluoranthene	0.05	µg/g	9.6	-	-	-	-	-	-	-	-	-	-
Fluorene	0.05	µg/g	62	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 1-	0.03	µg/g	34	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	0.03	µg/g	34	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	-	-	-	-	-	-	-	-	-	-
Naphthalene	0.013	µg/g	0.65	-	-	-	-	-	-	-	-	-	-
Phenanthrene	0.046	µg/g	270	-	-	-	-	-	-	-	-	-	-
Pyrene	0.05	µg/g	96	-	-	-	-	-	-	-	-	-	-
PCBs													
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/g	2.7	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
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na - Not applicable
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Conversion factor of 1% LEL = 110 ppmv applied
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% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location			Table 5[1]	BH-16-17	BH-16-17	BH-17-17	BH-17-17	BH-17-17	BH-17-17	BH-17-17	BH-17-17	BH-18-17	BH-18-17
Laboratory Sample ID			Standard	L2040320-10	L2040320-11	L2038487-10	L2038487-11	L2038487-12	L2038487-13	L2038487-14	L2038487-15	L2038487-18	L2038487-19
SNC-Lavalin Sample ID			RL/PL/IN CG	BH-16-17 SS3	BH-16-17 SS4	BH-17-17 SS3	BH-17-17 SS4	BH-17-17 SS5	BH-17-17 SS6	BH-17-17 SS7	BH-17-17 SS8	BH-18-17 SS3	BH-18D-17 SS3
Sampling Date (yyyy/mm/dd)			Subsurface	2017/12/22	2017/12/22	2017/12/14	2017/12/14	2017/12/14	2017/12/14	2017/12/14	2017/12/14	2017/12/15	2017/12/15
				1.5 - 2.1	2.3 - 2.9	1.5 - 2.1	2.3 - 2.9	3.0 - 3.7	4.6 - 5.2	6.1 - 6.7	6.9 - 7.5	1.5 - 2.1	1.5 - 2.1
				-	-	-	-	-	-	-	-	-	-
													Duplicate of
Parameter	**RDL**	**Units**											BH-18-17 SS3
General Chemistry													
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	1,660	1,190	372	-	667	528	709	506	179	171
pH [2]	-	pH	11	7.69	7.63	9.22	-	7.33	7.25	7.2	7.25	7.82	7.82
Sodium Adsorption Ratio [3]	-	None	na	41.5	21	4.54	-	2.21	2.87	2.55	7.67	0.37	0.36
Soluble Sodium	1	mg/L	na	345	232	43.3	-	54.4	49.3	63	67.7	2.7	2.6
Soluble Calcium	1	mg/L	na	5.2	7.5	5.1	-	29.8	14.2	24.2	4.1	4	3.9
Soluble Magnesium	1	mg/L	na	< 1.0	1.1	1.1	-	9.7	5	13.4	1.1	< 1.0	< 1.0
Total Metals													
Antimony	0.8	µg/g	63	< 1.0	< 1.0	1.7	4.3	2.4	6	< 1.0	< 1.0	2.1	1.9
Arsenic	0.2	µg/g	18	6.16	4.66	11.6	**18.9**	14.6	12.6	6.3	6.3	8.73	8.46
Barium	1	µg/g	7,700	204	116	121	309	186	89.1	55.2	42.1	423	360
Beryllium	0.5	µg/g	60	0.85	0.59	0.73	0.51	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Boron	5	µg/g	5,000	-	-	-	9.9	-	-	-	-	-	-
Boron (Hot Water Soluble)	0.1	µg/g	na	-	-	-	0.64	-	-	-	-	-	-
Cadmium	0.5	µg/g	7.9	< 0.50	< 0.50	0.84	0.55	0.54	< 0.50	< 0.50	< 0.50	0.9	0.79
Chromium (total)	1	µg/g	11,000	29.6	19.5	21.9	16.9	12.5	12.7	10.2	14	17.7	16.5
Chromium (VI)	0.2	µg/g	40	-	-	-	< 0.20	-	-	-	-	-	-
Cobalt	1	µg/g	250	13.4	11.1	7.8	8	6.2	5.5	5.3	7.9	7.4	7.3
Copper	1	µg/g	5,600	37.7	29.2	88.8	143	136	44.7	27	30.6	77.5	75.7
Lead	1	µg/g	1,000	13.4	10.5	192	301	250	159	72	8.8	233	201
Mercury	0.005	µg/g	0.27	0.0285	0.0186	**0.772**	**1.66**	**1.81**	**2.86**	**0.578**	0.0197	0.27	**0.336**
Molybdenum	0.5	µg/g	1,200	< 1.0	< 1.0	1.5	1.9	1.6	1.5	< 1.0	< 1.0	< 1.0	< 1.0
Nickel	1	µg/g	510	30.4	24.3	23.3	18.3	12.4	10.9	10.6	15.1	16.1	15.8
Selenium	0.4	µg/g	1,200	< 1.0	< 1.0	< 1.0	1.5	1.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Silver	0.2	µg/g	490	< 0.20	< 0.20	< 0.20	0.43	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Thallium	0.4	µg/g	3.3	-	-	-	< 0.50	-	-	-	-	-	-
Uranium	0.5	µg/g	300	-	-	-	< 1.0	-	-	-	-	-	-
Vanadium	1	µg/g	160	36.1	27.4	27.8	27.8	20.3	25.9	17.3	28.1	25	24.4
Zinc	5	µg/g	15,000	71.3	54.9	227	284	227	79.8	84.8	42.9	318	271
Volatiles													
Benzene	0.0068	µg/g	0.21	-	-	-	**2.97**	-	-	-	-	-	-
Toluene	0.05	µg/g	6.2	-	-	-	0.541	-	-	-	-	-	-
Ethylbenzene	0.018	µg/g	2	-	-	-	**2.49**	-	-	-	-	-	-
Xylenes	0.05	µg/g	3.1	-	-	-	**7.72**	-	-	-	-	-	-
m+p-Xylenes	0.03	µg/g	na	-	-	-	5.32	-	-	-	-	-	-
o-Xylenes	0.02	µg/g	na	-	-	-	2.4	-	-	-	-	-	-
Hexane (n)	0.05	µg/g	2.8	-	-	-	< 0.050	-	-	-	-	-	-
Petroleum Hydrocarbon (PHC) Fractions													
PHC F1	5	µg/g	55	-	-	-	18.7	-	-	-	-	-	-
PHC F2	10	µg/g	98	-	-	-	**422**	-	-	-	-	-	-
PHC F3	50	µg/g	5,800	-	-	-	532	-	-	-	-	-	-
PHC F4	50	µg/g	6,900	-	-	-	131	-	-	-	-	-	-
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	**10,200**	-	-	-	-	-	-
Volatile Organic Compounds													
Bromodichloromethane	0.05	µg/g	18	-	-	-	< 0.050	-	-	-	-	-	-
Bromoform	0.05	µg/g	0.27	-	-	-	< 0.050	-	-	-	-	-	-
Bromomethane	0.05	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Carbon Tetrachloride	0.05	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Chlorobenzene	0.05	µg/g	2.4	-	-	-	< 0.050	-	-	-	-	-	-
Chloroform	0.04	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Dibromochloromethane	0.05	µg/g	13	-	-	-	< 0.050	-	-	-	-	-	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	-	-	-	< 0.050	-	-	-	-	-	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	-	-	-	< 0.050	-	-	-	-	-	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	-	-	< 0.050	-	-	-	-	-	-
Dichlorodifluoromethane	0.05	µg/g	16	-	-	-	< 0.050	-	-	-	-	-	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	-	-	< 0.050	-	-	-	-	-	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	-	-	< 0.050	-	-	-	-	-	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	-	-	< 0.050	-	-	-	-	-	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	-	-	< 0.042	-	-	-	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Methyl Ethyl Ketone	0.5	µg/g	16	-	-	-	< 0.50	-	-	-	-	-	-
Methyl Isobutyl Ketone	0.5	µg/g	6.6	-	-	-	< 0.50	-	-	-	-	-	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	-	-	< 0.050	-	-	-	-	-	-
Methylene Chloride	0.05	µg/g	0.1	-	-	-	< 0.050	-	-	-	-	-	-
Styrene	0.05	µg/g	16	-	-	-	< 0.050	-	-	-	-	-	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	-	-	< 0.050	-	-	-	-	-	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Tetrachloroethylene	0.05	µg/g	0.28	-	-	-	< 0.050	-	-	-	-	-	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	-	-	< 0.050	-	-	-	-	-	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	-	-	< 0.050	-	-	-	-	-	-
Trichloroethylene	0.01	µg/g	0.061	-	-	-	< 0.010	-	-	-	-	-	-
Trichlorofluoromethane	0.05	µg/g	4	-	-	-	< 0.050	-	-	-	-	-	-
Vinyl Chloride [4]	0.02	µg/g	0.02	-	-	-	< 0.020	-	-	-	-	-	-
PAHs													
Acenaphthene	0.05	µg/g	7.9	-	-	-	**137**	-	-	-	-	-	-
Acenaphthylene	0.05	µg/g	0.15	-	-	-	**24.5**	-	-	-	-	-	-
Anthracene	0.05	µg/g	0.67	-	-	-	**135**	-	-	-	-	-	-
Benzo(a)anthracene	0.05	µg/g	0.96	-	-	-	**105**	-	-	-	-	-	-
Benzo(a)pyrene	0.05	µg/g	0.3	-	-	-	**68.3**	-	-	-	-	-	-
Benzo(b)fluoranthene	0.05	µg/g	0.96	-	-	-	**81.7**	-	-	-	-	-	-
Benzo(g,h,i)perylene	0.05	µg/g	9.6	-	-	-	**28.4**	-	-	-	-	-	-
Benzo(k)fluoranthene	0.05	µg/g	0.96	-	-	-	**23.4**	-	-	-	-	-	-
Chrysene	0.05	µg/g	9.6	-	-	-	**76.9**	-	-	-	-	-	-
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	-	-	-	**8**	-	-	-	-	-	-
Fluoranthene	0.05	µg/g	9.6	-	-	-	**275**	-	-	-	-	-	-
Fluorene	0.05	µg/g	62	-	-	-	**187**	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	-	-	-	**31.7**	-	-	-	-	-	-
Methylnaphthalene, 1-	0.03	µg/g	34	-	-	-	**118**	-	-	-	-	-	-
Methylnaphthalene, 2-	0.03	µg/g	34	-	-	-	**225**	-	-	-	-	-	-
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	-	-	-	**344**	-	-	-	-	-	-
Naphthalene	0.013	µg/g	0.65	-	-	-	**885**	-	-	-	-	-	-
Phenanthrene	0.046	µg/g	270	-	-	-	**455**	-	-	-	-	-	-
Pyrene	0.05	µg/g	96	-	-	-	**200**	-	-	-	-	-	-
PCBs													
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/g	2.7	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Parameter	RDL	Units	Table 5[1] Standard RL/PL/IN CG Subsurface	BH-18-17 L2038487-20 BH-18-17 SS4 2017/12/15 2.3 - 2.9 -	BH-18-17 L2038487-21 BH-18-17 SS5 2017/12/15 3.0 - 3.7 -	BH-19-17 L2038487-24 BH-19-17 SS3 2017/12/14 1.5 - 2.1 -	BH-19-17 L2038487-25 BH-19-17 SS4 2017/12/14 2.3 - 2.9 -	BH-19-17 L2038487-26 BH-19-17 SS5 2017/12/14 3.0 - 3.7 -	BH-19-17 L2038487-27 BH-19-17 SS6 2017/12/14 4.6 - 5.2 -	BH-19-17 L2038487-28 BH-19-17 SS7 2017/12/14 6.1 - 6.7 -	BH-19-17 L2038487-29 BH-19-17 SS8 2017/12/14 6.9 - 7.5 -	BH-19-17 L2038487-30 BH-19-17 SS9 2017/12/14 7.6 - 8.2 -	BH-101 4802100 BH-101-5 2013/10/01 3.0 - 3.7 <25
General Chemistry													
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	< 0.04
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	369	295	659	1,340	380	953	702	534	501	134
pH [2]	-	pH	11	7.51	7.38	5.23	6.84	7.49	7.35	7.55	7.63	7.45	7.64
Sodium Adsorption Ratio [3]	-	None	na	2.4	3.3	1.88	0.91	8.28	1	2.59	2.19	2.82	4.72
Soluble Sodium	1	mg/L	na	31.3	24.2	53.6	56.1	51	43.5	63.8	42	45.1	-
Soluble Calcium	1	mg/L	na	11	4.1	45.3	256	2.9	110	23.9	17.8	11.8	-
Soluble Magnesium	1	mg/L	na	1.2	< 1.0	9.8	19.5	< 1.0	19.9	13.3	6	4.6	-
Total Metals													
Antimony	0.8	µg/g	63	3.1	< 1.0	29.6	10.9	13.5	8.1	1.4	1.3	< 1.0	< 0.8
Arsenic	0.2	µg/g	18	**64.4**	4.91	**22.9**	13	15.2	14.6	10.2	11.1	4.47	4
Barium	1	µg/g	7,700	113	30	124	123	63.6	79.3	101	78	60.2	20
Beryllium	0.5	µg/g	60	0.75	< 0.50	< 0.50	1.05	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.5
Boron	5	µg/g	5,000	-	-	-	-	-	-	-	-	-	< 5
Boron (Hot Water Soluble)	0.1	µg/g	na	-	-	-	-	-	-	-	-	-	0.18
Cadmium	0.5	µg/g	7.9	0.58	< 0.50	< 0.50	0.86	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.5
Chromium (total)	1	µg/g	11,000	56.3	15.7	26.2	18.3	13.7	17.1	13.2	18.8	11.3	9
Chromium (VI)	0.2	µg/g	40	-	-	-	-	-	-	-	-	-	< 0.2
Cobalt	1	µg/g	250	13.6	6.1	6.2	14	5.5	6.7	7.1	6.1	5.5	5.8
Copper	1	µg/g	5,600	96	28.5	103	778	102	673	72	60.1	27.7	22
Lead	1	µg/g	1,000	121	7.7	709	856	140	542	139	255	21.5	7
Mercury	0.005	µg/g	0.27	**0.57**	0.0203	**1.21**	**1.05**	**2**	**2.98**	**4.46**	**0.926**	0.128	< 0.1
Molybdenum	0.5	µg/g	1,200	2.9	< 1.0	1.5	1.2	< 1.0	1.3	1.2	< 1.0	< 1.0	< 0.5
Nickel	1	µg/g	510	31.3	12.8	10.8	36.6	15.3	58.9	15	12.7	9.4	11
Selenium	0.4	µg/g	1,200	1.9	< 1.0	< 1.0	< 1.0	< 1.0	3.5	1.4	< 1.0	< 1.0	< 0.4
Silver	0.2	µg/g	490	0.57	< 0.20	0.25	< 0.20	< 0.20	0.53	0.26	< 0.20	< 0.20	< 0.2
Thallium	0.4	µg/g	3.3	-	-	-	-	-	-	-	-	-	< 0.4
Uranium	0.5	µg/g	300	-	-	-	-	-	-	-	-	-	< 0.5
Vanadium	1	µg/g	160	39.7	34.3	56	30.4	28.5	30.1	23.1	25.6	20.5	20
Zinc	5	µg/g	15,000	188	36	58.2	384	280	443	192	162	34.2	34
Volatiles													
Benzene	0.0068	µg/g	0.21	0.0773	-	-	-	-	-	-	-	-	-
Toluene	0.05	µg/g	6.2	0.362	-	-	-	-	-	-	-	-	-
Ethylbenzene	0.018	µg/g	2	0.088	-	-	-	-	-	-	-	-	-
Xylenes	0.05	µg/g	3.1	0.783	-	-	-	-	-	-	-	-	-
m+p-Xylenes	0.03	µg/g	na	0.488	-	-	-	-	-	-	-	-	-
o-Xylenes	0.02	µg/g	na	0.296	-	-	-	-	-	-	-	-	-
Hexane (n)	0.05	µg/g	2.8	0.222	-	-	-	-	-	-	-	-	-
Petroleum Hydrocarbon (PHC) Fractions													
PHC F1	5	µg/g	55	9.7	-	-	-	-	-	-	-	-	-
PHC F2	10	µg/g	98	11	-	-	-	-	-	-	-	-	-
PHC F3	50	µg/g	5,800	< 50	-	-	-	-	-	-	-	-	-
PHC F4	50	µg/g	6,900	< 50	-	-	-	-	-	-	-	-	-
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds													
Bromodichloromethane	0.05	µg/g	18	< 0.050	-	-	-	-	-	-	-	-	-
Bromoform	0.05	µg/g	0.27	< 0.050	-	-	-	-	-	-	-	-	-
Bromomethane	0.05	µg/g	0.05	< 0.050	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	0.05	µg/g	0.05	< 0.050	-	-	-	-	-	-	-	-	-
Chlorobenzene	0.05	µg/g	2.4	< 0.050	-	-	-	-	-	-	-	-	-
Chloroform	0.04	µg/g	0.05	< 0.050	-	-	-	-	-	-	-	-	-
Dibromochloromethane	0.05	µg/g	13	< 0.050	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	< 0.050	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	< 0.050	-	-	-	-	-	-	-	-	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	< 0.050	-	-	-	-	-	-	-	-	-
Dichlorodifluoromethane	0.05	µg/g	16	< 0.050	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	< 0.050	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	< 0.050	-	-	-	-	-	-	-	-	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	< 0.050	-	-	-	-	-	-	-	-	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	< 0.050	-	-	-	-	-	-	-	-	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	< 0.050	-	-	-	-	-	-	-	-	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	< 0.050	-	-	-	-	-	-	-	-	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	< 0.042	-	-	-	-	-	-	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	< 0.050	-	-	-	-	-	-	-	-	-
Methyl Ethyl Ketone	0.5	µg/g	16	< 0.50	-	-	-	-	-	-	-	-	-
Methyl Isobutyl Ketone	0.5	µg/g	6.6	< 0.50	-	-	-	-	-	-	-	-	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	< 0.050	-	-	-	-	-	-	-	-	-
Methylene Chloride	0.05	µg/g	0.1	< 0.050	-	-	-	-	-	-	-	-	-
Styrene	0.05	µg/g	16	< 0.050	-	-	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	< 0.050	-	-	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	< 0.050	-	-	-	-	-	-	-	-	-
Tetrachloroethylene	0.05	µg/g	0.28	< 0.050	-	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	< 0.050	-	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	< 0.050	-	-	-	-	-	-	-	-	-
Trichloroethylene	0.01	µg/g	0.061	**2.47**	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	0.05	µg/g	4	< 0.050	-	-	-	-	-	-	-	-	-
Vinyl Chloride [4]	0.02	µg/g	0.02	< 0.020	-	-	-	-	-	-	-	-	-
PAHs													
Acenaphthene	0.05	µg/g	7.9	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	0.05	µg/g	0.15	-	-	-	-	-	-	-	-	-	-
Anthracene	0.05	µg/g	0.67	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	0.05	µg/g	0.96	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	0.05	µg/g	0.3	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	0.05	µg/g	0.96	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	0.05	µg/g	9.6	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	0.05	µg/g	0.96	-	-	-	-	-	-	-	-	-	-
Chrysene	0.05	µg/g	9.6	-	-	-	-	-	-	-	-	-	-
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	-	-	-	-	-	-	-	-	-	-
Fluoranthene	0.05	µg/g	9.6	-	-	-	-	-	-	-	-	-	-
Fluorene	0.05	µg/g	62	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 1-	0.03	µg/g	34	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	0.03	µg/g	34	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	-	-	-	-	-	-	-	-	-	-
Naphthalene	0.013	µg/g	0.65	-	-	-	-	-	-	-	-	-	-
Phenanthrene	0.046	µg/g	270	-	-	-	-	-	-	-	-	-	-
Pyrene	0.05	µg/g	96	-	-	-	-	-	-	-	-	-	-
PCBs													
Arochlor 1242	0.01	µg/g	na	< 0.020	-	-	-	-	-	-	-	-	< 0.1
Arochlor 1248	0.01	µg/g	na	< 0.010	-	-	-	-	-	-	-	-	< 0.1
Arochlor 1254	0.01	µg/g	na	< 0.010	-	-	-	-	-	-	-	-	< 0.1
Arochlor 1260	0.01	µg/g	na	< 0.010	-	-	-	-	-	-	-	-	< 0.1
Total PCBs	0.1	µg/g	2.7	< 0.020	-	-	-	-	-	-	-	-	< 0.1

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location			Table 5[1] Standard	BH-101	BH-101	BH-101	BH-102	BH-102	BH-102	BH-102	BH-102	BH-102	BH-103	BH-103	BH-103	BH-104
Laboratory Sample ID				4802103	4802171	4802209	4813335	4813336	4813337	4813338	4813340	4813345	4802070	4802071	4802075	4802247
SNC-Lavalin Sample ID			RL/PL/IN CG	BH-101-9	BH-101-99	BH-101-11a	BH-102-3a	BH-102-3aa	BH-102-3b	BH-102-3bb	BH-102-5	BH-102-12b	BH-103-4	BH-103-11	BH-103-12b	BH-104-3
Sampling Date (yyyy/mm/dd)			Subsurface	2013/10/01	2013/10/01	2013/10/01	2013/10/02	2013/10/02	2013/10/02	2013/10/02	2013/10/02	2013/10/02	2013/09/30	2013/09/30	2013/09/30	2013/09/30
				6.1 - 6.7	6.1 - 6.7	7.6 - 7.8	1.5 - 1.8	1.5 - 1.8	1.8 - 2.1	1.8 - 2.1	3.0 - 3.7	8.5 - 9.0	2.3 - 2.9	7.6 - 8.2	8.7 - 9.0	1.5 - 2.1
				225	225	25	25	25	25	25	50	<25	25	<25	<25	<25
					Duplicate of			Duplicate of		Duplicate of						
Parameter	**RDL**	**Units**			BH-101-9			BH-102-3a		BH-102-3b						
General Chemistry																
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	< 0.04	-	-	-	< 0.04	< 0.04
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	-	-	-	-	-	-	-	327	-	-	-	366	324
pH [2]	-	pH	11	-	-	-	-	-	-	-	7.56	-	-	-	7.96	7.96
Sodium Adsorption Ratio [3]	-	None	na	-	-	-	-	-	-	-	7.53	-	-	-	2.01	1.71
Soluble Sodium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Calcium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																
Antimony	0.8	µg/g	63	-	-	-	-	-	-	-	< 0.8	-	-	-	< 0.8	< 0.8
Arsenic	0.2	µg/g	18	-	-	-	-	-	-	-	4	-	-	-	4	10
Barium	1	µg/g	7,700	-	-	-	-	-	-	-	21	-	-	-	90	52
Beryllium	0.5	µg/g	60	-	-	-	-	-	-	-	0.6	-	-	-	< 0.5	< 0.5
Boron	5	µg/g	5,000	-	-	-	-	-	-	-	8	-	-	-	8	10
Boron (Hot Water Soluble)	0.1	µg/g	na	-	-	-	-	-	-	-	0.48	-	-	-	0.28	0.87
Cadmium	0.5	µg/g	7.9	-	-	-	-	-	-	-	< 0.5	-	-	-	< 0.5	< 0.5
Chromium (total)	1	µg/g	11,000	-	-	-	-	-	-	-	13	-	-	-	12	13
Chromium (VI)	0.2	µg/g	40	-	-	-	-	-	-	-	< 0.2	-	-	-	< 0.2	< 0.2
Cobalt	1	µg/g	250	-	-	-	-	-	-	-	8	-	-	-	7.8	7.2
Copper	1	µg/g	5,600	-	-	-	-	-	-	-	30	-	-	-	19	35
Lead	1	µg/g	1,000	-	-	-	-	-	-	-	12	-	-	-	9	130
Mercury	0.005	µg/g	0.27	-	-	-	-	-	-	-	< 0.1	-	-	-	< 0.1	0.2
Molybdenum	0.5	µg/g	1,200	-	-	-	-	-	-	-	0.5	-	-	-	< 0.5	0.9
Nickel	1	µg/g	510	-	-	-	-	-	-	-	15	-	-	-	15	14
Selenium	0.4	µg/g	1,200	-	-	-	-	-	-	-	< 0.4	-	-	-	< 0.4	1.1
Silver	0.2	µg/g	490	-	-	-	-	-	-	-	< 0.2	-	-	-	< 0.2	< 0.2
Thallium	0.4	µg/g	3.3	-	-	-	-	-	-	-	< 0.4	-	-	-	< 0.4	< 0.4
Uranium	0.5	µg/g	300	-	-	-	-	-	-	-	< 0.5	-	-	-	< 0.5	0.5
Vanadium	1	µg/g	160	-	-	-	-	-	-	-	22	-	-	-	17	23
Zinc	5	µg/g	15,000	-	-	-	-	-	-	-	50	-	-	-	39	76
Volatiles																
Benzene	0.0068	µg/g	0.21	< 0.02	< 0.02	< 0.02	-	-	0.2	< 0.02	< 0.02	-	< 0.02	< 0.02	-	-
Toluene	0.05	µg/g	6.2	< 0.05	< 0.05	< 0.05	-	-	0.41	0.05	< 0.05	-	< 0.05	< 0.05	-	-
Ethylbenzene	0.018	µg/g	2	< 0.05	< 0.05	< 0.05	-	-	0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Xylenes	0.05	µg/g	3.1	1.9	1.9	< 0.05	-	-	0.28	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
m+p-Xylenes	0.03	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylenes	0.02	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexane (n)	0.05	µg/g	2.8	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Petroleum Hydrocarbon (PHC) Fractions																
PHC F1	5	µg/g	55	**180**	**180**	< 5	-	-	6	< 5	-	-	< 5	< 5	-	-
PHC F2	10	µg/g	98	**1,900**	**3,600**	15	-	-	13	35	-	< 10	< 10	< 10	-	-
PHC F3	50	µg/g	5,800	2,600	4,300	< 50	-	-	420	1,000	-	< 50	110	< 50	-	-
PHC F4	50	µg/g	6,900	< 50	< 50	< 50	-	-	280	310	-	< 50	< 50	< 50	-	-
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds																
Bromodichloromethane	0.05	µg/g	18	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Bromoform	0.05	µg/g	0.27	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Bromomethane	0.05	µg/g	0.05	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Carbon Tetrachloride	0.05	µg/g	0.05	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Chlorobenzene	0.05	µg/g	2.4	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Chloroform	0.04	µg/g	0.05	< 0.04	< 0.04	< 0.04	-	-	< 0.04	< 0.04	< 0.04	-	< 0.04	< 0.04	-	-
Dibromochloromethane	0.05	µg/g	13	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Dichlorodifluoromethane	0.05	µg/g	16	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	< 0.02	< 0.02	< 0.02	-	-	< 0.02	< 0.02	< 0.02	-	< 0.02	< 0.02	-	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	< 0.03	< 0.03	< 0.03	-	-	< 0.03	< 0.03	< 0.03	-	< 0.03	< 0.03	-	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	< 0.02	< 0.02	< 0.02	-	-	< 0.02	< 0.02	< 0.02	-	< 0.02	< 0.02	-	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	< 0.03	< 0.03	< 0.03	-	-	< 0.03	< 0.03	< 0.03	-	< 0.03	< 0.03	-	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	< 0.04	< 0.04	< 0.04	-	-	< 0.04	< 0.04	< 0.04	-	< 0.04	< 0.04	-	-
Ethylene Dibromide	0.04	µg/g	0.05	< 0.04	< 0.04	< 0.04	-	-	< 0.04	< 0.04	< 0.04	-	< 0.04	< 0.04	-	-
Methyl Ethyl Ketone	0.5	µg/g	16	< 0.5	< 0.5	< 0.5	-	-	< 0.5	< 0.5	< 0.5	-	< 0.5	< 0.5	-	-
Methyl Isobutyl Ketone	0.5	µg/g	6.6	< 0.5	< 0.5	< 0.5	-	-	< 0.5	< 0.5	< 0.5	-	< 0.5	< 0.5	-	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Methylene Chloride	0.05	µg/g	0.1	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Styrene	0.05	µg/g	16	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	< 0.04	< 0.04	< 0.04	-	-	< 0.04	< 0.04	< 0.04	-	< 0.04	< 0.04	-	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Tetrachloroethylene	0.05	µg/g	0.28	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	< 0.04	< 0.04	< 0.04	-	-	< 0.04	< 0.04	< 0.04	-	< 0.04	< 0.04	-	-
Trichloroethylene	0.01	µg/g	0.061	< 0.03	< 0.03	< 0.03	-	-	< 0.03	< 0.03	< 0.03	-	< 0.03	< 0.03	-	-
Trichlorofluoromethane	0.05	µg/g	4	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-
Vinyl Chloride [4]	0.02	µg/g	0.02	< 0.02	< 0.02	< 0.02	-	-	< 0.02	< 0.02	< 0.02	-	< 0.02	< 0.02	-	-
PAHs																
Acenaphthene	0.05	µg/g	7.9	< 0.05	< 0.05	< 0.05	-	-	0.18	0.98	-	< 0.05	< 0.05	< 0.05	-	-
Acenaphthylene	0.05	µg/g	0.15	< 0.05	< 0.05	< 0.05	-	-	**0.64**	**3.4**	-	< 0.05	0.09	< 0.05	-	-
Anthracene	0.05	µg/g	0.67	0.21	0.18	< 0.05	-	-	0.41	**2.7**	-	< 0.05	0.26	< 0.05	-	-
Benzo(a)anthracene	0.05	µg/g	0.96	0.14	0.34	< 0.05	-	-	0.4	**7.1**	-	0.11	**1.7**	< 0.05	-	-
Benzo(a)pyrene	0.05	µg/g	0.3	0.05	0.09	< 0.05	-	-	**0.47**	**5.4**	-	0.11	**1.5**	< 0.05	-	-
Benzo(b)fluoranthene	0.05	µg/g	0.96	0.05	0.09	< 0.05	-	-	0.62	**7.7**	-	0.15	**2.1**	< 0.05	-	-
Benzo(g,h,i)perylene	0.05	µg/g	9.6	< 0.05	< 0.05	< 0.05	-	-	0.24	2.2	-	0.06	0.73	< 0.05	-	-
Benzo(k)fluoranthene	0.05	µg/g	0.96	< 0.05	< 0.05	< 0.05	-	-	0.31	**4.5**	-	0.11	0.53	< 0.05	-	-
Chrysene	0.05	µg/g	9.6	0.18	0.35	< 0.05	-	-	0.45	6.9	-	0.14	1.3	< 0.05	-	-
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	< 0.05	< 0.05	< 0.05	-	-	0.05	**0.83**	-	< 0.05	**0.12**	< 0.05	-	-
Fluoranthene	0.05	µg/g	9.6	< 0.05	0.08	< 0.05	-	-	1.2	**18**	-	0.2	2.7	< 0.05	-	-
Fluorene	0.05	µg/g	62	0.47	0.65	< 0.05	-	-	0.66	2.4	-	< 0.05	0.05	< 0.05	-	-
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	< 0.05	< 0.05	< 0.05	-	-	0.32	**1**	-	0.08	0.72	< 0.05	-	-
Methylnaphthalene, 1-	0.03	µg/g	34	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	0.03	µg/g	34	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	0.58	1	< 0.05	-	-	1.4	7.4	-	0.07	< 0.05	< 0.05	-	-
Naphthalene	0.013	µg/g	0.65	< 0.05	< 0.05	< 0.05	-	-	**7.3**	**37**	-	< 0.05	< 0.05	< 0.05	-	-
Phenanthrene	0.046	µg/g	270	1.4	2.1	0.05	-	-	1.7	9.9	-	0.12	1	< 0.05	-	-
Pyrene	0.05	µg/g	96	0.37	0.57	< 0.05	-	-	0.95	14	-	0.15	2.5	< 0.05	-	-
PCBs																
Arochlor 1242	0.01	µg/g	na	< 0.3	< 0.3	-	< 0.1	< 0.1	-	-	< 0.1	-	-	-	< 0.1	< 0.1
Arochlor 1248	0.01	µg/g	na	< 0.3	< 0.3	-	< 0.1	< 0.1	-	-	< 0.1	-	-	-	< 0.1	< 0.1
Arochlor 1254	0.01	µg/g	na	< 0.3	< 0.3	-	< 0.1	< 0.1	-	-	< 0.1	-	-	-	< 0.1	< 0.1
Arochlor 1260	0.01	µg/g	na	< 0.3	< 0.3	-	< 0.1	< 0.1	-	-	< 0.1	-	-	-	< 0.1	< 0.1
Total PCBs	0.1	µg/g	2.7	< 0.3	< 0.3	-	< 0.1	< 0.1	-	-	< 0.1	-	-	-	< 0.1	< 0.1

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location			Table 5[1]	BH-104	BH-104	BH-104	BH-104	BH-105	BH-105	BH-106	BH-106	BH-109	BH-110	BH-111	BH-111	BH-112
Laboratory Sample ID			Standard	4802260	4802275	4802286	4802306	4813368	4813369	4813352	4813354	4813373	4813383	4813396	4813400	4813409
SNC-Lavalin Sample ID			RL/PL/IN CG	BH-104-12b	BH-104-13	BH-104-16	BH-104-17	BH-105-3	BH-105-4	BH-106-4a	BH-106-4b	BH-109-3	BH-110-3	BH-111-3	BH-111-4	BH-112-3
Sampling Date (yyyy/mm/dd)			Subsurface	2013/09/30	2013/09/30	2013/09/30	2013/09/30	2013/10/02	2013/10/02	2013/10/02	2013/10/02	2013/10/02	2013/10/02	2013/10/03	2013/10/03	2013/10/03
				8.7 - 9.0	9.1 - 9.8	11.4 - 12.0	12.2 - 12.8	1.5 - 2.1	2.3 - 2.9	2.3 - 2.5	2.5 - 2.9	1.5 - 2.1	1.5 - 2.1	1.5 - 2.1	2.3 - 2.9	1.5 - 2.1
				<25	<25	<25	<25	<25	<25	<25	<25	<25	25	<25	<25	<25
Parameter	**RDL**	**Units**														
General Chemistry																
Cyanide (CN-)	0.04	µg/g	0.051	-	< 0.04	-	-	-	-	< 0.04	-	-	-	-	< 0.04	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	-	384	-	-	-	-	848	-	-	-	-	253	-
pH [2]	-	pH	11	-	7.76	-	-	-	-	8.26	-	-	-	-	7.93	-
Sodium Adsorption Ratio [3]	-	None	na	-	2.94	-	-	-	-	0.685	-	-	-	-	0.142	-
Soluble Sodium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Calcium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																
Antimony	0.8	µg/g	63	-	< 0.8	-	-	-	-	< 0.8	-	-	-	-	0.9	-
Arsenic	0.2	µg/g	18	-	2	-	-	-	-	5	-	-	-	-	**20**	-
Barium	1	µg/g	7,700	-	18	-	-	-	-	25	-	-	-	-	102	-
Beryllium	0.5	µg/g	60	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	1.1	-
Boron	5	µg/g	5,000	-	< 5	-	-	-	-	8	-	-	-	-	41	-
Boron (Hot Water Soluble)	0.1	µg/g	na	-	0.25	-	-	-	-	0.24	-	-	-	-	1.19	-
Cadmium	0.5	µg/g	7.9	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Chromium (total)	1	µg/g	11,000	-	9	-	-	-	-	12	-	-	-	-	21	-
Chromium (VI)	0.2	µg/g	40	-	< 0.2	-	-	-	-	< 0.2	-	-	-	-	< 0.2	-
Cobalt	1	µg/g	250	-	5.1	-	-	-	-	8.1	-	-	-	-	8.5	-
Copper	1	µg/g	5,600	-	21	-	-	-	-	29	-	-	-	-	86	-
Lead	1	µg/g	1,000	-	20	-	-	-	-	9	-	-	-	-	226	-
Mercury	0.005	µg/g	0.27	-	< 0.1	-	-	-	-	< 0.1	-	-	-	-	**40.5**	-
Molybdenum	0.5	µg/g	1,200	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	2.1	-
Nickel	1	µg/g	510	-	9	-	-	-	-	16	-	-	-	-	19	-
Selenium	0.4	µg/g	1,200	-	< 0.4	-	-	-	-	< 0.4	-	-	-	-	0.8	-
Silver	0.2	µg/g	490	-	< 0.2	-	-	-	-	< 0.2	-	-	-	-	< 0.2	-
Thallium	0.4	µg/g	3.3	-	< 0.4	-	-	-	-	< 0.4	-	-	-	-	0.5	-
Uranium	0.5	µg/g	300	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	0.5	-
Vanadium	1	µg/g	160	-	18	-	-	-	-	19	-	-	-	-	28	-
Zinc	5	µg/g	15,000	-	36	-	-	-	-	50	-	-	-	-	198	-
Volatiles																
Benzene	0.0068	µg/g	0.21	**0.23**	-	< 0.02	-	-	-	-	< 0.02	-	-	-	-	-
Toluene	0.05	µg/g	6.2	0.27	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Ethylbenzene	0.018	µg/g	2	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Xylenes	0.05	µg/g	3.1	0.14	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
m+p-Xylenes	0.03	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylenes	0.02	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexane (n)	0.05	µg/g	2.8	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Petroleum Hydrocarbon (PHC) Fractions																
PHC F1	5	µg/g	55	< 5	-	< 5	-	-	-	-	< 5	-	-	-	-	-
PHC F2	10	µg/g	98	85	-	< 10	-	-	< 10	-	< 10	22	-	< 10	-	-
PHC F3	50	µg/g	5,800	190	-	< 50	-	-	84	-	< 50	170	-	94	-	-
PHC F4	50	µg/g	6,900	< 50	-	< 50	-	-	< 50	-	< 50	230	-	< 50	-	-
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds																
Bromodichloromethane	0.05	µg/g	18	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Bromoform	0.05	µg/g	0.27	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Bromomethane	0.05	µg/g	0.05	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Carbon Tetrachloride	0.05	µg/g	0.05	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Chlorobenzene	0.05	µg/g	2.4	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Chloroform	0.04	µg/g	0.05	< 0.04	-	< 0.04	-	-	-	-	< 0.04	-	-	-	-	-
Dibromochloromethane	0.05	µg/g	13	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Dichlorodifluoromethane	0.05	µg/g	16	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	< 0.02	-	< 0.02	-	-	-	-	< 0.02	-	-	-	-	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	-	-	-	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	< 0.02	-	< 0.02	-	-	-	-	< 0.02	-	-	-	-	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	-	-	-	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	< 0.04	-	< 0.04	-	-	-	-	< 0.04	-	-	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	< 0.04	-	< 0.04	-	-	-	-	< 0.04	-	-	-	-	-
Methyl Ethyl Ketone	0.5	µg/g	16	< 0.5	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	-
Methyl Isobutyl Ketone	0.5	µg/g	6.6	< 0.5	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Methylene Chloride	0.05	µg/g	0.1	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Styrene	0.05	µg/g	16	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	< 0.04	-	< 0.04	-	-	-	-	< 0.04	-	-	-	-	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Tetrachloroethylene	0.05	µg/g	0.28	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	< 0.04	-	< 0.04	-	-	-	-	< 0.04	-	-	-	-	-
Trichloroethylene	0.01	µg/g	0.061	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	-	-	-	-
Trichlorofluoromethane	0.05	µg/g	4	< 0.05	-	< 0.05	-	-	-	-	< 0.05	-	-	-	-	-
Vinyl Chloride [4]	0.02	µg/g	0.02	< 0.02	-	< 0.02	-	-	-	-	< 0.02	-	-	-	-	-
PAHs																
Acenaphthene	0.05	µg/g	7.9	1.7	-	0.05	0.18	-	0.32	-	< 0.05	< 0.05	-	< 0.05	-	-
Acenaphthylene	0.05	µg/g	0.15	**0.22**	-	< 0.05	< 0.05	-	< 0.05	-	< 0.05	**0.42**	-	0.05	-	-
Anthracene	0.05	µg/g	0.67	**1.3**	-	< 0.05	0.09	-	**0.84**	-	< 0.05	0.54	-	0.16	-	-
Benzo(a)anthracene	0.05	µg/g	0.96	**1.1**	-	< 0.05	0.1	-	**1.5**	-	< 0.05	**2.5**	-	0.33	-	-
Benzo(a)pyrene	0.05	µg/g	0.3	**1.1**	-	< 0.05	< 0.05	-	**1.2**	-	< 0.05	**2.2**	-	0.25	-	-
Benzo(b)fluoranthene	0.05	µg/g	0.96	**1.4**	-	< 0.05	0.06	-	**1.7**	-	< 0.05	**2.7**	-	0.25	-	-
Benzo(g,h,i)perylene	0.05	µg/g	9.6	0.47	-	< 0.05	< 0.05	-	0.46	-	< 0.05	1.3	-	0.1	-	-
Benzo(k)fluoranthene	0.05	µg/g	0.96	0.38	-	< 0.05	< 0.05	-	0.7	-	< 0.05	**1.4**	-	0.18	-	-
Chrysene	0.05	µg/g	9.6	0.9	-	< 0.05	0.09	-	1.5	-	< 0.05	2.5	-	0.34	-	-
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	0.06	-	< 0.05	< 0.05	-	0.09	-	< 0.05	**0.28**	-	< 0.05	-	-
Fluoranthene	0.05	µg/g	9.6	2.5	-	< 0.05	0.26	-	3.9	-	< 0.05	4.5	-	0.75	-	-
Fluorene	0.05	µg/g	62	1.6	-	< 0.05	0.15	-	0.43	-	< 0.05	0.17	-	< 0.05	-	-
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	0.46	-	< 0.05	< 0.05	-	0.73	-	< 0.05	**1.9**	-	0.13	-	-
Methylnaphthalene, 1-	0.03	µg/g	34	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	0.03	µg/g	34	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	3	-	0.52	0.19	-	0.16	-	< 0.05	0.09	-	< 0.05	-	-
Naphthalene	0.013	µg/g	0.65	**24**	-	**5.7**	**1.5**	-	0.22	-	< 0.05	0.07	-	< 0.05	-	-
Phenanthrene	0.046	µg/g	270	4.4	-	< 0.05	0.5	-	4	-	< 0.05	1.4	-	0.52	-	-
Pyrene	0.05	µg/g	96	2.2	-	< 0.05	0.21	-	3.1	-	< 0.05	4.3	-	0.66	-	-
PCBs																
Arochlor 1242	0.01	µg/g	na	-	< 0.1	-	-	< 0.1	-	< 0.1	-	< 0.1	< 0.1	-	< 0.1	< 0.1
Arochlor 1248	0.01	µg/g	na	-	< 0.1	-	-	< 0.1	-	< 0.1	-	< 0.1	< 0.1	-	< 0.1	< 0.1
Arochlor 1254	0.01	µg/g	na	-	< 0.1	-	-	< 0.1	-	< 0.1	-	< 0.1	< 0.1	-	< 0.1	< 0.1
Arochlor 1260	0.01	µg/g	na	-	< 0.1	-	-	< 0.1	-	< 0.1	-	0.3	< 0.1	-	< 0.1	< 0.1
Total PCBs	0.1	µg/g	2.7	-	< 0.1	-	-	< 0.1	-	< 0.1	-	0.3	< 0.1	-	< 0.1	< 0.1

