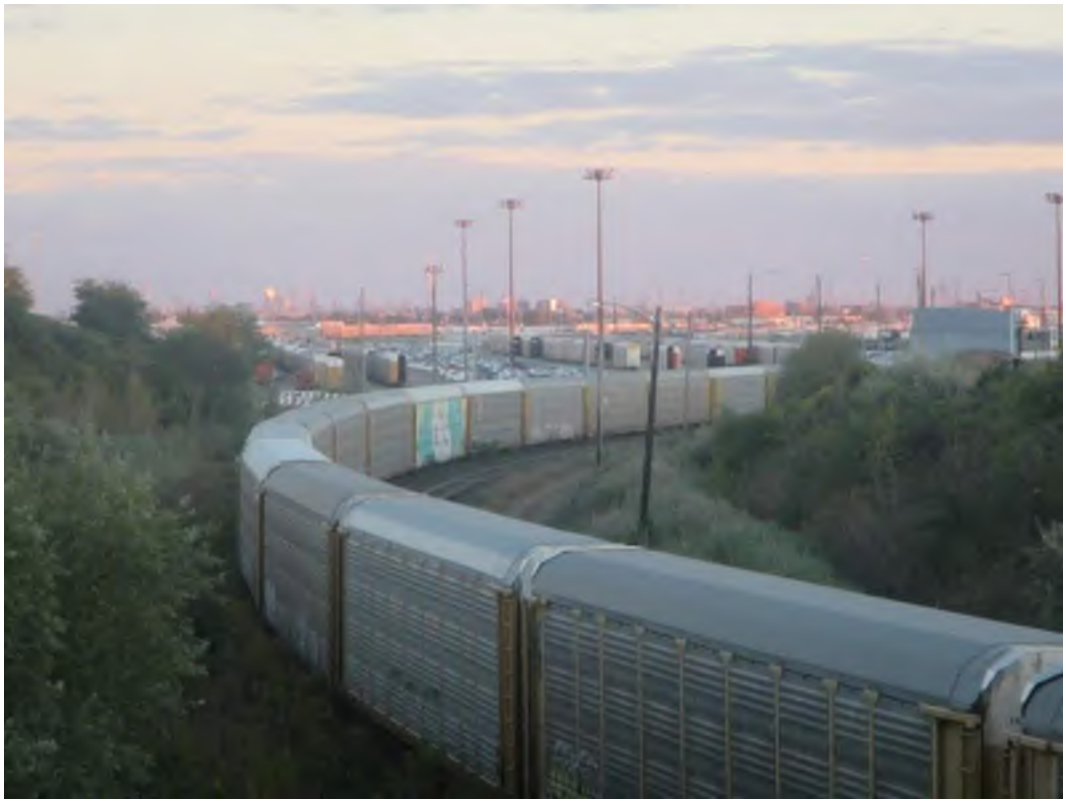
THE REGIONAL MUNICIPALITY OF YORK

LANGSTAFF ROAD BETWEEN WESTON ROAD AND HIGHWAY 7 HYDROGEOLOGICAL ASSESSMENT

SCHEDULE ‘C’ MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT



ARPIIL 8, 2022

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THE REGIONAL MUNICIPALITY OF YORK

PROJECT NO.: 16M-01457-01
APRIL 2022

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EXECUTIVE SUMMARY

NOTE – this report was prepared March 26, 2018, slight modifications to the report were completed on December 10, 2021, and April 8, 2022; however, all the databases searches etc. are only up to date to March 2018.

The Regional Municipality of York (York Region) is conducting a Schedule 'C' Class Environmental Assessment of the Langstaff Road corridor (study area) between Weston Road and Highway 7, in order to evaluate transportation and infrastructure improvements needed to accommodate anticipated future urban growth conditions. Based on the preliminary design proposed, York Region (2017) is considering the following improvements to Langstaff Road and Highway 400 within the study area:

1. Widening of Langstaff Road to three lanes each direction to accommodate increased road traffic, including storm sewer improvements as required to accommodate this option;
2. Intersection improvements, including re-designed turning lanes and refinements to traffic signaling;
3. A grade-separated connection across the CN MacMillan Rail Classification Yard (underpass or overpass);
4. A grade separation to replace the existing at-grade railway crossing of the Metrolinx Barrie GO line;
5. Improvements to the interchange of Langstaff Road and Highway 400 to upgrade to a full-move interchange;
6. Associated improvements along Highway 400 north to accommodate the proposed Highway 400 and Langstaff Road interchange improvements;
7. A wider bridge structure for Langstaff Road over the West Don River;
8. Potential modifications to the Langstaff Road culvert at Westminster Creek;
9. Potential improvements to transit (bus transportation) and active transportation (sidewalks, pathways, and bicycle lanes) within the Langstaff Road EA study area; and
10. Necessary improvements and relocations to municipal services and utilities to accommodate these proposed road improvements (storm sewers, sanitary sewers, water mains, hydro, gas, telecommunications, and storm water management infrastructure).

The Langstaff Road corridor between Weston Road and Highway 7 is already fully urbanized (Figure 1-1), primarily with light industrial lands, along with commercial and residential lands, parks and open spaces, natural and naturalized lands, and transportation related lands and corridors, most notably the CN MacMillan Rail Classification Yard. The most notable naturalized corridor is the greenbelt along the West Don River, and there are smaller greenbelts along tributaries to the West Don River, including Westminster Creek, as well as Black Creek (Humber River tributary). There are also isolated woodlots and green spaces

around storm water management facilities, as well as manicured parks and lawns. Otherwise, the land is heavily urbanized, including large areas of industrial and commercial buildings with flat roofs surrounded by pavement areas for parking and driveways.

The geology in the study area is generally described as follows, as per TRCA (2008 and 2009c):

- The surficial geology has been heavily modified as a result of urban developments;
- The near-surface geology consists almost entirely of low-permeability sandy to clayey silt till (Halton Till);
- The regionally extensive Halton Till provides a protective cover for the underlying regionally extensive silty to gravely sand aquifer, referred to as the Oak Ridges Moraine Aquifer Complex;
- There are numerous deeper sequences of regionally extensive aquitards (glacial till units) and aquifers, including (in descending order): the Newmarket Till, the Thorncliffe Aquifer, the Sunnybrook Drift, and the Scarborough Aquifer; and
- Total overburden thickness ranges from 100 to 200 meters thick in the study area, overlying bedrock, consisting of grey shale interbedded with lesser amounts of limestone (Georgian Bay Formation).
- In addition:
- WSP reviewed MOECC water well records along the Langstaff Road corridor, to produce a generalized geological cross section, depicting the upper overburden units as part of this sequence (**Appendix D**); and
- It is noted that the area is now fully municipally serviced, and it is interpreted that there are few remaining groundwater users. Nonetheless, there may be property owners who have drilled or maintained a water well for auxiliary water supplies.
- As per the Toronto and region SPA Assessment Report (2015), total annual precipitation is approximately 970 mm/year in the area. Due to the fact that much of the land use in the vicinity of Langstaff Road includes commercial and industrial related buildings with flat roofs and surrounded by paved parking and driveway areas, a high percentage of precipitation water (estimated as 2/3, or 67%) is estimated to end up as runoff, with only a small percentage (10% or less) infiltrating into groundwater, for the area as a whole.
- The Toronto and Region Conservation Authority (2009b) notes that additional storm water management infrastructure is needed to address high storm water runoff rates as noted above; and
- The City of Vaughan (Cole Engineering, June 2014) has identified several existing problem areas with respect to erosion along creeks in the area, as well as flood prone areas, and therefore has

developed a strategy for creek corridor naturalization and bank stabilization, as well as storm water management improvement opportunities.

Hydrogeological Impacts (Construction Dewatering):

In order to widen Langstaff Road, improve and / or relocate buried municipal services, construct the proposed bridge structures and modify existing structures as noted, construction dewatering will or may be required, as per the following:

1. Construction dewatering is interpreted to be required for any grade separation (bridge or tunnel structure) for Langstaff Road to cross the CN MacMillan Rail Classification Yard. Substantial construction dewatering is interpreted to be required if a tunnel option is selected, due to the fact that the tunnel may intersect with Oak Ridges Moraine aquifer sediments, and ongoing dewatering via active means (pumping) is likely to be required once the structure is operational;
2. Construction dewatering is interpreted to be required for any grade separation work at the railroad crossing between Langstaff Road and the Metrolinx-Barrie GO track, and ongoing dewatering may be required (active pumping) once the structure is operational, if an underpass option is selected;
3. Construction dewatering is interpreted to be required while building bridge and culvert structures around creeks, which includes reconstruction of the Langstaff Road bridge over the West Don River, potential modification to the culvert at Westminster Creek, and potential modification to bridges and culverts spanning Black Creek around the Highway 400 interchange. Temporary creek diversions may be required during these works as well, particularly culvert works;
4. An existing creek flowing within the roadside ditch along the north side of Langstaff Road, from the intersection of Dufferin Street towards Westminster Creek, would likely need to be either relocated or re-routed through storm sewers, potentially requiring temporary construction dewatering as well as temporary flow diversion;
5. Construction dewatering is interpreted to be required to reconstruct, improve, or re-locate below-ground municipal services (sanitary sewers, sanitary force mains, water mains, and storm sewers); and
6. Additional works may require temporary construction dewatering (sign post foundations, or road cut excavations).

The proposed reconstruction and widening of Langstaff Road will require widening of the bridge crossings over the West Don River, and potentially the culvert crossings for Westminster Creek, and Black Creek. It may also involve encroachment into the woodlot and storm water management pond on the north side of Langstaff Road, east of Dufferin Street. This work will likely also require relocating an existing creek, currently flowing within the roadside ditch, from Dufferin Street towards Westminster Creek, as noted in Item #4 above. There are also isolated smaller wetlands alongside Langstaff Road, in the vicinity of Dufferin Street (on a property with an older residential home), as well as along Langstaff Road, east of the Langstaff

Historical Cemetery, but west of the Metrolinx Barrie GO Railroad, in Langstaff Park. The West Don River, Westminster Creek, the identified tributary to Westminster Creek, as well as Black Creek, are all identified as warm water creeks (**Figure 2-2**). Work in or near watercourses will require appropriate fisheries timing restrictions for the protection of warm water fish, as directed by TRCA, as well as sediment and erosion control best management practices (BMPs) to ensure that soil and sediment-laden water does not enter watercourses and riparian areas alongside creeks.

As indicated, as part of the construction for the proposed road crossing, dewatering may be required during road and bridge construction, for below-grade excavations. Construction dewatering rates are likely to be low in glacial till and glaciolacustrine sediments, however higher dewatering rates will result where there are saturated lenses of coarser grained materials (localized shallow aquifers), or where excavations intercept more regionally continuous deeper aquifers, particularly the Oak Ridges Moraine Complex. Site-specific geotechnical investigations will be required to affirm construction dewatering requirements, with particular attention to determining if groundwater is under artesian conditions in aquifers beneath river valleys, such as the West Don River.

Review of the CTC Approved Source Protection Plan (December 2015) indicates that the section of Langstaff Road, between Weston Road and Highway 7, does not pass through any municipal wellhead protection areas (WHPA) or intake protection zones (IPZ), however it is within the well head protection area (WHPA) Q1/Q2 of moderate risk. This well head protection area has been established to protect groundwater recharge to regional aquifer units which are generally used as a source of groundwater.

Although it is interpreted that all properties in the area have municipal water and waste water servicing, there may be some properties with water supplies for auxiliary uses, particularly within the industrial lands, and potentially within the CN MacMillan Rail Classification Yard, which was constructed before municipal servicing existed. As such, **targeted door-to-door water well surveys should be undertaken during the detailed design phase in areas where construction dewatering is anticipated for proposed works.**

Additional site-specific geotechnical and hydrogeological investigations will be required once further design details have been developed, to confirm local area conditions.

Environmental Risks (Contaminant Overview):

The proposed proposed improvements on Langstaff Road may pass through areas where there are potential environmental concerns related to soil or groundwater quality, particularly near gasoline stations, industrial buildings, warehouses, automotive service centers, or along railroad tracks and the CN MacMillan Rail Classification Yard. In addition, sodium adsorption ratios may be high within shallow soils along roadways, attributed to application of road salt for winter road maintenance. Best practices outlined in York Region's Winter Maintenance Program will be implemented.

More detailed and site-specific soil and groundwater quality investigations will be required at select locations, during the detailed design phase, as deemed necessary, to evaluate existing soil and

groundwater quality conditions. This will be of particular importance around structures to be re-built, requiring substantial excavation and earth moving, as well as where additional lands must be acquired for road widening.

Operational Considerations:

Widening of Langstaff Road, as proposed by York Region, will result in a larger paved area footprint, and therefore will result in increased runoff during storm events and decreased infiltration, in an area where creek erosion and storm water management is already a high concern (TRCA, 2009b and Cole Engineering, 2014). In particular for the section of Langstaff Road between Dufferin Street and Keele Street, widening of Langstaff Road may require replacement of the existing roadside ditches containing cattails (vegetated swale) with storm sewers, therefore resulting in faster movement of runoff water to natural watercourses (West Don River and Westminster Creek) as well as less natural filtration capacity. As such, enhanced storm water management measures need to be considered, in keeping with the City of Vaughan Storm Water Master Plan (Cole Engineering, 2014) and TRCA (2009b).

SIGNATURES

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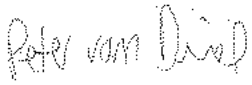

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APPENDICES

1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by the Regional Municipality of York (York Region) to complete a hydrogeological assessment in support of a Schedule 'C' Municipal Class Environmental Assessment Study for Langstaff Road between Weston Road and Highway 7, as shown on **Figure 1-1**. The work proposed is widening of Langstaff Road to 6 lanes between Weston Road to Dufferin Street, including construction of a connection across the Canadian National Railroad (CN) MacMillan Rail Classification Yard. Potential road and infrastructure improvements being evaluated as part of this Environmental Assessment (EA), as per York Region (2017) include:

1. Widening of Langstaff Road to three lanes each direction to accommodate increased road traffic, including storm sewer improvements as required to accommodate this option;
2. Intersection improvements, including re-designed turning lanes and refinements to traffic signaling;
3. A grade-separated connection across the CN MacMillan Rail Classification Yard (underpass or overpass);
4. A grade separation to replace the existing at-grade railway crossing of the Metrolinx Barrie GO line;
5. Improvements to the interchange of Langstaff Road and Highway 400 to upgrade to a full-move interchange;
6. Associated improvements along Highway 400 to accommodate the proposed Highway 400 and Langstaff Road interchange improvements;
7. A wider bridge structure for Langstaff Road over the West Don River;
8. Potential modifications to the Langstaff Road culvert at Westminster Creek;
9. Potential improvements to transit (bus transportation) and active transportation (sidewalks, pathways, and bicycle lanes) within the Langstaff Road EA study area; and
10. Necessary improvements and relocations to municipal services and utilities to accommodate these proposed road improvements (storm sewers, sanitary sewers, water mains, hydro, gas, telecommunications, and storm water management infrastructure).

