Humber Station – Comprehensive Environmental Impact Study and Management Plan

Phase 1 – Characterization/Existing Conditions and Baseline Inventory

Town of Caledon, Ontario

Submitted to:
Humber Station Village Landowners Group Inc.
C/O Delta Urban Inc.
8800 Dufferin Street, Suite 104
Vaughan, ON L4K 0C5

Submitted by:
GEI Consultants Canada Ltd.
Schaeffers Consulting Engineers
Arcadis Professional Services (Canada) Inc.

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Executive Summary

The Humber Station Employment Area is a new Employment Area in the Town of Caledon (the Town) which will accommodate population growth to 2031. According to the Region of Peel Official Plan (RPOP; 2022), Employment Areas within the 2051 New Urban Area will accommodate approximately 38,000 jobs as the focus for new clusters of business and economic activities. The Humber Station Employment Area is approximately 220.55 ha in size and is bounded by Humber Station Road to the west, Mayfield Road to the south, Healey Road to the north and the Coleraine West Employment Area Secondary Plan Area boundary to the east. **Figure 1** (**Appendix A1**) illustrates the location of the Humber Station Employment Area, herein referred to as the Study Area.

In November 2020, the Local Planning Appeal Tribunal (LPAT, now Ontario Land Tribunal) directed that ROPA 30 be modified as defined in Attachment 1 of the decision. The current RPOP (2022) identifies the lands as part of the Urban System, within the Bolton Residential Settlement Area. The RPOP (2022) designates the Study Area as an Employment Area.

The Caledon Official Plan (1978, Consolidated 2024) designates the majority of the Study Area as a Prime Agricultural Area, as well as an Environmental Policy Area (EPA). The Study Area is predominantly active agriculture, with scattered residential estates fronting onto the bordering roads, and a tributary of the West Humber River (Clarkway Drive Tributary) and its associated valley along the east boundary.

A local subwatershed Study, or a Comprehensive Environmental Impact Study and Management Plan (CEISMP), prepared in accordance with an approved Town Terms of Reference (TOR), is required for the Study Area, as it contains EPAs. The TOR for this CEISMP was submitted to the Toronto and Region Conservation Authority (TRCA) and the Town in January 2022 and approved in August 2022.

Similar to a Subwatershed Study (SWS), a CEISMP is a comprehensive planning framework that describes how a wide range of elements of development will be addressed. This CEISMP will include a preliminary assessment of environmental impacts, to address a range of environmental and servicing issues including the protection and management of surface water, groundwater, fluvial geomorphology, terrestrial and aquatic resources and the identification of the Natural Heritage System (NHS). Municipal servicing needs, including stormwater management, sanitary and water servicing, and site grading requirements are also addressed. The Management Plan component of the CEISMP informs planning and decision making so that changes in land use are compatible with natural systems and consistent with the Provincial Planning Statement (PPS; MMAH 2024) and applicable Region of Peel and Town of Caledon Official Plan policies.

GEI Consultants Canada Ltd. (GEI) has partnered with Schaeffers Consulting Engineers (SCE) and Arcadis Professional Services (Canada) Inc. (Arcadis), along with the Humber Station Village Landowners Group Inc. (HSV LOG), to prepare a CEISMP in support of development applications for the Lots 1-5, Concession 5 (Albion) within the Humber Station Employment Area Secondary Plan.

This Phase 1 report fulfils the first of three phases of the CEISMP in support of a Secondary Plan application. Phase 1 is the characterization of existing conditions, including the natural heritage features, hydrologic features, and surface and groundwater systems. Phase 2 includes the analysis, impact assessment, mitigation, and recommendations. Phase 3 consists of a comprehensive implementation plan, monitoring plan, and adaptive management plan.

The following summarizes the Phase 1 CEISMP key findings and recommendations and notes where additional discussion/details are provided in the CEISMP for each topic noted.

- The Humber Station Employment Area is located within the West Humber River subwatershed. The Clarkway Drive Tributary flows in a north to south direction along the east Study Area boundary. The tributary exhibits permanent flow, while other drainage features present are Headwater Drainage Features (HDFs) that generally flow intermittently or ephemerally (**Table 1, Appendix C1**).
- Numerous field investigations were completed to characterize existing conditions. **Tables 2** (**Appendix C1**) and **C2-1** (**Appendix C2**) include an extensive list of fieldwork undertaken from 2017 to 2025 in the Study Area.
- Based on the review of background studies and multi-year monitoring of groundwater and surface water conditions (see **Figure A2-6**, **Appendix A2**, for monitoring locations/types), the existing geological and hydrogeological setting was characterized. This includes a description of site stratigraphy and hydrostratigraphy, areas of groundwater recharge and discharge, hydraulic properties of stratigraphic units including those units that transmit groundwater to natural features such as watercourses and wetlands, groundwater flow patterns, surface water and groundwater supported natural features, potential surface water infiltration opportunities based on soils information, depth to water table and aquifer vulnerability.
- Surficial geological deposits at the Site are predominantly fine-grained silt to silty clay till, interpreted to be Halton Till. The Halton Till is interpreted to be quite thick across the Site, ranging from approximately 5 m to 15 m in thickness. The Oak Ridges Moraine (ORM) aquifer underlies the Halton Till unit and represents a regional confined aquifer.
- None of the HDFs or wetlands across the Study Area are interpreted to be directly connected to the ORM aquifer. The Halton Till acts as a barrier, preventing hydraulic connection between the ORM aquifer and these features. Natural features are surface water fed.
- A site water balance analysis was completed which indicated that the predevelopment recharge rate is approximately 100mm/yr, which is considered low, and is a result of the tight soil conditions associated with the Halton Till. Post-development, recharge is anticipated to be approximately 16 mm/year, reflective of 86% increase in impervious cover over the Study Area. There will be an increase in runoff and a decrease in evapotranspiration in the post-development scenario. Opportunities to reduce of mitigate impacts to infiltration and evapotranspiration through the implementation of Low Impact Development (LID) designs at site level will be discussed in later phases of the CEISMP.
- The existing drainage condition and hydrology features were characterized, and floodplain analyses were conducted to identify the extent of the existing floodplain (**Appendix D**), which was used to identify the preliminary Natural Heritage System (NHS). Hydraulic modelling of the Study Area was also completed under existing conditions (**Appendix D**), which is used to help identify sizing for the proposed drainage realignment and wetland compensation/relocation areas, as well as water elevations and extent of the floodplain mapping.

- Vegetation mapping (Ecological Land Classification) was undertaken throughout the Study Area. As depicted on **Figure 4a** (**Appendix A1**), the majority of natural vegetation communities occur along the Clarkway Drive Tributary, with two woodlots also occurring on the tableland in the north portion of the Study Area. The tablelands are dominated by active agriculture and residential uses that have been present on the landscape for decades.
- Three wetlands (Wetlands D1, E1, F1) in the Study Area were documented by GEI to meet the criteria for significance as per the Ontario Wetland Evaluation System (OWES), and one (Wetland G1) is assumed to be significant, as identified on **Figure 4a** (**Appendix A1**). Two significant wetlands (D1 and F1) and the presumed significant wetland (G1) are located in the valley of the Clarkway Drive Tributary, and Wetland E1 is associated with a historical agricultural pond near Humber Station Road. The boundaries of all wetlands in the Study Area were staked in the field with TRCA staff and surveyed.
- Three non-provincially significant wetlands (Wetlands A1, B1, C1) occur in the Study Area, as per GEI's OWES assessment (**Figure 4a**, **Appendix A1**). All these wetlands are associated with HDF-3, except for a small historical agricultural pond (MAS2-1) in the north portion of the Study Area. For the participating lands, these wetlands were documented to have common and secure species present.
- Two forest communities in the Study Area are considered significant woodlands. The northwest woodlot, located within non-participating lands, is a deciduous forest and includes an HDF and associated mix of meadow marsh and open aquatic wetland units. A second woodland in the north-central portion of the Study Area is composed of Basswood deciduous forest. Natural features, including top-of-bank, wetland limits, and dripline of woodland communities were staked and surveyed with representatives of the TRCA, the Town of Caledon, and GEI.
- The TRCA Humber River Fisheries Management Plan (FMP; TRCA 2005) states that the West Humber River subwatershed supports a fish community dominated by tolerant warmwater species. Fish captured in the Study Area by GEI were tolerant warmwater species, which reflects the conclusions of the FMP. GEI's water temperature recordings within the Study Area were reflective of the thermal regime noted in the FMP, which depicts the Study Area as "small riverine warmwater". The FMP notes that small riverine warmwater habitats have poor infiltration rates and minimal groundwater inputs, causing many of the reaches to dry up during the summer months, or reduced to standing pools of water. These conditions were observed by GEI, with the exception of the Clarkway Drive Tributary which had perennial flow, as well as HDF-3 which had perennial flow in 2017 but ephemeral flow in 2022 and 2023.
- The Clarkway Drive Tributary located at the east end of the Study Area is a confined valley corridor containing two significant wetlands (D1 and F1) and one presumed significant wetland (G1). Detailed fluvial geomorphological assessments were conducted to characterize stream conditions and inform erosion threshold analysis. The confined valleyland along the Clarkway Drive Tributary and the associated long-term stable slope was also identified. HDFs within the Study Area were assessed using the Credit Valley Conservation (CVC) and TRCA (2014) guidelines. Outcomes of the HDF assessments resulted in the identification management recommendations for each HDF of Protection, Conservation, Mitigation or No Management as outlined in **Table 1** (**Appendix C1**).

- HDF-8 is an ephemeral feature that drains much of the southern portion of the Study Area. The majority of the feature is ploughed through for agricultural purposes with no naturalized riparian vegetation. No fish were captured or observed in HDF-8.
- HDF-3 (**Figure 4b**, **Appendix A1)** is generally characterized as having intermittent flow and provides direct fish habitat. This feature was historically altered to create an online pond for agricultural use.
- Various wildlife surveys for breeding birds, breeding amphibians, reptiles, bat habitat and acoustic monitoring, insects, and wildlife observations using camera traps and road transects occurred in various years between 2017 and 2022 utilizing standard protocols. The results are described in **Section 3.7** of the CEISMP. The wildlife species occurring in the Study Area were generally found to consist of common and secure species (ranked S5).
- Four Endangered (END) or Threatened (THR) species or their habitat have been identified within or adjacent to the Study Area: Silver-haired Bat (END), Eastern Red Bat (END), Hoary Bat (END), and Bank Swallow (THR). SAR bat habitat is associated with the FOD and FOD8-3 communities. However, SAR bats may be foraging throughout the Study Area. Bank Swallow foraging habitat occurs over the north riparian significant wetland surrounding the Clarkway Drive Tributary which extends onto a small portion of the east end of the Study Area. Occupied Redside Dace (END) habitat is located approximately 4.5km from the Study Area, downstream of the Clarkway Drive Tributary and HDF-8, and south of Castlemore Drive. However, there is no documented Redside Dace habitat within the Study Area.

Based on the results of this CEISMP, GEI (and others) have reviewed and confirmed the extent of the preliminary NHS for the Study Area. A series of analyses were completed to identify natural hazards, natural features and functions that meet the definition of NHS components as described in the Town of Caledon Official Plan and Region of Peel Official Plan. The preliminary NHS includes valley and stream corridors, wetlands, woodlands, significant wildlife habitat, habitat of endangered and threatened species, fish habitat, and their Vegetation Protection Zones (VPZs) or buffers. The preliminary NHS also includes a conceptual drainage realignment for HDF-3, and wetland relocation and/or compensation, which is anticipated to achieve a net ecological gain compared to existing conditions.

1. Introduction

GEI Consultants Canada Ltd. (GEI), in collaboration with Schaeffers Consulting Engineers (SCE), and Arcadis Professional Services (Canada) Inc. (Arcadis) have been retained by the Humber Station Village Landowners Group Inc. to prepare a Comprehensive Environmental Impact Study and Management Plan (CEISMP) in support of the Humber Station Employment Area Secondary Plan application for lands identified as Lots 1-5, Concession 5 (Albion) in the Town of Caledon, Regional Municipality of Peel (herein referred to as the Study Area). SGL Planning and Design Inc. (SGL) has provided input and review of the policy components of the CEISMP.

The Study Area is approximately 220.55 ha, located in the West Humber River watershed, and generally bound by Healey Road to the north, the Coleraine West Employment Area Secondary Plan Area boundary to the east, Mayfield Road to the south, and Humber Station Road to the west (**Figure 1, Appendix A1**). The Study Area is predominantly actively cultivated fields with the majority of natural and cultural vegetation found within the east valley which contains a tributary of the West Humber River (Clarkway Drive Tributary). Two woodlots occur in the northwest and north-central portion of the Study Area, and scattered residential dwellings front onto the bordering roads.

The Town of Caledon policies require that a CEISMP be prepared in support of applications for development that are adjacent to Environmental Protection Areas (EPAs). The CEISMP addresses a range of environmental and servicing issues, including the protection and management of surface water, groundwater, fluvial geomorphology, terrestrial and aquatic resources, identification of a preliminary Natural Heritage System (NHS) and municipal servicing needs, including stormwater management, sanitary and water servicing and site grading requirements.

A Terms of Reference (TOR) for the CEISMP was submitted to the Toronto and Region Conservation Authority (TRCA) and the Town of Caledon (the Town) on January 28, 2022. The TOR was revised to address comments from the TRCA and re-submitted on July 6, 2022 (**Appendix B**).

As outlined in the TOR, the CEISMP consists of three phases:

- Phase 1 – Characterization/Existing Conditions and Baseline Inventory;
- Phase 2 – Analysis, Impact Assessment, Mitigation, and Recommendations; and
- Phase 3 – Comprehensive Implementation Plan, Monitoring Plan, and Adaptive Management Plan.

This report addresses Phase 1 of the CEISMP.

1.1 Planning and Policy Context

The Study Area was re-designated from Rural System to Rural Service Centre on Schedule D (Regional Structure) of the Peel Region Official Plan in December 2016. This occurred through the approval of ROPA 30 by Regional Council; however, this decision was appealed by multiple parties. In November 2020, a settlement was reached, and the Local Planning Appeal Tribunal (LPAT, now Ontario Land Tribunal) allowed the appeal, directing that ROPA 30 be modified as defined in Attachment 1 of the decision. The current Region of Peel Official Plan (RPOP; 2022) identifies the lands as part of the Urban System, within the Bolton Residential Settlement Area. The RPOP designates the Study Area as an Employment Area.

The Study Area is located within the Bolton Settlement Area, as per the Caledon Official Plan (Caledon OP; 1978, consolidated 2024), and is designated as New Employment Area and Highway 413 Transportation Corridor towards the southwest and has Environmental Policy Area (EPA) designation along the northwestern limits. The Study Area is adjacent to General and Prestige Industrial land use to the east, and Prime Agricultural Area to the west, as per Schedule C ("Bolton Land Use Plan"). While a Future Caledon Official Plan has been drafted, it states that the 1978 Official Plan, as per the most recent consolidation, provides the policy framework for the Bolton Settlement Area, including the Study Area.

Reflective of the Caledon OP designations, the Town's Zoning By-law (Zoning By-law 2006-50, revised 2023) has zoned the Study Area primarily as Agricultural (A1), with a small area zoned as Small Agricultural Holdings (A3). The area also contains limited areas zoned as EPA Zone (EPA1 and EPA2). The lands will be rezoned to permit employment use though the proceeding development process.

1.2 Purpose

The CEISMP characterizes the biophysical environment and identifies constraints and opportunities for future development to help guide the design of the development and associated supporting environmental management systems. The management plan component informs planning and decision making so that changes in land use are compatible with natural systems and consistent with applicable federal, provincial, and municipal legislation, including the Provincial Planning Statement (PPS; MMAH 2024) and the RPOP and Caledon OP policies.

The CEISMP serves to:

- Provide characterization of existing environmental conditions;
- Address the relevant natural features and functions identified in the PPS, RPOP, and Caledon OP;
- Provide the foundation for the layout of the Secondary Plan by defining and delineating elements such as the NHS and transportation and servicing networks;
- Assess environmental impacts for proposed Secondary Plan land uses, development and infrastructure and identify avoidance or mitigation measures;
- Provide strategies to support the objectives and targets of the Town of Caledon OP as it relates to the protection, restoration and enhancement of the Natural Environment System;
- Define measures to protect and/or enhance the NHS; and
- Establish targets to maintain, restore and enhance existing environmental conditions, and provide monitoring and adaptive management recommendations.

1.3 Study Area

This CEISMP utilizes an integrated subwatershed based study approach. Therefore, the Study Area limits change by discipline and scale of investigation. When characterizing groundwater and surface water resources, the Study Area boundaries extend to the limits of the drainage catchments.

Natural heritage resource characterization limits are based on application of the 120 m lands adjacent to the Study Area, as depicted on **Figure 2** (**Appendix A1**).

1.4 Existing Land Use and Ownership

The Study Area is predominantly active agricultural land, with some estate residential properties and woodlots. The land is owned by various parties, the majority of which (approximately two thirds) are participating with respect to the CEISMP. Participating properties are identified on **Figure 2** (**Appendix A1**).

1.5 Supporting Materials

There are numerous other studies, plans, guidelines, etc. that will provide input and guidance to the preparation of the CEISMP.

The following list outlines the relevant studies reviewed:

- *Humber Station Villages Master* Environmental *Servicing Plan* (September 2007; Stonybrook Consulting, Savanta Inc., Stantec Consulting Ltd., KLM Planning Partners Inc., Parish Geomorphic Ltd., R.J. Burnside & Associates, SCE; Prepared for Solmar Development Company);
- Consolidated Linear Infrastructure Environmental Compliance Approval for the Corporation of the Town of Caledon (ECA No. 324-S701);
- Master Environmental Servicing Plan: Hwy 427 Industrial Secondary Plan Area (Area 47) (Aquafor Beech Ltd., 2016);
- Scoped Subwatershed Study Settlement Area Boundary Expansion (Wood et al., January 2022);
- Guideline for Planning and Design of the GTA West Corridor Through the Greenbelt GTA: West Corridor Environmental Assessment Study (August 2013; ECOPLANS MRC, MMM Group);
- Humber River Fisheries Management Plan (TRCA, 2005);
- Humber River Watershed Plan (TRCA, 2008a);
- Humber River Watershed Plan Implementation Guide (TRCA, 2008b);
- Humber River Watershed Report Card (TRCA, 2018a);
- Final Report Humber River Hydrology Update (TRCA, 2015a) for Existing Condition; and
- Final Report Humber River Hydrology Update (TRCA, 2018b) for Future Condition.

The following list outlines the relevant guidelines and procedures used:

- Town of Caledon: Development Standards Manual (2019);

- TRCA:
  - TRCA Master Environment and Servicing Plan Guideline (TRCA, 2015b);
  - Evaluation, Classification, and Management of Headwater Drainage Features Guidelines (TRCA and CVC, 2014);
  - TRCA Guidelines for Review of SWM Pond Location with Respect to Groundwater Conditions;
  - TRCA Stormwater Management Criteria Document (TRCA, 2012);
  - Erosion and Sediment Control Guide for Urban Construction (TRCA, 2019);
  - Crossings Guideline for Valley and Stream Corridors (TRCA, 2015c);
  - Channel Modification Design and Submission Requirements (TRCA, 2007);
  - Technical Guidelines for Flood Hazard Mapping (TRCA and other Conservation Authorities, 2017);
  - Low Impact Development Stormwater Management Planning and Design Guide (TRCA and CVC, 2010); and
  - Geotechnical Engineering Design and Submission Requirements (TRCA, November 2007 Toronto and Region Conservation Authority. TRSPA Water Balance Tool (2025)).
- Ministry of Natural Resources (MNR):
  - Technical Guide for River & Stream Systems: Erosion Hazard Limit (MNRF, 2002).
- Ministry of Environment, Conservation, and Parks (MECP):
  - Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under and Environmental Compliance Approval (MECP, v.2.0, May 31, 2023);
  - Water Well Information System (MECP, 2020); and
  - Source Water Protection Atlas (MECP, 2025).
- Oak Ridges Moraine Groundwater Program (ORMGP, 2025).

2. Environmental Policy Context

The Study Area is subject to the planning policy framework, including direction related to environmental matters, established by the Province and the Town under the *Planning Act.* Consideration was also given to policies outlined in the RPOP and *The Living City Policies for Planning and Development in the Watersheds of the Toronto and Region Conservation Authority* (TRCA 2014).

An assessment of the quality and extent of natural heritage features found on, and adjacent to the Study Area and the potential impacts to these features from the proposed development was undertaken to comply with legislation at the federal, provincial, and municipal levels.

The following federal legislation, regulations, and guidelines were reviewed:

- *Fisheries Act* (1985);
- *Species at Risk Act* (SARA; 2002):
    - *Critical Habitat of the Redside Dace (Clinostomus elongatus) Order (SOR/2019-330);*
    - *Redside Dace Recovery Strategy* (DFO, 2024);
    - *Migratory Birds Convention Act* (MBCA; 1994); and
    - *Migratory Birds Regulation* (MBR; 2022).

The following provincial legislation, regulations, and guidelines were reviewed:

- *Planning Act* (1990):
    - Provincial Planning Statement (PPS; MMAH 2024).
- Natural Heritage Reference Manual: Second Edition (NHRM; Ontario Ministry of Natural Resources (OMNR) 2010):
    - Significant Wildlife Habitat Technical Guide (OMNR, 2000).
- *Conservation Authorities Act*:
    - *Ontario Regulation (O. Reg.) 41/24*; and
    - *The Living City Policies* (TRCA, 2014).
- *Endangered Species Act* (ESA; 2007):
    - *O. Reg. 230/08: Species at Risk in Ontario (SARO) List*;
    - *Redside Dace Recovery Strategy* (MECP, 2010);
    - *Guidance for Development Activities in Redside Dace Protected Habitat* (MECP, 2016); and
    - *Thermal Mitigation Checklist for Stormwater Management Ponds Discharging into Redside Dace Habitat* (MNRF, 2014).
- Bill 5 – Protect Ontario by Unleashing our *Economy Act* (Draft, 2025):
    - *Species Conservation Act* (SCA; Draft, 2025).
- *Fish and Wildlife Conservation Act* (FWCA; 1997).

The following municipal legislation was reviewed:

- Region of Peel Official Plan (RPOP; 2022);
- Town of Caledon Official Plan (1978, consolidated 2024):
    - *Town of Caledon Zoning By-law* (Zoning By-law 2006-50, revised 2023).

The following subsections will provide an overview of the policy framework.

2.1 Federal Policy Framework

The Study Area does not contain any federally regulated land. Other federal legislation, as described below, may also apply in specific situations within provincially regulated lands.

2.1.1 Fisheries Act

Fisheries and Oceans Canada (DFO) administers the federal *Fisheries Act* (1985), which defines fish habitat as "spawning grounds and other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes" (subsection (2)1). The *Fisheries Act* prohibits the death of fish by means other than fishing (subsection 34.4 (1)) and the harmful alteration, disruption or destruction of fish habitat (HADD; subsection 35. (1)). A HADD is defined under the *Fisheries Act* as "any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes" (DFO 2019).

The *Fisheries Act* applies wherever fish or fish habitat may be present. Where a project has the potential to cause impacts, consultation with the DFO should occur to identify whether additional permits or approvals are required.

2.1.2 Species at Risk Act

The SARA applies principally on federally owned lands, however there are general prohibitions in the SARA against killing an individual of a protected aquatic or migratory bird species, or destroying their residence, which apply to all lands, and with respect to critical habitat for aquatic Species at Risk (SAR) identified in Schedule 1 of SARA. SARA is administered by the DFO for aquatic species.

Where SAR listed on Schedule 1 of SARA are also listed on the SARO List as Threatened or Endangered, they are offered provincial protection under the *Endangered Species Act* (ESA). As discussed in **Section 2.2.2** below, some changes to this process are proposed via Bill 5.

Redside Dace

As discussed above, the DFO administers the *Critical Habitat of the Redside Dace (Clinostomus elongatus) Order* (SOR/2025-4) under the SARA. This order provides protections for Redside Dace and their critical habitat, which is identified within the *Recovery Strategy and Action Plan for the Redside Dace (Clinostomus elongatus) in Canada* (proposed) (DFO, 2024). This Recovery Strategy is intended to replace the provincial one that was prepared in 2010.

2.1.3 Migratory Birds Convention Act

Environment and Climate Change Canada (ECCC) administers the MBCA and MBR, which protects the nests of migratory bird species from destruction, including incidental take (i.e., the unintentional destruction of a nest), as well as from disturbance. The *MBCA* does not provide a set date where activities, such as tree removal, can be completed without the risk of incidental harm to the nests of birds. The requirement to ensure that no bird nests are present within the work area rests with the proponent of the activity. The MBCA and MBR apply on all lands.

2.2 Provincial Policy Framework

The Study Area contains provincially regulated land, and the following legislation applies to the entire area.

2.2.1 Planning Act

The *Planning Act* (1990, Amended 2024) provides for a land use planning system that is led by provincial policy. It recognizes the decision-making authority of municipal councils in planning matters and integrates matters of provincial interest into municipal planning decisions. It has the goal of promoting sustainable economic development in a healthy natural environment.

Matters of provincial interest include, but are not limited to:

- the protection of ecological systems, including natural areas;
- the conservation of features of significant scientific interest;
- the protection of public health and safety; and
- the appropriate location of growth and development.

Per the *Planning Act*, the Town of Caledon is considered a lower tier municipality with planning authority, and the Region of Peel is considered an upper tier municipality without planning authority.

2.2.1.1 Provincial Planning Statement

The *Provincial Planning Statement* (PPS; MMAH, 2024) is the guiding document providing policy direction on matters of provincial interest related to land use and development. Section 3(5) of the *Planning Act, 1990* requires that all decisions that affect planning matters be consistent with the PPS, which is issued under the Act. The PPS is to be read in its entirety and land use planners and decision-makers need to consider all relevant policies and how they work together.

This report addresses those policies that are specific to Natural Heritage (Section 4.1) with some reference to other policies with relevance to Natural Heritage and impact assessment considerations and areas of overlap (e.g., those related to Efficient and Resilient Development and Land Use Patterns, Section 2; Infrastructure and Facilities, Section 3; Water, Section 4.2; and Natural Hazards, Section 5.2).

Natural Heritage:

Section 4.1 outlines the natural heritage goals of the province. These goals include the long-term protection of natural features and areas, the maintenance of diversity and connectivity of natural features in an area, the maintenance of ecological function and biodiversity of natural heritage systems, and recognizes the linkages between and among natural heritage, surface water, and groundwater features and areas.

The protected natural heritage features within ecosite 6E and 7E include:

- Significant wetlands (PPS Section 4.1.4a);
- Significant coastal wetlands (4.1.4b);

- Other coastal wetlands (4.1.5.f);
- Significant woodlands (4.1.5.b);
- Significant valleylands (4.1.5.c);
- Significant wildlife habitat (4.1.5.d);
- Significant areas of natural and scientific interest (4.1.5.e);
- Fish habitat (4.1.6);
- Habitat of endangered or threatened species (Section 4.1.7); and
- Adjacent lands to above noted natural heritage features (except habitat of endangered or threatened species) (4.1.8).

Apart from significant wetlands and significant coastal wetlands, which are not be found within the Study Area, the PPS permits development within the above natural heritage features where it is done in accordance with provincial or federal requirements (fish habitat/endangered and threatened species), or where an Environmental Impact Study (EIS) is completed that demonstrates no negative impact on the natural features or their ecological functions.

2.2.2 Species at Risk Legislation

The Province of Ontario is actively pursuing changes to SAR legislation through Bill 5, Protect Ontario by Unleashing our *Economy Act*, 2025, which has received Royal Assent as of June 5th, 2025. Bill 5 includes changes to the ESA, the *Environmental Protection Act*, *Ontario Heritage Act, Ontario Energy Board Act, Mining Act, Electricity Act,* and *Rebuilding Ontario Place Act*. It also introduces the Species Conservation Act (SCA).

2.2.2.1 Endangered Species Act

The ESA was developed to identify SAR based upon best available science, including information obtained from community and indigenous traditional ecological knowledge, and to provide protection and conservation of SAR while taking into account social and economic considerations including the need for sustainable economic growth in Ontario.

The ESA protects all Endangered, Threatened, and Extirpated species listed on the SARO list (*O. Reg. 230/08: Species at Risk in Ontario List*; Government of Ontario 2007b). These species are legally protected from harm. In addition, the habitat of Endangered and Threatened species is also legally protected from damage or destruction, as defined under the ESA.

Schedule 2 of Bill 5 included updates to the ESA, specifically relating to an updated habitat definition, and removal of various programs including the Species Conservation Charges. A general ‘habitat’ definition for SAR is provided in the updated Section 2(1). Wildlife habitat is defined as a dwelling-place (i.e. den, nest, or similar) that is occupied (presently or habitually) by a species for the purposes of breeding, rearing, staging, wintering or hibernating, and the area immediately around it. Habitat for vascular plants is defined as the critical root zone. These updated definitions replace the previous species recovery strategies and O. Reg. 832/21: Habitat.

2.2.2.2 Species Conservation Act, 2025 (DRAFT)

As part of Bill 5, the SCA received Royal Assent and will be enacted on a date yet to be determined. Upon its enactment, the ESA and its associated regulations will be repealed (Section 70 of the SCA). The SCA has the goal of streamlining project approvals while maintaining species protection and balancing environmental and economic needs.

Notable items from the SCA include:

- Launch of a new online registration system;
- Changing to a registration-first approach (high-risk activities may still require a permit); and
- Removing authorization duplication for species already protected under SARA (migratory birds and aquatic species).

2.2.2.3 Removing authorization duplication for species already protected under SARA (migratory birds and aquatic species). Redside Dace Guidelines

The province has approved the *Redside Dace Recovery Strategy* (Redside Dace Recovery Team, 2010) as well as a number of technical guidelines for development which may be referenced throughout this CEISMP Phase 1 Report, as well as subsequent Phase 2 and Phase 3 Reports.

The *Redside Dace Recovery Strategy* (Redside Dace Recovery Team, 2010) provides an overview of the habitat requirements, and causes of decline, for the Redside Dace. It also provides an overview of ESA regulated habitat, including habitat it currently or has previously occupied, and a description of how to identify additional habitat (not yet mapped by the province). Based on the updated definition of "habitat" introduced in Schedule 2 of Bill 5, only areas identified as occupied Redside Dace habitat receive protection under the revised ESA.

The MNRF prepared the *Guidance for Development Activities in Redside Dace Protected Habitat* (2016) to provide best management practices (BMPs) that support decision making related to development in and adjacent to Redside Dace habitat. The guideline outlines BMPs at the subwatershed planning scale, for stream crossing installations, for construction activities, stormwater management creation and maintenance, utilities and supporting infrastructure, and for stream alignment and relocation activities.

In addition to the development guidance document for areas within Redside Dace habitat, the MNRF also prepared a *Thermal Mitigation* Checklist *for Stormwater Management Ponds Discharging into Redside Dace Habitat* guideline (MNRF, 2014). As Redside Dace are sensitive to runoff and water temperatures, stormwater discharge should be managed to ensure that watercourses that contain Redside Dace or contribute to Redside Dace habitat maintain adequate temperatures and water quality. The thermal checklist should be used to ensure appropriate stormwater management design elements are incorporated.

2.2.3 Fish and Wildlife Conservation Act

The FWCA was developed to set out regulations for hunting, trapping, fishing, and other activities related to the intentional capture or harm of wildlife in Ontario. Where this Act conflicts with the ESA, the Act that provides provisions offering the highest protections prevail.

2.2.4 Conservation Authorities Act

The *Conservation Authorities Act* (1990, Amended 2024) provides for the organization and delivery of programs and services that further the conservation, restoration, development and management of natural resources in watersheds across Ontario. Part VI of this Act provides the framework for the jurisdiction of conservation authorities, the areas in which they regulate, and the process for issuing permits.

Section 28(1) of this Act states that: *"No person shall carry on the following activities, or permit another person to carry on the following activities, in the area of jurisdiction of an authority:*

1. *Activities to straighten, change, divert or interfere in any way with the existing channel of a river, creek, stream or watercourse or to change or interfere in any way with a wetland.*
2. *Development activities in areas that are within the authority's area of jurisdiction and are,*
   i. *hazardous lands,*
   ii. *wetlands,*
   iii. *river or stream valleys the limits of which shall be determined in accordance with the regulations,*
   iv. *areas that are adjacent or close to the shoreline of the Great Lakes-St. Lawrence River System or to an inland lake and that may be affected by flooding, erosion or dynamic beach hazards, such areas to be further determined or specified in accordance with the regulations, or*
   v. *other areas in which development should be prohibited or regulated, as may be determined by the regulations."*

2.2.4.1 Ontario Regulation 41/24: Prohibited Activities, Exemptions and Permits

Effective April 1, 2024, O. Reg. 41/24: Prohibited Activities, Exemptions and Permits has come into force, replacing the former O. Reg. 166/06: Toronto and Region Conservation Authority: Development, Interference with Wetlands, Alterations to Shorelines and Watercourses Regulation.

The TRCA is responsible for administering O. Reg. 41/24, which allows them to implement Section 28 of the *Conservation Authorities Act*. The TRCA has prepared a number of guidelines and protocols. To support proponents with application submittals.

Pursuant to O. Reg. 41/24, any development within TRCA regulated areas requires permission from the Conservation Authority. The Conservation Authority may issue permits under Section 28.1 and may attach conditions on the permits per Section 9(1) of the Regulation.

A review of the Regulation Limit Mapping from the TRCA (2022) was completed to understand whether TRCA regulated areas are found within, or adjacent to, the boundaries of the Study Area. The Study Area contains TRCA regulated features, generally associated with the West Humber River and the Clarkway Drive Tributary (**Figure 3**, **Appendix A1**).

The Living City Policies (TRCA)

The *Living City Policies for Planning and Development in the Watersheds of the Toronto and Region Conservation Authority* (Living City; TRCA, November 2014) "is the new policy document of the TRCA approved by the TRCA's Board on November 28, 2014. It is a conservation authority policy document to guide the implementation of the TRCA's legislated and delegated roles and responsibilities in the planning and development approvals process for the next ten years" (Page 1 Summary). The Living City establishes the TRCA's vision, mission, strategic objectives and principles, as well as policies for advocacy for sustainable communities (e.g., climate change, energy, transportation); environmental planning including environmental protection and environmental management; and for the administration of TRCA's development interference with wetlands and alterations to shorelines and watercourses regulation.

2.3 Municipal Policy Framework

The Study Area is located within the lower tier municipality of the Town of Caledon and the upper tier municipality of the Region of Peel. As of July 1st, 2024, the Region of Peel is no longer considered an upper tier municipality with planning authority, and therefore the RPOP now constitutes an official plan of Peel's lower-tier municipalities. As such, the Town is now responsible for the interpretation and implementation of the RPOP.

2.3.1 The Region of Peel Official Plan

The RPOP (2022) outlines strategies to guide growth and development in the Region.

The Study Area is within the Urban System and the Bolton Residential Expansion Settlement Area under Schedule E-1 ("Regional Structure") of the RPOP (2022). The Bolton Residential Expansion Settlement Area will contribute to the development of the Bolton urban area to be a complete community that includes employment lands, local services, housing, community infrastructure, and transportation options while ensuring natural heritage features are identified and protected. Schedule E-3 ("The Growth Plan Policy Areas in Peel") identified the Study Area as Designated Greenfield Area, while Schedule E-4 ("Employment Areas") designates the site as Employment Area. Designated Greenfield Areas are locations where new residential communities and Employment Areas will be accommodated up to 2051.

The Clarkway Drive Tributary, the northern woodlot and pond associated with HDF-3 are identified as part of the Greenlands System as per Schedule C-1 ("Greenlands System"). Further, the Clarkway Drive Tributary is designated as Core Areas of the Greenlands System and Natural Areas and Corridors (NAC), while the northern woodlot is shown as NAC as per Figure 7 ("Regional Greenlands System- Core Areas, Natural Areas and Corridors and Potential Natural Areas and Corridors"). The northern portion of the Clarkway Drive Tributary and the pond associated with HDF-3 are identified as Potential Natural Areas and Corridors (PNAC). The Greenlands System is based on natural heritage features and areas and the linkages among them.

Core Areas of the Greenlands System are defined within Section 2.14.12 of the RPOP as:

- Significant wetlands;
- Significant coastal wetlands;
- Woodlands meeting one or more of the criteria for Core Area woodland (RPOP Table 1);
- Environmental Sensitive Areas;
- Provincial Life Science ANSI;
- Escarpment Natural Areas of the Niagara Escarpment Plan; and
- Valley and stream corridors meeting one or more of the criteria for Core Area valley and stream corridors (RPOP Table 2).

NAC of the Greenlands System are defined within Section 2.14.18 of the RPOP as:

- Evaluated non-provincially significant wetlands and coastal wetlands;
- Woodlands meeting one or more of the criteria for NAC woodland (RPOP Table 1);
- Significant wildlife habitat;
- Fish habitat;

- Habitat of aquatic species at risk;
- Habitat of endangered and threatened species;
- Regionally significant life science ANSI;
- Provincially significant earth science ANSI;
- Escarpment Protection Areas of the Niagara Escarpment Plan;
- The Lake Ontario shoreline and littoral zone and other natural lakes and their shorelines;
- Any other valley and stream corridors that have not been defined as part of the Core Areas;
- Sensitive headwater areas and sensitive ground water discharge areas; and
- Any other natural features and functional areas interpretated as part of the Greenlands System NAC by the local municipalities, in consultation with the conservation authorities and MNR, including as appropriate, elements of the PNAC.

PNAC of the Greenlands System are defined in Section 2.14.19 of the RPOP as:

- Unevaluated wetlands and coastal wetlands;
- Cultural woodlands and cultural savannahs within the Urban System meeting one or more of the criteria for PNAC woodland in Table 1 of the RPOP;
- Any other woodlands greater than 0.5 hectares;
- Regionally significant earth science ANSI;
- Sensitive ground water recharge areas;
- Portions of Historic shorelines;
- Open space portions of the Parkway Belt West Plan Area;
- Enhancement areas, buffers and linkages; and
- Any other natural features and functional areas interpreted as part of the Greenlands System PNAC, by the individual local municipalities in consultation with the conservation authorities.

As per Section 2.14 of the RPOP, development and site alteration will not be permitted in the Core Areas except for permitted uses as outlined in Section 2.14.15. Refinements to the Greenlands System may be permitted through an approved development plan as per Section 2.14.10. In general, it would be expected that any impact shall be mitigated through restoration and enhancement or compensation/relocation.

Development or site alteration within or on adjacent lands to natural heritage features and areas identified as Greenlands System Core Areas, NAC and PNAC will require the preparation of an Environmental Impact Study (EIS) which will:

- Inventory and refine the boundaries of the Greenlands System features and areas;
- Establish limits of development and site alteration in relation to the Greenlands System's natural heritage features and areas requiring protection;
- Assess the potential environmental impacts of the development and site alteration;
- Make recommendations to avoid, minimize, and mitigate impacts; and
- Identify requirements to restore or establish linkages between and among natural heritage features and areas, surface water features and ground water features.

In addition, Figure 8 of the RPOP ("Conservation Authority Natural Heritage System") shows the Clarkway Drive Tributary, both woodlots and the pond as part of the Conservation Authority Natural Heritage System and identifies the lands as Existing Natural Cover and Potential Enhancement Area. The objectives and targets for restoration and enhancement recommended in the natural heritage system studies should be addressed when implementing the Greenlands System policy direction of the RPOP.

2.3.2 The Town of Caledon Official Plan

The Caledon OP was originally prepared in 1978 and has since been amended several times; the most recent consolidation of this Official Plan was completed in March 2024. While a Future Caledon Official Plan has been drafted and is currently being reviewed by the province, it states that the 1978 Official Plan, as per the most recent consolidation, provides the policy framework for the Bolton Settlement Area including the Study Area.

Within the Caledon OP, the Study Area is located within the Bolton Settlement Area and is designated as New Employment Area, contains the Highway 413 Transportation Corridor towards the southwest, and has EPA designation along the northwestern limits. The Study Area is adjacent to General and Prestige Industrial land use to the east, and Prime Agricultural Area to the west, as per Schedule C ("Bolton Land Use Plan"). In addition, HDF-3 and its associated pond, the Clarkway Drive Tributary, and the northern woodlot, are identified as EPAs as per Schedule C-7 ("Coleraine West Employment Area Land Use Plan").

As per Section 5.7 of the Caledon OP, EPAs consist of Natural Core Areas and Natural Corridors, as defined within Table 3.1 of the Caledon OP. These components are subject to detailed land use policies for EPAs as outlined in Section 5.7.

Natural Core Areas include:

- All Woodland Core Areas;
- All Wetland Core Areas;
- All Niagara Escarpment Natural Areas;
- All Life Science ANSIs;
- All Environmentally Significant Areas;
- All Significant Wildlife Habitat; and
- All Significant Habitat of Threatened and Endangered Species.

Natural Corridors include:

- All Core Fishery Resource Areas; and
- All Valley and Stream Corridors.

New infrastructure will not be permitted in EPA, except for essential infrastructure which may be subject to an EIS and Management Plan (MP) approved by the Town and other relevant agencies. The reports shall demonstrate that all reasonable alternatives to locating the proposed infrastructure outside of EPA have been explored.

As per Section 5.7.3.1.1 of the Caledon OP, major development is not permitted within lands designated EPA. Minor refinements to the limits of an EPA may be made through environmental studies without the need for an Official Plan Amendment (OPA). Major modifications to an EPA would require an OPA and be supported by an EIS and MP.

In general, an EIS and MP shall:

- Identify existing ecosystem forms, functions and integrity within EPA, and further refine the limits of EPA;
- Identify and assess the existing and potential function and integrity of Supportive Natural Systems and Natural Linkages and existing and potential ecological linkages between EPA lands, adjacent lands, and broader ecological systems;
- Assess the anticipated immediate and longer-term environmental impacts of the proposal and to identify all mitigation measures;
- Demonstrate how the proposed development satisfies the environmental policies and performance measures contained in the OP;
- Recommend site-specific protection, enhancement, restoration and management programs, and recommend appropriate mechanisms for implementing such programs; and
- Provide base line environmental data which will support environmental monitoring programs.

3. Characterization of Existing Conditions

To characterize existing conditions within the Study Area, fieldwork was completed as part of the CEISMP on participating lands. This included extensive inventories and assessments listed in **Table 2** (**Appendix C1**) and **Table C2-1** (**Appendix C2**). This field program included all necessary fieldwork to characterize existing conditions and provide inputs to the CEISMP to inform future detailed design. Existing physical and biophysical conditions characterized through this CEISMP include:

- Bedrock Geology;
- Physiography and Surficial Geology;
- Topography;
- Soils;
- Surface Water Resources;
- Groundwater Resources;
- Terrestrial Resources; and
- Aquatic Resources.

3.1 Physical Setting

The understanding of the regional geology and hydrogeology for the regional area is based on work conducted by the Geological Survey of Canada (GSC), the Ontario Geological Survey (OGS), and the ORMGP, and the TRCA (TRCA, 2008a).

Several local hydrogeological and / or geotechnical studies have been completed across portions of the Study Area since 2007, as summarized in **Table C2-1 (Appendix C2)**. Available borehole logs from these studies are provided in **Appendix G**. Information available from these studies was used to inform the interpretation of local geological and hydrogeological conditions. These studies include:

- A hydrogeological investigation completed by RJ Burnside (RJB) in 2007 for a large parcel of land that includes the current Study Area and additional areas to the east and west. Three monitoring wells were installed within the Study Area as part of this study;
- A hydrogeology study completed by COLE Engineering Group Ltd. (COLE, now Arcadis) in 2017 for a portion of the Study Area as part of the Bolton Residential Expansion Study (BRES). As part of that study, Soil Engineers Ltd. (Soil Engineers) was retained to drill and install five monitoring well nests within the Study Area;
- Additional monitoring completed by Arcadis in 2022 and 2023 as part of the current study;
- Geotechnical studies completed by Pinchin (retained by HSV LOG) and DS Consultants (retained by Prologis) in 2022 and 2023. Studies were conducted in different portion of the study area, and available water level data from these studies have been incorporated in the CEISMP;
- Additional groundwater monitoring of accessible monitoring wells installed across the Study Area, completed by Palmer Environmental, on behalf of Prologis, in 2022 and 2023; and

- Additional geotechnical and hydrogeological drilling and monitoring well installation completed by Arcadis and PNJ Engineering Inc. (PNJ) in 2025 as part of the CEISMP. The additional investigations were intended to investigate the areas of the proposed George Bolton Parkway, including the crossing of the Clarkway Drive Tributary, Street A-2 and the three proposed SWM ponds.

Table C2-1 (**Appendix C2**) summarizes the work completed as part of these previous studies. The findings from these reports are provided in the following section of the CEISMP.

3.1.1 Topography and Drainage

The regional topography of the Study Area generally slopes in a southeasterly direction, as illustrated on **Figure A2-1**. Ground elevations at the Study Area range from about 245 metres above sea level (masl) in the northern portion of the Study Area to approximately 230 masl in the southern portion of the Study Area. Regional drainage is generally directed south/southeast into the Humber River, and eventually into Lake Ontario.