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Field Screen - organic vapour meter reading
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[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max{1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Parameter	RDL	Units	Table 5[1] Standard RL/PL/IN CG Subsurface	BH-112 4813410 BH-112-4 2013/10/03 2.3 - 2.9 <25	BH-113 4813423 BH-113-4 2013/10/03 2.3 - 2.9 50	BH-115 4812872 BH-115-3 2013/10/03 1.5 - 2.1 50	BH-115 4812877 BH-115-5 2013/10/03 3.0 - 3.7 25	BH-115 4812878 BH-115-6 2013/10/03 3.8 - 4.4 25	BH-115 4812879 BH-115-9 2013/10/03 6.1 - 6.7 <25	BH-116 5968916 BH-116-1 2014/10/17 9.1 - 9.8 <25	BH-116 5968917 BH-116-4 2014/10/17 11.4 - 12.0 <25	BH-116 5968919 BH-116-44 2014/10/17 11.4 - 12.0 <25 Duplicate of BH-116-4	BH-116 5968941 BH-116-6 2014/10/17 13.0 - 13.6 <25	BH-117 5968824 BH-117-3 2014/10/17 1.5 - 2.1 <25	BH-117 5968869 BH-117-4 2014/10/17 2.3 - 2.9 -	BH-117 5968874 BH-117-44 2014/10/17 2.3 - 2.9 - Duplicate of BH-117-4	BH-201 7757571 BH-201-1 2016/08/05 1.5 - 2.1 -
General Chemistry																	
Cyanide (CN-)	0.04	µg/g	0.051	< 0.04	< 0.04	< 0.04	-	< 0.04	-	-	-	-	< 0.04	-	-	-	< 0.04
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	147	168	937	-	945	-	-	-	-	507	-	-	-	516
pH [2]	-	pH	11	7.78	7.66	8.05	-	7.32	-	-	-	-	8.04	-	-	-	7.43
Sodium Adsorption Ratio [3]	-	None	na	0.23	0.817	2.84	-	2.8	-	-	-	-	4.35	-	-	-	3.53
Soluble Sodium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Calcium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																	
Antimony	0.8	µg/g	63	1	< 0.8	2.4	-	12.4	-	-	-	-	< 0.8	-	-	-	7.7
Arsenic	0.2	µg/g	18	14	4	16	-	12	-	-	-	-	4	-	-	-	14
Barium	1	µg/g	7,700	84	26	180	-	143	-	-	-	-	79	-	-	-	82
Beryllium	0.5	µg/g	60	0.6	< 0.5	< 0.5	-	< 0.5	-	-	-	-	0.6	-	-	-	< 0.5
Boron	5	µg/g	5,000	11	< 5	8	-	10	-	-	-	-	14	-	-	-	7
Boron (Hot Water Soluble)	0.1	µg/g	na	0.46	0.19	1.69	-	2.32	-	-	-	-	2.78	-	-	-	2.78
Cadmium	0.5	µg/g	7.9	< 0.5	< 0.5	< 0.5	-	< 0.5	-	-	-	-	< 0.5	-	-	-	< 0.5
Chromium (total)	1	µg/g	11,000	18	10	14	-	12	-	-	-	-	19	-	-	-	13
Chromium (VI)	0.2	µg/g	40	< 0.2	< 0.2	< 0.2	-	< 0.2	-	-	-	-	< 0.2	-	-	-	< 0.2
Cobalt	1	µg/g	250	9.7	5.2	9	-	7.4	-	-	-	-	9.4	-	-	-	7.2
Copper	1	µg/g	5,600	119	20	64	-	68	-	-	-	-	22	-	-	-	53
Lead	1	µg/g	1,000	113	19	**1,100**	-	648	-	-	-	-	11	-	-	-	377
Mercury	0.005	µg/g	0.27	**0.64**	0.23	**3.42**	-	**1.04**	-	-	-	-	< 0.1	-	-	-	**1.66**
Molybdenum	0.5	µg/g	1,200	1.1	< 0.5	4.6	-	2.2	-	-	-	-	< 0.5	-	-	-	1.5
Nickel	1	µg/g	510	20	9	20	-	18	-	-	-	-	18	-	-	-	15
Selenium	0.4	µg/g	1,200	0.5	< 0.4	1.2	-	< 0.4	-	-	-	-	< 0.4	-	-	-	0.6
Silver	0.2	µg/g	490	0.2	1.1	0.3	-	0.3	-	-	-	-	< 0.2	-	-	-	0.4
Thallium	0.4	µg/g	3.3	< 0.4	< 0.4	< 0.4	-	< 0.4	-	-	-	-	< 0.4	-	-	-	< 0.4
Uranium	0.5	µg/g	300	0.6	< 0.5	< 0.5	-	< 0.5	-	-	-	-	0.6	-	-	-	< 0.5
Vanadium	1	µg/g	160	31	17	18	-	21	-	-	-	-	25	-	-	-	21
Zinc	5	µg/g	15,000	169	40	238	-	188	-	-	-	-	51	-	-	-	196
Volatiles																	
Benzene	0.0068	µg/g	0.21	< 0.02	< 0.02	-	< 0.02	-	< 0.02	-	-	-	-	< 0.02	0.06	0.05	< 0.02
Toluene	0.05	µg/g	6.2	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	0.32	0.26	< 0.05
Ethylbenzene	0.018	µg/g	2	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	0.26	0.22	< 0.05
Xylenes	0.05	µg/g	3.1	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	0.93	0.79	< 0.05
m+p-Xylenes	0.03	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylenes	0.02	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexane (n)	0.05	µg/g	2.8	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Petroleum Hydrocarbon (PHC) Fractions																	
PHC F1	5	µg/g	55	< 5	< 5	-	< 5	-	< 5	-	-	-	-	< 5	< 5	47	< 5
PHC F2	10	µg/g	98	13	< 10	-	< 10	-	< 10	-	-	-	-	**1,500**	**320**	**270**	**1,100**
PHC F3	50	µg/g	5,800	400	< 50	-	380	-	< 50	-	-	-	-	**9,800**	170	150	**19,000**
PHC F4	50	µg/g	6,900	< 50	< 50	-	< 50	-	< 50	-	-	-	-	470	< 50	< 50	1,200
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds																	
Bromodichloromethane	0.05	µg/g	18	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Bromoform	0.05	µg/g	0.27	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Bromomethane	0.05	µg/g	0.05	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Carbon Tetrachloride	0.05	µg/g	0.05	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Chlorobenzene	0.05	µg/g	2.4	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Chloroform	0.04	µg/g	0.05	< 0.04	< 0.04	-	< 0.04	-	< 0.04	-	-	-	-	< 0.04	< 0.04	< 0.04	< 0.04
Dibromochloromethane	0.05	µg/g	13	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Dichlorodifluoromethane	0.05	µg/g	16	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Dichloroethane, 1,1-	0.02	µg/g	3.5	< 0.02	< 0.02	-	< 0.02	-	< 0.02	-	-	-	-	< 0.02	< 0.02	< 0.02	< 0.02
Dichloroethane, 1,2-	0.03	µg/g	0.05	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	< 0.03	< 0.03	< 0.03
Dichloroethylene, 1,1-	0.05	µg/g	0.05	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	< 0.02	< 0.02	-	< 0.02	-	< 0.02	-	-	-	-	< 0.02	< 0.02	< 0.02	< 0.02
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Dichloropropane, 1,2-	0.03	µg/g	0.05	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	< 0.03	< 0.03	< 0.03
Dichloropropene, 1,3-	0.042	µg/g	0.05	< 0.04	< 0.04	-	< 0.04	-	< 0.04	-	-	-	-	< 0.04	< 0.04	< 0.04	-
Ethylene Dibromide	0.04	µg/g	0.05	< 0.04	< 0.04	-	< 0.04	-	< 0.04	-	-	-	-	< 0.04	< 0.04	< 0.04	< 0.04
Methyl Ethyl Ketone	0.5	µg/g	16	< 0.5	< 0.5	-	< 0.5	-	< 0.5	-	-	-	-	< 0.5	< 0.5	< 0.5	< 0.5
Methyl Isobutyl Ketone	0.5	µg/g	6.6	< 0.5	< 0.5	-	< 0.5	-	< 0.5	-	-	-	-	< 0.5	< 0.5	< 0.5	< 0.5
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Methylene Chloride	0.05	µg/g	0.1	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Styrene	0.05	µg/g	16	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	< 0.04	< 0.04	-	< 0.04	-	< 0.04	-	-	-	-	< 0.04	< 0.04	< 0.04	< 0.04
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Tetrachloroethylene	0.05	µg/g	0.28	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	< 0.04	< 0.04	-	< 0.04	-	< 0.04	-	-	-	-	< 0.04	< 0.04	< 0.04	< 0.04
Trichloroethylene	0.01	µg/g	0.061	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	< 0.03	< 0.03	< 0.03
Trichlorofluoromethane	0.05	µg/g	4	< 0.05	< 0.05	-	< 0.05	-	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
Vinyl Chloride [4]	0.02	µg/g	0.02	< 0.02	< 0.02	-	< 0.02	-	< 0.02	-	-	-	-	< 0.02	< 0.02	< 0.02	< 0.02
PAHs																	
Acenaphthene	0.05	µg/g	7.9	0.05	< 0.05	-	0.57	-	0.72	< 0.05	< 0.05	< 0.05	-	**97**	4	-	7.5
Acenaphthylene	0.05	µg/g	0.15	0.07	< 0.05	-	**0.24**	-	**0.18**	< 0.05	< 0.05	< 0.05	-	**5.2**	**0.25**	-	**8.5**
Anthracene	0.05	µg/g	0.67	0.21	< 0.05	-	**6.6**	-	0.61	< 0.05	< 0.05	< 0.05	-	**350**	**11**	-	**51**
Benzo(a)anthracene	0.05	µg/g	0.96	0.58	< 0.05	-	**10**	-	**1.8**	< 0.05	< 0.05	< 0.05	-	**200**	**5.1**	-	**130**
Benzo(a)pyrene	0.05	µg/g	0.3	**0.57**	< 0.05	-	**7.3**	-	**1.7**	< 0.05	< 0.05	< 0.05	-	**100**	**3.4**	-	**95**
Benzo(b)fluoranthene	0.05	µg/g	0.96	0.66	< 0.05	-	**8.3**	-	**2.2**	< 0.05	< 0.05	< 0.05	-	**150**	**5.9**	-	**87**
Benzo(g,h,i)perylene	0.05	µg/g	9.6	0.21	< 0.05	-	2.4	-	0.56	< 0.05	< 0.05	< 0.05	-	**46**	1.8	-	**54**
Benzo(k)fluoranthene	0.05	µg/g	0.96	0.41	< 0.05	-	**7.3**	-	0.96	< 0.05	< 0.05	< 0.05	-	**79**	**2.2**	-	**48**
Chrysene	0.05	µg/g	9.6	0.62	< 0.05	-	**11**	-	1.7	< 0.05	< 0.05	< 0.05	-	**170**	5	-	**95**
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	0.05	< 0.05	-	**0.63**	-	0.09	< 0.05	< 0.05	< 0.05	-	**9.9**	**0.3**	-	**12**
Fluoranthene	0.05	µg/g	9.6	1.1	< 0.05	-	**31**	-	3.2	< 0.05	< 0.05	< 0.05	-	**660**	**23**	-	**250**
Fluorene	0.05	µg/g	62	0.05	< 0.05	-	1	-	0.18	< 0.05	< 0.05	< 0.05	-	**130**	5	-	11
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	0.31	< 0.05	-	**3.1**	-	0.75	< 0.05	< 0.05	< 0.05	-	**45**	**1.7**	-	**52**
Methylnaphthalene, 1-	0.03	µg/g	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	0.03	µg/g	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	0.07	< 0.05	-	0.19	-	0.91	< 0.05	< 0.05	< 0.05	-	**94**	3	-	1.2
Naphthalene	0.013	µg/g	0.65	0.06	< 0.05	-	0.18	-	**1.7**	< 0.05	< 0.05	< 0.05	-	**180**	**5.9**	-	0.16
Phenanthrene	0.046	µg/g	270	0.67	< 0.05	-	6.8	-	1.7	< 0.05	< 0.05	< 0.05	-	**910**	31	-	130
Pyrene	0.05	µg/g	96	0.92	< 0.05	-	25	-	3	< 0.05	< 0.05	< 0.05	-	**460**	16	-	**240**
PCBs																	
Arochlor 1242	0.01	µg/g	na	< 0.1	< 0.1	-	< 0.3	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g	na	< 0.1	< 0.1	-	< 0.3	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g	na	< 0.1	< 0.1	-	< 0.3	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g	na	< 0.1	< 0.1	-	< 0.3	-	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/g	2.7	< 0.1	< 0.1	-	< 0.3	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location			Table 5[1]	BH-201	BH-201	BH-201	BH-202	BH-202	BH-202	BH-203	BH-203	BH-204	BH-204	BH-205	BH-205
Laboratory Sample ID			Standard	7757576	7763116	7763133	7836452	7836457	7836470	7757581	7757589	7757597	7757602	7763137	7763140
SNC-Lavalin Sample ID			RL/PL/IN CG	BH-201-3	BH-201-7	BH-201-15	BH-202-3	BH-202-1	BH-202-5	BH-203-1	BH-203-12	BH-204-1	BH-204-10	BH-205-1	BH-205-8
Sampling Date (yyyy/mm/dd)			Subsurface	2016/08/05	2016/08/08	2016/08/08	2016/09/08	2016/09/07	2016/09/07	2016/08/03	2016/08/03	2016/08/04	2016/08/04	2016/08/10	2016/08/10
				3.0 - 3.6	6.1 - 6.7	17.5 - 18.1	12.2 - 12.8	5.5 - 6.1	18.3 - 18.9	9.1 - 9.7	17.5 - 18.1	9.1 - 9.7	18.3 - 18.9	7.6 - 8.1	18.3 - 18.9
				-	-	-	-	-	-	-	-	-	-	-	-
Parameter	**RDL**	**Units**													
General Chemistry															
Cyanide (CN-)	0.04	µg/g	0.051	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	441	497	355	415	637	319	507	227	258	364	394	378
pH [2]	-	pH	11	7	7.18	7.88	7.79	7.87	8.27	7.95	8.36	7.18	8.03	7.51	8.05
Sodium Adsorption Ratio [3]	-	None	na	5.44	4.79	4.42	2.75	5.8	4.28	11	1.11	1.38	5.12	5.56	4.97
Soluble Sodium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Calcium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals															
Antimony	0.8	µg/g	63	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Arsenic	0.2	µg/g	18	5	5	4	4	4	4	3	3	7	4	3	4
Barium	1	µg/g	7,700	43	40	90	93	36	91	26	114	43	95	38	103
Beryllium	0.5	µg/g	60	< 0.5	< 0.5	0.6	0.6	< 0.5	< 0.5	< 0.5	0.6	< 0.5	< 0.5	< 0.5	0.7
Boron	5	µg/g	5,000	6	7	14	11	6	12	6	10	6	12	6	16
Boron (Hot Water Soluble)	0.1	µg/g	na	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78
Cadmium	0.5	µg/g	7.9	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium (total)	1	µg/g	11,000	9	11	19	19	8	20	9	20	10	18	8	22
Chromium (VI)	0.2	µg/g	40	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Cobalt	1	µg/g	250	5.9	6.7	9.8	9.1	5.1	8.8	6.5	9.5	5.4	9.2	6.6	10.9
Copper	1	µg/g	5,600	20	27	22	20	20	19	21	20	40	22	16	21
Lead	1	µg/g	1,000	27	50	12	10	11	11	6	11	116	12	7	13
Mercury	0.005	µg/g	0.27	0.23	**0.47**	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	**1.26**	< 0.1	< 0.1	< 0.1
Molybdenum	0.5	µg/g	1,200	< 0.5	0.8	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	1	µg/g	510	11	12	21	20	10	21	12	21	10	21	10	23
Selenium	0.4	µg/g	1,200	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Silver	0.2	µg/g	490	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.2	< 0.2	< 0.2	< 0.2
Thallium	0.4	µg/g	3.3	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Uranium	0.5	µg/g	300	< 0.5	< 0.5	0.7	0.7	< 0.5	0.7	< 0.5	0.6	< 0.5	0.6	< 0.5	0.9
Vanadium	1	µg/g	160	16	20	26	26	15	28	16	26	18	25	14	30
Zinc	5	µg/g	15,000	41	81	51	49	33	45	34	48	105	47	28	55
Volatiles															
Benzene	0.0068	µg/g	0.21	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Toluene	0.05	µg/g	6.2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ethylbenzene	0.018	µg/g	2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Xylenes	0.05	µg/g	3.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
m+p-Xylenes	0.03	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylenes	0.02	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-
Hexane (n)	0.05	µg/g	2.8	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Petroleum Hydrocarbon (PHC) Fractions															
PHC F1	5	µg/g	55	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
PHC F2	10	µg/g	98	< 10	< 10	< 10	< 10	< 10	22	< 10	< 10	< 10	11	< 10	20
PHC F3	50	µg/g	5,800	< 50	< 50	< 50	< 50	< 50	82	< 50	< 50	54	83	< 50	150
PHC F4	50	µg/g	6,900	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds															
Bromodichloromethane	0.05	µg/g	18	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Bromoform	0.05	µg/g	0.27	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Bromomethane	0.05	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Carbon Tetrachloride	0.05	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chlorobenzene	0.05	µg/g	2.4	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chloroform	0.04	µg/g	0.05	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Dibromochloromethane	0.05	µg/g	13	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichlorodifluoromethane	0.05	µg/g	16	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichloroethane, 1,1-	0.02	µg/g	3.5	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dichloroethane, 1,2-	0.03	µg/g	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dichloroethylene, 1,1-	0.05	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichloropropane, 1,2-	0.03	µg/g	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	-	-	-	-	-	-	-	-	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Methyl Ethyl Ketone	0.5	µg/g	16	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Methyl Isobutyl Ketone	0.5	µg/g	6.6	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Methylene Chloride	0.05	µg/g	0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Styrene	0.05	µg/g	16	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Tetrachloroethylene	0.05	µg/g	0.28	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Trichloroethylene	0.01	µg/g	0.061	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Trichlorofluoromethane	0.05	µg/g	4	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Vinyl Chloride [4]	0.02	µg/g	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
PAHs															
Acenaphthene	0.05	µg/g	7.9	< 0.05	< 0.05	< 0.05	< 0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	0.05	µg/g	0.15	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	0.05	µg/g	0.67	< 0.05	< 0.05	< 0.05	< 0.05	0.07	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	0.05	µg/g	0.96	0.06	< 0.05	< 0.05	< 0.05	0.11	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	0.05	µg/g	0.3	< 0.05	< 0.05	< 0.05	< 0.05	0.08	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	0.05	µg/g	0.96	< 0.05	< 0.05	< 0.05	< 0.05	0.14	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(g,h,i)perylene	0.05	µg/g	9.6	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	0.05	µg/g	0.96	< 0.05	< 0.05	< 0.05	< 0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	0.05	µg/g	9.6	< 0.05	< 0.05	< 0.05	< 0.05	0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	0.05	µg/g	9.6	0.12	< 0.05	< 0.05	< 0.05	0.31	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	0.05	µg/g	62	< 0.05	< 0.05	< 0.05	< 0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Methylnaphthalene, 1-	0.03	µg/g	34	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	0.03	µg/g	34	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	< 0.05	< 0.05	< 0.05	0.05	0.08	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Naphthalene	0.013	µg/g	0.65	< 0.05	< 0.05	< 0.05	0.13	0.15	0.06	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	0.046	µg/g	270	0.06	< 0.05	< 0.05	< 0.05	0.23	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	0.05	µg/g	96	0.11	< 0.05	< 0.05	< 0.05	0.25	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
PCBs															
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/g	2.7	-	-	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Parameter	RDL	Units	Table 5[1] Standard RL/PL/IN CG Subsurface	BH-205 7763144 BH-205-88 2016/08/10 18.3 - 18.9 -	BH18-01 L2156982-2 BH18-01-6 2018/08/29 3.8 - 4.4 <5	BH18-01 L2156982-3 BH18-01-8 2018/08/29 5.3 - 5.9 <5	BH18-01 L2156982-4 BH18-01-9 2018/08/29 6.1 - 6.7 <5	BH18-01 L2156982-6 BH18-01-16 2018/08/29 11.4 - 12.0 <5	BH18-02 L2156982-12 BH18-02-5 2018/08/29 3.0 - 3.7 <5	BH18-02 L2156982-13 BH18-02-6 2018/08/29 3.8 - 4.4 <5	BH18-02 L2156982-14 BH18-02-9 2018/08/29 6.1 - 6.7 <5	BH18-02 L2156982-15 BH18-02-9/10 2018/08/29 6.1 - 7.5 <5	BH18-02 L2156982-16 BH18-02-12 2018/08/29 8.4 - 9.0 <5	BH18-03 L2166311-1 BH18-03-3 2018/09/17 1.5 - 2.1 <5
General Chemistry														
Cyanide (CN-)	0.04	µg/g	0.051	< 0.04	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	< 0.050
Electrical Conductivity	0.004	mS/cm	na	383	-	-	-	-	-	-	-	-	-	172
pH [2]	-	pH	11	8.04	-	-	-	-	-	-	-	-	-	7.88
Sodium Adsorption Ratio [3]	-	None	na	4.38	-	-	-	-	-	-	-	-	-	1.16
Soluble Sodium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	6.2
Soluble Calcium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	2.1
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	< 1.0
Total Metals														
Antimony	0.8	µg/g	63	< 0.8	-	-	< 1.0	-	-	< 1.0	-	-	-	< 1.0
Arsenic	0.2	µg/g	18	4	-	-	3.5	-	-	4.4	-	-	-	4.3
Barium	1	µg/g	7,700	147	-	-	30.6	-	-	43.5	-	-	-	42.9
Beryllium	0.5	µg/g	60	0.8	-	-	< 0.50	-	-	< 0.50	-	-	-	< 0.50
Boron	5	µg/g	5,000	16	-	-	7.4	-	-	5.9	-	-	-	7.7
Boron (Hot Water Soluble)	0.1	µg/g	na	2.78	-	-	0.28	-	-	0.52	-	-	-	0.38
Cadmium	0.5	µg/g	7.9	< 0.5	-	-	< 0.50	-	-	< 0.50	-	-	-	< 0.50
Chromium (total)	1	µg/g	11,000	26	-	-	10.5	-	-	12.5	-	-	-	13.3
Chromium (VI)	0.2	µg/g	40	< 0.2	-	-	< 0.20	-	-	0.28	-	-	-	< 0.20
Cobalt	1	µg/g	250	12.2	-	-	6	-	-	7.2	-	-	-	6.9
Copper	1	µg/g	5,600	25	-	-	19.8	-	-	30.7	-	-	-	25.9
Lead	1	µg/g	1,000	14	-	-	7.2	-	-	18.1	-	-	-	22
Mercury	0.005	µg/g	0.27	< 0.1	-	-	0.0087	-	-	0.0278	-	-	-	0.0614
Molybdenum	0.5	µg/g	1,200	0.5	-	-	< 1.0	-	-	< 1.0	-	-	-	< 1.0
Nickel	1	µg/g	510	26	-	-	11.3	-	-	14.2	-	-	-	13.1
Selenium	0.4	µg/g	1,200	< 0.4	-	-	< 1.0	-	-	< 1.0	-	-	-	< 1.0
Silver	0.2	µg/g	490	< 0.2	-	-	< 0.20	-	-	< 0.20	-	-	-	< 0.20
Thallium	0.4	µg/g	3.3	< 0.4	-	-	< 0.50	-	-	< 0.50	-	-	-	< 0.50
Uranium	0.5	µg/g	300	0.9	-	-	< 1.0	-	-	< 1.0	-	-	-	< 1.0
Vanadium	1	µg/g	160	35	-	-	19.6	-	-	23.1	-	-	-	28
Zinc	5	µg/g	15,000	61	-	-	32.5	-	-	49.4	-	-	-	51.5
Volatiles														
Benzene	0.0068	µg/g	0.21	< 0.02	< 0.0068	< 0.0068	-	< 0.0068	< 0.0068	-	< 0.0068	-	-	-
Toluene	0.05	µg/g	6.2	< 0.05	< 0.080	< 0.080	-	< 0.080	< 0.080	-	< 0.080	-	-	-
Ethylbenzene	0.018	µg/g	2	< 0.05	< 0.018	< 0.018	-	< 0.018	< 0.018	-	< 0.018	-	-	-
Xylenes	0.05	µg/g	3.1	< 0.05	< 0.050	< 0.050	-	< 0.050	< 0.050	-	< 0.050	-	-	-
m+p-Xylenes	0.03	µg/g	na	-	< 0.030	< 0.030	-	< 0.030	< 0.030	-	< 0.030	-	-	-
o-Xylenes	0.02	µg/g	na	-	< 0.020	< 0.020	-	< 0.020	< 0.020	-	< 0.020	-	-	-
Hexane (n)	0.05	µg/g	2.8	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Petroleum Hydrocarbon (PHC) Fractions														
PHC F1	5	µg/g	55	< 5	-	< 5.0	-	< 5.0	< 5.0	-	-	-	-	-
PHC F2	10	µg/g	98	24	-	< 10	-	< 10	< 10	-	-	< 10	-	-
PHC F3	50	µg/g	5,800	160	-	< 50	-	< 50	< 50	-	-	< 50	-	-
PHC F4	50	µg/g	6,900	< 50	-	< 50	-	< 50	< 50	-	-	< 50	-	-
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds														
Bromodichloromethane	0.05	µg/g	18	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Bromoform	0.05	µg/g	0.27	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Bromomethane	0.05	µg/g	0.05	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Carbon Tetrachloride	0.05	µg/g	0.05	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Chlorobenzene	0.05	µg/g	2.4	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Chloroform	0.04	µg/g	0.05	< 0.04	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Dibromochloromethane	0.05	µg/g	13	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Dichlorodifluoromethane	0.05	µg/g	16	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	< 0.02	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	< 0.03	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	< 0.02	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	< 0.03	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	< 0.042	< 0.042	-	< 0.042	-	-	< 0.042	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	< 0.04	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Methyl Ethyl Ketone	0.5	µg/g	16	< 0.5	< 0.50	< 0.50	-	< 0.50	-	-	< 0.50	-	-	-
Methyl Isobutyl Ketone	0.5	µg/g	6.6	< 0.5	< 0.50	< 0.50	-	< 0.50	-	-	< 0.50	-	-	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Methylene Chloride	0.05	µg/g	0.1	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Styrene	0.05	µg/g	16	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	< 0.04	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Tetrachloroethylene	0.05	µg/g	0.28	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	< 0.04	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Trichloroethylene	0.01	µg/g	0.061	< 0.03	< 0.010	< 0.010	-	< 0.010	-	-	< 0.010	-	-	-
Trichlorofluoromethane	0.05	µg/g	4	< 0.05	< 0.050	< 0.050	-	< 0.050	-	-	< 0.050	-	-	-
Vinyl Chloride [4]	0.02	µg/g	0.02	< 0.02	< 0.020	< 0.020	-	< 0.020	-	-	< 0.020	-	-	-
PAHs														
Acenaphthene	0.05	µg/g	7.9	< 0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	-
Acenaphthylene	0.05	µg/g	0.15	< 0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	-
Anthracene	0.05	µg/g	0.67	< 0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	-
Benzo(a)anthracene	0.05	µg/g	0.96	< 0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	-
Benzo(a)pyrene	0.05	µg/g	0.3	< 0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	-
Benzo(b)fluoranthene	0.05	µg/g	0.96	< 0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	-
Benzo(g,h,i)perylene	0.05	µg/g	9.6	< 0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	-
Benzo(k)fluoranthene	0.05	µg/g	0.96	< 0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	-
Chrysene	0.05	µg/g	9.6	< 0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	-
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	< 0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	-
Fluoranthene	0.05	µg/g	9.6	< 0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	-
Fluorene	0.05	µg/g	62	< 0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	-
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	< 0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	-
Methylnaphthalene, 1-	0.03	µg/g	34	-	-	< 0.030	-	< 0.030	< 0.030	-	-	-	< 0.030	-
Methylnaphthalene, 2-	0.03	µg/g	34	-	-	< 0.030	-	< 0.030	< 0.030	-	-	-	< 0.030	-
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	< 0.05	-	< 0.042	-	< 0.042	< 0.042	-	-	-	< 0.042	-
Naphthalene	0.013	µg/g	0.65	< 0.05	-	< 0.013	-	< 0.013	< 0.013	-	-	-	< 0.013	-
Phenanthrene	0.046	µg/g	270	< 0.05	-	< 0.046	-	< 0.046	< 0.046	-	-	-	< 0.046	-
Pyrene	0.05	µg/g	96	< 0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	-
PCBs														
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/g	2.7	-	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location / Laboratory Sample ID / SNC-Lavalin Sample ID / Sampling Date (yyyy/mm/dd)	RDL	Units	Table 5[1] Standard RL/PL/IN CG Subsurface	BH18-03 L2166311-2 BH18-03-33 2018/09/17 1.5 - 2.1 <5 Duplicate of BH18-03-3	BH18-03 L2166311-11 BH18-03-23 2018/09/17 16.8 - 17.4 <5	BH18-03 L2166311-5 BH18-03-6 2018/09/17 3.8 - 4.4 <5	BH18-03 L2166311-6 BH18-03-7 2018/09/17 4.6 - 5.2 <5	BH18-03 L2166311-7 BH18-03-77 2018/09/17 4.6 - 5.2 <5 Duplicate of BH18-03-7	BH18-03 L2166311-8 BH18-03-20 2018/09/17 14.5 - 15.1 <5	BH18-03 L2166311-9 BH18-03-21 2018/09/17 15.2 - 15.8 <5	BH18-03 L2166311-10 BH18-03-211 2018/09/17 15.2 - 15.8 <5 Duplicate of BH18-03-21	BH18-04 L2157466-2 BH18-04-6 2018/08/30 3.8 - 4.4 <5	BH18-04 L2157466-3 BH18-04-7 2018/08/30 4.6 - 5.2 <5	BH18-05 L2157466-6 BH18-05-5 2018/08/30 3.0 - 3.7 <5
Parameter														
General Chemistry														
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	< 0.050	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	156	-	-	-	-	-	-	-	-	-	-
pH [2]	-	pH	11	7.6	-	-	-	-	-	-	-	-	-	-
Sodium Adsorption Ratio [3]	-	None	na	0.71	-	-	-	-	-	-	-	-	-	-
Soluble Sodium	1	mg/L	na	4.5	-	-	-	-	-	-	-	-	-	-
Soluble Calcium	1	mg/L	na	3	-	-	-	-	-	-	-	-	-	-
Soluble Magnesium	1	mg/L	na	< 1.0	-	-	-	-	-	-	-	-	-	-
Total Metals														
Antimony	0.8	µg/g	63	< 1.0	-	-	-	-	< 1.0	-	-	-	< 1.0	-
Arsenic	0.2	µg/g	18	4.6	-	-	-	-	3.5	-	-	-	< 1.0	-
Barium	1	µg/g	7,700	46.8	-	-	-	-	90.9	-	-	-	1.8	-
Beryllium	0.5	µg/g	60	< 0.50	-	-	-	-	0.56	-	-	-	< 0.50	-
Boron	5	µg/g	5,000	8.3	-	-	-	-	12.7	-	-	-	5.8	-
Boron (Hot Water Soluble)	0.1	µg/g	na	0.46	-	-	-	-	-	-	-	-	-	-
Cadmium	0.5	µg/g	7.9	< 0.50	-	-	-	-	< 0.50	-	-	-	< 0.50	-
Chromium (total)	1	µg/g	11,000	14.3	-	-	-	-	20.1	-	-	-	< 1.0	-
Chromium (VI)	0.2	µg/g	40	< 0.20	-	-	-	-	-	-	-	-	-	-
Cobalt	1	µg/g	250	6.8	-	-	-	-	9.1	-	-	-	< 1.0	-
Copper	1	µg/g	5,600	27.1	-	-	-	-	20.2	-	-	-	3	-
Lead	1	µg/g	1,000	34.3	-	-	-	-	11.9	-	-	-	1.8	-
Mercury	0.005	µg/g	0.27	0.13	-	-	-	-	0.0178	-	-	-	0.124	-
Molybdenum	0.5	µg/g	1,200	< 1.0	-	-	-	-	< 1.0	-	-	-	< 1.0	-
Nickel	1	µg/g	510	12.7	-	-	-	-	20.4	-	-	-	< 1.0	-
Selenium	0.4	µg/g	1,200	< 1.0	-	-	-	-	< 1.0	-	-	-	< 1.0	-
Silver	0.2	µg/g	490	< 0.20	-	-	-	-	< 0.20	-	-	-	< 0.20	-
Thallium	0.4	µg/g	3.3	< 0.50	-	-	-	-	< 0.50	-	-	-	< 0.50	-
Uranium	0.5	µg/g	300	< 1.0	-	-	-	-	< 1.0	-	-	-	< 1.0	-
Vanadium	1	µg/g	160	31.9	-	-	-	-	28.6	-	-	-	< 1.0	-
Zinc	5	µg/g	15,000	56.7	-	-	-	-	45.6	-	-	-	< 5.0	-
Volatiles														
Benzene	0.0068	µg/g	0.21	-	< 0.0068	-	< 0.0068	< 0.0068	-	-	-	0.0181	0.021	< 0.0068
Toluene	0.05	µg/g	6.2	-	< 0.080	-	< 0.080	< 0.080	-	-	-	< 0.080	< 0.080	< 0.080
Ethylbenzene	0.018	µg/g	2	-	< 0.018	-	< 0.018	< 0.018	-	-	-	< 0.018	< 0.018	< 0.018
Xylenes	0.05	µg/g	3.1	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
m+p-Xylenes	0.03	µg/g	na	-	< 0.030	-	< 0.030	< 0.030	-	-	-	< 0.030	< 0.030	< 0.030
o-Xylenes	0.02	µg/g	na	-	< 0.020	-	< 0.020	< 0.020	-	-	-	< 0.020	< 0.020	< 0.020
Hexane (n)	0.05	µg/g	2.8	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Petroleum Hydrocarbon (PHC) Fractions														
PHC F1	5	µg/g	55	-	< 5.0	-	< 5.0	< 5.0	-	-	-	< 5.0	< 5.0	< 5.0
PHC F2	10	µg/g	98	-	< 10	-	< 10	< 10	-	-	-	< 10	< 10	< 10
PHC F3	50	µg/g	5,800	-	< 50	-	< 50	< 50	-	-	-	103	122	< 50
PHC F4	50	µg/g	6,900	-	< 50	-	< 50	< 50	-	-	-	< 50	< 50	< 50
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds														
Bromodichloromethane	0.05	µg/g	18	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Bromoform	0.05	µg/g	0.27	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Bromomethane	0.05	µg/g	0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Carbon Tetrachloride	0.05	µg/g	0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Chlorobenzene	0.05	µg/g	2.4	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Chloroform	0.04	µg/g	0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Dibromochloromethane	0.05	µg/g	13	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Dichlorodifluoromethane	0.05	µg/g	16	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	< 0.042	-	< 0.042	< 0.042	-	-	-	< 0.042	< 0.042	< 0.042
Ethylene Dibromide	0.04	µg/g	0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Methyl Ethyl Ketone	0.5	µg/g	16	-	< 0.50	-	< 0.50	< 0.50	-	-	-	< 0.50	< 0.50	< 0.50
Methyl Isobutyl Ketone	0.5	µg/g	6.6	-	< 0.50	-	< 0.50	< 0.50	-	-	-	< 0.50	< 0.50	< 0.50
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Methylene Chloride	0.05	µg/g	0.1	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Styrene	0.05	µg/g	16	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Tetrachloroethylene	0.05	µg/g	0.28	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Trichloroethylene	0.01	µg/g	0.061	-	< 0.010	-	< 0.010	< 0.010	-	-	-	< 0.010	< 0.010	< 0.010
Trichlorofluoromethane	0.05	µg/g	4	-	< 0.050	-	< 0.050	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050
Vinyl Chloride [4]	0.02	µg/g	0.02	-	< 0.020	-	< 0.020	< 0.020	-	-	-	< 0.020	< 0.020	< 0.020
PAHs														
Acenaphthene	0.05	µg/g	7.9	-	-	< 0.050	-	-	-	< 0.050	< 0.050	< 0.050	0.052	< 0.050
Acenaphthylene	0.05	µg/g	0.15	-	-	< 0.050	-	-	-	< 0.050	< 0.050	0.12	**0.239**	< 0.050
Anthracene	0.05	µg/g	0.67	-	-	< 0.050	-	-	-	< 0.050	< 0.050	0.158	0.323	< 0.050
Benzo(a)anthracene	0.05	µg/g	0.96	-	-	< 0.050	-	-	-	< 0.050	< 0.050	**1.14**	**1.36**	< 0.050
Benzo(a)pyrene	0.05	µg/g	0.3	-	-	< 0.050	-	-	-	< 0.050	< 0.050	**1.23**	**1.35**	< 0.050
Benzo(b)fluoranthene	0.05	µg/g	0.96	-	-	< 0.050	-	-	-	< 0.050	< 0.050	**1.23**	**1.29**	< 0.050
Benzo(g,h,i)perylene	0.05	µg/g	9.6	-	-	< 0.050	-	-	-	< 0.050	< 0.050	0.648	0.823	< 0.050
Benzo(k)fluoranthene	0.05	µg/g	0.96	-	-	< 0.050	-	-	-	< 0.050	< 0.050	0.943	**1.1**	< 0.050
Chrysene	0.05	µg/g	9.6	-	-	< 0.050	-	-	-	< 0.050	< 0.050	1.11	1.34	< 0.050
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	-	-	< 0.050	-	-	-	< 0.050	< 0.050	**0.199**	**0.245**	< 0.050
Fluoranthene	0.05	µg/g	9.6	-	-	< 0.050	-	-	-	< 0.050	< 0.050	1.68	2.55	< 0.050
Fluorene	0.05	µg/g	62	-	-	< 0.050	-	-	-	< 0.050	< 0.050	0.052	0.112	< 0.050
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	-	-	< 0.050	-	-	-	< 0.050	< 0.050	0.673	0.754	< 0.050
Methylnaphthalene, 1-	0.03	µg/g	34	-	-	< 0.030	-	-	-	< 0.030	< 0.030	< 0.030	0.054	< 0.030
Methylnaphthalene, 2-	0.03	µg/g	34	-	-	< 0.030	-	-	-	< 0.030	< 0.030	0.041	0.074	< 0.030
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	-	-	< 0.042	-	-	-	< 0.042	< 0.042	< 0.042	0.128	< 0.042
Naphthalene	0.013	µg/g	0.65	-	-	< 0.013	-	-	-	< 0.013	< 0.013	0.103	0.173	< 0.013
Phenanthrene	0.046	µg/g	270	-	-	< 0.046	-	-	-	< 0.046	< 0.046	0.526	1.11	< 0.046
Pyrene	0.05	µg/g	96	-	-	< 0.050	-	-	-	< 0.050	< 0.050	1.55	2.31	< 0.050
PCBs														
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	< 0.010	-	-
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	< 0.010	-	-
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	< 0.010	-	-
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	< 0.010	-	-
Total PCBs	0.1	µg/g	2.7	-	-	-	-	-	-	-	-	< 0.020	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location			Table 5[1] Standard RL/PL/IN CG Subsurface	BH18-05	BH18-05	BH18-06	BH18-06	BH18-06	BH18-06	BH18-07	BH18-07	BH18-07	BH18-08	BH18-08	BH18-08	BH18-08
Laboratory Sample ID				L2157466-7	L2157466-8	L2157467-4	L2157467-5	L2157467-6	L2157467-8	L2157468-2	L2157468-3	L2157468-4	L2157466-10	L2157466-9	L2157468-6	L2157468-7
SNC-Lavalin Sample ID				BH18-05-55	BH18-05-4	BH18-06-5	BH18-06-55	BH18-06-6	BH18-06-8B	BH18-07-6	BH18-07-9	BH18-07-12	BH18-08-7	BH18-08-8	BH18-08-7	BH18-08-10
Sampling Date (yyyy/mm/dd)				2018/08/30	2018/08/30	2018/08/30	2018/08/30	2018/08/30	2018/08/30	2018/08/31	2018/08/31	2018/08/31	2018/08/30	2018/08/30	2018/08/31	2018/08/31
				3.0 - 3.7	2.3 - 2.9	3.0 - 3.7	3.0 - 3.7	3.8 - 4.4	5.3 - 5.9	3.8 - 4.4	6.1 - 6.7	8.4 - 9.0	4.6 - 5.1	5.3 - 5.9	4.6 - 5.1	6.9 - 7.5
				<5	<5	80	80	90	<5	<5	<5	<5	<5	<5	<5	<5
				Duplicate of			Duplicate of									
Parameter	**RDL**	**Units**		BH18-05-5			BH18-06-5									
General Chemistry																
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	-	-	-	-	-	-	-	-	-	-	-	-	-
pH [2]	-	pH	11	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium Adsorption Ratio [3]	-	None	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Sodium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Calcium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																
Antimony	0.8	µg/g	63	-	< 1.0	2.1	2.1	-	-	-	< 1.0	-	-	-	-	-
Arsenic	0.2	µg/g	18	-	< 1.0	12.2	9.3	-	-	-	5.9	-	-	-	-	-
Barium	1	µg/g	7,700	-	1.4	92.6	126	-	-	-	50	-	-	-	-	-
Beryllium	0.5	µg/g	60	-	< 0.50	0.89	< 0.50	-	-	-	< 0.50	-	-	-	-	-
Boron	5	µg/g	5,000	-	< 5.0	13.8	9.4	-	-	-	5.3	-	-	-	-	-
Boron (Hot Water Soluble)	0.1	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	0.5	µg/g	7.9	-	< 0.50	< 0.50	0.58	-	-	-	< 0.50	-	-	-	-	-
Chromium (total)	1	µg/g	11,000	-	< 1.0	13.7	15.7	-	-	-	11.6	-	-	-	-	-
Chromium (VI)	0.2	µg/g	40	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	1	µg/g	250	-	< 1.0	6.8	6.1	-	-	-	5	-	-	-	-	-
Copper	1	µg/g	5,600	-	1	74	154	-	-	-	21	-	-	-	-	-
Lead	1	µg/g	1,000	-	< 1.0	174	250	-	-	-	135	-	-	-	-	-
Mercury	0.005	µg/g	0.27	-	0.0052	**1.32**	**2.99**	-	-	-	0.208	-	-	-	-	-
Molybdenum	0.5	µg/g	1,200	-	< 1.0	1.2	< 1.0	-	-	-	< 1.0	-	-	-	-	-
Nickel	1	µg/g	510	-	< 1.0	17	14.4	-	-	-	10	-	-	-	-	-
Selenium	0.4	µg/g	1,200	-	< 1.0	1.6	1.4	-	-	-	< 1.0	-	-	-	-	-
Silver	0.2	µg/g	490	-	< 0.20	< 0.20	0.41	-	-	-	< 0.20	-	-	-	-	-
Thallium	0.4	µg/g	3.3	-	< 0.50	< 0.50	< 0.50	-	-	-	< 0.50	-	-	-	-	-
Uranium	0.5	µg/g	300	-	< 1.0	< 1.0	< 1.0	-	-	-	< 1.0	-	-	-	-	-
Vanadium	1	µg/g	160	-	< 1.0	26.8	23.5	-	-	-	20.7	-	-	-	-	-
Zinc	5	µg/g	15,000	-	< 5.0	205	229	-	-	-	129	-	-	-	-	-
Volatiles																
Benzene	0.0068	µg/g	0.21	< 0.0068	-	-	-	**1.18**	< 0.0068	< 0.0068	-	**0.352**	< 0.0068	-	0.0073	< 0.0068
Toluene	0.05	µg/g	6.2	< 0.080	-	-	-	2.48	< 0.080	< 0.080	-	0.403	< 0.080	-	< 0.080	< 0.080
Ethylbenzene	0.018	µg/g	2	< 0.018	-	-	-	**2.64**	< 0.018	< 0.018	-	0.083	< 0.018	-	< 0.018	< 0.018
Xylenes	0.05	µg/g	3.1	< 0.050	-	-	-	**10.3**	< 0.050	< 0.050	-	0.534	< 0.050	-	< 0.050	< 0.050
m+p-Xylenes	0.03	µg/g	na	< 0.030	-	-	-	7.29	< 0.030	< 0.030	-	0.382	< 0.030	-	< 0.030	< 0.030
o-Xylenes	0.02	µg/g	na	< 0.020	-	-	-	3.05	< 0.020	< 0.020	-	0.152	< 0.020	-	< 0.020	< 0.020
Hexane (n)	0.05	µg/g	2.8	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Petroleum Hydrocarbon (PHC) Fractions																
PHC F1	5	µg/g	55	< 5.0	-	-	-	9.8	< 5.0	< 5.0	-	< 5.0	< 5.0	-	< 5.0	< 5.0
PHC F2	10	µg/g	98	< 10	-	-	-	**7,690**	15	**571**	-	**288**	< 10	-	< 10	< 10
PHC F3	50	µg/g	5,800	< 50	-	-	-	4,030	< 50	4,810	-	2,000	< 50	-	< 50	< 50
PHC F4	50	µg/g	6,900	< 50	-	-	-	< 250	< 50	351	-	410	< 50	-	< 50	< 50
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	1,910	-	-	-	-
Volatile Organic Compounds																
Bromodichloromethane	0.05	µg/g	18	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Bromoform	0.05	µg/g	0.27	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Bromomethane	0.05	µg/g	0.05	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Carbon Tetrachloride	0.05	µg/g	0.05	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Chlorobenzene	0.05	µg/g	2.4	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Chloroform	0.04	µg/g	0.05	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Dibromochloromethane	0.05	µg/g	13	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Dichlorodifluoromethane	0.05	µg/g	16	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Dichloroethane, 1,1-	0.02	µg/g	3.5	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Dichloroethane, 1,2-	0.03	µg/g	0.05	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Dichloroethylene, 1,1-	0.05	µg/g	0.05	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Dichloropropane, 1,2-	0.03	µg/g	0.05	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Dichloropropene, 1,3-	0.042	µg/g	0.05	< 0.042	-	-	-	< 0.042	< 0.042	-	-	< 0.042	< 0.042	-	< 0.042	< 0.042
Ethylene Dibromide	0.04	µg/g	0.05	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Methyl Ethyl Ketone	0.5	µg/g	16	< 0.50	-	-	-	< 0.50	< 0.50	-	-	< 0.50	< 0.50	-	< 0.50	< 0.50
Methyl Isobutyl Ketone	0.5	µg/g	6.6	< 0.50	-	-	-	< 0.50	< 0.50	-	-	< 0.50	< 0.50	-	< 0.50	< 0.50
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Methylene Chloride	0.05	µg/g	0.1	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Styrene	0.05	µg/g	16	< 0.050	-	-	-	0.381	< 0.050	-	-	0.087	< 0.050	-	< 0.050	< 0.050
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Tetrachloroethylene	0.05	µg/g	0.28	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Trichloroethylene	0.01	µg/g	0.061	< 0.010	-	-	-	0.012	< 0.010	-	-	0.018	0.011	-	< 0.010	< 0.010
Trichlorofluoromethane	0.05	µg/g	4	< 0.050	-	-	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050
Vinyl Chloride [4]	0.02	µg/g	0.02	< 0.020	-	-	-	< 0.020	< 0.020	-	-	< 0.020	< 0.020	-	< 0.020	< 0.020
PAHs																
Acenaphthene	0.05	µg/g	7.9	< 0.050	-	-	-	**499**	1.14	-	1.55	5.55	-	< 0.050	< 0.050	< 0.050
Acenaphthylene	0.05	µg/g	0.15	< 0.050	-	-	-	**13.9**	< 0.050	-	**1.86**	**11.8**	-	< 0.050	< 0.050	< 0.050
Anthracene	0.05	µg/g	0.67	< 0.050	-	-	-	**130**	0.511	-	**6.55**	**52.9**	-	< 0.050	0.064	< 0.050
Benzo(a)anthracene	0.05	µg/g	0.96	< 0.050	-	-	-	**24.2**	0.097	-	**17**	**38.2**	-	< 0.050	0.105	< 0.050
Benzo(a)pyrene	0.05	µg/g	0.3	< 0.050	-	-	-	**10.3**	< 0.050	-	**15.4**	**27.6**	-	< 0.050	0.079	< 0.050
Benzo(b)fluoranthene	0.05	µg/g	0.96	< 0.050	-	-	-	**9**	< 0.050	-	**11.8**	**22.4**	-	< 0.050	0.081	< 0.050
Benzo(g,h,i)perylene	0.05	µg/g	9.6	< 0.050	-	-	-	< 5.0	< 0.050	-	7.33	8.96	-	< 0.050	< 0.050	< 0.050
Benzo(k)fluoranthene	0.05	µg/g	0.96	< 0.050	-	-	-	**10.9**	< 0.050	-	**12.1**	**21.6**	-	< 0.050	0.067	< 0.050
Chrysene	0.05	µg/g	9.6	< 0.050	-	-	-	**22**	0.089	-	**15.7**	**32.9**	-	< 0.050	0.102	< 0.050
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	< 0.050	-	-	-	< 5.0[1]	< 0.050	-	**2.43**	**3.7**	-	< 0.050	< 0.050	< 0.050
Fluoranthene	0.05	µg/g	9.6	< 0.050	-	-	-	**250**	0.924	-	**37.5**	**95.9**	-	< 0.050	0.232	< 0.050
Fluorene	0.05	µg/g	62	< 0.050	-	-	-	**362**	1.06	-	4.22	29.7	-	< 0.050	0.053	< 0.050
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	< 0.050	-	-	-	< 5.0[1]	< 0.050	-	**7.09**	**11.1**	-	< 0.050	< 0.050	< 0.050
Methylnaphthalene, 1-	0.03	µg/g	34	< 0.030	-	-	-	**207**	0.331	-	0.717	10.1	-	< 0.030	< 0.030	< 0.030
Methylnaphthalene, 2-	0.03	µg/g	34	< 0.030	-	-	-	**497**	0.767	-	0.66	2.46	-	< 0.030	< 0.030	< 0.030
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	< 0.042	-	-	-	**704**	1.1	-	1.38	12.6	-	< 0.042	< 0.042	< 0.042
Naphthalene	0.013	µg/g	0.65	< 0.013	-	-	-	**2,360**	**3.71**	-	**5.68**	**6.25**	-	< 0.013	0.052	0.018
Phenanthrene	0.046	µg/g	270	< 0.046	-	-	-	**705**	2.66	-	16.9	115	-	< 0.046	0.235	< 0.046
Pyrene	0.05	µg/g	96	< 0.050	-	-	-	**152**	0.555	-	31.7	76	-	< 0.050	0.187	< 0.050
PCBs																
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/g	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location			Table 5[1]	BH18-08	BH18-08	BH18-08	BH18-09	BH18-09	BH18-09	BH18-10	BH18-10	BH18-10	BH18-12	BH18-13	BH18-13
Laboratory Sample ID			Standard	L2157468-8	L2157468-9	L2157468-10	L2159176-2	L2159176-3	L2159176-4	L2159639-3	L2159639-4	L2159639-5	L2159639-8	L2159639-10	L2159639-11
SNC-Lavalin Sample ID			RL/PL/IN CG	BH18-08-100	BH18-08-11	BH18-08-111	BH18-09-6	BH18-09-9	BH18-09-11	BH18-10-3	BH18-10-9	BH18-10-11	BH18-12-3	BH18-13-4	BH18-13-44
Sampling Date (yyyy/mm/dd)			Subsurface	2018/08/31	2018/08/31	2018/08/31	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04
				6.9 - 7.5	7.6 - 8.2	7.6 - 8.2	3.8 - 4.4	6.1 - 6.7	7.6 - 8.2	1.5 - 2.1	6.1 - 6.7	6.7 - 8.2	1.5 - 2.1	2.3 - 3.0	2.3 - 3.0
				<5	5	5	<5	<5	<5	<5	<5	<5	<5	<5	<5
				Duplicate of		Duplicate of									Duplicate of
Parameter	**RDL**	**Units**		BH18-08-10		BH18-08-11									BH18-13-4
General Chemistry															
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	-	-	-	-	-	-	-	-	-	-	-	-
pH [2]	-	pH	11	-	-	-	-	-	-	-	-	-	-	-	-
Sodium Adsorption Ratio [3]	-	None	na	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Sodium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Calcium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals															
Antimony	0.8	µg/g	63	-	< 1.0	< 1.0	-	-	< 1.0	-	< 1.0	-	-	< 1.0	< 1.0
Arsenic	0.2	µg/g	18	-	3.9	4.4	-	-	4.1	-	4.1	-	-	5.1	4.6
Barium	1	µg/g	7,700	-	69.6	43.2	-	-	58.8	-	38	-	-	27	23.5
Beryllium	0.5	µg/g	60	-	< 0.50	< 0.50	-	-	< 0.50	-	< 0.50	-	-	< 0.50	< 0.50
Boron	5	µg/g	5,000	-	< 5.0	< 5.0	-	-	< 5.0	-	< 5.0	-	-	5.6	< 5.0
Boron (Hot Water Soluble)	0.1	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	0.5	µg/g	7.9	-	< 0.50	< 0.50	-	-	< 0.50	-	< 0.50	-	-	< 0.50	< 0.50
Chromium (total)	1	µg/g	11,000	-	8.5	9.9	-	-	8.6	-	8.8	-	-	12.7	11
Chromium (VI)	0.2	µg/g	40	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	1	µg/g	250	-	4.5	5.4	-	-	5.3	-	4.7	-	-	7.4	6.5
Copper	1	µg/g	5,600	-	23.9	24.2	-	-	21.4	-	19.9	-	-	29.6	26.5
Lead	1	µg/g	1,000	-	194	85.1	-	-	6.8	-	5.4	-	-	9.9	8.9
Mercury	0.005	µg/g	0.27	-	0.171	**0.327**	-	-	0.0067	-	0.0085	-	-	0.008	0.0067
Molybdenum	0.5	µg/g	1,200	-	< 1.0	< 1.0	-	-	< 1.0	-	< 1.0	-	-	< 1.0	< 1.0
Nickel	1	µg/g	510	-	8.6	10.6	-	-	11	-	9	-	-	15.2	13.4
Selenium	0.4	µg/g	1,200	-	< 1.0	< 1.0	-	-	< 1.0	-	< 1.0	-	-	< 1.0	< 1.0
Silver	0.2	µg/g	490	-	< 0.20	< 0.20	-	-	< 0.20	-	< 0.20	-	-	< 0.20	< 0.20
Thallium	0.4	µg/g	3.3	-	< 0.50	< 0.50	-	-	< 0.50	-	< 0.50	-	-	< 0.50	< 0.50
Uranium	0.5	µg/g	300	-	< 1.0	< 1.0	-	-	< 1.0	-	< 1.0	-	-	< 1.0	< 1.0
Vanadium	1	µg/g	160	-	17.2	20	-	-	15.8	-	12.7	-	-	23.9	20.8
Zinc	5	µg/g	15,000	-	47.2	52.7	-	-	26.9	-	29.6	-	-	45	39.9
Volatiles															
Benzene	0.0068	µg/g	0.21	< 0.0068	-	-	< 0.0068	< 0.0068	-	0.0096	< 0.0068	< 0.0068	< 0.0068	< 0.0068	-
Toluene	0.05	µg/g	6.2	< 0.080	-	-	< 0.080	< 0.080	-	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	-
Ethylbenzene	0.018	µg/g	2	< 0.018	-	-	< 0.018	< 0.018	-	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	-
Xylenes	0.05	µg/g	3.1	< 0.050	-	-	< 0.050	< 0.050	-	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	-
m+p-Xylenes	0.03	µg/g	na	< 0.030	-	-	< 0.030	< 0.030	-	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	-
o-Xylenes	0.02	µg/g	na	< 0.020	-	-	< 0.020	< 0.020	-	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	-
Hexane (n)	0.05	µg/g	2.8	< 0.050	-	-	-	0.06	-	< 0.050	-	< 0.050	-	-	-
Petroleum Hydrocarbon (PHC) Fractions															
PHC F1	5	µg/g	55	< 5.0	-	-	< 5.0	< 5.0	-	-	< 5.0	< 5.0	< 5.0	< 5.0	-
PHC F2	10	µg/g	98	< 10	-	-	< 10	< 10	-	-	< 10	< 10	< 10	< 10	-
PHC F3	50	µg/g	5,800	< 50	-	-	< 50	< 50	-	-	< 50	< 50	< 50	< 50	-
PHC F4	50	µg/g	6,900	< 50	-	-	< 50	< 50	-	-	< 50	< 50	< 50	< 50	-
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds															
Bromodichloromethane	0.05	µg/g	18	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Bromoform	0.05	µg/g	0.27	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Bromomethane	0.05	µg/g	0.05	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Carbon Tetrachloride	0.05	µg/g	0.05	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Chlorobenzene	0.05	µg/g	2.4	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Chloroform	0.04	µg/g	0.05	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Dibromochloromethane	0.05	µg/g	13	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Dichlorodifluoromethane	0.05	µg/g	16	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	< 0.042	-	-	-	< 0.042	-	< 0.042	-	< 0.042	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Methyl Ethyl Ketone	0.5	µg/g	16	< 0.50	-	-	-	< 0.50	-	< 0.50	-	< 0.50	-	-	-
Methyl Isobutyl Ketone	0.5	µg/g	6.6	< 0.50	-	-	-	< 0.50	-	< 0.50	-	< 0.50	-	-	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Methylene Chloride	0.05	µg/g	0.1	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Styrene	0.05	µg/g	16	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Tetrachloroethylene	0.05	µg/g	0.28	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Trichloroethylene	0.01	µg/g	0.061	< 0.010	-	-	-	< 0.010	-	< 0.010	-	0.041	-	-	-
Trichlorofluoromethane	0.05	µg/g	4	< 0.050	-	-	-	< 0.050	-	< 0.050	-	< 0.050	-	-	-
Vinyl Chloride [4]	0.02	µg/g	0.02	< 0.020	-	-	-	< 0.020	-	< 0.020	-	< 0.020	-	-	-
PAHs															
Acenaphthene	0.05	µg/g	7.9	< 0.050	-	-	< 0.050	< 0.050	-	0.055	-	< 0.050	< 0.050	< 0.050	-
Acenaphthylene	0.05	µg/g	0.15	< 0.050	-	-	< 0.050	< 0.050	-	**0.295**	-	< 0.050	< 0.050	< 0.050	-
Anthracene	0.05	µg/g	0.67	< 0.050	-	-	< 0.050	< 0.050	-	0.433	-	< 0.050	< 0.050	< 0.050	-
Benzo(a)anthracene	0.05	µg/g	0.96	< 0.050	-	-	0.199	< 0.050	-	**2.81**	-	< 0.050	< 0.050	< 0.050	-
Benzo(a)pyrene	0.05	µg/g	0.3	< 0.050	-	-	0.211	< 0.050	-	**2.91**	-	< 0.050	< 0.050	< 0.050	-
Benzo(b)fluoranthene	0.05	µg/g	0.96	< 0.050	-	-	0.274	< 0.050	-	**3.42**	-	< 0.050	< 0.050	< 0.050	-
Benzo(g,h,i)perylene	0.05	µg/g	9.6	< 0.050	-	-	0.126	< 0.050	-	2.36	-	< 0.050	< 0.050	< 0.050	-
Benzo(k)fluoranthene	0.05	µg/g	0.96	< 0.050	-	-	0.183	< 0.050	-	**1.37**	-	< 0.050	< 0.050	< 0.050	-
Chrysene	0.05	µg/g	9.6	< 0.050	-	-	0.248	< 0.050	-	2.58	-	< 0.050	< 0.050	< 0.050	-
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	< 0.050	-	-	< 0.050	< 0.050	-	**0.642**	-	< 0.050	< 0.050	< 0.050	-
Fluoranthene	0.05	µg/g	9.6	< 0.050	-	-	0.522	< 0.050	-	5.07	-	< 0.050	< 0.050	< 0.050	-
Fluorene	0.05	µg/g	62	< 0.050	-	-	< 0.050	< 0.050	-	0.077	-	< 0.050	< 0.050	< 0.050	-
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	< 0.050	-	-	0.146	< 0.050	-	**2.44**	-	< 0.050	< 0.050	< 0.050	-
Methylnaphthalene, 1-	0.03	µg/g	34	< 0.030	-	-	< 0.030	< 0.030	-	0.04	-	< 0.030	< 0.030	< 0.030	-
Methylnaphthalene, 2-	0.03	µg/g	34	< 0.030	-	-	< 0.030	< 0.030	-	0.049	-	< 0.030	< 0.030	< 0.030	-
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	< 0.042	-	-	< 0.042	< 0.042	-	0.09	-	< 0.042	< 0.042	< 0.042	-
Naphthalene	0.013	µg/g	0.65	< 0.013	-	-	< 0.013	< 0.013	-	0.101	-	< 0.013	< 0.013	< 0.013	-
Phenanthrene	0.046	µg/g	270	< 0.046	-	-	0.248	< 0.046	-	1.42	-	< 0.046	< 0.046	< 0.046	-
Pyrene	0.05	µg/g	96	< 0.050	-	-	0.42	< 0.050	-	4.78	-	< 0.050	< 0.050	< 0.050	-
PCBs															
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/g	2.7	-	-	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location			Table 5[1]	BH18-14	BH18-14	BH18-14	BH18-14	BH18-15	BH18-16	BH18-16	BH18-16	BH18-16	BH18-17	BH18-17	BH18-17	BH18-17
Laboratory Sample ID			Standard	L2159183-1	L2159183-2	L2159183-4	L2159183-5	L2159175-2	L2159176-5	L2159176-6	L2159176-7	L2159176-8	L2159176-10	L2160443-1	L2160443-2	L2160443-3
SNC-Lavalin Sample ID			RL/PL/IN CG	BH18-14-3	BH18-14-4	BH18-14-7	BH18-14-77	BH18-15-4	BH18-16-3	BH18-16-5/6	BH18-16-8	BH18-16-10	BH18-17-6	BH18-17-9	BH18-17-11	BH18-17-111
Sampling Date (yyyy/mm/dd)			Subsurface	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/04	2018/09/05	2018/09/05	2018/09/05
				1.5 - 2.1	2.3 - 2.9	4.6 - 5.1	4.6 - 5.1	2.3 - 2.9	1.5 - 2.1	3.0 - 4.4	5.3 - 5.9	6.9 - 7.5	3.8 - 4.4	6.1 - 6.7	7.6 - 8.2	7.6 - 8.2
				<5	<5	<5	<5	130	<5	<5	<5	<5	<5	<5	<5	<5
							Duplicate of									Duplicate of
Parameter	**RDL**	**Units**					BH18-14-7									BH18-17-11
General Chemistry																
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	< 0.050	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	-	-	-	-	-	173	-	-	-	-	-	-	-
pH [2]	-	pH	11	-	-	-	-	-	7.65	-	-	-	-	-	-	-
Sodium Adsorption Ratio [3]	-	None	na	-	-	-	-	-	0.11	-	-	-	-	-	-	-
Soluble Sodium	1	mg/L	na	-	-	-	-	-	1	-	-	-	-	-	-	-
Soluble Calcium	1	mg/L	na	-	-	-	-	-	4.8	-	-	-	-	-	-	-
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	1.5	-	-	-	-	-	-	-
Total Metals																
Antimony	0.8	µg/g	63	-	-	< 1.0	-	< 1.0	< 1.0	-	-	1.1	-	-	< 1.0	< 1.0
Arsenic	0.2	µg/g	18	-	-	3.6	-	4.4	8.1	-	-	9.1	-	-	4.1	5.3
Barium	1	µg/g	7,700	-	-	26.2	-	28.6	72.6	-	-	105	-	-	47.1	44.1
Beryllium	0.5	µg/g	60	-	-	< 0.50	-	< 0.50	< 0.50	-	-	< 0.50	-	-	< 0.50	< 0.50
Boron	5	µg/g	5,000	-	-	6.9	-	5.6	5.7	-	-	8	-	-	5.7	5.4
Boron (Hot Water Soluble)	0.1	µg/g	na	-	-	-	-	-	0.32	-	-	-	-	-	-	-
Cadmium	0.5	µg/g	7.9	-	-	< 0.50	-	< 0.50	< 0.50	-	-	0.57	-	-	< 0.50	< 0.50
Chromium (total)	1	µg/g	11,000	-	-	10.5	-	11.4	16.3	-	-	12.7	-	-	10.4	10.3
Chromium (VI)	0.2	µg/g	40	-	-	-	-	-	0.43	-	-	-	-	-	-	-
Cobalt	1	µg/g	250	-	-	6	-	5.7	8.2	-	-	6.1	-	-	5.5	5
Copper	1	µg/g	5,600	-	-	22.4	-	28.2	46.8	-	-	77.7	-	-	19.1	19.9
Lead	1	µg/g	1,000	-	-	7.4	-	7	90.5	-	-	246	-	-	8.6	10.8
Mercury	0.005	µg/g	0.27	-	-	0.0083	-	0.0061	**0.438**	-	-	**0.841**	-	-	0.0115	0.0249
Molybdenum	0.5	µg/g	1,200	-	-	< 1.0	-	< 1.0	< 1.0	-	-	1.3	-	-	< 1.0	< 1.0
Nickel	1	µg/g	510	-	-	12.3	-	10.4	18.2	-	-	13	-	-	11.5	10
Selenium	0.4	µg/g	1,200	-	-	< 1.0	-	< 1.0	< 1.0	-	-	< 1.0	-	-	< 1.0	< 1.0
Silver	0.2	µg/g	490	-	-	< 0.20	-	< 0.20	< 0.20	-	-	< 0.20	-	-	< 0.20	< 0.20
Thallium	0.4	µg/g	3.3	-	-	< 0.50	-	< 0.50	< 0.50	-	-	< 0.50	-	-	< 0.50	< 0.50
Uranium	0.5	µg/g	300	-	-	< 1.0	-	< 1.0	< 1.0	-	-	< 1.0	-	-	< 1.0	< 1.0
Vanadium	1	µg/g	160	-	-	18.9	-	24.9	30	-	-	23.1	-	-	17.6	17.7
Zinc	5	µg/g	15,000	-	-	33.7	-	35.5	166	-	-	312	-	-	30.7	29.7
Volatiles																
Benzene	0.0068	µg/g	0.21	-	< 0.0068	< 0.0068	< 0.0068	< 0.0068	-	0.0208	< 0.0068	-	0.0423	-	< 0.0068	< 0.0068
Toluene	0.05	µg/g	6.2	-	< 0.080	< 0.080	< 0.080	< 0.080	-	< 0.080	< 0.080	-	0.302	-	< 0.080	< 0.080
Ethylbenzene	0.018	µg/g	2	-	< 0.018	< 0.018	< 0.018	< 0.018	-	< 0.018	< 0.018	-	0.025	-	< 0.018	< 0.018
Xylenes	0.05	µg/g	3.1	-	< 0.050	< 0.050	< 0.050	0.138	-	< 0.050	< 0.050	-	< 0.050	-	< 0.050	< 0.050
m+p-Xylenes	0.03	µg/g	na	-	< 0.030	< 0.030	< 0.030	0.047	-	< 0.030	< 0.030	-	< 0.030	-	< 0.030	< 0.030
o-Xylenes	0.02	µg/g	na	-	< 0.020	< 0.020	< 0.020	0.09	-	< 0.020	< 0.020	-	< 0.020	-	< 0.020	< 0.020
Hexane (n)	0.05	µg/g	2.8	-	-	-	-	-	-	0.121	-	-	< 0.050	-	< 0.050	< 0.050
Petroleum Hydrocarbon (PHC) Fractions																
PHC F1	5	µg/g	55	-	< 5.0	< 5.0	< 5.0	44.8	-	< 5.0	< 5.0	-	< 5.0	-	< 5.0	< 5.0
PHC F2	10	µg/g	98	-	< 10	< 10	< 10	**1,360**	-	< 10	< 10	-	24	-	< 10	< 10
PHC F3	50	µg/g	5,800	-	< 50	< 50	< 50	3,330	-	< 50	< 50	-	178	-	< 50	< 50
PHC F4	50	µg/g	6,900	-	< 50	< 50	< 50	62	-	< 50	< 50	-	< 50	-	< 50	< 50
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds																
Bromodichloromethane	0.05	µg/g	18	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Bromoform	0.05	µg/g	0.27	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Bromomethane	0.05	µg/g	0.05	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Carbon Tetrachloride	0.05	µg/g	0.05	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Chlorobenzene	0.05	µg/g	2.4	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Chloroform	0.04	µg/g	0.05	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Dibromochloromethane	0.05	µg/g	13	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Dichlorodifluoromethane	0.05	µg/g	16	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	-	-	-	-	-	< 0.042	-	-	< 0.042	-	< 0.042	< 0.042
Ethylene Dibromide	0.04	µg/g	0.05	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Methyl Ethyl Ketone	0.5	µg/g	16	-	-	-	-	-	-	< 0.50	-	-	< 0.50	-	< 0.50	< 0.50
Methyl Isobutyl Ketone	0.5	µg/g	6.6	-	-	-	-	-	-	< 0.50	-	-	< 0.50	-	< 0.50	< 0.50
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Methylene Chloride	0.05	µg/g	0.1	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Styrene	0.05	µg/g	16	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Tetrachloroethylene	0.05	µg/g	0.28	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Trichloroethylene	0.01	µg/g	0.061	-	-	-	-	-	-	< 0.010	-	-	< 0.010	-	< 0.010	< 0.010
Trichlorofluoromethane	0.05	µg/g	4	-	-	-	-	-	-	< 0.050	-	-	< 0.050	-	< 0.050	< 0.050
Vinyl Chloride [4]	0.02	µg/g	0.02	-	-	-	-	-	-	< 0.020	-	-	< 0.020	-	< 0.020	< 0.020
PAHs																
Acenaphthene	0.05	µg/g	7.9	0.216	-	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	0.191	< 0.050	< 0.050	< 0.050
Acenaphthylene	0.05	µg/g	0.15	< 0.050	-	< 0.050	< 0.050	0.067	-	< 0.050	< 0.050	-	**0.306**	< 0.050	< 0.050	< 0.050
Anthracene	0.05	µg/g	0.67	0.426	-	< 0.050	< 0.050	0.055	-	< 0.050	< 0.050	-	0.287	< 0.050	< 0.050	< 0.050
Benzo(a)anthracene	0.05	µg/g	0.96	**1.11**	-	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	0.657	< 0.050	< 0.050	< 0.050
Benzo(a)pyrene	0.05	µg/g	0.3	**1**	-	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	**0.505**	< 0.050	< 0.050	< 0.050
Benzo(b)fluoranthene	0.05	µg/g	0.96	**1.19**	-	< 0.050	< 0.050	< 0.050	-	< 0.050	0.05	-	0.782	< 0.050	< 0.050	< 0.050
Benzo(g,h,i)perylene	0.05	µg/g	9.6	0.764	-	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	0.425	< 0.050	< 0.050	< 0.050
Benzo(k)fluoranthene	0.05	µg/g	0.96	0.473	-	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	0.294	< 0.050	< 0.050	< 0.050
Chrysene	0.05	µg/g	9.6	1.02	-	< 0.050	< 0.050	0.142	-	< 0.050	< 0.050	-	0.708	< 0.050	< 0.050	< 0.050
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	**0.206**	-	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	**0.135**	< 0.050	< 0.050	< 0.050
Fluoranthene	0.05	µg/g	9.6	2.74	-	< 0.050	< 0.050	0.083	-	0.057	0.096	-	2.1	0.085	< 0.050	0.091
Fluorene	0.05	µg/g	62	0.211	-	< 0.050	< 0.050	0.183	-	< 0.050	< 0.050	-	0.228	< 0.050	< 0.050	< 0.050
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	0.749	-	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	0.441	< 0.050	< 0.050	< 0.050
Methylnaphthalene, 1-	0.03	µg/g	34	0.196	-	< 0.030	< 0.030	1.91	-	< 0.030	< 0.030	-	0.756	< 0.030	< 0.030	0.04
Methylnaphthalene, 2-	0.03	µg/g	34	0.197	-	< 0.030	< 0.030	0.096	-	< 0.030	< 0.030	-	1.2	< 0.030	< 0.030	0.049
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	0.393	-	< 0.042	< 0.042	2.01	-	< 0.042	< 0.042	-	1.96	< 0.042	< 0.042	0.089
Naphthalene	0.013	µg/g	0.65	0.182	-	< 0.013	< 0.013	< 0.050	-	< 0.013	0.023	-	**5.5**	0.079	0.029	0.107
Phenanthrene	0.046	µg/g	270	2.14	-	< 0.046	< 0.046	1.74	-	0.048	0.069	-	1.32	0.057	< 0.046	0.115
Pyrene	0.05	µg/g	96	2.28	-	< 0.050	< 0.050	0.114	-	< 0.050	0.085	-	1.83	0.079	< 0.050	0.08
PCBs																
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/g	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Parameter	RDL	Units	Table 5[1] Standard RL/PL/IN CG Subsurface	BH18-17 L2160443-4 BH18-17-13/14 2018/09/05 9.1 - 10.5 <5	BH18-18 L2160425-5 BH18-18-12A 2018/09/05 8.4 - 8.9 <5	BH18-18 L2160425-6 BH18-18-122A 2018/09/05 8.4 - 8.9 <5 Duplicate of BH18-18-12A	BH18-18 L2160425-8 BH18-18-5 2018/09/05 3.0 - 3.7 <5	BH18-23 L2161122-5 BH18-23-5 2018/09/06 3.0 - 3.7 <5	BH18-23 L2161122-8 BH18-23-8 2018/09/06 5.3 - 5.9 <5	BH18-23 L2161122-9 BH18-23-13 2018/09/06 9.1 - 9.8 <5	BH18-24 L2165098-1 BH18-24-6 2018/09/12 3.8 - 4.4 <5	BH18-24 L2165098-2 BH18-24-7 2018/09/12 4.6 - 5.2 <5	BH18-24 L2165098-3 BH18-24-12 2018/09/12 8.4 - 9.0 <5	BH18-25 L2165098-5 BH18-25-8 2018/09/12 5.3 - 5.9 <5	BH18-25 L2165098-6 BH18-25-12 2018/09/12 8.4 - 9.0 <5
General Chemistry															
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	-	-	-	-	-	-	-	-	-	-	-	-
pH [2]	-	pH	11	-	-	-	-	-	-	-	-	-	-	-	-
Sodium Adsorption Ratio [3]	-	None	na	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Sodium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Calcium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals															
Antimony	0.8	µg/g	63	-	< 1.0	< 1.0	-	< 1.0	-	-	< 1.0	-	< 1.0	-	-
Arsenic	0.2	µg/g	18	-	4.8	5.6	-	7.4	-	-	4.9	-	3.3	-	-
Barium	1	µg/g	7,700	-	67.2	59	-	60.5	-	-	63.1	-	127	-	-
Beryllium	0.5	µg/g	60	-	< 0.50	< 0.50	-	0.57	-	-	< 0.50	-	0.66	-	-
Boron	5	µg/g	5,000	-	< 5.0	6.2	-	9.1	-	-	7.4	-	12.2	-	-
Boron (Hot Water Soluble)	0.1	µg/g	na	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	0.5	µg/g	7.9	-	< 0.50	< 0.50	-	< 0.50	-	-	< 0.50	-	< 0.50	-	-
Chromium (total)	1	µg/g	11,000	-	16.1	16.5	-	16.6	-	-	12.9	-	21.5	-	-
Chromium (VI)	0.2	µg/g	40	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	1	µg/g	250	-	6.5	6.2	-	8.9	-	-	7.9	-	10.6	-	-
Copper	1	µg/g	5,600	-	21.8	23.3	-	37.5	-	-	26.3	-	25.6	-	-
Lead	1	µg/g	1,000	-	23.8	25.9	-	86.1	-	-	8.7	-	11.7	-	-
Mercury	0.005	µg/g	0.27	-	**0.453**	**0.512**	-	**0.689**	-	-	0.0055	-	0.0111	-	-
Molybdenum	0.5	µg/g	1,200	-	< 1.0	< 1.0	-	< 1.0	-	-	< 1.0	-	< 1.0	-	-
Nickel	1	µg/g	510	-	13.1	13.1	-	16.9	-	-	15.4	-	23.2	-	-
Selenium	0.4	µg/g	1,200	-	< 1.0	< 1.0	-	< 1.0	-	-	< 1.0	-	< 1.0	-	-
Silver	0.2	µg/g	490	-	< 0.20	< 0.20	-	< 0.20	-	-	< 0.20	-	< 0.20	-	-
Thallium	0.4	µg/g	3.3	-	< 0.50	< 0.50	-	< 0.50	-	-	< 0.50	-	< 0.50	-	-
Uranium	0.5	µg/g	300	-	< 1.0	< 1.0	-	< 1.0	-	-	< 1.0	-	< 1.0	-	-
Vanadium	1	µg/g	160	-	23.7	23.7	-	30	-	-	24.7	-	31.6	-	-
Zinc	5	µg/g	15,000	-	47.8	48.2	-	87.3	-	-	37.9	-	54.1	-	-
Volatiles															
Benzene	0.0068	µg/g	0.21	< 0.0068	0.011	< 0.0068	0.0195	< 0.0068	< 0.0068	-	-	< 0.0068	< 0.0068	**0.438**	-
Toluene	0.05	µg/g	6.2	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	-	-	< 0.080	< 0.080	0.269	-
Ethylbenzene	0.018	µg/g	2	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	-	-	< 0.018	< 0.018	0.189	-
Xylenes	0.05	µg/g	3.1	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	-	-	< 0.050	< 0.050	0.55	-
m+p-Xylenes	0.03	µg/g	na	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	-	-	< 0.030	< 0.030	0.365	-
o-Xylenes	0.02	µg/g	na	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	-	-	< 0.020	< 0.020	0.185	-
Hexane (n)	0.05	µg/g	2.8	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Petroleum Hydrocarbon (PHC) Fractions															
PHC F1	5	µg/g	55	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	-	-	< 5.0	< 5.0	< 5.0	-
PHC F2	10	µg/g	98	< 10	< 10	< 10	< 10	< 10	< 10	-	-	< 10	< 10	**699**	-
PHC F3	50	µg/g	5,800	< 50	< 50	< 50	112	< 50	< 50	-	-	< 50	< 50	3,910	-
PHC F4	50	µg/g	6,900	< 50	< 50	< 50	< 50	< 50	< 50	-	-	< 50	< 50	846	-
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-	-	2,720	-
Volatile Organic Compounds															
Bromodichloromethane	0.05	µg/g	18	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Bromoform	0.05	µg/g	0.27	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Bromomethane	0.05	µg/g	0.05	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Carbon Tetrachloride	0.05	µg/g	0.05	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Chlorobenzene	0.05	µg/g	2.4	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Chloroform	0.04	µg/g	0.05	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Dibromochloromethane	0.05	µg/g	13	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Dichlorodifluoromethane	0.05	µg/g	16	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	< 0.042	< 0.042	< 0.042	-	< 0.042	< 0.042	-	-	< 0.042	< 0.042	< 0.042	-
Ethylene Dibromide	0.04	µg/g	0.05	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Methyl Ethyl Ketone	0.5	µg/g	16	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	-	-	< 0.50	< 0.50	< 0.50	-
Methyl Isobutyl Ketone	0.5	µg/g	6.6	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	-	-	< 0.50	< 0.50	< 0.50	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Methylene Chloride	0.05	µg/g	0.1	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Styrene	0.05	µg/g	16	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	0.097	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Tetrachloroethylene	0.05	µg/g	0.28	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Trichloroethylene	0.01	µg/g	0.061	< 0.010	< 0.010	< 0.010	-	< 0.010	< 0.010	-	-	< 0.010	< 0.010	< 0.010	-
Trichlorofluoromethane	0.05	µg/g	4	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	-	-	< 0.050	< 0.050	< 0.050	-
Vinyl Chloride [4]	0.02	µg/g	0.02	< 0.020	< 0.020	< 0.020	-	< 0.020	< 0.020	-	-	< 0.020	< 0.020	< 0.020	-
PAHs															
Acenaphthene	0.05	µg/g	7.9	< 0.050	< 0.050	0.051	0.059	-	< 0.050	< 0.050	< 0.050	-	< 0.050	-	**11.8**
Acenaphthylene	0.05	µg/g	0.15	< 0.050	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	< 0.050	-	< 0.050	-	**2.53**
Anthracene	0.05	µg/g	0.67	< 0.050	< 0.050	0.095	0.215	-	< 0.050	< 0.050	< 0.050	-	< 0.050	-	**18.3**
Benzo(a)anthracene	0.05	µg/g	0.96	< 0.050	0.217	0.227	0.642	-	< 0.050	< 0.050	< 0.050	-	< 0.050	-	**29.2**
Benzo(a)pyrene	0.05	µg/g	0.3	< 0.050	0.239	0.218	**0.548**	-	< 0.050	< 0.050	< 0.050	-	< 0.050	-	**24.7**
Benzo(b)fluoranthene	0.05	µg/g	0.96	< 0.050	0.221	0.234	0.56	-	< 0.050	< 0.050	< 0.050	-	< 0.050	-	**20.9**
Benzo(g,h,i)perylene	0.05	µg/g	9.6	< 0.050	0.121	0.119	0.291	-	< 0.050	< 0.050	< 0.050	-	< 0.050	-	**13.2**
Benzo(k)fluoranthene	0.05	µg/g	0.96	< 0.050	0.168	0.171	0.438	-	< 0.050	< 0.050	< 0.050	-	< 0.050	-	**15.6**
Chrysene	0.05	µg/g	9.6	< 0.050	0.198	0.231	0.637	-	< 0.050	< 0.050	< 0.050	-	< 0.050	-	**25.5**
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	< 0.050	< 0.050	< 0.050	0.096	-	< 0.050	< 0.050	< 0.050	-	< 0.050	-	**4.47**
Fluoranthene	0.05	µg/g	9.6	< 0.050	0.211	0.441	1.58	-	< 0.050	< 0.050	< 0.050	-	< 0.050	-	**64.6**
Fluorene	0.05	µg/g	62	< 0.050	< 0.050	0.078	0.144	-	< 0.050	< 0.050	< 0.050	-	< 0.050	-	11.7
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	< 0.050	0.141	0.133	0.319	-	< 0.050	< 0.050	< 0.050	-	< 0.050	-	**9.92**
Methylnaphthalene, 1-	0.03	µg/g	34	< 0.030	< 0.030	< 0.030	< 0.030	-	< 0.030	< 0.030	< 0.030	-	< 0.030	-	4.86
Methylnaphthalene, 2-	0.03	µg/g	34	< 0.030	< 0.030	0.037	< 0.030	-	< 0.030	< 0.030	< 0.030	-	< 0.030	-	6.33
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	< 0.042	< 0.042	< 0.042	< 0.042	-	< 0.042	< 0.042	< 0.042	-	< 0.042	-	11.2
Naphthalene	0.013	µg/g	0.65	0.031	< 0.013	0.064	0.041	-	< 0.013	< 0.013	< 0.013	-	< 0.013	-	**20.1**
Phenanthrene	0.046	µg/g	270	< 0.046	< 0.046	0.333	0.665	-	< 0.046	< 0.046	< 0.046	-	< 0.046	-	65.3
Pyrene	0.05	µg/g	96	< 0.050	0.192	0.36	1.31	-	< 0.050	< 0.050	< 0.050	-	< 0.050	-	55
PCBs															
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	< 0.010	-	-	-	-
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	< 0.010	-	-	-	-
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	< 0.010	-	-	-	-
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	< 0.010	-	-	-	-
Total PCBs	0.1	µg/g	2.7	-	-	-	-	-	-	-	< 0.020	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location			Table 5[1] Standard	BH18-25	BH18-25	BH18-25	BH18-26	BH18-26	BH18-26	BH18-26	BH18-27	BH18-27	BH18-27	BH18-27
Laboratory Sample ID				L2165098-7	L2165098-8	L2165098-9	L2165098-10	L2165098-11	L2165098-12	L2165096-1	L2165631-2	L2165631-3	L2165631-4	L2165631-5
SNC-Lavalin Sample ID			RL/PL/IN CG	BH18-25-13	BH18-25-17	BH18-25-18	BH18-26-4	BH18-26-14	BH18-26-18	BH18-26-188	BH18-27-4	BH18-27-5	BH18-27-6	BH18-27-66
Sampling Date (yyyy/mm/dd)			Subsurface	2018/09/12	2018/09/12	2018/09/12	2018/09/13	2018/09/13	2018/09/13	2018/09/13	2018/09/13	2018/09/13	2018/09/13	2018/09/13
				9.1 - 9.8	12.2 - 12.8	13.0 - 13.4	2.3 - 2.9	9.9 - 10.5	13.0 - 13.6	13.0 - 13.6	2.3 - 2.9	3.0 - 3.7	3.8 - 4.4	3.8 - 4.4
				<5	<5	<5	<5	<5	<5	<5	55	110	5	5
										Duplicate of				Duplicate of
Parameter	**RDL**	**Units**								BH18-26-18				BH18-27-6
General Chemistry														
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	< 0.050	-	-	-	-	< 0.050	-	< 0.050	-	-	-
Electrical Conductivity	0.004	mS/cm	na	969	-	-	-	-	354	-	201	-	-	-
pH [2]	-	pH	11	7.92	-	-	-	-	8.2	-	7.4	-	-	-
Sodium Adsorption Ratio [3]	-	None	na	4.27	-	-	-	-	2.23	-	<	-	-	-
Soluble Sodium	1	mg/L	na	112	-	-	-	-	30.2	-	< 1.0	-	-	-
Soluble Calcium	1	mg/L	na	39.7	-	-	-	-	8.1	-	11.6	-	-	-
Soluble Magnesium	1	mg/L	na	7.7	-	-	-	-	3.5	-	1.1	-	-	-
Total Metals														
Antimony	0.8	µg/g	63	2.2	-	-	-	< 1.0	< 1.0	-	1.1	-	-	-
Arsenic	0.2	µg/g	18	11.6	-	-	-	3.3	4.1	-	7.6	-	-	-
Barium	1	µg/g	7,700	42	-	-	-	53.8	114	-	48.7	-	-	-
Beryllium	0.5	µg/g	60	< 0.50	-	-	-	0.56	0.66	-	< 0.50	-	-	-
Boron	5	µg/g	5,000	7	-	-	-	9.3	11.7	-	8.1	-	-	-
Boron (Hot Water Soluble)	0.1	µg/g	na	0.48	-	-	-	-	0.85	-	0.27	-	-	-
Cadmium	0.5	µg/g	7.9	< 0.50	-	-	-	< 0.50	< 0.50	-	< 0.50	-	-	-
Chromium (total)	1	µg/g	11,000	13.5	-	-	-	19.2	23.2	-	14.3	-	-	-
Chromium (VI)	0.2	µg/g	40	< 0.20	-	-	-	-	< 0.20	-	< 0.20	-	-	-
Cobalt	1	µg/g	250	6.8	-	-	-	11.7	10.5	-	5	-	-	-
Copper	1	µg/g	5,600	89.4	-	-	-	25.4	24.3	-	57.3	-	-	-
Lead	1	µg/g	1,000	234	-	-	-	11.6	14.7	-	44.8	-	-	-
Mercury	0.005	µg/g	0.27	**0.693**	-	-	-	0.0158	0.0778	-	0.0449	-	-	-
Molybdenum	0.5	µg/g	1,200	1.9	-	-	-	< 1.0	< 1.0	-	1	-	-	-
Nickel	1	µg/g	510	14.9	-	-	-	23.7	23.6	-	11.3	-	-	-
Selenium	0.4	µg/g	1,200	1.1	-	-	-	< 1.0	< 1.0	-	< 1.0	-	-	-
Silver	0.2	µg/g	490	0.31	-	-	-	< 0.20	< 0.20	-	< 0.20	-	-	-
Thallium	0.4	µg/g	3.3	< 0.50	-	-	-	< 0.50	< 0.50	-	< 0.50	-	-	-
Uranium	0.5	µg/g	300	< 1.0	-	-	-	< 1.0	< 1.0	-	< 1.0	-	-	-
Vanadium	1	µg/g	160	29.1	-	-	-	27.5	32.5	-	28.8	-	-	-
Zinc	5	µg/g	15,000	304	-	-	-	54.9	54.2	-	93.5	-	-	-
Volatiles														
Benzene	0.0068	µg/g	0.21	-	**0.242**	-	**1.58**	-	< 0.0095	< 0.0068	-	**27.5**	-	-
Toluene	0.05	µg/g	6.2	-	0.402	-	2.42	-	< 0.080	< 0.080	-	**13.6**	-	-
Ethylbenzene	0.018	µg/g	2	-	0.882	-	0.16	-	< 0.018	< 0.018	-	**4.91**	-	-
Xylenes	0.05	µg/g	3.1	-	**3.55**	-	**3.25**	-	< 0.050	< 0.050	-	**20.7**	-	-
m+p-Xylenes	0.03	µg/g	na	-	2.54	-	2.49	-	< 0.030	< 0.030	-	14.5	-	-
o-Xylenes	0.02	µg/g	na	-	1.01	-	0.76	-	< 0.020	< 0.020	-	6.24	-	-
Hexane (n)	0.05	µg/g	2.8	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Petroleum Hydrocarbon (PHC) Fractions														
PHC F1	5	µg/g	55	-	< 5.0	-	5.2	-	< 5.0	< 5.0	-	< 40	-	-
PHC F2	10	µg/g	98	-	**113**	-	**814**	-	< 10	15	-	**13,200**	-	-
PHC F3	50	µg/g	5,800	-	55	-	3,590	-	< 50	< 50	-	**8,620**	-	-
PHC F4	50	µg/g	6,900	-	< 50	-	295	-	< 50	< 50	-	1,020	-	-
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds														
Bromodichloromethane	0.05	µg/g	18	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Bromoform	0.05	µg/g	0.27	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Bromomethane	0.05	µg/g	0.05	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Carbon Tetrachloride	0.05	µg/g	0.05	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Chlorobenzene	0.05	µg/g	2.4	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Chloroform	0.04	µg/g	0.05	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Dibromochloromethane	0.05	µg/g	13	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Dichlorodifluoromethane	0.05	µg/g	16	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	< 0.042	-	< 0.042	-	-	-	-	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Methyl Ethyl Ketone	0.5	µg/g	16	-	< 0.50	-	< 0.50	-	-	-	-	-	-	-
Methyl Isobutyl Ketone	0.5	µg/g	6.6	-	< 0.50	-	< 0.50	-	-	-	-	-	-	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Methylene Chloride	0.05	µg/g	0.1	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Styrene	0.05	µg/g	16	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Tetrachloroethylene	0.05	µg/g	0.28	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Trichloroethylene	0.01	µg/g	0.061	-	< 0.010	-	< 0.010	-	-	-	-	-	-	-
Trichlorofluoromethane	0.05	µg/g	4	-	< 0.050	-	< 0.050	-	-	-	-	-	-	-
Vinyl Chloride [4]	0.02	µg/g	0.02	-	< 0.020	-	< 0.020	-	-	-	-	-	-	-
PAHs														
Acenaphthene	0.05	µg/g	7.9	-	-	2.02	-	5.91	0.929	-	-	-	**464**	4.46
Acenaphthylene	0.05	µg/g	0.15	-	-	0.097	-	0.088	< 0.050	-	-	-	**39.6**	**0.47**
Anthracene	0.05	µg/g	0.67	-	-	0.219	-	**1.02**	0.15	-	-	-	**136**	**2**
Benzo(a)anthracene	0.05	µg/g	0.96	-	-	0.069	-	0.699	0.112	-	-	-	**74.7**	**2.91**
Benzo(a)pyrene	0.05	µg/g	0.3	-	-	0.053	-	**0.374**	0.064	-	-	-	**47.2**	**2.37**
Benzo(b)fluoranthene	0.05	µg/g	0.96	-	-	< 0.050	-	0.356	0.063	-	-	-	**62.4**	**3.2**
Benzo(g,h,i)perylene	0.05	µg/g	9.6	-	-	< 0.050	-	0.203	< 0.050	-	-	-	**23.5**	1.33
Benzo(k)fluoranthene	0.05	µg/g	0.96	-	-	< 0.050	-	0.272	< 0.050	-	-	-	**23.2**	**1.13**
Chrysene	0.05	µg/g	9.6	-	-	0.084	-	0.601	0.125	-	-	-	**60**	2.63
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	-	-	< 0.050	-	0.07	< 0.050	-	-	-	**6.2**	**0.34**
Fluoranthene	0.05	µg/g	9.6	-	-	0.341	-	4.27	0.594	-	-	-	**361**	8.43
Fluorene	0.05	µg/g	62	-	-	1.59	-	4.42	0.667	-	-	-	**397**	3.89
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	-	-	< 0.050	-	0.144	< 0.050	-	-	-	**24.7**	**1.37**
Methylnaphthalene, 1-	0.03	µg/g	34	-	-	2	-	0.891	0.182	-	-	-	**211**	3.86
Methylnaphthalene, 2-	0.03	µg/g	34	-	-	3.91	-	0.085	< 0.030	-	-	-	**450**	5.91
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	-	-	5.91	-	0.976	0.182	-	-	-	**661**	9.76
Naphthalene	0.013	µg/g	0.65	-	-	**29.8**	-	**1.1**	0.281	-	-	-	**2,530**	**84.2**
Phenanthrene	0.046	µg/g	270	-	-	2.07	-	8.55	1.18	-	-	-	**840**	11
Pyrene	0.05	µg/g	96	-	-	0.216	-	2.69	0.376	-	-	-	**223**	6.4
PCBs														
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/g	2.7	-	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is incalculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location			Table 5[1]	BH18-27	BH18-28	BH18-28	BH18-29	BH18-29	BH18-29	BH18-29	BH18-29	BH18-29	BH18-30
Laboratory Sample ID			Standard	L2165631-6	L2165631-8	L2165631-9	L2165631-12	L2165631-13	L2165631-14	L2165631-15	L2165631-16	L2165631-17	L2165705-3
SNC-Lavalin Sample ID			RL/PL/IN CG	BH18-27-14	BH18-28-5	BH18-28-9	BH18-29-3	BH18-29-33	BH18-29-4	BH18-29-44	BH18-29-7	BH18-29-12	BH18-30-3
Sampling Date (yyyy/mm/dd)			Subsurface	2018/09/13	2018/09/14	2018/09/14	2018/09/14	2018/09/14	2018/09/14	2018/09/14	2018/09/14	2018/09/14	2018/09/14
				9.9 - 10.5	2.3 - 2.9	6.1 - 6.7	1.5 - 2.1	1.5 - 2.1	2.3 - 2.9	2.3 - 2.9	4.6 - 5.2	8.4 - 9.0	1.5 - 2.1
				<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
								Duplicate of		Duplicate of			
Parameter	**RDL**	**Units**						BH18-29-3		BH18-29-4			
General Chemistry													
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	-	-	-	-
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	< 0.050	-
Electrical Conductivity	0.004	mS/cm	na	-	-	-	-	-	-	-	-	388	-
pH [2]	-	pH	11	-	-	-	-	-	-	-	-	7.63	-
Sodium Adsorption Ratio [3]	-	None	na	-	-	-	-	-	-	-	-	2.49	-
Soluble Sodium	1	mg/L	na	-	-	-	-	-	-	-	-	30.5	-
Soluble Calcium	1	mg/L	na	-	-	-	-	-	-	-	-	8.6	-
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	-	-	-	1.6	-
Total Metals													
Antimony	0.8	µg/g	63	-	-	< 1.0	-	-	-	-	-	< 1.0	-
Arsenic	0.2	µg/g	18	-	-	**23.8**	-	-	-	-	-	6.9	-
Barium	1	µg/g	7,700	-	-	111	-	-	-	-	-	101	-
Beryllium	0.5	µg/g	60	-	-	< 0.50	-	-	-	-	-	0.56	-
Boron	5	µg/g	5,000	-	-	< 5.0	-	-	-	-	-	9.2	-
Boron (Hot Water Soluble)	0.1	µg/g	na	-	-	0.34	-	-	-	-	-	0.47	-
Cadmium	0.5	µg/g	7.9	-	-	< 0.50	-	-	-	-	-	< 0.50	-
Chromium (total)	1	µg/g	11,000	-	-	10.7	-	-	-	-	-	18.3	-
Chromium (VI)	0.2	µg/g	40	-	-	-	-	-	-	-	-	< 0.20	-
Cobalt	1	µg/g	250	-	-	4.8	-	-	-	-	-	9	-
Copper	1	µg/g	5,600	-	-	35.7	-	-	-	-	-	41.5	-
Lead	1	µg/g	1,000	-	-	490	-	-	-	-	-	79.3	-
Mercury	0.005	µg/g	0.27	-	-	**2.43**	-	-	-	-	-	**0.38**	-
Molybdenum	0.5	µg/g	1,200	-	-	2.3	-	-	-	-	-	< 1.0	-
Nickel	1	µg/g	510	-	-	9.3	-	-	-	-	-	18.9	-
Selenium	0.4	µg/g	1,200	-	-	< 1.0	-	-	-	-	-	< 1.0	-
Silver	0.2	µg/g	490	-	-	0.33	-	-	-	-	-	0.23	-
Thallium	0.4	µg/g	3.3	-	-	< 0.50	-	-	-	-	-	< 0.50	-
Uranium	0.5	µg/g	300	-	-	< 1.0	-	-	-	-	-	< 1.0	-
Vanadium	1	µg/g	160	-	-	21.1	-	-	-	-	-	28.5	-
Zinc	5	µg/g	15,000	-	-	194	-	-	-	-	-	103	-
Volatiles													
Benzene	0.0068	µg/g	0.21	0.0529	**1.78**	**2.5**	**2.21**	**2.22**	-	-	-	0.0153	-
Toluene	0.05	µg/g	6.2	< 0.080	0.473	0.212	0.173	0.235	-	-	-	< 0.080	-
Ethylbenzene	0.018	µg/g	2	0.028	**14.1**	0.982	**4.27**	**4.59**	-	-	-	0.029	-
Xylenes	0.05	µg/g	3.1	0.092	**24.9**	2.97	**6.71**	**6.96**	-	-	-	0.076	-
m+p-Xylenes	0.03	µg/g	na	0.063	20.2	1.52	5.7	5.8	-	-	-	0.055	-
o-Xylenes	0.02	µg/g	na	0.028	4.7	1.45	1.01	1.16	-	-	-	0.021	-
Hexane (n)	0.05	µg/g	2.8	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Petroleum Hydrocarbon (PHC) Fractions													
PHC F1	5	µg/g	55	< 5.0	44	< 5.0	17.7	18.6	-	-	-	< 5.0	-
PHC F2	10	µg/g	98	38	**1,670**	**4,330**	**437**	**664**	-	-	-	53	-
PHC F3	50	µg/g	5,800	64	1,260	2,500	243	488	-	-	-	66	-
PHC F4	50	µg/g	6,900	< 50	100	610	81	158	-	-	-	< 50	-
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	< 250	-	-	-	-	-	-
Volatile Organic Compounds													
Bromodichloromethane	0.05	µg/g	18	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Bromoform	0.05	µg/g	0.27	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Bromomethane	0.05	µg/g	0.05	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Carbon Tetrachloride	0.05	µg/g	0.05	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Chlorobenzene	0.05	µg/g	2.4	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Chloroform	0.04	µg/g	0.05	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Dibromochloromethane	0.05	µg/g	13	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Dichlorodifluoromethane	0.05	µg/g	16	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Dichloroethane, 1,1-	0.02	µg/g	3.5	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Dichloroethane, 1,2-	0.03	µg/g	0.05	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Dichloroethylene, 1,1-	0.05	µg/g	0.05	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Dichloropropane, 1,2-	0.03	µg/g	0.05	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Dichloropropene, 1,3-	0.042	µg/g	0.05	< 0.042	-	< 0.042	-	-	-	-	-	< 0.042	-
Ethylene Dibromide	0.04	µg/g	0.05	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Methyl Ethyl Ketone	0.5	µg/g	16	< 0.50	-	< 0.50	-	-	-	-	-	< 0.50	-
Methyl Isobutyl Ketone	0.5	µg/g	6.6	< 0.50	-	< 0.50	-	-	-	-	-	< 0.50	-
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Methylene Chloride	0.05	µg/g	0.1	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Styrene	0.05	µg/g	16	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Tetrachloroethylene	0.05	µg/g	0.28	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Trichloroethylene	0.01	µg/g	0.061	< 0.010	-	< 0.010	-	-	-	-	-	< 0.010	-
Trichlorofluoromethane	0.05	µg/g	4	< 0.050	-	< 0.050	-	-	-	-	-	< 0.050	-
Vinyl Chloride [4]	0.02	µg/g	0.02	< 0.020	-	< 0.020	-	-	-	-	-	< 0.020	-
PAHs													
Acenaphthene	0.05	µg/g	7.9	4.62	**127**	**65.8**	-	-	6.75	**8.5**	**31.2**	-	-
Acenaphthylene	0.05	µg/g	0.15	**0.22**	< 1.3[1]	**5**	-	-	**0.33**	< 1.3[1]	< 1.3[1]	-	-
Anthracene	0.05	µg/g	0.67	**1.35**	**48**	**23.5**	-	-	**2.16**	**2.2**	**7.6**	-	-
Benzo(a)anthracene	0.05	µg/g	0.96	0.67	**10.2**	**26.7**	-	-	**1.92**	**3.4**	**4.9**	-	-
Benzo(a)pyrene	0.05	µg/g	0.3	**0.42**	**4**	**21.5**	-	-	**1.75**	**2.9**	**3.5**	-	-
Benzo(b)fluoranthene	0.05	µg/g	0.96	0.55	**6.1**	**26.4**	-	-	**2.5**	**3.9**	**4.9**	-	-
Benzo(g,h,i)perylene	0.05	µg/g	9.6	0.25	1.8	**10**	-	-	1.13	1.8	2.1	-	-
Benzo(k)fluoranthene	0.05	µg/g	0.96	0.2	**2**	**9.8**	-	-	0.91	**1.5**	**1.7**	-	-
Chrysene	0.05	µg/g	9.6	0.55	8.5	**21.9**	-	-	1.86	3.2	4.6	-	-
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	< 0.13[1]	< 1.3[1]	**2.7**	-	-	**0.28**	< 1.3[1]	< 1.3[1]	-	-
Fluoranthene	0.05	µg/g	9.6	2.92	**67.2**	**57.7**	-	-	5.7	9.3	**22.9**	-	-
Fluorene	0.05	µg/g	62	4.45	**100**	48.7	-	-	4.54	4.2	23.3	-	-
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	0.27	**1.9**	**11.1**	-	-	**1.17**	**1.8**	**2.1**	-	-
Methylnaphthalene, 1-	0.03	µg/g	34	2.7	**52.5**	**125**	-	-	9.59	9.97	20.4	-	-
Methylnaphthalene, 2-	0.03	µg/g	34	2.05	**102**	**251**	-	-	12.8	13	33.6	-	-
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	4.75	**154**	**375**	-	-	22.3	23	**54**	-	-
Naphthalene	0.013	µg/g	0.65	**12.5**	**789**	**1,170**	-	-	**233**	**209**	**286**	-	-
Phenanthrene	0.046	µg/g	270	7.63	192	128	-	-	11.9	12.9	56.7	-	-
Pyrene	0.05	µg/g	96	1.85	40.8	42.1	-	-	4.08	6.7	14.5	-	-
PCBs													
Arochlor 1242	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	< 0.010
Arochlor 1248	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	< 0.010
Arochlor 1254	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	< 0.010
Arochlor 1260	0.01	µg/g	na	-	-	-	-	-	-	-	-	-	< 0.010
Total PCBs	0.1	µg/g	2.7	-	-	-	-	-	-	-	-	-	< 0.020

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location			Table 5[1]	BH18-30	BH18-30	BH18-30	BH18-30	BH18-30	BH18-30	TP-1	TP-1	TP-1	TP-1	TP-2
Laboratory Sample ID			Standard	L2165705-4	L2165705-5	L2165705-6	L2165705-8	L2165705-7	L2165705-9	4780045	4780050	4780055	4780060	4780097
SNC-Lavalin Sample ID			RL/PL/IN CG	BH18-30-33	BH18-30-5	BH18-30-55	BH18-30-6	BH18-30-66	BH18-30-7	TP-1-3	TP-1-7	TP-1-9	TP-1-10	TP-2-4
Sampling Date (yyyy/mm/dd)			Subsurface	2018/09/14	2018/09/14	2018/09/14	2018/09/14	2018/09/14	2018/09/14	2013/09/24	2013/09/24	2013/09/24	2013/09/24	2013/09/25
				1.5 - 2.1	3.0 - 3.7	3.0 - 3.7	3.8 - 4.4	3.8 - 4.4	4.6 - 5.2	2.0	4.1	5.0	6.0	2.0
				<5	<5	<5	<5	<5	<5	50	75	<25	<25	50
				Duplicate of		Duplicate of		Duplicate of						
Parameter	**RDL**	**Units**		BH18-30-3		BH18-30-5		BH18-30-6						
General Chemistry														
Cyanide (CN-)	0.04	µg/g	0.051	-	-	-	-	-	-	< 0.04	**0.121**	< 0.04	< 0.04	< 0.04
Cyanide (WAD)	0.05	µg/g	0.051	-	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	0.004	mS/cm	na	-	-	-	-	-	-	198	1,390	318	361	876
pH [2]	-	pH	11	-	-	-	-	-	-	7.67	8.42	7.11	7.24	7.28
Sodium Adsorption Ratio [3]	-	None	na	-	-	-	-	-	-	0.158	13.4	2.98	3.08	3.95
Soluble Sodium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-
Soluble Calcium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-
Soluble Magnesium	1	mg/L	na	-	-	-	-	-	-	-	-	-	-	-
Total Metals														
Antimony	0.8	µg/g	63	-	-	-	-	-	< 1.0	1.8	1.7	< 0.8	< 0.8	1.6
Arsenic	0.2	µg/g	18	-	-	-	-	-	3.6	16	10	5	4	**100**
Barium	1	µg/g	7,700	-	-	-	-	-	34.6	98	119	102	52	95
Beryllium	0.5	µg/g	60	-	-	-	-	-	< 0.50	0.5	< 0.5	< 0.5	< 0.5	0.9
Boron	5	µg/g	5,000	-	-	-	-	-	5.1	8	20	12	< 5	8
Boron (Hot Water Soluble)	0.1	µg/g	na	-	-	-	-	-	-	0.74	2.89	0.54	0.69	1.2
Cadmium	0.5	µg/g	7.9	-	-	-	-	-	< 0.50	0.9	0.7	< 0.5	< 0.5	< 0.5
Chromium (total)	1	µg/g	11,000	-	-	-	-	-	10.9	17	8	13	11	13
Chromium (VI)	0.2	µg/g	40	-	-	-	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Cobalt	1	µg/g	250	-	-	-	-	-	5.2	7.5	6.5	6.2	7.2	9.1
Copper	1	µg/g	5,600	-	-	-	-	-	26.6	295	71	32	35	42
Lead	1	µg/g	1,000	-	-	-	-	-	5.6	624	636	101	50	68
Mercury	0.005	µg/g	0.27	-	-	-	-	-	0.0097	**0.94**	**0.78**	**0.29**	0.15	**1.58**
Molybdenum	0.5	µg/g	1,200	-	-	-	-	-	< 1.0	1.4	0.9	< 0.5	< 0.5	3.6
Nickel	1	µg/g	510	-	-	-	-	-	10.1	18	10	12	13	22
Selenium	0.4	µg/g	1,200	-	-	-	-	-	< 1.0	1	1.1	< 0.4	0.5	1.2
Silver	0.2	µg/g	490	-	-	-	-	-	< 0.20	0.3	0.4	< 0.2	< 0.2	< 0.2
Thallium	0.4	µg/g	3.3	-	-	-	-	-	< 0.50	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Uranium	0.5	µg/g	300	-	-	-	-	-	< 1.0	< 0.5	< 0.5	< 0.5	< 0.5	0.7
Vanadium	1	µg/g	160	-	-	-	-	-	27.7	28	12	20	19	38
Zinc	5	µg/g	15,000	-	-	-	-	-	26.6	847	788	70	135	79
Volatiles														
Benzene	0.0068	µg/g	0.21	-	< 0.0068	< 0.0068	-	-	< 0.0068	0.14	< 0.02	< 0.02	0.16	0.1
Toluene	0.05	µg/g	6.2	-	< 0.080	< 0.080	-	-	< 0.080	0.57	< 0.05	< 0.05	0.22	< 0.05
Ethylbenzene	0.018	µg/g	2	-	< 0.018	< 0.018	-	-	< 0.018	0.1	< 0.05	< 0.05	< 0.05	< 0.05
Xylenes	0.05	µg/g	3.1	-	< 0.050	< 0.050	-	-	< 0.050	0.51	< 0.05	< 0.05	0.16	< 0.05
m+p-Xylenes	0.03	µg/g	na	-	< 0.030	< 0.030	-	-	< 0.030	-	-	-	-	-
o-Xylenes	0.02	µg/g	na	-	< 0.020	< 0.020	-	-	< 0.020	-	-	-	-	-
Hexane (n)	0.05	µg/g	2.8	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Petroleum Hydrocarbon (PHC) Fractions														
PHC F1	5	µg/g	55	-	< 5.0	< 5.0	-	-	< 5.0	< 5	< 10	< 5	< 5	< 5
PHC F2	10	µg/g	98	-	< 10	< 10	-	-	< 10	**1,600**	< 20	< 10	< 10	< 10
PHC F3	50	µg/g	5,800	-	< 50	< 50	-	-	< 50	**7,300**	140	< 50	77	< 50
PHC F4	50	µg/g	6,900	-	< 50	< 50	-	-	< 50	610	< 100	< 50	< 50	< 50
PHC F4 (silica gel)	250	µg/g	6,900	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds														
Bromodichloromethane	0.05	µg/g	18	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Bromoform	0.05	µg/g	0.27	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Bromomethane	0.05	µg/g	0.05	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Carbon Tetrachloride	0.05	µg/g	0.05	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chlorobenzene	0.05	µg/g	2.4	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chloroform	0.04	µg/g	0.05	-	< 0.050	< 0.050	-	-	-	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Dibromochloromethane	0.05	µg/g	13	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichlorodifluoromethane	0.05	µg/g	16	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichloroethane, 1,1-	0.02	µg/g	3.5	-	< 0.050	< 0.050	-	-	-	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dichloroethane, 1,2-	0.03	µg/g	0.05	-	< 0.050	< 0.050	-	-	-	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dichloroethylene, 1,1-	0.05	µg/g	0.05	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	-	< 0.050	< 0.050	-	-	-	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichloropropane, 1,2-	0.03	µg/g	0.05	-	< 0.050	< 0.050	-	-	-	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dichloropropene, 1,3-	0.042	µg/g	0.05	-	< 0.042	< 0.042	-	-	-	-	-	-	-	-
Ethylene Dibromide	0.04	µg/g	0.05	-	< 0.050	< 0.050	-	-	-	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Methyl Ethyl Ketone	0.5	µg/g	16	-	< 0.50	< 0.50	-	-	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Methyl Isobutyl Ketone	0.5	µg/g	6.6	-	< 0.50	< 0.50	-	-	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Methylene Chloride	0.05	µg/g	0.1	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Styrene	0.05	µg/g	16	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	-	< 0.050	< 0.050	-	-	-	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Tetrachloroethylene	0.05	µg/g	0.28	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	-	< 0.050	< 0.050	-	-	-	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Trichloroethylene	0.01	µg/g	0.061	-	< 0.010	< 0.010	-	-	-	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Trichlorofluoromethane	0.05	µg/g	4	-	< 0.050	< 0.050	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Vinyl Chloride [4]	0.02	µg/g	0.02	-	< 0.020	< 0.020	-	-	-	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
PAHs														
Acenaphthene	0.05	µg/g	7.9	-	-	-	0.085	0.086	0.225	2.1	2.7	< 0.05	1.6	**11**
Acenaphthylene	0.05	µg/g	0.15	-	-	-	< 0.050	< 0.050	< 0.050	**1.1**	**0.35**	< 0.05	**1.7**	< 0.05
Anthracene	0.05	µg/g	0.67	-	-	-	0.05	0.431	0.292	**4.7**	**12**	< 0.05	**4.6**	0.16
Benzo(a)anthracene	0.05	µg/g	0.96	-	-	-	< 0.050	< 0.050	0.079	**8.4**	**13**	< 0.05	**13**	< 0.05
Benzo(a)pyrene	0.05	µg/g	0.3	-	-	-	< 0.050	< 0.050	< 0.050	**7.7**	**8.3**	< 0.05	**13**	< 0.05
Benzo(b)fluoranthene	0.05	µg/g	0.96	-	-	-	< 0.050	< 0.050	0.065	**11**	**9.4**	< 0.05	**16**	< 0.05
Benzo(g,h,i)perylene	0.05	µg/g	9.6	-	-	-	< 0.050	< 0.050	< 0.050	3.2	2	< 0.05	4.4	< 0.05
Benzo(k)fluoranthene	0.05	µg/g	0.96	-	-	-	< 0.050	< 0.050	< 0.050	**3.9**	**4.3**	< 0.05	**5.9**	< 0.05
Chrysene	0.05	µg/g	9.6	-	-	-	< 0.050	< 0.050	0.065	8.6	**12**	< 0.05	**12**	< 0.05
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	-	-	-	< 0.050	< 0.050	< 0.050	**1.1**	**0.68**	< 0.05	**1.5**	< 0.05
Fluoranthene	0.05	µg/g	9.6	-	-	-	0.166	0.175	0.434	**22**	**27**	< 0.05	**24**	0.07
Fluorene	0.05	µg/g	62	-	-	-	0.124	0.639	0.445	2.5	4.3	< 0.05	1.8	3.5
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	-	-	-	< 0.050	< 0.050	< 0.050	**4.4**	**3.1**	< 0.05	**6.1**	< 0.05
Methylnaphthalene, 1-	0.03	µg/g	34	-	-	-	< 0.030	0.034	0.04	-	-	-	-	-
Methylnaphthalene, 2-	0.03	µg/g	34	-	-	-	< 0.030	< 0.030	0.057	-	-	-	-	-
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	-	-	-	< 0.042	< 0.042	0.097	0.52	1.2	< 0.05	1.3	0.4
Naphthalene	0.013	µg/g	0.65	-	-	-	0.027	0.055	0.166	0.38	0.2	< 0.05	**1.3**	0.52
Phenanthrene	0.046	µg/g	270	-	-	-	0.409	1.38	1.22	14	31	< 0.05	12	0.24
Pyrene	0.05	µg/g	96	-	-	-	0.104	0.102	0.266	18	22	< 0.05	24	< 0.05
PCBs														
Arochlor 1242	0.01	µg/g	na	< 0.010	-	-	-	-	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.3
Arochlor 1248	0.01	µg/g	na	< 0.010	-	-	-	-	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.3
Arochlor 1254	0.01	µg/g	na	< 0.010	-	-	-	-	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.3
Arochlor 1260	0.01	µg/g	na	< 0.010	-	-	-	-	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.3
Total PCBs	0.1	µg/g	2.7	< 0.020	-	-	-	-	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.3

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Laboratory analysis by ALS, Mississauga, ON
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< - Denotes concentration less than indicated detection limit
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na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
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% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
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Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

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[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 2: **Preliminary Screening of COCs In Subsurface Soil 2013**
Central Park, Hamilton, ON

Sample Location Laboratory Sample ID SNC-Lavalin Sample ID Sampling Date (yyyy/mm/dd)			Table 5[1] Standard RL/PL/IN CG Subsurface	COCs	RDL (most updated)	Maximum RDL	Maximum (0 means no detects)	Maximum with RDL	Maximum with RDL x 1.2	Maximum Concentration Exceeded Generic Standard
Parameter	**RDL**	**Units**								
General Chemistry				**General Chemistry**						
Cyanide (CN-)	0.04	µg/g	0.051	Cyanide (CN-)	0.04	0.04	0.121	0.121	0.1452	Yes
Cyanide (WAD)	0.05	µg/g	0.051	Cyanide (WAD)	0.05	0.05	0	0.05	0.06	No
Electrical Conductivity	0.004	mS/cm	na	Electrical Conductivity	0.004	0.005	3680	3680	4416	No
pH [2]	-	pH	11	pH			9.22	9.22	11.064	No
Sodium Adsorption Ratio [3]	-	None	na	Sodium Adsorption Ratio			84.5	84.5	101.4	No
Soluble Sodium	1	mg/L	na	Soluble Sodium	1	1	790	790	948	No
Soluble Calcium	1	mg/L	na	Soluble Calcium	1	1	256	256	307.2	No
Soluble Magnesium	1	mg/L	na	Soluble Magnesium	1	1	19.9	19.9	23.88	No
Total Metals				**Total Metals**						
Antimony	0.8	µg/g	63	Antimony	1	1	29.6	29.6	35.52	No
Arsenic	0.2	µg/g	18	Arsenic	1	1	100	100	120	Yes
Barium	1	µg/g	7,700	Barium	1	1	1510	1510	1812	No
Beryllium	0.5	µg/g	60	Beryllium	0.5	0.5	1.1	1.1	1.32	No
Boron	5	µg/g	5,000	Boron	5	5	41	41	49.2	No
Boron (Hot Water Soluble)	0.1	µg/g	na	Boron (Hot Water Soluble)	0.1	0.1	2.89	2.89	3.468	No
Cadmium	0.5	µg/g	7.9	Cadmium	0.5	0.5	1.2	1.2	1.44	No
Chromium (total)	1	µg/g	11,000	Chromium (total)	1	1	56.3	56.3	67.56	No
Chromium (VI)	0.2	µg/g	40	Chromium (VI)	0.2	0.2	0.85	0.85	1.02	No
Cobalt	1	µg/g	250	Cobalt	1	1	14	14	16.8	No
Copper	1	µg/g	5,600	Copper	1	10	778	778	933.6	No
Lead	1	µg/g	1,000	Lead	1	10	1690	1690	2028	Yes
Mercury	0.005	µg/g	0.27	Mercury	0.005	0.5	40.5	40.5	48.6	Yes
Molybdenum	0.5	µg/g	1,200	Molybdenum	1	1	4.6	4.6	5.52	No
Nickel	1	µg/g	510	Nickel	1	1	58.9	58.9	70.68	No
Selenium	0.4	µg/g	1,200	Selenium	1	1	4.2	4.2	5.04	No
Silver	0.2	µg/g	490	Silver	0.2	0.2	1.1	1.1	1.32	No
Thallium	0.4	µg/g	3.3	Thallium	0.5	0.5	0.5	0.5	0.6	No
Uranium	0.5	µg/g	300	Uranium	1	1	0.9	1	1.2	No
Vanadium	1	µg/g	160	Vanadium	1	1	56	56	67.2	No
Zinc	5	µg/g	15,000	Zinc	5	800	847	847	1016.4	No
Volatiles				**Volatiles**						
Benzene	0.0068	µg/g	0.21	Benzene	0.0068	0.22	27.5	27.5	33	Yes
Toluene	0.05	µg/g	6.2	Toluene	0.08	2.6	13.6	13.6	16.32	Yes
Ethylbenzene	0.018	µg/g	2	Ethylbenzene	0.018	0.072	14.1	14.1	16.92	Yes
Xylenes	0.05	µg/g	3.1	Xylenes	0.05	0.96	24.9	24.9	29.88	Yes
m+p-Xylenes	0.03	µg/g	na	m+p-Xylenes	0.03	0.96	20.2	20.2	24.24	No
o-Xylenes	0.02	µg/g	na	o-Xylenes	0.02	0.08	6.24	6.24	7.488	No
Hexane (n)	0.05	µg/g	2.8	Hexane (n)	0.05	0.2	0.222	0.222	0.2664	No
Petroleum Hydrocarbon (PHC) Fractions				**Petroleum Hydrocarbon (PHC) Fractions**						
PHC F1	5	µg/g	55	PHC F1	5	5	180	180	216	Yes
PHC F2	10	µg/g	98	PHC F2	10	50	13200	13200	15840	Yes
PHC F3	50	µg/g	5,800	PHC F3	50	500	19000	19000	22800	Yes
PHC F4	50	µg/g	6,900	PHC F4	50	500	2170	2170	2604	No
PHC F4 (silica gel)	250	µg/g	6,900	PHC F4 (silica gel)	250	250	10200	10200	12240	Yes
Volatile Organic Compounds				**Volatile Organic Compounds**						
Bromodichloromethane	0.05	µg/g	18	Bromodichloromethane	0.05	0.05	0	0.05	0.06	No
Bromoform	0.05	µg/g	0.27	Bromoform	0.05	0.05	0	0.05	0.06	No
Bromomethane	0.05	µg/g	0.05	Bromomethane	0.05	0.05	0	0.05	0.06	No
Carbon Tetrachloride	0.05	µg/g	0.05	Carbon Tetrachloride	0.05	0.05	0	0.05	0.06	No
Chlorobenzene	0.05	µg/g	2.4	Chlorobenzene	0.05	0.05	0	0.05	0.06	No
Chloroform	0.04	µg/g	0.05	Chloroform	0.05	0.05	0	0.05	0.06	No
Dibromochloromethane	0.05	µg/g	13	Dibromochloromethane	0.05	0.05	0	0.05	0.06	No
Dichlorobenzene, 1,2- (o-DCB)	0.05	µg/g	34	Dichlorobenzene, 1,2- (o-DCB)	0.05	0.05	0	0.05	0.06	No
Dichlorobenzene, 1,3- (m-DCB)	0.05	µg/g	59	Dichlorobenzene, 1,3- (m-DCB)	0.05	0.05	0	0.05	0.06	No
Dichlorobenzene, 1,4- (p-DCB)	0.05	µg/g	0.083	Dichlorobenzene, 1,4- (p-DCB)	0.05	0.05	0	0.05	0.06	No
Dichlorodifluoromethane	0.05	µg/g	16	Dichlorodifluoromethane	0.05	0.05	0	0.05	0.06	No
Dichloroethane, 1,1-	0.02	µg/g	3.5	Dichloroethane, 1,1-	0.05	0.05	0	0.05	0.06	No
Dichloroethane, 1,2-	0.03	µg/g	0.05	Dichloroethane, 1,2-	0.05	0.05	0	0.05	0.06	No
Dichloroethylene, 1,1-	0.05	µg/g	0.05	Dichloroethylene, 1,1-	0.05	0.05	0	0.05	0.06	No
Dichloroethylene, cis-1,2-	0.02	µg/g	3.4	Dichloroethylene, cis-1,2-	0.05	0.05	0	0.05	0.06	No
Dichloroethylene, trans-1,2-	0.05	µg/g	0.084	Dichloroethylene, trans-1,2-	0.05	0.05	0	0.05	0.06	No
Dichloropropane, 1,2-	0.03	µg/g	0.05	Dichloropropane, 1,2-	0.05	0.05	0	0.05	0.06	No
Dichloropropene, 1,3-	0.042	µg/g	0.05	Dichloropropene, 1,3-	0.042	0.042	0	0.042	0.05	No
Ethylene Dibromide	0.04	µg/g	0.05	Ethylene Dibromide	0.05	0.05	0	0.05	0.06	No
Methyl Ethyl Ketone	0.5	µg/g	16	Methyl Ethyl Ketone	0.5	0.5	0	0.5	0.60	No
Methyl Isobutyl Ketone	0.5	µg/g	6.6	Methyl Isobutyl Ketone	0.5	0.5	0	0.5	0.60	No
Methyl tert butyl ether (MTBE)	0.05	µg/g	0.75	Methyl tert butyl ether (MTBE)	0.05	0.05	0	0.05	0.06	No
Methylene Chloride	0.05	µg/g	0.1	Methylene Chloride	0.05	0.05	0	0.05	0.06	No
Styrene	0.05	µg/g	16	Styrene	0.05	0.05	0.381	0.381	0.46	No
Tetrachloroethane, 1,1,1,2-	0.04	µg/g	0.058	Tetrachloroethane, 1,1,1,2-	0.05	0.05	0	0.05	0.06	No
Tetrachloroethane, 1,1,2,2-	0.05	µg/g	0.05	Tetrachloroethane, 1,1,2,2-	0.05	0.05	0	0.05	0.06	No
Tetrachloroethylene	0.05	µg/g	0.28	Tetrachloroethylene	0.05	0.05	0	0.05	0.06	No
Trichloroethane, 1,1,1-	0.05	µg/g	0.38	Trichloroethane, 1,1,1-	0.05	0.05	0	0.05	0.06	No
Trichloroethane, 1,1,2-	0.04	µg/g	0.05	Trichloroethane, 1,1,2-	0.05	0.05	0	0.05	0.06	No
Trichloroethylene	0.01	µg/g	0.061	Trichloroethylene	0.01	0.03	2.47	2.47	2.96	Yes
Trichlorofluoromethane	0.05	µg/g	4	Trichlorofluoromethane	0.05	0.05	0	0.05	0.06	No
Vinyl Chloride [4]	0.02	µg/g	0.02	Vinyl Chloride	0.02	0.02	0	0.267	0.32	Yes
PAHs				**PAHs**						
Acenaphthene	0.05	µg/g	7.9	Acenaphthene	0.05	0.05	499	499	598.8	Yes
Acenaphthylene	0.05	µg/g	0.15	Acenaphthylene	0.05	0.05	39.6	39.6	47.52	Yes
Anthracene	0.05	µg/g	0.67	Anthracene	0.05	0.05	350	350	420	Yes
Benzo(a)anthracene	0.05	µg/g	0.96	Benzo(a)anthracene	0.05	0.05	200	200	240	Yes
Benzo(a)pyrene	0.05	µg/g	0.3	Benzo(a)pyrene	0.05	0.05	100	100	120	Yes
Benzo(b)fluoranthene	0.05	µg/g	0.96	Benzo(b)fluoranthene	0.05	0.05	150	150	180	Yes
Benzo(g,h,i)perylene	0.05	µg/g	9.6	Benzo(g,h,i)perylene	0.05	0.05	54	54	64.8	Yes
Benzo(k)fluoranthene	0.05	µg/g	0.96	Benzo(k)fluoranthene	0.05	0.05	79	79	94.8	Yes
Chrysene	0.05	µg/g	9.6	Chrysene	0.05	0.05	170	170	204	Yes
Dibenzo(a,h)anthracene	0.05	µg/g	0.1	Dibenzo(a,h)anthracene	0.05	0.05	12	12	14.4	Yes
Fluoranthene	0.05	µg/g	9.6	Fluoranthene	0.05	0.05	660	660	792	Yes
Fluorene	0.05	µg/g	62	Fluorene	0.05	0.05	397	397	476.4	Yes
Indeno(1,2,3-cd)pyrene	0.05	µg/g	0.96	Indeno(1,2,3-cd)pyrene	0.05	0.05	52	52	62.4	Yes
Methylnaphthalene, 1-	0.03	µg/g	34	Methylnaphthalene, 1-	0.03	0.03	211	211	253.2	Yes
Methylnaphthalene, 2-	0.03	µg/g	34	Methylnaphthalene, 2-	0.03	0.03	497	497	596.4	Yes
Methylnaphthalene, 1- & 2- [5]	0.042	µg/g	345	Methylnaphthalene, 1- & 2-	0.042	0.042	704	704	844.8	Yes
Naphthalene	0.013	µg/g	0.65	Naphthalene	0.013	0.05	2530	2530	3036	Yes
Phenanthrene	0.046	µg/g	270	Phenanthrene	0.05	0.05	910	910	1092	Yes
Pyrene	0.05	µg/g	96	Pyrene	0.05	0.05	460	460	552	Yes
PCBs				**PCBs**						
Arochlor 1242	0.01	µg/g	na	Arochlor 1242	0.01	0.3	0	0.3	0.36	No
Arochlor 1248	0.01	µg/g	na	Arochlor 1248	0.01	0.3	0	0.3	0.36	No
Arochlor 1254	0.01	µg/g	na	Arochlor 1254	0.01	0.3	0	0.3	0.36	No
Arochlor 1260	0.01	µg/g	na	Arochlor 1260	0.01	0.3	0.3	0.3	0.36	No
Total PCBs	0.1	µg/g	2.7	Total PCBs	0.02	0.3	0.3	0.3	0.36	No

