LOPERS & ASSOCIATES

Impact Assessment of Adjacent Waste Disposal Site/Former Landfill Site

Proposed Residential Development
2829 Dumaurier Avenue
Ottawa, Ontario

Prepared for:

3223701 Canada Inc.

April 6, 2021

Ref: LOP20-004B

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1. Executive Summary

Lopers & Associates (Lopers) was retained by 3223701 Canada Inc. (BRIGIL) to complete an Impact Assessment of Adjacent Waste Disposal/Former Landfill Site (IAWDS) of the commercial property with Civic address No. 2829 Dumaurier Avenue, Ottawa, Ontario ("Property" or "Site").

Lopers understands that the Site is currently owned by 1248816 Ontario Inc., with a vendor take back agreement signed in 2018 for ownership to transfer to 3223701 Canada Inc. (Brigil) by July 2023. It is understood that the intended future use is for residential purposes, with possible commercial use on the ground floor. It is also understood that several subgrade levels of underground parking have been proposed as part of the current concept for Site redevelopment.

Based on environmental research the Site was formerly partially occupied by a former waste disposal site (former Pinecrest Landfill Site) on the northeast portion of the Property. The aforementioned former waste disposal site at the Property is a Potentially Contaminating Activity (PCA) which could be interpreted as an Area of Potential Environmental Concern (APEC) for the Property.

Additional concerns have been identified by The Corporation of the City of Ottawa ("City" or "City of Ottawa") with respect to potential on-going environmental issues associated with the former waste disposal site. The City has requested that an IAWDS be completed and submitted to the City as part of a Preliminary Assessment of the Site for proposed redevelopment. It is expected that the predominant concerns are from the potential exposure of future occupants of the Site to methane gas, originating from the former waste disposal site.

An evaluation and interpretation of the following were completed as part of this IAWDS:

- Review of historical environmental reports;
- Approximate Footprint and Extents of a former landfill site at the Property;
- Subsurface vapour monitoring and data trends of on-Site methane gas concentrations;
- Methane gas migration pathways;
- Excavation and blasting procedures and safety considerations; and,
- Environmental remediation approach.

Based on the evaluation and interpretation of the available information and the proposed redevelopment concept, several environmental considerations and/or mitigation actions are required prior to, during and following redevelopment of the Site. The mitigation actions are required as a result of the presence of a former waste disposal site on a portion of the Site and at neighbouring properties to the north and east. These environmental considerations and/or mitigation actions include, but are not limited to:

- Evaluation of the implication of methane gas concentrations at the Site and neighbouring properties will be required on behalf of the excavation and blasting contractors to ensure safe construction procedures and to safeguard against an increase for the potential of off-Site subsurface methane gas migration.
- Remediation and off-Site disposal of the on-Site waste materials is recommended to be completed as part of preliminary environmental remediation to support redevelopment activities.
- Monitoring of methane gas concentrations at the Site during excavation and construction activities is recommended to ensure worker safety. Monitoring following construction is recommended to ensure suitability for occupancy.
- The installation of a vapour collection/extraction system within the foundation perimeter backfill, which could be vented to the atmosphere or connected to a City of Ottawa owned methane extraction system on adjacent land, provides a simple construction solution which would offer a mitigation solution in the event of potential future methane gas migration into the proposed building.

Evaluation of monitoring data, to be collected at various stages of redevelopment as noted above, is required to confirm the effectiveness of the aforementioned mitigation measures. The approach to assessment, review and implementation of the aforementioned environmental considerations and/or mitigation actions for methane gas are expected to permit safe construction practices and an indoor environment which is suitable for the proposed use.

2. Introduction

Lopers & Associates (Lopers) was retained by 3223701 Canada Inc. (BRIGIL) to complete an Impact Assessment of Adjacent Waste Disposal/Former Landfill Site (IAWDS) of the commercial property with Civic address No. 2829 Dumaurier Avenue, Ottawa, Ontario ("Property" or "Site"). The location of the IAWDS Property is depicted on Figure 1: Key Plan.

Lopers understands that the Site is currently owned by 1248816 Ontario Inc., with a vendor take back agreement signed in 2018 for ownership to transfer to 3223701 Canada Inc. (Brigil) by July 2023. It is understood that the intended future use is for residential purposes, with possible commercial use on the ground floor. It is also understood that several subgrade levels of underground parking have been proposed as part of the current concept for Site redevelopment. A copy of the current Site development design concept plan, as prepared by RLA Architecture, is presented in Appendix A.

Based on environmental research completed as part of a concurrent Phase One Environmental Site Assessment completed by Lopers (2021 Lopers Phase One ESA), previous investigations and reports by others, the Site was formerly partially occupied by a former waste disposal site (former Pinecrest Landfill Site) on the northeast portion of the Property. The aforementioned former waste disposal site at the Property is a Potentially Contaminating Activity (PCA) which could be interpreted as an Area of Potential Environmental Concern (APEC) for the Property.

Additional concerns have been identified by The Corporation of the City of Ottawa ("City" or "City of Ottawa") with respect to potential on-going environmental issues associated with the former waste disposal site. The City has requested that an Impact Assessment of Adjacent Waste Disposal/Former Landfill Site (IAWDS) be completed and submitted to the City as part of a Preliminary Assessment of the Site for proposed redevelopment. It is expected that the predominant concerns are from the potential exposure of future occupants of the Site to methane gas, originating from the former waste disposal site.

It is understood that no general format is available for this type of study, however, a general outline of the topics discussed herein and the intent of the study was communicated to the City's representatives on January 8, 2021 and no response confirming acceptability or request for additional information to the proposed scope for this IAWDS Study has been provided. This IAWDS was designed to meet the general considerations presented in Ontario Regulation (O.Reg.) 232/98 (as amended in 2011), with details of scope presented in Lopers' Letter entitled "Proposal for Impact Assessment of Adjacent Waste Disposal/Former Landfill Site, 2829 Dumaurier Avenue, Ottawa, ON", dated April 6, 2021, reference, No. LOP-004B-20-BRIGIL.

i. Site Description

The Phase Two Property has a Civic address of 2829 Dumaurier Avenue, Ottawa, Ontario. The Phase One Property is legally described as Part of Lot 20, Concession 2, Ottawa Front, Registered Plan 479600, Township of Nepean, now in the City of Ottawa and has a property identifier number of 03944-0237. A Legal Survey completed by Annis, O'Sullivan, Vollebekk Ltd., on November 20, 2000, was provided by Brigil and is presented in Appendix B.

Based on approximate dimensions obtained from the City of Ottawa's GIS mapping software, the Phase One Property has an approximate area of 4,200 m^2 (0.42 Hectares) and a zoning designation of GM[62] F(0.25), which signifies a general mixed use zone with a gross floor area restriction of 0.25 m^2 per m^2 of Property. The approximate elevation of the Phase One Property as indicated on the City of Ottawa mapping and the Ministry of Natural Resources topographic mapping is between approximately 74 and 78 m above mean sea level (m AMSL). The approximate centre of the Phase One Property has Latitude and Longitude coordinates of 45° 21′ 03″ N and 75° 47′ 37″ W and Universal Transverse Mercator (UTM) coordinates of 437831 m E and 5022219 m N.

The Property is legally described as Part of Block R1 on Plan 847 and Part 1 on registered Plan 5R2136, as ancillary fire station parking, in the City of Ottawa and has a property identifier number of 04514-0024. The boundaries of the Phase Two Property are presented on Figure 2: Site Plan. For the purposes of this Phase Two ESA, the section of Penfield Drive fronting the Property is considered to the be east-west axis.

Based on approximate dimensions obtained from the City of Ottawa's GIS mapping software, the Phase Two Property has an approximate area of 2075 m^2 (0.21 Hectares). The Phase Two Property is bounded to the north by approximately 15 m of undeveloped land followed by a residential development, to the east by residential townhomes, to the south by Penfield Drive and to the west by a Fire Station, parkland and a commercial plaza.

ii. Property Ownership

The Site is currently owned by 1248816 Ontario Inc. with a vendor take back agreement signed in 2018 for ownership to transfer to 3223701 Canada Inc. by July 2023. 3223701 Canada Inc. is a subsidiary company of Brigil Construction ("Brigil").

This IAWDS was commissioned by Mr. Jean-Luc Rivard, Director of Land Development and Infrastructure for Brigil Construction (Brigil), operating as 3223701 Canada Inc. Brigil has a business address of 98 Rue Lois, Gatineau, Quebec, J8Y 3R7 and a business telephone number of 819-243-7392.

i. Current and Proposed Future Use

It is Lopers' understanding that Brigil intends to redevelop the Phase One Property for mixed use (commercial and residential purposes), including the current concept for construction of one

building, approximately 30 storeys in height, with subgrade parking, commercial ground floors and residential units above.

3. Review of Environmental Reports

i. List of Previous Environmental Reports

Brigil and/or representatives of the City of Ottawa provided the following six reports and 2020 monitoring data for review as part of this IAWDS:

1. "Phase I Environmental Site Assessment, 2831, 2833, 2835, 2841 and 2865 Dumaurier Avenue, Ottawa, Ontario", dated August 16, 2018, completed by GHD Limited for 3223701 Canada Inc.
2. "Phase II Environmental Site Assessment, 2831, 2833, 2835, 2841 and 2865 Dumaurier Avenue, Ottawa, Ontario", dated April 2, 2019, completed by GHD Limited for 3223701 Canada Inc.
3. "Phase One Environmental Site Assessment, 2829 Dumaurier Avenue, Ottawa, Ontario", dated January 8, 2021, completed by Lopers & Associates for 3223701 Canada Inc.
4. "Geotechnical Investigation, Proposed Hi-Rise Building, 2829 Dumaurier Avenue, Ottawa, Ontario", dated December 18, 2019, completed by Paterson Group Inc. for 3223701 Canada Inc.
5. "Detailed Methane Gas Migration Study, Closed Landfill Sites 1, 3, 5 and 10", dated March 1982, completed by Gartner Lee Associates Limited for The Corporation of the City of Ottawa.
6. "Methane Gas Detection Monitoring Program (2015-2019), Dumaurier Plaza - 2829 Dumaurier Avenue, Closed Pinecrest Landfill Site, Ottawa, Ontario", dated August 26, 2020, completed by Wood Canada Limited for 1248816 Ontario Inc.
7. Reported Observation and Monitoring Data for 2020 Methane Gas Monitoring Program event, Dumaurier Plaza - 2829 Dumaurier Avenue, Closed Pinecrest Landfill Site, Ottawa, Ontario, provided by The Corporation of the City of Ottawa on November 24, 2020, prepared by Wood Canada Limited for The Corporation of the City of Ottawa.