This EA assessment provides a summary of existing geological and hydrogeological conditions, as well as natural environmental features, surface water drainage, existing land uses, existing groundwater usage, groundwater source protection policies and initiatives in place, and potential locations of environmental contamination as may be encountered by the proposed improvements being evaluated.

2 BACKGROUND

The study area is located in the Regional Municipality of York, specifically the City of Vaughan, and includes lands within 500 meters of Langstaff Road, between Weston Road and Highway 7. Additional lands are included in the study area north along Highway 400 to Rutherford Road, as well as the CN MacMillan Rail Classification Yard, due to the fact that proposed improvements to Langstaff Road require special considerations for these two transportation corridors / lands. The study area is an urban setting with land use including residential, commercial and industrial, as well as some natural and park land areas. It is interpreted that the area is municipally serviced, however private wells may exist as secondary water supplies at older properties. The Site location is shown on **Figure 2-1**, natural features on **Figure 2-2**, surficial geology on **Figure 2-3**, Ontario Ministry of the Environment and Climate Change (MOECC) well records on **Figure 2-4**, a provincial monitoring well hydrograph in **Figure 2-5**, and land uses along with potential sources of environmental contamination on **Figure 2-6**.

Appendix A provides a compilation of detailed maps and site photographs for the study area.

Appendix B provides excerpts from the City of Vaughan Storm Water Management Plan including civic land use mapping;

Appendix C includes generalized geological diagrams and geological cross sections, prepared by the Toronto and Region Conservation Authority (2008 and 2009C).

Appendix D provides an interpreted geological cross section along Langstaff Road between Weston Road and Highway 7, constructed by WSP utilizing nearby Ontario Ministry of the Environment and Climate Change (MOECC) well record data;

Appendix E includes figure excerpts from the Toronto and Region Source Protection Authority depicting groundwater recharge (**Figure C-1**), and aquifer vulnerability (**Figure C-2**), within this regional Source Protection study area;

Appendix F includes a map showing location of MOECC Environmental Activity Sector Registry (EASR) activities, and Environmental Compliance Approvals (ECA); and

Appendix G provides the Environmental Risk Information System (ERIS) Environmental Database Report for the Study Area.

2.1 CLIMATE

WSP completed a review of climate data for the closest Government of Canada weather station at Toronto North York Ontario. The following **Figure 2-1** shows the daily temperature and precipitation data recorded at the station since 2012.

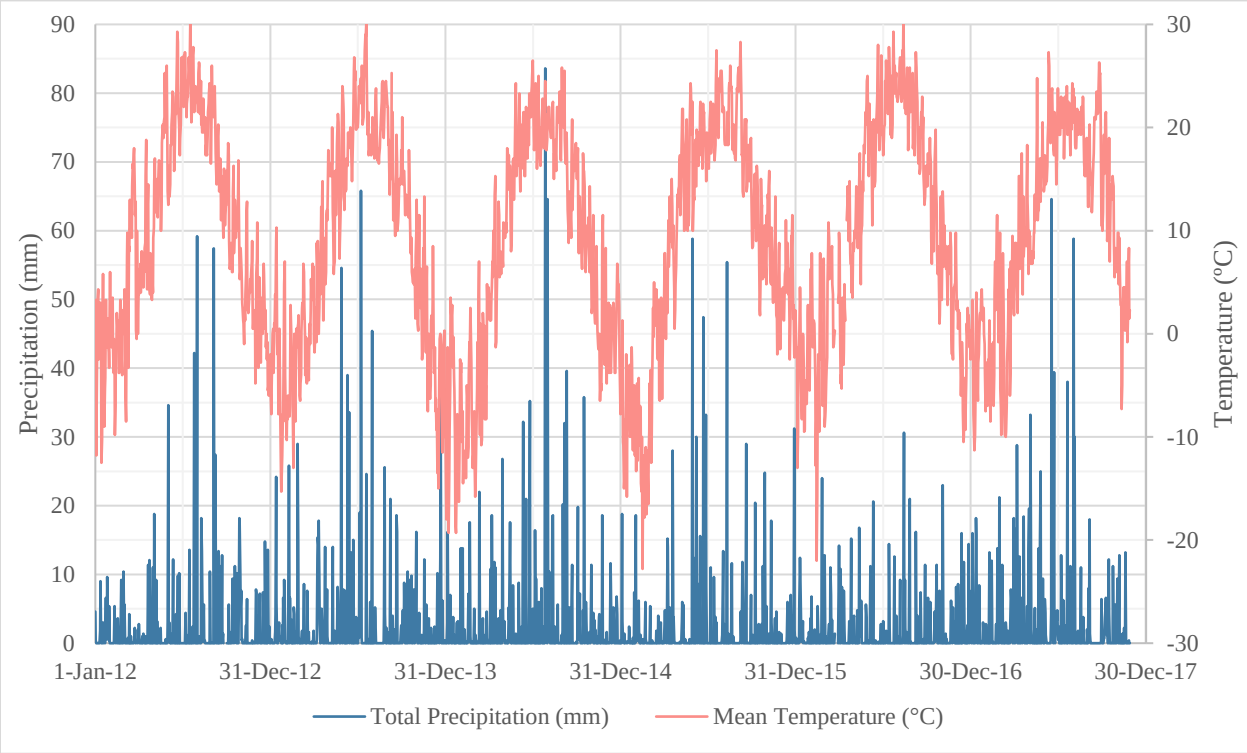

Figure 2-1: Historical Climate Data (Government of Canada, 2017)

As shown on the above Figure 2-1 the precipitation has generally remained below 30 millimeters (mm) per day, with a range of 0 to 83.6 mm and an average of 2.5 mm der day. The temperature follows the typically seasonal trends with highs in the summers up to 31.0 Degrees Celsius (°C) and lows in the winters down to -22.8 °C and an overall average of 9.2 °C.

2.2 LAND USE

The study area is within an urban area with the most widespread land use being industrial (primarily light industrial with local heavy industrial). Other land uses include commercial, residential, transportation (including the CN MacMillan Rail Classification Yard, and highway 400), and natural areas and corridors. There is also an area of agricultural lands with proposed future urban (industrial and commercial) development, on the west side of Highway 400, between Bass Pro Mills Drive and Rutherford Road. Land use types are depicted on **Figure 2-6**. Further information about civic land use as well as storm water management throughout the City of Vaughan is provided in **Appendix B**.

2.3 NATURAL FEATURES

The study area is highly urbanized, with only a small percentage of the landscape (less than 10%) remaining in a relatively natural state, as per **Figure 2-2**. Noteworthy natural features and green spaces include:

The Don River west branch flows within a green belt including park land and naturalized areas within the river valley and valley side-walls, and this is the most notable natural features and natural corridors within the study area. Three tributaries converge to become the West Don River to the north of Langstaff Road;

Westminster Creek, a tributary to the West Don River, flows north-to-south and crosses Langstaff Road approximately 200 meters west of Dufferin Street, following a channelized route in a narrow green belt;

There is a larger woodlot, approximately 10 hectares in size, located on the northeast corner of the intersection of Langstaff Road and Dufferin Street, containing a wetland area and the source of a permanent flowing but small creek, as well as a large wet storm water management pond to the east of this wood lot;

Black Creek, a tributary to the Humber River, flows through the EA study area and crosses Langstaff Road within the existing interchange at Highway 400. The Black Creek corridor has been channelized throughout much of the EA corridor; and

Otherwise there are isolated natural areas and green spaces including storm water management facilities, as well as a park with sports fields (Leparc Park) on the south side of Langstaff Road, approximately 800 meters west of Dufferin Street.

Don River West Branch:

The Don River West Branch flows in a south-southeasterly direction towards Lake Ontario and crosses Langstaff Road approximately 250 meters east of Keele Street. The West Don river valley is classified as a Greenbelt Urban River Valley, as per the Ontario Provincial Greenbelt Act. The West Don River has its headwaters atop the Oak Ridges Moraine, specifically, the Maple Spur, approximately eight kilometers north-northwest of the study area. There are a number of small tributaries to the West Don River within the study area, including:

Westminster Creek: A small and mainly channelized warm water creek which flows north to south and crosses Langstaff Road approximately 300 meters west of Dufferin Street;

Three small warm water tributaries south of Langstaff Road at the CN MacMillian Yard;

Numerous small and short distance warm water tributaries; and

As per **Figure 2-2**, the West Don River, and all of these tributaries, within the Langstaff EA study area, are classified as warm water fisheries, with the exception of a small tributary to the West Don River in the vicinity of Rutherford Road and Jane Street. Additional information regarding watershed characteristics of the West Don River are provided in TRCA (2009a).

Black Creek:

Black Creek, a tributary to the Humber River, flows through the western portion of the study area, in a north to south direction. The headwaters for Black Creek are northwest of the intersection of Rutherford Road and Weston Road, in areas now under residential development. Black Creek flows through a mainly channelized corridor south-southeast through the study area, however certain reaches have been re-naturalized. Black Creek crosses Langstaff Road within the existing interchange with Highway 400, whereby the creek flows through a wide ditch with wetland vegetation (cattails). As per Figure 2-2, Black Creek is indicated to be a warm water creek within the Langstaff EA study area. The drainage divide

between Black Creek (Humber River Watershed) and the West Don River (Don River Watershed) lies within the CN McMillan Rail Classification Yards.

Additionally, there are some more notable storm water management facilities in the study area including:

- A storm water management pond within the northwest interchange loop at the Bass Pro Mills Drive and Highway 400 interchange;
- Two storm water management ponds along Black Creek northwest of the existing interchange of Highway 400 and Langstaff Road;
- A storm water management pond east of Highway 400, approximately 500 meters north of Langstaff Road, and southwest of Four Valley Drive;
- Two storm water management ponds on the west side of the CN McMillan Yard, including one east of Creditstone Road, approximately 1,500 m north of Langstaff Road, and one east of the industrial buildings on the east side of Creditstone road, approximately 500 meters south of Langstaff Road; and
- A large pond north of Langstaff Road, approximately 250 meters east of Dufferin Street.

The Kleinburg Woodlots, Humber River Valley-Kleinburg and Boyd Conservation Area and Adjacent Lands Areas of Natural and Scientific Interest are located to the northwest of the study area. The Baker's Woods Area of Natural and Scientific Interest is located to the east of the study area. A number of small provincially significant and non-evaluated wetlands are located at the edge and beyond the study area. All natural features are shown on attached Figure 2-2.

The Toronto and Region Conservation Authority (TRCA) (2009b) has identified the following priorities for natural regeneration and flood control in the Upper West Don River:

- Whitebelt development potential north of Teston Road – the TRCA regards this as the last opportunity for state of the art greenfield development within the West Don River Watershed;
- There is a high concentration of existing industrial and commercial land uses, which presents the opportunity to explore regeneration within these land uses;
- Storm water management infrastructure is generally lacking south of Rutherford Road within the West Don River watershed;
- Flood vulnerable areas in Fisherville Creek, Westminster Creek and industrial lands north of Highway 7 and east of Keele Street;
- High erosion risk on West Don River tributaries south and east of the CN McMillan Yard;
- The Upper West Don River watershed contains half of the watershed's higher quality terrestrial habitat and some of the best opportunity to add natural cover; and
- The whitebelt area (north of Teston Road) contains aquatic habitat supporting some of the few remaining aquatic species that are habitat specialists (i.e. Redside Dace).

Detailed mapping and photographs of these features are provided in **Appendix A**.

2.4 TOPOGRAPHY AND DRAINAGE

The Langstaff EA study area is relatively flat with a slight slope from north to south, towards Lake Ontario, with the exception of small incised valleys around the smaller rivers and creeks, most notably the West Don River. Ground elevations range from a high of 230 meters above mean sea level (m AMSL) to a low of 195 m AMSL, with a high on the north-central region of the study area. Topographic contours are shown on attached Figure 2-2. Drainage in the area is interpreted to generally be directed to storm sewers as the area is entirely urbanized, with the storm sewers outlets anticipated to be along the Don River west branch, Westminster Creek, or Black Creek.

The study area lies within the Peel Plain physiographic region, which consists of glaciolacustrine deposits draped over glacial till deposits (Chapman and Putnam, 2007, and TRCA (2009). The Peel Plain is a level to undulating area of silt and clay soils, where larger rivers and creeks have formed incised valleys. Ground elevations generally range from 150 to 250 m AMSL with a gradual slope towards Lake Ontario. In the vicinity of the study area, the clay soils associated with Lake Peel are draped over top of a drumlinized till plain, whereby the drumlins are oriented in a north-south direction, and have local relief of five to fifteen meters, forming gently rolling hills (Chapman and Putnam, 2007). Creeks and rivers have created incised valleys throughout the Peel Plain, the largest being the West Don River.

In the Site-vicinity, the Oak Ridges Moraine physiographic region is approximately five to ten kilometers to the north. The Oak Ridges Moraine consists of an area of hummocky upland topography, it is regionally the highest land elevation, and also the location where several rivers and creeks in the area have their headwaters, including the West Don River (Chapman and Putnam, 2007).

2.5 REGIONAL GEOLOGY

In summary, the geology in the area consists of the following as per the TRCA (2009c):

- Halton Till: 10 meter (m) thick aquitard composed of clayey silt till;
- Oak Ridges Moraine: 2 - 20 m thick aquifer composed of fining upwards gravel to sand to silt;
- Newmarket Till: 30 m thick aquitard composed of sandy silt;
- Thorncliffe Formation: 20 m thick aquifer composed of silty sand;
- Sunnybrook Drift: 20 m thick aquitard composed of silt and clay;
- Scarborough Formation: 60 m aquifer composed of silt and clay; and
- Upper Georgian Bay Formation: shale bedrock interbedded with lesser amounts of limestone.

