REPORT

Teston Road Area Transportation Improvements Individual Environmental Assessment

Hydrogeology Study

Presented to:

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Report No. 1902618.00 April 8, 2024

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EXECUTIVE SUMMARY

Morrison Hershfield Limited now Stantec (MH) was retained by The Regional Municipality of York (York Region) to conduct a Hydrogeological Assessment Study (the Study) for the proposed improvements to Teston Road between Keele Street and Bathurst Street. The study documents the existing conditions, potential effects of the proposed improvements and recommends mitigation measures.

The proposed improvements include realignment of Teston Road between Keele Street and about 500 m east of Keele Street, constructing a new segment of Teston Road from 500m east of Keele Street to Dufferin Street, and widening and rehabilitation of Teston Road between Dufferin Street and Bathurst Street.

The proposed right-of-way travels between three landfills namely the Vaughan Landfill, the Keele Valley Landfill and the Disposal Services Landfill. This report discusses the potential impacts of the proposed improvements to Teston Road on these landfills and provides recommendations and mitigation measures.

The key findings of the Study are summarized below:

- Most of the proposed construction work is above the water table, and dewatering will be limited to certain areas near the water crossings, and related to the deepest parts of the storm water system (including storm water storage facilities). The protections of the permit to take water (PTTW) or environmental activity site registry (EASR) system are sufficient to mitigate potential impacts.
- Despite any desire to practice Low Impact Development as part of this project, the storm water from the road should not be infiltrated into the sandy soils that host the landfills. This is to avoid impacting the chloride plumes located beneath the Vaughan Landfill and the Keele Valley Landfill.
- There may be some limited domestic use of groundwater in the area which should be further explored during design stages.
- Some landfill infrastructure is in conflict with the proposed road design. Detailed assessment of the severity of the conflict and the appropriate mitigation measures is recommended in later design stages. Any changes to the landfill infrastructure will require amendments to the ECA under which the affected landfill operates.

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1. INTRODUCTION

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1.1 Project and Study Area

The proposed improvements include realignment of Teston Road between Keele Street and about 500 m east of Keele Street, constructing a new segment of Teston Road from 500 m east of Keele Street to Dufferin Street, and widening and rehabilitation of Teston Road between Dufferin Street and Bathurst Street (Project Area). The Study Area extends to a 500 m buffer radius around the Project Area. The Project Area and Study Area are shown in **Figures 1 through 5** in **Appendix A**.

It is useful for the reader to know that the chainage of the project starts at 1+000, just west of Keele Street. Key points along the road alignment are noted in **Table 1-1**:

Table 1-1: Key Points Along the Road Alignment

Location	Chainage (Approx.)
Keele Street	1+271
West side of Disposal Services Landfill (DSL)	1+600
Rodinea Road	1+765
West side of Vaughan Landfill (VL)	1+800
West side of Keele Valley Landfill (KVL)	1+950
High point of land	2+250
East side of VL and KVL (approx.)	2+650
East Don River Tributary	3+040
Dufferin Street	3+375
Watercourse, existing box culvert	4+607
Bathurst Street	5+405

1.2 Scope of Work

The purpose of this groundwater study is to assess groundwater resources and determine and mitigate impacts associated with the proposed improvements to Teston Road between Keele Street and Bathurst Street. The scope of the groundwater study incorporates the following elements: 1) establishment of a Study Area; 2) compilation and assessment of background information such as geological and topographic mapping, water well records, geological information, published hydrogeological, water resources studies, and geotechnical studies; 3) field investigation as necessary to meet the objectives, conducted in conjunction with the geotechnical investigation; 4) hydrogeological assessment and determination of significance; 5) assessment of impacts; and 6) proposed environmental protection/mitigation measures. The scope of work for the Study included the following field-specific elements:

- Monitoring groundwater levels and determining the hydraulic conductivity in monitoring wells installed during a concurrent soil investigation and geotechnical investigation.
- Collecting water samples from the monitoring wells installed during a concurrent soil investigation and geotechnical investigation.
- Comparing water analytical results with Provincial Water Quality Objectives (PWQOs) (MECP, 1994) and the Sewer Use Bylaw for York Region (York Region Bylaw) to establish the water quality and any notable exceedances.

1.3 Contents of Report

This section of the report provides information on the context for the study, the scope of work and the layout of the report. **Section 2** describes the methods used in the study. **Section 3** describes the results including background information, the results of field investigations, and any calculations necessary for the impact assessment. **Section 4** describes the assessment of impacts of the project on all identified potential receptors. **Section 5** presents a summary of the results and the potential impacts, describes any recommended monitoring, and contingency plans to be implemented in the event of certain occurrences. **Section 6** provides closure notes and signatures of the report authors, and **Section 0** presents the limitations and use of this report. References are provided in **Section 8**. Figures, tables, and supporting documents are provided in the appendices.

2. METHODS

This section describes the methods used in this study. Specifics to the project, including dates, specific data sources and specific details of the chosen methodology are included as part of the results.

2.1 Background Data Review

Background data review was conducted in accordance with industry standard practices using readily available information from federal, provincial, municipal, and other sources of information.

The background review included analysis as necessary to develop an overall understanding of the hydrogeological setting. In this case, the analysis included the tabulation and use of the Water Well Information System (WWIS) to determine depths and available drawdown in area wells; plan view plotting of surface water features such as streams, rivers, lakes and wetlands to assess groundwater and surface water interaction; and plan view plotting of surficial and bedrock geology to determine the likely occurrence of surficial deposits as well as the occurrence and thickness of aquifers.

2.2 Water Investigation

In hydrogeological studies, especially at a regional scale, it is necessary to understand the interaction of groundwater and surface water. This section describes methods used to assess this.

2.2.1 Groundwater Level Monitoring and Hydraulic Testing

Water levels were measured by MH staff relative to the top of the monitoring well casings using an electronic water level tape. Groundwater elevations were determined by subtracting the measured depth to water from the estimated elevation of the casing top.

The soil hydraulic conductivities for the project area were calculated by MH. The hydrogeological properties were measured through rising head hydraulic conductivity tests (bailer test). A known volume of water was removed from the well, and the displacement and gradual re-equilibration of the water level in the well was measured using an electronic pressure transducer (data logger). The hydraulic conductivity was calculated using Hvorslev method (Freeze and Cherry, 1979):

$$K = r^2 \ln\left(\frac{L_e}{R}\right) / 2L_e t_{37} \qquad (1)$$

where:

K	=	hydraulic conductivity [m/s]
r	=	effective radius of the monitoring well (m)

L_e = screen length (m)

R = radius of the well including gravel pack (m)

t_{37} = time lag when $h_t/h_0 = 0.37$ (s)

h_t = displacement as a function of time (m)

h_0 = initial displacement (m)

2.2.2 Water Inspection & Sampling

MH collected water samples from monitoring wells using a peristaltic pump. All equipment was decontaminated prior to and after each use with Alconox and distilled water. The pump collected the water sample at a low flow setting to avoid any disturbance to the sediment that might be present in the well. Water samples were kept in cooler with ice and were shipped to Eurofins Environment Testing Canada Inc (Eurofins), Toronto, Ontario under a Chain of Custody.

The samples were submitted for the analysis of the one or more of the following parameters as regulated under the York Region Bylaw:

- General Chemistry – pH, cyanide (CN), phenols, total suspended solids (TSS), biochemical oxygen demand (BOD).
- Nutrients – total phosphorous (TP) and total kjeldahl nitrogen (TKN)
- Metals and Inorganics – Total aluminum (Al), total antimony (Sb), total arsenic (As), total cadmium (Cd), total chromium (Cr), total cobalt (Co), total copper (Cu), total lead (Pb), total manganese (Mn), total mercury (Hg), total molybdenum (Mo), total nickel (Ni), total selenium (Se), total silver (Ag), total tin (Tn), total titanium (Ti), total zinc (Zn), and total cyanide (CN).

In addition, the samples were submitted for the analysis of the one or more of the following parameters as regulated under the PWQO:

- Metals – Total as well as dissolved aluminum (Al), total antimony (Sb), total arsenic (As), total beryllium (Be), total boron (B), total cadmium (Cd), total chromium (Cr), total cobalt (Co), total copper (Cu), total iron (Fe), total lead (Pb), total manganese (Mn), total as well as dissolved mercury (Hg), total molybdenum (Mo), total nickel (Ni), total selenium (Se), total silver (Ag), total strontium (Sr), total thallium (Tl), total uranium (U), total vanadium (V), total zinc (Zn), total zirconium (Zr).

2.3 Impact Assessment

Groundwater impacts are generally assessed based on calculated or estimated drawdown of the water table/potentiometric surface, and on calculated or estimated changes in volumetric flow (such as loss of baseflow to local streams). The impact assessment is made by considering the impacts of these project-induced calculated or estimated hydrogeological effects on the following potential receptors:

- Wells and Aquifers
- Actual or Potential Contamination
- Surface Water
- Structures
- Ecology

All receptors identified within the Project Area based on background data review and site visits, and were given individual receptor numbers and shown on **Figure 9** in **Appendix A**.

3. RESULTS

3.1 Physiography & Topography

The Oak Ridges Moraine is a massive ridge of glacial drift extending between Caledon and Rice Lake, near Peterborough, containing significant amounts of sand and gravel. The moraine has a geographic area of 1,900 square kilometres with overburden that is up to 200 m thick. According to Chapman and Putnam (1984), a lobe of the moraine proper occupies the central part of the Study Area (see **Figure 1** in **Appendix A**), which is flanked on either side by the till plains of the area known as the South Slope of the Oak Ridges Moraine.

According to the Atlas of Canada (Natural Resources Canada, 2014), the topography of the Study Area drops from (approximately 310 m elevation in the) northwest to (approximately 230 m elevation in the) southeast, towards Lake Ontario, as is consistent with the South slope physiography. The northwestern part of the Study Area is a height of land, on the other side of which the topography drops off towards King City in the northwest.

Multiple tributaries of the Don River East Branch originate in the Study Area, flowing toward Lake Ontario, incised 10 to 20 m into the landscape.

Along the alignment of the proposed Teston Road, the topography is highest (approximately 285 m elevation) just east of Rodinea Road, and drops into the valley of Don River East Branch which crosses the alignment at just less than 250 m elevation. Moving east, the topography climbs back up as the alignment crosses Dufferin Street, to approximately 280 m elevation, before dropping back below 250 m elevation at another branch of the Don River East Branch (mid-block). The topography climbs again and drops again to another branch of the Don River East Branch, approximately coincident with Bathurst Street.

3.2 Drainage & Surface Water (Hydrology)

The central and eastern parts of the Study Area is located in the headwaters of the Don River East Branch. West of the height of land and west of Keele Street is within the watershed of the Don River West Branch. Whether East or West Don, these rivers are sourced by the lobe of the Oak Ridges Morraine which traverses approximately north south through the Study Area. Within their incised valleys these streams are surrounded by wetlands. The wetlands surrounding the branch of the Don River East Branch that traverses the proposed road alignment west of Dufferin Street have been evaluated and are Provincially Significant. The wetlands surrounding the other more easterly branches are unevaluated. The water bodies in and around the project area are shown on **Figure 1 through 5** in **Appendix A**.

3.3 Geology

A generalized description of the geology of the region between lakes Simcoe and Ontario is given in Amstrong *et al. (2007),* and Gerber *et al.* (2018), much of which is based on the work of Sharpe *et al.* (2007). The main geological units are identified as (*i*) bedrock; (*ii*) the “Lower sediment" consisting of pre-Thorncliffe Formation which includes Sunnybrook drift and Scarborough Formation and Thorncliffe Formation; (*iii*) the Newmarket Till; (*iv*) Oak Ridges Moraine; (*v*) Halton Till; and (*vi*) overlying glaciolacustrine sediment fill. The Lower sediment is 75 to 160 m thick and is formed of poorly exposed, interbedded lake sediment and till, comprised of sand, silt, clay, till, and distinctive organic-rich and fossil-bearing beds. The Newmarket Till is up to 25 m thick and is dense, pebbly, sandy silt diamicton. The Oak Ridges Moraine rises up to 300 metres above Lake Ontario and contains deposits of sand and gravel up to 200 metres thick. Overlying the northern and southern flanks of the Oak Ridges Moraine, the Halton Till is predominantly a massive to laminated mud unit with local interbeds of sand and gravel. On the northern flanks of the Oak Ridges Moraine the unit is 1 to 5 m thick and on the southern flanks it is up to 30 m think.

According to “Quaternary Geology of Ontario, Southern Sheet” (Ontario Geological Survey, Map 2556, Scale 1:1,000,000), and “Surficial Geology of Southern Ontario” (2010, Northern Development and Mines), the quaternary deposit at the edges of the Study Area consists of Halton Till. Where the Oak Ridges Moraine occupies the central part of the Study Area, the geology is mapped as glaciofluvial ice-contact deposits consisting of gravel and sand, minor till, including esker, kame, end moraine, ice-marginal delta and subaqueous fan deposits. The surficial geology of Study Area is provided on **Figure 3** in **Appendix A.**

A review of wells in the WWIS indicates that in areas mapped as gravel and sand, the sand is often described as very fine, and interbedded with silt and clay. In areas mapped as till, the soils are typically described as clay or clayey, interbedded with silt, and sometimes sandy. Between the VL and the KVL, the upper 30 m to 50 m is typically sand and gravel before the first significant silty or clayey layer appears. South of Teston Road, mid-block between Dufferin Street and Bathurst Street, the overburden is 136 m thick, as one well in this area extended into bedrock. This particular well was entirely clayey and produced no water.

According to “Bedrock Geology of Ontario, Southern Sheet” (Ontario Geological Survey, Map 2544), the underlying bedrock within Study Area is Upper Ordovician aged shale of the Georgian Bay, Blue Mountain and Lindsay Formation. Bedrock is encountered at depths ranging from approximately 80 meters below ground surface (mbgs) at the southern limit to approximately 250 mbgs at the northern limit of the Study Area. The bedrock geology of the Study Area is provided on **Figure 4** in **Appendix A.**

3.4 Hydrogeology

Referring again to Gerber *et al.*, 2018 and Sharpe *et al.*, 2007, the Lower sediment, which is characterized by sandy formations with good hydraulic conductivity, is considered an aquifer, or containing significant regional aquifers. The Lower sediment is confined by the Newmarket Till and, where present, the Halton Till. The Oak Ridges Moraine is an unconfined aquifer (except where it underlies and is confined by the Halton Till) with good hydraulic conductivity and an aquifer potential that is one of the highest of the country. The Oak Ridges Moraine forms a major recharge area, being the source of baseflow in dozens of headwater stream springs and also the source of water in underlying aquifers within the Lower sediment. Within the Oak Ridges Moraine, the water table can be 30 m to 40 m below ground surface while in the tills beyond the Oak Ridges Moraine, the water table is generally within a few (5-10) metres of surface.

3.4.1 Wells

The Ministry of the Environment, Conservation and Parks (MECP) Water Well Information System (WWIS) database was queried for records of water supply wells within 500 m of Study Area (MECP, 2020). A total of approximately nine-hundred and forty (940) water well records were identified including: one-hundred and ninety-three (193) domestic supply wells, one-hundred and eighty-five (185) monitoring wells, twenty-two (22) commercial use wells, eighteen (18) agricultural wells, sixteen (16) industrial use wells, and ten (10) irrigation wells. The well installation dates ranged from 1947 to 2020. The locations of the wells are shown on **Figure 2** in **Appendix A**. The stratigraphy, water found, and static water levels noted by the well drillers are shown in cross-sections AA' and BB' on **Figure 6** in **Appendix A**.

Despite the relatively large number of wells in the MECP database, it is considered that the actual use of groundwater for domestic, agricultural or industrial purposes is minimal. The main reason for this is that municipal/piped water supply is available throughout the study area. Areas with existing subdivisions east of the valley may still have a small number of domestic wells in use. A desktop survey is recommended to identify the areas that may still be using groundwater wells for domestic or agricultural use. Review of aerial imagery can be used in identifying the approximate age of the houses in Study Area to determine the potential for the presence of domestic well(s) on the property. Houses built as part of a residential subdivision are unlikely to rely on groundwater as a source of domestic supply. A well survey may then be required to confirm the existence of in-use wells within specific identified areas.