There is an incised tributary of the West Humber River that trends in a north south direction along the eastern subject area boundary, referred to as the Clarkway Drive Tributary. This tributary is located within a valley surrounded by riparian meadow marsh and meadow shallow marsh vegetation communities.

Two other incised HDFs occur within the Study area:

- HDF-8 is oriented in a generally north-south direction and transects the Study Area. It was observed to be dry during much of the monitoring period. Ephemeral flow was observed during the spring freshet and the feature was dry by late spring; and
- HDF-3 extends from midway along Humber Station Road and extends to the northeast. This feature appears to have historically been realigned for farming purposes. It was observed to be flowing in 2017 but had ephemeral flow in 2022 and 2023.

The topography and drainage features are illustrated on **Figure A2-1** (**Appendix A2**).

3.1.2 Monitoring Well Groundwater Levels and Vertical Hydraulic Gradients

As per borehole analyses, the Study Area is underlain with 5-15 metres of the Halton Till, below which is the ORM Aquifer. The Halton Till with its tight soils acts as a barrier, preventing hydraulic connection between the aquifer and natural features on the surface. See cross-section drawing (**Figure A2-7 Appendix A2**) which illustrates the thickness of the Halton Till, location of the ORM Aquifer, and the monitoring well stations across the Study Area. The water levels discussed in the monitoring discussion below reflect saturated soil conditions observed within the Halton Till, for the shallow monitoring wells.

Available monitoring well water level data collected by Arcadis or others is presented in **Table C2-4** (**Appendix C2**). The water level data from the Pinchin wells that are available was collected by Palmer in 2022 and 2023.

Throughout the monitoring period, water levels were observed to fluctuate on a seasonal basis, with water levels generally lower in the fall and higher in the spring. Water level fluctuations in monitoring wells ranged from 0.3 m (MW2-17S/D) to 1.5 m (MW8). The highest groundwater level (244.73 masl) was measured in MW1-17 near the northeastern corner of the Study Area on April 23, 2018. The lowest water level (224.99 masl) was measured in BH23-2A near the southeastern corner of the Study Area on June 2, 2023. Based on the monitoring well data, the groundwater flow direction at the Study Area is towards the southeast, similar to the regional hydrogeological interpretation. A groundwater contour map is provided as **Figure A2-8** (**Appendix A2**).

Based on available water level data, depths to water level were generally shallow and ranged from 0.61 m above ground surface at MW5-17D to 5.5 m below ground surface (mbgs) at BH1. The shallow water levels were typically within the upper Halton Till deposits. An interpolated depth to groundwater map is provided as **Figure A2-9 (Appendix A2)**. Water levels above ground surface were only observed at monitoring well MW5-17S/D. Monitoring well MW5-17D is believed to be an artesian well representative of pressurized conditions from the ORM Formation. As such, artesian conditions may also be present in other areas of the Study Area where the overlying till unit is thin. The depth to groundwater was generally lowest along the headwater drainage features.

Vertical hydraulic gradients were estimated at nine monitoring well nests (MW2-17S/D, MW4-17S/D, MW5-17S/D, BH23-1A/B, BH23-2A/B, BH23-7A/B, BH23-11A/B, MW25-1A/B, and MW25-3A/B). Overall, hydraulic gradients at the above nested wells were noted to be downward to near neutral hydraulic gradients at MW2-17S/D, MW4-17S/D, BH23-7A/B, BH23-1A/B, and BH23-11A/B located in the north, central and south portions of the Study Area, respectively. Conversely, MW5-17S/D had upward hydraulic gradients, with artesian conditions being observed at MW5-17S/D. Monitoring well nest BH23-2A/B was noted to show variable hydraulic gradients further south of MW5-17S/D along the Clarkway Drive Tributary. Monitoring well nest MW25-1A/B installed in 2025 along the proposed George Bolton Parkway had a slightly upward vertical gradient. Monitoring well nest MW25-3A/B installed in 2025 along the proposed Street A2 had a variable gradient.

Table C2-5 (**Appendix C2**) summarizes the calculated vertical hydraulic gradients for the water level monitoring events at monitoring wells. Vertical hydraulic gradients for monitoring wells are displayed in **Figure A2-10** (**Appendix A2**).

3.1.3 Surficial Geology

The mapped surficial Quaternary deposits at the Study Area consist predominantly of clayey silt till with shale and siltstone clasts. This till unit is interpreted to be the Halton Till; however, the original OGS mapping (White et al., 1968) named the local surficial till as the Wildfield Till. These generally correspond with the South Slope physiographic region. An area of fine-textured glaciolacustrine deposits (predominantly fine-grained) has been mapped in the southwest portion of the Study Area, which corresponds with the Peel Plain physiographic region. In general, all these glacial deposits are primarily fine grained, composed mainly of silts and clays. Maps of the Regional Physiography and Quaternary Geology are provided as **Figure A2-2** and **Figure A2-3** (**Appendix A2**).

A narrow area of modern alluvium consisting of silt, sand, and gravel, with organics has been mapped within the Clarkway Drive Tributary valley at the south end of the Study Area.

3.1.4 Soils

Soils information was derived from the "Soil Survey of Peel County" (Hoffman and Richards, 1953). Soils in the area were derived from parent materials of lacustrine soil over clay till or heavy textured till with imperfect drainage. The Peel clay member and / or Monaghan clay loam covers much of the Bolton area. The internal drainage is low, and the runoff is slow. The surface soil is high in organic matter, which is well incorporated with the mineral portion of the soil. The type responds to tile drainage. The Peel clay member generally corresponds to areas of glaciolacustrine deposits, and the Monaghan clay loam corresponds to the area of surficial till.

3.1.5 Bedrock Geology and Bedrock Topography

The uppermost mapped bedrock unit underlying the Study Area is the Upper Ordovician Georgian Bay Formation. The Georgian Bay Formation consists of dark blue grey to black shale with interbeds of limestone. The Georgian Bay Formation shale is not typically considered an aquifer. The Queenston Formation shale is located approximately 4 km to the northwest. The Queenston Formation is characterized by red shale with interbeds of red siltstone, minor green shale, and siltstone, sandstone, and limestone (Ontario Geological Survey, 2005). A bedrock geology map is presented as **Figure A2-4** (**Appendix A2**).

The bedrock surface in the area is expected to be approximately 200-215 masl based on OGS mapping with an overall slope to the southeast. The ORMGP has interpreted a deep buried bedrock valley up to 80 m deep that traverses the Study Area in an east-west direction. This interpolation was based on regional data and extrapolation between data points; however, there has been no borehole drilling confirmation of this potential valley feature within the Study Area. The bedrock surface may be below 160 masl in areas of the buried valley feature in portions of the Study Area based on the ORMGP's interpolation of this feature. This would need to be confirmed through additional drilling.

3.1.6 Overburden Thickness

In general, overburden thickness is interpreted to range from approximately 3 m to 30 m. MECP well records intersecting bedrock in the vicinity of the Study Area vary from approximately 3 m to 28 m. The ORMGP interpolation of the buried bedrock valley feature described in **Section 3.1.5** indicates that the overburden thickness may be up to 70 m thick within the potential valley feature across the Study Area. A depth of overburden map based on the ORMGP interpolation is presented as **Figure A2-5 (Appendix A2)**. As noted above, the buried bedrock valley would need to be confirmed through additional drilling within the Study Area.

3.1.7 Regional Hydrostratigraphy

Hydrostratigraphic units are developed by grouping or dividing geological / stratigraphic units based on their hydrogeologic properties. Permeable geologic materials that can transmit significant or potentially useable quantities of water are considered aquifers. Less permeable units are known as aquitards, although water can still be transmitted slowly through these units. The understanding of regional hydrostratigraphy was based on work conducted by the GSC, OGS, and ORMGP as part of the studies of the Oak Ridges Moraine (ORM). Based on a review of information available from the ORMGP, the following hydrostratigraphic units have been interpreted to overlie the bedrock in the regional area:

- Halton Till (Aquitard);
- ORM (Aquifer);
- Newmarket Till (Aquitard);

- Thorncliffe Formation (Aquifer);
- Sunnybrook Aquitard (Aquitard);
- Scarborough Formation (Aquifer); and
- Bedrock (Aquitard).

Halton Till –The Halton Till generally consists of fine-grained silt to silty clay till with occasional gravel. This till acts as an aquitard of regional extent and is the surficial hydrostratigraphic unit over most of the Site. The Halton Till is interpreted to be quite thick across the Site, based on borehole drilling results. In the central portion of the Site, near George Bolton Parkway, the upper till unit is over 15 m thick.

Oak Ridges Moraine – The ORM Aquifer is an extensive stratified sediment complex, 160 km long and 5 km to 20 km wide, located to the north of the Study Area. The aquifer deposits are typically non-cohesive and may consist of silt, sand, and gravel. Locally, it may exist as a confined aquifer unit underlying the surficial Halton Till. The aquifer is commonly used for water supply.

Newmarket Till – The Newmarket Till is a regionally extensive till sheet and is typically a massive, frequently over-consolidated, stony and dense silty sand till. It acts as a regional aquitard separating the ORM Aquifer from the underlying Thorncliffe Aquifer.

Thorncliffe Formation – The Thorncliffe Formation is comprised of glaciofluvial and lacustrine deposits containing sand, silt, and clay. The Thorncliffe Formation varies considerably in grain size and thickness. Locally, it can vary between 5 m to 10 m in thickness. Where present, it acts as an aquifer of regional extent.

Sunnybrook Drift – The Sunnybrook Drift is a clast-poor silt to silty clay unit and is a regionally extensive aquitard. The thickness of the Sunnybrook Drift is generally less than 10 m to 20 m, although locally it can reach a thickness of 30 m.

Scarborough Formation – The Scarborough Formation is composed of variable deposits ranging from fine silts and clays to sand. This unit is mostly found within bedrock valleys and thins laterally away from the valleys. Where present, it acts as an aquifer of regional extent.

Bedrock – Underlying the unconsolidated sedimentary material is bedrock from the Georgian Bay Formation, as discussed in **Section 3.1.5**.

It should be noted that not all the hydrostratigraphic units discussed above may be present within the local area. Typically, the deeper units are only present when there is a sufficiently thickness of overburden, such as in the area of the ORM or within deeper buried valley segments.

3.1.8 Local Geology and Hydrostratigraphy

Location and depth details of the available monitoring wells used in the CEISMP are provided in **Table C2-2** (**Appendix C2**) and illustrated on **Figure A2-6** (**Appendix A2**). The following monitoring wells were used:

- RJB installed three monitoring wells (MW7, MW8, MW9) to depths up to approximately 5mbgs as part of that investigation;

- Five monitoring wells (MW1-17, MW2-17S/D, MW3-17, MW4-17S/D, and MW517S/D) were installed in the Study Area under the supervision of Arcadis in 2016 to depths ranging from 6 mbgs to 12.2 mbgs;
- DS Consultants installed four monitoring well nests (BH23-1A/B, BH23-2A/B, BH237A/B, and BH23-11A/B) in 2023 at depths ranging from 4.6 mbgs to 8.2 mbgs;
- Pinchin installed 12 monitoring wells (BH1, BH9, BH12, BH13, BH15, BH18, MW103, MW108, MW124, MW160, MW161, and MW168) in 2023 at depths ranging from 3.4 mbgs to 6.7 mbgs; and
- Arcadis / PNJ installed 10 monitoring wells (MW25-1A, MW25-1B, MW25-02, MW25-3A, MW25-3B, MW25-SWM1, MW25-SWM2, MW-SWM3, MW25-CR1, and MW25-CR2) as part of the 2025 investigation. This included two nested locations (MW25-1A/MW25-1B, and MW25-3A/MW-3B.).

Available borehole logs (**Appendix G**) from the drilling programs were reviewed to interpret the local geological and hydrostratigraphic conditions across the Study Area. Based on these borehole logs, the following conditions are noted:

- In general, the Study Area is covered by a thin layer of topsoil or fill, which is interpreted to be reworked native material. The approximate thickness of this unit is 0.2 m, but it can be up to 0.9 m locally;
- A silty clay to clay silt till layer was encountered across the Study Area underlying the topsoil / fill layer. This silty clay till layer is interpreted to be the Halton Till, which has been mapped across the Study Area. The thickness of the silty clay till is interpreted to range from approximately 2 m to over 17 m based on available borehole logs;
- A dense sandy silt till was also encountered underneath the silty clay till layer at numerous borehole locations across the Study Area between depths of approximately 4 m to 17 m. This dense silt to sandy silt till layer may represent the lower portion of the Halton Till or the Newmarket Till or may be a subunit of the Halton Till;
- Silt to silty sand to sand was noted in several borehole locations across the Study Area, underlying the upper till units. This unit was most noted in the boreholes advanced by DS Consultants in the southern portion of the Study Area. Where encountered, the unit was often several metres thick and extended to the bottom of the boreholes. This unit may represent the ORM aquifer deposit, which would suggest that the overlying sandy silt till is a variation of the Halton Till and is not the Newmarket Till, based on the regional hydrostratigraphy; and
- Both the upper silty clay to clayey silt till and the sandy silt till units are interpreted to be relatively low permeability aquitard units. The underlying silty sand to sand unit, where present may represent a localized aquifer unit. A north-south oriented geological cross section was constructed across the Study Area using Arcadis and RJB borehole data and is presented as **Figure A2-7** (**Appendix A2**). As illustrated, the shallow subsurface has been logged as predominantly fine-grained till.

The deeper units (Thorncliffe Formation, Sunnybrook Drift, and Scarborough Formation) noted in **Section 3.1.7** may be present within the deeper buried bedrock valley feature but have not been encountered as part of this study.

Bedrock was not encountered during any of the subsurface investigations referenced in **Section 3.1.** A review of several nearby IWA Site 34-b (Interim Waste Authority landfill search – Site 34-b) borehole logs available through the ORMGP database provided information of the hydrostratigraphy at depths greater than approximately 20 m. The IWA Site 34-b was located 1 km to 2 km northwest of the Study Area, in the block south of King Street and west of Humber Station Road. Deep boreholes drilled as part of that study indicated depths to bedrock ranging from approximately 10 m to 60 m. The boreholes reviewed contained a significant thickness of surficial fine-grained soils (till, clay, silt), typically >25 m thick where bedrock was deeper. A silt to sand aquifer was noted in several of the boreholes at depths > 25 m. This sand unit may correspond to the ORM aquifer unit.

As noted above, the ORMGP has interpreted the depth to bedrock to vary between approximately 20 m and 70 m (**Figure A2-5; Appendix A2**).

3.1.9 Hydraulic Properties of Stratigraphic Units

RJB conducted hydraulic testing at several of the installed monitoring wells and found that in--situ hydraulic conductivity (K) values were generally low, between 1.6 x 10^{-7} m/sec to 6.5 x 10^{-8} m/sec. Soils in the Study Area are generally fine grained, composed mainly of silt, clay, and silty clays.

Single-well hydraulic conductivity testing was completed in August 2017 by Arcadis field staff in select monitoring wells (MW1-17, MW2-17S, MW2-17D, MW3-17, MW4-17S, MW4-17D, MW5-17S, and MW5-17D). The estimated in-situ K values were generally low and similar to the RJB results. The calculated results ranged from 2.2 × 10^{-9} m/s to 1.1 × 10^{-7} m/s.

In May 2025, Arcadis field staff completed additional testing on select monitoring wells installed in 2025 (MW25-1A, MW25-1B, MW25-3A, MW25-3B, MW25-SWM1, MW25-SWM2, and MW25-SWM3). The estimated in-situ K values were similar to the previously estimated K values. The calculated results ranged from 3.1 x 10^{-10} m/s to 6.8 x 10^{-7} m/s. Overall, the low estimated hydraulic conductivities are within the range for the types of materials (Halton Till and Newmarket Till) in which the monitoring wells were screened. Hydraulic testing of the underlying ORM aquifer was completed on monitoring wells MW25-1A and MW25-3A as mentioned above. The calculated results were 3.0 x 10^{-10} m/s and 6.1 x 10^{-7}, respectively. However, the calculated result for MW25-1A is considered to be anomalously low and may be attributed to screening the monitoring well across two different stratigraphic units. The hydraulic conductivity results from the interpreted OMR sediments from MW25-3A are also relatively low but consistent with the silt unit noted at that location.

A summary of the calculated hydraulic conductivities is provided in **Table C2-3** (**Appendix C2**).

3.2 Local Hydrogeology

3.2.1 Groundwater Quality

Groundwater samples were collected from three shallow wells (MW1-17, MW3-17, and MW5-17S) and one deep well (MW4-17D) on September 22, 2017. The groundwater samples were sent to Maxxam Analytics Inc. (Maxxam) in Mississauga for laboratory analysis of general inorganics and metals to characterize the baseline groundwater quality at the Study Area.

In 2025, Arcadis collected groundwater samples from MW25-1B, and MW25-CR1 for comparison with the Region of Peel Sewer Use Bylaw and the Ontario Provincial Water Quality Objectives (PWQO). Groundwater samples collected in 2025 were submitted to AGAT Laboratories (AGAT) in Mississauga.

Given the likelihood that construction dewatering discharge (if required) will be directed either to the on-site watercourse or a local Region of Peel sewer, the analytical results were compared with both the PWQO and the Region of Peel Storm and Sanitary sewer criteria. Various groundwater exceedances of the PWQO and/or the Region of Peel Storm and Sanitary sewer criteria were identified from each sample as summarized in **Table C2-6** (**Appendix C2**).

3.2.2 Mini-Piezometer Groundwater Levels and Vertical Hydraulic Gradients

Seven wetlands have been identified in the Study Area which are associated with the riparian habitat of the Clarkway Drive Tributary (Wetlands D1, F1, G1) and HDF-3 (Wetlands A1, B1, C1, E1). The hydrology of these wetlands is dominated by surface water processes:

- **Precipitation and surface runoff** from adjacent upland areas provide the primary sources of water;
- **Snowmelt** and seasonal overland flow contribute significantly to wetland recharge during the spring;
- **Infiltration** is minimal due to the low hydraulic conductivity of the till (often < 10^{-7} m/s), resulting in poor drainage and frequent surface ponding; and
- **Lateral shallow subsurface flow** within any weathered or fractured till near the surface may contribute locally but is generally of limited significance.

The underlying **confined ORM aquifer** does not provide a meaningful source of water to these wetlands. The thick till layer acts as an effective aquitard, preventing hydraulic connection between the wetland and the deeper groundwater system under natural conditions. Similarly, wetland water levels and hydrological function have no significant influence on the confined aquifer.

Wetland Characteristics

- Wetlands in these landscapes are typically **perched** above the regional water table or may represent **isolated depressional wetlands**;
- Water level fluctuations correspond to seasonal climatic conditions, with maximum ponding in the spring and gradual drawdown during the summer and fall due to evapotranspiration and lack of sustained inflow; and
- The undulating topography of the till plain results in a patchwork of wet and dry areas, where low-lying zones collect and retain water, while intervening ridges act as local runoff source areas.

Monitoring Locations

Nested mini-piezometers were installed by Arcadis in 2017 within riparian wetlands and HDFs to measure groundwater levels and evaluate groundwater levels, vertical hydraulic gradients, and possible groundwater-surface water interactions. In 2025, a mini-piezometer nest was also installed along the Clarkway Drive Tributary at the proposed George Bolton Crossing, and two individual mini-piezometers were along HDF-8. Surface water monitoring locations are illustrated in **Figure A2-11 (Appendix A2)**.

The mini-piezometers were installed as part of a surface water monitoring program, discussed in **Section 3.2.3**. All mini-piezometers consisted of 1.9 cm diameter galvanized steel pipe with a 0.3 m screened drive-point and were manually driven into the ground. Location and depth details of the available mini-piezometers used in this study are provided in **Table C2-7** (**Appendix C2**). Streambed dataloggers were also installed at mini-piezometer stations and continuous data is available for 2017 and 2018. The dataloggers were removed before the winter season each year. Hydrographs for the mini-piezometers are provided in **Appendix A2**.

Available mini-piezometer monitoring data collected by Arcadis and others is presented in **Tables C2-8** and **C2-9** (**Appendix C2**). Observed water levels range from depths of 0.2 m above ground surface to 1.1 mbgs. It should be noted that several mini-piezometers were commonly dry, including SF2-17 (Clarkway Drive Tributary) and SF4-17 (HDF-3). Updated water levels during the 2022 and 2023 monitoring events were similar to the data collected in 2017 and 2018. However, surface water monitoring stations SF3-17S/D and SF4-17S/D were observed to be damaged and unusable in 2022 and 2023.

Vertical hydraulic gradients were estimated at each piezometer nest to assess potential groundwater-surface water interactions and are summarized below:

- Mini-piezometer nest SF3-17, located in Wetland F1 along the Clarkway Drive Tributary at the southeast portion of the Study Area showed predominantly upward gradients during the monitoring event (**Figure A2-12, Appendix A2**)**.** Monitoring well MW5-17, which also has upward gradients (**Figure A2-10, Appendix A2**) is also located nearby within the Clarkway Drive Tributary valley and associated riparian Wetland F1. Groundwater discharge is interpreted to be occurring in this area;
- Mini-piezometers PZS-CWT-2025 / PZD-CWT-2025 at Station CWT-25, located upstream of the proposed George Bolton Crossing on the Clarkway Drive Tributary (north of the SF3-17), showed neutral to slightly upwards gradients in the spring of 2025 after their installation;
- Station SF6-17 (Wetland F1; **Figure A2-11**), which is located downstream of SF3-17 within the Clarkway Drive Tributary floodplain showed predominantly upward gradients in the spring. This suggests that this area may be receiving groundwater discharge during a portion of the year and may represent a permanent stream classification in these areas;
- SF5-17 located immediately upstream of Wetland E1 in HDF-3 (**Figure A2-12**) has upward gradients during the spring and may also receive groundwater discharge for a portion of the year;
- WL1-17 within Wetland B1 (**Figure A2-11**) near the upper portion of HDF-3 had a noted upward gradient in the late fall / early winter of 2017 and 2018. This may represent minor intermittent groundwater discharge in these areas;
- SF4-17 was dry during all but two monitoring events during 2017 and 2018. This is interpreted to be representative of an overall downward gradient. The deeper piezometer is disconnected from the groundwater table and groundwater would not have been discharging to HDF-3 at that time. The station was destroyed after the 2018 field season; and
- Mini-piezometers HDF-8-b and HDF-8-c installed along HDF-8 both had downward gradients.

Table C2-10 (**Appendix C2**) and **Figure A2-12** (**Appendix A2**) summarize the calculated vertical hydraulic gradients at the piezometer nests for the water level monitoring events.

3.2.3 Groundwater Surface Water Interactions

3.2.3.1 Surface Water Flow and Baseflow

A surface water monitoring network was set up across the Study Area by Arcadis in 2017 to measure surface water flow under baseflow conditions. Arcadis installed nine surface water monitoring stations at the Site in July 2017. These included seven stream flow stations (SF1-17, SF2-17, SF3-17, SF4-17, SF5 17, SF6-17, and SF7-17) installed along tributaries of the Humber River, and two wetland monitoring stations (WL1-17, WL2-17) at two locations at the Study Area. Additional surface water flow stations were installed in 2022 (SF8-22, SF9-22, SF10-22, and SF11-22). Arcadis staff also installed a surface water station (CWT-25) at the proposed George Bolton crossing of the Clarkway Drive Tributary in 2025. This station included a mini-piezometer nest (PZS-CWT-2025 and PZD-CWT-2025) plus a staff gauge.

The surface water monitoring locations are illustrated in **Figure A2-11 (Appendix A2).**

Baseflow conditions were analyzed to assess potential groundwater contribution to the on-site features. Baseflow represents the portion of stream discharge derived from natural storage such as groundwater discharge. Storm flow represents the surface runoff from precipitation events and is generally indicated on the hydrograph by the rapid increase in flow following a precipitation event. The Ontario Stream Assessment Protocol (OSAP; Stanfield, 2010) suggests that baseflow conditions exist when there is no evidence in the discharge hydrograph of any recent storm event. The TRCA recommends a minimum 72-hour dry period following precipitation for measurement of stream discharge representative of baseflow conditions.

The baseflow results were assessed, and the flow regime for each feature was interpreted. The flow regime for each feature was defined as one of the following:

- **Permanen**t – maintains continuous surface flows most years. These features typically have a low-flow channel that is well defined;
- **Intermittent** – water flows for several months during the year, typically during the spring, early summer, and late fall. These drainage features generally have a high flow channel that is poorly defined; and
- **Ephemeral** – Water flows for a short period of time primarily during snow melt (spring freshet) or spring events, frequently occurring as vegetated swales or bare soil rigs in agricultural fields where they are often ploughed through.

Based on the analysis of meteorological data obtained from **Environment Canada Toronto International Airport Climate Station (ID No. 6158731)** for the period of the monitoring program (July 2017 to April 2018), it is noted that the streamflow measurements collected on September 21, 2017, and November 10, 2017, represent baseflow contribution for the tributaries. These measurements were all taken after a minimum of three consecutive days without precipitation. Similarly, the readings taken in 2022 and 2023 represent baseflow conditions, except for the May 2023 event.

Five rounds of stream flow monitoring were conducted at stream flow monitoring stations along HDF-3, HDF-8, and the Clarkway Drive Tributary from July 2017 to April 2018. Three stream flow monitoring events were also completed in 2022 and 2023. Dataloggers at all the stream monitoring stations were retrieved during the winter months (early December 2017 to late April 2018) to avoid freezing conditions. The stream flow was measured using the area times velocity method specified in OSAP Version 8 (Stanfield, 2010). In 2025, stream flow observations were made on three occasions at the CWT-25 station at the Clarkway Drive Tributary crossing. Observations on each occasion were made after a minimum of three consecutive days without precipitation.

In general, when precipitation data was compared with the stream flow, it was observed that most precipitation events trigger rapid increases in the stream flow and stream water level at each location. Higher flows were observed in spring (late April) due to snow melt and higher volume of precipitation. Stream flow in the summer and autumn months (July to November) was generally lower.

Table C2-11 (**Appendix C2**) summarizes the stream flow and staff gauge measurements obtained during 2017-2018 and 2022-2023. The vertical gradient results for mini-piezometers are illustrated in **Figure A2-12** (**Appendix A2**). Stream water level hydrographs and the associated estimated stream flow hydrographs are presented in **Appendix A2**. Additional details are provided below.

Clarkway Drive Tributary (East Side of Study Area)

Three surface water monitoring stations were installed in 2017 along the Clarkway Drive Tributary at upstream (SF2-17), mid-stream (SF317), and downstream (SF6-17). One surface water monitoring station was installed in 2025 at the George Bolton crossing approximately midway between SF2-17 and SF3-17. The baseflow was estimated as follows:

- Station SF2-17 (Upstream) – 0.4 L/s to 41.1 L/s;
- Station SF3-17 (Mid-stream) – 3.3 L/s to 144.3 L/s; and
- Station SF6-17 (Downstream) – 3.3 L/s to 143.7 L/s.

It was observed that the baseflow measurement obtained at the midstream station (SF317) was higher than that estimated at the upstream location (SF2-17), which indicates that a portion of the reach between stations is gaining baseflow through groundwater discharge. This reach may receive some groundwater discharge during the spring and/or late fall based on the vertical hydraulic gradient data. Station SF10-22 was also installed in 2022 at the downstream end of the tributary at Mayfield Road to provide qualitative observations of streamflow. This station was observed to be flowing during each monitoring event in 2022 and 2023. Similarly, qualitative observations of baseflow at CWT-25 indicated that this station was observed to be flowing during each monitoring event in 2025.

Flow was observed within this tributary during each monitoring event and upward gradients indicative of groundwater discharge were noted at the four mini-piezometer stations located along this this tributary. As such, the Clarkway Drive Tributary is interpreted to have a permanent flow regime.

Further, based on the streambed datalogger data available from 2017 and 2018 (SF2-17, SF3-17, SF6-17), as well as 2025 data (CWT-25), the estimated stream water levels and stream flows show a strong response to precipitation events, which indicates that storm flow (surface water runoff) provides some input to the observed flows in the tributary.

HDF-3 (West Side of Study Area)

Three surface water monitoring stations were installed along HDF-3, along the west side of the Study Area: up-stream (SF1-17); mid-stream (SF4-17), and downstream (SF5-17). HDF-3 was noted to have intermittent flow. In 2022 and 2023, GEI staff noted that the drainage feature was dry in late spring. It was assessed that the estimated baseflow at the HDF-3 is relatively low, and ranged along each station as follows:

- Station SF1-17 (Upstream) – 2.5 L/s to 2.7 L/s;
- Station SF4-17 (Mid-stream) – 2.8 L/s to 5 L/s; and
- Station SF5-17 (Downstream) – 0.5 L/s.

For all events considered to be representative of baseflow conditions, the baseflow estimated at the downstream station (SF5-17) was lower than the baseflow estimated at the upstream station (SF1-17) and midstream station (SF4-17), which suggests that HDF-3 may be losing water through infiltration or discharge to other receivers (e.g., riparian wetlands) at SF1-17 and SF4-17 before reaching SF5-17.

During the September 2023 monitoring event, stations SF1-17, SF4-17, SF5-17, and WL3-17 were observed to be dry. The dry conditions observed in September 2023 may have been influenced by a beaver dam upstream. Some intermittent groundwater discharge may be occurring in the area of SF5-17 (just upstream of Wetland E1 within HDF-3) based on the upward gradients noted in the mini-piezometer during spring (see **Section 3.2.2**).

Based on the streamflow observations presented above and the vertical hydraulic gradient data, presented in **Section 3.2.2**, HDF-3 is interpreted to have an intermittent flow regime. This is supported by the downward gradient in SF4-17 and the commonly dry deeper mini-piezometer at that location. This is also supported by the observation that the estimated stream water levels and stream flows show close correlations with the precipitation data, which further confirms that storm flow (surface water runoff) makes up most of the flows in HDF-3.

HDF-8 (Centre Drainage Feature)

One monitoring station (SF7-17) was installed adjacent to the mapped headwater drainage feature in 2017. SF7-17 was observed to be dry throughout the monitoring period of 2017-2018. GEI staff noted flow during spring freshet however, the HDF was dry by May/June (depending on the year).

Two observational stations (SF9-22 and SF11-22) were established in 2022, and two additional stations (HDF-8-b and HDF-8-c) were established in 2025 to record / observe flow conditions. No stream flow was observed at the monitoring station during any of the monitoring events, except for May 5, 2023, when minor to moderate flow was observed. Review of precipitation records indicated precipitation events with >5 mm/day occurred on May 2, 2023, and May 3, 2023, and minor precipitation on May 5, 2023. This flow is interpreted to represent runoff and not baseflow. On April 9, 2025, stagnant surface water was observed at both stations. GEI ecologists similarly recorded that much of this feature is ploughed through and does not provide riparian habitat.

Based on these observations, HDF-8 is interpreted to have an ephemeral flow regime.

3.2.3.2 Surface Water Quality

A total of three surface water samples (including one field duplicate) were collected on September 17, 2017, from the following three stream flow monitoring locations:

- Upstream - HDF-3 (SF1-17);
- Downstream - HDF-3 (SF5-17); and
- Downstream - Clarkway Drive Tributary (SF6-17).

All three samples were submitted to Maxxam in Mississauga for laboratory analysis of general inorganics and metals to characterize the background water quality of the watercourses.

On April 9, 2025, one surface water sample was collected from the Clarkway Drive Tributary at the proposed George Bolton Crossing at station CWT-2025. The sample was submitted to AGAT in Mississauga. The analytical results were compared with PWQOs to identify potential exceedances of water quality criteria. Various surface water exceedances of the PWQO were identified from each sample as summarized in **Table C2-6** (**Appendix C2**).

A summary of the analytical results and laboratory certificates of analysis are provided in **Appendix C2**.

3.2.4 Areas of Groundwater Recharge and Discharge

None of the HDFs or wetlands across the Study Area are interpreted to be directly connected to the ORM aquifer. As such, any seepage from the water table in the upper Halton Till unit may occur in topographically low areas, where water stored in the shallow saturated zone within the till discharges to the base or margins of wetlands or HDFs. The discharge of water from the shallow till unit to low-lying HDFs or wetlands is typically in response to a topographical gradient and not a vertical gradient. The corresponding seepage rates will be low as they are directly correlated with the hydraulic conductivity of the upper till unit.

Groundwater recharge is where water infiltrates the ground and moves vertically downward through the unsaturated zone until it reaches the groundwater table. Areas that are not groundwater discharge areas are typically considered a groundwater recharge area; however, the rate of groundwater recharge is greater in areas of permeable surficial sediments. Since most of the Study Area has mapped fined-grained Halton Till at surface, the groundwater recharge rates should not be significant; however, there would be some recharge to the underlying aquifers. Additional details regarding recharge rates and the Study Area water balance are provided in **Section 3.2.5.**

Groundwater discharge occurs along streams, rivers, lakes, and springs, where the water table intersects the ground surface. Groundwater discharge areas also coincide with areas with upward vertical gradients and where the water table is at or above the ground surface. Groundwater discharge is interpreted to occur where stream reaches or wetlands occur in low-lying areas of the Halton Till where the water table is at or near ground surface.

Groundwater, mini-piezometer, and baseflow monitoring data were reviewed to interpret local groundwater recharge and discharge conditions. Typically, areas with observed upward hydraulic gradients were considered to represent potential groundwater discharge locations and areas with downward hydraulic gradients were interpreted to represent surface discharge conditions.

The relevant observations, described above in **Section 3.2.3** and **Section 3.2.4** were used to assess groundwater discharge and recharge conditions, as follows:

- Monitoring well MW5-17D (Wetland F1) located adjacent to the Clarkway Drive Tributary in the southern portion of Study Area is an artesian well with consistent upward hydraulic gradients. This may be representative of pressurized conditions from the ORM aquifer;
- Mini-piezometer SF3-17 (Wetland F1) in the southeast portion of the Study Area within the Clarkway Drive Tributary showed predominantly upward gradients during the monitoring events. Station SF6-17 (Wetland F1), which is located downstream of SF3-17 within the Clarkway Drive Tributary showed predominantly upward gradients in the spring, which suggests that this area may be receiving groundwater discharge during a portion of the year. SF2-17 (Wetland D1), which is located within the Clarkway Drive Tributary further north in the Study Area showed predominantly downward gradients;
- Most monitoring well nests away from HDFs (MW2-17S/D, and MW4-17S/D) were observed with downward vertical hydraulic gradients, indicating groundwater recharge conditions. Monitoring well nest MW25-1A/B installed in 2025 along the proposed George Bolton Parkway had a slightly upward vertical gradient; however, this is interpreted to be representative of pressurized conditions from the underlying ORM aquifer and not representative of a discharge condition, since the lower coarse-grained sediments are overlain by over 15 m of fine-grained Halton Till;
- Downward or hydraulic gradients observed in most of the mini-piezometer nests suggest that the wetlands and the stream features on-site are not receiving groundwater discharge and are unlikely to be groundwater dependent; and
- Mini-piezometer SF5-17 located in HDF-3 showed upward gradients during the spring and may also receive groundwater discharge for a portion of the year. Mini-piezometer WL1-17 within Wetland B1 near the upper portion of HDF-3 had a noted upward gradient in the late fall / early winter of 2017 and 2018. This may represent minor intermittent groundwater discharge within HDF-3.

3.2.5 Estimation of Pre and Post Development Site Water Balance

Natural consequences of urban development include a reduction in groundwater infiltration, diversion of this infiltration towards surface water bodies as runoff, altered flow regimes, and channel erosion. Infiltrating rainwater also plays an important role in the protection of surface water and groundwater quality, as the percolation through soil pores acts as a natural filter to contaminants. An increased contaminant load to surface water bodies is a common hydrologic consequence in the urban water cycle.

A water balance provides for an accounting of water transfers across a defined system's boundaries over a defined period. Any difference between the inflows to the system and the outflows from the system during this period must be balanced by a change of storage within the system.

In designing infiltration targets for a defined area, the approach is modified through the introduction of mitigation measures, best practices or Low Impact Development (LID) tools at site-level to help maintain inputs and outputs to pre-development levels.

At a regional level, modelled groundwater water budget mapping by the ORMGP indicates that most of the Study Area is considered a groundwater recharge area with annual average recharge rates varying from approximately 100 mm/year to 120 mm/year. This is a low to moderate recharge rate, reflective of the nature of the fine-grained till deposits across most of the Study Area and is similar to other areas within the South Slope physiographic region within the Region of Peel. ORMGP mapping also indicates that recharge in the local area ranges from approximately 110 mm/year to 160 mm/year.

None of the Study Area has been mapped as Significant Groundwater Recharge Area (SGRA) based on Source Water Protection mapping. A recharge area is significant when the rate of recharge, relative to the source protection area, is 15% higher than average.

3.2.5.1 Methodology

A site scale water balance analysis was completed following the Thornthwaite and Mather water balance method outlined in Chapter 3 of the Ministry of Environment's (MOEs) Stormwater Management Planning and Design Manual (MOE, 2003). The water balance method estimates evapotranspiration, infiltration, and runoff volumes based on precipitation and site factors such as soil type, vegetation cover, and topography.

The Albion Field Centre climate station (ID# 6150103) is the closest meteorological station to the Study Area. The 30-year climate normal is considered as the dataset most representative of Study Area conditions and uses data collected from 1981-2010. It is noted that data collected at the Albion Field Centre climate station from 1991-2020 was not available and daily precipitation data is unavailable after 2001. The climate data was obtained from Environment Canada as input into the Thornthwaite and Mather model.

The monthly mean temperature and monthly precipitation data were used in the Thornthwaite and Mather Equation to estimate the monthly potential evapotranspiration. The estimated monthly potential evapotranspiration was adjusted using a daylight correction value to account for varying length of daylight throughout the year.

The precipitation surplus (amount of water available to infiltrate or runoff) was estimated by calculating the difference of the yearly precipitation and potential evapotranspiration. Infiltration was estimated by multiplying a set of infiltration factors (dependent on the topography, soil type, and land cover) to the estimated precipitation surplus.

Impervious percentages for the pre-development and post-development scenarios were estimated by measuring the total impervious areas (including rooftops, surface parking, concrete surfaces, walkways, and road surfaces) across the Study Area. The estimations of the pre-development pervious area are based on current conditions within the Study Area, while the post-development pervious area has been based on the Conceptual Site Plan, prepared by SGL Planning. Lands zoned for General Industrial and Prestige Industrial are assumed to be completely impervious, whether occupied by buildings or paved lands in the future. The lands to be occupied by roadways, including future highway expansion, are also considered to be impervious.

In both the pre-development and post-development scenarios, evapotranspiration from impervious surfaces has been assumed to be 20% precipitation. The infiltration factor was selected from Table 3.1 in the MOE's Stormwater Management Planning and Design Manual (MOE, 2003) based on the summation of various factors (topography, soil type, and land cover).

3.2.5.2 Water Balance Results Summary

A summary of the key water balance elements for the Study Area is presented in **Table C2-12** (**Appendix C2**).

The Study Area is currently covered by mostly agricultural land or natural vegetated land cover. Scattered residential properties are present, usually inclusive of a driveway at each property. The predevelopment recharge was estimated to be approximately 102 mm/year (per unit area), which reflects fine-grained soil, gently rolling hills, and agricultural land.

Hydrogeological data of the local area surrounding the Study Area was used from the TRCA water balance tool as a comparison to the calculated results. Based on the mapping, precipitation, evapotranspiration, runoff, and recharge were averaged to be 861 mm/year, 592 mm/year, 213 mm/year, and 114 mm/year, respectively. In comparison to the results presented in **Table C2-13**, there is no significant variance and as such, the 30-year climate normal data used from the Albion Field Centre climate station is considered appropriate for the water balance analysis.

An additional comparison was made using the hydrogeological data from the ORMGP's Water Balance tool pertaining solely in the Study Area. Based on the mapping, precipitation, evapotranspiration, runoff, and recharge were averaged to be 796 mm/year, 548 mm/year, 127 mm/year, and 115 mm/year, respectively. These results also corroborate the results of the analysis completed as part of this investigation. **Figure A2-13 (Appendix A2)** illustrates the output of recharge from the ORMGP program.

The introduction of industrial land uses, with paved ground cover, in the proposed post-development scenario will significantly decrease net infiltration and increase overall runoff across the Study Area. It is understood that approximately 86% of the Study Area may be considered impervious based on the current proposed land use. This was calculated to significantly reduce recharge to approximately 16 mm/year per unit area. Runoff would commensurately be increased from approximately 165 mm/year in the pre-development scenario to 589 mm/year in the post-development scenario.

The increased runoff may result in erosional impacts to nearby natural surface water features over time, as well as water quality impacts that are commonly present in urban watersheds. The decreased infiltration may also impact the local and regional water table over time, which could result in negative impacts on the natural ecosystem.

Evapotranspiration decreases from approximately 554 mm in the predevelopment scenario to 218 mm in the post development scenario due to an increase in impervious surface, which represents an approximate 61% reduction in evapotranspiration.

Impacts to infiltration and evapotranspiration could be reduced or mitigated through the implementation of LID designs at site level, which will also help control the increased runoff. Civil and stormwater management design at site level should consider these impacts to the water balance across the Study Area.

The detailed water balance calculations are presented in **Table C2-13** and **C2-14** (**Appendix C2**).

3.2.6 Potential Surface Water Infiltration Opportunities

As discussed above, there is one tributary, two HDFs, and several wetland features located within the Study Area. Based on the field data collected to date, most surface water features and wetlands identified in the Study Area are not groundwater-dependent (as indicated by downward hydraulic gradients).

Areas within the Clarkway Drive Tributary display upward hydraulic gradients and support the interpretation of localized baseflow contribution to the tributaries. The potential of reduced on-site infiltration is unlikely to have an impact on the hydrological and ecologic function of this tributary since the discharge is interpreted to occur in low-lying areas of the Halton Till / upper clay based on a topographical gradient and the resulting volumetric discharge may be low. Direct discharge from the underlying ORM aquifer is not interpreted to occur across the Study Area, although upward gradients resulting from the high potentiometric levels in the underlying confined ORM aquifer may contribute to some groundwater discharge, given tight soils of the Halton Till.

On a regional scale, most aquifer recharge occurs in the ORM or in areas where coarse-grained units are found at shallow depths. The Study Area is not identified as an area of significant groundwater recharge (TRCA, 2008) and does not contribute a significant amount of infiltration on a watershed scale due to the generally low overburden permeability.

Further, Halton Till clay silt deposits have been mapped across the Site and, as such, the Site is interpreted to be in an area of relatively low to moderate recharge. As noted, in **Section 3.1.9**, the hydraulic conductivity values of the near surface Halton Till deposits were calculated to be quite low ranging from 2.2×10^{-9} m/s to 1.1×10^{-7} m/s, which would correspond to an infiltration rate of less than 15 mm/hour (1×10^{-6} cm/s). The upper portion of Halton Till may be weathered and fractured and may have a slightly higher infiltration rate as a result. Localized areas with closed depressions may also have higher infiltration rates on a local scale.

Any proposed on-site SWM pond(s) would capture the storm runoff and provide water quality treatment, including temperature and flow moderation prior to discharge to the creek. Combined with various BMPs, the SWM pond will help mitigate potential impacts to on-site and nearby watercourses. Use of trench plugs, anti-seepage collars, or other methods to restrict the preferential movement of groundwater along the subsurface infrastructure corridors should be considered.

Additionally, LID measures (e.g., water reuse systems, infiltration trenches, roof leader connections to soak-away pits, grassed swales, rain gardens, enhanced grassed swales, pervious pipe systems) will be proposed and designed at the Draft Plan Approval stage to promote infiltration and decrease in runoff to address the infiltration deficit and help preserve the existing groundwater flow regime, maintain groundwater contributions to nearby groundwater-dependent features as well as minimize channel erosion and sediment loading into downstream surface water features.

To maintain recharge across the Study Area, it is recommended that future LID facilities be distributed across the Study Area where there is sufficient separation distance to the groundwater table rather than concentrated in a few areas. The number of LID facilities will be identified at the Draft Plan Approval stage. According to the TRCA/CVC Low Impact Development Stormwater Management Planning and Design Guide (2010, v1.0), the recommended vertical separation

distance between the bottom (base) of an infiltration-based LID practice (e.g., bioretention, infiltration trench) and the seasonally high groundwater table (or bedrock) is 1 m. This 1 m "safety buffer" ensures adequate unsaturated soil beneath the structure for treatment and buffering and allows for potential groundwater mounding. It should be noted that infiltration is not feasible when excavations extend below the groundwater level

The feasibility for LID facilities based on groundwater separation distances and considering post-development grading is assessed in the Phase 2 CEISMP report.

The location of LID measures should also consider maintaining baseflow to retained features (i.e., Clarkway Tributary, HDF-8) to maintain aquatic habitat contributions.

To assess infiltration rates in potential stormwater management facilities, a preliminary infiltration testing program was completed. Details are discussed in **Section 3.2.7**.

3.2.7 Preliminary Infiltration Testing Program

An infiltration testing program was completed by Arcadis in 2024 to inform consideration of LID opportunities as part of the proposed development. The infiltration testing work plan was designed following the requirements from the LID Stormwater Management Planning and Design Guide, Appendix C – Site Evaluation and Soil Testing Protocol for Stormwater Infiltration (TRCA, 2012). The locations of potential LID facilities will be identified at the Draft Plan Approval stage.