The Toronto Region Source Protection Authority Assessment Report (2015) indicates that the surficial soil types consist mainly of clay and clay loam, in the study area.

As per the TRCA (2009c) geological overviews of both the Don River and Humber River watersheds, the typical geological sequence consists of earth fill (topsoil, underlain by engineered fill) of variable thickness followed by recent sediments, including alluvial deposits along river valleys, which are generally less than three meters thick. In tableland areas, the uppermost native geological unit is typically glaciolacustrine sediments associated with glacial Lake Peel, which is generally less than three meters thick. This unit is underlain by Halton Till with thickness of ten to fifteen meters. Next is the Oak Ridges Moraine Deposits, with approximate thickness of ten meters, followed by the Newmarket Till, which is ten to twenty-five meters thick. In select areas, tunnel channels were eroded into the Newmarket Till during times of glacial melt, and these tunnel channels were infilled by varying deposits of gravel, sand, silt, and clay. As per TRCA (2009c), such tunnel channel features are not known to be present beneath this study area.

Below the Newmarket Till, there are deeper overburden sediments, including the Thorncliffe Formation, Sunnybrook Drift, and the Scarborough Formation. The Thorncliffe Formation (sandy deposits transitioning downwards into finer deposits) is approximately ten to twenty meters thick. The Sunnybrook Drift (clayey silt glaciolacustrine deposits interbedded with glacial till) is ten to twenty meters thick. The Scarborough Formation (sandy deposits transiting downward into finer grained deposits) ranges from twenty to forty meters thick. The bedrock in the Site Vicinity consists of dark grey shale interbedded with lesser limestone seams and layers up to thirty centimeters thick, and consists of the Georgian Bay Formation, as per Hewitt, 1972.

The total depth of overburden sediments within the study area is approximately one hundred meters, whereby the total overburden thickness increases to up to 160 meters towards the north (Oak Ridges Moraine). Locally, the overburden is also thicker (up to 200 meters thick) atop buried bedrock valleys, including the Laurentian Bedrock Valley, as per The Toronto Region Source Protection Authority Assessment Report (2015). The Laurentian Bedrock Valley crosses under the western portion of the study area, trending north-south, and a smaller north-south trending bedrock valley has been found approximately 2 km to the east of the study area.

TRCA (2008 and 2009c) describes the overburden geology in detail, in descending order (shallowest to deepest).

- Due to urbanization, **it is interpreted that the near surface geology has generally been modified** throughout the study area, such that the native geological units have been graded, re-worked, or replaced by earth fill. Exceptions may include naturalized corridors, and agricultural lands or vacant fields where minimal grading has occurred.
- Where still present, the first native and widespread geological unit present at the ground surface in tableland areas is **glaciolacustrine deposits associated with glacial Lake Peel** consisting of fine sands, silt and clay.

- **Alluvial deposits** are interpreted to be present along river valleys and floodplains, and localized peat deposits may be present below wetland areas.
- **Halton Till** is interpreted to underlie the glaciolacustrine deposits throughout the area, and is composed of sandy silt to clayey silt till with local gravel, sand and clay deposits (TRCA, 2007 and 2009a).
- The **Oak Ridge Moraine Deposits** which consist of interbedded sands and silts along with coarse grained sand and heterogeneous gravel deposits of glaciofluvial origin (TRCA, 2007 and 2009a). The Oak Ridges Moraine deposits have variable thickness in the study area (generally around 10 meters, but up to 20 meters thick), and may be absent in select areas.
- Below the Oak Ridges Moraine deposits, there are **tunnel channel sediments** in select areas interpreted as deposits within glacial meltwater channels, incised into the underlying Newmarket Till. These glaciofluvial deposits may include both fine grained and coarse grained materials, and can be locally heterogeneous. Tunnel channel sediments are however not indicated to be in the study area (TRCA, 2009a).
- The **Newmarket Till**, which is composed of dense, poorly sorted calcite cemented sandy silt to silty sand till, with limestone clasts and stony sediments.
- The **Thorncliffe Formation** consists of sand and silty sand, of glaciolacustrine or glaciofluvial origins (TRCA, 2007 and 2009a), and includes finer grained lacustrine deposits, as well as clayey to sandy silt glacial tills in the lower portion.
- The **Sunnybrook Drift** is composed of silt and clay, with very limited larger clasts, and is interpreted to be of glaciolacustrine origin (TRCA, 2007 and 2009a).
- The deepest overburden deposit is the **Scarborough Formation**, which is composed of fluvial deltaic sand (channelized as a result of erosion of paleo-fluvial channels) overlying sand and clay lacustrine deposits, with occasional peat deposits (TRCA, 2007 and 2009a).
- The bedrock geology beneath the study area consists of Upper-Ordovician aged shale and carbonate sedimentary rocks, referred to as the Georgian Bay Formation (dark grey shale), as per (Hewitt, 1972).

The typical geological sequence may vary from location to location such that not all of these units may be encountered at any given location. Deeper ravines, including the East Don River, also have incised into the overburden geological sequence, up to approximately 20 meters, exposing the upper overburden units (generally Lake Peel sediments, Halton Till, and in some areas Oak Ridges Moraine sediments) in the valley side walls.

Surficial geology in the study area, as mapped by the Ontario Geological Survey consists of sandy silt till, clayey silt till, silt and clay, silty sand, modern alluvium and organic deposits, all of which is shown on **Figure**

2.1. These units represent expressions of the Lake Peel glaciolacustrine veneer, or where absent, either the Halton or Newmarket till sheets. Figure 2.1 also depicts alluvial sediments along river and creek valleys.

Appendix C includes excerpts from TRCA (2008) – Geology of the Humber River Watershed, and TRCA (2009c) – Geology of the Don River Watershed, and includes:

1. **Figure C-1** - **T**he generalized stratigraphic sequence in York Region south of the Oak Ridges Moraine, including the Langstaff Road Site-vicinity;
2. **Figure C-2** – Locations of geological cross sections through the Humber and Don River Watersheds as compiled by TRCA (2008) and (2009c) respectively;
3. **Figure C-3** – Cross section generally following the West Don River, which intersects the southern portion of the Study Area;
4. **Figure C-4** – Cross section along an alignment slightly south of Major Mackenzie Drive, which is approximately three kilometers north of the study area; and
5. **Figure C-5** – Cross section along the East Humber River, which comes within 3 km of the western margin of the study area.

Collectively, the cross sections by TRCA (2008 and 2009c) indicate that the total overburden thickness is greatest in the northern end of the Study Area (around 160 meters thick), and decreases to around a minimum of around 100 meters thick, within the Study Area. These figures also indicate the presence of a deep bedrock valley, infilled primarily with the Scarborough Formation sediments, within the study area. Generally, all the major geological units as outlined in this section are present throughout the Study Area.

2.5.1 SITE-SPECIFIC GEOLOGY

As per OGS 2011, the native surficial geology of study area is predominantly clay to silt till (Halton Till), with modern alluvial deposits along the Don River west branch. There is sandy silt till along the southern edge of the study area and pockets of silt and clay on the east and west sides of the study area, all as shown on Figure 2-4. It is noted that on September 21, 2017, there was work ongoing on the roadside ditch on the north side of Langstaff Road, approximately 200 meters west of Dufferin Street, and WSP observed the surficial geology, at the bottom of the ditch, where soils had been excavated, to consist of silty sand.

Utilizing MOECC water well record data, WSP prepared a geological cross-section of Langstaff Road across the CN MacMillan Rail Classification Yard, as provided in **Appendix D**. This cross section is considered a generalized interpretation, subject to the limitations of data quality of the MOECC well records, and it indicates the following trends:

- The ground surface varies in elevation from 200 to 212 m AMSL, lowest at the West Don River and highest around Jane Street. Langstaff Road also slowly climbs in elevation heading east

from the West Don River, to reach an elevation of approximately 210 m AMSL at Dufferin Street;

- Topsoil and earth fill deposits are present at the ground surface, with depths up to five meters deep, and locally greater in select areas. One such area includes within the valley of the West Don River, where earth fill and alluvial deposits were found to be up to eight meters deep;
- The Halton Till unit is interpreted to be present throughout the study area, with a thickness between five and ten meters, locally up to 15 meters;
- The Oak Ridges Moraine Aquifer Complex is present throughout the study area, with a variable thickness, ranging from two to more than 20 meters. This aquifer is interpreted to be thicker under the eastern portion of the Study Area. The top elevation of this aquifer is generally within the range of 195 to 202 m AMSL. As per TRCA (2009c), and also as interpreted from MOECC well record data, the composition of this aquifer is highly variable, ranging from sand and gravel to fine silty sand, even silty clay. TRCA (2009c) interprets that this aquifer formed on account of multiple glaciofluvial outwash flow events, resulting in a complex stratigraphy consisting of stacked channel fill deposits with fining upward sedimentary sequences;
- The top of the Oak Ridges Moraine aquifer is typically between 195 and 200 m AMSL, which is approximately five to 15 m BGS;
- **The groundwater level in the Oak Ridges Moraine Aquifer Complex is interpreted to be generally between 200 and 205 meters above sea level, or approximately five meters below the ground surface in most areas. The Oak Ridges Moraine Aquifer may be locally under artesian conditions with respect to the ground surface within the West Don River Valley, resulting in upward hydraulic gradients in this area;**
- The Newmarket Till unit is interpreted to underlie the Oak Ridges Moraine aquifer sediments, with a top elevation around 190 m AMSL between Weston Road and Keele Street, and then dropping to around 175 m AMSL around Dufferin Street;
- The Thorncliffe Aquifer is interpreted to be present, with a top elevation at approximately 150 to 155 m AMSL. Groundwater levels in this aquifer were found to range between 184 and 192 m AMSL, for wells completed into this aquifer; and
- One well penetrated through the deeper overburden units, and encountered shale bedrock at 119.3 m AMSL.
- WSP notes limitations on the accuracy of MOECC well record data, including but not limited to:
- Particularly for older water well records, the location information for the water well is very approximate;

- Ground surface elevations are interpreted using more recent ArcGIS online data for the location of well records;
- Geological logs on well records were recorded by water well drillers, and their ability to collect and observe soil samples while drilling is also subject to the drilling methods used. As such, the description of geological units encountered may be highly approximated as compared to information that would be obtained by trained geoscientists logging boreholes drilled using more precise soil coring methods; and
- Many older well records do not report the static groundwater level.

Additional geotechnical investigations will need to be undertaken during the detailed design phase of the project, to understand local geological conditions around areas where works and improvements are proposed.

2.6 REGIONAL HYDROGEOLOGY

There are four significant overburden aquifers within both watersheds as per the TRCA (2008 and 2009c) and they are as follows:

- Shallow Aquifer (localized sandy lenses in Lake Peel deposits or Halton Till, and weathered Halton Till);
- Oak Ridges Moraine Deposits;
- Thorncliffe Aquifer; and
- Scarborough Aquifer.
- The Georgian Bay Formation shale is interpreted to be a poor aquifer in the upper weathered portion and is seldom used as a water supply due to better well yields in overburden aquifers.

Localized shallow aquifers occur in deeper pockets of surficial sandy glaciolacustrine deposits as well as within localized sand lenses in the Halton Till, whereas the regionally extensive Oak Ridges Moraine Aquifer Complex occurs within the Oak Ridges Moraine deposits and the tunnel channels (TRCA, 2008 and 2009c). Shallow overburden groundwater water flow is generally horizontal (north to south according to the general topographic gradient in the region) and controlled by surface topography, noting that the Halton Till reduces vertical infiltration (TRCA, 2009c). This report however indicates that a limited amount of downward infiltration still occurs (50 to 100 mm/year) through the Halton Till, in the study area (**Appendix E Figure E-1**).

Groundwater water recharge rates are relatively low in the Peel Plain portion of the Humber and Don River watersheds, because of the mostly fine grained nature of these sediments, as well as the underlying fine grained Halton Till. Greater amounts of recharge occur in the northern limits of these watersheds, where the Oak Ridges Moraine outcrops (TRCA, 2008 and TRCA, 2009c), as well as other pockets of sandier

Lake Peel sediments, as shown in **Appendix E Figure E-1**. In naturalized areas and fields, net groundwater recharge rates are generally less than 100 mm/year in the Peel Plain portion of the Humber and Don River watersheds, as per the TRCA (2009c), and around 350 mm/year or greater on top of the Oak Ridges Moraine, where sandy deposits are present. Infiltration rates are generally reduced in urban areas due to impervious surfaces (rooftops and pavement).

Groundwater quality is reported as generally good but hard and in upper aquifers, and the water has been influenced by sodium and chloride (road salt use) and nitrate (fertilizer applications). In the lower aquifer systems (Thorncliffe and Scarborough Aquifers), there are naturally elevated concentrations of hardness, iron, manganese, total phosphorous, methane and chloride, whereas in the Oak Ridges Moraine aquifer, there are elevated concentrations of sodium, chloride, nitrate and occasionally methane (TRCA, 2009c).

Groundwater is widely used in the Upper Humber River watershed (TRCA, 2008) through private water supply wells, generally beyond the limits of urban areas with municipal water servicing. It is used at private residences for domestic use, agricultural purposes, commercial supply, industrial uses, livestock water supply and recreational purposes, including golf courses and sports field irrigation. In the Don River watershed (TRCA, 2009c), most of the watershed is now municipally serviced (water mains), such that only limited areas in the northern most portion are beyond municipal servicing. Therefore, over most of the watershed, groundwater is withdrawn primarily for remediation, dewatering, industrial and commercial use. Several golf courses have obtained a PTTW for groundwater or surface water use.

In the study area, municipal water is interpreted to be available to all buildings and developments, with very limited exceptions, which may include select older properties which did not connect, or kept their water well(s) for auxiliary uses.