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
Field Screen - organic vapour meter reading
mbgs - meter below ground surface
Conversion factor of 1% LEL = 110 ppmv applied
ppmv - parts per million by volume (relative to hexane)
% - percent
µg/g - micrograms per gram, dry weight basis
mg/L - milligrams per litre
mS/cm - milliSiemens per centimetre
Yes - COCs that were retained for further secondary screening
No - COCs that were not retained for further secondary screening
BOLD Concentration greater than Table 5 Standard

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[3] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[5] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

TABLE 3: **Preliminary Screening of Groundwater Analytical Results - Shallow Groundwater Condition**
Central Park, Hamilton, ON

Sample Location			Table 7[2]	MW-104	MW-104	MW-104	MW-104	MW-115	MW-115	MW-115	MW-116
Laboratory Sample ID			Standard	4841730	4974192	7757452	L2162292-1	4841744	4974191	L2163169-4	14T916426
SNC-Lavalin Sample ID			CG	MW-104	MW-104	MW-104	MW-104	MW-115	MW-115	MW-115	MW-116
Sampling Date (yyyy/mm/dd)				2013/10/11	2013/11/18	2016/08/15	2018/09/10	2013/10/11	2013/11/18	2018/09/11	2014/11/14
Parameter	**RDL**	**Units**									
Water Table Depth				2.2	2.2	2.2	2.2	2.5	2.5	2.5	2.1
General Chemistry											
Chloride	0.1	mg/L	1,800	721	-	908	-	860	-	-	-
Cyanide (CN-)	0.002	mg/L	0.052	0.007	-	< 0.002	-	< 0.002	-	-	-
Electrical Conductivity	2	µS/cm	na	3,460	-	4,070	-	3,300	-	-	-
Nitrite	0.25	mg/L	na	< 0.25	-	-	-	< 1	-	-	-
pH	-	pH	na	8.12	-	8.03	-	8.12	-	-	-
Total Suspended Solids	10	mg/L	na	-	11	-	-	-	-	-	-
Dissolved Metals											
Antimony	0.10	µg/L	16,000	< 0.5	-	< 1.0	< 1.0	< 0.5	-	< 1.0	-
Arsenic	1.0	µg/L	1,500	10.7	-	4	< 1.0	5.8	-	7.4	-
Barium	1.0	µg/L	23,000	374	-	329	389	167	-	239	-
Beryllium	0.10	µg/L	53	3.4	-	< 0.5	< 1.0	2.2	-	< 1.0	-
Boron	10	µg/L	36,000	484	-	394	450	255	-	280	-
Cadmium	0.010	µg/L	2.1	< 0.2	-	< 0.2	< 0.050	< 0.2	-	< 0.050	-
Chromium (total)	0.50	µg/L	640	5.5	-	12.4	< 5.0	2.7	-	< 5.0	-
Chromium (VI)	5	µg/L	110	< 5	-	5	-	< 5	-	-	-
Cobalt	0.10	µg/L	52	1	-	< 0.5	< 1.0	< 0.5	-	< 1.0	-
Copper	0.20	µg/L	69	< 1	-	< 1	< 2.0	< 1	-	< 2.0	-
Lead	0.050	µg/L	20	< 0.5	-	< 0.5	< 0.50	< 0.5	-	< 0.50	-
Mercury	0.010	µg/L	0.1	< 0.02	-	< 0.02	< 0.010	< 0.02	-	< 0.010	-
Molybdenum	0.050	µg/L	7,300	0.7	-	< 0.5	< 0.50	< 0.5	-	< 0.50	-
Nickel	0.50	µg/L	390	1.7	-	< 1	< 5.0	1.5	-	< 5.0	-
Selenium	0.050	µg/L	50	< 1	-	< 1	< 0.50	2.2	-	< 0.50	-
Silver	0.050	µg/L	1.2	< 0.2	-	< 0.2	< 0.50	< 0.2	-	< 0.50	-
Sodium	1,000	µg/L	1,800,000	383,000	-	498,000	492,000	367,000	-	451,000	-
Thallium	0.010	µg/L	400	< 0.3	-	< 0.3	< 0.10	< 0.3	-	< 0.10	-
Uranium	0.10	µg/L	330	0.6	-	< 0.5	< 0.10	< 0.5	-	< 0.10	-
Vanadium	0.50	µg/L	200	3.7	-	2.1	< 5.0	2.9	-	< 5.0	-
Zinc	1.0	µg/L	890	< 5	-	< 5	< 10	< 5	-	< 10	-
Petroleum Hydrocarbon (PHC) Fractions											
PHC F1	25	µg/L	420	< 25	100	< 25	< 64	40	< 25	< 67	-
PHC F2	100	µg/L	150	12,000	19,000	10,000	12,700	1,500	5,800	7,460	230
PHC F3	100	µg/L	500	< 100	2,300	< 100	550	< 100	510	< 250	< 100
PHC F4	100	µg/L	500	< 100	< 100	< 100	< 500	< 100	< 100	< 250	< 100
Volatile Organic Compounds											
Acetone	1	µg/L	100,000	< 10.0	< 1	< 1	< 30	< 10.0	< 4.0	< 30	-
Benzene	0.2	µg/L	0.5	350	200	170	195	320	660	318	-
Bromodichloromethane	0.2	µg/L	67,000	< 2.00	< 0.2	< 0.2	< 2.0	< 2.00	< 0.80	< 2.0	-
Bromoform	0.1	µg/L	5	< 1.00	< 0.1	< 0.1	< 5.0	< 1.00	< 0.40	< 5.0	-
Bromomethane	0.2	µg/L	0.89	< 2.00[1]	< 0.2	< 0.2	< 0.50	< 2.00[1]	< 0.80	< 0.50	-
Carbon Tetrachloride	0.20	µg/L	0.2	< 2.00[1]	< 0.2	< 0.2	< 0.20	< 2.00[1]	< 0.79[1]	< 0.20	-
Chlorobenzene	0.1	µg/L	140	< 1.00	< 0.1	< 0.1	< 0.50	< 1.00	< 0.40	< 0.50	-
Chloroform	0.2	µg/L	2	< 2.00	< 0.2	< 0.2	< 1.0	< 2.00	< 0.80	< 1.0	-
Dibromochloromethane	0.1	µg/L	65,000	< 1.00	< 0.1	< 0.1	< 2.0	< 1.00	< 0.40	< 2.0	-
Dichlorobenzene, 1,2- (o-DCB)	0.1	µg/L	150	< 1.00	< 0.1	< 0.1	< 0.50	< 1.00	< 0.40	< 0.50	-
Dichlorobenzene, 1,3- (m-DCB)	0.1	µg/L	7,600	< 1.00	< 0.1	< 0.1	< 0.50	< 1.00	< 0.40	< 0.50	-
Dichlorobenzene, 1,4- (p-DCB)	0.1	µg/L	0.5	< 1.00[1]	< 0.1	< 0.1	< 0.50	< 1.00[1]	< 0.40	< 0.50	-
Dichlorodifluoromethane	0.2	µg/L	3,500	< 2.00	< 0.2	< 0.2	< 2.0	< 2.00	< 0.80	< 2.0	-
Dichloroethane, 1,1-	0.3	µg/L	11	< 3.00	< 0.3	< 0.3	< 0.50	< 3.00	< 1.20	< 0.50	-
Dichloroethane, 1,2-	0.2	µg/L	0.5	< 2.00[1]	0.27	< 0.2	< 0.50	< 2.00[1]	< 0.80[1]	< 0.50	-
Dichloroethylene, 1,1-	0.3	µg/L	0.5	< 3.00[1]	< 0.3	< 0.3	< 0.50	< 3.00[1]	< 1.20[1]	< 0.50	-
Dichloroethylene, cis-1,2-	0.2	µg/L	1.6	< 2.00[1]	< 0.2	< 0.2	< 0.50	< 2.00[1]	< 0.80	< 0.50	-
Dichloroethylene, trans-1,2-	0.2	µg/L	1.6	< 2.00[1]	< 0.2	< 0.2	< 0.50	< 2.00[1]	< 0.80	< 0.50	-
Dichloropropane, 1,2-	0.2	µg/L	0.58	< 2.00[1]	< 0.2	< 0.2	< 0.50	< 2.00[1]	< 0.80[1]	< 0.50	-
Dichloropropene, 1,3-	0.50	µg/L	0.5	-	-	-	< 0.50	-	-	< 0.50	-
Dichloropropene, cis-1,3-	0.30	µg/L	na	-	-	-	< 0.30	-	-	< 0.30	-
Dichloropropene, trans-1,3-	0.30	µg/L	na	-	-	-	< 0.30	-	-	< 0.30	-
Ethylbenzene	0.1	µg/L	54	90	48	44	41.9	100	190	121	-
Ethylene Dibromide (Dibromoethane, 1,2-)	0.1	µg/L	0.2	< 1.00[1]	< 0.1	< 0.1	< 0.20	< 1.00[1]	< 0.25[1]	< 0.20	-
Hexane (n)	0.10	µg/L	5	< 2.00	< 0.2	< 0.2	< 0.50	< 2.00	< 0.80	< 0.50	-
Methyl Ethyl Ketone	1	µg/L	21,000	< 10.0	< 1	< 1	< 20	< 10.0	< 4.0	< 20	-
Methyl Isobutyl Ketone	1	µg/L	5,200	< 10.0	< 1	< 1	< 20	< 10.0	< 4.0	< 20	-
Methyl t-butyl ether (MTBE)	0.2	µg/L	15	< 2.00	< 0.2	< 0.2	< 2.0	< 2.00	< 0.80	< 2.0	-
Methylene Chloride	0.3	µg/L	26	< 3.00	< 0.3	< 0.3	< 5.0	< 3.00	< 1.20	< 5.0	-
Styrene	0.1	µg/L	43	1.7	1.7	0.54	< 0.50	< 1.00	< 0.40	< 0.50	-
Tetrachloroethane, 1,1,1,2-	0.1	µg/L	1.1	< 1.00	< 0.1	< 0.1	< 0.50	< 1.00	< 0.40	< 0.50	-
Tetrachloroethane, 1,1,2,2-	0.1	µg/L	0.5	< 1.00[1]	< 0.1	< 0.1	< 0.50	< 1.00[1]	< 0.40	< 0.50	-
Tetrachloroethylene	0.2	µg/L	0.5	< 2.00[1]	< 0.2	< 0.2	< 0.50	< 2.00[1]	< 0.80[1]	< 0.50	-
Toluene	0.2	µg/L	320	94	53	40	48.6	2.2	9.4	3.97	-
Trichloroethane, 1,1,1-	0.3	µg/L	23	< 3.00	< 0.3	< 0.3	< 0.50	< 3.00	< 1.20	< 0.50	-
Trichloroethane, 1,1,2-	0.2	µg/L	0.5	< 2.00[1]	< 0.2	< 0.2	< 0.50	< 2.00[1]	< 0.80[1]	< 0.50	-
Trichloroethylene	0.2	µg/L	0.5	< 2.00[1]	< 0.2	< 0.2	< 0.50	< 2.00[1]	< 0.80[1]	< 0.50	-
Trichlorofluoromethane	0.4	µg/L	2,000	< 4.00	< 0.4	< 0.4	< 5.0	< 4.00	< 1.60	< 5.0	-
Vinyl Chloride [4]	0.17	µg/L	0.5	< 1.70[1]	< 0.17	< 0.17	< 0.50	< 1.70[1]	< 0.50	< 0.50	-
Xylenes	0.2	µg/L	72	290	150	110	139	55	110	56.4	-
Xylenes, m+p-	0.40	µg/L	na	-	-	-	81.1	-	-	32.1	-
Xylenes, o-	0.30	µg/L	na	-	-	-	57.6	-	-	24.3	-
PAHs											
Acenaphthene	0.020	µg/L	17	370	310	270	219	58	80	152	-
Acenaphthylene	0.020	µg/L	1	19	7.4	< 0.2	2.32	< 0.2	0.43	0.852	-
Anthracene	0.020	µg/L	1	16	18	14	10.1	< 0.1	0.2	0.096	-
Benzo(a)anthracene	0.020	µg/L	1.8	< 0.2	0.21	0.55	0.351	< 0.2	< 0.2	0.02	-
Benzo(a)pyrene	0.010	µg/L	0.81	< 0.01	< 0.01	0.42	0.097	< 0.01	< 0.01	0.012	-
Benzo(b)fluoranthene	0.020	µg/L	0.75	< 0.1	< 0.1	0.57	0.132	< 0.1	< 0.1	< 0.020	-
Benzo(g,h,i)perylene	0.020	µg/L	0.2	< 0.2	< 0.2	0.27	0.037	< 0.2	< 0.2	< 0.020	-
Benzo(k)fluoranthene	0.020	µg/L	0.4	< 0.1	< 0.1	0.27	0.043	< 0.1	< 0.1	< 0.020	-
Chrysene	0.020	µg/L	0.7	0.16	0.16	0.39	0.236	< 0.1	< 0.1	< 0.020	-
Dibenzo(a,h)anthracene	0.020	µg/L	0.4	< 0.2	< 0.2	< 0.2	< 0.020	< 0.2	< 0.2	< 0.020	-
Fluoranthene	0.020	µg/L	44	9.7	11	12	9.68	< 0.2	< 0.2	0.113	-
Fluorene	0.020	µg/L	290	130	130	110	90.2	4.2	7.6	17.2	-
Indeno(1,2,3-cd)pyrene	0.020	µg/L	0.2	< 0.2	< 0.2	0.2	0.049	< 0.2	< 0.2	< 0.020	-
Methylnaphthalene, 1-	0.020	µg/L	1,500	-	-	-	343	-	-	247	-
Methylnaphthalene, 2-	0.020	µg/L	1,500	-	-	-	484	-	-	246	-
Methylnaphthalene, 1- & 2-	0.028	µg/L	1500 [3]	-	-	-	827	-	-	494	-
Naphthalene	0.050	µg/L	7	12,000	14,000	10,000	8,880	1,500	2,900	5,520	-
Phenanthrene	0.020	µg/L	380	120	140	120	90.8	1.3	2.8	10.2	-
Pyrene	0.020	µg/L	5.7	5.9	7	7.7	5.2	< 0.2	< 0.2	0.076	-
PCBs											
Arochlor 1242	0.020	µg/L	na	< 0.1	-	-	-	< 0.1	-	-	-
Arochlor 1248	0.020	µg/L	na	< 0.1	-	-	-	< 0.1	-	-	-
Arochlor 1254	0.020	µg/L	na	< 0.1	-	-	-	< 0.1	-	-	-
Arochlor 1260	0.020	µg/L	na	< 0.1	-	-	-	< 0.1	-	-	-
Total PCBs	0.1	µg/L	0.2	< 0.1	-	-	-	< 0.1	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/L – micrograms per litre
µS/cm - microSiemens per centimetre
mg/L - milligrams per litre
UNDERLINE Concentration greater than Table 7 Standard

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

[2] Table 7 generic site condition standards for shallow soils in a non-potable groundwater condition for all types of property use, coarse textured soils (MOE, 2011)

[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

TABLE 3: **Preliminary Screening of Groundwater Analyt**
Central Park, Hamilton, ON

Sample Location			Table 7[2]	MW-116	MW-116	MW-116	MW-116	MW-116	MW-09-17	BH-17-17	MW18-02	MW18-05	MW18-07	MW-18-17	MW18-24
Laboratory Sample ID			Standard	14T916999	5999699	5999703	6282368	L2163993-3	L2163169-3	L2171531-1	L2162292-6	L2162292-3	L2162292-7	L2163993-1	L2170681-1
SNC-Lavalin Sample ID			CG	MW-116	MW-116	MW-120	MW-116	MW-116	MW-09-17	BH-17-17	MW18-02	MW18-05	MW18-07	MW18-17	MW18-24
Sampling Date (yyyy/mm/dd)				2014/11/17	2014/10/24	2014/10/24	2015/01/28	2018/09/12	2018/09/11	2018/09/25	2018/09/10	2018/09/10	2018/09/10	2018/09/12	2018/09/24
Parameter	**RDL**	**Units**													
Water Table Depth				2.1	2.1	2.1	2.1	2.1	1.7	?	3	2.8	2.45	2.4	2.8
General Chemistry															
Chloride	0.1	mg/L	1,800	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide (CN-)	0.002	mg/L	0.052	-	-	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	2	µS/cm	na	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite	0.25	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-
pH	-	pH	na	-	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids	10	mg/L	na	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Metals															
Antimony	0.10	µg/L	16,000	-	-	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.3	< 1.0
Arsenic	1.0	µg/L	1,500	-	-	-	-	1.1	< 1.0	19.9	< 1.0	< 1.0	< 1.0	2.3	< 1.0
Barium	1.0	µg/L	23,000	-	-	-	-	101	162	272	75.1	100	86.4	72.5	63.5
Beryllium	0.10	µg/L	53	-	-	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Boron	10	µg/L	36,000	-	-	-	-	1,930	200	230	290	310	220	260	290
Cadmium	0.010	µg/L	2.1	-	-	-	-	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	0.167	0.118
Chromium (total)	0.50	µg/L	640	-	-	-	-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chromium (VI)	5	µg/L	110	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	0.10	µg/L	52	-	-	-	-	1.1	< 1.0	< 1.0	1.8	< 1.0	< 1.0	3.7	1.8
Copper	0.20	µg/L	69	-	-	-	-	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	9.5	< 2.0
Lead	0.050	µg/L	20	-	-	-	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Mercury	0.010	µg/L	0.1	-	-	-	-	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Molybdenum	0.050	µg/L	7,300	-	-	-	-	45	< 0.50	< 0.50	1.01	0.52	< 0.50	21.9	0.83
Nickel	0.50	µg/L	390	-	-	-	-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	11.2	< 5.0
Selenium	0.050	µg/L	50	-	-	-	-	< 0.50	6.22	< 0.50	0.64	0.78	0.82	< 0.50	< 0.50
Silver	0.050	µg/L	1.2	-	-	-	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sodium	1,000	µg/L	1,800,000	-	-	-	-	310,000	333,000	361,000	269,000	758,000	438,000	369,000	322,000
Thallium	0.010	µg/L	400	-	-	-	-	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Uranium	0.10	µg/L	330	-	-	-	-	4.38	1.57	< 0.10	2.01	0.8	0.78	4.76	2.07
Vanadium	0.50	µg/L	200	-	-	-	-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Zinc	1.0	µg/L	890	-	-	-	-	11	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Petroleum Hydrocarbon (PHC) Fractions															
PHC F1	25	µg/L	420	-	< 25	-	< 25	< 25	< 25	270	< 25	< 25	< 25	< 25	< 25
PHC F2	100	µg/L	150	620	510	-	< 100	< 100	< 100	20,400	< 100	< 100	< 100	< 100	< 100
PHC F3	100	µg/L	500	< 100	< 100	-	< 100	< 250	< 250	< 500	< 250	< 250	< 250	< 250	< 250
PHC F4	100	µg/L	500	< 100	< 100	-	< 100	< 250	< 250	< 500	< 250	< 250	< 250	< 250	< 250
Volatile Organic Compounds															
Acetone	1	µg/L	100,000	-	< 1	< 1	-	< 30	< 30	< 30	32	35	73	< 30	< 30
Benzene	0.2	µg/L	0.5	-	1.4	1.5	-	< 0.50	< 0.50	374	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Bromodichloromethane	0.2	µg/L	67,000	-	< 0.2	< 0.2	-	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Bromoform	0.1	µg/L	5	-	< 0.1	< 0.1	-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Bromomethane	0.2	µg/L	0.89	-	< 0.2	< 0.2	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Carbon Tetrachloride	0.20	µg/L	0.2	-	< 0.2	< 0.2	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chlorobenzene	0.1	µg/L	140	-	< 0.1	< 0.1	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chloroform	0.2	µg/L	2	-	< 0.2	< 0.2	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromochloromethane	0.1	µg/L	65,000	-	< 0.1	< 0.1	-	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dichlorobenzene, 1,2- (o-DCB)	0.1	µg/L	150	-	< 0.1	< 0.1	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorobenzene, 1,3- (m-DCB)	0.1	µg/L	7,600	-	< 0.1	< 0.1	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorobenzene, 1,4- (p-DCB)	0.1	µg/L	0.5	-	< 0.1	< 0.1	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorodifluoromethane	0.2	µg/L	3,500	-	< 0.2	< 0.2	-	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dichloroethane, 1,1-	0.3	µg/L	11	-	< 0.3	< 0.3	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethane, 1,2-	0.2	µg/L	0.5	-	< 0.2	< 0.2	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethylene, 1,1-	0.3	µg/L	0.5	-	< 0.3	< 0.3	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethylene, cis-1,2-	0.2	µg/L	1.6	-	< 0.2	< 0.2	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.84
Dichloroethylene, trans-1,2-	0.2	µg/L	1.6	-	< 0.2	< 0.2	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloropropane, 1,2-	0.2	µg/L	0.58	-	< 0.2	< 0.2	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloropropene, 1,3-	0.50	µg/L	0.5	-	-	-	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloropropene, cis-1,3-	0.30	µg/L	na	-	-	-	-	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Dichloropropene, trans-1,3-	0.30	µg/L	na	-	-	-	-	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Ethylbenzene	0.1	µg/L	54	-	10	19	-	< 0.50	< 0.50	195	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Ethylene Dibromide (Dibromoethane, 1,2-)	0.1	µg/L	0.2	-	< 0.1	< 0.1	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Hexane (n)	0.10	µg/L	5	-	< 0.2	< 0.2	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Methyl Ethyl Ketone	1	µg/L	21,000	-	< 1	< 1	-	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Methyl Isobutyl Ketone	1	µg/L	5,200	-	< 1	< 1	-	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Methyl t-butyl ether (MTBE)	0.2	µg/L	15	-	< 0.2	< 0.2	-	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Methylene Chloride	0.3	µg/L	26	-	< 0.3	< 0.3	-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Styrene	0.1	µg/L	43	-	< 0.1	< 0.1	-	< 0.50	< 0.50	2.84	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Tetrachloroethane, 1,1,1,2-	0.1	µg/L	1.1	-	< 0.1	< 0.1	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Tetrachloroethane, 1,1,2,2-	0.1	µg/L	0.5	-	< 0.1	< 0.1	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Tetrachloroethylene	0.2	µg/L	0.5	-	< 0.2	< 0.2	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Toluene	0.2	µg/L	320	-	0.81	0.82	-	< 0.50	< 0.50	70.5	< 0.50	< 0.50	< 0.50	0.55	< 0.50
Trichloroethane, 1,1,1-	0.3	µg/L	23	-	< 0.3	< 0.3	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Trichloroethane, 1,1,2-	0.2	µg/L	0.5	-	< 0.2	< 0.2	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Trichloroethylene	0.2	µg/L	0.5	-	< 0.2	< 0.2	-	< 0.50	< 0.50	< 0.50	< 0.50	0.56	0.64	< 0.50	17.6
Trichlorofluoromethane	0.4	µg/L	2,000	-	< 0.4	< 0.4	-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Vinyl Chloride [4]	0.17	µg/L	0.5	-	< 0.17	< 0.17	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Xylenes	0.2	µg/L	72	-	9.6	22	-	< 0.50	< 0.50	468	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Xylenes, m+p-	0.40	µg/L	na	-	-	-	-	< 0.40	< 0.40	292	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
Xylenes, o-	0.30	µg/L	na	-	-	-	-	< 0.30	< 0.30	176	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
PAHs															
Acenaphthene	0.020	µg/L	17	-	36	-	< 0.2	2.46	< 0.020	154	< 0.020	< 0.020	0.684	< 0.020	< 0.020
Acenaphthylene	0.020	µg/L	1	-	1.4	-	0.41	0.065	< 0.020	2.81	< 0.020	< 0.020	1.47	< 0.020	< 0.020
Anthracene	0.020	µg/L	1	-	2.3	-	0.12	0.255	< 0.020	5.56	< 0.020	< 0.020	0.792	< 0.020	< 0.020
Benzo(a)anthracene	0.020	µg/L	1.8	-	< 0.2	-	< 0.2	0.146	< 0.020	0.211	< 0.020	< 0.020	0.163	0.091	< 0.020
Benzo(a)pyrene	0.010	µg/L	0.81	-	0.03	-	< 0.01	0.062	< 0.010	0.072	< 0.010	< 0.010	0.048	0.08	< 0.010
Benzo(b)fluoranthene	0.020	µg/L	0.75	-	< 0.1	-	< 0.1	0.082	< 0.020	0.116	< 0.020	< 0.020	0.065	0.108	< 0.020
Benzo(g,h,i)perylene	0.020	µg/L	0.2	-	< 0.2	-	< 0.2	0.036	< 0.020	0.027	< 0.020	< 0.020	0.02	0.057	< 0.020
Benzo(k)fluoranthene	0.020	µg/L	0.4	-	< 0.1	-	< 0.1	0.033	< 0.020	0.04	< 0.020	< 0.020	0.026	0.037	< 0.020
Chrysene	0.020	µg/L	0.7	-	< 0.1	-	< 0.1	0.109	< 0.020	0.148	< 0.020	< 0.020	0.109	0.073	< 0.020
Dibenzo(a,h)anthracene	0.020	µg/L	0.4	-	< 0.2	-	< 0.2	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
Fluoranthene	0.020	µg/L	44	-	0.84	-	< 0.2	0.558	< 0.020	2.27	< 0.020	< 0.020	1.58	0.138	< 0.020
Fluorene	0.020	µg/L	290	-	22	-	< 0.2	0.929	< 0.020	73.6	< 0.020	< 0.020	2.22	< 0.020	< 0.020
Indeno(1,2,3-cd)pyrene	0.020	µg/L	0.2	-	< 0.2	-	< 0.2	0.042	< 0.020	0.038	< 0.020	< 0.020	0.029	0.074	< 0.020
Methylnaphthalene, 1-	0.020	µg/L	1,500	-	-	-	-	1.78	< 0.020	330	< 0.020	< 0.020	1.42	< 0.020	< 0.020
Methylnaphthalene, 2-	0.020	µg/L	1,500	-	-	-	-	0.023	< 0.020	571	< 0.020	< 0.020	0.229	< 0.020	< 0.020
Methylnaphthalene, 1- & 2-	0.028	µg/L	1500 [3]	-	-	-	-	1.81	< 0.028	902	< 0.028	< 0.028	1.65	< 0.028	< 0.028
Naphthalene	0.050	µg/L	7	-	30	-	< 0.2	0.286	< 0.050	7,710	0.054	< 0.050	2.7	0.066	0.094
Phenanthrene	0.020	µg/L	380	-	16	-	< 0.1	1.23	< 0.020	48.8	< 0.020	< 0.020	3.15	0.049	0.031
Pyrene	0.020	µg/L	5.7	-	0.47	-	< 0.2	0.447	< 0.020	1.34	< 0.020	< 0.020	1.26	0.128	< 0.020
PCBs															
Arochlor 1242	0.020	µg/L	na	-	-	-	-	-	-	-	-	-	-	-	< 0.020
Arochlor 1248	0.020	µg/L	na	-	-	-	-	-	-	-	-	-	-	-	< 0.020
Arochlor 1254	0.020	µg/L	na	-	-	-	-	-	-	-	-	-	-	-	< 0.020
Arochlor 1260	0.020	µg/L	na	-	-	-	-	-	-	-	-	-	-	-	< 0.020
Total PCBs	0.1	µg/L	0.2	-	-	-	-	-	-	-	-	-	-	-	< 0.040

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/L – micrograms per litre
µS/cm - microSiemens per centimetre
mg/L - milligrams per litre
UNDERLINE Concentration greater than Table 7 Standard

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

[2] Table 7 generic site condition standards for shallow soils in a non-potable groundwater condition for all types of property use, coarse textured soils (MOE, 2011)

[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

TABLE 3: **Preliminary Screening of Groundwater Analyt**
Central Park, Hamilton, ON

Sample Location			Table 7[2]	MW18-25	MW18-26	MW18-27	MW18-28	MW18-29	TP-1
Laboratory Sample ID			Standard	L2170681-2	L2170681-3	L2170681-4	L2171531-2	L2171531-3	4781208
SNC-Lavalin Sample ID			CG	MW18-25	MW18-26	MW18-27	MW18-28	MW18-29	TP-1
Sampling Date (yyyy/mm/dd)				2018/09/24	2018/09/24	2018/09/24	2018/09/25	2018/09/25	2013/09/25
Parameter	**RDL**	**Units**							
Water Table Depth				2.6	3	2.8	2.2	2.1	
General Chemistry									
Chloride	0.1	mg/L	1,800	-	-	-	-	-	-
Cyanide (CN-)	0.002	mg/L	0.052	-	-	-	-	-	-
Electrical Conductivity	2	µS/cm	na	-	-	-	-	-	-
Nitrite	0.25	mg/L	na	-	-	-	-	-	-
pH	-	pH	na	-	-	-	-	-	-
Total Suspended Solids	10	mg/L	na	-	-	-	-	-	-
Dissolved Metals									
Antimony	0.10	µg/L	16,000	-	-	1.4	< 1.0	-	-
Arsenic	1.0	µg/L	1,500	-	-	16.9	2.8	-	-
Barium	1.0	µg/L	23,000	-	-	193	228	-	-
Beryllium	0.10	µg/L	53	-	-	< 1.0	< 1.0	-	-
Boron	10	µg/L	36,000	-	-	450	270	-	-
Cadmium	0.010	µg/L	2.1	-	-	< 0.050	< 0.050	-	-
Chromium (total)	0.50	µg/L	640	-	-	< 5.0	< 5.0	-	-
Chromium (VI)	5	µg/L	110	-	-	-	-	-	-
Cobalt	0.10	µg/L	52	-	-	< 1.0	< 1.0	-	-
Copper	0.20	µg/L	69	-	-	< 2.0	< 2.0	-	-
Lead	0.050	µg/L	20	-	-	< 0.50	< 0.50	-	-
Mercury	0.010	µg/L	0.1	-	-	< 10[1]	< 0.010	-	-
Molybdenum	0.050	µg/L	7,300	-	-	3.47	< 0.50	-	-
Nickel	0.50	µg/L	390	-	-	< 5.0	< 5.0	-	-
Selenium	0.050	µg/L	50	-	-	0.6	< 0.50	-	-
Silver	0.050	µg/L	1.2	-	-	< 0.50	< 0.50	-	-
Sodium	1,000	µg/L	1,800,000	-	-	55,500	265,000	-	-
Thallium	0.010	µg/L	400	-	-	< 0.10	< 0.10	-	-
Uranium	0.10	µg/L	330	-	-	1.15	< 0.10	-	-
Vanadium	0.50	µg/L	200	-	-	< 5.0	< 5.0	-	-
Zinc	1.0	µg/L	890	-	-	< 10	10	-	-
Petroleum Hydrocarbon (PHC) Fractions									
PHC F1	25	µg/L	420	< 25	670	< 3,600[1]	1,380	790	-
PHC F2	100	µg/L	150	610	16,600	33,900	28,200	24,000	2,600
PHC F3	100	µg/L	500	< 250	500	< 1,000[1]	890	< 500	1,100
PHC F4	100	µg/L	500	< 250	< 500	< 1,000[1]	< 500	< 500	< 100
Volatile Organic Compounds									
Acetone	1	µg/L	100,000	-	< 30	< 30	< 30	< 30	-
Benzene	0.2	µg/L	0.5	2.85	215	17,100	1,510	1,110	-
Bromodichloromethane	0.2	µg/L	67,000	-	< 2.0	< 2.0	< 2.0	< 2.0	-
Bromoform	0.1	µg/L	5	-	< 5.0	< 5.0	< 5.0	< 5.0	-
Bromomethane	0.2	µg/L	0.89	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Carbon Tetrachloride	0.20	µg/L	0.2	-	< 0.20	< 0.20	< 0.20	< 0.20	-
Chlorobenzene	0.1	µg/L	140	-	< 8.0	< 5.5	< 0.50	< 0.50	-
Chloroform	0.2	µg/L	2	-	< 1.0	< 1.0	< 1.0	< 1.0	-
Dibromochloromethane	0.1	µg/L	65,000	-	< 2.0	< 2.0	< 2.0	< 2.0	-
Dichlorobenzene, 1,2- (o-DCB)	0.1	µg/L	150	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Dichlorobenzene, 1,3- (m-DCB)	0.1	µg/L	7,600	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Dichlorobenzene, 1,4- (p-DCB)	0.1	µg/L	0.5	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Dichlorodifluoromethane	0.2	µg/L	3,500	-	< 2.0	< 2.0	< 2.0	< 2.0	-
Dichloroethane, 1,1-	0.3	µg/L	11	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Dichloroethane, 1,2-	0.2	µg/L	0.5	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Dichloroethylene, 1,1-	0.3	µg/L	0.5	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Dichloroethylene, cis-1,2-	0.2	µg/L	1.6	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Dichloroethylene, trans-1,2-	0.2	µg/L	1.6	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Dichloropropane, 1,2-	0.2	µg/L	0.58	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Dichloropropene, 1,3-	0.50	µg/L	0.5	-	< 0.50	< 0.67[1]	< 0.50	< 0.50	-
Dichloropropene, cis-1,3-	0.30	µg/L	na	-	< 0.30	< 0.60	< 0.30	< 0.30	-
Dichloropropene, trans-1,3-	0.30	µg/L	na	-	< 0.30	< 0.30	< 0.30	< 0.30	-
Ethylbenzene	0.1	µg/L	54	0.9	391	504	413	436	-
Ethylene Dibromide (Dibromoethane, 1,2-)	0.1	µg/L	0.2	-	< 0.20	< 0.20	< 0.20	< 0.20	-
Hexane (n)	0.10	µg/L	5	-	< 0.55	3.08	< 0.50	< 0.50	-
Methyl Ethyl Ketone	1	µg/L	21,000	-	< 20	< 20	< 20	< 20	-
Methyl Isobutyl Ketone	1	µg/L	5,200	-	< 20	< 20	< 20	< 20	-
Methyl t-butyl ether (MTBE)	0.2	µg/L	15	-	< 2.0	< 2.0	< 2.0	< 2.0	-
Methylene Chloride	0.3	µg/L	26	-	< 5.0	< 5.0	< 5.0	< 5.0	-
Styrene	0.1	µg/L	43	-	< 0.50	180	1.85	< 0.50	-
Tetrachloroethane, 1,1,1,2-	0.1	µg/L	1.1	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Tetrachloroethane, 1,1,2,2-	0.1	µg/L	0.5	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Tetrachloroethylene	0.2	µg/L	0.5	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Toluene	0.2	µg/L	320	3.63	5.55	4,300	687	12.3	-
Trichloroethane, 1,1,1-	0.3	µg/L	23	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Trichloroethane, 1,1,2-	0.2	µg/L	0.5	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Trichloroethylene	0.2	µg/L	0.5	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Trichlorofluoromethane	0.4	µg/L	2,000	-	< 5.0	< 5.0	< 5.0	< 5.0	-
Vinyl Chloride [4]	0.17	µg/L	0.5	-	< 0.50	< 0.50	< 0.50	< 0.50	-
Xylenes	0.2	µg/L	72	4.96	879	1,960	1,200	853	-
Xylenes, m+p-	0.40	µg/L	na	3.25	767	1,320	769	690	-
Xylenes, o-	0.30	µg/L	na	1.71	112	641	434	163	-
PAHs									
Acenaphthene	0.020	µg/L	17	30	646	571	139	193	8.8
Acenaphthylene	0.020	µg/L	1	5.59	2.27	61.2	1.44	1.74	< 0.2
Anthracene	0.020	µg/L	1	3.29	2.64	19.6	12.8	3.99	1
Benzo(a)anthracene	0.020	µg/L	1.8	0.412	0.315	0.243	0.609	0.143	0.91
Benzo(a)pyrene	0.010	µg/L	0.81	0.184	0.118	0.161	0.584	0.027	0.76
Benzo(b)fluoranthene	0.020	µg/L	0.75	0.25	0.194	0.262	0.85	0.048	1.4
Benzo(g,h,i)perylene	0.020	µg/L	0.2	0.094	0.054	0.045	0.197	< 0.020	0.33
Benzo(k)fluoranthene	0.020	µg/L	0.4	0.083	0.061	0.082	0.254	< 0.020	0.53
Chrysene	0.020	µg/L	0.7	0.268	0.207	0.172	0.443	0.098	0.96
Dibenzo(a,h)anthracene	0.020	µg/L	0.4	0.024	< 0.020	< 0.020	0.064	< 0.020	< 0.2
Fluoranthene	0.020	µg/L	44	5.53	16.4	4.95	5.39	2.12	4
Fluorene	0.020	µg/L	290	21.5	56.4	251	98.4	77.4	5.5
Indeno(1,2,3-cd)pyrene	0.020	µg/L	0.2	0.12	0.07	0.066	0.298	< 0.020	0.47
Methylnaphthalene, 1-	0.020	µg/L	1,500	16.9	613	733	589	320	-
Methylnaphthalene, 2-	0.020	µg/L	1,500	20.6	82.4	1,150	1,140	552	-
Methylnaphthalene, 1- & 2-	0.028	µg/L	1500 [3]	37.5	695	1,890	1,730	872	-
Naphthalene	0.050	µg/L	7	327	10,400	22,900	10,500	8,740	2.9
Phenanthrene	0.020	µg/L	380	16.7	123	202	68	37.8	2.5
Pyrene	0.020	µg/L	5.7	3.4	5.13	2.69	3.2	1.19	3.6
PCBs									
Arochlor 1242	0.020	µg/L	na	-	-	< 0.20	-	-	-
Arochlor 1248	0.020	µg/L	na	-	-	< 0.20	-	-	-
Arochlor 1254	0.020	µg/L	na	-	-	< 0.20	-	-	-
Arochlor 1260	0.020	µg/L	na	-	-	< 0.20	-	-	-
Total PCBs	0.1	µg/L	0.2	-	-	< 0.40[1]	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/L – micrograms per litre
µS/cm - microSiemens per centimetre
mg/L - milligrams per litre
UNDERLINE Concentration greater than Table 7 Standard

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

[2] Table 7 generic site condition standards for shallow soils in a non-potable groundwater condition for all types of property use, coarse textured soils (MOE, 2011)

[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

TABLE 3: **Preliminary Screening of Groundwater Analyt**
Central Park, Hamilton, ON

Sample Location Laboratory Sample ID SNC-Lavalin Sample ID Sampling Date (yyyy/mm/dd)			Table 7[2] Standard CG	RDL (most recent)	Maximum (0 means no detection)	Maximum With RDL	Maximum With RDL x 1.2	Exceeded Generic Table 7 SCS
Parameter	**RDL**	**Units**						
Water Table Depth								
General Chemistry								
Chloride	0.1	mg/L	1,800	0.1	908	908	1089.6	No
Cyanide (CN-)	0.002	mg/L	0.052	0.002	0.007	0.007	0.0084	No
Electrical Conductivity	2	µS/cm	na	2	4070	4070	4884	No
Nitrite	0.25	mg/L	na	1	0	1	1.2	No
pH	-	pH	na		8.12	8.12	9.744	No
Total Suspended Solids	10	mg/L	na	10	11	11	13.2	No
Dissolved Metals								
Antimony	0.10	µg/L	16,000	1	1.4	1.4	1.68	No
Arsenic	1.0	µg/L	1,500	1	19.9	19.9	23.88	No
Barium	1.0	µg/L	23,000	1	389	389	466.8	No
Beryllium	0.10	µg/L	53	1	3.4	3.4	4.08	No
Boron	10	µg/L	36,000	10	1930	1930	2316	No
Cadmium	0.010	µg/L	2.1	0.05	0.167	0.167	0.2004	No
Chromium (total)	0.50	µg/L	640	5	12.4	12.4	14.88	No
Chromium (VI)	5	µg/L	110	5	5	5	6	No
Cobalt	0.10	µg/L	52	0.1	3.7	3.7	4.44	No
Copper	0.20	µg/L	69	0.2	9.5	9.5	11.4	No
Lead	0.050	µg/L	20	0.5	0	0.5	0.6	No
Mercury	0.010	µg/L	0.1	10	0	10	12	Yes
Molybdenum	0.050	µg/L	7,300	0.5	45	45	54	No
Nickel	0.50	µg/L	390	5	11.2	11.2	13.44	No
Selenium	0.050	µg/L	50	0.5	6.22	6.22	7.464	No
Silver	0.050	µg/L	1.2	0.5	0	0.5	0.6	No
Sodium	1,000	µg/L	1,800,000	500	758000	758000	909600	No
Thallium	0.010	µg/L	400	0.1	0	0.1	0.12	No
Uranium	0.10	µg/L	330	0.1	4.76	4.76	5.712	No
Vanadium	0.50	µg/L	200	5	3.7	5	6	No
Zinc	1.0	µg/L	890	10	11	11	13.2	No
Petroleum Hydrocarbon (PHC) Fractions								
PHC F1	25	µg/L	420	3,600	1380	3600	4320	Yes
PHC F2	100	µg/L	150	1000	33,900	33900	40680	Yes
PHC F3	100	µg/L	500	1000	2300	2300	2760	Yes
PHC F4	100	µg/L	500	1000	0	1000	1200	Yes
Volatile Organic Compounds								
Acetone	1	µg/L	100,000	30	73	73	87.6	No
Benzene	0.2	µg/L	0.5	0.5	17100	17100	20520	Yes
Bromodichloromethane	0.2	µg/L	67,000	2	0	2	2.4	No
Bromoform	0.1	µg/L	5	5	0	5	6	No
Bromomethane	0.2	µg/L	0.89	0.5	0	0.5	0.6	No
Carbon Tetrachloride	0.20	µg/L	0.2	0.2	0	0.2	0.24	No
Chlorobenzene	0.1	µg/L	140	0.5	0	0.5	0.6	No
Chloroform	0.2	µg/L	2	1	0	1	1.2	No
Dibromochloromethane	0.1	µg/L	65,000	2	0	2	2.4	No
Dichlorobenzene, 1,2- (o-DCB)	0.1	µg/L	150	0.5	0	0.5	0.6	No
Dichlorobenzene, 1,3- (m-DCB)	0.1	µg/L	7,600	0.5	0	0.5	0.6	No
Dichlorobenzene, 1,4- (p-DCB)	0.1	µg/L	0.5	0.5	0	0.5	0.6	No
Dichlorodifluoromethane	0.2	µg/L	3,500	2	0	2	2.4	No
Dichloroethane, 1,1-	0.3	µg/L	11	0.5	0	0.5	0.6	No
Dichloroethane, 1,2-	0.2	µg/L	0.5	0.5	0.27	0.5	0.6	No
Dichloroethylene, 1,1-	0.3	µg/L	0.5	0.5	0	0.5	0.6	No
Dichloroethylene, cis-1,2-	0.2	µg/L	1.6	0.5	0.84	0.84	1.008	No
Dichloroethylene, trans-1,2-	0.2	µg/L	1.6	0.5	0	0.5	0.6	No
Dichloropropane, 1,2-	0.2	µg/L	0.58	0.5	0	0.5	0.6	No
Dichloropropene, 1,3-	0.50	µg/L	0.5	0.67	0	0.67	0.804	No
Dichloropropene, cis-1,3-	0.30	µg/L	na	0.3	0	0.3	0.36	No
Dichloropropene, trans-1,3-	0.30	µg/L	na	0.3	0	0.3	0.36	No
Ethylbenzene	0.1	µg/L	54	0.5	504	504	604.8	Yes
Ethylene Dibromide (Dibromoethane, 1,2-)	0.1	µg/L	0.2	0.2	0	0.2	0.24	No
Hexane (n)	0.10	µg/L	5	0.55	3.08	3.08	3.696	No
Methyl Ethyl Ketone	1	µg/L	21,000	20	0	20	24	No
Methyl Isobutyl Ketone	1	µg/L	5,200	20	0	20	24	No
Methyl t-butyl ether (MTBE)	0.2	µg/L	15	2	0	2	2.4	No
Methylene Chloride	0.3	µg/L	26	5	0	5	6	No
Styrene	0.1	µg/L	43	0.5	180	180	216	Yes
Tetrachloroethane, 1,1,1,2-	0.1	µg/L	1.1	0.5	0	0.5	0.6	No
Tetrachloroethane, 1,1,2,2-	0.1	µg/L	0.5	0.5	0	0.5	0.6	No
Tetrachloroethylene	0.2	µg/L	0.5	0.5	0	0.5	0.6	No
Toluene	0.2	µg/L	320	0.5	4300	4300	5160	Yes
Trichloroethane, 1,1,1-	0.3	µg/L	23	0.5	0	0.5	0.6	No
Trichloroethane, 1,1,2-	0.2	µg/L	0.5	0.5	0	0.5	0.6	No
Trichloroethylene	0.2	µg/L	0.5	0.5	17.6	17.6	21.12	Yes
Trichlorofluoromethane	0.4	µg/L	2,000	5	0	5	6	No
Vinyl Chloride [4]	0.17	µg/L	0.5	0.5	0	2.17	2.60	Yes
Xylenes	0.2	µg/L	72	0.5	1960	1960	2352	Yes
Xylenes, m+p-	0.40	µg/L	na	0.4	1320	1320	1584	No
Xylenes, o-	0.30	µg/L	na	0.3	641	641	769.2	No
PAHs								
Acenaphthene	0.020	µg/L	17	0.02	646	646	775.2	Yes
Acenaphthylene	0.020	µg/L	1	0.02	61.2	61.2	73.44	Yes
Anthracene	0.020	µg/L	1	0.02	19.6	19.6	23.52	Yes
Benzo(a)anthracene	0.020	µg/L	1.8	0.02	0.91	0.91	1.092	No
Benzo(a)pyrene	0.010	µg/L	0.81	0.01	0.76	0.76	0.912	Yes
Benzo(b)fluoranthene	0.020	µg/L	0.75	0.02	1.4	1.4	1.68	Yes
Benzo(g,h,i)perylene	0.020	µg/L	0.2	0.02	0.33	0.33	0.396	Yes
Benzo(k)fluoranthene	0.020	µg/L	0.4	0.02	0.53	0.53	0.636	Yes
Chrysene	0.020	µg/L	0.7	0.02	0.96	0.96	1.152	Yes
Dibenzo(a,h)anthracene	0.020	µg/L	0.4	0.02	0.064	0.064	0.0768	No
Fluoranthene	0.020	µg/L	44	0.02	16.4	16.4	19.68	No
Fluorene	0.020	µg/L	290	0.02	251	251	301.2	Yes
Indeno(1,2,3-cd)pyrene	0.020	µg/L	0.2	0.02	0.47	0.47	0.564	Yes
Methylnaphthalene, 1-	0.020	µg/L	1,500	0.02	733	733	879.6	No
Methylnaphthalene, 2-	0.020	µg/L	1,500	0.02	1150	1150	1380	No
Methylnaphthalene, 1- & 2-	0.028	µg/L	1500 [3]	0.028	1890	1890	2268	No
Naphthalene	0.050	µg/L	7	0.05	22900	22900	27480	Yes
Phenanthrene	0.020	µg/L	380	0.02	202	202	242.4	No
Pyrene	0.020	µg/L	5.7	0.02	7.7	7.7	9.24	Yes
PCBs								
Arochlor 1242	0.020	µg/L	na	0.04	0	0.04	0.048	No
Arochlor 1248	0.020	µg/L	na	0.02	0	0.02	0.024	No
Arochlor 1254	0.020	µg/L	na	0.02	0	0.02	0.024	No
Arochlor 1260	0.020	µg/L	na	0.02	0	0.02	0.024	No
Total PCBs	0.1	µg/L	0.2	0.4	0	0.4	0.48	No

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/L – micrograms per litre
µS/cm - microSiemens per centimetre
mg/L - milligrams per litre

UNDERLINE Concentration greater than Table 7 Standard

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

[2] Table 7 generic site condition standards for shallow soils in a non-potable groundwater condition for all types of property use, coarse textured soils (MOE, 2011)

[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

TABLE 4: **Preliminary Screening of Groundwater COCs - Depth > 3 m bgs**
Central Park, Hamilton, ON

Sample Location			Table 5[2]	MW-101	MW-101	MW-101	MW-101	MW-102	MW-102	MW-102	MW-102	MW-103
Laboratory Sample ID			Standard	4841700	4841715	7757425	L2163169-5	4841679	4841679	7757438	L2163993-2	4841684
SNC-Lavalin Sample ID			R/P/I	MW-101	MW-1011	MW-101	MW-101	MW-102	MW-102	MW-102	MW-102	MW-103
Sampling Date (yyyy/mm/dd)			CG	2013/10/11	2013/10/11 Duplicate of MW-101	2016/08/04	2018/09/11	2013/10/11	2013/10/16	2016/08/04	2018/09/12	2013/10/11
Parameter	**RDL**	**Units**										
Water Table Depth (m bgs)				6.5	6.5	6.5	6.5	3.7	3.7	3.7	3.7	5.1
General Chemistry												
Chloride	0.1	mg/L	2,300	250	246	379	-	-	267	4.11	-	498
Cyanide (CN-)	0.002	mg/L	0.066	< 0.002	< 0.002	< 0.002	-	-	< 0.002	< 0.002	-	0.003
Electrical Conductivity	2	µS/cm	na	1,620	1,620	2,240	-	-	2,920	976	-	2,350
Nitrite	0.25	mg/L	na	< 0.25	< 0.25	-	-	-	< 1	-	-	< 0.5
pH	-	pH	na	7.74	7.75	7.81	-	-	8.53	8.08	-	8.04
Total Suspended Solids	10	mg/L	na	-	-	-	-	-	-	-	-	-
Dissolved Metals												
Antimony	0.10	µg/L	20,000	< 0.5	< 0.5	< 1.0	< 0.10	-	0.6	< 1.0	0.2	< 0.5
Arsenic	1.0	µg/L	1,900	2.5	2.2	4.2	4.53	-	24.7	6	5.39	2.2
Barium	1.0	µg/L	29,000	358	393	458	391	-	185	27.5	26.5	203
Beryllium	0.10	µg/L	67	1.8	2.6	< 0.5	< 0.10	-	1	< 0.5	< 0.10	1.7
Boron	10	µg/L	45,000	241	253	233	229	-	499	229	204	347
Cadmium	0.010	µg/L	2.7	< 0.2	< 0.2	< 0.2	< 0.010	-	< 0.2	< 0.2	< 0.010	< 0.2
Chromium (total)	0.50	µg/L	810	3.6	4.5	7.4	< 0.50	-	5.5	2.9	< 0.50	2.8
Chromium (VI)	5	µg/L	140	< 5	< 5	< 5	-	-	< 5	< 5	-	< 5
Cobalt	0.10	µg/L	66	2.3	2.5	1.8	0.75	-	0.5	< 0.5	0.22	1.5
Copper	0.20	µg/L	87	< 1	1.2	2	0.38	-	2.3	1.1	1.01	2.5
Lead	0.050	µg/L	25	< 0.5	< 0.5	< 0.5	< 0.050	-	< 0.5	< 0.5	0.073	< 0.5
Mercury	0.010	µg/L	0.29	< 0.02	< 0.02	< 0.02	< 0.010	-	< 0.02	< 0.02	< 0.010	< 0.02
Molybdenum	0.050	µg/L	9,200	1.6	1.7	0.6	0.489	-	53.8	3.5	3.32	1.4
Nickel	0.50	µg/L	490	3	3.3	< 1	0.81	-	2.1	< 1	1.77	2.5
Selenium	0.050	µg/L	63	< 1	3.3	1	1.22	-	< 1	< 1	0.327	< 1
Silver	0.050	µg/L	1.5	< 0.2	< 0.2	< 0.2	< 0.050	-	< 0.2	< 0.2	< 0.050	< 0.2
Sodium	1,000	µg/L	2,300,000	138,000	170,000	213,000	130,000	-	537,000	14,000	15,200	271,000
Thallium	0.010	µg/L	510	< 0.3	< 0.3	< 0.3	< 0.010	-	< 0.3	< 0.3	< 0.010	< 0.3
Uranium	0.10	µg/L	420	0.8	0.9	< 0.5	0.372	-	16.8	2.4	1.73	3
Vanadium	0.50	µg/L	250	7.9	6.5	1	< 0.50	-	14.3	0.8	< 0.50	7.9
Zinc	1.0	µg/L	1,100	< 5	< 5	7.1	< 1.0	-	< 5	42.5	192	< 5
Petroleum Hydrocarbon (PHC) Fractions												
PHC F1	25	µg/L	750	< 25	< 25	< 25	51	< 25	-	< 25	< 25	< 25
PHC F2	100	µg/L	150	**280**	**340**	< 100	**210**	< 100	-	< 100	< 100	< 100
PHC F3	100	µg/L	500	340	340	< 100	< 250	< 100	-	< 100	< 250	< 100
PHC F4	100	µg/L	500	< 100	< 100	< 100	< 250	< 100	-	< 100	< 250	< 100
Volatile Organic Compounds												
Acetone	1	µg/L	130,000	< 1	< 1	< 1	< 30	< 2.0	-	< 1	< 30	< 1
Benzene	0.2	µg/L	44	< 0.2	< 0.2	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50	< 0.2
Bromodichloromethane	0.2	µg/L	85,000	< 0.2	< 0.2	< 0.2	< 2.0	< 0.40	-	< 0.2	< 2.0	< 0.2
Bromoform	0.1	µg/L	380	< 0.1	< 0.1	< 0.1	< 5.0	< 0.20	-	< 0.1	< 5.0	< 0.1
Bromomethane	0.2	µg/L	5.6	< 0.2	< 0.2	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50	< 0.2
Carbon Tetrachloride	0.20	µg/L	0.79	< 0.2	< 0.2	< 0.2	< 0.20	< 0.40[1]	-	< 0.2	< 0.20	< 0.2
Chlorobenzene	0.1	µg/L	630	< 0.1	< 0.1	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50	< 0.1
Chloroform	0.2	µg/L	2.4	< 0.2	< 0.2	< 0.2	< 1.0	< 0.40	-	< 0.2	< 1.0	< 0.2
Dibromochloromethane	0.1	µg/L	82,000	< 0.1	< 0.1	< 0.1	< 2.0	< 0.20	-	< 0.1	< 2.0	< 0.1
Dichlorobenzene, 1,2- (o-DCB)	0.1	µg/L	4,600	< 0.1	< 0.1	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50	< 0.1
Dichlorobenzene, 1,3- (m-DCB)	0.1	µg/L	9,600	0.12	0.11	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50	< 0.1
Dichlorobenzene, 1,4- (p-DCB)	0.1	µg/L	8	< 0.1	< 0.1	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50	< 0.1
Dichlorodifluoromethane	0.2	µg/L	4,400	< 0.2	< 0.2	< 0.2	< 2.0	< 0.40	-	< 0.2	< 2.0	< 0.2
Dichloroethane, 1,1-	0.3	µg/L	320	< 0.3	< 0.3	< 0.3	< 0.50	< 0.60	-	< 0.3	< 0.50	< 0.3
Dichloroethane, 1,2-	0.2	µg/L	1.6	< 0.2	< 0.2	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50	< 0.2
Dichloroethylene, 1,1-	0.3	µg/L	1.6	< 0.3	< 0.3	< 0.3	< 0.50	< 0.60[1]	-	< 0.3	< 0.50	< 0.3
Dichloroethylene, cis-1,2-	0.2	µg/L	1.6	< 0.2	< 0.2	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50	0.44
Dichloroethylene, trans-1,2-	0.2	µg/L	1.6	< 0.2	< 0.2	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50	< 0.2
Dichloropropane, 1,2-	0.2	µg/L	16	< 0.2	< 0.2	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50	< 0.2
Dichloropropene, 1,3-	0.50	µg/L	5.2	-	-	-	< 0.50	-	-	-	< 0.50	-
Dichloropropene, cis-1,3-	0.30	µg/L	na	-	-	-	< 0.30	-	-	-	< 0.30	-
Dichloropropene, trans-1,3-	0.30	µg/L	na	-	-	-	< 0.30	-	-	-	< 0.30	-
Ethylbenzene	0.1	µg/L	2,300	< 0.1	< 0.1	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50	< 0.1
Ethylene Dibromide (Dibromoethane, 1,2-)	0.1	µg/L	0.25	< 0.1	< 0.1	< 0.1	< 0.20	< 0.20	-	< 0.1	< 0.20	< 0.1
Hexane (n)	0.10	µg/L	51	< 0.2	< 0.2	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50	< 0.2
Methyl Ethyl Ketone	1	µg/L	470,000	< 1	< 1	< 1	< 20	< 2.0	-	< 1	< 20	< 1
Methyl Isobutyl Ketone	1	µg/L	140,000	< 1	< 1	< 1	< 20	< 2.0	-	< 1	< 20	< 1
Methyl t-butyl ether (MTBE)	0.2	µg/L	190	< 0.2	< 0.2	< 0.2	< 2.0	< 0.40	-	< 0.2	< 2.0	< 0.2
Methylene Chloride	0.3	µg/L	610	< 0.3	< 0.3	< 0.3	< 5.0	< 0.60	-	< 0.3	< 5.0	< 0.3
Styrene	0.1	µg/L	1,300	< 0.1	< 0.1	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50	< 0.1
Tetrachloroethane, 1,1,1,2-	0.1	µg/L	3.4	< 0.1	< 0.1	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50	< 0.1
Tetrachloroethane, 1,1,2,2-	0.1	µg/L	3.2	< 0.1	< 0.1	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50	< 0.1
Tetrachloroethylene	0.2	µg/L	1.6	< 0.2	< 0.2	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50	< 0.2
Toluene	0.2	µg/L	18,000	< 0.2	< 0.2	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50	< 0.2
Trichloroethane, 1,1,1-	0.3	µg/L	640	< 0.3	< 0.3	< 0.3	< 0.50	< 0.60	-	< 0.3	< 0.50	< 0.3
Trichloroethane, 1,1,2-	0.2	µg/L	4.7	< 0.2	< 0.2	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50	< 0.2
Trichloroethylene	0.2	µg/L	1.6	< 0.2	< 0.2	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50	**12**
Trichlorofluoromethane	0.4	µg/L	2,500	< 0.4	< 0.4	< 0.4	< 5.0	< 0.80	-	< 0.4	< 5.0	< 0.4
Vinyl Chloride [4]	0.17	µg/L	0.5	< 0.17	< 0.17	< 0.17	< 0.50	< 0.34	-	< 0.17	< 0.50	< 0.17
Xylenes	0.2	µg/L	4,200	0.46	0.46	0.22	< 0.50	< 0.40	-	< 0.2	< 0.50	< 0.2
Xylenes, m+p-	0.40	µg/L	na	-	-	-	< 0.40	-	-	-	< 0.40	-
Xylenes, o-	0.30	µg/L	na	-	-	-	< 0.30	-	-	-	< 0.30	-
PAHs												
Acenaphthene	0.020	µg/L	600	0.39	0.43	< 0.2	< 0.15	< 0.2	-	< 0.2	< 0.020	< 0.2
Acenaphthylene	0.020	µg/L	1.8	< 0.2	< 0.2	< 0.2	0.038	< 0.2	-	< 0.2	< 0.020	< 0.2
Anthracene	0.020	µg/L	2.4	0.36	0.37	< 0.1	0.059	< 0.1	-	< 0.1	< 0.020	< 0.1
Benzo(a)anthracene	0.020	µg/L	4.7	< 0.2	< 0.2	< 0.2	< 0.020	< 0.2	-	< 0.2	< 0.020	< 0.2
Benzo(a)pyrene	0.010	µg/L	0.81	< 0.01	< 0.01	< 0.01	< 0.010	< 0.01	-	< 0.01	< 0.010	< 0.01
Benzo(b)fluoranthene	0.020	µg/L	0.75	< 0.1	< 0.1	< 0.1	< 0.020	< 0.1	-	< 0.1	< 0.020	< 0.1
Benzo(g,h,i)perylene	0.020	µg/L	0.2	< 0.2	< 0.2	< 0.2	< 0.020	< 0.2	-	< 0.2	< 0.020	< 0.2
Benzo(k)fluoranthene	0.020	µg/L	0.4	< 0.1	< 0.1	< 0.1	< 0.020	< 0.1	-	< 0.1	< 0.020	< 0.1
Chrysene	0.020	µg/L	1	< 0.1	< 0.1	< 0.1	< 0.020	< 0.1	-	< 0.1	< 0.020	< 0.1
Dibenzo(a,h)anthracene	0.020	µg/L	0.52	< 0.2	< 0.2	< 0.2	< 0.020	< 0.2	-	< 0.2	< 0.020	< 0.2
Fluoranthene	0.020	µg/L	130	0.28	0.29	< 0.2	0.03	< 0.2	-	< 0.2	< 0.020	< 0.2
Fluorene	0.020	µg/L	400	1	1.1	0.63	0.422	< 0.2	-	< 0.2	< 0.020	< 0.2
Indeno(1,2,3-cd)pyrene	0.020	µg/L	0.2	< 0.2	< 0.2	< 0.2	< 0.020	< 0.2	-	< 0.2	< 0.020	< 0.2
Methylnaphthalene, 1-	0.020	µg/L	1,800	-	-	-	0.888	-	-	-	< 0.020	-
Methylnaphthalene, 2-	0.020	µg/L	1,800	-	-	-	0.027	-	-	-	< 0.020	-
Methylnaphthalene, 1- & 2-	0.028	µg/L	1800 [4]	-	-	-	0.915	-	-	-	< 0.028	-
Naphthalene	0.050	µg/L	1,400	1.2	1.4	0.71	< 0.58	0.44	-	< 0.2	< 0.050	2.9
Phenanthrene	0.020	µg/L	580	2.4	2.4	0.63	0.404	< 0.1	-	< 0.1	< 0.020	< 0.1
Pyrene	0.020	µg/L	68	0.22	0.23	< 0.2	0.061	< 0.2	-	< 0.2	< 0.020	< 0.2
PCBs												
Arochlor 1242	0.020	µg/L	na	< 0.1	< 0.1	-	-	< 0.1	-	-	-	< 0.1
Arochlor 1248	0.020	µg/L	na	< 0.1	< 0.1	-	-	< 0.1	-	-	-	< 0.1
Arochlor 1254	0.020	µg/L	na	< 0.1	< 0.1	-	-	< 0.1	-	-	-	< 0.1
Arochlor 1260	0.020	µg/L	na	< 0.1	< 0.1	-	-	< 0.1	-	-	-	< 0.1
Total PCBs	0.1	µg/L	7.8	< 0.1	< 0.1	-	-	< 0.1	-	-	-	< 0.1

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/L – micrograms per litre
µS/cm - microSiemens per centimetre
mg/L - milligrams per litre

BOLD Concentration greater than Table 5 Standard

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

[2] Table 5 stratified site condition standards in a non-potable groundwater condition for all types of property use, coarse textured soils (MOE, 2011)

[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011)

TABLE 4: **Preliminary Screening of Groundwater C**
Central Park, Hamilton, ON

Sample Location			Table 5[2]	MW-103	MW-103	MW-103	MW-103	MW-103	MW-201	MW-201	MW-201	MW-202	MW-202	MW-203
Laboratory Sample ID			Standard	7757487	4974191	4974191	7836683	L2163169-2	7782070	7836662	L2162292-8	7844784	L2164646-2	7782105
SNC-Lavalin Sample ID			R/P/I	MW-103	MW-183	MW-183	MW-103	MW-103	MW-201	MW-201	MW-201	MW-202	MW-202	MW-203
Sampling Date (yyyy/mm/dd)			CG	2016/08/05	2013/11/18 Duplicate of MW-103	2016/08/05	2016/09/09	2018/09/11	2016/08/15	2016/09/09	2018/09/10	2016/09/13	2018/09/13	2016/08/15
Parameter	**RDL**	**Units**												
Water Table Depth (m bgs)				5.1	5.1	5.1	5.1	5.1	3.7	3.7	3.7	4	4	8
General Chemistry														
Chloride	0.1	mg/L	2,300	260	-	258	-	-	218	-	-	294	-	184
Cyanide (CN-)	0.002	mg/L	0.066	0.004	-	0.003	-	-	< 0.002	-	-	< 0.002	-	< 0.002
Electrical Conductivity	2	µS/cm	na	1,680	-	1,670	-	-	1,400	-	-	1,600	-	1,190
Nitrite	0.25	mg/L	na	-	-	-	-	-	-	-	-	-	-	-
pH	-	pH	na	7.91	-	8.1	-	-	8.14	-	-	7.98	-	8.1
Total Suspended Solids	10	mg/L	na	-	33	-	-	-	-	-	-	-	-	-
Dissolved Metals														
Antimony	0.10	µg/L	20,000	< 1.0	-	< 1.0	-	< 1.0	< 1.0	-	< 1.0	< 1.0	-	< 1.0
Arsenic	1.0	µg/L	1,900	1.2	-	1.3	-	< 1.0	1	-	< 1.0	2.5	-	1.2
Barium	1.0	µg/L	29,000	55.5	-	54.6	-	79.1	112	-	82.4	65.1	-	119
Beryllium	0.10	µg/L	67	< 0.5	-	< 0.5	-	< 1.0	< 0.5	-	< 1.0	< 0.5	-	< 0.5
Boron	10	µg/L	45,000	262	-	268	-	290	106	-	1,050	924	-	111
Cadmium	0.010	µg/L	2.7	< 0.2	-	< 0.2	-	< 0.050	< 0.2	-	< 0.050	< 0.2	-	< 0.2
Chromium (total)	0.50	µg/L	810	5.5	-	4.7	-	< 5.0	2.9	-	< 5.0	< 2	-	< 2
Chromium (VI)	5	µg/L	140	< 5	-	< 5	-	-	< 5	-	-	< 5	-	< 5
Cobalt	0.10	µg/L	66	0.8	-	0.7	-	< 1.0	1.2	-	< 1.0	< 0.5	-	1.3
Copper	0.20	µg/L	87	1.5	-	1.6	-	< 2.0	2.4	-	< 2.0	< 1	-	1.3
Lead	0.050	µg/L	25	< 0.5	-	< 0.5	-	< 0.50	< 0.5	-	< 0.50	< 0.5	-	< 0.5
Mercury	0.010	µg/L	0.29	< 0.02	-	< 0.02	-	< 0.010	< 0.02	-	< 0.010	< 0.02	-	< 0.02
Molybdenum	0.050	µg/L	9,200	0.6	-	0.6	-	0.51	5.8	-	27.1	23.9	-	13.3
Nickel	0.50	µg/L	490	< 1	-	< 1	-	< 5.0	2	-	< 5.0	< 1	-	1.6
Selenium	0.050	µg/L	63	3	-	3.2	-	1.22	3.9	-	< 0.50	6	-	4.2
Silver	0.050	µg/L	1.5	< 0.2	-	< 0.2	-	< 0.50	< 0.2	-	< 0.50	< 0.2	-	< 0.2
Sodium	1,000	µg/L	2,300,000	194,000	-	196,000	-	218,000	109,000	-	256,000	230,000	-	98,800
Thallium	0.010	µg/L	510	< 0.3	-	< 0.3	-	< 0.10	< 0.3	-	< 0.10	< 0.3	-	< 0.3
Uranium	0.10	µg/L	420	1.1	-	1	-	1.31	4.3	-	4.44	2.3	-	6.4
Vanadium	0.50	µg/L	250	1.7	-	1.8	-	< 5.0	0.9	-	< 5.0	0.6	-	1.2
Zinc	1.0	µg/L	1,100	< 5	-	< 5	-	< 10	11.4	-	47	< 5	-	< 5
Petroleum Hydrocarbon (PHC) Fractions														
PHC F1	25	µg/L	750	< 25	-	< 25	-	< 25	< 25	< 25	< 25	< 25	< 25	< 25
PHC F2	100	µg/L	150	< 100	-	< 100	-	< 100	**330**	< 100	< 100	< 100	< 100	**970**
PHC F3	100	µg/L	500	< 100	-	< 100	-	< 250	190	< 100	< 250	< 100	< 250	**1,700**
PHC F4	100	µg/L	500	< 100	-	< 100	-	< 250	< 100	< 100	< 250	< 100	< 250	< 100
Volatile Organic Compounds														
Acetone	1	µg/L	130,000	-	-	-	< 1	< 30	72	-	< 30	< 1	< 30	95
Benzene	0.2	µg/L	44	< 0.2	-	< 0.2	< 0.2	< 0.50	0.27	-	< 0.50	< 0.2	< 0.50	0.93
Bromodichloromethane	0.2	µg/L	85,000	-	-	-	< 0.2	< 2.0	< 0.2	-	< 2.0	< 0.2	< 2.0	< 0.2
Bromoform	0.1	µg/L	380	-	-	-	< 0.1	< 5.0	< 0.1	-	< 5.0	< 0.1	< 5.0	< 0.1
Bromomethane	0.2	µg/L	5.6	-	-	-	< 0.2	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2
Carbon Tetrachloride	0.20	µg/L	0.79	-	-	-	< 0.2	< 0.20	< 0.2	-	< 0.20	< 0.2	< 0.20	< 0.2
Chlorobenzene	0.1	µg/L	630	-	-	-	< 0.1	< 0.50	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1
Chloroform	0.2	µg/L	2.4	-	-	-	< 0.2	< 1.0	< 0.2	-	< 1.0	< 0.2	< 1.0	< 0.2
Dibromochloromethane	0.1	µg/L	82,000	-	-	-	< 0.1	< 2.0	< 0.1	-	< 2.0	< 0.1	< 2.0	< 0.1
Dichlorobenzene, 1,2- (o-DCB)	0.1	µg/L	4,600	-	-	-	< 0.1	< 0.50	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1
Dichlorobenzene, 1,3- (m-DCB)	0.1	µg/L	9,600	-	-	-	< 0.1	< 0.50	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1
Dichlorobenzene, 1,4- (p-DCB)	0.1	µg/L	8	-	-	-	< 0.1	< 0.50	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1
Dichlorodifluoromethane	0.2	µg/L	4,400	-	-	-	< 0.2	< 2.0	< 0.2	-	< 2.0	< 0.2	< 2.0	< 0.2
Dichloroethane, 1,1-	0.3	µg/L	320	-	-	-	< 0.3	< 0.50	< 0.3	-	< 0.50	< 0.3	< 0.50	< 0.3
Dichloroethane, 1,2-	0.2	µg/L	1.6	-	-	-	< 0.2	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2
Dichloroethylene, 1,1-	0.3	µg/L	1.6	-	-	-	< 0.3	< 0.50	< 0.3	-	< 0.50	< 0.3	< 0.50	< 0.3
Dichloroethylene, cis-1,2-	0.2	µg/L	1.6	-	-	-	< 0.2	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2
Dichloroethylene, trans-1,2-	0.2	µg/L	1.6	-	-	-	< 0.2	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2
Dichloropropane, 1,2-	0.2	µg/L	16	-	-	-	< 0.2	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2
Dichloropropene, 1,3-	0.50	µg/L	5.2	-	-	-	-	< 0.50	-	-	< 0.50	-	< 0.50	-
Dichloropropene, cis-1,3-	0.30	µg/L	na	-	-	-	-	< 0.30	-	-	< 0.30	-	< 0.30	-
Dichloropropene, trans-1,3-	0.30	µg/L	na	-	-	-	-	< 0.30	-	-	< 0.30	-	< 0.30	-
Ethylbenzene	0.1	µg/L	2,300	< 0.1	-	< 0.1	< 0.1	< 0.50	1.3	-	< 0.50	< 0.1	< 0.50	3.6
Ethylene Dibromide (Dibromoethane, 1,2-)	0.1	µg/L	0.25	-	-	-	< 0.1	< 0.20	< 0.1	-	< 0.20	< 0.1	< 0.20	< 0.1
Hexane (n)	0.10	µg/L	51	-	-	-	< 0.2	< 0.50	< 0.2	-	0.56	< 0.2	< 0.50	0.63
Methyl Ethyl Ketone	1	µg/L	470,000	-	-	-	< 1	< 20	18	-	< 20	< 1	< 20	21
Methyl Isobutyl Ketone	1	µg/L	140,000	-	-	-	< 1	< 20	< 1	-	< 20	< 1	< 20	< 1
Methyl t-butyl ether (MTBE)	0.2	µg/L	190	-	-	-	< 0.2	< 2.0	< 0.2	-	< 2.0	< 0.2	< 2.0	< 0.2
Methylene Chloride	0.3	µg/L	610	-	-	-	< 0.3	< 5.0	< 0.3	-	< 5.0	< 0.3	< 5.0	< 0.3
Styrene	0.1	µg/L	1,300	-	-	-	< 0.1	< 0.50	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1
Tetrachloroethane, 1,1,1,2-	0.1	µg/L	3.4	-	-	-	< 0.1	< 0.50	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1
Tetrachloroethane, 1,1,2,2-	0.1	µg/L	3.2	-	-	-	< 0.1	< 0.50	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1
Tetrachloroethylene	0.2	µg/L	1.6	-	-	-	< 0.2	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	0.41
Toluene	0.2	µg/L	18,000	< 0.2	-	< 0.2	0.33	< 0.50	4.3	-	< 0.50	< 0.2	< 0.50	18
Trichloroethane, 1,1,1-	0.3	µg/L	640	-	-	-	< 0.3	< 0.50	< 0.3	-	< 0.50	< 0.3	< 0.50	< 0.3
Trichloroethane, 1,1,2-	0.2	µg/L	4.7	-	-	-	< 0.2	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2
Trichloroethylene	0.2	µg/L	1.6	-	-	-	**7.6**	**1.64**	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2
Trichlorofluoromethane	0.4	µg/L	2,500	-	-	-	< 0.4	< 5.0	< 0.4	-	< 5.0	< 0.4	< 5.0	< 0.4
Vinyl Chloride [4]	0.17	µg/L	0.5	-	-	-	< 0.17	< 0.50	< 0.17	-	< 0.50	< 0.17	< 0.50	< 0.17
Xylenes	0.2	µg/L	4,200	< 0.2	-	< 0.2	< 0.2	< 0.50	8.7	-	< 0.50	< 0.2	< 0.50	21
Xylenes, m+p-	0.40	µg/L	na	-	-	-	-	< 0.40	-	-	< 0.40	-	< 0.40	-
Xylenes, o-	0.30	µg/L	na	-	-	-	-	< 0.30	-	-	< 0.30	-	0.35	-
PAHs														
Acenaphthene	0.020	µg/L	600	0.35	-	0.42	-	< 0.020	< 0.2	-	< 0.020	< 0.2	0.099	< 0.2
Acenaphthylene	0.020	µg/L	1.8	< 0.2	-	< 0.2	-	< 0.020	< 0.2	-	< 0.020	< 0.2	0.093	< 0.2
Anthracene	0.020	µg/L	2.4	0.12	-	0.1	-	< 0.020	< 0.1	-	< 0.020	< 0.1	0.193	< 0.1
Benzo(a)anthracene	0.020	µg/L	4.7	< 0.2	-	< 0.2	-	< 0.020	< 0.2	-	< 0.020	< 0.2	0.638	< 0.2
Benzo(a)pyrene	0.010	µg/L	0.81	< 0.01	-	< 0.01	-	< 0.010	< 0.01	-	< 0.010	< 0.01	0.336	< 0.01
Benzo(b)fluoranthene	0.020	µg/L	0.75	< 0.1	-	< 0.1	-	< 0.020	< 0.1	-	< 0.020	< 0.1	0.554	< 0.1
Benzo(g,h,i)perylene	0.020	µg/L	0.2	< 0.2	-	< 0.2	-	< 0.020	< 0.2	-	< 0.020	< 0.2	0.148	< 0.2
Benzo(k)fluoranthene	0.020	µg/L	0.4	< 0.1	-	< 0.1	-	< 0.020	< 0.1	-	< 0.020	< 0.1	0.182	< 0.1
Chrysene	0.020	µg/L	1	< 0.1	-	< 0.1	-	< 0.020	< 0.1	-	< 0.020	< 0.1	0.496	< 0.1
Dibenzo(a,h)anthracene	0.020	µg/L	0.52	< 0.2	-	< 0.2	-	< 0.020	< 0.2	-	< 0.020	< 0.2	0.041	< 0.2
Fluoranthene	0.020	µg/L	130	< 0.2	-	< 0.2	-	< 0.020	< 0.2	-	0.03	< 0.2	1.79	< 0.2
Fluorene	0.020	µg/L	400	0.23	-	0.26	-	< 0.020	< 0.2	-	< 0.020	< 0.2	0.062	0.55
Indeno(1,2,3-cd)pyrene	0.020	µg/L	0.2	< 0.2	-	< 0.2	-	< 0.020	< 0.2	-	< 0.020	< 0.2	**0.212**	< 0.2
Methylnaphthalene, 1-	0.020	µg/L	1,800	-	-	-	-	< 0.020	-	-	< 0.020	-	0.113	-
Methylnaphthalene, 2-	0.020	µg/L	1,800	-	-	-	-	< 0.020	-	-	< 0.020	-	0.023	-
Methylnaphthalene, 1- & 2-	0.028	µg/L	1800 [4]	-	-	-	-	< 0.028	-	-	< 0.028	-	0.136	-
Naphthalene	0.050	µg/L	1,400	2.1	-	2	-	< 0.050	1.1	-	0.125	8.3	1.37	1.9
Phenanthrene	0.020	µg/L	580	0.47	-	0.55	-	< 0.020	0.24	-	0.022	0.26	0.472	1.1
Pyrene	0.020	µg/L	68	< 0.2	-	< 0.2	-	< 0.020	< 0.2	-	0.031	< 0.2	1.46	< 0.2
PCBs														
Arochlor 1242	0.020	µg/L	na	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.020	µg/L	na	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.020	µg/L	na	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.020	µg/L	na	-	-	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/L	7.8	-	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/L – micrograms per litre
µS/cm - microSiemens per centimetre
mg/L - milligrams per litre
BOLD Concentration greater than Table 5 Standa

[1] Laboratory detection limit exceeds regulatory standard/guideline.
[2] Table 5 stratified site condition standards in a non-potable groundwater condition for all types of property use, coarse textured soils (MOE, 2011)
[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.
[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011)