The pertinent findings of the aforementioned reports and monitoring data are provided are discussed below.

a. 1982 Closed Landfill Site Detailed Methane Gas Migration Study by Gartner Lee (1982 Gartner Lee Methane Study)

The 1982 Gartner Lee Methane Study report was completed to assess the presence methane at of several former waste disposal sites in the City of Ottawa in 1980 and 1981, including at the subject Site ("Site 1"). This report provides the approximate extents of the former Pinecrest Landfill Site, which includes a segment on the northeast portion of the Site, as well

as neighbouring properties to the north and east. The reported former landfill site boundaries with respect to the Site and neighbouring properties are depicted on Figure 3: Surrounding Land Use Observations.

A pocket of waste was reportedly intersected by one of the "Monitors" (Landfill Gas (LFG) Probes), M12, which was drilled to the east of the on-Site Dumaurier plaza building. The waste was described as "*SAND FILL MIXED WITH REFUSE: black silty fine sand, loose to very loose, moist. Mixed with cinders, wood fibre, tin, organics, etc. Slight oily odour*." M12 was not located within the limits of the former Pinecrest Landfill Site identified by Gartner Lee, however, it was noted that waste may extend onto the Dumaurier Plaza Property from the adjacent former landfill site. Further investigation into the limits of the waste was not complete as part of the 1982 Gartner Lee Methane Study. The approximate location of M12 is depicted on Figure 2: Site Plan.

Methane gas, in potentially explosive concentrations (approximately 5% LEL), were reported in located near Dumaurier Plaza (M12); significantly higher methane concentrations (approximately 50% LEL), were reported in M13, located on the adjacent property to the south, approximately 50 m south of the Site. An additional Monitor (M8, near the east limits of the Site reported methane concentrations between approximately 1.5 and 35% LEL. The report stated that "*No gas has been detected within any of the buildings on or around the (Former Pinecrest Landfill) Site*".

The Study recommended two alternatives for methane mitigation in vicinity of the aforementioned buildings: an active venting system be constructed around the foundation of each building or regular monitoring within the buildings and implementation of remedial measures (i.e. active venting) should a potentially hazardous situation develop.

b. 2018 Phase I Environmental Site Assessment by GHD (2018 GHD Phase I ESA)

The 2018 GHD Phase I ESA was completed for a larger parcel of land which included that Property and the adjacent commercial land to the south, including the entire Dumaurier Plaza. The Property was occupied by the northern portion of the present day commercial plaza building at the time of the 2018 GHD Phase I ESA. The occupants of the plaza were commercial and did not include any operations which were interpreted as PCAs. The presence of a former waste disposal site was identified on the north portion of the Property and on adjacent land to the east. This former waste disposal site is associated with the PCA of "Waste Disposal and Waste Management, including thermal treatment, landfilling and transfer of waste, other than use of biosoils as soil conditioners". This former waste disposal site is a PCA and was considered to represent an area of Potential Environmental Concern (APEC) for the Property. The location of this PCA and APEC are depicted on Figure 2: Site Plan and Figure 3: Surrounding Land Use Observations.

An additional PCA, "Importation of Fill material of Unknown Quality" was identified to south of the Property (O.Reg. PCA item #30). This fill placement occurred off-Site and interpreted down-

or cross-gradient with respect to the Property and is not considered to represent an APEC for the Property.

Based on the identification of a PCA and APEC at the Property, a Phase Two Environmental Site Assessment was recommended to be completed to assess the soil and/or groundwater quality in the vicinity of the identified on-Site APEC. Investigation of the aforementioned fill material was also recommended as part of the Phase Two ESA.

c. 2019 Phase Two Environmental Site Assessment by GHD (2019 GHD Phase Two ESA)

The 2019 GHD Phase Two ESA was completed for a larger parcel of land which included that Property and the adjacent commercial land to the south, including the entire Dumaurier Plaza. Only the findings at the Property have been included in this report summary.

The 2019 GHD Phase Two Environmental Site Assessment (2019 GHD Phase Two ESA) was completed to assess the APECs identified through a review of the 2018 GHD Phase I ESA, namely, the potential for residual soil and groundwater contamination in the vicinity of the former waste disposal site on the north and east portions of the Property, as well as fill material on the commercial property adjacent to the south of the Property.

Five boreholes, each instrumented with a groundwater monitoring well, were drilled as part of the 2019 GHD Phase Two ESA, however, only two of these boreholes/monitoring wells were located at the Property. The approximate location of the on-Site boreholes are depicted on Figure 2: Site Plan. Soil conditions on the northeast portion of the Property were found to consist of a layer silty sand and gravel fill, underlain by peat, followed by fractured limestone bedrock at approximately 3.7 m below ground surface (m BGS). Black staining was observed in the fill material. Groundwater was encountered at depths ranging from approximately 1.3 to 1.4 m BGS.

Soil and groundwater samples were submitted from each of the borehole/monitoring well locations, which were analyzed for a combination of petroleum hydrocarbons (PHCs), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), metals and inorganics. The one analyzed soil sample from the Property was in compliance with the site condition standards. One of the three analyzed groundwater samples from the Property had exceedances of the site condition standards, with respect to PHCs. The 2019 GHD Phase Two ESA report concluded that the Property would require remediation or a risk assessment to be in compliance with the site condition standards. It was recommended that a remedial action plan, including a soil and groundwater management program be completed prior to the construction phase of redevelopment.

d. 2021 Phase One Environmental Site Assessment by Lopers (2021 Lopers Phase One ESA)

The 2021 Lopers Phase One ESA was completed exclusively for the Site and is expected to be included as part of engineering studies to be provided to the City as part of an application for redevelopment. The Property was occupied by the northern portion of the present day commercial plaza building at the time of the 2021 Lopers Phase One ESA. The occupants of the plaza were commercial and did not include any operations which were interpreted as PCAs. The presence of a former waste disposal site was identified on the north portion of the Property and on adjacent land to the east. This former waste disposal site is associated with the PCA of "Waste Disposal and Waste Management, including thermal treatment, landfilling and transfer of waste, other than use of biosoils as soil conditioners". This former waste disposal site is a significant PCA and was considered to represent APEC #1 for the Property.

The contaminants of potential concern (CPCs) associated with the former waste disposal site are VOCs (for groundwater only), metals, PAHs and PHCs/BTEXs. An investigation of the soil and groundwater quality with respect to these CPCs at the Property was completed as part of the 2019 GHD Phase Two ESA.

Based on the identification of an APEC at the Phase One Property, a Phase Two Environmental Site Assessment is required prior to the filing of a record of site condition (RSC). The RSC Phase Two ESA will require the removal of contaminated soil and any waste materials associated with former landfilling operations, and as such, it is recommended that this be completed at the time of redevelopment of the Site in several years. It is expected for the purposes of an application for redevelopment, that the existing 2019 GHD Phase Two ESA provides sufficient assessment of the APECs identified at the Site.

e. 2019 Geotechnical Investigation by Paterson Group Inc. (2019 Paterson Geotechnical Investigation)

The 2019 Paterson Geotechnical Investigation was completed for the Property to assess subsurface conditions for the proposed redevelopment. Three boreholes, each instrumented with a groundwater monitoring well, were drilled as part of the 2019 Paterson Geotechnical Investigation. The approximate location of the geotechnical boreholes are depicted on Figure 2: Site Plan. Soil conditions at the Property were found to consist of a layer silty sand and gravel fill, underlain by glacial till, fine sand and/or silty clay, followed by limestone bedrock at depths ranging from approximately 3.9 to 5.3 m BGS. No evidence of waste or deleterious fill material was reported by Paterson. Each of the boreholes were cored into the bedrock and monitoring wells were installed with their screens set at approximately 15 to 18 m BGS. Groundwater was encountered at depths ranging from approximately 5.8 to 7.1 m BGS.

f. 2020 Methane Gas Detection Monitoring Program by Wood (2020 Wood Methane Monitoring Report)

The 2020 Wood Methane Monitoring report was completed to assess the presence methane at the Site, which was a result of a former waste disposal site. Monitoring data was collected from three on-Site Methane Landfill Gas ("LFG") Probes (GP16-1, GP16-2 and M12) which are present at the Property. The methane monitoring was conducted over the period from 2015 to 2019, at approximately quarterly intervals. The LFG probes were reportedly constructed with their screens situated "just above the water table" in a shallow sand fill layer. The approximate locations of the LFG Probes are depicted on Figure 2: Site Plan.

The results of the methane monitoring indicate that, while a decreasing trend in methane concentrations does appear evident from 2015 to 2019, several regulation criteria including concentration at the site boundary (2.5% volume methane/total volume), concentration of indoor air in an on-site building (1% volume methane/total volume) and concentration of indoor air in an off-site building (0.05% volume methane/total volume) were intermittently exceeded in the observed methane concentrations in some of the LFG probes over the monitoring period.

It is noted that the regulation which applies to landfills is Ontario Regulation (O.Reg.) 232/98 (as amended in 2011). It should also be noted that the on-Site building and off-Site building criteria presented in O.Reg. 232/98 are based on monitoring of indoor air, and as such the methane monitoring data collected from the LFG probes may provide data which is a conservative approximation of what indoor conditions may be. It is not known if any indoor air monitoring for methane has been completed at the Property over the monitoring period.