As part of the Provincial Groundwater Monitoring Network, the Ontario Ministry of Environment and Climate Change (MOECC) has a monitoring well approximately 3.5 kilometers northwest of the study area. This well is 36 meters deep at a ground surface elevation of 206 meters above mean sea level, and the well is screened in a gravel in sand unit, interpreted to be the Thorncliffe Formation aquifer. Groundwater elevations have been monitored at this well between 2001 and 2010, as shown in the following **Figure 2-5.**

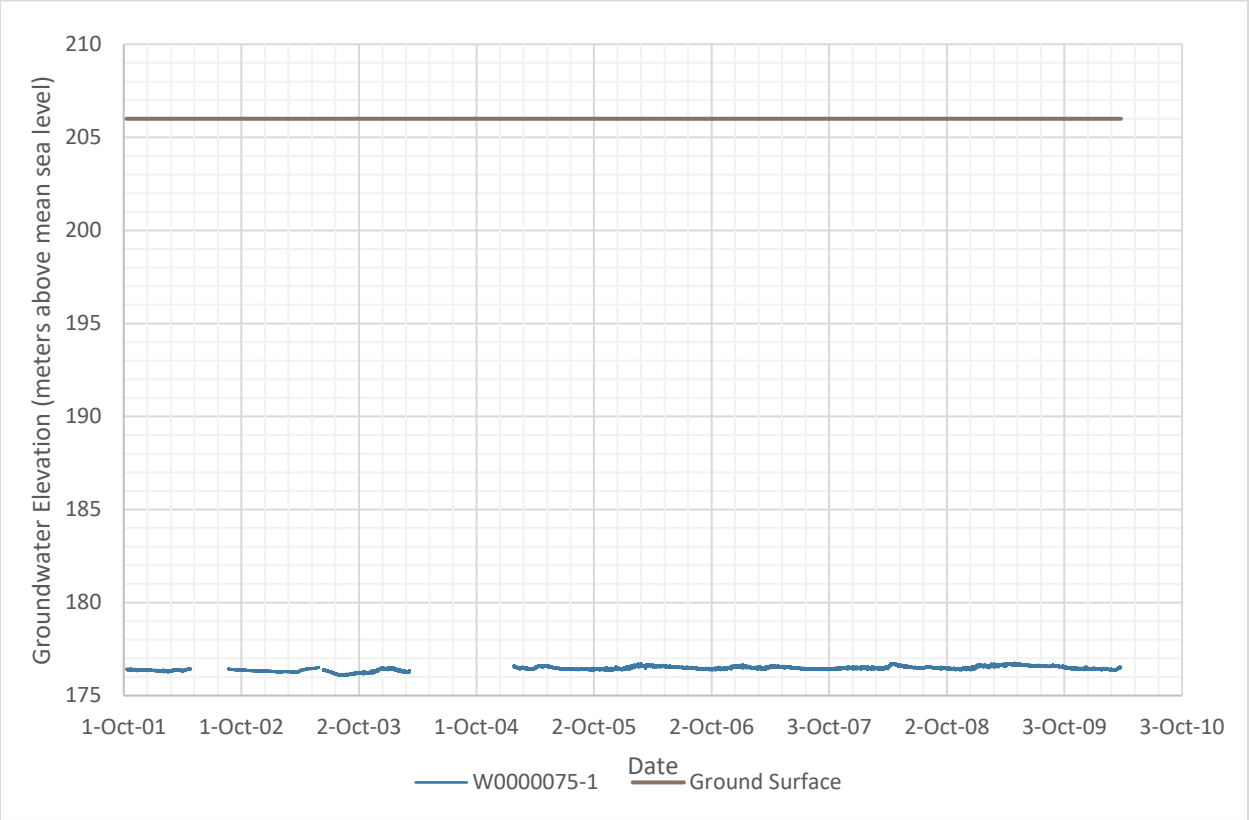

Figure 2-5: MOECC PGMN Well 75-1

As shown on the above figure the water level has remained very stable, only fluctuating within a one meter interval, approximately 30 meters below ground surface, over the course of ten years, with a maximum of 176.75 m AMSL and minimum of 176.09 m AMSL and an average of 176.45 m AMSL.

2.6.1 SITE-SPECIFIC HYDROGEOLOGY

WSP completed a review of all the MOECC water well records in the study area, which included 234 records (plus 10 duplicate records). The following summarizes the well uses:

- 122 groundwater monitoring wells;
- 50 records of wells being decommissioned;
- 29 wells with unreported uses;
- 15 domestic water supply wells (many likely to have been more recently decommissioned, as noted following this list);
- 8 wells for dewatering purposes (i.e. construction dewatering);
- 5 Agricultural water supply wells (for domestic and livestock watering), whereby most, if not all, are likely to have been more recently decommissioned, as noted following this list;
- 2 Industrial water supply wells;

- 1 commercial water supply well; and
- 1 unspecified water supply well.

WSP considers that most of the domestic and agricultural water supply wells in the study area have now been decommissioned, on account of more recent urban growth with municipal water servicing throughout the area, and given the fact that there is no longer any agricultural land use in the study area.

All water wells listed above were completed between 1956 and 2017. It is likely that there were even more domestic and agricultural water wells present, than what is reported in the MOECC well record database was established, due to wells constructed before the database was established, or wells never registered. As noted, these wells are interpreted to no longer be present. Well depth range from 3 meters to 93 meters, with a geometric mean of 8.2 meters. 49 wells are defined as overburden and 3 wells are defined as bedrock. 42 wells were classified as fresh water. Static water levels range from 0 to 26.8 meters or 183.4 to 214.45 m AMSL, with a geometric mean of 199.8 m AMSL. It is interpreted that the older water supply wells, originally drilled for rural residences and farms, have since been decommissioned, when more recent urban developments were built. A complete summary of MOECC well records is provided in **Table 2-1**.

As per **Section 2.5.1**, WSP constructed an interpreted geological and hydrogeological cross section along Langstaff Road, between Weston Road and Highway 7 (**Appendix D**). The principal regional aquifers are interpreted to be the Oak Ridges Moraine Aquifer Complex (generally 10-30 meters below ground surface), and the Thorncliffe Formation aquifer (45-55 meters below ground surface). There are also localized areas with sandy deposits at or near the ground surface, either associated with earth fill, alluvium (along the West Don River), or Lake Peel sediments, which may have localized perched aquifers. As per **Section 2.5.1**, the groundwater level in the Oak Ridges Moraine Aquifer is interpreted to be approximately five meters below ground surface in most areas, however may be locally under artesian conditions within the West Don River valley, resulting in upward hydraulic gradients in this area.

Additional hydrogeological investigations will need to be undertaken during the detailed design phase of the project, to understand local hydrogeological conditions around areas where works and improvements are proposed, including aquifer stratigraphy, groundwater levels, aquifer properties, and groundwater quality.

2.7 SOURCE WATER PROTECTION

The study area lies within the CTC (Credit Valley, Toronto and Region, Central Lake Ontario) Source Protection Region, specifically the Toronto and Region Source Protection Area (SPA). Key findings and recommendations from the Toronto and region SPA Assessment Report (2015) with respect to the study area include the following:

- Figure 3.2 indicates that annual precipitation is approximately 970 mm/year;

- Figure 3.5 indicates that a high amount of annual precipitation runs off (600-675 mm/year, or approximately 2/3 (67%) of total annual precipitation) due to the large amount of impervious surfaces (pavement, roof top, etc.);
- Figure 3.6 (also shown in **Appendix E-1**) indicates that average annual recharge is less than 100 mm/year, due to a combination of low permeable surficial geological units and a large amount of impervious surfaces (pavement, roof top, etc.);
- Figure 3.7 indicates that a limited amount of groundwater discharges to the West Don River and its tributaries in the Site-vicinity, but there is very little groundwater discharge to Black Creek;
- Figure 3.34 indicates that the West Don River is under moderate water use stress in the study area, with respect to surface water use, but not for groundwater use (Figure 3.36);
- Figure 3.44 indicates that the study area is within the area demarcated as WHPA Q1/Q2, indicating at least a moderate risk for land use changes and groundwater demand to impact water quantity in groundwater aquifers. Land use changes considered (urban developments in areas currently under rural or natural land uses) have the potential to impact groundwater recharge, and thus, groundwater quantity, if more areas with impervious surfaces (buildings, parking lots and paved areas) are constructed. It is noted however that the Langstaff Road EA study area is already heavily urbanized, with the exception of some remaining agricultural lands on the west side of Highway 400 and north of Bass Pro Mills Drive, and green belt lands as noted in **Section 2.3**; and
- As per **Section 2.3**, TRCA (2009b) wishes to encourage state-of-the-art green field development, incorporating low impact development practices, in the Upper West Don River watershed, to protect the natural and hydrogeological regime of the watershed. They also note that storm water management infrastructure is generally lacking south of Rutherford Road within the West Don River watershed. As per **Appendix B**, the City of Vaughan (Cole Engineering, June 2014) has identified numerous urban creek restoration and storm water management improvement opportunities within the general vicinity of the Langstaff Road study area, particularly along Black Creek and the West Don River.
- Parts of the site are also in areas defined as highly vulnerable aquifers.

As part of the detailed design for Langstaff Road improvements, the City of Vaughan and the TRCA should be consulted with respect to proposed urban creek restoration plans for re-naturalization and erosion mitigation, and storm water management improvements.

Relevant Source Water Protection figures are provided in **Appendix E** (Toronto and Region SPA Assessment Report, 2015).

As the site is within a WHPA-Q1/Q2 moderate risk area the following Policies (CTC Source Protection Committee, 2022) apply:

i. DEM-1: An activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body (MECP) Prescribed Instrument (Permit to Take Water Policies); MON-4
ii. DEM-2: An activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body (Planning Approval Authority) Land Use Planning (Planning Policies); MON-1
iii. DEM-3: An activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body (MMAH, MECP) Specify Action (Growth Management/Planning Ministries to Review Growth); MON-4
iv. DEM-4: An activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body (Municipality) Specify Action (Municipal Water Conservation Plans); MON-1
v. DEM-8: An activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body (MECP) Specify Action (MECP to Adopt and Fund Maintenance of the Tier 3 Water Budget Model); MON-4
vi. DEM-10: An activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body (Municipality) Specify Action; MON-1
vii. REC-1: An activity that reduces recharge to an aquifer (Planning Approval Authority) Land Use Planning (planning policies for Protecting Groundwater Recharge); MON-1

These policies must be considered during detailed design.

The following two Monitoring Policies apply:

1. MON-1 (Municipality): The municipality or planning approval authority shall, by February 1 of each year, prepare and submit a report equivalent to s. 65 of O. Reg. 287/07 under the Clean Water Act, 2006 to the Source Protection Authority on the actions taken in the previous calendar year to achieve the outcomes of the source protection policy. Where applicable, municipal planning authorities shall provide a copy of the notice of adoption of amendments to official plans and/or zoning by laws. Reporting shall include information related to the effectiveness of the policies in ensuring a threat ceases to be, or does not become significant, and any actions required to respond to a drinking water threat during the reporting period.
2. MON-4 (Provincial Ministry): The provincial ministry shall, by February 1 of each year, prepare and submit a report to the Source Protection Authority on the actions taken in the previous calendar year to achieve the outcomes of the source protection policy. Reporting shall include information related to the effectiveness of the policies in ensuring a threat ceases to be, or does not become significant, and any actions required to respond to a drinking water threat during the reporting period.

These above two monitoring policies must be adhered to during construction.

2.8 CONTAMINANT REVIEW (ERIS)

WSP obtained an ERIS database report on October 5, 2017 with a total of 3,532 records in the study area, it is noted that the study area of the ERIS report differs slightly from the study area of this report (as shown of page 354 of the ERIS report in **Appendix F**), as summarized in the following **Table 2-2** as well as a more detailed summary in **Table 2-3**.

Table 2-2: ERIS Records Summary

ID	DATABASE	NUMBER OF RECORDS
ANDR	Anderson's Waste Disposal Sites	2

ID	DATABASE	NUMBER OF RECORDS
AUWR	Automobile Wrecking & Supplies	4
BORE	Borehole	73
CA	Certificates of Approval	166
CFOT	Commercial Fuel Oil Tanks	1
CHEM	Chemical Register	3
CONV	Compliance and Convictions	1
EASR	Environmental Activity and Sector Registry	15
EBR	Environmental Registry	92
ECA	Environmental Compliance Approval	158
EHS	ERIS Historical Searches	190
EXP	List of TSSA Expired Facilities	139
FST	Fuel Storage Tank	20
FSTH	Fuel Storage Tank - Historic	14
GEN	Ontario Regulation 347 Waste Generators Summary	1442
HINC	TSSA Historic Incidents	4
INC	TSSA Incidents	9
NPCB	National PCB Inventory	15
NPRI	National Pollutant Release Inventory	210
OOGW	Ontario Oil and Gas Wells	1
OPCB	Inventory of PCB Storage Sites	5
PES	Pesticide Register	15
PINC	TSSA Pipeline Incidents	2
PRT	Private and Retail Fuel Storage Tanks	23
PTTW	Permit to Take Water	2
REC	Ontario Regulation 347 Waste Receivers Summary	21
RSC	Record of Site Condition	5
RST	Retail Fuel Storage Tanks	8
SCT	Scott's Manufacturing Directory	573
SPL	Ontario Spills	306
WDS	Waste Disposal Sites - MOE CA Inventory	13

WSP reviewed the report and completed a summary based on the following:

- Fuel Storage and Handling:
    - Includes all CFOT, EXP, FST, FSTH, PRT and RST database records.

- Spills and Releases:
    - Includes all SPL database records.
- Waste Disposal:
    - Includes all ANDR, AUWR, REC and WDS database records.
- Chemical Storage:
    - Includes all CHEM, NPCB, OPCB and PES database records.
- Regulatory Approvals:
    - Includes some CA, EASR, EBR and ECA database records and all CONV database records.
- Other:
    - Includes some HINC and INC database records and all OOGW database records.

A summary of properties and there applicable databases is provided in attached **Table 2-3,** along with distance to Langstaff Road within the study area. The locations of properties with identified environmental risks are shown in the attached **Figure 2-5**, and this figure also shows general land use within the study area. The complete ERIS database report is provided in **Appendix B**.

