# Phase Two Environmental Site Assessment

## 17 Sophia Street East

## Barrie, Ontario

Prepared for:
1758601 Ontario Inc.

Prepared by:
Azimuth Environmental
Consulting, Inc.

May 2017

AEC 16-180

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

May 22, 2017 AEC 16-180

1758601 Ontario Inc.
c/o WJR Hart Holdings Ltd.
35 Tudhope Street, Unit 1
Parry Sound, ON
P2A 2H9

Attention: Mr. Robert Anderson
Owner

Re: **Phase Two Environmental Site Assessment**
**17 Sophia Street East, Barrie, ON**

Dear Mr. Hart:

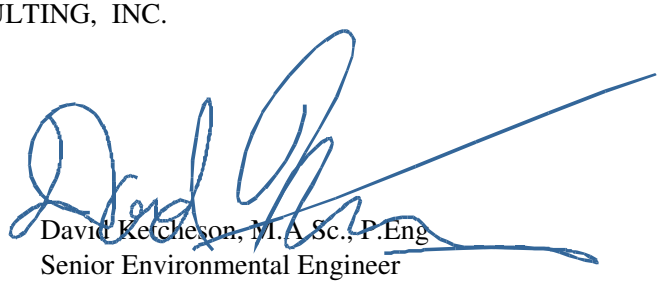
Azimuth Environmental Consulting, Inc. (Azimuth) is pleased to provide you with the following report documenting the Phase Two Environmental Site Assessment (ESA) conducted at series of five (5) adjacent properties being 17 Sophia Street East and 3, 5, 7, 11 McDonald Street in the City of Barrie, Ontario (the "RSC Property").

This assessment was conducted to evaluate the areas of potential environmental concern (APECs) on the Phase Two Property associated with past and present Site activities, as well as adjacent land use(s) in accordance with Ontario Regulation 153/04 (as amended). This work was conducted for the purpose of obtaining a Record of Site Condition (RSC) for due diligence purposes as part of a Site redevelopment project.

The Phase Two ESA program completed to date consisted of drilling 12 boreholes, and installation of 11 ground water monitoring wells. The results of the Phase Two ESA indicated that environmental impacts (*i.e.,* parameter concentrations above the applicable O.Reg. 153/04 Table 8 site condition standards) are present at the RSC Property. This consists of ground water volatile organic compounds (VOC) impacts in the southwestern corner of the RSC Property. Based on the above results, a site specific risk assessment (RA) is proposed to address the RSC requirements for submission to the Ministry of the Environment and Climate Change (the "Ministry").

We trust this report is sufficient for your current requirements and would like to thank you for the opportunity to work with you on this project. Please do not hesitate to contact us if you have any questions.

Yours truly,
AZIMUTH ENVIRONMENTAL CONSULTING, INC.



Ian Acheson, B.Sc.
Environmental Scientist

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Senior Environmental Engineer

DRK:ia

Attach:

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## 1.0 EXECUTIVE SUMMARY

A Phase Two Environmental Site Investigation (ESA) was undertaken by Azimuth Environmental Consulting, Inc. (Azimuth) for the properties being collectively called 17 Sophia Street East, Barrie, Ontario (the "RSC Property" or the "Site"); but collectively being 17 Sophia Street East and 3, 5, 7 and 11 McDonald Street. The current legal owner of the RSC Property is 1758601 Ontario Inc. Mr. Robert Anderson is the designated contact for this corporation. The RSC Property is to be redeveloped for residential development. The RSC Property was formally five (5) adjacent single-family residential properties, originally developed circa 1870 until 2012 when these homes were demolished. Following demolition fill was purchased to level the ground in the area of the former foundations at the RSC Property; but this material was not geochemically assessed prior to placement and was therefore assessed as part of this evaluation. Since that time the RSC Property has remained vacant.

The RSC Property is situated in the physiographic area known as the Simcoe Lowlands. The South Simcoe Groundwater Study (Golder, 2004) suggests that the property lies on the second deepest aquifer complex present in the Barrie Area. Immediately north and also east-northeast of the RSC Property are a pair of former glacial stream corridors that have cut into the topographic surface. Sophia Creek is the remnant stream corridor that ran along the north side of Sophia Street according to the historical fire insurance mapping reviewed. Over time, Sophia Creek was engineered and incorporated into the City's storm water infrastructure such that it is now completely buried from Peel Street which is 300 m east of the RSC Property. The former Sophia Creek corridor that ran along the north side of the street continues to be retained by the City as a Level 1 Natural Heritage Feature and as such is designated as an environmentally significant. For these reasons, the RSC Property has been designated to reside within 30 m of a water body and therefore the Table 8 Generic Site Condition Standards (SCS) should be applied. Based on the planned future land use, the Residential/ Parkland/ Institutional/ Industrial/ Commercial/ Community property use guidelines are most appropriate of the land-use specific guidelines presented in Table 8 SCS (MOECC, 2011 [as amended]).

There were no existing surface water bodies identified in the Phase One Study Area as part of the Phase One ESA (Azimuth, 2016). The nearest surface water body is Sophia Creek ~300 m to the ENE and Lake Simcoe is located ~0.5 kilometres south of the RSC Property. The topographic elevation at the RSC Property is approximately 234 meters above mean sea level (mASL) on the north side of Kempenfelt Bay. The RSC Property lies on the brow of one of several former glacial shoreline features (*i.e.,* benches) within the Lake Simcoe basin. As such, the lands slope south into the Lake Simcoe basin.

Immediately south of the RSC Property, the topographic descent increases markedly as the surface slopes down to the next glacial shoreline at about Dunlop Street. The local geology at the RSC Property results from the Simcoe Lowlands, former Lake Algonquin shore features. The lowland soils are described as being composed of interbedded sands, silt and clay.

A summary of the "*areas of potential environmental concern* (APECs)" associated with the RSC Property is summarized below (Table A – overleaf). The scope of work for the current investigation involved conducting a surface soil sampling program to evaluate the imported sediments on the RSC Property and a contaminant delineation program for the ground water impact detected at the RSC Property.

Based on the results of the Phase One ESA (Azimuth, 2016), including the Site inspection, information provided by Site representatives and regulatory agencies, documents reviewed, the review of the Site history, and receipt and review of information from the Ministry of the Environment and Climate Change, Azimuth identified the following *areas of potential environmental concern* (APECs) to be associated with the RSC Property:

1. Importation of Fill Material of Unknown Quality:
   Based on interviews of the RSC Property inspection, private housing on the RSC Property were demolished in 2012 and reportedly clean fills were brought in to level the remaining foundations. Importing soil of an unknown quality is a *potential contaminating activity* (PCA) that is carried out at the RSC Property;

2. Measured Chlorinated Solvents in ground water samples collection on the RSC Property:
   Based on the review of historical environmental reports, chlorinated ethenes were detected in a ground water monitor near the southwest corner of the RSC Property. Reported concentrations of chlorinated ethenes are a PCA that is carried out at the RSC Property;

3. Operation of Dry Cleaning Equipment (where chemicals are used):
   Based on the RSC Property inspection and review of historical environmental reports, since 1971 a dry cleaning facility has been operating within 50 m of the Site. This facility has had one reported spill in 1995. The nature of the impacts associated with this PCA which may percolate through the soil media suggest it is an APEC for the RSC Property.

**Table A: Areas of Potential Environmental Concern[1]**

| **17 Sophia Street East, Barrie, ON** | | | | | |
|---|---|---|---|---|---|
| Area of Potential Environmental Concern[2] | Location of Area of Potential Environmental Concern on RSC Property | Potentially Contaminating Activity[3] | Location of PCA (on-Site or off-Site) | Contaminants of Potential Concern[4] | Media Potentially Impacted (Groundwater, soil and/or sediment) |
| Importation of Fill Material of Unknown Quality | In the foundations of the former buildings located throughout the Site | 30 – Importation of fill material of unknown quality | On-Site | VOCs, PHCs & Metals | Soil & Ground Water |
| Operation of Dry Cleaning Equipment (where chemicals are used) | Operation of Dry Cleaning Equipment (where chemicals are used) | 37 – Operation of Dry Cleaning Equipment (where chemicals are used) | Off-Site | VOCs | Soil & Ground Water |
| Measured Chlorinated Solvents in ground water samples collection on the RSC Property | South west corner of the RSC Property | N/A – Measured Chlorinated Solvents in ground water samples collection on the RSC Property | On-Site | VOCs | Ground Water |

Notes:
1 Refer to clause 16(2)(a), Schedule D, O.Reg. 153/04
2 Area of Potential Environmental Concern means the area on, in or under a RSC Property when one or more contaminants are potentially present, as determined through the Phase One environmental site assessment, including through,
(a) identification of past or present uses on, in or under the RSC Property, and
(b) identification of potentially contaminating activity.
3 Potentially Contaminating Activity means a use or activity set out in Column A of Table 1 of Schedule D that is occurring or has occurred in a Phase One Study Area
4 Contaminants of Concern
PHCs – Petroleum Hydrocarbons VOCs – Volatile Organic Compounds

Figure 3 shows the locations of all APECs at the RSC Property. Table A (above) summarizes each APEC described above and the associated potential contaminants of concern at the RSC Property.

All other PCAs in the Phase Two Study Area were assessed and not considered to be APECs for the RSC Property given their distance to the RSC Property, the inferred ground water flow direction and subsurface conditions.