The TRCA guideline indicates that at least one test should be conducted at the proposed bottom elevation of the infiltration measures, plus additional tests at every other soil horizon encountered within 1.5 m below the proposed bottom elevation. As such, the infiltration tests were completed at depths of approximately 2.5 mbgs and 3.5 mbgs at several locations across the Study Area. Additional testing at the specific proposed LID locations will be required at the Draft Plan Approval stage.

Five test pits were excavated on June 6 and June 7, 2024, within the Study Area, as shown in **Figure A2-14**. Infiltration testing was completed using a Guelph Permeameter. The soil encountered at each of the test pit locations consisted mainly of clayey silt to silty clay till materials. Groundwater seepage was encountered at two test pits at approximately 2.5 mbgs. The estimated saturated hydraulic conductivity for tested soils ranged between 1.48×10^{9} cm/s and 2.44×10^{-4} cm/s, with geometric means ranging between 3.18×10^{-8} cm/s and 3.95×10^{-6} cm/s. These values were converted into infiltration rates using the methodology outlined in the *Low Impact Development Stormwater Management Planning and Design Guide* (TRCA and CVC, 2012).The calculated geometric mean infiltration rate ranged from 5 to 19 mm/hour. The calculated design infiltration rate, incorporating a safety factor as outlined in the TRCA and CVC guide (2012), ranged from 1.4 mm/hour to 7.8 mm/hour. This is considered relatively low and generally consistent with the observed soil types. It should be noted that infiltration testing was completed at only three localized areas across the Study Area. Additional infiltration testing is recommended at each proposed LID location at the Draft Plan Approval stage to inform specific design requirements.

The results are presented in **Table C2-15** in **Appendix C2**.

As noted in the TRCA and CVC guide (2012), when soils are of low infiltration rate, design modifications such as the inclusion of an underdrain, allowing for storage under an underdrain to draw down over a longer period of time or more vertical orientated Best Management Practices (BMPs) to provide greater hydraulic head may be necessary. As such, various LID measures can be contemplated to mitigate the reduction in recharge in the post-development scenario; however, soil amendments may be required. Various BMPs could be incorporated into future development to promote infiltration and decrease runoff to help preserve the existing groundwater flow regime. Other opportunities to maximize the infiltration capacity of proposed LIDs should be considered at the Draft Plan Approval stage.

Additional details regarding the methodology, analysis, and results are provided in **Appendix G**.

3.3 Desktop Assessment of Existing Water Supply Wells

An updated search of the MECP well records database was conducted in June 2025 within a 500 m radius of the Study Area. The search returned a total of 128 records for the area of the Study Area (**Figure A2-15, Appendix A2**). Well usage details are summarized in **Table C2-16** (**Appendix C2**).

Based on the records reviewed, the primary well usage in the area is for water supply purposes. A water well survey was completed on September 21, 2023, to assess if there are any property owners within the Study Area that rely on the local groundwater resources in the area for water supply. To date, no responses have been received. A list of properties visited is included in **Table C2-17** (**Appendix C2**).

The Village of Bolton relies on a lake-based municipal water supply derived from Lake Ontario. The water supply is managed by the Region of Peel. Prior to 2002, Bolton obtained its potable water from several municipal groundwater wells, which were screened within a deep sand/gravel aquifer situated near the bottom of a deep bedrock valley that roughly follows the trend of the Humber River.

There are no records of permits to take water (PTTW) within 500 m of the Study Area.

3.4 Surface Water Hydrology

3.4.1 Existing Drainage Condition

The ground cover of the Study Area, as described previously, is predominantly agricultural lands with smaller parcels of estate residential, and woodlots.

There are three main water features within the Study Area. HDF-3 enters the Study Area by crossing Healey Road, crosses the Study Area with diagonal alignment, and eventually exits the Study Area by crossing Humber Station Road. This HDF has a confluence with Gore Road Tributary Reach 1, immediately west of the Humber Station Road crossing. The Clarkway Drive Tributary Reach 2 flows along the East boundary of the site area. Please refer to **Figure 2** (**Appendix A3**) for the location of these features.

HDF-8 flows north-south through the middle of the Study Area and connects with the Clarkway Drive Tributary Reach 2 on the south side of Mayfield Road just outside of the Study Area. The drainage area of HDF-8 north of Mayfield Road is about 72.73 ha and it does not have any external drainage area, as shown in **Figure 2** (**Appendix A3**). The drainage area to HDF-8, north of the proposed Highway 413 corridor, is approximately 52 ha.

Gore Road Tributary 1 drains the northwestern part of the Study Area which is about 40% of the entire area. About 60% of the Study Area is draining through the Clarkway Drive Tributary Reach 2.

3.4.2 Existing Storm Servicing

The existing storm infrastructure within the vicinity of the Study Area includes:

1. Existing culvert and ditches along Humber Station Road;
2. Existing culvert and storm sewer along Mayfield Road; and
3. Existing ditches and culverts along Healey Road.

Please refer to **Figure 3** (**Appendix A3**) for the existing culverts. **Table 2.1** (**Appendix C3**) summarizes the size of the existing culverts.

3.4.3 Existing Studies, Plans and Mapping

3.4.3.1 Humber River Hydrology Update (April 2018)

The hydrologic model of Humber River was originally created in Visual OTTHYMO for existing and future catchments in the Humber River Hydrology Updated Report dated 2015. Later, future catchments were refined in the Humber River Hydrology Update Report 2018. The last update kept the existing condition report in 2015 unchanged. The Humber River Hydrology Update was completed in April 2018, by Civica, prepared for the TRCA and has been updated to account for recent development, infrastructure, and hydrology data. The updates to the model are based on the latest urban developments, SWM infrastructure, and the model has been calibrated to reflect recent storm events.

3.4.4 Characterization of Hydrology Features

3.4.4.1 Existing Catchment Parameters

The drainage to the Main Humber River will be affected by the development of the Study Area, and as such, the Humber River Hydrology Model has been modified where directly influenced by the future development to assess any changes to the peak flow and flood plain. The Drainage Area as shown in **Figure 1, Appendix A3**, is fully contained within nine catchments in the 2015 Humber River Hydrology Update VO model which presents the existing condition. The western three of these catchments, named 41.06, 41.07 and 41.08 in the hydrology model, cover the northwest portion of the site that drains to the Gore Road Tributary Reach 1 and Reach 2. There is a small HDF in 41.07 (Humber Station Reach 1), which connects with Gore Road Tributary Reach 1. The eastern six catchments, named 43.03, 43.10, 43.06, 43.05, 43.04, and 43.02 in the model, drain to the Clarkway Drive Tributary Reach 2. The TRCA Existing and Future Catchments were captured in **Table 2.2 (Appendix C3)**. It should be noted that in the downstream assessment in **Section 3.4.5.2,** the TRCA future model has been revised to reflect the ultimate imperviousness proposed within the Study Area.

3.4.4.2 Pre-development Hydrologic Setting

The Humber River drainage model with existing catchments has been revised to reflect the catchment boundary changes which are required for the post-development and downstream assessment analysis. As a result of this discretization, some of the parameters such as imperviousness were refined. Therefore, the modified existing model was calibrated to provide similar peak flows to the existing TRCA Model. Eventually with the calibration, we came up with the same Time to Peak as TRCA. In the modified existing model, each catchment was split into external area and Study Area. The changes made are summarized in **Table 2.3 (Appendix C3).**

3.4.5 Corresponding Flows

The flows from the TRCA Existing Hydrology model corresponding to the catchments and the flows from the modified existing model are summarized in **Table 2.4** (**Appendix C3**).

3.4.5.1 Mid Headwater Drainage Feature

HDF-8 occurs in the middle of catchment 43.03. Based on the discussion that occurred with TRCA on July 19, 2023, it was agreed that the conveyance of drainage feature within the upstream 50 ha of the drainage area is not regulatory floodplain and hence the flow should be conveyed safely and compensation for floodplain storage will not be required.

Hence, in the current analysis in Phase 1 of the CEISMP, the regulatory floodplain has been characterized downstream of a 50 ha drainage limit. The total length of HDF-8 north of Mayfield Road is approximately 900 m from which 200 m is within the block north of proposed Highway 413 corridor. The existing floodplain storage of HDF-8 within the regulatory boundary in the block is approximately 1300 m^3.

Please refer to the Floodplain Report in **Appendix D**.

3.4.5.2 Downstream Assessment

The Humber River drainage model with future scenario from Hydrology Update Report 2018, has been modified to reflect the impact on the downstream based on the proposed development. In the modified model, 100% imperviousness was assigned to the updated catchments of the site area. The flow resulting from a regional storm event of the post-development scenario was compared with the original future scenario model of TRCA and the modified future model in the drainage nodes to establish the analysis extent for the next phases. The summary of the flow comparison is shown in **Table 2.5** (**Appendix C3**).

As the result shows, flow change after the node J 4045.633 is only 1%, which is negligible. Therefore, in the next phases, the extent of the downstream analysis should be proposed up to J4045.633 node.

3.5 Floodplain Analysis

Floodplain analyses have been done to identify the extent of the existing floodplain through the completion of HEC-RAS modeling and mapping of the regulatory flood line along various drainage features in the Study Area as part of the Humber Station CEISMP (Phase 1) Report. The existing channel storage volume was also estimated as needed. The regulatory floodplain map will be considered to define the development limit of the Study Area as well as an input to the conceptual channel design for the proposed realignment of HDF-3 (Figure 6, Appendix A1 of the Floodplain Analysis Report provided in **Appendix D**).

The floodplain analysis has been conducted along all drainage features within and around the Study Area. It should be noted that TRCA has an approved hydraulic model for the area. SCE has updated the TRCA model based on detailed topographic and hydrological information and established SCE Revised Existing HEC-RAS model for the subject area. The floodplain mapping is provided in Appendix B of the Floodplain Analysis Report found in **Appendix D** of the CEISMP**.**

Within the Study Area, there are two HDFs and one watercourse. The HDFs are defined in the current HEC-RAS Model as "Humber Station HDF" (equivalent to HDF-3) and "Mid-Headwater Feature" (equivalent to HDF-8), and the watercourse is referred to as "Clarkway Trib A". These features, as well as the purpose of the hydraulic analysis to each drainage features is further discussed as follows:

- Humber Station HDF (HDF-3) was defined along the existing drainage feature that starts around Healey Road and drains to the southwest, leaving the Study Area via an existing culvert at Humber Station Road. The feature is classified as HDF. The drainage is aligned across farmland on which the area is farmed until the edge of the banks. There is no riparian vegetation observed. It should be noted that there are two wetland features observed along the HDF around the middle and end of the feature as depicted on GEI's **Figure 6** (**Appendix A1**). Humber Station HDF joins the major watercourse defined as "Gore Road Tributary" after crossing Humber Station Road. At the current level of study, the existing condition hydraulic analysis and floodplain mapping was performed. The existing condition hydraulic analysis helps to understand the channel storage volume, water elevations and extent of the floodplain mapping. The existing condition channel storage volume calculation results will dictate sizing and alignment of the proposed channel realignment in Phase 2 of the CEISMP. The proposed channel realignment shall be designed to attain the same flood attenuation as the existing condition. The existing condition floodplain map of HDF-3 analyzed at the current stage of the analysis depicts the drainage feature and flood lines. It should be noted that the wetland features along this drainage feature will be considered as part of the proposed channel realignment design.
- Mid-Headwater Feature (HDF-8): It is an HDF draining southward across farmland. The flow of this feature is generated fully from the Study Area. Since the HDF drainage area is small and has a narrow drainage channel after discussing with TRCA we concluded that the first 50 ha drainage area of the feature is not a regulatory floodplain. Hence, in the current analysis, the HDF was analyzed after the drainage area was nearly higher than 47 ha as shown in the Floodplain Report (**Appendix D**). The feature length is approximately 900 m, of which the first 200 m length is within the Study Area and the remaining length falls within the proposed Highway 413 corridor. The channel storage volume of the HDF within the regulated portion of the feature was approximated to be 1750 m^3. At the current level of study, the HDF water elevation, channel storage volume, and flood lines were estimated, which will provide input for estimating the required wetland compensation/relocation and flood attenuation in the proposed wetland compensation/relocation design in the Phase 2 CEISMP. For further detailed information, please see the Floodplain Report (**Appendix D**).
- Clarkway Trib A: a perennial watercourse draining in the south direction following the east boundary of the Study Area. There is an engineered channel coming from Colerain Drive to the east that connects to this watercourse. It should be noted that the two major tributaries (i.e., Clarkway and Gore Road Tributaries) drain parallel to one another for more than 10 km before the confluence at West Humber River. At current Phase 1 CEISMP level of study, water elevations and regulatory floodplain mapping has been generated for the Clarkway Trib A. The regulatory floodplain map will be considered as a factor to define the development limit of the subject area.

3.5.1 Hydraulic Modelling and Floodplain Analysis

Steady State Flow Analysis in HEC-RAS has been completed to perform hydraulic modelling of the subject development under existing conditions. Hydraulic modelling has been completed for the 100-year (AES 6-hr and AES 12-hr distributions) and Regional (Hurricane Hazel) storm events. The SCE Modified Existing HECRAS model is based on existing flows and existing channel geometry conditions.

It should be noted that all hydraulic and hydrological information, such as; flow information, culvert information, channel manning, and contraction and expansion coefficients are applied properly. Hydraulic analysis results are computed, and the water elevations are applied to generated floodplain mappings. The regional water elevation was found to be a regulatory floodplain. In addition to the floodplain mapping, the hydraulic analysis results are adopted to estimate channel storage volumes. **Table 3.1** (**Appendix C3**) presents the summary of the water elevations and flows in each cross-section and the summary of the floodplain calculations.

3.6 Fluvial Geomorphology

The fluvial geomorphic assessment consisted of a review of existing conditions, documenting observed indicators of channel instability and ecological function of the feature from a geomorphic perspective. Three features were examined as part of this assessment: HDF-3, HDF-8, and the Clarkway Drive Tributary, a tributary of the West Humber River (WHT-1) (**Figure 4b**, **Appendix A1**). The following section describes the findings of the geomorphic assessment.

Humber Station HDF (HDF-3)

The field assessment completed for HDF-3, examined reaches HDF-3g, HDF-3e, HDF-3d, and HDF-3c, on the participating lands within the Study Area, plus HDF-3i within the road right of way at Healey Road (**Figure 4b**, **Appendix A1**).

Channel geometry was found to vary over the assessed length of the feature, with the channel losing definition at the transition between wetlands. For HDF-3 within the Study Area, where defined, the bankfull widths ranged between 1.0-2.0 m, and bankfull depths ranged between 0.30-0.50 m. Flowing water was observed during the field visit. Adjacent land use consisted of agricultural uses. Riparian vegetation was sparse; it appeared that the soil is typically tilled to the banks of the channel. Bankfull width for HDF-3i was found to be 2.5 m and bankfull depth was 0.40 m.

Distinct riffles and pools were not observed, with a uniform velocity and depth condition on the day of the assessment. Observed substrates consisted primarily of sand, silt, and clay, with occasional gravel and cobbles present. Some evidence of erosion and sediment transport functions were observed, but are likely occurring during periods of high flow, such as during the spring freshet.

A review of historical aerial imagery (2002, 2013, and 2022 obtained from First Base Solutions) indicated minimal channel migration over the time period under consideration. An old farm residence was present to the west of the channel, which had been decommissioned in the interim period following 2013. An old CSP culvert was noted during the field visit, which was in poor condition, and was not conveying flows through. The channel had been diverted around this old culvert after 2013, likely through farming practices.

Based on the existing field conditions and a brief review of historical planform adjustments, this feature provides minimal geomorphic function, although there is evidence of erosion and sediment transport to the downstream system. Therefore, the feature is classified as HDF. The results of the HDF assessments are provided in **Section 3.7.5**. HDF management recommendations should consider flow conveyance and sediment supply functions that the feature currently provides.

Mid-Headwater Feature (HDF-8)

The field assessment completed for HDF-8, examined reaches HDF-8c, HDF-8b, and HDF-8a within the participating lands of Study Area, and a portion of HDF-8a within the road right-of-way at Mayfield Road.

Channel geometry varied within the assessed reaches, generally poorly defined in the upper reaches, then gaining definition briefly midway through HDF-8a, and losing definition further downstream. Where defined, bankfull widths ranged between 1.0-2.5 m, and bankfull depths ranged between 0.20-0.50 m. No flow was noted during the field visit, but standing water was noted in some of the deeper sections.

Distinct riffles and pools were not observed. Observed substrates consisted primarily of sand, silt, and clay. Some evidence of erosion and sediment transport functions were observed, but are likely occurring during periods of high flow, such as during the spring freshet.

A review of historical aerial imagery (2002, 2013, and 2022 obtained from First Base Solutions) indicated minimal channel migration over the time period under consideration. Land use has also been consistent over the time period under consideration, remaining agricultural. Riparian vegetation was sparse to non-existent.

Based on the existing field conditions and a brief review of historical planform adjustments, this feature provides minimal geomorphic function, although there is evidence of erosion and sediment transport to the downstream system. Therefore, the feature is classified as HDF, and we defer to the results of the HDF assessments (**Section 3.7.5**). Management recommendations should consider flow conveyance and sediment supply functions that the feature currently provides.

Clarkway Trib A (WHT-1)

WHT-1 was assessed within the participating lands along the east side of the Study Area, and within the road right of way at Mayfield Road.

WHT-1 was a well-defined, perennial watercourse, situated in a confined valley. It was characterized by a moderate gradient and moderate sinuosity. Adjacent land use consisted of agricultural fields. Riparian vegetation was mostly non-woody, with some localized trees.

Distinct riffles and pools were not identified, but a defined channel was noted. Bankfull widths ranged between 2.5-5.0, and bankfull depths ranged between 0.80-1.5 m. Channel substrate consisted primarily of sand and silt, with boulders and cobbles also present in some sections. Bank materials consisted of sand, silt, and clay. Evidence of beaver activity was noted within the channel and floodplain, with a large beaver dam noted within the channel approximately 800 m north of Mayfield Road.

A geomorphic assessment was conducted for this reach, which consisted of a Rapid Geomorphic Assessment (RGA), a modified Rapid Stream Assessment Technique (RSAT) and classification of the reach using the Downs method.

The RGA (MOE, 2003) documents observed indicators of channel instability. Observations made during the field investigation are quantified using an index that identifies channel sensitivity based on evidence of aggradation, degradation, channel widening, and planform adjustment. The index produces values that indicate whether the channel is stable/in regime (score <0.20), stressed/transitional (score 0.21-0.40), or adjusting (score >0.41).

The RSAT (Galli, 1996) provides an assessment of the channel by also considering the ecological function of the stream. Observations under the modified RSAT include channel stability, channel scouring/sediment deposition, physical instream habitat, water quality, and riparian habitat condition. The RSAT scores rank the channel as maintaining a poor (<13), fair (13-24), good (25-34), or excellent (35-42) degree of stream health.

The Downs method, as outlined in Thorne et al. (1997), was developed based on adjustment processes and trends of channel change and links these processes and trends to the fluvial and sediment processes responsible for driving channel change. This system classifies streams as stable, depositional, laterally migrating, enlarging, compound, recovering, or undercutting.

The RGA produced a score of 0.24, which indicates that the reach was in transition/stressed. Evidence of aggradation was the dominant geomorphic process, with evidence of widening also being observed. The RSAT score of 22 indicates that this reach was in a fair state of ecological health. The Downs method classified this reach as D – depositional.

3.6.1 Erosion Hazard Assessment

Streams and rivers are dynamic features on the landscape, and their configuration and position on the floodplain changes as part of meander evolution, development, and migration processes. When development or other activities are contemplated near a watercourse, it is desirable to designate a corridor that is intended to contain all the natural meander and migration tendencies of the channel. The *Technical Guide – Rivers and Streams: Erosion Hazard Limit* (MNR 2002) was developed in support of the Provincial Policy Statement (PPS; MMAH 2020), to assist members of the public and planning authorities in understanding the PPS, particularly Section 3.1, relating to natural hazards. The guide is based on a standard methodology, intended to be applied to two generalized landform systems through which river and stream systems flow: confined and unconfined systems. Confined systems are ones in which the physical presence of a valley corridor containing a river or stream is visibly discernible. Unconfined systems are ones in which a river or stream is present but there is no discernible valley slope.

In the case of unconfined systems, the erosion hazard allowance consists of the meander belt and an access allowance. The space that a meandering watercourse occupies on its floodplain, and in which all natural processes occur, is referred to as the meander belt (TRCA 2004). In the case of confined systems, the erosion hazard allowance consists of the stable slope allowance and toe erosion allowance, in addition to the access allowance.

The TRCA (2004) Belt Width Delineation Procedures document was created to recommend a protocol for delineation of meander belt for river systems within the TRCA's jurisdiction and is accepted by Conservation Authorities throughout Ontario as a primary method for delineating the belt width.

As HDF-3 and HDF-8 were assessed to be HDFs, a meander belt width was not delineated for these features. As WHT-1 was assessed to be a confined system, the erosion hazard allowance consists of the stable slope allowance and toe erosion allowance, rather than a meander belt.

3.6.2 Toe Erosion and Stable Slope Allowance

For WHT-1, which was assessed as a confined system, the erosion hazard consists of a toe erosion allowance and the stable slope allowance. When a watercourse is within 15 m of a valley wall, the toe erosion allowance can be identified using measurements of the average recession rate, and characteristics of soil types and hydraulic processes. When the watercourse is 15 m or more from the valley, the stable slope is determined from the toe of the valley.

The stable slope allowance is typically based on a stability analysis using specific subsurface and groundwater conditions identified through a geotechnical study. Alternatively, it may be taken as equivalent to at least three times the height of the slope, drawn from the toe of the slope to intersect the table land above the slope crest, in accordance with the *Technical Guide – Rivers and Streams: Erosion Hazard Limit* guidelines developed by the MNR (2002). The stable slope allowance is shown in **Figure 6** (**Appendix A1**).

A detailed slope stability analysis for the Site following the TRCA's 2007 guidelines was completed by PNJ Engineering Inc. (PNJ) in June 2025. The slope stability analysis delineated Long Term Stable Top of Slope (LTSTOS) along the Clarkway Drive Tributary through a combination of site-specific geotechnical investigations and conceptual projections of a 3:1 slope. The LTSTOS has been incorporated into the preliminary NHS for the Study Area.

The Slope Stability Analysis is included in **Appendix G.**

3.7 Natural Heritage Resources

This section of the report characterizes the natural heritage features in the Study Area and describes their functional relationships in the broader natural heritage system. Natural heritage resources are characterized using available background information and data gathered through field investigations completed by GEI starting in 2017 until 2024 (**Table 2**, **Appendix C1**).

3.7.1 Background Information Review

The following resources were reviewed for information relating to natural heritage features and species that may be found in the Study Area:

- MNRF's Land Information Ontario (LIO) database (2025);
- Ministry of Natural Resources and Forestry's (MNRF) Natural Heritage Information Centre (NHIC) database (2025);
- Bird Studies Canada's Atlas of the Breeding Birds of Ontario (BSC et al. 2006);
- Ontario Nature's Reptile and Amphibian Atlas (2020);
- Toronto Entomologists' Association's (TEA) Ontario Butterfly and Moth Atlases (2023, 2020);
- DFO's Aquatic Species at Risk Map (2025); and
- Other sources (e.g., subwatershed studies, watershed management plans, fisheries management plans).

The results of the background review are discussed in the following sections. This information assisted in defining the search effort and target species for studies on and immediately adjacent to the Study Area.

3.7.1.1 Land Information Ontario Natural Features Summary

Based on the Ministry of Natural Resources and Forestry (MNRF) Land Information Ontario (LIO) geographic database, the following features were identified on or adjacent to the Study Area (**Figure 3**, **Appendix A1**):

- HDF-3 and associated pond along the western boundary;
- Clarkway Drive Tributary of the West Humber River along the eastern boundary;
- A woodlot located in the northwest corner of the Study Area;
- A woodlot located in the north-central portion of the Study Area; and
- Unevaluated Wetlands.

No other known natural heritage features were identified on or adjacent to the Study Area. Within the broader local area, the following features were identified:

- Bolton Wetland Complex is located approximately 4.4 km northeast of the Study Area; and
- Tormore Wetland Complex is found approximately 3.5 km northwest of the Study Area.

3.7.1.2 Natural Heritage Information Centre

The Natural Heritage Information Centre (NHIC) database (MNRF 2025) was searched for records of provincially significant plants, vegetation communities and wildlife on, and in the vicinity of the Study Area. The database provides occurrence data by 1 km^2 area squares, with eight squares overlapping at least a portion of the Study Area (17PJ0156, 17PJ0256, 17PJ0155, 17PJ0255, 17PJ0154, 17PJ0254, 17PJ0354 AND 17PJ0353). Within these squares, the search revealed the following records:

- American Brook Lamprey (*Lethenteron appendix*, S3);
- Midland Painted Turtle (Chrysemys picta marginata; S4)
- Butternut (*Juglans cinerea;* Endangered);
- Eastern Meadowlark (*Sturnella magna*; Threatened);
- Bobolink (*Dolichonyx oryzivorus;* Threatened);
- Eastern Wood-pewee *(Contopus virens;* Special Concern);
- Wood Thrush (*Hylocichla mustelina*; Special Concern); and
- Yellow-banded Bumble Bee (*Bombus terricola*; Special Concern).

A summary of the species identified via the NHIC database is available in **Table 3**, **Appendix C1**.

3.7.1.3 Ontario Breeding Bird Atlas

The Ontario Breeding Bird Atlas (OBBA) contains detailed information on the population and distribution status of Ontario birds (Bird Studies Canada et al. 2006). The data is presented on 100 km^2 area squares with one square overlapping a portion of the Study Area (17TPJ05). It should be noted that the Study Area is a small component of the overall bird atlas square, and therefore it is unlikely that all bird species are found within the Study Area. Habitat type, availability and size are all contributing factors in bird species presence and use.

A total of 117 species were recorded in the atlas squares that overlap with the Study Area, with the following species of interest noted:

- Species listed as Threatened or Endangered on the SARO list:
    - Acadian Flycatcher (*Empidonax virescens*; Endangered);

  - Red-headed Woodpecker (*Melanerpes erythrocephalus*; Endangered);
  - Bank Swallow (*Riparia riparia*; Threatened);
  - Bobolink (Threatened);
  - Chimney Swift (*Chaetura pelagica;* Threatened); and
  - Eastern Meadowlark (Threatened).
- Species of Conservation Concern (i.e., listed as Special Concern on the SARO list, or identified as an S1-S3 species):
  - Barn Swallow (*Hirundo rustica*; Special Concern);
  - Common Nighthawk (*Chordeiles minor*; Special Concern);
  - Eastern Wood-Pewee (Special Concern);
  - Wood Thrush (Special Concern);
  - Red-necked Grebe (*Podiceps grisegena*; S3); and
  - Upland Sandpiper (*Bartramia longicauda*; S2B).

A summary of all species identified via the OBBA database is available in **Table 4**, **Appendix C1**.

3.7.1.4 Ontario Reptile and Amphibian Atlas

The Ontario Reptile and Amphibian Atlas contains detailed information on the population and distribution status of Ontario herpetofauna (Ontario Nature 2020). The data is presented on 100 km^2 area squares with one square overlapping a portion of the Study Area (17PJ05). It should be noted that the Study Area is a small component of the overall atlas square, and therefore it is unlikely that all herpetofauna species are found within the Study Area. Habitat type, availability and size are all contributing factors in herpetofauna species' presence and use.

A total of 17 species were recorded in the atlas squares that overlap with the Study Area, of which three are salamander species, eight are frog and toad species, two are turtle species, and four are snake species. Of these species, the following species of interest are noted:

- Species of Conservation Concern (i.e., listed as Special Concern on the SARO list, or identified as an S1-S3 species):
  - Eastern Ribbonsnake (*Thamnophis sauritus*; Special Concern); and
  - Snapping Turtle (*Chelydra serpentina*; Special Concern).

A summary of all species identified via the Ontario Reptile and Amphibian Atlas database is available in **Table 5**, **Appendix C1**.

3.7.1.5 Ontario Butterfly and Moth Atlas

The Ontario Butterfly and Moth Atlases (Toronto Entomologists' Association 2023, 2020) contain detailed information on the population and distribution status of Ontario butterflies and moths. The data is presented on 100 km^2 area squares with one square overlapping a portion of the Study Area (17PJ05). It should be noted that the Study Area is a small component of the overall atlas square, and therefore it is unlikely that all butterfly and moth species are found within the Study Area. Habitat type, availability and size are all contributing factors in butterfly and moth species' presence and use.

A total of 64 species were recorded in the atlas squares that overlap with the Study Area, all of which are butterfly species. Of these species, one species was noted: Monarch (*Danaus plexippus;* Special Concern).

A summary of all species identified via the OBMA database is available in **Table 6**, **Appendix C1**.

3.7.1.6 Fisheries and Oceans Canada Review

Aquatic species at risk distribution mapping (DFO 2023) was reviewed to identify any known occurrences of aquatic species at risk, including fish and mussels, within the subwatershed where the Study Area is located. No aquatic species at risk were identified on or within 120 m of the Study Area. Occupied Redside Dace habitat is mapped within a tributary of the West Humber River located approximately 4.9 km south of the Study Area.

3.7.1.7 West Humber River Fish Community

The Humber River Fisheries Management Plan (FMP; MNR and TRCA 2005) states that the West Humber River subwatershed is dominated by agricultural land-uses with highly impermeable clay soil. The West Humber River subwatershed contains the least amount of riparian vegetation out of the entire Humber River watershed. Historically the West Humber River supported species such as American Brook Lamprey (*Lethenteron appendix*), Brassy Minnow (*Hybognathus hankinsoni*), Brook Trout (*Salvelinus fontinalis*), Mottled Sculpin (*Cottus bairdii*), Redside Dace (*Clinostomus elongatus*), Smallmouth Bass (*Micropterus dolomieu*), Stonecat (*Noturus flavus*) and Yellow Perch (*Perca flavescens*). As of 2001, only 17 fish species were found within the watershed, with the fish community dominated by tolerant warmwater species. The FMP notes that there is potential for the above noted species to persist within the subwatershed.

As illustrated in Figure 2 of the FMP (Stream Order for the Humber River Watershed), first and second order streams are found within the Study Area. No instream barriers are illustrated within the general vicinity of HDF-3 and the Clarkway Drive Tributary on Figure 10 (Instream Barriers in the Humber River Watershed) of the FMP. Fisheries and benthic invertebrate sample stations are not identified within the FMP for the Clarkway Drive Tributary and HDF-3. The Study Area is in TRCA's Fish Management Zone 7 (Figure 5-1; TRCA 2008), with target species of Redside Dace, Rainbow Darter, and Smallmouth Bass.

Figure 22 (Locations of the Aquatic Habitat Categories in the Humber River Watershed) of the FMP illustrates that both the Clarkway Drive Tributary and HDF-3 are classified as small riverine warmwater systems. The FMP notes that small riverine warmwater habitats have poor infiltration rates and minimal groundwater inputs, causing many of the reaches to dry up during the summer months or are reduced to standing pools of water. Goldfish, a non-native species, are prevalent throughout these habitats.

3.7.2 Agency Consultation Overview

3.7.2.1 Information Request Form

An Information Request Form (IRF) pertaining to Species at Risk (SAR) and natural heritage features on, and adjacent to, the Study Area was submitted to MNRF Aurora District Office on April 17, 2017. An electronic response was received on May 29, 2017 and is included in **Appendix C.** MNRF identified the following records of SAR found on or within the immediate vicinity of the Study Area:

- Butternut (Endangered in Ontario);
- Bobolink (Threatened in Ontario);
- Eastern Wood-Pewee (Special Concern in Ontario); and
- Wood Thrush (Special Concern in Ontario).

MNRF also noted there is potential for Endangered bat species to be found within cavities or leaf clusters within the Study Area.

A SAR Assessment was completed by GEI in 2023 and was updated in 2025 to reflect current SARO listings, and changes to the ESA enacted through Bill 5. The SAR Assessment is shown in **Table 7**, **Appendix C1**.

Prior to Draft Plan approval, proponents will be required to consult with the MECP as applicable to ensure compliance with SAR legislation.

3.7.3 Existing Natural Heritage Conditions

Ecological field investigations were completed for the Study Area in 2017, 2018, 2021, 2022, 2023, and 2024 as detailed in **Table 2 (Appendix C1)**. The field program was designed with consideration of data collected during the background NHIC and wildlife atlas searches, SAR preliminary screening, and aerial photo interpretation. The following ecological surveys were completed within the Study Area:

- ELC and Botanical Inventory;
- Wetland Evaluation;
- Breeding Bird Surveys;
- Amphibian Call Count and Egg Mass Surveys;
- Reptile Surveys (Snake Surveys, Turtle Basking and Nesting Surveys);
- Insect Surveys;
- Bat Habitat Assessment and Acoustic Monitoring;
- Wildlife Camera Trap Surveys;
- Terrestrial Crayfish Surveys;
- Headwater Drainage Feature Assessment;
- Fluvial Geomorphic Assessment;
- Aquatic Habitat Assessment; and
- Fish Community Sampling.

Ecological survey methodology is found in **Appendix E**.

3.7.4 Landscape Ecology

The Study Area is unique as it spans a portion of both Ecoregion 6E and 7E. The southern fifth of the Study Area is located within Ecoregion 7E (eco-district 7E-4), while the remainder of the Study Area is located within Ecoregion 6E (eco-district 6E-7). Ecoregion 7E is located within the Carolinian, or Deciduous Forest Zone (also referred to as the mixed wood plains), an area characterized by a relatively warmer climate, which supports plant species typical of more southern areas. Broadleaved trees, including American Beech (*Fagus grandifolia*), Sugar Maple (*Acer saccharum*), Basswood (*Tilia americana)*, Red Maple (*Acer rubrum)*, White Oak (*Quercus alba)* and Bur Oak (*Quercus macrocarpa)*, dominate natural upland forest cover in this region (Rowe 1972). Also found in this region are Canada's main distribution of Black Walnut, Sycamore, Swamp White Oak (*Quercus bicolor)* and Shagbark Hickory (*Carya ovata)*.

The majority of the Study Area is located within the Lake Simcoe-Rideau Ecoregion 6E, which extends from Lake Huron to the Ottawa River, and includes most of the Lake Ontario shore and the Ontario portion of the St. Lawrence River Valley. Ecoregion 6E falls within the Great Lakes – St. Lawrence forest region, an area of moderate climate where natural succession leads to forests of shade tolerant hardwood species including Sugar Maple, American Beech and shade intermediate species such as Red Oak (*Quercus rubra*) and Yellow Birch (*Betula alleghaniensis*), as well as associations of White Pine (*Pinus strobus*) and Red Pine (*Pinus resinosa*).

Consideration of the larger ecological matrix or landscape contributes to a better understanding of potential interactions between abiotic and biotic flows and exchanges. The Study Area is situated in the West – East Branch Humber River secondary subwatershed unit (TRCA 2008) which is characterized as containing little habitat with small, fragmented patches that are mostly constrained to valley corridors and tableland forests (TRCA 2008). Figure 3-11 (Terrestrial System – Existing Conditions Landscape Analysis) of the Humber River Watershed Plan (TRCA 2008) displays the habitat patch quality of the identified natural heritage features within the Study Area as poor.

The West – East Branch Humber River secondary subwatershed is dominated by agriculture in the north and urbanized in the south. As such, the Clarkway Drive Tributary is expected to serve as a primary wildlife corridor and linkage for terrestrial, semi-aquatic and aquatic species. North of Healey Road, the Clarkway Drive Tributary corridor becomes channelized and less prominent. However, smaller woodlots and wetlands likely act as stepping-stone habitat to provide connectivity to the Main Humber River watershed located further north (i.e., just north of Highway 9). The Main Humber River is generally surrounded by large woodlands and wetlands and includes several conservation areas such as the Bolton Resource Management Tract, the Nashville Conservation Reserve, the Cold Creek Conservation Area and the Albion Hills Conservation Park, allowing species to move north, south, east and west across the landscape. Continuous forest cover protects wildlife while they are foraging, migrating, mating and/or overwintering. South of Mayfield Road, the Clarkway Drive Tributary corridor continues through agricultural fields to Castlemore Road, where it becomes surrounded by residential development before converging with the Lower Humber River at Claireville Conservation Area.

The existing road network surrounding the Study Area serves as a significant barrier to wildlife movement and includes busy roads. Specifically, Mayfield Road is a major arterial roadway for Caledon and Brampton. With increased population projected for the Town of Caledon, it is anticipated that Humber Station Road and Healey Road will be widened and become busier and will pose an increased risk to wildlife movement. Wildlife passage opportunities are recommended to be assessed during Phase 2 of the CEISMP.

3.7.5 Headwater Drainage Features

The Study Area occurs in the headwaters of the West Humber River and supports a number of HDFs (**Figure 4b**, **Appendix A1**). TRCA policies require that HDFs be identified and managed in accordance with their *Evaluation, Classification, and Management of Headwater Drainage Features Guideline* (CVC and TRCA 2014). HDFs are defined as non-permanently flowing drainage features that contribute to the overall health of the watershed. As such, the selection of the appropriate management recommendations is required to adequately protect the feature and its ecological functions from any proposed development.

As per the HDF Guidelines, GEI completed three rounds of surveys and identified a total of 15 HDFs in the Study Area. HDF Nos. 4, 5, 6, 10, 11, 12, 13, 14, and 15 drain to the Clarkway Drive Tributary along the east boundary of the Study Area. Downstream of the Study Area, the Clarkway Drive Tributary flows through agricultural fields, followed by residential neighborhoods before outletting to the Humber River within Clairville Conservation Area. HDF-3 originates at Healey Road flowing across the northwest portion of the Study Area towards an online pond and outlets to The Gore Road Tributary located immediately west of Humber Station Road. This feature has been historically straightened for agricultural purposes. The Gore Road Tributary flows through agricultural fields and residential neighborhoods before outletting to the Humber River within Clairville Conservation Area. Several smaller HDFs (1, 2, 7 and 9) along the west edge of the Study Area drain to the Humber Station Road ditch, which also outlets to The Gore Road Tributary, downstream of HDF-3. HDF-8 originates in the north-central portion of the Study Area, bisecting the site flowing north to south, and outlets to the Clarkway Drive Tributary at Mayfield Road.

Classification

GEI utilized the guidance provided in Part Two of the HDF Guidelines (CVC and TRCA, 2014), which addresses the approach for the assessment and classification of HDFs. **Table 1** (**Appendix C1**) highlights the key components of this analysis and resulting classification per the HDF Guidelines based on assessment of field data regarding hydrology, riparian cover, fish habitat and terrestrial habitat. By design, the HDF Guidelines are focused on the classification of ephemeral and intermittent headwater drainage features and are not intended to characterize those features that are watercourses.

At the time of first submission of Phase 1 of the CEISMP, the ESA defined “contributing habitat” for Redside Dace, protected habitat under O.Reg 832/21, as a stream, permanent or intermittent HDF, groundwater discharge area or wetland that augments or maintains the baseflow, coarse sediment supply or surface water quality of occupied Redside Dace habitat. As the updated definition of habitat replaces O.Reg 832/21, Redside Dace contributing habitat is no longer regulated by MECP.

Table 1 in **Appendix C** has been updated to align with the current ESA by updating Step 3 – Fish and Fish Habitat classification to reflect functions that consider direct or critical habitat for SAR, and functions associated with generalized fish habitat, in accordance with Table 6 of the HDF Guidelines.

Management Recommendations

Management recommendations for all HDFs were decided upon utilizing Part Three of the HDF Guidelines (CVC and TRCA 2014). This section of the Guidelines provides guidance in linking the habitat classification information noted within **Table 1** (**Appendix C1**) with the proposed management approach for each HDF. The guidelines and information collected from the surveys were utilized to identify management recommendations. All HDF reaches and their management recommendations are depicted in **Figure 4b** (**Appendix A1**).

It is important to acknowledge that as with any guidelines, the HDF Guidelines are intended to have flexibility to best reflect additional considerations regarding the site-specific nature of features, such as historical straightening for agricultural purposes, impairment related to surrounding active agriculture, the replication of contributing functions to downstream fish habitat

and compatibility with land uses. As such, there are situations where recommendations are made for an alternative management recommendation based on site-specific understanding of these additional factors. Management recommendations are provided in the right-hand column of **Table 1** (**Appendix C1**) titled 'Interpreted Management Recommendation – Humber Station Consultant Team'.

The application of the HDF Guidelines to existing site conditions results in recommendations for protection, conservation, mitigation or no management. Strict application of the HDF Guidelines to certain HDFs that have upstream wetlands would result in management recommendations of protection. Recognizing the agricultural impacts on some of the HDFs, including straightening and impairment (i.e., siltation due to ploughing up to the edge of the feature and pollution due to fertilizers), as well as lack of riparian habitat, these features are proposed for realignment and/or compensation with replication or enhancement of their functions expected to be achieved.

The HDF Guidelines suggest implementation techniques for each of the 'Protection', 'Conservation', 'Mitigation' and 'No management required' recommendations. The HDF Guideline wording for implementation techniques is provided below.

Protection

Reaches HDF-3b, 3c, 3e, and 3h are classified as 'Protection' and are located within the preliminary NHS (**Figure 6, Appendix A1**) and will be protected from development.

As described in the HDF Guidelines, the Protection designation is for those features with important functions that are to be maintained and protected from potential development impacts. The protection designation should:

- Protect and/or enhance the existing feature and its riparian zone corridor, and groundwater discharge or wetland in-situ;
- Maintain hydroperiod;
- Incorporate shallow groundwater and base flow protection techniques such as infiltration treatment;
- Use natural channel design techniques or wetland design to restore and enhance existing habitat features, if necessary; realignment not generally permitted; and
- Design and location of the SWM system (e.g., extended detention outfalls) are to be designed and located to avoid impacts (i.e., sediment, temperature) to the feature.

Conservation

Reaches HDF-3a, 3d, 3g, 3i, 8a1, 8a2 and 8a3 have an Interpreted Management Recommendation of 'Conservation'. As described in the HDF Guidelines, the Conservation designation affords the ability to realign drainage features using natural channel design, or to maintain or replace on-site flows using wetland creation. Management of HDFs identified for Conservation should:

- Maintain, relocate, and/or enhance drainage feature and its riparian zone corridor;
- If catchment drainage has been previously removed or will be removed due to diversion of stormwater flows, restore lost functions through enhanced lot level controls (i.e., restore original catchment using clean roof drainage), as feasible;

- Maintain or replace on-site flows using mitigation measures and/or wetland creation, if necessary;
- Maintain or replace external flows;
- Use natural channel design techniques to maintain or enhance overall productivity of the reach; and
- Drainage feature must connect to downstream.

Mitigation

The 'Mitigation' management recommendations are made for reaches within tableland agricultural fields. Here, they are generally ephemeral swales that convey flow during the freshet but are otherwise dry and cultivated, with the reaches being ploughed through.

Reaches HDF-1a, 1b, 2a, 4a, 7a, 8a, 8b, 9a, 9b, 10a, 11a, 12a, 13a and 15a have an Interpreted Management Recommendation of 'Mitigation', based on the anticipated ability to replicate contributing hydrology to downstream fish habitat. As noted in the HDF Guidelines, Mitigation management allows for the replication of the function of the HDF to:

- Replicate functions by lot level conveyance measures (e.g., vegetated swales) connected to the preliminary natural heritage system, as feasible and/or LID stormwater options;
- Replicate on-site flow and outlet flows at the top end of system to maintain feature functions; and
- Specific implementation techniques to replicate functions should be identified at the MESP stage and may include LID measures.

No Management Required: The 'No Management Required' reaches were identified through pre-screening but through field verification were confirmed to provide limited functions. Here they are generally cropped lands with minimal or no flow.

Reaches HDF-2-1a, 2-2a, 3-1a, 3-2a, 5a, 6a, 7-1a, 8c, 8c-1, 8c-2, 8d, and 14a have an Interpreted Management Recommendation of 'No Management Required', based on the absence of hydrology or habitat functions.

3.7.6 Aquatic Habitat Assessment

An aquatic habitat assessment for the Clarkway Drive Tributary was conducted in 2017 and is characterized as follows.

AHA-1

Reach AHA-1 is located in the upstream extent of the Clarkway Drive Tributary (**Figure 5**, **Appendix A1)** and was observed to have permanent flow with natural stream morphology with a meandering channel.

Runs and riffles were observed. The riparian vegetation within the valley corridor is dominated by Reed-canary Grass meadow marsh with scattered Cattail (*Typha spp.*), Bullrushes (*Scirpus spp.*), Tall White Aster (*Doellingeria umbellata*), Goldenrod (*Solidago spp.)* and Thistles (*Cirsium spp.*).

The mean bankfull width is approximately 3.46 m with a mean depth of about 0.56 m. The mean wetted width is approximately 1.35 m and mean water depth is 10 cm. The substrate is primarily silt and clay with gravel. The bank was observed to be slightly unstable with minor erosion. Water temperature was 24.7 degrees Celsius in July. No fish were observed in the reach during the aquatic habitat assessment.

AHA-2

Reach AHA-2 is located in the downstream extent of the Clarkway Drive Tributary (**Figure 5**, **Appendix A1)** and was observed to have permanent flow with natural stream morphology with a meandering channel.