3.4.2 Groundwater

MH reviewed the groundwater contours provided in 'Golder Associates, Input to Teston Road IEA presentation, June 17th, 2020'. Groundwater elevation varies approximately between 247 meters above sea level (masl) at Dufferin Street and 257 masl at Keele Street. Between the VL and KVL, the purge well system draws the water table down to an elevation of 252 m. The water table across the entire Project Area is also shown in Cross Section AA' on **Figure 6** in **Appendix A**. Between the landfills the water table is tens of metres below ground, while elsewhere the water table is less than 10 m below ground.

3.4.3 Wellhead Protection Areas, Highly Vulnerable and Significant Groundwater Recharge Areas

These areas were delineated for the protection of Ontario's drinking water, under the Clean Water Act, 2006 (CWA). The CWA has a focus on sources of water that have been designated by a municipality as being a current or future source of residential municipal drinking water for the community. These sources are protected in each Source Protection Region (SPR) through the development and implementation of a Source Protection Plan (SPP). These areas are all shown on the Source Water Protection Information Atlas which is compiled by the Ontario Ministry of the Environment, Conservation and Parks.

The Project is entirely contained within the CTC (Credit Valley-Toronto and Region-Central Lake Ontario) SPR. As such, the policies of the Approved Source Protection Plan: CTC Source Protection Region (the SPP) apply. In the following discussion, the site-specific applicability of these policies is identified and discussed.

3.4.3.1 Wellhead Protection Areas

A Wellhead Protection Areas (WHPA) is the area or capture zone surrounding the wellhead where land use activities have the greatest potential to affect the quality of groundwater within the aquifer from which the well derives its source. In Ontario WHPAs have been delineated for all municipal wells. According to Source Protection Information Atlas, no WHPAs are within the Study Area. The closest WHPA was identified more than a kilometer away from the Project Area. Hence, no impacts to this WHPA are anticipated from the Project.

The entire Study Area falls within the WHPA-Q1 (for the York-Durham Municipal wells, Map 3.4 in the SPP). WHPA-Q1 refers to an area where activities that take water without returning it to the same source may be a threat. Other than minor and temporary water taking that may be required for construction dewatering, the Project is not an activity that takes water without returning it to the same source. As such, none of the SPP policies that would be triggered by WHPA-Q1 (specifically, DEM-1, DEM-2, DEM-3, DEM-4, DEM-9, and DEM-10, see the Section 10 of the SPP) result in any EA commitments.

The entire Study Area falls within the WHPA-Q2 (also for the York-Durham Municipal wells, Map 3.4 in the SPP). WHPA-Q2 refers to the area where activities that reduce recharge may be a threat. The only SPP policy triggered by WHPA-Q2 is REC-1, which is to be implemented by the Planning Approval Authority. The policy requires the Planning Approval Authority to act in certain ways with respect to their role in land use planning and applications under the Planning Act. The following is the most applicable part of the policy to the Project:

> *For applications under the Planning Act within the Tier 3 Water Budget WHPA-Q2 identified as having significant water quantity threats, the relevant Planning Approval Authority shall ensure recharge reduction does not become a significant drinking water threat by:*
>
> *2) Requiring that that all site plan (excluding an application for one single family dwelling) and subdivision applications for new residential, commercial, industrial and institutional uses provide a water balance assessment for the proposed development to*

the satisfaction of the Planning Approval Authority which addressed each of the following requirements:

a) maintain pre-development recharge to the greatest extent feasible through best management practices such as LID, minimizing impervious surfaces, and lot level infiltration; and

b) where pre-development recharge cannot be maintained on site, implement and maximize off-site recharge enhancement (within the same WHPA-Q2) to compensate for any predicted loss of recharge from the development

The Project will not result in an application under the Planning Act, and, as such, the above policy is not applicable. It is noted, however, that the project will incorporate "best management practices such as LID". Caution is required to ensure that any infiltration of potentially salt-impacted road runoff does not interfere with the monitoring of the landfills in the area (see Section 3.5)

3.4.3.2 Highly Vulnerable Aquifers

A highly vulnerable aquifer (HVA) is an aquifer that is rapid to recharge from precipitation or other water at the ground surface. Such aquifers are, by virtue of the short travel time between ground surface and water table more vulnerable to contamination. These aquifers typically occur in areas of coarse or sandy soils with a high groundwater table. According to Source Protection Information Atlas, an HVA was found over the majority of the Teston Road right-of-way, from approximately 900 m east of Keele Street eastwards to Bathurst Street. The location and extent of this HVA within the Study Area is shown on **Figure 5.**

SPP policies triggered by HVA include four related to the protection of aquifers from application and/or handling and storage of road salt (specifically, SAL-10, SAL-11, SAL-12, and SAL-13, see the Section 10 of the SPP). These policies are to be implemented by various bodies, and generally relate to when a salt management plan shall be required as part of a development application, when to encouraging the use of best management practices, when to require e use of trained individuals in the application of road salt, and when to require trends in sodium and chloride monitoring to be reported to the Source Protection Authority. The most applicable policy is SAL-10, excerpted here:

Where the application of road salt would be a moderate or low drinking water threat, the planning approval authority is encouraged to require a salt management plan, which includes a reduction in the future use of salt, as part of a complete application for development… Such plans should include, but not be limited to, mitigation measures regarding design of parking lots, roadways and sidewalks to minimize the need for repeat application of road salt such as reducing ponding in parking areas, directing stormwater discharge outside of vulnerable areas where possible, and provisions to hire certified contractors.

The aquifer beneath the Study Area is "vulnerable" to contamination by road salt specifically because of the existence of landfill-related chloride plumes within it (see Section 3.5).

Stormwater discharge to ground should be directed outside the area where these plumes exist and are monitored.

Other SPP policies triggered by HVA are for the protection of aquifers from contamination by the handling and storage of Dense Non-Aqueous Phase Liquids (DNAPLs) and Organic Solvents. As such, none of the SPP policies that would be triggered by HVA (specifically, DNAP-3, and OS-3, see the Section 10 of the SPP) result in any EA commitments.

3.4.3.3 Significant Groundwater Recharge Areas

Most groundwater recharge occurs from the downwards percolation of precipitation/surface water from the ground surface to the water table. The rate of recharge is proportional to the permeability of the shallow soils but is also affected by a number of other factors, such as depth to water table. Significant Groundwater Recharge Areas (SGRAs) are characterized by the Province of Ontario as having highly permeable soils at surface, such as sand and/or gravel, which allows water to readily pass from the ground surface to an aquifer. These areas are considered significant when they aid in maintaining the water level in an aquifer that provides water for potable means or supplies groundwater to a cold-water ecosystem. According to Source Protection Information Atlas, the Teston Road right-of-way is within an SGRA from approximately the center line northerly, from 300 m west of Keele Street to the center line of Keele Street, and from 35 m east of Dufferin Street to 630 m east of Dufferin Street. The location and extent of this SGRA within the Study Area is shown on **Figure 5.**

The same policies are triggered by SGRA as are triggered by HVA (specifically, SAL-10, SAL-11, SAL-12, SAL-13, DNAP-3, and OS-3, see the Section 10 of the SPP). As such, the reader is referred to the previous section for a discussion of EA commitments.

3.4.3.4 Intake Protection Zones

The closest intake protection zone is identified in Lake Ontario, located more than 25 kilometers away from the Study Area. No impacts to this intake protection zone are anticipated from this Project.

3.5 Landfills

Based on a historical records review, it appears Study Area was primarily agricultural land with a gravel pit in operation prior to 1956. The gravel pit was eventually transformed into three landfills: Vaughan Landfill (VL) starting in the mid-1960s, Disposal Services Landfill (DSL) starting in the mid-1970s and the Keele Valley Landfill (KVL) starting in the mid-1980s. The properties surrounding the landfills have experienced major development in the southwest, southeast and northeast quadrants of Study Area. The development has consisted of industrial, commercial and residential properties. The northwest quadrant remains primarily used for agricultural purposes.

Table 3-1: Summary of Current and Past Uses of Study area

Year or Period	Description of Study Area Use
Prior to 1956	The gravel pit is in operation at the location of the VL and KVL. The remainder of the Study Area is used for agricultural purposes.
1964	Minor residential development near Major Mackenzie Drive West and Keele Street
Mid-1960s	VL begins operation north of Teston Road.
1973	Development of industrial park west of the landfill begins. Further residential development at Major Mackenzie Drive West and Keele Street.
1983	KVL begins operation south of Teston Road.
1984	VL closes. Further development of industrial park. Development of multiple residential neighborhoods.
2003	KVL closes.
2004	Industrial park development similar to present day. Residential developments found throughout southwest, and northeast quadrants of Study Area. Southeast and northwest portions of Study Area still used for agricultural purposes.
Present	Southeast quadrant of project area is now primarily residential. Northwest portion of Study Area is still used for agricultural purposes.

In total, twelve (12) potentially contaminating activities (PCA) were identified within the Study Area. The PCA identified include:

- Waste Disposal and Waste Management, including thermal treatment, landfilling and transfer of waste, other than use of biosoils as soil conditioners
- Chemical Manufacturing, Processing and Bulk Storage
- Asphalt and Bitumen Manufacturing
- Concrete, Cement and Lime Manufacturing
- Plastics (including Fibreglass) Manufacturing and Processing
- Metal Treatment, Coating, Plating and Finishing
- Electronic and Computer Equipment Manufacturing
- Commercial Trucking and Container Terminals
- Rail Yards, Tracks and Spurs
- Commercial Autobody Shops
- Gasoline and Associated Products Storage in Fixed Tanks
- Operation of Dry Cleaning Equipment (where chemicals are used)

The main contamination concerns with the Project Area include the three landfills and the northern portion of the industrial park.

The following landfill related environmental/hydrogeology reports and documents were referred by MH to obtain historical and/or operational details of the three landfills:

- Conestoga-Rovers & Associates, 2002a. Post Closure Liner Performance Program – Keele Valley Landfill, Maple Ontario, December.
- Conestoga-Rovers & Associates, 2002b. Draft Closure Plan – Certificate of Approval (C of A) No. A230610 – Keele Valley Landfill Site, Toronto, Ontario, December 30.
- Dixon Hydrogeology Limited, 2000. Liaison Committee Presentation, March.
- Dixon Hydrogeology Limited, date unknown. Post Closure Groundwater Performance Report.
- Golder Associates, 2018. Feasibility and Remedial Options Study – Vaughan Township Landfill Site End Use, January.
- Golder Associates, 2018. Feasibility and Remedial Options Study – Keele Valley Landfill Site End Use, January.
- Golder Associates, 2020. Input to Teston Road IEA presentation, June 17th.
- Giffels Associates Limited, Class Environmental Assessment – Widening and Reconstruction of Teston Road, February 24th, 2003.
- Morrison Environmental Limited, 2007. Groundwater Quality Monitoring Report – Keele Valley Power Plant, March.
- Morrison Hershfield, 2022. Teston Road Area Transportation Improvements Individual Environmental Assessment, Contamination Overview Study, October 27.
- Toronto Works Department, 1998. Keele Valley Landfill, January.

3.5.1 Vaughan Landfill

3.5.1.1 Background Information

The site was originally operated as a gravel pit and transitioned into a landfill in the mid-1960s. The landfill accepted domestic, commercial and industrial waste until its closure in 1984. The landfill was never equipped with a liner or leachate collection system. The original final cover was composed of a sandy till with varying thicknesses from 0.5 to 6.5 metres. In 1997, the final cover was upgraded to a clayey soil with a thickness ranging from 1.5 to 6.5 m. The waste is approximately 20 to 23 m thick in the central portion of the site and decreases to approximately 15 m near the east and west ends.

3.5.1.2 Groundwater Contaminant Plumes

Due to the lack of liner or leachate collection system, multiple chloride plumes have migrated south and southeasterly from DSL and VL underneath the KVL. Two distinct chloride plumes and at least six isolated chloride plumes have been identified, as shown on **Figure 7.** The largest plume that covers the DSL and VL, and migrating through KVL is referred to as the "Vaughan Landfill Chloride Plume". The plume located to the west of the KVL is referred to as the "Industrial Park Chloride Plume". The groundwater is impacted from leachate and possibly road salt. The chloride concentrations are known to be greater than 15 mg/L and up to 750 mg/L. It should be noted that elevated concentrations of multiple volatile organic compounds (VOC) have also been identified in wells along the southeastern limit of the landfill. The groundwater travels in a southeasterly direction with flow rate of approximately 60 m/year.

One of the isolated plumes, located northeast of the southern Industrial Park Chloride Plume on **Figure 7**, investigated by Dixon Hydrogeology in 1996, migrates easterly towards the East Branch of the Don River and is confined to the upper aquifer. The chloride concentrations were determined to be within the Ontario Drinking Water Standards.

The maximum concentration of chloride measured in 2019 in the VL groundwater monitoring wells located east of the landfill, (see the monitoring well symbols shown on **Figure 7**) was reported to be 148 mg/L. The concentration measured in ten (10) other monitoring wells ranged from 2.9 mg/L to 21.2 mg/L. The plume tracked during the VL groundwater monitoring round in 2019 was similar to that identified by Dixon Hydrogeology Ltd. in 1996.

3.5.1.3 Landfill Infrastructure

In order to intercept the Vaughan Landfill Chloride Plume, a purge well system was installed in 1984 at the southern limit of the landfill. The Teston Road Purge Well System (TPWS) is operated by the City of Toronto and consists of thirteen (13) purge wells in addition to approximately 21 observation wells. The TPWS collects approximately 384 m^3/day of contaminated groundwater that is discharged to the sanitary sewer system. This system is scheduled to stay in operation until at least 2040. MH carried out a conflict check for the proposed road design with these purge wells and no conflicts were identified. The approximate locations of these wells are shown on **Figures 7** and **7a**. Although no direct conflicts were identified, the wells may be impacted by ground disturbance associated with the construction and excavation activities.

A leachate main collecting leachate from all the purge wells runs underneath the proposed road in a north-south orientation between 21 Rodinea Road and KVL as shown on **Figure 7a** and is considered a direct conflict with the proposed road design.

A system of landfill gas extraction wells was also installed in 1984 and later upgraded in 1997 and 1998. As of 2019 there are twenty-seven (27) gas wells located along the south and southwest limit of the landfill. The gas is collected and flared at a plant located west of the TPWS. The flare facility emits combusted gases that are released into the atmosphere which may induce exposure to the construction workers and future road users. MH carried out a conflict check of the proposed road design with these gas extraction wells based on a review of available information and satellite image. The approximate locations of the gas extraction wells are shown on **Figures 8 and 8a**. The following conflicts and issues were identified:

- Gas Manhole MH1, gas wells GW4/97 and GW597, and a gas header connecting them are within 2 m (and possibly underneath) of the proposed multi-use pathway (MUP), and may be impacted by ground disturbance associated with the construction and excavation activities.

- Some of the on-site and off-site gas probes shown in **Figure 8a** (pink triangles, north of proposed road, between landfill access road and the Blower Building; light blue triangles, south of proposed road, between Rodinea Road and KVL entrance) may be impacted as they most likely fall under the proposed pavement and/or MUP.

3.5.2 Keele Valley Landfill

3.5.2.1 Background Information

The KVL began operation in 1983 and remained in operation until 2003. Similar to the VL the KVL was set in the footprint of the former gravel pit. Unlike the VL, the KVL was constructed with a compacted 1.2 m thick clay liner with a minimum permeability of 1 x 10^{-8} cm/sec along the base and side slopes used to contain leachate and gas. The liner was constructed in four stages with the final stage being completed in 1994. The KVL is also equipped with a leachate collection system.

During its time of operation KVL accepted 28.1 million tonnes of domestic, commercial and industrial waste, including biomedical waste and asbestos. The waste area is approximately 99.1 hectares in size.

3.5.2.2 Groundwater Contaminant Plumes

Two distinct chloride plumes have been identified traveling under the KVL, as shown on **Figure 7**. The first plume has originated from the VL and the second from the industrial park. The chloride concentrations are known to be greater than 15 mg/L and up to 750 mg/L. Both plumes are traveling in southeastern direction.