The Phase Two ESA consisted of drilling a series of eleven boreholes and the installation of ten ground water monitoring wells. The borehole locations were primarily chosen to investigate the various APECs identified in the Phase One ESA. The soil boreholes were advanced to the depth of the detected chlorinated ethenes in past Site investigations (*i.e.,* ~11 m below ground surface [mbgs]). All monitoring wells were completed with the intent that the screened interval was positioned in proximity to the chlorinated ethane depth (or deeper) and in conductive seams of the interbedded soils to evaluate the lateral and vertical extent of the detected contamination. Field screening of soil samples was conducted during the drilling program to evaluate the potential for volatile contaminants at each of the borehole locations, with soil samples being selected for laboratory analysis based on the field screening results. All the ground water monitoring wells were sampled following completion of the soil drilling program.

The results of the analytical testing indicated that ground water impacts were present at a single sampling location at the RSC Property. This location is defined by the southwest RSC Property corner, an area where an inferred chlorinated ethene release had occurred.

Based on the results of the Site investigation, no evidence was found of any soil impacts above the applicable standards. A single ground water monitoring location measured chlorinated ethenes above the applicable standards. Due to the marginal exceedence measured at this one sampling location, it is recommended that a Site Specific Risk Assessment (RA) be used to address this concern for the RSC submission.

# 2.0 INTRODUCTION

## 2.1 Site Description

Azimuth has been retained by 1758601 Ontario Inc. to conduct a Phase Two ESA for a parcel of land consisting of five adjacent properties located at 17 Sophia Street East, and 3, 5, 7, and 11 McDonald Street in the City of Barrie, Ontario (the "RSC Property" or the "Site") (Figure 1)[1]. The RSC Property includes seven (7) separate parcels that occupy an

[1] All figures can be found in Appendix A.

area of 0.23 hectares (ha) in size and can be found in the city block bound by Bayfield Street to the west, Sophia and McDonald Streets to the north, Worsley Street to the south and Clapperton Street to the east (Figure 2). The Phase Two Property is an irregularly shaped parcel of land which has a frontage of ~64 m and a depth as much as ~51 m.

The municipal addresses, Property Identification Numbers (PIN), and legal description of the RSC Property are as follows (Table B – below):

**Table B: RSC Property Identification and Description**

| Legal Description as it Appears on the Abbreviated Parcel Register | Legal Description | Property Identification Number | Municipal Address |
|---|---|---|---|
| Part of Lot 15 south side of Sophia St as per Registered Plan 31 and Part of Lots 12 to 14 south side of McDonald St as per Registered Plan 31 and Parts 2 and 4 of Plan 51R34525, City of Barrie | Part of Lot 15 south side of Sophia St as per Registered Plan 31, Plan 51R34525, City of Barrie | 58817-0015 (LT) | 17 Sophia St E, Barrie, ON |
| | Part of Lot 12 south side of Sophia St as per Registered Plan 31, Part 2 of Plan 51R34525, City of Barrie | 58817-0016 (LT) | 3 McDonald St, Barrie, ON |
| | Part of Lot 12 south side of Sophia St as per Registered Plan 31, Part 2 of Plan 51R34525, City of Barrie | 58817-0017 (LT) | 5 McDonald St, Barrie, ON |
| | Part of Lot 13 south side of Sophia St as per Registered Plan 31 , Part 4 of Plan 51R34525, City of Barrie | 58817-0020 (LT) & 58817-0389 (LT) | 7 McDonald St, Barrie, ON |
| | Part of Lot 14 south side of Sophia St as per Registered Plan 31 , Part 4 of Plan 51R34525, City of Barrie | 58817-0021 (LT) & 58817-0390 (LT) | 11 McDonald St, Barrie, ON |

According to the City of Barrie By-Law No.: 2009-141, the RSC Property is currently zoned as "RA2-1 – Residential" land. A Phase One ESA was completed at the RSC Property in October 2016.

## 2.2 Property Ownership

The current legal owner of the RSC Property is 1758601 Ontario Inc. ("1758601 ON"). Mr. Robert Anderson is the designated contact for the corporation. Contact information

for Mr. Anderson is provided below:

1758601 Ontario Inc.
Attn: Robert Anderson

35 Tudhope Street, Unit 1
Parry Sound, Ontario
P2A 2H9

(705) 746-2904
robertanderson746@gmail.com

### 2.3 Current and Proposed Future Use

The RSC Property is currently vacant with no permanent structures (Figure 2). The southern parcel (PIN No.: 58817-0390) is partially utilized as a driveway for 54 Clapperton Street. The RSC Property historically contained a single-family detached residential home on each parcel bordering the municipal road. According to the client, the RSC Property will continue to be used for residential land use in the future.

### 2.4 Applicable Site Condition Standard

Based on the following available information, the RSC Property is considered to be environmentally sensitive as defined in Sections 41and 43 of the Ontario Regulation 153/04 (O.Reg. 153/04 as amended):

- the are no nature reserves, areas of natural or scientific interest, or provincial parks present. The RSC Property is located within an area developed for residential land use;
- the RSC Property does not include all or part of a water body, the RSC Property is not adjacent to a water body, and the RSC Property does not include lands that are within 30 m of a water body. There are no surface water bodies or watercourses located on the RSC Property. The closest surface water body (Sophia Creek) is located about a 300 m east of the RSC Property; and
- the overburden was encountered during Site investigation activities up to a depth of 15 mbgs and bedrock was not encountered. Therefore, the RSC Property is not considered to be a shallow soil property.

The RSC Property has not been formally screened for butternut. However, it is our opinion that this habitat is unlikely for the developed area of the City. Finally, the former

Sophia Creek corridor that ran along the north side of Sophia Street continues to be retained by the City as a Level 1 Natural Heritage Feature and as such is designated as environmentally significant. In reality, these designated lands have been fully urbanized/ developed such that no distinguishing feature remains. Regardless, the RSC Property will need to address this situation since it remains a mapped feature by the City.

For these reasons, the RSC Property has been designated to reside within 30 m of a water body and therefore the Table 8 Generic SCS should be used. Based on the planned future land use, the Residential / Parkland / Institutional / Industrial / Commercial / Community property use guidelines are most appropriate of the land-use specific guidelines presented in Table 8 SCS (MOECC, 2011 [as amended]). The overburden soil conditions were primarily composed of interbedded sands. As a result, the laboratory analytical data has been compared to the coarse-grained standards, where applicable. Under Table 8 SCS ground water laboratory analytical data will be compared to all types of property uses.

All the environmental standards presented and discussed in the current report have been used for evaluation purposes.

# 3.0 BACKGROUND INFORMATION

## 3.1 Physical Setting

The RSC Property is located on the south side of Sophia and McDonald Streets in the City of Barrie, Ontario (Figure 2). The RSC Property has an irregular shape parcel with approximate dimensions of 63.5 m across the frontage, 51 m, 43.7 m and 49.5 m being the north, east, south and west property boundaries, respectively. The RSC Property lies within a city block bounded by Bayview Street on the west side, Sophia and McDonald Streets to the north, Clapperton Street to the west and Worsley Street to the south. The RSC Property is reported to be 0.23 ha in size.

The RSC Property since it was originally developed has remained single-family residential lots until 2012 when the detached homes on these five properties were demolished. Since that time the property has remained vacant. The RSC Property exists within a mixed residential city block (Figure 2). Retail commercial enterprises exist along Bayview Street. Commercial enterprises also exist, mostly in converted residential dwellings; on the other surrounding streets.

The RSC Property is located at an elevation of 234 to 236 mASL. The RSC Property is lies on the brow of a former glacial shoreline within the Lake Simcoe basin and slopes down towards Kempenfelt Bay to the south of the Site. The subsurface beneath the RSC Property consists of a complex of interbedded sands and silts/clays deposited as part of

one of the former glacial shorelines present on the north slope of the Lake Simcoe watershed. While a significant portion of this soil profile is composed of finer grained sediments; it is suggested that the conductive layers / seams which existed within this soil profile are being targeted to assess contaminant migration pathways which potentially exist at the RSC Property and are considered to be coarse grained materials as define in O.Reg. 153/04. The measured high water table in the zone of impact is ~229 mASL or ~5.5 mbgs. Shallow ground water flow direction was towards the southwest for September 2016 ground water sampling event. It is known that this ground water flow is towards Kempenfelt Bay located 500 m to the south of the RSC Property at a lake elevation of 220 mASL.

Based on the ground water equipotential contours for the monitoring event on September 2016, the average horizontal hydraulic gradient within the uppermost aquifer at the RSC Property was estimated to be 0.039 m/m. The average vertical hydraulic gradient is downward at 0.10 m/m.

### 3.2 Past Investigations

No environmental reports were provided to Azimuth for the RSC Property. A phased ESA report of the RSC Property was reported to have been completed for a prospective purchaser in 2015; but this document was never released to the owner. As part of this Site evaluation MW-N and MW-S were drilled on the RSC Property. However, no documentation was provided on these ground water monitoring wells. Field measurements were performed to assess the monitoring details associated with these wells.

The most recent investigations at the RSC Property have been completed by Azimuth. These programs include a preliminary Site ground water sampling program (Azimuth, 2015), a drilling and sampling program (Azimuth, 2016a), a Phase Two Sampling & Analysis Plan Program (Azimuth, 2016b). This has lead to a Phase One ESA Report (Azimuth, 2016) and finally this report.

The following is a summary of the results of the Phase One ESA and specifically the PCAs associated with this evaluation and subsequent Site investigations. A discussion on the overall interpretation of the APECs and results of the assessment at the Phase Two Property is provided in Section 6.0. Figure 3 shows the location of the various APECs identified as part of the Phase One ESA.