In summary, **within 200 meters of Langstaff Road, between Weston Road and Highway 7:**

- There are 14 properties with records of bulk storage and handling of fuels;
- There are 35 reported chemical spills;
- There are two records indicating waste receiving or waste disposal sites (one related to automobile wrecking, and one related to receiving hazardous waste);
- There are six properties where hazardous chemicals are stored or handled (five related to pesticides, and one related to polychlorinated biphenyls (PCBs);
- There are six properties with regulatory approvals, including Environmental Compliance Approvals (ECA) (3), Environmental Bill of Rights (EBR) (2), Certificates of Approval (CA) (2), and Environmental Activity Sector Registry (EASR) (1); and
- There are three properties with reported TSSA incidents, which involved underground pipeline leaks or accidental strikes.

Collectively, the ERIS database indicates that there are many potential locations of environmental concern along and near Langstaff Road, within the study area, which will require further environmental evaluation and investigation during the detailed design phase.

WSP (December 2017) completed a Contaminant Overview Study (COS) for this same study area, and evaluated many of these areas in greater detail, as well as existing and historical land uses.

2.9 CONTAMINANT OVERVIEW STUDY

WSP Canada Group Limited (December 2017) completed a Contaminant Overview Study along the alignment, in order to identify environmental risks with respect to soil and groundwater quality, referred to as areas of potential environmental concern (APEC). This report included review of old municipal records, old aerial photographs, obtaining and reviewing an environmental database report (ERIS), reviewing the MOECC's Brownfield Environmental Site Registry, Waste Disposal Site Inventory, and Federal Contaminated Site Inventory.

WSP (2017) identified a total of 73 areas of potential concern (APEC) ranking as high, and a further 16 ranking as moderate, within 250 meters of Langstaff Road, between Weston Road and Highway 7. Of the 73 APECs ranked as high, these locations include the following land uses: gas stations (active and historical), automotive centers, dry cleaners, industrial plazas, rail yards and rail lines, transport depots, historic cemeteries, and construction sites.

WSP (2017) classifies areas of **high potential concern** as areas correspond to locations where land uses consist of commercial/industrial operations that could impact soil and/or groundwater quality within the Study Area, according to Ontario Regulation 153/04, as amended.

MMM Group (2017) classifies areas of **moderate potential concern** as locations where land uses consist of commercial/light industrial operations, suspected of using chemical compounds of performing activities that could impact soil and/or groundwater quality within the Study Area, according to Ontario Regulation 153/04 as amended.

All other areas indicate land use features considered to have a low potential for site contamination. The areas are generally classified as natural areas, open space or residential land use, which are not suspected of using chemical compounds harmful to the environment or human health.

Selected figures from the WSP (December 2017) report are included in Appendix H. **As per Appendix H, most of the lands along Langstaff Road, in the industrialized area between Dufferin Street and Weston Road, including the CN MacMillan Rail Classification Yard, are ranked as high or moderate APEC.**

WSP (December 2017) provided the following recommendations for environmental management of soil and groundwater quality, including environmental due diligence:

1. With respect to **property acquisitions environmental due diligence**: For the purposes of undertaking the Langstaff Road improvements, if property acquisitions are required within APECs with high potential for contamination, it is recommended that property specific Phase One ESAs (and if necessary Phase Two ESAs) be completed in such areas in support of the property acquisitions.
2. With respect to **road construction and management of surplus/excess soil:** WSP recommends that a soil contaminant investigation, where excavations are proposed, be carried out by a qualified environmental consultant to assess soil quality in support of surplus/excess soil management in areas

within or in close proximity to APECs with high potential for contamination. This recommendation should be reviewed and refined during Detail Design.

3 GROUNDWATER ASSESSMENT

The following section evaluates potential ways which proposed works will affect groundwater resources, or where hydrogeological conditions are important considerations when planning and designing the proposed works, as per Section 1.0:

Hydrogeological Impacts (Construction Dewatering):

In order to widen Langstaff Road, improve and / or relocate buried municipal services, construct the proposed bridge structures and modify existing structures as noted, construction dewatering will or may be required, as per the following:

1. Construction dewatering is interpreted to be required for any grade separated crossing (bridge or tunnel structure) for Langstaff Road to cross the CN MacMillan Rail Classification Yard. If a road tunnel option is selected, substantial construction dewatering is interpreted to be required, due to the fact that the tunnel alignment will likely intersect with the Oak Ridges Moraine aquifer sediments, and the interpreted groundwater level in the Oak Ridges Moraine aquifer sediments is five to ten meters below the existing ground surface (Appendix D). Ongoing dewatering via active means (pumping) is also likely to be required once the tunnel structure is operational;
2. Construction dewatering is interpreted to be required for any grade separation work at the railroad crossing between Langstaff Road and the Metrolinx-Barrie GO track. If an underpass (subway) option is selected for Langstaff Road, higher amounts of construction dewatering may be required due to the fact that the subway may intersect with the Oak Ridges Moraine aquifer, and ongoing dewatering may be required (active pumping) once the structure is operational;
3. Construction dewatering is interpreted to be required while building bridge and culvert structures around creeks, which includes reconstruction of the Langstaff Road bridge over the West Don River, potential modification to the culvert at Westminster Creek, and potential modification to bridges and culverts spanning Black Creek around the Highway 400 interchange. Temporary creek diversions may be required during these works as well, particularly culvert works;
4. An existing creek flowing within the roadside ditch along the north side of Langstaff Road, from the intersection of Dufferin Street towards Westminster Creek, would likely need to be either relocated or re-routed through storm sewers, potentially requiring temporary construction dewatering as well as temporary flow diversion;
5. Construction dewatering is interpreted to be required to reconstruct, improve, or re-locate below-ground municipal services (sanitary sewers, sanitary force mains, water mains, and storm sewers); and
6. Additional works may require temporary construction dewatering (sign post foundations, or road cut excavations).

The proposed reconstruction and widening of Langstaff Road will require widening of the bridge crossings over the West Don River, and potentially the culvert crossings for Westminster Creek, and Black Creek. It may also involve encroachment into the woodlot and storm water management pond on the north side of Langstaff Road, east of Dufferin Street. This work will likely also require relocating an existing creek, currently flowing within the roadside ditch, from Dufferin Street towards Westminster Creek, as noted in Item #4 above. There are also isolated smaller wetlands alongside Langstaff Road, in the vicinity of Dufferin Street (on a property with an older residential home), as well as along Langstaff Road, east of the Langstaff Historical Cemetery, but west of the Metrolinx Barrie GO Railroad, in Langstaff Park. The West Don River, Westminster Creek, the identified tributary to Westminster Creek, as well as Black Creek, are all identified as warm water creeks (**Figure 2-2**). Work in or near watercourses will require appropriate fisheries timing restrictions for the protection of warm water fish, as directed by TRCA, as well as sediment and erosion control best management practices (BMPs) to ensure that soil and sediment-laden water does not enter watercourses and riparian areas alongside creeks.

As indicated, as part of the construction for the proposed road crossing, dewatering may be required during road and bridge construction, for below-grade excavations. Construction dewatering rates are likely to be low in glacial till and glaciolacustrine sediments, however higher dewatering rates will result where there are saturated lenses of coarser grained materials (localized shallow aquifers), or where excavations intercept more regionally continuous deeper aquifers, particularly the Oak Ridges Moraine Complex. Site-specific geotechnical investigations will be required to affirm construction dewatering requirements, with particular attention to determining if groundwater is under artesian conditions in aquifers beneath river valleys, such as the West Don River.

Review of the CTC Approved Source Protection Plan (December 2015) indicates that the section of Langstaff Road, between Weston Road and Highway 7, does not pass through any municipal wellhead protection areas (WHPA) or intake protection zones (IPZ), however it is within the well head protection area (WHPA) Q1/Q2 of moderate risk. This well head protection area has been established to protect groundwater recharge to regional aquifer units which are generally used as a source of groundwater.

Although it is interpreted that all properties in the area have municipal water and waste water servicing, there may be some properties with water supplies for auxiliary uses, particularly within the industrial lands, and potentially within the CN MacMillan Rail Classification Yard, which was constructed before municipal servicing existed. As such, **targeted door-to-door water well surveys should be undertaken during the detailed design phase in areas where construction dewatering is anticipated for proposed works.**

Additional site-specific geotechnical and hydrogeological investigations will be required once further design details have been developed, to confirm local area conditions.

Environmental Risks (Contaminant Overview):

The proposed proposed improvements on Langstaff Road may pass through areas where there are potential environmental concerns related to soil or groundwater quality, particularly near gasoline stations,

industrial buildings, warehouses, automotive service centers, or along railroad tracks and the CN MacMillan Rail Classification Yard. In addition, sodium adsorption ratios may be high within shallow soils along roadways, attributed to application of road salt for winter road maintenance. Best practices outlined in York Region's Winter Maintenance Program will be implemented.

More detailed and site-specific soil and groundwater quality investigations will be required at select locations, during the detailed design phase, as deemed necessary, to evaluate existing soil and groundwater quality conditions. This will be of particular importance around structures to be re-built, requiring substantial excavation and earth moving, as well as where lands must be expropriated for road widening.

Operational Considerations:

Widening of Langstaff Road, as proposed by York Region, will result in a larger paved area footprint, and therefore will result in increased runoff during storm events and decreased infiltration, in an area where creek erosion and storm water management is already a high concern (TRCA, 2009b and Cole Engineering, 2014). In particular for the section of Langstaff Road between Dufferin Street and Keele Street, widening of Langstaff Road may require replacement of the existing roadside ditches containing cattails (vegetated swale) with storm sewers, therefore resulting in faster movement of runoff water to natural watercourses (West Don River and Westminster Creek) as well as less natural filtration capacity. As such, enhanced storm water management measures need to be considered, in keeping with the City of Vaughan Storm Water Master Plan (Cole Engineering, 2014) and TRCA (2009b).

4 STANDARD LIMITATIONS

This Report was prepared for the Client, The Regional Municipality of York, in accordance with the professional services agreement, solely for their exclusive use to provide an assessment of current environmental conditions in association with the Site. The intended recipient is solely responsible for the disclosure of any information contained in this report. The content and opinions contained in the present report are based on the observations and/or information available to WSP at the time of preparation. If a third party makes use of, relies on, or makes decisions in accordance with this report, said third party is solely responsible for such use, reliance or decisions. WSP does not accept responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken by said third party based on this report. This limitations statement is considered an integral part of this report.

The Report summarizes WSP's review of available data in accordance with the principal components of the stated regulations, standards and guidelines and the scope, terms and conditions of the contract or proposal to which the Assignment was conducted. No other warranties are either expressed or implied with respect to the professional services provided under the terms of the contract or proposal and represented in this Report. Conditions may exist which were not detected given the nature of the inquiry WSP was retained to undertake with respect to the Site. Additional environmental studies and actions may be recommended.

The Report is based on data and information collected at the time of this Assessment, as stated in the Report. Site use or conditions change and the information and conclusions in the Report may no longer apply following the date of this Report. If any conditions become apparent that differ significantly from that presented in this Report, we request that we be notified to reassess the conclusions and recommendations provided herein. WSP disclaims any obligation to update this Report for conditions that may be identified after the date of this Report; however, WSP reserves the right to amend or supplement this report based on additional information, documentation or evidence.

In evaluating the Site, WSP has relied in good faith on information provided by others, as noted in the Report. WSP has assumed that the information provided is correct and WSP assumes no responsibility for the accuracy, completeness or workmanship of any such information.

The Report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings in the assessment.

The conclusions are based on the Site conditions observed by WSP at the time the work was performed and may include information obtained at specific testing and/or sampling locations. It is recognized that overall conditions can only be extrapolated to an undefined limited area around these testing and sampling locations. The conditions that WSP interprets to exist between testing and sampling points may differ from those that actually exist. The accuracy of any extrapolation and interpretation beyond the sampling locations will depend on natural conditions, the history of Site development and changes through construction and other activities. In addition, analysis has been carried out for the identified chemical and physical parameters only, and it should not be inferred that other chemical species or physical conditions are not present. WSP cannot warrant against undiscovered environmental liabilities or adverse impacts off-Site.

The conclusions presented in this Report are based on Work undertaken by trained professional and technical staff and the reasonable and professional interpretation of the information considered. Conclusions presented in this report should not be construed as legal advice. WSP makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in the Report, including, but not limited to, ownership of any property, or the application of any law to the findings of the Assessment.

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TABLES

TABLE 2.1
ONTARIO MINISTRY OF THE ENVIRONMENT AND CLIMATE CHANGE WELL RECORDS SUMMARY
HYDROGEOLOIGAL ASSESSMENT
LANGSTAFF ROAD CLASS ENVIRONMENTAL ASSESSMENT
BETWEEN WESTON ROAD AND HIGHWAY 7
REGIONAL MUNICIPALITY OF YORK