3.5.2.3 Landfill Infrastructure

The KVL's leachate collection system consists of 200 millimeter (mm) diameter perforated high density polyethylene pipes and gravel drains located above the liner. The leachate is directed towards the pumping station and discharged into the sanitary sewer system.

An additional purge well system is located at the southern limit of the KVL. The Southern Purge Well System (SPWS) is operated by the City of Toronto and consists of three (3) purge wells. The SPWS collects approximately 641 m^3/day of contaminated groundwater. The collected groundwater is discharged to the sanitary sewer system. This system is scheduled to stay in operation until the year 2200 at minimum (City of Toronto, personal communication during meetings).

A system of horizontal gas collection trenches and supplementary vertical gas wells are installed in the waste area at regular intervals. A vacuum is applied to these trenches by means of a multi-stage blower and header pipe system that draws the landfill gas out of the waste. The system collects approximately 7.0 m^3/s of landfill gas which contains approximately 47% methane. The gas is used to power a 30 megawatt electrical generation plant that is located south of landfill. The remaining unused gas is burned in back-up incinerators.

A summary of the landfill infrastructure includes:

- Gas extraction wells (Across landfill in regular intervals)
- Maintenance chambers for landfill gas infrastructure (location unknown)
- Landfill gas plant incorporating a flare and electricity generation facilities (Southern limit, west of SPWS)
- Groundwater purge wells (SPWS, southern limit of landfill)
- Leachate pumping chamber (2 located near Teston Rd north of landfill, 4 located at southern limit of KVL)
- Leachate collection pipe clean-outs (2 located at west limit, 5 located at south limit of landfill)
- Stormwater ponds (1 west of landfill near Rodinea Road, 1 east of LF on golf course, 1 south of landfill on golf course)
- Groundwater monitoring wells (200+, throughout landfill)

MH carried out a conflict check for the proposed road design with the purge wells and observation wells. The approximate locations of these wells are shown in **Figures 7 and 7a**. Some observation wells including, but not limited to, 8/83, 16/88 and 17/88 may be directly impacted by the ground disturbance associated with the construction and excavation activities.

MH also carried out a conflict check for the proposed road design with gas probes located south of the proposed road (yellow triangles, south of proposed road, between KVL entrance and VL entrance). The approximate locations of these wells are shown in **Figure 8a**. These gas probes may be impacted by ground disturbance associated with the construction and excavation activities.

3.5.3 Disposal Services Landfill

The DSL is a privately owned and operated landfill located north of the intersection of Teston Road and Rodinea Road. Based on a review of 'Teston Road from Keele Street to Bathurst Street, Individual Environmental Assessment, Terms of Reference, Appendix G - Consultation Record', MH noted the following information on the DSL:

- It is owned by Teston View Holdings Inc. and was operated between 1974 and 1986 and then it was closed.
- Soil was imported to this landfill in 1999 following an Environmental Compliance Approval (ECA) amendment.
- An additional 390,200 m^3 of apparently clean fill was imported to the landfill between 2006 and 2015 with no formal design plans or specific ECA amendment.
- The owner is now prohibited from any further fill import and has a provincial offense against it currently due to contaminated soil, excessive height, inadequate monitoring and reporting.

3.6 Water Investigations

3.6.1 Groundwater Monitoring

Five monitoring wells were installed as part of the concurrent geotechnical and hydrogeological investigations, at locations shown on **Figure 9** in **Appendix A**. These were monitored for groundwater levels on March 28, 2023. Monitoring wells MH-BH2 and MH-BH3 were found to be dry, while A22-3 was inaccessible due to thick layer of mud. The groundwater level was measured at 0.28 meters below ground surface in A22-2 and 0.25 meters above ground surface in C1.

3.6.2 Horizontal Hydraulic Conductivity

The horizontal hydraulic conductivities of monitoring wells A22-2 and C1 were calculated from the data collected during the rising head hydraulic conductivity test (bailer test) conducted on March 29, 2023. The horizontal hydraulic conductivity was calculated to be 8.5×10^{-7} meters per second (m/s) in monitoring well A22-2 and 8.8×10^{-6} m/s in C1.

3.6.3 Water Inspection and Sampling

MH collected water samples from two monitoring wells A22-2 and C1 on March 29, 2023. All the analytical results are summarized in Table C1 and Table C2 in **Appendix C** and are illustrated on **Figure 9** under **Appendix A**.

The analytical results for metals were compared to the PWQOs and York Region Sewer-Use Bylaw. The summary of the exceedances is described below:

- Sample from both wells exceeded PWQOs for cobalt, copper, iron, lead, molybdenum, vanadium and/or zinc.
- Samples from both wells exceeded the York Region Bylaw for total suspended solids (TSS), compared against both storm and sanitary sewer use guidelines.

Elevated TSS in the samples indicates that, despite the use of low-flow sampling techniques, some sediment was entrained in the water, as it was collected into the sample bottles. The elevated metals concentrations, relative to PWQO, likely reflects the presence of this sediment.

4. IMPACT ASSESSMENT

Impact assessment was carried out for all receptors within 500 m of the proposed construction.

4.1 Description of the Project

The proposed improvements include realignment and widening of Teston Road between Keele Street and about 500 m east of Keele Street, constructing a new segment of Teston Road from 500m east of Keele Street to Dufferin Street, and widening and rehabilitation of Teston Road between Dufferin Street and Bathurst Street (Project Area).

Teston Road is proposed to cross the East Branch of the Don River at 3+036 (centreline) approximately 14 m above original grade, and significant grade raise is required for this from 2+700 to 3+300. The grade raise will be achieved by embankments, a mechanically stabilized earth wall with precast concrete facing (2+290 to 3+100, approximately, but not including the bridge span), and a 40 m long, single-span bridge. The footings for the MSE wall and the bridge are proposed to be not significantly below the original ground.

At the other crossing of the East Branch of the Don River, an existing box culvert will be lengthened or otherwise rehabilitated.

Storm sewers will be constructed beneath the road effectively across the entire alignment, generally at depths ranging between 4 and 6 m. A storm pond is proposed just southwest of the intersection of Keele Street and Teston Road, which will accept runoff from west of the height of land at 2+250. Undeground storage (in pipes/chambers of larger diameter) of stormwater is proposed east and west of the Tributary of the East Branch of the Don River. These will be built effectively within the proposed embankment, and will not require significant subsurface work.

Underground storage of stormwater is also proposed west of the box culvert in the east segment of the alignment. At 4+450, the invert of this storage chamber will be approximately 12 m below original ground, which represents the deepest excavation in the project.

4.2 Receptor-By-Receptor Assessment

A total of five (5) receptors were identified within the Project Area. Impacts to these receptors are assessed in the remainder of this section.

4.2.1 Receptor 1: Vaughan Landfill

Potential impacts to the VL as a result of the proposed road improvements are as follows:

- As discussed in section 3.1.1, the gas manhole MH1, gas wells GW4/97 and GW5/97, and a gas header connecting them may be impacted by ground disturbance associated with the construction and excavation activities. Also, some of the on-site and off-site gas probes fall under the proposed pavement and MUP and will need to be decommisioned and relocated at a safe distance from the proposed road. Any changes to the landfill infrastructure will require amendments to the ECA under which the VL operates.

- A leachate collection main runs underneath the proposed road in a north-south orientation between 21 Rodinea Road and KVL, which may be impacted by ground disturbance associated with the construction and excavation activities.
- The Vaughan Landfill Chloride Plume, a chloride contamination plume, exists in the groundwater below the VL approximately below 260 masl. The road improvements will reduce the perviousness of the area and may result in slightly reduced groundwater recharge to the aquifer, which could slightly increase the chloride plume concentrations.
- The proposed road improvements will most likely result in the use of salt-application in the winters which, if not properly managed, could potentially contribute to (increase) the chloride plume concentrations. It is expected that the road runoff will be collected in storm drains, which should remove most of the chloride from the groundwater environment. Storm drains should be designed to minimize leakage of storm water from the storm drains into the subsurface. Storm drain outlets, particularly if they are designed to encourage infiltration, should be located outside the area of the chloride plumes (see **Figure 7**).
- The groundwater dewatering associated with the proposed bridge constuction across the valley east of Vaughan Landfill may influence the groundwater flow temporarily or permanently and could slightly affect the movement of the chloride plume. Although significant impacts on the plume are considered unlikely (given the distances between the future bridge and the existing plume), enhanced monitoring of the chloride plume in this area is recommended during and following construction.
- Based on the proposed relatively shallow depth of storm sewers, it is unlikely that the associated excavation will intercept any leachate from the landfill.

4.2.2 Receptor 2: Keele Valley Landfill

KVL is located immediately south of the VL and is also a receptor of the proposed road improvements. Potential impacts to the KVL as a result of the proposed road improvements are as follows:

- Ground disturbance associated with the construction and excavation activities may directly impact some observation wells including, but not limited to, 8/83, 16/88 and 17/88. Also, some of the gas probes located south of the proposed road design will be impacted and will need to be decommisioned and relocated at a safe distance from the proposed road. Any changes to the landfill infrastructure will require amendments to the ECA under which the KVL operates.

4.2.3 Receptor 3: Valley to the East of Vaughan Landfill

A tributary of the Don River East Branch flows through the valley and a proposed bridge is to be constructed across the valley as part of the road improvements. Embankments, foundations, footings, abutments and piers constructed for bridges can obstruct and/or intercept groundwater as baseflow to surface watercourses.

Groundwater taking for construction dewatering is governed by the Ontario Water Resources Act (OWRA), Environmental Protection Act (EPA) the Water Taking and Transfer Regulation 387/04, a regulation under the OWRA, and the regulations made under the EPA regarding the Environmental Activity and Sector Registry (EASR). If the groundwater taking rate will be greater than 50,000 litres/day (L/day) and less than 400,000 L/day, then registration on the Environmental Activity and Sector Registry (EASR) will be required. If the groundwater taking rate will be greater than 400,000 L/day, then a Category 3 PTTW will be required.

As discussed in section 4.2.1, the eastern edge of the chloride plume is well defined by the VL groundwater monitoring wells as the concentrations of chloride are close to background levels in these wells. Given the distance from the potential dewatering location to the eastern edge of the chloride plume, there is a low probability that it will be disturbed/mobilized. Nonetheless, an enhanced groundwater and surface water monitoring is recommended during the construction activities.

4.2.4 Receptor 4: Culvert Location East of Dufferin Street

There are proposed culvert modifications (new headwalls) as part of the road improvements, and it is anticipated that groundwater dewatering will likely be required during the construction. As such, during the construction, it may be necessary to obtain either an EASR or a PTTW from the MECP for surface water diversions and/or groundwater taking. Potential impacts would be addressed under the EASR registration process or the PTTW application process.

4.2.5 Receptor 5: Disposal Services Landfill

Disposal Services Landfill (DSL) is a private landfill located north of the intersection of Teston Road and Rodinea Road. Based on the inferred shallow depth of proposed excavation in this segment of Teston Road, the proposed road improvement is likely to have little or no effects on this landfill. However, KVL observation well 3/92 may be in conflict with the proposed road design and may need to be decommissioned and/or relocated to a safe distance away from the proposed road. Any changes to the landfill infrastructure will require amendments to the ECA under which the DSL operates.

4.3 Impact on Wells & Aquifers

4.3.1 Water Levels & Well Yields

Well yields may be negatively affected by temporary or permanent lowering of the groundwater level in aquifers. Temporary groundwater level lowering is typically associated with construction dewatering when excavations are pumped to keep them dry and safe for workers. Permanent groundwater level lowering is commonly associated with permanent topographic changes, such as when deep rock cuts are blasted for highway construction. Permanent groundwater level lowering can also result from permanent major groundwater takings (for irrigation, industry, etc.), and from drainage at sumps (in mines, quarries, etc.) and foundations. Permanent groundwater level lowering may also be associated with reduced recharge of aquifers caused by development and associated increased imperviousness.

As noted above, a small number of water wells may still be in use, particularly east of the valley. The impact of road improvements on these well yields, if in use at all, will depend on the specifics such as distance from the road, depth of well, etc. A desktop and potentially in-field well survey is recommended at a later design stage, to determine these details. The availability of municipal water supply throughout the study area tends to mitigate risk related to water wells and provide a ready contingency in the event of well impacts.

4.3.2 Water Quality

Water quality in aquifers and wells may be negatively affected by introduced contaminant sources, by mobilization of existing contaminant sources and by ground movement. During construction, introduced contaminant sources may include degraded surface water caused by poor erosion and sediment control, and fuel and chemical spills from construction equipment. The risk of aquifer and well contamination due to these possible sources of contamination must be managed through proper construction practices and mitigation measures as set out in Section 5.

Mobilization of existing contaminant sources is addressed on a receptor-by-receptor basis in Section 4.2. Overall, the risk of mobilization of contaminant sources is considered low.

Following construction, improper use of road de-icing materials may result in impairment of groundwater quality in previously undeveloped areas. These risks are managed through proper design and by following best management practices for road de-icing.

Overall, there will be minimal temporary and residual effects to the groundwater quality resulting from the project.

4.4 Impact on Surface Water

4.4.1 Flow Amounts

Flow amounts in surface water may be affected by temporary or permanent changes in groundwater discharge rate or location. Dewatering at a bridge abutment, for example, may temporarily change the way groundwater discharges into a stream bed, or may result in greater volumes of groundwater being discharged than would occur naturally. Generally, these are minor changes and temporary, with negligible impact on surface water flow.

Given the potential for construction dewatering in select areas of the project there is some potential for temporary changes to the groundwater discharge to the tributaries of the Don River East Branch and in the smaller watercourses. Impacts will be managed through mitigation measures developed as part of permitting for the water taking. Erosion and sedimentation caused by dewatering discharge should be controlled by proper construction practices.

4.4.2 Water Quality

Water quality in surface water may be affected by changes in the rate of groundwater discharge, by changes in the quality of groundwater discharge, or by contaminants introduced by way of a dewatering system.

As noted above, the rate of groundwater discharge is not expected to change as a result of the project.

Similarly, the quality of the natural groundwater discharge is not expected to change, and the risk of a groundwater-related change to surface water quality is considered negligible.

If groundwater becomes contaminated due to construction operations (e.g., vehicle refueling), then this contamination will tend to be discharged into the surface water either naturally as groundwater discharge or via the dewatering system. The risk of releases of hydrocarbons (diesel, gas, or hydraulic oil) can be minimized or managed by implementing prevention measures discussed in Section 5.

4.5 Impact on Structures

Structures can be affected by settlement caused by soil consolidation related to groundwater level lowering. Generally, this is a concern where structures are founded on thick clay deposits, which are permanently dewatered (by under-draining, for example).

The overburden material within the Project Area does consist of silt and clay components but there are no elements of the project (significant road cuts, deep sewers, etc.) with the potential to cause permanent lowering of the water table.

Impacts on structures from dewatering will be evaluated as part of the permitting of these activities.

4.6 Impact on Ecology

There is a Provincially Significant Wetland, other wetlands, swamps, and surface water features connected to the construction area. The minor changes in hydrogeology associated with the hard surfacing and the temporary construction dewatering are not anticipated to have any impact on ecology. Notwithstanding, additional impact assessment will occur as part of the permitting process for any construction dewatering.

5. ENVIRONMENTAL PROTECTION/MITIGATION

5.1 Summary of the Results & Impact Assessment

The current design appears to avoid impacts to the landfill purge well systems and the vast majority (all but three KVL monitoring wells) of the groundwater monitoring systems. The current design, specifically the MUP on the north side of the road, may just conflict with three VL gas collection wells and associated header pipe. The current design definitely conflicts with approximately nine (9) VL gas monitoring probes and up to three (3) KVL gas monitoring probes. Any changes to the landfill infrastructure will require amendments to the ECA under which the affected landfill operates.

The study has determined that the hard surfacing and drainage changes may result in slight changes in plume chemistry (less dilution of the chloride plumes that are present beneath the landfills), but this is not expected to be significant and may not be detectable in the existing groundwater monitoring program. Conversely, infiltration of salt-impacted road-runoff into the highly permeable soils in the area of the landfills does have the potential to contribute to the existing chloride plumes and to interfere with the ongoing landfill monitoring.