- the Phase Two Property was formally occupied by single-family residential dwellings, demolished in 2012. Fill material were reportedly purchased and

deposited onto the Site following the site demolition work in 2012. The fill was reported to be clean; but no formal testing of these materials were performed;

- following an unsuccessful land transaction, the initial Site reconnaissance work measured chlorinated solvents in ground water samples collection from MW-S. Subsequent water quality monitoring confirmed these results;
- between 1925 and 1935 three properties (58, 66 and 75 Bayfield Street) were developed into metal fabrication facilities;
    - the 58 Bayfield Street parcel was developed between 1925 and 1930 as a Tinsmith and historically operated between the years 1930 and 1942. There is no evidence of any significant environmental spills from this parcel. In addition, the parcel is considered downgradient of the RSC Property and is therefore not a significant environmental concern;
    - the 66 Bayfield Street parcel was developed between 1925 and 1935 as a blacksmith and historically operated between the years 1937 and 1942, and use as a radiator service shop after 1950. There is no evidence of any significant environmental spills from this parcel. In addition, the parcel is considered downgradient of the RSC Property and is therefore not a significant environmental concern; and
    - the 75 Bayfield Street parcel was developed between 1925 and 1930 as a blacksmith and historically operated between the years 1930 and 1937 where it became vacant in 1942. There is no evidence of any significant environmental spills from this parcel. In addition, the parcel is considered downgradient of the RSC Property and is therefore not a significant environmental concern.
- historical fuel storage tank facilities have been reported within the vicinity of the RSC Property;
    - the 80 Bayfield Street parcel (at Ross Street) was used as a service station between 1942 and 1991. The 80 Bayfield Street previously held thirteen (13) O.Reg. 347/90 Waste Generator records for the generation of FS Liquid Fuel Tank, FS Piping, and FS Gasoline Station – Full Service in the year of 1993. There has also been one account of Private and Retail Fuel Storage Tanks for retail use in 1993. This parcel is considered downgradient to the RSC Property and therefore due to the location it is not a significant environmental concern;
    - the 100 Bayfield Street parcel (at Sophia Street) was developed between 1965 and 1970 and has historically been used as a service station in 1971. The property was redeveloped sometime prior to 1989 as a small strip mall. The parcel is considered cross gradient to the RSC Property and is therefore not a significant environmental concern;
    - the 140 Bayfield Street parcel (at Wellington Street) was developed around 1962 and has historically been used as Bell Canada telephone switching station. In

1990 a fiberglass reinforced plastic commercial fuel oil tank in size of 10,066 L was registered under the number 200204-1560. TSSA expired facilities for the fuel oil tank in November 2013. 140 Bayfield Street parcel previously held two Waste Generator records for the generation of light fuel wastes. It is speculated that emergency generators on the property were fueled by this stored fuel. The Bell property is north of the RSC Property; but also west and if ground water flow is southwest then it is unlikely that this facility could influence the RSC Property unless there was significant dispersion to the contaminant migration. For this reason, this parcel is considered cross gradient of the RSC Property and is therefore not a significant environmental concern; and

  - the 14 Collier Street parcel (at Clapperton Street) was commercially redeveloped sometime between 1953 and 1961 and used as a service station to at least 1980. By 1989 the service station had been demolished. Reportedly, a dissolved-phase chlorinated solvent plume originates from this location and travels southwest toward the "Five Points" intersection at Dunlop and Bayfield Streets. This dissolved-phase contaminant plume direction is consistent with the ground water flow direction interpreted from the RSC Property. The parcel is downgradient of the RSC Property and is therefore not a significant environment concern.

- the 103 Bayfield Street parcel was commercially developed sometime in the 1960s for dry cleaning operations. In 1971 Wright's Dry Cleaners commenced operations at this location. It was reported that Wright Cleaners had 135 L spill incident in 1995 which involved a container of waste dry cleaning solvent spilt to a gravel soil surface and was cleaned up. Wright Cleaners has previously held twelve (12) O.Reg. 347/90 Waste Generator records for halogenated solvent wastes and residues between 1986 and 2015. This parcel is considered downgradient of the RSC Property since it is located 50 m west of the Site. However, non aqueous phase liquid migration is also influenced by geologic bedding (Pankow and Cherry, 1996) and thus the potential for influence may exist;
- historically, a number of automotive repair shops have existed south of Worsley Street on Bayfield Street. All of these facilities are downgradient of the RSC Property and are therefore not a significant environment concern. The same can be stated for a more distant location on Maple Street;
- the 12 Drury Lane parcel has presumably had the application and storage of commercial pesticides associated with the sports facility. The MOECC (2011) Guidance document for Phase I ESAs states "… 'bulk storage', in terms of scale or volume of material can include large numbers, amounts or volumes of material for commercial or industrial use, even if the material is packaged in smaller consumer-sized containers …". Our interpretation of this guidance is that there is no reference to agricultural / recreational uses. The guidance appears to reference the

manufacturing or distribution side of the process. Proper use of herbicides, fungicides and pesticides on recreational lands should not result in unacceptable soil contamination. While there was little site specific information on past practices related to the maintenance of this sports field, there was no evidence to suggest over-application of such products. Also chemicals used prior to the 1950s are much different than those of greatest concern and used in the post-1950s (*i.e.*, chlorinated chemicals). Thus, it was assumed that compounds were properly applied and therefore are not of consequence to this Site evaluation; and

- at present, a funeral home business operates from the 30 Worsley Street parcel (at Clapperton Street) and a historical operation was present at the 127 Bayfield Street parcel. These operations do not pose a high environmental concern. Operation requires the storage of formaldehyde for embalming purposes. With operations in the area for over 40 years, any environmental losses from over 40 years ago are unlikely to be present in the Phase One Study Area given the local ground water flow regime. Formaldehyde is unlikely to sorb to soils and hence is not persistent over time from the source location (ATSDR, 1999). Finally, according to published literature dissolved formaldehyde will biodegrade to low levels in a few days (Howard, 1989). Thus, the only PCA would be the Worsley Street property since it represents an active operation. However, this facility is downgradient of the RSC Property and is therefore not a significant environment concern.

# 4.0 SCOPE OF THE INVESTIGATION

## 4.1 Overview of the Site Investigations

The RSC Property investigations consisted of conducting a soil drilling and ground water sampling program at the various APECs. Twelve soil boreholes were advanced at the Phase Two Property, with 11 boreholes completed as ground water monitoring wells (Figure 4).

For the confirmatory soil drilling programs, each of the soil boreholes was advanced using a combination of hollow-stem augers and a split spoon sampling device. The soil samples were field screened, and selected samples were submitted for laboratory analysis of a range of parameters.

### 4.1.1 July 2015 Program

The initial evaluation program conducted at the RSC Property was to collect ground water samples at the existing wells (*i.e.,* MW-N and MW-S) to determine whether any impacts could be measured. Detection of chlorinated solvents marginally above applicable standards was measured at MW-S; but no detection occurred at MW-N.

Conversely, MW-N detected elevated road salt parameters despite the fact that this Site has been vacant for the past three years.

The initial program also measured the depth of each monitoring wells that had been drilling earlier in 2015. It revealed that MW-S was drilled deeper in the soil profile at ~11 mbgs. MW-N had been instrumented higher in the soil profile at ~8 mbgs.

### 4.1.2 November 2015 Program

The November 2015 program was designed to determine whether the detected chlorinated solvents were migrating from an upgradient / off-Site source. The inferred ground water flow direction was deemed to be southwest and therefore a series of ground water monitors were constructed along the northern and western property boundaries. Monitoring wells were targeted at ~11 mbgs horizon; but also to the closest conductive zone. Table C (below) presents a list of the soil boreholes and ground water monitoring wells, their location, and the rationale for their installation.

**Table C: Sample Analysis Plan – Exploration Program**

| Borehole/ Well Name | Location | Rationale |
|---|---|---|
| BH-1/MW-1 | SW corner of property | Delineate the vertical and horizontal extents of a chlorinated solvent detection at MW-S |
| BH-2/MW-2 | NW property corner adjacent to MW-N | Evaluate potential upgradient sources of ground water impacts along the north and west property boundary and determine the stratigraphic profile at MW-N |
| BH-3/MW-3 | N side of property | Evaluate potential upgradient sources of ground water impacts along the north property boundary |
| BH-4/MW-4 & BH-4a/ MW-4a | NE property corner | Evaluate potential upgradient sources of ground water impacts along the north property boundary |
| Borehole | SW side of property | Determine the stratigraphic profile at MW-S |

The findings of this exploration program revealed that the off-Site chlorinated solvent PCA was not influencing the RSC Property because elevated COCs were not detected in the conductive zones being monitored along the western property boundary. The evaluation of the north property boundary also revealed that the chlorinated solvent detection at MW-S was not due to an off-Site source from the northeast. The chlorinated ethene detection was inferred to have occurred from an on-Site source.

### 4.1.3 June 2016 Program

As a result of these findings a second drilling program was conducted to delineate the chlorinated ethene contamination detected at MW-S. Table D (below) presents a list of the soil boreholes and ground water monitoring wells, their location, and the rationale for their installation.