Well ID*	Date Completed	Ground Surface Elevation (m AMSL)	Well Depth (m BGS)	Well Use	Static Water Level (m BGS)	Static Groundwater Elevation (m AMSL)	Bedrock Elevation (m AMSL)	Well Type	Water Found at Depth (m BGS)	Water Found at Elevation (m AMSL)	Water Type
6906432	11-Sep-61	207.88	9.14	Domestic Water Supply	4.57	203.30		Overburden	7.92	199.95	Fresh
6906535	20-Jan-58	204.48	30.48	Domestic Water Supply	1.52	202.96		Overburden	30.48	174.00	Fresh
6906536	8-Feb-60	201.16	33.53	Domestic Water Supply	9.14	192.02		Overburden	33.53	167.64	Fresh
6906537	20-May-60	201.06	15.24	Domestic Water Supply	3.05	198.01		Overburden	13.72	187.34	Fresh
6906538	15-Jun-61	211.94	92.96	Monitoring			304	Bedrock			
6906539	15-Nov-62	207.70	59.74	Commercial Water Supply	15.24	192.46		Overburden	57.30	150.40	Fresh
6906540	7-Nov-59	214.32	20.12	Abandoned				Overburden			
6906541	18-Nov-60	214.22	12.19	Domestic & Livestock Water Supply	3.05	211.17		Overburden	4.57	209.64	Fresh
6906641	26-Oct-57	203.58	13.72	Domestic Water Supply	6.10	197.49		Overburden	13.41	190.17	Fresh
6906643	23-Aug-63	207.42	7.92	Domestic Water Supply	2.44	204.98		Overburden	5.49	201.93	Fresh
6906645	13-Jun-61	207.63	60.35	Monitoring			193	Bedrock			
6906646	4-Apr-62	211.40	63.09	Domestic & Livestock Water Supply	26.82	184.58		Overburden	57.30	154.10	Fresh
6906647	10-Oct-59	207.38	14.02	Domestic Water Supply	6.10	201.29		Overburden	14.02	193.36	Fresh
6906648	10-Jan-66	213.16	20.42	Domestic & Livestock Water Supply	6.10	207.07		Overburden	19.20	193.96	Fresh
6906650	6-Jun-62	215.21	24.69	Domestic & Livestock Water Supply	1.83	213.38		Overburden	21.34	193.87	Fresh
6906651	23-May-56	217.50	13.41	Domestic Water Supply	3.05	214.45		Overburden	13.41	204.08	Fresh
6906652	22-Jul-60	217.39	30.78	Domestic & Livestock Water Supply	6.71	210.69		Overburden	23.16	194.23	Fresh
6909672	12-Nov-69	217.97	88.09	Abandoned				Overburden			
6911177	2-Nov-72	218.23	12.80	Domestic Water Supply	4.88	213.36		Overburden	4.57	213.66	Fresh
6911209	29-May-72	202.00	9.14	Domestic Water Supply	3.35	198.65		Overburden	7.01	194.99	Fresh
6911695	11-Jul-73	204.37	55.17	Abandoned			170	Bedrock			
6913183	30-Apr-75	219.65	28.65	Domestic Water Supply	10.97	208.67		Overburden	25.91	193.74	Fresh
6913411	20-Aug-76	205.99	8.84	Domestic Water Supply	1.22	204.77		Overburden	7.01	198.97	
6914272	12-Oct-77	214.06	25.30	Domestic Water Supply	5.49	208.57		Overburden	23.77	190.28	
6916661	30-Jul-82	220.79	31.09	Monitoring	7.32	213.47		Overburden	18.29	202.50	Fresh
6917981	14-May-85	205.69	51.82	Industrial Water Supply	21.64	184.05		Overburden	43.59	162.11	Fresh
6917982	7-May-85	205.69	54.86	Industrial Water Supply	22.25	183.44		Overburden	45.11	160.58	Fresh
6919312	9-Jan-87	204.01	38.10	Domestic Water Supply	6.40	197.61		Overburden	28.96	175.06	Fresh
6921790	10-Sep-91	203.84	12.80	Domestic Water Supply	3.05	200.79		Overburden	3.05	200.79	
6925635	16-Oct-00	217.88		Abandoned							
6925636	16-Oct-00	218.23		Abandoned							
6925637	5-Oct-00	217.88		Abandoned							
6925638	5-Oct-00	217.39		Abandoned							
6926006	30-Jul-01	208.83		Abandoned							
6926819	9-Dec-02	209.37	15.54	Dewatering	6.40	202.97		Overburden	10.67	198.70	Fresh
6926820	9-Dec-02	209.37	28.65	Monitoring	6.71	202.66		Overburden			Fresh
6926822	21-Nov-02	204.09	28.35	Water Supply	4.88	199.22		Overburden			
6926823	5-Dec-02	209.37	28.65	Monitoring	5.79	203.58		Overburden	8.53	200.83	Fresh
6927166	20-May-03	208.39		Abandoned							
6927948	13-Jul-04	203.00		Monitoring							
6928214	26-Aug-04	205.01		Monitoring							
6928580	1-Oct-04	205.06		Monitoring							
6929203	4-Jul-05	216.38	6.10	Monitoring				Overburden	4.20	212.18	Fresh
6929280	29-Jul-05	200.01	6.10	Monitoring				Overburden	4.50	195.51	Fresh
6929282	28-Jul-05	206.80	6.10	Monitoring				Overburden	5.20	201.60	Fresh
6929356	16-Aug-05	205.78	3.10	Monitoring				Overburden			
6930427	3-Jul-06	211.58	8.00	Monitoring				Overburden	1.50	210.08	Fresh
6930458	27-Jun-06	201.58	6.00	Monitoring				Overburden	4.50	197.08	Fresh
6930635	25-Aug-06	204.65	5.50	Monitoring				Overburden			
6930790	13-Sep-06	205.78		Monitoring							
6930865	28-Jul-06	216.27	6.10	Monitoring				Overburden			
7040949	2-Feb-07	197.33	15.00	Dewatering				Overburden	1.00	196.33	Fresh
7042956	16-Mar-07	197.33	15.00	Abandoned				Overburden			
7046138	11-Jan-07	210.58	6.10	Monitoring							
7046392	13-May-07	206.18	7.60	Monitoring					3.00	203.18	Fresh
7048893	6-Jul-07	205.71	6.10	Monitoring					5.00	200.71	Fresh
7052448	4-Oct-07	197.95		Monitoring							
7053801	5-Nov-07	206.44	6.10	Monitoring							
7104053	19-Mar-08	211.83	4.50	Monitoring							
7104064	10-Mar-08	211.70	4.50	Monitoring							
7104268	31-Mar-08	207.95	5.80	Monitoring							
7107277	23-Nov-07	204.47	18.30	Dewatering					3.00	201.47	Fresh
7107278	7-Jan-08	204.47		Abandoned							
7108277	16-Apr-08	203.36	7.32	Monitoring							
7109046 (3)	11-Jul-08			Unknown							
7110198	5-Aug-08	206.90		Abandoned							
7112521 (6)	7-Aug-08		5.30	Monitoring	3.6			Overburden			
7115823	24-Oct-08	204.87	6.00	Monitoring	0.00	204.87					
7117914	14-Nov-08	204.56	5.18	Monitoring							
7120163 (11)	28-Jul-08		6.00	Monitoring				Overburden			
7120713	25-Feb-09	206.43	6.10	Monitoring							
7121188 (3)	10-Mar-09			Monitoring				Overburden	3.20		Fresh
7122812	6-Apr-09	200.21		Abandoned							
7122813	6-Apr-09	199.72		Abandoned							
7122814	6-Apr-09	199.58		Abandoned							
7122815	6-Apr-09	198.48		Abandoned							
7122816	6-Apr-09	197.95		Abandoned							
7122817	6-Apr-09	197.98		Abandoned							
7122818	6-Apr-09	198.01		Abandoned							
7122819	6-Apr-09	197.99		Abandoned							
7122820	6-Apr-09	198.17		Abandoned							
7122821	6-Apr-09	197.97		Abandoned							

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LANGSTAFF ROAD CLASS ENVIRONMENTAL ASSESSMENT
BETWEEN WESTON ROAD AND HIGHWAY 7
REGIONAL MUNICIPALITY OF YORK

Well ID*	Date Completed	Ground Surface Elevation (m AMSL)	Well Depth (m BGS)	Well Use	Static Water Level (m BGS)	Static Groundwater Elevation (m AMSL)	Bedrock Elevation (m AMSL)	Well Type	Water Found at Depth (m BGS)	Water Found at Elevation (m AMSL)	Water Type
7122822	6-Apr-09	198.19		Abandoned							
7123397	7-May-09	205.82		Abandoned							
7123461 (3)	9-Mar-09		6.00	Monitoring	1			Overburden	1.00		Fresh
7124252	6-Feb-09	208.00	38.10	Dewatering	20.42	187.58			28.35	179.65	Fresh
7124252	6-Feb-09	208.00	38.10	Dewatering	20.4216	187.578766			28.35	179.65	Fresh
7124253	20-Feb-09	208.01	41.45	Dewatering	23.16	184.84			31.70	176.31	Fresh
7124253	20-Feb-09	208.01	41.45	Dewatering	23.1648	184.844431			31.70	176.31	Fresh
7124253	20-Feb-09	208.01	41.45	Dewatering	23.16	184.84			31.70	176.31	Fresh
7124565	13-Feb-09	203.74	6.90	Monitoring					0.30	203.44	
7126915	29-May-09	204.34	4.57	Monitoring							
7126916	29-May-09	205.10		Abandoned							
7127323		219.08	4.88	Monitoring							
7132819	17-Sep-09	215.06	6.10	Monitoring							
7137075 (5)	11-Dec-09		4.60	Monitoring				Overburden			
7138889 (4)	10-Sep-09		7.62	Monitoring	2.4384			Overburden	2.44		Fresh
7141399	10-Feb-10	206.00	4.42	Monitoring							
7144431	11-Mar-10	206.03	6.40	Monitoring							
7144748	19-Apr-10	206.23	3.05	Abandoned							
7145155 (6)	21-May-10		5.18	Monitoring				Overburden			
7145291 (6)	7-May-10		4.88	Monitoring				Overburden			
7145960 (4)	27-May-10		5.90	Monitoring				Overburden			
7147795	3-Jun-10	206.12	4.57	Monitoring							
7148107	27-May-10	214.06	22.86	Abandoned	2.1336	211.929556					
7148971	30-Jun-10	203.74		Abandoned							
7154438	27-Oct-10		4.57	Monitoring							
7157634	30-Sep-10	207.78	5.79	Monitoring							
7160991	8-Mar-11	198.54	4.57	Monitoring							
7160992	3-Mar-11	199.32	4.57	Monitoring							
7162217	1-Apr-11	201.71	6.70	Monitoring					4.58	197.13	
7163839	12-May-11	206.34	7.62	Monitoring							
7163840	12-May-11	206.14	7.62	Monitoring							
7168095	27-Jul-11	215.95	10.67	Monitoring							
7168098	26-Jul-11	216.06	10.67	Monitoring							
7170665	24-Oct-11	204.45	3.35	Monitoring							
7170666	7-Oct-11	204.92	4.27	Monitoring							
7171238	6-Oct-11	205.25	4.57	Monitoring					1.07	204.18	
7172683	7-Jul-11	207.66	6.10	Monitoring							
7173805	6-Nov-11	198.08		Unknown							
7178272	9-Mar-11	197.75		Unknown							
7181227	13-Apr-12	210.27	6.10	Monitoring							
7181228	13-Apr-12	210.11	4.88	Monitoring							
7183384	26-Jun-12	206.12		Unknown							
7183698	11-May-12	198.17	4.57	Monitoring							
7183713	11-May-12	198.39	4.57	Monitoring							
7191043	22-Oct-12	214.09	6.71	Monitoring							
7191044	22-Oct-12	214.03	6.71	Monitoring							
7195509	19-Dec-12	207.89	4.57	Monitoring					2.44	205.45	
7195510	19-Dec-12	207.55	4.57	Monitoring					1.83	205.72	
7195511	19-Dec-12	207.27	4.57	Monitoring					1.83	205.44	
7195512	19-Dec-12	207.56	4.57	Monitoring					1.83	205.74	
7196445	2-Oct-12	209.01	4.57	Monitoring							
7205664	19-Jun-13	206.92	3.96	Unknown							
7207765	15-Nov-12	217.47	9.14	Monitoring					4.57	212.90	
7211324	11-Sep-13	206.12		Unknown							
7215936	31-Jan-14	216.35		Unknown							
7222940	11-Feb-10	206.04	6.10	Monitoring							
7223331	6-Jun-14	200.47	7.62	Monitoring							
7224121	16-Jul-14	205.70	4.57	Monitoring							
7224122	16-Jul-14	206.16	4.57	Monitoring							
7224123	16-Jul-14	206.37	4.57	Unknown							
7228303	28-Jul-14	204.66		Unknown							
7228631	22-May-14	206.63	6.10	Monitoring					3.35	203.28	
7228632	21-May-14	208.05	4.57	Monitoring					5.18	202.87	
7228633	21-May-14	207.02	6.10	Monitoring					3.35	203.67	
7239177	16-May-14	216.04		Unknown							
7246909	17-Jul-15	206.59	5.64	Monitoring							
7246910	17-Jul-15	203.72	5.33	Monitoring							
7246911	17-Jul-15	203.82	5.33	Monitoring							
7246912	17-Jul-15	206.46	5.64	Monitoring							
7246919		213.68	4.57	Monitoring							
7246920	13-Jul-15	214.00	5.79	Monitoring							
7246921	13-Jul-15	213.78	5.79	Monitoring							
7247625	18-Aug-15	210.10	5.20	Abandoned							
7247626	18-Aug-15	208.27	4.60	Abandoned							
7247627	18-Aug-15	209.64	7.60	Abandoned							
7247628	18-Aug-15	210.03	3.80	Abandoned							
7247629	18-Aug-15	210.00	4.90	Abandoned							
7247630	18-Aug-15	209.87	6.00	Abandoned							
7247631	18-Aug-15	209.93	4.90	Abandoned							
7247632	18-Aug-15	209.75	5.90	Abandoned							
7247633	18-Aug-15	209.40	3.70	Abandoned							
7247634	18-Aug-15	209.90	4.70	Abandoned							