The study has determined that there may be relatively minor lowering of the groundwater level at and around the dewatering locations, particularly at the proposed bridge over the East Branch of the Don River and at proposed storm water storage facility east of Dufferin Street. Impacts are expected to be temporary and minor but will be further assessed as part of the permitting of water taking activities.

The possibility exists for a small number of domestic wells to remain in use, within 500 m of the project. A desk-top and field well survey can provide further information at later design stages of the project. Availability of municipal water supply mitigates the risk to wells and provides a ready contingency measure.

5.2 Recommended Mitigation Measures

The following mitigation measures are recommended to address the environmental risk identified in this study:

- All the conflicts identified with the Vaughan Landfill, Keele Valley Landfill and Disposal Services Landfill infrastructure should be communicated to the landfill operators. Detailed assessment of the severity of the conflict and the appropriate mitigation measures is recommended in later design stages. Any changes to the landfill infrastructure will require amendments to the ECA under which the affected landfill operates.
- The flare facility may induce exposure of the combusted gases to the construction workers and future road users and modifications to the ECA (or EASR registration) for air/noise may be required.

- The purge well leachate main should be protected during the construction activities and the proposed design should provide adequate protection against the dynamic load of future traffic on Teston Road.
- All storm drains between Keele Street and the Don River East Branch should be designed to minimize leakage of storm water from the storm drains into the subsurface.
- While the infiltration of storm water is a common practice for “Low Impact Development” or LID, it should not be included in the design of the current project, at least between Keele Street and the Don River East Branch.
- Enhanced monitoring of the eastern edge of the chloride plume is recommended during construction of the bridge over the Don River East Branch.
- Effective erosion and sediment control measures shall be put in place at all outfalls to prevent surface water contamination by sediment.
- Follow all Ontario regulations concerning the taking and discharging of water. This may include application for a permit to take water (PTTW), or registration in the Environmental Activity and Sector Registry (EASR), depending on the nature and duration of each taking.
- Develop and implement a Spill Management Plan (SMP) for all construction activities. The contractor will develop and implement the SMP to ensure the construction activities do not increase the risk of release of fuel, oils, or other hazardous materials to the environment which could impact the aquifer systems and/or surface water. The SMP will describe the procedures and equipment in place to minimize spills, leaks, or releases of hazardous materials. In addition, the plan will address the reporting and response procedures in the event of an incident.
- Perform a desktop and possibly a field survey to further identify in-use water wells within 500 m of the proposed road alignment. Inform all well users withing 500 m of the construction project and its potential effect on wells.

6. CLOSURE

We trust the above meets with your current requirements. Should you have any comments, questions, or require additional information, please do not hesitate to contact this office.

Respectfully submitted,
Morrison Hershfield Limited

Prepared by:

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7. LIMITATIONS & USE

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The report, which specifically includes all tables, figures and appendices is based on data and information collected during investigations conducted by Morrison Hershfield and is based solely on the conditions of the site at the time of the investigation, supplemented by historical information and data obtained by Morrison Hershfield as described in this report.

Morrison Hershfield has exercised professional judgment in collecting and analyzing the information and formulating recommendations based on the results of the study. The services performed as described in this report were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits and financial and physical constraints applicable to this study. No other warranty or representation, either expressed or implied, as to the accuracy of the information or recommendations included or intended in this report.

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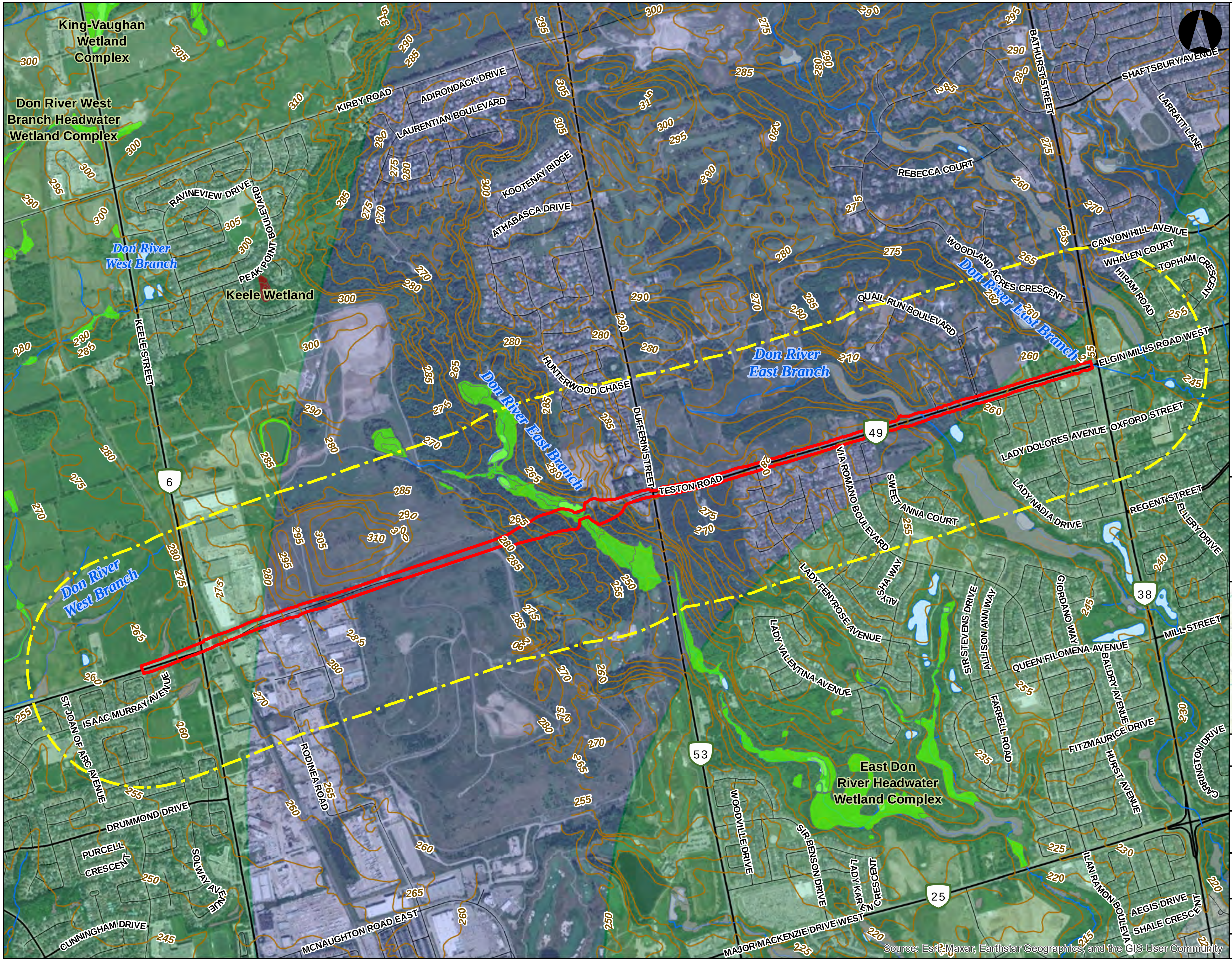
APPENDIX A – Figures



ENVIRONMENTAL SERVICES DEPARTMENT

LEGEND

- Project Area

Land Information Ontario Data

- Contours (mASL)
- Watercourse
- Waterbodies

Wetlands

- Evaluated-Other Wetlands
- Evaluated-Provincially Significant Wetlands
- Unevaluated Wetlands

Physiographic Regions

- Bevelled Till Plains
- Oak Ridges Moraine
- South Slope

Transportation Network

- Arterial / Collector
- Local Roads

NOTES:

- The area shown is within the jurisdiction of the Ministry of Natural Resources and Forestry (MNRF) Aurora midhurst Owen Sound District and theToronto and Region Conservation Authority Area

Coordinate System: NAD 1983 UTM Zone 17N

Sources: MNRF, ESRI Basemaps, Government of Canada, Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,

MORRISON HERSHFIELD

SCALE: 1:16,000

0 125 250 500 750 1,000

Meters

TITLE:

Physiography and Topography

PROJECT NO.: 190261800

Teston Road, Vaughan Ontario (From Keele Street to Bathurst Street)

DATE: March 2024

Figure 1

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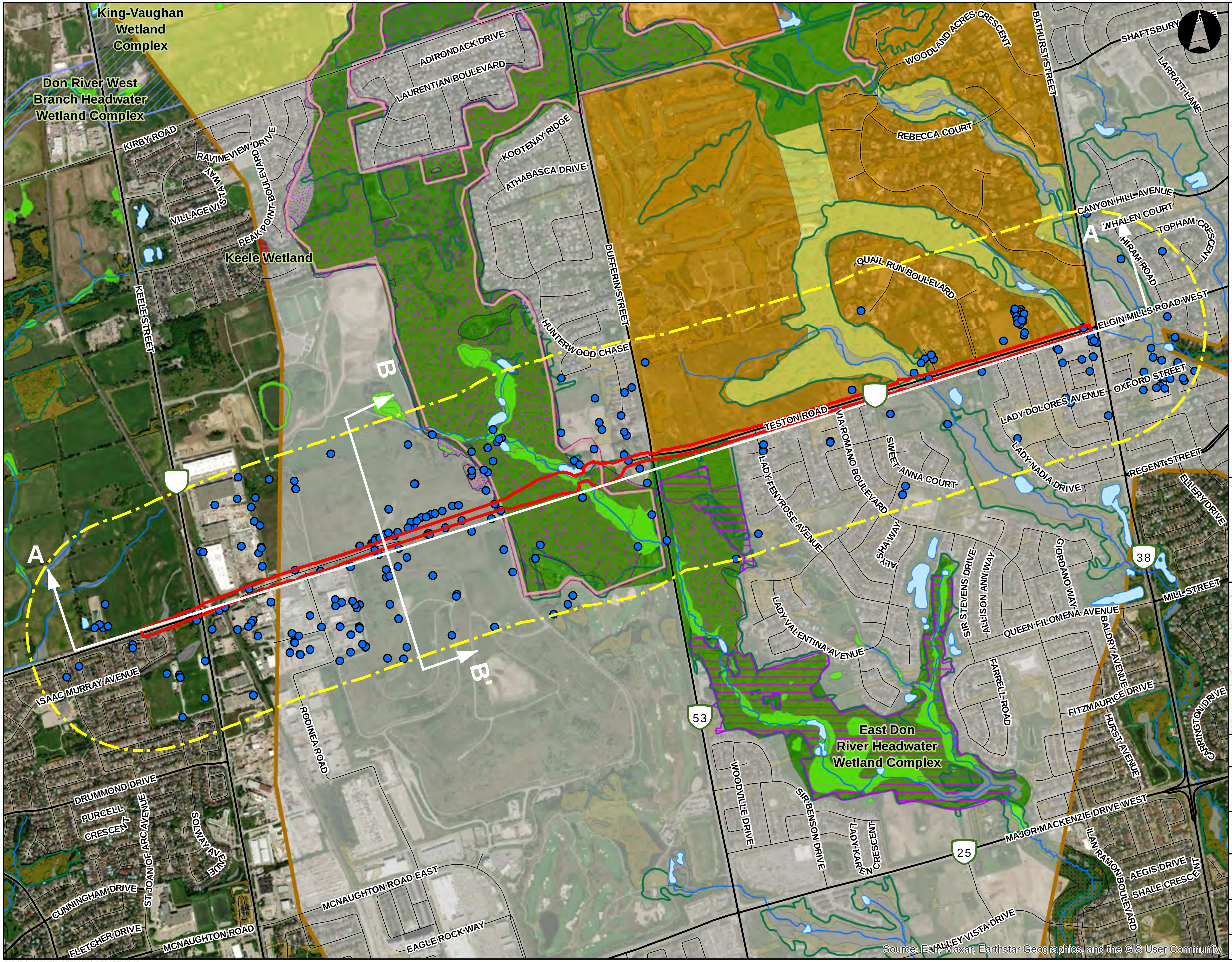

LEGEND

- Study Area (500 m)
- Project Area
- Cross Sections (shown in white)
- MECP Wells in Provincial System

Land Information Ontario Data

- Watercourse
- Waterbodies
- Wooded Areas
- Environmentally Sensitive Areas
- Significant Forests
- Oak Ridge Moraine Conservation Plan Boundary
- ANSI, Earth Science
- Candidate ANSI, Life Science

Greenbelt Designation

- Protected Countryside
- Urban River Valley

Wetlands

- Evaluated-Provincially Significant Wetlands
- Evaluated-Other Wetlands
- Unevaluated Wetlands

Oak Ridge Moraine Conservation Plan

- Countryside Area
- Natural Core Area
- Natural Linkage Area
- Settlement Area

Transportation Network

- Arterial / Collector
- Local Roads

NOTES:

- The area shown is within the jurisdiction of the Ministry of Natural Resources and Forestry (MNRF) Aurora midhurst Owen Sound District and theToronto and Region Conservation Authority Area

Coordinate System: NAD 1983 UTM Zone 17N
Sources: MNRF, ESRI Basemaps

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MORRISON HERSHFIELD

SCALE: 1:16,000

0 125 250 500 750 1,000 Meters

TITLE:

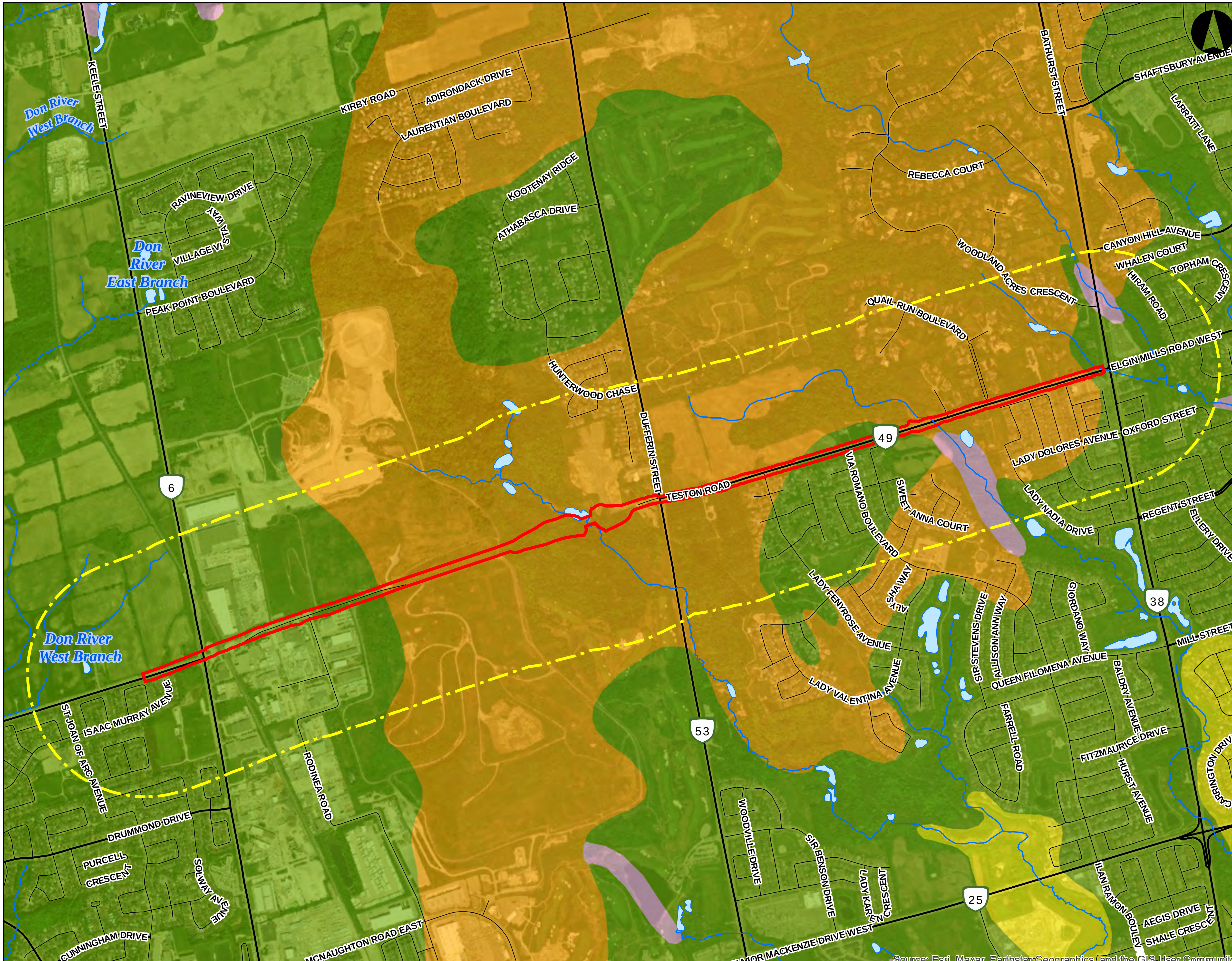
MECP Records

PROJECT NO.: 190261800

Teston Road, Vaughan Ontario
(From Keele Street to Bathurst Street)