Wood also completed some vapour sample collection and laboratory analysis as a means to characterize the methane as a result of a potential natural gas pipe leak or as a result of the former waste disposal site, and concluded: "*at the time the samples were collected, the landfill gas present at GP16-1 and GP16-2 was generated in an oxygen deprived environment with elevated levels of carbon dioxide which infers localized production of methane via the decomposition of organic matter. These findings coupled with the C_{13} and H_2 measured in methane from these locations would suggest that the gas is landfill gas and is being produced on-site in proximity to the LFG probes.*"

Based on the findings and interpretation presented by Wood, the removal of on-Site waste would be expected to provide some mitigation of methane gas concentrations at the Site. Based on the current concept for construction for redevelopment of the Property, it is expected that all waste on the Property will be excavated and sent off-Site for disposal.

g. 2020 Methane Gas Monitoring Data reported by Wood (2020 Wood Methane Monitoring Data)

The 2020 Wood Methane Monitoring Data was provided by the City of Ottawa as a response to a request on behalf of BRIGIL. Lopers reviewed the reported methane data trends from three

on-Site LFG Probes (GP16-1, GP16-2 and M12) from 2015 up to and including 2020. It should be noted that progressive chronological sequential monitoring data trends were considered, as well as seasonal monitoring data trends. The following comments and interpretation are provided with respect to the on-Site reported Methane monitoring.

- **GP16-1** – A general decreasing trend in reported Methane Concentrations is observed in this LFG Probe. The initial Peak/Stable Methane Concentrations were 30.5/30.3 % Methane volume/total volume (v/v) compared to the most recent Peak/Stable Methane Concentrations of 0.4/0.0 % v/v. The seasonal (fall) Methane monitoring data also indicates a decreasing Methane Concentration trend, as reported Peak/Stable Methane Concentrations were 23.2/20.9 % v/v in September 2015, 0.8/0.7 % v/v in September 2017 and 0.4/0.0 % v/v in September 2020. It was noted that the September 2020 Peak methane concentration did exceed the O.Reg. 232/98 criteria for an off-Site building or foundation.

- **GP16-2** – A general decreasing trend in reported Methane Concentrations is observed in this LFG Probe during progressive chronological sequential monitoring. The initial Peak/Stable Methane Concentrations were 33.3/15.2 % v/v compared to the most recent reported Peak/Stable Methane Concentrations of 34.4/7.3 % v/v. The seasonal (fall) Methane monitoring data also indicates a decreasing Methane Concentration trend, as reported Peak/Stable Methane Concentrations were 59.0/56.6 % v/v in September 2015, 32.9/13.5 % v/v in September 2017 and 34.4/7.3 % v/v in September 2020. It was noted that the September 2020 Peak/Stable methane concentrations both exceed the O.Reg. 232/98 criteria for each of the Property Boundary Subsurface, an on-Site building or foundation and an off-Site building or foundation.

- **M12** – A general stable trend in reported Methane Concentrations was observed in this LFG Probe. Some seasonal exceedances of the O.Reg. 232/98 criteria for an off-Site building or foundation were observed throughout the three year monitoring period (2017 to 2020), however most recently, no methane concentrations were measured or detected at this LFG Probe during the 2020 monitoring events.

The source of the observed methane concentrations is expected to be the former waste disposal site on the northern portion of the Site and the neighbouring properties to the north and east. It is expected that conduits existing in the subsurface environment which facilitate the migration of methane gas through the subsurface environment, which can include but are not limited to: porous subgrade soil and/or fill materials, presence of municipal and private infrastructure, and bedrock fracturing. Additionally, the presence of less permeable surface or near-surface materials (including asphalt, concrete and clay soil cover may restrict the release of methane gas to the atmosphere, and hence result in an accumulation of these gases in the subsurface. It should be noted that all LFG Probes at the Site are in areas which have asphaltic concrete surface cover.

The LFG Probe monitoring procedure conducted by Wood was not described is unknown at this time. It is expected that accumulation of vapours within the LFG Probes and the immediately surrounding subsurface environment readily occurs during periods where the LFG Probes are sealed between monitoring events as result of larger void spaces in these areas; this could contribute to elevated Peak readings upon opening and initializing methane gas concentration measurements during monitoring events. It is also noted that stable methane concentrations, as recorded in LFG Probes may not be representative of stable methane concentrations in an indoor environment, which may be measured over many hours or several days for increased accuracy. It is also expected that indoor air would be subject to significant dilution of methane gas with supplied air through ventilation systems.

4. Approximate Footprint and Extents of a Former Landfill Site at the Property

The approximate footprint of a former waste disposal site (former Pinecrest Landfill) has been depicted in various historical environmental studies and reports specific to the former Pinecrest Landfill, several of which are publicly available environmental studies. All known available historical studies and other sources (including historical aerial photography) documenting the former Pinecrest Landfill and its approximate historical footprint were reviewed as part of the 2021 Lopers Phase One ESA and/or this IAWDS. Additionally, a previous Phase II ESA and Geotechnical Investigation were recently completed by others at the Site, and provide subsurface data, which may be used for interpretation of former waste disposal site boundaries.

It was reported in the 1982 Gartner Lee Methane Study, that a pocket of waste material intermixed with silty sand fill was observed from a depth of approximately 0.15 to 2.54 m below ground surface (m BGS) in borehole M12, located to the east of Dumaurier Plaza.

The 2019 GHD Phase Two ESA did not report the observations of any waste, however, fill material was reported, with an approximate thickness of 2.4 m, near ground surface in borehole BH3D/MW3D, located on the northeast portion of the Site.

The 2019 Paterson Geotechnical did not report the observations of any waste, however, fill material was reported, with an approximate thickness ranging from 1.3 to 2.9 m, near ground surface in all three boreholes drilled across the Site.

For the purposes of this IAWDS, the boundaries of the former Pinecrest Landfill identified in historical environmental studies is considered representative of Site conditions, with the exception that pockets of waste material may be present in various locations outside of the historically depicted former waste disposal site boundaries. The approximate extents of the

former Pinecrest Landfill are depicted on Figure 2: Site Plan and Figure 3: Surrounding Land Use Observations.

The present concept for redevelopment of the Site with a residential tower and associated underground parking garage, will include excavation of all subsurface materials to, and including some bedrock, across a majority of the Site. It is expected that based on the current concept for redevelopment, as well as the requirement to remediate the Site to the MECP residential land use standards prior to filing a RSC to support a change in land use to a more sensitive use, all waste present at the Site will be excavated and removed for off-Site disposal at an approved facility. This remediation would address any remnant pockets of waste at the Site, if present.

5. On-Site Methane Gas Concentrations

It has been reported that elevated methane gas concentrations are present in the subsurface at the Site, as measured in LFG Probes present at the Site. Although the methane gas concentrations appear to fluctuate seasonally, peak and stable methane gas concentrations were reported at 34.4 % and 7.3 % as recently as September 2020. These concentrations should be used as conservative comparisons when evaluating construction methodologies for the proposed redevelopment of the Site.

The most recent methane monitoring data from the Site as reported in the 2020 Wood Methane Monitoring Data, as provided to the City of Ottawa by Wood, is presented in Appendix C.

6. Methane Gas Migration

Methane gas has an approximate density of 55% of atmospheric air, and therefore, should preferential pathways exist for methane gas to migrate from the subsurface to the atmosphere, it is expected this would occur readily. Typical building foundation construction includes placement of backfill on the exterior of the foundation with coarse grain type soil, which would be expected to have higher void ratios than typical overburden soil, and hence, would allow methane gas to escape to the atmosphere prior to entering a building. Possible evidence of this migration concept includes historical monitoring of detectable and/or elevated methane gas concentrations in LFG probes in the vicinity of the former Pinecrest Landfill Site, and no reported methane gas observations on the interior of buildings in the immediate vicinity.

Below the ground surface it is expected that methane gas migrates laterally predominantly through subsurface void spaces in the overburden soil and within fractures in the bedrock. It is

not expected that preferential pathways would exist for methane gas to migrate downward, since the local shallow groundwater table has been identified between approximately 1.3 and 3 m BGS. When present below the groundwater table, it is expected that methane gas would migrate in the approximate direction of shallow groundwater flow. Since the majority of the waste at the former Pinecrest Landfill was reported to have been buried relatively shallow on the northern portion of this former waste disposal site, it is suspected that the majority of methane gas migrates laterally within the unsaturated overburden soil in this portion of the former landfill site. Where waste deposits are deeper than the groundwater table, lateral methane gas migration is expected to be in the direction of groundwater flow in the saturated zones.

7. Excavation and Blasting: Contractor Safety Considerations for Construction

As previously noted, elevated methane concentrations have been recorded in sub-grade soil vapour probes installed at the Property. It should be noted that the recorded methane concentrations are considered representative of conditions within the vapour probes. It is expected that accumulation of vapours within the LFG Probes and the immediately surrounding subsurface environment readily occurs during periods where the LFG Probes are sealed between monitoring events as result of larger void spaces in these areas. The accumulation of methane in these areas could contribute to elevated PEAK readings upon opening and initializing methane gas concentration measurements during monitoring events. It is also noted that stable methane concentrations, as recorded in LFG Probes may not be representative of stable methane concentrations in an indoor environment, which may be measured over many hours or even several days for increased accuracy. It is also expected that indoor air would be subject to significant dilution of methane gas with supplied air through ventilation systems.

In the presence of open atmosphere excavation activities, it should be expected that the availability of fresh air would readily mix with residual methane vapours, migrating through the subsurface. Following the excavation and removal of remnant waste from the Site, the only source of methane gas would be from off-Site properties; the open air mixing would be expected to significantly reduce methane concentrations in the area of construction.

The excavation contractor who is retained for this redevelopment, will be made aware of the sub-grade soil vapour concentrations from LFG probes present at the Property and will be required to provide a safe excavation approach, which considers the potential presence of methane gas. It should be noted that various subsurface overburden excavation activities have been completed in the overburden soil within the footprint of this former landfill site, which included excavation for the installation of municipal infrastructure, including a methane gas collection system to the east of the Property.

Prior to blasting and removal of bedrock, the blasting contractor will be made aware of the sub-grade soil vapour concentrations from soil vapour probes present at the Property and will be required to provide a safe blasting approach, which considers the potential presence of methane gas in the subgrade environment at the Site and neighbouring properties.

The potential implications of the future proposed blasting approach to develop additional bedrock fractures (or microfractures) within the area of impacted from the localized blasting at the Site should be assessed as part of development of a blasting methodology. This assessment will be the responsibility of the blasting contractor and their engineering consultant, and the selected approach should minimize the development of bedrock fractures from the former Pinecrest Landfill Site to surrounding structures.