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Well ID*	Date Completed	Ground Surface Elevation (m AMSL)	Well Depth (m BGS)	Well Use	Static Water Level (m BGS)	Static Groundwater Elevation (m AMSL)	Bedrock Elevation (m AMSL)	Well Type	Water Found at Depth (m BGS)	Water Found at Elevation (m AMSL)	Water Type
7247635	18-Aug-15	210.06	4.60	Abandoned							
7247636	18-Aug-15	209.93	5.30	Abandoned							
7247637	18-Aug-15	209.56	4.00	Unknown							
7247638	19-Aug-15	209.39	4.80	Unknown							
7247639	19-Aug-15	209.27	5.20	Abandoned							
7247640	19-Aug-15	207.04	6.10	Abandoned							
7247641	19-Aug-15	206.45	3.50	Abandoned							
7247642	19-Aug-15	205.07	4.50	Abandoned							
7247643	19-Aug-15	205.07	4.50	Abandoned							
7247644	19-Aug-15	210.12	4.90	Abandoned							
7247645	19-Aug-15	210.40		Abandoned							
7247646	19-Aug-15	210.27		Abandoned							
7249725	9-Jun-15	207.83	7.62	Monitoring							
7249726	9-Jun-15	210.15	7.62	Monitoring							
7256706	27-Nov-15	207.83	10.06	Monitoring							
7256723	30-Nov-15	205.94	6.10	Monitoring							
7256724	27-Nov-15	208.06	7.62	Monitoring							
7256725	27-Nov-15	207.06	6.10	Monitoring							
7256727	24-Nov-15	207.13	6.10	Monitoring							
7256728	24-Nov-15	207.52	7.62	Monitoring							
7256729	26-Nov-15	207.78	6.10	Monitoring							
7256730	26-Nov-15	207.52	6.10	Monitoring							
7257950	8-Jan-16	210.03	4.57	Monitoring							
7258820	31-Aug-15	203.86		Monitoring					6.10	197.76	
7258821	31-Aug-15	204.90		Monitoring					6.10	198.80	
7258822	31-Aug-15	204.78		Monitoring					6.10	198.68	
7258823	31-Aug-15	202.54		Monitoring					6.10	196.44	
7258824	31-Aug-15	204.59		Monitoring					6.10	198.50	
7258825	31-Aug-15	203.20		Monitoring					6.10	197.10	
7258826	31-Aug-15	206.00		Monitoring					6.10	199.90	
7258827	31-Aug-15	204.14		Monitoring					6.10	198.05	
7259800	30-Nov-15	218.05	6.10	Monitoring					5.10	212.95	Fresh
7262460	2-Oct-15	208.01		Unknown							
7262703	12-Apr-16	207.32	6.00	Monitoring							
7262704	12-Apr-16	206.30	5.70	Monitoring							
7262705	12-Apr-16	205.96	5.70	Monitoring							
7262706	11-Apr-16	204.87	5.10	Monitoring							
7262707	11-Apr-16	208.11	7.30	Monitoring							
7262708	11-Apr-16	207.82	7.30	Monitoring							
7262839	22-Jan-16	202.86		Unknown							
7262840	22-Jan-16	202.86		Unknown							
7262841	20-Jan-16	204.64		Unknown							
7264365	10-May-16	207.77		Abandoned					2.34	205.43	
7264366	10-May-16	210.16		Abandoned					1.20	208.96	
7264844	17-May-16	207.98	5.79	Monitoring							
7264845	17-May-16	207.86	7.62	Monitoring							
7264846	17-May-16	207.55	6.10	Monitoring							
7265891	10-Jun-16	202.10	6.10	Monitoring							
7265926	10-Jun-16	202.99	6.10	Monitoring							
7265927	10-Jun-16	202.31	5.49	Monitoring							
7265928	10-Jun-16	202.23	6.10	Monitoring							
7267231	3-Feb-14	218.60		Unknown							
7268234		217.70		Unknown							
7270635	15-May-15	217.78		Unknown							
7270637	16-Feb-16	217.33		Unknown							
7270759	25-Apr-16	211.80		Unknown							
7271390	18-Dec-15	216.10		Unknown							
7271770		218.14		Unknown							
7272094	17-Aug-16	209.91	7.32	Monitoring							
7272095	17-Aug-16	209.93	7.32	Monitoring							
7272413	26-May-16	217.15	3.96	Monitoring					2.74	214.40	
7275767		210.02		Unknown							
7281068	19-Jan-17	207.99	6.00	Monitoring							
7281069	19-Jan-17	208.03	10.00	Monitoring							
7283661		211.76		Unknown							
7284555	11-Jan-17	209.98		Unknown							
7285848	3-Mar-17	216.54		Unknown							
7286165	13-Apr-17	214.00		Unknown							
7288995	29-Jul-16	218.30		Unknown							

Notes:
Well ID for one well record unless otherwise noted in brackets.
m AMSL - meters above mean sea level
m BGS - meters below ground surface

TABLE 2-3
ENVIRONMENTAL RISK INFORMATION SYSTEM PROPERTY SUMMARY
HYDROGEOLOIGAL ASSESSMENT
LANGSTAFF ROAD CLASS ENVIRONMENTAL ASSESSMENT
BETWEEN WESTON ROAD AND HIGHWAY 7
REGIONAL MUNICIPALITY OF YORK

Property with ERIS recoRd.s	ERIS Records	Distance from Langstaff Road
Fuel Storage and Handling		
61 Adminstration Rd (CN MacMillan Yard).	1 PRT	<1,500 - Location not well defined.
61/62 Adminstration Rd.	5 EXP	1,000
62 Adminstration Rd.	1 FST & 1 PRT	1,000
681 Chrislea Dr.	4 FST & 2 FSTH	100
147 Citation Dr.	1 RST	400
15 Connie Cres.	5 EXP, 4 FST, 1 FSTH & 5 PRT	100
69 Connie Cres.	11 EXP & 1 PRT	300
391 Creditstone Rd.	21 EXP & 4 PRT	1,700
767 Creditstone Rd.	2 EXP & 1 PRT	600
8400 Jane St.	11 EXP, 1 FSTH, 1 PRT & 1 RST	100
7900 Keele St.	1 EXP & 1 PRT	1,400
8470 Keele St.	14 EXP, 3 PRT & 1 RST	100
8474 Keele St.	6 EXP	50
8484 Keele St.	7 EXP & 1 PRT	50
8540 Keele St.	1 RST	100
8550 Keele St.	7 EXP & 1 PRT	200
8555 Keele St.	18 EXP, 4 FST, 2 FSTH, 1 PRT & 2 RST	25
8575 Keele St.	1 RST	100
8672 Keele St.	1 RST	550
8820 Keele St.	30 EXP, 2 FSTH & 1 PRT	800
2777 Langstaff Rd.	1 CFOT, 2 FST, 2 FSTH & 1 PRT	50
3680 Langstaff Rd.	5 FST & 2 FSTH	50
Canadian National Railroad MacMillan Yard	2 FSTH	<1,500 - Location not well defined.
21 Staffern Dr.	1 EXP	50
Spills and Releases		
1 Administration Rd.	99 SPL	<1,500 - Location not well defined.
61 Administration Dr.	1 SPL	<1,500 - Location not well defined.
140 Applewood Cres.	1 SPL	180
330 Applewood Cres.	1 SPL	250
222 Bellview Ave.	1 SPL	160
45 Basaltic Rd.	1 SPL	50
60 Basaltic Rd.	1 SPL	200
Bowes Rd. & Keele St.	2 SPL	425
751 Bowes Rd.	3 SPL	400
571 Chrislea Rd.	1 SPL	500
91 Citation Dr.	2 SPL	100
15 Connie Cres.	1 SPL	100
69 Connie Cres.	1 SPL	300
124 Connie Cres	1 SPL	250
345 Courtland Ave.	1 SPL	100
Creditstone Rd. & Langstaff Rd.	2 SPL	0
Creditstone Rd. & Pippin Rd. to Hwy 7 & Hwy 400	1 SPL	500
391 Creditstone Rd.	9 SPL	1,700
395 Creditstone Rd.	1 SPL	1,600
619 Creditstone Rd.	1 SPL	1,000
989 Creditstone Ave.	1 SPL	300
1201 Creditstone Rd.	1 SPL	400
221 Creditview Rd.	1 SPL	600
Dufferin St & Langstaff Rd.	4 SPL	0
830 Edgeley Blvd.	1 SPL	450
960 Edgeley Blvd.	1 SPL	840
140 Fernstaff Ct	1 SPL	100
71 Four Valley Dr	2 SPL	580
1200 Hwy 7 W	2 SPL	1,800
Hwy 400 & Rutherford Rd.	5 SPL	2,000
Jane St. and Langstaff Rd.	3 SPL	0
8400 Jane St.	1 SPL	100
8520 Jane St.	1 SPL	100
8540 Jane St.	1 SPL	400
Keele St. & Langstaff Rd.	2 SPL	0
7900 Keele St.	3 SPL	1,400
8200 Keele St.	17 SPL	725
8470 Keele St.	5 SPL	100
8484 Keele St.	1 SPL	50
8500 Keele St.	2 SPL	0
8540 Keele St.	1 SPL	50
8555 Keele St.	1 SPL	25
8600 Keele St.	2 SPL	400
8820 Keele St.	27 SPL	800
9020 Keele St.	1 SPL	1,400
9030 Keele St.	1 SPL	1,500
2800 Langstaff	1 SPL	25
3310 Langstaff Rd.	1 SPL	25
3600 Langstaff Rd.	1 SPL	25
3680 Langstaff Rd.	1 SPL	25
Canadian National Railroad Macmillan Yard	64 SPL	<1,500 - Location not well defined.
655 Millway Ave.	2 SPL	150
Pikaka Crt.	1 SPL	2,200
10 Planchet Rd.	2 SPL	50
25 Planchet Rd.	1 SPL	25
70 Planchet Rd.	1 SPL	200
20 N Rivermede Rd.	1 SPL	650
3300 RutherfoRd. Rd.	4 SPL	180
30 Saramia Cres.	1 SPL	150
60 Saramia Cres.	1 SPL	150
800 Tesma Way	1 SPL	1,700
80 Tigi Crt.	2 SPL	1,700
31 Westcreek Dr.	1 SPL	260
8401 Weston Rd.	1 SPL	50

TABLE 2-3
ENVIRONMENTAL RISK INFORMATION SYSTEM PROPERTY SUMMARY
HYDROGEOLOIGAL ASSESSMENT
LANGSTAFF ROAD CLASS ENVIRONMENTAL ASSESSMENT
BETWEEN WESTON ROAD AND HIGHWAY 7
REGIONAL MUNICIPALITY OF YORK

Property with ERIS recoRd.s	ERIS Records	Distance from Langstaff Road
Waste Disposal		
55 Administration Dr.	2 AUWR	1,000
36 Basaltic Rd.	2 AUWR and 4 REC	180
750 Bowes Rd.	3 REC and 1 WDS	500
69 Connie Cres.	2 REC	300
Keele St.	3 REC	<1,500 - Location not well defined.
7900 Keele St.	1 REC	1,400
8200 Keele St.	8 REC and 8 WDS	725
130 McCleary Crt.	4 WDS	1,800
8841 Weston Rd.	2 ANDR	1,000
Chemical Storage		
55 Administration Dr.	2 CHEM	1,500
147 Bourbon St.	1 PES	100
15 Connie Cres.	3 PES	100
69 Connie Cres.	2 NPCB and 2 OPCB	300
140 Fernstaff Crt.	2 PES	100
7900 Keele St.	4 NPCB and 2 OPCB	1,400
8200 Keele St.	4 NPCB and 1 OPCB	725
8300 Keele St.	4 NPCB	600
8540 Keele St.	5 PES	50
8500 Keele St.	1 NPCB	0
46 Ledge Rock Dr.	1 PES	2,200
23 McCleary Crt.	1 CHEM	1,900
8401 Weston Rd.	2 PES	50
8955 Weston Rd.	1 PES	1,500
Regulatory Approvals		
1 Administration Rd.	4 ECA	1,500
1 Bass Pro Mills Dr.	1 ECA	1,200
750 Bowes Rd.	2 CA and 2 ECA	300
700 Chrislea Rd.	1 EASR	300
321 Courtland Ave.	7 ECA	50
989 Creditstone Rd.	1 CA and 1 ECA	300
221 Creditview Rd.	1 CA and 1 ECA	600
661 Crislea Rd.	1 EBR	100
50 Four Valley Dr.	3 ECA	600
7880 Keele St.	3 CA, 3 ECA, and 2 PTTW	1,400
8100 Keele St.	1 CA	1,100
8200 Keele St.	1 CA	725
8300 Keele St.	1 EBR	50
8540 Keele St.	1 CA, 2 EASR and1 ECA	25
8555 Keele St.	1 ECA	25
8820 Keele St.	1 CONV, 1 EBR and 1 ECA	800
665 Millway Ave.	2 CA and 2 ECA	50
20 N Rivermede Rd.	1 EASR	650
600 Tesma Way	1 ECA	1,800
800 Tesma Way	1 ECA	1,800
65 Tigi Crt.	1 ECA	1,700
8955 Weston Rd.	1 CA	1,500
Other		
61 Administration Rd.	1 INC	<1,500 - Location not well defined.
8400 Jane St.	1 HINC	100
1681 Langstaff Rd.	1 HINC	25
2180 Langstaff Rd.	1 OOGW	25

Notes:

ANDR: Anderson's Waste Disposal Sites; AUWR: Automobile Wrecking & Supplies; CA: Certificates of Approval; CFOT: Commercial Fuel Oil Tanks; CHEM: Chemical Register; CONV: Compliance and Convictions; CPU: Certificates of Property Use; EASR: Environmental Activity and Sector Registry; EBR: Environmental Registry; ECA: Environmental Compliance Approval; EXP: List of TSSA Expired Facilities; FST: Fuel Storage Tank; FSTH: Fuel Storage Tank - Historic; GEN: Ontario Regulation 347 Waste Generators Summary; HINC: TSSA Historic Incidents; INC: TSSA Incidents; NCPL: Non-Compliance Reports; NEES: National Environmental Emergencies System; NPCB: National PCB Inventory; NPRI: National Pollutant Release Inventory; OOGW: Ontario Oil and Gas Well RecoRd.; OPCB: Ontario Inventory of PCB Storage Sites; PES: Pesticide Register; PINC: TSSA Pipeline Incidents; PRT: Private and Retail Fuel Storage Tanks; PTTW: Permit-to-Take-Water; REC: Ontario Regulation 347 Waste Receivers Summary; RSC: RecoRd. of Site Condition; RST: Retail Fuel Storage Tank; SCT: Scott's Manufacturing Directory; SPL: Ontario Spills; VAR: TSSA Variances for Abandonment of Underground Storage Tanks; WDS: Waste Disposal Sites - MOE CA Inventory; WDSH: Waste Disposal Sites - MOE 1991 Historical Approval Inventory.