TABLE 4: **Preliminary Screening of Groundwater C**
Central Park, Hamilton, ON

Sample Location			Table 5[2]	MW-203	MW-203	MW-204	MW-204	MW-205	MW-205	MW-01-17	BH-17-17	MW18-01	MW18-02
Laboratory Sample ID			Standard	7844800	L2164646-1	7782151	7836666	7836670	L2163169-1	L2163169-6	L2171531-1	L2162292-5	L2162292-6
SNC-Lavalin Sample ID			R/P/I	MW-203	MW-203	MW-204	MW-204	MW-205	MW-205	MW-01-17	BH-17-17	MW18-01	MW18-02
Sampling Date (yyyy/mm/dd)			CG	2016/09/13	2018/09/13	2016/08/15	2016/09/09	2016/09/09	2018/09/11	2018/09/11	2018/09/25	2018/09/10	2018/09/10
Parameter	**RDL**	**Units**											
Water Table Depth (m bgs)				8	8	3.9	3.9	5.6	5.6	3.4	?	5.7	3
General Chemistry													
Chloride	0.1	mg/L	2,300	-	-	257	-	215	-	-	-	-	-
Cyanide (CN-)	0.002	mg/L	0.066	-	-	< 0.002	-	< 0.002	-	-	-	-	-
Electrical Conductivity	2	µS/cm	na	-	-	1,660	-	1,400	-	-	-	-	-
Nitrite	0.25	mg/L	na	-	-	-	-	-	-	-	-	-	-
pH	-	pH	na	-	-	8.12	-	8.01	-	-	-	-	-
Total Suspended Solids	10	mg/L	na	-	-	-	-	-	-	-	-	-	-
Dissolved Metals													
Antimony	0.10	µg/L	20,000	-	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	1.0	µg/L	1,900	-	1.1	1.9	-	1.3	< 1.0	< 1.0	19.9	< 1.0	< 1.0
Barium	1.0	µg/L	29,000	-	11.5	93.9	-	104	65.7	74.4	272	115	75.1
Beryllium	0.10	µg/L	67	-	< 1.0	< 0.5	-	< 0.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Boron	10	µg/L	45,000	-	< 100	1,450	-	784	970	210	230	< 100	290
Cadmium	0.010	µg/L	2.7	-	< 0.050	< 0.2	-	< 0.2	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Chromium (total)	0.50	µg/L	810	-	< 5.0	3.2	-	< 2	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chromium (VI)	5	µg/L	140	-	-	< 5	-	< 5	-	-	-	-	-
Cobalt	0.10	µg/L	66	-	< 1.0	1.4	-	1.6	< 1.0	< 1.0	< 1.0	< 1.0	1.8
Copper	0.20	µg/L	87	-	< 2.0	< 1	-	2.2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Lead	0.050	µg/L	25	-	< 0.50	< 0.5	-	< 0.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Mercury	0.010	µg/L	0.29	-	< 0.010	< 0.02	-	< 0.02	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Molybdenum	0.050	µg/L	9,200	-	1.77	49.7	-	24.6	39.6	< 0.50	< 0.50	1.11	1.01
Nickel	0.50	µg/L	490	-	< 5.0	< 1	-	1.1	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Selenium	0.050	µg/L	63	-	< 0.50	5.4	-	5.4	< 0.50	4.35	< 0.50	2.39	0.64
Silver	0.050	µg/L	1.5	-	< 0.50	< 0.2	-	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sodium	1,000	µg/L	2,300,000	-	24,000	247,000	-	178,000	256,000	492,000	361,000	303,000	269,000
Thallium	0.010	µg/L	510	-	< 0.10	< 0.3	-	< 0.3	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Uranium	0.10	µg/L	420	-	0.96	5.2	-	6.4	3.27	1.33	< 0.10	1.52	2.01
Vanadium	0.50	µg/L	250	-	< 5.0	2.1	-	1.7	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Zinc	1.0	µg/L	1,100	-	**2,420**	< 5	-	5.2	20	< 10	< 10	< 10	< 10
Petroleum Hydrocarbon (PHC) Fractions													
PHC F1	25	µg/L	750	< 25	< 25	< 25	< 25	< 25	< 25	< 25	270	< 25	< 25
PHC F2	100	µg/L	150	150	< 100	**240**	< 100	< 100	< 100	< 100	**20,400**	< 100	< 100
PHC F3	100	µg/L	500	< 100	< 250	240	< 100	< 100	< 250	< 250	< 500	< 250	< 250
PHC F4	100	µg/L	500	< 100	< 250	< 100	< 100	< 100	< 250	< 250	< 500	< 250	< 250
Volatile Organic Compounds													
Acetone	1	µg/L	130,000	-	< 30	65	-	< 1	< 30	< 30	< 30	< 30	32
Benzene	0.2	µg/L	44	-	< 0.50	< 0.2	-	< 0.2	< 0.50	< 0.50	**374**	< 0.50	< 0.50
Bromodichloromethane	0.2	µg/L	85,000	-	< 2.0	< 0.2	-	< 0.2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Bromoform	0.1	µg/L	380	-	< 5.0	< 0.1	-	< 0.1	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Bromomethane	0.2	µg/L	5.6	-	< 0.50	< 0.2	-	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Carbon Tetrachloride	0.20	µg/L	0.79	-	< 0.20	< 0.2	-	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chlorobenzene	0.1	µg/L	630	-	< 0.50	< 0.1	-	< 0.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chloroform	0.2	µg/L	2.4	-	< 1.0	< 0.2	-	< 0.2	< 1.0	< 1.0	< 1.0	1.3	< 1.0
Dibromochloromethane	0.1	µg/L	82,000	-	< 2.0	< 0.1	-	< 0.1	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dichlorobenzene, 1,2- (o-DCB)	0.1	µg/L	4,600	-	< 0.50	< 0.1	-	< 0.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorobenzene, 1,3- (m-DCB)	0.1	µg/L	9,600	-	< 0.50	< 0.1	-	< 0.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorobenzene, 1,4- (p-DCB)	0.1	µg/L	8	-	< 0.50	< 0.1	-	< 0.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorodifluoromethane	0.2	µg/L	4,400	-	< 2.0	< 0.2	-	< 0.2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dichloroethane, 1,1-	0.3	µg/L	320	-	< 0.50	< 0.3	-	< 0.3	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethane, 1,2-	0.2	µg/L	1.6	-	< 0.50	< 0.2	-	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethylene, 1,1-	0.3	µg/L	1.6	-	< 0.50	< 0.3	-	< 0.3	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethylene, cis-1,2-	0.2	µg/L	1.6	-	< 0.50	< 0.2	-	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethylene, trans-1,2-	0.2	µg/L	1.6	-	< 0.50	< 0.2	-	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloropropane, 1,2-	0.2	µg/L	16	-	< 0.50	< 0.2	-	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloropropene, 1,3-	0.50	µg/L	5.2	-	< 0.50	-	-	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloropropene, cis-1,3-	0.30	µg/L	na	-	< 0.30	-	-	-	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Dichloropropene, trans-1,3-	0.30	µg/L	na	-	< 0.30	-	-	-	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Ethylbenzene	0.1	µg/L	2,300	-	< 0.50	0.86	-	< 0.1	< 0.50	< 0.50	195	< 0.50	< 0.50
Ethylene Dibromide (Dibromoethane, 1,2-)	0.1	µg/L	0.25	-	< 0.20	< 0.1	-	< 0.1	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Hexane (n)	0.10	µg/L	51	-	< 0.50	< 0.2	-	< 0.2	< 0.50	1.12	< 0.50	0.72	< 0.50
Methyl Ethyl Ketone	1	µg/L	470,000	-	< 20	19	-	< 1	< 20	< 20	< 20	< 20	< 20
Methyl Isobutyl Ketone	1	µg/L	140,000	-	< 20	< 1	-	< 1	< 20	< 20	< 20	< 20	< 20
Methyl t-butyl ether (MTBE)	0.2	µg/L	190	-	< 2.0	< 0.2	-	< 0.2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Methylene Chloride	0.3	µg/L	610	-	< 5.0	< 0.3	-	< 0.3	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Styrene	0.1	µg/L	1,300	-	< 0.50	< 0.1	-	< 0.1	< 0.50	< 0.50	2.84	< 0.50	< 0.50
Tetrachloroethane, 1,1,1,2-	0.1	µg/L	3.4	-	< 0.50	< 0.1	-	< 0.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Tetrachloroethane, 1,1,2,2-	0.1	µg/L	3.2	-	< 0.50	< 0.1	-	< 0.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Tetrachloroethylene	0.2	µg/L	1.6	-	< 0.50	0.41	-	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Toluene	0.2	µg/L	18,000	-	< 0.50	2.5	-	< 0.2	< 0.50	0.5	70.5	< 0.50	< 0.50
Trichloroethane, 1,1,1-	0.3	µg/L	640	-	< 0.50	< 0.3	-	< 0.3	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Trichloroethane, 1,1,2-	0.2	µg/L	4.7	-	< 0.50	< 0.2	-	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Trichloroethylene	0.2	µg/L	1.6	-	< 0.50	< 0.2	-	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Trichlorofluoromethane	0.4	µg/L	2,500	-	< 5.0	< 0.4	-	< 0.4	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Vinyl Chloride [4]	0.17	µg/L	0.5	-	< 0.50	< 0.17	-	< 0.17	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Xylenes	0.2	µg/L	4,200	-	< 0.50	4.7	-	< 0.2	< 0.50	< 0.50	468	< 0.50	< 0.50
Xylenes, m+p-	0.40	µg/L	na	-	< 0.40	-	-	-	< 0.40	< 0.40	292	< 0.40	< 0.40
Xylenes, o-	0.30	µg/L	na	-	< 0.30	-	-	-	< 0.30	< 0.30	176	< 0.30	< 0.30
PAHs													
Acenaphthene	0.020	µg/L	600	-	< 0.020	< 0.2	-	< 0.2	< 0.020	< 0.020	154	0.031	< 0.020
Acenaphthylene	0.020	µg/L	1.8	-	< 0.020	< 0.2	-	< 0.2	< 0.020	< 0.020	**2.81**	< 0.020	< 0.020
Anthracene	0.020	µg/L	2.4	-	< 0.020	< 0.1	-	< 0.1	< 0.020	< 0.020	**5.56**	< 0.020	< 0.020
Benzo(a)anthracene	0.020	µg/L	4.7	-	0.04	< 0.2	-	< 0.2	< 0.020	< 0.020	0.211	< 0.020	< 0.020
Benzo(a)pyrene	0.010	µg/L	0.81	-	0.032	0.09	-	< 0.01	< 0.010	< 0.010	0.072	< 0.010	< 0.010
Benzo(b)fluoranthene	0.020	µg/L	0.75	-	0.044	< 0.1	-	< 0.1	< 0.020	< 0.020	0.116	< 0.020	< 0.020
Benzo(g,h,i)perylene	0.020	µg/L	0.2	-	0.023	< 0.2	-	< 0.2	< 0.020	< 0.020	0.027	< 0.020	< 0.020
Benzo(k)fluoranthene	0.020	µg/L	0.4	-	< 0.020	< 0.1	-	< 0.1	< 0.030	< 0.020	0.04	< 0.020	< 0.020
Chrysene	0.020	µg/L	1	-	0.033	< 0.1	-	< 0.1	< 0.020	< 0.020	0.148	< 0.020	< 0.020
Dibenzo(a,h)anthracene	0.020	µg/L	0.52	-	< 0.020	< 0.2	-	< 0.2	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
Fluoranthene	0.020	µg/L	130	-	0.06	< 0.2	-	< 0.2	< 0.020	< 0.020	2.27	0.048	< 0.020
Fluorene	0.020	µg/L	400	-	< 0.020	< 0.2	-	< 0.2	< 0.020	< 0.020	73.6	< 0.020	< 0.020
Indeno(1,2,3-cd)pyrene	0.020	µg/L	0.2	-	0.027	< 0.2	-	< 0.2	< 0.020	< 0.020	0.038	< 0.020	< 0.020
Methylnaphthalene, 1-	0.020	µg/L	1,800	-	< 0.020	-	-	-	< 0.020	< 0.020	330	< 0.020	< 0.020
Methylnaphthalene, 2-	0.020	µg/L	1,800	-	< 0.020	-	-	-	< 0.020	< 0.020	571	< 0.020	< 0.020
Methylnaphthalene, 1- & 2-	0.028	µg/L	1800 [4]	-	< 0.028	-	-	-	< 0.028	< 0.028	902	< 0.028	< 0.028
Naphthalene	0.050	µg/L	1,400	-	< 0.050	< 0.2	-	< 0.2	0.139	< 0.050	**7,710**	0.078	0.054
Phenanthrene	0.020	µg/L	580	-	< 0.020	0.32	-	< 0.1	< 0.020	< 0.020	48.8	0.054	< 0.020
Pyrene	0.020	µg/L	68	-	0.06	< 0.2	-	< 0.2	< 0.020	< 0.020	1.34	0.036	< 0.020
PCBs													
Arochlor 1242	0.020	µg/L	na	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	0.020	µg/L	na	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	0.020	µg/L	na	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	0.020	µg/L	na	-	-	-	-	-	-	-	-	-	-
Total PCBs	0.1	µg/L	7.8	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/L – micrograms per litre
µS/cm - microSiemens per centimetre
mg/L - milligrams per litre
BOLD Concentration greater than Table 5 Standa

[1] Laboratory detection limit exceeds regulatory standard/guideline.
[2] Table 5 stratified site condition standards in a non-potable groundwater condition for all types of property use, coarse textured soils (MOE, 2011)
[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.
[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011)

TABLE 4: **Preliminary Screening of Groundwater C**
Central Park, Hamilton, ON

Sample Location			Table 5[2]	MW18-03	MW18-04	MW18-08	MW18-09	MW18-14	MW18-16	MW18-17	MW18-23	MW18-26	MW18-30	TP-1
Laboratory Sample ID			Standard	L2173188-1	L2161100-4	L2161100-1	L2161100-2	L2162292-4	L2161100-3	L2161100-5	L2162292-2	L2170681-3	L2173188-2	4781208
SNC-Lavalin Sample ID			R/P/I	MW18-03	MW18-04	MW18-08	MW18-09	MW18-14	MW18-16	MW18-17	MW18-23	MW18-26	MW18-30	TP-1
Sampling Date (yyyy/mm/dd)			CG	2018/09/27	2018/09/07	2018/09/07	2018/09/07	2018/09/10	2018/09/07	2018/09/07	2018/09/10	2018/09/24	2018/09/27	2013/09/25
Parameter	**RDL**	**Units**												
Water Table Depth (m bgs)				5.1	3.5	4.2	4.4	4.2	4.6	3.08	4.4	3	4	
General Chemistry														
Chloride	0.1	mg/L	2,300	-	-	-	-	-	-	-	-	-	-	-
Cyanide (CN-)	0.002	mg/L	0.066	-	-	-	-	-	-	-	-	-	-	-
Electrical Conductivity	2	µS/cm	na	-	-	-	-	-	-	-	-	-	-	-
Nitrite	0.25	mg/L	na	-	-	-	-	-	-	-	-	-	-	-
pH	-	pH	na	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids	10	mg/L	na	-	-	-	-	-	-	-	-	-	-	-
Dissolved Metals														
Antimony	0.10	µg/L	20,000	0.65	-	< 1.0	< 1.0	-	< 1.0	-	< 1.0	-	< 0.10	-
Arsenic	1.0	µg/L	1,900	1.39	-	9.1	2.8	-	17.8	-	6	-	3.28	-
Barium	1.0	µg/L	29,000	51.7	-	191	178	-	138	-	253	-	216	-
Beryllium	0.10	µg/L	67	< 0.10	-	< 1.0	< 1.0	-	< 1.0	-	< 1.0	-	< 0.10	-
Boron	10	µg/L	45,000	402	-	440	410	-	620	-	370	-	61	-
Cadmium	0.010	µg/L	2.7	< 0.010	-	< 0.050	0.056	-	< 0.050	-	< 0.050	-	< 0.010	-
Chromium (total)	0.50	µg/L	810	< 0.50	-	< 5.0	< 5.0	-	< 5.0	-	< 5.0	-	< 0.50	-
Chromium (VI)	5	µg/L	140	-	-	-	-	-	-	-	-	-	-	-
Cobalt	0.10	µg/L	66	< 0.10	-	< 1.0	2.7	-	1.2	-	1.3	-	0.52	-
Copper	0.20	µg/L	87	1.13	-	< 2.0	3.3	-	< 2.0	-	< 2.0	-	< 0.20	-
Lead	0.050	µg/L	25	0.067	-	< 0.50	< 0.50	-	< 0.50	-	< 0.50	-	< 0.050	-
Mercury	0.010	µg/L	0.29	< 0.010	-	< 0.010	< 0.010	-	< 0.010	-	< 0.010	-	< 0.010	-
Molybdenum	0.050	µg/L	9,200	20.5	-	3.43	3.89	-	4.94	-	2.16	-	1.22	-
Nickel	0.50	µg/L	490	0.87	-	< 5.0	6.1	-	< 5.0	-	< 5.0	-	0.53	-
Selenium	0.050	µg/L	63	0.248	-	< 0.50	12.6	-	< 0.50	-	< 0.50	-	0.171	-
Silver	0.050	µg/L	1.5	< 0.050	-	< 0.50	< 0.50	-	< 0.50	-	< 0.50	-	< 0.050	-
Sodium	1,000	µg/L	2,300,000	83,200	-	252,000	320,000	-	106,000	-	442,000	-	72,900	-
Thallium	0.010	µg/L	510	0.023	-	< 0.10	< 0.10	-	< 0.10	-	< 0.10	-	< 0.010	-
Uranium	0.10	µg/L	420	1.58	-	0.59	2.51	-	0.77	-	2.97	-	0.405	-
Vanadium	0.50	µg/L	250	1	-	< 5.0	< 5.0	-	< 5.0	-	< 5.0	-	< 0.50	-
Zinc	1.0	µg/L	1,100	1.5	-	< 10	< 10	-	< 10	-	< 10	-	< 1.0	-
Petroleum Hydrocarbon (PHC) Fractions														
PHC F1	25	µg/L	750	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	670	165	-
PHC F2	100	µg/L	150	< 100	< 100	< 100	< 100	150	< 100	< 100	< 100	**16,600**	**230**	**2,600**
PHC F3	100	µg/L	500	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	500	< 250	**1,100**
PHC F4	100	µg/L	500	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 500	< 250	< 100
Volatile Organic Compounds														
Acetone	1	µg/L	130,000	< 30	< 30	< 30	< 30	83	< 30	-	202	< 30	< 30	-
Benzene	0.2	µg/L	44	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	**215**	< 0.50	-
Bromodichloromethane	0.2	µg/L	85,000	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	-	< 2.0	< 2.0	< 2.0	-
Bromoform	0.1	µg/L	380	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0	< 5.0	-
Bromomethane	0.2	µg/L	5.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Carbon Tetrachloride	0.20	µg/L	0.79	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	-	< 0.20	< 0.20	< 0.20	-
Chlorobenzene	0.1	µg/L	630	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 8.0	< 0.50	-
Chloroform	0.2	µg/L	2.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0	-
Dibromochloromethane	0.1	µg/L	82,000	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	-	< 2.0	< 2.0	< 2.0	-
Dichlorobenzene, 1,2- (o-DCB)	0.1	µg/L	4,600	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Dichlorobenzene, 1,3- (m-DCB)	0.1	µg/L	9,600	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Dichlorobenzene, 1,4- (p-DCB)	0.1	µg/L	8	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Dichlorodifluoromethane	0.2	µg/L	4,400	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	-	< 2.0	< 2.0	< 2.0	-
Dichloroethane, 1,1-	0.3	µg/L	320	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Dichloroethane, 1,2-	0.2	µg/L	1.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Dichloroethylene, 1,1-	0.3	µg/L	1.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Dichloroethylene, cis-1,2-	0.2	µg/L	1.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Dichloroethylene, trans-1,2-	0.2	µg/L	1.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Dichloropropane, 1,2-	0.2	µg/L	16	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Dichloropropene, 1,3-	0.50	µg/L	5.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Dichloropropene, cis-1,3-	0.30	µg/L	na	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	-	< 0.30	< 0.30	< 0.30	-
Dichloropropene, trans-1,3-	0.30	µg/L	na	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	-	< 0.30	< 0.30	< 0.30	-
Ethylbenzene	0.1	µg/L	2,300	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	391	2.27	-
Ethylene Dibromide (Dibromoethane, 1,2-)	0.1	µg/L	0.25	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	-	< 0.20	< 0.20	< 0.20	-
Hexane (n)	0.10	µg/L	51	< 0.50	< 0.50	< 0.50	< 0.50	0.73	< 0.50	-	< 0.50	< 0.55	< 0.10	-
Methyl Ethyl Ketone	1	µg/L	470,000	< 20	< 20	< 20	< 20	< 20	< 20	-	< 20	< 20	< 20	-
Methyl Isobutyl Ketone	1	µg/L	140,000	< 20	< 20	< 20	< 20	< 20	< 20	-	< 20	< 20	< 20	-
Methyl t-butyl ether (MTBE)	0.2	µg/L	190	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	-	< 2.0	< 2.0	< 2.0	-
Methylene Chloride	0.3	µg/L	610	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0	< 5.0	-
Styrene	0.1	µg/L	1,300	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Tetrachloroethane, 1,1,1,2-	0.1	µg/L	3.4	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Tetrachloroethane, 1,1,2,2-	0.1	µg/L	3.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Tetrachloroethylene	0.2	µg/L	1.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Toluene	0.2	µg/L	18,000	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	5.55	< 0.50	-
Trichloroethane, 1,1,1-	0.3	µg/L	640	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Trichloroethane, 1,1,2-	0.2	µg/L	4.7	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Trichloroethylene	0.2	µg/L	1.6	< 0.50	**2.95**	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Trichlorofluoromethane	0.4	µg/L	2,500	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0	< 5.0	-
Vinyl Chloride [4]	0.17	µg/L	0.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	-
Xylenes	0.2	µg/L	4,200	< 0.50	< 0.50	< 0.50	< 0.50	1.01	< 0.50	< 0.50	< 0.50	879	1.59	-
Xylenes, m+p-	0.40	µg/L	na	< 0.40	< 0.40	< 0.40	< 0.40	0.55	< 0.40	< 0.40	< 0.40	767	1.59	-
Xylenes, o-	0.30	µg/L	na	< 0.30	< 0.30	< 0.30	< 0.30	0.46	< 0.30	< 0.30	< 0.30	112	< 0.30	-
PAHs														
Acenaphthene	0.020	µg/L	600	0.04	< 0.020	0.18	< 0.020	< 0.030	1.43	0.024	4.31	**646**	4.87	8.8
Acenaphthylene	0.020	µg/L	1.8	< 0.020	< 0.020	0.043	< 0.020	< 0.020	0.283	0.039	0.04	**2.27**	0.112	< 0.2
Anthracene	0.020	µg/L	2.4	0.026	< 0.020	< 0.020	< 0.020	< 0.020	0.348	< 0.020	0.021	**2.64**	2.34	1
Benzo(a)anthracene	0.020	µg/L	4.7	0.025	< 0.020	< 0.020	< 0.020	< 0.020	0.086	< 0.020	< 0.020	0.315	0.202	0.91
Benzo(a)pyrene	0.010	µg/L	0.81	0.015	< 0.010	< 0.010	< 0.010	< 0.010	0.059	< 0.010	< 0.010	0.118	0.014	0.76
Benzo(b)fluoranthene	0.020	µg/L	0.75	0.024	< 0.020	< 0.020	< 0.020	< 0.020	0.078	< 0.020	< 0.020	0.194	0.024	**1.4**
Benzo(g,h,i)perylene	0.020	µg/L	0.2	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	0.035	< 0.020	< 0.020	0.054	< 0.020	**0.33**
Benzo(k)fluoranthene	0.020	µg/L	0.4	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	0.027	< 0.020	< 0.020	0.061	< 0.020	**0.53**
Chrysene	0.020	µg/L	1	0.033	< 0.020	< 0.020	< 0.020	< 0.020	0.074	< 0.020	< 0.020	0.207	0.178	0.96
Dibenzo(a,h)anthracene	0.020	µg/L	0.52	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.2
Fluoranthene	0.020	µg/L	130	0.138	< 0.020	0.025	< 0.020	0.027	0.484	0.056	0.109	16.4	5.11	4
Fluorene	0.020	µg/L	400	0.046	< 0.020	0.114	< 0.020	0.278	1.05	0.075	0.992	56.4	6.84	5.5
Indeno(1,2,3-cd)pyrene	0.020	µg/L	0.2	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	0.042	< 0.020	< 0.020	0.07	< 0.020	**0.47**
Methylnaphthalene, 1-	0.020	µg/L	1,800	0.031	< 0.020	0.122	< 0.020	0.028	0.86	0.363	< 0.020	613	2.77	-
Methylnaphthalene, 2-	0.020	µg/L	1,800	0.045	< 0.020	0.118	< 0.020	0.03	1.03	0.526	< 0.020	82.4	1.25	-
Methylnaphthalene, 1- & 2-	0.028	µg/L	1800 [4]	0.076	< 0.028	0.24	< 0.028	0.057	1.89	0.89	< 0.028	695	4.02	-
Naphthalene	0.050	µg/L	1,400	0.061	< 0.050	2.47	0.164	0.614	8.08	4.23	0.122	**10,400**	6.06	2.9
Phenanthrene	0.020	µg/L	580	0.14	< 0.020	0.13	< 0.020	0.06	1.87	0.218	< 0.020	123	17.1	2.5
Pyrene	0.020	µg/L	68	0.097	< 0.020	< 0.020	< 0.020	0.028	0.386	0.056	0.022	5.13	2.97	3.6
PCBs														
Arochlor 1242	0.020	µg/L	na	< 0.020	-	-	-	< 0.040	-	-	-	-	< 0.020	-
Arochlor 1248	0.020	µg/L	na	< 0.020	-	-	-	< 0.020	-	-	-	-	< 0.020	-
Arochlor 1254	0.020	µg/L	na	< 0.020	-	-	-	< 0.020	-	-	-	-	< 0.020	-
Arochlor 1260	0.020	µg/L	na	< 0.020	-	-	-	< 0.020	-	-	-	-	< 0.020	-
Total PCBs	0.1	µg/L	7.8	< 0.040	-	-	-	< 0.053	-	-	-	-	< 0.040	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/L – micrograms per litre
µS/cm - microSiemens per centimetre
mg/L - milligrams per litre
BOLD Concentration greater than Table 5 Standa

[1] Laboratory detection limit exceeds regulatory standard/guideline.
[2] Table 5 stratified site condition standards in a non-potable groundwater condition for all types of property use, coarse textured soils (MOE, 2011)
[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.
[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011)

TABLE 4: **Preliminary Screening of Groundwater C**
Central Park, Hamilton, ON

Sample Location Laboratory Sample ID SNC-Lavalin Sample ID Sampling Date (yyyy/mm/dd)			Table 5[2] Standard R/P/I CG	RDL (most recent and highest)	Maximum (0 means no detection)	Maximum With RDL	Maximum With RDL x 1.2	Exceeded Generic Table 5 SCS
Parameter	**RDL**	**Units**						
Water Table Depth (m bgs)								
General Chemistry								
Chloride	0.1	mg/L	2,300	0.1	498	498	597.6	No
Cyanide (CN-)	0.002	mg/L	0.066	0.002	0.004	0.004	0.0048	No
Electrical Conductivity	2	µS/cm	na	0.002	2920	2920	3504	No
Nitrite	0.25	mg/L	na	1	0	1	1.2	No
pH	-	pH	na		8.53	8.53	10.236	No
Total Suspended Solids	10	mg/L	na	10	33	33	39.6	No
Dissolved Metals								
Antimony	0.10	µg/L	20,000	1	0.65	1	1.2	No
Arsenic	1.0	µg/L	1,900	1	24.7	24.7	29.64	No
Barium	1.0	µg/L	29,000	1	458	458	549.6	No
Beryllium	0.10	µg/L	67	1	2.6	2.6	3.12	No
Boron	10	µg/L	45,000	100	1450	1450	1740	No
Cadmium	0.010	µg/L	2.7	0.05	0.056	0.056	0.0672	No
Chromium (total)	0.50	µg/L	810	0.5	7.4	7.4	8.88	No
Chromium (VI)	5	µg/L	140	5	0	5	6	No
Cobalt	0.10	µg/L	66	0.1	2.7	2.7	3.24	No
Copper	0.20	µg/L	87	2	3.3	3.3	3.96	No
Lead	0.050	µg/L	25	0.5	0.073	0.5	0.6	No
Mercury	0.010	µg/L	0.29	0.02	0	0.02	0.024	No
Molybdenum	0.050	µg/L	9,200	0.05	53.8	53.8	64.56	No
Nickel	0.50	µg/L	490	0.5	6.1	6.1	7.32	No
Selenium	0.050	µg/L	63	0.5	12.6	12.6	15.12	No
Silver	0.050	µg/L	1.5	0.5	0	0.5	0.6	No
Sodium	1,000	µg/L	2,300,000	500	537000	537000	644400	No
Thallium	0.010	µg/L	510	0.1	0.023	0.1	0.12	No
Uranium	0.10	µg/L	420	0.1	16.8	16.8	20.16	No
Vanadium	0.50	µg/L	250	5	14.3	14.3	17.16	No
Zinc	1.0	µg/L	1,100	1	2420	2420	2904	Yes
Petroleum Hydrocarbon (PHC) Fractions								
PHC F1	25	µg/L	750	25	670	670	804	Yes
PHC F2	100	µg/L	150	100	20400	20400	24480	Yes
PHC F3	100	µg/L	500	500	1700	1700	2040	Yes
PHC F4	100	µg/L	500	500	0	500	600	No
Volatile Organic Compounds								
Acetone	1	µg/L	130,000	30	202	202	242.4	No
Benzene	0.2	µg/L	44	0.5	374	374	448.8	Yes
Bromodichloromethane	0.2	µg/L	85,000	2	0	2	2.4	No
Bromoform	0.1	µg/L	380	5	0	5	6	No
Bromomethane	0.2	µg/L	5.6	0.5	0	0.5	0.6	No
Carbon Tetrachloride	0.20	µg/L	0.79	0.2	0	0.2	0.24	No
Chlorobenzene	0.1	µg/L	630	8	0	8	9.6	No
Chloroform	0.2	µg/L	2.4	1	1.3	1.3	1.56	No
Dibromochloromethane	0.1	µg/L	82,000	2	0	2	2.4	No
Dichlorobenzene, 1,2- (o-DCB)	0.1	µg/L	4,600	0.5	0	0.5	0.6	No
Dichlorobenzene, 1,3- (m-DCB)	0.1	µg/L	9,600	0.5	0.12	0.5	0.6	No
Dichlorobenzene, 1,4- (p-DCB)	0.1	µg/L	8	0.5	0	0.5	0.6	No
Dichlorodifluoromethane	0.2	µg/L	4,400	2	0	2	2.4	No
Dichloroethane, 1,1-	0.3	µg/L	320	0.5	0	0.5	0.6	No
Dichloroethane, 1,2-	0.2	µg/L	1.6	0.5	0	0.5	0.6	No
Dichloroethylene, 1,1-	0.3	µg/L	1.6	0.6	0	0.6	0.72	No
Dichloroethylene, cis-1,2-	0.2	µg/L	1.6	0.5	0.44	0.5	0.6	No
Dichloroethylene, trans-1,2-	0.2	µg/L	1.6	0.5	0	0.5	0.6	No
Dichloropropane, 1,2-	0.2	µg/L	16	0.5	0	0.5	0.6	No
Dichloropropene, 1,3-	0.50	µg/L	5.2	0.5	0	0.5	0.6	No
Dichloropropene, cis-1,3-	0.30	µg/L	na	0.3	0	0.3	0.36	No
Dichloropropene, trans-1,3-	0.30	µg/L	na	0.3	0	0.3	0.36	No
Ethylbenzene	0.1	µg/L	2,300	0.5	391	391	469.2	No
Ethylene Dibromide (Dibromoethane, 1,2-)	0.1	µg/L	0.25	0.2	0	0.2	0.24	No
Hexane (n)	0.10	µg/L	51	0.55	1.12	1.12	1.344	No
Methyl Ethyl Ketone	1	µg/L	470,000	20	21	21	25.2	No
Methyl Isobutyl Ketone	1	µg/L	140,000	20	0	20	24	No
Methyl t-butyl ether (MTBE)	0.2	µg/L	190	2	0	2	2.4	No
Methylene Chloride	0.3	µg/L	610	5	0	5	6	No
Styrene	0.1	µg/L	1,300	0.5	2.84	2.84	3.408	No
Tetrachloroethane, 1,1,1,2-	0.1	µg/L	3.4	0.5	0	0.5	0.6	No
Tetrachloroethane, 1,1,2,2-	0.1	µg/L	3.2	0.5	0	0.5	0.6	No
Tetrachloroethylene	0.2	µg/L	1.6	0.5	0.41	0.5	0.6	No
Toluene	0.2	µg/L	18,000	0.5	70.5	70.5	84.6	No
Trichloroethane, 1,1,1-	0.3	µg/L	640	0.6	0	0.6	0.72	No
Trichloroethane, 1,1,2-	0.2	µg/L	4.7	0.5	0	0.5	0.6	No
Trichloroethylene	0.2	µg/L	1.6	0.5	12	12	14.4	Yes
Trichlorofluoromethane	0.4	µg/L	2,500	5	0	5	6	No
Vinyl Chloride [4]	0.17	µg/L	0.5	0.5	0	1.59	1.908	Yes
Xylenes	0.2	µg/L	4,200	0.5	879	879	1054.8	No
Xylenes, m+p-	0.40	µg/L	na	0.4	767	767	920.4	No
Xylenes, o-	0.30	µg/L	na	0.3	176	176	211.2	No
PAHs								
Acenaphthene	0.020	µg/L	600	0.15	646	646	775.2	Yes
Acenaphthylene	0.020	µg/L	1.8	0.02	2.81	2.81	3.372	Yes
Anthracene	0.020	µg/L	2.4	0.02	5.56	5.56	6.672	Yes
Benzo(a)anthracene	0.020	µg/L	4.7	0.02	0.91	0.91	1.092	No
Benzo(a)pyrene	0.010	µg/L	0.81	0.01	0.76	0.76	0.912	Yes
Benzo(b)fluoranthene	0.020	µg/L	0.75	0.02	1.4	1.4	1.68	Yes
Benzo(g,h,i)perylene	0.020	µg/L	0.2	0.02	0.33	0.33	0.396	Yes
Benzo(k)fluoranthene	0.020	µg/L	0.4	0.02	0.53	0.53	0.636	Yes
Chrysene	0.020	µg/L	1	0.02	0.96	0.96	1.152	Yes
Dibenzo(a,h)anthracene	0.020	µg/L	0.52	0.02	0.041	0.041	0.0492	No
Fluoranthene	0.020	µg/L	130	0.02	16.4	16.4	19.68	No
Fluorene	0.020	µg/L	400	0.02	73.6	73.6	88.32	No
Indeno(1,2,3-cd)pyrene	0.020	µg/L	0.2	0.02	0.47	0.47	0.564	Yes
Methylnaphthalene, 1-	0.020	µg/L	1,800	0.02	613	613	735.6	No
Methylnaphthalene, 2-	0.020	µg/L	1,800	0.02	571	571	685.2	No
Methylnaphthalene, 1- & 2-	0.028	µg/L	1800 [4]	0.028	902	902	1082.4	No
Naphthalene	0.050	µg/L	1,400	0.05	10400	10400	12480	Yes
Phenanthrene	0.020	µg/L	580	0.02	123	123	147.6	No
Pyrene	0.020	µg/L	68	0.02	5.13	5.13	6.156	No
PCBs								
Arochlor 1242	0.020	µg/L	na	0.04	0	0.04	0.048	No
Arochlor 1248	0.020	µg/L	na	0.02	0	0.02	0.024	No
Arochlor 1254	0.020	µg/L	na	0.02	0	0.02	0.024	No
Arochlor 1260	0.020	µg/L	na	0.02	0	0.02	0.024	No
Total PCBs	0.1	µg/L	7.8	0.05	0	0.05	0.06	No

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/L – micrograms per litre
µS/cm - microSiemens per centimetre
mg/L - milligrams per litre
BOLD Concentration greater than Table 5 Standa

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

[2] Table 5 stratified site condition standards in a non-potable groundwater condition for all types of property use, coarse textured soils (MOE, 2011)

[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011)

TABLE 5: **Soil Vapour Analytical Results**
Central Park, Hamilton, ON

SNC-Lavalin Sample ID Laboratory Sample ID Sample Location Sampling Date (yyyy/mm/dd)			Health Based Indoor Air Criteria (HBIAC) - Residential[2]	Sub-slab Vapour Criteria (Residential HBIAC adjusted with a residential alpha of 0.02)	SVP18-01 ICO051 SVP18-01/2785 2018/10/22	SVP18-02 ICO052 SVP18-02/7799 2018/10/22	SVP18-03 ICO053 SVP18-03/27662 2018/10/22	SVP18-03 ICO055 SVP18-DUP/114 2018/10/22 Duplicate of SVP18-03	SVP18-04 ICO054 SVP18-04/29293 2018/10/22
Parameter	**RDL**	**Units**							
Volatile Organics									
Acetone	1.4	µg/m3	2,500	125,000	42.8	71.3	67.4	121	61.6
Benzene	0.32	µg/m3	0.506	25.3	1.14	0.44	0.87	0.88	**83**
Benzyl chloride	2.6	µg/m3	na	na	< 2.6	< 2.6	< 2.6	< 2.6	< 2.6
Bromodichloromethane	1.3	µg/m3	na	na	< 1.3	< 1.3	< 1.3	< 1.3	< 1.3
Bromoform	2.1	µg/m3	na	na	< 2.1	< 2.1	< 2.1	< 2.1	< 2.1
Bromomethane	0.39	µg/m3	1.04	52	< 0.39	< 0.39	< 0.39	< 0.39	< 0.39
Butadiene, 1,3-	1.1	µg/m3	na	na	< 1.1	< 1.1	< 1.1	< 1.1	< 1.1
Carbon Disulphide	1.6	µg/m3	na	na	3.5	1.6	< 1.6	< 1.6	5.5
Carbon tetrachloride	0.63	µg/m3	0.417	20.9	< 0.63	< 0.63	< 0.63	< 0.63	< 0.63
Chlorobenzene	0.46	µg/m3	209	10,450	< 0.46	< 0.46	< 0.46	< 0.46	< 0.46
Chloroethane	0.79	µg/m3	na	na	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79
Chloroform	0.49	µg/m3	20.9	1,045	< 0.49	0.6	0.84	0.82	< 8.8
Chloromethane	0.62	µg/m3	na	na	< 0.62	< 0.62	0.77	0.74	< 0.62
Cyclohexane	0.69	µg/m3	na	na	1.55	< 0.69	< 0.69	< 0.69	16.1
Dibromochloromethane	1.7	µg/m3	na	na	< 1.7	< 1.7	< 1.7	< 1.7	< 1.7
Dichlorobenzene, 1,2-	0.60	µg/m3	125	6,250	< 0.60	< 0.60	< 0.60	< 0.60	< 0.60
Dichlorobenzene, 1,3-	2.4	µg/m3	na	na	< 2.4	2.7	< 2.4	< 2.4	2.5
Dichlorobenzene, 1,4-	0.60	µg/m3	0.278	13.9	< 0.60	< 0.60	< 0.60	< 0.60	< 0.60
Dichlorodifluoromethane	0.99	µg/m3	na	na	2	2.19	3.66	3.56	3.24
Dichloroethane, 1,1-	0.40	µg/m3	34.4	1,720	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
Dichloroethane, 1,2-	0.40	µg/m3	0.0428	2.1	< 0.40	< 0.40	< 0.40	< 0.40	< 2.4
Dichloroethylene, 1,1-	0.40	µg/m3	14.6	730	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
Dichloroethylene, cis-1,2-	0.40	µg/m3	31.3	1,565	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
Dichloroethylene, trans-1,2-	0.79	µg/m3	12.5	625	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79
Dichloropropane, 1,2-	0.46	µg/m3	0.834	41.7	< 0.46	< 0.46	< 0.46	< 0.46	< 0.46
Dichloropropene, cis-1,3-	0.45	µg/m3	na	na	< 0.45	< 0.45	< 0.45	< 0.45	< 0.45
Dichloropropene, trans-1,3-	0.45	µg/m3	na	na	< 0.45	< 0.45	< 0.45	< 0.45	< 0.45
Dichlorotetrafluoroethane, 1,2-	1.2	µg/m3	na	na	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Dioxane, 1,4	3.6	µg/m3	751	37,550	< 3.6	< 3.6	< 3.6	< 3.6	< 3.6
Ethanol	1.9	µg/m3	na	na	21.9	32.7	12.1	12.5	28.5
Ethyl acetate	3.6	µg/m3	na	na	16.4	20.9	7.1	7.4	26.1
Ethylbenzene	0.43	µg/m3	209	10,450	1.25	2.1	1.12	1.13	25
Ethylene Dibromide	0.77	µg/m3	0.00185	0.1	**< 0.77**	**< 0.77**	**< 0.77**	**< 0.77**	**< 0.77**
Ethyltoluene, 4-	2.5	µg/m3	na	na	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
Freon 113	1.2	µg/m3	na	na	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Hexachlorobutadiene	5.3	µg/m3	0.0506	2.5	**< 5.3**	**< 5.3**	**< 5.3**	**< 5.3**	**< 5.3**
Hexane (n)	0.70	µg/m3	521	26,050	1.14	< 0.70	< 0.70	< 0.70	51
Hexanone, 2-	4.1	µg/m3	na	na	< 4.1	< 4.1	< 4.1	< 4.1	< 4.1
Isopropanol	2.5	µg/m3	na	na	< 2.5	9.9	3.4	3.9	2.6
Methyl ethyl ketone	0.59	µg/m3	1,000	50,000	2.45	3.07	2.43	2.11	< 5.9
Methyl isobutyl ketone	0.82	µg/m3	602	30,100	< 0.82	< 0.82	< 0.82	< 0.82	< 0.82
Methyl tert-butyl ether	0.72	µg/m3	4.28	214	< 0.72	< 0.72	< 0.72	< 0.72	< 0.72
Methylene Chloride	2.1	µg/m3	48.4	2,420	< 2.1	< 2.1	< 2.1	< 2.1	< 2.1
Naphthalene	1.0	µg/m3	0.772	38.6	< 1.0	10.8	4.5	4.4	25.7
n-Heptane	1.2	µg/m3	na	na	< 1.2	< 1.2	< 1.2	< 1.2	22.7
Propene	0.86	µg/m3	na	na	< 0.86	< 0.86	< 2.1	< 2.9	< 340
Styrene	0.43	µg/m3	54.2	2,710	< 0.43	< 0.85	< 0.43	< 0.43	< 0.85
Tetrachloroethane, 1,1,1,2-	0.69	µg/m3	0.15	7.5	< 0.69	< 0.69	< 0.69	< 0.69	< 0.69
Tetrachloroethane, 1,1,2,2-	0.69	µg/m3	0.0192	1.0	< 0.69	< 0.69	< 0.69	< 0.69	< 0.69
Tetrachloroethylene	0.68	µg/m3	4.28	214	1.02	< 0.68	< 0.68	< 0.68	< 0.68
Tetrahydrofuran	1.2	µg/m3	na	na	< 1.2	1.8	< 1.2	< 1.2	< 1.2
Toluene	0.38	µg/m3	1,040	52,000	4.15	3.93	2.26	2.33	27.2
Trichlorobenzene, 1,2,4-	3.7	µg/m3	1.67	83.5	< 3.7	< 3.7	< 3.7	< 3.7	< 3.7
Trichloroethane, 1,1,1-	0.55	µg/m3	209	10,450	< 0.55	0.87	< 0.55	< 0.55	< 0.55
Trichloroethylene	0.54	µg/m3	0.271	13.6	< 0.54	< 0.54	< 0.54	< 0.54	< 0.54
Trichlorofluoromethane	1.1	µg/m3	na	na	< 1.1	6.3	1.3	1.3	< 1.1
Trimethylbenzene, 1,3,5-	2.5	µg/m3	na	na	< 2.5	< 2.5	< 2.5	< 2.5	2.8
Trimethylpentane, 2,2,4-	0.93	µg/m3	na	na	< 0.93	< 0.93	< 0.93	< 0.93	41.2
Vinyl acetate	0.70	µg/m3	na	na	< 0.70	< 0.70	< 0.70	< 0.70	< 0.70
Vinyl bromide	0.87	µg/m3	na	na	< 0.87	< 0.87	< 0.87	< 0.87	< 0.87
Vinyl chloride	0.26	µg/m3	0.126	6.3	< 0.26	< 0.26	< 0.26	< 0.26	< 0.26
Xylenes	1.3	µg/m3	146	7,300	4.9	6.1	2.9	2.9	27.9
Xylenes, m+p-	0.87	µg/m3	na	na	3.19	3.78	1.78	1.8	14.8
Xylenes, o-	0.43	µg/m3	na	na	1.69	2.33	1.07	1.08	13.1

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by Maxxam Analytics Inc., ,
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/m^3 - micrograms per cubic metres

BOLD Concentration greater than Health Based Sub-Slab Vapour Criteria- Residential

TABLE 6: Monitoring Wells for Off-Site Indoor Air Inhalation Assessment

MWs For Offsite Indoor Air	Residential Scenario	Commercial Scenario
MW-103	X	
MW-102	X	
MW-104	X	X
MW-115	X	
MW-116	X	
MW-201	X	X
MW-202	X	X
MW-203		X
MW-205	X	
MW-09-17	X	
BH-17-17	X	
MW18-01	X	
MW18-02	X	
MW18-08	X	
MW18-09	X	
MW18-14		X
MW18-17	X	
MW18-23	X	X
MW18-25	X	X
MW18-26	X	X
MW18-27	X	X
MW18-28	X	
MW18-29	X	
MW18-30		X

TABLE7: **Preliminary Screening of Groundwater COCs - Shallow GW Condition For Residential Indoor Air Inhalation GW-IA (Human Health)**
Central Park, Hamilton, ON

Sample Location			Table 7[2] Standard CG	MW-103	MW-103	MW-103	MW-103	MW-103	MW-102	MW-102	MW-102	MW-102
Laboratory Sample ID				4841684	7757487	4974191	7836683	L2163169-2	4841679	4841679	7757438	L2163993-2
SNC-Lavalin Sample ID				MW-103	MW-103	MW-183	MW-103	MW-103	MW-102	MW-102	MW-102	MW-102
Sampling Date (yyyy/mm/dd)				2013/10/11	2016/08/05	2016/08/05	2016/09/09	2018/09/11	2013/10/11	2013/10/16	2016/08/04	2018/09/12
Parameter	**RDL**	**Units**										
Water Table Depth				5.1	5.1	5.1	5.1	5.1	3.7	3.7	3.7	3.7
Dissolved Metals												
Mercury	0.010	µg/L	0.1	< 0.02	< 0.02	< 0.02	-	< 0.010	-	< 0.02	< 0.02	< 0.010
Petroleum Hydrocarbon (PHC) Fractions												
PHC F1	25	µg/L	420	< 25	< 25	< 25	-	< 25	< 25	-	< 25	< 25
PHC F2	100	µg/L	150	< 100	< 100	< 100	-	< 100	< 100	-	< 100	< 100
PHC F3	100	µg/L	500	< 100	< 100	< 100	-	< 250	< 100	-	< 100	< 250
PHC F4	100	µg/L	500	< 100	< 100	< 100	-	< 250	< 100	-	< 100	< 250
Volatile Organic Compounds												
Acetone	1	µg/L	100,000	< 1	-	-	< 1	< 30	< 2.0	-	< 1	< 30
Benzene	0.2	µg/L	0.5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50
Bromodichloromethane	0.2	µg/L	67,000	< 0.2	-	-	< 0.2	< 2.0	< 0.40	-	< 0.2	< 2.0
Bromoform	0.1	µg/L	5	< 0.1	-	-	< 0.1	< 5.0	< 0.20	-	< 0.1	< 5.0
Bromomethane	0.2	µg/L	0.89	< 0.2	-	-	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50
Carbon Tetrachloride	0.20	µg/L	0.2	< 0.2	-	-	< 0.2	< 0.20	< 0.40[1]	-	< 0.2	< 0.20
Chlorobenzene	0.1	µg/L	140	< 0.1	-	-	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50
Chloroform	0.2	µg/L	2	< 0.2	-	-	< 0.2	< 1.0	< 0.40	-	< 0.2	< 1.0
Dibromochloromethane	0.1	µg/L	65,000	< 0.1	-	-	< 0.1	< 2.0	< 0.20	-	< 0.1	< 2.0
Dichlorobenzene, 1,2- (o-DCB)	0.1	µg/L	150	< 0.1	-	-	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50
Dichlorobenzene, 1,3- (m-DCB)	0.1	µg/L	7,600	< 0.1	-	-	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50
Dichlorobenzene, 1,4- (p-DCB)	0.1	µg/L	0.5	< 0.1	-	-	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50
Dichlorodifluoromethane	0.2	µg/L	3,500	< 0.2	-	-	< 0.2	< 2.0	< 0.40	-	< 0.2	< 2.0
Dichloroethane, 1,1-	0.3	µg/L	11	< 0.3	-	-	< 0.3	< 0.50	< 0.60	-	< 0.3	< 0.50
Dichloroethane, 1,2-	0.2	µg/L	0.5	< 0.2	-	-	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50
Dichloroethylene, 1,1-	0.3	µg/L	0.5	< 0.3	-	-	< 0.3	< 0.50	< 0.60[1]	-	< 0.3	< 0.50
Dichloroethylene, cis-1,2-	0.2	µg/L	1.6	0.44	-	-	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50
Dichloroethylene, trans-1,2-	0.2	µg/L	1.6	< 0.2	-	-	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50
Dichloropropane, 1,2-	0.2	µg/L	0.58	< 0.2	-	-	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50
Dichloropropene, 1,3-	0.50	µg/L	0.5	-	-	-	-	< 0.50	-	-	-	< 0.50
Dichloropropene, cis-1,3-	0.30	µg/L	na	-	-	-	-	< 0.30	-	-	-	< 0.30
Dichloropropene, trans-1,3-	0.30	µg/L	na	-	-	-	-	< 0.30	-	-	-	< 0.30
Ethylbenzene	0.1	µg/L	54	< 0.1	< 0.1	< 0.1	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50
Ethylene Dibromide (Dibromoethane, 1,2-)	0.1	µg/L	0.2	< 0.1	-	-	< 0.1	< 0.20	< 0.20	-	< 0.1	< 0.20
Hexane (n)	0.10	µg/L	5	< 0.2	-	-	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50
Methyl Ethyl Ketone	1	µg/L	21,000	< 1	-	-	< 1	< 20	< 2.0	-	< 1	< 20
Methyl Isobutyl Ketone	1	µg/L	5,200	< 1	-	-	< 1	< 20	< 2.0	-	< 1	< 20
Methyl t-butyl ether (MTBE)	0.2	µg/L	15	< 0.2	-	-	< 0.2	< 2.0	< 0.40	-	< 0.2	< 2.0
Methylene Chloride	0.3	µg/L	26	< 0.3	-	-	< 0.3	< 5.0	< 0.60	-	< 0.3	< 5.0
Styrene	0.1	µg/L	43	< 0.1	-	-	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50
Tetrachloroethane, 1,1,1,2-	0.1	µg/L	1.1	< 0.1	-	-	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50
Tetrachloroethane, 1,1,2,2-	0.1	µg/L	0.5	< 0.1	-	-	< 0.1	< 0.50	< 0.20	-	< 0.1	< 0.50
Tetrachloroethylene	0.2	µg/L	0.5	< 0.2	-	-	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50
Toluene	0.2	µg/L	320	< 0.2	< 0.2	< 0.2	0.33	< 0.50	< 0.40	-	< 0.2	< 0.50
Trichloroethane, 1,1,1-	0.3	µg/L	23	< 0.3	-	-	< 0.3	< 0.50	< 0.60	-	< 0.3	< 0.50
Trichloroethane, 1,1,2-	0.2	µg/L	0.5	< 0.2	-	-	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50
Trichloroethylene	0.2	µg/L	0.5	**12**	-	-	**7.6**	**1.64**	< 0.40	-	< 0.2	< 0.50
Trichlorofluoromethane	0.4	µg/L	2,000	< 0.4	-	-	< 0.4	< 5.0	< 0.80	-	< 0.4	< 5.0
Vinyl Chloride [4]	0.17	µg/L	0.5	< 0.17	-	-	< 0.17	< 0.50	< 0.34	-	< 0.17	< 0.50
Xylenes	0.2	µg/L	72	< 0.2	< 0.2	< 0.2	< 0.2	< 0.50	< 0.40	-	< 0.2	< 0.50
Xylenes, m+p-	0.40	µg/L	na	-	-	-	-	< 0.40	-	-	-	< 0.40
Xylenes, o-	0.30	µg/L	na	-	-	-	-	< 0.30	-	-	-	< 0.30
PAHs												
Acenaphthene	0.020	µg/L	17	< 0.2	0.35	0.42	-	< 0.020	< 0.2	-	< 0.2	< 0.020
Acenaphthylene	0.020	µg/L	1	< 0.2	< 0.2	< 0.2	-	< 0.020	< 0.2	-	< 0.2	< 0.020
Anthracene	0.020	µg/L	1	< 0.1	0.12	0.1	-	< 0.020	< 0.1	-	< 0.1	< 0.020
Benzo(a)anthracene	0.020	µg/L	1.8	< 0.2	< 0.2	< 0.2	-	< 0.020	< 0.2	-	< 0.2	< 0.020
Benzo(a)pyrene	0.010	µg/L	0.81	< 0.01	< 0.01	< 0.01	-	< 0.010	< 0.01	-	< 0.01	< 0.010
Benzo(b)fluoranthene	0.020	µg/L	0.75	< 0.1	< 0.1	< 0.1	-	< 0.020	< 0.1	-	< 0.1	< 0.020
Benzo(g,h,i)perylene	0.020	µg/L	0.2	< 0.2	< 0.2	< 0.2	-	< 0.020	< 0.2	-	< 0.2	< 0.020
Benzo(k)fluoranthene	0.020	µg/L	0.4	< 0.1	< 0.1	< 0.1	-	< 0.020	< 0.1	-	< 0.1	< 0.020
Chrysene	0.020	µg/L	0.7	< 0.1	< 0.1	< 0.1	-	< 0.020	< 0.1	-	< 0.1	< 0.020
Dibenzo(a,h)anthracene	0.020	µg/L	0.4	< 0.2	< 0.2	< 0.2	-	< 0.020	< 0.2	-	< 0.2	< 0.020
Fluoranthene	0.020	µg/L	44	< 0.2	< 0.2	< 0.2	-	< 0.020	< 0.2	-	< 0.2	< 0.020
Fluorene	0.020	µg/L	290	< 0.2	0.23	0.26	-	< 0.020	< 0.2	-	< 0.2	< 0.020
Indeno(1,2,3-cd)pyrene	0.020	µg/L	0.2	< 0.2	< 0.2	< 0.2	-	< 0.020	< 0.2	-	< 0.2	< 0.020
Methylnaphthalene, 1-	0.020	µg/L	1,500	-	-	-	-	< 0.020	-	-	-	< 0.020
Methylnaphthalene, 2-	0.020	µg/L	1,500	-	-	-	-	< 0.020	-	-	-	< 0.020
Methylnaphthalene, 1- & 2-	0.028	µg/L	1500 [3]	-	-	-	-	< 0.028	-	-	-	< 0.028
Naphthalene	0.050	µg/L	7	2.9	2.1	2	-	< 0.050	0.44	-	< 0.2	< 0.050
Phenanthrene	0.020	µg/L	380	< 0.1	0.47	0.55	-	< 0.020	< 0.1	-	< 0.1	< 0.020
Pyrene	0.020	µg/L	5.7	< 0.2	< 0.2	< 0.2	-	< 0.020	< 0.2	-	< 0.2	< 0.020
PCBs												
Arochlor 1242	0.020	µg/L	na	< 0.1	-	-	-	-	< 0.1	-	-	-
Arochlor 1248	0.020	µg/L	na	< 0.1	-	-	-	-	< 0.1	-	-	-
Arochlor 1254	0.020	µg/L	na	< 0.1	-	-	-	-	< 0.1	-	-	-
Arochlor 1260	0.020	µg/L	na	< 0.1	-	-	-	-	< 0.1	-	-	-
Total PCBs	0.1	µg/L	0.2	< 0.1	-	-	-	-	< 0.1	-	-	-

Sample Location	MW-104	MW-104	MW-104	MW-104	MW-115	MW-115	MW-115	MW-116	MW-116	MW-116	MW-116
Laboratory Sample ID	4841730	4974192	7757452	L2162292-1	4841744	4974191	L2163169-4	14T916426	14T916999	5999699	5999703
SNC-Lavalin Sample ID	MW-104	MW-104	MW-104	MW-104	MW-115	MW-115	MW-115	MW-116	MW-116	MW-116	MW-120
Sampling Date (yyyy/mm/dd)	2013/10/11	2013/11/18	2016/08/15	2018/09/10	2013/10/11	2013/11/18	2018/09/11	2014/11/14	2014/11/17	2014/10/24	2014/10/24
Parameter											
Water Table Depth	2.2	2.2	2.2	2.2	2.5	2.5	2.5	2.1	2.1	2.1	2.1
Dissolved Metals											
Mercury	< 0.02	-	< 0.02	< 0.010	< 0.02	-	< 0.010	-	-	-	-
Petroleum Hydrocarbon (PHC) Fractions											
PHC F1	< 25	100	< 25	< 64	40	< 25	< 67	-	-	< 25	-
PHC F2	12,000	19,000	10,000	12,700	1,500	5,800	7,460	230	620	510	-
PHC F3	< 100	2,300	< 100	550	< 100	510	< 250	< 100	< 100	< 100	-
PHC F4	< 100	< 100	< 100	< 500	< 100	< 100	< 250	< 100	< 100	< 100	-
Volatile Organic Compounds											
Acetone	< 10.0	< 1	< 1	< 30	< 10.0	< 4.0	< 30	-	-	< 1	< 1
Benzene	350	200	170	195	320	660	318	-	-	1.4	1.5
Bromodichloromethane	< 2.00	< 0.2	< 0.2	< 2.0	< 2.00	< 0.80	< 2.0	-	-	< 0.2	< 0.2
Bromoform	< 1.00	< 0.1	< 0.1	< 5.0	< 1.00	< 0.40	< 5.0	-	-	< 0.1	< 0.1
Bromomethane	< 2.00[1]	< 0.2	< 0.2	< 0.50	< 2.00[1]	< 0.80	< 0.50	-	-	< 0.2	< 0.2
Carbon Tetrachloride	< 2.00[1]	< 0.2	< 0.2	< 0.20	< 2.00[1]	< 0.79[1]	< 0.20	-	-	< 0.2	< 0.2
Chlorobenzene	< 1.00	< 0.1	< 0.1	< 0.50	< 1.00	< 0.40	< 0.50	-	-	< 0.1	< 0.1
Chloroform	< 2.00	< 0.2	< 0.2	< 1.0	< 2.00	< 0.80	< 1.0	-	-	< 0.2	< 0.2
Dibromochloromethane	< 1.00	< 0.1	< 0.1	< 2.0	< 1.00	< 0.40	< 2.0	-	-	< 0.1	< 0.1
Dichlorobenzene, 1,2- (o-DCB)	< 1.00	< 0.1	< 0.1	< 0.50	< 1.00	< 0.40	< 0.50	-	-	< 0.1	< 0.1
Dichlorobenzene, 1,3- (m-DCB)	< 1.00	< 0.1	< 0.1	< 0.50	< 1.00	< 0.40	< 0.50	-	-	< 0.1	< 0.1
Dichlorobenzene, 1,4- (p-DCB)	< 1.00[1]	< 0.1	< 0.1	< 0.50	< 1.00[1]	< 0.40	< 0.50	-	-	< 0.1	< 0.1
Dichlorodifluoromethane	< 2.00	< 0.2	< 0.2	< 2.0	< 2.00	< 0.80	< 2.0	-	-	< 0.2	< 0.2
Dichloroethane, 1,1-	< 3.00	< 0.3	< 0.3	< 0.50	< 3.00	< 1.20	< 0.50	-	-	< 0.3	< 0.3
Dichloroethane, 1,2-	< 2.00[1]	0.27	< 0.2	< 0.50	< 2.00[1]	< 0.80[1]	< 0.50	-	-	< 0.2	< 0.2
Dichloroethylene, 1,1-	< 3.00[1]	< 0.3	< 0.3	< 0.50	< 3.00[1]	< 1.20[1]	< 0.50	-	-	< 0.3	< 0.3
Dichloroethylene, cis-1,2-	< 2.00[1]	< 0.2	< 0.2	< 0.50	< 2.00[1]	< 0.80	< 0.50	-	-	< 0.2	< 0.2
Dichloroethylene, trans-1,2-	< 2.00[1]	< 0.2	< 0.2	< 0.50	< 2.00[1]	< 0.80	< 0.50	-	-	< 0.2	< 0.2
Dichloropropane, 1,2-	< 2.00[1]	< 0.2	< 0.2	< 0.50	< 2.00[1]	< 0.80[1]	< 0.50	-	-	< 0.2	< 0.2
Dichloropropene, 1,3-	-	-	-	< 0.50	-	-	< 0.50	-	-	-	-
Dichloropropene, cis-1,3-	-	-	-	< 0.30	-	-	< 0.30	-	-	-	-
Dichloropropene, trans-1,3-	-	-	-	< 0.30	-	-	< 0.30	-	-	-	-
Ethylbenzene	90	48	44	41.9	100	190	121	-	-	10	19
Ethylene Dibromide (Dibromoethane, 1,2-)	< 1.00[1]	< 0.1	< 0.1	< 0.20	< 1.00[1]	< 0.25[1]	< 0.20	-	-	< 0.1	< 0.1
Hexane (n)	< 2.00	< 0.2	< 0.2	< 0.50	< 2.00	< 0.80	< 0.50	-	-	< 0.2	< 0.2
Methyl Ethyl Ketone	< 10.0	< 1	< 1	< 20	< 10.0	< 4.0	< 20	-	-	< 1	< 1
Methyl Isobutyl Ketone	< 10.0	< 1	< 1	< 20	< 10.0	< 4.0	< 20	-	-	< 1	< 1
Methyl t-butyl ether (MTBE)	< 2.00	< 0.2	< 0.2	< 2.0	< 2.00	< 0.80	< 2.0	-	-	< 0.2	< 0.2
Methylene Chloride	< 3.00	< 0.3	< 0.3	< 5.0	< 3.00	< 1.20	< 5.0	-	-	< 0.3	< 0.3
Styrene	1.7	1.7	0.54	< 0.50	< 1.00	< 0.40	< 0.50	-	-	< 0.1	< 0.1
Tetrachloroethane, 1,1,1,2-	< 1.00	< 0.1	< 0.1	< 0.50	< 1.00	< 0.40	< 0.50	-	-	< 0.1	< 0.1
Tetrachloroethane, 1,1,2,2-	< 1.00[1]	< 0.1	< 0.1	< 0.50	< 1.00[1]	< 0.40	< 0.50	-	-	< 0.1	< 0.1
Tetrachloroethylene	< 2.00[1]	< 0.2	< 0.2	< 0.50	< 2.00[1]	< 0.80[1]	< 0.50	-	-	< 0.2	< 0.2
Toluene	94	53	40	48.6	2.2	9.4	3.97	-	-	0.81	0.82
Trichloroethane, 1,1,1-	< 3.00	< 0.3	< 0.3	< 0.50	< 3.00	< 1.20	< 0.50	-	-	< 0.3	< 0.3
Trichloroethane, 1,1,2-	< 2.00[1]	< 0.2	< 0.2	< 0.50	< 2.00[1]	< 0.80[1]	< 0.50	-	-	< 0.2	< 0.2
Trichloroethylene	< 2.00[1]	< 0.2	< 0.2	< 0.50	< 2.00[1]	< 0.80[1]	< 0.50	-	-	< 0.2	< 0.2
Trichlorofluoromethane	< 4.00	< 0.4	< 0.4	< 5.0	< 4.00	< 1.60	< 5.0	-	-	< 0.4	< 0.4
Vinyl Chloride [4]	< 1.70[1]	< 0.17	< 0.17	< 0.50	< 1.70[1]	< 0.50	< 0.50	-	-	< 0.17	< 0.17
Xylenes	290	150	110	139	55	110	56.4	-	-	9.6	22
Xylenes, m+p-	-	-	-	81.1	-	-	32.1	-	-	-	-
Xylenes, o-	-	-	-	57.6	-	-	24.3	-	-	-	-
PAHs											
Acenaphthene	370	310	270	219	58	80	152	-	-	36	-
Acenaphthylene	19	7.4	< 0.2	2.32	< 0.2	0.43	0.852	-	-	1.4	-
Anthracene	16	18	14	10.1	< 0.1	0.2	0.096	-	-	2.3	-
Benzo(a)anthracene	< 0.2	0.21	0.55	0.351	< 0.2	< 0.2	0.02	-	-	< 0.2	-
Benzo(a)pyrene	< 0.01	< 0.01	0.42	0.097	< 0.01	< 0.01	0.012	-	-	0.03	-
Benzo(b)fluoranthene	< 0.1	< 0.1	0.57	0.132	< 0.1	< 0.1	< 0.020	-	-	< 0.1	-
Benzo(g,h,i)perylene	< 0.2	< 0.2	0.27	0.037	< 0.2	< 0.2	< 0.020	-	-	< 0.2	-
Benzo(k)fluoranthene	< 0.1	< 0.1	0.27	0.043	< 0.1	< 0.1	< 0.020	-	-	< 0.1	-
Chrysene	0.16	0.16	0.39	0.236	< 0.1	< 0.1	< 0.020	-	-	< 0.1	-
Dibenzo(a,h)anthracene	< 0.2	< 0.2	< 0.2	< 0.020	< 0.2	< 0.2	< 0.020	-	-	< 0.2	-
Fluoranthene	9.7	11	12	9.68	< 0.2	< 0.2	0.113	-	-	0.84	-
Fluorene	130	130	110	90.2	4.2	7.6	17.2	-	-	22	-
Indeno(1,2,3-cd)pyrene	< 0.2	< 0.2	0.2	0.049	< 0.2	< 0.2	< 0.020	-	-	< 0.2	-
Methylnaphthalene, 1-	-	-	-	343	-	-	247	-	-	-	-
Methylnaphthalene, 2-	-	-	-	484	-	-	246	-	-	-	-
Methylnaphthalene, 1- & 2-	-	-	-	827	-	-	494	-	-	-	-
Naphthalene	12,000	14,000	10,000	8,880	1,500	2,900	5,520	-	-	30	-
Phenanthrene	120	140	120	90.8	1.3	2.8	10.2	-	-	16	-
Pyrene	5.9	7	7.7	5.2	< 0.2	< 0.2	0.076	-	-	0.47	-
PCBs											
Arochlor 1242	< 0.1	-	-	-	< 0.1	-	-	-	-	-	-
Arochlor 1248	< 0.1	-	-	-	< 0.1	-	-	-	-	-	-
Arochlor 1254	< 0.1	-	-	-	< 0.1	-	-	-	-	-	-
Arochlor 1260	< 0.1	-	-	-	< 0.1	-	-	-	-	-	-
Total PCBs	< 0.1	-	-	-	< 0.1	-	-	-	-	-	-

Sample Location	MW-116	MW-116	MW-201	MW-201	MW-201	MW-202	MW-202	MW-205	MW-205	MW-09-17	BH-17-17	MW18-01
Laboratory Sample ID	6282368	L2163993-3	7782070	7836662	L2162292-8	7844784	L2164646-2	7836670	L2163169-1	L2163169-3	L2171531-1	L2162292-5
SNC-Lavalin Sample ID	MW-116	MW-116	MW-201	MW-201	MW-201	MW-202	MW-202	MW-205	MW-205	MW-09-17	BH-17-17	MW18-01
Sampling Date (yyyy/mm/dd)	2015/01/28	2018/09/12	2016/08/15	2016/09/09	2018/09/10	2016/09/13	2018/09/13	2016/09/09	2018/09/11	2018/09/11	2018/09/25	2018/09/10
Parameter												
Water Table Depth	2.1	2.1	3.7	3.7	3.7	4	4	5.6	5.6	1.7	?	5.7
Dissolved Metals												
Mercury	-	< 0.010	< 0.02	-	< 0.010	< 0.02	-	< 0.02	< 0.010	< 0.010	< 0.010	< 0.010
Petroleum Hydrocarbon (PHC) Fractions												
PHC F1	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	270	< 25
PHC F2	< 100	< 100	**330**	< 100	< 100	< 100	< 100	< 100	< 100	< 100	20,400	< 100
PHC F3	< 100	< 250	190	< 100	< 250	< 100	< 250	< 100	< 250	< 250	< 500	< 250
PHC F4	< 100	< 250	< 100	< 100	< 250	< 100	< 250	< 100	< 250	< 250	< 500	< 250
Volatile Organic Compounds												
Acetone	-	< 30	72	-	< 30	< 1	< 30	< 1	< 30	< 30	< 30	< 30
Benzene	-	< 0.50	0.27	-	< 0.50	< 0.2	< 0.50	< 0.2	< 0.50	< 0.50	374	< 0.50
Bromodichloromethane	-	< 2.0	< 0.2	-	< 2.0	< 0.2	< 2.0	< 0.2	< 2.0	< 2.0	< 2.0	< 2.0
Bromoform	-	< 5.0	< 0.1	-	< 5.0	< 0.1	< 5.0	< 0.1	< 5.0	< 5.0	< 5.0	< 5.0
Bromomethane	-	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50
Carbon Tetrachloride	-	< 0.20	< 0.2	-	< 0.20	< 0.2	< 0.20	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20
Chlorobenzene	-	< 0.50	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1	< 0.50	< 0.50	< 0.50	< 0.50
Chloroform	-	< 1.0	< 0.2	-	< 1.0	< 0.2	< 1.0	< 0.2	< 1.0	< 1.0	< 1.0	1.3
Dibromochloromethane	-	< 2.0	< 0.1	-	< 2.0	< 0.1	< 2.0	< 0.1	< 2.0	< 2.0	< 2.0	< 2.0
Dichlorobenzene, 1,2- (o-DCB)	-	< 0.50	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorobenzene, 1,3- (m-DCB)	-	< 0.50	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorobenzene, 1,4- (p-DCB)	-	< 0.50	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorodifluoromethane	-	< 2.0	< 0.2	-	< 2.0	< 0.2	< 2.0	< 0.2	< 2.0	< 2.0	< 2.0	< 2.0
Dichloroethane, 1,1-	-	< 0.50	< 0.3	-	< 0.50	< 0.3	< 0.50	< 0.3	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethane, 1,2-	-	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethylene, 1,1-	-	< 0.50	< 0.3	-	< 0.50	< 0.3	< 0.50	< 0.3	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethylene, cis-1,2-	-	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethylene, trans-1,2-	-	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50
Dichloropropane, 1,2-	-	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50
Dichloropropene, 1,3-	-	< 0.50	-	-	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Dichloropropene, cis-1,3-	-	< 0.30	-	-	< 0.30	-	< 0.30	-	< 0.30	< 0.30	< 0.30	< 0.30
Dichloropropene, trans-1,3-	-	< 0.30	-	-	< 0.30	-	< 0.30	-	< 0.30	< 0.30	< 0.30	< 0.30
Ethylbenzene	-	< 0.50	1.3	-	< 0.50	< 0.1	< 0.50	< 0.1	< 0.50	< 0.50	195	< 0.50
Ethylene Dibromide (Dibromoethane, 1,2-)	-	< 0.20	< 0.1	-	< 0.20	< 0.1	< 0.20	< 0.1	< 0.20	< 0.20	< 0.20	< 0.20
Hexane (n)	-	< 0.50	< 0.2	-	0.56	< 0.2	< 0.50	< 0.2	< 0.50	< 0.50	< 0.50	0.72
Methyl Ethyl Ketone	-	< 20	18	-	< 20	< 1	< 20	< 1	< 20	< 20	< 20	< 20
Methyl Isobutyl Ketone	-	< 20	< 1	-	< 20	< 1	< 20	< 1	< 20	< 20	< 20	< 20
Methyl t-butyl ether (MTBE)	-	< 2.0	< 0.2	-	< 2.0	< 0.2	< 2.0	< 0.2	< 2.0	< 2.0	< 2.0	< 2.0
Methylene Chloride	-	< 5.0	< 0.3	-	< 5.0	< 0.3	< 5.0	< 0.3	< 5.0	< 5.0	< 5.0	< 5.0
Styrene	-	< 0.50	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1	< 0.50	< 0.50	2.84	< 0.50
Tetrachloroethane, 1,1,1,2-	-	< 0.50	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1	< 0.50	< 0.50	< 0.50	< 0.50
Tetrachloroethane, 1,1,2,2-	-	< 0.50	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1	< 0.50	< 0.50	< 0.50	< 0.50
Tetrachloroethylene	-	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50
Toluene	-	< 0.50	4.3	-	< 0.50	< 0.2	< 0.50	< 0.2	< 0.50	< 0.50	70.5	< 0.50
Trichloroethane, 1,1,1-	-	< 0.50	< 0.3	-	< 0.50	< 0.3	< 0.50	< 0.3	< 0.50	< 0.50	< 0.50	< 0.50
Trichloroethane, 1,1,2-	-	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50
Trichloroethylene	-	< 0.50	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	< 0.50	< 0.50	< 0.50	< 0.50
Trichlorofluoromethane	-	< 5.0	< 0.4	-	< 5.0	< 0.4	< 5.0	< 0.4	< 5.0	< 5.0	< 5.0	< 5.0
Vinyl Chloride [4]	-	< 0.50	< 0.17	-	< 0.50	< 0.17	< 0.50	< 0.17	< 0.50	< 0.50	< 0.50	< 0.50
Xylenes	-	< 0.50	8.7	-	< 0.50	< 0.2	< 0.50	< 0.2	< 0.50	< 0.50	468	< 0.50
Xylenes, m+p-	-	< 0.40	-	-	< 0.40	-	< 0.40	-	< 0.40	< 0.40	292	< 0.40
Xylenes, o-	-	< 0.30	-	-	< 0.30	-	0.35	-	< 0.30	< 0.30	176	< 0.30
PAHs												
Acenaphthene	< 0.2	2.46	< 0.2	-	< 0.020	< 0.2	0.099	< 0.2	< 0.020	< 0.020	154	0.031
Acenaphthylene	0.41	0.065	< 0.2	-	< 0.020	< 0.2	0.093	< 0.2	< 0.020	< 0.020	2.81	< 0.020
Anthracene	0.12	0.255	< 0.1	-	< 0.020	< 0.1	0.193	< 0.1	< 0.020	< 0.020	5.56	< 0.020
Benzo(a)anthracene	< 0.2	0.146	< 0.2	-	< 0.020	< 0.2	0.638	< 0.2	< 0.020	< 0.020	0.211	< 0.020
Benzo(a)pyrene	< 0.01	0.062	< 0.01	-	< 0.010	< 0.01	0.336	< 0.01	< 0.010	< 0.010	0.072	< 0.010
Benzo(b)fluoranthene	< 0.1	0.082	< 0.1	-	< 0.020	< 0.1	0.554	< 0.1	< 0.020	< 0.020	0.116	< 0.020
Benzo(g,h,i)perylene	< 0.2	0.036	< 0.2	-	< 0.020	< 0.2	0.148	< 0.2	< 0.020	< 0.020	0.027	< 0.020
Benzo(k)fluoranthene	< 0.1	0.033	< 0.1	-	< 0.020	< 0.1	0.182	< 0.1	< 0.030	< 0.020	0.04	< 0.020
Chrysene	< 0.1	0.109	< 0.1	-	< 0.020	< 0.1	0.496	< 0.1	< 0.020	< 0.020	0.148	< 0.020
Dibenzo(a,h)anthracene	< 0.2	< 0.020	< 0.2	-	< 0.020	< 0.2	0.041	< 0.2	< 0.020	< 0.020	< 0.020	< 0.020
Fluoranthene	< 0.2	0.558	< 0.2	-	0.03	< 0.2	1.79	< 0.2	< 0.020	< 0.020	2.27	0.048
Fluorene	< 0.2	0.929	< 0.2	-	< 0.020	< 0.2	0.062	< 0.2	< 0.020	< 0.020	73.6	< 0.020
Indeno(1,2,3-cd)pyrene	< 0.2	0.042	< 0.2	-	< 0.020	< 0.2	**0.212**	< 0.2	< 0.020	< 0.020	0.038	< 0.020
Methylnaphthalene, 1-	-	1.78	-	-	< 0.020	-	0.113	-	< 0.020	< 0.020	330	< 0.020
Methylnaphthalene, 2-	-	0.023	-	-	< 0.020	-	0.023	-	< 0.020	< 0.020	571	< 0.020
Methylnaphthalene, 1- & 2-	-	1.81	-	-	< 0.028	-	0.136	-	< 0.028	< 0.028	902	< 0.028
Naphthalene	< 0.2	0.286	1.1	-	0.125	8.3	1.37	< 0.2	0.139	< 0.050	7,710	0.078
Phenanthrene	< 0.1	1.23	0.24	-	0.022	0.26	0.472	< 0.1	< 0.020	< 0.020	48.8	0.054
Pyrene	< 0.2	0.447	< 0.2	-	0.031	< 0.2	1.46	< 0.2	< 0.020	< 0.020	1.34	0.036
PCBs												
Arochlor 1242	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	-	-	-	-	-	-	-	-	-	-	-	-
Total PCBs	-	-	-	-	-	-	-	-	-	-	-	-

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/L – micrograms per litre
µS/cm - microSiemens per centimetre
mg/L - milligrams per litre
UNDERLINE Concentration greater than Table 7 Standard
[1] Laboratory detection limit exceeds regulatory standard/guideline.
[2] Table 7 generic site condition standards for shallow soils in a non-potable groundwater condition for all types of property use, coarse textured soils (MOE, 2011)
[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.
[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

TABLE7: **Preliminary Screening of Groundwater COCs**
Central Park, Hamilton, ON

Sample Location			Table 7[2]	MW18-02	MW18-08	MW18-09	MW18-17	MW18-17	MW18-23	MW18-25	MW18-26	MW18-27	MW18-28	MW18-29
Laboratory Sample ID				L2162292-6	L2161100-1	L2161100-2	L2163993-1	L2161100-5	L2162292-2	L2170681-2	L2170681-3	L2170681-4	L2171531-2	L2171531-3
SNC-Lavalin Sample ID			Standard CG	MW18-02	MW18-08	MW18-09	MW18-17	MW18-17	MW18-23	MW18-25	MW18-26	MW18-27	MW18-28	MW18-29
Sampling Date (yyyy/mm/dd)				2018/09/10	2018/09/07	2018/09/07	2018/09/12	2018/09/07	2018/09/10	2018/09/24	2018/09/24	2018/09/24	2018/09/25	2018/09/25
Parameter	**RDL**	**Units**												
Water Table Depth				3	4.2	4.4	2.4	3.08	4.4	2.6	3	2.8	2.2	2.1
Dissolved Metals														
Mercury	0.010	µg/L	0.1	< 0.010	< 0.010	< 0.010	< 0.010	-	< 0.010	-	-	< 10[1]	< 0.010	-
Petroleum Hydrocarbon (PHC) Fractions														
PHC F1	25	µg/L	420	< 25	< 25	< 25	< 25	< 25	< 25	< 25	670	< 3,600[1]	1,380	790
PHC F2	100	µg/L	150	< 100	< 100	< 100	< 100	< 100	< 100	610	16,600	33,900	28,200	24,000
PHC F3	100	µg/L	500	< 250	< 250	< 250	< 250	< 250	< 250	< 250	500	< 1,000[1]	890	< 500
PHC F4	100	µg/L	500	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 500	< 1,000[1]	< 500	< 500
Volatile Organic Compounds														
Acetone	1	µg/L	100,000	32	< 30	< 30	< 30	-	202	-	< 30	< 30	< 30	< 30
Benzene	0.2	µg/L	0.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	2.85	215	17,100	1,510	1,110
Bromodichloromethane	0.2	µg/L	67,000	< 2.0	< 2.0	< 2.0	< 2.0	-	< 2.0	-	< 2.0	< 2.0	< 2.0	< 2.0
Bromoform	0.1	µg/L	5	< 5.0	< 5.0	< 5.0	< 5.0	-	< 5.0	-	< 5.0	< 5.0	< 5.0	< 5.0
Bromomethane	0.2	µg/L	0.89	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Carbon Tetrachloride	0.20	µg/L	0.2	< 0.20	< 0.20	< 0.20	< 0.20	-	< 0.20	-	< 0.20	< 0.20	< 0.20	< 0.20
Chlorobenzene	0.1	µg/L	140	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 8.0	< 5.5	< 0.50	< 0.50
Chloroform	0.2	µg/L	2	< 1.0	< 1.0	< 1.0	< 1.0	-	< 1.0	-	< 1.0	< 1.0	< 1.0	< 1.0
Dibromochloromethane	0.1	µg/L	65,000	< 2.0	< 2.0	< 2.0	< 2.0	-	< 2.0	-	< 2.0	< 2.0	< 2.0	< 2.0
Dichlorobenzene, 1,2- (o-DCB)	0.1	µg/L	150	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorobenzene, 1,3- (m-DCB)	0.1	µg/L	7,600	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorobenzene, 1,4- (p-DCB)	0.1	µg/L	0.5	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorodifluoromethane	0.2	µg/L	3,500	< 2.0	< 2.0	< 2.0	< 2.0	-	< 2.0	-	< 2.0	< 2.0	< 2.0	< 2.0
Dichloroethane, 1,1-	0.3	µg/L	11	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethane, 1,2-	0.2	µg/L	0.5	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethylene, 1,1-	0.3	µg/L	0.5	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethylene, cis-1,2-	0.2	µg/L	1.6	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethylene, trans-1,2-	0.2	µg/L	1.6	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Dichloropropane, 1,2-	0.2	µg/L	0.58	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Dichloropropene, 1,3-	0.50	µg/L	0.5	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.67[1]	< 0.50	< 0.50
Dichloropropene, cis-1,3-	0.30	µg/L	na	< 0.30	< 0.30	< 0.30	< 0.30	-	< 0.30	-	< 0.30	< 0.60	< 0.30	< 0.30
Dichloropropene, trans-1,3-	0.30	µg/L	na	< 0.30	< 0.30	< 0.30	< 0.30	-	< 0.30	-	< 0.30	< 0.30	< 0.30	< 0.30
Ethylbenzene	0.1	µg/L	54	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.9	391	504	413	436
Ethylene Dibromide (Dibromoethane, 1,2-)	0.1	µg/L	0.2	< 0.20	< 0.20	< 0.20	< 0.20	-	< 0.20	-	< 0.20	< 0.20	< 0.20	< 0.20
Hexane (n)	0.10	µg/L	5	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.55	3.08	< 0.50	< 0.50
Methyl Ethyl Ketone	1	µg/L	21,000	< 20	< 20	< 20	< 20	-	< 20	-	< 20	< 20	< 20	< 20
Methyl Isobutyl Ketone	1	µg/L	5,200	< 20	< 20	< 20	< 20	-	< 20	-	< 20	< 20	< 20	< 20
Methyl t-butyl ether (MTBE)	0.2	µg/L	15	< 2.0	< 2.0	< 2.0	< 2.0	-	< 2.0	-	< 2.0	< 2.0	< 2.0	< 2.0
Methylene Chloride	0.3	µg/L	26	< 5.0	< 5.0	< 5.0	< 5.0	-	< 5.0	-	< 5.0	< 5.0	< 5.0	< 5.0
Styrene	0.1	µg/L	43	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	180	1.85	< 0.50
Tetrachloroethane, 1,1,1,2-	0.1	µg/L	1.1	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Tetrachloroethane, 1,1,2,2-	0.1	µg/L	0.5	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Tetrachloroethylene	0.2	µg/L	0.5	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Toluene	0.2	µg/L	320	< 0.50	< 0.50	< 0.50	0.55	< 0.50	< 0.50	3.63	5.55	4,300	687	12.3
Trichloroethane, 1,1,1-	0.3	µg/L	23	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Trichloroethane, 1,1,2-	0.2	µg/L	0.5	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Trichloroethylene	0.2	µg/L	0.5	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Trichlorofluoromethane	0.4	µg/L	2,000	< 5.0	< 5.0	< 5.0	< 5.0	-	< 5.0	-	< 5.0	< 5.0	< 5.0	< 5.0
Vinyl Chloride [4]	0.17	µg/L	0.5	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Xylenes	0.2	µg/L	72	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	4.96	879	1,960	1,200	853
Xylenes, m+p-	0.40	µg/L	na	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	3.25	767	1,320	769	690
Xylenes, o-	0.30	µg/L	na	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	1.71	112	641	434	163
PAHs														
Acenaphthene	0.020	µg/L	17	< 0.020	0.18	< 0.020	< 0.020	0.024	4.31	30	646	571	139	193
Acenaphthylene	0.020	µg/L	1	< 0.020	0.043	< 0.020	< 0.020	0.039	0.04	5.59	2.27	61.2	1.44	1.74
Anthracene	0.020	µg/L	1	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	0.021	3.29	2.64	19.6	12.8	3.99
Benzo(a)anthracene	0.020	µg/L	1.8	< 0.020	< 0.020	< 0.020	0.091	< 0.020	< 0.020	0.412	0.315	0.243	0.609	0.143
Benzo(a)pyrene	0.010	µg/L	0.81	< 0.010	< 0.010	< 0.010	0.08	< 0.010	< 0.010	0.184	0.118	0.161	0.584	0.027
Benzo(b)fluoranthene	0.020	µg/L	0.75	< 0.020	< 0.020	< 0.020	0.108	< 0.020	< 0.020	0.25	0.194	0.262	0.85	0.048
Benzo(g,h,i)perylene	0.020	µg/L	0.2	< 0.020	< 0.020	< 0.020	0.057	< 0.020	< 0.020	0.094	0.054	0.045	0.197	< 0.020
Benzo(k)fluoranthene	0.020	µg/L	0.4	< 0.020	< 0.020	< 0.020	0.037	< 0.020	< 0.020	0.083	0.061	0.082	0.254	< 0.020
Chrysene	0.020	µg/L	0.7	< 0.020	< 0.020	< 0.020	0.073	< 0.020	< 0.020	0.268	0.207	0.172	0.443	0.098
Dibenzo(a,h)anthracene	0.020	µg/L	0.4	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	0.024	< 0.020	< 0.020	0.064	< 0.020
Fluoranthene	0.020	µg/L	44	< 0.020	0.025	< 0.020	0.138	0.056	0.109	5.53	16.4	4.95	5.39	2.12
Fluorene	0.020	µg/L	290	< 0.020	0.114	< 0.020	< 0.020	0.075	0.992	21.5	56.4	251	98.4	77.4
Indeno(1,2,3-cd)pyrene	0.020	µg/L	0.2	< 0.020	< 0.020	< 0.020	0.074	< 0.020	< 0.020	0.12	0.07	0.066	0.298	< 0.020
Methylnaphthalene, 1-	0.020	µg/L	1,500	< 0.020	0.122	< 0.020	< 0.020	0.363	< 0.020	16.9	613	733	589	320
Methylnaphthalene, 2-	0.020	µg/L	1,500	< 0.020	0.118	< 0.020	< 0.020	0.526	< 0.020	20.6	82.4	1,150	1,140	552
Methylnaphthalene, 1- & 2-	0.028	µg/L	1500 [3]	< 0.028	0.24	< 0.028	< 0.028	0.89	< 0.028	37.5	695	1,890	1,730	872
Naphthalene	0.050	µg/L	7	0.054	2.47	0.164	0.066	4.23	0.122	327	10,400	22,900	10,500	8,740
Phenanthrene	0.020	µg/L	380	< 0.020	0.13	< 0.020	0.049	0.218	< 0.020	16.7	123	202	68	37.8
Pyrene	0.020	µg/L	5.7	< 0.020	< 0.020	< 0.020	0.128	0.056	0.022	3.4	5.13	2.69	3.2	1.19
PCBs														
Arochlor 1242	0.020	µg/L	na	-	-	-	-	-	-	-	-	< 0.20	-	-
Arochlor 1248	0.020	µg/L	na	-	-	-	-	-	-	-	-	< 0.20	-	-
Arochlor 1254	0.020	µg/L	na	-	-	-	-	-	-	-	-	< 0.20	-	-
Arochlor 1260	0.020	µg/L	na	-	-	-	-	-	-	-	-	< 0.20	-	-
Total PCBs	0.1	µg/L	0.2	-	-	-	-	-	-	-	-	< 0.40[1]	-	-