**Table D: Sample Analysis Plan – Delineation Program**

| Borehole/ Well Name | Location | Rationale |
|---|---|---|
| BH-A1/MW-A1 & BH-A2/ MW-A2 | N side of MW-S | Delineate the vertical and horizontal extents of a chlorinated solvent source |
| BH-B1/MW-B1 & BH-B2/ MW-B2 | W side of MW-S | Delineate the vertical and horizontal extents of a chlorinated solvent source |
| BH-C1/MW-C1 & BH-C2/ MW-C2 | E side of MW-S | Delineate the vertical and horizontal extents of a chlorinated solvent source |

A similar drilling strategy was used where monitoring wells situated around MW-S were to be installed in a conductive zone at about 11 mbgs and then the next closest conductive zone found deeper in the soil horizon which was ~15 mbgs. As indicated above, the intent of targeting conductive seams in the soil profile was to assess whether there was any potential for lateral or vertical migration of chlorinated ethenes from the general proximity of the MW-S well location (*i.e.,* source zone).

Following installation of the ground water monitoring wells, each well was purged to remove at least three well volumes. Ground water samples were then collected from each well and submitted for analysis of a range of parameters.

## 4.2 Media Investigated

Previous investigations provided an understanding of the local geology at the RSC Property. Regionally, three interconnected aquifer sequences have been identified within the overburden sequence, which are characterized by coarse-grained sediments interbedded with discontinuous layers of finer-grained materials. In the vicinity of Kempenfelt Bay the deepest aquifer sequence tends to be much more coarse-grained than the overlying aquifer units. This produces a fairly complicated hydrogeological sequence that can be conceptualized simplistically as a series of two, and occasionally three, aquifers separated by discontinuous fine-grained layers. The lower aquifer can generally be thought of as a larger aquifer complex in the vicinity of the Phase One Study Area although it may represent more distinct aquifers elsewhere. The middle aquifer complex is inferred as being confined by the repetitive layering of the fine-grained sediments and

the upper aquifer is unconfined. The coarse-grained nature of the deep aquifer sediments makes it highly permeable and suitable for use as a municipal source of water. Because of its position within the northern glacial shoreline, the upper aquifer system is absent at the RSC Property and resides higher in the topographic slope into the Lake Simcoe basin.

The Site lies within the middle aquifer complex. The thickness of the surficial aquifer system at the Phase Two Property was estimated to range between 7 and 15 mbgs. As a result, the scope of the current investigation included both soil and ground water components. The intent of the program was to investigate the overburden deposits to the approximate depth of the chlorinated ethenes detected at MW-S.

The drilling program represented the presence (or absence) evaluation of potential Site contamination. Specific details outlining the borehole advancement, associated soil sampling, and monitoring well installations, with subsequent ground water sampling, at the RSC Property can be found in Appendix B, Sampling and Analysis Plan.

### 4.3 Phase Conceptual Site Model

The Phase One Conceptual Site Model presented in the Phase Two Conceptual Site Model Report (Azimuth, 2017) is as follows:

> "… the Site falls within the Simcoe Lowlands[2] physiographic region. The RSC Property lies on one of the numerous glacial shorelines that define the Lake Simcoe basin. In general, the upper 15 m of the subsurface stratigraphy consisted of interbedded or laminated structure consisting of sands and finer grained materials (*i.e.,* silts to clay sediments). Variations were encountered across the RSC Property and attributed to the fluvial / littoral deposition. Very thinly bedded layers predominated the subsurface environment with occasional lacustrine (*i.e.*, lake lain / quiet water) units. The layering is relatively thin (*i.e.,* ~5 to 10 cm or less) and interdispersed with clayey sand sediments. Our interpretation is that the deposition is reflective of a braided glaciofluvial river setting which is in keeping with that found throughout the City area within the Kempenfelt Bay vicinity ...".

Information acquired as part of the Phase Two ESA was in general agreement with the Phase One ESA Conceptual Model. Lithological observations across the 12 sampled

[2] Chapman, L.J. and D.F. Putnam, 1984
The Physiography of Southern Ontario; 3rd Edition, OGS Special Volume 2, MNR.

locations were multiple medium and fine sand layers sand, trace silt and clay. These observations are presented in field borehole logs, in Appendix D.

### 4.4 Deviations from Sampling and Analysis Plan

The sampling and analysis plan for the Phase Two ESA is presented in Appendix B. One deviation from the SAP was noted during the field program. The existing ground water monitoring wells (MW-N & MW-S) were used by Azimuth to continually evaluate conditions at the Site. No drilling notes or construction details, identifying soil stratigraphy were obtained from the advancement of these ground water monitoring wells. To compensate for this missing information, a borehole was advanced directly next to monitor MW-S to confirm the soil stratigraphy in the area on-Site where known environmental impacts were located.

### 4.5 Impediments

No access issues were encountered during the Phase Two ESA field program.

## 5.0 INVESTIGATION METHOD

### 5.1 General

The evaluation of the RSC Property was conducted through two successive drilling programs and subsequent ground water sampling events. Our understanding of the CSM was refined through these field investigation programs.

The geologic nature of the RSC Property being a conductive media suggested that the detection of significant contamination associated with the past and present uses of the Site should be possible at the selected drilling locations. Investigation of the subsurface profile across the RSC Property limits; especially where known VOC compounds were found permitted a reasonable assessment of the Site condition. Residues of PCE and its daughter products in the saturated zone can be expected to be encountered; yet the purpose is to delineate the extents; then its dispersion and detection in the ground water should be possible using the proposed "*Sample and Analysis Plan* (SAP)" (Appendix B).

The standard operating procedures for the various components of the Phase Two ESA (as stipulated in O.Reg. 153/04 Schedule E, Part Two, s.3(5)) are presented in Appendix C.

### 5.2 Drilling

The soil and ground water drilling programs were conducted on November 3 to 6, 2015 and June 6 to 9, 2016. Walker Drilling Ltd. (Walker) of Utopia, Ontario was retained to provide the drilling equipment for the November 2015 drilling event. During this event,

soil boreholes were advanced at the Phase Two Property using a D-50 Track Mounted Drill Rig, using 210 mm (nominal) ID hollow stem augers, with 56 mm (nominal) OD stainless steel split spoon sampling devices for collecting soil samples when using the hollow stem augers. Lantech Drilling Services Inc. (Lantech) of Sharon, Ontario was retained to provide the drilling equipment for the June 2016 drilling event. During this event, the soil boreholes at the Phase Two Property were advanced using a Mobile Model track mounted CME 75, using 210 mm (nominal) ID hollow stem augers, with 56 mm (nominal) OD stainless steel split spoon sampling devices for collecting soil samples when using the hollow stem augers. The soil cores obtained by the split spoon samplers were examined by field staff, logged, and field screened for volatile gases, and representative samples were collected according to the SAP (Appendix B). Figure 4 shows the soil borehole and ground water monitoring well locations.

Measures followed during the soil sampling to minimize the potential for cross-contamination included:

- Washing and rinsing the split spoon sampling devices after each use;
- Using new nitrile gloves during the collection of all soil samples; and
- Collecting all soil samples in new, laboratory provided containers.

### 5.3 Soil: Sampling

For the borehole drilling, undisturbed soil cores were collected by the use of the split spoon sampling devices. Since the split spoon sampling device also served in effect as the drilling/coring tool, this allowed for logging and collection of the soil profile in regular intervals at each borehole location. Soil samples were collected directly from the individual split spoon samplers, according to the methods presented in the soil sampling SOP (Appendix C). Soil was collected by hand, using new nitrile gloves for each split spoon, and was immediately transferred from the split spoon into the appropriate sampling container. Samples for field screening measurements were collected in a similar fashion.

The finalized field logs, which are presented in Appendix D, provide a description of the geology encountered at each soil borehole, and indicated the soil sampling frequency.

### 5.4 Field Screening Measurements

Field screening for the chlorinated solvents consisted of a visual and olfactory inspection of the soil profile, as well as testing using a portable gas detector. The gas detector used at the Phase Two Property for all the soil sampling was a RKI Instruments Eagle organic

vapour analyzer (OVA), in methane elimination mode. The technical details for the RKI Eagle, including gases detected, measuring range and accuracy of the measurements are provided in Appendix E. The OVA was calibrated with a 15% Lower Explosive Limit (LEL) using 1,650 parts per million by volume (ppmv) hexane standard on November 3, 2015 and June 6, 2016, immediately prior to beginning each soil sampling program.

The results of the field screening measurements were identified for use as a guide for soil sample selection and laboratory submission. Higher readings on the RKI Eagle suggest the presence of flammable organic vapours, and would indicate potential soil sampling locations. The RKI Eagle does not analyze specific parameter concentrations therefore the relative concentrations between readings formed the basis for comparison. As a general rule of thumb, readings above about 25 ppmv on the RKI Eagle instrument are taken to be indicative of the potential presence of organic contamination. For the most part OVA readings at the Phase Two Property ranged between 0 and 260 ppmv (Appendix D). Where OVA measurements below 25 ppmv were measured throughout the soil column, soils in the vicinity of the ground water table or ~11 mbgs were targeted for analytical submission.

### 5.5 Ground Water: Monitoring Well Installation

The ground water monitoring wells were installed according to the SOP presented in Appendix C, and in accordance with O.Reg. 903/00. All monitoring wells were constructed using new, 51 mm (nominal) diameter, Sch 40 PVC pipe and screen sections. New nitrile gloves were worn by all field staff during the handling of the PVC and the well installation process. Completion details for the individual wells are presented as part of the borehole logs (Appendix D). No well development was conducted as part of the installation process. Registration of the monitoring wells as part of the Ministry water well database was performed by Walker and Lantech.