Regardless of air mixing and votalitization potential of residual methane gas from off-Site sources, there is a potential that methane could accumulate within the excavation and create an atmospheric hazard for workers during construction.

It is recommended that an air monitoring program be implemented during construction to monitor the methane concentrations within the excavation. This program could be completed by a representative of BRIGIL, a third party consultant and/or by representatives of the excavation contractor. The air monitoring program and should include record keeping and review of observed methane concentrations, their recorded locations dates/times of data collection at the Site.

8. Remediation Environmental Approach During Construction

i. Historical On-Site Waste

As a result of proposed redevelopment concept, the majority of the footprint of the former landfill site located at the Property will be excavated to bedrock, as presented in the Site Development Design Concept Plan, included as Appendix A. This material will be removed from the Site for disposal at an approved waste disposal site. Subsequent bedrock removal will also be required to reach the proposed construction elevations.

As a recommended risk mitigation measure for vapour intrusion following construction, and to ensure compliance with the MECP Residential Site Condition Standards, it is also recommended that any residual waste materials or potentially deleterious fill material observed at the Property, outside of the proposed building footprint, be excavated and transported off-Site for disposal at an approved waste disposal site.

It is expected that the majority of the methane gas migration potential originating at the Property, which may contribute to adverse indoor air quality, will be remediated during excavation of waste and shallow soil at the Property prior to construction.

ii. Historical Off-Site Waste

The majority of the total footprint of the former landfill site is located at neighbouring properties to the north and east of the Site. There is no known concept for active remediation of the off-Site waste in the footprint of the former Pinecrest Landfill, as such, it is expected that this waste (and source of continuing methane gas migration) will remain at neighbouring properties following redevelopment of the Site.

It has been reported by City of Ottawa representatives that there is an inactive methane collection system, which consists of 18 extraction wells (EW1 to EW18) located along Dumaurier Avenue and Watson Street. This system is reportedly still connected to the control building on the north edge of Dumaurier Park. The system was installed in 1989 and operated until 2003. The City reportedly offered to connect adjacent landowners within the landfill footprint to the system, but no adjacent owners accepted the offer. It is recommended that the proposed Site building have a vapour collection system installed during construction, which could be connected to the City of Ottawa's methane collection system, in the event that indoor air methane gas concentrations are detected that may adversely impact air quality. The incorporation of this system into a purpose designed and installed foundation vapour collection system during construction would be expected to mitigate the potential for migration of methane gas from off-Site waste into the Site building.

9. Preliminary Recommendations for Potential Risk Mitigation Measures During Construction

i. Methane Gas Monitoring

Residual methane gas concentrations should be expected to persist at neighbouring properties which had formerly been used for waste disposal, primarily to the east and northeast, so long as these properties remain unremediated. It would also be expected that some migration of methane gas from neighbouring properties will continue onto the Site during construction, given that the open excavation will create preferential pathways and a negative concentration gradient, which will increase the migration of soil vapours onto the Site.

As a measure safeguard for worker safety during construction, primarily as a result of an expected increased vapour migration to the Site, continuous daily atmospheric monitoring is recommended prior to commencement of, and during construction work hours. An industry standard method for atmospheric monitoring would include the continuous utilization, operation and monitoring of a 4-gas meter prior to commencing work each day and throughout work operations. Readings and monitoring should be completed and recorded intermittently throughout the work area and each work day. Monitoring would provide warning to workers in the event of an atmospheric hazard as a result of methane, as well as other gases which may accumulate in an excavation and pose an atmospheric hazard. In the event of a potential atmospheric hazard, a stop work order would be implemented and ventilation solutions would be determined to resolve the hazard.

It is not expected that an atmospheric hazard would exist on any above grade levels (above the first storey), prior to installation of windows on these levels of the proposed building.

ii. Foundation Backfill

As part of standard construction procedures, the expectation for foundation backfill is that the exterior of the foundation would be backfilled with coarse grained fill material. This type of material is expected to increase the potential for subsurface vapour exchange in the building exterior subsurface environment. The use of the coarse grained backfill material would be expected to be continuous around the perimeter of the proposed building. The backfill type is expected to facilitate the effectiveness of potential ventilation systems.

iii. Installation of Perimeter Vapour Collection and Ventilation Infrastructure

Given the potential for continued migration of methane gas onto the Site from neighbouring properties following construction, the installation of infrastructure, to be available for future use in an active vapour collection system, is recommended. Simple vapour collection systems can typically be installed during construction, with minimal cost implications, when the potential exists for vapour migration onto a property and/or vapour infiltration into a building.

A preliminary concept for a vapour collection system could include the installation of perforated piping around the perimeter of the foundation. The piping should be installed above the seasonal high groundwater table and would be situated within the permeable foundation backfill material. The system should be connected, or at least installed in such a manner that it could be connected in the future, to the existing methane collection system present on adjacent City of Ottawa property.

A passive ventilation system could also be incorporated to the suggested perimeter ventilation infrastructure design. This type of system may include such features as sealable vertical conduits (piping) to the open atmosphere, which would permit the passive ventilation of vapours accumulating in the perimeter fill materials to the open atmosphere. The option to have these

ventilation conduits sealable would be important if active ventilation of methane vapours is deemed necessary.

iv. Active Air Exchange Ventilation for Subgrade Construction

It has been proposed that subgrade construction consist of several underground parking levels for the subject building. As a standard practice during construction, there is a requirement for ventilation and active fresh air exchange within these subgrade levels. It is expected that any remnant infiltration of methane gas vapours into the subgrade levels of the proposed building will be addressed by the ventilation and air exchange systems, which have been designed as part of conventional construction practices.

There is minimal to no perceived concern for infiltration of methane gas vapours into the above grade levels of the proposed building from the exterior of the building. It would also be expected that an air exchange system would be present within the above grade levels of the proposed building under occupied conditions, which is expected to further reduce the exposure potential of building occupants to methane gas vapours.

10. Preliminary Recommendations for Monitoring Following Construction

Continuity of the previously discussed methane monitoring program is recommended to be focused on the subgrade, and first above grade levels of the proposed building following installation of windows and doors on these levels. This monitoring would provide a preliminary indication if the potential exists for methane gas migration into the building under somewhat static conditions (i.e. prior to operation of a ventilation system).

Following installation of windows and doors, periodic atmospheric monitoring is recommended at each level of construction of the proposed building.

An evaluation of the remnant methane gas concentrations in the subject building (if present) will be completed prior to application for occupancy. If required, one of more mitigation alternatives will be implemented to reduce indoor methane gas concentrations to permissible levels.

11. Conclusions

An evaluation and interpretation of the following were completed as part of this IAWDS:

- Review of historical environmental reports;

- Approximate Footprint and Extents of a former landfill site at the Property;
- Subsurface vapour monitoring and data trends of on-Site methane gas concentrations;
- Methane gas migration pathways;
- Excavation and blasting procedures and safety considerations; and,
- Environmental remediation approach.

Based on the evaluation and interpretation of the available information and the proposed redevelopment concept, several environmental considerations and/or mitigation actions are required prior to, during and following redevelopment of the Site. The mitigation actions are required as a result of the presence of a former waste disposal site on a portion of the Site and at neighbouring properties to the north and east. These environmental considerations and/or mitigation actions include, but are not limited to:

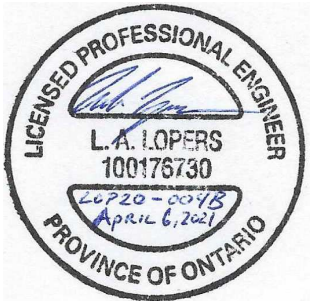
- Evaluation of the implication of methane gas concentrations at the Site and neighbouring properties will be required on behalf of the excavation and blasting contractors to ensure safe construction procedures and to safeguard against an increase for the potential of off-Site subsurface methane gas migration.
- Remediation and off-Site disposal of the on-Site waste materials is recommended to be completed as part of preliminary environmental remediation to support redevelopment activities.
- Monitoring of methane gas concentrations at the Site during excavation and construction activities is recommended to ensure worker safety. Monitoring following construction is recommended to ensure suitability for occupancy.
- The installation of a vapour collection/extraction system within the foundation perimeter backfill, which could be vented to the atmosphere or connected to a City of Ottawa owned methane extraction system on adjacent land, provides a simple construction solution which would offer a mitigation solution in the event of potential future methane gas migration into the proposed building.

Evaluation of monitoring data, to be collected at various stages of redevelopment as noted above, is required to confirm the effectiveness of the aforementioned mitigation measures. The approach to assessment, review and implementation of the aforementioned environmental considerations and/or mitigation actions for methane gas are expected to permit safe construction practices and an indoor environment which is suitable for the proposed use.

i. Qualifications of the Assessor

The Qualified Person for this study is Mr. Luke Lopers, P. Eng. Mr. Lopers has been a Professional Engineer, registered in Ontario since 2012 and has been working on environmental site assessments and environmental liability assessments since 2006. Mr. Lopers has completed undergraduate studies in Landfill Design and Management. Mr. Lopers professional experience includes preliminary historical landfill assessment, data compilation and inventory summary preparation. Mr. Lopers has practical field experience with landfill gas monitoring and management/maintenance of landfill gas collection and ventilation systems. Mr. Lopers has completed, supervised, and directed field programs for subgrade vapour probe monitoring for qualitative observations as well as collection of analytical subsurface vapour samples for quantitative laboratory analysis and associated reporting.

Sincerely,



Luke Lopers, P.Eng.

12. Limitations

The findings and conclusions of this Impact Assessment of Adjacent Waste Disposal/Former Landfill Site (IAWDS) are based on the information provided and/or reviewed as part of this study.

This IAWDS has been completed with the standard of care generally expected in the industry for a study of this nature at the time it was completed.

This IAWDS has been prepared for the sole use of 3223701 Canada Inc. for the purposes of a preliminary assessment of the potential liabilities which may exist at the IAWDS Property. No other party is permitted to rely on the conclusions or findings of this report without the written consent of Lopers & Associates and 3223701 Canada Inc. Any such reliance on this report, the findings or the conclusions herein will be at the third party's risk. No warranties or representations expressed or implied in this report are made to any such third party.