FIGURES

REFERENCE
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http://www.bing.com/maps
Projection: UTM Zone 17N Datum: NAD 83

0 0.5 1 1.5 2 Kilometers

Scale: As Shown

HYDROGEOLOGICAL ASSESSMENT
LANGSTAFF ROAD SCHEDULE "C" MUNICIPAL CLASS ENIRONMENTAL ASSESSMENT
VAUGHAN, ONTARIO

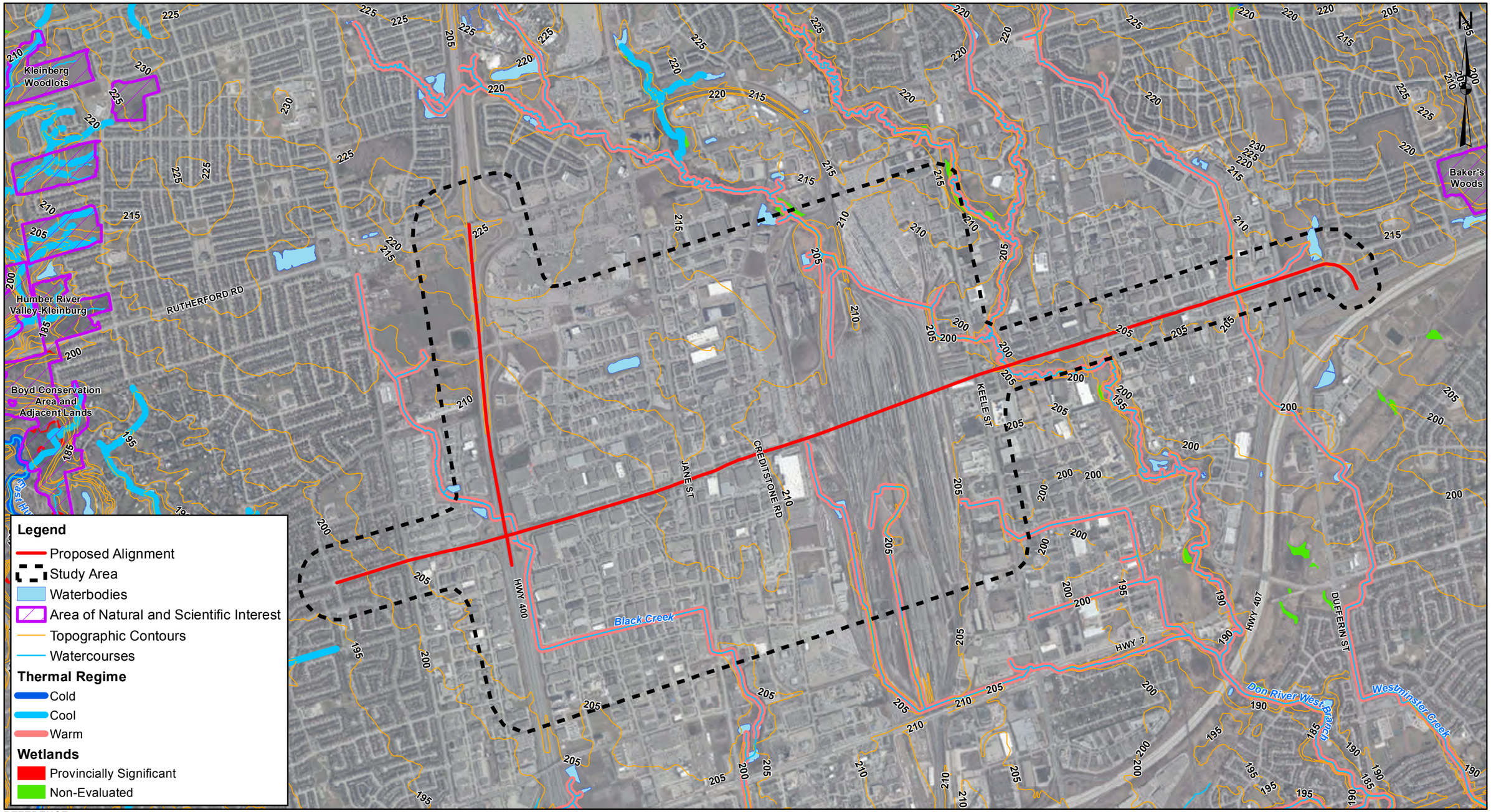
SITE LOCATION

DATE: DECEMBER 2017

PROJECT: 16M-01457-01

FIGURE 1-1

I:\EngSoftware\2016\32\3216079\I&E\Env Mgmt\ARC\MXD\HG Study\Figure 1-1 Site Location.mxd



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Projection: UTM Zone 17N Datum: NAD 83

0 0.5 1 1.5 2 Kilometers

Scale: As Shown

HYDROGEOLOGICAL ASSESSMENT
LANGSTAFF ROAD SCHEDULE "C" MUNICIPAL CLASS ENIRONMENTAL ASSESSMENT
VAUGHAN, ONTARIO

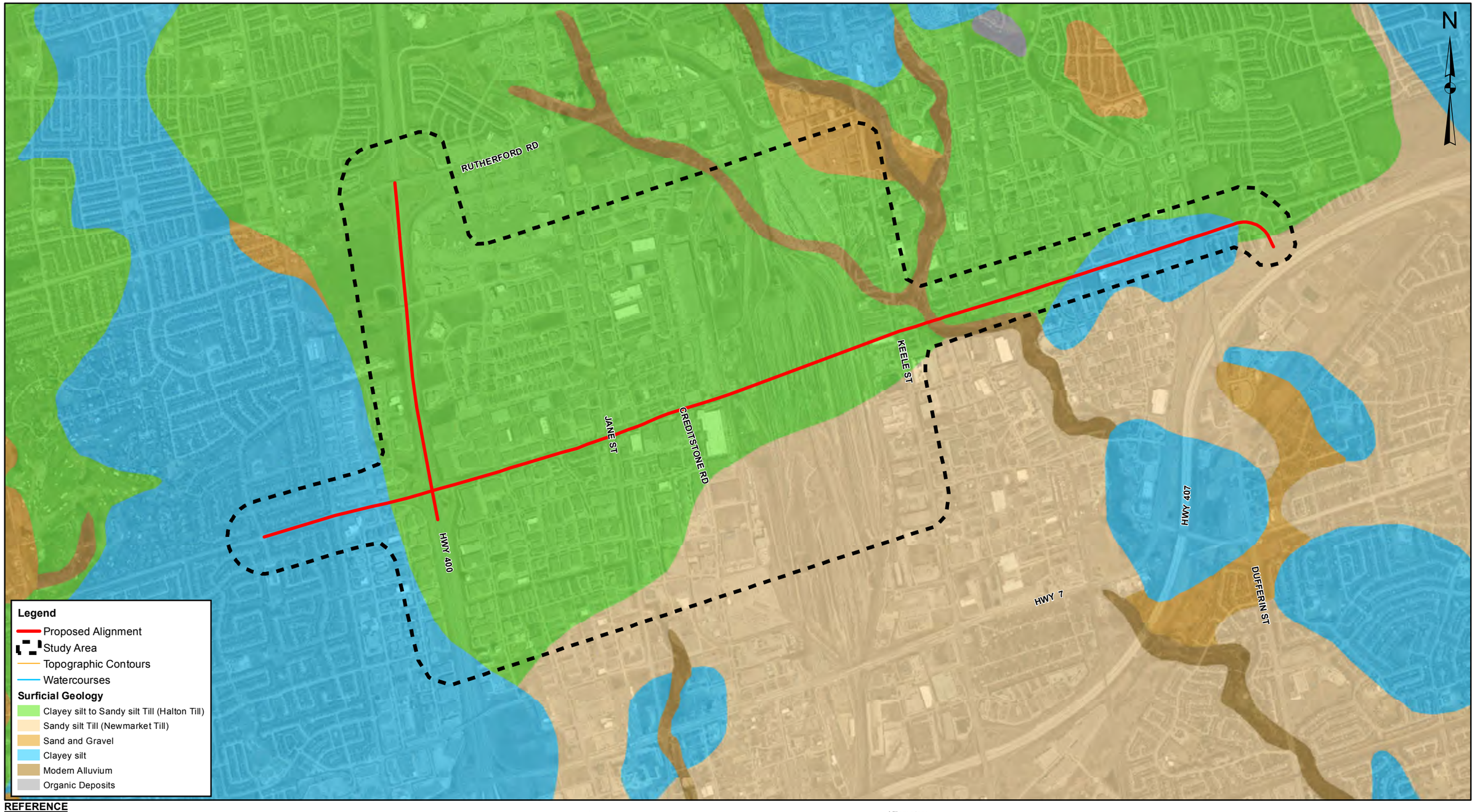
NATURAL FEATURES

DATE: DECEMBER 2017

PROJECT: 16M-01457-01

FIGURE 2-2

I:\EngSoftware\2016\32\3216079\I&E\Env Mgmt\ARC\MXD\HG Study\Figure 2-2 Natural Features.mxd



REFERENCE
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Projection: UTM Zone 17N Datum: NAD 83

Scale: As Shown

HYDROGEOLOGICAL ASSESSMENT
LANGSTAFF ROAD SCHEDULE "C" MUNICIPAL CLASS ENIRONMENTAL ASSESSMENT
VAUGHAN, ONTARIO

SURFICIAL GEOLOGY

DATE: DECEMBER 2017

PROJECT: 16M-01457-01

FIGURE 2-3

I:\EngSoftware\2016\32\3216079\I&E\Env Mgmt\ARC\MXD\HG Study\Figure 2-3 Surficial_Geology.mxd

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Projection: UTM Zone 17N Datum: NAD 83

0 0.5 1 1.5 2 Kilometers

Scale: As Shown

HYDROGEOLOGICAL ASSESSMENT
LANGSTAFF ROAD SCHEDULE "C" MUNICIPAL CLASS ENIRONMENTAL ASSESSMENT
VAUGHAN, ONTARIO

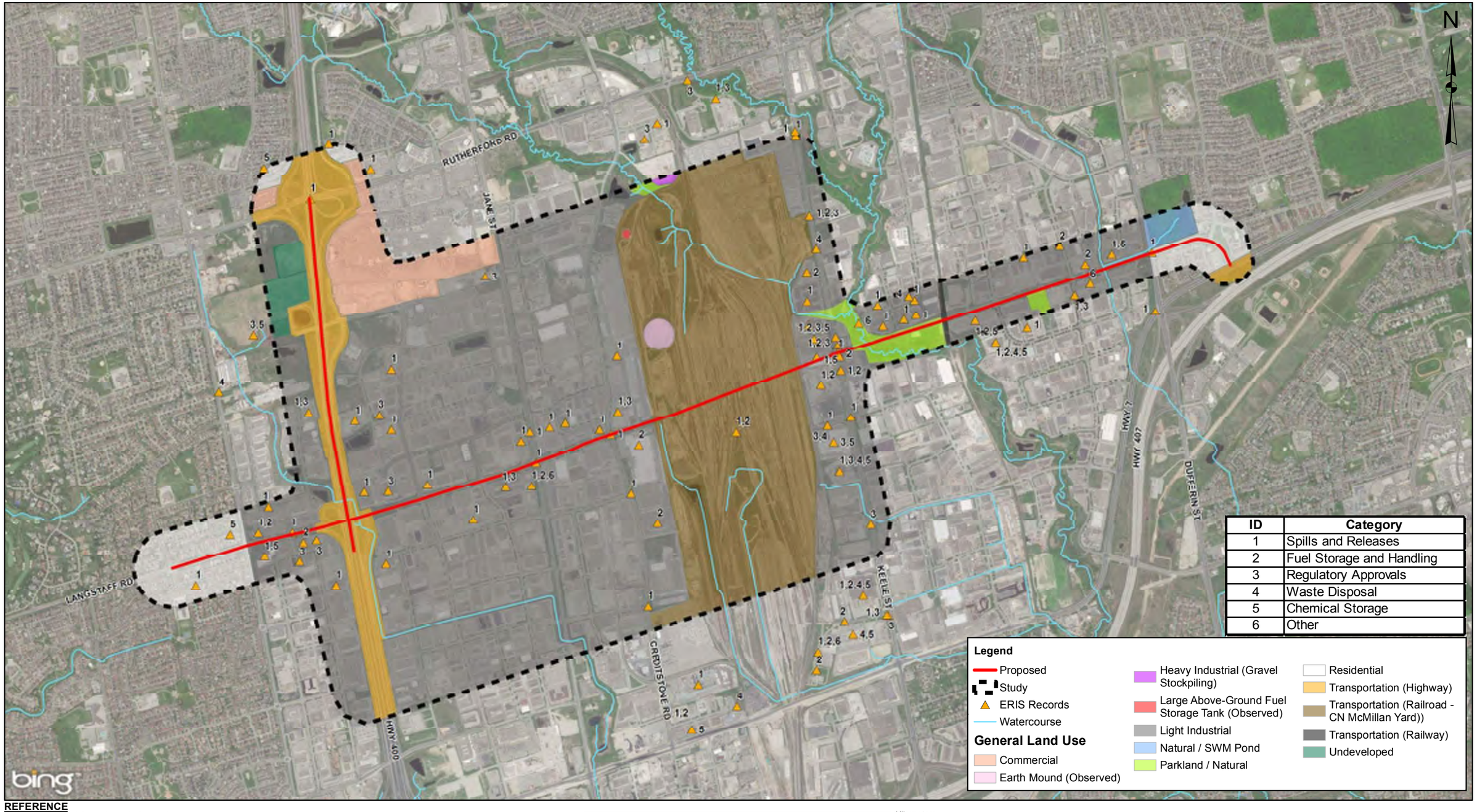
MOECC WATER WELL RECORDS

DATE: DECEMBER 2017

PROJECT: 16M-01457-01

FIGURE 2-4

I:\EngSoftware\2016\32\3216079\I&E\Env Mgmt\ARC\MXD\HG Study\Figure 2-4 MOECC WWRs.mxd



ID	Category
1	Spills and Releases
2	Fuel Storage and Handling
3	Regulatory Approvals
4	Waste Disposal
5	Chemical Storage
6	Other

Legend

- Proposed
- Study
- ERIS Records
- Watercourse

General Land Use

- Commercial
- Earth Mound (Observed)
- Heavy Industrial (Gravel Stockpiling)
- Large Above-Ground Fuel Storage Tank (Observed)
- Light Industrial
- Natural / SWM Pond
- Parkland / Natural
- Residential
- Transportation (Highway)
- Transportation (Railroad - CN McMillan Yard))
- Transportation (Railway)
- Undeveloped

REFERENCE

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http://www.bing.com/maps
Projection: UTM Zone 17N Datum: NAD 83

0 0.5 1 1.5 2 Kilometers

Scale: As Shown

HYDROGEOLOGICAL ASSESSMENT
LANGSTAFF ROAD SCHEDULE "C" MUNICIPAL CLASS ENIRONMENTAL ASSESSMENT
VAUGHAN, ONTARIO

GENERAL LAND USE AND ERIS PROPERTY SUMMARY

DATE: JANUARY 2018

PROJECT: 16M-01457-01

FIGURE 2-6

L:\Projects\2016\3216079_LangstaffEA\MXDs\HydroG\Figure 2-6 ERIS Property Summary.mxd