Two existing monitoring wells were installed at the Site by others. Details of the soil descriptions are not known, yet their depths and screen lengths are known. For the purposes of this report, these wells will be identified according to their directional position on the Site. The well on the north side of the property, adjacent to Sophia Street East, will be identified as MW-N. The well located on the south side of the property, will be identified as MW-S. Monitoring well MW-N has a measured depth of 6.95 mbgs and an inferred screen length of 2.9 m which is installed between 4.0 and 6.9 mbgs. Monitoring well MW-S has a measured depth of 11.35 mbgs and an inferred screen length of 2.9 m which is installed between 8.4 and 11.3 mbgs. Well locations are presented in Figure 4.

## 5.6 Ground Water: Hydraulic Field Measurements

In order to understand the hydraulic characteristics of the underlying overburden, transient hydraulic tests were performed on the newly constructed monitoring wells following the November 2015 drilling program. The transient test involves the instantaneous injection or withdrawal of a volume or slug of water or solid cylinder of known volume. This is accomplished by adding or displacing a known volume to/from a well and measuring water level response time to return to equilibrium. Water level measurements were recorded both manually and with automatic dataloggers, which were programmed to record the pressure of water above the data logger every 3 seconds. Data was analyzed using the Hvorslev Method (1951), which assumes a homogeneous, isotropic medium in which soil and water are incompressible. Hydraulic testing results are summarized in Table E (below).

**Table E: Hydraulic Testing Results**

| Monitoring Well | Hydraulic Conductivity (m/s) | Transmissivity ($m^2/s$) | Soil Description |
|---|---|---|---|
| MW-1* | $1 \times 10^{-2}$ to $1 \times 10^{-4}$ | $2 \times 10^{-5}$ to $200 \times 10^{-5}$ | 15 cm gravel seam |
| MW-2 | $3 \times 10^{-6}$ | $0.8 \times 10^{-5}$ | interbedded sand |
| MW-3 | $4 \times 10^{-6}$ | $0.8 \times 10^{-5}$ | interbedded sand |
| MW-4 | $7 \times 10^{-6}$ | $2 \times 10^{-5}$ | interbedded sand |
| MW-4a | $4 \times 10^{-5}$ | $3 \times 10^{-5}$ | interbedded sand |
| MW-S** | $8 \times 10^{-7}$ | $0.2 \times 10^{-5}$ | interbedded sand |

Notes: Values rounded off for presentation purposes

* - It is likely that the bulk lateral hydraulic conductivity at MW-1 is at least $1 \times 10^{-3}$ m/s

** - It is assumed that MW-S has a 2.9 m well screen which fully contributes to the ground water flow at this location.

The soil transmissivity for all sampling locations is roughly similar, barring MW-S which is slightly less transmissive. The differences in bulk lateral hydraulic conductivity results illustrate the variations in the bulk contributing zone used in each of the analyses. For example, a 0.15 m sand and gravel seam was used for MW-1 whereas larger intervals up to ~4 m were estimated for some of the other monitors. It is speculated that potentially all of the monitoring wells are intersecting a conductive zone with a limited thickness; but which will convey the ground water laterally through the soil profile.

In the southwest corner, the most conductive lateral ground water flow zone was encountered at MW-1 in a thin sand and gravel seam. In essence, this sand and gravel seam could be up to 100 times more conductive than that measured at most other sampling locations. From a contaminant transport perspective, this seam represents a "path of least resistance" which would serve to move contaminant mass readily within the local ground water flow system if it were present.

The other inferred hydraulic aspect to the ground water flow system is that the vertical conductance through this layered sequence of materials would be quite small. In a laterally bedded ground water flow system, the most conductive layers will reflect the lateral transmissivity of the system and the least conductive layers are representative of the vertical transmissivity through the same system. In this case, the low permeability clay layers encountered throughout the soil profile will limit the vertical conductance of the ground water flow system. In essence, the ground water system is indicative of a laterally dominated flow regime.

### 5.7 Ground Water: Field Measurement of Water Quality

Field-measured parameters were collected as part of the ground water sampling process. The field parameters collected included pH, electrical conductivity (EC), temperature, and redox potential (Eh). Prior to collecting field-measured parameters, ground water level measurements, the presence of non-aqueous phase fluids are determined using an electronic multi-phase water level tape. Three times the well volume is purged with field-measured parameters collected during or following the process. Field-measured parameters are collected until each parameter has stabilized. Stabilization of parameters indicates new ground water is moving into the well. All field-measured parameters were collected according to the SOP provided in Appendix C.

### 5.8 Ground Water: Sampling

Ground water samples were collected from the RSC Property over three sampling events between 2015 and 2016. An initial sampling event was completed in July 2015; further sampling events were added as additional monitoring wells were installed across the Site.

Historical on-Site monitoring wells (MW-N & MW-S) were initially sampled to determine a baseline ground water quality and determine whether any ground water impacts existed at these sampling horizons. A diverse group of parameters were selected for this initial analysis in order to develop a baseline of results for the RSC Property. Ground water samples were submitted for BTEX[3], PHC $F_1$ – $F_4$ fractionations ($F_1$ – $F_4$), VOCs and trace metals during the initial monitoring well sampling event in July 2015. Results collected from the July 2015 sampling event reported measurable concentrations of toluene, PHC $F_3$, *trans*-1,2-dichloroethene (*trans*-1,2-DCE), *cis*-1,2-dichloroethene (*cis*-1,2-DCE), trichloroethene (TCE), tetrachloroethene (PCE), and hexane in monitoring well MW-S, with *cis*-1,2-DCE, TCE and PCE concentrations exceeding Table 8 SCS. Monitoring well MW-S was sampled in two subsequent events as additional monitoring wells were installed across the RSC Property. Toluene and PHC $F_3$ concentrations were

[3] BTEX – benzene, toluene, ethylbenzene and xylenes

not detected at MW-S upon the completion of the additional two sampling events. During each sampling event, concentrations of *cis*-1,2-DCE, TCE and PCE were reported exceeding Table 8 SCS. Inorganic and metals parameters were reported below the Table 8 SCS. Monitoring well MW-N was sampled exclusively during the initial ground water sampling event in July 2015. There were no measureable detections of BTEX, PHCs and VOCs at this location. However, MW-N did measure road salt parameters above permissible standards.

Upon the installation of five new on-Site monitoring wells (MW-1, MW-2, MW-3, MW-4 & MW-4a) in November 2015; a ground water sampling event ensued. Ground water samples were submitted for six monitoring wells (MW-S, MW-1, MW-2, MW-3, MW-4 & MW-4a) and analyzed for BTEX, PHC $F_1 – F_4$ and VOCs during this sampling event. Results collected from the November 2015 sampling event reported measurable concentrations of toluene, *cis*-1,2-DCE, TCE, and hexane in monitoring well MW-1 (*i.e.,* SW property corner); none of these parameters had concentrations exceed Table 8 SCS. Measurable concentrations of toluene, *cis*-1,2-DCE, TCE, and hexane in monitoring well MW-2 (NW property corner); none of these parameters had concentrations exceed the applicable standards. Concentrations of toluene, ethylbenzene, total xylenes in monitoring well MW-3 (N property boundary); none of these parameters had concentrations exceed Table 8 SCS. Monitoring well MW-4 had reported concentrations of toluene, ethylbenzene and hexane with none exceeding Table 8 SCS. Monitoring well MW-4a had reported concentrations of toluene and Methyl Isobutyl Ketone with neither exceeding Table 8 SCS.

In June 2016, six additional ground water monitoring wells (MW-A1, MW-A2, MW-B1, MW-B2, MW-C1, & MW-C2) were installed with subsequent ground water samples collected. Samples were submitted for BTEX and PHC $F_1 – F_4$ exclusively. All wells had concentrations of toluene reported below Table 8 SCS. Acetone was reported in three monitoring wells: MW-A1, MW-B1 and MW-B2. Monitoring well MW-A2 had reported measureable concentrations of *cis*-1,2-DCE and TCE. Monitoring well MW-C2 had reported measureable concentrations of chloroform and bromodichloromethane. Each of these above mentioned concentrations were below the Table 8 SCS.

MW-A2 was instrumented with a pressure transducer from March to August 2017 and recorded a seasonal high water table elevation of 288.9 mASL in the "zone of impact" or 5.5 mbgs. The interpreted high water table elevation on the RSC Property in the northeast corner of the property is 231.3 mASL, barring the perched condition evident at MW-N in the northwest corner.

All ground water samples were collected according the SOP provided in Appendix C.

### 5.9 Analytical Testing

All soil and ground water samples were submitted to AGAT Laboratories, of Mississauga, Ontario (the 'Laboratory') for analysis. AGAT's Mississauga laboratory is accredited by the Canadian Association of Laboratory Accreditation (CALA). The laboratory analytical reports are presented in Appendix E.

### 5.10 Residue Management Procedures

All soil cuttings produced during the drilling program were disposed of on the RSC Property after analytical testing had shown that no detectable contaminants were found in these materials.

### 5.11 Elevation Survey

An elevation survey was completed during the Phase Two investigation (Appendix F). The elevation survey was completed by Rudy Mac Surveying Ltd., of Barrie, Ontario, on December 30, 2016. The newly installed monitoring wells had their elevations referenced and reported to the nearest centimetre relative to a geodetic or permanent and recoverable benchmark by a qualified person.