It is expected that the preliminary conclusions and recommendations provided herein will be provided to potential or selected subcontractors as part of budgetary estimation considerations for the construction tendering purposes. Subcontractors and their respective consultants will be responsible for their own independent analysis, interpretation and determination of risks and selection of environmental mitigation measures associated with their proposed construction methodology for redevelopment of the Site.

The LFG monitoring data, provided by others and reviewed and referenced as part of this IAWDS, is considered to be qualitative and interpretive, as the data presented is based on field observations and has not been certified by an approved analytical laboratory. For the purposes of this IAWDS, the referenced monitoring data is considered to be valid for the locations and dates at which they were collected and do not necessarily reflect the stabilized indoor air quality elsewhere at the Site.

Changes to the physical setting of the IAWDS Property, the neighbouring properties and applicable regulations governing assessment and management of former waste disposal/landfill sites have the potential to influence the validity of the conclusions and opinions presented in this IAWDS.

13. References

Legal Survey Plan, Annis, O'Sullivan, Vollebekk Ltd., dated November 20, 2000.

City of Ottawa, geoOttawa mapping website, Visited October 2020 through April 2021. http://maps.ottawa.ca/geoottawa/

Google Earth, Visited October 2020 through April 2021.

Current Site Development Design Concept Plan, RLA Architecture, dated July 15, 2020.

"Waste Disposal Site Inventory", produced by the Ontario Ministry of the Environment, dated June 1991.

"Old Landfill Management Strategy, Phase 1 – Identification of Sites, City of Ottawa, Ontario", produced by Golder Associates Ltd., Dated October 2004.

"Phase I Environmental Site Assessment, 2831, 2833, 2835, 2841 and 2865 Dumaurier Avenue, Ottawa, Ontario", dated August 16, 2018, completed by GHD Limited for 3223701 Canada Inc.

"Phase II Environmental Site Assessment, 2831, 2833, 2835, 2841 and 2865 Dumaurier Avenue, Ottawa, Ontario", dated April 2, 2019, completed by GHD Limited for 3223701 Canada Inc.

"Phase One Environmental Site Assessment, 2829 Dumaurier Avenue, Ottawa, Ontario", dated January 8, 2021, completed by Lopers & Associates for 3223701 Canada Inc.

"Geotechnical Investigation, Proposed Hi-Rise Building, 2829 Dumaurier Avenue, Ottawa, Ontario", dated December 18, 2019, completed by Paterson Group Inc. for 3223701 Canada Inc.

"Detailed Methane Gas Migration Study, Closed Landfill Sites 1, 3, 5 and 10", dated March 1982, completed by Gartner Lee Associates Limited for The Corporation of the City of Ottawa.

"Methane Gas Detection Monitoring Program (2015-2019), Dumaurier Plaza - 2829 Dumaurier Avenue, Closed Pinecrest Landfill Site, Ottawa, Ontario", dated August 26, 2020, completed by Wood Canada Limited for 1248816 Ontario Inc.

Reported Observation and Monitoring Data for 2020 Methane Gas Monitoring Program event, Dumaurier Plaza - 2829 Dumaurier Avenue, Closed Pinecrest Landfill Site, Ottawa, Ontario, provided by The Corporation of the City of Ottawa on November 24, 2020, prepared by Wood Canada Limited for The Corporation of the City of Ottawa.

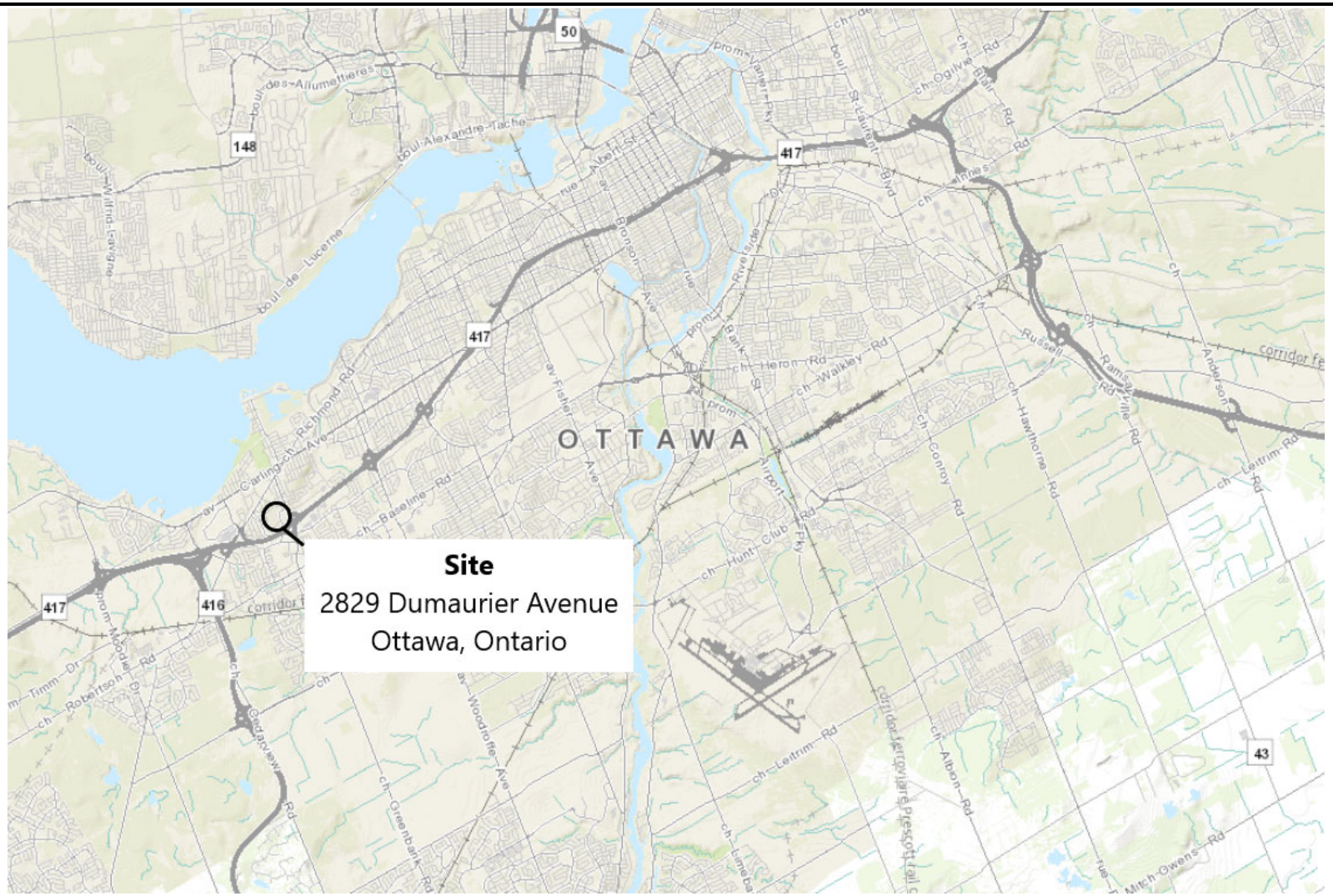
14. Appendices

Appendix A – Site Development Design Concept Plan

Appendix B – Legal Survey Plan

Appendix C – 2020 Wood Methane Monitoring Data

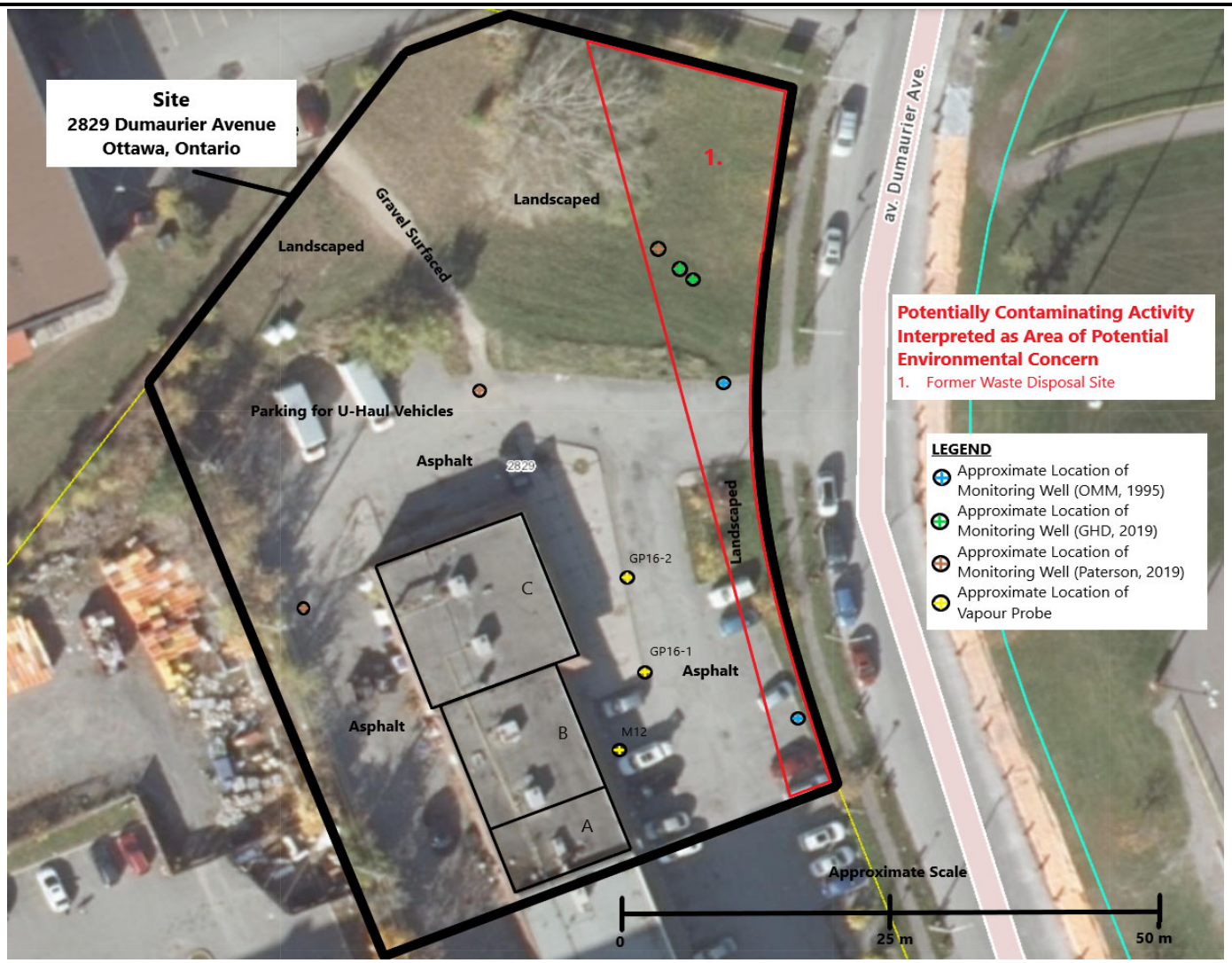
Figures



LOPERS & ASSOCIATES

Figure 1: Key Plan
Impact Assessment of Adjacent Waste Disposal Site
2829 Dumaurier Avenue, Ottawa, Ontario
3223701 Canada Inc.