DATE: March 2024

Figure 2



LEGEND

- Study Area (500 m)
- Project Area

Surficial Geology

- 5d: Glaciolacustrine-derived silty to clayey till
- 6: Ice-contact stratified deposits
- 9c: Foreshore-basinal deposits
- 20: Organic deposits

Land Information Ontario Data

- Watercourse
- Waterbodies

Transportation Network

- Arterial / Collector
- Local Roads

NOTES:

- The area shown is within the jurisdiction of the Ministry of Natural Resources and Forestry (MNRF) Aurora midhurst Owen Sound District and theToronto and Region Conservation Authority Area

Coordinate System: NAD 1983 UTM Zone 17N
Sources: MNRF, ESRI Basemaps

MORRISON HERSHFIELD

SCALE: 1:16,000

0 125 250 500 750 1,000
Meters

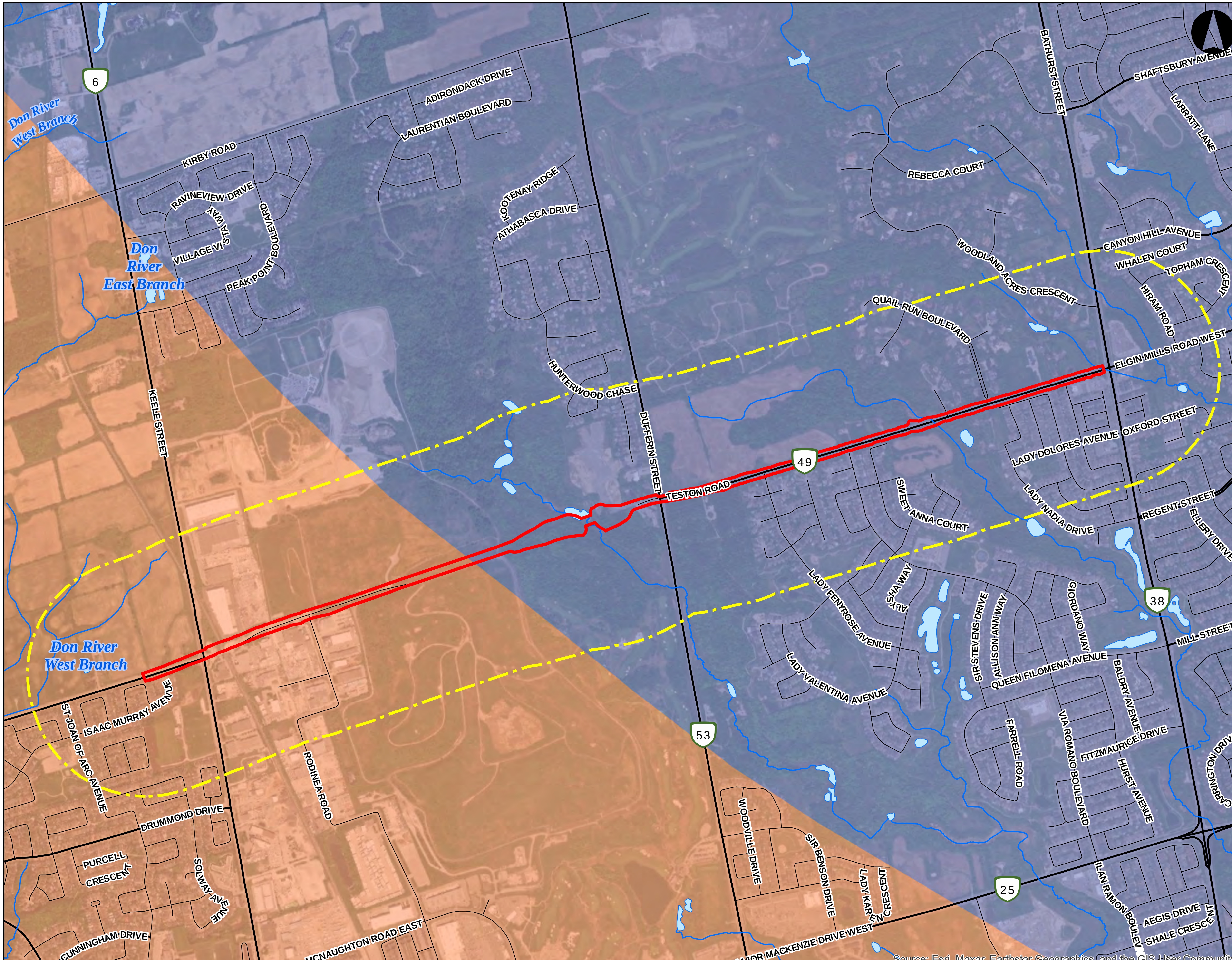
TITLE:

Surficial Geology

PROJECT NO.: 190261800
Teston Road, Vaughan Ontario
(From Keele Street to Bathurst Street)

DATE: April 2024

Figure 3



LEGEND

Study Area (500 m)
Project Area

Bedrock Geology

14: Georgian Bay - shale
12: Blue Mountain - shale

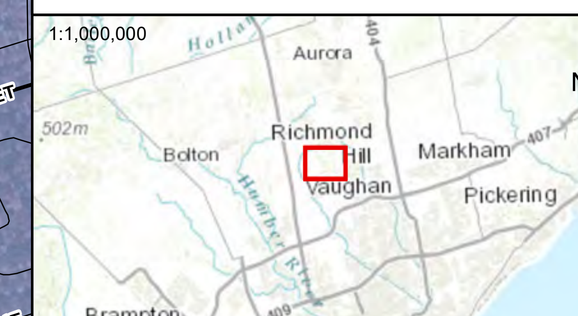
Land Information Ontario Data

Watercourse
Waterbodies

Transportation Network

Arterial / Collector
Local Roads

NOTES:
- The area shown is within the jurisdiction of the Ministry of Natural Resources and Forestry (MNRF) Aurora midhurst Owen Sound District and theToronto and Region Conservation Authority Area



Coordinate System: NAD 1983 UTM Zone 17N
Sources: MNRF, TRCA, ESRI Basemaps, York Region Official Plan - 2022 Z Map 7 - Vulnerable Aquifers Within the ORM Plan and Clean Water Act

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,

SCALE: 1:16,000
0 125 250 500 750 1,000 Meters

TITLE:
Bedrock Geology

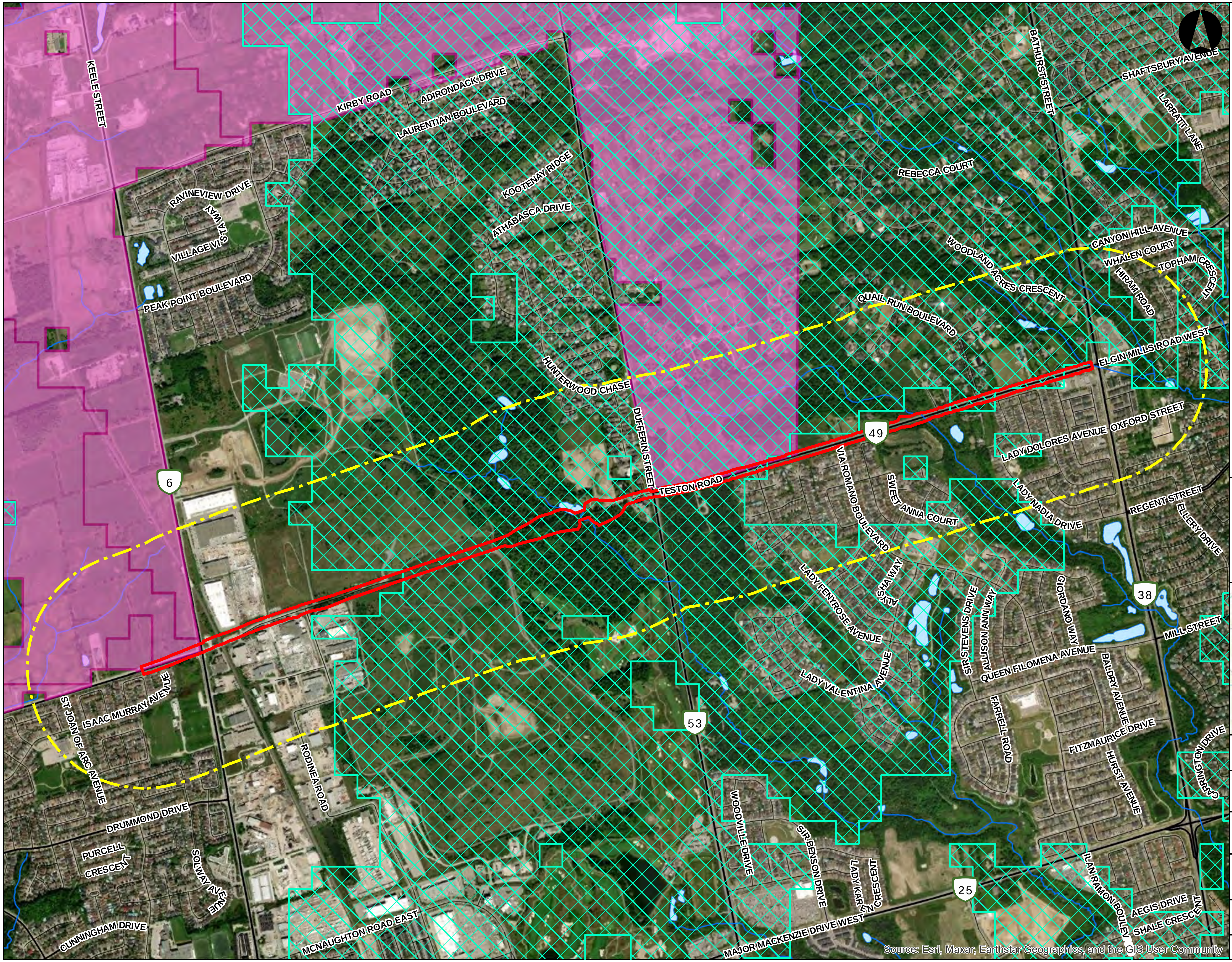
PROJECT NO.: 190261800
Teston Road, Vaughan Ontario
(From Keele Street to Bathurst Street)

DATE: **April 2024**

Figure 4

ENVIRONMENTAL SERVICES DEPARTMENT

G:\2019\190261800_Teston_Rd\Maps\Geo_Maps\DesignandWatercourse\April_2023_Proposed_Phase_I_ESA\May_2023\Bedrock_Geology.mxd



LEGEND

- Study Area (500 m)
- Project Area
- Significant Groundwater Recharge Area (SGRA)
- Highly Vulnerable Aquifers (HVA)

Land Information Ontario Data

- Watercourse
- Waterbodies

Transportation Network

- Arterial / Collector
- Local Roads

NOTES:

- The area shown is within the jurisdiction of the Ministry of Natural Resources and Forestry (MNRF) Aurora midhurst Owen Sound District and theToronto and Region Conservation Authority Area

1:1,000,000

Coordinate System: NAD 1983 UTM Zone 17N
Sources: MNRF, TRCA, ESRI Basemaps, York Region

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN

MORRISON HERSHFIELD

SCALE: 1:16,000

0 125 250 500 750 1,000 Meters

TITLE:

HVAs and SGRAs within Study Area

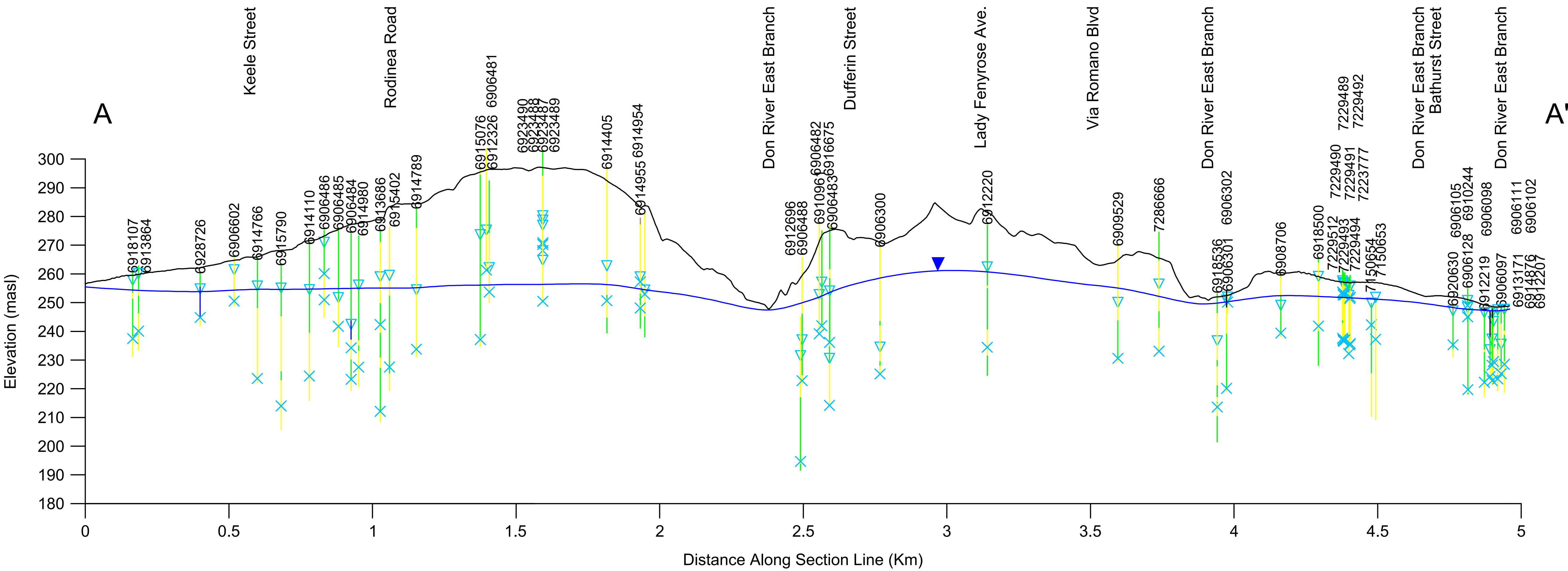
PROJECT NO.: 190261800

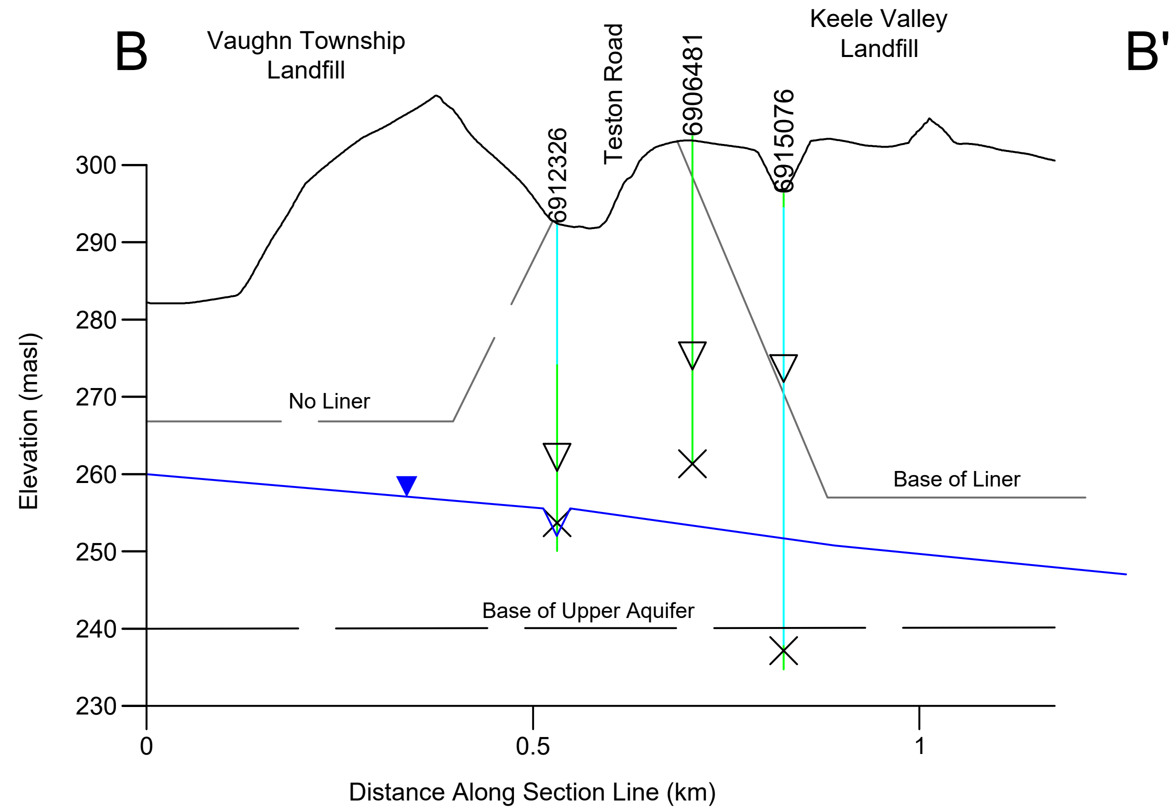
Teston Road, Vaughan Ontario (From Keele Street to Bathurst Street)