Runs, riffles, and flats were observed. Instream vegetation included Cattails. The riparian vegetation within the valley corridor was identified to be a cultural meadow dominated by Tall White Aster, Goldenrod, Thistles, Crown Vetch (*Securigera varia*), Queen Anne's lace (*Daucus carota*), and Awnless Brome (*Bromus inermis*).

The mean bankfull width is approximately 3.51 m with a mean depth of about 0.94 m. The mean wetted width is approximately 1.97 m and mean water depth is 14 cm. The substrate is primarily silt and sand with gravel. The banks were observed to be slightly unstable with areas of erosion and minor overhang (~20 cm). The water temperature was 26.1 degrees Celsius in July. Unidentified fish species were observed in the reach during the aquatic habitat assessment.

3.7.7 Ecological Land Classification

The Study Area is dominated by actively cultivated fields, with row crops of soybean and corn. Natural areas, with associated cultural vegetation types, are limited to a few locations of regenerative communities of young deciduous forest and thicket, as well as linear systems of marshes and wet meadows along the tributary and drainages, most of which occur at the eastern edge of the Study Area. A large agricultural pond is located in the central-west portion of the site near Humber Station Road and is bordered by a narrow zone of wetland vegetation.

ELC mapping of the Study Area is shown in **Figure 4a** (**Appendix A1**), and a detailed list and description of ELC units is provided in **Table 8** (**Appendix C1**). No provincially rare vegetation communities were present in the Study Area (NHIC 2025).

3.7.8 Wetland Characterization

Seven wetlands (A1 through G1) are present in the Study Area (**Figure 4a; Appendix A1**). Two meadow marsh vegetation communities, one shallow marsh vegetation community, one shallow water vegetation community and one thicket swamp community are present. **Tables 9 through 16** (**Appendix C1**) provide a characterization summary of each wetland (A1 through G1), including: size; type, contributing drainage area, underlying geology; soil conditions; groundwater conditions; hydroperiod/surface water conditions; surface water inputs and inlet conditions; outlet conditions; ELC vegetation types; dominant vegetation species per strata; fish and wildlife use; special features; sensitivity to water budget change and management recommendations. Phase 2 of the CEISMP will identify wetlands proposed for retention or removal and provide updated management recommendations based on this categorization.

3.7.9 Botanical Inventory

Botanical inventories completed in the Study Area identified a total of 153 species of vascular plants. Of that number, 74 (or 48%) are native and 79 (or 52%) are exotic. A full species list is included in **Table 17 (Appendix C1).** The majority of the native species (97%) are ranked S5 (secure in Ontario), with two species (3%) ranked S4 (apparently secure in Ontario; NHIC 2025).

Nine locally (Peel Region, Credit Valley Conservation [CVC]) rare plants were observed, as per the rankings of Varga et al. (2005) and CVC (2002). None of the regionally rare species are considered rare in Ontario. None of the species recorded from the Study Area had a co-efficient of conservatism value of 9 or 10. The locally rare species were:

- White Spruce (*Picea glauca*) – planted;
- Tall Beggarticks (*Bidens vulgata*) – occasional at edges of meadows along the tributary;
- Marsh Seedbox (*Ludwigia palustris*) – occasional in MAM2-2;
- Pennsylvania Smartweed (*Persicaria pensylvanica*) – occasional on shore of SAS1-1;
- Catchweed Bedstraw (*Galium aparine*) – occasional in unit FOD8-3;
- Peach-leaved Willow (*Salix amygdaloides*) – local along the tributary, drainages, and SAS1-1;
- Sandbar Willow (*Salix interior*) – local along the tributary, drainages, and SAS1-1;
- Small's Spike-rush (*Eleocharis palustris*) – local in MAM2-2 and along exposed banks of the tributary; and
- Small Pondweed (*Potamogeton pusillus*) – common in SAS1-1.

3.7.10 Natural Heritage Feature Staking

The limits of wetlands, dripline, and Top of Bank were staked by TRCA, the Town of Caledon, and GEI on October 19, 2021. The limits of these features are identified in **Figures 4a** and **6** (**Appendix A1**). GEI notes that the entirety of all features were not staked in the field due to access restrictions on non-participating properties. Where development is proposed on non-participating properties, these features shall be field verified during the Draft Plan Approval process, in accordance with the methodology used for the participating properties, and as outlined in this CEISMP.

3.7.11 Ontario Wetland Evaluation System

Within the Study Area, three wetland polygons were evaluated under the Ontario Wetland Evaluation System (OWES; 2022). The remaining wetlands within the Study Area did not meet the criteria for completing an OWES (<2 ha).

One wetland polygon (Wetland D1) is associated with the upstream extent of the Clarkway Drive Tributary. This feature meets the criteria for significance, which can be achieved by having an overall score of 600 or more points, or by scoring 200 or more points in the Biological component or Special Features component. This wetland meets criteria due to wetland rarity within the landscape, use by provincially significant animal species, and presence of habitat features for waterfowl and fish.

A second wetland polygon (Wetland F1) associated with the downstream extent of the Clarkway Drive Tributary has been designated as Significant due to the rarity of the wetland on the landscape, and the presence of provincially significant and locally significant species. Wetland G1 was located downstream of Wetland F1 along the Clarkway Drive Tributary and was on non-participating lands. Based on the OWES assessment of Wetland F1 and connectivity to Wetland F1 within the riparian zone of the Clarkway Drive Tributary, Wetland G1 has been assumed to meet the criteria for significance.

Wetland E1, associated with the pond at the downstream limit of HDF-3 (SAS1-1/SWT2-2) and located just east of Humber Station Road is designated as Significant due to the rarity of the wetland on the landscape, and the presence of provincially significant and locally significant species.

The Significant Wetlands are shown in **Figure 4a** (**Appendix A1**).

3.7.12 Amphibian Call Count and Egg Mass Surveys

Amphibian Call Surveys were conducted at 23 stations within the Study Area and Egg Mass Surveys were conducted at three of these stations. Station locations are illustrated in **Figure 5** (**Appendix A1**).

A cumulative total of four amphibian species were recorded during the amphibian call surveys. No amphibians were recorded during the egg mass surveys. Detailed results of these surveys, including a complete list of amphibians recorded, are provided in **Table 18 and Table 19 (Appendix C1)**, respectively. All the amphibian species are provincially ranked S5 (common and secure) or S4 (apparently common and secure).

3.7.13 Breeding Bird Surveys

A total of 11-point count stations were surveyed within the Study Area and are illustrated in **Figure 5** (**Appendix A1**).

A total of 56 bird species were observed within the Study Area. Of this total, 10 species are confirmed, 27 are probable, and 14 are possible breeders in the Study Area. The remaining five bird species are considered non-breeders, flyovers, or migrants. The observed breeding bird species are discussed in the sections below. All species observed within the Study Area are listed in **Table 20** (**Appendix C1**).

A total of 51 (100%) of the confirmed, probable or possible breeders are provincially ranked S5, S4 or SNA (species not native to Ontario). No bird species are considered provincially rare (S1-S3).

The following SAR were observed in, or adjacent to, the Study Area:

Eastern Wood-Pewee (Special Concern): In 2017, three singing males were detected in the woodland in the north-west corner of the Study Area which was considered suitable breeding habitat for Eastern Wood-Pewee.

Barn Swallow (Special Concern): In 2017, several barn structures were observed with Barn Swallow nests. In 2022, one shed with a Barn Swallow nest was observed in the southern portion of the Study Area. In 2017, when the species was considered Threatened (it has since been downlisted to Special Concern), a Notice of Activity for Barn Swallow was registered, before structures with nests were removed and two Replacement Habitat Structures (RHS) were constructed with the appropriate number of nest cups. The RHSs are located within the edge of the preliminary NHS, as shown in **Figure 4a** (**Appendix A1**). These replacement structures were monitored for three years.

Barn Swallow was also observed in 2023 foraging off-site, east of the Study Area over the north riparian Significant Wetland surrounding the Clarkway Drive Tributary. The wetland habitat extends onto a small portion of the east end of the Study Area.

Bobolink (Threatened): A single flyover in late June 2017 was considered a dispersing bird, and no breeding habitat was observed in the Study Area.

One Bobolink was observed in 2023 perching off-site, east of the Study Area over the north riparian Significant Wetland (MAS2-1/MAM2-2) surrounding the Clarkway Drive Tributary. This habitat is not considered breeding habitat, and the individual was identified to be using the wetland for resting.

Bank Swallow (Threatened): Bank Swallow was observed foraging off-site, east of the Study Area over the north riparian Significant Wetland surrounding the Clarkway Drive Tributary. The wetland habitat extends onto a small portion of the east end of the Study Area.

3.7.14 Bat Habitat Assessment and Acoustic Monitoring

Within the Study Area, one woodland (FOD8-3) was identified as potentially providing bat habitat. Therefore, a bat habitat assessment and acoustic monitoring was completed for this woodland. The northern FOD feature and the southern FOD7-6 are located on non-participating properties, and surveys were not conducted in those locations. It is assumed that they also provide suitable bat habitat.

3.7.14.1 Bat Habitat Assessment Results

One polygon (i.e., the FOD8-3) was assessed on the Study Area as it was located on the property of participating landowners (**Figure 5, Appendix A1**).

Based on the results presented above, Polygon 1 (i.e., the FOD8-3) contains a suitable number of trees per hectare (≥10 cavity trees/hectare) to be considered candidate habitat under Significant Wildlife Habitat criteria for Bat Maternity Colonies. Detailed results can be found in **Table 21 (Appendix C1)**.

3.7.14.2 Acoustic Bat Monitoring Results

Bat species can be identified using sonographic characteristics from calls used by bats to echolocate. These ultrasonic calls can be detected, recorded, and analyzed by biologists trained in bat sonogram interpretation to reasonably predict the species of bats present. All ultrasonic recordings were filtered to eliminate recordings with high levels of noise or with no bat calls, and then further analyzed using SonoBat's auto-classification tool. Any calls with a positive identification were manually vetted by a wildlife ecologist with training in bat species identification by sonogram. All species of bats can make calls that range in frequencies and sonogram shape, depending on the behavior at the time of call recording. Echolocation calls are not unique to species and vary between social echolocation calls, and foraging calls in addition to the search phase calls used to identify species. Calls recorded during a bat's search phase are the most reliable for accurate species identification.

Four bat species were confirmed to be present within the FOD8-3 at Station WOOD1 (**Figure 5**, **Appendix A1**): Big Brown Bat *(Eptesicus fuscus),* Hoary Bat (*Lasiurus cinereus*), Silver-haired Bat *(Lasionycteris noctivagans),* and Eastern Red Bat *(Lasiurus borealis)*. During the evenings of acoustic surveys, a total of 77 low frequency calls and 29 high frequency calls were recorded; with a cumulative total of 106 passes by all species. Of the low frequency calls, 16 calls were confirmed to be Big Brown Bat, seven calls were confirmed to be Hoary Bat, four confirmed calls were Silver-haired, and the remaining 51 low frequency calls were not identifiable to species (**Table 22, Appendix C1**). Of the high frequency calls, 5 calls were confirmed to be Eastern Red Bat. No Myotis species were recorded within this feature.

3.7.14.3 Bat Transects and Bat Points

Bat transects and bat point stations were completed at structures and along hedgerows throughout the Study Area to assess bat presence and movement across the landscape (**Figure 5**, **Appendix A1**). Several species were identified including Big Brown Bat, Silver-haired Bat, and Eastern Red Bat (**Table 22**, **Appendix C1**). It should be noted that these transect, and point surveys can only confirm bat presence and potential foraging within the Study Area. Habitat assessments and acoustic monitoring in woodlands and/or bat exit surveys for structures are required to confirm habitat use.

3.7.15 Reptile Surveys

2017 Results

During turtle nesting surveys one Snapping Turtle was observed incidentally within the Clarkway Drive Tributary. The observation occurred in June, which suggests the individual was foraging. No other turtle species were observed in the Study Area and no turtle nesting evidence was recorded. Soil auger tests completed at turtle nesting stations 1 to 11 depicted poor nesting suitability due to low quality nesting substrate (clay to clay-loam soil type). Turtle nesting station 12 had a suitable substrate (gravel), though it was assessed that nesting suitability would still be poor due to anthropogenic effects (driveway). No evidence of nesting was recorded at nesting station 12. Detailed results of the turtle nesting surveys are provided in **Table 23 (Appendix C1)**.

Thirteen snake transects were surveyed within Reptile Search Areas in the Study Area (refer to **Figure 5**, **Appendix A1**). No snake species were recorded during these surveys. Detailed results of the snake surveys are provided in **Table 24 (Appendix C1).** A total of 15 cover boards were deployed on the property (see **Figure 5, Appendix A1** for locations).

Three wildlife road crossing transects were surveyed on, and adjacent to, the Study Area. Two reptiles were recorded: Eastern Gartersnake (*Thamnophis sirtalis sirtalis)* and Midland Painted Turtle (*Chrysemys picta marginata*). Two amphibian species, one insect species and one mammal species were recorded, all of which are listed as S5 or S4 species. Detailed results of the wildlife road crossing surveys are provided in **Table 25 (Appendix C1).**

2018 Results

Five turtle basking stations were surveyed in the Study Area. One Midland Painted Turtle was observed at TB3 (**Figure 5, Appendix A1**). Detailed results of the turtle basking surveys are provided in **Table 26** (**Appendix C1**).

Fourteen transects, four area searches and 13 cover boards were surveyed during each round of snake surveys in 2018. Staff were unable to locate two cover boards that were deployed in 2017; it is assumed that they were removed from the Study Area by tenant farmers. No snake species were recorded during these surveys. An additional five cover boards were deployed on newly participating lands along Mayfield Road for future ecological surveys. Detailed results of the snake surveys are provided in **Table 24** (**Appendix C1**).

Four wildlife road crossing transects were surveyed on and adjacent to the Study Area. Two reptile species were recorded: Eastern Gartersnake and Midland Painted Turtle. Two amphibian species, two unidentified bird species and two mammal species were also recorded, all of which are S5 or SNA. Detailed results of the wildlife road crossing surveys are provided in **Table 25** (**Appendix C1**).

The most wildlife records were recorded along RT1 (Healey Road), at the north end of the Study Area. Reptile observations included five dead turtles (could not be identified to species since only partial carcass, highly desiccated and only small shell fragments remained) and two live Eastern Gartersnake. The other two wildlife road crossing transects were located along Humber Station Road. No wildlife was recorded along RT2. Two dead amphibian species were recorded along RT3.

2023 Observations

One Snapping Turtle was observed incidentally at the SAS1-1 wetland community associated with HDF-3 (TB3). The observation occurred in July, which suggests the individual was foraging.

3.7.16 Wildlife Camera Traps

Wildlife cameras were deployed along potential wildlife corridors to understand the utilization and functionality of features on the landscape by semi-aquatic and terrestrial species. Locations of wildlife camera traps are found in **Figure 5** (**Appendix A1**). A total of nine species were captured. No species presence was recorded near camera traps 1 and 6. All species are listed as S5, S4 or SNA. Detailed results can be found on **Table 27** (**Appendix C1**).

3.7.17 Insect Surveys

There were 14 butterfly, and 20 dragonfly species recorded in the Study Area. All species observed within the Study Area are listed in the Master Wildlife List **Table 28** (**Appendix C1**). All species observed are provincially ranked S5 (common and secure), S4 (apparently common and secure) or SNA (species not native to Ontario). Two SAR insect species were observed in the Study Area: Monarch (Special Concern in Ontario and Endangered in Canada) and Yellow-banded Bumble Bee (*Bombus terricola)* (Special Concern in Ontario and Canada).

Monarch was observed on two rounds of surveying at various old field/meadow locations with peak numbers (three individuals). Common Milkweed (*Asclepias syriaca*) is widespread along the eastern watercourse, and some hedgerows, providing areas for reproduction of this species.

A male, Yellow-banded Bumble Bee was observed along the eastern watercourse/ agricultural hard edge between PC 10 and PC 11. This species is known to prefer wetlands and forest for foraging and nest site selection, and forages on a variety of flowers including Sweet Clover (*Melilotus sp*.) and Dandelions (*Taraxacum sp*.) which are present in the field edges. It was observed foraging on Common Burdock (*Arctium minus*).

3.7.18 Fish Community Sampling

A total of five reaches were sampled throughout the Study Area to understand the fish community. A total of five species were collected between all five sampling stations. Fisheries results collected indicate a tolerant warmwater fish community assemblage presence within HDF-3 and the Clarkway Drive Tributary in the Study Area. Fish collected within these reaches are common (i.e., S5) species that are tolerant of local disturbances such as increased siltation as well as increases in thermal regime. Detailed survey results can be found in **Table 29 (Appendix C1)**.

All the HDFs were classified as intermittent or ephemeral and therefore provide seasonal fish habitat. Reaches that contain water year-round (i.e., the Clarkway Drive Tributary) and maintain a downstream connection provide permanent direct fish habitat. Direct fish habitat is limited to the Clarkway Drive Tributary (**Figure 4b**, **Appendix A1**).

3.7.19 Non-Participating Properties

For all non-participating properties, it is expected that a similar level of field investigation would be required for any land use changes proposed to identify existing characteristics and conditions present.

3.8 Key Ecological Features and Functions

3.8.1 Significant Wetlands

GEI assessed the provincial significance of three wetlands (Wetlands D1, E1 and F1) using the current OWES protocol (MNRF 2022) and determined that they meet the criteria for significance as per OWES. These wetlands are associated with the Clarkway Drive Tributary and the pond at the downstream extent of HDF-3 (**Figure 4a**, **Appendix A1**). All other wetland communities are too small (<2 ha) to meet the OWES size criteria.

Clarkway Drive Tributary

Two riparian wetlands of the Clarkway Drive Tributary (Wetlands D1 and F1) have been classified as a complex of wetland communities. The northern wetland complex is composed of Mineral Meadow Marsh and Mineral Shallow Marsh (MAS2/MAM2), Reed-canary Grass Mineral Meadow Marsh and Forb Mineral Meadow Marsh (MAM2-2/MAM2-10), Mineral Shallow Marsh (MAS2) The southern wetland complex is composed of Reed-canary Grass Mineral Meadow Marsh and Forb Mineral Meadow Marsh and (MAM2-2/MAM2-10) and Cattail Mineral Shallow Marsh (MAS2-1).

The riparian wetlands surrounding the Clarkway Drive Tributary were staked on participating properties within the Study Area on October 19, 2021. The majority of the valley land is not located within the Study Area and could not be fully staked. Within the Study Area, wetland limits and the hydrologic edge of the wetland were staked. The hydrologic edge of wetland is identified as the high-water mark, a temporarily flooded area that was actively farmed. TRCA agreed that while it was not a wetland, the high-water mark delineation would assist with any potential SWM outlet infrastructure in this general area.

Wetland G1 was also identified as a riparian wetland along the Clarkway Drive Tributary. It is downstream of Wetland F1 and located on non-participating lands. The boundary of Wetland G1 could not be staked or assessed using OWES to the same extent as Wetlands D1 or F1. However, it has been assumed to meet the criteria for significance based on proximity to Wetland F1 and similarities of hydrology and features.

Online Pond

Along HDF-3, an online pond fringed with wetland vegetation is present. This feature has been classified Pondweed Submerged Shallow Aquatic (SAS1-1) and Willow Mineral Thicket Swamp (SWT2-2). It is identified as Wetland E1 (**Figure 4a, Appendix A1**) and was determined to be significant per OWES criteria.

3.8.2 Significant Woodlands

Significant woodlands are identified by the planning authority in consideration of criteria established by the MNRF. Under the Natural Heritage Reference Manual (NHRM; 2010), woodlands are defined as:

> *"...treed areas that provide environmental and economic benefits to both the private landowner and the general public, such as erosion prevention, hydrological and nutrient cycling, provision of clean air and the long-term storage of carbon, provision of wildlife habitat, outdoor recreational opportunities, and the sustainable harvest of a wide range of woodland products. Woodlands include treed areas, woodlots or forested areas and vary in their level of significance at the local, regional and provincial levels."*

Woodlands, as defined by the RPOP include woodlots, cultural woodlands, cultural savannahs, plantations and forested areas and may also contain remnant of old growth forests. They further define woodlands as any area greater than 0.5 ha that has:

a. A tree crown cover of over 60% of ground, determinable from aerial photography, or;
b. A tree crown cover of over 25% of the ground, determinable from aerial photography, together with on-ground stem estimates of at least:
    i. 1,000 trees of any size per hectare;
    ii. 750 trees measuring over five centimeters in diameter at breast height (1.37 m), per hectare;
    iii. 500 trees measuring over 12 centimeters in diameter at breast height (1.37 m), per hectare; or
    iv. 250 trees measuring over 20 centimeters in diameter at breast height (1.37 m), per hectare (densities based on the Forestry Act of Ontario 1998).

and, which have a minimum average width of 40 meters or more measured to crown edges.

Based on this definition, the Deciduous Forest (FOD) within the northwest corner of the Study Area, and the Fresh – Moist Basswood Deciduous Forest (FOD8-3; **Figure 4a**, **Appendix A1)** are considered woodlands and will be further assessed for significance. The FOD7-6 in the south-central portion of the Study Area is located within a non-participating property, is <0.5 ha in size and therefore does not meet the size criteria. While it is acknowledged that this FOD7-6 is adjacent to a nursery and orchard, these features are not considered woodlands as per 2.14.31 of the RPOP and cannot be included in the woodland polygon.

The RPOP further evaluates woodlands as being Core Area, NAC, or PNAC. The requirements for this classification are derived from Table 1 (Criteria and Thresholds for the Identification of Core Areas, Natural Areas and Corridors (NAC) and Potential Natural Areas and Corridors (PNAC) Woodlands) of the RPOP. The Region of Peel considers NAC and Core woodlands to be significant.

Using these criteria, the woodlands within the Study Area were found to be Significant Woodlands. A brief summary of the assessment of each is provided below.

Deciduous Forest (FOD): This feature meets the criteria for Core Woodland considering the following criteria:

- **Significant Species and Communities:** The woodland is greater than 4 ha in size and provides habitat for Eastern Wood Peewee, which has been designated as Special Concern by the Committee on the Status of Species at Risk in Ontario (COSSARO) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Fresh – Moist Basswood Deciduous Forest (FOD8-3): This feature is >0.5 ha and meets the following criteria for NAC Woodland:

- **Surface Water Quality**: HDF-3 and its associated wetland are located within 30 m of the woodland.

3.8.3 Significant Valleylands

Significant valleylands are defined and designated by the planning authority. General guidelines for determining the significance of these features are presented in the NHRM (MNR 2010) for the Natural Heritage policies of the PPS. Recommended criteria for designating significant valleylands include prominence as a distinctive landform, degree of naturalness, and importance of its ecological functions, restoration potential, and historical and cultural values.

No significant valleylands are present on or adjacent to the Study Area.

3.8.4 Significant Wildlife Habitat

Significant wildlife habitat (SWH) is one of the more complex natural heritage features to identify and evaluate. There are several provincial documents that discuss identifying and evaluating SWH including the NHRM (MNR 2010), the Significant Wildlife Habitat Technical Guide (MNR 2000), and the SWH Eco-Region Criterion Schedules (MNRF 2015a and MNRF 2015b). As discussed previously, the Study Area is located in two Eco-Regions: 6E and 7E. Therefore, the Study Area was assessed using both 6E and 7E Criterion Schedules (MNRF 2015a and MNRF 2015b).

There are four general types of SWH:

- Seasonal concentration areas;
- Rare or specialized habitats;
- Habitat for species of conservation concern; and
- Animal movement corridors.

Seasonal Concentration Areas

Seasonal concentration areas are those sites where large numbers of a species gather together at one time of the year, or where several species congregate. Seasonal concentration areas include deer yards; wintering sites for snakes, bats, raptors and turtles; waterfowl staging and molting areas, bird nesting colonies, shorebird staging areas, and migratory stopover areas for passerines or butterflies. Only the best examples of these concentration areas are usually designated as SWH. Areas that support Special Concern species or provincially vulnerable to imperiled species (S1-S3), or if a large proportion of the population may be lost if the habitat is destroyed, are examples of seasonal concentration areas which should be designated as significant.

Rare or Specialized Habitats

Rare and specialized habitat are two separate components. Rare habitats are those with vegetation communities that are considered rare in the province. S-Ranks are rarity rankings applied to species at the 'state', or in Canada at the provincial level, and are part of a system developed under the auspices of the Nature Conservancy (Arlington, VA). Generally, community types with S-Ranks of S1 to S3 (extremely rare to rare-uncommon in Ontario), as defined by the NHIC (MNRF 2025), could qualify. It is to be assumed that these habitats are at risk and that they are also likely to support additional wildlife species that are considered significant. Specialized habitats are microhabitats that are critical to some wildlife species. The NHRM (MNR 2010) defines specialized habitats as those that provide for species with highly specific habitat requirements; areas with exceptionally high species diversity or community diversity; and areas that provide habitat that greatly enhances species' survival.

Habitat for Species of Conservation Concern

Species of conservation concern include those that are provincially rare (S1 to S3), provincially historic records (SH) and Special Concern species. Several specialized wildlife habitats are also included in this SWH category, i.e., terrestrial crayfish habitat and significant breeding bird habitats for marsh, open country and early successional bird species.

Habitats of species of conservation concern do not include habitats of endangered or threatened species as identified by the ESA (2007). Endangered and threatened species are discussed in section 5.2.

Animal Movement Corridors

Animal movement corridors are areas that are traditionally used by wildlife to move from one habitat to another. This is usually in response to different seasonal habitat requirements, including areas used by amphibians between breeding and summer/over-wintering habitats, called amphibian movement corridors.

Table 30 (**Appendix C1**) assesses all types of SWH relevant to the Study Area considering the ecological data collected by GEI.

In addition to applying the provincial criteria, GEI also considered the regional SWH criteria of the Peel-Caledon Significant Woodlands and Significant Wildlife Habitat Study (NSEI et al. 2009), as presented in **Table 31** (**Appendix C1)**. However, the regional criteria pre-date the provincial criteria and have not been formally adopted in the Region of Peel's policies. Therefore, greater importance has been placed on the provincial criteria which is more recent and comprehensive.

As detailed in the tables, the following SWH types are present on the Study Area:

- Seasonal Concentration Areas of Animals:
    - Candidate Bat Maternity Colonies within a northwestern FOD community and southeast FOD7-6 community located in non-participating properties; and
    - Candidate Over-Wintering Turtle Habitat within OA ponds in northwestern FOD community.
- Specialized Wildlife Habitat:
    - Candidate Seeps and Spring within a northwestern FOD community and southeast FOD7-6 community located in non-participating properties; and
    - Candidate Amphibian Breeding Habitat (Wetland) within the pond just east of Humber Station Road.

- Species of Conservation Concern:
  - Terrestrial Crayfish;
  - Snapping Turtle;
  - Eastern Wood Peewee;
  - Monarch; and
  - Yellow-banded Bumblebee.

3.8.5 Fish Habitat

Fish habitat, as defined in the federal *Fisheries Act*, C. F-14, means "spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes". Fish, as defined in S.2 of the *Fisheries Act*, C. F-14, includes "parts of fish, shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and the eggs, sperm, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals" (DFO 2019).

Direct fish habitat has been confirmed within the Clarkway Drive Tributary and possible direct habitat was identified in HDF-3 based on presence of flow through the summer of 2017 (**Figure 4b, Appendix A1**). The other HDFs do not provide direct fish habitat.

3.8.5.1 Thermal Regime

The fish species captured in the Study Area are tolerant warmwater species (**Table 29**, **Appendix C1**), consistent with the TRCA Humber River Fisheries Management Plan (FMP; TRCA 2005) which identifies the Study Area as having small riverine warmwater habitat.

This conclusion is further supported by water temperatures recorded by GEI in the Clarkway Drive Tributary (summer average of 25.4 degrees Celsius) and the fact that the HDFs were generally ephemeral, except HDF-3 which had perennial flow in 2017 but was dry by June 2022 and May 2023.

3.8.6 Habitat of Endangered and Threatened Species

Species designated as Threatened or Endangered in Ontario are afforded both individual and habitat protection under the ESA (2007). To identify the presence of any Threatened or Endangered species, a background information review and detailed field investigation were completed within the Study Area.

The agency information requests, and background information review identified that a number of SAR could potentially be present within the Study Area. To assess habitat suitability and species present/absence, a number of targeted surveys were undertaken. A discussion of the potential for endangered and threatened SAR and their habitat within the Study Area is provided in **Table 7** (**Appendix C1**).

Redside Dace contributing habitat was previously confirmed present within the Study Area, within the Clarkway Drive Tributary and HDF-8. However, based on changes to the definition of habitat, implemented through Bill 5, only occupied RSD habitat is regulated under the current ESA.

Bank Swallow was observed foraging off-site, east of the Study Area over the north riparian Significant Wetland surrounding the Clarkway Drive Tributary. The wetland habitat extends onto a small portion of the east end of the Study Area.

Silver-haired Bat, Hoary Bat, and Eastern Red Bat were identified within the FOD8-3 on multiple evenings. Silver-haired Bat was also identified adjacent to the northwestern FOD within the non-participating lands. The FOD and FOD7-6 communities located on non-participating properties, were assessed as providing candidate Bat Maternity Roosting SWH and may provide habitat for SAR bats. -

Phase 2 and 3 of the CEISMP will provide mitigation and management recommendations as appropriate. However, it is the responsibility of the proponent to ensure they are in compliance with current SAR legislation at the time of submission in accordance with recommendations of the site-specific EIS, where applicable.

3.8.7 Areas of Natural and Scientific Interest

No ANSIs are identified on or adjacent to the Study Area.

3.8.8 Town of Caledon

Within the Study Area, the following features of the Town of Caledon's Ecosystem Framework for Environmental Protection Areas have been identified:

Natural Core Areas:

- Significant Woodlands (Northwestern FOD community and FOD8-3 community);
- PSWs associated with Clarkway Drive Tributary (MAS2/MAM2, MAM2-2/MAM2-10, MAS2 and MAM2-2/MAM2-10, MAS2-1);
- PSW (SWT2-2, SAS1-1);
- Candidate Habitats of Endangered Species (bat SAR; northwestern FOD community, southern FOD7-6 community);
- SWH:
    - Seasonal Concentration Areas of Animals (Candidate Bat Maternity Colonies within FOD habitats; Candidate Over-Wintering Turtle Habitat within pond in northwestern FOD community);
    - Specialized Wildlife Habitat (Candidate Seeps and Spring; Candidate Amphibian Breeding Habitat (Wetland) within pond associated with Humber Station Road); and
    - Species of Conservation Concern (Terrestrial Crayfish, Snapping Turtle, Eastern Wood Peewee, Monarch, and Yellow-banded Bumblebee).
- Natural Corridors:
    - Valley and Stream Corridor (Clarkway Drive Tributary).
- Supporting Natural Systems:
    - Other woodlands (southern FOD7-6 community); and
    - All other wetlands.

3.8.9 Key Ecological Features and Functions that Contribute Significantly to the Ecological Integrity of the Proposed Natural Heritage System

An analysis of existing natural features in the Study Area was completed, followed by an evaluation of their significance against criteria in the Significant Wildlife Habitat Technical Guide and Eco-region 6E Criteria Schedule (MNRF 2015b), as well as under criteria recommended in the RPOP (2022) and the NHRM (MNR 2010).

Through the background review and field investigations completed by GEI, as outlined in **Section 3.7**, the following natural heritage features have been identified within the Study Area and its adjacent lands (i.e. 120 m):

- Significant wetlands;
- Significant woodlands;
- Habitat of endangered and threatened species (SAR Bats and Bank Swallow foraging habitat);
- Fish habitat (HDF-3 and the Clarkway Drive Tributary); and
- Significant wildlife habitat:
    - Seasonal Concentration Areas of Animals (Candidate Bat Maternity Colonies within FOD habitats; Candidate Turtle Over-Wintering Habitat within OA ponds in northwestern FOD community);
    - Specialized Wildlife Habitat (Candidate Seeps and Spring; Candidate Amphibian Breeding Habitat (Wetland) within pond near Humber Station Road); and
    - Species of Conservation Concern (Terrestrial Crayfish, Snapping Turtle, Eastern Wood Peewee, Monarch, and Yellow-banded Bumblebee).

In addition, other non-significant features including one ‘other woodlands’, a valley and stream corridor, and other wetlands as defined by the Caledon OP’s (2018) Ecosystem Framework were identified within the Study Area.

3.9 Constraints and Opportunities

The constraints and opportunity analysis serves to:

a) Identify significant and sensitive biophysical features and functions that could potentially constrain how the Study Area is developed in the future;
b) Establish environmental targets to maintain, restore, and enhance existing conditions; and
c) Identify potential opportunities for enhancement of natural features and ecological functions in association with future development.

The proposed preliminary NHS (**Figure 6**, **Appendix A1**) is founded upon a sound technical understanding of the extent and quality of natural heritage features and functions, and natural hazards that meet the definition of NHS components as described in the Town of Caledon OP and RPOP.

The preliminary NHS represents an interconnected system of natural features and functions, including valley and stream corridors, wetlands, woodlands, significant wildlife habitat, habitat of endangered and threatened species, fish habitat, and their Vegetation Protection Zones/ buffers. It is anticipated that the stormwater management strategy will include LID techniques and other innovative approaches to support existing watercourses and wetlands, as well as the proposed drainage realignment for HDF-3 and wetland relocation/compensation areas, and achieve a net ecological gain compared to existing conditions.

3.9.1 Natural Heritage Feature Buffers

Natural heritage feature buffers, or Vegetation Protection Zones (VPZs), and setbacks were reviewed including requirements set out in the TRCA Living Cities Policies (2014), the Town of Caledon OP (2018), the RPOP (2022), the Significant Wildlife Habitat Criteria Schedules For Ecoregion 6E and 7E (MNRF 2015a and 2015b), and the Natural Heritage Reference Manual (MNR 2010).

These policy requirements were reviewed in the context of feature form, functions, sensitivity and location within the preliminary NHS, as well as the extent and nature of the proposed development or site alteration on adjacent lands to support VPZ recommendations. Based on this review, the following VPZs are recommended to be applied to features in the Study Area. The guiding principles are listed in brackets.

- Significant Wetlands: 30 m (TRCA 2014; Town of Caledon OP 2018);
- Other Wetlands = 10 m (TRCA 2014; Town of Caledon OP 2018);
- Woodlands: 10 m (TRCA 2014; Town of Caledon OP 2018);
- SWH habitat for Species of Conservation Concern – Terrestrial Crayfish, Snapping Turtle, Eastern Wood Peewee, Monarch, and Yellow-banded Bumblebee: 10 m (MNRF 2015a/2015b);
- Candidate bat maternity colony SWH: 10 m (MNRF 2015a/2015b);
- Candidate turtle over-wintering habitat: 10 m (MNRF 2015a/2015b);
- Specialized Wildlife Habitat (Candidate Seeps and Spring, Candidate Wetland Amphibian Breeding Habitat Wetland): 10 m (MNRF 2015a/2015b);
- Fish habitat (warm water): 15 m (MNR 2010); and
- Valley and stream corridors (Top of Bank; Regulatory Floodplain; and Floodplain Erosion hazard allowance (Meander belt for unconfined systems and stable slope for confined systems)): 10 m (TRCA 2014; Town of Caledon OP 2018).

These VPZs will be further refined as part of the Phase 2 CEISMP, with appropriate rationalization for their refinements provided in that report.

3.9.2 Floodplain Limits

The extents of the existing floodplain limit were established in Appendix B of SCE's Floodplain Analysis Report provided in **Appendix D**. The Floodplain is shown on GEI's **Figure 6 (Appendix A1)** and was used to help identify the preliminary NHS as detailed in **Section 3.9.1**.

3.9.3 Environmental Targets

The overall goal of the proposed NHS is to establish a healthy and diverse ecosystem that enhances and complements native vegetation coverage and strengthens its ecological resilience.

The following environmental targets are recommended to maintain, restore, and enhance existing conditions:

- Provide natural vegetative cover across the entire created NHS and all NHS buffers;
- Achieve an overall measurable net gain in native vegetation community type and species diversity (flora and fauna);

- Provide habitat for certain life stages of various bird and small and medium sized mammal species;
- Mitigate removal of wetlands by providing appropriate areas for wetland compensation/relocation and by increasing ecological functions within created wetland features;
- Map abundance of Category 1 invasive species (i.e., *Rhamnus cathartica*, *Phragmites australis ssp. australis*) and *Populus alba* (Category 2) within retained natural features;
- Invasive species management (risk) assessment to assess whether it is ecologically, socially, and economically viable to manage a given invasive species population;
- Where invasive species risk assessment identifies invasive management, for a given species, carry out invasive management as per Ontario Invasive Plant Council best management practices;
- Explore salvage and transplant of native species within removed features into created features and or retained feature buffers, where feasible;
- Enhance local linkages and connectivity for wildlife movement and gene flow; and
- Consider best management practices for road crossings to support movement of amphibian, reptile, small and medium sized mammals under road crossings.

3.9.4 Proposed Drainage Realignment

As described in **Section 3.2.3.2**, HDF-3 was historically straightened for agricultural purposes, and is ploughed to the edge of the feature, preventing growth of riparian vegetation. HDF-3 provides possible direct fish habitat and is proposed for realignment with a natural corridor design. GEI expects a vegetated corridor will provide a net ecological gain compared to the existing agricultural conditions surrounding HDF-3.

Corridor Requirements

In support of defining the requirements for a realigned drainage feature within the proposed development, a meander belt width was delineated for HDF-3. Given that the existing drainage feature has been historically modified by straightening and channelization, a meander belt based on the existing channel dimensions was not deemed to be appropriate. Rather, the proposed channel realignment was sized according to modelled flows, as identified by SCE.

Channel dimensions are identified by bankfull discharge, as this represents what is generally considered the channel-forming discharge or the dominant discharge. The bankfull discharge is the flow that reaches the transition between the channel and its floodplain (Leopold et al. 1964) and is significant because it is the flow at which the channel is the most effective at moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the shaping of the channel (Dunne & Leopold 1978). Typically, the recurrence interval/frequency of the bank forming flow event is typically that of the spring freshet, or 1-2-years recurrence.

The bankfull discharge can be identified using different methods; the most typical is to back calculate the flow from a ‘reference reach’, based on field indicators of bankfull geometry. As noted, the existing channel has been historically modified, with sections that were poorly defined. Therefore, hydrologic modelling completed by SCE was used to identify an appropriate bankfull discharge. The 2-year flow provided by SCE was equal to 0.28 m^3/s at the upstream portion of the reach, and 0.42 m^3/s at the downstream portion.

The bankfull discharge was calculated to be approximately equivalent to three-quarters of the 2-year flow. Therefore, the corresponding bankfull discharges for the upstream portion and downstream portion of the reach were 0.21 m^3/s and 0.32 m^3/s, respectively. The channel was sized by iteratively adjusting the dimensions, until the bankfull flow could be accommodated within the channel. Based on topographic mapping for the site provided by SCE, the upstream portion of the reach had an overall gradient of 0.99%, and the downstream portion of the reach had an overall gradient of 0.62%. Therefore, a proposed channel with an average bankfull width of 1.6 m and an average bankfull depth of 0.20 m was identified for the upstream portion of the reach. Similarly, a proposed channel with an average bankfull width of 1.9 m and an average bankfull depth of 0.24 m was identified for the downstream portion of the reach.

Using these channel dimensions, an empirical approach was used to identify the meander belt width. There are a variety of empirical models available, which use simple power functions based on field-based measurements of average channel dimensions. The methods include those outlined by Williams involving bankfull width (W_b), (1986 – equation 1), Ward et al. involving bankfull width (2002 – equation 2), Lorenz et al. (1985 – equation 3), and a linear model presented by Howett (2017 – equation 4).

The results of the empirical approach are presented in **Table 39** (**Appendix C1**), which suggests that the recommended corridor widths for the upstream and downstream portions of the reach are 13 m and 15 m, respectively.

Because HDF-3 may provide direct fish habitat, the 15 m warm water fish habitat buffer has been applied to the drainage realignment as shown in **Figure 6** (**Appendix A1**). The meander belt falls within and/or matches this buffer.

3.9.5 Proposed Wetland Relocation and Compensation

Wetland B1 (MAS2-1; 0.077 ha) is proposed for removal and compensation. Part of Wetland C1 (MAM2-2; 0.092 ha) is proposed for partial removal and compensation. The location of proposed wetland removal and conceptual locations for wetland compensation and relocation are illustrated in **Figure 6** (**Appendix A1)**.

Wetland relocation/compensation is proposed to occur within or close to the existing wetlands, within the preliminary NHS. Compensation/relocation will meet a 1:1 removal to compensation/relocation ratio (**Figure 6, Appendix A1**). Because the proposed wetland relocation/compensation areas are connected to HDF-3, it is anticipated that the wetlands can be fed with sufficient volumes of water required to sustain wetland vegetation. A water availability assessment will be developed in Phase 2 to demonstrate that suitable hydrological conditions are provided within this realigned corridor to support a wetland community.

HDF-8a, HDF8b, HDF-8c, HDF-8c-1, HDF-8c-2, and HDF-8d are proposed for mitigation, and a wetland creation area is proposed as compensation. A portion of the drainage area in the south portion of the Study Area will be directed to a proposed created wetland that will receive flows before outletting to reach HDF-8a1. SCE's preliminary analysis has indicated that a floodplain volume of approx. 1,750 m^3 associated with HDF-8 is proposed to be removed. At an assumed depth of 0.7 m, the required wetland surface area to compensate for the loss of flood storage is 0.25ha. Protecting for any grading associated with the construction of the wetland, a conceptual compensation area of 0.35 ha has been identified, as shown in **Figure 6** (**Appendix A1**). Compared to existing agricultural activities that plough either through, or up to, the edge of HDF-8, the proposed wetland compensation area is expected to achieve a net ecological gain through the creation of wildlife habitat, water polishing, and thermal mitigation.

Wetland relocation and compensation design will be advanced further during Phase 2 of the CEISMP.

3.9.6 Wetland Risk Evaluation

A wetland water balance risk evaluation (TRCA 2017) was prepared to assess the need for and type of feature-based wetland water balance analysis for all wetlands (**Figure 4a, Appendix A1**; **Tables 32 thru 38, Appendix C1**) in the Study Area, including those associated with watercourses and HDFs. TRCA's risk evaluation was followed, and the protocol includes:

- Determining the potential magnitude of hydrological change post development without mitigation; and
- Assessing the sensitivity (flora and fauna) of the wetland to hydrological change.

The magnitude of hydrological change and sensitivity of the wetland are then located under the wetland risk evaluation decision tree (Figure 3; TRCA 2017) and categorized as low, medium or high risk. Each risk category has recommended measures for monitoring and water balance modeling.

The majority of the wetland units (9 of 15) were evaluated as low risk, including all of the wetlands associated with the Clarkway Tributary (Wetland D1, Wetland F1 and Wetland G1). One wetland was evaluated as medium risk: Wetland C1 (MAM2-2) at the eastern side of the FOD8-3. Five wetlands were evaluated as high risk: a MAM2-2 above Wetland A1, Wetland A1, Wetland B1, Wetland C1, and Wetland E1 It is worth noting that Wetland B1 is proposed for removal and compensation and part of Wetland C1 is proposed for removal and wetland relocation as part of the channel realignment.

GEI attended a virtual meeting with TRCA, Arcadis, and SCE on January 26, 2024, regarding the results of the Wetland Risk Evaluation. The consultant team requested to use stormwater management modelling for retained wetlands within existing riparian channels and for proposed wetland compensation/relocation areas within riparian channels. Post-development, the retained riparian wetlands will receive the same if not more water from stormwater outputs. While riparian wetland vegetation communities may change (i.e., from a meadow marsh to a shallow marsh), wetlands will be retained. TRCA acknowledged that they supported using stormwater management modeling to both demonstrate that riparian wetland will be retained post-development and that created wetlands will be supported in riparian channels. TRCA agreed that Feature-based Water Balance (FBWB) modeling is not required for riparian wetlands. Instead, the consultant team will demonstrate that erosion thresholds are not exceeded, and flows are contained within the channel corridor.

Interim and Post-development Mitigation to Maintain Water Balance

From an ecological perspective the timing, frequency, duration and volume of surface water inputs into wetlands needs to be considered to maintain the wetland vegetation community (i.e., mineral meadow marsh, shallow marsh, shallow aquatic, etc.) and wildlife habitat (i.e., breeding amphibian habitat, overwintering reptile habitat). Interim and -post development with mitigation water balance measures will be within 5% of monthly pre--development surface water inputs. Matching spring freshet surface inputs, and timing of summer dry periods (where applicable) should be targeted.

3.9.7 Natural Heritage System Limits

The preliminary NHS limits are the ‘greater of’ the various natural heritage feature buffers, as described above, including the proposed drainage realignment and wetland compensation/ relocation area and the recommended buffers for those features.

The preliminary NHS limits are shown in **Figure 6** (**Appendix A1**).

4. Summary and Conclusions

This CEISMP Phase 1 report provides support to the proposed Humber Station Employment Area Secondary Plan on a range of environmental and engineering matters. The report was prepared in accordance with the TOR that was approved by the TRCA, and characterizes the existing conditions relating to surface water, groundwater, terrestrial and aquatic resources, and defines the preliminary NHS. This CEISMP also provides the results of the wetland risk evaluation to understand future FBWB requirements, which will be further discussed in Phase 2 of the CEISMP.