Project Reference No:	LOP20-004B
Drawing No.:	LOP20-004B-1
Date:	April 2, 2021
Author:	L. Lopers
Source:	geoOttawa, Base Mapping



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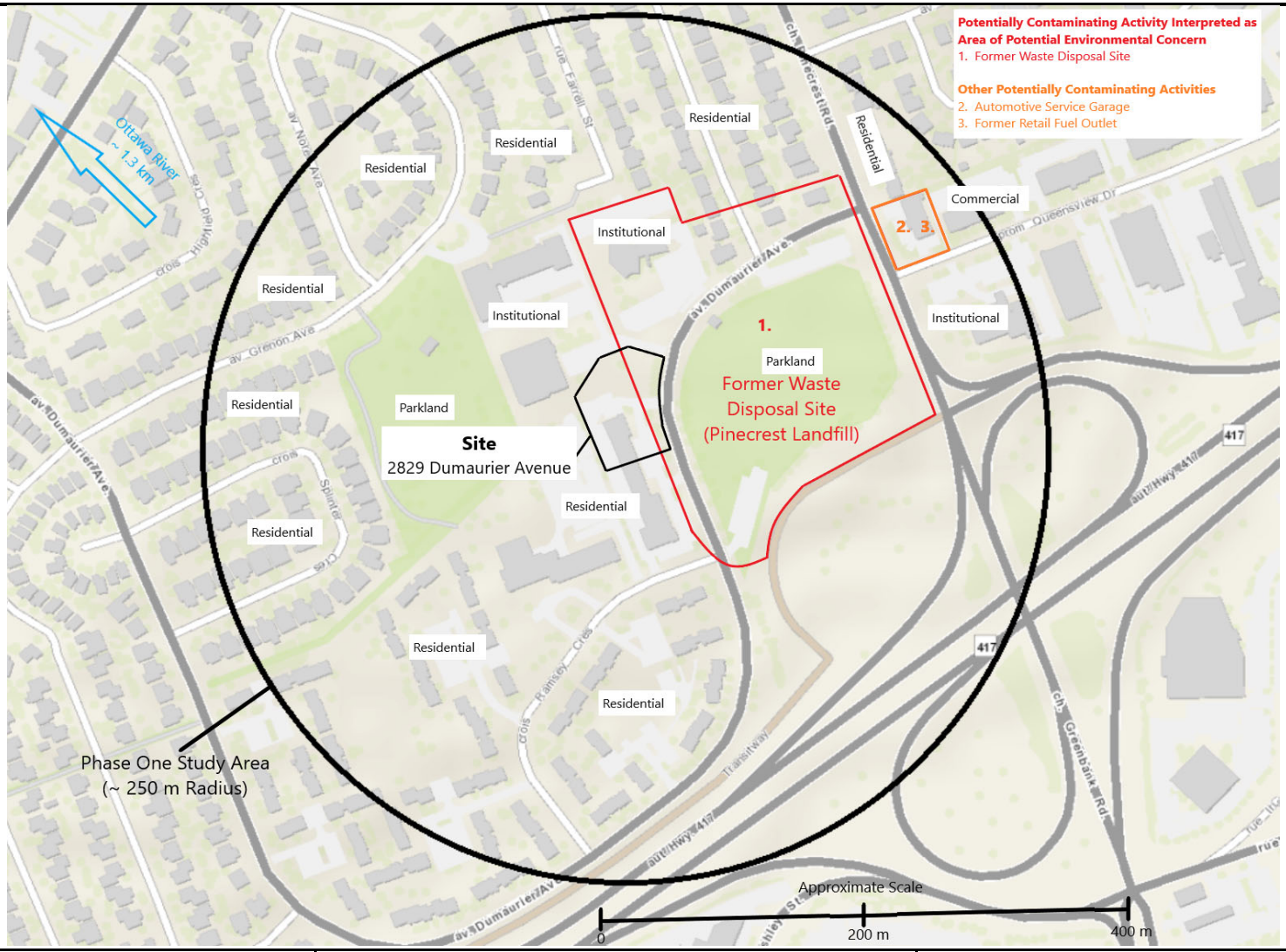
LOPERS & ASSOCIATES

Figure 2: Site Plan
Impact Assessment of Adjacent Waste Disposal Site
2829 Dumaurier Avenue, Ottawa, Ontario
3223701 Canada Inc.

Project Reference No:	LOP20-004B
Drawing No.:	LOP20-004B-2
Date:	April 2, 2021
Author:	L. Lopers
Source:	geoOttawa, 2019 Aerial Imagery



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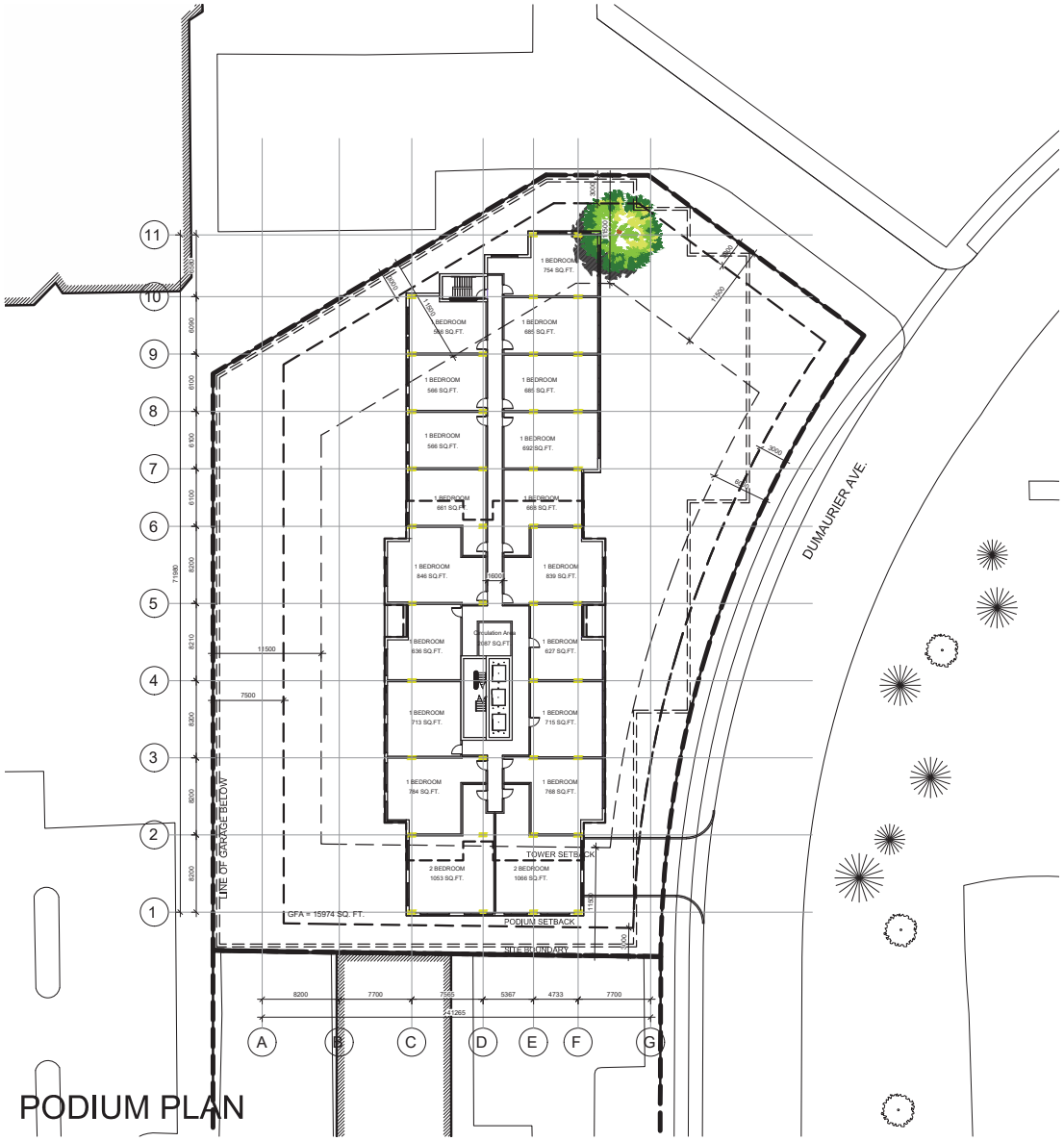
LOPERS & ASSOCIATES

Figure 3: Surronding Land Use Observations
Impact Assessment of Adjacent Waste Disposal Site
2829 Dumaurier Avenue, Ottawa, Ontario
3223701 Canada Inc.