COCs	RDL (most recent)	Maximum (0 means no detection)	Maximum With RDL	Maximum With RDL x 1.2	Exceeded Generic Table 7 SCS
Dissolved Metals					
Mercury	10	0	10	12	Yes
Petroleum Hydrocarbon (PHC) Fractions					
PHC F1	3,600	1380	3600	4320	Yes
PHC F2	1000	33900	33900	40680	Yes
PHC F3	1000	2300	2300	2760	Yes
PHC F4	1000	0	1000	1200	Yes
Volatile Organic Compounds					
Acetone	30	202	202	242.4	No
Benzene	0.5	17100	17100	20520	Yes
Bromodichloromethane	2	0	2	2.4	No
Bromoform	5	0	5	6	No
Bromomethane	0.5	0	0.5	0.6	No
Carbon Tetrachloride	0.2	0	0.2	0.24	No
Chlorobenzene	0.5	0	0.5	0.6	No
Chloroform	1	1.3	1.3	1.56	No
Dibromochloromethane	2	0	2	2.4	No
Dichlorobenzene, 1,2- (o-DCB)	0.5	0	0.5	0.6	No
Dichlorobenzene, 1,3- (m-DCB)	0.5	0	0.5	0.6	No
Dichlorobenzene, 1,4- (p-DCB)	0.5	0	0.5	0.6	No
Dichlorodifluoromethane	2	0	2	2.4	No
Dichloroethane, 1,1-	0.5	0	0.5	0.6	No
Dichloroethane, 1,2-	0.5	0.27	0.5	0.6	No
Dichloroethylene, 1,1-	0.5	0	0.5	0.6	No
Dichloroethylene, cis-1,2-	0.5	0.44	0.5	0.6	No
Dichloroethylene, trans-1,2-	0.5	0	0.5	0.6	No
Dichloropropane, 1,2-	0.5	0	0.5	0.6	No
Dichloropropene, 1,3-	0.67	0	0.67	0.804	No
Dichloropropene, cis-1,3-	0.3	0	0.3	0.36	No
Dichloropropene, trans-1,3-	0.3	0	0.3	0.36	No
Ethylbenzene	0.5	504	504	604.8	Yes
Ethylene Dibromide	0.2	0	0.2	0.24	No
Hexane (n)	0.55	3.08	3.08	3.696	No
Methyl Ethyl Ketone	20	18	20	24	No
Methyl Isobutyl Ketone	20	0	20	24	No
Methyl tert butyl ether (MTBE)	2	0	2	2.4	No
Methylene Chloride	5	0	5	6	No
Styrene	0.5	180	180	216	Yes
Tetrachloroethane, 1,1,1,2-	0.5	0	0.5	0.6	No
Tetrachloroethane, 1,1,2,2-	0.5	0	0.5	0.6	No
Tetrachloroethylene	0.5	0	0.5	0.6	No
Toluene	0.5	4300	4300	5160	Yes
Trichloroethane, 1,1,1-	0.5	0	0.5	0.6	No
Trichloroethane, 1,1,2-	0.5	0	0.5	0.6	No
Trichloroethylene	0.5	12	12	14.4	Yes
Trichlorofluoromethane	5	0	5	6	No
Vinyl Chloride	0.5	0	1.57	1.88	Yes
Xylenes	0.5	1960	1960	2352	Yes
Xylenes, m+p-	0.4	1320	1320	1584	No
Xylenes, o-	0.3	641	641	769.2	No
PAHs					
Acenaphthene	0.02	646	646	775.2	Yes
Acenaphthylene	0.02	61.2	61.2	73.44	Yes
Anthracene	0.02	19.6	19.6	23.52	Yes
Benzo(a)anthracene	0.02	0.638	0.638	0.7656	No
Benzo(a)pyrene	0.01	0.584	0.584	0.7008	No
Benzo(b)fluoranthene	0.02	0.85	0.85	1.02	Yes
Benzo(g,h,i)perylene	0.02	0.27	0.27	0.324	Yes
Benzo(k)fluoranthene	0.02	0.27	0.27	0.324	No
Chrysene	0.02	0.496	0.496	0.5952	No
Dibenzo(a,h)anthracene	0.02	0.064	0.064	0.0768	No
Fluoranthene	0.02	16.4	16.4	19.68	No
Fluorene	0.02	251	251	301.2	Yes
Indeno(1,2,3-cd)pyrene	0.02	0.298	0.298	0.3576	Yes
Methylnaphthalene, 1-	0.02	733	733	879.6	No
Methylnaphthalene, 2-	0.02	1150	1150	1380	No
Methylnaphthalene, 1- & 2-	0.028	1890	1890	2268	No
Naphthalene	0.05	22900	22900	27480	Yes
Phenanthrene	0.02	202	202	242.4	No
Pyrene	0.02	7.7	7.7	9.24	Yes
PCBs					
Arochlor 1242	0.04	0	0.04	0.048	No
Arochlor 1248	0.02	0	0.02	0.024	No
Arochlor 1254	0.02	0	0.02	0.024	No
Arochlor 1260	0.02	0	0.02	0.024	No
Total PCBs	0.4	0	0.4	0.48	No

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/L – micrograms per litre
µS/cm - microSiemens per centimetre
mg/L - milligrams per litre
UNDERLINE Concentration greater than Table 7 Standard

[1] Laboratory detection limit exceeds regulatory standard/guideline.
[2] Table 7 generic site condition standards for shallow soils in a non-potable groundwater condition for all types of property use, coarse textured soils (MOE, 2011)
[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.
[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

TABLE8: **Preliminary Screening of Groundwater COCs - Full Depth Condition For Commercial indoor Air Inhalation GW2-IA (Human Health)**
Central Park, Hamilton, ON

Sample Location			Table 5[2]	MW-201	MW-201	MW-201	MW-202	MW-202	MW-203	MW-203	MW-203	MW18-14
Laboratory Sample ID			Standard	7782070	7836662	L2162292-8	7844784	L2164646-2	7782105	7844800	L2164646-1	L2162292-4
SNC-Lavalin Sample ID			R/P/I	MW-201	MW-201	MW-201	MW-202	MW-202	MW-203	MW-203	MW-203	MW18-14
Sampling Date (yyyy/mm/dd)			CG	2016/08/15	2016/09/09	2018/09/10	2016/09/13	2018/09/13	2016/08/15	2016/09/13	2018/09/13	2018/09/10
Parameter	**RDL**	**Units**										
Water Table Depth (m bgs)				3.7	3.7	3.7	4	4	8	8	8	4.2
Dissolved Metals												
Mercury	0.010	µg/L	0.29	< 0.02	-	< 0.010	< 0.02	-	< 0.02	-	< 0.010	-
Petroleum Hydrocarbon (PHC) Fractions												
PHC F1	25	µg/L	750	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25
PHC F2	100	µg/L	150	**330**	< 100	< 100	< 100	< 100	**970**	150	< 100	150
PHC F3	100	µg/L	500	190	< 100	< 250	< 100	< 250	**1,700**	< 100	< 250	< 250
PHC F4	100	µg/L	500	< 100	< 100	< 250	< 100	< 250	< 100	< 100	< 250	< 250
Volatile Organic Compounds												
Acetone	1	µg/L	130,000	72	-	< 30	< 1	< 30	95	-	< 30	83
Benzene	0.2	µg/L	44	0.27	-	< 0.50	< 0.2	< 0.50	0.93	-	< 0.50	< 0.50
Bromodichloromethane	0.2	µg/L	85,000	< 0.2	-	< 2.0	< 0.2	< 2.0	< 0.2	-	< 2.0	< 2.0
Bromoform	0.1	µg/L	380	< 0.1	-	< 5.0	< 0.1	< 5.0	< 0.1	-	< 5.0	< 5.0
Bromomethane	0.2	µg/L	5.6	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	-	< 0.50	< 0.50
Carbon Tetrachloride	0.20	µg/L	0.79	< 0.2	-	< 0.20	< 0.2	< 0.20	< 0.2	-	< 0.20	< 0.20
Chlorobenzene	0.1	µg/L	630	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1	-	< 0.50	< 0.50
Chloroform	0.2	µg/L	2.4	< 0.2	-	< 1.0	< 0.2	< 1.0	< 0.2	-	< 1.0	< 1.0
Dibromochloromethane	0.1	µg/L	82,000	< 0.1	-	< 2.0	< 0.1	< 2.0	< 0.1	-	< 2.0	< 2.0
Dichlorobenzene, 1,2- (o-DCB)	0.1	µg/L	4,600	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1	-	< 0.50	< 0.50
Dichlorobenzene, 1,3- (m-DCB)	0.1	µg/L	9,600	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1	-	< 0.50	< 0.50
Dichlorobenzene, 1,4- (p-DCB)	0.1	µg/L	8	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1	-	< 0.50	< 0.50
Dichlorodifluoromethane	0.2	µg/L	4,400	< 0.2	-	< 2.0	< 0.2	< 2.0	< 0.2	-	< 2.0	< 2.0
Dichloroethane, 1,1-	0.3	µg/L	320	< 0.3	-	< 0.50	< 0.3	< 0.50	< 0.3	-	< 0.50	< 0.50
Dichloroethane, 1,2-	0.2	µg/L	1.6	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	-	< 0.50	< 0.50
Dichloroethylene, 1,1-	0.3	µg/L	1.6	< 0.3	-	< 0.50	< 0.3	< 0.50	< 0.3	-	< 0.50	< 0.50
Dichloroethylene, cis-1,2-	0.2	µg/L	1.6	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	-	< 0.50	< 0.50
Dichloroethylene, trans-1,2-	0.2	µg/L	1.6	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	-	< 0.50	< 0.50
Dichloropropane, 1,2-	0.2	µg/L	16	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	-	< 0.50	< 0.50
Dichloropropene, 1,3-	0.50	µg/L	5.2	-	-	< 0.50	-	< 0.50	-	-	< 0.50	< 0.50
Dichloropropene, cis-1,3-	0.30	µg/L	na	-	-	< 0.30	-	< 0.30	-	-	< 0.30	< 0.30
Dichloropropene, trans-1,3-	0.30	µg/L	na	-	-	< 0.30	-	< 0.30	-	-	< 0.30	< 0.30
Ethylbenzene	0.1	µg/L	2,300	1.3	-	< 0.50	< 0.1	< 0.50	3.6	-	< 0.50	< 0.50
Ethylene Dibromide (Dibromoethane, 1,2-)	0.1	µg/L	0.25	< 0.1	-	< 0.20	< 0.1	< 0.20	< 0.1	-	< 0.20	< 0.20
Hexane (n)	0.10	µg/L	51	< 0.2	-	0.56	< 0.2	< 0.50	0.63	-	< 0.50	0.73
Methyl Ethyl Ketone	1	µg/L	470,000	18	-	< 20	< 1	< 20	21	-	< 20	< 20
Methyl Isobutyl Ketone	1	µg/L	140,000	< 1	-	< 20	< 1	< 20	< 1	-	< 20	< 20
Methyl t-butyl ether (MTBE)	0.2	µg/L	190	< 0.2	-	< 2.0	< 0.2	< 2.0	< 0.2	-	< 2.0	< 2.0
Methylene Chloride	0.3	µg/L	610	< 0.3	-	< 5.0	< 0.3	< 5.0	< 0.3	-	< 5.0	< 5.0
Styrene	0.1	µg/L	1,300	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1	-	< 0.50	< 0.50
Tetrachloroethane, 1,1,1,2-	0.1	µg/L	3.4	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1	-	< 0.50	< 0.50
Tetrachloroethane, 1,1,2,2-	0.1	µg/L	3.2	< 0.1	-	< 0.50	< 0.1	< 0.50	< 0.1	-	< 0.50	< 0.50
Tetrachloroethylene	0.2	µg/L	1.6	< 0.2	-	< 0.50	< 0.2	< 0.50	0.41	-	< 0.50	< 0.50
Toluene	0.2	µg/L	18,000	4.3	-	< 0.50	< 0.2	< 0.50	18	-	< 0.50	< 0.50
Trichloroethane, 1,1,1-	0.3	µg/L	640	< 0.3	-	< 0.50	< 0.3	< 0.50	< 0.3	-	< 0.50	< 0.50
Trichloroethane, 1,1,2-	0.2	µg/L	4.7	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	-	< 0.50	< 0.50
Trichloroethylene	0.2	µg/L	1.6	< 0.2	-	< 0.50	< 0.2	< 0.50	< 0.2	-	< 0.50	< 0.50
Trichlorofluoromethane	0.4	µg/L	2,500	< 0.4	-	< 5.0	< 0.4	< 5.0	< 0.4	-	< 5.0	< 5.0
Vinyl Chloride [4]	0.17	µg/L	0.5	< 0.17	-	< 0.50	< 0.17	< 0.50	< 0.17	-	< 0.50	< 0.50
Xylenes	0.2	µg/L	4,200	8.7	-	< 0.50	< 0.2	< 0.50	21	-	< 0.50	1.01
Xylenes, m+p-	0.40	µg/L	na	-	-	< 0.40	-	< 0.40	-	-	< 0.40	0.55
Xylenes, o-	0.30	µg/L	na	-	-	< 0.30	-	0.35	-	-	< 0.30	0.46
PAHs												
Acenaphthene	0.020	µg/L	600	< 0.2	-	< 0.020	< 0.2	0.099	< 0.2	-	< 0.020	< 0.030
Acenaphthylene	0.020	µg/L	1.8	< 0.2	-	< 0.020	< 0.2	0.093	< 0.2	-	< 0.020	< 0.020
Anthracene	0.020	µg/L	2.4	< 0.1	-	< 0.020	< 0.1	0.193	< 0.1	-	< 0.020	< 0.020
Benzo(a)anthracene	0.020	µg/L	4.7	< 0.2	-	< 0.020	< 0.2	0.638	< 0.2	-	0.04	< 0.020
Benzo(a)pyrene	0.010	µg/L	0.81	< 0.01	-	< 0.010	< 0.01	0.336	< 0.01	-	0.032	< 0.010
Benzo(b)fluoranthene	0.020	µg/L	0.75	< 0.1	-	< 0.020	< 0.1	0.554	< 0.1	-	0.044	< 0.020
Benzo(g,h,i)perylene	0.020	µg/L	0.2	< 0.2	-	< 0.020	< 0.2	0.148	< 0.2	-	0.023	< 0.020
Benzo(k)fluoranthene	0.020	µg/L	0.4	< 0.1	-	< 0.020	< 0.1	0.182	< 0.1	-	< 0.020	< 0.020
Chrysene	0.020	µg/L	1	< 0.1	-	< 0.020	< 0.1	0.496	< 0.1	-	0.033	< 0.020
Dibenzo(a,h)anthracene	0.020	µg/L	0.52	< 0.2	-	< 0.020	< 0.2	0.041	< 0.2	-	< 0.020	< 0.020
Fluoranthene	0.020	µg/L	130	< 0.2	-	0.03	< 0.2	1.79	< 0.2	-	0.06	0.027
Fluorene	0.020	µg/L	400	< 0.2	-	< 0.020	< 0.2	0.062	0.55	-	< 0.020	0.278
Indeno(1,2,3-cd)pyrene	0.020	µg/L	0.2	< 0.2	-	< 0.020	< 0.2	**0.212**	< 0.2	-	0.027	< 0.020
Methylnaphthalene, 1-	0.020	µg/L	1,800	-	-	< 0.020	-	0.113	-	-	< 0.020	0.028
Methylnaphthalene, 2-	0.020	µg/L	1,800	-	-	< 0.020	-	0.023	-	-	< 0.020	0.03
Methylnaphthalene, 1- & 2-	0.028	µg/L	1800 [4]	-	-	< 0.028	-	0.136	-	-	< 0.028	0.057
Naphthalene	0.050	µg/L	1,400	1.1	-	0.125	8.3	1.37	1.9	-	< 0.050	0.614
Phenanthrene	0.020	µg/L	580	0.24	-	0.022	0.26	0.472	1.1	-	< 0.020	0.06
Pyrene	0.020	µg/L	68	< 0.2	-	0.031	< 0.2	1.46	< 0.2	-	0.06	0.028
PCBs												
Arochlor 1242	0.020	µg/L	na	-	-	-	-	-	-	-	-	< 0.040
Arochlor 1248	0.020	µg/L	na	-	-	-	-	-	-	-	-	< 0.020
Arochlor 1254	0.020	µg/L	na	-	-	-	-	-	-	-	-	< 0.020
Arochlor 1260	0.020	µg/L	na	-	-	-	-	-	-	-	-	< 0.020
Total PCBs	0.1	µg/L	7.8	-	-	-	-	-	-	-	-	< 0.053

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/L – micrograms per litre
µS/cm - microSiemens per centimetre
mg/L - milligrams per litre
BOLD Concentration greater than Table 5 Standard

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

[2] Table 5 stratified site condition standards in a non-potable groundwater condition for all types of property use, coarse textured soils (MOE, 2011)

[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance.

TABLE8: **Preliminary Screening of Groundwater Cc**
Central Park, Hamilton, ON

Sample Location			Table 5[2]	MW18-23	MW18-26	MW18-30	MW-104	MW-104	MW-104	MW-104	MW18-25	MW18-27
Laboratory Sample ID			Standard	L2162292-2	L2170681-3	L2173188-2	4841730	4974192	7757452	L2162292-1	L2170681-2	L2170681-4
SNC-Lavalin Sample ID			R/P/I	MW18-23	MW18-26	MW18-30	MW-104	MW-104	MW-104	MW-104	MW18-25	MW18-27
Sampling Date (yyyy/mm/dd)			CG	2018/09/10	2018/09/24	2018/09/27	2013/10/11	2013/11/18	2016/08/15	2018/09/10	2018/09/24	2018/09/24
Parameter	**RDL**	**Units**										
Water Table Depth (m bgs)				4.4	3	4	2.2	2.2	2.2	2.2	2.6	2.8
Dissolved Metals												
Mercury	0.010	µg/L	0.29	< 0.010	-	< 0.010	< 0.02	-	< 0.02	< 0.010	-	< 10[1]
Petroleum Hydrocarbon (PHC) Fractions												
PHC F1	25	µg/L	750	< 25	670	165	< 25	100	< 25	< 64	< 25	< 3,600[1]
PHC F2	100	µg/L	150	< 100	**16,600**	**230**	12,000	19,000	10,000	12,700	610	33,900
PHC F3	100	µg/L	500	< 250	500	< 250	< 100	2,300	< 100	550	< 250	< 1,000[1]
PHC F4	100	µg/L	500	< 250	< 500	< 250	< 100	< 100	< 100	< 500	< 250	< 1,000[1]
Volatile Organic Compounds												
Acetone	1	µg/L	130,000	202	< 30	< 30	< 10.0	< 1	< 1	< 30	-	< 30
Benzene	0.2	µg/L	44	< 0.50	**215**	< 0.50	350	200	170	195	2.85	17,100
Bromodichloromethane	0.2	µg/L	85,000	< 2.0	< 2.0	< 2.0	< 2.00	< 0.2	< 0.2	< 2.0	-	< 2.0
Bromoform	0.1	µg/L	380	< 5.0	< 5.0	< 5.0	< 1.00	< 0.1	< 0.1	< 5.0	-	< 5.0
Bromomethane	0.2	µg/L	5.6	< 0.50	< 0.50	< 0.50	< 2.00[1]	< 0.2	< 0.2	< 0.50	-	< 0.50
Carbon Tetrachloride	0.20	µg/L	0.79	< 0.20	< 0.20	< 0.20	< 2.00[1]	< 0.2	< 0.2	< 0.20	-	< 0.20
Chlorobenzene	0.1	µg/L	630	< 0.50	< 8.0	< 0.50	< 1.00	< 0.1	< 0.1	< 0.50	-	< 5.5
Chloroform	0.2	µg/L	2.4	< 1.0	< 1.0	< 1.0	< 2.00	< 0.2	< 0.2	< 1.0	-	< 1.0
Dibromochloromethane	0.1	µg/L	82,000	< 2.0	< 2.0	< 2.0	< 1.00	< 0.1	< 0.1	< 2.0	-	< 2.0
Dichlorobenzene, 1,2- (o-DCB)	0.1	µg/L	4,600	< 0.50	< 0.50	< 0.50	< 1.00	< 0.1	< 0.1	< 0.50	-	< 0.50
Dichlorobenzene, 1,3- (m-DCB)	0.1	µg/L	9,600	< 0.50	< 0.50	< 0.50	< 1.00	< 0.1	< 0.1	< 0.50	-	< 0.50
Dichlorobenzene, 1,4- (p-DCB)	0.1	µg/L	8	< 0.50	< 0.50	< 0.50	< 1.00[1]	< 0.1	< 0.1	< 0.50	-	< 0.50
Dichlorodifluoromethane	0.2	µg/L	4,400	< 2.0	< 2.0	< 2.0	< 2.00	< 0.2	< 0.2	< 2.0	-	< 2.0
Dichloroethane, 1,1-	0.3	µg/L	320	< 0.50	< 0.50	< 0.50	< 3.00	< 0.3	< 0.3	< 0.50	-	< 0.50
Dichloroethane, 1,2-	0.2	µg/L	1.6	< 0.50	< 0.50	< 0.50	< 2.00[1]	0.27	< 0.2	< 0.50	-	< 0.50
Dichloroethylene, 1,1-	0.3	µg/L	1.6	< 0.50	< 0.50	< 0.50	< 3.00[1]	< 0.3	< 0.3	< 0.50	-	< 0.50
Dichloroethylene, cis-1,2-	0.2	µg/L	1.6	< 0.50	< 0.50	< 0.50	< 2.00[1]	< 0.2	< 0.2	< 0.50	-	< 0.50
Dichloroethylene, trans-1,2-	0.2	µg/L	1.6	< 0.50	< 0.50	< 0.50	< 2.00[1]	< 0.2	< 0.2	< 0.50	-	< 0.50
Dichloropropane, 1,2-	0.2	µg/L	16	< 0.50	< 0.50	< 0.50	< 2.00[1]	< 0.2	< 0.2	< 0.50	-	< 0.50
Dichloropropene, 1,3-	0.50	µg/L	5.2	< 0.50	< 0.50	< 0.50	-	-	-	< 0.50	-	< 0.67[1]
Dichloropropene, cis-1,3-	0.30	µg/L	na	< 0.30	< 0.30	< 0.30	-	-	-	< 0.30	-	< 0.60
Dichloropropene, trans-1,3-	0.30	µg/L	na	< 0.30	< 0.30	< 0.30	-	-	-	< 0.30	-	< 0.30
Ethylbenzene	0.1	µg/L	2,300	< 0.50	391	2.27	90	48	44	41.9	0.9	504
Ethylene Dibromide (Dibromoethane, 1,2-)	0.1	µg/L	0.25	< 0.20	< 0.20	< 0.20	< 1.00[1]	< 0.1	< 0.1	< 0.20	-	< 0.20
Hexane (n)	0.10	µg/L	51	< 0.50	< 0.55	< 0.10	< 2.00	< 0.2	< 0.2	< 0.50	-	3.08
Methyl Ethyl Ketone	1	µg/L	470,000	< 20	< 20	< 20	< 10.0	< 1	< 1	< 20	-	< 20
Methyl Isobutyl Ketone	1	µg/L	140,000	< 20	< 20	< 20	< 10.0	< 1	< 1	< 20	-	< 20
Methyl t-butyl ether (MTBE)	0.2	µg/L	190	< 2.0	< 2.0	< 2.0	< 2.00	< 0.2	< 0.2	< 2.0	-	< 2.0
Methylene Chloride	0.3	µg/L	610	< 5.0	< 5.0	< 5.0	< 3.00	< 0.3	< 0.3	< 5.0	-	< 5.0
Styrene	0.1	µg/L	1,300	< 0.50	< 0.50	< 0.50	1.7	1.7	0.54	< 0.50	-	180
Tetrachloroethane, 1,1,1,2-	0.1	µg/L	3.4	< 0.50	< 0.50	< 0.50	< 1.00	< 0.1	< 0.1	< 0.50	-	< 0.50
Tetrachloroethane, 1,1,2,2-	0.1	µg/L	3.2	< 0.50	< 0.50	< 0.50	< 1.00[1]	< 0.1	< 0.1	< 0.50	-	< 0.50
Tetrachloroethylene	0.2	µg/L	1.6	< 0.50	< 0.50	< 0.50	< 2.00[1]	< 0.2	< 0.2	< 0.50	-	< 0.50
Toluene	0.2	µg/L	18,000	< 0.50	5.55	< 0.50	94	53	40	48.6	3.63	4,300
Trichloroethane, 1,1,1-	0.3	µg/L	640	< 0.50	< 0.50	< 0.50	< 3.00	< 0.3	< 0.3	< 0.50	-	< 0.50
Trichloroethane, 1,1,2-	0.2	µg/L	4.7	< 0.50	< 0.50	< 0.50	< 2.00[1]	< 0.2	< 0.2	< 0.50	-	< 0.50
Trichloroethylene	0.2	µg/L	1.6	< 0.50	< 0.50	< 0.50	< 2.00[1]	< 0.2	< 0.2	< 0.50	-	< 0.50
Trichlorofluoromethane	0.4	µg/L	2,500	< 5.0	< 5.0	< 5.0	< 4.00	< 0.4	< 0.4	< 5.0	-	< 5.0
Vinyl Chloride [4]	0.17	µg/L	0.5	< 0.50	< 0.50	< 0.50	< 1.70[1]	< 0.17	< 0.17	< 0.50	-	< 0.50
Xylenes	0.2	µg/L	4,200	< 0.50	879	1.59	290	150	110	139	4.96	1,960
Xylenes, m+p-	0.40	µg/L	na	< 0.40	767	1.59	-	-	-	81.1	3.25	1,320
Xylenes, o-	0.30	µg/L	na	< 0.30	112	< 0.30	-	-	-	57.6	1.71	641
PAHs												
Acenaphthene	0.020	µg/L	600	4.31	**646**	4.87	370	310	270	219	30	571
Acenaphthylene	0.020	µg/L	1.8	0.04	**2.27**	0.112	19	7.4	< 0.2	2.32	5.59	61.2
Anthracene	0.020	µg/L	2.4	0.021	**2.64**	2.34	16	18	14	10.1	3.29	19.6
Benzo(a)anthracene	0.020	µg/L	4.7	< 0.020	0.315	0.202	< 0.2	0.21	0.55	0.351	0.412	0.243
Benzo(a)pyrene	0.010	µg/L	0.81	< 0.010	0.118	0.014	< 0.01	< 0.01	0.42	0.097	0.184	0.161
Benzo(b)fluoranthene	0.020	µg/L	0.75	< 0.020	0.194	0.024	< 0.1	< 0.1	0.57	0.132	0.25	0.262
Benzo(g,h,i)perylene	0.020	µg/L	0.2	< 0.020	0.054	< 0.020	< 0.2	< 0.2	0.27	0.037	0.094	0.045
Benzo(k)fluoranthene	0.020	µg/L	0.4	< 0.020	0.061	< 0.020	< 0.1	< 0.1	0.27	0.043	0.083	0.082
Chrysene	0.020	µg/L	1	< 0.020	0.207	0.178	0.16	0.16	0.39	0.236	0.268	0.172
Dibenzo(a,h)anthracene	0.020	µg/L	0.52	< 0.020	< 0.020	< 0.020	< 0.2	< 0.2	< 0.2	< 0.020	0.024	< 0.020
Fluoranthene	0.020	µg/L	130	0.109	16.4	5.11	9.7	11	12	9.68	5.53	4.95
Fluorene	0.020	µg/L	400	0.992	56.4	6.84	130	130	110	90.2	21.5	251
Indeno(1,2,3-cd)pyrene	0.020	µg/L	0.2	< 0.020	0.07	< 0.020	< 0.2	< 0.2	0.2	0.049	0.12	0.066
Methylnaphthalene, 1-	0.020	µg/L	1,800	< 0.020	613	2.77	-	-	-	343	16.9	733
Methylnaphthalene, 2-	0.020	µg/L	1,800	< 0.020	82.4	1.25	-	-	-	484	20.6	1,150
Methylnaphthalene, 1- & 2-	0.028	µg/L	1800 [4]	< 0.028	695	4.02	-	-	-	827	37.5	1,890
Naphthalene	0.050	µg/L	1,400	0.122	**10,400**	6.06	12,000	14,000	10,000	8,880	327	22,900
Phenanthrene	0.020	µg/L	580	< 0.020	123	17.1	120	140	120	90.8	16.7	202
Pyrene	0.020	µg/L	68	0.022	5.13	2.97	5.9	7	7.7	5.2	3.4	2.69
PCBs												
Arochlor 1242	0.020	µg/L	na	-	-	< 0.020	< 0.1	-	-	-	-	< 0.20
Arochlor 1248	0.020	µg/L	na	-	-	< 0.020	< 0.1	-	-	-	-	< 0.20
Arochlor 1254	0.020	µg/L	na	-	-	< 0.020	< 0.1	-	-	-	-	< 0.20
Arochlor 1260	0.020	µg/L	na	-	-	< 0.020	< 0.1	-	-	-	-	< 0.20
Total PCBs	0.1	µg/L	7.8	-	-	< 0.040	< 0.1	-	-	-	-	< 0.40[1]

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/L – micrograms per litre
µS/cm - microSiemens per centimetre
mg/L - milligrams per litre
BOLD Concentration greater than Table 5 Standar

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

[2] Table 5 stratified site condition standards in a non-potable groundwater condition for all types of property use, coarse textured soils (MOE, 2011)

[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance.

TABLE8: **Preliminary Screening of Groundwater CC**
Central Park, Hamilton, ON

Sample Location Laboratory Sample ID SNC-Lavalin Sample ID Sampling Date (yyyy/mm/dd)			Table 5[2] Standard R/P/I CG	COCs	RDL (most recent and highest)	Maximum (0 means no detection)	Maximum With RDL	Maximum With RDL x 1.2	Exceeded Generic Table 5 SCS
Parameter	**RDL**	**Units**							
Water Table Depth (m bgs)									
Dissolved Metals				**Dissolved Metals**					
Mercury	0.010	µg/L	0.29	**Mercury**	0.02	0	0.02	0.024	No
Petroleum Hydrocarbon (PHC) Fractions				**Petroleum Hydrocarbon (PHC) Fractions**					
PHC F1	25	µg/L	750	**PHC F1**	25	670	670	804	Yes
PHC F2	100	µg/L	150	**PHC F2**	100	33900	33900	40680	Yes
PHC F3	100	µg/L	500	**PHC F3**	500	2300	2300	2760	Yes
PHC F4	100	µg/L	500	**PHC F4**	500	0	500	600	No
						0			
Volatile Organic Compounds				**Volatile Organic Compounds**		0			
Acetone	1	µg/L	130,000	**Acetone**	30	202	202	242.4	No
Benzene	0.2	µg/L	44	**Benzene**	0.5	17100	17100	20520	Yes
Bromodichloromethane	0.2	µg/L	85,000	**Bromodichloromethane**	2	0	2	2.4	No
Bromoform	0.1	µg/L	380	**Bromoform**	5	0	5	6	No
Bromomethane	0.2	µg/L	5.6	**Bromomethane**	0.5	0	0.5	0.6	No
Carbon Tetrachloride	0.20	µg/L	0.79	**Carbon Tetrachloride**	0.2	0	0.2	0.24	No
Chlorobenzene	0.1	µg/L	630	**Chlorobenzene**	8	0	8	9.6	No
Chloroform	0.2	µg/L	2.4	**Chloroform**	1	0	1	1.2	No
Dibromochloromethane	0.1	µg/L	82,000	**Dibromochloromethane**	2	0	2	2.4	No
Dichlorobenzene, 1,2- (o-DCB)	0.1	µg/L	4,600	**Dichlorobenzene, 1,2- (o-DCB)**	0.5	0	0.5	0.6	No
Dichlorobenzene, 1,3- (m-DCB)	0.1	µg/L	9,600	**Dichlorobenzene, 1,3- (m-DCB)**	0.5	0	0.5	0.6	No
Dichlorobenzene, 1,4- (p-DCB)	0.1	µg/L	8	**Dichlorobenzene, 1,4- (p-DCB)**	0.5	0	0.5	0.6	No
Dichlorodifluoromethane	0.2	µg/L	4,400	**Dichlorodifluoromethane**	2	0	2	2.4	No
Dichloroethane, 1,1-	0.3	µg/L	320	**Dichloroethane, 1,1-**	0.5	0	0.5	0.6	No
Dichloroethane, 1,2-	0.2	µg/L	1.6	**Dichloroethane, 1,2-**	0.5	0.27	0.5	0.6	No
Dichloroethylene, 1,1-	0.3	µg/L	1.6	**Dichloroethylene, 1,1-**	0.6	0	0.6	0.72	No
Dichloroethylene, cis-1,2-	0.2	µg/L	1.6	**Dichloroethylene, cis-1,2-**	0.5	0	0.5	0.6	No
Dichloroethylene, trans-1,2-	0.2	µg/L	1.6	**Dichloroethylene, trans-1,2-**	0.5	0	0.5	0.6	No
Dichloropropane, 1,2-	0.2	µg/L	16	**Dichloropropane, 1,2-**	0.5	0	0.5	0.6	No
Dichloropropene, 1,3-	0.50	µg/L	5.2	**Dichloropropene, 1,3-**	0.5	0	0.5	0.6	No
Dichloropropene, cis-1,3-	0.30	µg/L	na	**Dichloropropene, cis-1,3-**	0.3	0	0.3	0.36	No
Dichloropropene, trans-1,3-	0.30	µg/L	na	**Dichloropropene, trans-1,3-**	0.3	0	0.3	0.36	No
Ethylbenzene	0.1	µg/L	2,300	**Ethylbenzene**	0.5	504	504	604.8	No
Ethylene Dibromide (Dibromoethane, 1,2-)	0.1	µg/L	0.25	**Ethylene Dibromide**	0.2	0	0.2	0.24	No
Hexane (n)	0.10	µg/L	51	**Hexane (n)**	0.55	3.08	3.08	3.696	No
Methyl Ethyl Ketone	1	µg/L	470,000	**Methyl Ethyl Ketone**	20	21	21	25.2	No
Methyl Isobutyl Ketone	1	µg/L	140,000	**Methyl Isobutyl Ketone**	20	0	20	24	No
Methyl t-butyl ether (MTBE)	0.2	µg/L	190	**Methyl tert butyl ether (MTBE)**	2	0	2	2.4	No
Methylene Chloride	0.3	µg/L	610	**Methylene Chloride**	5	0	5	6	No
Styrene	0.1	µg/L	1,300	**Styrene**	0.5	180	180	216	No
Tetrachloroethane, 1,1,1,2-	0.1	µg/L	3.4	**Tetrachloroethane, 1,1,1,2-**	0.5	0	0.5	0.6	No
Tetrachloroethane, 1,1,2,2-	0.1	µg/L	3.2	**Tetrachloroethane, 1,1,2,2-**	0.5	0	0.5	0.6	No
Tetrachloroethylene	0.2	µg/L	1.6	**Tetrachloroethylene**	0.5	0.41	0.5	0.6	No
Toluene	0.2	µg/L	18,000	**Toluene**	0.5	4300	4300	5160	No
Trichloroethane, 1,1,1-	0.3	µg/L	640	**Trichloroethane, 1,1,1-**	0.6	0	0.6	0.72	No
Trichloroethane, 1,1,2-	0.2	µg/L	4.7	**Trichloroethane, 1,1,2-**	0.5	0	0.5	0.6	No
Trichloroethylene	0.2	µg/L	1.6	**Trichloroethylene**	0.5	0	0.5	0.6	No
Trichlorofluoromethane	0.4	µg/L	2,500	**Trichlorofluoromethane**	5	0	5	6	No
Vinyl Chloride [4]	0.17	µg/L	0.5	**Vinyl Chloride**	0.5	0	0.346	0.4152	No
Xylenes	0.2	µg/L	4,200	**Xylenes**	0.5	1960	1960	2352	No
Xylenes, m+p-	0.40	µg/L	na	**Xylenes, m+p-**	0.4	1320	1320	1584	No
Xylenes, o-	0.30	µg/L	na	**Xylenes, o-**	0.3	641	641	769.2	No
PAHs				**PAHs**					
Acenaphthene	0.020	µg/L	600	**Acenaphthene**	0.15	646	646	775.2	Yes
Acenaphthylene	0.020	µg/L	1.8	**Acenaphthylene**	0.02	61.2	61.2	73.44	Yes
Anthracene	0.020	µg/L	2.4	**Anthracene**	0.02	19.6	19.6	23.52	Yes
Benzo(a)anthracene	0.020	µg/L	4.7	**Benzo(a)anthracene**	0.02	0.638	0.638	0.7656	No
Benzo(a)pyrene	0.010	µg/L	0.81	**Benzo(a)pyrene**	0.01	0.42	0.42	0.504	No
Benzo(b)fluoranthene	0.020	µg/L	0.75	**Benzo(b)fluoranthene**	0.02	0.57	0.57	0.684	No
Benzo(g,h,i)perylene	0.020	µg/L	0.2	**Benzo(g,h,i)perylene**	0.02	0.27	0.27	0.324	Yes
Benzo(k)fluoranthene	0.020	µg/L	0.4	**Benzo(k)fluoranthene**	0.02	0.27	0.27	0.324	No
Chrysene	0.020	µg/L	1	**Chrysene**	0.02	0.496	0.496	0.5952	No
Dibenzo(a,h)anthracene	0.020	µg/L	0.52	**Dibenzo(a,h)anthracene**	0.02	0.041	0.041	0.0492	No
Fluoranthene	0.020	µg/L	130	**Fluoranthene**	0.02	16.4	16.4	19.68	No
Fluorene	0.020	µg/L	400	**Fluorene**	0.02	251	251	301.2	No
Indeno(1,2,3-cd)pyrene	0.020	µg/L	0.2	**Indeno(1,2,3-cd)pyrene**	0.02	0.212	0.212	0.2544	Yes
Methylnaphthalene, 1-	0.020	µg/L	1,800	**Methylnaphthalene, 1-**	0.02	733	733	879.6	No
Methylnaphthalene, 2-	0.020	µg/L	1,800	**Methylnaphthalene, 2-**	0.02	1150	1150	1380	No
Methylnaphthalene, 1- & 2-	0.028	µg/L	1800 [4]	**Methylnaphthalene, 1- & 2-**	0.028	1890	1890	2268	No
Naphthalene	0.050	µg/L	1,400	**Naphthalene**	0.05	22900	22900	27480	Yes
Phenanthrene	0.020	µg/L	580	**Phenanthrene**	0.02	202	202	242.4	No
Pyrene	0.020	µg/L	68	**Pyrene**	0.02	7.7	7.7	9.24	No
PCBs				**PCBs**					
Arochlor 1242	0.020	µg/L	na	**Arochlor 1242**	0.04	0	0.04	0.048	No
Arochlor 1248	0.020	µg/L	na	**Arochlor 1248**	0.02	0	0.02	0.024	No
Arochlor 1254	0.020	µg/L	na	**Arochlor 1254**	0.02	0	0.02	0.024	No
Arochlor 1260	0.020	µg/L	na	**Arochlor 1260**	0.02	0	0.02	0.024	No
Total PCBs	0.1	µg/L	7.8	**Total PCBs**	0.05	0	0.05	0.06	No

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
< - Denotes concentration less than indicated detection limit
"-" - Not analyzed
na - Not applicable
µg/L – micrograms per litre
µS/cm - microSiemens per centimetre
mg/L - milligrams per litre
BOLD Concentration greater than Table 5 Standar
[1] Laboratory detection limit exceeds regulatory standard/guideline.
[2] Table 5 stratified site condition standards in a non-potable groundwater condition for all types of property use, coarse textured soils (MOE, 2011)
[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard.
[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance.

TABLE 9: **Soil Secondary Screening of COCs Results – Surface Soil (Human Health)**
Central Park, Hamilton, ON

Parameter	RDL	Units	Table 3 Generic SCS R/P/I_CG_NPG [1]	Exceeded Generic SCS	1.2xMaximum	On. Soil Bkgrd	Human Health Component Values					Quantitative Assessment Receptors/Pathways Selections					
							Soil Contact S1 Risk R/P/I_CG_NPG [2]	Soil Contact S2 Risk I/C/C_CG_NPG [3]	Soil Contact S3 Risk I/C/C_CG_NPG [3]	Indoor Air S-IA I/C/C_CG_NPG [3]	Outdoor Air R/P/I_CG_NPG [2]	General Public Inhalation of particulates (exceeded S1)	Onsite Park Visitor Direct Contact with Soil (exceeded S1)	Adult Subsurface Worker Trench Air Inhalation (exceeded S-IA C/I)	Adult Surface Worker Direct Contact with Soil (exceeded S2)	Adult Subsurface Worker Direct Contact with Soil (exceeded S3)	Outdoor Air (Exceeded Outdoor Air)
General Chemistry																	
Cyanide (WAD)	0.050	µg/g	0.051	Yes	2.8	0.051	380	3200	7900	insufficiently volatiles	insufficiently volatiles	No	No	No	No	No	No
Total Metals																	
Antimony	0.8	µg/g	7.5	Yes	63.12	1.3	7.5	63	63	insufficiently volatiles	insufficiently volatiles	Yes	Yes	No	Yes	Yes	No
Arsenic	0.20	µg/g	18	Yes	51.6	18	0.95	1.3	47	insufficiently volatiles	insufficiently volatiles	Yes	Yes	No	Yes	Yes	No
Barium	1.0	µg/g	390	Yes	1092	220	3800	32000	8600	insufficiently volatiles	insufficiently volatiles	No	No	No	No	No	No
Cadmium	0.50	µg/g	1.2	Yes	54.96	1.2	0.69	7.9	7.9	insufficiently volatiles	insufficiently volatiles	Yes	Yes	No	Yes	Yes	No
Copper	1.0	µg/g	140	Yes	8880	92	600	5600	5600	insufficiently volatiles	insufficiently volatiles	Yes	Yes	No	Yes	Yes	No
Lead	1.0	µg/g	120	Yes	4920	120	200	1000	1000	insufficiently volatiles	insufficiently volatiles	Yes	Yes	No	Yes	Yes	No
Mercury	0.0050	µg/g	0.27	Yes	6.948	0.27	9.8	67	670	3.9	36	No	No	Yes	No	No	No
Nickel	1.0	µg/g	100	Yes	130.8	82	330	2200	510	insufficiently volatiles	insufficiently volatiles	No	No	No	No	No	No
Selenium	0.4	µg/g	2.4	Yes	3.24	1.5	110	1200	1200	insufficiently volatiles	insufficiently volatiles	No	No	No	No	No	No
Zinc	5.0	µg/g	340	Yes	49920	290	5600	47000	47000	insufficiently volatiles	insufficiently volatiles	Yes	Yes	No	Yes	Yes	No
Volatiles																	
Benzene	0.0068	µg/g	0.21	Yes	169.2	0.02	9.3	13	480	0.32	17	Yes	Yes	Yes	Yes	No	Yes
Toluene	0.05	µg/g	2.3	Yes	246	0.2	1700	18000	180000	99	34000	No	No	Yes	No	No	No
Ethylbenzene	0.018	µg/g	2	Yes	25.2	0.05	2100	22000	22000	34	7600	No	No	No	No	No	No
Xylenes	0.050	µg/g	3.1	Yes	403.2	0.05	4200	44000	88000	50	4900	No	No	Yes	No	No	No
Hexane (n)	0.050	µg/g	2.8	Yes	6.696	0.05	na	na	21000000	46	130000	No	No	No	No	No	No
Petroleum Hydrocarbon (PHC) Fractions																	
PHC F1	5.0	µg/g	55	Yes	1104	25	6900	47000	100000	580	26000	No	No	Yes	No	No	No
PHC F2	10	µg/g	98	Yes	6588	10	3100	22000	48000	380	25000	Yes	Yes	Yes	No	No	No
PHC F3	50	µg/g	300	Yes	13560	240	5800	40000	260000	insufficiently volatiles	insufficiently volatiles	Yes	Yes	No	No	No	No
PHC F4 (silica gel)	250	µg/g	2,800	Yes	6204	120	6100	42000	400000	insufficiently volatiles	insufficiently volatiles	Yes	Yes	No	No	No	No
Volatile Organic Compounds																	
Styrene	0.050	µg/g	0.7	Yes	162	0.05	2500	26000	26000	42	3400	No	No	Yes	No	No	No
PAHs																	
Acenaphthene	0.050	µg/g	7.9	Yes	39.6	0.072	78	96	3600	120	1300	No	No	No	No	No	No
Acenaphthylene	0.050	µg/g	0.15	Yes	12	0.093	7.8	9.6	360	6.6	96	Yes	Yes	Yes	Yes	No	No
Anthracene	0.050	µg/g	0.67	Yes	120	0.16	5400	42000	420000	na	na	No	No	No	No	No	No
Benzo(a)anthracene	0.050	µg/g	0.5	Yes	104.4	0.36	0.78	0.96	36	970	330	Yes	Yes	No	Yes	Yes	No
Benzo(a)pyrene	0.050	µg/g	0.3	Yes	76.8	0.3	0.078	0.096	3.6	12000	170	Yes	Yes	No	Yes	Yes	No
Benzo(b)fluoranthene	0.050	µg/g	0.78	Yes	90	0.47	0.78	0.96	36	81000	2000	Yes	Yes	No	Yes	Yes	No
Benzo(g,h,i)perylene	0.050	µg/g	6.6	Yes	30	0.68	7.8	9.6	360	na	na	Yes	Yes	No	Yes	No	No
Benzo(k)fluoranthene	0.050	µg/g	0.78	Yes	43.2	0.48	0.78	0.96	36	99000	2100	Yes	Yes	No	Yes	Yes	No
Chrysene	0.050	µg/g	7	Yes	90	2.8	7.8	9.6	360	28000	6600	Yes	Yes	No	Yes	No	No
Dibenzo(a,h)anthracene	0.050	µg/g	0.1	Yes	13.2	0.1	0.078	0.096	3.6	480000	430	Yes	Yes	No	Yes	Yes	No
Fluoranthene	0.050	µg/g	0.69	Yes	324	0.56	7.8	9.6	360	3700	2500	Yes	Yes	No	Yes	No	No
Fluorene	0.050	µg/g	62	Yes	76.8	0.12	720	5600	56000	na	na	No	No	No	No	No	No
Indeno(1,2,3-cd)pyrene	0.050	µg/g	0.38	Yes	34.8	0.23	0.78	0.96	36	670000	4000	Yes	Yes	No	Yes	No	No
Methylnaphthalene, 1-	0.030	µg/g	0.99	Yes	4.032	0.59	72	560	560	na	na	No	No	No	No	No	No
Methylnaphthalene, 2-	0.030	µg/g	0.99	Yes	8.832	0.59	72	560	560	na	na	No	No	No	No	No	No
Methylnaphthalene, 1- & 2-	0.042	µg/g	0.99 [6]	Yes	74.4	0.59	72	560	560	na	na	Yes	Yes	No	No	No	No
Naphthalene	0.013	µg/g	0.6	Yes	65.04	0.09	360	2800	28000	9.6	270	No	No	Yes	No	No	No
Phenanthrene	0.046	µg/g	6.2	Yes	372	0.69	5400	42000	420000	na	na	No	No	No	No	No	No
Pyrene	0.050	µg/g	78	Yes	264	1	78	96	3600	28000	23000	Yes	Yes	No	Yes	No	No
PCBs																	
Total PCBs	0.020	µg/g	0.35	Yes	1.92	0.3	0.35	2.7	4.1	45	120	Yes	Yes	No	No	No	No

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
na - Not applicable or not available
µg/g - micrograms per gram, dry weight basis
mS/cm - milliSiemens per centimetre
Yes - COCs exceeded component values and were carried forward for further evaluation.
No - COCs didn't exceed component values and were not carried forward for further evaluation.

[1] Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] Soil component for Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011). Soil component values were selected for the protection of human health based on residential parkland land use, included park visitors (S1) and outdoor air inhalation.

[3] Soil components for Table 3 full depth site condition standards in a non-potable groundwater condition for industrial/commercial/community property use (I/C/C), coarse textured surface soils (MOE, 2011). Soil component values were selected for the protection of human health based on industrial/commercial/community land use, included surface worker (S2) and subsurface worker (S3 and S-IA).

[4] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[5] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecatble. Dectection limit represents maximum possible SAR value (<).

[6] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard. Individual isomer is not carried forward for evaluation as the methylnaphthalene, 1-,2- is retained for further evaluation

TABLE 10: **Soil Secondary Screening of COCs Results – Subsurface Soil (Human Health)**
Central Park, Hamilton, ON

Parameter	RDL	Units	Table 5 Generic SCSRL/PL/INCG [1]	Exceeded Generic SCS	1.2xMaximum	On. Soil Bkgrd	Human Health Component Values				Quantitative Assessment Receptors/Pathways Selections		
							Soil Contact S1 Risk R/P/I_CG_NPG	Soil Contact S3 Risk R/P/I_CG_NPG [2]	Indoor Air S-IA I/C/C_CG_NPG [3]	Free Phase Threshold R/P/I_CG_NPG [2]	General Public Inhalation of Particulate (exceeded S1)	Adult Subsurface Worker Trench Air Inhalation (exceeded S-IA)	Adult Subsurface Worker Direct Contact with Soil (exceeded S3)
General Chemistry [4]													
Cyanide (CN-)	0.04	µg/g	0.051	Yes	0.1452	0.051	380	7900	ufficiently volati	240000	No	No	No
Total Metals													
Arsenic	0.20	µg/g	18	Yes	120	18	0.95	47	ufficiently volati	12000	Yes	No	Yes
Lead	1.0	µg/g	1,000	Yes	2028	120	200	1000	ufficiently volati	24000	Yes	No	Yes
Mercury	0.0050	µg/g	0.27	Yes	48.6	0.27	9.8	670	0.25	34000	Yes	Yes	No
Volatiles													
Benzene	0.0068	µg/g	0.21	Yes	33	0.02	9.3	480	0.21	5000	Yes	Yes	No
Toluene	0.05	µg/g	6.2	Yes	16.32	0.2	1700	180000	6.2	3300	No	Yes	No
Ethylbenzene	0.018	µg/g	2	Yes	16.92	0.05	2100	22000	2.1	2700	No	Yes	No
Xylenes	0.050	µg/g	3.1	Yes	29.88	0.05	4200	88000	3.1	2300	No	Yes	No
Petroleum Hydrocarbon (PHC) Fractions													
PHC F1	5.0	µg/g	55	Yes	216	25	6900	100000	130	1700	No	Yes	No
PHC F2	10	µg/g	98	Yes	15840	10	3100	48000	98	2700	Yes	Yes	No
PHC F3	50	µg/g	5,800	Yes	22800	240	5800	260000	ufficiently volati	5800	Yes	No	No
PHC F4 (silica gel)	250	µg/g	6,900	Yes	12240	120	6100	400000	ufficiently volati	6900	Yes	No	No
Volatile Organic Compounds [5]													
Trichloroethylene	0.010	µg/g	0.061	Yes	2.964	0.05	31	53	0.00044	4100	No	Yes	No
Vinyl Chloride	0.020	µg/g	0.02	Yes	0.320	0.02	0.57	29	0.0021	6100	No	Yes	No
PAHs [6]													
Acenaphthene	0.050	µg/g	7.9	Yes	598.8	0.072	78	3600	7.9	2800	Yes	Yes	No
Acenaphthylene	0.050	µg/g	0.15	Yes	47.52	0.093	7.8	360	0.45	2900	Yes	Yes	No
Anthracene	0.050	µg/g	0.67	Yes	420	0.16	5400	420000	na	2700	No	No	No
Benzo(a)anthracene	0.050	µg/g	0.96	Yes	240	0.36	0.78	36	65	7600	Yes	Yes	Yes
Benzo(a)pyrene	0.050	µg/g	0.3	Yes	120	0.3	0.078	3.6	820	7600	Yes	No	Yes
Benzo(b)fluoranthene	0.050	µg/g	0.96	Yes	180	0.47	0.78	36	5500	7600	Yes	No	Yes
Benzo(g,h,i)perylene	0.050	µg/g	9.6	Yes	64.8	0.68	7.8	360	na	7600	Yes	No	No
Benzo(k)fluoranthene	0.050	µg/g	0.96	Yes	94.8	0.48	0.78	36	6700	7600	Yes	No	Yes
Chrysene	0.050	µg/g	9.6	Yes	204	2.8	7.8	360	1900	7700	Yes	No	No
Dibenzo(a,h)anthracene	0.050	µg/g	0.1	Yes	14.4	0.1	0.078	3.6	33000	7600	Yes	No	Yes
Fluoranthene	0.050	µg/g	9.6	Yes	792	0.56	7.8	360	250	7600	Yes	Yes	Yes
Fluorene	0.050	µg/g	62	Yes	476.4	0.12	720	56000	na	2800	No	No	No
Indeno(1,2,3-cd)pyrene	0.050	µg/g	0.96	Yes	62.4	0.23	0.78	36	46000	7600	Yes	No	Yes
Methylnaphthalene, 1- & 2-	0.042	µg/g	34	Yes	844.8	0.59	72	560	na	3600	Yes	No	Yes
Naphthalene	0.013	µg/g	0.65	Yes	3036	0.09	360	28000	0.65	2800	Yes	Yes	No
Phenanthrene	0.046	µg/g	270	Yes	1092	0.69	5400	420000	na	2300	No	No	No
Pyrene	0.050	µg/g	96	Yes	552	1	78	3600	1900	7700	Yes	No	No

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
na - Not applicable or not available
µg/g - micrograms per gram, dry weight basis
mS/cm - milliSiemens per centimetre
Yes - COCs exceeded component values and were carried forward for further evaluation.
No - COCs didn't exceed component values and were not carried forward for further evaluation.

[1] Table 5 Stratified site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] Soil component for Table 3 full dpeth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011). Soil component values were selected for the protection of human health based on residential parkland land use, residents direct contact with soil (S1) was used for the screening of COCs that will be retained further for inhalation of particulates for the general public during excavation activities. S1 is direct contact and does not include inhalation of particulate, however, it's more conservative as the potential risk for direct contact is higher than inhalation of particulate.

[2] Soil component for Table 5 Sub-surface site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011). Soil component values were selected for the protection of human health based on residential parkland land use, included long-term surface worker (S2), subsurface worker (S3), and trench air inhalation (based on S-IA).

[3] Soil components for Table 5 sub-surface site condition standards in a non-potable groundwater condition for industrial/commercial/community property use (I/C/C), coarse textured surface soils (MOE, 2011). Soil component values were selected for the protection of human health based on industrial/commercial/community land use, included subsurface worker (S-IA), which is for screening of inhalation of trench air pathway

[4] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[5] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

[6] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard. Individual isomer is not carried forward for evaluation as the methylnaphthalene, 1-,2- is retained for further evaluation

TABLE 11: **Groundwater Secondary Screening Results - Shallow Groundwater (Human Health)**
Central Park, Hamilton, ON

Parameter	Units	Secondary Screening Selection	Maximum X 1.2	Human Health Component Values			Pathways for Quantitative Assessment		
				GW1 [1] Potable GW I/C/C	Res GW2[2] Shallow GW R/P/I	Ind GW2[3] Shallow GW I/C/C	Subsurface Worker Direct Contact with GW (Exeeded GW1 I/C/C)	On-site Park Visitor Outdoor Air Inhalation (Exceeded Res GW2)	Subsurface Worker Trench Air (Exceeded Shallow GW2 I/C/C)
Dissolved Metals									
Mercury	µg/L	Yes	12	1	0.0047	0.081	Yes	Yes	Yes
Volatiles									
Benzene	µg/L	Yes	20,520	5	0.17	2.8	Yes	Yes	Yes
Toluene	µg/L	Yes	5,160	24	320	5,400	Yes	Yes	No
Ethylbenzene	µg/L	Yes	605	2.4	57	970	Yes	Yes	No
Xylenes	µg/L	Yes	2,352	300	26	450	Yes	Yes	Yes
Petroleum Hydrocarbon (PHC) Fractions									
PHC F1	µg/L	Yes	4,320	820	3.4	58	Yes	Yes	Yes
PHC F2	µg/L	Yes	40,680	300	5.7	97	Yes	Yes	Yes
PHC F3	µg/L	Yes	2,760	1,000	nsufficiently volatile	sufficiently volatil	Yes	No	No
PHC F4	µg/L	Yes	1,200	1,100	nsufficiently volatile	sufficiently volatil	Yes	No	No
Volatile Organic Compounds [4]									
Styrene	µg/L	Yes	216	100	43	740	Yes	Yes	No
Trichloroethylene	µg/L	Yes	21.12	5	0.053	0.4	Yes	Yes	Yes
Vinyl Chloride	µg/L	Yes	2.60	2	0.0072	0.12	Yes	Yes	Yes
PAHs									
Acenaphthene	µg/L	Yes	775.2	4.1	17	270	Yes	Yes	Yes
Acenaphthylene	µg/L	Yes	73.44	0.45	0.96	15	Yes	Yes	Yes
Anthracene	µg/L	Yes	23.52	890	na	na	No	No	No
Benzo(a)pyrene	µg/L	Yes	0.91	0.01	14	220	Yes	No	No
Benzo(b)fluoranthene	µg/L	Yes	1.68	0.1	81	1,300	Yes	No	No
Benzo(g,h,i)perylene	µg/L	Yes	0.4	1	na	na	No	No	No
Benzo(k)fluoranthene	µg/L	Yes	0.64	0.1	100	1,600	Yes	No	No
Chrysene	µg/L	Yes	1.15	0.1	95	1,500	Yes	No	No
Fluorene	µg/L	Yes	301.2	120	na	na	Yes	Yes	Yes
Indeno(1,2,3-cd)pyrene	µg/L	Yes	0.56	0.1	190	3,100	Yes	No	No
Naphthalene	µg/L	Yes	27,480	59	4.4	75	Yes	Yes	Yes
Pyrene	µg/L	Yes	9.24	4.1	340	5,400	No	No	No

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
na - Not applicable or not available
µg/L – micrograms per litre
Yes - COCs exceeded component values and were carried forward for further evaluation.
No - COCs didn't exceed component values and were not carried forward for further evaluation.

[1] Groundwater components for potable site condition, industrial/commercial/community land use, coarse textured grain. The component values are for the protection of human health, including direct contact with groundwater for subsurface worker when soil excavation activities take place

[2] Groundwater components for shallow groundwater non-potable site condition, residential/parkland/institution (R/P/I) land use, coarse textured grain. The component values are for the protection of human health, included GW2 for downgradient off-site residents.

[3] Groundwater components for shallow groundwater non-potable site condition, industrial/commercial/community (I/C/C) land use, coarse textured grain. The component values are for the protection of human health, including GW2 for subsurface worker, which is for screening of inhalation of trench air exposure for subsurface workers.

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC <

TABLE 12: **Groundwater Secondary Screening Results - GW Depth >3 m bgs (Human Health)**
Central Park, Hamilton, ON

Parameter	Units	Exceeded Generic SCS	Maximum X 1.2	Human Health Component Values		Pathways for Quantative Assessment	
				Res GW2[1]	Ind GW2[2]		
				R/P/I NPG	I/C/C NPG	On-site Park Visitor Outdoor Air Inhalation (Exceeded Res GW2)	Subsurface Worker Trench Air (Exceeded GW2 I/C/C NPG)
Dissolved Metals							
Zinc	µg/L	Yes	2904	insufficiently volatile	insufficiently volatile	No	No
Volatiles							
Benzene	µg/L	Yes	448.8	44	830	Yes	No
Petroleum Hydrocarbon (PHC) Fractions							
PHC F1	µg/L	Yes	804	1,400	28,000	No	No
PHC F2	µg/L	Yes	24480	2,300	47,000	Yes	No
PHC F3	µg/L	Yes	2040	insufficiently volatile	insufficiently volatile	No	No
Volatile Organic Compounds [3]							
Trichloroethylene	µg/L	Yes	14.4	1.5	13	Yes	Yes
Vinyl Chloride	µg/L	Yes	1.9	0.16	3	Yes	No
PAHs							
Acenaphthene	µg/L	Yes	775.2	600	13,000	Yes	No
Acenaphthylene	µg/L	Yes	3.4	36	750	No	No
Anthracene	µg/L	Yes	6.7	na	na	No	No
Benzo(a)pyrene	µg/L	Yes	0.9	130	2,500	No	No
Benzo(b)fluoranthene	µg/L	Yes	1.68	1,100	25,000	No	No
Benzo(g,h,i)perylene	µg/L	Yes	0.4	na	na	No	No
Benzo(k)fluoranthene	µg/L	Yes	0.6	1,300	28,000	No	No
Chrysene	µg/L	Yes	1.2	2,400	63,000	No	No
Indeno(1,2,3-cd)pyrene	µg/L	Yes	0.6	2,200	42,000	No	No
Naphthalene	µg/L	Yes	12480	1,400	30,000	Yes	No

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
na - Not applicable or not available
µg/L – micrograms per litre
Yes - COCs exceeded component values and were carried forward for further evaluation.
No - COCs didn't exceed component values and were not carried forward for further evaluation.

[1] Groundwater components for non-potable site condition, residential/parkland/institution (R/P/I) land use, coarse textured grain. The component values are for the protection of human health, included GW2 for downgradient off-site residents.

[2] Groundwater components for non-potable site condition, industrial/commercial/community (I/C/C) land use, coarse textured grain. The component values are for the protection of human health, including GW2 for subsurface worker, which is for screening of inhalation of trench air exposure for subsurface workers.

[3] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

TABLE 13: **Groundwater Secondary Screening Results - Shallow For Residential Indoor Air Inhalation GW-IA**
Central Park, Hamilton, ON

Parameter	Units	Secondary Screening Selection	Maximum X 1.2	Human Health Component Values	Pathways for Quantitative Assessment
				Res GW2[2] Shallow GW R/P/I	Off-site Resident Indoor Air Inhalation (Exceed Shallow GW2 R/P/I)
Dissolved Metals					
Mercury	µg/L	Yes	12	0.0047	Yes
Volatiles					
Benzene	µg/L	Yes	20,520	0.17	Yes
Toluene	µg/L	Yes	5,160	320	Yes
Ethylbenzene	µg/L	Yes	605	57	Yes
Xylenes	µg/L	Yes	2,352	26	Yes
Petroleum Hydrocarbon (PHC) Fractions					
PHC F1	µg/L	Yes	4,320	3.4	Yes
PHC F2	µg/L	Yes	40,680	5.7	Yes
PHC F3	µg/L	Yes	2,760	insufficiently volatile	No
PHC F4	µg/L	Yes	1,200	insufficiently volatile	No
Volatile Organic Compounds [4]					
Styrene	µg/L	Yes	216	43	Yes
Trichloroethylene	µg/L	Yes	14	0.053	Yes
Vinyl Chloride	µg/L	Yes	2	0.0072	Yes
PAHs					
Acenaphthene	µg/L	Yes	775	17	Yes
Acenaphthylene	µg/L	Yes	73	0.96	Yes
Anthracene	µg/L	Yes	24	na	No
Benzo(b)fluoranthene	µg/L	Yes	1.0	81	No
Benzo(g,h,i)perylene	µg/L	Yes	0.3	na	No
Fluorene	µg/L	Yes	301	na	Yes
Indeno(1,2,3-cd)pyrene	µg/L	Yes	0.4	190	No
Naphthalene	µg/L	Yes	27,480	4.4	Yes
Pyrene	µg/L	Yes	9.2	340	No

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
na - Not applicable or not available
µg/L – micrograms per litre
Yes - COCs exceeded component values and were carried forward for further evaluation.
No - COCs didn't exceed component values and were not carried forward for further evaluation.

[1] Groundwater components for potable site condition, industrial/commercial/community land use, coarse textured grain. The component values are for the protection of human health, including direct contact with groundwater for subsurface worker when soil excavation activities take place

[2] Groundwater components for shallow groundwater non-potable site condition, residential/parkland/institution (R/P/I) land use, coarse textured grain. The component values are for the protection of human health, included GW2 for downgradient off-site residents.

[3] Groundwater components for shallow groundwater non-potable site condition, industrial/commercial/community (I/C/C) land use, coarse textured grain. The component values are for the protection of human health, including GW2 for subsurface worker, which is for screening of inhalation of trench air exposure for subsurface workers.

[4] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL,

TABLE 14: **Groundwater Secondary Screening Results - Depth > 3m bgs for Commercial Indoor Air Inhalation GW-IA**
Central Park, Hamilton, ON

Parameter	Units	Exceeded Generic SCS	Maximum X 1.2	Human Health Component Values	Pathways for Quantative Assessment
				Ind GW2[2]	
				I/C/C NPG	Off-Site Commercial Indoor Air Inhalation (Exceeded GW2 I/C/C NPG)
Dissolved Metals					
Zinc	µg/L	Yes	2904	insufficiently volatile	No
Volatiles					
Benzene	µg/L	Yes	20520	830	Yes
Petroleum Hydrocarbon (PHC) Fractions					
PHC F1	µg/L	Yes	804	28,000	No
PHC F2	µg/L	Yes	40680	47,000	No
PHC F3	µg/L	Yes	2760	insufficiently volatile	No
PAHs					
Acenaphthene	µg/L	Yes	775.2	13,000	No
Acenaphthylene	µg/L	Yes	73.44	750	No
Anthracene	µg/L	Yes	23.52	na	No
Benzo(g,h,i)perylene	µg/L	Yes	0.324	na	No
Indeno(1,2,3-cd)pyrene	µg/L	Yes	0.2544	42,000	No
Naphthalene	µg/L	Yes	27480	30,000	No

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
na - Not applicable or not available
µg/L – micrograms per litre
Yes - COCs exceeded component values and were carried forward for further evaluation.
No - COCs didn't exceed component values and were not carried forward for further evaluation.

[1] Groundwater components for non-potable site condition, residential/parkland/institution (R/P/I) land use, coarse textured grain. The component values are for the protection of human health, included GW2 for downgradient off-site residents.

[2] Groundwater components for non-potable site condition, industrial/commercial/community (I/C/C) land use, coarse textured grain. The component values are for the protection of human health, including GW2 for subsurface worker, which is for screening of inhalation of trench air exposure for subsurface workers.

[3] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

TABLE 15: **Secondary Screening of COCs Results - Surface Soil (Ecological)**
Central Park, Hamilton, ON

Parameter	RDL	Units	Table 3 Generic SCS R/P/I GC [1]	Exceeded Generic SCS	1.2xMaximum	On. Soil Bkgrd	Ecological Health Component Values				Quantitative Assessment Receptors/Pathways Selections	
							Plants& Soil Org. R/P/I_CG_NPG [2]	MEP (1.9x)	Mammals & Birds R/P/I_CG_NPG [2]	MEP (1000x)	Plants and Soil Organisms Direct Contact	Mammals and Birds Direct Contact
								1.9		1000		
General Chemistry												
Cyanide (WAD)	0.050	µg/g	0.051	Yes	2.8	0.051	0.9	1.71	0.11	110	Yes	No
Electrical Conductivity	0.0040	mS/cm	0.7	Yes	3456.0	0.57	0.7	1.33	na	na	Yes	No
Sodium Adsorption Ratio	-	None	5 [5]	Yes	130.8	2.4	5	9.5	na	na	Yes	No
Total Metals												
Antimony	0.8	µg/g	7.5	Yes	63.1	1.3	20	38	25	25000	Yes	No
Arsenic	0.20	µg/g	18	Yes	51.6	18	20	38	51	51000	Yes	No
Barium	1.0	µg/g	390	Yes	1092	220	750	1425	390	390000	No	No
Boron (Hot Water Soluble)	0.10	µg/g	1.5	Yes	4.4	0.5	1.5	2.85	na	na	Yes	No
Cadmium	0.50	µg/g	1.2	Yes	55.0	1.2	12	22.8	1.9	1900	Yes	No
Copper	1.0	µg/g	140	Yes	8880	92	140	266	770	770000	Yes	No
Lead	1.0	µg/g	120	Yes	4920	120	250	475	32	32000	Yes	No
Mercury	0.0050	µg/g	0.27	Yes	6.9	0.27	10	19	20	20000	No	No
Nickel	1.0	µg/g	100	Yes	130.8	82	100	190	5000	5000000	No	No
Selenium	0.4	µg/g	2.4	Yes	3.2	1.5	10	19	2.4	2400	No	No
Zinc	5.0	µg/g	340	Yes	49920	290	400	760	340	340000	Yes	No
Volatiles												
Benzene	0.0068	µg/g	0.21	Yes	169.2	0.02	25	47.5	370	370000	Yes	No
Toluene	0.05	µg/g	2.3	Yes	246	0.2	150	285	140	140000	No	No
Ethylbenzene	0.018	µg/g	2	Yes	25.2	0.05	55	104.5	90	90000	No	No
Xylenes	0.050	µg/g	3.1	Yes	403.2	0.05	95	180.5	96	96000	Yes	No
Hexane (n)	0.050	µg/g	2.8	Yes	6.7	0.05	na	na	75[a]	75000	No	No
Petroleum Hydrocarbon (PHC) Fractions												
PHC F1	5.0	µg/g	55	Yes	1104	25	210	399	na	na	Yes	No
PHC F2	10	µg/g	98	Yes	6588	10	150	285	na	na	Yes	No
PHC F3	50	µg/g	300	Yes	13560	240	300	570	na	na	Yes	No
PHC F4 (silica gel)	250	µg/g	2,800	Yes	6204	120	2800	5320	na	na	Yes	No
Volatile Organic Compounds												
Styrene	0.050	µg/g	0.7	Yes	162	0.05	17	32.3	370[b]	370000	Yes	No
PAHs												
Acenaphthene	0.050	µg/g	7.9	Yes	39.6	0.072	ncv	na	6600	6600000	No	No
Acenaphthylene	0.050	µg/g	0.15	Yes	12	0.093	ncv	na	ncv	na	No	No
Anthracene	0.050	µg/g	0.67	Yes	120	0.16	2.5	4.75	38000	38000000	Yes	No
Benzo(a)anthracene	0.050	µg/g	0.5	Yes	104.4	0.36	0.5	0.95	6.2[a]	6200	Yes	No
Benzo(a)pyrene	0.050	µg/g	0.3	Yes	76.8	0.3	20	38	1600	1600000	Yes	No
Benzo(b)fluoranthene	0.050	µg/g	0.78	Yes	90	0.47	7.6	14.44	6.2[a]	6200	Yes	No
Benzo(g,h,i)perylene	0.050	µg/g	6.6	Yes	30	0.68	6.6	12.54	ncv	na	Yes	No
Benzo(k)fluoranthene	0.050	µg/g	0.78	Yes	43.2	0.48	7.6	14.44	6.2[a]	6200	Yes	No
Chrysene	0.050	µg/g	7	Yes	90	2.8	7	13.3	6.2[a]	6200	Yes	No
Dibenzo(a,h)anthracene	0.050	µg/g	0.1	Yes	13.2	0.1	ncv	na	ncv	na	No	No
Fluoranthene	0.050	µg/g	0.69	Yes	324	0.56	50	95	0.69	690	Yes	No
Fluorene	0.050	µg/g	62	Yes	76.8	0.12	ncv	na	15.4[a]	15400	No	No
Indeno(1,2,3-cd)pyrene	0.050	µg/g	0.38	Yes	34.8	0.23	0.38	0.722	ncv	na	Yes	No
Methylnaphthalene, 1- & 2-	0.042	µg/g	0.99 [6]	Yes	74.4	0.59	ncv	na	ncv	na	No	No
Naphthalene	0.013	µg/g	0.6	Yes	65.0	0.09	0.6	1.14	380	380000	Yes	No
Phenanthrene	0.046	µg/g	6.2	Yes	372	0.69	6.2	11.78	2700	2700000	Yes	No
Pyrene	0.050	µg/g	78	Yes	264	1	ncv	na	4700	4700000	No	No
LMW PAH [7]	na	µg/g	na	na	690	na	29 [c]	55.1	100[e]	100000	Yes	No
HMW PAH [8]	na	µg/g	na	na	1057.2	na	18[d]	34.2	1.1[f]	1100	Yes	No
PCBs												
Total PCBs	0.1	µg/g	0.35	Yes	1.92	0.3	33	62.7	1.1	1100	No	No

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
na - Not applicable or not available
ncv - No component value available from MOE (2011)
µg/g - micrograms per gram, dry weight basis
mS/cm - milliSiemens per centimetre
Yes - COCs exceeded component values and were carried forward for further evaluation.
No - COCs didn't exceed component values and were not carried forward for further evaluation.

[1] Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] Soil component for Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011). Soil component values were selected for the protection of ecological health based on residential parkland land use, plant & soil organisms, mammals & birds, soil leaching to groundwater and migrating to surface water (S-GW3).

[3] Site-specific GW3 for COCs were derived using Modified Generic Risk Assessment "Approved Model" November 2016, site specific distance to downgradient surface water body is 600m, hydraulic gradient is 0.03 m/m, FOC between 0.8 to 1.5 m bgs is between 0.0035~0.02, 0.0035 is used. The default values for all other subsurface properties for Table 3 - full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils were used.

[4] acceptable pH range for applying generic standards (O. Reg. 153/04, as amended): 5 to 9 for surface soil (0-1.5 mbg); 5 to 11 for subsurface soil (>1.5 mbg)

[5] SAR is inclaculable when Calcium and Magnesium are below the detection limit. In this occurance, the lowest possible SAR is reported as a minimum value (>). SAR is incalculable when Na is undetecable. Dectection limit represents maximum possible SAR value (<).

[6] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard. Individual isomer is not carried forward for evaluation as the methylnaphthalene, 1-,2- is retained for further evaluation.

[7] Low Molecular Weight (LMW) PAH consisting of: Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Methylnaphthalenes, Naphthalene and Phenanthrene.

[8] High Molecular Weight (HMW) PAH consisting of: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene and Pyrene.

[a] CCME CanadianSoil Quality Guidelines (CCME, 2010), Soil and food ingestion pathway criteria protective of mammals and birds.
[b] Styrene is a derivative of benzene structurally. Therefore, mammals and birds component value for benzene was used for styrene.
[c] 29µg/g is the US EPA Eco-SSL protective of soil invertebrates for LMW-PAHs (acenaphthene, acenaphthylene, fluorene, and 1,2-methylnaphthalene) that do not have Plants & Soil Org. component values from MOE, 2011.
[d] 18µg/g is the US EPA Eco-SSL protective of soil invertebrates for HMW-PAHs (dibenzo(a,h)anthracene and pyrene) that do not have Plants & Soil Org. component values from MOE, 2011.
[e] 100µg/g is the US EPA Eco-SSL protective of mammals for LMW-PAHs (acenaphthylene and 1,2-methylnaphthalene) that do not have Mammals&Birds component values from MOE, 2011.
[f] 1.1µg/g is the US EPA Eco-SSL protective of mammals for HMW-PAHs (benzo(g,h,i)perylene, dibenzo(a,h)anthracene and indeno[1,2,3-cd]pyrene) that do not have Mammals&Birds component values from MOE, 2011.

TABLE 16: **Groundwater Secondary Screening Results - Shallow GW Scenario (Ecological)**
Central Park, Hamilton, ON

Parameter	Units	Secondary Screening Selection	Maximum X 1.2	Ecological Component Values		Pathway for Quantitative Assessment
				GW3[1] Shallow GW	Site-Specific GW3[2]	Aquatic Life GW3
Dissolved Metals						
Mercury	µg/L	Yes	1.20E+01	7.70E+00	8.50E+03	No
Volatiles						
Benzene	µg/L	Yes	2.05E+04	4.60E+03	7.50E+04	No
Toluene	µg/L	Yes	5.16E+03	1.40E+04	2.30E+05	No
Ethylbenzene	µg/L	Yes	6.05E+02	1.80E+03	3.00E+04	No
Xylenes	µg/L	Yes	2.35E+03	3.30E+03	5.40E+04	No
Petroleum Hydrocarbon (PHC) Fractions						
PHC F1	µg/L	Yes	4.32E+03	4.20E+02	6.90E+03	No
PHC F2	µg/L	Yes	4.07E+04	1.70E+02	6.90E+03	Yes
PHC F3	µg/L	Yes	2.76E+03	na	na	No
PHC F4	µg/L	Yes	1.20E+03	na	na	No
Volatile Organic Compounds [3]						
Styrene	µg/L	Yes	2.16E+02	7.20E+03	1.20E+05	No
Trichloroethylene	µg/L	Yes	2.11E+01	2.20E+05	3.60E+06	No
Vinyl Chloride	µg/L	Yes	2.60E+00	3.60E+05	5.80E+06	No
PAHs						
Acenaphthene	µg/L	Yes	7.75E+02	5.20E+03	8.50E+04	No
Acenaphthylene	µg/L	Yes	7.34E+01	1.40E+00	2.30E+01	Yes
Anthracene	µg/L	Yes	2.35E+01	1.00E+00	1.60E+01	Yes
Benzo(a)pyrene	µg/L	Yes	9.12E-01	2.10E+00	7.80E+03	No
Benzo(b)fluoranthene	µg/L	Yes	1.68E+00	4.20E+00	1.80E+04	No
Benzo(g,h,i)perylene	µg/L	Yes	3.96E-01	2.00E-01	8.30E+10	No
Benzo(k)fluoranthene	µg/L	Yes	6.36E-01	1.40E+00	5.20E+03	No
Chrysene	µg/L	Yes	1.15E+00	7.00E-01	2.00E+01	No
Fluorene	µg/L	Yes	3.01E+02	2.90E+02	4.70E+03	No
Indeno(1,2,3-cd)pyrene	µg/L	Yes	5.64E-01	1.40E+00	5.80E+11	No
Naphthalene	µg/L	Yes	2.75E+04	6.20E+03	1.00E+05	No
Pyrene	µg/L	Yes	9.24E+00	5.70E+00	9.30E+01	No

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

Laboratory analysis by ALS, Mississauga, ON

na - Not applicable or not available

µg/L – micrograms per litre

Yes - COCs exceeded component values and were carried forward for further evaluation.

No - COCs didn't exceed component values and were not carried forward for further evaluation.

[1] Groundwater components for shallow groundwater non-potable site condition, residential/parkland/institution (R/P/I) land use, coarse textured grain. The component values are for the protection of ecological health, included GW3 for downgradient off-site aquatic life.