Phase 2 of the CEISMP will include the analysis, impact assessment, proposed mitigation, and monitoring recommendations. Phase 3 will consist of an implementation plan, monitoring plan, and adaptive management plan.

A detailed summary of CEISMP findings and conclusions is provided in the Executive Summary at the beginning of this report.

Prepared By:

GEI Consultants Canada Ltd.



Anne McDonald
Project Manager
519-803-4355
anmcdonald@geiconsultants.com

Prepared By:

GEI Consultants Canada Ltd.



Ahmed Siddiqui
Senior Fluvial Geomorphologist
416-991-3169
asiddiqui@geiconsultants.com

Prepared By:

GEI Consultants Canada Ltd.



Michelle Nieroda
Ecologist
905-699-3644
mnieroda@geiconsultants.com

Prepared By:

Arcadis Professional Services (Canada) Inc.



Steve Davies
Associate - Manager, Environmental Services, Geosciences
289 815 2975
steve.davies@arcadis.com

Prepared By:

Schaeffers Consulting Engineers



Koryun Shahbikian
Partner
905 738-6100
kshahbikian@schaeffers.com

Reviewed By:

GEI Consultants Canada Ltd.



Heather Whitehouse
Project Director
416 568-7284
hwhitehouse@geiconsultants.com

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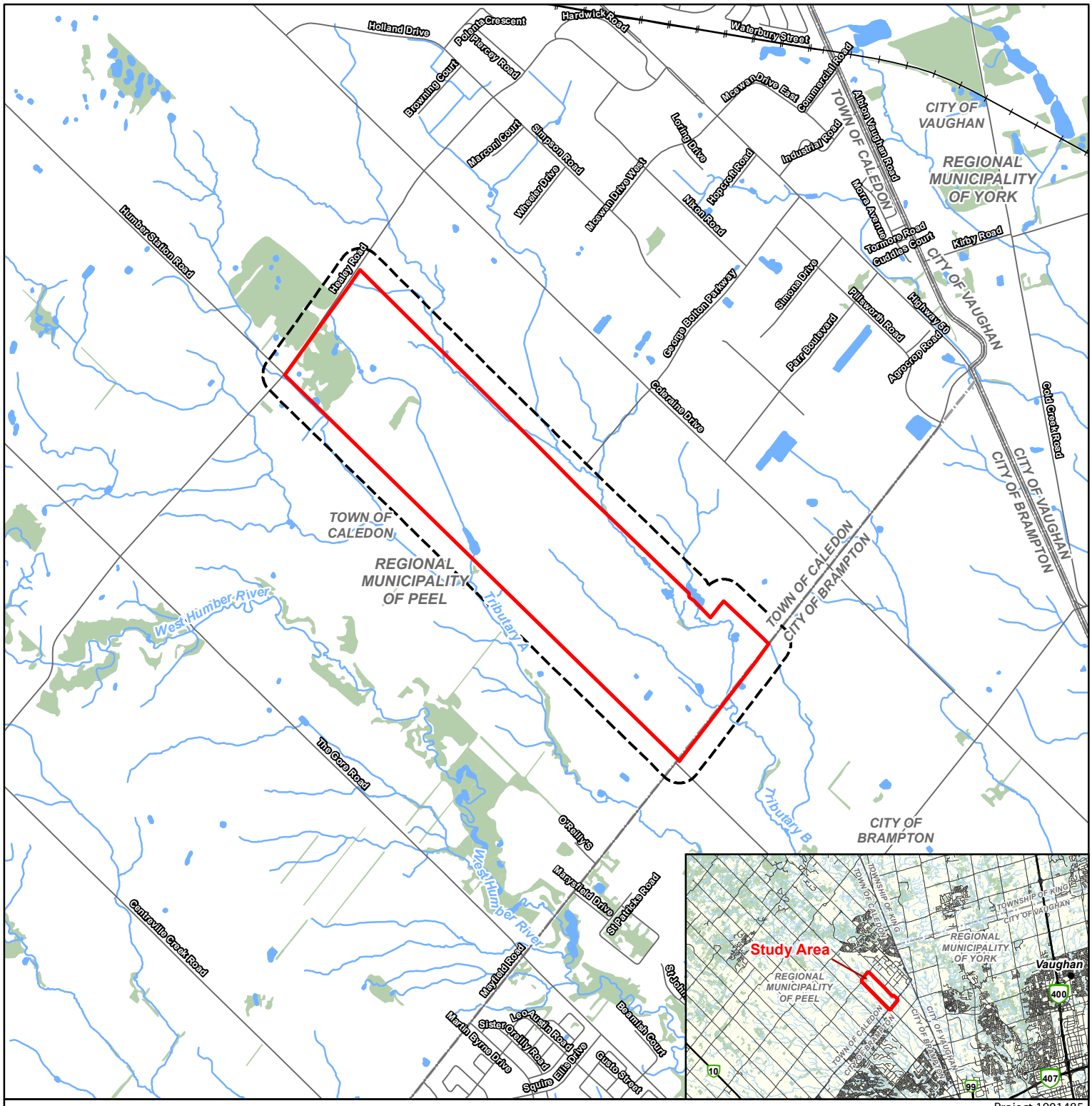
Appendix A Figures

A.1. Figures – GEI Consultants Canada Ltd.

A.2. Figures – Arcadis

A.3. Figures – Schaeffers

A.1. Figures – GEI Consultants Canada Ltd.



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NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2024.

Legend

- Study Area
- 120 m Adjacent Lands
- Railway
- Municipal Boundary, Lower/Single Tier
- Municipal Boundary, Upper Tier
- Watercourse
- Waterbody
- Wooded Area

Humber Station, Town of Caledon, ON

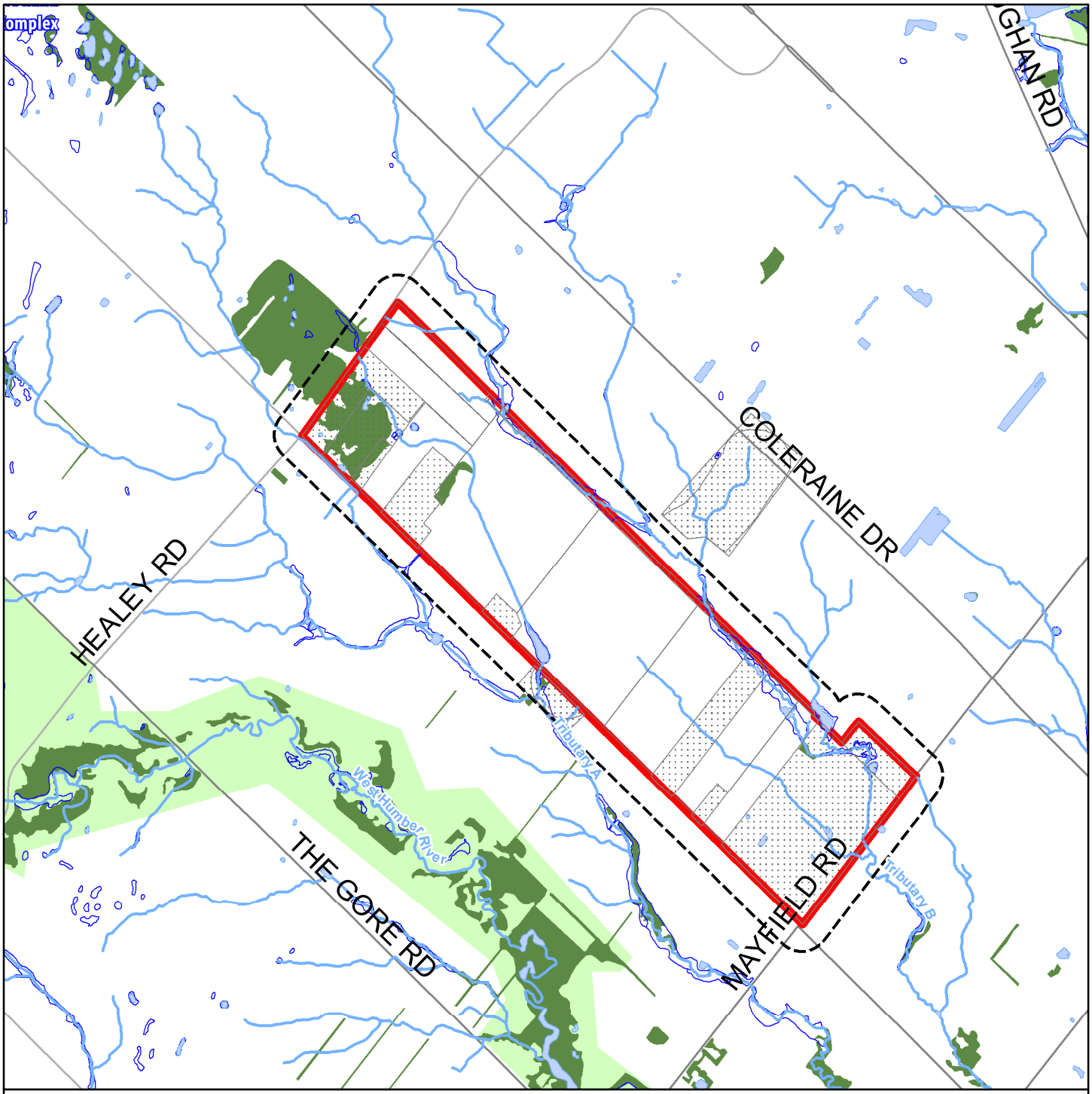
Figure 1
Location of Study Area

0 500 m
1:30,000

N

GEI Consultants

Path: \\bos-pzcc-1\data_storage\Working\HUMBER STATION VILLAGE LANDOWNERS GROUP INC\1901485 Humber Station Village Caledon CEISMP\05_GIS\figures\report_figures\2023-09 CEISMP\1901485_rpt_fig01_LocationOfStudyArea.mxd Date Saved: Thursday, July 4, 2024



NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
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Legend

- Study Area
- 120 m Adjacent Lands
- Non-Participating Properties
- Participating Properties
- Waterbody (MNRF LIO)
- Watercourse (MNRF LIO)
- Wetland not evaluated per OWES (MNRF LIO)
- Evaluated-Provincial
- Woodland (MNRF LIO)
- Protected Countryside

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Humber Station, Town of Caledon, ON

Figure 2
Landscape Setting

0 500 Meters

1:25,000

N

GEI Consultants

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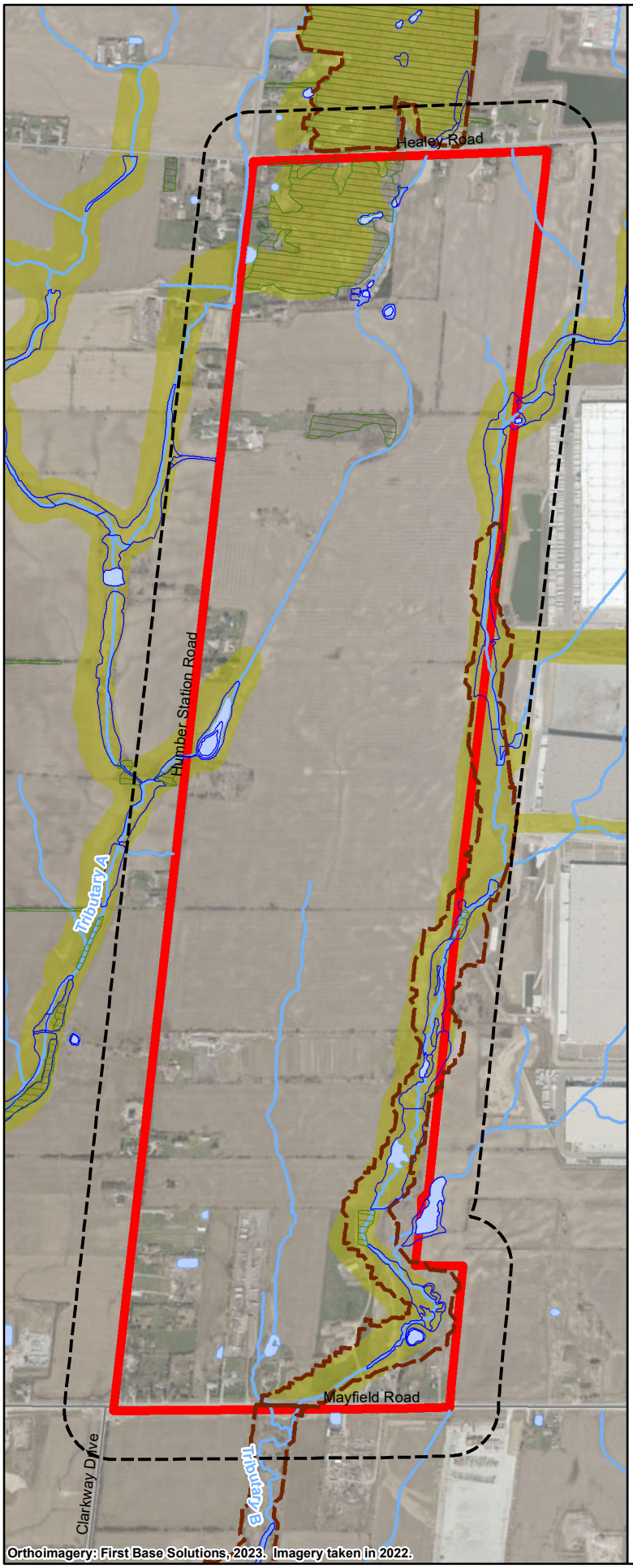

Legend

- Study Area
- 120 m Adjacent Lands
- Core Areas of the Greenland System (Peel Region 2020, Schedule A)
- Town of Caledon Environmental Policy Area (Schedule C, Approximate)
- Waterbody (MNRF LIO)
- Watercourse (MNRF LIO)
- Wetland not evaluated per OWES (MNRF LIO)
- Woodland (MNRF LIO)

NOTES:

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Humber Station, Town of Caledon, ON

Figure 3
Designated Natural Features

0 200 Meters

1:15,000

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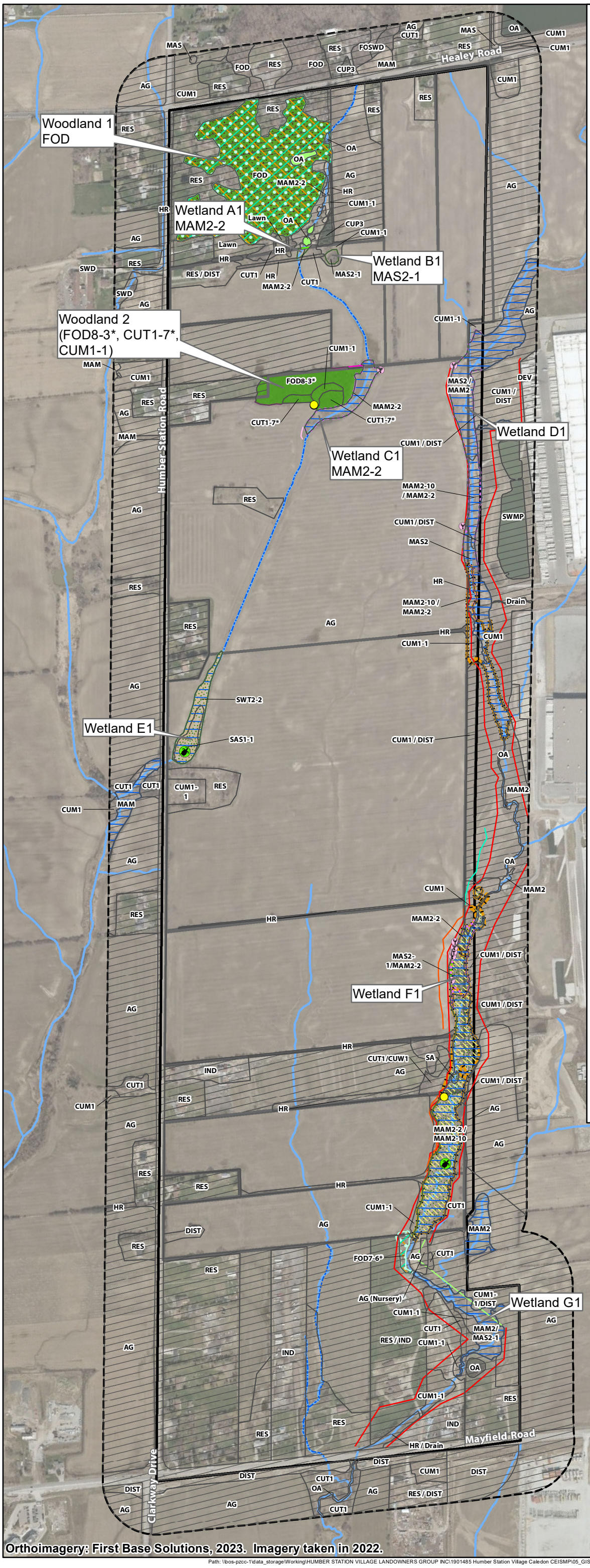

ELC Legend

CUM1	Mineral Cultural Meadow
CUM1-1	Dry Moist Old Field Meadow
CUP	Plantation
CUP3	Coniferous Plantation
CUT	Cultural Thicket
CUT1	Mineral Cultural Thicket
CUT1-1	Sumac Cultural Thicket
CUT1-7*	Buckthorn Cultural Thicket
FOD	Deciduous Forest
FOD7-6*	Fresh-Moist Manitoba Maple Lowland Deciduous Forest
FOD8-3*	Fresh-Moist Basswood Deciduous Forest
MAM	Meadow Marsh
MAM2	Mineral Meadow Marsh
MAM2-2	Reed-canary Grass Mineral Meadow Marsh
MAM2-10	Forb Mineral Meadow Marsh
MAS	Shallow Marsh
MAS2	Mineral Shallow Marsh
MAS2-1	Cattail Mineral Shallow Marsh
OA	Open Aquatic
SAS1-1	Pondweed Submerged Shallow Aquatic
SWD	Deciduous Swamp
SWT2-2	Willow Mineral Thicket Swamp

AG	Agricultural
DIST	Disturbed
H	Hedgerow
IND	Industrial
Lawn	Lawn
Pond	Pond
RES	Residential

**Not included in Southern Ontario ELC Field Guide.*

- Study Area
- 120 m Adjacent Lands
- Participating Properties
- Non-participating Properties
- Ecological Land Classification
- Watercourse/Drainage
- Significant Woodland
- Significant Wetland (GEI Consultants Ltd.)
- Snapping Turtle Observation
- Terrestrial Crayfish Chimney Observation
- Replacement Habitat Structure for Barn Swallow
- Top of Bank Estimate Based on LiDAR (GEI)
- Top of Stable Slope (GEI)
- Unconfined Meanderbelt (GEI)
- Creek Bank (Staked on October 19, 2021 by TRCA and GEI)
- Dripline (Staked on October 19, 2021 by TRCA and GEI)
- Hydrologic Edge of Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Top of Bank (Staked on October 19, 2021 by TRCA and GEI)
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Terrestrial Crayfish Significant Wildlife Habitat
- Monarch Butterfly Significant Wildlife Habitat
- Yellow Banded Bumblebee Significant Wildlife Habitat
- Eastern Wood Peewee Significant Wildlife Habitat
- Snapping Turtle Significant Wildlife Habitat
- Candidate Seeps and Springs Significant Wildlife Habitat
- Candidate Bat Maternity Colonies Significant Wildlife Habitat
- Candidate Habitat for Species at Risk Bats
- Candidate Turtle Over-Wintering Habitat Significant Wildlife Habitat
- Candidate Amphibian Breeding Habitat (Wetland) Significant Wildlife Habitat
- Feature Proposed for Realignment

NOTES:

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Humber Station, Town of Caledon, ON

Figure 4a
Observed Natural Heritage Features - Terrestrial

0 100 Meters

1:8,500

GEI Consultants

Orthoimagery: First Base Solutions, 2023. Imagery taken in 2022.

ELC Legend

CUM1-1	Dry Moist Old Field Meadow
CUP	Coniferous Plantation
CUT	Cultural Thicket
CUT1	Mineral Cultural Thicket
CUT1-1	Sumac Cultural Thicket
CUT1-7*	Buckthorn Cultural Thicket
FOD	Deciduous Forest
FOD7-6*	Fresh-Moist Manitoba Maple Lowland Deciduous Forest
FOD8-3*	Fresh-Moist Basswood Deciduous Forest
MAM	Meadow Marsh
MAM2	Mineral Meadow Marsh
MAM2-2	Reed-canary Grass Mineral Meadow Marsh
MAM2-10	Forb Mineral Meadow Marsh
MAS	Shallow Marsh
MAS2	Mineral Shallow Marsh
MAS2-1	Cattail Mineral Shallow Marsh
OA	Open Aquatic
SAS1-1	Pondweed Submerged Shallow Aquatic
SWT2-2	Willow Mineral Thicket Swamp

AG	Agricultural
DIST	Disturbed
H	Hedgerow
IND	Industrial
Lawn	Lawn
Pond	Pond
RES	Residential

**Not included in Southern Ontario ELC Field Guide.*

- Study Area
- Participating Properties
- Non-participating Properties
- Ecological Land Classification
- Watercourse (MNRF LIO)

HDF Management Recommendations

- Conservation
- Protection
- Mitigation
- No Management Required
- Conservation - Non-participating Ownership
- Protection - Non-participating Ownership
- Mitigation - Non-participating Ownership

NOTES:

1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2025.
3. Orthoimagery © First Base Solutions, 2025. Imagery taken in 2022.

Project 1901485

Humber Station, Town of Caledon, ON

Figure 4B
Observed Natural Heritage Features - Aquatic

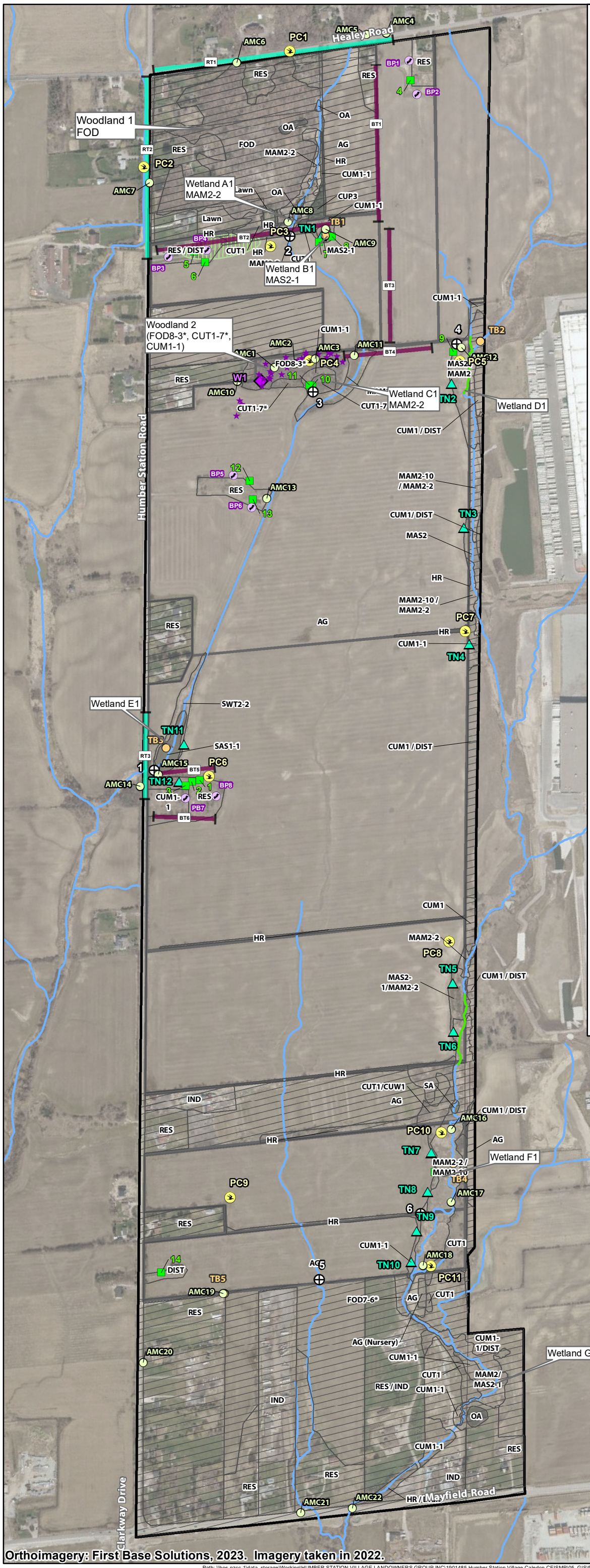
0 100 Meters

1:8,000

GEI Consultants

Orthoimagery: First Base Solutions, 2023. Imagery taken in 2022.

Path: \\bos-pzcc-1\data_storage\Working\HUMBER STATION VILLAGE LANDOWNERS GROUP INC\1901485 Humber Station Village Caledon CEISMP\05_GIS\figures\report_figures\2023-09 CEISMP\1901485_rpt_fig04b_observed_nhf_aquatic.mxd REVISED: Friday, July 11, 2025



ELC Legend

CUM1-1	Dry Moist Old Field Meadow
CUP	Coniferous Plantation
CUT	Cultural Thicket
CUT1	Mineral Cultural Thicket
CUT1-1	Sumac Cultural Thicket
CUT1-7*	Buckthorn Cultural Thicket
FOD	Deciduous Forest
FOD7-6*	Fresh-Moist Manitoba Maple Lowland Deciduous Forest
FOD8-3*	Fresh-Moist Basswood Deciduous Forest
MAM	Meadow Marsh
MAM2	Mineral Meadow Marsh
MAM2-2	Reed-canary Grass Mineral Meadow Marsh
MAM2-10	Forb Mineral Meadow Marsh
MAS	Shallow Marsh
MAS2	Mineral Shallow Marsh
MAS2-1	Cattail Mineral Shallow Marsh
OA	Open Aquatic
SAS1-1	Pondweed Submerged Shallow Aquatic
SWT2-2	Willow Mineral Thicket Swamp
AG	Agricultural
DIST	Disturbed
H	Hedgerow
IND	Industrial
Lawn	Lawn
Pond	Pond
RES	Residential

**Not included in Southern Ontario ELC Field Guide.*

- Study Area
- Participating Properties
- Non-participating Properties
- Ecological Land Classification
- Wildlife Camera Location
- Snake Coverboard Survey
- Turtle Nesting Survey
- Reptile Search Area
- Breeding Bird Point Count Station Location
- Bat Point Count Station
- Cavity Tree
- Amphibian Call Count Station
- Turtle Basking Survey
- SM3 Acoustic Monitoring Station
- Bat Transect Location
- Road Transect Location
- Aquatic Habitat Assessment (AHA)
- Watercourse/Drainage

NOTES:

1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2025.
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Project 1901485

Humber Station, Town of Caledon, ON

Figure 5
Survey Stations and Transects

0 100 Meters

1:8,000

N

GEI Consultants

Orthoimagery: First Base Solutions, 2023. Imagery taken in 2022.

ELC Legend

CUM1-1	Dry Moist Old Field Meadow
CUP	Coniferous Plantation
CUT	Cultural Thicket
CUT1	Mineral Cultural Thicket
CUT1-1	Sumac Cultural Thicket
CUT1-7*	Buckthorn Cultural Thicket
FOD	Deciduous Forest
FOD7-6*	Fresh-Moist Manitoba Maple Lowland Deciduous Forest
FOD8-3*	Fresh-Moist Basswood Deciduous Forest
MAM	Meadow Marsh
MAM2	Mineral Meadow Marsh
MAM2-2	Reed-canary Grass Mineral Meadow Marsh
MAM2-10	Forb Mineral Meadow Marsh
MAS	Shallow Marsh
MAS2	Mineral Shallow Marsh
MAS2-1	Cattail Mineral Shallow Marsh
OA	Open Aquatic
SAS1-1	Pondweed Submerged Shallow Aquatic
SWT2-2	Willow Mineral Thicket Swamp

AG	Agricultural
DIST	Disturbed
H	Hedgerow
IND	Industrial
Lawn	Lawn
Pond	Pond
RES	Residential

**Not included in Southern Ontario ELC Field Guide.*

- Study Area
- Participating Properties
- Non-participating Properties
- Significant Wetland (GEI Consultants Ltd.)
- Drainage (Suitable for Realignment)
- Drainage (Suitable for Realignment Non-participating Owner)
- Conceptual Drainage Realignment
- Long Term Stable Top of Slope (PNJ)
- Creek Bank (Staked on October 19, 2021 by TRCA and GEI)
- Dripline (Staked on October 19, 2021 by TRCA and GEI)
- Hydrologic Edge of Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Long Term Stable Top of Slope (PNJ) + 10 m
- Significant Wetland + 30 m
- Top of Bank Estimate Based on LiDAR + 10 m
- Wetland + 10 m
- Floodplain (Schaeffers 2023) + 10 m
- Top of Bank + 10 m (Staked on October 19, 2021 by TRCA and GEI)
- Significant Woodland + 10 m
- Warm Water Fish Habitat + 15 m
- Preliminary Natural Heritage System Limit
- Preliminary Natural Heritage System Limit (Potential for Realignment)
- Proposed MAS2-1 Wetland Removal (0.077 ha)
- Proposed MAS2-1 Wetland Compensation (0.077 ha)
- Proposed MAM2-2 Wetland Removal (0.098 ha)
- Proposed MAM2-2 Wetland Compensation (0.098 ha)
- Conceptual Wetland Compensation (0.35 ha)
- Approximate Highway 413 Alignment

Staked Features East Of Subject Lands (A.M. Candaras)

- Top of Bank Line

Humber Station, Town of Caledon, ON

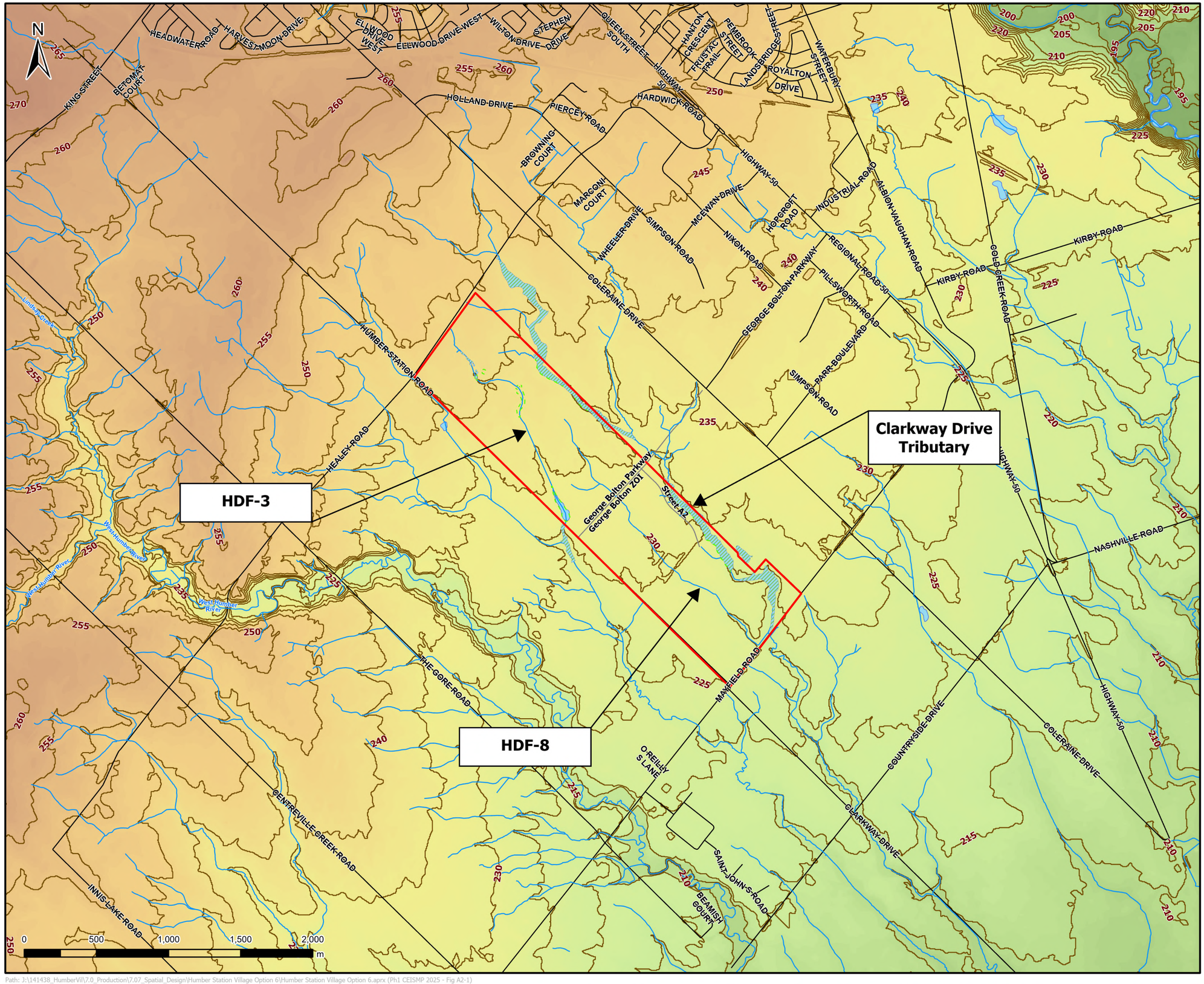
Figure 6
Opportunities and Constraints

0 100 Meters

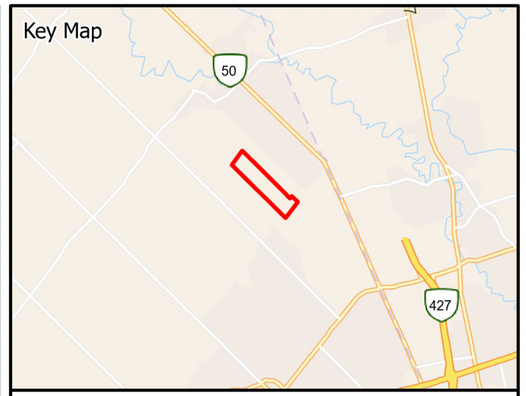
GEI Consultants

Orthoimagery: First Base Solutions, 2023. Imagery taken in 2021.

A.2. Figures – Arcadis



Key Map



Legend

- Study Area
- Wetland
- Waterbody
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Watercourse/Drainage
- Elevation Contours (m)
- Roads
- Proposed Street

Ground Surface Elevation (masl)

280
265
260
256
252
247
243
238
234
229
225
220
216
211
207
203
198
194
189
185

Figure A2-1

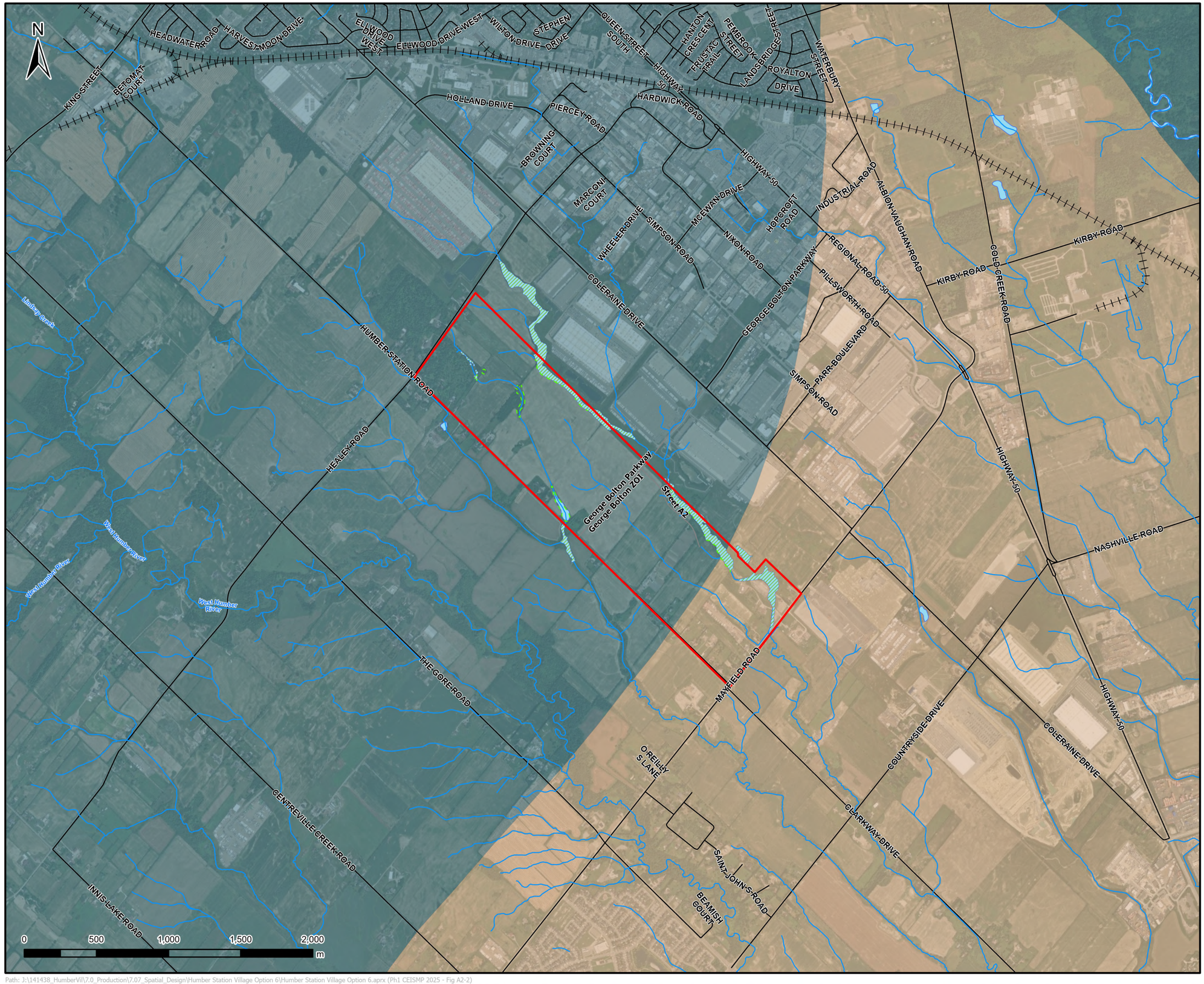
Regional Topography

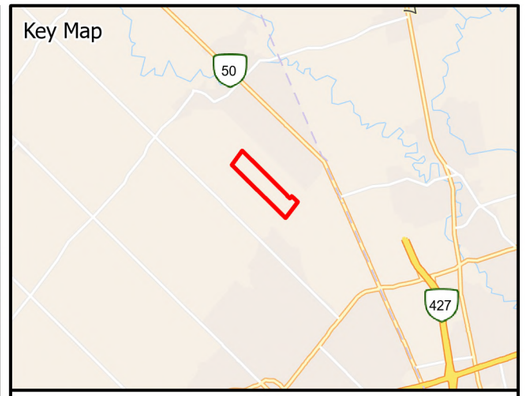
CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

ARCADIS

Project #: 30258580

Date: July 2025





Legend

- Study Area
- Wetland
- Watercourse/Drainage
- Waterbody
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Railway
- Roads
- Proposed Street

Physiographic Region

- Peel Plain
- South Slope

Figure A2-2

Regional Physiography

CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

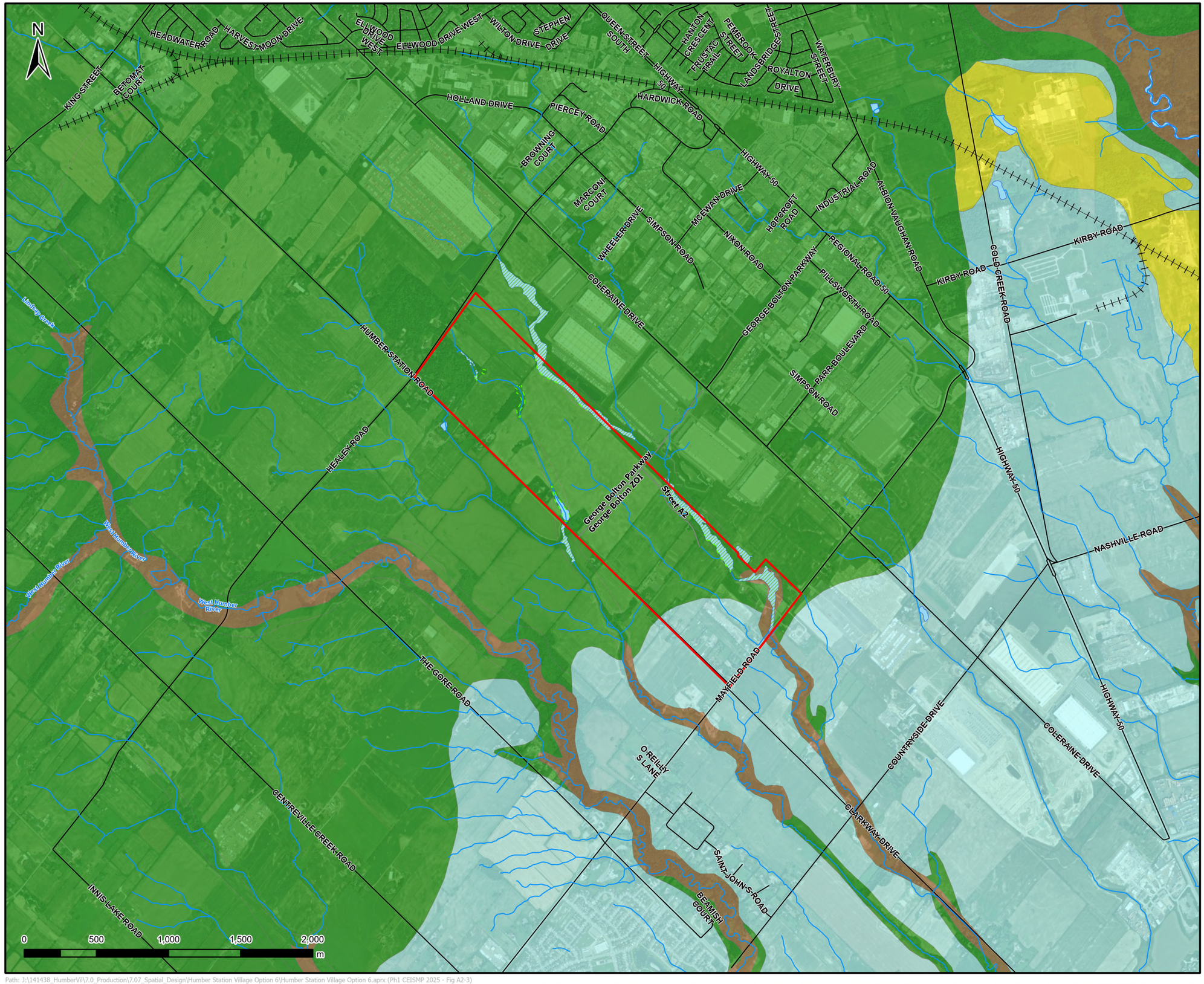
ARCADIS

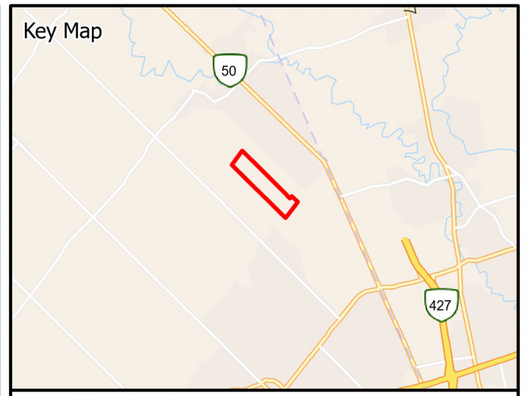
Project #: 30258580

Date: July 2025

Path: J:\141438_HumberVil\7.0_Production\7.07_Spatial_Design\Humber Station Village Option 6\Humber Station Village Option 6.aprx (Ph1 CEISMP 2025 - Fig A2-2)

Last updated on 6/25/2025 by TRINHB6397





Legend

- Study Area
- Wetland
- Watercourse/Drainage
- Waterbody
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Railway
- Roads
- Proposed Street

Quaternary Geology

- 5d Halton Till
- 8b Fine-textured glaciolacustrine deposits
- 9c Coarse-textured glaciolacutrine deposits
- 19 Modern alluvial deposits