### 5.12 Quality Assurance and Quality Control Measures

Azimuth uses numerous quality assurance/quality control (QA/QC) procedures, some of which have been previously discussed. The Sampling and Analysis Plan (SAP) provide some discussion on the quality control program (Appendix B). An overview of these measures is highlighted below.

#### 5.12.1 Field Evaluation Protocols

Standard operating procedures for aspects of the Phase Two ESA are presented in Appendix C. In brief, the intrusive RSC Property investigation used several quality control measures. The PCOCs included PHCs, VOCs, and heavy metals (Table A). Some of these contaminant types are known to volatilize and therefore soil gas screening techniques were used to identify potential contaminant sampling locations.

Visual screening techniques are possible for PHCs. Soil staining is typical for PHC detection in soil profiles. PHC "smear zones" can occur at or near water table locations and provide an indicator for the detection of this feature in the subsurface. As has been mentioned, the development of the CSM was of assistance in targeting contaminant migration pathways. Among the evidence compiled during the field program was the

geologic consistency seen across the RSC Property. During the drilling, visual observations of the soil profile was unable to confirm the presence/ absence of PHC in the soils.

### 5.12.2 Sample Collection Protocols

All containers for the soil, ground water and wastewater samples were provided by the Laboratory, and were specific to the individual types of analysis required. Sample preservation methods (if any) were followed as specified by the Laboratory. All sample containers were labelled by field staff with the date, Azimuth project number, sampler's name, and sample name. Upon collection, each sample was placed in an ice filled cooler for temporary storage prior to delivery to the Laboratory. For the field programs, all samples were collected at the RSC Property, stored as indicated above, and transported to the Azimuth office in Barrie, Ontario where they were picked up the following day by courier and delivered to the Laboratory. Laboratory provided chain of custody forms were prepared which documented all the samples and sampling information and provide a record of the sample handling between collection and delivery to the Laboratory. The chain of custody form is included with the analytical testing results (see Appendix E). All equipment cleaning procedures used by Azimuth are presented in Appendix C.

### 5.12.3 Analytical Data Review

The purpose of this effort is to ensure the representativeness of the analytical data. For thoroughness, an evaluation of each investigation collecting analytical samples is summarized below. Quality assurance data for the Phase Two ESA is presented in Appendix E.

#### 5.12.3.1 July 2015 Program

The initial Site evaluation program was conducted on July 21, 2015. The purpose of this investigation was to sample the existing ground water monitors, installed as a result of the 2015 ESA completed by others. The sampling was to investigate suspected yet unknown contaminants that may be present at the RSC Property. There was no understanding of the contaminants of concern therefore a wide selection of parameters were selected for analysis, including: PHCs, VOCs and trace metals.

*Petroleum Hydrocarbons Summary*

The quality assurance data from AGAT Laboratories indicates that the relative percent difference (RPD) on duplicate ground water sample controls for the PHC evaluation completed were all below the measureable detection limits (MDL) for all compounds analyzed. The method blank showed no detections as anticipated. The reference material evaluation results ranged from 96% to 107%; but all were within the acceptable limits.

The majority of constituents had limits from 60% to 140% noted. These ranges are typical for analytical results. Both the Method Blank Spike and Matrix Spike recoveries were found to be within 15% of the values as was the chemical surrogate (*e.g.,* terphenyl).

*Volatile Organic Compounds Summary*
The quality assurance data from AGAT Laboratories indicates that the RPD on duplicate ground water sample controls for the VOCs evaluation completed were all below the MDL for all compounds analyzed. The method blank showed no detections as anticipated. The reference material evaluation results ranged from 78% to 127%; but all were within the acceptable limits. The all of constituents had limits from 50% to 140% noted. Both the Method Blank Spike and Matrix Spike recoveries were found to be within acceptable limits. Similarly, the surrogate recoveries were within acceptable limits and within 15% of the actual value.

*Trace Metals Summary*
The quality assurance data from AGAT Laboratories indicates that the RPD on duplicate ground water sample controls for the trace metals evaluation completed varied by as much as 15.4%. The method blank showed no detections as anticipated. The reference material evaluation results ranged from 94% to 108%; but all were within the acceptable limits. The all of constituents had limits from 70% to 130% noted. These ranges are typical for analytical results. Both the Method Blank Spike and Matrix Spike recoveries were found to be within acceptable limits.

#### 5.12.3.2 November 2015 Program

A delineation drilling program was completed by November 10, 2015. The purpose of this investigation was to confirm the presence / absence of the VOC compounds throughout the south west property and investigate PCAs from identified off-Site sources. Six boreholes were advanced, with five completed as monitoring wells. Each of these newly installed ground water monitoring wells were sampled during the November 2015 program.

*Petroleum Hydrocarbons Summary*
The quality assurance data from AGAT Laboratories indicates that the RPD on duplicate soil sample controls for the PHC evaluation completed were all below the MDL for all compounds analyzed. The method blank showed no detections as anticipated. The reference material evaluation results ranged from 80% to 107%; but all were within the acceptable limits. Constituents had limits from 60% to 130% noted. These ranges are typical for analytical results. Both the Method Blank Spike and Matrix Spike recoveries

were found to be within acceptable limits. Similarly, the surrogate recoveries were within acceptable limits and within 15% of the actual value.

The quality assurance data from AGAT Laboratories indicates that the RPD on duplicate ground water sample controls for the PHC evaluation completed were all below the MDL for all compounds analyzed. The method blank showed no detections as anticipated. The reference material evaluation results ranged from 104% to 115%; but all were within the acceptable limits. Constituents had limits from 60% to 140% noted. These ranges are typical for analytical results. Both the Method Blank Spike and Matrix Spike recoveries were found to be within acceptable limits. Similarly, the surrogate recoveries were within acceptable limits and within 15% of the actual value.

*Volatile Organic Compounds Summary*

The quality assurance data from AGAT Laboratories indicates that the RPD on duplicate soil sample controls for the VOCs evaluation completed were all below the MDL for all compounds analyzed. The method blank showed no detections as anticipated. The reference material evaluation results ranged from 71% to 123%; but all were within the acceptable limits. Constituents had limits from 50% to 140% noted. These ranges are typical for analytical results. Both the Method Blank Spike and Matrix Spike recoveries were found to be within acceptable limits. Similarly, the surrogate recoveries were within acceptable limits and within 15% of the actual value.

The quality assurance data from AGAT Laboratories indicates that the RPD on duplicate ground water sample controls for VOCs evaluation completed were all below the MDL for all compounds analyzed. The method blank showed no detections as anticipated. The reference material evaluation results ranged from 68% to 123%; but all were within the acceptable limits. Constituents had limits from 50% to 140% noted. Both the Method Blank Spike and Matrix Spike recoveries were found to be within 15% of the values.

#### 5.12.3.3 June 2016 Program

A second drilling program for the Phase Two ESA was completed on June 9, 2016 and then wells were sampled on June 15, 2016 to further delineate found soil and ground water impacts. Water samples were collected from all new ground water well locations, following the well development, and existing well location MW-S. The soil quality samples were evaluated for PHCs, VOCs and lead. Water quality samples were evaluated for PHCs and VOCs.

*Petroleum Hydrocarbons Summary*

The quality assurance data from AGAT Laboratories indicates that the RPD on duplicate soil sample controls for the PHC evaluation completed were all below the MDL for all compounds analyzed. The method blank showed no detections as anticipated. The reference material evaluation results ranged from 83% to 98%; but all were within the acceptable limits. Constituents had limits from 50% to 140% noted. Both the Method Blank Spike and Matrix Spike recoveries were found to be within acceptable limits. Similarly, the surrogate recoveries were within acceptable limits and within 15% of the actual value.

The quality assurance data from AGAT Laboratories indicates that the RPD on duplicate ground water sample controls for the PHC evaluation completed were all below the MDL for all compounds analyzed. The method blank showed no detections as anticipated. The reference material evaluation results ranged from 75% to 104%; but all were within the acceptable limits. Constituents had limits from 60% to 140% noted. Both the Method Blank Spike and Matrix Spike recoveries were found to be within acceptable limits. Similarly, the surrogate recoveries were within acceptable limits and within 15% of the actual value.

*Volatile Organic Compounds Summary*

The quality assurance data from AGAT Laboratories indicates that the RPD on duplicate soil sample controls for the VOCs evaluation completed were all below the MDL for all compounds analyzed. The method blank showed no detections as anticipated. The reference material evaluation results ranged from 70% to 130%; but all were within the acceptable limits. All of the constituents had limits from 50% to 140% noted. Both the Method Blank Spike and Matrix Spike recoveries were found to be within acceptable limits. Similarly, the surrogate recoveries were within acceptable limits and within 15% of the actual value.

The quality assurance data from AGAT Laboratories indicates that the RPD on duplicate ground water sample controls for the VOCs evaluation completed were all below the MDL for all compounds analyzed. The method blank showed no detections as anticipated. The reference material evaluation results ranged from 82% to 119%; but all were within the acceptable limits. All of the constituents had limits from 50% to 140% noted. Both the Method Blank Spike and Matrix Spike recoveries were found to be within acceptable limits. Similarly, the surrogate recoveries were within acceptable limits and within 15% of the actual value.

*Lead Summary*
The quality assurance data from AGAT Laboratories indicates that the RPD on duplicate soil sample controls for the lead evaluation had no variance. The method blank showed no detections as anticipated. The reference material evaluation results 100%; within the acceptable limits. This constituent had limits from 70% to 130% noted. This range is typical for analytical results. Both the Method Blank Spike and Matrix Spike recoveries were found to be within acceptable limits.