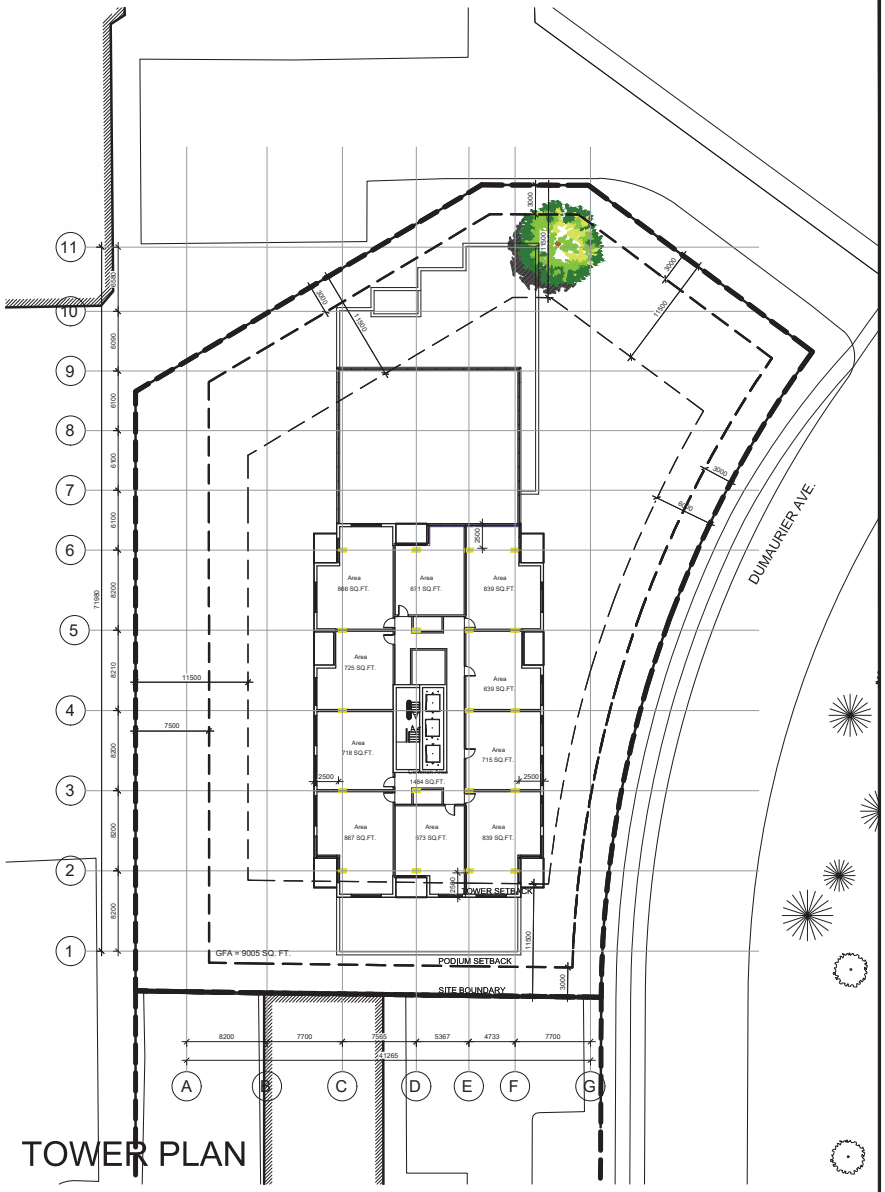
Project Reference No:	LOP20-004B
Drawing No.:	LOP20-004B-3
Date:	April 2, 2021
Author:	L. Lopers
Source:	geoOttawa, Base Mapping

Appendix A

Site Development Design Concept Plan



PODIUM PLAN



TOWER PLAN

rla/architecture
roderick lahey architect inc.

PLOT SCALE : 1:500

2829 DUMAURIER AVE.

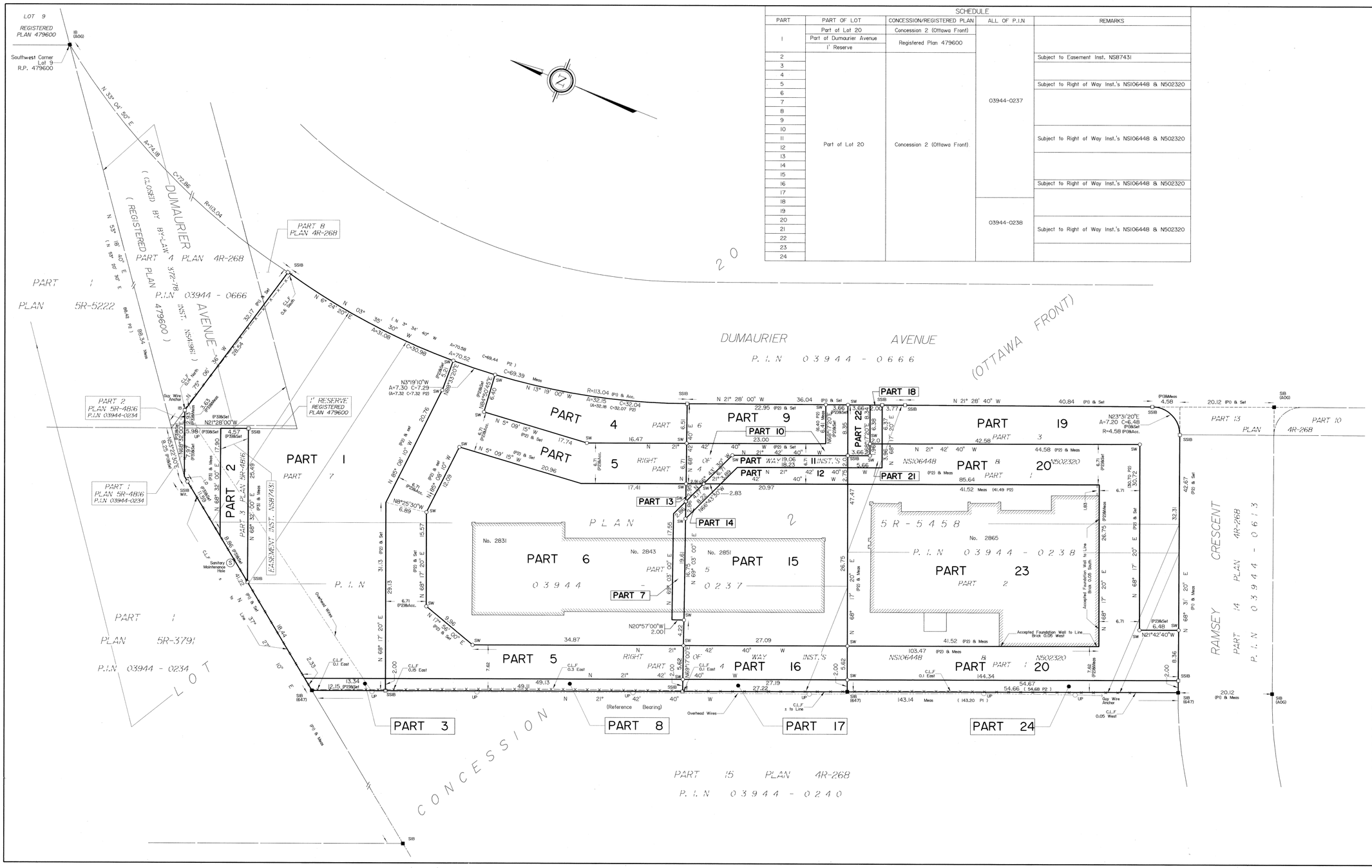
OTTAWA, ONTARIO

BRIGIL

PAPER SIZE: ----
PLOT DATE: Wednesday, July 15, 2020
PLOT SCALE: 1:
PEN STYLE: ----
F:\2019\1922 - 2829 Dumaurier\01_Design Development\1922 2829 Dumaurier Site Plan 2020-07-15.dwg

Appendix B

Legal Survey Plan



SCHEDULE				
PART	PART OF LOT	CONCESSION/REGISTERED PLAN	ALL OF P.I.N	REMARKS
1	Part of Lot 20 Part of Dumaurier Avenue 1' Reserve	Concession 2 (Ottawa Front) Registered Plan 479600		
2	Part of Lot 20	Concession 2 (Ottawa Front)	03944-0237	Subject to Easement Inst. NS87431
3				
4				Subject to Right of Way Inst.'s NS106448 & N502320
5				
6				
7				Subject to Right of Way Inst.'s NS106448 & N502320
8				
9				
10				Subject to Right of Way Inst.'s NS106448 & N502320
11				
12				
13				
14				
15				
16				Subject to Right of Way Inst.'s NS106448 & N502320
17				
18			03944-0238	
19				
20				Subject to Right of Way Inst.'s NS106448 & N502320
21				
22				
23				
24				

I REQUIRE THIS PLAN TO BE DEPOSITED UNDER THE LAND TITLES ACT.

DATE Nov 20, 2000

V. ANDREW SHELP
ONTARIO LAND SURVEYOR

PLAN 4R-16235

RECEIVED AND DEPOSITED

DATED Nov 20th 2000

LAND REGISTRAR FOR THE LAND TITLES DIVISION OF OTTAWA-CARLETON NO. 4.

PLAN OF SURVEY OF

PART OF LOT 20
CONCESSION 2 (Ottawa Front)
Township of Nepean
NOW CITY OF OTTAWA
PART OF DUMAURIER AVENUE
(As Closed by By-Law 372-78 Inst. NS41961)
AND PART OF THE 1' RESERVE
REGISTERED PLAN 479600
CITY OF OTTAWA

REGIONAL MUNICIPALITY OF OTTAWA-CARLETON

Surveyed by
ANNIS, O'SULLIVAN, VOLLEBEKK LTD.

Scale 1 : 300

12 9 6 3 0 6 12 Metres

Metric

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

Surveyor's Certificate

I CERTIFY THAT:

1. This survey and plan are correct and in accordance with The Surveys Act, The Surveyors Act and The Land Titles Act and the regulations made under them.
2. The survey was completed on October 27, 2000

Nov 20, 2000
Date

V. ANDREW SHELP
ONTARIO LAND SURVEYOR

Notes & Legend

—□—	Denotes	Survey Monument Planted.
—■—	=	Survey Monument Found.
SIB	=	Standard Iron Bar.
SSIB	=	Short Standard Iron Bar.
IB	=	Iron Bar.
SW	=	Spike & Washer in Asphalt
Wit.	=	Witness
(P1)	=	Plan 4R-268
(P2)	=	Plan 5R-5458
(P3)	=	Plan 5R-4816
(AOG)	=	Annis, O'Sullivan, Vollebekk Ltd.
C.L.F	=	Chain Link Fence
UP	=	Utility Pole

Bearings are astronomic derived from the westerly limit of Plan 5R-5458 shown to be N21°42'40"W thereon.