DATE: **March 2024** | **Figure 5**

G:\2019\190261800_Teston_Rd\Maps\Geo_Maps\DesignandWatercourse\April_2023_Proposed_Phase_I_ESA\May_2023\SGA_Mapping.mxd

\\EgnyteDrive\MH Cloud\Proj\2019\190261800-P-19-218-Teston Road IEA\08. Working\Contamination-Waste\Hydro G\Cross Sections\Nick\Teston_road_xsection update.dwg





LEGEND

- Silt and/or Clay
- Sand and/or Gravel
- Garbage/Fill
- Water Table or Deeper Potentiometric Surface
- Groundwater Elevation
- Elevation of Water Found

NOTES

Morrison Hershfield now Stantec

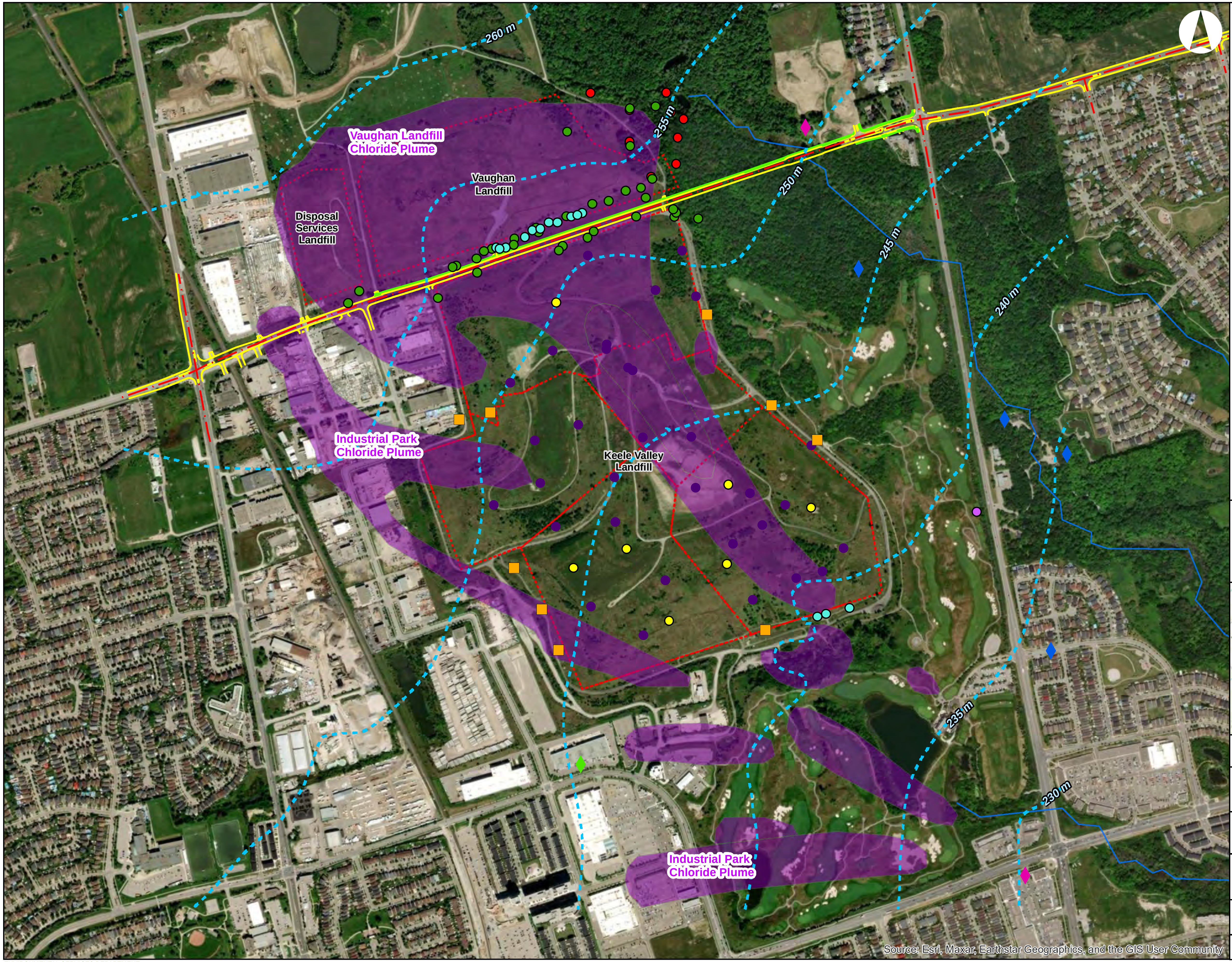
PROJECT: Teston Road, Vaughn, Ontario, (From Keele to Bathurst Street)

PREPARED FOR: York Region

DESIGNED BY:	I.B
DRAWN BY:	N.M
CHECKED BY:	A.W
DATE:	March 2024
SCALE:	See axes
PROJECT NO:	190261800

TITLE: Geological and Hydrogeological Cross-Sections

FIGURE NO: 6



LEGEND

- Instrumentation Monitoring Station
- Upper Aquifer Well Sampling
- Intermediate Aquifer Well Sampling
- Lower Aquifer Well Sampling
- Vibrating Wire Piezometer Above-
- Lower Aquifer Well Sampling Point - MacINTYRE
- Sub-Liner Sampler (with VWP in Sampler Nest)
- Purge Well
- Keele Valley Landfill Observation Wells
- Vaughan Landfill Groundwater Monitoring Wells
- Landfill Extent
- Chloride Plumes identified by Dixon Hydrogeology (Concentrations ranging from 15mg/L to 750mg/L)
- Watercourses
- Groundwater Contours (m) by Golder Associates

Design Features

- Edge of Pavement
- Proposed Multi-Use Pathway
- Proposed C/L

NOTES:

- The area shown is within the jurisdiction of the Ministry of Natural Resources and Forestry (MNRF) Aurora midhurst Owen Sound District and the Toronto and Region Conservation Authority Area

1:1,000,000

Coordinate System: NAD 1983 UTM Zone 17N
Sources: MNR, Golder, Dixon Hydrogeology
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,

MORRISON HERSHFIELD

SCALE: 1:10,000

0 60 120 240 360 480
Meters

TITLE:
Approximate Locations of Landfill Monitoring Systems and Chloride Plume Extent

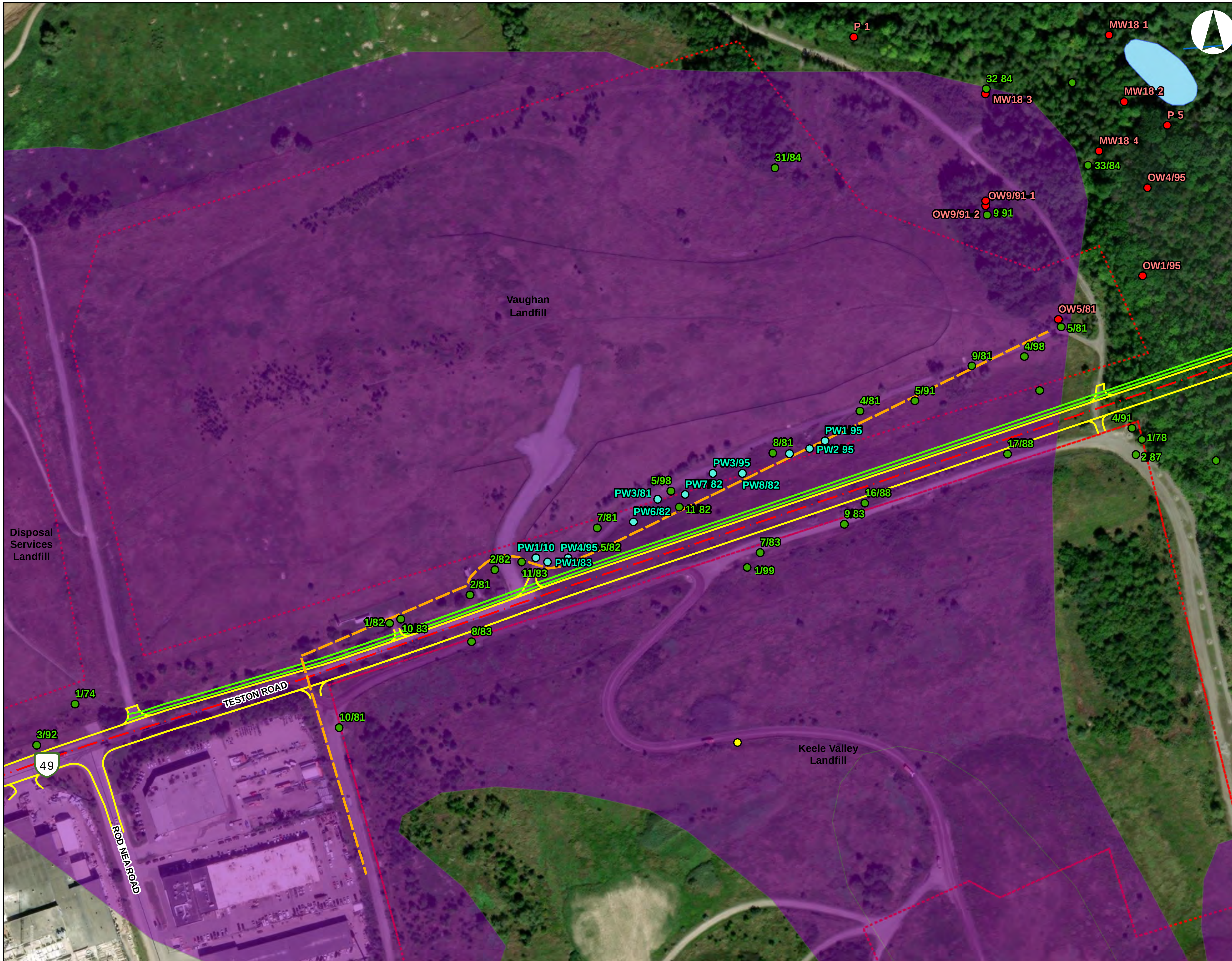
PROJECT NO.: 190261800
Teston Road, Vaughan Ontario (From Keele Street to Bathurst Street)

DATE: March 2024

Figure 7

ENVIRONMENTAL SERVICES DEPARTMENT

G:\2019\190261800_Teston_Rd\Maps\Geo_Maps\DesignandWatercourse\April_2023_Proposed_Phase_I_ESA\May_2023\Landfill_Monitoring_Systems_and_Chloride_Plume_Extent.mxd



LEGEND

- Instrumentation Monitoring Station
- Vibrating Wire Piezometer Above-Liner
- Purge Well
- Keele Valley Landfill Observation Wells
- Vaughan Landfill Groundwater Monitoring Wells
- Landfill Extent
- Chloride Plumes identified by Dixon Hydrogeology (Concentrations ranging from 15mg/L to 750mg/L)
- Waterbodies
- Watercourses

Design Features

- Edge of Pavement
- Proposed Multi-Use Pathway
- Proposed C/L
- Purge Well Leachate Main

Transportation Network

- Local Roads

NOTES:

- The area shown is within the jurisdiction of the Ministry of Natural Resources and Forestry (MNRF) Aurora midhurst Owen Sound District and theToronto and Region Conservation Authority

Coordinate System: NAD 1983 UTM Zone 17N
Sources: MNR, Golder, Dixon Hydrogeology

MORRISON HERSHFIELD

SCALE: 1:3,000

0 60 120
Meters

TITLE:

Approximate Locations of Landfill Monitoring Systems

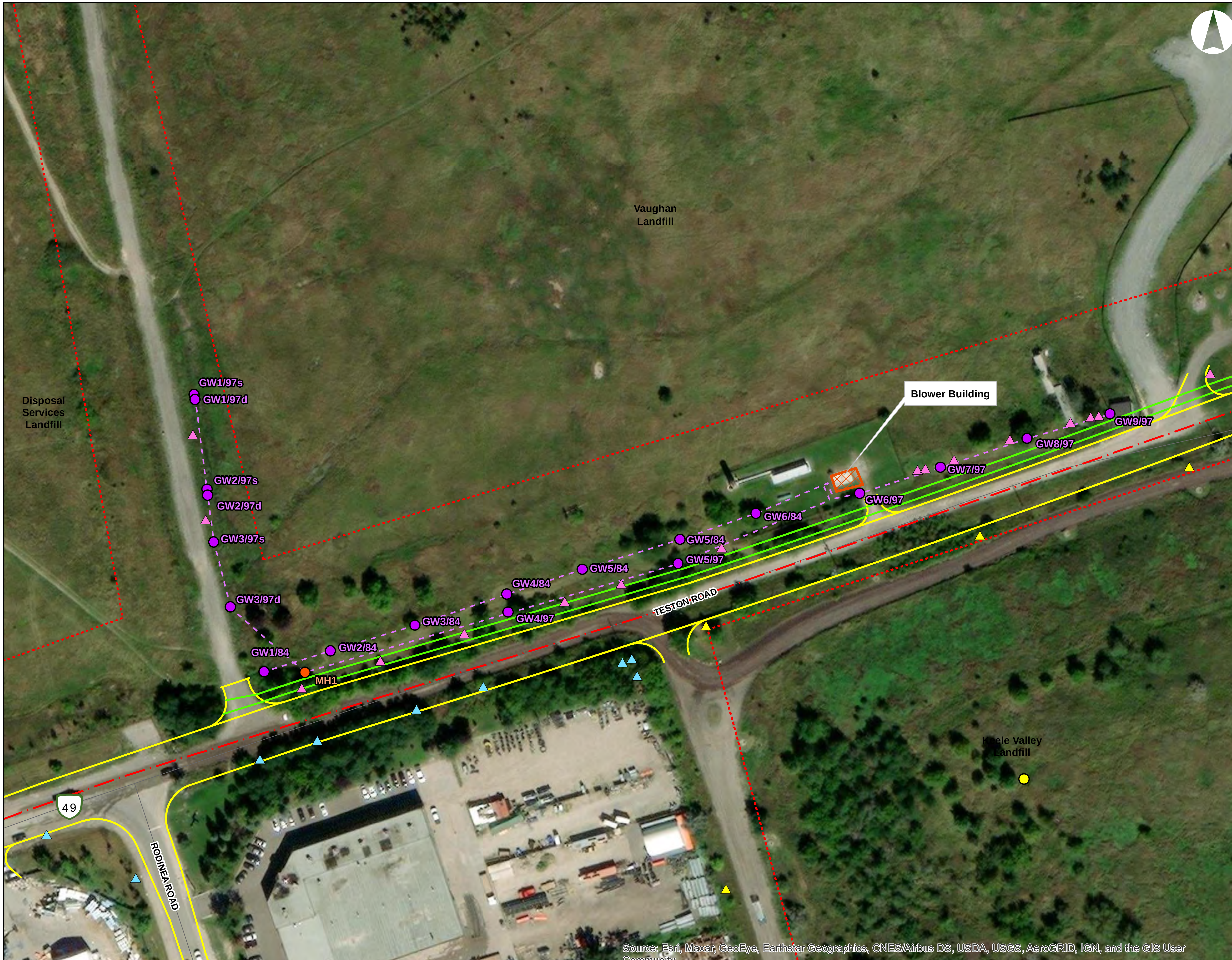
PROJECT NO.: 190261800

Teston Road, Vaughan Ontario
(From Keele Street to Bathurst Street)