5.12.3.4 December 2016 Fill Sampling Program

A soil sampling program for the Phase Two ESA was conducted on December 2, 2016. Soil samples were collected from the former residential house foot prints to evaluate the backfill of unknown quality for PHCs, VOCs, inorganics and trace metals.

*Petroleum Hydrocarbons Summary*
The quality assurance data from AGAT Laboratories indicates that the RPD on duplicate soil sample controls for the PHC evaluation completed were all below the MDL for all compounds analyzed. The method blank showed no detections as anticipated. The reference material evaluation results ranged from 82% to 92%; but all were within the acceptable limits. All of the constituents had limits from 60% to 130% noted. Both the Method Blank Spike and Matrix Spike recoveries were found to be within acceptable limits. Similarly, the surrogate recoveries were within acceptable limits and within 15% of the actual value.

*Volatile Organic Compounds Summary*
The quality assurance data from AGAT Laboratories indicates that the RPD on duplicate soil sample controls for the VOCs evaluation completed were all below the MDL for all compounds analyzed. The method blank showed no detections as anticipated. The reference material evaluation results ranged from 85% to 117%; but all were within the acceptable limits. All of the constituents had limits from 50% to 140% noted. Both the Method Blank Spike and Matrix Spike recoveries were found to be within acceptable limits. Similarly, the surrogate recoveries were within acceptable limits and within 15% of the actual value.

*Inorganics and Trace Metals Summary*
The quality assurance data from AGAT Laboratories indicates that the RPD on duplicate soil sample controls for the trace metals evaluation completed varied by as much as 9.5%. The method blank showed no detections as anticipated. The reference material evaluation results ranged from 74% to 114%; but all were within the acceptable limits. The all of constituents ranged between limits from 60% to 140% noted. These ranges are

typical for analytical results. Both the Method Blank Spike and Matrix Spike recoveries were found to be within acceptable limits.

#### 5.12.3.5 Quality Assurance and Quality Control Results

The Certificates of Analysis (CoAs) for all the samples submitted for laboratory analysis are presented in full in Appendix E. All the CoAs comply with Section 47(3) of O.Reg. 153/04. The CoAs provide a list of comments pertaining to each sample submitted for analysis, including where the laboratory qualified any of the analytical results. No qualifications are noted for any of the samples submitted as part of the current program.

As part of the field program, duplicate soil and ground water samples were submitted for each of the analyzed parameters. Table 8 presents a summary of the relative percent difference (RPD) calculations for the various soil and ground water samples. The majority of analyses were below the detection limit and therefore provide no opportunity for evaluation. Two of the three PHC evaluations were below 10% and the third showed a 0.03 µg/g difference between samples at the detection limit. The same general results occurred for the two VOC evaluations. The inorganic evaluation were generally <15% difference. Nickel with 1 mg/L difference near the detection limit reports a 29% difference.

#### 5.12.3.6 Quality Assurance and Quality Control Summary

Several techniques have been used in evaluating the quality assurance/quality control (QA/QC) program for the Phase Two ESA. The replication of results over a few different sampling programs has established a level of confidence with the data.

The certainty associated with this process has provided great certainty associated with the RSC Property investigation. In that regard, the QA/QC program followed the design of the Sampling and Analysis Plan.

# 6.0 REVIEW AND EVALUATION

## 6.1 Geology

The results of the drilling program showed that the superficial geology at the RSC Property remained consistent across the drilling locations. Figures 5 and 6 present geological cross-sections across the RSC Property.

The results of the drilling programs showed the surficial geology at the RSC Property consisted of discontinuous geologic layers of silts, sands, and clays at layers of thickness

ranging between 1.5 m and 3.8 m of differing stratigraphic packages of soil. These interbedded layers are found at each throughout the RSC Property. The soil profile in general is a poorly sorted interbedded layers which range from medium to dark brown medium to coarse grained sand to grey and/or mottled dense to very dense clay to fine to medium sand with silt to sandy silt to silty sand to silt and clay. The soil was generally wet to saturated.

Based on the nature of the drilling and appearances of the drill cuttings and minor amounts of soil obtained in the split spoon sampling devices, it seemed that the occurrence of poor soil returns generally coincided with the presence of fine-medium grained material (*e.g.* sands, silts, & clays) in the overburden profile.

Bedrock was not observed during the advancement of the borehole program. The bedrock is reportedly composed of very-fine grained limestone and grey-green calcareous shale found at a depth of more than 50 mbgs as identified in the Phase One ESA completed by Azimuth (2016).

### 6.2 Ground Water: Elevations and Flow Direction

The primary rationale for the ground water monitoring well locations was to evaluate APECs (both on-Site and potential off-Site), with the secondary purpose of evaluating shallow ground water flow pattern across the RSC Property (*i.e.,* positioning the wells to allow triangulation).

The hydraulic information from the various monitoring wells is provided in Table 1. The nested ground water monitoring location at MW-N and MW-2 reveals a perched ground water condition at MW-N. The water elevation at MW-N is consistently higher than MW-2 by a few metres. MW-2 being deeper in the soil profile reflects the conductive seam occurring at about 11 mbgs (*i.e.,* MW-S monitoring depth). It is assumed that the near-surface finer-grained sediments evident in the northwest corner have contributed to this perched condition. Thus, this perched condition at MW-N is discounted when evaluating the water table condition present elsewhere on the RSC Property.

The water table varies close to 2 m seasonally. MW-A2 was instrumented with a pressure transducer from March to August 2017 and recorded a seasonal high water table elevation of 288.9 mASL in the "zone of impact" or 5.5 mbgs. The interpreted high water table elevation on the RSC Property in the northeast corner of the property is 231.3 mASL, barring the perched condition evident at MW-N in the northwest corner. All water level measurements were collected using a Heron Instruments multi-phase electric water level tape, and no free-phase light non-aqueous phase liquid (LNAPL)

product was noted on the water surface at any of the monitoring wells. The depth of each monitoring well was confirmed with the electronic tape, and no evidence of free-phase dense non-aqueous phase liquid (DNAPL) was noted at any of the wells.

Figure 7 shows the ground water elevations and the inferred shallow ground water flow direction based on the measured elevations. The inferred shallow ground water flow direction over the RSC Property at the time of the last monitoring event in March 2017 is to the southwest. The shallow ground water flow direction is generally consistent with the topographic slope across the RSC Property, which would normally be expected in shallow overburden aquifers, in addition to the RSC Property positioned on a brow of one of several former glacial shoreline features within the Lake Simcoe basin.

### 6.3 Ground Water: Hydraulic Gradients

Ground water elevations collected from the eight monitoring wells at the RSC Property on September 16, 2016 ranged from 228.2 mASL near the southwest corner to 230.3 mASL at the northeast corner. Based on the ground water equipotential contours for the above mentioned monitoring event, the average lateral hydraulic gradient within the uppermost aquifer was estimated to be 0.039 m/m. The average vertical hydraulic gradient is downward at 0.10 m/m.

### 6.4 Coarse Grained Soil Texture

Based on the drilling results, the overburden deposits at the RSC Property primarily consisted of medium-fine grained deposits, with fine-grained material being noted in several locations, particularly along the eastern boundary. The grain size of the soil was confirmed through analytical testing and the laboratory results are provided in Appendix E. Despite the occurrence of silt and silty material across the RSC Property, it is hypothesized that ground water movement and hence contaminant migration would occur primarily throughout the medium-grained overburden. As a result, it has been assumed that the coarse-grained standards are applicable.

### 6.5 Soil: Field Screening

The finalized borehole logs, presented in Appendix D, from the exploration drilling program include the field screening results for the selected soil samples. The OVA readings for the samples collected as part of the drilling program were below the rule-of-thumb value of 25 ppmv. Visual and olfactory field screening in this area was in agreement with the OVA results. As noted in Section 5.4, OVA measurements were below 25 ppmv throughout the soil column, soils in the vicinity of the ground water table were targeted for submission.

Note that the field screening methods used in the current program are intended to detect potential contaminants which have a visual or olfactory component, or would produce a response in an OVA. Soil assessments during the monitoring well installations included visual and olfactory screening for metals or hydrocarbon staining.

### 6.6 Soil Quality

The results of the laboratory soil quality analyses are presented in the following tabular summaries:

- Table 2 – Soil PHCs;
- Table 3 – Soil VOCs; and
- Table 4 – Soil Trace Metals.

All raw laboratory analytical data reports are included in Appendix E. Tables 2 through 4 also indicate the location and depth of all the soil samples.

The PHC analytical results for the soil borehole and backfill samples (Table 2) indicate that there are no reportable PHC concentrations above the Table 8 SCS. All results were reported to be below laboratory detection limits.

The VOC analytical results (Table 3) show that all of the soil samples submitted for laboratory analysis had soil VOC concentrations below their respective Table 8 SCS and their respective method detection limits.

The trace metal analytical results (Table 4) show that all of the analyzed samples had trace metals concentrations below Table 8 SCS. Soil samples collected in the backfill program indicate low concentrations of barium, chromium, cobalt, copper, lead, nickel, uranium, vanadium and zinc. The measurable results for each sample are below the Table 8 SCS. With each of these metals within similar concentration, it can be hypothesized that the backfill soil came from the same source.

### 6.7 Ground Water Quality

The results of the laboratory soil quality analyses are presented in the following tabular summaries:

- Table 5 – Ground Water PHCs;
- Table 6 – Ground Water VOCs; and
- Table 7 – Ground Water Trace Metals.