Figure A2-3

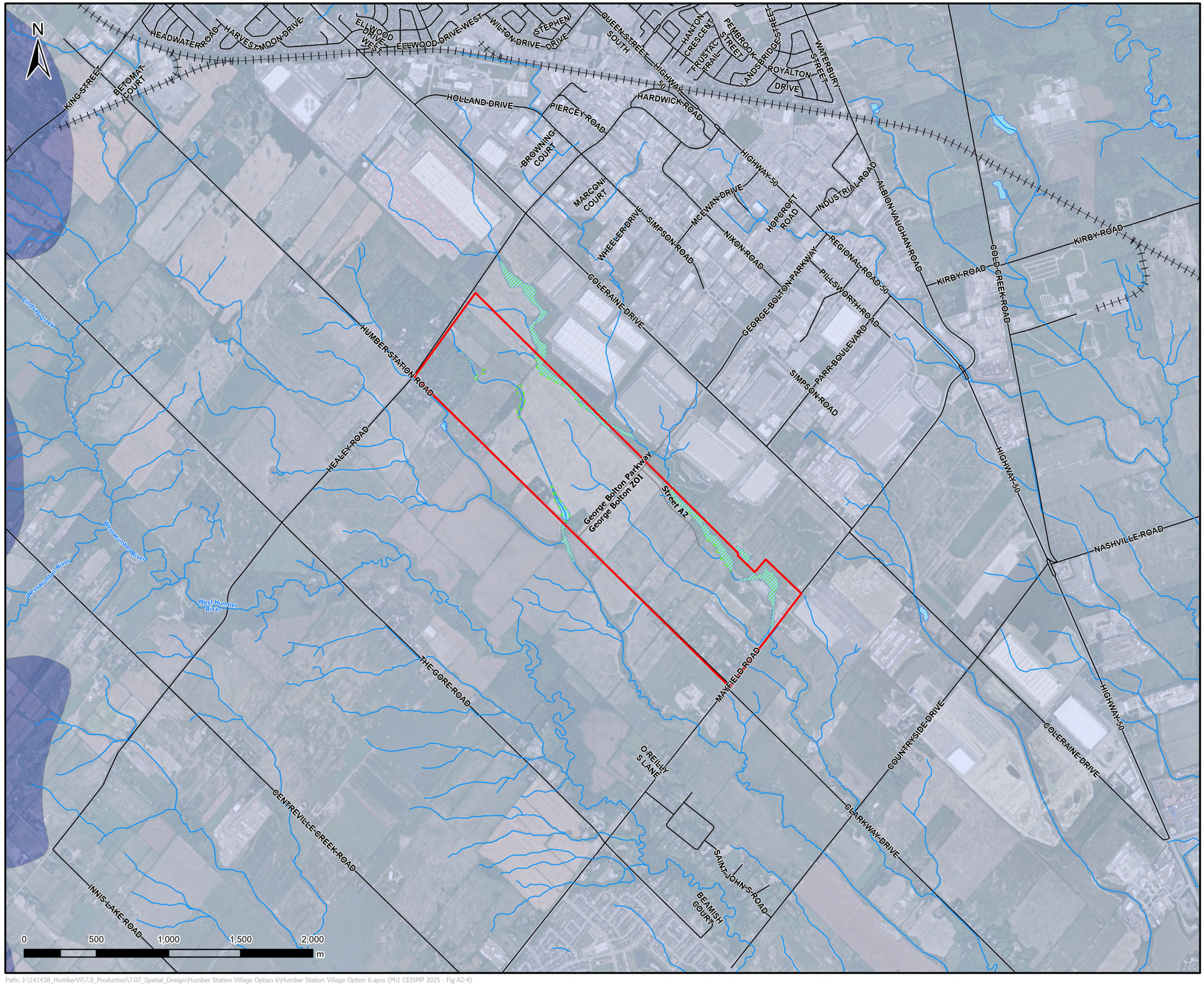
Quaternary Geology

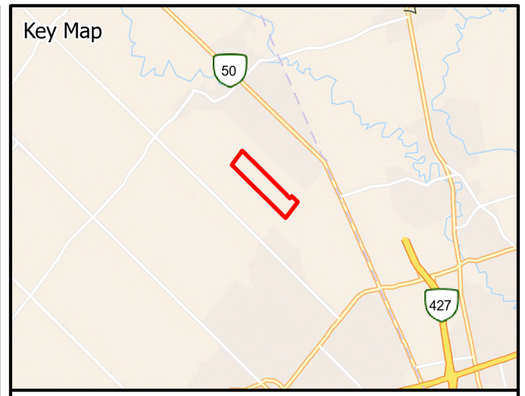
CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

ARCADIS

Project #: 30258580

Date: July 2025





Legend

- Study Area
- Wetland
- Watercourse/Drainage
- Waterbody
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Railway
- Roads
- Proposed Street

Bedrock Formation

- Georgian Bay Formation
- Queenston Formation

Figure A2-4

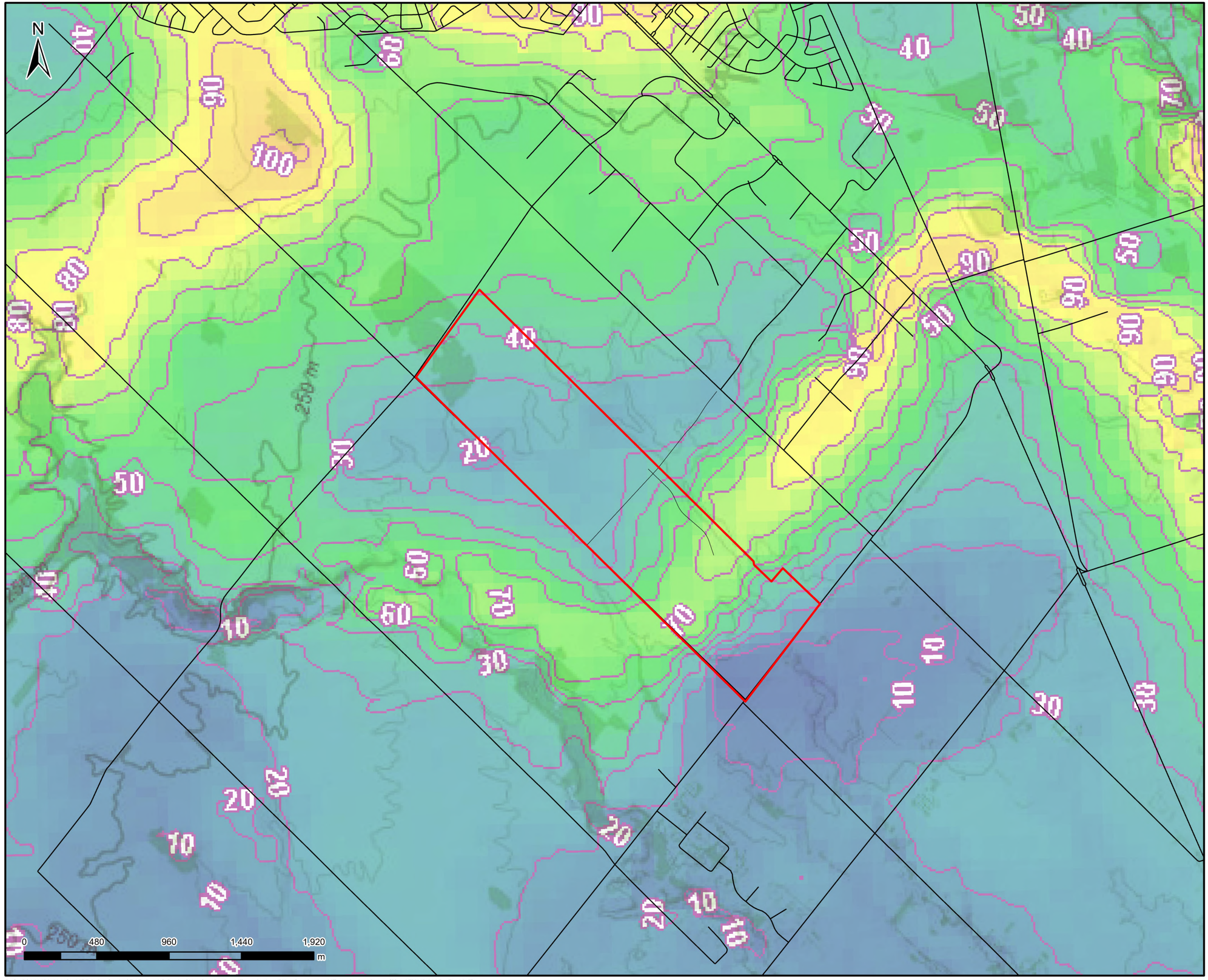
Bedrock Geology

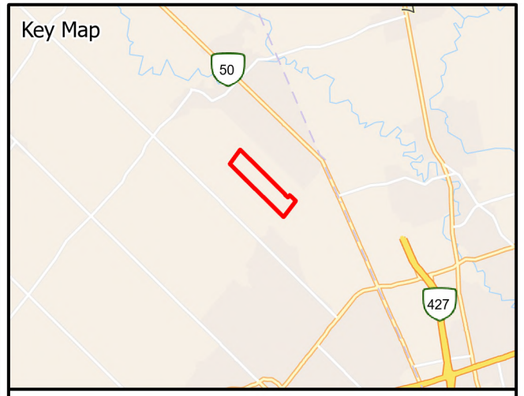
CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

ARCADIS

Project #: 30258580

Date: July 2025





Legend

- Study Area
- Roads
- Proposed Street
- Depth to Bedrock (m)

Note: Depth to bedrock mapping was generated by the Oak Ridges Moraine Groundwater Program mapping system.

Figure A2-5

Interpolated Overburden Thickness

CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

ARCADIS

Project #: 30258580

Date: June 2025

N

MW1-17
BH23-11A
BH23-11B
MW25-SWM1
MW25-SWM2
BH1
MW2-17D
MW2-17S
MW103(20')
MW3-17
MW124(20')
MW108(20')
BH12b
BH12
BH9
BH25-CR1
MW25-CR1
MW25-CR2
BH25-CR2
BH13
MW25-02
MW9(BH1)
BH15
MW168(20')
MW25-3B
MW4-17D
MW25-3A
MW4-17S
BH25-02
BH25-03
MW5-17D
MW5-17S
BH25-01
BH25-04
MW160(20')
MW25-1B
MW25-1A
BH18
MW161(20')
BH23-7A
BH23-7B
MW8(BH2)
MW25-SWM3
BH23-2A
BH23-2B
MW7(BH3)
BH23-1B
BH23-1A

HEALEY ROAD
HUMBER STATION ROAD
George Bolton Parkway
COLERAINE DRIVE
SIMPSON ROAD
NIXON ROAD
GEORGE BOLTON PARKWAY
SIMONA DRIVE
PILLSWORTH ROAD
PARR BOULEVARD
Street A2
MAYFIELD ROAD
THE GORE ROAD
West Humber River

0 220 440 660 880 m

Key Map

50
427

Legend

- Study Area
- Waterbody
- Wetland
- Watercourse/Drainage
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Roads
- Proposed Street
- Arcadis Monitoring Well (formerly Arcadis IBI)
- DS Consultant Monitoring Well
- PNJ Borehole
- PNJ Monitoring Well
- Pinchin (Palmer) Monitoring Well
- RJB Monitoring Well

Figure A2-6

Monitoring Well Locations

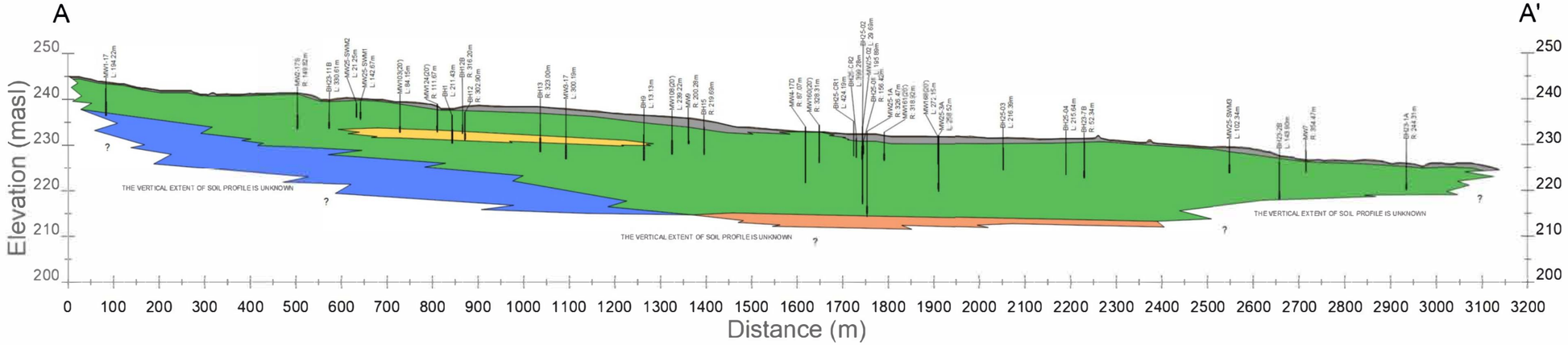
CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

ARCADIS

Project #: 30258580

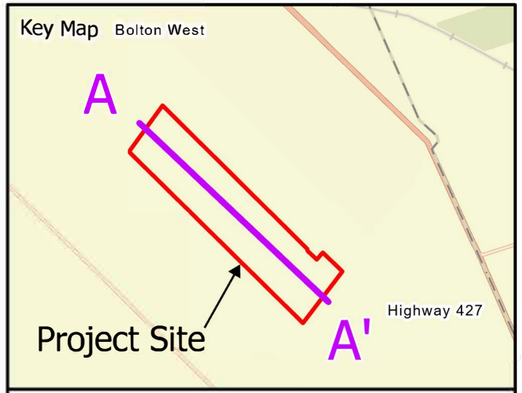
Date: July 2025

A



A'

Key Map Bolton West



Legend

- TOPSOIL
- FILL
- CLAY SILT TILL TO SANDY SILT TILL
- SILT, CLAY SILT, SANDY SILT
- SAND, SANDY SILT, SILTY SAND
- GRAVELLY SAND

MW2-17S - MONITORING WELL / BOREHOLE ID
R: 149.82m - OFFSET SIDE: OFFSET DISTANCE

Figure A2-7

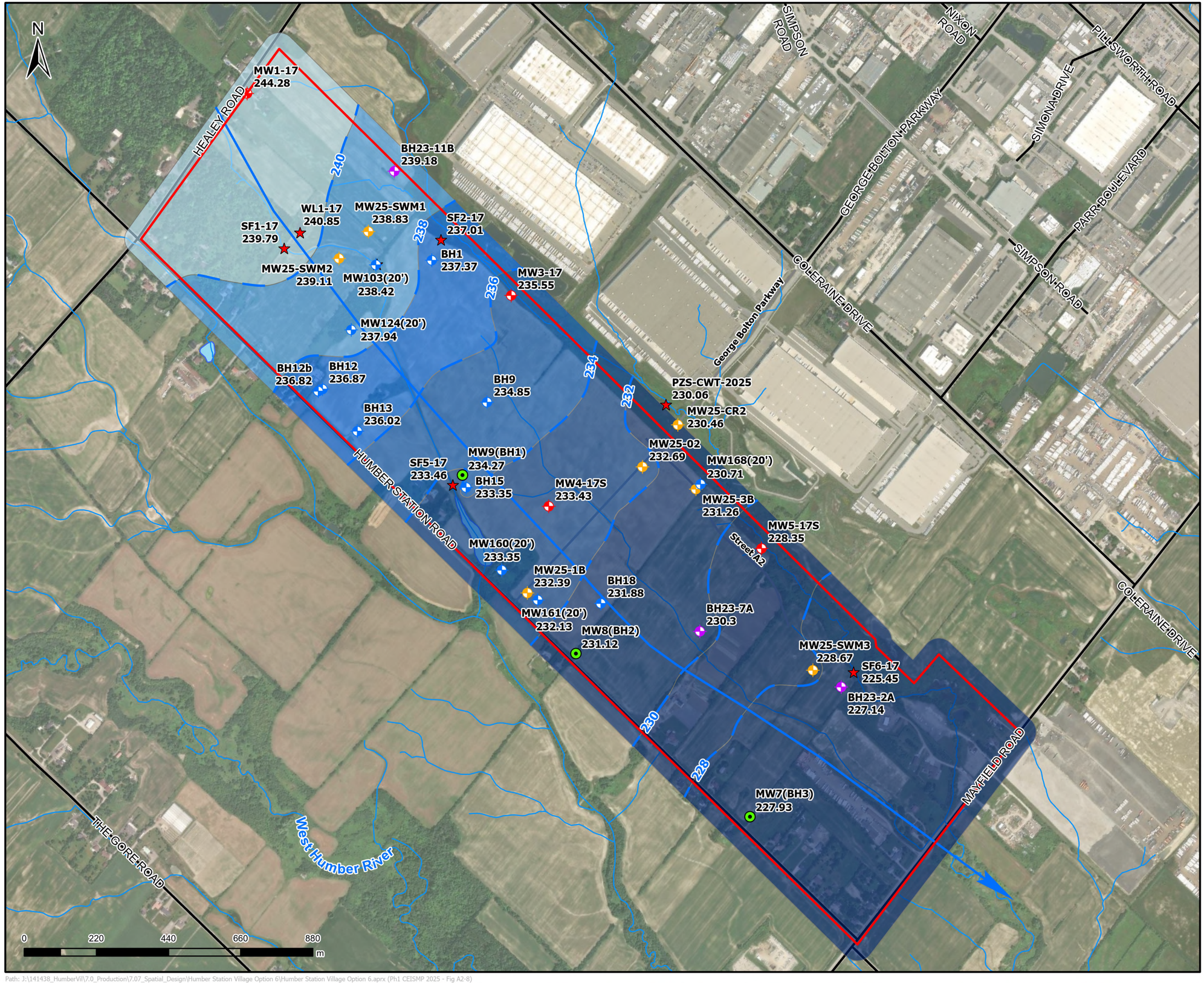
Local Cross-Section

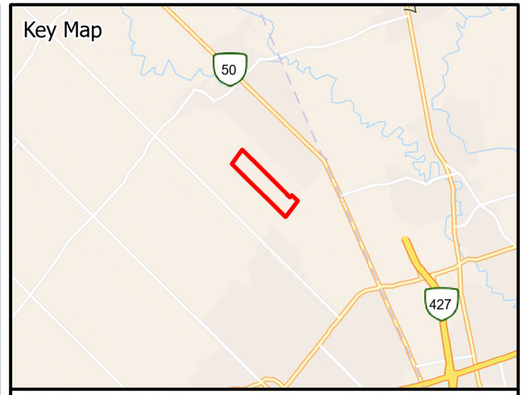
CEISMP - Phase 1
Bolton, Ontario

ARCADIS

Project #: 141438

Date: June 2025





Legend

- Study Area
- Waterbody
- Watercourse/Drainage
- Interpreted Groundwater Flow Direction
- Roads
- Proposed Street
- Arcadis IBI Monitoring Well
- Arcadis Shallow Piezometer
- DS Consultant Monitoring Well
- PNJ Monitoring Well
- Pinchin Monitoring Well
- RJB Monitoring Well
- Interpreted Groundwater Contour Line

Groundwater Level (masl)

- 242
- 240
- 238
- 236
- 234
- 232
- 230
- 228

Note: Monitoring wells MW2-17S and MW108(20') were excluded due to anomalous data. Monitoring well MW25-CR1 has been excluded as it is located north of the Clarkway Tributary.

Figure A2-8

Shallow Groundwater Flow Direction Based on Spring 2024-2025 Readings

CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

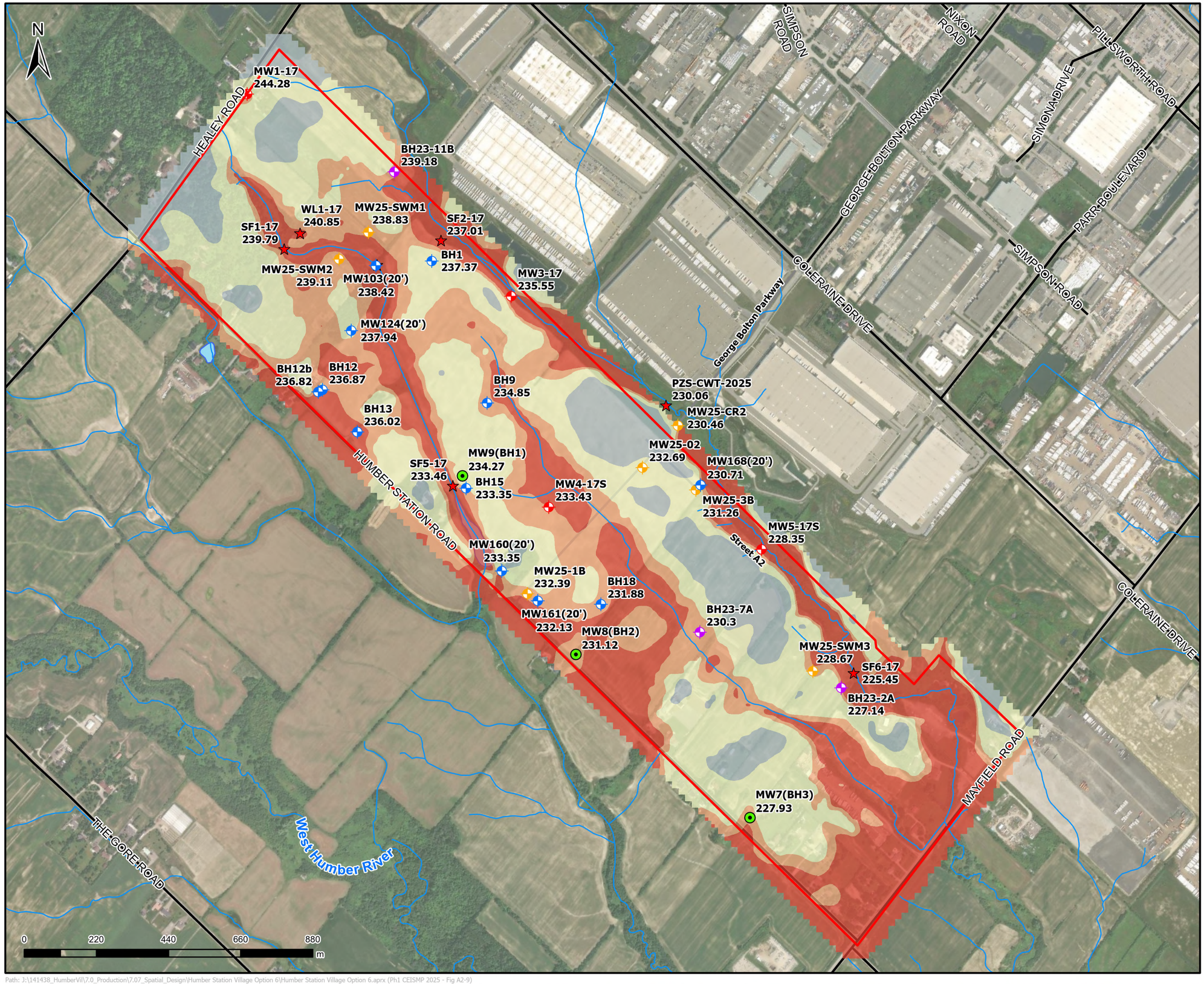
ARCADIS

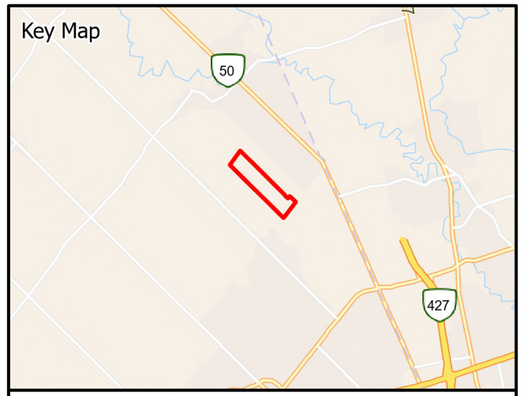
Project #: 30258580

Date: June 2025

Path: J:\141438_HumberVil\7.0_Production\7.07_Spatial_Design\Humber Station Village Option 6\Humber Station Village Option 6.aprx (Ph1 CEISMP 2025 - Fig A2-8)

Last updated on 6/20/2025 by TRINHB6397





Legend

- Study Area
- Watercourse/Drainage
- Waterbody
- Roads
- Proposed Street
- Arcadis IBI Monitoring Well
- Arcadis Shallow Piezometer
- DS Consultant Monitoring Well
- PNJ Monitoring Well
- Pinchin Monitoring Well
- RJB Monitoring Well

Depth to Groundwater (m)

- 0 - 0.5m
- 0.5 - 1m
- 1 - 2m
- 2 - 4m
- > 4m

Note: Monitoring wells MW2-17S and MW108(20') were excluded due to anomalous data. Monitoring well MW25-CR1 has been excluded as it is located north of the Clarkway Tributary.

Figure A2-9

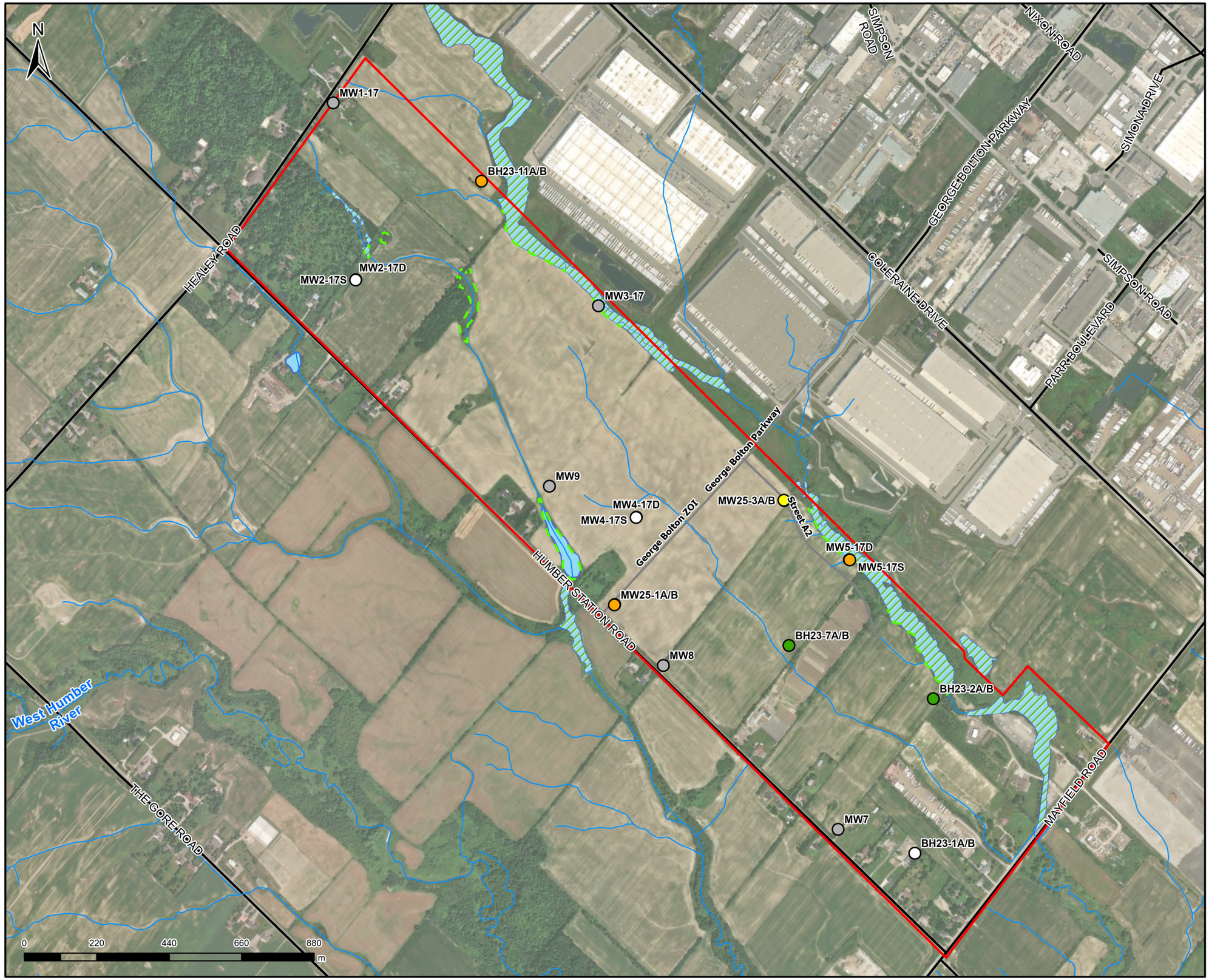
Interpreted Depth to Groundwater
(Feb 2024 - June 2025)

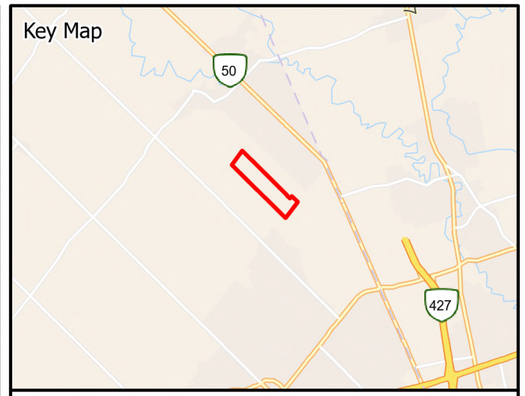
CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

ARCADIS

Project #: 30258580

Date: June 2025





Legend

- Study Area
- Wetland
- Waterbody
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Watercourse/Drainage
- Roads
- Proposed Street

Vertical Hydraulic Gradient

- Not Determined
- Neutral Gradient
- Upward Gradient
- Variable Gradient
- Downward Gradient

Figure A2-10

Monitoring Well Hydraulic Gradients
(Summer 2017 to Spring 2018 &
Winter 2022 / Summer 2023 / Summer 2024
/ Spring 2025)

CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

ARCADIS

Project #: 30258580

Date: July 2025

N

SF8-22
WL1-17
SF1-17
WL2-17
SF2-17
SF4-17
PZ-CWT-2025
SF5-17
SF3-17
HDF-8-c
SF9-22
SF6-17
HDF-8-b
SF7-17
SF10-22
SF11-22

HEALEY ROAD
NIXON ROAD
PILLSWORTH ROAD
GEORGE BOLTON PARKWAY
SIMONA DRIVE
PARR BOULEVARD
COLERAINE DRIVE
SIMPSON ROAD
George Bolton Parkway
George Bolton ZOI
Street A2
HUMBER STATION ROAD
MAYFIELD ROAD
THE GORE ROAD
West Humber River

0 220 440 660 880 m

Key Map

50
427

Legend

- Study Area
- Wetland
- Waterbody
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Watercourse/Drainage
- Roads
- Proposed Street
- Mini-Piezometer / Streamflow Station
- Water Level Station

Figure A2-11
Surface Water / Mini-Piezometer Station Monitoring Locations

CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

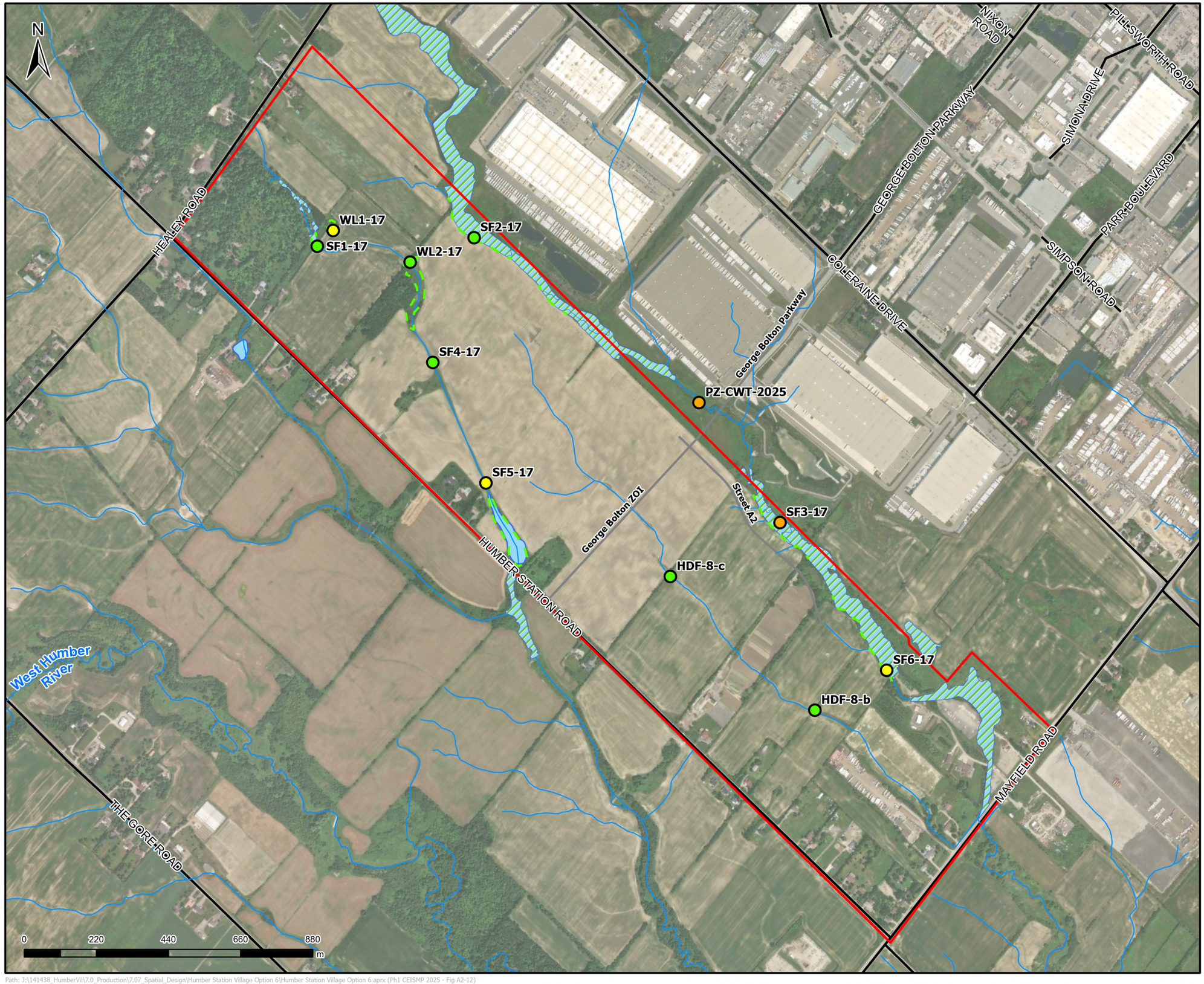
ARCADIS

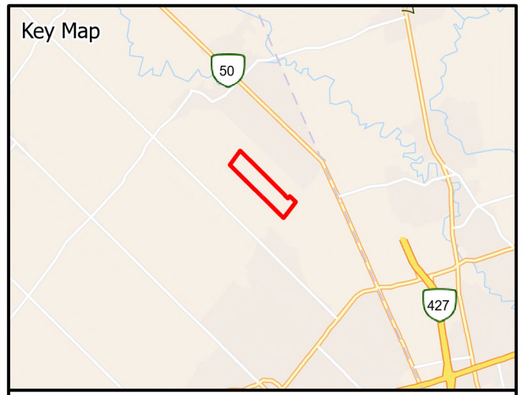
Project #: 30258580

Date: July 2025

Path: J:\141438_HumberVil\7.0_Production\7.07_Spatial_Design\Humber Station Village Option 6\Humber Station Village Option 6.aprx (Ph1 CEISMP 2025 - Fig A2-11)

Last updated on 7/2/2025 by TRINHB6397





Legend

- Study Area
- Wetland
- Waterbody
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Watercourse/Drainage
- Roads
- Proposed Street

Vertical Hydraulic Gradient

- Downward Gradient
- Upward Gradient
- Variable Gradient

Figure A2-12

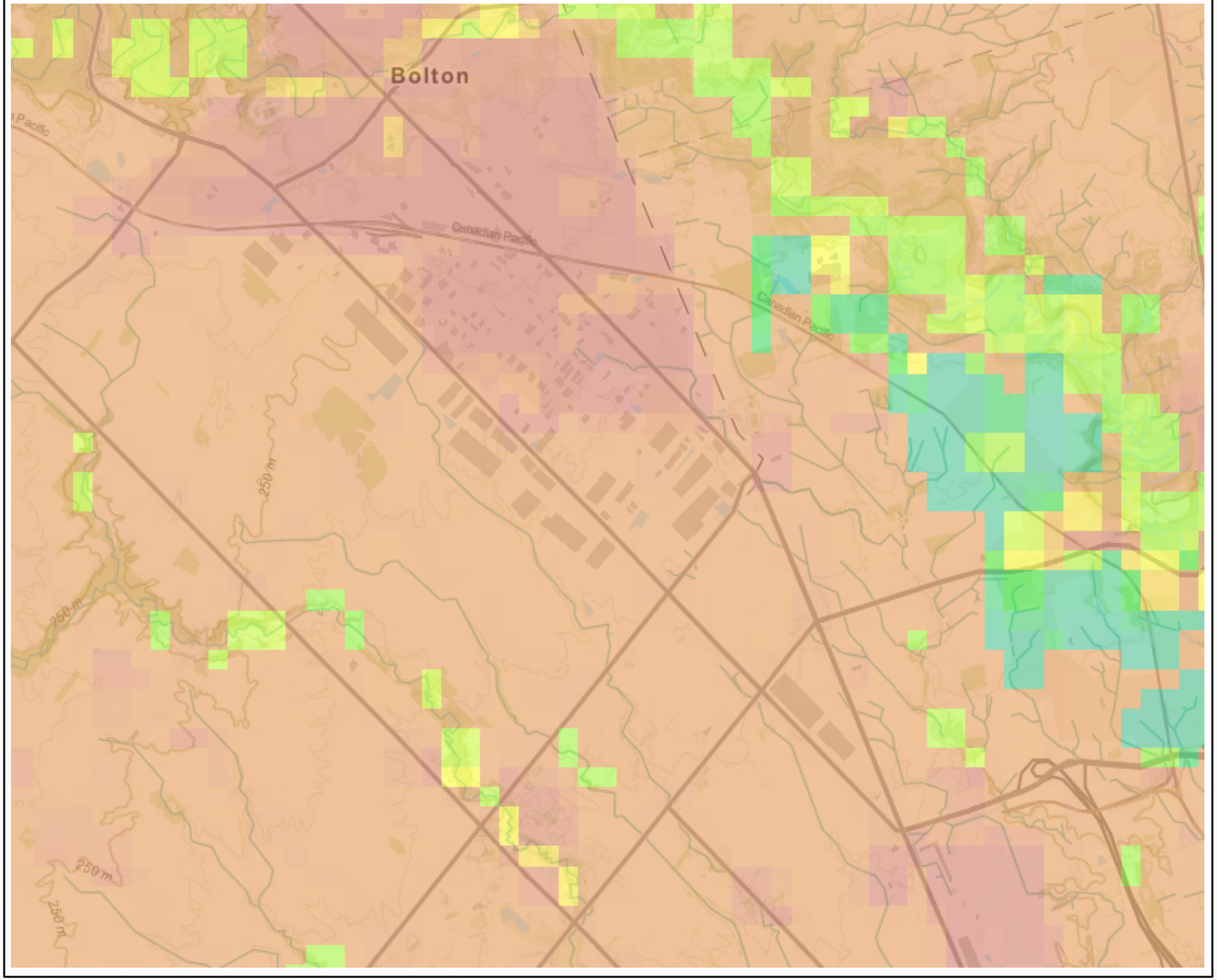
Piezometers Vertical Hydraulic Gradients (Summer 2017 to Spring 2018 & Winter 2022 / Summer 2023 / Summer 2024 / Spring 2025)

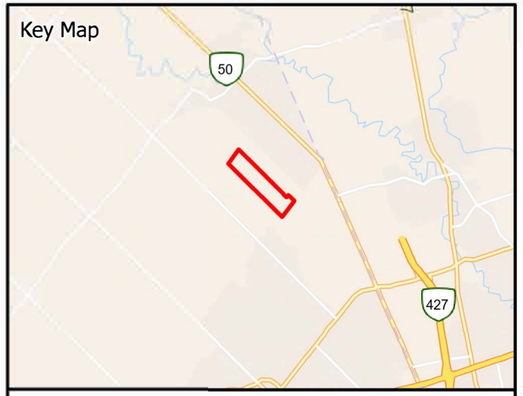
CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

ARCADIS

Project #: 30258580

Date: July 2025





Legend

Water Budget

Runoff - 127 mm/year
Recharge - 115 mm/year
Evapotranspiration - 548 mm/year

Precipitation - 796 mm/year

Note: Mapping was generated by the Oak Ridges Moraine Groundwater Program Water Budget Mapping system.