DATE: March 2024

Figure 7a

G:\2019\190261800_Teston_Rd\Maps\Geo_Maps\DesignandWatercourse\April_2023_Proposed_Phase_I_ESA\May_2023\Figure_7a_Landfill_Gas_Extraction.mxd



LEGEND

- Landfill Extent
- Surrounding Building

Gas Extraction Well Locations

- Keele Valley Landfill (Approximate Locations)
- Vaughan Landfill
- Gas Manhole

Gas Probes

- Keele Valley Landfill Gas Probe
- Offsite Gas Probe (1986, 1987 A&B Series)
- Onsite Gas Probe (1984, 1987 B Series, 1997)

Design Features

- Edge of Pavement
- Proposed Multi-Use Pathway
- Proposed C/L
- Gas Header

Transportation Network

- Local Roads

NOTES:
- The area shown is within the jurisdiction of the Ministry of Natural Resources and Forestry (MNRF) Aurora midhurst Owen Sound District and theToronto and Region Conservation Authority Area

Coordinate System: NAD 1983 UTM Zone 17N
Sources: MNR, Golder, Dixon Hydrogeology
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,

MORRISON HERSHFIELD

SCALE: 1:1,250
0 25 50
Meters

TITLE:
Approximate Locations of Gas Wells and Gas Probes

PROJECT NO.: 190261800
Teston Road, Vaughan Ontario
(From Keele Street to Bathurst Street)

DATE: July 2023

Figure 8a

ENVIRONMENTAL SERVICES DEPARTMENT

G:\2019\190261800_Teston_Rd\Maps\Geo_Maps\DesignandWatercourse\April_2023_Proposed_Phase_I_ESA\May_2023\Figure_8a_Landfill_Gas_Extraction_Well_Locations.mxd

LEGEND

- Landfill Extent
- Surrounding Building

Gas Extraction Well Locations

- Keele Valley Landfill (Approximate Locations)
- Vaughan Landfill

Design Features

- Edge of Pavement
- Proposed Multi-Use Pathway
- Proposed C/L

Transportation Network

- Arterial / Collector
- Local Roads

NOTES:

- The area shown is within the jurisdiction of the Ministry of Natural Resources and Forestry (MNRF) Aurora midhurst Owen Sound District and theToronto and Region Conservation Authority Area

Coordinate System: NAD 1983 UTM Zone 17N
Sources: MNR, Golder, Dixon Hydrogeology
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,

MORRISON HERSHFIELD

SCALE: 1:7,000
0 50 100 200 300 400
Meters

TITLE:

Landfill Gas Extraction Well Approximate Locations

PROJECT NO.: 190261800
Teston Road, Vaughan Ontario
(From Keele Street to Bathurst Street)

DATE: July 2023

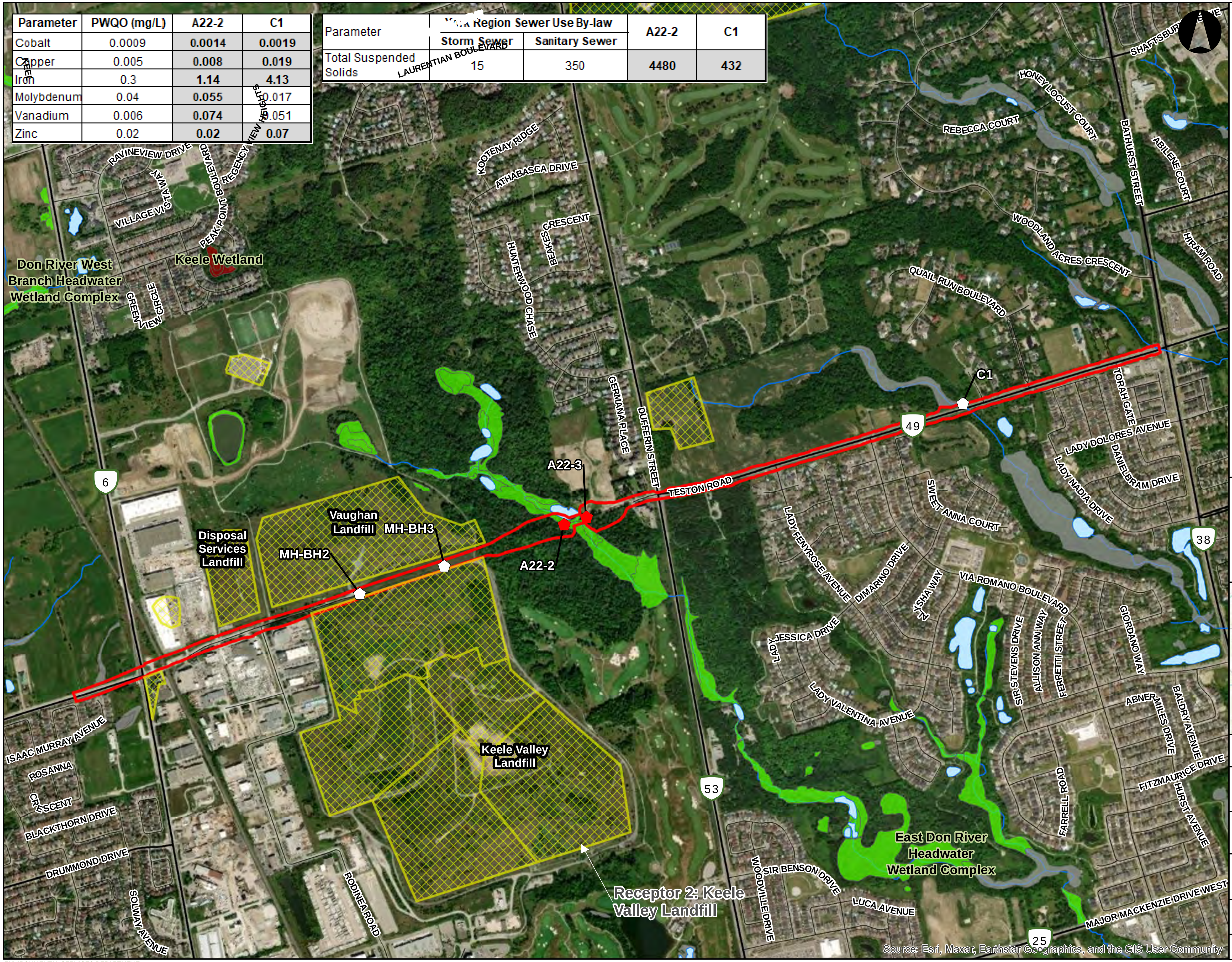
Figure 8

ENVIRONMENTAL SERVICES DEPARTMENT

G:\2019\190261800_Teston_Rd\Maps\Geo_Maps\DesignandWatercourse\April_2023_Proposed_Phase_I_ESA\May_2023\Landfill_Gas_Extraction_Well_Locations.mxd

Parameter	PWQO (mg/L)	A22-2	C1
Cobalt	0.0009	0.0014	0.0019
Copper	0.005	0.008	0.019
Iron	0.3	1.14	4.13
Molybdenum	0.04	0.055	0.017
Vanadium	0.006	0.074	0.051
Zinc	0.02	0.02	0.07

Parameter	York Region Sewer Use By-law		A22-2	C1
	Storm Sewer	Sanitary Sewer		
Total Suspended Solids	15	350	4480	432



LEGEND

- Monitoring Wells
- Monitoring Wells sampled for and exceeded select parameters against PWQO and York Region Sewer Use By-law
- Landfill
- Project Area

Land Information Ontario Data

- Watercourse
- Waterbodies

Wetlands

- Evaluated-Other Wetlands
- Evaluated-Provincially Significant Wetlands
- Unevaluated Wetlands

Transportation Network

- Arterial / Collector
- Local Roads

NOTES:

- The area shown is within the jurisdiction of the Ministry of Natural Resources and Forestry (MNRF) Aurora midhurst Owen Sound District and theToronto and Region Conservation Authority Area

Coordinate System: NAD 1983 UTM Zone 17N
Sources: MNRF, ESRI Basemaps

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,

MORRISON HERSHFIELD

SCALE: 1:14,000 (0, 125, 250, 500, 750 Meters)

TITLE: **Analytical Results Exceedance Summary Map**

PROJECT NO.: 190261800

Teston Road, Vaughan Ontario (From Keele Street to Bathurst Street)

DATE: March 2024

Figure 9

ENVIRONMENTAL SERVICES DEPARTMENT

G:\2019\190261800_Teston_Rd\Maps\Geo_Maps\DesignandWatercourse\April_2023_Proposed_Phase_I_ESA\May_2023\Analytical_Results_Exceedance_Summary.mxd

APPENDIX B – Analytical Tables

Table B-1: Summary of Groundwater Samples Analytical Results
PWQO Metals

Teston Road IEA			Groundwater Investigation	
Sample ID:	**Units**	**PWQO(1)**	A22-2	C1
Sample Date:			29-Mar-23	29-Mar-23
Certificate of Analysis			1679593	1679594
Parameter				
Alluminium (Dissolved)	mg/L	0.075	<0.01	<0.01
Antimony	mg/L	0.02	0.0008	0.0006
Arsenic	mg/L	0.005	0.004	0.003
Beryllium	mg/L	0.011	<0.0005	<0.0005
Boron	mg/L	0.2	0.09	0.05
Cadmium	mg/L	0.001	<0.0001	0.0001
Chromium	mg/L	NV	0.042	0.048
Cobalt	mg/L	0.0009	**0.0014**	**0.0019**
Copper	mg/L	0.005	**0.008**	**0.019**
Iron	mg/L	0.3	**1.14**	**4.13**
Lead	mg/L	0.001	0.001	0.004
Mercury (Dissolved)	mg/L	NV	<0.0001	<0.0001
Molybdenum	mg/L	0.04	**0.055**	0.017
Nickel	mg/L	0.025	<0.005	0.016
Selenium	mg/L	0.01	<0.001	0.001
Silver	mg/L	0.0001	<0.0001	<0.0001
Thallium	mg/L	0.003	<0.0001	<0.0001
Tungsten	mg/L	0.03	0.02	0.003
Uranium	mg/L	0.005	0.002	0.002
Vanadium	mg/L	0.006	**0.074**	0.051
Zinc	mg/L	0.02	0.02	**0.07**
Zirconium	mg/L	0.004	<0.002	<0.002

Notes:

All values in µg/L

ND - Not detected above the reporting detection limits (RDL)

NV - No Value

NA - Not Analyzed

Screening:

BOLD

Parameter exceeded PWQO Standards(1)

References:

1- Water Management: Policies, Guidelines, Provincial Water Quality Objectives, Table 2, July 1994.

Table B-2: Summary of Groundwater Samples Analytical Results
York Region Sewer Use By-law

Teston Road IEA				Groundwater Investigation	
Sample ID:	**Units**	**Storm Sewer**	**Sanitary Sewer**	A22-2	C1
Sample Date:				29-Mar-23	29-Mar-23
Certificate of Analysis				1679593	1679594
Parameter					
Conventional					
Phenolics (4AAP)	NV	NV	NV	8.53	8.08
Biochemical Oxygen Demand	mg/L	15	300	<1	1
Total Kjeldahl Nitrogen	mg/L	1	100	0.325	0.55
Phenolics (4AAP)	mg/L	0.008	1	<0.002	<0.002
Total Phosphorous	mg/L	0.4	10	0.143	0.165
Total Suspended Solids	mg/L	15	350	**4480**	**432**
Other					
Total Cyanide	mg/L	0.02	2	<0.005	<0.005
Aqua-Regia Digest	NA	NV	NV	Yes	Yes
Total Metals					
Aluminium	mg/L	NV	50	NA	NA
Antimony	mg/L	NV	5	0.0008	0.0006
Arsenic	mg/L	0.02	1	<0.02	<0.02
Cadmium	mg/L	0.008	0.7	<0.008	<0.008
Chromium	mg/L	0.08	2	0.05	0.06
Cobalt	mg/L	NV	5	0.0014	0.0019
Copper	mg/L	0.05	3	<0.01	0.02
Lead	mg/L	0.12	1	<0.01	<0.01
Manganese	mg/L	NV	5	0.04	0.2
Mercury	mg/L	0.0004	0.01	<0.0001	<0.0001
Molybdenum	mg/L	NV	5	NA	NA
Nickel	mg/L	0.08	2	<0.01	0.02
Selenium	mg/L	0.02	1	<0.02	<0.02
Silver	mg/L	0.12	5	<0.01	<0.01
Tin	mg/L	NV	5	NA	NA
Titanium	mg/L	NV	5	NA	NA
Zinc	mg/L	0.04	2	<0.04	0.08
Organics					
Benzene	µg/L	2	10	<0.5	<0.5
Chlorofrom	µg/L	2	40	<0.5	<0.5
1,2 - dichlorobenzene	µg/L	5.6	50	<0.4	<0.4
1,4 - dichlorobenzene	µg/L	6.8	80	<0.4	<0.4
Cis-1,2 - dichloroethylene	µg/L	5.6	4000	<0.4	<0.4
Trans-1,3 - dichloropropylene	µg/L	5.6	140	<0.5	<0.5
Ethylbenzene	µg/L	2	160	<0.5	<0.5
Methylene Chloride	µg/L	5.2	2000	NA	NA
1,1,2,2 - tetrachloroethane	µg/L	17	1400	<0.5	<0.5
Tetrachloroethylene	µg/L	4.4	1000	<0.3	<0.3
Toluene	µg/L	2	270	<0.4	<0.4
Toluene-d8	%	NV	NV	75	97
Trichloroethylene	µg/L	8	400	<0.3	<0.3
Xylenes (Total)	µg/L	4.4	1400	<0.5	<0.5
Xylenes (m,p)	µg/L	NV	NV	<0.4	<0.4
Xylenes (o)	µg/L	NV	NV	<0.4	<0.4
Di-n-butyl phthalate	µg/L	15	80	<1.3	<1.3
Bis (2-ethylexyl) phthalate	µg/L	8.8	12	3.6	0.7
PCBs	µg/L	0.4	1	<0.1	<0.1
Methyl Ethyl Ketone	µg/L	NV	8000	NA	NA
Styrene	µg/L	NV	200	NA	NA
Nonylphenols	µg/L	NV	20	NA	NA
Nonylphenol ethoxylates	µg/L	NV	200	NA	NA
1,2-dichloroethane-d4	%	NV	NV	119	112
4-bromofluorobenzene	%	NV	NV	83	75
Dichloromethane	µg/L	NV	NV	<4.0	<4.0

Notes:

NV - No Value

NA - Not Analyzed

Screening:

BOLD

Parameter exceeded York Region Sewer Use By-law for Storm Sewer

BOLD

Parameter exceeded York Region Sewer Use By-law for Sanitary Sewer

Prepared by: SS
Reviewed by: AW
Date: 5/26/2023
Analytical Results

APPENDIX C – Laboratory Certificates of Analyses

Certificate of Analysis

Client:	Morrison Hershfield Limited 2440 Don Reid Drive, Suite 200 Ottawa, ON K1H 1E1	Report Number:	1995273
		Date Submitted:	2023-03-29
		Date Reported:	2023-04-03
		Project:	
Attention:	Mr. Sarth Sheth	COC #:	221770
PO#:			
Invoice to:	Morrison Hershfield Limited		

Dear Sarth Sheth:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: ______________________________
Raheleh Zafari, Environmental Chemist

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: https://directory.cala.ca/.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

Certificate of Analysis

eurofins | Environment Testing

Client:	Morrison Hershfield Limited 2440 Don Reid Drive, Suite 200 Ottawa, ON K1H 1E1	Report Number:	1995273
Attention:	Mr. Sarth Sheth	Date Submitted:	2023-03-29
PO#:		Date Reported:	2023-04-03
Invoice to:	Morrison Hershfield Limited	Project:	
		COC #:	221770

Group	Analyte	MRL	Units	Guideline	1679595	1679596
				Lab I.D.	1679595	1679596
				Sample Matrix	SURF W	SURF W
				Sample Type		
				Sampling Date	2023-03-29	2023-03-29
				Sample I.D.	A22-2	C1
Metals	Ag	0.0001	mg/L	PWQO 0.0001	<0.0001	<0.0001
	Al (dissolved)	0.01	mg/L	IPWQO 0.075	<0.01	<0.01
	As	0.001	mg/L	PWQO 0.100	0.004	0.003
	B	0.01	mg/L	IPWQO 0.200	0.09	0.05
	Be	0.0005	mg/L	PWQO 0.011	<0.0005	<0.0005
	Cd	0.0001	mg/L	PWQO 0.0002	<0.0001	0.0001
	Co	0.0002	mg/L	PWQO 0.0009	0.0014*	0.0019*
	Cr	0.001	mg/L		0.042	0.048
	Cu	0.001	mg/L	PWQO 0.005	0.008*	0.019*
	Fe	0.03	mg/L	PWQO 0.30	1.14*	4.13*
	Hg Dissolved	0.0001	mg/L		<0.0001	<0.0001
	Mo	0.005	mg/L	IPWQO 0.040	0.055*	0.017
	Ni	0.005	mg/L	PWQO 0.025	<0.005	0.016
	Pb	0.001	mg/L	PWQO 0.005	0.001	0.004
	Sb	0.0005	mg/L	IPWQO 0.020	0.0008	0.0006
	Se	0.001	mg/L	PWQO 0.100	<0.001	0.001
	Tl	0.0001	mg/L	IPWQO 0.0003	<0.0001	<0.0001
	U	0.001	mg/L	IPWQO 0.005	0.002	0.002
	V	0.001	mg/L	IPWQO 0.006	0.074*	0.051*
	W	0.002	mg/L	IPWQO 0.030	0.020	0.003
	Zn	0.01	mg/L	PWQO 0.030	0.02	0.07*
	Zr	0.002	mg/L	IPWQO 0.004	<0.002	<0.002

Guideline = PWQO - Ontario *** = Guideline Exceedence**

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

Certificate of Analysis

eurofins Environment Testing

Client:	Morrison Hershfield Limited 2440 Don Reid Drive, Suite 200 Ottawa, ON K1H 1E1	Report Number:	1995273
Attention:	Mr. Sarth Sheth	Date Submitted:	2023-03-29
PO#:		Date Reported:	2023-04-03
Invoice to:	Morrison Hershfield Limited	Project:	
		COC #:	221770

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 439416 **Analysis/Extraction Date** 2023-03-30 **Analyst** SD **Method** EPA 200.8			
Silver	<0.0001 mg/L	108	80-120
Al (dissolved)	<0.01 mg/L	107	80-120
Arsenic	<0.001 mg/L	90	80-120
Boron (total)	<0.01 mg/L	100	80-120
Beryllium	<0.0005 mg/L	100	80-120
Cadmium	<0.0001 mg/L	97	80-120
Cobalt	<0.0002 mg/L	102	80-120
Chromium Total	<0.001 mg/L	101	80-120
Copper	<0.001 mg/L	103	80-120
Iron	<0.03 mg/L	105	80-120
Hg Dissolved	<0.0001 mg/L	90	
Molybdenum	<0.005 mg/L	93	80-120
Nickel	<0.005 mg/L	104	80-120
Lead	<0.001 mg/L	101	80-120
Antimony	<0.0005 mg/L	114	80-120
Selenium	<0.001 mg/L	92	80-120

Guideline = PWQO - Ontario *** = Guideline Exceedence**

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

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Methods references and/or additional QA/QC information available on request.

Certificate of Analysis

Environment Testing

Client:	Morrison Hershfield Limited 2440 Don Reid Drive, Suite 200 Ottawa, ON K1H 1E1	Report Number: Date Submitted: Date Reported: Project:	1995273 2023-03-29 2023-04-03
Attention:	Mr. Sarth Sheth	COC #:	221770
PO#:			
Invoice to:	Morrison Hershfield Limited		

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Thallium	<0.0001 mg/L	99	80-120
Uranium	<0.001 mg/L	99	80-120
Vanadium	<0.001 mg/L	97	80-120
W	<0.002 mg/L	90	80-120
Zinc	<0.01 mg/L	100	80-120
Zr	<0.002 mg/L	76	80-120

Guideline = PWQO - Ontario *** = Guideline Exceedence**

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Certificate of Analysis

Client:	Morrison Hershfield Limited 2440 Don Reid Drive, Suite 200 Ottawa, ON K1H 1E1	Report Number:	1995272
		Date Submitted:	2023-03-29
		Date Reported:	2023-04-05
		Project:	
Attention:	Mr. Sarth Sheth	COC #:	221769
PO#:			
Invoice to:	Morrison Hershfield Limited		

Dear Sarth Sheth:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: ______________________________

Raheleh Zafari, Environmental Chemist

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: https://directory.cala.ca/.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

Certificate of Analysis

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Client:	Morrison Hershfield Limited 2440 Don Reid Drive, Suite 200 Ottawa, ON K1H 1E1		Report Number:	1995272
Attention:	Mr. Sarth Sheth		Date Submitted:	2023-03-29
PO#:			Date Reported:	2023-04-05
Invoice to:	Morrison Hershfield Limited		Project:	
			COC #:	221769

Group	Analyte	MRL	Units	Guideline	1679593	1679594
				Lab I.D.	1679593	1679594
				Sample Matrix	STRM W	STRM W
				Sample Type		
				Sampling Date	2023-03-29	2023-03-29
				Sample I.D.	A22-2	C1
General Chemistry	BOD5	1	mg/L	MAC 15	<1	1
	Cyanide (total)	0.005	mg/L	MAC 0.020	<0.005	<0.005
	pH	1.00		6.0-9.0	8.53	8.08
	Phenols	0.002	mg/L	MAC 0.008	<0.002	<0.002
	Total Suspended Solids	2	mg/L	MAC 15	4480*	432*
Mercury	Hg	0.0001	mg/L	MAC 0.0004	<0.0001	<0.0001
Metals	Ag	0.01	mg/L	MAC 0.120	<0.01	<0.01
	Aqua-Regia Digest		mg/L		Y	Y
	As	0.02	mg/L	MAC 0.020	<0.02	<0.02
	Cd	0.008	mg/L	MAC 0.008	<0.008	<0.008
	Cr	0.05	mg/L	MAC 0.080	0.05	0.06
	Cu	0.01	mg/L	MAC 0.050	<0.01	0.02
	Mn	0.01	mg/L	MAC 0.150	0.04	0.20*
	Ni	0.01	mg/L	MAC 0.080	<0.01	0.02
	Pb	0.01	mg/L	MAC 0.120	<0.01	<0.01
	Se	0.02	mg/L	MAC 0.020	<0.02	<0.02
	Zn	0.04	mg/L	MAC 0.040	<0.04	0.08*
Nutrients	Total Kjeldahl Nitrogen	0.100	mg/L	MAC 1	0.325	0.550
	Total P	0.020	mg/L	MAC 0.400	0.143	0.165
PCBs	Polychlorinated Biphenyls (PCBs)	0.1	ug/L	MAC 0.4	<0.1	<0.1
Semi-Volatiles	Bis(2-ethylhexyl)phthalate	0.4	ug/L	MAC 8.8	3.6	0.7
	Di-n-butylphthalate	1.3	ug/L	MAC 15.0	<1.3	<1.3
VOCs Surrogates	1,2-dichloroethane-d4	0	%		119	112
	4-bromofluorobenzene	0	%		83	75
	Toluene-d8	0	%		75	97

Guideline = Storm Sewer - York

*** = Guideline Exceedence**

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Methods references and/or additional QA/QC information available on request.

eurofins Environment Testing

Certificate of Analysis

Client: Morrison Hershfield Limited
2440 Don Reid Drive, Suite 200
Ottawa, ON
K1H 1E1
Attention: Mr. Sarth Sheth
PO#:
Invoice to: Morrison Hershfield Limited

Report Number: 1995272
Date Submitted: 2023-03-29
Date Reported: 2023-04-05
Project:
COC #: 221769

Group	Analyte	MRL	Units	Guideline	1679593	1679594
				Lab I.D.	1679593	1679594
				Sample Matrix	STRM W	STRM W
				Sample Type		
				Sampling Date	2023-03-29	2023-03-29
				Sample I.D.	A22-2	C1
Volatiles	1,1,2,2-tetrachloroethane	0.5	ug/L	MAC 17.0	<0.5	<0.5
	1,2-dichlorobenzene	0.4	ug/L	MAC 5.6	<0.4	<0.4
	1,4-dichlorobenzene	0.4	ug/L	MAC 6.8	<0.4	<0.4
	Benzene	0.5	ug/L	MAC 2.0	<0.5	<0.5
	c-1,2-Dichloroethylene	0.4	ug/L	MAC 5.6	<0.4	<0.4
	Chloroform	0.5	ug/L	MAC 2.0	<0.5	<0.5
	Dichloromethane	4.0	ug/L	MAC 5.2	<4.0	<4.0
	Ethylbenzene	0.5	ug/L	MAC 2.0	<0.5	<0.5
	m/p-xylene	0.4	ug/L		<0.4	<0.4
	o-xylene	0.4	ug/L		<0.4	<0.4
	t-1,3-Dichloropropylene	0.5	ug/L	MAC 5.6	<0.5	<0.5
	Tetrachloroethylene	0.3	ug/L	MAC 4.4	<0.3	<0.3
	Toluene	0.4	ug/L	MAC 2.0	<0.4	<0.4
	Trichloroethylene	0.3	ug/L	MAC 8.0	<0.3	<0.3
	Xylene; total	0.5	ug/L	MAC 4.4	<0.5	<0.5

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Client:	Morrison Hershfield Limited 2440 Don Reid Drive, Suite 200 Ottawa, ON K1H 1E1		Report Number:	1995272
Attention:	Mr. Sarth Sheth		Date Submitted:	2023-03-29
PO#:			Date Reported:	2023-04-05
Invoice to:	Morrison Hershfield Limited		Project:	
			COC #:	221769

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 438460 **Analysis/Extraction Date** 2023-03-31 **Analyst** C M **Method** B 625/P 8270			
Bis(2-ethylhexyl)phthalate	<0.4 ug/L	108	20-140
Di-n-butylphthalate	<1.3 ug/L	80	20-140
Run No 439407 **Analysis/Extraction Date** 2023-03-30 **Analyst** SKH **Method** EPA 351.2			
Total Kjeldahl Nitrogen	<0.100 mg/L	103	70-130
Run No 439408 **Analysis/Extraction Date** 2023-03-30 **Analyst** SKH **Method** EPA 365.1			
Total P	<0.020 mg/L	102	80-120
Run No 439415 **Analysis/Extraction Date** 2023-03-31 **Analyst** SKH **Method** C SM2540			
Total Suspended Solids	<2 mg/L	96	90-110
Run No 439433 **Analysis/Extraction Date** 2023-03-30 **Analyst** AET **Method** SM2320,2510,4500H/F			
pH		100	90-110
Run No 439488 **Analysis/Extraction Date** 2023-03-31 **Analyst** SD **Method** EPA 200.8			
Silver	<0.01 mg/L	110	70-130

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Certificate of Analysis

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Client:	Morrison Hershfield Limited 2440 Don Reid Drive, Suite 200 Ottawa, ON K1H 1E1		Report Number: Date Submitted: Date Reported: Project: COC #:	1995272 2023-03-29 2023-04-05 221769
Attention:	Mr. Sarth Sheth			
PO#:				
Invoice to:	Morrison Hershfield Limited			

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Arsenic	<0.02 mg/L	98	70-130
Cadmium	<0.008 mg/L	103	70-130
Chromium Total	<0.05 mg/L	112	70-130
Copper	<0.01 mg/L	111	70-130
Manganese	<0.01 mg/L	110	70-130
Nickel	<0.01 mg/L	110	70-130
Lead	<0.01 mg/L	96	70-130
Selenium	<0.02 mg/L	91	70-130
Zinc	<0.04 mg/L	98	70-130
Run No 439489 **Analysis/Extraction Date** 2023-03-31 **Analyst** SD **Method** EPA 200.8			
Aqua-Regia Digest			
Run No 439501 **Analysis/Extraction Date** 2023-04-03 **Analyst** R G **Method** EPA 8081B			
Polychlorinated Biphenyls	<0.1 ug/L	91	60-140
Run No 439506 **Analysis/Extraction Date** 2023-04-03 **Analyst** IP **Method** SM5530D/EPA420.2			
Phenols	<0.002 mg/L	106	50-120

Guideline = Storm Sewer - York

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Client:	Morrison Hershfield Limited 2440 Don Reid Drive, Suite 200 Ottawa, ON K1H 1E1	Report Number:	1995272
Attention:	Mr. Sarth Sheth	Date Submitted:	2023-03-29
PO#:		Date Reported:	2023-04-05
Invoice to:	Morrison Hershfield Limited	Project:	
		COC #:	221769

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 439510 **Analysis/Extraction Date** 2023-04-01 **Analyst** PJ **Method** EPA 8260			
Tetrachloroethane, 1,1,2,2-	<0.5 ug/L	99	60-130
Dichlorobenzene, 1,2-	<0.4 ug/L	94	60-130
Dichlorobenzene, 1,4-	<0.4 ug/L	90	60-130
Benzene	<0.5 ug/L	94	60-130
Dichloroethylene, 1,2-cis-	<0.4 ug/L	90	60-130
Chloroform	<0.5 ug/L	93	60-130
Methylene Chloride	<4.0 ug/L	97	60-130
Ethylbenzene	<0.5 ug/L	90	60-130
m/p-xylene	<0.4 ug/L	97	60-130
o-xylene	<0.4 ug/L	92	60-130
Dichloropropene,1,3-trans-	<0.5 ug/L	86	60-130
Tetrachloroethylene	<0.3 ug/L	90	60-130
Toluene	<0.4 ug/L	88	60-130
Trichloroethylene	<0.3 ug/L	89	60-130
Run No 439513 **Analysis/Extraction Date** 2023-04-03 **Analyst** PJ **Method** EPA 8260			

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Client:	Morrison Hershfield Limited 2440 Don Reid Drive, Suite 200 Ottawa, ON K1H 1E1	Report Number:	1995272
Attention:	Mr. Sarth Sheth	Date Submitted:	2023-03-29
PO#:		Date Reported:	2023-04-05
Invoice to:	Morrison Hershfield Limited	Project:	
		COC #:	221769

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Xylene Mixture			
Run No 439516 **Analysis/Extraction Date** 2023-04-03 **Analyst** Z S **Method** SM4500-CNC/MOE E3015			
Cyanide (total)	<0.005 mg/L	90	61-139
Run No 439525 **Analysis/Extraction Date** 2023-04-03 **Analyst** AaN **Method** M SM3112B-3500B			
Mercury	<0.0001 mg/L	101	76-123
Run No 439626 **Analysis/Extraction Date** 2023-04-05 **Analyst** AET **Method** SM 5210B			
BOD5	<1 mg/L	89	75-125

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