Field-measured parameters collected as part of the ground water sampling program included pH, electrical conductivity (EC), and temperature. The following Table F presents the field-measured parameter data collected during the various ground water sampling events throughout 2015 and 2016.

**Table F: Ground Water Field Measured Parameters[1]**

| Well | Screening Date | pH (unit less) | EC (mS/cm) | Temperature ($^{o}$C) |
|---|---|---|---|---|
| MW-N | N/A | N/A | N/A | N/A |
| MW-S | 15-Jun-16 | 6.5 | 2,120 | 12.0 |
| MW-1 | 15-Jun-16 | 7.0 | 2,440 | 11.0 |
| MW-2 | 10-Nov-15 | 7.3 | >4,000 | 10.4 |
| MW-3 | 10-Nov-15 | 7.1 | 1,220 | 10.7 |
| MW-4 | N/A | N/A | N/A | N/A |
| MW-4a | 10-Nov-15 | 7.2 | 2,160 | 10.2 |
| MW-A1 | 15-Jun-16 | 6.4 | 1,750 | 10.5 |
| MW-A2 | 15-Jun-16 | 7.0 | 1,800 | 11.0 |
| MW-B1 | 15-Jun-16 | 7.2 | 1,930 | 10.3 |
| MW-B2 | 15-Jun-16 | 7.1 | 2,340 | 10.7 |
| MW-C1 | 15-Jun-16 | 6.7 | 2,620 | 11.0 |
| MW-C2 | 15-Jun-16 | 6.5 | 1,590 | 13.0 |

Notes: [1] – values rounded to presentation purposes
N/A – not analyzed

The range in each of the ground water field-measured parameters was relatively small, and none of the measured values appear to be anomalous or suggestive of ground water impacts. The ground water temperatures were consistent with that expected of a shallow ground water table.

The results of the laboratory ground water quality analyses are presented in Table 5 (PHCs), Table 6 (VOCs), and Table 7 (Inorganics & Metals). All the raw laboratory analytical data reports are included in Appendix E.

The PHC analytical results for the ground water samples (Table 5) indicate that through three sampling events, toluene and PHC $F_3$ detections were detected for the initial sampling event in monitoring well MW-S; but absent from all other sampling events. All monitoring wells barring MW-N had detected concentrations of toluene in the November 2015 and June 2016 sampling events. Monitoring well, MW-3 and MW-4 also noted detectable concentrations of ethylbenzene. Total xylenes were noted in

monitoring well MW-3. All measureable concentrations of the above noted detections were below Table 8 SCS.

The purpose of the November 2015 and June 2016 sampling events was to further delineate the VOC exceedances discovered in the vicinity of monitoring wells MW-S and to assess the presence/ absence of off-Site PCAs. Specifically, borehole BH-1 and Monitoring wells MW-1, MW-A1, MW-A2, MW-B1, MW-B2, MW-C1, and MW-C2 were advanced to map the extent of the exceedances. Whereas, monitoring wells MW-2, MW-3, MW-4, and MW-4a were advanced to confirm the presence/ absence of off-Site PCAs.

Monitoring well MW-S had measureable concentrations of *cis*-1,2-DCE, TCE and PCE above the Table 8 SCS through all three sampling events. Hexane was also detected in the first sampling event, yet this was below the applicable standards. The advancement of the well grouping (as noted above) around MW-S has successfully delineated the VOC impacts. Monitoring well MW-1 had measureable concentrations of *cis*-1,2-DCE, TCE, PCE, and hexane below Table 8 SCS. Monitoring well MW-A1 had no measureable detections of the PCE and daughter products found in MW-S; yet acetone was detected below the applicable SCS. Ground water well MW-A2 had reported concentrations of *cis*-1,2-DCE and TCE, yet these were below Table 8 SCS. Monitoring well MW-B1 had reported detections of acetone below the SCS. Ground water well MW-C1 had no reportable VOC detections. Other spurious parameters were detected at isolated locations below Table 8 SCS.

The concentrations of VOCs at MW-1 identify the southern limit of the zone of impact. The absence of *cis*-1,2-DCE, TCE, and PCE in ground water wells MW-B1, MW-B2, MW-C1 and MW-C2 suggest that the impacts do not exceed these monitors and delineate the VOC impacts to the east and west. To the north, monitoring well MW-A1 have no detections of *cis*-1,2-DCE, TCE, and PCE. Monitoring well MW-A2 have a trace detection of *cis*-1,2-DCE and TCE indicate the northern contamination limit.

It is speculated that the source of the PCE and its daughter products impacts were a result of a release or “spill” from one of the historical residents on the RSC Property. The detection of acetone among monitoring wells MW-A, MW-B1 and MW-B2 is speculated to be a deeper dissolved phase plume in the interbedded profile of the aquifer from and upper gradient and off-Site location.

The inorganic and trace metals analytical results (Table 7) show that the concentrations of the various parameters were all below the Table 8 SCS at the two (MW-N & MW-S)

measured monitoring wells except for road salt parameters at MW-N. The lands have been vacant for years and it is assumed the concentrations are attributable to salt spray from the adjacent roadway and therefore exempt under O.Reg. 153/04 s.48(3).

### 6.8 Phase Two Conceptual Site Model

The Phase One ESA (Azimuth, 2016) identified the following on-Site APECs at the RSC Property:

- Importation of Fill Material of Unknown Quality;
- Measured Chlorinated Solvents in ground water samples collection; and
- Operation of Dry Cleaning Equipment (where chemicals are used).

The RSC Property has been historically used as a residential block for single-family residential houses since about 1870. The private housing on the RSC Property was demolished in 2012 and was backfilled with fill of an unknown quality which has since been tested and found to be of an adequate quality to remain on the RSC Property (*i.e.,* clean fill).

Initial Site investigation discovered evidence of chlorinated solvents in the ground water beneath the RSC Property. An active dry cleaning shop is present ~50 m west of the RSC Property. This facility is located at 103 Bayfield Street had been in operation since 1971 and has reported at least one PCE spill of 135 L in 1995. Although there is no evidence to suggest any environmental concern due to the spill, the proximity to the RSC Property is an environmental concern; especially in terms of the contaminants of concern for the Site.

The RSC Property is located in a mixed residential area of the City of Barrie. Figures 5 and 6 show the geological cross sections across the RSC Property based on the results of the Phase Two ESA drilling program. The surficial geology at the RSC Property has been found to primarily consist of interbedded deposits of sand and silt. The depths of the limestone and shale bedrock are reported to be at a depth below 50 mbgs (OGS, 2016).

The water table varies close to 2 m seasonally. A seasonal high water table elevation of 288.9 mASL was found in the "zone of impact" or 5.5 mbgs. The interpreted high water table elevation on the RSC Property is 231.3 mASL in the northeast corner of the property. The lateral ground water flow direction is to the southwest, which is consistent with the directional flow towards Kempenfelt Bay. The lateral hydraulic gradient across the RSC Property in the shallow ground water flow zone is 0.039 m/m.

The results of the Phase Two ESA program indicate that there are no soil impacts detected across the RSC property that would be of environmental significance. Samples collected from the fill within the footprint of the former houses are below the Table 8 SCS, therefore the backfill used to fill the footprints of the former residential houses can be ruled out as a PCA.

Chlorinated ethene impacts are present in the ground water at southwestern property corner have been defined through the installation of ground water monitors. Suspected VOC impacts from the nearby dry cleaning facility were not correlated to the VOC impacts within the ground water found at the RSC Property and as the dry cleaning facility is downgradient from the Site it was ruled out as a PCA. The delineation of the impacts, through the ground water monitors, suggest that the VOC impacts at the Site are from a source release from within the RSC Property. The evidence suggests that the VOC impacts are not migrating beyond the RSC Property boundaries. The VOC impact at MW-S is attributed to a presumed release on the RSC Property.

The VOC impact is not detected in the conductive seams that surround MW-S. This lower permeability seam may represent a remnant of a sorbed release which continues to bleed away; but not at a rate which significantly influences the surrounding environment.

It is not anticipated that climatic or meteorological events or variations would have significant effect on the distribution or fate of the various contaminants noted at the RSC Property.

## 7.0 CONCLUSIONS

The Phase One ESA identified a total of three APECs at the RSC Property. Each of these will be discussed in turn.

Eight soil boreholes and seven ground water monitoring wells were advanced in the vicinity of the former monitoring well MW-S at the RSC Property. Field screening data and soil analytical results indicated that no detected environmental impacts were measured within the soils at this location. This is anticipated given the low ground water concentrations measured in the zone of impact. Ground water analytical results indicate and have delineated a chlorinated ethene contamination at this location.

Soil grab samples were collected from the fill used in the footprints of the former residential houses. Field screening data and soil analytical results indicated that no detected environmental impacts were measured from these locations.

A single ground water monitoring location measured chlorinated ethenes above the applicable standards. Due to the marginal exceedence measured at this one sampling location, it is recommended that a RA be used to address this concern for the RSC submission.

### 7.1 Signatures

The signature and statements required as part of O.Reg. 153/04, Schedule E, Table 1, are provided in the transmittal letter at the front of this report.

## 8.0 REFERENCES


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## APPENDICES

**APPENDIX A**

**Figures**

# APPENDIX B

## Sampling and Analysis Plan

# APPENDIX C

## Standard Operating Procedures

# APPENDIX D

**Finalized Field Logs and Field Equipment Information**

**APPENDIX E**

**Laboratory Analytical Reports**

**APPENDIX F**

**RSC Property Survey**