[2] Site-specific GW3 for COCs were derived using Modified Generic Risk Assessment "Approved Model" November 2016, under non-potable water scenario, site specific distance to downgradient surface water body is 600m, hydraulic gradient is 0.03 m/m, FOC between 0.8 to 1.5 m bgs is between 0.0035~0.02, 0.0035 is used. The default values for all other subsurface properties for Table 3 - full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils were used.

[3] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

TABLE 17: **Groundwater Secondary Screening Results - GW Depth > 3 m bgs (Ecological)**
Central Park, Hamilton, ON

Parameter	Units	Secondary Screening Selection	Maximum X 1.2	Ecological Component Values		Pathway for Quantative Assessment Aquatic Life GW3
				GW3[1] Full Depth R/P/I CG	Site-Specific GW3 [2] R/P/I CG	
Dissolved Metals						
Zinc	µg/L	Yes	2904	1.10E+03	1.50E+04	No
Volatiles						
Benzene	µg/L	Yes	448.8	5.80E+03	7.50E+04	No
Petroleum Hydrocarbon (PHC) Fractions						
PHC F1	µg/L	Yes	804	7.50E+02	6.90E+03	No
PHC F2	µg/L	Yes	24480	9.70E+02	6.90E+03	Yes
PHC F3	µg/L	Yes	2040	na	na	No
Volatile Organic Compounds [3]						
Trichloroethylene	µg/L	Yes	14.4	2.80E+05	3.60E+06	No
Vinyl Chloride	µg/L	Yes	1.9	4.50E+05	5.80E+06	No
PAHs						
Acenaphthene	µg/L	Yes	775.2	6.60E+03	8.50E+04	No
Acenaphthylene	µg/L	Yes	3.4	1.80E+00	2.30E+01	No
Anthracene	µg/L	Yes	6.7	2.40E+00	1.60E+01	No
Benzo(a)pyrene	µg/L	Yes	0.912	3.40E+12	7.80E+03	No
Benzo(b)fluoranthene	µg/L	Yes	1.7	6.90E+12	1.80E+04	No
Benzo(g,h,i)perylene	µg/L	Yes	0.4	3.30E+11	8.30E+10	No
Benzo(k)fluoranthene	µg/L	Yes	0.6	2.30E+12	5.20E+03	No
Chrysene	µg/L	Yes	1.2	1.10E+11	2.00E+01	No
Indeno(1,2,3-cd)pyrene	µg/L	Yes	0.6	2.30E+12	5.80E+11	No
Naphthalene	µg/L	Yes	12480	7.80E+03	1.00E+05	No

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
na - Not applicable or not available
µg/L – micrograms per litre
Yes - COCs exceeded component values and were carried forward for further evaluation.
No - COCs didn't exceed component values and were not carried forward for further evaluation.

[1] Groundwater components for non-potable site condition, residential/parkland/institution (R/P/I) land use, coarse textured grain. The component values are for the protection of ecological health, included GW3 for downgradient off-site aquatic life.

[2] Site-specific GW3 for COCs were derived using Modified Generic Risk Assessment "Approved Model" November 2016, under non-potable water scenioar, site specific distance to downgradient surface water body is 600m, hydraulic gradient is 0.03 m/m, FOC between 0.8 to 1.5 m bgs is between 0.0035~0.02, 0.0035 is used. The default values for all subsurface properties for non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured subsurface soils were used

[3] For vinyl chloride, the EPC was estimated by accounting for potentialdegradation of its parent compounds, as per MOECC (2011) guidance. The EPC for vinyl chloride was determined to be equal to max(VC)+ (max[PCE] + max[TCE] + max[1,1-DCE] + max[cis-1,2-DCE] + max [trans-1,2-DCE]) x 10%, if any of the product or VC < RDL, 1/2RDL was used.

Appendix A

Human Health Risk Assessment Calculations

Table A-1: Average Daily Doses for Direct Contact with Surface Soil (Park Visitors All Ages) (S1)

COC	Exposure Point Concentration (mg/kg)	RAF_{derm} (Unitless)	RAF_{oral} (Unitless)	Soil Dermal Contact (mg/kg-d) S1ADDCR Non-Carcinogenic	Soil Dermal Contact (mg/kg-d) S1LADDCR Carcinogenic	Incidental Soil Ingestion (mg/kg-d) S1ADSIR Non-Carcinogenic	Incidental Soil Ingestion (mg/kg-d) S1LADSIR Carcinogenic
BTEX							
Benzene	1.69E+02	3.00E-02	1.00E+00	9.27E-05	2.86E-05	1.77E-03	2.18E-04
PHCs							
PHC F2	6.59E+03						
Aliphatic C>10-C12	2.37E+03	2.00E-01	1.00E+00	8.66E-03	2.68E-03	2.48E-02	3.05E-03
Aliphatic C>12-C16	2.90E+03	2.00E-01	1.00E+00	1.06E-02	3.27E-03	3.03E-02	3.73E-03
Aromatic C>10-C12	5.93E+02	2.00E-01	1.00E+00	2.16E-03	6.69E-04	6.20E-03	7.63E-04
Aromatic C>12-C16	7.25E+02	2.00E-01	1.00E+00	2.65E-03	8.18E-04	7.58E-03	9.32E-04
PHC F3	1.36E+04						
Aliphatic C>16-C21	7.59E+03	2.00E-01	1.00E+00	2.77E-02	8.57E-03	7.94E-02	9.77E-03
Aliphatic C>21-C34	3.25E+03	2.00E-01	1.00E+00	1.19E-02	3.67E-03	3.40E-02	4.19E-03
Aromatic C>16-C21	1.90E+03	2.00E-01	1.00E+00	6.93E-03	2.14E-03	1.99E-02	2.44E-03
Aromatic C>21-C34	8.14E+02	2.00E-01	1.00E+00	2.97E-03	9.18E-04	8.51E-03	1.05E-03
PHC F4	6.20E+03						
Aliphatic C>34	4.96E+03	2.00E-01	1.00E+00	1.81E-02	5.60E-03	5.19E-02	6.39E-03
Aromatic C>34	1.24E+03	2.00E-01	1.00E+00	4.53E-03	1.40E-03	1.30E-02	1.60E-03
PAHs							
Acenaphthylene	1.20E+01	1.30E-01	1.00E+00	2.85E-05	8.80E-06	1.26E-04	1.54E-05
Benz[a]anthracene	1.04E+02	1.30E-01	1.00E+00	2.48E-04	7.66E-05	1.09E-03	1.34E-04
Benzo[a]pyrene	7.68E+01	1.30E-01	1.00E+00	1.82E-04	5.63E-05	8.03E-04	9.88E-05
Benzo[b]fluoranthene	9.00E+01	1.30E-01	1.00E+00	2.14E-04	6.60E-05	9.41E-04	1.16E-04
Benzo[ghi]perylene	3.00E+01	1.30E-01	1.00E+00	7.12E-05	2.20E-05	3.14E-04	3.86E-05
Benzo[k]fluoranthene	4.32E+01	1.30E-01	1.00E+00	1.03E-04	3.17E-05	4.52E-04	5.56E-05
Chrysene	9.00E+01	1.30E-01	1.00E+00	2.14E-04	6.60E-05	9.41E-04	1.16E-04
Dibenz[a h]anthracene	1.32E+01	1.30E-01	1.00E+00	3.13E-05	9.68E-06	1.38E-04	1.70E-05
Fluoranthene	3.24E+02	1.30E-01	1.00E+00	7.69E-04	2.38E-04	3.39E-03	4.17E-04
Indeno[1 2 3-cd]pyrene	3.48E+01	1.30E-01	1.00E+00	8.26E-05	2.55E-05	3.64E-04	4.48E-05
Methlynaphthalene, 2-(1-)	7.44E+01	1.30E-01	1.00E+00	1.77E-04	5.46E-05	7.78E-04	9.57E-05
Pyrene	2.64E+02	1.30E-01	1.00E+00	6.26E-04	1.94E-04	2.76E-03	3.40E-04
Metals & Inorganics							
Antimony	6.31E+01	1.00E-01	1.00E+00	1.15E-04	3.56E-05	6.60E-04	8.12E-05
Arsenic	5.16E+01	3.00E-02	5.00E-01	2.83E-05	8.74E-06	2.70E-04	3.32E-05
Cadmium	5.50E+01	1.00E-02	1.00E+00	1.00E-05	3.10E-06	5.75E-04	7.07E-05
Copper	8.88E+03	6.00E-02	1.00E+00	9.73E-03	3.01E-03	9.29E-02	1.14E-02
Lead	4.92E+03	1.00E+00	1.00E+00	8.98E-02	2.78E-02	5.15E-02	6.33E-03
Zinc	4.99E+04	1.00E-01	1.00E+00	9.11E-02	2.82E-02	5.22E-01	6.42E-02
PCBs							
Polychlorinated Biphenyls	1.92E+00	1.40E-01	1.00E+00	4.91E-06	1.52E-06	2.01E-05	2.47E-06

Formula:

Average Daily Soil Ingestion Rate for S1(non-carcinogenic exposure) - Toddler

$S1ADSIR = (C_s \times SIR \times EF_b \times EF_c \times ED \times RAF_{oral}) / (BW \times AP_{NC}) \times 365$ days/yr

Lifetime Average Daily Soil Ingestion Rate for S1 (carcinogenic exposure) - Composite Residents

$S1LADSIR = (((SIR_1 \times ED_1)/BW_1 + (SIR_2 \times ED_2)/BW_2 + (SIR_3 \times ED_3)/BW_3 + (SIR_4 \times ED_4)/BW_4 + (SIR_5 \times ED_5)/BW_5) \times (C_s \times EF_b \times EF_c \times RAF_{oral}))/(AP_C) \times 365$ days/yr

Average Daily Soil Dermal Contact Rate for S1 (non-carcinogenic exposure)

$S1ADDCR = (C_s \times SSA \times SA \times EF_b \times EF_c \times ED \times RAF_{derm}) / (BW \times AP_{NC}) \times 365$ days/yr

Lifetime Average Daily Soil Dermal Contact Rate for S1 (carcinogenic exposure)

$S1LADDCR = ((SSA_1 \times SA_1 \times ED_1)/BW_1 + (SSA_2 \times SA_2 \times ED_2)/BW_2 + (SSA_3 \times SA_3 \times ED_3)/BW_3 + (SSA_4 \times SA_4 \times ED_4)/BW_4 + (SSA_5 \times SA_5 \times ED_5)/BW_5) \times (C_s \times EF_b \times EF_c \times RAF_{derm}))/(AP_C) \times 365$ days/yr

Note: subscripted numbers refer to lifestages, as defined in the table below.

Parameter	Description	Unit	Value	Formula	Reference
					MOE (2011b)
S1(L)ADSIR	(Lifetime) Average Daily Soil Ingestion Rate for S1	mg/kg-d	Calculated	See above	MOE (2011b)
S1(L)ADDCR	(Lifetime) Average Daily Soil Dermal Contact Rate for S1	mg/kg-d	Calculated	See above	
C_S	Soil concentration	mg/kg = µg/g	Site Specific		
RAF_{derm}	Dermal relative absorption factor	unitless	Chemical specific		MOE (2011b)
RAF_{oral}	Ingestion relative absorption factor	unitless	Chemical specific		MOE (2011b)
AP_{NC}	Averaging period	years	4.5		MOE (2011b)
AP_C	Averaging period	years	76		MOE (2011b)
EF_b	Exposure frequency	days/week	7		MOE (2011b)
EF_c	Exposure frequency	weeks/year	45		MOE (2011b)

Life Stage	Infant	Toddler	Child	Teen	Adult	Adult female
SSA = Average Skin Surface Area (m^2) =	1.11E-01	1.75E-01	2.82E-01	3.86E-01	4.34E-01	
SA = Soil Adherence Factor (loading rate on exposed skin) (kg/m^2-day) =	7.00E-04	2.00E-03	2.00E-03	7.00E-04	7.00E-04	
SIR = soil ingestion rate (kg/day) =	3.00E-05	2.00E-04	5.00E-05	5.00E-05	5.00E-05	
ED = exposure duration (years) =	0.5	4.5	7	8	56	
BW = body weight (kg) =	8.2	16.5	32.9	59.7	70.7	63.1
Lifestage (subscripts in equations)	1	2	3	4	5	5

Table A-2: Average Daily Doses for the Direct Contact with Surface Soil (Long-Term Surface Outdoor Worker) Exposure Pathway (S2)

COC	COC Considered Developmental Toxicant (Oral)?	Exposure Point Concentration (mg/kg) or (µg/g)	RAF_{derm} (Unitless) (unitless)	RAF_{oral} (Unitless) (unitless)	Soil Dermal Contact S2ADSIR Non-Carcinogenic (mg/kg-d)	Soil Dermal Contact S2LADSIR Carcinogenic (mg/kg-d)	Soil Dermal Contact $S2ADSIR_D$ Developmental (mg/kg-d)	Incidental Soil Ingestion S2ADDCR Non-Carcinogenic (mg/kg-d)	Incidental Soil Ingestion S2LADDCR Carcinogenic (mg/kg-d)	Incidental Soil Ingestion $S2ADDCR_D$ Developmental (mg/kg-d)
BTEX										
Benzene	No	1.69E+02	3.00E-02	1.00E+00	4.21E-05	4.21E-05	NC	2.07E-04	2.07E-04	NC
PAHs										
Acenaphthylene	No	1.20E+01	1.30E-01	1.00E+00	1.29E-05	1.29E-05	NC	1.46E-05	1.46E-05	NC
Benz[a]anthracene	No	1.04E+02	1.30E-01	1.00E+00	1.13E-04	1.13E-04	NC	1.27E-04	1.27E-04	NC
Benzo[a]pyrene	No	7.68E+01	1.30E-01	1.00E+00	8.29E-05	8.29E-05	NC	9.37E-05	9.37E-05	NC
Benzo[b]fluoranthene	No	9.00E+01	1.30E-01	1.00E+00	9.71E-05	9.71E-05	NC	1.10E-04	1.10E-04	NC
Benzo[ghi]perylene	No	3.00E+01	1.30E-01	1.00E+00	3.24E-05	3.24E-05	NC	3.66E-05	3.66E-05	NC
Benzo[k]fluoranthene	No	4.32E+01	1.30E-01	1.00E+00	4.66E-05	4.66E-05	NC	5.27E-05	5.27E-05	NC
Chrysene	No	9.00E+01	1.30E-01	1.00E+00	9.71E-05	9.71E-05	NC	1.10E-04	1.10E-04	NC
Dibenz[a h]anthracene	No	1.32E+01	1.30E-01	1.00E+00	1.42E-05	1.42E-05	NC	1.61E-05	1.61E-05	NC
Fluoranthene	No	3.24E+02	1.30E-01	1.00E+00	3.50E-04	3.50E-04	NC	3.95E-04	3.95E-04	NC
Indeno[1 2 3-cd]pyrene	No	3.48E+01	1.30E-01	1.00E+00	3.76E-05	3.76E-05	NC	4.25E-05	4.25E-05	NC
Pyrene	No	2.64E+02	1.30E-01	1.00E+00	2.85E-04	2.85E-04	NC	3.22E-04	3.22E-04	NC
Metals & Inorganics										
Antimony	No	6.31E+01	1.00E-01	1.00E+00	5.24E-05	5.24E-05	NC	7.70E-05	7.70E-05	NC
Arsenic	No	5.16E+01	3.00E-02	5.00E-01	1.28E-05	1.28E-05	NC	3.15E-05	3.15E-05	NC
Cadmium	No	5.50E+01	1.00E-02	1.00E+00	4.56E-06	4.56E-06	NC	6.71E-05	6.71E-05	NC
Copper	No	8.88E+03	6.00E-02	1.00E+00	4.42E-03	4.42E-03	NC	1.08E-02	1.08E-02	NC
Lead	Yes	4.92E+03	1.00E+00	1.00E+00	4.08E-02	4.08E-02	4.81E-02	6.01E-03	6.01E-03	7.78E-03
Zinc	No	4.99E+04	1.00E-01	1.00E+00	4.14E-02	4.14E-02	NC	6.09E-02	6.09E-02	NC

Formulas:

Average Daily Soil Ingestion Rate for S2 (non-carcinogenic exposure) - Adult Long-Term Surface Outdoor Worker

$S2ADSIR = (C_s \times SIR \times EF_b \times EF_c \times ED \times RAF_{oral})/(BW \times AP_{NC}) \times 365$ days/yr

Lifetime Average Daily Soil Ingestion Rate for S2 (carcinogenic exposure) - Adult Long-Term Surface Outdoor Worker

$S2LADSIR = (C_s \times SIR \times EF_b \times EF_c \times ED \times RAF_{oral})/(BW \times AP_{C}) \times 365$ days/yr

Average Daily Soil Dermal Contact Rate for S2 (non-carcinogenic exposure)- Adult Long-Term Surface Outdoor Worker

$S2ADDCR = (C_s \times SSA \times SA \times EF_b \times EF_c \times ED \times RAF_{derm}) / (BW \times AP_{NC}) \times 365$ days/yr

Lifetime Average Daily Soil Dermal Contact Rate for S2 (carcinogenic exposure) - Adult Long-Term Surface Outdoor Worker

$S2LADDCR = (C_s \times SSA \times SA \times EF_b \times EF_c \times ED \times RAF_{derm}) / (BW \times AP_{C}) \times 365$ days/yr

Parameter	Description	Unit	Value	Formula	Reference
S2(L)ADSIR	(Lifetime) Average Daily Soil Ingestion Rate for S2	(mg/kg-d)	Calculated	See above	MOE (2011b)
S2(L)ADDCR	(Lifetime) Average Daily Soil Dermal Contact Rate for S2	(mg/kg-d)	Calculated	See above	MOE (2011b)
C_S	Soil concentration	mg/kg = µg/g	Site Specific		
RAF_{derm}	Dermal relative absorption factor	Unitless	Chemical specific		MOE (2011b)
RAF_{oral}	Ingestion relative absorption factor	Unitless	Chemical specific		MOE (2011b)
$AP_{C\ or\ NC}$	Averaging period	years	56		MOE (2011b) - 20440 days (adult worker - carcinogen and non-carcinogen)
EFa	Exposure frequency	hours/day	9.8		MOE (2011b)
EFa	Exposure frequency	hours/day	24		MOE (2011b) - applicable to developmental toxicants
EFb	Exposure frequency	days/week	7		MOE (2011b)
EFb	Exposure frequency	days/week	7		MOE (2011b) - applicable to developmental toxicants
EFc	Exposure frequency	weeks/year	45		MOE (2011b)
EFc	Exposure frequency	weeks/year	52		MOE (2011b) - applicable to developmental toxicants
BW	Body weight	kg	70.7		MOE (2011b)
BW_{female}	Body weight	kg	63.1		MOE (2011b) - applicable to developmental toxicants
ED	Exposure duration	years	56		MOE (2011b)
SIRs	Soil ingestion rate	kg/day	1.00E-04		MOE (2011b)
SSA	Average Skin Surface Area	m^2	0.34		MOE (2011b)
SSA	Average Skin Surface Area	m^2	0.309		MOE (2011b) - applicable to developmental toxicants
SA	Soil Adherence Factor (loading rate on exposed skin)	kg/m^2-day	2.00E-03		MOE (2011b)
NC	Not Calculated				

Table A-3: **Average Daily Doses for the Direct Contact with Surface Soil (Subsurface Worker) Exposure Pathway (S3)**

COC	Exposure Point Concentration (mg/kg)-Surface Soil	RAF_{derm} (Unitless)	RAF_{oral} (Unitless)	RAF_{i} (Unitless)	COC Considered Developmental Toxicant (Oral)?	Soil Dermal Contact (mg/kg-d)			Incidental Soil Ingestion (mg/kg-d)			COC Considered Developmental Toxicant (Inhalation)?	Soil Particulate Inhalation (mg/m^3)		
						S3ADDCR	S3LADDCR	$S3ADDCR_D$	S3ADSIR	S3LADSIR	$S3ADSIR_D$		S3ADSIE	S3LADSIE	$S3ADSIE_D$
						Non-Carcinogenic	Carcinogenic	Developmental	Non-Carcinogenic	Carcinogenic	Developmental		Non-Carcinogenic	Carcinogenic	Developmental
PAHs															
Benz[a]anthracene	1.04E+02	1.30E-01	1.00E+00	1.00E+00	No	8.05E-05	2.16E-06	NC	9.10E-05	2.44E-06	NC	No	2.81E-06	7.53E-08	NC
Benzo[a]pyrene	7.68E+01	1.30E-01	1.00E+00	1.00E+00	No	5.92E-05	1.59E-06	NC	6.70E-05	1.79E-06	NC	No	2.07E-06	5.54E-08	NC
Benzo[b]fluoranthene	9.00E+01	1.30E-01	1.00E+00	1.00E+00	No	6.94E-05	1.86E-06	NC	7.85E-05	2.10E-06	NC	No	2.42E-06	6.49E-08	NC
Benzo[k]fluoranthene	4.32E+01	1.30E-01	1.00E+00	1.00E+00	No	3.33E-05	8.92E-07	NC	3.77E-05	1.01E-06	NC	No	1.16E-06	3.11E-08	NC
Dibenz[a h]anthracene	1.32E+01	1.30E-01	1.00E+00	1.00E+00	No	1.02E-05	2.73E-07	NC	1.15E-05	3.08E-07	NC	No	3.55E-07	9.52E-09	NC
Metals & Inorganics															
Antimony	6.31E+01	1.00E-01	1.00E+00	1.00E+00	No	3.74E-05	1.00E-06	NC	5.50E-05	1.47E-06	NC	No	1.70E-06	4.55E-08	NC
Arsenic	5.16E+01	3.00E-02	5.00E-01	1.00E+00	No	9.18E-06	2.46E-07	NC	2.25E-05	6.03E-07	NC	Yes	1.39E-06	3.72E-08	1.65E-07
Cadmium	5.50E+01	1.00E-02	1.00E+00	1.00E+00	No	3.26E-06	8.73E-08	NC	4.79E-05	1.28E-06	NC	No	1.48E-06	3.96E-08	NC
Copper	8.88E+03	6.00E-02	1.00E+00	1.00E+00	No	3.16E-03	8.46E-05	NC	7.74E-03	2.07E-04	NC	No	2.39E-04	6.40E-06	NC
Lead	4.92E+03	1.00E+00	1.00E+00	1.00E+00	Yes	2.92E-02	7.81E-04	4.81E-02	4.29E-03	1.15E-04	2.08E-04	No	1.32E-04	3.55E-06	NC
Zinc	4.99E+04	1.00E-01	1.00E+00	1.00E+00	No	2.96E-02	7.93E-04	NC	4.35E-02	1.17E-03	NC	No	1.34E-03	3.60E-05	NC

Formula:

Average Daily Soil Ingestion Rate for S3 (non-carcinogenic and carcinogeic exposure) - Adult Subsurface Worker

S3ADSIR or S3LADSIR = $(C_s \times SIR \times EF_b \times EF_c \times ED \times RAF_{oral})/(BW \times AP_{NC}$ or $AP_C) \times 365$ days/yr

Average Daily Dermal Contact Rate for S3 (non-carcinogenic and carcinogenic exposure) - Adult Subsurface Worker

S3ADDCR or S3LADDCR= $(C_s \times SSA \times SA \times EF_b \times EF_c \times ED \times RAF_{derm}) / (BW \times AP_{NC}$ or $AP_C) \times 365$ days/yr

Average Daily Soil Inhalation Exposure for S3 (non-carcinogenic and carcinogenic exposure) - Subsurface Worker

S3ADSIE or S3LADSIE = $(C_s \times [PM_{10}] \times FPM_{inh} \times IR_w \times EF_a \times EF_b \times EF_c \times ED \times BW_{assumed} \times RAF_i)/(BW_w \times AP_{NC}$ or $AP_C \times IR_{assumed}) \times 365$ days/yr

Parameter	Description	Unit	Value	Formula	Reference
S3ADSIR or S3LADSIR	(Lifetime) Average Daily Soil Ingestion Rate (Dose)	(mg/kg-d)	Calculated	See above	MOE (2011b)
S3ADDCR OR S3LADDCR	(Lifetime) Average Daily Dermal Contact Rate (Dose)	(mg/kg-d)	Calculated	See above	MOE (2011b)
S3ADSIE or S3LADSIE	(Lifetime) Average Daily Soil Inhalation Exposure (Dose)	mg_{soil}/m^3	Calculated	See above	MOE (2011b)
C_S	Soil concentration	mg/kg = µg/g	Site Specific		
RAF_{derm}	Dermal relative absorption factor	unitless	Chemical specific		MOE (2011b)
RAF_{oral}	Ingestion relative absorption factor	unitless	Chemical specific		MOE (2011b)
RAF_i	Inhalation relative absorption factor	unitless	1		MOE (2011b)
AP_C	Averaging period	years	56		MOE (2011b)- (adult worker - carcinogen)
AP_{NC}	Averaging period	years	1.5		MOE (2011b) - (adult woker - non-carcinogens and female worker - developmental toxicans)
EF_a	Exposure frequency	hours/day	9.8		MOE (2011b)
EF_a	Exposure frequency	hours/day	24		MOE (2011b) - developmental toxicans
EF_b	Exposure frequency	days/week	5		MOE (2011b)
EF_b	Exposure frequency	days/week	7		MOE (2011b) - developmental toxicans
EF_c	Exposure frequency	weeks/year	45		MOECC (2016)
EF_c	Exposure frequency	weeks/year	52		MOE (2011b) - developmental toxicans
ED	Exposure duration	years	1.5		MOE (2011b)
SIR_S	Soil ingestion rate	kg/day	0.0001		MOE (2011b)
SSA	Average Skin Surface Area	m^2	0.34		MOE (2011b)
SSA	Average Skin Surface Area	m^2	0.309		MOE (2011b) - developmental toxicans for female
SA	Soil Adherence Factor (loading rate on exposed skin)	kg/m^2-day	2.00E-03		MOE (2011b)
IR_w	Inhalation rate for worker during the exposure period	m^3/hour	1.5		MOE (2011b)
$IR_{assumed}$	Assumed air inhalation rate in development of TRV	m^3/day	20		MOE (2011b) - only for inhalation
BW_w	Body weight of adult worker	kg	70.7		MOE (2011b)
Bw_{female}	Body weight of female worker	kg	63.1		MOE (2011b) - developmental toxicans
$BW_{assumed}$	Assumed body weight in development of inhalation TRV	kg	70		MOE (2011b) - only for inhalation
PM_{10}	Concentration in air of particles ≤ 10 µm in diameter	kg_{soil}/m^3	1.00E-07		MOE (2011b) - dust concentration
FPM_{inh}	Fraction of $PM_{10\ that}$ is deposited	unitless	0.6		MOE (2011b)
SAF	Source allocation factor	unitless	0.2		MOE (2011b)
NC	Not Calculated				

Table A-4: **Average Daily Doses for the Direct Contact with Subsurface Soil (Subsurface Worker) Exposure Pathway (S3)**

COC	Exposure Point Concentration (mg/kg)- Subsurface Soil	RAF_{derm} (Unitless)	RAF_{oral} (Unitless)	RAF_i (Unitless)	COC Considered Developmental Toxicant (Oral)?	Soil Dermal Contact S3ADDCR Non-Carcinogenic	S3LADDCR Carcinogenic	$S3ADDCR_D$ Developmental	Incidental Soil Ingestion S3ADSIR Non-Carcinogenic	S3LADSIR Carcinogenic	$S3ADSIR_D$ Developmental	COC Considered Developmental Toxicant (Inhalation)?	Soil Particulate Inhalation S3ADSIE Non-Carcinogenic	S3LADSIE Carcinogenic	$S3ADSIE_D$ Developmental
PAHs															
Benz[a]anthracene	2.40E+02	1.30E-01	1.00E+00	1.00E+00	No	1.85E-04	4.95E-06	NC	2.09E-04	5.61E-06	NC	No	6.46E-06	1.73E-07	NC
Benzo[a]pyrene	1.20E+02	1.30E-01	1.00E+00	1.00E+00	No	9.25E-05	2.48E-06	NC	1.05E-04	2.80E-06	NC	No	3.23E-06	8.65E-08	NC
Benzo[b]fluoranthene	1.80E+02	1.30E-01	1.00E+00	1.00E+00	No	1.39E-04	3.72E-06	NC	1.57E-04	4.20E-06	NC	No	4.84E-06	1.30E-07	NC
Benzo[k]fluoranthene	9.48E+01	1.30E-01	1.00E+00	1.00E+00	No	7.31E-05	1.96E-06	NC	8.27E-05	2.21E-06	NC	No	2.55E-06	6.83E-08	NC
Dibenz[a h]anthracene	1.44E+01	1.30E-01	1.00E+00	1.00E+00	No	1.11E-05	2.97E-07	NC	1.26E-05	3.36E-07	NC	No	3.88E-07	1.04E-08	NC
Fluoranthene	7.92E+02	1.30E-01	1.00E+00	1.00E+00	No	6.10E-04	1.64E-05	NC	6.91E-04	1.85E-05	NC	No	2.13E-05	5.71E-07	NC
Indeno[1 2 3-cd]pyrene	6.24E+01	1.30E-01	1.00E+00	1.00E+00	No	4.81E-05	1.29E-06	NC	5.44E-05	1.46E-06	NC	No	1.68E-06	4.50E-08	NC
Methlynaphthalene, 2-(1-)	8.45E+02	1.30E-01	1.00E+00	1.00E+00	No	6.51E-04	1.74E-05	NC	7.37E-04	1.97E-05	NC	No	2.27E-05	6.09E-07	NC
Metals & Inorganics															
Arsenic	1.20E+02	3.00E-02	5.00E-01	1.00E+00	No	2.13E-05	5.72E-07	NC	5.23E-05	1.40E-06	NC	Yes	3.23E-06	8.65E-08	3.84E-07
Lead	2.03E+03	1.00E+00	1.00E+00	1.00E+00	Yes	1.20E-02	3.22E-04	1.98E-02	1.77E-03	4.74E-05	8.59E-05	No	5.46E-05	1.46E-06	NC

Formula:

Average Daily Soil Ingestion Rate for S3 (non-carcinogenic and carcinogeic exposure) - Adult Subsurface Worker

S3ADSIR or S3LADSIR = $(C_s \times SIR \times EF_b \times EF_c \times ED \times RAF_{oral})/(BW \times AP_{NC}$ or $AP_C) \times 365$ days/yr

Average Daily Dermal Contact Rate for S3 (non-carcinogenic and carcinogenic exposure) - Adult Subsurface Worker

S3ADDCR or S3LADDCR= $(C_s \times SSA \times SA \times EF_b \times EF_c \times ED \times RAF_{derm}) / (BW \times AP_{NC}$ or $AP_C) \times 365$ days/yr

Average Daily Soil Inhalation Exposure for S3 (non-carcinogenic and carcinogenic exposure) - Subsurface Worker

S3ADSIE or S3LADSIE = $(C_s \times [PM_{10}] \times FPM_{inh} \times IR_w \times EF_a \times EF_b \times EF_c \times ED \times BW_{assumed} \times RAF_i)/(BW_w \times AP_{NC}$ or $AP_C \times IR_{assumed}) \times 365$ days/yr

Parameter	Description	Unit	Value	Formula	Reference
S3ADSIR or S3LADSIR	(Lifetime) Average Daily Soil Ingestion Rate (Dose)	(mg/kg-d)	Calculated	See above	MOE (2011b)
S3ADDCR OR S3LADDCR	(Lifetime) Average Daily Dermal Contact Rate (Dose)	(mg/kg-d)	Calculated	See above	MOE (2011b)
S3ADSIE or S3LADSIE	(Lifetime) Average Daily Soil Inhalation Exposure (Dose)	mg_{soil}/m^3	Calculated	See above	
C_S	Soil concentration	mg/kg = µg/g	Site Specific		
RAF_{derm}	Dermal relative absorption factor	unitless	Chemical specific		MOE (2011b)
RAF_{oral}	Ingestion relative absorption factor	unitless	Chemical specific		MOE (2011b)
RAF_i	Inhalation relative absorption factor	unitless	1		MOE (2011b)
AP_C	Averaging period	years	56		MOE (2011b)- (adult worker - carcinogen)
AP_{NC}	Averaging period	years	1.5		MOE (2011b) - (adult woker - non-carcinogens and female worker - developmental toxicans)
EF_a	Exposure frequency	hours/day	9.8		MOE (2011b)
EF_a	Exposure frequency	hours/day	24		MOE (2011b) - developmental toxicans
EF_b	Exposure frequency	days/week	5		MOE (2011b)
EF_b	Exposure frequency	days/week	7		MOE (2011b)- developmental toxicans
EF_c	Exposure frequency	weeks/year	45		MOE (2011b)
EF_c	Exposure frequency	weeks/year	52		MOE (2011b)- developmental toxicans
ED	Exposure duration	years	1.5		MOE (2011b)
SIR_S	Soil ingestion rate	kg/day	0.0001		MOE (2011b)
SSA	Average Skin Surface Area	m^2	0.34		MOE (2011b)
SSA	Average Skin Surface Area	m^2	0.309		MOE (2011b) - developmental toxicans for female
SA	Soil Adherence Factor (loading rate on exposed skin)	kg/m^2-day	2.00E-03		MOE (2011b)
IR_w	Inhalation rate for worker during the exposure period	m^3/hour	1.5		MOE (2011b)
$IR_{assumed}$	Assumed air inhalation rate in development of TRV	m^3/day	20		MOECC (2011) - only for inhalation
BW_w	Body weight of adult worker	kg	70.7		MOE (2011b)
Bw_{female}	Body weight of female worker	kg	63.1		MOE (2011b)- developmental toxicans
$BW_{assumed}$	Assumed body weight in development of inhalation TRV	kg	70		MOE (2011b)- only for inhalation
PM_{10}	Concentration in air of particles ≤ 10 µm in diameter	kg_{soil}/m^3	1.00E-07		MOE (2011b)- dust concentration
FPM_{inh}	Fraction of $PM_{10\ that}$ is deposited	unitless	0.6		MOE (2011b)
SAF	Source allocation factor	unitless	0.2		MOE (2011b)
NC	Not Calculated				

Table A-5: **Average Daily Doses for the Inhalation of Particulates (Offsite Residential Receptors) Exposure Pathway**

	COC	Exposure Point Concentration (mg/kg)-Surface Soil	Exposure Point Concentration (mg/kg)-Subsurface Soil	RAF_i (Unitless)	COC Considered Developmental Toxicant (Inhalation)?	Soil Particulate Inhalation-Surface Soil			Soil Particulate Inhalation-SubSoil		
						S3ADSIE	S3LADSIE	$S3ADSIE_D$	S3ADSIE	S3LADSIE	$S3ADSIE_D$
						Non-Carcinogenic (mg/m^3)	Carcinogenic (mg/m^3)	Developmental (mg/m^3)	Non-Carcinogenic (mg/m^3)	Carcinogenic (mg/m^3)	Developmental (mg/m^3)
	BTEX										
	Benzene	169.2	33	1.00E+00	No	6.89E-07	8.61E-09	NC	1.34E-07	1.68E-09	NC
	PHCs										
subfracti	**PHC F2**	6588	1.58E+04								
0.36	*Aliphatic C>10-C12*	2372	5.70E+03	1.00E+00	No	9.65E-06	1.21E-07	NC	2.32E-05	2.90E-07	NC
0.44	*Aliphatic C>12-C16*	2899	6.97E+03	1.00E+00	No	1.18E-05	1.47E-07	NC	2.84E-05	3.55E-07	NC
0.09	*Aromatic C>10-C12*	593	1.43E+03	1.00E+00	No	2.41E-06	3.02E-08	NC	5.80E-06	7.25E-08	NC
0.11	*Aromatic C>12-C16*	725	1.74E+03	1.00E+00	No	2.95E-06	3.69E-08	NC	7.09E-06	8.87E-08	NC
	PHC F3	13560	22800								
0.56	*Aliphatic C>16-C21*	7594	1.28E+04	1.00E+00	No	3.09E-05	3.86E-07	NC	5.20E-05	6.50E-07	NC
0.24	*Aliphatic C>21-C34*	3254	5.47E+03	1.00E+00	No	1.32E-05	1.66E-07	NC	2.23E-05	2.78E-07	NC
0.14	*Aromatic C>16-C21*	1898	3.19E+03	1.00E+00	No	7.73E-06	9.66E-08	NC	1.30E-05	1.62E-07	NC
0.06	*Aromatic C>21-C34*	814	1.37E+03	1.00E+00	No	3.31E-06	4.14E-08	NC	5.57E-06	6.96E-08	NC
	PHC F4	6204	12240								
0.8	*Aliphatic C>34*	4963	9.79E+03	1.00E+00	No	2.02E-05	2.53E-07	NC	3.99E-05	4.98E-07	NC
0.2	*Aromatic C>34*	1241	2.45E+03	1.00E+00	No	5.05E-06	6.31E-08	NC	9.96E-06	1.25E-07	NC
	PAHs										
	Acenaphthene	NV	5.99E+02	1.00E+00	No	NC	NC	NC	2.44E-06	3.05E-08	NC
	Acenaphthylene	12	4.75E+01	1.00E+00	No	4.88E-08	6.11E-10	NC	1.93E-07	2.42E-09	NC
	Benz[a]anthracene	104.4	2.40E+02	1.00E+00	No	4.25E-07	5.31E-09	NC	9.77E-07	1.22E-08	NC
	Benzo[a]pyrene	76.8	1.20E+02	1.00E+00	No	3.13E-07	3.91E-09	NC	4.88E-07	6.11E-09	NC
	Benzo[b]fluoranthene	90	1.80E+02	1.00E+00	No	3.66E-07	4.58E-09	NC	7.33E-07	9.16E-09	NC
	Benzo[ghi]perylene	30	6.48E+01	1.00E+00	No	1.22E-07	1.53E-09	NC	2.64E-07	3.30E-09	NC
	Benzo[k]fluoranthene	43.2	9.48E+01	1.00E+00	No	1.76E-07	2.20E-09	NC	3.86E-07	4.82E-09	NC
	Chrysene	90	2.04E+02	1.00E+00	No	3.66E-07	4.58E-09	NC	8.30E-07	1.04E-08	NC
	Dibenz[a h]anthracene	13.2	1.44E+01	1.00E+00	No	5.37E-08	6.72E-10	NC	5.86E-08	7.33E-10	NC
	Fluoranthene	324	7.92E+02	1.00E+00	No	1.32E-06	1.65E-08	NC	3.22E-06	4.03E-08	NC
	Indeno[1 2 3-cd]pyrene	34.8	6.24E+01	1.00E+00	No	1.42E-07	1.77E-09	NC	2.54E-07	3.18E-09	NC
	Methlynaphthalene, 2-(1-)	74.4	8.45E+02	1.00E+00	No	3.03E-07	3.79E-09	NC	3.44E-06	4.30E-08	NC
	Naphthalene	NV	3.04E+03	1.00E+00	No	NC	NC	NC	1.24E-05	1.54E-07	NC
	Pyrene	264	5.52E+02	1.00E+00	No	1.07E-06	1.34E-08	NC	2.25E-06	2.81E-08	NC
	Metals & Inorganics										
	Antimony	63.12	NV	1.00E+00	No	2.57E-07	3.21E-09	NC	NC	NC	NC
	Arsenic	51.6	1.20E+02	1.00E+00	Yes	2.10E-07	2.63E-09	4.25E-06	4.88E-07	6.11E-09	4.25E-06
	Cadmium	54.96	NV	1.00E+00	No	2.24E-07	2.80E-09	NC	NC	NC	NC
	Copper	8880	NV	1.00E+00	No	3.61E-05	4.52E-07	NC	NC	NC	NC
	Lead	4920	2.03E+03	1.00E+00	No	2.00E-05	2.50E-07	NC	8.25E-06	1.03E-07	NC
	Mercury	NV	4.86E+01	1.00E+00	No	NC	NC	NC	1.98E-07	2.47E-09	NC
	Zinc	49920	NV	1.00E+00	No	2.03E-04	2.54E-06	NC	NC	NC	NC
	PCBs										
	Polychlorinated Biphenyls	1.92	NV	6.00E+00	No	4.69E-08	5.86E-10	NC	NC	NC	NC

Notes:

Average Daily Soil Inhalation Exposure (non-carcinogenic and carcinogenic exposure) - Offsite Residents (Toddler and Adult)

S3ADSIE or S3LADSIE = $(C_s \times [PM_{10}] \times FPM_{inh} \times IR \times EF_a \times EF_b \times EF_c \times ED \times BW_{assumed} \times RAF_i)/((BW \times AP_{NC}$ or $AP_C \times IR_{assumed}) * (365 \times 24) hrs/yr)$

Parameter	Description	Unit	Value	Formula	Reference
S3ADSIE or S3LADSIE	(Lifetime) Average Daily Soil Inhalation Exposure (Dose)	mg_{soil}/m^3	Calculated	See above	MOE (2011b)
C_S	Soil COC concentration	mg/kg = µg/g	Site Specific		
RAF_i	Inhalation relative absorption factor	unitless	1		MOE (2011b)
AP_C	Averaging period	years	56		MOE (2011b)
AP_{NC}	Averaging period	years	1.5		MOE (2011b)
EF_a	Exposure frequency for outdoor exposure for residents (both adult and toddler)	hours/day	1.5		HC, 2012.
EF_a	Exposure frequency	hours/day	24		MOE (2011b) - applicable to developmental toxicants
EF_b	Exposure frequency	days/week	5		MOE (2011b)
EF_b	Exposure frequency	days/week	7		MOE (2011b) - applicable to developmental toxicants
EF_c	Exposure frequency	weeks/year	45		MOE (2011b)
EF_c	Exposure frequency	weeks/year	52		MOE (2011b) - applicable to developmental toxicants
ED	Exposure duration	years	1.5		MOE (2011b)
SIR_S	Soil ingestion rate	mg/day	100		MOE (2011b)
IR_w	Inhalation rate for worker during the exposure period	m^3/hour	1.5		MOE (2011b)
IR	Inhalation rate for resident adult during the exposure period	m^3/day	16.6		HC (2012)
IR	Inhalation rate for resident toddler during the exposure period	m^3/day	8.3		HC (2012)
$IR_{assumed}$	Assumed air inhalation rate in development of TRV	m^3/day	20		MOE (2011b)
BW	Body weight of adult resident	kg	70.7		MOE (2011b)
BW	Body weight of toddler resident	kg	16.5		MOE (2011b)
BW_{female}	Body weight of female worker	kg	63.1		MOE (2011b) - applicable to developmental toxicants
$BW_{assumed}$	Assumed body weight in development of inhalation TRV	kg	70		MOE (2011b)
PM_{10}	Concentration in air of dust particles ≤ 10 µm in diameter	kg_{soil}/m^3	1.00E-07		MOE (2011b)
FPM_{inh}	Fraction of $PM_{10\ that}$ is deposited in lungs	unitless	0.6		MOE (2011b)
NV	No Value				
NC	Not Calculated				

Table A-6: Benzene Indoor Air Concentration Modeling Spreadsheet US EPA J&E Model

DATA ENTRY SHEET

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES X

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
71432	2.05E+04	Benzene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
15	11.25	260	11.25	30	218.75	C	S			0.000000178

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
0	1.7	0.36	0.119	0	1.6	0.4	0.01	0	1.7	0.36	0.119

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
11.25	20	2000	1500	300	0.1	1	9.8

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	0.000001	0.2
				Used to calculate risk-based groundwater concentration.	

END

Table A-6: Benzene Indoor Air Concentration Modeling Spreadsheet US EPA J&E Model

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
8.80E-02	9.80E-06	5.55E-03	25	7,342	353.24	562.16	3.31E+02	1.79E+03	7.8E-06	3.0E-02

END

Table A-6: Benzene Indoor Air Concentration Modeling Spreadsheet US EPA J&E Model

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	248.75	0.241	0.390	0.241	#N/A	#N/A	#N/A	1.78E-07	17.05	0.36	0.107	0.253	7,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
2.50E+05	3.00E+06	2.33E-04	11.25	8,071	3.46E-03	1.46E-01	1.77E-04	5.94E-03	2.39E-02	5.94E-03	4.00E-04	3.20E-03	248.75

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
11.25	3.00E+06	0.10	1.63E+02	5.94E-03	7.00E+02	6.57E+191	1.25E-04	3.75E+02	7.8E-06	3.0E-02

END

Qsoil/Qbuilding	6.53E-04	MOE Limit	0.05 to	0.0001	Is site value within MOE range?	YES
Qsoil	1.63E+02	MOE Limit	0.3 coarse soil		Is site value above MOE **coarse** soil value?	YES
			0.06 M/F soil		Is site value above MOE **M/F** soil value?	YES

3.581161932

Table A-6: Benzene Indoor Air Concentration Modeling Spreadsheet US EPA J&E Model

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	1.79E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.2E-03	1.2E+01

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Table A-7: **Indoor Air Inhalation Exposure to Site Volatile Shallow Groundwater COCs - Offsite Residential Receptor**

COC	$C_{GW\text{-}Shallow\ GW}$ (µg/L or mg/m^3)	Henry's Law Constant	Calculated Indoor Indoor Air COC Concentration - Shallow GW (Residential)	COC Considered Developmental Toxicant (Inhalation)?	Residential Indoor Air Prorated Exposure Concentration - Shallow GW		
					NCRIAP	$NCRIAP_D$	CRIAP
		H'	$C_{IA\text{-}GW}$ (shallow-depth)		Non-Carcinogens	Developmental Non-Carcinogens	Carcinogens
		Unitless	(mg/m^3)		(mg/m^3)	(mg/m^3)	(mg/m^3)
BTEX							
Benzene	20,520	2.27E-01	9.32E+01	No	8.94E+01	NC	8.38E+01
Toluene	5,160	2.71E-01	2.80E+01	No	2.68E+01	NC	2.52E+01
Ethylbenzene	605	3.22E-01	3.90E+00	Yes	3.74E+00	3.90E+00	3.51E+00
Xylene Mixture	2352	2.71E-01	1.27E+01	No	1.22E+01	NC	1.15E+01
PHCs							
PHC F1	4320						
Aliphatic C6-C8	2613.6	5.00E+01	2.61E+03	No	2.51E+03	NC	2.35E+03
Aliphatic C>8-C10	272.16	8.00E+01	4.35E+02	No	4.18E+02	NC	3.92E+02
Aromatic C>8-C10	1434.24	4.80E-01	1.38E+01	No	1.32E+01	NC	1.24E+01
PHC F2	40680						
Aliphatic C>10-C12	976.32	1.20E+02	2.34E+03	No	2.25E+03	NC	2.11E+03
Aliphatic C>12-C16	81.36	5.20E+02	8.46E+02	No	8.12E+02	NC	7.62E+02
Aromatic C>10-C12	24530.04	1.40E-01	6.87E+01	No	6.59E+01	NC	6.18E+01
Aromatic C>12-C16	15092.28	5.30E-02	1.60E+01	No	1.54E+01	NC	1.44E+01
VOCs							
Styrene	216	1.12E-01	4.84E-01	No	4.64E-01	NC	4.35E-01
Trichloroethylene	21.12	4.03E-01	1.70E-01	No	1.63E-01	NC	1.53E-01
Vinyl Chloride	2.6	1.14E+00	5.93E-02	No	5.70E-02	NC	5.34E-02
PAHs							
Acenaphthene	775.2	7.44E-03	1.15E-01	No	1.11E-01	NC	1.04E-01
Acenaphthylene	73.44	5.11E-03	7.51E-03	No	7.21E-03	NC	6.76E-03
Fluorene	301	3.93E-03	2.37E-02	No	2.27E-02	NC	2.13E-02
Naphthalene	27480	1.80E-02	9.89E+00	No	9.50E+00	NC	8.90E+00
Metals & Inorganics							
Mercury	12	4.70E-01	1.13E-01	No	1.08E-01	NC	1.02E-01

Formula:

NCRIAP/NCICIAP = Non-Cancer Residential Indoor Air Proprated Exposure Concentration

NCRIAP/NCICIAP = C_{IA} x NCRIAP Value or = C_{IA} x EF_a x EF_b x EF_c x ED / AP_{NC}

CRIAP/CICIAP = Carcinogenic Residential Indoor Air Prorated Exposure Concentration

CRIAP/CICIAP= C_{IA} x CRIAP value or = C_{IA} x (EF_a x EF_b) x (EF_{c1} x ED_1 + EF_{c2} x ED_2 + … + EF_{c5} x ED_5)/AP_C

Parameter	Description	Unit	Value	Formula	Reference
$C_{IA\text{-}GW}$ (shallow-depth)	Indoor air concentration is calculated - shallow groundwater	mg/m^3	Calculated	C_{IA} = Cgw x α x H'	MOE (2011b)- Page 316
CRIAP	Cancer Residential Indoor Air Prorating Exposure Concentration	mg/m^3	Calculated	see above	MOE (2011b)
NCRIAP	Non-cancer Residential Indoor Air Proprating Exposure Concentration	mg/m^3	Calculated	see above	MOE (2011b)
α-residential	Alpha soil gas to indoor attenuation - residential shallow groundwater (<3m bgs)	Unitless	0.02		MOE (2011b) - Page 316
α-commercial	Alpha soil gas to indoor attenuation - commercial shallow groundwater (<3m bgs)	Unitless	0.004		MOE (2011b)- Page 316
H'	Henry's Law Constant	Unitless	Chemical specific		MOE (2011b)
C_{GW}	Groundwater COC concentration	µg/L = mg/m^3	Site Specific		Laboratory analysis
NCRIAP value	Non-Carcinogen Residential Indoor Air Prorating Factor	Unitless	0.96		MOE (2011b - Table 2.31)
$NCRIAP_D$ value	Non-Carcinogen Residential Indoor Air Prorating Factor (Developmental)	Unitless	1		MOE (2011b - Table 2.31)
CRIAP value	Carcinogen Residential Indoor Air Prorating Factor	Unitless	0.9		MOE (2011b - Table 2.31)
EF_a	Exposure frequency	days/week	5		MOE (2011b)- indoor worker commercial
EF_a	Exposure frequency	days/week	7		MOE (2011b) - residential
EF_b	Exposure frequency	weeks/year	50		MOE (2011b)- non-carcinogens and carcinogens
EF_b	Exposure frequency	weeks/year	52		MOE (2011b) - developmental toxicants
AP_{NC}	Averaging period	years	4.5		MOE (2011b) - toddler - non-carcinogen
AP_C	Averaging period	years	76		MOE (2011b) - composite resident - carcinogen
AP	Averaging period	years	56		MOE (2011b) - female -developmental
NC	Not Calculated				

Table A-8: Indoor Air Inhalation Exposure to Site Volatile Full Depth Groundwater COC - Offsite Commercial Office Worker

COC	C_{GW}	Henry's Law Constant	Modelled Indoor Air Concentration - J&E Model	Commercial Indoor Air Prorated Exposure Concentration - Full Depth GW			
				NCRIAP	$NCRIAP_D$	CRIAP	COC Considered Developmental Toxicant (Inhalation)?
		H'	(C_{IA-GW})	Non-Carcinogens	opmental Non-Carcin(	Carcinogens	
	(µg/L)	Unitless	(mg/m^3)	(mg/m^3)	(mg/m^3)	(mg/m^3)	
BTEX							
Benzene	20520	2.27E-01	3.75E-01	1.05E-01	0.374573498	0.10488058	No

Formula

NCRIAP = Non-Cancer Commercial Indoor Air Prorated Exposure Concentration

NCRIAP = C_{IA} x NCRIAP value or = $C_{IA} \times EF_a \times EF_b \times EF_c \times ED / AP_{NC}$

CRIAP = Carcinogenic Commercial Indoor Air Prorated Exposure Concentration

CRIAP = C_{IA} x CRIAP Value or = $C_{IA} \times (EF_a \times EF_b) \times (EF_{c1} \times ED_1 + EF_{c2} \times ED_2 + \ldots + EF_{c5} \times ED_5)/AP_C$

Parameter	Description	Unit	Value	Formula	Reference
C_{IA-GW}	Indoor air concentration modelled with J&E model	mg/m^3	Site Specific		
CRIAP	Cancer Residential Indoor Air Prorating Exposure Concentration	mg/m^3	Calculated	see above	MOE (2011b)
NCRIAP	Non-cancer Residential Indoor Air Proprating Exposure Concentration	mg/m^3	Calculated	see above	MOE (2011b)
C_{GW}	Groundwater concentration	µg/L	Site Specific		
C_{SV}	Soil vapour concentration	mg/m^3	Site Specific		
NCRIAP value	Non-Carcinogen Commercial Indoor Air Prorating Factor	unitless	0.28		MOE (2011b - Table 2.32)
$NCRIAP_D$ Value	Non-Carcinogen Commercial Indoor Air Prorating Factor (Developmental)	unitless	1		MOE (2011b - Table 2.32)
CRIAP Value	Carcinogen Commercial Indoor Air Prorating Factor	unitless	0.28		MOE (2011b - Table 2.32)
EF_a	Exposure frequency	days/week	7		MOE (2011b)
EF_b	Exposure frequency	weeks/year	50		MOE (2011b)
EF_b	Exposure frequency for pregnant woman	weeks/year	52		MOE (2011b) - developmental toxicants
$AP_{C\ or\ NC}$	Averaging period for adults	years	56		MOE (2011b)

Table A-9: **Trench COC Volatization Factor Calculation - Surface and Subsurface Soil to Trench Air for Subsurface Workers**

Media	COC	Thickness of COC Contaminated Soil Interval ds = (Dts-Ds) (m)	Depth to Top of Subsurface Soil Contamination Layer Ls (m)	MOE (2011d) MOE Adjusted Organic Carbon Partition Coefficient Koc (L/kg or cm³/g)	MOE (2011d) Henry's Law Constant H (atm-m³/mole)	MOE (2011d) Diffusivity in air, Da (cm²/s)	MOE (2011d) Diffusivity in water, Dw (cm²/s)	ASTM E2081-00 (2004) Soil to Porewater Concentration Ratio Ksw (cm³/g)	ASTM E2081-00 (2004) Effective Henry's Law Constant Heff (cm³/cm³)	ASTM E2081-00 (2004) Effective Vadose Zone Diffusion Coefficient Deff.vad (cm²/s)	ASTM E2081-00 (2004) Volatization Factor VFs.amb (g-soil/cm³-air)	ASTM E2081-00 (2004) Volatization Factor VFs.amb (kg-soil/m³-air)	ASTM E2081-00 (2004) Mass Limiting Case VFs.amb-fs (g/cm²)	ASTM E2081-00 (2004) Mass Limiting Case VFs.amb-fs (kg/m²)	Final VFs.amb *Minimum of Either Volatization Factor* VFs.amb (kg/m³)
	BTEX														
Shallow Soil	Benzene	0.7	NA	3.31E+02	5.55E-03	8.80E-02	9.80E-06	1.76E+00	2.35E-01	5.94E-03	1.15E-04	1.15E-01	4.81E-05	4.81E-02	4.81E-02
Shallow Soil	Toluene	0.7	NA	5.36E+02	6.63E-03	8.70E-02	8.60E-06	2.79E+00	2.80E-01	5.88E-03	9.94E-05	9.94E-02	4.81E-05	4.81E-02	4.81E-02
Shallow Soil	Xylene Mixture	0.7	NA	8.86E+02	6.63E-03	7.14E-02	9.34E-06	4.54E+00	2.80E-01	4.82E-03	7.06E-05	7.06E-02	4.81E-05	4.81E-02	4.81E-02
	PHCs														
	PHC F1														
Shallow Soil	*Aliphatic C6-C8*	0.7	NA	7.96E+03	1.22E+00	5.00E-02	6.00E-06	4.72E+01	5.17E+01	3.38E-03	2.49E-04	2.49E-01	4.81E-05	4.81E-02	4.81E-02
Shallow Soil	*Aliphatic C>8-C10*	0.7	NA	6.32E+04	1.96E+00	5.00E-02	6.00E-06	3.28E+02	8.28E+01	3.38E-03	1.19E-04	1.19E-01	4.81E-05	4.81E-02	4.81E-02
Shallow Soil	*Aromatic C>8-C10*	0.7	NA	3.17E+03	1.17E-02	5.00E-02	6.00E-06	1.60E+01	4.97E-01	3.38E-03	4.19E-05	4.19E-02	4.81E-05	4.81E-02	4.19E-02
	PHC F2														
Shallow Soil	*Aliphatic C>10-C12*	0.7	NA	5.02E+05	2.94E+00	5.00E-02	6.00E-06	2.53E+03	1.24E+02	3.38E-03	5.26E-05	5.26E-02	4.81E-05	4.81E-02	4.81E-02
Shallow Soil	*Aliphatic C>12-C16*	0.7	NA	1.00E+07	1.27E+01	5.00E-02	6.00E-06	5.02E+04	5.38E+02	3.38E-03	2.46E-05	2.46E-02	4.81E-05	4.81E-02	2.46E-02
Shallow Soil	*Aromatic C>10-C12*	0.7	NA	5.02E+03	3.43E-03	5.00E-02	6.00E-06	2.52E+01	1.45E-01	3.38E-03	1.80E-05	1.80E-02	4.81E-05	4.81E-02	1.80E-02
Shallow Soil	*Aromatic C>12-C16*	0.7	NA	1.00E+04	1.30E-03	5.00E-02	6.00E-06	5.02E+01	5.48E-02	3.38E-03	7.85E-06	7.85E-03	4.81E-05	4.81E-02	7.85E-03
	VOCs														
Shallow Soil	Styrene	0.7	NA	1.04E+03	2.74E-03	7.10E-02	8.00E-06	5.26E+00	1.16E-01	4.80E-03	4.20E-05	4.20E-02	4.81E-05	4.81E-02	4.20E-02
	PAHs														
Shallow Soil	Acenaphthylene	0.7	NA	1.22E+04	1.25E-04	4.39E-02	7.53E-06	6.13E+01	5.29E-03	2.97E-03	2.07E-06	2.07E-03	4.81E-05	4.81E-02	2.07E-03
Shallow Soil	Naphthalene	0.7	NA	3.67E+03	4.40E-04	5.90E-02	7.50E-06	1.84E+01	1.86E-02	3.99E-03	8.20E-06	8.20E-03	4.81E-05	4.81E-02	8.20E-03
	Metals & Inorganics														
Shallow Soil	Mercury	0.7	NA	1.32E+06	1.15E-02	3.07E-02	6.30E-06	6.60E+03	4.86E-01	2.07E-03	1.60E-06	1.60E-03	4.81E-05	4.81E-02	1.60E-03
	BTEX														
Subsoil	Benzene	NA	0.5	3.31E+02	5.55E-03	8.80E-02	9.80E-06	1.76E+00	2.35E-01	5.94E-03	1.19E-04	1.19E-01	NC	NC	1.19E-01
Subsoil	Toluene	NA	0.5	5.36E+02	6.63E-03	8.70E-02	8.60E-06	2.79E+00	2.80E-01	5.88E-03	8.82E-05	8.82E-02	NC	NC	8.82E-02
Subsoil	Ethylbenzene	NA	0.5	1.04E+03	7.88E-03	7.50E-02	7.80E-06	5.30E+00	3.33E-01	5.07E-03	4.76E-05	4.76E-02	NC	NC	4.76E-02
Subsoil	Xylene Mixture	NA	0.5	8.86E+02	6.63E-03	7.14E-02	9.34E-06	4.54E+00	2.80E-01	4.82E-03	4.45E-05	4.45E-02	NC	NC	4.45E-02
	PHCs														
	PHC F1														
Subsoil	*Aliphatic C6-C8*	NA	0.5	7.96E+03	1.22E+00	5.00E-02	6.00E-06	4.72E+01	5.17E+01	3.38E-03	5.53E-04	5.53E-01	NC	NC	5.53E-01
Subsoil	*Aliphatic C>8-C10*	NA	0.5	6.32E+04	1.96E+00	5.00E-02	6.00E-06	3.28E+02	8.28E+01	3.38E-03	1.27E-04	1.27E-01	NC	NC	1.27E-01
Subsoil	*Aromatic C>8-C10*	NA	0.5	3.17E+03	1.17E-02	5.00E-02	6.00E-06	1.60E+01	4.97E-01	3.38E-03	1.57E-05	1.57E-02	NC	NC	1.57E-02
	PHC F2														
Subsoil	*Aliphatic C>10-C12*	NA	0.5	5.02E+05	2.94E+00	5.00E-02	6.00E-06	2.53E+03	1.24E+02	3.38E-03	2.48E-05	2.48E-02	NC	NC	2.48E-02
Subsoil	*Aliphatic C>12-C16*	NA	0.5	1.00E+07	1.27E+01	5.00E-02	6.00E-06	5.02E+04	5.38E+02	3.38E-03	5.41E-06	5.41E-03	NC	NC	5.41E-03
Subsoil	*Aromatic C>10-C12*	NA	0.5	5.02E+03	3.43E-03	5.00E-02	6.00E-06	2.52E+01	1.45E-01	3.38E-03	2.90E-06	2.90E-03	NC	NC	2.90E-03
Subsoil	*Aromatic C>12-C16*	NA	0.5	1.00E+04	1.30E-03	5.00E-02	6.00E-06	5.02E+01	5.48E-02	3.38E-03	5.52E-07	5.52E-04	NC	NC	5.52E-04
	VOCs														
Subsoil	Trichloroethylene	NA	0.5	1.35E+02	9.86E-03	7.90E-02	9.10E-06	8.06E-01	4.17E-01	5.34E-03	4.12E-04	4.12E-01	NC	NC	4.12E-01
Subsoil	Vinyl Chloride	NA	0.5	4.75E+01	2.79E-02	1.06E-01	1.23E-06	4.75E-01	1.18E+00	7.16E-03	2.66E-03	2.66E+00	NC	NC	2.66E+00
	PAHs														
Subsoil	Acenaphthene	NA	0.5	1.22E+04	1.82E-04	4.21E-02	7.69E-06	6.13E+01	7.70E-03	2.85E-03	5.35E-08	5.35E-05	NC	NC	5.35E-05
Subsoil	Acenaphthylene	NA	0.5	1.22E+04	1.25E-04	4.39E-02	7.53E-06	6.13E+01	5.29E-03	2.97E-03	3.83E-08	3.83E-05	NC	NC	3.83E-05
Subsoil	Benz[a]anthracene	NA	0.5	4.62E+05	1.20E-05	5.10E-02	9.00E-06	2.31E+03	5.08E-04	3.56E-03	1.17E-10	1.17E-07	NC	NC	1.17E-07
Subsoil	Fluoranthene	NA	0.5	1.42E+05	8.86E-06	3.02E-02	6.35E-06	7.09E+02	3.75E-04	2.15E-03	1.70E-10	1.70E-07	NC	NC	1.70E-07
Subsoil	Naphthalene	NA	0.5	3.67E+03	4.40E-04	5.90E-02	7.50E-06	1.84E+01	1.86E-02	3.99E-03	6.02E-07	6.02E-04	NC	NC	6.02E-04
	Metals & Inorganics														
Subsoil	Mercury	NA	0.5	1.32E+06	1.15E-02	3.07E-02	6.30E-06	6.60E+03	4.86E-01	2.07E-03	2.28E-08	2.28E-05	NC	NC	2.28E-05

Formular

1) VFss = volatilization factor, surface l soil to ambient outdoor air (g/cm3)

$$VFs.amb = \frac{\rho b}{DF_{amb}} \sqrt{\frac{4 \times DF_{eff-vadose} \times H_{eff}}{\pi \times t \times \frac{31536000s}{y} \times K_{sw} \times \rho b}}$$

2) VFss = volatilization factor, surface l soil to ambient outdoor air (g/cm3)

$$VF_{s.amb} = \frac{\rho b \times (Dts - Ds) \times C_1}{DF_{amb} \times t \times \frac{31536000s}{y}}$$

3)VFsub = volatilization factor, subsurface soil to ambient outdoor air (g/cm3)

$$VF_{s.amb} = \sqrt{\left[(1 + \frac{DF_{amb} \times L_s \times Cl}{D_{eff.vad}}) \times \frac{K_{sw}}{H_{eff}}\right]}$$

Effective Vadose Zone Diffusion Coefficient

$$D_{eff.vad} = D_a \times \frac{\theta_a^{3.33}}{\theta_t^2} + \left[\frac{D_w}{H_{eff}}\right] \times \left[\frac{\theta_w^{3.33}}{\theta_t^2}\right]$$

Dispersion factor for ambient air from trench surface

$$DF_{amb} = \frac{V \times LS \times DH}{A}$$

Parameter	Description	Units	Value	Equations	Reference
VFs.amb	Volatilization factor, surficial soil to ambient outdoor air	g/cm3	calculated	VFs.amb = (ρ_b/DF_{amb}) (4 x $DF_{eff.vad}$ x H_{eff}/(π x t x 31536000s/y x K_{sw} x ρ_b))^0.5	ASTM E2081-00 (2004)
VFs.amb	Volatilization factor, subsurficial soil to ambient outdoor air	g/cm4	calculated	VFs.amb = 1/[(1 + (DFamb x Ls x 100 cm/m/Deff-vad)) x (Ksw/Heff)]	ASTM E2081-00 (2004)
Deff.vad	Effective vadose zone diffusion coefficient	cm2/s	calculated	Deff.vad = [Da x (θa^3.33/θt^2)] + [Dw x (1/Heff) x (θw^3.33/θt^2)]	ASTM E2081-00 (2004)
Heff	Effective Henry's Law Constant Coefficient (unitless)	cm3/cm3	chemical specific	Heff = (Ht1/(R x (T + 273.15))) x 1000	MOE, 2011b
DF_{amb}	Dispersion factor for ambint air from trench surface (surface soil)	(cm/s)	5.23E-02	DFamb = (V x LS x DH)/A	ASTM E2081-00 (2004)
DF_{amb}	Dispersion factor for ambint air from trench surface (subsoil)	(cm/s)	1.34E-01	DFamb = (V x LS x DH)/A	ASTM E2081-00 (2004)
K_{SW}	Soil to water partition coefficient	cm3/g	calculated	Ksw = [θw + (foc x Koc x pb) + (Heff x θa)]/pb	ASTM E2081-00 (2004)
Da	Diffusivity in air	cm2/s	chemical specific		MOE, 2011b
Dw	Diffusivity in water	cm2/s	chemical specific		MOE, 2011b
θw	Volumetric Water Content in Vadose Zone Soil	(cm^3-H_2O/(g-soil)	0.119		MOE, 2011b
θa	Volumetric Air Content in Vadose Zone Soil	(cm^3-air/g-soil)	0.241		MOE, 2011b
θt	Total Soil Porosity	(cm^3/cm^3-soil)	0.36		MOE, 2011b
V	Ambient air velocity in mixing zone (wind speed in breathing zone)	(m/sec)	0.0014	V= ACR*$Trench_{wd}$/3600*A	Meridian, 2010
LS	Length of Longest Side of Contaminated Trench	(m)	13		Site specific
A	Total area of source-zone for surface soil contamination (all faces)	(m^2)	69		Site specific
A	Total area of source-zone (0.5 height of wall face + floor base)	(m^2)	27		Site specific
DH	Diffusion Height or Box Model Mixing Height (breathing zone)	(m)	2		MOE, 2011b
T	Ambient Temperature	(C)	15		MOE, 2011b
R	Ideal Gas Constant	(atm-m^3/mol)	0.08206		MOE, 2011b
pb	Dry Soil Bulk Density	(g/cm^3)	1.7		MOE, 2011b
f_{oc}	Fraction Organic Carbon in Soil	(g/g)	0.005	VFs.amb-fs = ((Dts-Ds) x 100 cm/m x pb)/(DFamb x t x 31536000 s/y)	ASTM E2081-00 (2004)
t	Exposure Interval (average time for surface emission vapour flux)	yr	1.5	t = ED	Site specific
Ds	Depth to surface soil	(m bgs)	0.8	the shallowest depth of surface soil impact (<1.5m bgs) is at 0.8 m bgs for benzene	Site specific
Ls	Depth from Trench Base to Top of Subsurface Soil Contamination (Depth to contaminant in subsurface soil)	(m bgs)	0.5	the shallowest depth of subsurface soil impact (> 1.5 m bgs) is at 1.5 m bgs, the greatest depth is at 12.8 m bgs for benzene.	Site specific
ds	Depth to base of surface soil zone	(m bgs)	0.7		Site specific
Dts (Lss)	Thickness of surface soil	(m bgs)	1.5		Site specific
C1	Conversion Factor	(cm/m)	100		
C2	Conversion Factor	(cm^3-kg/m^3-g) OR mg/g OR ug/mg	1000		
CF	Conversion Factor	(L/m^3)	1000		
CF	K at 0 degrees C	(K) at 0 degrees C	273.15		
ARC	Air Exchange Rate	hr^{-1}	5		MOE (2011b)
$Trench_{width}$	Trench Width	m	1		MOE (2011b)
NA	Not Applicable				

Table A-10: Trench Air COC Exposure Concentrations (Subsurface Workers)

COC	Source Media	Source COC Concentration C_{soil} or C_{gw}	Concentration Units	Volatization Factor VF	Volatization Factor Units	Trench Air Concentration $C_{tr\text{-}air}$ (mg/m^3)	Exposure Concentration Non-Carcinogens $NCEC_{tr\text{-}air}$ (mg/m^3)	Exposure Concentration Developmental Non-Carcinogens $NC_DEC_{tr\text{-}air}$ (mg/m^3)	Exposure Concentration Carcinogens $CEC_{tr\text{-}air}$ (mg/m^3)	COC Considered Developmental Toxicant (Inhalation)?
BTEX										
Benzene	Shallow Soil	169.2	µg/g or mg/kg	4.81E-02	kg/m^3	8.13E+00	2.05E+00	NC	5.48E-02	No
Toluene	Shallow Soil	246		4.81E-02	kg/m^3	1.18E+01	2.98E+00	NC	7.97E-02	No
Xylene Mixture	Shallow Soil	403.2	µg/g or mg/kg	4.81E-02	kg/m^3	1.94E+01	4.88E+00	NC	1.31E-01	No
PHCs										
PHC F1		1104								
Aliphatic C6-C8	Shallow Soil	607.2	µg/g or mg/kg	4.81E-02	kg/m^3	3.17E+02	7.97E+01	NC	2.14E+00	No
Aliphatic C>8-C10	Shallow Soil	397.44	µg/g or mg/kg	4.81E-02	kg/m^3	1.91E+01	4.81E+00	NC	1.29E-01	No
Aromatic C>8-C10	Shallow Soil	99.36	µg/g or mg/kg	4.19E-02	kg/m^3	4.16E+00	1.05E+00	NC	2.81E-02	No
PHC F2		6588								
Aliphatic C>10-C12	Shallow Soil	2371.68	µg/g or mg/kg	4.81E-02	kg/m^3	1.14E+02	2.87E+01	NC	7.69E-01	No
Aliphatic C>12-C16	Shallow Soil	2898.72	µg/g or mg/kg	2.46E-02	kg/m^3	7.13E+01	1.79E+01	NC	4.81E-01	No
Aromatic C>10-C12	Shallow Soil	592.92	µg/g or mg/kg	1.80E-02	kg/m^3	1.07E+01	2.69E+00	NC	7.20E-02	No
Aromatic C>12-C16	Shallow Soil	724.68	µg/g or mg/kg	7.85E-03	kg/m^3	5.69E+00	1.43E+00	NC	3.84E-02	No
VOCs										
Styrene	Shallow Soil	162	µg/g or mg/kg	4.20E-02	kg/m^3	6.81E+00	1.71E+00	NC	4.59E-02	No
PAHs										
Acenaphthylene	Shallow Soil	12	µg/g or mg/kg	2.07E-03	kg/m^3	2.48E-02	6.25E-03	NC	1.67E-04	No
Naphthalene	Shallow Soil	65.04	µg/g or mg/kg	8.20E-03	kg/m^3	5.34E-01	1.34E-01	NC	3.60E-03	No
Metals & Inorganics										
Mercury	Shallow Soil	6.948	µg/g or mg/kg	1.60E-03	kg/m^3	1.11E-02	2.79E-03	NC	7.49E-05	No
BTEX										
Benzene	Subsoil	33	µg/g or mg/kg	1.19E-01	kg/m^3	3.91E+00	9.85E-01	NC	2.64E-02	No
Toluene	Subsoil	16.32	µg/g or mg/kg	8.82E-02	kg/m^3	1.44E+00	3.63E-01	NC	9.71E-03	No
Ethylbenzene	Subsoil	16.92	µg/g or mg/kg	4.76E-02	kg/m^3	8.06E-01	2.03E-01	8.04E-01	5.43E-03	Yes
Xylene Mixture	Subsoil	29.88	µg/g or mg/kg	4.45E-02	kg/m^3	1.33E+00	3.35E-01	NC	8.97E-03	No
PHCs										
PHC F1		216								
Aliphatic C6-C8	Subsoil	118.8	µg/g or mg/kg	5.53E-01	kg/m^3	6.57E+01	1.65E+01	NC	4.43E-01	No
Aliphatic C>8-C10	Subsoil	77.76	µg/g or mg/kg	1.27E-01	kg/m^3	9.90E+00	2.49E+00	NC	6.68E-02	No
Aromatic C>8-C10	Subsoil	19.44	µg/g or mg/kg	1.57E-02	kg/m^3	3.05E-01	7.67E-02	NC	2.06E-03	No
PHC F2		15840								
Aliphatic C>10-C12	Subsoil	5702.4	µg/g or mg/kg	2.48E-02	kg/m^3	1.41E+02	3.56E+01	NC	9.53E-01	No
Aliphatic C>12-C16	Subsoil	6969.6	µg/g or mg/kg	5.41E-03	kg/m^3	3.77E+01	9.49E+00	NC	2.54E-01	No
Aromatic C>10-C12	Subsoil	1425.6	µg/g or mg/kg	2.90E-03	kg/m^3	4.14E+00	1.04E+00	NC	2.79E-02	No
Aromatic C>12-C16	Subsoil	1742.4	µg/g or mg/kg	5.52E-04	kg/m^3	9.61E-01	2.42E-01	NC	6.48E-03	No
VOCs										
Trichloroethylene	Subsoil	2.964	µg/g or mg/kg	4.12E-01	kg/m^3	1.22E+00	3.08E-01	NC	8.24E-03	No
Vinyl Chloride	Subsoil	0.3204	µg/g or mg/kg	2.66E+00	kg/m^3	8.52E-01	2.14E-01	NC	5.74E-03	No
PAHs										
Acenaphthene	Subsoil	598.8	µg/g or mg/kg	5.35E-05	kg/m^3	3.20E-02	8.06E-03	NC	2.16E-04	No
Acenaphthylene	Subsoil	47.52	µg/g or mg/kg	3.83E-05	kg/m^3	1.82E-03	4.58E-04	NC	1.23E-05	No
Benz[a]anthracene	Subsoil	240	µg/g or mg/kg	1.17E-07	kg/m^3	2.81E-05	7.07E-06	NC	1.89E-07	No
Fluoranthene	Subsoil	792	µg/g or mg/kg	1.70E-07	kg/m^3	1.34E-04	3.38E-05	NC	9.06E-07	No
Naphthalene	Subsoil	3036	µg/g or mg/kg	6.02E-04	kg/m^3	1.83E+00	4.60E-01	NC	1.23E-02	No
Metals & Inorganics										
Mercury	Subsoil	48.6	µg/g or mg/kg	2.28E-05	kg/m^3	1.11E-03	2.79E-04	NC	7.48E-06	No
BTEX										
Benzene	Shallow Groundwater	20520	µg/L	2.65E-11	cm^3/cm^3	5.45E-07	1.37E-07	NC	3.67E-09	No
Xylene Mixture	Shallow Groundwater	2352	µg/L	2.57E-11	cm^3/cm^3	6.05E-08	1.52E-08	NC	4.08E-10	No
PHCs										
PHC F1		4320								
Aliphatic C6-C8	Shallow Groundwater	3684.96	µg/L	3.31E-09	cm^3/cm^3	1.22E-05	3.07E-06	NC	8.23E-08	No
Aliphatic C>8-C10	Shallow Groundwater	613.44	µg/L	5.30E-09	cm^3/cm^3	3.25E-06	8.19E-07	NC	2.19E-08	No
Aromatic C>8-C10	Shallow Groundwater	17.28	µg/L	3.19E-11	cm^3/cm^3	5.50E-10	1.39E-10	NC	3.71E-12	No
PHC F2		40680								
Aliphatic C>10-C12	Shallow Groundwater	31201.56	µg/L	7.95E-09	cm^3/cm^3	2.48E-04	6.25E-05	NC	1.67E-06	No
Aliphatic C>12-C16	Shallow Groundwater	8380.08	µg/L	3.45E-08	cm^3/cm^3	2.89E-04	7.27E-05	NC	1.95E-06	No
Aromatic C>10-C12	Shallow Groundwater	894.96	µg/L	9.31E-12	cm^3/cm^3	8.34E-09	2.10E-09	NC	5.62E-11	No
Aromatic C>12-C16	Shallow Groundwater	203.4	µg/L	3.55E-12	cm^3/cm^3	7.22E-10	1.82E-10	NC	4.87E-12	No
VOCs										
Trichloroethylene	Shallow Groundwater	21.12	µg/L	4.23E-11	cm^3/cm^3	8.92E-10	2.25E-10	NC	6.02E-12	No
Vinyl Chloride	Shallow Groundwater	2.6028	µg/L	1.60E-10	cm^3/cm^3	4.17E-10	1.05E-10	NC	2.81E-12	No
PAHs										
Acenaphthene	Shallow Groundwater	775.2	µg/L	4.56E-13	cm^3/cm^3	3.54E-10	8.90E-11	NC	2.38E-12	No
Acenaphthylene	Shallow Groundwater	73.44	µg/L	3.36E-13	cm^3/cm^3	2.46E-11	6.20E-12	NC	1.66E-13	No
Naphthalene	Shallow Groundwater	27480	µg/L	1.45E-12	cm^3/cm^3	3.99E-08	1.00E-08	NC	2.69E-10	No
Metals & Inorganics										
Mercury	Shallow Groundwater	12	µg/L	1.92E-11	cm^3/cm^3	2.30E-10	5.79E-11	NC	1.55E-12	No
VOCs										
Trichloroethylene	Deep GW	14.4	µg/L	4.23E-11	cm^3/cm^3	6.09E-10	1.53E-10	NC	4.10E-12	No

Trench Air Exposure Concentration

$CEC_{tr\text{-}air}$ or $NCEC_{tr\text{-}air}$ or $NC_DEC_{tr\text{-}air}$= ($C_{tr\text{-}air}$ x RAF_i x EF_a x EF_b x EF_c x ED)/(AP_C or AP_{NC}*C)

Parameter	Description	Value	Unit	Formula	Reference
ED	Exposure Duration - adult and female adult	1.5	yr		MOE (2011b) – Table 2.10
AP_{NC}	Averaging Period – non-carcinogenic for Adult and developmental for female adult	1.5	yr		MOE (2011b) – Table 2.11
AP_C	Averaging Period – carcinogenic for Adult	56	yr		MOE (2011b) – Table 2.12
EF_a	Exposure Frequency	9.8	hours/day		MOE (2011b)
EF_a	Exposure Frequency	24	hours/day		MOE (2011b) - developmental toxicans
EF_b	Exposure Frequency	5	days/week		MOE (2011b)
EF_b	Exposure Frequency	7	days/week		MOE (2011b) - developmental toxicans
EF_c	Exposure Frequency	45	weeks/year		MOE (2011b)
EF_c	Exposure Frequency	52	weeks/year		MOE (2011b) - developmental toxicans
C	Conversion Factor	8760	hr/yr		Constant
RAF_i	Inhalation relative absorption factor	1	unitless		MOE (2011b)
$CEC_{tr\text{-}air}$	Cancinogenic Trench Air Exposure Concentration	Calculated	(mg/m^3)	See above	Calculated
$NCEC_{tr\text{-}air}$	Non-Cancinogenic Trench Air Exposure Concentration	Calculated	(mg/m^3)	See above	Calculated
$NCDEC_{tr\text{-}air}$	Non-Cancinogenic Developmental Trench Air Exposure Concentration	Calculated	(mg/m^3)	See above	Calculated
$C_{tr\text{-}air}$	Trench Air Concentration	Calculated	mg/m^3	$C_{tr\text{-}air} = C_{soil}$ x VF or $C_{tr\text{-}air} = C_{gw}$ x VF	
VF	Volatilization Factor	Table A-9 and A-13		Table A-9 and A-13	
NC	Not Calculated				

Table A-11 Outdoor COC Volatization Factor Calculation - Surfce Soil to Outdoor Air (Park Visitor)

COC	Thickness of COC Contaminated Soil Interval ds = (Dts-Ds) (m)	Depth to Top of Subsurface Soil Contamination Layer Ls (m)	MOE (2011d) MOE Adjusted Organic Carbon Partition Coefficient Koc (L/kg or cm^3/g)	MOE (2011d) Henry's Law Constant H (atm-m^3/mole)	MOE (2011d) Diffusivity in air, Da (cm^2/s)	MOE (2011d) Diffusivity in water, Dw (cm^2/s)	ASTM E2081-00 (2004) Soil to Porewater Concentration Ratio Ksw (cm^3/g)	ASTM E2081-00 (2004) Effective Henry's Law Constant Heff (cm^3/cm^3)	ASTM E2081-00 (2004) Effective Vadose Zone Diffusion Coefficient Deff.vad (cm^2/s)	ASTM E2081-00 (2004) Volatization Factor VFs.amb (g-soil/cm^3-air)	ASTM E2081-00 (2004) Volatization Factor VFs.amb (kg-soil/m^3-air)	ASTM E2081-00 (2004) Mass Limiting Case VFs.amb-fs (g/cm^3)	ASTM E2081-00 (2004) Mass Limiting Case VFs.amb-fs (kg/m^3)	Final VFs.amb *Minimum of Either Volatization Factor* VFs.amb (kg/m^3)
BTEX														
Benzene	1.5		3.31E+02	5.55E-03	8.80E-02	9.80E-06	1.76E+00	2.35E-01	5.86E-03	9.58E-07	9.58E-04	8.63E-07	8.63E-04	8.63E-04
Benzene	0.5		3.31E+02	5.55E-03	8.80E-02	9.80E-06	1.76E+00	2.35E-01	5.86E-03	9.58E-07	9.58E-04	2.88E-07	2.88E-04	2.88E-04

1) VFss = volatilization factor, surface l soil to ambient outdoor air (g/cm3)

$$VFs.amb = \frac{\rho b}{DF_{amb}} \sqrt{\frac{4 \times DF_{eff-vadose} \times H_{eff}}{\pi \times t \times \frac{31536000s}{y} \times K_{sw} \times \rho b}}$$

2) VFss = volatilization factor, surface l soil to ambient outdoor air (g/cm3)

$$VF_{s.amb} = \frac{\rho b \times (Dts - Ds) \times C_1}{DF_{amb} \times t \times \frac{31536000s}{y}}$$

3) VFsub = volatilization factor, subsurface soil to ambient outdoor air (g/cm3)

$$VF_{s.amb} = \frac{1}{\left[(1 + \frac{DF_{amb} \times L_s \times C1}{D_{eff.vad}}) \times \frac{K_{sw}}{H_{eff}}\right]}$$