Figure A2-13

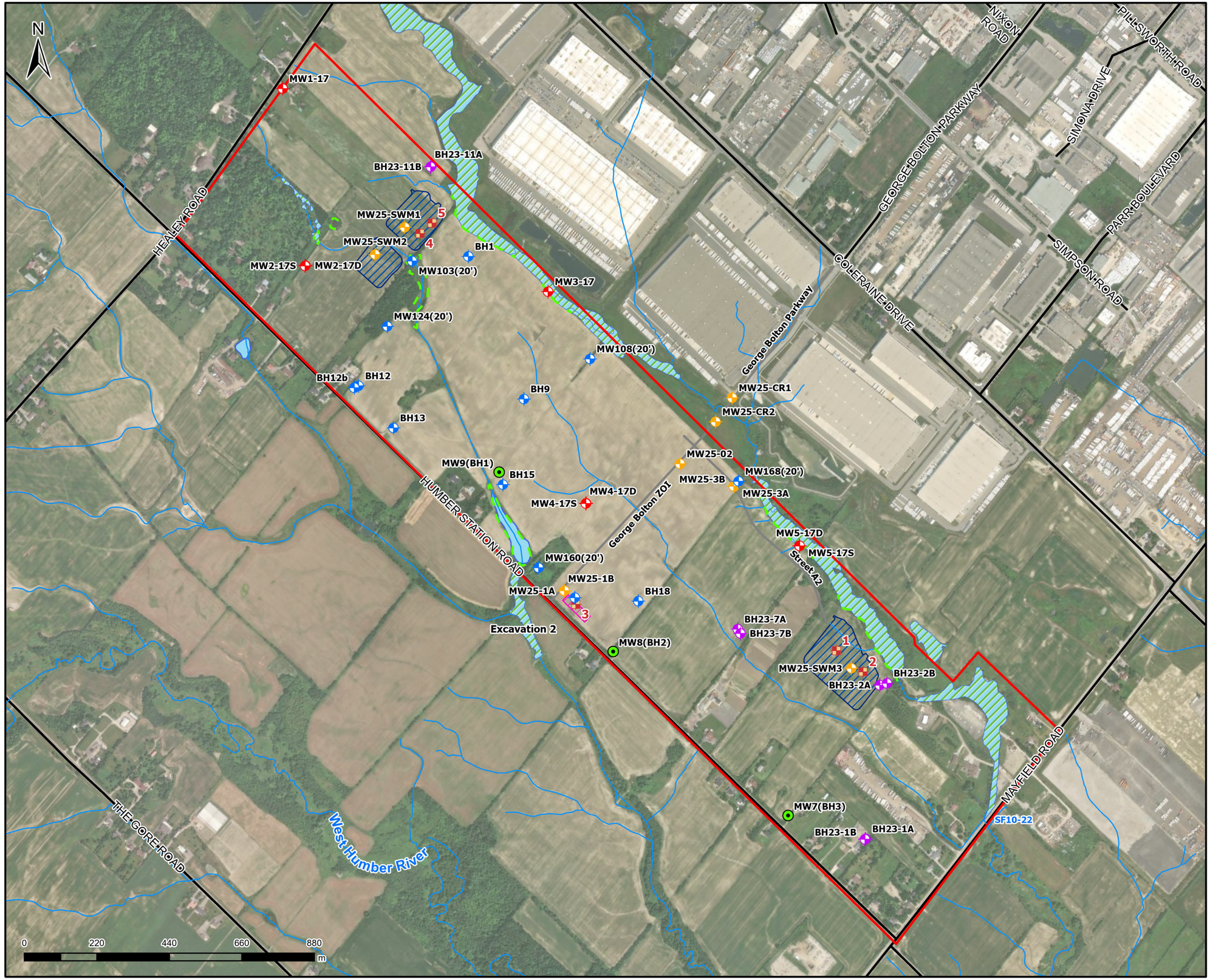
Water Balance - Infiltration (ORMGP)

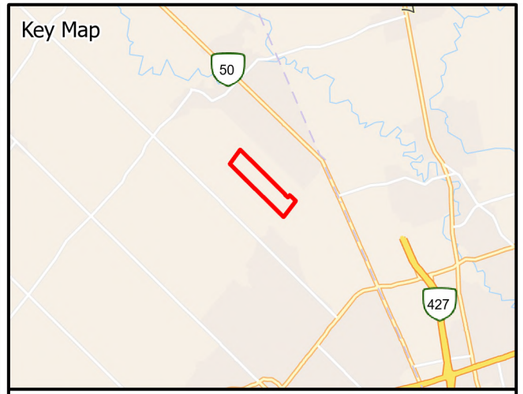
CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

ARCADIS

Project #: 30258580

Date: June 2025





Legend

- Study Area
- Wetland
- Waterbody
- Proposed SWM Facility
- Proposed SWM Tank
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Watercourse/Drainage
- Roads
- Proposed Street
- Test Pit

Monitoring Well

- Arcadis IBI Monitoring Well
- DS Consultant Monitoring Well
- PNJ Monitoring Well
- Pinchin Monitoring Well
- RJB Monitoring Well

Figure A2-14

Infiltration Test Pit Location Map

CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

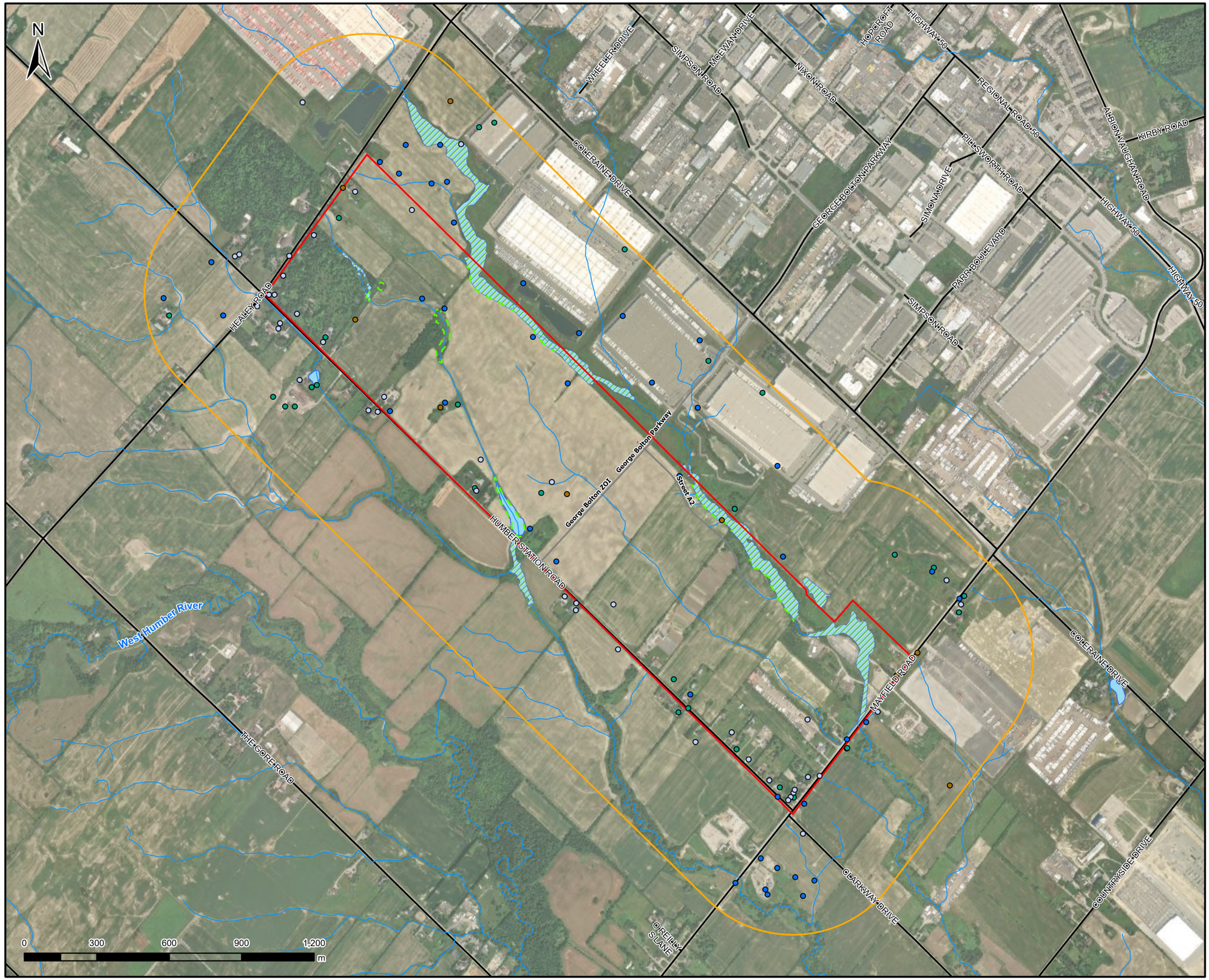
ARCADIS

Project #: 30258580

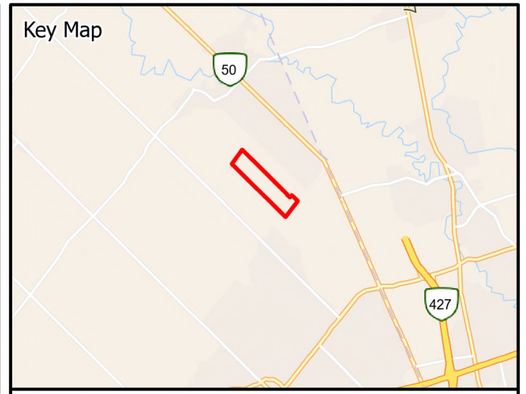
Date: July 2025

Path: J:\141438_HumberVil\7.0_Production\7.07_Spatial_Design\Humber Station Village Option 6\Humber Station Village Option 6.aprx (Ph1 CEISMP 2025 - Fig A2-14)

Last updated on 7/2/2025 by TRINHB6397



Key Map



Legend

- Study Area
- 500m Buffer
- Wetland
- Waterbody
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Watercourse/Drainage
- Roads
- Proposed Street

Well Final Status

- Abandoned Well
- Observation, Monitoring and Test Wells / Holes
- Other or Unknown Status
- Water Supply

Figure A2-15

MECP Well Records

CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

ARCADIS

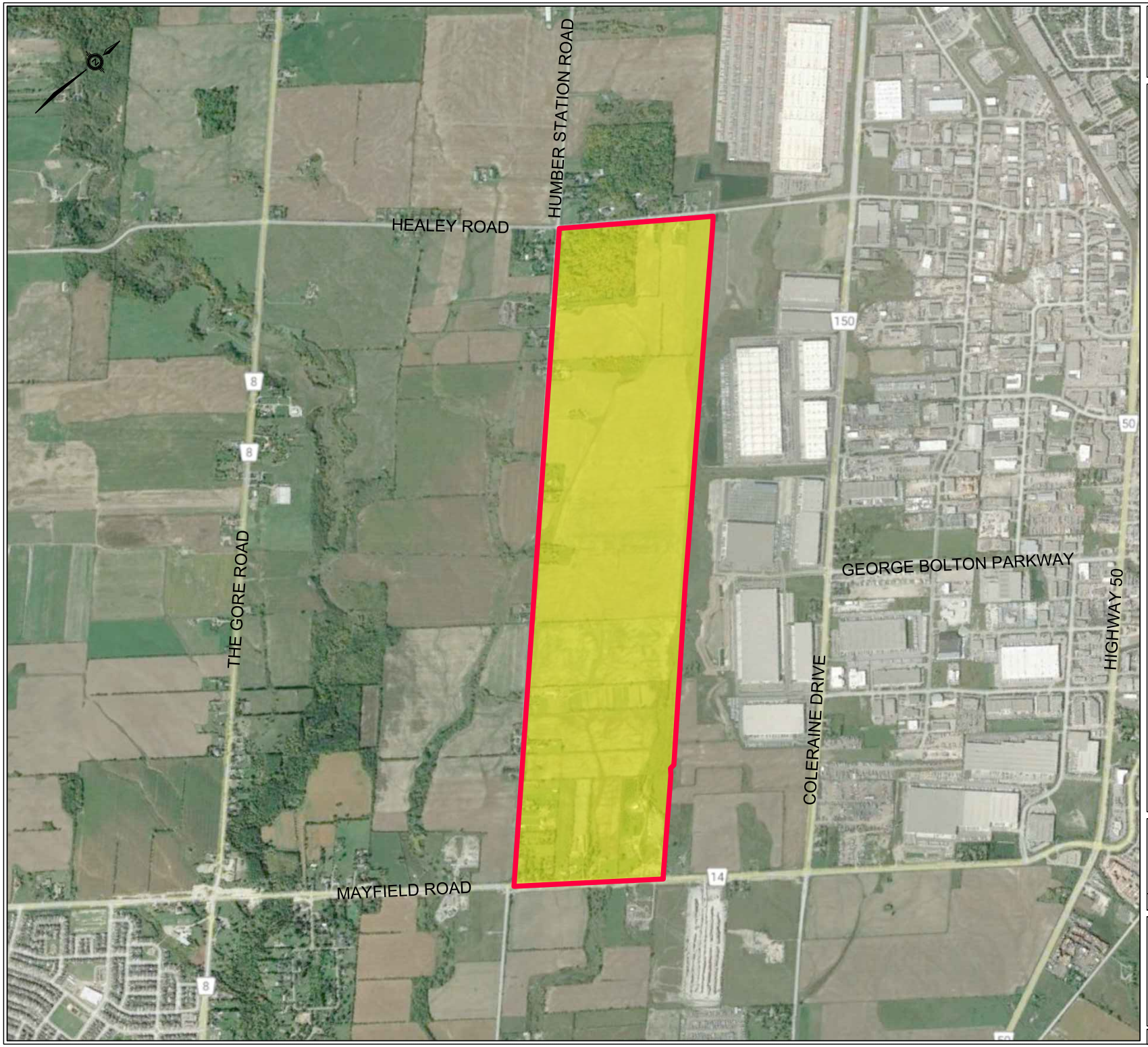
Project #: 30258580

Date: July 2025

Path: J:\141438_HumberVil\7.0_Production\7.07_Spatial_Design\Humber Station Village Option 6\Humber Station Village Option 6.aprx (Ph1 CEISMP 2025 - Fig A2-15)

Last updated on 7/2/2025 by TRINHB6397

A.3. Figures – Schaeffers



HUMBER STATION VILLAGES
TOWN OF CALEDON

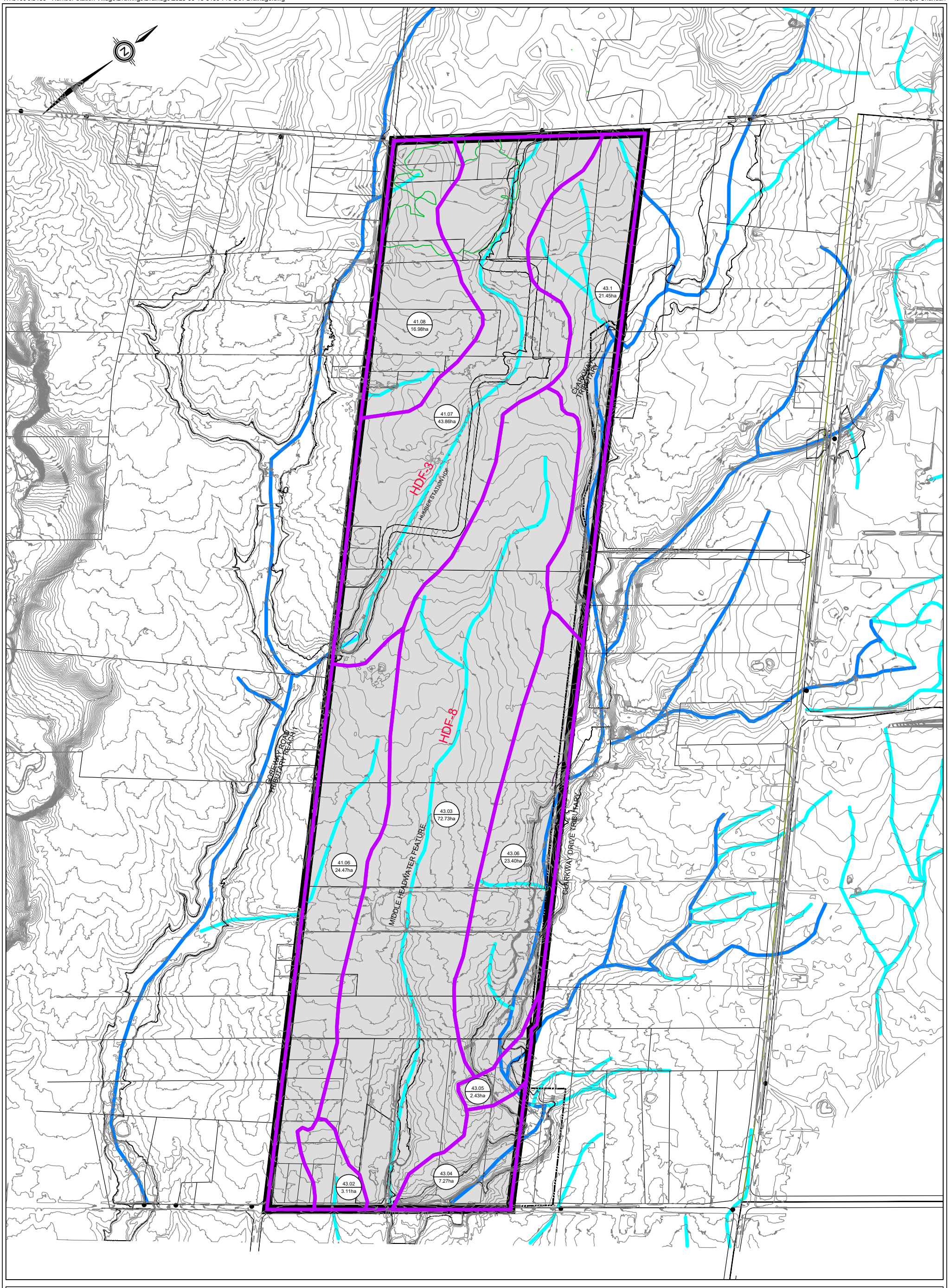
LEGEND

SUBJECT LOCATION

SCHAEFFERS
CONSULTING ENGINEERS
6 Ronrose Drive, Concord, Ontario L4K 4R3
Tel: (905) 738-6100 Email: general@schaeffers.com
www.schaeffers.com

FIGURE 1
LOCATION PLAN

2021-5139	JUNE 2025	SCALE: N.T.S.



HUMBER STATION VILLAGES
TOWN OF CALEDON

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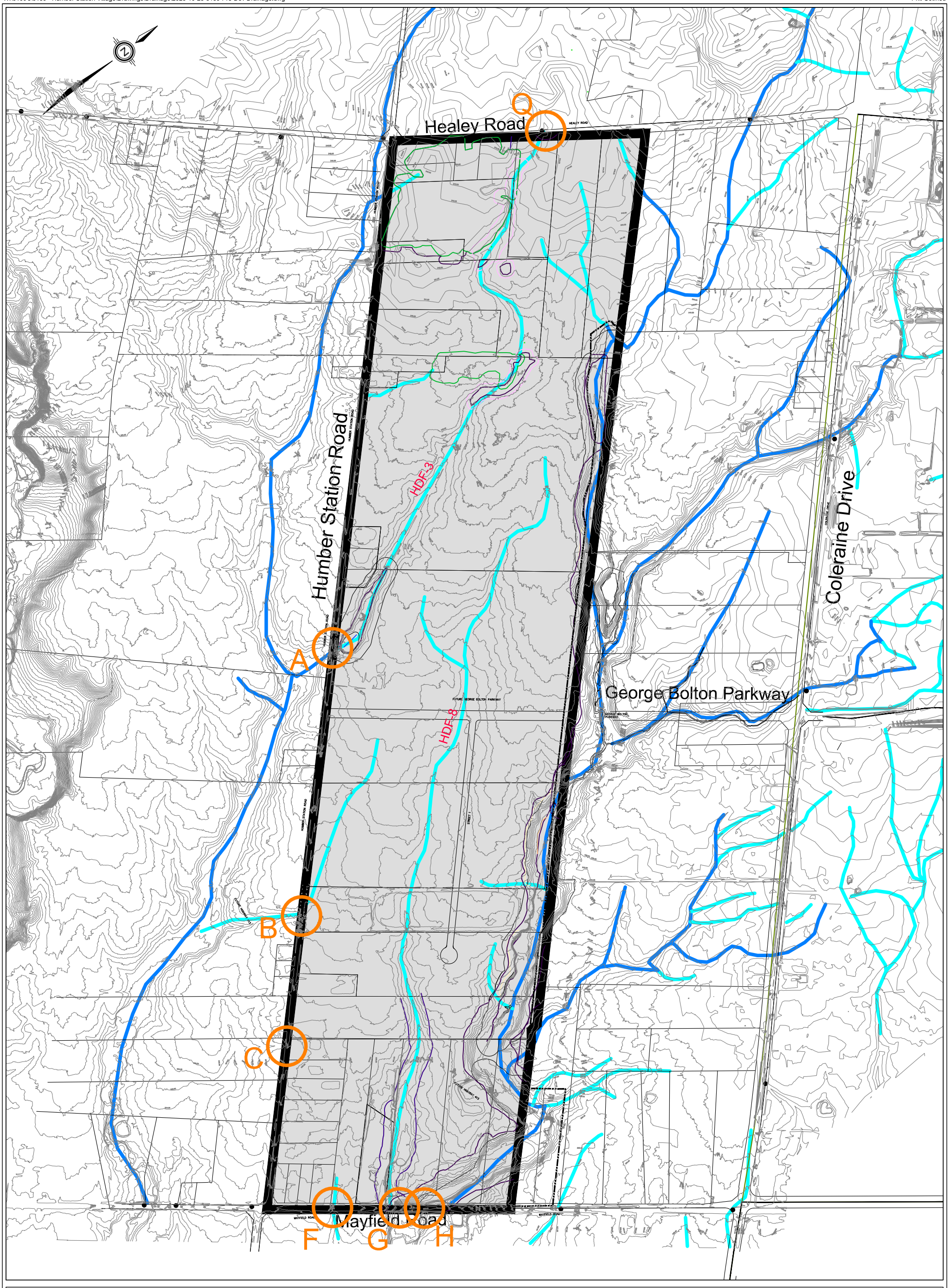
6 Ronrose Drive, Concord, Ontario L4K 4R3
Tel: (905) 738-6100 Email: general@schaeffers.com
www.schaeffers.com

LEGEND

- SUBJECT LOCATION
- PRE DEVELOPMENT DRAINAGE BOUNDARY
- 43.02 / 3.11ha — TRCA CATCHMENT ID / TRCA AREA IN HECTARES
- WATERCOURSE
- HDF

FIGURE 2
PRE-DEVELOPMENT
DRAINAGE PLAN

2021-5139	JUNE 2025	SCALE: N.T.S.



HUMBER STATION VILLAGES
TOWN OF CALEDON

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www.schaeffers.com

LEGEND

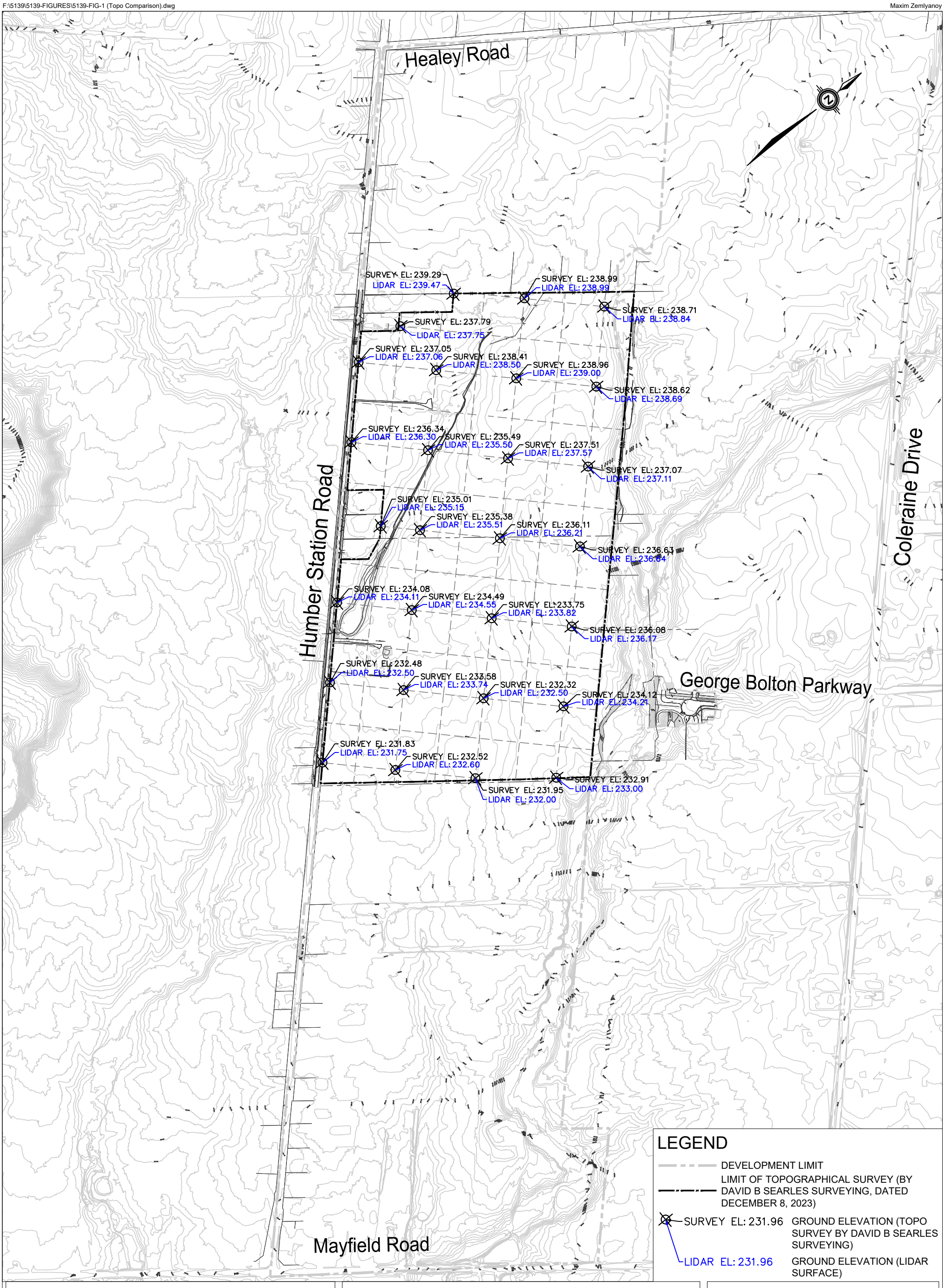
- SUBJECT LOCATION
- EXISTING CULVERT LOCATION
- WATERCOURSE
- HDF

FIGURE 3
EXISTING
CULVERT LOCATION

2021-5139	JUNE 2025	SCALE: N.T.S.

F:\5139\5139-FIGURES\5139-FIG-1 (Topo Comparison).dwg

Maxim Zemlyanoy



LEGEND

- DEVELOPMENT LIMIT
- LIMIT OF TOPOGRAPHICAL SURVEY (BY DAVID B SEARLES SURVEYING, DATED DECEMBER 8, 2023)
- SURVEY EL: 231.96 — GROUND ELEVATION (TOPO SURVEY BY DAVID B SEARLES SURVEYING)
- LIDAR EL: 231.96 — GROUND ELEVATION (LIDAR SURFACE)

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CONSULTING ENGINEERS
6 Ronrose Drive, Concord, Ontario L4K 4R3
Tel: (905) 738-6100 Email: general@schaeffers.com
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HUMBER STATION VILLAGES

FIGURE 1
TOPOGRAPHIC SURVEY REVIEW
-
SURVEY DATA VS LIDAR

2022-5139	JUNE 2025	SCALE: N.T.S.

Appendix B Accompanying Documents

B.1. Terms of Reference

B.2. Correspondence with Toronto and Region Conservation Authority

B.1. Terms of Reference

HUMBER STATION VILLAGE

TOWN OF CALEDON

COMREHENSIVE ENVIRONMENTAL IMPACT STUDY AND MANAGEMENT PLAN

TERMS OF REFERENCE

Revision	Description	Date
A	First Draft for Internal Review	Nov. 2018
B	Second Draft for Internal Review	Nov. 2021
C	Third Draft for Internal Review	Jun. 2022

JUNE 2022

PREPARED BY:

Schaeffers Consulting Engineers
GEI Consultants Ltd.
IBI Group
SGL Planning & Design Inc.

SCHAEFFERS
CONSULTING
ENGINEERS

IBI

GEI Consul

SGL
Planning & Design Inc.

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APPENDICES

APPENDIX A: TRCA ENVIRONMENTAL IMPACT STATEMENT GUIDELINES

APPENDIX B: TRCA MASTER ENVIRONMENTAL SERVICING PLAN GUIDELINE, MARCH 2015

1.0 INTRODUCTION

1.1 Purpose

The Town of Caledon draft Official Plan designates the Humber Station Village (Option 6) lands as Employment Area within the Urban Area boundary.

An Official Plan Amendment (ROPA 30) to the Region of Peel Official Plan established an expansion to the Bolton Rural Service Centre, which proposed the Option 6 Lands as an addition to the Designated Greenfield Area. The Humber Station Village Landowners Group are initiating a Comprehensive Environmental Impact Study and Management Plan (CEISMP) to support a Secondary Plan process for the area brought into the Urban Area by ROPA 30. The proposed scope of work for the CEISMP is outlined in the following sections.

1.2 Study Area

The Humber Station Village Area is approximately 236 hectares and is located on existing farmland and rural properties near to developed land within the Bolton area in the Town of Caledon. The site is generally bounded by Healey Road to the northwest, Coleraine Drive to the northeast, Mayfield Road to the southeast, and Humber Station Road to the southwest as shown in **Figure 1**. The site is generally characterized by agricultural land and drainage into the West Humber River. The proposed scope of work for the CEISMP is outlined in the following sections.

1.3 Existing Land Use & Ownership

The subject lands are generally occupied by agricultural land, with some estate residential properties and woodlots. Within the subject lands, there are two drainage features and one reach of the West Humber River. The land is owned by various parties that are participating or non-participating with respect to the CEISMP.

1.4 Official Plan and Zoning

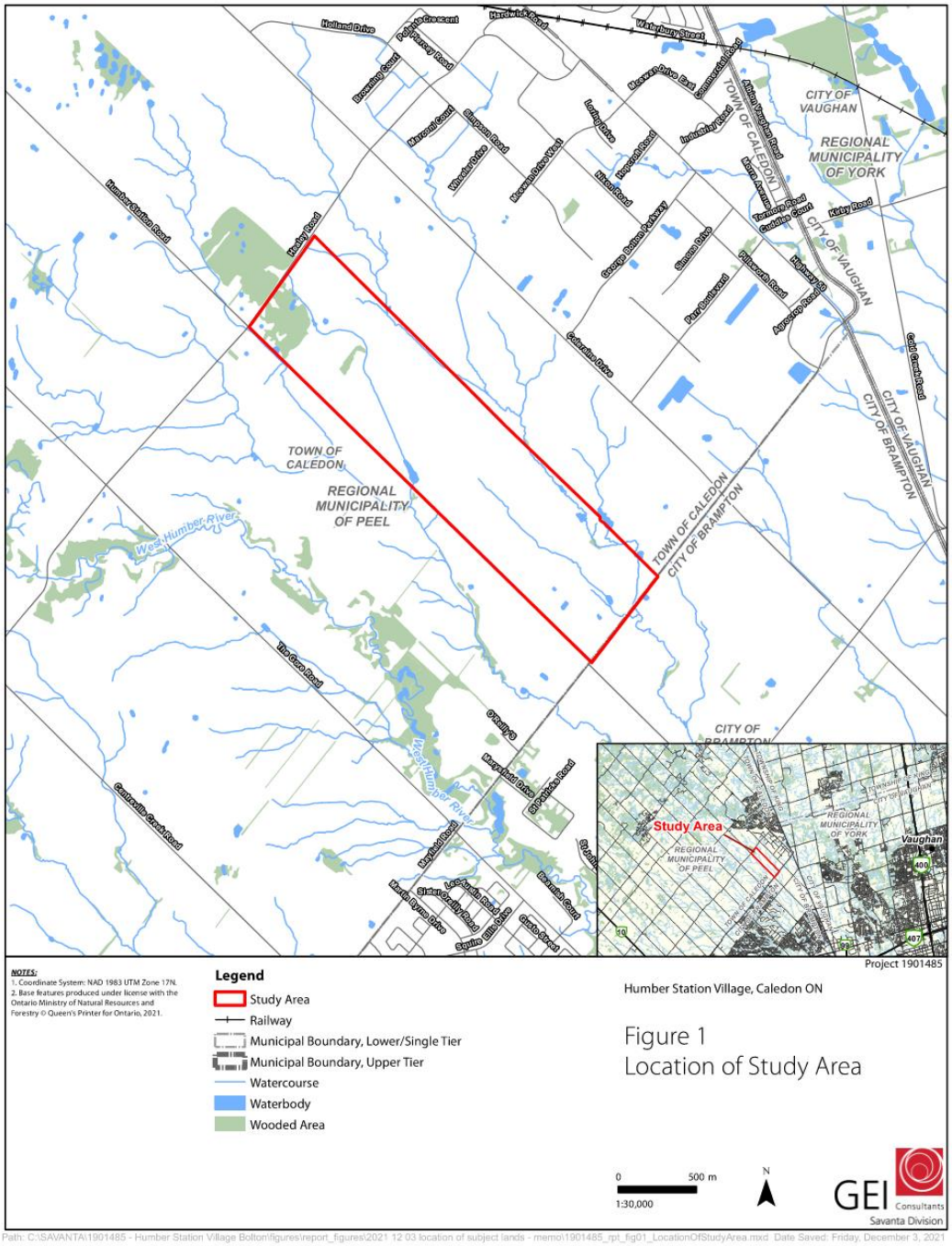
The subject area was re-designated from Rural System to Rural Service Centre on Schedule D (Regional Structure) of the Peel Region Official Plan in December 2016. This occurred through the approval of ROPA 30 by Regional Council, however this decision was appealed by multiple parties. In November 2020, a settlement was reached, and the Local Planning Appeal Tribunal (LPAT, now Ontario Land Tribunal) allowed the appeal, directing that ROPA 30 be modified as defined in Attachment 1 of

the decision. The new 2022 Regional Official Plan identifies the lands as part of the Urban System, within the Bolton Residential Settlement Area, and designated as an Employment Area.

In the draft Caledon Official Plan, the subject property is currently designated Employment Area.

Reflective of the previous Official Plan Prime Agricultural and Environmental Policy Area designations, the subject property is zoned primarily as Agricultural (A1), with a small area zoned as Small Agricultural Holdings (A3). The area also contains limited areas zoned Environmental Policy Area Zone (EPA1 and EPA2).

Figure 1: Location Plan



SCHAEFFERS IBI GEI Consul SGL Planning & Design Inc.

1.5 Previous Studies

There are numerous other studies, plans, guidelines, etc. that will provide input and guidance to the preparation of the CEISMP. The following list outlines a number of these studies:

- Humber Station Villages Master Environmental Servicing Plan (September 2007; Stonybrook Consulting, Savanta Inc., Stantec Consulting Ltd., KLM Planning Partners Inc., Parish Geomorphic Ltd., R.J. Burnside & Associates, Schaeffers Consulting Engineers; Prepared for Solmar Development Company);
- Region of Peel Official Plan (2022);
- Town of Caledon Official Plan (2018);
- Draft Town of Caledon Official Plan (2021)
- Town of Caledon: Development Standards Manual (2019);
- Species at Risk in Ontario (SARO) List, regulation to the Endangered Species Act, 2007 (ESA);
- Ministry of Natural Resources: Natural Heritage Reference Manual: Second Edition (OMNR 2010);
- Humber River Watershed Plan (TRCA, 2008);
- Humber River Watershed Plan Implementation Guide (TRCA, 2008);
- Humber River State of the Watershed Reports (2008);
- Final Report Humber River Hydrology Update (TRCA, 2018);
- Listen to Your River: A Report Card on the Health of the Humber River Watershed (TRCA, 2007);
- Humber River Fisheries Management Plan (MNR and TRCA, 2005);
- TRCA Master Environment and Servicing Plan Guideline (TRCA, 2015);
- Evaluation, Classification, and Management of Headwater Drainage Features: Interim Guidelines (TRCA, 2014);

- TRCA Guidelines for Review of SWM Pond Location with Respect to Groundwater Conditions;
- TRCA Stormwater Management Criteria Document (TRCA, 2012);
- Erosion and Sediment Control Guide for Urban Construction (TRCA, 2019);
- Crossings Guideline for Valley and Stream Corridors (TRCA, 2015);
- Channel Modification Design and Submission Requirements (TRCA, 2007);
- Technical Guidelines For Flood Hazard Mapping (TRCA and other Conservation Authorities, 2017);
- TRCA/CVC Low Impact Development Stormwater Management Planning and Design Guide (2010);
- Geotechnical Engineering Design and Submission Requirements (TRCA, November 2007);
- Hydrogeological Assessment Submissions – Conservation Authority Guidelines to Support Development Applications (Conservation Ontario, 2013)
- Technical Guide for River & Stream Systems: Erosion Hazard Limit (MNRF, 2002); and,
- Ministry of the Environment Water Well Records.

2.0 CEISMP (COMPREHENSIVE ENVIRONMENTAL IMPACT STUDY AND MANAGEMENT PLAN)

2.1 Introduction

The CEISMP will address a range of environmental and servicing issues associated with the Humber Station Village Area, including the protection and management of surface water, groundwater, fluvial geomorphology, terrestrial and aquatic resources, and the identification of the Natural Heritage System (NHS) and municipal servicing needs, including stormwater management, sanitary and water servicing and site grading requirements.

The CEISMP serves to:

- Address the relevant natural features and functions identified in the Provincial Policy Statement (PPS; MMAH 2020), Region of Peel Official Plan, and Town of Caledon Official Plan;
- Provide the foundation for the layout of the Secondary Plan by defining and delineating elements such as the NHS and transportation and servicing networks; and
- Define measures to protect and/or enhance the NHS.

This Terms of Reference (TOR) was developed with reference to the TOR guidelines outlined by the Toronto and Region Conservation Authority (TRCA) in Appendix 1 of the Bolton Residential Expansion Study Background Environmental Study (2014). As noted in the TOR guidelines, the CEISMP is to include three phases of reporting. As practical, the CEISMP components may be submitted in phases before proceeding to the next phase. The individual study components will be integrated across the various disciplines in the characterization, impact assessment, and implementation phases of the CEISMP.

Some aspects of subwatershed studies have been included as a requirement for this CEISMP as per input by the TRCA on October 6, 2016 (Appendix C). The requirements for this have been outlined in Section 2.2 of this Terms of Reference.

The CEISMP is to be completed in three phases as described in Sections 2.3.2.4 and 2.5 of this Terms of Reference.

The TRCA's Environmental Impact Statement Guidelines (dated October 2014),

presented in Appendix A, and the TRCA's Master Environmental Servicing Plan Guideline (dated March 2015), presented in Appendix B shall be utilized when preparing the CEISMP.

The CEISMP shall follow all requirements of the Regional Plan, Region of Peel Official Plan, Town of Caledon Official Plan, and the TRCA.

2.2 Subwatershed Context

The following sections outline aspects of a subwatershed study as requested by TRCA (February 5, 2016, and October 6, 2016) to support the CEISMP.

i. Regional Storm

1. Obtain and refine existing conditions hydrology and hydraulic models of Humber River Watershed from TRCA as necessary to establish baseline flood conditions;
2. Update existing and future conditions hydrologic models, if needed, to reflect existing drainage boundaries and proposed future land uses in the subject watershed;
3. Update hydraulic models to reflect existing and future uncontrolled flows. Delineate existing and future uncontrolled Regional Stormwater levels in downstream areas;
4. Assess implications of uncontrolled future flows to flood levels in downstream areas to determine the location and frequency of flooding, types of structures, and/or land uses that could be flooded including the predicted change from existing conditions;
5. Confirm the need for the management of Regional Storm flows (in case, the increase of flow causes unacceptable impacts to downstream culverts and flood vulnerable areas);
6. Identify and assess options to manage Regional Storm flows (if it is required). Make recommendations on the preferred Measures. Measures can include on-site and off-site control;

7. The future development model will be provided based on the TRCA hydrology model and the study area will be included. The impact of future development in the Humber Station Village Area at the downstream river flow will be assessed. It will be determined whether any Regional Control will be required for the development within the Humber Station Village Area to mitigate the impact of future developments; and,
8. Flow monitoring at critical locations such as culverts.

ii. Floodplain Delineation

1. Survey and field inspection of existing culverts; and,
2. Extend TRCA existing hydraulic models to cover extension areas as needed and plot flood lines to confirm the extent of hazard potential hazards within the development limit as per the 2018 final TRCA hydrology model (limit of delineation will be any drainage area larger than 50 ha).

iii. Natural Heritage Characterization

Section 2.3v. below, provides a detailed account of the suite of ecological surveys and inventories that will assist in determining the extent and quality of natural heritage features within the Humber Station Village Area, and which will form a key part of the CEISMP.

For example, as part of site characterization:

1. The subwatershed context work identifies headwater drainage features that have been assessed; management recommendations will be developed for incorporation into the CEISMP;
2. The subwatershed context work will include a discussion regarding Endangered Species Act legislation, and will identify a ‘go forward’ plan for addressing species at risk (SAR) through the CEISMP and subsequent stages of the development process;
3. The subwatershed context work will include targeted SAR surveys as needed and these data will assist in characterizing potential SAR habitat within the subwatershed; and,

4. A range of other ecological surveys have been completed (as per Section 2.3v). To the extent that these data will aid in the characterization of the Natural Heritage Features at the subwatershed level, they will be presented and discussed within the Subwatershed Study.

A terrestrial connectivity and landscape scale screening exercise will be undertaken to assess linkages both on-site and within the broader surrounding lands. This will include an analysis of both feature based and functional connections, as well as larger scale NHS conditions.

iv. Hydrogeological Characterization

1. Implement a groundwater-surface water monitoring program in 2022 at the Site to build upon the results of the previously completed monitoring;
2. Interpret monitoring data to characterize existing hydrogeological conditions for the land within the boundary of the Humber Station Village area;
3. Identify preliminary potential constraints and opportunities related to hydrogeological conditions in expansion areas;
4. Identify the extent of the hydrogeological and surface water monitoring program for 2022 and beyond;
5. Identify monitoring requirements for feature-based water balance analyses;
6. Specify recharge/ discharge areas within the Humber Station Village area;
7. Identify areas with high aquifer vulnerability; and,
8. Identify wells and water uses.

2.3 Phase 1 – Characterization/Existing Conditions and Baseline Inventory

The scope of work in Phase 1 includes the characterization of existing conditions and baseline inventory, as well as the cross-synthesis of the various disciplines, as outlined in the following sections.

i. Background study including:

1. Compile and review existing studies, plans, mapping, etc.; and,
2. Summarize existing policies, guidelines, legislation affecting CEISMP study components.

ii. Characterization of hydrology features:

1. Characterize the existing hydrologic setting;
2. Identify existing storm drainage patterns and external drainage impacting the Humber Station Village Area;
3. Review and verify existing conditions hydrology model prepared based on available monitoring data;
4. Characterize all hydrologic features (watercourses, headwater drainage features (HDFs; utilizing the TRCA's Interim Guidelines for the "Evaluation, Classification, and Management of Headwater Drainage Features" (2014)), natural areas providing flood storage attenuation, depression storage, recharge areas, seepage areas or springs) utilizing data from existing environmental studies and the field surveys. Complete the headwater drainage feature assessment (HDFA)
5. Calculate existing annual water budget within the Humber Station Village Area;
6. Calculate meander belt widths along stream and valley corridors and the 100-year erosion limits along valley corridors; and,
7. Identify where detailed slope stability assessments are required and complete long-term stable top of slope analyses where needed. Slope conditions will be modeled and stability will be assessed. The stable slope inclination corresponding to a minimum factor of safety of 1.5 should be determined.

iii. Characterize the existing geological and hydrogeological setting. Results from the studies outlined in the previous section will be used to build upon the current understanding of geology and groundwater systems determined from the review of past studies. The main objectives of this undertaking are to:

1. Identify site stratigraphy and hydrostratigraphy;

2. Identify areas of groundwater recharge, and discharge;
3. Determine hydraulic properties of stratigraphic units including those units that transmit groundwater to natural features such as watercourses and wetlands;
4. Delineate shallow and deeper groundwater flow patterns and hydraulic gradients in the Humber Station Village Area;
5. Identify surface water and groundwater supported natural features;
6. Quantify baseflow contributions to streams and/or wetlands in the Humber Station Village Area;
7. Estimate the pre- and post-development overall site water balance to determine the change in annual site infiltration and runoff rates due to the proposed development plans; and
8. Identify potential surface water infiltration opportunities based on soils information, depth to the water table, and aquifer vulnerability.

iv. Desktop assessment of existing water supply wells to identify the local use of groundwater resources in the study area. A door-to-door water well survey within a 500 m radius around the Humber Station Village Area is required to develop an understanding of local groundwater usage in the area.

1. This information will be used to establish baseline groundwater levels and quality of nearby well users
2. The information should be used to support the development of a baseline aquifer monitoring program.

v. Characterize natural heritage features through the following ecological inventories (completed in 2017 and 2018):

1. Winter wildlife surveys – camera trap surveys were undertaken to assess the types of mammals using the Humber Station Village Area and their movement patterns;
2. Fish community sampling was completed in conjunction with the second round HDF survey to confirm the distribution and extent of direct fish habitat in the watercourses on the Subject Lands, identify species diversity and relative abundance;

3. Ecological Land Classification (ELC) and botanical surveys – these occurred on all participating lands to ensure current vegetation mapping is available;
4. Breeding bird surveys – conventional breeding surveys were conducted across the Humber Station Village Area and a survey of structures was completed to determine the potential use by Barn Swallow;
5. Insects were surveyed in three separate site visits. These surveys represent early, mid, and late-season flight times for two groups of insects, dragonflies, and butterflies. These two groups represent insects as a whole and are most easily detectable in our surveying methods;
6. Bat habitat assessments and bat acoustic surveys were conducted to understand the presence/absence of Species at Risk (SAR) bats and bat Significant Wildlife Habitat;
7. Reptile surveys – snake and turtle surveys were completed to determine if there is suitable reptile habitat in the Humber Station Village Area during spring and fall;
8. SAR assessments – based on the information in the MNR's 2017 SAR Screening Letter, specific effort was made to assess the potential presence of Butternut, Bobolink, Eastern Wood-Pewee, Wood Thrush, and SAR bats within the Humber Station Village Area;
9. Headwater drainage feature assessment – assessment occurred across the Humber Station Village Area to ensure that all headwater drainage features were characterized using current standards;
10. Breeding amphibian surveys –call surveys were completed within suitable habitat areas that have the potential to undergo direct or indirect impacts from adjacent development within the Humber Station Village Area; and,
11. Staking of natural heritage features – GEI and TRCA staked the boundaries of natural heritage features (e.g., dripline limits, top-of-bank, and wetlands) in 2021.

vi. Existing natural heritage/ conditions in the Humber Station Village Area will be described, including aquatic and terrestrial features and functions. This will include:

1. All pertinent information relating to the data collection will be summarized including dates and times of field visits, names of surveyors, and weather conditions;
2. Protocols for the various surveys will be documented and mapping will be prepared to identify the location of all sampling/survey efforts;
3. ELC mapping will be prepared to identify vegetation communities and other important features on and adjacent to the property and this will include a description of vegetation and wildlife within ELC units (to the extent possible). Mapping will also be prepared to identify significant species and feature locations. An assessment of terrestrial connectivity will also be undertaken;
4. The CEISMP will review and identify inter-relationships between surface water, groundwater, and environmental features to address specific issues such as:
    a. surface and subsurface soils analysis, including groundwater conditions and inter-relationships with environmental features such as watercourses and wetlands (i.e., sources of water to feature);
    b. identification of local landform types;
    c. catchment boundaries and topographic conditions within surface water features, including wetlands;
    d. completion of wetland screening and water balance risk evaluation to identify the need for wetland specific water balance analyses and subsequent completion of water balance calculations/recommendations to manage water sources to environmental features; and,
    e. infiltration capabilities of the site with respect to appropriate SWM and LID measures recommendations.
5. Key ecological features and functions will be identified and analyzed and consideration will be given as to whether any refinements to the (additions or minor deletions) are warranted based on current site data. This will include the following components of the proposed NHS:

a. identify key features and ecological functions, including the natural heritage features identified in the PPS, both on the Option 6 lands and, to the extent possible using aerial photography, on adjacent lands that may be affected by development. This will include a Significant Wildlife Habitat screening and detailed analysis;

b. identify key features and/or functions that contribute significantly to the ecological integrity or importance of the proposed NHS and,

c. identify features (e.g., certain vegetation communities that support concentrations of significant species, structures, habitat elements) that would qualify as significant habitat.

vii. Perform a feature-based water balance to evaluate tributaries, woodlands, and wetlands with the Humber Station Village Plan for the natural heritage features as directed by the TRCA on October 6, 2016, attached in Appendix C;

viii. Geomorphic Analysis and Erosion Hazard delineation for applicable tributaries;

ix. Slope Stability Analysis (if applicable); and,

x. Prepare Opportunities and Constraints mapping that would include:

1. Watercourses;
2. Existing flood limits and associated setbacks;
3. Erosion limits, meander belt widths, and associated setbacks;
4. Staked top-of-bank, long-term stable top-of-bank, wetland and dripline boundaries, and associated buffers;
5. Preliminary stormwater management concept including facility locations; and,
6. Natural heritage system limits including natural heritage features, hydrologic features, and minimum vegetation protection zones.

This mapping will be provided to the Planner for the Plan to integrate into the proposed land use concept, and to other Plan studies for consideration when siting potential uses in the open space system (i.e., infrastructure, trails, etc.).

2.4 Phase 2: Analysis, Impact Assessment, Mitigation, and

Recommendations

The results of the Phase 1 Study are utilized to complete the analysis required for Phase 2. The scope of work is outlined in the following sections.

i. Servicing & Grading plan:

1. Grading:

    a. To assist the identification of future drainage patterns, preliminary internal road alignments should be identified; and,

    b. Road crossings at watercourses should have preliminary road crossings prepared.