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
Ontario Land Surveyors
14 CONCOURSE GATE, SUITE 500, NEPEAN, ONTARIO K2E 7S6
TEL.(613)727-0850 FAX(613)727-1079

Job No. 1355-00 B

Appendix C

2020 Wood Methane Monitoring Data

Table 1. Landfill Gas Monitoring Data for 2829 Dumaurier Ave (2015 - 2019)

Monitor ID	Monitoring Date	In-Situ Measurements							Comments (Status of Landfill Gas Probes)
		Methane (CH_4)			Carbon Dioxide (%)	Oxygen (%)	Balance Gases - %	Relative Pressure (Inches of Water)	
		% (v/v)		% LEL					
		Initial and/or Peak	Long Term and/or Stable	Long Term and/or Stable	Long Term and/or Stable	Long Term and/or Stable	Long Term and/or Stable		
GP16-2 (GP5-03)	19-Jun-15	**30.5**	**30.3**	*>100*	2.1	12.1	55.5	-0.50	Removed water from riser; reading may not be representative.
	18-Sep-15	**23.2**	**20.9**	*>100*	1.7	15.3	62.1	-2.60	Removed water from riser; reading may not be representative.
	3-Dec-15	**34.6**	**25.8**	*>100*	1.8	14.2	58.2	2.40	Removed water from riser; reading may not be representative.
	21-Mar-16	**9.3**	**9.2**	*>100*	0.9	17.7	72.2	0.00	Removed water from riser; reading may not be representative.
	12-May-16	**11.8**	**11.4**	*>100*	0.8	16.1	71.7	0.00	Removed water from riser; reading may not be representative.
	17-Aug-16	**11.3**	**7.6**	*>100*	0.8	18.1	73.5	-3.00	Removed water from riser; reading may not be representative.
	18-Nov-16	**0.3**	**0.2**	5	2.8	17.0	80.0	-0.10	In good condition. (Probe was replaced on September 19, 2016)
	3-Mar-17	0.0	0.0	0	0.6	20.8	78.6	0.00	In good condition.
	14-Jun-17	0.0	0.0	0	5.7	13.1	81.2	-0.20	In good condition.
	21-Aug-17	**1.2**	**1.1**	-	11.6	2.1	85.2	-0.80	Removed water from riser; reading may not be representative.
	11-Sep-17	**0.8**	**0.7**	14	7.7	7.6	83.9	-0.80	In good condition.
	14-Nov-17	**1.0**	**0.5**	9	1.5	17.7	80.2	-0.40	In good condition.
	23-Feb-18	-	-	-	-	-	-	-	Could not open.
	24-May-18	**0.1**	**0.1**	**0.1**	6.6	8.1	85.2	0.00	In good condition.
	14-Aug-18	**0.1**	**0.2**	0.1	9.4	6.9	83.5	0.00	Removed water from riser; reading may not be representative.
	13-Nov-18	0.0	0.0	0	0.9	20.5	78.5	1.60	Removed water from riser; reading may not be representative.
	27-Feb-19	-	-	-	-	-	-	-	Inaccessible, ice/snow cover, pooling water.
	8-May-19	**0.1**	0.0	0	1.1	17.9	81.0	-0.80	In good condition.
	7-Aug-19	0.0	0.0	0	10.0	3.0	87.0	0.00	In good condition.
	26-Nov-19	**0.3**	**0.3**	6	1.7	18.5	79.5	0.00	Removed water and ice obstruction; reading may not be representative.
GP16-1 (GP6-04)	19-Jun-15	**33.3**	**15.2**	*>100*	1.4	17.4	66.0	0.20	Removed water from riser; reading may not be representative.
	18-Sep-15	**59.0**	**56.6**	*>100*	9.3	4.3	29.8	0.00	Venting to air, water in riser; reading may not be representative.
	3-Dec-15	**40.8**	**40.8**	*>100*	4.4	10.6	44.2	0.00	Removed water from riser; reading may not be representative.
	21-Mar-16	-	-	-	-	-	-	0.50	Ice obstruction.
	12-May-16	-	-	-	-	-	-	-	Water in riser, could not be fully removed.
	17-Aug-16	**63.4**	**63.3**	*>100*	11.1	3.6	22.0	0.00	Removed water from riser; reading may not be representative.
	18-Nov-16	**5.4**	**0.1**	*21*	4.1	12.7	83.1	-0.10	In good condition. (Probe was replaced on September 19, 2016)
	3-Mar-17	**1.1**	**3.2**	*22*	1.8	14.2	80.8	0.00	In good condition.
	14-Jun-17	**34.1**	**1.0**	*21*	9.4	6.6	83.0	0.20	In good condition.
	21-Aug-17	**12.3**	**9.0**	-	11.3	0.3	79.4	-0.60	In good condition.
	11-Sep-17	**32.9**	**13.5**	*>100*	8.4	0.5	77.5	0.00	Removed water from riser; reading may not be representative.
	14-Nov-17	**34.1**	**2.9**	*50*	5.0	10.5	81.6	-0.80	In good condition.
	23-Feb-18	**33.8**	**34.0**	*>100*	2.3	0.6	63.2	0.00	In good condition.
	24-May-18	**0.4**	**0.8**	14	6.8	9.9	82.8	0.00	In good condition.
	14-Aug-18	**14.2**	**69.7**	*>100*	10.6	2.2	73.0	-0.60	In good condition.
	13-Nov-18	**2.7**	**2.1**	*42*	4.2	8.4	85.3	1.40	Removed water from riser; reading may not be representative.
	26-Feb-19	**22.7**	**8.5**	*>100*	2.3	16.8	78.4	0.00	In good condition.
	8-May-19	**3.5**	**0.1**	2	3.9	14.2	81.8	0.40	In good condition.
	7-Aug-19	-	-	-	-	-	-	-	Removed water from riser; flow failure.
	26-Nov-19	**0.1**	**0.1**	2	3.2	14.6	82.1	0.00	Removed water from riser; reading may not be representative.

Table 1. Landfill Gas Monitoring Data for 2829 Dumaurier Ave (2015 - 2019)

Monitor ID	Monitoring Date	In-Situ Measurements							Comments (Status of Landfill Gas Probes)
		Methane (CH_4)			Carbon Dioxide (%)	Oxygen (%)	Balance Gases - %	Relative Pressure (Inches of Water)	
		% (v/v)		% LEL					
		Initial and/or Peak	Long Term and/or Stable	Long Term and/or Stable	Long Term and/or Stable	Long Term and/or Stable	Long Term and/or Stable		
M12	11-Sep-17	0.0	0.0	0	0.0	20.6	79.3	0.00	In good condition.
	14-Nov-17	0.0	0.0	0	0.1	21.0	78.9	-0.10	In good condition.
	23-Feb-18	**0.1**	**0.1**	0.1	0.2	20.3	79.4	0.00	Water valve frozen.
	24-May-18	0.0	**0.1**	0	0.1	20.9	79.0	0.00	In good condition.
	14-Aug-18	**0.1**	**0.4**	0.2	0.1	20.5	79.3	-0.20	In good condition.
	13-Nov-18	0.0	0.0	0	0.2	21.6	78.2	0.10	In good condition.
	26-Feb-19	**0.1**	0.0	0	0.1	21.7	78.2	0.00	In good condition.
	8-May-19	0.0	0.0	0	0.1	21.9	78.0	-0.10	In good condition.
	7-Aug-19	**0.1**	0.0	0	0.4	19.8	79.8	-0.20	In good condition.
	26-Nov-19	0.0	0.0	0	0.3	21.3	78.4	0.00	In good condition.

Notes:

Monitoring Performed by Amec Foster Wheeler Since 2013 Using a Landtec GEM 2000 Landfill Gas Analyzer.

Where %LEL Values Not Reported by CRA, Values Have Been Calculated Using Ratio of 5% Methane v/v = 100% LEL.

21	Methane Concentration Exceeds 20% LEL Threshold Limit as Provided in Procedure D-4-1.
2.6	Percent Methane by Volume Exceeds MOE Regulation 232/98 for Landfill Property Boundary Subsurface.
1.1	Percent Methane by Volume Exceeds MOE Regulation 232/98 for Landfill On-Site Building or Foundation.
0.06	Percent Methane by Volume Exceeds MOE Regulation 232/98 for Landfill Off-Site Building or Foundation.

Table 2
Summary of Landfill Gas Analyses

Parameters	Units	RDL	Analytical Results - µg/m^3					
Sample Location			GP16-1	GP16-2				
Sample ID			GP6-04-1/2465	GP5-03-1/363				
Sample Volume (m3)			0.0014	0.0014				
Laboratory ID			EZH859	EZH858				
Sample Date			21-Aug-17	21-Aug-17				
Light Hydrocarbons								
Methane	ppm	0.17	84000	11000				
Acetylene	ppm	0.17	< 0.17	< 0.17				
n-Butane	ppm	0.17	0.53	< 0.17				
Ethane	ppm	0.17	< 0.17	0.21				
Ethylene	ppm	0.17	< 0.17	< 0.17				
n-Pentane	ppm	0.17	0.3	< 0.17				
Propane	ppm	0.17	2.5	0.91				
Propene	ppm	0.17	< 0.17	< 0.17				
Propyne	ppm	0.17	< 0.17	< 0.17				
Mercaptans								
Methyl Mercaptan	ppmv	1.0	< 1.0	< 1.0				
Ethyl Mercaptan	ppmv	0.50	< 0.50	< 0.50				
1-Propyl Mercaptan	ppmv	0.60	< 0.60	< 0.60				

Notes:
RDL = Laboratory Analytical Method Detection Limit.
DUP = Quality Assurance/Quality Control Duplicate Sample.
RPD = Relative Percent Difference (Between Primary and Duplicate Samples).
< = Less Than Laboratory Analytical Reporting Detection Limit.