Effective Vadose Zone Diffusion Coefficient

$$D_{eff.vad} = Da \times \frac{\theta_a^{3.33}}{\theta_t^2} + \left[\frac{D_w}{H_{eff}}\right] \times \left[\frac{\theta_w^{3.33}}{\theta_t^2}\right]$$

Dispersion factor for ambient air from trench surface

$$DF_{amb} = \frac{V \times LS \times DH}{A}$$

Parameter	Description	Units	Value	Equations		Reference
VFs.amb	Volatilization factor, surficial soil to ambient outdoor air	g/cm3	calculated	VFs.amb = (1/[(1 + ((DFamb x Ls x 100 cm/m)/Deff-vad)) x (Ksw/Heff)])		ASTM E2081-00 (2004)
VFs.amb	Volatilization factor, surficial soil to ambient outdoor air (mass limiting)		calculated	VFs.amb-fs = ((Dts-Ds) x 100 cm/m x pb)/(DFamb x t) x 31536000s/y		ASTM E2081-00 (2004)
Deff.vad	Effective vadose zone diffusion coefficient	cm2/s	calculated	Deff.vad = [Da x (θa^3.33/θt^2)] + [Dw x (1/Heff) x (θw^3.33/θt^2)]		ASTM E2081-00 (2004)
Heff	Effective Henry's Law Constant Coefficient (unitless)	cm3/cm3	chemical specific	Heff = (H1/(R x (T + 273.15))) x 1000		MOE (2011b)
DF_{amb}	Dispersion factor for ambint air from trench surface (surface soil)	(cm/s)	6.25E+00	DFamb = (V x LS x DH)/A*C1		ASTM E2081-00 (2004)
K_{SW}	Soil to water partition coefficient	cm3/g	calculated	Ksw = [θw + (foc x Koc x ρb) + (Heff x θa)]/ρb		ASTM E2081-00 (2004)
Da	Diffusivity in air	cm2/s	chemical specific			MOE (2011b)
Dw	Diffusivity in water	cm2/s	chemical specific			MOE (2011b)
θw	Volumetric Water Content in Vadose Zone Soil	(cm^3-H_2O/g-soil)	0.12			MOE (2011b)
θa	Volumetric Air Content in Vadose Zone Soil	(cm^3-air/g-soil)	0.24			MOE (2011b)
θt	Total Soil Porosity	(cm^3/cm^3-soil)	0.36			MOE (2011b)
V	Ambient air velocity in mixing zone (wind speed in breathing zone)	(m/sec)	4.1			MOE (2011b)
LS	Length of Longest Side of Contaminated Trench	(m)	200			Site specific
A	Total area of source-zone for surface soil contamination	(m^2)	26250	area of the RA property		Site specific
DH	Diffusion Height at breathing zone	(m)	2.0			MOE (2011b)
T	Ambient Temperature	(C)	15			MOE (2011b)
R	Ideal Gas Constant	(atm-m^3/mol)	0.08206			MOE (2011b)
ρb	Dry Soil Bulk Density	(g/cm^3)	1.7			MOE (2011b)
f_{oc}	Fraction Organic Carbon in Soil	(g/g)	0.005			MOE (2011b)
t	Exposure Interval (average time for surface emission vapour flux)	yr	1.5	t = ED		Site specific
Ls	Depth to contaminant in subsurface soil	(m bgs)	1.5			
ds	Thickness of contamination source at the surface soil	(m bgs)	1.5	ds=Dts-0	the shallowest depth (<1.5m bgs) is assumed at the surface 0 m bgs for benzene as no vertical delineation was achieved	
Dts (Lss)	Thickness of surface soil	(m bgs)	1.5			Site Specific
C1	Conversion Factor	(cm/m)	100			
C2						
	Conversion Factor	(cm^3-kg/m^3-g) OR mg/g OR ug/mg	1000			
CF	Conversion Factor	(L/m^3)	1000			
CF	K at 0 degrees C	(K) at 0 degrees C	273.15			

Table A-12 **Outdoor Air COC Exposure Concentrations (Park Visitor)**

COC	Source Media	Source COC Concentration C_{soil} or C_{gw}	Concentration Units	Volatization Factor VF	Volatization Factor Units	Outdoor Air Concentration C_{OA} (mg/m^3)	Exposure Concentration Non-Carcinogens $NCEC_{OA}$ (mg/m^3)	Exposure Concentration Developmental Non-Carcinogens NC_DEC_{OA} (mg/m^3)	Exposure Concentration Carcinogens CEC_{OA} (mg/m^3)	COC Considered Developmental Toxicant (Inhalation)?
BTEX										
Benzene	Shallow Soil	169.2	µg/g or mg/kg	8.63E-04	kg/m^3	1.46E-01	7.87E-03	NC	7.87E-03	No
BTEX										
Benzene	Shallow GW	20520	µg/L	7.87E-09	m^3/m^3	1.61E-04	8.71E-06	NC	8.71E-06	No
Xylene Mixture	Shallow GW	2352	µg/L	7.62E-09	m^3/m^3	1.79E-05	9.67E-07	NC	9.67E-07	No
PHCs	Shallow GW									
PHC F1		4320								
Aliphatic C6-C8	Shallow GW	3684.96	µg/L	9.82E-07	m^3/m^3	3.62E-03	1.95E-04	NC	1.95E-04	No
Aliphatic C>8-C10	Shallow GW	613.44	µg/L	1.57E-06	m^3/m^3	9.64E-04	5.20E-05	NC	5.20E-05	No
Aromatic C>8-C10	Shallow GW	17.28	µg/L	9.44E-09	m^3/m^3	1.63E-07	8.80E-09	NC	8.80E-09	No
PHC F2		40680								
Aliphatic C>10-C12	Shallow GW	31201.56	µg/L	2.36E-06	m^3/m^3	7.36E-02	3.97E-03	NC	3.97E-03	No
Aliphatic C>12-C16	Shallow GW	8380.08	µg/L	1.02E-05	m^3/m^3	8.56E-02	4.62E-03	NC	4.62E-03	No
Aromatic C>10-C12	Shallow GW	894.96	µg/L	2.76E-09	m^3/m^3	2.47E-06	1.33E-07	NC	1.33E-07	No
Aromatic C>12-C16	Shallow GW	203.4	µg/L	1.05E-09	m^3/m^3	2.14E-07	1.15E-08	NC	1.15E-08	No
VOCs										
Trichloroethylene	Shallow GW	21.12	µg/L	1.25E-08	m^3/m^3	2.65E-07	1.43E-08	NC	1.43E-08	No
Vinyl Chloride	Shallow GW	2.6028	µg/L	4.75E-08	m^3/m^3	1.24E-07	6.67E-09	NC	6.67E-09	No
PAHs										
Acenaphthene	Shallow GW	775.2	µg/L	1.35E-10	m^3/m^3	1.05E-07	5.65E-09	NC	5.65E-09	No
Acenaphthylene	Shallow GW	73.44	µg/L	9.95E-11	m^3/m^3	7.30E-09	3.94E-10	NC	3.94E-10	No
Fluorene	Shallow GW	74.44	µg/L	6.70E-11	m^3/m^3	4.98E-09	2.69E-10	NC	2.69E-10	No
Naphthalene	Shallow GW	27480	µg/L	4.30E-10	m^3/m^3	1.18E-05	6.37E-07	NC	6.37E-07	No
Metals & Inorganics										
Mercury	Shallow GW	12	µg/L	5.68E-09	m^3/m^3	6.82E-08	3.68E-09	NC	3.68E-09	No
BTEX										
Benzene	Deep GW	448.8	µg/L	7.87E-09	m^3/m^3	3.53E-06	1.90E-07	NC	1.90E-07	No
PHCs										
PHC F2										
Aliphatic C>10-C12	Deep GW	18776.16	µg/L	2.36E-06	m^3/m^3	4.43E-02	2.39E-03	NC	2.39E-03	No
Aliphatic C>12-C16	Deep GW	5042.88	µg/L	1.02E-05	m^3/m^3	5.15E-02	2.78E-03	NC	2.78E-03	No
Aromatic C>10-C12	Deep GW	538.56	µg/L	2.76E-09	m^3/m^3	1.49E-06	8.02E-08	NC	8.02E-08	No
Aromatic C>12-C16	Deep GW	122.4	µg/L	1.05E-09	m^3/m^3	1.29E-07	6.94E-09	NC	6.94E-09	No
VOCs										
Trichloroethylene	Deep GW	14.4	µg/L	1.25E-08	m^3/m^3	1.80E-07	9.73E-09	NC	9.73E-09	No
Vinyl Chloride	Deep GW	1.9	µg/L	4.75E-08	m^3/m^3	9.02E-08	4.87E-09	NC	4.87E-09	No
PAHs										
Acenaphthene	Deep GW	775.2	µg/L	1.35E-10	m^3/m^3	1.05E-07	5.65E-09	NC	5.65E-09	No
Naphthalene	Deep GW	12480	µg/L	4.30E-10	m^3/m^3	5.37E-06	2.90E-07	NC	2.90E-07	No

Formula:

CEC_{OA} or NC_DEC_{OA}= (C_{OA} x EF_a x EF_b x EF_c x ED)/(AP_CxC)

$NCEC_{OA}$ = (C_{OA} x EF_a x EF_b x EFc) x (ED_1+ED_2+ED_3+ED_4+ED_5)/(AP_{NC}xC)

Where,

Parameter	Description	Value	Unit	Formula	Reference
AP_{NC}	Averaging Period – non-carcinogenic for toddler	4.5	yr		MOE, 2011b – Table 2.11
AP_C	Averaging Period – carcinogenic for Adult Composite	76	yr		MOE, 2011b – Table 2.12
EF_a	Exposure frequency	1.5	hours/day		HC, 2012
EF_a	Exposure frequency	24	hours/day		MOE, 2011b - developmental toxicants
EF_b	Exposure frequency	7	days/week		MOE, 2011b
EF_b	Exposure frequency	7	days/week		MOE, 2011b - developmental toxicants
EF_c	Exposure frequency	45	weeks/year		MOE, 2011b
EF_c	Exposure frequency	52	weeks/year		MOE, 2011b - developmental toxicants
C	Conversion Factor	8760	hr/yr		Constant
CEC_{OA}	Cancinogenic Outdoor Air Exposure Concentration	Calculated	(mg/m^3)	See Above	MOE (2011b)
$NCEC_{OA}$	Non-Cancinogenic Outdoor Air Exposure Concentration	Calculated	(mg/m^3)	See Above	MOE (2011b)
$NCDEC_{OA}$	Non-Cancinogenic Developmental Outdoor Air Exposure Concentration	Calculated	(mg/m^3)	See Above	MOE (2011b)
C_{OA}	Outdoor Air Concentration	Calculated	mg/m^3	C_{OA} = C_{soil} x VF or C_{OA} = C_{gw} x VF	
VF	Volatilization Factor	Table A-11			MOE (2011b)
NC	Not Calculated				

Life Stage	Infant	Toddler	Child	Teen	Adult	Adult female	Site specific
ED = exposure duration (years) =	0.5	4.5	7	8	56		
BW = body weight (kg) =	8.2	16.5	32.9	59.7	70.7	63.1	
EFa = exposure frequency (hr/day) =	24	24	22.23	21.83	22.5	24	1.5
Lifestage (subscripts in equations)	1	2	3	4	5	5	

Table A-13: Trench COC Volatization Factor Calculation - Groundwater to Trench Air Subsurface Worker (groundwater not in contact with trench floor)

COC	MOE (2011b) MOE Adjusted Organic Carbon Partition Coefficient Koc (L/kg or cm^3/g)	MOE (2011b) Henry's Law Constant H ($atm\text{-}m^3/mole$)	MOE (2011b) Diffusivity in air, Da (cm^2/s)	MOE (2011b) Diffusivity in water, Dw (cm^2/s)	ASTM E2081-00 (2004) Effective Henry's Law Constant Heff (cm^3/cm^3)	ASTM E2081-00 (2004) Effective Vadose Zone COC Diffusion Coefficient Deff.vad (cm^2/s)	ASTM E2081-00 (2004) Effective Capillary Fringe COC Diffusion Coefficient Deff.cap (cm^2/s)	ASTM E2081-00 (2004) Effective Averaged Water Table to Surface COC Diffusion Coefficient Deff.ws (cm^2/s)	ASTM E2081-00 (2004) Volatization Factor VFgw.amb (cm^3/cm^3)
Shallow GW									
BTEX									
Benzene	3.31E+02	5.55E-03	8.80E-02	9.80E-06	2.35E-01	5.86E-03	5.86E-04	4.64E-07	2.65E-11
Xylene Mixture	8.86E+02	6.63E-03	7.14E-02	9.34E-06	2.80E-01	4.76E-03	4.75E-04	3.76E-07	2.57E-11
PHCs									
PHC F1									
Aliphatic C6-C8	7.96E+03	1.22E+00	5.00E-02	6.00E-06	5.17E+01	3.33E-03	3.31E-04	2.63E-07	3.31E-09
Aliphatic C>8-C10	6.32E+04	1.96E+00	5.00E-02	6.00E-06	8.28E+01	3.33E-03	3.31E-04	2.63E-07	5.30E-09
Aromatic C>8-C10	3.17E+03	1.17E-02	5.00E-02	6.00E-06	4.97E-01	3.33E-03	3.32E-04	2.63E-07	3.19E-11
PHC F2									
Aliphatic C>10-C12	5.02E+05	2.94E+00	5.00E-02	6.00E-06	1.24E+02	3.33E-03	3.31E-04	2.63E-07	7.95E-09
Aliphatic C>12-C16	1.00E+07	1.27E+01	5.00E-02	6.00E-06	5.38E+02	3.33E-03	3.31E-04	2.63E-07	3.45E-08
Aromatic C>10-C12	5.02E+03	3.43E-03	5.00E-02	6.00E-06	1.45E-01	3.33E-03	3.34E-04	2.64E-07	9.31E-12
Aromatic C>12-C16	1.00E+04	1.30E-03	5.00E-02	6.00E-06	5.48E-02	3.33E-03	3.38E-04	2.65E-07	3.55E-12
VOCs									
Trichloroethylene	1.35E+02	9.86E-03	7.90E-02	9.10E-06	4.17E-01	5.26E-03	5.25E-04	4.16E-07	4.23E-11
Vinyl Chloride	4.75E+01	2.79E-02	1.06E-01	1.23E-06	1.18E+00	7.06E-03	7.02E-04	5.57E-07	1.60E-10
PAHs									
Acenaphthene	1.22E+04	1.82E-04	4.21E-02	7.69E-06	7.70E-03	2.81E-03	3.45E-04	2.43E-07	4.56E-13
Acenaphthylene	1.22E+04	1.25E-04	4.39E-02	7.53E-06	5.29E-03	2.93E-03	3.85E-04	2.60E-07	3.36E-13
Naphthalene	3.67E+03	4.40E-04	5.90E-02	7.50E-06	1.86E-02	3.93E-03	4.18E-04	3.20E-07	1.45E-12
Metals & Inorganics									
Mercury	1.32E+06	1.15E-02	3.07E-02	6.30E-06	4.86E-01	2.04E-03	2.04E-04	1.62E-07	1.92E-11
Deep GW									
VOCs									
Trichloroethylene	1.35E+02	9.86E-03	7.90E-02	9.10E-06	4.17E-01	5.26E-03	5.25E-04	4.16E-07	4.23E-11

Parameter	Description	Units	Value	Equations	Reference
VFgw.amb	COC volatization factor from groundwater to ambient air	cm^3/cm^3	calculated	VFgw.amb = (1/[(1 + ((DFamb x Lgw x 100 cm/m)/Deff-ws)) x (1/Heff)])	ASTM E2081-00 (2004)
Deff.vad	Effective vadose zone COC diffusion coefficient	(cm^2/s)	calculated	Deff.vad = [Da x (θa^3.33/θt^2)] + [Dw x (1/Heff) x (θw^3.33/θt^2)]	ASTM E2081-00 (2004)
Deff.cap	Effective capillary fringe zone COC diffusion coefficient	(cm^2/s)	calculated	Deff.cap = [Da x (θa^3.33/θt^2)] + [Dw x (1/Heff) x (θw^3.33/θt^2)]	ASTM E2081-00 (2004)
Deff.ws	Effective averaged water table to surface COC diffusion coefficient	(cm^2/s)	calculated	Deff.ws = Lgw/((((hv-hcap)x100 cm/m)/Deff.vad)+((hcap x 100 cm/m)/Deff.cap))	ASTM E2081-00 (2004)
Heff	Effective Henry's Law Constant	unitless	calculated	Heff = (H1/(R x (T + 273.15))) x 1000	ASTM E2081-00 (2004)
T	Ambient Temperature	(C)	15		MOE (2011b)
R	Ideal Gas Constant	($atm\text{-}m^3/mol$)	0.082		MOE (2011b)
CF	Conversion Factor	(L/m^3)	1000		
CF	K at 0 degrees C	(K) at 0 degrees C	273		
θw	Volumetric Water Content in Vadose Zone Soil	(cm^3-H_2O/g-soil)	0.12		MOE (2011b)
θa	Volumetric Air Content in Vadose Zone Soil	(cm^3-air/g-soil)	0.24		MOE (2011b)
θw	Volumetric Water Content in Caplillary Fringe Soil	(cm^3-H_2O/g-soil)	0.24		MOE (2011b)
θa	Volumetric Air Content in Capillary Fringe Soil	(cm^3-air/g-soil)	0.12		MOE (2011b)
θt	Total Soil Porosity	(cm^3/cm^3-soil)	0.36		MOE (2011b)
LS	Length of Longest Side of Contaminated Trench	(m)	13		Site specific
LS	Length of Longest Side of Contaminated Trench	(cm)	1300		Site specific
DFamb	Ambient Air Dispersion Factor	(cm/s)	1388.89	DFamb = (V x LSx100cm/m x DH)/A	ASTM E2081-00 (2004)
V	Wind Speed in Breathing Zone	(m/sec)	0.0014	V= ACR*$Trench_{vol}$/3600*A	Maridian, 2010
V	Wind Speed in Breathing Zone	(cm/sec)	0.1389		Site specific
DH	Diffusion Height or Box Model Mixing Height in trench or breathing zone	(m)	2		MOE (2011b)
DH	Diffusion Height or Box Model Mixing Height	(cm)	200		MOE (2011b)
A	Trench Cross sectional area	(m^2)	26	A = LS x $Trench_{Width}$	Site specific
C1	Conversion Factor	(cm/m)	100		
hv	Observed Depth to Groundwater	(m)	2.2	The shallowest depth greater than 2 m bgs that is observed at the site	Site specific
hcap	Capillary Fringe Thickness	(m)	0.17	hcap = 0.15/2*mean grain diameter (0.044 for sand)/(100cm/m)	MOE (2011b)
htrench	Trench depth	(m)	2		MOE (2011b)
Lgw	Depth to Groundwater from Trench Base	(m)	0.030	Lgw = hv-hcap-htrench	Site specific
ACR	Air Exchange Rate	hr^{-1}	5	MOE (2011b)	MOE (2011b)
$Trench_{Width}$	Trench Width	(m)	1	MOE (2011b)	MOE (2011b)
$Trench_{Vol}$	Trench Volume	(m^3)	26	$Trench_{vol}$ = LS x DH X $Trench_{width}$	MOE (2011b)

Table A-14: Outdoor COC Volatization Factor Calculation - Groundwater to Outdoor Air (Park Visitor)

COC	MOE (2011d) MOE Adjusted Organic Carbon Partition Coefficient Koc (L/kg or cm^3/g)	MOE (2011d) Henry's Law Constant H ($atm\text{-}m^3$/mole)	MOE (2011d) Diffusivity in air, Da (cm^2/s)	MOE (2011d) Diffusivity in water, Dw (cm^2/s)	ASTM E2081-00 (2004) Effective Henry's Law Constant Heff (cm^3/cm^3)	ASTM E2081-00 (2004) Effective Vadose Zone Diffusion Coefficient Deff.vad (cm^2/s)	ASTM E2081-00 (2004) Effective Capillary Fringe Diffusion Coefficient Deff.cap (cm^2/s)	ASTM E2081-00 (2004) Effective Averaged Water Table to Surface Diffusion Coefficient Deff.ws (cm^2/s)	ASTM E2081-00 (2004) Volatization Factor VFgw.amb (cm^3/cm^3)
Shallow GW									
BTEX									
Benzene	3.31E+02	5.55E-03	8.80E-02	9.80E-06	2.35E-01	5.86E-03	5.86E-04	3.18E-05	7.87E-09
Xylene Mixture	8.86E+02	6.63E-03	7.14E-02	9.34E-06	2.80E-01	4.76E-03	4.75E-04	2.58E-05	7.62E-09
PHCs									
PHC F1									
Aliphatic C6-C8	7.96E+03	1.22E+00	5.00E-02	6.00E-06	5.17E+01	3.33E-03	3.31E-04	1.81E-05	9.82E-07
Aliphatic C>8-C10	6.32E+04	1.96E+00	5.00E-02	6.00E-06	8.28E+01	3.33E-03	3.31E-04	1.81E-05	1.57E-06
Aromatic C>8-C10	3.17E+03	1.17E-02	5.00E-02	6.00E-06	4.97E-01	3.33E-03	3.32E-04	1.81E-05	9.44E-09
PHC F2									
Aliphatic C>10-C12	5.02E+05	2.94E+00	5.00E-02	6.00E-06	1.24E+02	3.33E-03	3.31E-04	1.81E-05	2.36E-06
Aliphatic C>12-C16	1.00E+07	1.27E+01	5.00E-02	6.00E-06	5.38E+02	3.33E-03	3.31E-04	1.81E-05	1.02E-05
Aromatic C>10-C12	5.02E+03	3.43E-03	5.00E-02	6.00E-06	1.45E-01	3.33E-03	3.34E-04	1.81E-05	2.76E-09
Aromatic C>12-C16	1.00E+04	1.30E-03	5.00E-02	6.00E-06	5.48E-02	3.33E-03	3.38E-04	1.82E-05	1.05E-09
VOCs									
Styrene	1.04E+03	2.74E-03	7.10E-02	8.00E-06	1.16E-01	4.73E-03	4.75E-04	2.58E-05	3.14E-09
Trichloroethylene	1.35E+02	9.86E-03	7.90E-02	9.10E-06	4.17E-01	5.26E-03	5.25E-04	2.86E-05	1.25E-08
Vinyl Chloride	4.75E+01	2.79E-02	1.06E-01	1.23E-06	1.18E+00	7.06E-03	7.02E-04	3.83E-05	4.75E-08
PAHs									
Acenaphthene	1.22E+04	1.82E-04	4.21E-02	7.69E-06	7.70E-03	2.81E-03	3.45E-04	1.67E-05	1.35E-10
Acenaphthylene	1.22E+04	1.25E-04	4.39E-02	7.53E-06	5.29E-03	2.93E-03	3.85E-04	1.79E-05	9.95E-11
Fluorene	2.26E+04	9.62E-05	3.63E-02	7.88E-06	4.07E-03	2.43E-03	3.69E-04	1.57E-05	6.70E-11
Naphthalene	3.67E+03	4.40E-04	5.90E-02	7.50E-06	1.86E-02	3.93E-03	4.18E-04	2.20E-05	4.30E-10
Metals & Inorganics									
Mercury	1.32E+06	1.15E-02	3.07E-02	6.30E-06	4.86E-01	2.04E-03	2.04E-04	1.11E-05	5.68E-09
Deep GW									
BTEX									
Benzene	3.31E+02	5.55E-03	8.80E-02	9.80E-06	2.35E-01	5.86E-03	5.86E-04	3.18E-05	7.87E-09
PHCs									
PHC F2									
Aliphatic C>10-C12	5.02E+05	2.94E+00	5.00E-02	6.00E-06	1.24E+02	3.33E-03	3.31E-04	1.81E-05	2.36E-06
Aliphatic C>12-C16	1.00E+07	1.27E+01	5.00E-02	6.00E-06	5.38E+02	3.33E-03	3.31E-04	1.81E-05	1.02E-05
Aromatic C>10-C12	5.02E+03	3.43E-03	5.00E-02	6.00E-06	1.45E-01	3.33E-03	3.34E-04	1.81E-05	2.76E-09
Aromatic C>12-C16	1.00E+04	1.30E-03	5.00E-02	6.00E-06	5.48E-02	3.33E-03	3.38E-04	1.82E-05	1.05E-09
VOCs									
Trichloroethylene	1.35E+02	9.86E-03	7.90E-02	9.10E-06	4.17E-01	5.26E-03	5.25E-04	2.86E-05	1.25E-08
Vinyl Chloride	4.75E+01	2.79E-02	1.06E-01	1.23E-06	1.18E+00	7.06E-03	7.02E-04	3.83E-05	4.75E-08
PAHs									
Acenaphthene	1.22E+04	1.82E-04	4.21E-02	7.69E-06	7.70E-03	2.81E-03	3.45E-04	1.67E-05	1.35E-10
Naphthalene	3.67E+03	4.40E-04	5.90E-02	7.50E-06	1.86E-02	3.93E-03	4.18E-04	2.20E-05	4.30E-10

Parameter	Description	Units	Value	Equations	Reference
VFgw.amb	Volatization factor from groundwater to ambient air	unitless	calculated	VFgw.amb = (1/[(1 + ((DFamb x Lgw x 100 cm/m)/Deff-ws)) x (1/Heff)])	ASTM E2081-00 (2004)
Deff.vad	Effective vadose zone diffusion coefficient	(cm^2/s)	calculated	Deff.vad = [Da x (θa^3.33/θt^2)] + [Dw x (1/Heff) x (θw^3.33/θt^2)]	ASTM E2081-00 (2004)
Deff.cap	Effective capillary fringe zone diffusion coefficient	(cm^2/s)	calculated	Deff.cap = [Da x (θa^3.33/θt^2)] + [Dw x (1/Heff) x (θw^3.33/θt^2)]	ASTM E2081-00 (2004)
Deff.ws	Effective averaged water table to surface diffusion coefficient	(cm^2/s)	calculated	Deff.ws = Lgw/((((hv-hcap)x100 cm/m)/Deff.vad)+((hcap x 100 cm/m)/Deff.cap))	ASTM E2081-00 (2004)
Heff	Effective Henry's Law Constant	unitless	calculated	Heff = (H1/(R x (T + 273.15))) x 1000	ASTM E2081-00 (2004)
T	Ambient Temperature	(C)	15		MOE (2011b)
R	Ideal Gas Constant	($atm\text{-}m^3$/mol)	0.08206		MOE (2011b)
CF	Conversion Factor	(L/m^3)	1000		
CF	K at 0 degrees C	(K) at 0 degrees C	273.15		
θw	Volumetric Water Content in Vadose Zone Soil	(cm^3-H_2O/g-soil)	0.12		MOE (2011b)
θa	Volumetric Air Content in Vadose Zone Soil	(cm^3-air/g-soil)	0.24		MOE (2011b)
θw	Volumetric Water Content in Caplillary Fringe Soil	(cm^3-H_2O/g-soil)	0.24		MOE (2011b)
θa	Volumetric Air Content in Capillary Fringe Soil	(cm^3-air/g-soil)	0.12		MOE (2011b)
θt	Total Soil Porosity	(cm^3/cm^3-soil)	0.36		MOE (2011b)
LS	Length of Longest Side of Contaminated Area	(m)	200		Site specific
LS	Length of Longest Side of Contaminated Area	(cm)	20000		Site specific
DFamb	Ambient Air Dispersion Factor	(cm/s)	4.69E+00	DFamb = (V x LS x x DH)/A	ASTM E2081-00 (2004)
V	Wind Speed in Breathing Zone	(m/sec)	4.1		MOE (2011b)
V	Wind Speed in Breathing Zone	(cm/sec)	410		MOE (2011b)
DH	Diffusion Height or Box Model Mixing Height in trench or breathing zone for outdoor air	(m)	1.5		MOE (2011b)
DH	Diffusion Height or Box Model Mixing Height	(cm)	150		MOE (2011b)
A	Area of Contamination	(m^2)	2.63E+08	area of the RA property	Site specific
C1	Conversion Factor	(cm/m)	100		
hv	Observed Depth to Groundwater	(m)	2.2	the shallowest depth greater than 2 m bgs observed at the site	Site specific
hcap	Capillary Fringe Thickness	(m)	0.170454545	hcap = 0.15/2*mean grain diameter (0.044 for sand)	MOE (2011b)
htrench	Trench depth	(m)	2	Lgw = hv-hcap-htrench	MOE (2011b)
Lgw	Depth to Groundwater	(m)	2.029545455		Site specific
	Air Exchange Rate	hr^{-1}	5		MOE (2011b)

Table A-15: **Shallow Groundwater Dermal Contact Exposure Pathway - COC Absorption Calculation (Subsurface Worker)**

COC	Groundwater Concentration (C_w) (µg/L)	Groundwater Concentration (C_w) (mg/L)	Groundwater Concentration (C_w) (mg/cm^3)	Molecular Weight (g/mol)	Log Kow	Fraction Absorbed (FA) (unitless)	Dermal Permeability Coefficient (K_p) (cm/hr)	Time to Reach Steady State (t*) (hrs)	t* When B>0.6	Flynn Dataset Correlation Coeficient (b)	Flynn Dataset Correlation Coeficient (c)	Lag time Per Event (τ_{event}) (hr/event)	Effective Diffusivity of Chemical Transfer Through Skin (Dsc) (cm^2/hr)	Ratio of Permeabilty in Strateum Corneum to Viable Epidermis (B) (unitless)	Non-Steady State Dermal Absorbed Dose Per Event (DA_{event}) (mg/cm^2-event)	Steady State Dermal Absorbed Dose Per Event (DA_{event}) (mg/cm^2-event)	Effective Predictive Domain Boundary 1	Effective Predictive Domain Boundary 2	Is COC Outside EPD for Dermal Transfer Modelling?	Applicable DA_{event} Modelling Method	Applicable DA_{event} for Modelling
BTEX																					
Benzene	20520	20.52	2.05E-02	7.81E+01	2.13E+00	1.00E+00	1.47E-02	1.11E+00	1.11E+00	1.34E+00	1.15E+00	2.87E-01	5.79E-07	9.77E-01	6.34E-04	3.46E-04	1.59E-01	7.98E-02	No	Steady State	3.46E-04
Toluene	5160	5.16	5.16E-03	9.21E+01	2.73E+00	1.00E+00	3.06E-02	1.35E+00	1.35E+00	1.87E+00	1.42E+00	3.44E-01	4.83E-07	1.27E+00	3.62E-04	2.28E-04	2.00E-01	1.06E-01	No	Steady State	2.28E-04
Ethylbenzene	605	0.605	6.05E-04	1.06E+02	3.15E+00	1.00E+00	4.84E-02	1.66E+00	1.66E+00	2.66E+00	1.76E+00	4.13E-01	4.03E-07	1.64E+00	7.35E-05	5.30E-05	2.31E-01	1.23E-01	No	Steady State	5.30E-05
Xylene Mixture	2352	2.352	2.35E-03	1.06E+02	3.12E+00	1.00E+00	4.62E-02	1.66E+00	1.66E+00	2.66E+00	1.76E+00	4.13E-01	4.03E-07	1.64E+00	2.73E-04	1.97E-04	2.29E-01	1.21E-01	No	Steady State	1.97E-04
PHCs																					
PHC F1	4320	4.32	4.32E-03																		
Aliphatic C6-C8	3.68E+03	3.68496	3.68E-03	1.00E+02	3.60E+00	1.00E+00	1.04E-01	1.51E+00	1.51E+00	2.27E+00	1.60E+00	3.81E-01	4.37E-07	1.47E+00	9.23E-04	6.27E-04	2.53E-01	1.51E-01	No	Steady State	6.27E-04
Aliphatic C>8-C10	6.13E+02	0.61344	6.13E-04	1.30E+02	4.50E+00	1.00E+00	2.77E-01	2.34E+00	2.34E+00	5.07E+00	2.56E+00	5.61E-01	2.96E-07	2.46E+00	4.97E-04	4.50E-04	3.19E-01	1.86E-01	Yes	Non-Steady State-Qualified	4.97E-04
Aromatic C>8-C10	1.73E+01	0.01728	1.73E-05	1.20E+02	3.20E+00	1.00E+00	4.37E-02	2.02E+00	2.02E+00	3.85E+00	2.19E+00	4.93E-01	3.37E-07	2.08E+00	2.07E-06	1.71E-06	2.41E-01	1.18E-01	No	Non-Steady State	2.07E-06
PHC F2	40680	40.68	4.07E-02																		
Aliphatic C>10-C12	31201.56	31.20156	3.12E-02	1.60E+02	5.40E+00	1.00E+00	7.38E-01	3.58E+00	3.58E+00	1.20E+01	4.09E+00	8.26E-01	2.01E-07	4.02E+00	8.18E-02	9.67E-02	3.85E-01	2.22E-01	Yes	Non-Steady State-Qualified	8.18E-02
Aliphatic C>12-C16	8380.08	8.38008	8.38E-03	2.00E+02	6.70E+00	1.00E+00	3.18E+00	6.21E+00	6.21E+00	3.87E+01	7.57E+00	1.38E+00	1.20E-07	7.53E+00	1.22E-01	2.01E-01	4.78E-01	2.74E-01	Yes	Non-Steady State-Qualified	1.22E-01
Aromatic C>10-C12	894.96	0.89496	8.95E-04	1.30E+02	3.40E+00	1.00E+00	5.20E-02	2.34E+00	2.34E+00	5.07E+00	2.56E+00	5.61E-01	2.96E-07	2.46E+00	1.36E-04	1.23E-04	2.57E-01	1.25E-01	No	Non-Steady State	1.36E-04
Aromatic C>12-C16	203.4	0.2034	2.03E-04	1.50E+02	3.70E+00	1.00E+00	6.34E-02	3.11E+00	3.11E+00	8.95E+00	3.50E+00	7.26E-01	2.29E-07	3.42E+00	4.30E-05	4.66E-05	2.84E-01	1.31E-01	No	Non-Steady State	4.30E-05
PHC F3	2760	2.76	2.76E-03																		
Aliphatic C>16-C21	1545.6	1.5456	1.55E-03	2.70E+02	8.80E+00	1.00E+00	3.13E+01	1.58E+01	1.58E+01	3.03E+02	2.16E+01	3.41E+00	4.88E-08	2.16E+01	3.50E-01	9.56E-01	6.32E-01	3.56E-01	Yes	Non-Steady State-Qualified	3.50E-01
Aliphatic C>21-C34	662.4	0.6624	6.62E-04	4.00E+02	0.00E+00	1.00E+00	9.12E-06	8.59E+01	8.59E+01	1.26E+04	1.40E+02	1.82E+01	9.12E-09	1.40E+02	1.01E-07	6.58E-07	2.04E-01	-2.04E-01	No	Non-Steady State	1.01E-07
Aromatic C>16-C21	386.4	0.3864	3.86E-04	1.80E+02	4.20E+00	1.00E+00	9.20E-02	4.72E+00	4.72E+00	2.15E+01	5.57E+00	1.07E+00	1.56E-07	5.52E+00	1.44E-04	2.01E-04	3.28E-01	1.44E-01	No	Non-Steady State	1.44E-04
Aromatic C>21-C34	165.6	0.1656	1.66E-04	2.50E+02	5.10E+00	1.00E+00	1.47E-01	1.21E+01	1.21E+01	1.69E+02	1.61E+01	2.64E+00	6.31E-08	1.60E+01	1.54E-04	3.66E-04	4.14E-01	1.59E-01	No	Non-Steady State	1.54E-04
PHC F4	1200	1.2	1.20E-03																		
Aliphatic C>34	960	0.96	9.60E-04	5.00E+02	0.00E+00	1.00E+00	2.51E-06	3.12E+02	3.12E+02	2.07E+05	5.70E+02	6.63E+01	2.51E-09	5.70E+02	7.67E-08	9.57E-07	2.55E-01	-2.55E-01	No	Non-Steady State	7.67E-08
Aromatic C>34	240	0.24	2.40E-04	4.00E+02	0.00E+00	1.00E+00	9.12E-06	8.59E+01	8.59E+01	1.26E+04	1.40E+02	1.82E+01	9.12E-09	1.40E+02	3.66E-08	2.38E-07	2.04E-01	-2.04E-01	No	Non-Steady State	3.66E-08
VOCs																					
Styrene	216	0.216	2.16E-04	1.04E+02	2.95E+00	1.00E+00	3.66E-02	1.61E+00	1.61E+00	2.53E+00	1.71E+00	4.02E-01	4.14E-07	1.58E+00	1.96E-05	1.39E-05	2.19E-01	1.13E-01	No	Steady State	1.39E-05
Trichloroethylene	21.12	0.02112	2.11E-05	1.31E+02	2.42E+00	1.00E+00	1.15E-02	2.38E+00	2.38E+00	5.27E+00	2.61E+00	5.71E-01	2.91E-07	2.52E+00	7.19E-07	6.59E-07	2.03E-01	6.89E-02	No	Non-Steady State	7.19E-07
Vinyl Chloride	2.6	0.0026	2.60E-06	6.25E+01	1.62E+00	1.00E+00	8.30E-03	9.12E-01	9.12E-01	9.63E-01	9.09E-01	2.35E-01	7.08E-07	7.15E-01	4.09E-08	1.91E-08	1.23E-01	5.91E-02	No	Steady State	1.91E-08
PAHs																					
Acenaphthene	775.2	0.7752	7.75E-04	1.54E+02	3.92E+00	1.00E+00	8.39E-02	3.30E+00	3.30E+00	1.01E+01	3.73E+00	7.67E-01	2.17E-07	3.66E+00	2.23E-04	2.50E-04	2.99E-01	1.41E-01	No	Non-Steady State	2.23E-04
Acenaphthylene	73.44	0.07344	7.34E-05	1.52E+02	3.94E+00	1.00E+00	8.87E-02	3.20E+00	3.20E+00	9.54E+00	3.62E+00	7.47E-01	2.23E-07	3.55E+00	2.20E-05	2.43E-05	2.99E-01	1.44E-01	No	Non-Steady State	2.20E-05
Benzo[a]pyrene	0.91	0.00091	9.10E-07	2.52E+02	6.13E+00	1.00E+00	6.80E-01	1.25E+01	1.25E+01	1.81E+02	1.66E+01	2.72E+00	6.12E-08	1.66E+01	3.99E-06	9.63E-06	4.73E-01	2.16E-01	Yes	Non-Steady State-Qualified	3.99E-06
Benzo[b]fluoranthene	1.68	0.00168	1.68E-06	2.52E+02	5.78E+00	1.00E+00	4.00E-01	1.25E+01	1.25E+01	1.81E+02	1.66E+01	2.72E+00	6.12E-08	1.66E+01	4.33E-06	1.04E-05	4.53E-01	1.96E-01	Yes	Non-Steady State-Qualified	4.33E-06
Benzo[k]fluoranthene	0.64	0.00064	6.40E-07	2.52E+02	6.11E+00	1.00E+00	6.60E-01	1.25E+01	1.25E+01	1.81E+02	1.66E+01	2.72E+00	6.12E-08	1.66E+01	2.72E-06	6.57E-06	4.72E-01	2.14E-01	Yes	Non-Steady State-Qualified	2.72E-06
Chrysene	1.15	0.00115	1.15E-06	2.28E+02	5.81E+00	1.00E+00	5.70E-01	9.09E+00	9.09E+00	8.92E+01	1.16E+01	1.99E+00	8.35E-08	1.16E+01	3.62E-06	7.34E-06	4.43E-01	2.10E-01	Yes	Non-Steady State-Qualified	3.62E-06
Fluorene	301.2	0.3012	3.01E-04	1.66E+02	4.18E+00	1.00E+00	1.07E-01	3.90E+00	3.90E+00	1.43E+01	4.50E+00	8.95E-01	1.86E-07	4.44E+00	1.19E-04	1.48E-04	3.20E-01	1.50E-01	No	Non-Steady State	1.19E-04
Indeno[1 2 3-cd]pyrene	0.56	0.00056	5.60E-07	2.76E+02	6.70E+00	6.00E-01	1.19E+00	1.72E+01	1.72E+01	3.64E+02	2.37E+01	3.70E+00	4.49E-08	2.37E+01	5.00E-06	8.57E-06	5.17E-01	2.35E-01	Yes	Non-Steady State-Qualified	5.00E-06
Naphthalene	27480	27.48	2.75E-02	1.28E+02	3.30E+00	1.00E+00	4.57E-02	2.28E+00	2.28E+00	4.82E+00	2.49E+00	5.48E-01	3.04E-07	2.39E+00	3.64E-03	3.24E-03	2.51E-01	1.20E-01	No	Non-Steady State	3.64E-03
Metals & Inorganics																					
Mercury	12	0.012	1.20E-05	2.01E+02	6.20E-01	1.00E+00	1.00E-03	6.26E+00	6.26E+00	3.94E+01	7.64E+00	1.39E+00	1.19E-07	7.60E+00	2.40E-08	9.11E-08	1.37E-01	-6.75E-02	No	Non-Steady State	2.40E-08

$$DA_{event} = 2 \times FA \times K_p \times C_w \sqrt{\frac{6 \times \tau_{event} \times t_{event}}{\pi}}$$

$$DA_{event} = K_P \times C_w \times t_{event}$$

$$DA = FA \times K_p \times C_{GW} \left[\frac{t_{event}}{1+B} + 2\tau_{event} \left(\frac{1+3B+3B^2}{(1+B)^2} \right) \right]$$

Description	Value	Unit	Formula	Reference
Dermal absorbed dose per event (organics)	Calculated	mg/cm^2- event	see above	Page A-32, Equation 3.2, US EPA, 2004
Dermal absorbed dose per event (inorganics)	Calculated	mg/cm^2- event	see above	Page A-16, Equation 3.4, US EPA, 2004
Fraction absorbed	1	unitless	Constant	MOE, 2011
Dermal permeability coefficient of compound in water	Calculated and /or chemical specific	cm/hr	$K_p = 10^{(-2.8 + 0.66 \times \log Kow - 0.0056 \times MW)}$	page A-2, Equation 3.8, US EPA, 2004; Dermal permeability coefficients: Values for metals and inorganics are obtained from Appendix B of US EPA (2004).
Chemical concentration in water	Site specific	mg/cm^3		
Lag time per event	Calculated	hr/event	$\tau event = l^2sc / 6Dsc = 0.105 \times 10^{(0.0056 \times MW)}$	(page A-33, Equation A.4, US EPA, 2004.)
Event duration for all receptors	2	hr/event	Professional judgement	Site specific
pi	3.14		Constant	
Log of the octanol-water partition coefficient	chemical specific	unitless		MOE (2011b)
Molecular weight.	chemical specific	g/mole		MOE (2011b)
Apparent thickness of stratum corneum	0.001	cm		Default value, USEPA (2004)
Apparent thickness of stratum corneum (0.001cm)				Default value, USEPA (2004)
-2.8 -0.0056MW				USEPA (2004)
Effective diffusion coefficient for chemical transfer through the stratum corneum (cm2/hr) - chemical specific				Equation A.3 (EPA 2004).
Ratio of permeability coefficient through stratum corneum relative to across the viable epidermis (unitless) B= K_p x (MW^0.5)/2.6				US EPA, 2004 Eqation A.1, based on Bunge and Cleek 1995.
Calculated using either equation A.5 or A.6 (EPA 1998). Which equation is used depends on how large B is. B value greater than 0.6 means a lipophilic compound; chemical moves quickly through stratum corneum and limiting layer is viable epidermis. Low B value (< or = 0.6) means chemical has low permeability in stratum corneum and that layer is controlling.				
				Equation A.7 in EPA 2004
				Equation A.7 in EPA 2004
				Equation A.6 in EPA 2004

US EPA (2004)"Risk Assessment Guidance for Superfund Volume I - Human Health Effects Evaluation Manual" (Part E: Supplemental Guidance for Dermal Risk Assessment), Office of Superfund Remediation and Technology Innovation, United States Environmental Protection Agency, July 2004. Equation 3.3 of US EPA (2004)

Table A-16: **Shallow Groundwater Ingestion and Dermal Contact Exposure Concentrations (GW1 - Subsurface Worker)**

COC	Exposure Point Concentration (C_w) (µg/L)	Dermal Absorbed Dose Per Event (DAevent) (mg/cm^2-event)	Applicable DA_{event} Modelling Method	Ingestion Relative Absorption Factor (RAF_{oral}) (unitless)	Dermal Contact with Groundwater			Incidental Groundwater Ingestion			COC Considered Developmental Toxicant (Oral)?
					NCGWDC	CGWDC	$NCGWDC_D$	NCDWEF	CDWEF	$NCDWEF_D$	
					Non-Carcinogenic (mg/kg$_{BW}$/day)	Carcinogenic (mg/kg$_{BW}$/day)	Developmental (mg/kg$_{BW}$/day)	Non-Carcinogenic (mg/kg$_{BW}$/day)	Carcinogenic (mg/kg$_{BW}$/day)	Developmental (mg/kg$_{BW}$/day)	
BTEX											
Benzene	2.05E+04	3.46E-04	Steady State	1.00E+00	1.03E-02	2.75E-04	NC	8.95E-03	2.40E-04	NC	No
Toluene	5.16E+03	2.28E-04	Steady State	1.00E+00	6.75E-03	1.81E-04	NC	2.25E-03	6.03E-05	NC	No
Ethylbenzene	6.05E+02	5.30E-05	Steady State	1.00E+00	1.57E-03	4.21E-05	NC	2.64E-04	7.06E-06	NC	No
Xylene Mixture	2.35E+03	1.97E-04	Steady State	1.00E+00	5.84E-03	1.56E-04	NC	1.03E-03	2.75E-05	NC	No
PHCs											
PHC F1	4320										
Aliphatic C6-C8	3.68E+03	6.27E-04	Steady State	1.00E+00	1.86E-02	4.98E-04	NC	1.61E-03	4.30E-05	NC	No
Aliphatic C>8-C10	6.13E+02	4.97E-04	Non-Steady State-Qualified	1.00E+00	1.47E-02	3.95E-04	NC	2.67E-04	7.16E-06	NC	No
Aromatic C>8-C10	1.73E+01	2.07E-06	Non-Steady State	1.00E+00	6.14E-05	1.64E-06	NC	7.53E-06	2.02E-07	NC	No
PHC F2	40680										
Aliphatic C>10-C12	3.12E+04	8.18E-02	Non-Steady State-Qualified	1.00E+00	2.43E+00	6.50E-02	NC	1.36E-02	3.64E-04	NC	No
Aliphatic C>12-C16	8.38E+03	1.22E-01	Non-Steady State-Qualified	1.00E+00	3.63E+00	9.72E-02	NC	3.65E-03	9.79E-05	NC	No
Aromatic C>10-C12	8.95E+02	1.36E-04	Non-Steady State	1.00E+00	4.04E-03	1.08E-04	NC	3.90E-04	1.05E-05	NC	No
Aromatic C>12-C16	2.03E+02	4.30E-05	Non-Steady State	1.00E+00	1.27E-03	3.41E-05	NC	8.87E-05	2.38E-06	NC	No
PHC F3	2760										
Aliphatic C>16-C21	1.55E+03	3.50E-01	Non-Steady State-Qualified	1.00E+00	1.04E+01	2.78E-01	NC	6.74E-04	1.80E-05	NC	No
Aliphatic C>21-C34	6.62E+02	1.01E-07	Non-Steady State	1.00E+00	2.99E-06	8.01E-08	NC	2.89E-04	7.74E-06	NC	No
Aromatic C>16-C21	3.86E+02	1.44E-04	Non-Steady State	1.00E+00	4.26E-03	1.14E-04	NC	1.68E-04	4.51E-06	NC	No
Aromatic C>21-C34	1.66E+02	1.54E-04	Non-Steady State	1.00E+00	4.57E-03	1.22E-04	NC	7.22E-05	1.93E-06	NC	No
PHC F4	1200										
Aliphatic C>34	9.60E+02	7.67E-08	Non-Steady State	1.00E+00	2.27E-06	6.09E-08	NC	4.19E-04	1.12E-05	NC	No
Aromatic C>34	2.40E+02	3.66E-08	Non-Steady State	1.00E+00	1.08E-06	2.90E-08	NC	1.05E-04	2.80E-06	NC	No
VOCs											
Styrene	2.16E+02	1.39E-05	Steady State	1.00E+00	4.11E-04	1.10E-05	NC	9.42E-05	2.52E-06	NC	No
Trichloroethylene	2.11E+01	7.19E-07	Non-Steady State	1.00E+00	2.13E-05	5.71E-07	3.51E-05	9.21E-06	2.47E-07	1.67E-05	Yes
Vinyl Chloride	2.60E+00	1.91E-08	Steady State	1.00E+00	5.66E-07	1.52E-08	NC	1.13E-06	3.04E-08	NC	No
PAHs											
Acenaphthene	7.75E+02	2.23E-04	Non-Steady State	1.00E+00	6.60E-03	1.77E-04	NC	3.38E-04	9.05E-06	NC	No
Acenaphthylene	7.34E+01	2.20E-05	Non-Steady State	1.00E+00	6.53E-04	1.75E-05	NC	3.20E-05	8.58E-07	NC	No
Benzo[a]pyrene	9.10E-01	3.99E-06	Non-Steady State-Qualified	1.00E+00	1.18E-04	3.17E-06	NC	3.97E-07	1.06E-08	NC	No
Benzo[b]fluoranthene	1.68E+00	4.33E-06	Non-Steady State-Qualified	1.00E+00	1.28E-04	3.44E-06	NC	7.32E-07	1.96E-08	NC	No
Benzo[k]fluoranthene	6.40E-01	2.72E-06	Non-Steady State-Qualified	1.00E+00	8.07E-05	2.16E-06	NC	2.79E-07	7.47E-09	NC	No
Chrysene	1.15E+00	3.62E-06	Non-Steady State-Qualified	1.00E+00	1.07E-04	2.88E-06	NC	5.01E-07	1.34E-08	NC	No
Fluorene	3.01E+02	1.19E-04	Non-Steady State	1.00E+00	3.52E-03	9.44E-05	NC	1.31E-04	3.52E-06	NC	No
Indeno[1 2 3-cd]pyrene	5.60E-01	5.00E-06	Non-Steady State-Qualified	1.00E+00	1.48E-04	3.97E-06	NC	2.44E-07	6.54E-09	NC	No
Naphthalene	2.75E+04	3.64E-03	Non-Steady State	1.00E+00	1.08E-01	2.89E-03	NC	1.20E-02	3.21E-04	NC	No
Metals & Inorganics											
Mercury	1.20E+01	2.40E-08	Non-Steady State	1.00E+00	7.11E-07	1.91E-08	NC	5.23E-06	1.40E-07	NC	No

Formula:
NCGWDC = Non-Carcinogenic Groundwater Dermal Contact Exposure Concentration (Dose)
NCGWDC = (DA_{event} x SSA x EF_{event} x EF_b x EF_c x ED)/(BW x AP_{NC}xC)
CGWDC = Carcinogenic Groundwater Dermal Contact Exposure Concentration (Dose)
CGWDC = (DA_{event} x SSA x EF_{event} x EF_b x EF_c x ED)/(BW x AP_CXC)
$NCGWDC_D$ = Non-Carcinogenic Groundwater Dermal Contact Exposure for Developmental Toxicants
$NCGWDC_D$ = (DA_{event} x SSA x EF_{event} x EF_b x EF_c x ED)/(BW x AP_{NC} XC)
NCDWEF = Non-Carcinogenic Drinking Water Exposure Factor (Dose)
NCDWEF = (C_{GW} x DW_{IR} x RAF_{oral} x EF_b x EF_c x ED x 0.001mg/µg)/(BW x AP_{NC}XC)
CDWEF = Carcinogenic Drinking Water Exposure Factor (Dose)
CDWEF = (C_{GW} x DW_{IR} x RAF_{oral} x EF_b x EF_c x Edx 0.001mg/µg)/(BW x AP_C XC)
$NCDWEF_D$ = Non-Carcinogenic Drinking Water Exposure Factor for Developmental Toxicants (Dose)
$NCDWEF_D$ = (C_{GW} x DW_{IR} x RAF_{oral} x EF_b x EF_c x ED x 0.001mg/µg)/(BW x AP_{NC} XC)

Parameter	Description	Value	Units	Formula	Reference
NCGWDC	Non-Carcinogenic Groundwater Dermal Contact Exposure Concentration (Dose)	Calculated	mg/kg$_{BW}$/day	see above	US EPA, 2004
CGWDC	Carinogenic Groundwater Dermal Contact Exposure Concentration (Dose)	Calculated	mg/kg$_{BW}$/day	see above	US EPA, 2005
$NCGWDC_D$	Non-Carcinogenic Groundwater Dermal Contact Exposure for Developmental Toxicans	Calculated	mg/kg$_{BW}$/day	see above	US EPA, 2006
NCDWEF	Non-Carcinogenic Drinking Water Exposure Factor (Dose)	Calculated	mg/kg$_{BW}$/day	see above	MOE (2011b)
CDWEF	Carcinogenic Drinking Water Exposure Factor (Dose)	Calculated	mg/kg$_{BW}$/day	see above	MOE (2011b)
$NCDWEF_D$	Non-Carcinogenic Drinking Water Exposure Factor for Developmental Toxicans (Dose)	Calculated	mg/kg$_{BW}$/day	see above	MOE (2011b)
C_{GW}	Groundwater COC concentration	Site Specific	µg/L		
DW_{IR}	Incidental Groundwater intake rate	0.05	L/d		US EPA, 1989a
RAF_{oral}	Relative Oral Absorption Factor, from water	Chemical specific	Unitless		MOE (2011b)
DA_{event}	Dermal absorb dose per event	Calculated	mg/cm^2-event	Table A-16	US EPA, 2004
SSA	Average Skin Surface Area (head, hands & forearms)	3400	cm^2		MOE (2011b)
SSA	Average Skin Surface Area (head, hands & forearms)	3090	cm^2		MOE (2011b) - Applicable to developmental toxicants
EF_{event}	Event frequency for dermal contact	1	events/day		Professional Judgement
ED	Exposure duration	1.5	years		MOE (2011b)
EF_b	Exposure frequency	5	days/week		MOE (2011b)
EF_b	Exposure frequency	7	days/week		MOE (2011b) - Applicable to developmental toxicants
EF_c	Exposure frequency	45	weeks/year		MOE (2011b)
EF_c	Exposure frequency	52	weeks/year		MOE (2011b) - Applicable to developmental toxicants
AP_C	Averaging time for carcinogenic exposure	56	years		MOE (2011b) - adult worker - carcinogenic
AP_{NC}	Averaging time for non-carcinogenic exposure	1.5	years		MOE (2011b) - adult worker
BW	Body weight	70.7	kg		MOE (2011b) - adult
BW	Body weight	63.1	kg		MOE (2011b) - female
C	Conversion Factor	365	days/year		
NC	Not Calculated				

Table A-17: **Human Health Toxicity Reference Values**

CHEMICAL NAME	CAS RN (Chemical Abstracts Service Registry Number)	Oral Chronic TRV (mg/kg-day)	Ref.	Is the oral chronic non-cancer TRV based on reproductive or developmental effects?	Oral Sub-chronic TRV (mg/kg-day)	Ref.	Inhalation Chronic TRV (mg/m3)	Ref.	Is the inhalation chronic non-cancer TRV based on reproductive or developmental effects?	Oral Slope Factor (mg/kg-day)-1	Ref.	Inhalation Unit Risk (mg/m3)-1	Ref.	subchronic inhal TRV (mg/m3)	Ref.
Dibenz[a h]anthracene	53703		none selected			none selected		none selected		7.30E+00	Kalberlah et al 1995 (TEF=1) & IRIS 1992	1.10E+00	Kalberlah et al 1995 (TEF=1) & CalEPA ATH 2005/1993		
Ethylbenzene	100414	1.00E-01	IRIS 1991; RIVM 2001; WHO DW 2003			none selected	1.00E+00	IRIS 1991			none selected		none selected	1.00E+00	IRIS 1991 ch NC. Chronic TRV is based on developmental effects, thus SDF should not be applied.
Ethylene dibromide	106934	9.00E-03	IRIS 2004		2.5E-02	modified from CalEPA DW 2003	8.00E-04	CalEPA ChREL 2001		3.60E+00	CalEPA DW 2003	6.00E-01	IRIS 2004		
Fluoranthene	206440	4.00E-02	IRIS 1993		4.0E-01	modified from IRIS 1993		none selected		7.30E-02	Kalberlah et al 1995 (TEF=0.01) & IRIS 1992	1.10E-02	Kalberlah et al 1995 (TEF=0.01) & CalEPA ATH 2005/1993		
Fluorene	86737	4.00E-02	IRIS 1990		4.0E-01	modified from IRIS 1990		none selected			Kalberlah et al 1995 (TEF=0) & IRIS 1992		Kalberlah et al 1995 (TEF=0) & CalEPA ATH 2005/1993		
Hexane (n)	11053		none selected			none selected	2.50E+00	MOE 24-h AAQC 2005			none selected		none selected		
Indeno[1 2 3-cd]pyrene	193395		none selected			none selected		none selected		7.30E-01	Kalberlah et al 1995 (TEF=0.1) & IRIS 1992	1.10E-01	Kalberlah et al 1995 (TEF=0.1) & CalEPA ATH 2005/1993		
Lead	7439921	1.30E-03	SNC-Lavalin, 2012			none selected		none selected			none selected		none selected		
Mercury	7439976	3.00E-04	IRIS 1995		3.0E-03	modified from IRIS 1995	9.00E-05	CalEPA ChREL 2000			none selected		none selected		no subchronic inhalation TRV available
Methlynaphthalene, 2-(1-) ***	91576	4.00E-03	IRIS 2003			none selected		none selected			Kalberlah et al 1995 (no TEF) & IRIS 1992		Kalberlah et al 1995 (no TEF) & CalEPA ATH 2005/1993		
Molybdenum	7439987	5.00E-03	IRIS 1993			none selected	1.20E-02	RIVM 2001			none selected		none selected		
Naphthalene	91203	2.00E-02	IRIS 1998		2.0E-01	modified from IRIS 1998	3.70E-03	ATSDR 2005			Kalberlah et al 1995 (no TEF) & IRIS 1992		Kalberlah et al 1995 (no TEF) & CalEPA ATH 2005/1993		
Nickel	7440020	2.00E-02	IRIS 1996			none selected	6.00E-05	modified from TERA 1999			none selected	2.40E-01	IRIS 1991		
Petroleum Hydrocarbons F1****	PHCF1														
Aliphatic C6-C8	PHCAL0608	5.00E+00	TPHCWG 1997; CCME 2000			none selected	1.84E+01	TPHCWG 1997; CCME 2000			none selected		none selected		
Aliphatic C>8-C10	PHCAL0810	1.00E-01	TPHCWG 1997; CCME 2000		1	modified from TPHCWG 1997 & CCME 2000.	1.00E+00	TPHCWG 1997; CCME 2000			none selected		none selected		
Aromatic C>8-C10	PHCAR0810	4.00E-02	TPHCWG 1997; CCME 2000			none selected	2.00E-01	TPHCWG 1997; CCME 2000			none selected		none selected		
Petroleum Hydrocarbons F2	PHCF2														
Aliphatic C>10-C12	PHCAL1012	1.00E-01	TPHCWG 1997; CCME 2000		1	modified from TPHCWG 1997 & CCME 2000.	1.00E+00	TPHCWG 1997; CCME 2000			none selected		none selected		
Aliphatic C>12-C16	PHCAL1216	1.00E-01	TPHCWG 1997; CCME 2000		1	modified from TPHCWG 1997 & CCME 2000.	1.00E+00	TPHCWG 1997; CCME 2000			none selected		none selected		
Aromatic C>10-C12	PHCAR1012	4.00E-02	TPHCWG 1997; CCME 2000			none selected	2.00E-01	TPHCWG 1997; CCME 2000			none selected		none selected		

Table A-17: **Human Health Toxicity Reference Values**

CHEMICAL NAME	CAS RN (Chemical Abstracts Service Registry Number)	Oral Chronic TRV (mg/kg-day)	Ref.	Is the oral chronic non-cancer TRV based on reproductive or developmental effects?	Oral Sub-chronic TRV (mg/kg-day)	Ref.	Inhalation Chronic TRV (mg/m3)	Ref.	Is the inhalation chronic non-cancer TRV based on reproductive or developmental effects?	Oral Slope Factor (mg/kg-day)-1	Ref.	Inhalation Unit Risk (mg/m3)-1	Ref.	subchronic inhal TRV (mg/m3)	Ref.
Aromatic C>12-C16	PHCAR1216	4.00E-02	TPHCWG 1997; CCME 2000			none selected	2.00E-01	TPHCWG 1997; CCME 2000			none selected		none selected		
Petroleum Hydrocarbons F3	PHCF3														
Aliphatic C>16-C21	PHCAL1621	2.00E+00	TPHCWG 1997; CCME 2000			none selected		none selected			none selected		none selected		
Aliphatic C>21-C34	PHCAL2134	2.00E+00	TPHCWG 1997; CCME 2000			none selected		none selected			none selected		none selected		
Aromatic C>16-C21	PHCAR1621	3.00E-02	TPHCWG 1997; CCME 2000		0.3	modified from TPHCWG 1997 & CCME 2000.		none selected			none selected		none selected		
Aromatic C>21-C34	PHCAR2134	3.00E-02	TPHCWG 1997; CCME 2000		0.3	modified from TPHCWG 1997 & CCME 2000.		none selected			none selected		none selected		
Petroleum Hydrocarbons F4	PHCF4														
Aliphatic C>34	PHCAL3499	2.00E+01	TPHCWG 1997; CCME 2000			*none selected*		none selected			*none selected*		*none selected*		
Aromatic C>34	PHCAR3499	3.00E-02	TPHCWG 1997; CCME 2000		3.0E-01	*modified from TPHCWG 1997 & CCME 2000.*		none selected			*none selected*		*none selected*		
Phenanthrene	85018		none selected			none selected		none selected			Kalberlah et al 1995 (TEF=0) & IRIS 1992		Kalberlah et al 1995 (TEF=0) & CalEPA ATH 2005/1993		
Polychlorinated Biphenyls	1336363	2.00E-05	ATSDR 2000; WHO CICAD 2003		3.0E-05	ATSDR 2000	5.00E-04	RIVM 2001				1.00E-01	IRIS 1997		
Pyrene	129000	3.00E-02	IRIS 1993		3.0E-01	modified from IRIS 1993		none selected		7.30E-03	Kalberlah et al 1995 (TEF=0.001) & IRIS 1992	1.10E-03	Kalberlah et al 1995 (TEF=0.001) & CalEPA ATH 2005/1993		
Selenium	7782492	5.00E-03	IRIS 1991; CalEPA ChREL 2001			none selected		none selected			none selected		none selected		
Silver	7440224	5.00E-03	IRIS 1996			none selected		none selected			none selected		none selected		
Styrene	100425	1.20E-01	RIVM 2001; HC PSL1 1993; HC 1996			none selected	2.60E-01	modified from WHO Air 2000			none selected		none selected		
Thallium	7440280	1.35E-05	CalEPA DW 1999		1.4E-04	modified from CalEPA DW 1999		none selected			none selected		none selected		
Toluene	108883	8.00E-02	IRIS 2005		8.0E-01	modified from IRIS 2005	5.00E+00	IRIS 2005			none selected		none selected	5.00E+00	IRIS 2005 ch NC. Short-term & long-term effects are in same range (IRIS 2005), thus SDF should not be applied.
Trichloroethylene	79016	5.00E-04	USEPA IRIS 2011	D		none selected	2.00E-03	USEPA IRIS 2011	D	4.60E-02	USEPA IRIS 2011	4.10E-03	USEPA IRIS 2011		
Uranium	7440611	6.00E-04	HC DWQ 1999		0.0006	HC DWQ 1999	3.00E-04	ATSDR 1999			none selected		none selected		
Vanadium	7440622	2.10E-03	CalEPA DW 2000	D	2.1E-03	CalEPA DW 2000	1.00E-03	WHO Air 2000			none selected		none selected		
Vinyl Chloride	75014	3.00E-03	ATSDR 2006; IRIS 2000			none selected	1.00E-01	IRIS 2000		1.40E+00	IRIS 2000	8.80E-03	IRIS 2000		
Xylene Mixture	1330207	2.00E-01	IRIS 2003; ATSDR 2007		4.0E-01	ATSDR 2007	7.00E-01	CalEPA chREL 2005			none selected		none selected	2.60E+00	ATSDR int 2007
Zinc	7440666	3.00E-01	IRIS 2005			none selected		none selected			none selected		none selected		

Table A-18: Final Risk Calculations (HQs and ILCRs) for the Incidental Direct Contact with Soil (Park Visitor All Ages) Exposure Pathway (S1)

	COC	TRV Oral Reference Dose (mg/kg-d)	TRV Oral Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$	Hazard Quotient			Incremental Lifetime Cancer Risk			Risk-Based Concentrations (Non-Carcinogenic) (µg/g) RBC			Risk-Based Concentrations RBC (Carcinogenic) (µg/g)			Lowest RBC (µg/g)
				Dermal Contact	Incidental Ingestion	Sum of HQs by Pathway	Dermal Contact	Incidental Ingestion	Sum of ILCRs by Pathway	Dermal Contact	Incidental Ingestion	Sum of HQs by Pathway	Dermal Contact	Incidental Ingestion	Sum of ILCRs by Pathway	
	BTEX															
	Benzene	4.00E-03	8.50E-02	2.32E-02	4.42E-01	4.66E-01	2.43E-06	1.85E-05	2.09E-05	1.46E+03	7.65E+01	7.27E+01	6.95E+01	9.14E+00	8.08E+00	8.08E+00
	PHCs															
	PHC F2			3.13E-01	8.96E-01	1.21E+00				1.05E+04	3.68E+03	2.73E+03				2.73E+03
0.36	*Aliphatic C>10-C12*	1.00E-01	NV	8.66E-02	2.48E-01	3.35E-01	NC	NC	NC	1.37E+04	1.91E+03	1.42E+03	NC	NC	NC	NC
0.44	*Aliphatic C>12-C16*	1.00E-01	NV	1.06E-01	3.03E-01	4.09E-01	NC	NC	NC	5.48E+03	1.91E+03	1.42E+03	NC	NC	NC	NC
0.09	*Aromatic C>10-C12*	4.00E-02	NV	5.41E-02	1.55E-01	2.09E-01	NC	NC	NC	2.19E+03	7.65E+02	5.67E+02	NC	NC	NC	NC
0.11	*Aromatic C>12-C16*	4.00E-02	NV	6.61E-02	1.90E-01	2.56E-01	NC	NC	NC	2.19E+03	7.65E+02	5.67E+02	NC	NC	NC	NC
	PHC F3			3.50E-01	1.00E+00	1.35E+00				1.94E+04	6.76E+03	5.01E+03				5.01E+03
0.56	*Aliphatic C>16-C21*	2.00E+00	NV	1.39E-02	3.97E-02	5.36E-02	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
0.24	*Aliphatic C>21-C34*	2.00E+00	NV	5.94E-03	1.70E-02	2.30E-02	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
0.14	*Aromatic C>16-C21*	3.00E-02	NV	2.31E-01	6.62E-01	8.93E-01	NC	NC	NC	1.64E+03	5.74E+02	4.25E+02	NC	NC	NC	4.25E+02
0.06	*Aromatic C>21-C34*	3.00E-02	NV	9.90E-02	2.84E-01	3.83E-01	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	PHC F4			1.52E-01	4.35E-01	5.87E-01				2.04E+04	7.13E+03	5.28E+03				5.28E+03
0.8	*Aliphatic C>34*	2.00E+01	NV	9.06E-04	2.60E-03	3.50E-03	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
0.2	*Aromatic C>34*	3.00E-02	NV	1.51E-01	4.33E-01	5.84E-01	NC	NC	NC	1.64E+03	5.74E+02	4.25E+02	NC	NC	NC	4.25E+02
	PAHs															
	Acenaphthylene	6.00E-02	7.30E-02	4.75E-04	2.09E-03	2.57E-03	6.43E-07	1.13E-06	1.77E-06	5.06E+03	1.15E+03	9.35E+02	1.87E+01	1.06E+01	6.78E+00	6.78E+00
	Benz[a]anthracene	NV	7.30E-01	NC	NC	NC	5.59E-05	9.81E-05	1.54E-04	NC	NC	NC	1.87E+00	1.06E+00	6.78E-01	6.78E-01
	Benzo[a]pyrene	NV	7.30E+00	NC	NC	NC	4.11E-04	7.21E-04	1.13E-03	NC	NC	NC	1.87E-01	1.06E-01	6.78E-02	6.78E-02
	Benzo[b]fluoranthene	NV	7.30E-01	NC	NC	NC	4.82E-05	8.45E-05	1.33E-04	NC	NC	NC	1.87E+00	1.06E+00	6.78E-01	6.78E-01
	Benzo[ghi]perylene	NV	7.30E-02	NC	NC	NC	1.61E-06	2.82E-06	4.42E-06	NC	NC	NC	1.87E+01	1.06E+01	6.78E+00	6.78E+00
	Benzo[k]fluoranthene	NV	7.30E-01	NC	NC	NC	2.31E-05	4.06E-05	6.37E-05	NC	NC	NC	1.87E+00	1.06E+00	6.78E-01	6.78E-01
	Chrysene	NV	7.30E-02	NC	NC	NC	4.82E-06	8.45E-06	1.33E-05	NC	NC	NC	1.87E+01	1.06E+01	6.78E+00	6.78E+00
	Dibenz[a h]anthracene	NV	7.30E+00	NC	NC	NC	7.07E-05	1.24E-04	1.95E-04	NC	NC	NC	1.87E-01	1.06E-01	6.78E-02	6.78E-02
	Fluoranthene	4.00E-02	7.30E-02	1.92E-02	8.47E-02	1.04E-01	1.74E-05	3.04E-05	4.78E-05	3.37E+03	7.65E+02	6.23E+02	1.87E+01	1.06E+01	6.78E+00	6.78E+00
	Indeno[1 2 3-cd]pyrene	NV	7.30E-01	NC	NC	NC	1.86E-05	3.27E-05	5.13E-05	NC	NC	NC	1.87E+00	1.06E+00	6.78E-01	6.78E-01
	Methlynaphthalene, 2-(1-)	4.00E-03	NV	4.41E-02	1.95E-01	2.39E-01	NC	NC	NC	3.37E+02	7.65E+01	6.23E+01	NC	NC	NC	6.23E+01
	Pyrene	3.00E-02	7.30E-03	2.09E-02	9.21E-02	1.13E-01	1.41E-06	2.48E-06	3.89E-06	2.53E+03	5.74E+02	4.68E+02	1.87E+02	1.06E+02	6.78E+01	6.78E+01
	Metals & Inorganics															
	Antimony	4.00E-04	NV	2.88E-01	1.65E+00	1.94E+00	NC	NC	NC	4.38E+01	7.65E+00	6.51E+00	NC	NC	NC	6.51E+00
	Arsenic	3.00E-04	1.50E+00	9.42E-02	9.00E-01	9.94E-01	1.31E-05	4.98E-05	6.29E-05	1.10E+02	1.15E+01	1.04E+01	3.94E+00	1.04E+00	8.20E-01	8.20E-01
	Cadmium	3.20E-05	NV	3.14E-01	1.80E+01	1.83E+01	NC	NC	NC	3.51E+01	6.12E-01	6.01E-01	NC	NC	NC	6.01E-01
	Copper	3.00E-02	NV	3.24E-01	3.10E+00	3.42E+00	NC	NC	NC	5.48E+03	5.74E+02	5.19E+02	NC	NC	NC	5.19E+02
	Lead	1.30E-03	NV	1.50E+02	8.58E+01	2.35E+02	NC	NC	NC	6.57E+00	1.15E+01	4.18E+00	NC	NC	NC	4.18E+00
	Zinc	3.00E-01	NV	3.04E-01	1.74E+00	2.04E+00	NC	NC	NC	3.29E+04	5.74E+03	4.88E+03	NC	NC	NC	4.88E+03
	PCBs															
	Polychlorinated Biphenyls	2.00E-05	NV	2.45E-01	1.00E+00	1.25E+00	NC	NC	NC	1.57E+00	3.82E-01	3.07E-01	NC	NC	NC	3.07E-01

Formula:

Hazard quotients (HQ) or Incremental Lifetime cancer risks (ILCR) from average daily doses were calculated using the following equation:

HQ = ADSIR or ADDCR/ RfD_{oral}

ILCR = LADSIR or LADDCR x CSF_{oral}

RBC = C_S x 0.2 / HQ

RBC = C_S x 1E-06 / ILCR

RBC for PHCs = Sum of (subfractions RBC x mass fraction of each sub-fraction within fraction)

Parameter	Description	Unit	Value	Formula	Reference
HQ	Hazard quotient	unitless	Calculated	See above	MOE, 2011b
RfD_{oral}	Oral reference dose	mg/kg-d	chemical specific		MOE, 2011b
CSF_{oral}	Oral cancer slope factor	$(mg/kg\text{-}d)^{-1}$	chemical specific		MOE, 2011b
ILCR	Incremental lifetime cancer risk	unitless	Calculated	See above	MOE, 2011b
S1(L)ADSIR	(Lifetime) Average Daily Soil Ingestion Rate for S1	mg/kg-d	Calculated	Table A-1	MOE, 2011b
S1(L)ADDCR	(Lifetime) Average Daily Soil Dermal Contact Rate for S1	mg/kg-d	Calculated	Table A-1	MOE, 2011b
CRL	Lifetime cancer risk level	unitless	$1x10^{-5}$		MOE, 2011b
SAF(target HQ)	Source Allocation Factor (Target HQ)	unitless	0.2 (or 0.5 for PHCs)		MOE, 2011b
RBC_{Soil}	Risk-based concentrations	µg/g	Calculated	See above	
RfDoral	Oral reference dose for Lead - Toddler	mg/kg-d	6.00E-04		
NV	No Value				
NC	Not Calculated				
	Exceed CRL or SAF				

Table A-19: Final Risk Calculations (HQs and ILCRs)for the Incidental Direct Contact with Soil (Commercial-Long-Term Outdoor Worker) Exposure Pathway (S2)

COC	Oral Reference Dose (mg/kg-d)	Oral Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$	Hazard Quotient			Incremental Lifetime Cancer Risk			Risk-Based Concentrations (Non-Carcinogenic)			Risk-Based Concentrations (Carcinogenic)			Lowest RBC
			Dermal Contact	Incidental Ingestion	Sum of HQs by Pathway	Dermal Contact	Incidental Ingestion	Sum of ILCRs by Pathway	Dermal Contact	Incidental Ingestion	Sum of HQs by Pathway	Dermal Contact	Incidental Ingestion	Sum of ILCRs by Pathway	
BTEX															
Benzene	4.00E-03	8.50E-02	1.05E-02	5.16E-02	6.22E-02	3.58E-06	1.76E-05	2.11E-05	3.21E+03	6.55E+02	5.44E+02	4.72E+01	9.64E+00	8.00E+00	8.00E+00
PAHs															
Acenaphthylene	6.00E-02	7.30E-02	2.16E-04	2.44E-04	4.60E-04	9.45E-07	1.07E-06	2.01E-06	1.11E+04	9.83E+03	5.22E+03	1.27E+01	1.12E+01	5.96E+00	5.96E+00
Benz[a]anthracene	NV	7.30E-01	NC	NC	NC	8.22E-05	9.30E-05	1.75E-04	NC	NC	NC	1.27E+00	1.12E+00	5.96E-01	5.96E-01
Benzo[a]pyrene	NV	7.30E+00	NC	NC	NC	6.05E-04	6.84E-04	1.29E-03	NC	NC	NC	1.27E-01	1.12E-01	5.96E-02	5.96E-02
Benzo[b]fluoranthene	NV	7.30E-01	NC	NC	NC	7.09E-05	8.02E-05	1.51E-04	NC	NC	NC	1.27E+00	1.12E+00	5.96E-01	5.96E-01
Benzo[ghi]perylene	NV	7.30E-02	NC	NC	NC	2.36E-06	2.67E-06	5.04E-06	NC	NC	NC	1.27E+01	1.12E+01	5.96E+00	5.96E+00
Benzo[k]fluoranthene	NV	7.30E-01	NC	NC	NC	3.40E-05	3.85E-05	7.25E-05	NC	NC	NC	1.27E+00	1.12E+00	5.96E-01	5.96E-01
Chrysene	NV	7.30E-02	NC	NC	NC	7.09E-06	8.02E-06	1.51E-05	NC	NC	NC	1.27E+01	1.12E+01	5.96E+00	5.96E+00
Dibenz[a h]anthracene	NV	7.30E+00	NC	NC	NC	1.04E-04	1.18E-04	2.22E-04	NC	NC	NC	1.27E-01	1.12E-01	5.96E-02	5.96E-02
Fluoranthene	4.00E-02	7.30E-02	8.74E-03	9.89E-03	1.86E-02	2.55E-05	2.89E-05	5.44E-05	7.41E+03	6.55E+03	3.48E+03	1.27E+01	1.12E+01	5.96E+00	5.96E+00
Indeno[1 2 3-cd]pyrene	NV	7.30E-01	NC	NC	NC	2.74E-05	3.10E-05	5.84E-05	NC	NC	NC	1.27E+00	1.12E+00	5.96E-01	5.96E-01
Pyrene	3.00E-02	7.30E-03	9.50E-03	1.07E-02	2.02E-02	2.08E-06	2.35E-06	4.43E-06	5.56E+03	4.92E+03	2.61E+03	1.27E+02	1.12E+02	5.96E+01	5.96E+01
Metals & Inorganics															
Antimony	4.00E-04	NV	1.31E-01	1.93E-01	3.24E-01	NC	NC	NC	9.64E+01	6.55E+01	3.90E+01	NC	NC	NC	3.90E+01
Arsenic	3.00E-04	1.50E+00	4.28E-02	1.05E-01	1.48E-01	1.93E-05	4.72E-05	6.65E-05	2.41E+02	9.83E+01	6.98E+01	2.68E+00	1.09E+00	7.76E-01	7.76E-01
Cadmium	3.20E-05	NV	1.43E-01	2.10E+00	2.24E+00	NC	NC	NC	7.71E+01	5.24E+00	4.91E+00	NC	NC	NC	4.91E+00
Copper	3.00E-02	NV	1.47E-01	3.61E-01	5.09E-01	NC	NC	NC	1.20E+04	4.92E+03	3.49E+03	NC	NC	NC	3.49E+03
Lead	1.30E-03	NV	3.70E+01	5.98E+00	4.29E+01	NC	NC	NC	2.66E+01	1.65E+02	2.29E+01	NC	NC	NC	2.29E+01
Zinc	3.00E-01	NV	1.38E-01	2.03E-01	3.41E-01	NC	NC	NC	7.23E+04	4.92E+04	2.93E+04	NC	NC	NC	2.93E+04

Formula:

Hazard quotients (HQ) or Incremental Lifetime cancer risks (ILCR) from average daily doses were calculated using the following equation:

$HQ = ADSIR \text{ or } ADDCR / RfD_{oral}$

$ILCR = LADSIR \text{ or } LADDCR \times CSF_{oral}$

$RBC = C_S \times 0.2 / HQ$

$RBC = C_S \times 1E\text{-}06 / ILCR$

Parameter	Description	Unit	Value	Formula	Reference
HQ	Hazard quotient	unitless	Calculated	see above	MOE, 2011b
RfD_{oral}	Oral reference dose	mg/kg-d	chemical specific		MOE, 2011b
CSF_{oral}	Oral cancer slope factor	$(mg/kg\text{-}d)^{-1}$	chemical specific		MOE, 2011b
ILCR	Incremental lifetime cancer risk	unitless	Calculated	see above	MOE, 2011b
S2(L)ADSIR	(Lifetime) Average Daily Soil Ingestion Rate for S2	mg/kg-d	Calculated	Table A-2	MOE, 2011b
S2(L)ADDCR	(Lifetime) Average Daily Soil Dermal Contact Rate for S2	mg/kg-d	Calculated	Table A-2	MOE, 2011b
CRL	lifetime cancer risk level	unitless	$1x10^{-6}$		MOE, 2011b
SAF(target HQ)	Source Allocation Factor (target HQ)	unitless	0.2 (or 0.5 for PHCs)		MOE, 2011b
RBC_{Soil}	Risk-based concentrations	µg/g	Calculated	see above	
NV	No Value				
NC	Not Calculated				
	Exceed CRL or SAF				

Table A-20: Final Risk Calculations HQs and ILCRs for the Direct Contact with Surface and Subsurface soil (Subsurface Worker) Exposure Pathway (S3)

COC	TRVs				Hazard Quotient				Incremental Lifetime Cancer Risk				Risk-Based Concentrations (Non-Carcinogenic) (µg/g)			Risk-Based Concentrations (Carcinogenic) (µg/g)			Lowest RBC (µg/g)
	RfD_{Oral} Oral Reference Dose (mg/kg-d)	TC Inhalation Reference Concentration (mg/m^3)	CSF Oral Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$	IUR Inhalation Unit Risk Factor $(mg/m^3)^{-1}$	Dermal Contact	Incidental Ingestion	Sum of Dermal and Ingestion	Soil Particulate Inhalation	Dermal Contact	Incidental Ingestion	Sum of Dermal and Ingestion	Soil Particulate Inhalation	Sum of Dermal and Ingestion	Soil Particulate Inhalation	Lower RBC (Non-Carcinogenic)	Sum of Dermal and Ingestion	Soil Particulate Inhalation	Lower RBC (Carcinogenic)	
Surface Soil																			
PAHs										1.7812									
Benz[a]anthracene	NV	NV	7.30E-01	1.10E-01	NC	NC	NC	NC	1.57E-06	1.78E-06	3.35E-06	8.28E-09	NC	NC	NC	3.11E+01	1.26E+04	1.26E+04	3.11E+01
Benzo[a]pyrene	NV	NV	7.30E+00	1.10E+00	NC	NC	NC	NC	1.16E-05	1.31E-05	2.47E-05	6.09E-08	NC	NC	NC	3.11E+00	1.26E+03	1.26E+03	3.11E+00
Benzo[b]fluoranthene	NV	NV	7.30E-01	1.10E-01	NC	NC	NC	NC	1.36E-06	1.53E-06	2.89E-06	7.14E-09	NC	NC	NC	3.11E+01	1.26E+04	1.26E+04	3.11E+01
Benzo[k]fluoranthene	NV	NV	7.30E-01	1.10E-01	NC	NC	NC	NC	6.51E-07	7.37E-07	1.39E-06	3.43E-09	NC	NC	NC	3.11E+01	1.26E+04	1.26E+04	3.11E+01
Dibenz[a h]anthracene	NV	NV	7.30E+00	1.10E+00	NC	NC	NC	NC	1.99E-06	2.25E-06	4.24E-06	1.05E-08	NC	NC	NC	3.11E+00	1.26E+03	1.26E+03	3.11E+00
Metals & Inorganics																			
Antimony	4.00E-04	2.00E-04	NV	NV	9.36E-02	1.38E-01	2.31E-01	8.49E-03	NC	NC	NC	NC	5.46E+01	1.49E+03	5.46E+01	NC	NC	NC	5.46E+01
Arsenic	3.00E-04	3.00E-05	1.50E+00	1.50E+00	3.06E-02	7.50E-02	1.06E-01	4.63E-02	3.69E-07	9.04E-07	1.27E-06	5.58E-08	9.77E+01	2.23E+02	9.77E+01	4.05E+01	9.25E+02	9.65E+02	4.05E+01
Cadmium	3.20E-05	3.00E-05	NV	9.80E+00	1.02E-01	1.50E+00	1.60E+00	4.93E-02	NC	NC	NC	3.88E-07	6.87E+00	2.23E+02	6.87E+00	NC	1.42E+02	1.42E+02	6.87E+00
Copper	3.00E-02	NV	NV	NV	1.05E-01	2.58E-01	3.63E-01	NC	NC	NC	NC	NC	4.89E+03	NC	NC	NC	NC	NC	4.89E+03
Lead	1.30E-03	NV	NV	NV	2.24E+01	3.30E+00	2.57E+01	NC	NC	NC	NC	NC	3.82E+01	NC	NC	NC	NC	NC	3.82E+01
Zinc	3.00E-01	NV	NV	NV	9.87E-02	1.45E-01	2.44E-01	NC	NC	NC	NC	NC	4.10E+04	NC	NC	NC	NC	NC	4.10E+04
Subsoil																			
PAHs																			
Benz[a]anthracene	NV	NV	7.30E-01	1.10E-01	NC	NC	NC	NC	3.62E-06	4.09E-06	7.71E-06	1.90E-08	NC	NC	NC	3.11E+01	1.26E+04	1.26E+04	3.11E+01
Benzo[a]pyrene	NV	NV	7.30E+00	1.10E+00	NC	NC	NC	NC	1.81E-05	2.05E-05	3.85E-05	9.52E-08	NC	NC	NC	3.11E+00	1.26E+03	1.26E+03	3.11E+00
Benzo[b]fluoranthene	NV	NV	7.30E-01	1.10E-01	NC	NC	NC	NC	2.71E-06	3.07E-06	5.78E-06	1.43E-08	NC	NC	NC	3.11E+01	1.26E+04	1.26E+04	3.11E+01
Benzo[k]fluoranthene	NV	NV	7.30E-01	1.10E-01	NC	NC	NC	NC	1.43E-06	1.62E-06	3.04E-06	7.52E-09	NC	NC	NC	3.11E+01	1.26E+04	1.26E+04	3.11E+01
Dibenz[a h]anthracene	NV	NV	7.30E+00	1.10E+00	NC	NC	NC	NC	2.17E-06	2.46E-06	4.63E-06	1.14E-08	NC	NC	NC	3.11E+00	1.26E+03	1.26E+03	3.11E+00
Fluoranthene	4.00E-02	NV	7.30E-02	1.10E-02	1.53E-02	1.73E-02	3.25E-02	NC	1.19E-06	1.35E-06	2.54E-06	6.28E-09	4.87E+03	NC	NC	3.11E+02	1.26E+05	1.26E+05	3.11E+02
Indeno[1 2 3-cd]pyrene	NV	NV	7.30E-01	1.10E-01	NC	NC	NC	NC	9.40E-07	1.06E-06	2.00E-06	4.95E-09	NC	NC	NC	3.11E+01	1.26E+04	1.26E+04	3.11E+01
Methlynaphthalene, 2-(1	4.00E-03	NV	NV	NV	1.63E-01	1.84E-01	3.47E-01	NC	NC	NC	NC	NC	4.87E+02	NC	NC	NC	NC	NC	4.87E+02
Metals & Inorganics																			
Arsenic	3.00E-04	3.00E-05	1.50E+00	1.50E+00	7.11E-02	1.74E-01	2.46E-01	1.08E-01	8.58E-07	2.10E-06	2.96E-06	1.30E-07	9.77E+01	2.23E+02	9.77E+01	4.05E+01	9.25E+02	9.65E+02	4.05E+01
Lead	1.30E-03	NV	NV	NV	1.52E+01	6.60E-02	1.53E+01	NC	NC	NC	NC	NC	2.65E+01	NC	NC	NC	NC	NC	2.65E+01

Formula:

Hazard quotients (HQ) or Incremental Lifetime Cancer Risks (ILCR) from average daily doses were calculated using the following equation:

HQ = ADSIR or ADDCR / RfD_{oral}

HQ = ADSIE / TC

ILCR = LADSIR or LADDCR x CSF_{oral}

ILCR = LADSIE x IUR

RBC = C_S x 0.2 / HQ

RBC = C_S x 1E-06 / ILCR

Parameter	Description	Unit	Value	Formula	Reference
HQ	Hazard quotient	unitless	Calculated	see above	MOE, 2011b
RfD_{oral}	Oral reference dose	mg/kg-d	chemical specific		MOE, 2011b
CSF_{oral}	Oral cancer slope factor	$(mg/kg\text{-}d)^{-1}$	chemical specific		MOE, 2011b
ILCR	Incremental lifetime cancer risk	unitless	Calculated	see above	MOE, 2011b
S3(L)ADSIR	(Lifetime) Average Daily Soil Ingestion Rate for S3	mg/kg-d	Calculated	Table A-3	MOE, 2011b
S3(L)ADDCR	(Lifetime) Average Daily Soil Dermal Contact Rate for S3	mg/kg-d	Calculated	Table A-3	MOE, 2011b
S3(L)ADSIE	(Lifetime) Average Daily Soil Inhalation Exposure (Dose)	mg_{soil}/m^3	Calculated	Table A-3	MOE, 2011b
CRL	Lifetime cancer risk level	unitless	$1x10^{-6}$		MOE, 2011b
SAF(target HQ)	Source Allocation Factor (target HQ)	unitless	0.2 (or 0.5 for PHCs)		MOE, 2011b
RBC_{Soil}	Risk-based concentrations			see above	
NC	Not Calculated				
NV	No Value				
	exceed CRL or SAF				

Additional Notes:
HQ for ingestion and dermal contact is the sum of the HQ of the two pathways
RBC for ingestion and dermal contact is based on the sum of HQ of both pathways
The final RBC for S3 is based on the lowest RBC derived from RBC of sum ingestion and dermal and RBC of inhalation of particulates

Table A-21: Final Risk Calculations HQs and ILCRs for the Particulate Inhalation (Offsite Resident-Toddlers and Adults) Exposure Pathway

	TRVs		Surface Soil Risk		Subsoil Risk		Surface Soil Risk-Based Concentrations $RBC_{Surface\ Soil}$			Subsoil Risk-Based Concentrations $RBC_{Subsoil}$		
COC	**Inhalation Reference Concentration (mg/m^3)**	**Inhalation Unit Risk Factor $(mg/m^3)^{-1}$**	**Hazard Quotient (unitless)**	**Incremental Lifetime Cancer Risk (unitless)**	**Hazard Quotient (unitless)**	**Incremental Lifetime Cancer Risk (unitless)**	**Non-Carcinogenic (µg/g)**	**Carcinogenic (µg/g)**	**Lowest RBC Surface Soil (µg/g)**	**Non-Carcinogenic (µg/g)**	**Carcinogenic (µg/g)**	**Lowest RBC Subsoil (µg/g)**
BTEX												
Benzene	3.00E-02	2.20E-03	2.30E-05	1.89E-11	4.48E-06	3.69E-12	1.47E+06	8.93E+06	NC	1.47E+06	8.93E+06	NC
PHCs												
PHC F2												
Aliphatic C>10-C12	1.00E+00	NV	9.65E-06	NC	2.32E-05	NC	4.91E+07	NC	NC	4.91E+07	NC	NC
Aliphatic C>12-C16	1.00E+00	NV	1.18E-05	NC	2.84E-05	NC	4.91E+07	NC	NC	4.91E+07	NC	NC
Aromatic C>10-C12	2.00E-01	NV	1.21E-05	NC	2.90E-05	NC	9.83E+06	NC	NC	9.83E+06	NC	NC
Aromatic C>12-C16	2.00E-01	NV	1.47E-05	NC	3.55E-05	NC	9.83E+06	NC	NC	9.83E+06	NC	NC
PHC F3												
Aliphatic C>16-C21	NV	NV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Aliphatic C>21-C34	NV	NV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Aromatic C>16-C21	NV	NV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Aromatic C>21-C34	NV	NV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
PHC F4												
Aliphatic C>34	NV	NV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Aromatic C>34	NV	NV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
PAHs												
Acenaphthene	NV	1.10E-03	NC	NC	NC	3.35E-11	NC	NC	NC	NC	1.79E+07	NC
Acenaphthylene	NV	1.10E-02	NC	6.72E-12	NC	2.66E-11	NC	1.79E+06	NC	NC	1.79E+06	NC
Benz[a]anthracene	NV	1.10E-01	NC	5.84E-10	NC	1.34E-09	NC	1.79E+05	NC	NC	1.79E+05	NC
Benzo[a]pyrene	NV	1.10E+00	NC	4.30E-09	NC	6.72E-09	NC	1.79E+04	NC	NC	1.79E+04	NC
Benzo[b]fluoranthene	NV	1.10E-01	NC	5.04E-10	NC	1.01E-09	NC	1.79E+05	NC	NC	1.79E+05	NC
Benzo[ghi]perylene	NV	1.10E-02	NC	1.68E-11	NC	3.63E-11	NC	1.79E+06	NC	NC	1.79E+06	NC
Benzo[k]fluoranthene	NV	1.10E-01	NC	2.42E-10	NC	5.31E-10	NC	1.79E+05	NC	NC	1.79E+05	NC
Chrysene	NV	1.10E-02	NC	5.04E-11	NC	1.14E-10	NC	1.79E+06	NC	NC	1.79E+06	NC
Dibenz[a h]anthracene	NV	1.10E+00	NC	7.39E-10	NC	8.06E-10	NC	1.79E+04	NC	NC	1.79E+04	NC
Fluoranthene	NV	1.10E-02	NC	1.81E-10	NC	4.43E-10	NC	1.79E+06	NC	NC	1.79E+06	NC
Indeno[1 2 3-cd]pyrene	NV	1.10E-01	NC	1.95E-10	NC	3.49E-10	NC	1.79E+05	NC	NC	1.79E+05	NC
Methlynaphthalene, 2-(1	NV	NV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Naphthalene	3.70E-03	NV	NC	NC	3.34E-03	NC	NC	NC	NC	1.82E+05	NC	NC
Pyrene	NV	1.10E-03	NC	1.48E-11	NC	3.09E-11	NC	1.79E+07	NC	NC	1.79E+07	NC
Metals & Inorganics												
Antimony	2.00E-04	NV	1.28E-03	NC	NC	NC	9.83E+03	NC	NC	NC	NC	NC
Arsenic	3.00E-05	1.50E+00	1.42E-01	3.94E-09	1.42E-01	9.16E-09	7.28E+01	1.31E+04	NC	1.69E+02	1.31E+04	NC
Cadmium	3.00E-05	9.80E+00	7.46E-03	2.74E-08	NC	NC	1.47E+03	2.01E+03	NC	NC	NC	NC
Copper	NV	NV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	NV	NV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mercury	9.00E-05	NV	NC	NC	2.20E-03	NC	NC	NC	NC	4.42E+03	NC	NC
Zinc	NV	NV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
PCBs												
Polychlorinated Bipheny	5.00E-04	1.00E-01	9.38E-05	5.86E-11	NC	NC	4.10E+03	3.28E+04	NC	NC	NC	NC

Formula:

Hazard quotients (HQ) or Incremental Lifetime cancer risks (ILCR) from average daily doses were calculated using the following equation:

HQ = ADSIE/ TC

ILCR = LADSIE x IUR

$RBC_{soil} = C_S$ x 0.2 / HQ

$RBC_{soil} = C_S$ x 1E-06 / ILCR

RBC for PHCs = Sum of (subfractions RBC x mass fraction of each sub-fraction within fraction)

Parameter	Description	Unit	Value	Formula	Reference
HQ	Hazard quotient	unitless	Calculated	See above	MOE, 2011b
TRVs	Toxicity Reference Values (TC and IUR)				MOE, 2011b
TC or RfD	Tolerable Concentration	mg/m^3	chemical specific		MOE, 2011b
IUR	Oral cancer slope factor	$(mg/m^3)^{-1}$	chemical specific		MOE, 2011b
ILCR	Incremental lifetime cancer risk	unitless	Calculated	See above	MOE, 2011b
S3(L)ADSIE	(Lifetime) Average Daily Soil Inhalation Exposure (Dose)	mg_{soil}/m^3	Calculated	Table A-5	MOE, 2011b
CRL	lifetime cancer risk level	unitless	$1x10^{-6}$		MOE, 2011b
SAF(target HQ)	Source Allocation Factor (target HQ)	unitless	0.2 (or 0.5 for PHCs)		MOE, 2011b
RBC_{Soil}	Risk-based concentrations	µg/g	Calculated	See above	
NV	No Value				
NC	Not Calculated				
	Exceed CRL or SAF				

Table A-22: Final Risk Calculations (HQs and ILCRs) for the Inhalation of Indoor Air via Downgradient Groundwater Migration (Off-Site Residents and Commercial Office Worker) Exposure Pathway

	COC	Toxicity Reference Values (TRVs)		Hazard Quotient (HQ) (unitless)	Incremental Lifetime Cancer Risk (ILCR) (unitless)	Hazard Quotient (HQ) (unitless)	Incremental Lifetime Cancer Risk (ILCR) (unitless)	Residential Risk-Based Concentrations $RBC_{Indoor\ Air}$ (mg/m^3)		Residential Risk-Based Concentrations RBC_{GW} (µg/L)		Lowest RBC_{GW}-Residential (µg/L)	Commercial Risk-Based Concentrations $RBC_{Indoor\ Air}$ (mg/m^3)		Commercial Risk-Based Concentrations RBC_{GW} (µg/L)		Lowest RBC_{GW} - Commercial (µg/L)
		Tolerable Concentration (TC) (mg/m^3)	Inhalation Unit Risk Factor (IUR) $(mg/m^3)^{-1}$	Residental		Commercial		Non-Carcinogenic	Carcinogenic	Non-Carcinogenic	Carcinogenic		Non-Carcinogenic	Carcinogenic	Non-Carcinogenic	Carcinogenic	
	BTEX																
	Benzene	3.00E-02	2.20E-03	2.98E+03	1.84E-01	3.50E+00	2.31E-04	6.25E-03	5.05E-04	1.38E+00	1.11E-01	1.11E-01	2.14E-02	4.04E-01	2.36E+01	4.45E+02	2.36E+01
	Toluene	5.00E+00	NV	5.37E+00	NC	NC	NC	1.04E+00	NC	1.92E+02	NC	1.92E+02	NC	NC	NC	NC	NC
	Ethylbenzene	1.00E+00	NV	3.90E+00	NC	NC	NC	2.00E-01	NC	3.11E+01	NC	3.11E+01	NC	NC	NC	NC	NC
	Xylene Mixture	7.00E-01	NV	1.75E+01	NC	NC	NC	1.46E-01	NC	2.69E+01	NC	2.69E+01	NC	NC	NC	NC	NC
	PHCs																
	PHC F1			**6.20E+02**								3.48E+00					
0.605	*Aliphatic C6-C8*	1.84E+01	NV	1.36E+02	NC	NC	NC	9.58E+00	NC	9.58E+00	NC	9.58E+00	NC	NC	NC	NC	NC
0.063	*Aliphatic C>8-C10*	1.00E+00	NV	4.18E+02	NC	NC	NC	5.21E-01	NC	3.26E-01	NC	3.26E-01	NC	NC	NC	NC	NC
0.332	*Aromatic C>8-C10*	2.00E-01	NV	6.61E+01	NC	NC	NC	1.04E-01	NC	1.09E+01	NC	1.09E+01	NC	NC	NC	NC	NC
	PHC F2			**3.47E+03**								5.86E+00					
0.024	*Aliphatic C>10-C12*	1.00E+00	NV	2.25E+03	NC	NC	NC	5.21E-01	NC	2.17E-01	NC	2.17E-01	NC	NC	NC	NC	NC
0.002	*Aliphatic C>12-C16*	1.00E+00	NV	8.12E+02	NC	NC	NC	5.21E-01	NC	5.01E-02	NC	5.01E-02	NC	NC	NC	NC	NC
0.603	*Aromatic C>10-C12*	2.00E-01	NV	3.30E+02	NC	NC	NC	1.04E-01	NC	3.72E+01	NC	3.72E+01	NC	NC	NC	NC	NC
0.371	*Aromatic C>12-C16*	2.00E-01	NV	7.68E+01	NC	NC	NC	1.04E-01	NC	9.83E+01	NC	9.83E+01	NC	NC	NC	NC	NC
	VOCs																
	Styrene	2.60E-01	NV	1.79E+00	NC	NC	NC	5.42E-02	NC	2.42E+01	NC	2.42E+01	NC	NC	NC	NC	NC
	Trichloroethylene	4.00E-02	2.00E-03	4.09E+00	3.06E-04	NC	NC	8.33E-03	5.56E-04	1.03E+00	6.89E-02	6.89E-02	NC	NC	NC	NC	NC
	Vinyl Chloride	1.00E-01	8.80E-03	5.70E-01	4.70E-04	NC	NC	2.08E-02	1.26E-04	9.14E-01	5.54E-03	5.54E-03	NC	NC	NC	NC	NC
	PAHs																
	Acenaphthene	NV	1.10E-03	NC	1.14E-04	NC	NC	NC	1.01E-03	NC	6.79E+00	6.79E+00	NC	NC	NC	NC	NC
	Acenaphthylene	NV	1.10E-02	NC	7.43E-05	NC	NC	NC	1.01E-04	NC	9.88E-01	9.88E-01	NC	NC	NC	NC	NC
	Fluorene	NV	NV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Naphthalene	3.70E-03	NV	2.57E+03	NC	NC	NC	7.71E-04	NC	2.14E+00	NC	2.14E+00	NC	NC	NC	NC	NC
	Metals & Inorganics																
	Mercury	9.00E-05	NV	1.20E+03	NC	NC	NC	1.88E-05	NC	1.99E-03	NC	1.99E-03	NC	NC	NC	NC	NC

Formula:

Hazard quotients (HQ) or Incremental Lifetime cancer risks (ILCR) from average daily doses were calculated using the following equations:
HQ = NCRIAP or NCICIAP/ TC
ILCR = CRIAP or CICIAP x IUR
$RBC_{GW} = RBC_{IA}/(\alpha \times H')$
RBC for PHCs = Sum of (subfractions RBC x mass fraction of each sub-fraction within fraction)

Parameter	Description	Unit	Value	Formula	Reference
HQ	Hazard quotient	unitless	Calculated	See above	MOE (2011b)
TC	Tolerable Concentration	mg/m^3	chemical specific		MOE (2011b)
IUR	Oral cancer slope factor	$(mg/m^3)^{-1}$	chemical specific		MOE (2011b)
TRVs	Toxicity Reference Values (TC and IUR)				MOE (2011b)
ILCR	Incremental lifetime cancer risk	unitless	Calculated	See above	MOE (2011b)
(N)CRIAP	(Lifetime) Average Daily Residential Indoor Air Inhalation Exposure (Dose)	mg/m^3	Calculated	Table A-7	MOE (2011b)
$NCRIAP_D$ value	Non-Carcinogen Residential Indoor Air Prorating Factor (Developmental)	mg/m^3	Calculated	Table A-7	MOE (2011b)
(N)CICIAP value	(Lifetime) Average Daily Commercial Indoor Air Inhalation Exposure (Dose)	mg/m^3	Calculated	Table A-8	MOE (2011b)
$NCICIAP_D$	Non-Carcinogen Commercial Indoor Air Prorating Factor (Developmental)	mg/m^3	Calculated	Table A-8	MOE (2011b)
CRL	Cancer risk level	unitless	$1x10^{-6}$		MOE (2011b)
SAF(target HQ)	Source Allocation Factor (target HQ)	unitless	0.2 (or 0.5 for PHCs)		MOE (2011b)
α-residential	Alpha soil gas to indoor attenuation - residential buildings in a shallow groundwater (<3m bgs)	Unitless	0.02		MOE (2011b) - Page 316
H'	Henry's Law Constant	Unitless	Chemical specific		MOE (2011b)
NV	No Value				
NC	Not Calculated				
	exceed CRL or SAF				
RBC_{GW}	Risk-based concentration for groundwater along the property boundary upgradient from the Offsite Residential and Commercial Properties			see above	
RBC_{IA}	Risk-based concentration for modelled indoor air at the Offsite Residential and Commercial Properties	mg/m^3	Calculated	see above	

Table 23: Final Risk Calculations (HQs and ILCRs) for the Inhalation of Trench Air via COC Vapour Migration from Soil or Groundwater Exposure Pathway - Subsurface Worker

	COC	Source Media	TRVs		Hazard Quotient (HQ) (unitless)	Incremental Lifetime Cancer Risk (ILCR) (unitless)	Risk-Based Concentrations RBC - Trench Air (mg/m^3)		Risk-Based Concentrations RBC - Soil (mg/kg or µg/g) or GW (µg/L)		Lowest Risk-Based Concentrations (RBC) Soil (mg/kg or µg/g) or GW (µg/L)
			Tolerable Concentration (TC) (mg/m^3)	Inhalation Unit Risk Factor (IUR) $(mg/m^3)^{-1}$			Non-carcinogenic	Carcinogenic	Non-carcinogenic	Carcinogenic	
	BTEX										
	Benzene	Shallow Soil	3.00E-02	2.20E-03	6.82E+01	1.21E-04	2.38E-02	6.74E-02	4.96E-01	1.40E+00	4.96E-01
	Toluene	Shallow Soil	5.00E+00	NV	5.95E-01	NC	3.97E+00	NC	8.26E+01	NC	8.26E+01
	Xylene Mixture	Shallow Soil	7.00E-01	NV	6.97E+00	NC	5.56E-01	NC	1.16E+01	NC	1.16E+01
	PHCs										
	PHC F1										2.11E+01
0.55	*Aliphatic C6-C8*	Shallow Soil	1.84E+01	NV	4.33E+00	NC	1.46E+01	NC	3.04E+02	NC	3.04E+02
0.36	*Aliphatic C>8-C10*	Shallow Soil	1.00E+00	NV	4.81E+00	NC	7.95E-01	NC	1.65E+01	NC	1.65E+01
0.09	*Aromatic C>8-C10*	Shallow Soil	2.00E-01	NV	5.24E+00	NC	1.59E-01	NC	3.80E+00	NC	3.80E+00
	PHC F2										1.96E+01
0.36	*Aliphatic C>10-C12*	Shallow Soil	1.00E+00	NV	2.87E+01	NC	7.95E-01	NC	1.65E+01	NC	1.65E+01
0.44	*Aliphatic C>12-C16*	Shallow Soil	1.00E+00	NV	1.79E+01	NC	7.95E-01	NC	3.23E+01	NC	3.23E+01
0.09	*Aromatic C>10-C12*	Shallow Soil	2.00E-01	NV	1.34E+01	NC	1.59E-01	NC	8.82E+00	NC	8.82E+00
0.11	*Aromatic C>12-C16*	Shallow Soil	2.00E-01	NV	7.16E+00	NC	1.59E-01	NC	2.02E+01	NC	2.02E+01
	VOCs										
	Styrene	Shallow Soil	2.60E-01	NV	6.59E+00	NC	2.07E-01	NC	4.92E+00	NC	4.92E+00
	PAHs										
	Acenaphthylene	Shallow Soil	NV	1.10E-02	NC	1.84E-06	NC	1.35E-02	NC	6.51E+00	6.51E+00
	Naphthalene	Shallow Soil	3.70E-03	NV	3.63E+01	NC	2.94E-03	NC	3.58E-01	NC	3.58E-01
	Metals & Inorganics										
	Mercury	Shallow Soil	9.00E-05	NV	3.11E+01	NC	7.15E-05	NC	4.47E-02	NC	4.47E-02
	BTEX										
	Benzene	Subsoil	3.00E-02	2.20E-03	3.28E+01	5.81E-05	2.38E-02	6.74E-02	2.01E-01	5.68E-01	2.01E-01
	Toluene	Subsoil	5.00E+00	NV	7.25E-02	NC	3.97E+00	NC	4.50E+01	NC	NC
	Ethylbenzene	Subsoil	1.00E+00	NV	2.03E-01	NC	7.95E-01	NC	1.67E+01	NC	1.67E+01
	Xylene Mixture	Subsoil	7.00E-01	NV	4.78E-01	NC	5.56E-01	NC	1.25E+01	NC	1.25E+01
	PHCs										
	PHC F1										1.14E+01
0.55	*Aliphatic C6-C8*	Subsoil	1.84E+01	NV	8.98E-01	NC	1.46E+01	NC	2.65E+01	NC	2.65E+01
0.36	*Aliphatic C>8-C10*	Subsoil	1.00E+00	NV	2.49E+00	NC	7.95E-01	NC	6.24E+00	NC	6.24E+00
0.09	*Aromatic C>8-C10*	Subsoil	2.00E-01	NV	3.84E-01	NC	1.59E-01	NC	1.01E+01	NC	NC
	PHC F2										6.16E+01
0.36	*Aliphatic C>10-C12*	Subsoil	1.00E+00	NV	3.56E+01	NC	7.95E-01	NC	3.21E+01	NC	3.21E+01
0.44	*Aliphatic C>12-C16*	Subsoil	1.00E+00	NV	9.49E+00	NC	7.95E-01	NC	1.47E+02	NC	1.47E+02
0.09	*Aromatic C>10-C12*	Subsoil	2.00E-01	NV	5.20E+00	NC	1.59E-01	NC	5.48E+01	NC	5.48E+01
0.11	*Aromatic C>12-C16*	Subsoil	2.00E-01	NV	1.21E+00	NC	1.59E-01	NC	2.88E+02	NC	2.88E+02
	VOCs										
	Trichloroethylene	Subsoil	4.00E-02	2.00E-03	7.69E+00	1.65E-05	3.18E-02	7.42E-02	7.71E-02	1.80E-01	7.71E-02
	Vinyl Chloride	Subsoil	1.00E-01	8.80E-03	2.14E+00	5.05E-05	7.95E-02	1.69E-02	2.99E-02	6.34E-03	6.34E-03
	PAHs										
	Acenaphthene	Subsoil	NV	1.10E-03	NC	2.38E-07	NC	1.35E-01	NC	2.52E+03	NC
	Acenaphthylene	Subsoil	NV	1.10E-02	NC	1.35E-07	NC	1.35E-02	NC	3.52E+02	NC
	Benz[a]anthracene	Subsoil	NV	1.10E-01	NC	2.08E-08	NC	1.35E-03	NC	1.15E+04	NC
	Fluoranthene	Subsoil	NV	1.10E-02	NC	9.97E-09	NC	1.35E-02	NC	7.95E+04	NC
	Naphthalene	Subsoil	3.70E-03	NV	1.24E+02	NC	2.94E-03	NC	4.88E+00	NC	4.88E+00
	Metals & Inorganics										
	Mercury	Subsoil	9.00E-05	NV	3.10E+00	NC	7.15E-05	NC	3.13E+00	NC	3.13E+00
	BTEX										
	Benzene	Shallow Groundwater	3.00E-02	2.20E-03	4.57E-06	8.08E-12	2.38E-02	6.74E-02	8.98E+08	2.04E+07	NC
	Xylene Mixture	Shallow Groundwater	7.00E-01	NV	2.17E-08	NC	5.56E-01	NC	2.16E+10	NC	NC
	PHCs										
	PHC F1										
0.605	*Aliphatic C6-C8*	Shallow Groundwater	1.84E+01	NV	1.67E-07	NC	1.46E+01	NC	4.42E+09	NC	NC
0.063	*Aliphatic C>8-C10*	Shallow Groundwater	1.00E+00	NV	8.19E-07	NC	7.95E-01	NC	1.50E+08	NC	NC
0.332	*Aromatic C>8-C10*	Shallow Groundwater	2.00E-01	NV	6.93E-10	NC	1.59E-01	NC	4.99E+09	NC	NC
	PHC F2										
0.024	*Aliphatic C>10-C12*	Shallow Groundwater	1.00E+00	NV	6.25E-05	NC	7.95E-01	NC	9.99E+07	NC	NC
0.002	*Aliphatic C>12-C16*	Shallow Groundwater	1.00E+00	NV	7.27E-05	NC	7.95E-01	NC	2.31E+07	NC	NC
0.603	*Aromatic C>10-C12*	Shallow Groundwater	2.00E-01	NV	1.05E-08	NC	1.59E-01	NC	1.71E+10	NC	NC
0.371	*Aromatic C>12-C16*	Shallow Groundwater	2.00E-01	NV	9.08E-10	NC	1.59E-01	NC	4.48E+10	NC	NC
	VOCs										
	Trichloroethylene	Shallow Groundwater	4.00E-02	2.00E-03	5.62E-09	1.20E-14	3.18E-02	7.42E-02	7.52E+08	2.21E+11	NC
	Vinyl Chloride	Shallow Groundwater	1.00E-01	8.80E-03	1.05E-09	2.47E-14	7.95E-02	1.69E-02	4.96E+08	1.16E+10	NC
	PAHs										
	Acenaphthene	Shallow Groundwater	NV	1.10E-03	NC	2.62E-15	NC	1.35E-01	NC	7.04E+09	NC
	Acenaphthylene	Shallow Groundwater	NV	1.10E-02	NC	1.83E-15	NC	1.35E-02	NC	4.02E+10	NC
	Naphthalene	Shallow Groundwater	3.70E-03	NV	2.71E-06	NC	2.94E-03	NC	2.03E+09	NC	NC
	Metals & Inorganics										
	Mercury	Shallow Groundwater	9.00E-05	NV	6.43E-07	NC	7.15E-05	NC	3.73E+06	NC	NC
	VOCs										
	Trichloroethylene	Deep Groundwater	4.00E-02	2.00E-03	3.83E-09	8.21E-15	3.18E-02	7.42E-02	7.52E+08	1.75E+09	NC

Notes:
TRV - Toxicity Reference Value

Formula:

Hazard Quotients (HQ) or Incremental Lifetime Cancer Risks (ILCR) from average daily doses were calculated using the following equations:

$HQ = NCEC_{tr\text{-}air} / TC$

$ILCR = CEC_{tr\text{-}air} \times IUR$

$RBC_{GW\ or\ Soil} = RBC_{tr\text{-}air}/VF = (C_{tr\text{-}air} \times 0.2 / HQ)/VF$

$RBC_{GW\ or\ Soil} = RBC_{tr\text{-}air}/VF = (C_{tr\text{-}air} \times 1E\text{-}06 / ILCR)/VF$

RBC for PHCs = Sum of (subfractions RBC x mass fraction of each sub-fraction within fraction)

Parameter	Description	Unit	Value	Formula	Reference
HQ	Hazard Quotient	unitless	Calculated	See above	MOE, 2011b
TC	Tolerable Concentration	mg/m^3	chemical specific		MOE, 2011b
IUR	Inhalation Unit Risk	$(mg/m^3)^{-1}$	chemical specific		MOE, 2011b
ILCR	Lncremental lifetime cancer risk	unitless	Calculated	See above	MOE, 2011b
$CEC_{tr\text{-}air}$	Cancinogenic Trench Air Exposure Concentration	(mg/m^3)	Calculated	Table A-10	MOE, 2011b
$NCEC_{tr\text{-}air}$	Non-Cancinogenic Trench Air Exposure Concentration	(mg/m^3)	Calculated	Table A-10	MOE, 2011b
$NCDEC_{tr\text{-}air}$	Non-Cancinogenic Developmental Trench Air Exposure Concentration	(mg/m^3)	Calculated	Table A-10	MOE, 2011b
CRL	lifetime cancer risk level	unitless	$1x10^{-6}$		MOE, 2011b
SAF(target HQ)	Source Allocation Factor (target HQ)	unitless	0.2 (or 0.5 for PHCs)		MOE, 2011b
RBC_{GW}	Risk-based concentrations	µg/L	Calculated	see above	
RBC_{Soil}	Risk-based concentrations	µg/g	Calculated	see above	
VF	Volatilization Factor (surface soil to outdoor air)	kg/m^3	Calculated	Table A-10	
VF	Volatilization Factor (groundwater to outdoor air)	m^3/m^3	Calculated	Table A-10	
NV	No Value				
NC	Not Calculated				
	ILCR or HQ exceeds the CRL or SAF				

Table 24: Final Risk Calculations HQs and ILCRs for the Inhalation of Outdoor Air via Vapour Migration from Soil or Groundwater Exposure Pathway (Park Visitor)

	COC	Source Media	TRVs		Hazard Quotient	Incremental Lifetime Cancer Risk	Risk-Based Concentrations RBC_{OA} (Outdoor Air) (mg/m^3)		Risk-Based Concentrations Soil (µg/g) or Groundwater (µg/L)		Lowest RBC Soil (µg/g) or Groundwater (µg/L)
			TC Tolerable Concentration (mg/m^3)	IUR Inhalation Unit Risk Factor $(mg/m^3)^{-1}$	HQ (Unitless)	ILCR (Unitless)	Non-carcinogenic	Carcinogenic	Non-carcinogenic	Carcinogenic	
	BTEX										
	Benzene	Shallow Soil	3.00E-02	2.20E-03	2.62E-01	1.73E-05	1.11E-01	8.43E-03	1.29E+02	9.77E+00	9.77E+00
	BTEX										
	Benzene	Shallow GW	3.00E-02	2.20E-03	2.90E-04	1.92E-08	1.11E-01	8.43E-03	1.41E+07	1.07E+06	NC
	Xylene Mixture	Shallow GW	7.00E-01	NV	1.38E-06	NC	2.60E+00	NC	3.41E+08	NC	NC
	PHCs										
	PHC F1				6.27E-05				1.71E+08		NC
0.605	*Aliphatic C6-C8*	Shallow GW	1.84E+01	NV	1.06E-05	NC	1.71E+02	NC	1.74E+08	NC	NC
0.063	*Aliphatic C>8-C10*	Shallow GW	1.00E+00	NV	5.20E-05	NC	9.27E+00	NC	5.90E+06	NC	NC
0.332	*Aromatic C>8-C10*	Shallow GW	2.00E-01	NV	4.40E-08	NC	1.85E+00	NC	1.96E+08	NC	NC
	PHC F2				8.59E-03				1.06E+09		NC
0.024	*Aliphatic C>10-C12*	Shallow GW	1.00E+00	NV	3.97E-03	NC	9.27E+00	NC	3.93E+06	NC	NC
0.002	*Aliphatic C>12-C16*	Shallow GW	1.00E+00	NV	4.62E-03	NC	9.27E+00	NC	9.07E+05	NC	NC
0.603	*Aromatic C>10-C12*	Shallow GW	2.00E-01	NV	6.66E-07	NC	1.85E+00	NC	6.71E+08	NC	NC
0.371	*Aromatic C>12-C16*	Shallow GW	2.00E-01	NV	5.77E-08	NC	1.85E+00	NC	1.76E+09	NC	NC
	VOCs										
	Trichloroethylene	Shallow GW	4.00E-02	2.00E-03	3.57E-07	2.85E-11	1.48E-01	9.27E-03	1.18E+07	7.40E+05	NC
	Vinyl Chloride	Shallow GW	1.00E-01	8.80E-03	6.67E-08	5.87E-11	3.71E-01	2.11E-03	7.81E+06	4.44E+04	NC
	PAHs										
	Acenaphthene	Shallow GW	NV	1.10E-03	NC	6.22E-12	NC	1.69E-02	NC	1.25E+08	NC
	Acenaphthylene	Shallow GW	NV	1.10E-02	NC	4.33E-12	NC	1.69E-03	NC	1.69E+07	NC
	Fluorene	Shallow GW	NV	NV	NC	NC	NC	NC	NC	NC	NC
	Naphthalene	Shallow GW	3.70E-03	NV	1.72E-04	NC	1.37E-02	NC	3.19E+07	NC	NC
	Metals & Inorganics										
	Mercury	Shallow GW	9.00E-05	NV	4.09E-05	NC	3.34E-04	NC	5.87E+04	NC	NC
	BTEX										
	Benzene	Deep GW	3.00E-02	2.20E-03	6.35E-06	4.19E-10	1.11E-01	8.43E-03	1.41E+07	1.07E+06	NC
	PHCs										
	PHC F2				5.17E-03						NC
	Aliphatic C>10-C12	Deep GW	1.00E+00	NV	2.39E-03	NC	9.27E+00	NC	3.93E+06	NC	NC
	Aliphatic C>12-C16	Deep GW	1.00E+00	NV	2.78E-03	NC	9.27E+00	NC	9.07E+05	NC	NC
	Aromatic C>10-C12	Deep GW	2.00E-01	NV	4.01E-07	NC	1.85E+00	NC	6.71E+08	NC	NC
	Aromatic C>12-C16	Deep GW	2.00E-01	NV	3.47E-08	NC	1.85E+00	NC	1.76E+09	NC	NC
	VOCs										
	Trichloroethylene	Deep GW	4.00E-02	2.00E-03	2.43E-07	1.95E-11	3.71E-01	9.27E-03	2.96E+07	7.40E+05	NC
	Vinyl Chloride	Deep GW	1.00E-01	8.80E-03	4.87E-08	4.28E-11	9.27E-01	2.11E-03	1.95E+07	4.44E+04	NC
	PAHs										
	Acenaphthene	Deep GW	NV	1.10E-03	NC	6.22E-12	NC	1.69E-02	NC	1.25E+08	NC
	Naphthalene	Deep GW	3.70E-03	NV	7.82E-05	NC	3.43E-02	NC	7.97E+07	NC	NC

Formula:

Hazard quotients (HQ) or Incremental Lifetime cancer risks (ILCR) from average daily doses were calculated using the following equation:

$HQ = NCEC_{OA} / TC$

$ILCR = CEC_{OA} \times IUR$

$RBC_{GW \text{ or } Soil} = RBC_{OA}/VF = (C_{OA} \times 0.2 / HQ)/VF$

$RBC_{GW \text{ or } Soil} = RBC_{OA}/VF = (C_{OA} \times 1E\text{-}06 / ILCR)/VF$

RBC for PHCs = Sum of (subfractions RBC x mass fraction of each sub-fraction within fraction)

Parameter	Description	Unit	Value	Formula	Reference
HQ	Hazard quotient	unitless	Calculated	See above	MOE, 2011b
TC	Tolerable Concetnration	mg/m^3	chemical specific		MOE, 2011b
IUR	Oral cancer slope factor	$(mg/m^3)^{-1}$	chemical specific		MOE, 2011b
ILCR	Incremental lifetime cancer risk	unitless	Calculated	See above	MOE, 2011b
CEC_{OA}	Cancinogenic Trench Air Exposure Concentration	(mg/m^3)	Calculated	Table A-12	MOE, 2011b
$NCEC_{OA}$	Non-Cancinogenic Trench Air Exposure Concentration	(mg/m^3)	Calculated	Table A-12	MOE, 2011b
$NCDEC_{OA}$	Non-Cancinogenic Developmental Trench Air Exposure Concentration	(mg/m^3)	Calculated	Table A-12	MOE, 2011b
CRL	lifetime cancer risk level	unitless	$1x10^{-6}$		MOE, 2011b
SAF(target HQ)	Source Allocation Factor (target HQ)	unitless	0.2 (or 0.5 for PHCs)		MOE, 2011b
VF	Volatilization Factor (surface soil to outdoor air)	kg/m^3	Calculated	Table A-12	
VF	Volatilization Factor (groundwater to outdoor air)	m^3/m^3	Calculated	Table A-12	
RBC_{GW}	Risk-based concentrations in groundwater	µg/L	Calculated	See above	
RBC_{Soil}	Risk-based concentrations in soil	µg/g	Calculated	See above	
RBC_{OA}	Risk-based concentrations in modelled outdoor air				
NV	No Value				
NC	Not Calculated				
	Exceed CRL or SAF				

Table A-25: Final Risk Calculations (HQs and ILCRs) For the Incidential Groundwater Direct Contact (Shallow Groundwater)(Subsurface Worker) Exposure Pathway (GW1)

				Hazard Quotient (HQ) (unitless)					Incremental Lifetime Cancer Risk (ILCR) (unitless)					
	COC	Oral Reference Dose (mg/kg-d)	Oral Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$	Dermal Contact NCGWDC	Dermal Contact (Developmental) $NCGWDC_D$	Incidental Ingestion NCDWEF	Incidental Ingestion (Developmental) $NCDWEF_D$	Sum of HQs by Pathway	Dermal Contact CGWDC	Incidental Ingestion CDWEF	Sum of ILCRs by Pathway	Risk-Based Concentrations RBC_{GW1} (Non-Carcinogenic) (µg/L)	Risk-Based Concentrations RBC_{GW1} (Carcinogenic) (µg/L)	Lowest RBC $_{GW1}$ (µg/L)
	BTEX													
	Benzene	4.00E-03	8.50E-02	2.57E+00	NC	2.24E+00	NC	4.80E+00	2.34E-05	2.04E-05	4.37E-05	8.55E+02	4.69E+02	4.69E+02
	Toluene	8.00E-02	NV	8.44E-02	NC	2.81E-02	NC	1.13E-01	NC	NC	NC	9.17E+03	NC	NC
	Ethylbenzene	1.00E-01	NV	1.57E-02	NC	2.64E-03	NC	1.84E-02	NC	NC	NC	6.59E+03	NC	NC
	Xylene Mixture	2.00E-01	NV	2.92E-02	NC	5.13E-03	NC	3.43E-02	NC	NC	NC	1.37E+04	NC	NC
	PHCs													
	PHC F1													
0.605	*Aliphatic C6-C8*	5.00E+00	NV	3.72E-03	NC	3.21E-04	NC	4.04E-03	NC	NC	NC	4.56E+05	NC	NC
0.063	*Aliphatic C>8-C10*	1.00E-01	NV	1.47E-01	NC	2.67E-03	NC	1.50E-01	NC	NC	NC	2.04E+03	NC	NC
0.332	*Aromatic C>8-C10*	4.00E-02	NV	1.54E-03	NC	1.88E-04	NC	1.72E-03	NC	NC	NC	5.01E+03	NC	NC
	PHC F2							**6.09E+01**				3.34E+02	NC	3.34E+02
0.024	*Aliphatic C>10-C12*	1.00E-01	NV	2.43E+01	NC	1.36E-01	NC	2.44E+01	NC	NC	NC	6.40E+02	NC	6.40E+02
0.002	*Aliphatic C>12-C16*	1.00E-01	NV	3.63E+01	NC	3.65E-02	NC	3.63E+01	NC	NC	NC	1.15E+02	NC	1.15E+02
0.603	*Aromatic C>10-C12*	4.00E-02	NV	1.01E-01	NC	9.75E-03	NC	1.11E-01	NC	NC	NC	4.04E+03	NC	NC
0.371	*Aromatic C>12-C16*	4.00E-02	NV	3.18E-02	NC	2.22E-03	NC	3.41E-02	NC	NC	NC	2.99E+03	NC	NC
	PHC F3							**5.49E+00**				2.51E+02	NC	2.51E+02
0.56	*Aliphatic C>16-C21*	2.00E+00	NV	5.19E+00	NC	3.37E-04	NC	5.19E+00	NC	NC	NC	1.49E+02	NC	1.49E+02
0.24	*Aliphatic C>21-C34*	2.00E+00	NV	1.50E-06	NC	1.44E-04	NC	1.46E-04	NC	NC	NC	2.27E+06	NC	NC
0.14	*Aromatic C>16-C21*	3.00E-02	NV	1.42E-01	NC	5.62E-03	NC	1.48E-01	NC	NC	NC	1.31E+03	NC	NC
0.06	*Aromatic C>21-C34*	3.00E-02	NV	1.52E-01	NC	2.41E-03	NC	1.55E-01	NC	NC	NC	5.35E+02	NC	NC
	PHC F4													
0.8	*Aliphatic C>34*	2.00E+01	NV	1.14E-07	NC	2.09E-05	NC	2.10E-05	NC	NC	NC	2.28E+07	NC	NC
0.2	*Aromatic C>34*	3.00E-02	NV	3.61E-05	NC	3.49E-03	NC	3.52E-03	NC	NC	NC	3.41E+04	NC	NC
	VOCs													
	Styrene	1.20E-01	NV	3.43E-03	NC	7.85E-04	NC	4.21E-03	NC	NC	NC	1.03E+04	NC	NC
	Trichloroethylene	1.46E-03	1.30E-02	1.46E-02	2.41E-02	6.31E-03	1.14E-02	3.55E-02	7.42E-09	3.21E-09	1.06E-08	1.19E+02	1.99E+03	NC
	Vinyl Chloride	3.00E-03	1.40E+00	1.89E-04	NC	3.78E-04	NC	5.67E-04	2.12E-08	4.25E-08	6.37E-08	9.18E+02	4.08E+01	NC
	PAHs													
	Acenaphthene	6.00E-02	7.30E-03	1.10E-01	NC	5.63E-03	NC	1.16E-01	1.29E-06	6.61E-08	1.36E-06	1.34E+03	5.71E+02	5.71E+02
	Acenaphthylene	6.00E-02	7.30E-02	1.09E-02	NC	5.34E-04	NC	1.14E-02	1.28E-06	6.26E-08	1.34E-06	1.29E+03	5.48E+01	5.48E+01
	Benzo[a]pyrene	NV	7.30E+00	NC	NC	NC	NC	NC	2.31E-05	7.76E-08	2.32E-05	NC	3.92E-02	3.92E-02
	Benzo[b]fluoranthene	NV	7.30E-01	NC	NC	NC	NC	NC	2.51E-06	1.43E-08	2.52E-06	NC	6.66E-01	6.66E-01
	Benzo[k]fluoranthene	NV	7.30E-01	NC	NC	NC	NC	NC	1.58E-06	5.46E-09	1.58E-06	NC	4.04E-01	4.04E-01
	Chrysene	NV	7.30E-02	NC	NC	NC	NC	NC	2.10E-07	9.80E-10	2.11E-07	NC	5.45E+00	NC
	Fluorene	4.00E-02	NV	8.81E-02	NC	3.28E-03	NC	9.14E-02	NC	NC	NC	6.59E+02	NC	NC
	Indeno[1 2 3-cd]pyrene	NV	7.30E-01	NC	NC	NC	NC	NC	2.90E-06	4.77E-09	2.90E-06	NC	1.93E-01	1.93E-01
	Naphthalene	2.00E-02	NV	5.39E+00	NC	5.99E-01	NC	5.99E+00	NC	NC	NC	9.17E+02	NC	9.17E+02
	Metals & Inorganics													
	Mercury	3.00E-04	NV	2.37E-03	NC	1.74E-02	NC	1.98E-02	NC	NC	NC	1.21E+02	NC	NC

Formula:

Hazard quotients (HQ) or Incremental Lifetime cancer risks (ILCR) from average daily doses were calculated using the following equation:

HQ = NCGWDC or NCDWEF/ RfD_{oral}

ILCR = CGWDC or CDWEF x CSF_{oral}

Non-Carcinogenic COCs: $RBC_{GW1} = C_{GW}$ x 0.2 / HQ

Carcinogenic COCs: $RBC_{GW1} = C_{GW}$ x 1E-06 / ILCR

RBC for PHCs = Sum of (subfractions RBC x mass fraction of each sub-fraction within fraction)

Parameter	Description	Unit	Value	Formula	Reference
HQ or SAF	Hazard quotient	unitless	Calculated	See above	MOE, 2011b
RfD_{oral}	Oral reference dose	mg/kg-d	chemical specific		MOE, 2011b
CSF_{oral}	Oral cancer slope factor	$(mg/kg\text{-}d)^{-1}$	chemical specific		MOE, 2011b
ILCR or CRL	Incremental lifetime cancer risk	unitless	Calculated	See above	MOE, 2011b
(N)CGWDC	Non-Carcinogenic or Carcinogenic Groundwater Dermal Contact Exposure Concentration (Dose)	mg/kg-d	Calculated	Table A-16	MOE, 2011b
(N)CDWEF	Non-Carcinogenic or Carcinogenic Drinking Water Exposure Factor (Dose)	mg/kg-d	Calculated	Table A-16	MOE, 2011b
CRL	lifetime cancer risk level	unitless	$1x10^{-6}$		MOE, 2011b
SAF(target HQ)	Source Allocation Factor (target HQ)	unitless	(or 0.5 for PHCs)		MOE, 2011b
RBC_{GW}	Risk-based concentrations in groundwater	µg/L	Calculated	See above	
NV	No Value				
NC	Not Calculated				
	Exceed CRL or SAF				

Table A-26 **Human Health Risk-Based Concentration in Surface Soil and SubSoil (Park Visitor, Long-Term Outdoor Worker, Off-Site Resident, and Off-Site Commercial Worker)**

COC	Risk-based concentration S1	Risk-based concentration S2	Risk-based concentration Soil to outdoor air	Risk-based concentration inhalation of particulates	Lowest RBC soil
	RBC_{S1} (µg/g)	RBC_{S2} (µg/g)	$RBC_{S\text{-}OA}$ (µg/g)	$RBC_{Inhalation\ of\ Particulates}$ (µg/g)	$RBC_{surface\ or\ subsurface\ soil}$ (µg/g)
Surface Soil					
BTEX					
Benzene	8.08E+00	8.00E+00	9.77E+00	NC	8.00E+00
PHCs					
PHC F2	2.73E+03	NC	NC	NC	2.73E+03
PHC F3	5.01E+03	NC	NC	NC	5.01E+03
PHC F4	5.28E+03	NC	NC	NC	5.28E+03
PAHs					
Acenaphthylene	6.78E+00	5.96E+00	NC	NC	5.96E+00
Benz[a]anthracene	6.78E-01	5.96E-01	NC	NC	5.96E-01
Benzo[a]pyrene	6.78E-02	5.96E-02	NC	NC	5.96E-02
Benzo[b]fluoranthene	6.78E-01	5.96E-01	NC	NC	5.96E-01
Benzo[ghi]perylene	6.78E+00	5.96E+00	NC	NC	5.96E+00
Benzo[k]fluoranthene	6.78E-01	5.96E-01	NC	NC	5.96E-01
Chrysene	6.78E+00	5.96E+00	NC	NC	5.96E+00
Dibenz[a h]anthracene	6.78E-02	5.96E-02	NC	NC	5.96E-02
Fluoranthene	6.78E+00	5.96E+00	NC	NC	5.96E+00
Indeno[1 2 3-cd]pyrene	6.78E-01	5.96E-01	NC	NC	5.96E-01
Methlynaphthalene, 2-(1-)	6.23E+01	NC	NC	NC	6.23E+01
Pyrene	6.78E+01	5.96E+01	NC	NC	5.96E+01
Metals & Inorganics					
Antimony	6.51E+00	3.90E+01	NC	NC	6.51E+00
Arsenic	8.20E-01	7.76E-01	NC	NC	7.76E-01
Cadmium	6.01E-01	4.91E+00	NC	NC	6.01E-01
Copper	5.19E+02	3.49E+03	NC	NC	5.19E+02
Lead	4.18E+00	2.29E+01	NC	NC	4.18E+00
Zinc	4.88E+03	2.93E+04	NC	NC	4.88E+03
PCBs					
Polychlorinated Biphenyls	3.07E-01	NC	NC	NC	3.07E-01
Subsurface Soil					
BTEX					
Benzene	NA	NA	NA	NC	NC
PHCs					
PHC F2					
Aliphatic C>10-C12	NA	NA	NA	NC	NC
Aliphatic C>12-C16	NA	NA	NA	NC	NC
Aromatic C>10-C12	NA	NA	NA	NC	NC
Aromatic C>12-C16	NA	NA	NA	NC	NC
PHC F3					
Aliphatic C>16-C21	NA	NA	NA	NC	NC
Aliphatic C>21-C34	NA	NA	NA	NC	NC
Aromatic C>16-C21	NA	NA	NA	NC	NC
Aromatic C>21-C34	NA	NA	NA	NC	NC
PHC F4					
Aliphatic C>34	NA	NA	NA	NC	NC
Aromatic C>34	NA	NA	NA	NC	NC
PAHs					
Acenaphthene	NA	NA	NA	NC	NC
Acenaphthylene	NA	NA	NA	NC	NC
Benz[a]anthracene	NA	NA	NA	NC	NC
Benzo[a]pyrene	NA	NA	NA	NC	NC
Benzo[b]fluoranthene	NA	NA	NA	NC	NC
Benzo[ghi]perylene	NA	NA	NA	NC	NC
Benzo[k]fluoranthene	NA	NA	NA	NC	NC
Chrysene	NA	NA	NA	NC	NC
Dibenz[a h]anthracene	NA	NA	NA	NC	NC
Fluoranthene	NA	NA	NA	NC	NC
Indeno[1 2 3-cd]pyrene	NA	NA	NA	NC	NC
Methlynaphthalene, 2-(1-)	NA	NA	NA	NC	NC
Naphthalene	NA	NA	NA	NC	NC
Pyrene	NA	NA	NA	NC	NC
Metals & Inorganics					
Antimony	NA	NA	NA	NC	NC
Arsenic	NA	NA	NA	NC	NC
Cadmium	NA	NA	NA	NC	NC
Copper	NA	NA	NA	NC	NC
Lead	NA	NA	NA	NC	NC
Mercury	NA	NA	NA	NC	NC
Zinc	NA	NA	NA	NC	NC
PCBs					
Polychlorinated Biphenyls	NA	NA	NA	NC	NC

Formula:

$RBC_{surface\ or\ subsurface\ soil}$ = minimum of the four (4) pathway specific RBCs

RBC = C x 0.2 / HQ

RBC = C x 1E-06 / ILCR

RBC for PHCs = Sum of (subfractions RBC x mass fraction of each sub-fraction within fraction)

Parameter	Description	Unit	Value	Formula
$RBC_{surface\ soil}$	Risk-based concentration for surface soil	µg/g	calculated	See above
RBC S1	Risk-based concentration for surface soil derived from S1	µg/g	calculated	TableA-18
RBC S2	Risk-based concentration for surface soil derived from S2	µg/g	calculated	TableA-19
RBC S-OA	Risk-based concentration for surface soil derived from Soil to outdoor air	µg/g	calculated	TableA-24
RBC Inhalation of Particulate	Risk-based concentration for surface soil derived from inhalation of particulates	µg/g	calculated	TableA-21
NC	Not Calculated			
NA	Not Applicable			

Table A-27 **Human Health Risk-Based Concentration in Groundwater Along the Property Boundary Upgradient from the Offsite Residential and Commercial Properties**

COCs	Risk-based Concentration For Groundwater to Indoor Air Inhalation
	RBC_{GW} (µg/L)
Residential Scenario	
BTEX	
Benzene	1.11E-01
Toluene	1.92E+02
Ethylbenzene	3.11E+01
Xylene Mixture	2.69E+01
PHCs	
PHC F1	3.48E+00
PHC F2	5.86E+00
VOCs	
Styrene	2.42E+01
Trichloroethylene	6.89E-02
Vinyl Chloride	5.54E-03
PAHs	
Acenaphthene	6.79E+00
Acenaphthylene	9.88E-01
Naphthalene	2.14E+00
Metals & Inorganics	
Mercury	1.99E-03
Commercial Scenario	
Benzene	2.36E+01

Formula:

RBC_{GW-IA}

Non-Carcinogenic COCs: $RBC_{IA} = C_{IA} \times 0.2 / HQ_{IA}$

Carcinogenic COCs: $RBC_{IA} = C_{IA} \times 1E\text{-}06 / ILCR_{IA}$

$RBC_{GW} = RBC_{IA}/(\alpha \times H')$

Parameter	Description	Unit	Value	Formula
RBC_{GW}	Risk-based concentration for groundwater along the property boundary upgradient from the Offsite Residential and Commercial Properties	µg/L	calculated	Table A-22
RBC_{IA}	Risk-based concentration for modelled indoor air at the Offsite Residential and Commercial Properties	mg/m^3 = µg/L	calculated	Table A-22

Table A-28 **Human Health Risk-Based Concentration For Subsurface Workers**

COCs	RBC_{S3}	$RBC_{Soil-Tr}$	Lowest RBC_{Soil}
Units	µg/g	µg/g	µg/g
Surface Soil			
BTEX			
Benzene	NC	2.93E-03	2.93E-03
Toluene	NC	3.36E-01	3.36E-01
Xylene Mixture	NC	2.87E-02	2.87E-02
PHCs			
PHC F1	NC	1.09E-01	1.09E-01
PHC F2	NC	2.47E-02	2.47E-02
VOCs			
Styrene	NC	3.04E-02	3.04E-02
PAHs			
Acenaphthylene	NC	5.43E-01	5.43E-01
Benz[a]anthracene	5.87E-05	NC	5.87E-05
Benzo[a]pyrene	5.87E-06	NC	5.87E-06
Benzo[b]fluoranthene	5.87E-05	NC	5.87E-05
Benzo[k]fluoranthene	5.87E-05	NC	5.87E-05
Dibenz[a h]anthracene	5.87E-06	NC	5.87E-06
Naphthalene	NC	5.51E-03	5.51E-03
Metals & Inorganics			
Antimony	9.18E-05	NC	9.18E-05
Arsenic	5.71E-05	NC	5.71E-05
Cadmium	7.34E-06	NC	7.34E-06
Copper	6.88E-03	NC	6.88E-03
Lead	2.98E-04	NC	2.98E-04
Zinc	6.88E-02	NC	6.88E-02
Subsoil			
BTEX			
Benzene	NC	6.09E-03	6.09E-03
PHCs			
PHC F1	NC	3.51E-01	3.51E-01
PHC F2	NC	2.84E-02	2.84E-02
VOCs			
Trichloroethylene	NC	2.60E-02	2.60E-02
Vinyl Chloride	NC	1.98E-02	1.98E-02
PAHs			
Benz[a]anthracene	5.87E-05	NC	5.87E-05
Benzo[a]pyrene	5.87E-06	NC	5.87E-06
Benzo[b]fluoranthene	5.87E-05	NC	5.87E-05
Benzo[k]fluoranthene	5.87E-05	NC	5.87E-05
Dibenz[a h]anthracene	5.87E-06	NC	5.87E-06
Fluoranthene	5.87E-04	NC	5.87E-04
Indeno[1 2 3-cd]pyrene	5.87E-05	NC	5.87E-05
Methlynaphthalene, 2-(1-)	9.18E-04	NC	9.18E-04
Naphthalene	NC	1.61E-03	1.61E-03
Metals & Inorganics			
Arsenic	5.71E-05	NC	5.71E-05
Mercury	NC	6.44E-02	6.44E-02

COCs	RBC_{GW-Tr}	RBC_{GW1}	Lowest RBC_{GW}
	µg/L	µg/L	µg/L
Shallow Groundwater			
BTEX			
Benzene	NC	4.69E+02	4.69E+02
PHCs			
PHC F2	NC	3.34E+02	3.34E+02
PHC F3	NC	2.51E+02	2.51E+02
PAHs			
Acenaphthene	NC	5.71E+02	5.71E+02
Acenaphthylene	NC	5.48E+01	5.48E+01
Benzo[a]pyrene	NC	3.92E-02	3.92E-02
Benzo[b]fluoranthene	NC	6.66E-01	6.66E-01
Benzo[k]fluoranthene	NC	4.04E-01	4.04E-01
Indeno[1 2 3-cd]pyrene	NC	1.93E-01	1.93E-01
Naphthalene	NC	9.17E+02	9.17E+02

Formula:

RBC_{soil} = minimum of the two (2) pathway specific to soil exposure for subsurface workers

RBC_{GW} = minimum of the two (2) pathway specific to groundwater exposure for subsurface workers

Parameter	Description	Unit	Value	Formula
RBC_{soil}	Risk-based concentration for subsurface workers exposure to soil	µg/g	calculated	See above
RBC_{GW}	Risk-based concentration for subsurface workers exposure to groundwater	µg/L	calculated	See above
NC	Not Calculated			
RBC S3	Risk-based concentration for surface soil derived from S3	µg/g	calculated	TableA-20
RBC S-Tr	Risk-based concentration for surface soil derived from soil to trench air	µg/g	calculated	TableA-23
RBC GW-Tr	Risk-based concentration for groundwater derived from groundwater to trench air	µg/L	calculated	TableA-23
RBC GW1	Risk-based concentration for groundwater derived from incidental direct contact with groundwater	µg/L	calculated	TableA-25

Table A-29: Indoor Air Inhalation Exposure to Site Soil Vapour COCs - Offsite Residential Receptor

COC	Henry's Law Constant	Attenuated Indoor Air - Shallow GW (Residential)	Residential Indoor Air Prorated Exposure Concentration - Shallow GW			Toxicity Reference Values (TRVs)		Hazard Quotient (HQ) (unitless)	Incremental Lifetime Cancer Risk (ILCR) (unitless)	Residential Risk-Based Concentrations RBC $_{IA}$ (mg/m^3)		Lowest RBC_{IA}- Residential (mg/m^3)	Lowest RBC_{SV}- Residential (mg/m^3)
			NCRIAP	$NCRIAP_D$	CRIAP								
	H'	C_{IA} (shallow-depth)	Non-Carcinogens	Developmental Non-Carcinogens	Carcinogens	Tolerable Concentration (TC)	Inhalation Unit Risk Factor (IUR)	Residental		Non-Carcinogenic	Carcinogenic		
	Unitless	(mg/m^3)	(mg/m^3)	(mg/m^3)	(mg/m^3)	(mg/m3)	(mg/m3)-1						
BTEX													
Benzene	2.27E-01	1.66E-03	1.59E-03	NC	1.49E-03	3.00E-02	2.20E-03	5.31E-02	3.29E-06	6.25E-03	5.05E-04	5.05E-04	2.53E-02

Formula:

NCRIAP/NCICIAP = Non-Cancer Residential Indoor Air Proprated Exposure Concentration

NCRIAP/NCICIAP = C_{IA} x NCRIAP Value or = C_{IA} x EF_a x EF_b x EF_c x ED / AP_{NC}

CRIAP/CICIAP = Carcinogenic Residential Indoor Air Prorated Exposure Concentration

CRIAP/CICIAP= C_{IA} x CRIAP value or = C_{IA} x (EF_a x EF_b) x (EF_{c1} x ED_1 + EF_{c2} x ED_2 + … + EF_{c5} x ED_5)/AP_C

RBC_{SV} = RBC_{IA} /0.02

Parameter	Description	Unit	Value	Formula	Reference
C_{IA}	Attenuated Indoor air concentration converted from measured soil vapour concentration	mg/m^3	Calculated	C_{IA} = Csv x α	MOE (2011) - Page 316
CRIAP	Cancer Residential Indoor Air Prorating Exposure Concentration	mg/m^3	Calculated	see above	
NCRIAP	Non-cancer Residential Indoor Air Proprating Exposure Concentration	mg/m^3	Calculated	see above	
α-residential	Alpha soil gas to indoor attenuation - residential buildings in a shallow groundwater (<3m bgs)	Unitless	0.02		MOE (2011) - Page 316
H'	Henry's Law Constant	Unitless	Chemical specific		MOE (2011)
C_{GW}	Groundwater COC concentration	µg/L = mg/m^3	Site Specific		Laboratory analysis
NCRIAP value	Non-Carcinogen Residential Indoor Air Prorating Factor	Unitless	0.96		MOE (2011b - Table 2.31)
$NCRIAP_D$ value	Non-Carcinogen Residential Indoor Air Prorating Factor (Developmental)	Unitless	1		MOE (2011b - Table 2.31)
CRIAP value	Carcinogen Residential Indoor Air Prorating Factor	Unitless	0.9		MOE (2011b - Table 2.31)
EF_a	Exposure frequency	days/week	5		MOECC (2011) - indoor worker commercial
EF_a	Exposure frequency	days/week	7		MOECC (2011) - residential
EF_b	Exposure frequency	weeks/year	50		MOECC (2011) - non-carcinogens and carcinogens
EF_b	Exposure frequency	weeks/year	52		MOECC (2011) - developmental toxicans
AP_{NC}	Averaging period	years	4.5		MOECC (2011) - toddler - non-carcinogen
AP_C	Averaging period	years	76		MOECC (2011) - composite resident - carcinogen
AP	Averaging period	years	56		MOECC (2011) - female - non-carcinogen developmental
NC	Not Calculated				
RBC_{IA}	Risk-based concentration for indoor air at the Off-Site Residence	mg/m^3	calculated		
RBC_{SV}	Risk-based concentration for Soil Vapour Concentration	mg/m^3	calculated		
NC	Not Calculated				

Appendix B

Ecological Risk Assessment Calculations

TABLE B-1: **Surface Soil EPCs - Terrestrial Plant and Soil Organism Exposure**
Central Park, Hamilton, ON

Parameter	RDL	Units	Plants and Soil Organisms Direct Contact EPCs
General Chemistry			
Cyanide (WAD)	0.050	µg/g	2.8
Electrical Conductivity	0.0040	mS/cm	3456
Sodium Adsorption Ratio	-	None	130.8
Total Metals			
Antimony	0.8	µg/g	63.12
Arsenic	0.20	µg/g	51.6
Boron (Hot Water Soluble)	0.10	µg/g	4.4
Cadmium	0.50	µg/g	54.96
Copper	1.0	µg/g	8880
Lead	1.0	µg/g	4920
Zinc	5.0	µg/g	49920
Volatiles			
Benzene	0.0068	µg/g	169.2
Xylenes	0.050	µg/g	403.2
Petroleum Hydrocarbon (PHC) Fractions			
PHC F1	5.0	µg/g	1104
PHC F2	10	µg/g	6588
PHC F3	50	µg/g	13560
PHC F4 (silica gel)	250	µg/g	6204
Volatile Organic Compounds			
Styrene	0.050	µg/g	162
PAHs			
Anthracene	0.050	µg/g	120
Benzo(a)anthracene	0.050	µg/g	104.4
Benzo(a)pyrene	0.050	µg/g	76.8
Benzo(b)fluoranthene	0.050	µg/g	90
Benzo(g,h,i)perylene	0.050	µg/g	30
Benzo(k)fluoranthene	0.050	µg/g	43.2
Chrysene	0.050	µg/g	90
Fluoranthene	0.050	µg/g	324
Fluorene	0.050	µg/g	76.8
Indeno(1,2,3-cd)pyrene	0.050	µg/g	34.8
Methylnaphthalene, 1- & 2-	0.042	µg/g	74.4
Naphthalene	0.013	µg/g	65.04
Phenanthrene	0.046	µg/g	372
Pyrene	0.050	µg/g	264

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
RDL - Reportable Detection Limit, unless otherwise noted
na - Not applicable or not available
µg/g - micrograms per gram, dry weight basis
mS/cm - milliSiemens per centimetre

TABLE B-2: **Groundwater COPC Source Concentrations - Aquatic Life Exposure**
Central Park, Hamilton, ON

Parameter	Units	Shallow Groundwater Source Concentrations - Aquatic Life	Full Depth Groundwater Source Concentrations - Aquatic Life
Petroleum Hydrocarbon (PHC) Fractions			
PHC F1 (C6-C10)	µg/L	28440	
PHC F2	µg/L	40680	24480
PAHs			
Acenaphthylene	µg/L	73.44	
Anthracene	µg/L	23.52	

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
µg/L – micrograms per litre

Table B-3 **Ground Water Dilution Factor Calculation**
Central Park, Hamilton, ON
Shallow Groundwater COPC Discharge to Surface Water

Model Inputs		Reference
Inputs to Estimate Dispersivity		
Fraction of distance to downgradient well to use to determine x axis dispersivity	0.1	MOE (2011b), Gelhar et al (1992)
Fraction of x axis dispersivity to use to determine y axis dispersivity	0.1	MOE (2011b), Gelhar et al (1992)
Fraction of x axis dispersivity to use to determine z axis dispersivity	0	CCME (2006 generic case)
Inputs to Estimate Retarded COC Transport and DF 4		
Horizontal hydraulic conductivity (m/day)	0.059616	Geometric mean Site overburden hydraulic conductivity
Horizontal hydraulic gradient (dim)	0.023	Estimated from Site average 2018 elevation and Lake Ontario elevation
Aquifer total porosity (dim)	0.25	MOECC (2016) generic coarse soil value
Aquifer effective porosity (dim)	0.25	MOECC (2016) generic coarse soil value
Aquifer fOC (dim)	0.0003	MOECC (2016) generic coarse soil value
Depth to groundwater from surface (m)	1.7	Shallowest depth to groundwater at Site
Dry soil bulk density (g/cm3)	1.81	MOECC (2016) generic coarse soil value
Time since contaminant release (years)	56000	Minimal value based on presence of free-phase COPC at the Site
Distance to source well	560	Site to Hamilton Harbour (SNC-Lavalin, 2018)
Source dimension Y (width) (m)	200	Widest Site width perpendicular to groundwater flow
Source dimension Z (depth) (m)	12.8	Undelineated, therefore based on deepest soil standard exceedance (GW undelineated)
Distance to receptor perpendicular to groundwater flow (m)	0	Point of reception situated along centerline travel path
Estimated Dispersivities		
X axis dispersivity	56	
Y axis dispersivity	5.6	
Z axis dispersivity	0	
Non-Retarded Ground Water Flow Velocity		
Estimated average linear groundwater flow velocity (m/day)	0.005484672	

Infinite Source COPC Transport Including Biodegradation

Parameter	COC K_{OC} ml/g or cm^3/g	Soil OC Distribution Coefficient Kd cm^3/g	COC Retardation Factor R dim	Retarded COC Linear Groundwater Flow Velocity (m/year)	Half Life Saturated Zone (days)	Decay Constant Saturated Zone ($year^{-1}$)	Dilution Factor Variables A	B	C	D	DF4 4/(exp(A) * erfc(B) * [erf(C)-erf(D)])	Receptor Concentrations Cgw (µg/L) (EPC)
Acenaphthylene	5754.399373	1.726319812	13.49855544	0.148305149	120	0.156188763	-71.95898334	-87.4016	0.892857	-0.89286	2.24881E+31	3.26573E-30
Anthracene	25118.86432	7.535659295	55.55817329	0.036032597	912.5	0.004990425	-23.29462825	-12.2708	0.892857	-0.89286	16492680798	1.42609E-09
PHC F2(>C10-C16)	16836	5.0508	37.567792	0.053287808	1750	0.003848262	-15.7222753	-12.2882	0.892857	-0.89286	8485162.274	0.004794251

Table B-4

Ground Water Dilution Factor Calculation
Central Park, Hamilton, ON
Full Depth Groundwater COPC Discharge to Surface Water

Model Inputs		Reference
Inputs to Estimate Dispersivity		
Fraction of distance to downgradient well to use to determine x axis dispersivity	0.1	MOE (2011b), Gelhar et al (1992)
Fraction of x axis dispersivity to use to determine y axis dispersivity	0.1	MOE (2011b), Gelhar et al (1992)
Fraction of x axis dispersivity to use to determine z axis dispersivity	0	CCME (2006 generic case)
Inputs to Estimate Retarded COC Transport and DF 4		
Horizontal hydraulic conductivity (m/day)	0.059616	Geometric mean Site overburden hydraulic conductivity
Horizontal hydraulic gradient (dim)	0.023	Estimated from Site average 2018 elevation and Lake Ontario elevation
Aquifer total porosity (dim)	0.25	MOECC (2016) generic coarse soil value
Aquifer effective porosity (dim)	0.25	MOECC (2016) generic coarse soil value
Aquifer fOC (dim)	0.0003	MOECC (2016) generic coarse soil value
Depth to groundwater from surface (m)	1.7	Shallowest depth to groundwater at Site
Dry soil bulk density (g/cm3)	1.81	MOECC (2016) generic coarse soil value
Time since contaminant release (years)	56000	Minimal value based on presence of free-phase COPC at the Site
Distance to source well	560	Site to Hamilton Harbour (SNC-Lavalin, 2018)
Source dimension Y (width) (m)	200	Widest Site width perpendicular to groundwater flow
Source dimension Z (depth) (m)	12.8	Undelineated, therefore based on deepest soil standard exceedance (GW undelineated)
Distance to receptor perpendicular to groundwater flow (m)	0	Point of reception situated along centerline travel path
Estimated Dispersivities		
X axis dispersivity	56	
Y axis dispersivity	5.6	
Z axis dispersivity	0	
Non-Retarded Ground Water Flow Velocity		
Estimated average linear groundwater flow velocity (m/day)	0.005484672	

Infinite Source COPC Transport Including Biodegradation

Parameter	**COC K_{OC} ml/g or cm^3/g**	**Soil OC Distribution Coefficient Kd cm^3/g**	**COC Retardation Factor R dim**	**Retarded COC Linear Groundwater Flow Velocity (m/year)**	**Half Life Saturated Zone (days)**	**Decay Constant Saturated Zone ($year^{-1}$)**	**Dilution Factor Variables A**	**B**	**C**	**D**	**DF4 4/(exp(A) * erfc(B) * [erf(C)-erf(D)])**	**Receptor Concentrations Cgw (µg/L) (EPC)**
PHC F2(>C10-C16)	16836	5.0508	37.567792	0.053287808	1750	0.003848262	-15.7222753	-12.2882	0.892857	-0.89286	8485162.274	0.002885036

TABLE B-5: **Surface Water Exposure Point Concentrations (Groundwater Source) - Aquatic Life Exposure**
Central Park, Hamilton, ON

Parameter	Units	Shallow Groundwater Source Surface Water Exposure Point Concentrations - Aquatic Life	Full Depth Groundwater Source Surface Water Exposure Point Concentrations - Aquatic Life
Petroleum Hydrocarbon (PHC) Fractions			
PHC F2	µg/L	1.43E-10	2.89E-04
PAHs			
Acenaphthylene	µg/L	3.27E-31	na
Anthracene	µg/L	1.43E-10	na

All terms defined within the body of SNC-Lavalin's report.
Laboratory analysis by ALS, Mississauga, ON
µg/L – micrograms per litre
na - Not applicable

TABLE B-6: **Plant and Soil Organism Risk Characterization - Surface Soil COPCs**
Central Park, Hamilton, ON

Parameter	Units	EPC (1.2xMaximum)	Plants& Soil Org. R/P/I_CG_NPG [1]	Exposure Ratio (ER)
General Chemistry				
Cyanide (WAD)	µg/g	2.8	0.9	3.1
Electrical Conductivity	mS/cm	3456	0.7	4937
Sodium Adsorption Ratio	None	131	5	26.2
Total Metals				
Antimony	µg/g	63.1	20	3.2
Arsenic	µg/g	51.6	20	2.6
Boron (Hot Water Soluble)	µg/g	4.4	1.5	2.9
Cadmium	µg/g	55.0	12	4.6
Copper	µg/g	8880	140	63.4
Lead	µg/g	4920	250	19.7
Zinc	µg/g	49920	400	125
Volatiles				
Benzene	µg/g	169.2	25	6.8
Xylenes	µg/g	403.2	95	4.2
Petroleum Hydrocarbon (PHC) Fractions				
PHC F1	µg/g	1104	210	5.3
PHC F2	µg/g	6588	150	43.9
PHC F3	µg/g	13560	300	45.2
PHC F4 (silica gel)	µg/g	6204	2800	2.2
Volatile Organic Compounds				
Styrene	µg/g	162	17	9.5
PAHs				
Anthracene	µg/g	120	2.5	48.0
Benzo(a)anthracene	µg/g	104	0.5	209
Benzo(a)pyrene	µg/g	76.8	20	3.8
Benzo(b)fluoranthene	µg/g	90	7.6	11.8
Benzo(g,h,i)perylene	µg/g	30	6.6	4.5
Benzo(k)fluoranthene	µg/g	43.2	7.6	5.7
Chrysene	µg/g	90	7	12.9
Fluoranthene	µg/g	324	50	6.5
Fluorene	µg/g	76.8	ncv	2.6
Indeno(1,2,3-cd)pyrene	µg/g	34.8	0.38	91.6
Methylnaphthalene, 1- & 2-	µg/g	74.4	ncv	2.6
Naphthalene	µg/g	65.0	0.6	108
Phenanthrene	µg/g	372	6.2	60.0
Pyrene	µg/g	264	ncv	14.7
LMW PAH [1]	µg/g	690	29 [a]	23.8
HMW PAH [2]	µg/g	1057	18[b]	58.7

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

µg/g - micrograms per gram, dry weight basis

ncv - No component value

mS/cm - milliSiemens per centimetre

[1] Soil component for Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011). Soil component values were selected for the protection of ecological health based on residential parkland land use, plant & soil organisms, mammals & birds, soil leaching to groundwater and migrating to surface water (S-GW3).

[a] 29 µg/g is the US EPA (2007) Eco-SSL protective of soil invertebrates for LMW-PAHs that do not have Plants & Soil Org. component values from MOE, 2011.

[b] 18 µg/g is the US EPA Eco-SSL (2007) protective of soil invertebrates for HMW-PAHs that do not have Plants & Soil Org. component values from MOE, 2011.

TABLE B-7: Groundwater Risk Characterization - Shallow and Full Depth Groundwater
Central Park, Hamilton, ON

Parameter	Units	Shallow Groundwater Based Surface Water EPC	Full Depth Groundwater Based Surface Water EPC	Ecological Component Values GW3[1]	Shallow Groundwater Exposure Ratio	Full Depth Groundwater Exposure Ratio
PHC F2	µg/L	4.79E-03	2.89E-03	1.70E+02	2.82E-05	1.70E-05
Acenaphthylene	µg/L	3.27E-30	na	1.40E+00	2.33E-30	na
Anthracene	µg/L	1.43E-09	na	1.00E+00	1.43E-09	na

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

na - Not applicable or not available

µg/L – micrograms per litre

[1] Groundwater discharge to surface water aquatic life protection component value

TABLE B-8: **Ecological Site Specific Target Levels (E-SSTLs) - Surface Soil**
Central Park, Hamilton, ON

Parameter	Units	Table 3 Generic SCS R/P/I GC [1]	Site Maximum Concentration	EPC (1.2xMaximum)	Ontario Soil Background (Table 1)	Plants& Soil Org. R/P/I_CG_NPG [2]	MEP (1.9x) is Applied (1.9)	Mammals & Birds. R/P/I_CG_NPG [2]	MEP (1,000x) is Applied (1000)	MOE Free Phase Threshold (µg/g)	Final E-SSTL	RMM Required?
General Chemistry					ok							
Cyanide (WAD)	µg/g	0.051	2.3	2.8	0.051	0.9	1.71	0.11	110	240000	1.7	YES
Electrical Conductivity	mS/cm	0.7	2880	3456	0.57	0.7	1.33	na	na	na	1.3	YES
Sodium Adsorption Ratio	None	5 [5]	109	130.8	2.4	5	9.5	na	na	na	9.5	YES
Total Metals												
Antimony	µg/g	7.5	52.6	63.1	1.3	20	38	25	25000	8000	38	YES
Arsenic	µg/g	18	43.0	51.6	18	20	38	51	51000	12000	38	YES
Boron (Hot Water Soluble)	µg/g	1.5	3.6	4.4	0.5	1.5	2.85	na	na	5000	3	YES
Cadmium	µg/g	1.2	45.8	55.0	1.2	12	22.8	1.9	1900	18000	23	YES
Copper	µg/g	140	7400	8880	92	140	266	770	770000	na	266	YES
Lead	µg/g	120	4100	4920	120	250	475	32	32000	24000	475	YES
Zinc	µg/g	340	41600	49920	290	400	760	340	340000	15000	760	YES
Volatiles												
Benzene	µg/g	0.21	141	169	0.02	25	47.5	370	370000	5000.00	47.5	YES
Xylenes	µg/g	3.1	336	403	0.05	95	180.5	96	96000	2300	180.5	YES
Petroleum Hydrocarbon (PHC) Fractions												
PHC F1	µg/g	55	920	1104	25	210	399	na	na	1700	399	YES
PHC F2	µg/g	98	5490	6588	10	150	285	na	na	2700	285	YES
PHC F3	µg/g	300	11300	13560	240	300	570	na	na	5800	570	YES
PHC F4 (silica gel)	µg/g	2,800	5170	6204	120	2800	5320	na	na	6900	5320	YES
Volatile Organic Compounds												
Styrene	µg/g	0.7	0.05	162	0.05	17	32.3	370[b]	370000	3500	32.3	YES
PAHs												
Anthracene	µg/g	0.67	100	120	0.16	2.5	4.75	38000	38000000	2700	4.8	YES
Benzo(a)anthracene	µg/g	0.5	87	104	0.36	0.5	0.95	6.2[a]	6200	7600	0.95	YES
Benzo(a)pyrene	µg/g	0.3	64	76.8	0.3	20	38	1600	1600000	7600	38	YES
Benzo(b)fluoranthene	µg/g	0.78	75	90	0.47	7.6	14.44	6.2[a]	6200	7600	14.4	YES
Benzo(g,h,i)perylene	µg/g	6.6	25	30	0.68	6.6	12.54	1.1[d]	1100	7600	12.5	YES
Benzo(k)fluoranthene	µg/g	0.78	36	43.2	0.48	7.6	14.44	6.2[a]	6200	7600	14.4	YES
Chrysene	µg/g	7	75	90	2.8	7	13.3	6.2[a]	6200	7700	13.3	YES
Fluoranthene	µg/g	0.69	270	324	0.56	50	95	0.69	690	7600	95	YES
Fluorene	µg/g	62	64	76.8	0.12	ncv	55.1	15.4[a]	15400	2800	55.1	NO
Indeno(1,2,3-cd)pyrene	µg/g	0.38	29	34.8	0.23	0.38	0.722	1.1[d]	1100	7600	0.7	YES
Methylnaphthalene, 1- & 2-	µg/g	0.99 [3]	62	74.4	0.59	ncv	55.1	100[c]	100000	3600	55.1	NO
Naphthalene	µg/g	0.6	54.2	65.0	0.09	0.6	1.14	380	380000	2800	1.1	YES
Phenanthrene	µg/g	6.2	310	372	0.69	6.2	11.78	2700	2700000	2300	11.8	YES
Pyrene	µg/g	78	220	264	1	ncv	34.2	4700	4700000	7700	34.2	NO

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

µg/g - micrograms per gram, dry weight basis

ncv - No component value

ns - No MOE (2011) standard

na - Not applicable

mS/cm - milliSiemens per centimetre

[1] Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011)

[2] Soil component for Table 3 full depth site condition standards in a non-potable groundwater condition for residential/parkland/institutional property use (R/I/I), coarse textured surface soils (MOE, 2011). Soil component values were selected for the protection of ecological health based on residential parkland land use, plant & soil organisms, mammals & birds, soil leaching to groundwater and migrating to surface water (S-GW3).

[3] Standard applies to both 1- and 2- methylnaphthalene, with the provision that if both are detected the sum of the two must not exceed the standard. Individual isomer is not carried forward for evaluation as the methylnaphthalene, 1-,2- is retained for further evaluation.

[a] 29 µg/g is the US EPA (2007) Eco-SSL protective of soil invertebrates for LMW-PAHs that do not have Plants & Soil Org. component values from MOE, 2011.

[b] 18 µg/g is the US EPA Eco-SSL (2007) protective of soil invertebrates for HMW-PAHs that do not have Plants & Soil Org. component values from MOE, 2011.

[c] 100µg/g is the US EPA Eco-SSL protective of mammals for LMW-PAHs (acenaphthylene and 1,2-methylnaphthalene) that do not have Mammals&Birds component values from MOE, 2011.

[d] 1.1µg/g is the US EPA Eco-SSL protective of mammals for HMW-PAHs (benzo(g,h,i)perylene, dibenzo(a,h)anthracene and indeno[1,2,3-cd]pyrene) that do not have Mammals&Birds component values from MOE, 2011.

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