2. Sanitary sewer servicing:

    a. Context should be established with respect to the surrounding trunk and local sewers. Analysis of capacity should be determined through desktop study;

    b. Estimate the sanitary generation rates considering all available information on the land use; and,

    c. Preferred sewer outlet locations to be determined.

3. Water Supply and distribution:

    a. Background information assessment of existing water main infrastructure for available pressure/head and preferred connection locations;

    b. Estimate peak daily domestic demand and fire flow demand on the system considering information on land use;

    c. Conduct hydrant tests to assess the existing network near the preferred connection locations;

    d. Perform a hydraulic analysis using existing models to assess the impact of the development of the Humber Station Village

Area on the existing network; and,

e. Provide any water main upgrade recommendations uncovered through the hydraulic analysis.

ii. SWM Plan:

1. Review the Regional Storm assessment and determine if any updates are required based on the availability of more detailed information including but not limited to future land use. If warranted, verify any recommended approach to the management of Regional Storm flows;

2. Evaluate and recommend the use of alternative SWM practices including Low Impact Development (LID) measures (i.e., lot level, conveyance, and end-of-pipe solutions) to identify practices to be incorporated into development plans. Complete conceptual design of LID measures including identification of preliminary land areas required (location and size). The Humber River Watershed Plan specifically recommends that stormwater management measures to mitigate the increases in runoff volume from new impervious surfaces be incorporated into development plans;

3. Conceptual major and minor system design identifying drainage areas contributing to each SWM facility and external drainage area contributions;

4. Apply SWM design criteria recommended in the TRCA and Town reports and complete conceptual design of SWM practices, identifying the location, type, function, and preliminary sizing of recommended measures as well as outfall locations to watercourses considering the sensitivities and significance of natural features. This will include plans for each SWM facility presenting preliminary facility grading (existing and future grades), side slopes, storm sewer inlet locations, outfall locations, maintenance Access;

5. Identify seasonal water budgets for the Humber Station Village Area, including natural features reliant on surface water contributions and

groundwater contributions Calculations will be completed to compare pre-development and post-development conditions; results will be used to develop mitigation strategies to maintain functions of natural areas to the extent feasible in this future urban setting. Feature-based water balance models will be prepared for those areas where screening (to be completed in consultation with the TRCA) identifies the need for this work. Monitoring data describing existing conditions hydroperiods will be reviewed and utilized as feasible in these analyses to verify modeling;

6. Fluvial geomorphological evaluations will be incorporated into servicing, stormwater management, and transportation (valley crossing) designs;

7. Preliminary hydraulic, grading, and fluvial geomorphological design of channel;

8. Preliminary stormwater management recommendations should also use, where appropriate, overall principles established in the Town's Development Design Guidelines, Subdivision Design Manual, and Subdivision Design Standards and minimize future maintenance requirements, where possible; and,

9. Assess the SWM plan based on the proposed MOE guideline.

iii. Hydrogeological Assessment:

1. Characterize the regional and local scale hydrogeological setting and the linkages between the groundwater and surface water systems;

2. Identify groundwater-dependent natural features and characterize their relationship with the local surface water/groundwater flow conditions;

3. A wetland water balance risk evaluation will be completed for any significant wetlands identified in the Study Area;

4. Consideration will be given to completing a feature-based water balance assessment on any natural heritage features considered to be

at risk based on the results of the wetland water balance risk evaluation;

5. Potential impacts to local groundwater resources and groundwater supported features during construction will be identified;

6. A preliminary assessment of dewatering requirements during the installation of services will be completed. Should dewatering be required, the potential impacts on the natural flow regime and potential impacts to nearby water supply wells and natural features will be assessed;

7. Identify potential impacts resulting from development on local groundwater flow patterns; on infiltration and recharge; on discharge patterns; and the effects on existing well users and the natural environment, including a reduction in infiltration, impacts to natural flow system(s), and changes to groundwater and surface water quality;

8. Assess potential impacts to existing wellhead protection zones (if any) that may result during the construction and post-construction periods and increases to the aquifer vulnerability; and

9. Provide preliminary recommendations and measures to be considered both during construction and post-development to mitigate impacts to local groundwater resources. This may involve a “during and post-development” monitoring program and a comprehensive adaptive management plan. The comprehensive adaptive management plan will have methodologies to measure and mitigate any negative impact that may arise during construction and post-development.

iv. Geotechnical: A grading plan based on sound technical data should be recommended to minimize or eliminate the impact of the development and associated activities on valley slopes, and ensure that the development will be safe for a design period of 100 years. This work will include:

1. Provide preliminary cross-sections of proposed grading along the buffer;

Identify all grading in the buffer and retaining walls if proposed and slope stability implications if warranted, with consideration for the overall objective of avoiding grading and retaining walls in or immediately adjacent to the NHS;

2. Complete a geotechnical assessment of grading to the valley slope, if needed, including slope failures and soil settlement due to overburden pressure;

3. Identify any pond berm and associated retaining structures and the implication to valley slopes due to the construction of the berm. Geotechnical assessment of pond berm designs (seepage, settlement, and slope failure potential) may be required on a case-by-case basis. Boreholes for all proposed SWM Pond locations will be required;

4. Comment on /evaluate erosion and slope stability implications for all stormwater management outfalls and channels;

5. Evaluate the stability of the proposed road crossing and comment on how the crossing will be protected against instability; and,

6. Confirmation that roads and road embankments (with the exception of road crossings of valleys) are placed outside the long-term stable top of the slope and required buffers.

v. Wetland Evaluation

1. A wetland significance evaluation will be carried out to determine if any wetlands on the Option 6 lands meet the significance criteria as per the Ontario Wetland Evaluation System (OWES; MNRF 2014). The evaluation will be submitted to the Ministry of Natural Resources and Forestry (MNRF) for their review.

vi. Integration and Assessment of Potential Development Impacts and Mitigation Measures:

1. The CEISMP will confirm the environmentally appropriate limits of development and appropriate uses within the NHS. The CEISMP will

provide an assessment of the potential for impacts on natural heritage and hydrologic features and functions that might result from the proposed development and will identify suitable mitigation measures and recommend potential enhancements to the NHS where feasible. Section 2.3 outlines the tasks relating to the refinement of the NHS and understanding of the existing inter-relationships between groundwater, surface water, and natural heritage features. Impact assessment and identification of mitigative measures include the following tasks:

a. Describe the proposed development plan including site grading, servicing, stormwater management, uses in the NHS, and mitigation, restoration, and enhancement measures. Integrated assessments of potential negative impacts on terrestrial, aquatic, surface water, and groundwater systems will be completed, including a discussion related to the potential magnitude and longevity of impacts on the NHS;

b. The identification of mitigation techniques for impacts will be prescribed including consideration for:

    - NHS protection and enhancement measures, and where feasible, the types and locations of enhancement or restoration areas;
    - Feature-Based Water Balance implementation;
    - SWM and HDF mitigation and management strategies;
    - Construction timing; and,
    - Other Best Management Practices.

c. Demonstrate conformity with applicable policies, including the Provincial Policy Statement, Regional and Local Municipal Official Plans, the Conservation Authorities Act, the federal Species at Risk Act, and the provincial Endangered Species Act; and,

d. Identify permitting requirements of the TRCA, MECP, and DFO.

2.5 Phase 3: Comprehensive Implementation Plan, Monitoring Plan, and Adaptive Management Plan

Natural Heritage Study:

The restoration and enhancement of the NHS will aim to enhance ecological integrity and function, optimize biodiversity and restore natural features. The CEISMP will include a Restoration and Enhancement Plan that will include:

a) Establish ecological targets to guide the design of site-specific restoration/enhancement initiatives;

b) Overlay the Opportunities and Constraints map and the land use plan showing parks and open space to develop a Restoration and Enhancement Strategy concept plan;

c) Design the restoration/enhancement initiatives to correspond with the defined opportunities and constraints and the hydrogeological and stormwater management information;

d) Confirm that any proposed feature removals and compensation initiatives are technically feasible, including identification and quantification of those features that are proposed to be removed, and confirmation that:
   i. the restoration and enhancement strategy is of an appropriate scale, particularly when replicating and compensating for features that will be removed from the landscape; and,
   ii. the locations for restoration and enhancement are feasible for the type of the restoration or enhancement initiative that is proposed, in consideration of local site conditions; and,

e) Confirm that any proposed feature removals and compensation/restoration appropriately addresses policy and regulation requirements of the agencies having jurisdiction;

f) Prepare an implementation strategy to guide the timing/sequencing of implementation of the various restoration and enhancement initiatives in consideration of the following:
   i. Land ownership;
   ii. Sequencing of servicing and build-out;
   iii. Seasonal timing;

iv. Habitat protection requirements;
v. Requirements for the establishment of the restored areas;
vi. Practical considerations including site accessibility and construction logistics; and,
vii. Responsibilities for implementation.

g) Prepare a management plan that will address care of plantings, invasive species control, and other adaptive management initiatives that may be required to ensure that the restoration and enhancement initiatives become established and evolve to attain the defined ecological targets; and,

Hydrogeological Investigation:

The results of the Phase-1 and Phase-2 study will be used to establish the following:

- Phase-1 – The existing site geological, hydrological and hydrogeological conditions and an identification of constraint and opportunities (i.e, recharge or discharge areas, natural features, dewatering requirements, private well users etc.) with respect to the proposed plans for development at the Subject Lands; and

- Phase-2 – The potential for impact resulting from the proposed plans for development at the Subject Lands

Based on the findings of the Phase-1 and Phase-2, a Long Term Monitoring Plan (LTMP) and Comprehensive Adaptive Management Plan (CAMP) will be prepared to identify measures to be implemented during the construction and post-construction periods to mitigate the potential for significant impacts to the natural environment. The LTMP and CAMP will include the monitoring and management of (not limited to): groundwater levels, flow direction, groundwater gradients, groundwater-surface water interaction dynamics, volume and quality of dewatering effluent, quality of Site groundwater (from monitoring wells), and as well changes to potential changes to the water balance at the Site. The LTMP and CAMP are further detailed in the next sections.

Long Term Monitoring Plan (LTMP):

A LTMP will be designed such that impacts can be distinguished from natural trends

at an early stage. This will provide an ability to focus monitoring to help determine the how/why/frequency of potential impacts and will assess cause-effect relationships between the environment and land use change.

This will include the preparation of construction and post-construction environmental monitoring plan that will establish monitoring objectives, responsibilities, requirements, and timing for monitoring of components of the NHS where warranted. Consultation with agencies will be required to obtain input to a monitoring plan to yield targeted, useful data that will satisfy specific monitoring objectives.

Items that are recommended to be monitored over the long term include:

- Water quality and quantity, including stormwater system performance;
- Fisheries and aquatic resources;
- Hydrology and hydraulics;
- Groundwater quality and quantity;
- Stream morphology and slope stability;
- Terrestrial resources including woodlands, wetlands, flora and fauna, Environmentally Sensitive Areas, Areas of Natural or Scientific Interest, terrestrial linkages, buffer areas, invasive species, natural system encroachments, and natural system edge management; and,
- Feature Based and Site Water balance and the effectiveness of infiltration measures.

The LTMP will address costs and responsibilities for monitoring, and length of time for monitoring will be determined during the study.

Comprehensive Adaptative Management Plan (CAMP):

A CAMP will be developed to provide direction for monitoring the performance of the recommended aquatic and terrestrial mitigation strategies, and to provide a flexible mitigation system that can be adjusted in response to monitoring results.

The CAMP will include the following:

- Identify key features and functions and associated protection goals and objectives;
- Management targets required to meet goals and objectives;
- Mitigation measures to address the performance targets;
- Monitoring requirements to monitor the success of the mitigation measures in relation to the targets;
- Evaluation of the monitoring results in relation to the management targets; and
- Long term adjustment of the overall CAMP as needed.

Recommendations for long-term monitoring of surface water, groundwater, water quality, fisheries, stream morphology and terrestrial/wetland resources will be provided. The CAMP will discuss responses to changing conditions or anticipated impacts, which may include more aggressive monitoring.

3.0 STUDY DELIVERABLES

Through the completion of the CEISMP analyses, meetings will be held with TRCA and Town staff as needed to discuss technical matters, as needed. Site visits will be organized to stake the limits of features.

CEISMP findings will be documented in a report including supporting models, analyses, and input to the Secondary Plan. A draft report will be submitted to the TRCA and Town for review and comment prior to its finalization.

APPENDIX A

TRCA'S ENVIRONMENTAL IMPACT STATEMENT GUIDELINES

(DATED OCTOBER 2014)

TRCA Environmental Impact Statement Guidelines

Oct 2014



These guidelines are not meant to be exhaustive but present the typical requirements of the TRCA and are subject to change.

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INTRODUCTION

Purpose of an EIS

The purpose of an EIS is to determine the potential impacts, direct and indirect, of a proposed development application on the natural heritage system of an area, excluding areas on the Oak Ridges Moraine (note that technical papers have been prepared by Ontario Ministry of Natural Resources to guide the development of Natural Heritage Evaluations on the Oak Ridges Moraine). These studies are typically completed for smaller-scale developments or in-fill developments that are not associated with detailed studies conducted to satisfy higher-level planning processes (i.e. Secondary Plans, MESPs, etc.), although these guidelines can be used to guide the environmental components required for these higher-level studies as well. An EIS can also be required when an assessment of ecological impacts has not been addressed at earlier planning stages or one may be required at detailed design through the permitting process. Key components of the EIS reporting are:

- a biophysical inventory and analysis;
- identification of constraints and opportunities;
- an assessment of impacts from the proposed activities;
- the analysis of mitigation measures;
- the determination of net effects;
- the identification of monitoring for developments within and/or adjacent to natural areas or hazards.

The function of the EIS is to describe potential impacts, to better inform municipal and TRCA staff in making decisions about which impacts of development are acceptable, and which should be avoided. The EIS will assess impacts that are anticipated from the proposed development application on natural heritage features, functions and linkages including but not limited to:

- Watercourses and aquatic habitat;
- Wetlands;
- Woodlands;
- Valleylands;
- Wildlife Habitat;
- Vegetation Communities;
- Environmentally Significant Areas (ESAs);
- Areas of Natural and Scientific Interest (ANSIs);
- Habitats of Vulnerable, Threatened and Endangered Species (VTEs);
- TRCA's Terrestrial Natural Heritage System;
- Groundwater recharge and discharge areas;
- Groundwater and surface water quantity and quality as related to natural heritage features and functions;
- Flood and erosion hazards of streams and valleylands;
- Flood and erosion hazards of dynamic beaches.

The proponent of a given development has a financial responsibility to fulfill the requirements established by the Province and the municipality for an Environmental Impact Study. The EIS will contain recommendations that discuss whether or not the impacts of the proposed development are acceptable or not, and measures to maintain, mitigate or enhance the natural heritage features and functions of the site. This includes management and mitigation of impacts that are unavoidable. We expect that the results of the analysis be based in good sciences that are technically defensible and adequately protect the features and functions on the site.

Through this process it is anticipated that development proposals will be modified to reduce impacts where possible. The EIS will be reviewed for technical accuracy and extent of impacts. The completion of an EIS does not assure the approval of a development proposal. An EIS provides the mechanism for assessing impacts. Additional modification of development proposals may result during review, if the development concept is deemed to be acceptable. Accepting, modifying or rejecting development proposals in and adjacent to natural areas will take place after the EIS is completed and submitted. In general, the natural areas of concern to the municipality are those designated as natural heritage features in the Official Plan. Other natural heritage features not specifically identified may be identified as also requiring an EIS.

EIS REVIEW PROCESS

Step 1: Initial Consultation and EIS Scoping

Oftentimes, a proponent will make initial contact with TRCA planning staff when a development application is first contemplated. During this initial meeting, TRCA staff may establish the need for an EIS through an initial screening process. The planner will typically advise the proponent of the general expertise that the applicant should seek in order to meet the general requirements for the EIS. These requirements will be further refined through a scoping exercise meeting that will occur at a later date.

Prior to the scoping exercise that is conducted with TRCA's Technical Review Team, the proponent should retain appropriate technical staff at this time who would be qualified to carry out the expected works. TRCA expects that the EIS and the biophysical surveys undertaken in support of the EIS will be completed by competent, professional experts in a field relevant to the components of the report to which they are contributing. For example, a botanist must complete a flora survey; an aquatic biologist must complete a fisheries survey, a hydrogeologist (P.Geo) must complete the groundwater analysis, etc. The final EIS report must be analyzed and written by a qualified ecologist.

Members of the TRCA Technical Review Team will be identified at this stage. The Technical Review Team will provide technical advice and may consist of the TRCA staff (ecologists, planners, hydrogeologists, stormwater engineers, geotechnical engineers, etc.), but may also include municipal staff, and any relevant agencies (e.g. Ministry of Natural Resources and Forestry, Ministry of Environment, Department of Fisheries and Oceans, Environment Canada), as required.

The EIS scoping exercise is held to scope out the terms of reference for the EIS with technical staff from the agencies and the technical staff representing the applicant. The applicant is expected to provide information pertaining to the development application, permitted uses, and any existing background information available to the applicant. This review of background information should include existing fish and wildlife data records, soils mapping, aerial photos, Natural Heritage Information Centre (NHIC) websites, Species of Conservation Concern lists, etc.

TRCA and municipal staff will review current legislative and policy requirements with the applicant, advise of the planning context, and discuss existing information, known ecological sensitivities, available data and sources, and recommendations provided in other studies. Existing studies may include watershed and subwatershed studies, Wetland Evaluations, ESA reports, Fisheries Management Plans, and Natural Heritage Site Reports that may be relevant to the subject lands and the development proposal.

Step 2: Terms of Reference Development and Initial Site Visit

The applicant will be given direction and guidance as to the anticipated scoping, form and content of the EIS based on preliminary identification of issues and concerns in Step 1. It is at this stage that all parties will agree on whether the EIS will be scoped to exclude some or all expected biotic inventories, depending on the scale of the proposed development, anticipated impacts, and availability of existing data. Otherwise, a full EIS will be required.

The applicant and their consultants and members of the Technical Review Team should conduct a site visit. This will aid on-site interpretation and help to define pertinent natural heritage areas and identify natural hazard concerns that require further investigations. All natural feature boundaries will need to be staked at some point during the development and approval of the EIS. Staking could be completed at this time and could be included in the analysis of impacts through the EIS. Timing of the staking exercise should be identified in the Terms of Reference (TOR).

Gaps in information are determined through the review of secondary sources during the Step 1 and the subsequent site visit. The applicant's consultants develop the content and scope of the TOR for the EIS in consultation with TRCA Technical Review Team. This step provides details for the accepted methods of data collection, analysis and evaluation of potential impacts, and specifies the qualifications of personnel required to carry out these evaluations. The applicant and/or their consultants should provide a work plan and signed letter of understanding that formalizes the required TOR. In addition, some municipalities have their own EIS guidelines. Through the consultation process with municipalities, the TOR should incorporate both guidelines, if relevant. Once TRCA is in receipt of and is satisfied with the TOR, TRCA staff will provide final sign off.

Step 3: EIS Report

The following guidelines should be used when completing the EIS report. We have outlined specific direction and content for each heading that should be included in the final EIS report, as follows, unless scoped-out as part of Step 2.

Part I – Defining the Natural Heritage System

Prior to the assessment of the proposed development and anticipated impacts, the first step of the EIS report should analyze the existing natural heritage features and functions of the site in order to define the natural heritage system that will be required to maintain ecosystem function given that changes to the landscape or site may result. The natural heritage system should include linkages between natural features to ensure that life cycles can continue to be completed and that genetic exchanges can occur.

1.0 Existing Conditions

The initial step in defining the natural heritage system will be gathering existing or secondary source information to gain an understanding of the site, to identify preliminary issues, and to outline information gaps and the need for additional surveys and data collection. This first section should provide:

- The planning context including any existing designations, zoning, and permitted uses;
- Location maps detailing both site specific and regional perspectives;
- Identification of known natural heritage designations within and beyond the site, such as Areas of Natural and Scientific Interest (ANSI), Provincially and Locally Significant Wetlands (PSWs and LSWs), Environmentally Significant Areas (ESAs), Oak Ridges Moraine designations, Greenbelt designations, Niagara Escarpment designations, habitat of significant wildlife, habitat of endangered or at risk species, sensitive fish habitat, etc.
- Natural heritage features and functions present on the site and within the landscape;
- Potential cover that could be affected by the development which has been targeted under TRCA's Terrestrial Natural Heritage Strategy;
- Specific location of boundaries or edges of identified features or functions;
- Existing interconnections or corridors with adjacent natural features;
- Identification of hazards;
- Overview of critical issues;
- Watershed targets and recommendations.

1.1 Site Description

The importance of the site should be considered at all scales, including the landscape, vegetation community, species, and (if possible) the genetic scale. Site description of the area should include all primary source information collected in support of the EIS. This information should be as detailed as possible and should include the following requirements:

a) A description of the soils, landforms and surficial geology based on a review of available mapping and literature. Topographical information should be provided on constraints mapping. Any feature staking that has been done to date (e.g. staking the top and/or toe of the valley slope) should also be indicated as well as the calculated hazard land limits (e.g. floodplain analysis, geotechnical review of slope stability and watercourse erosion, meander belt width analysis, etc.).

b) Identify any hydrological or hydrogeological resources and issues, including surface water features, recharge/discharge zones, groundwater quality and quantity, groundwater elevations and flow directions, connections between groundwater and surface water features. More in-depth information (i.e. boreholes, surface flow measurements) may be required, depending on the scope, scale and issues identified for the proposal.

c) A pre-development water balance should be completed for the site in order to assess the quantity and quality of existing water budget components on the site. If there are existing natural heritage features on the subject property, including wetlands, woodlands, and watercourses, then a more detailed feature-based water balance may be required to determine existing flow paths and contributions to these features. This assessment will identify existing precipitation, evapotranspiration, runoff and infiltration volumes on a monthly basis.

d) A biophysical inventory and analysis of both terrestrial and aquatic communities, physical functions and processes that occur on and beyond the site that will be affected, or that might reasonably be expected to be affected, either directly or indirectly. This should include information addressing quality, quantity and distribution of the resource(s). Please refer to the Appendix for further detail regarding biophysical inventories. It is expected that studies will be undertaken during the appropriate season.

e) An analysis of the inter-relationship of the biophysical information, to provide an overview of the existing ecosystem both within the subject site and as it relates to the larger local and regional ecosystem. For example, linkages between features, such as groundwater-vegetation communities or groundwater-surface water relationships should be described. The investigation of the existing features should extend beyond the subject site and include adjacent areas. The level of effort may be reduced for the adjacent areas since a full investigation may be hindered by access issues, however a remote investigation should occur as a minimum. The extent of the off site investigation in terms of level of information and the geographic extent must be agreed to by the review team, and should occur during the consultation process.

f) A description of the present natural features and components of the natural heritage system of the subject property (i.e. wetland, ESA, ANSI, woodland, vegetation patch, geological or landform features, river, stream, or ravine corridor) and the proposed criteria to be applied for evaluation of their significance, if not yet established. The proponent is encouraged to refer to the TRCA Terrestrial Natural Heritage Strategy, our Vegetation Communities/Species of Conservation Concern lists, Natural Heritage Information Centre (NHIC) records, and COSEWIC/COSSARO lists. Consultation with MNRF regarding the Endangered Species Act is also recommended.

h) A description of the methodology, timing, and techniques selected and used to undertake the ecological inventory. Qualifications of the study team members should be outlined. Please refer to the Appendix for detailed requirements in this regard.

i) A complete literature review including relevant reports prepared for/by other agencies and consultation with local naturalists who may be familiar with the site should be part of the study.

j) Include the natural heritage planning components within the area under study, such as the following (if applicable):

- natural heritage features (woodlands, wetlands, watercourses, etc)
- adjacent sections of rivers and valleys;
- linkages and corridors to natural areas;
- information obtained from previous studies such as life science inventories;
- environmental targets and recommendations in local policy and watershed plans; and
- environmental management strategies and policies that may have been developed.

1.2 Assessment of Function

The EIS is to discuss in detail the nature and extent of ecological features and their functions on the subject site. This section should include an evaluation of components of the natural heritage system and the characteristics of the site. Identification of the key features and functions including:

- Whether the feature or function is measurable in its occurrence, and if so its significance in terms of maintaining biodiversity;
- Whether the feature or function contributed to the quality and integrity of the area;
- Whether the feature or function contributes to the identification of the area as a natural heritage feature or area or;
- Whether there is a reasonable expectation that the feature or function is sensitive to development of the type proposed.

A partial list of topics to be covered, as necessary, is provided below:

Ecological functions: are the natural processes, products or services that species and non-living environments provide or perform within or between ecosystems and landscapes. They include, but are not limited to the following:

- biodiversity (landscape, community, species and genetic levels)
- habitat (provision of food, shelter, reproduction, refuge from predators, and movement for species) for aquatic and terrestrial species
- habitat contiguity (size and shape)
- species and habitat representation and abundance
- vegetation structure, density, diversity and distribution
- connections and linkages
- proximity to other areas
- proximity to water
- hydrological functions (hydrogeology, fluvial geomorphology and hydrology)
- nutrient and energy cycling
- succession and disturbance
- reproduction and dispersal
- landscape linkages
- relationships between species and communities

Wetland Functions: (the biological, physical and socioeconomic interactions that occur in an environment because of the properties of the wetlands that are present). These may include, but not be limited to, the following:

- ground water recharge and discharge;
- water storage and release;
- flood damage reduction;
- shoreline stabilization;
- sediment trapping;
- nutrient and contaminant uptake and removal;
- food chain support;
- habitat for fish and wildlife;
- attendant social and economic benefits.

Natural Heritage Features and Landscapes:

Ecological functions and benefits include:

- Moderating climate
- Maintaining water cycles
- Providing habitat for all species
- Supplying oxygen and sequestering carbon dioxide

Benefits of importance to humans:

- Contributing to healthy and productive landscapes
- Cleaning, conveying and storing water
- Improving air quality
- Preventing erosion
- Converting and storing atmospheric carbon
- Providing natural resources and green space for human activities
- Aesthetic and quality-of-life benefit

Corridors and linkages:

Provide a discussion around the existing and potential linkages between natural heritage areas. The EIS should assess the following linkage functions of the site:

- Hydrological function (riparian areas, flood plains, valley lands, drainage areas, surface and ground water connections, recharge and discharge areas);
- Degree of connection with natural areas (proximity, distance, intervening land use, corridors) and opportunities for connections through restoration;
- Linkage along the river corridor and the effect of stormwater management proposals on these; Movement patterns of wildlife groups.

Assessment of linkages should take into account both linkage within the site and connections with other sites and include an evaluation of:

- The natural areas and habitats linked (number of sites linked and site sizes and conditions); Linkage habitat type (anthropogenic [e.g. utility corridor, hedgerow, plantation]; to natural community, river floodplain, etc);
- Main cover type quality;
- Width;

- Length;
- Continuity (e.g. long gaps >100 m, or gaps containing roads or other barriers to gaps <30 m wide containing no barriers);
- Existing wildlife use in corridors;
- Opportunities to restore or enhance cover within corridors between natural areas. Existing linkages should also consider the existing matrix and its ability to facilitate wildlife movement and how this matrix may change after the proposed development occurs. Existing linkage areas may not be located within natural areas.

1.3 Development of the Natural Heritage System

The end result of this assessment of function analysis will be the development of a natural heritage system that contains all features, functions, and connections between features. This is the Natural Heritage System that is to be protected from development. Once the natural heritage system is defined on constraints mapping, the preliminary development area will be identified. Note that the natural heritage system that is defined at this time will not include additional buffering that will likely be required to mitigate the impacts of the proposed development.

Part II – The Development Proposal

Part II will outline the proposed development, impact analysis, and recommended mitigation and/or compensation. A concept plan for the development should be provided that is respectful of the natural heritage system that has been identified in Part I. The intent of this piece of the EIS is to determine, first, whether the form of the development can be accommodated given the ecological sensitivities and natural hazards of the site. Secondly, if the development is not compatible on its own, whether mitigation and/or compensation measures could be proposed to ensure that negative effects are mitigated and that the development results in a net ecological gain. Although the development concept will be presented in the report as the final development proposal, the actual process will be *iterative* and will involve periodic revisions to the development layout as impacts are identified and mitigation is incorporated into the design.

If the impacts cannot be mitigated, then the form of development that is proposed made need to be revised in order to make the use more compatible. It is possible, however, that the area may be so ecologically sensitive that no form of development is compatible.

2.0 Evaluation of the Ecological Impacts

The following items are required for the evaluation of the effects of the proposal on the environment. Scientific literature must be consulted and cited in the body of the report to support all statements made. Although we have separated the impacts and mitigation into distinct sections below, these two pieces can be combined in the EIS report, if it makes more sense to do so.

a) Complete mapping of all resources including existing and proposed grades is required. The environmental constraints to development should be overlaid onto one map illustrating the subject site and adjacent lands so that the opportunities and constraints can be clearly identified. A current aerial photograph is ideal for this exercise. Mapping should also include an overlay of the proposed development concept onto the opportunities and constraints map. When there is a question whether there is adequate or suitable area for development, concept plans for the lots in question will be required showing building envelopes, relevant building setbacks, roads, driveways, parking, grading and location of utilities. Mapping shall be provided in paper copy and digital format compatible with the TRCA's GIS facilities, if required;

b) Map and describe the sensitivity of the features and functions to the development proposal.

c) Describe the environmental effects of the development proposal that might reasonably be expected to impact on the natural areas. This may include, but are not limited to the following:

- Direct on-site effects (i.e. direct loss of feature or habitat);
- Description of the nature, extent and duration of potential impacts to the site, adjacent lands, and potential cumulative effects;
- Impacts on areas targeted as the TRCA Terrestrial Natural Heritage System;
- Effects on surface drainage systems such as ponding, erosion, changes in volume of surface runoff, changes in water quality (e.g. temperature, suspended sediment, chlorides and other pollutants, clarity, etc.), timing and intensity of surface flow, associated impacts to natural features and functions, pre- to post-development water balance changes;
- Effects on groundwater such as reduced surface water recharge to groundwater, changes in groundwater contribution to natural features, impedance of groundwater movement, impacts to groundwater discharge areas, construction-related impacts to aquifer integrity (i.e. puncturing, dewatering requirements), groundwater contamination, and redirection of groundwater flow;
- A post-development overall water balance assessment will be required depending on the size, form, and use of the proposed development. A post-development feature-based water balance may be required for woodlots, wetlands and watercourses. The post-development scenario must be compared to the existing condition and mitigation measures will be required in order to maintain existing flow regimes on a monthly basis for both groundwater and surface water;
- A description of the municipal requirements, standards, such as setbacks that will effect the development proposal and could impact the ability to maintain appropriate buffers, etc.;
- A preliminary grading plan indicating both existing and proposed grades for services and building envelopes, including useable privacy areas, etc. It will need to be demonstrated that grading can be accommodated without impacts to natural features
- Effects on adjacent areas, including transported effects such as sedimentation;
- Effects on the key characteristics of the natural area including loss of habitat, change in habitat, edge effects and impacts to sensitive species or communities;
- Effects on connectivity, and fragmentation and isolation of habitat;
- Potential for further demand on resources;
- Cumulative effects;
- Irreversible and reversible effects;
- Immediate and long-term effects;
- Effects of occupancy (i.e. increased disturbance and indirect impact from increased access, pets, lighting, noise, encroachment, etc.).

d) Provide an explanation of the methods used to determine the effects and provide literature references in support of this, where possible.

e) Summarize the effects in table format.

2.1 Description of Mitigating Measures

The description of mitigation measures must include identification and detailed explanation of alternative options and measures that would mitigate any predicted environmental impacts. This should include modifications to development proposals to avoid effects on key features or functions, and/or methods to restore features or functions that might be impacted. Of these, avoidance is preferred. Where avoidance is not possible, a rationale should be provided along with alternative options including measures to

minimize impacts. Subsequent monitoring of effects to ensure successful implementation may be required. This section should include the following:

a) Indicate and explain as many feasible mitigating measures as possible that are relevant to the potential impacts of the proposed development.

b) Provide an analysis of buffers and setbacks that are relevant to protect the type of natural area being affected.

c) Describe in detail the mitigating measures proposed to eliminate or reduce the effects (e.g. timing restrictions, design techniques, buffers, sediment control fencing, tree hoarding, edge or buffer plantings, etc.) and include drawings or plans indicating the design details.

d) Describe any proposed compensation for those effects that cannot be mitigated and/or rehabilitation/restoration plans for areas disturbed.

e) Maps depicting the location and extent of all proposed mitigation measures, where applicable.

Please consult with the technical review team for more information on the various relevant guidelines that can provide more detailed direction on certain aspects of mitigation and restoration.

2.2 Policy and Legislative Framework

The proposed development may be subject to a number of federal, provincial, regional, or local policy or legislative requirements/restrictions relevant to the EIS. The proponent should be aware of how all applicable policy and legislation affects their property, and the EIS should detail how the proposed development meets the intent and requirements of this policy and legislative framework.

Federal legislative requirements that could apply on the property and the responsible agencies are partially listed below:

- Federal Fisheries Act (Department of Fisheries and Oceans);
- Migratory Birds Convention Act (Environment Canada);
- Navigable Waters (Transport Canada);
- Species at Risk Act (Environment Canada or Department of Fisheries and Oceans);
- Canadian Environmental Assessment Act (Canadian Environmental Assessment Agency or Responsible Authority).

Provincial and municipal legislative and policy requirements that could apply on the property, and the responsible agencies are partially listed below. In some cases, the responsible authority is the Province, however implementation and administration of the policy or legislation may be by a local authority, such as a municipality or relevant Conservation Authority, in this case the Toronto and Region Conservation Authority (TRCA):

- Provincial Policy Statement (Ministry of Municipal Affairs and Housing - municipalities and TRCA);
- Natural Heritage Reference Manual (Ontario Ministry of Natural Resources);
- Planning Act, Greenbelt Act and Plan, Oak Ridges Moraine Conservation Act and Plan (Ministry of Municipal Affairs and Housing - municipalities and TRCA);
- Official Plan Policies (local and regional municipalities)
- Endangered Species Act, Lakes and Rivers Improvement Act, Public Lands Act (Ontario Ministry of Natural Resources);
- Ontario Water Resources Act (Ontario Ministry of Environment);

- Conservation Authorities Act, Living City Policies, Terrestrial Natural Heritage System Strategy (TRCA);
- Tree Cutting Bylaws, Grading Bylaws (regional and local municipalities).

2.3 Recommendations

Recommendations should outline how the proposal can maintain or enhance ecological functions of the natural area and include the following issues:

- Should the proposal proceed as planned;
- Should the proposal be revised to reduce/eliminate effects and if so, how (proposed revisions should be illustrated conceptually on the resource mapping base);
- Mitigation and/or compensation measures required;
- Development conditions, including any recommended monitoring requirements.

It is expected that the EIS report will identify measures that *will be* taken to mitigate the effects on the natural heritage system. The proponent will be responsible for assessing the feasibility of the proposed mitigation measures and ensuring that they can be incorporated into the development proposal. Future reviews will ensure that these measures have been incorporated.

2.4 Appendices

The EIS appendices should include all relevant supplementary information such as the following:

- Literature cited;
- Field collection record, flora and fauna species lists by area and by date of inventory (see Appendix A for further detail on reporting);
- Borehole/water level reading data;
- Flow measurements;
- Water quality data sheets;
- Calculations;
- List of people contacted during the study or referenced in the report.

2.5 Executive Summary

Include a summary at the front of the report that contains a description of the proposed development, the effects of the environment and all recommendations.

Step 4: Ongoing Consultation

Interim reporting to the Technical Review Team is recommended so that the consulting team and the Technical Review Team can maintain an ongoing dialogue throughout the process and the Terms of Reference can be adapted as warranted.

Step 5: Review of EIS by the Technical Review Team

The EIS is submitted to the Technical Review Team for review. If the report is not acceptable it will be sent back to the consulting team for further work with comments from the Technical Review Team. The Technical Review Team will indicate when the EIS documents are satisfactory for content, clarity and completeness. At that time the municipality can accept and process the development application, taking

into consideration the final recommendations of the Technical Review Team for the EIS, or reject the application.

Step 6: Monitoring

The purpose of monitoring is to measure effects over time. Monitoring will enable planning agencies, through development agreements, to require subsequent changes to site conditions if the environmental effects are found to exceed predicted effects or targets, or if there are identifiable negative effects. Monitoring the environmental effects of developments also provides well-documented, local examples of best management practices for particular types of development and particular types of features or functions.

Where mitigation is achieved through avoidance of negative impacts, a simplified monitoring plan to ascertain the success of the project is all that may be required. In these situations, the predicted net effects after mitigation may be negligible, and only the assumptions need to be tested. However, where mitigation is achieved by methods or measures to minimize but not to eliminate environmental effects, the predicted net effects after mitigation will be described and a monitoring plan designed to measure those effects may be required.

The Natural Heritage Reference Manual produced by the Ministry of Natural Resources (MNR) states that monitoring may be required where:

- The large scale of a development or the sensitivity of the key functions are such that effects may be difficult to predict and/or are relatively untested or unproven in the field;
- The mitigation technology proposed is not proven in Ontario;
- There are some long-term operations associated with a development that could facilitate some future or ongoing refinement to the mitigation strategy.

Depending on specific circumstances, monitoring may be required in pre-construction, construction/operation and post construction periods. Details of the monitoring program will be specific to the development proposal and will be determined through the review of the development application and the EIS. Monitoring may be conducted by the proponent or can be completed by TRCA using cash-in-lieu funding from the proponent.

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APPENDIX A

Data Collection Standards for the Inventory of Natural Heritage Components for an EIS

DATA COLLECTION STANDARDS FOR THE INVENTORY OF NATURAL HERITAGE COMPONENTS FOR AN EIS

GUIDING PRINCIPLE

Knowledge about the features and function of natural areas is considered central to the assessment of the potential impacts of development.

BACKGROUND

A natural area is characterized by natural features and by ecological functions, and these are inter-connected. They form the basis for assessing the effects of a proposed development on an area and its adjacent lands. Establishment of "significance" (as in "significant woodland" in the Provincial Policy Statement) may be less clear until comparative evaluations are undertaken. Data from Ontario indicates that in landscapes with less than 30% natural cover, such as that within the TRCA jurisdiction, all natural heritage features are important to regional biodiversity and watershed function. Comparative evaluations require extensive knowledge of regional ecosystems. Similar comparisons will be more difficult in isolated studies such as a site-specific EIS unless regional information is available.

Watershed and sub-watershed studies establish a good baseline of information from which comparative evaluations can be made. The intention of data collection standards is to ensure that all new information collected for various studies, including an EIS, uses a similar approach and format so that it may be entered into regional databases and compared with existing information. The size of the study area should not affect the ability to make comparative evaluations.

The initial consultation between the proponent and the Technical Review Team will establish whether a principle for development is acceptable, or unacceptable because of the high probability of negative impacts on natural heritage features. The Technical Review Team will make recommendations on the level of effort required to address the potential for impacts, and the specific elements of study that will be required for the EIS based on our understanding of the environment. The specific elements required for the EIS will be selected from a detailed list. Not all elements will need to be studied for each EIS.

Specific requirements for the natural heritage inventory and analysis of an EIS will vary depending on the size, type, location of the development and the natural feature that may experience negative impacts. The following guidelines indicate the features and level of information that may be required.

BIOPHYSICAL INVENTORIES

Reporting on Aquatic and Terrestrial Species of Conservation Concern

Global, national, provincial, regional and local significance should be assessed from the best available information, including the following:

- COSEWIC status reports, or Federal Species at Risk listings;
- MNR species at risk in Ontario, COSSARO lists;
- Natural Heritage Information Centre (NHIC) website for G-ranks and S-ranks for various groups should be assessed based on the best available information including provincial atlases and county lists;
- Local status for terrestrial species should be determined using TRCA species of conservation concern lists.

Vegetation Communities Survey and Reporting

A survey of vegetation community types should be undertaken during the main growing season, preferably over three seasons (spring, summer and fall), but otherwise during the period late May to July. Community description outlines may be qualitative, but should follow the Ecological Land Classification for southern Ontario (Lee et al., 1998) to Vegetation Community Type, or contain an equivalent or greater level of structural and floristic detail. The report should present both a description of the communities and vegetation maps superimposed preferably on an air photo or a base map of scale no greater than 1:10,000 that shows contours and watercourses and the location of natural heritage features.

All vegetation communities that are considered to be of conservation concern by TRCA and MNR should be highlighted. Please refer to vegetation community scoring documents available from TRCA.

For each community type the following technical information should be included:

i) An assessment of soil type(s), drainage regime and moisture regime.
ii) An identification, where possible, of the Ecological Land Classification unit (Lee et al., 1998).
iii) The element ranking for each ELC community types identified (Bakowsky, 1997) and local vegetation community ranks, as determined by TRCA, and the location of all L1-L3 communities.
iv) Calculation of the following floristic quality indicators (Oldham et al. 1996) by community: number of native species, number of non-native species, number of conservative species (conservatism coefficient >=7), mean conservatism coefficient and sum of weediness scores.
v) A summary of tree species, with age and/or size class distribution, including basal area by size class and proportion of tree species within size classes.
vi) A summary of disturbance factors, including their intensity and extent as in ELC disturbance card (Lee et al., 1998).
vii) Other indications of community condition including amount of structural diversity, including snags, downed logs, cavity trees and decay levels (according to Stabb, 1996).
viii) Where appropriate, community profile diagrams showing the relationship between the vegetation communities and topographic features.

Vascular Plants Survey and Reporting

As surveyors traverse each vegetation community polygon, a complete list of all vascular plants observed on the site should be assembled.

Locations of globally, nationally, provincially, regionally and locally rare vascular plant species should be mapped and overlaid on an orthophoto base that also includes the ELC vegetation communities and their associated ELC codes. The extent of habitat for each species of conservation concern should be outlined. Annotations on the population size, condition, and the significance of the site for all species of concern should be included in the EIS. Recommendations should be made for additional protection that is required for each species of concern.

Nationally rare species are listed on the Federal Species at Risk website.

Provincially rare species are listed on the NHIC website. You may also refer to the Draft MNR document entitled *Distribution and status of Vascular Plants of the GTA* (2000) for Provincial status.

Local status (L ranks) of species of conservation concern should be assessed based on lists provided by the TRCA. Location of species with local ranks of L1-L3 should be indicated and the extent of habitat supporting these species should be mapped. In areas where the surrounding landuse matrix is predominately urban, L4 species should also be included and mapped. A list of local ranks for flora species is available from TRCA.

Reporting:

Flora species of concern should be identified as numbered points on constraints mapping. The following information must be included in the report regarding flora surveys:

1. Names of surveyors and qualifications;
2. Date of the survey;
3. The global, national, provincial, regional, and local priority ranks for each species;
4. Species observed by scientific name or NHIC code. Reporting should cross-reference each plant species back to the appropriate vegetation communities as through ELC data collection (as outlined above);
5. Population size (categories of "1-2"; "3-5", "6-20"; "21-50"; "51-100"; "over 100");
6. Whether the species was planted;
7. Geo-referenced digital data should be provided using UTM Zone 17 NAD83 ESRI Native File data (shapefiles).

Wildlife Surveys and Reporting

Habitat, den sites, nesting, breeding, migratory stopover, spawning, nursery, overwintering areas and other locations should be mapped for fauna that are sensitive to impacts associated with the development proposal, where appropriate. This will typically include all species with local ranks of L1, L2, and L3. Species of concern within urban areas (L4) are mapped generally within urban boundaries and up to a 2km distance outside of the urbanized area.

Other wildlife functions should be identified and assessed, and, where possible, mapped. Wildlife functions include, but are not limited to, waterfowl staging areas, fish spawning or nursery habitat, hepetofaunal breeding or hibernacula areas, wintering grounds, areas that provide temporary shelter or feeding areas for migratory wildlife, areas that provide critical life cycle habitat, and wildlife corridors.

Weather conditions can be deemed unfavourable when it affects the behaviour of the target species or when it negatively affects the effectiveness of the surveyor. The assessment of appropriate weather conditions for conducting a survey relies on the surveyor's own expertise, but some guidance is provided below.

While some taxa are often difficult to survey correctly, we have provided the preferred approach to surveying each taxonomic group below. The requirement to survey which of these groups will be established through the scoping exercise at the commencement of the EIS process. Please also refer to Table 3 which outlines the requirements for surveying fauna.

Breeding Bird Surveys

Survey Protocol:

A survey of breeding birds should be carried out between May and July following the Ontario Breeding Bird Atlas Protocol (2001). A minimum of 2 visits to the site is required to occur at least 15 days apart during the breeding season (early June to mid-July). All initial visits are to be completed by the end of the third week of June. Breeding bird surveys start at half an hour before sunrise and continue to about midday. For several songbird species the maximum song period will be from shortly after dawn to mid-morning, but other species are likely to continue singing, at least intermittently, into the early afternoon. A qualified person must carry out the survey.

Tape-Playback:

The use of tape-playback within the course of the bird surveys is standardized for the duration of playback and the target species. The more important of these two standardized elements is the choice of species targeted by playback. The selection has been based on:

- those species that tend not to voluntarily self-advertise
- the likelihood of eliciting a response to playback of that species' song or call.

The following is a list of species that should be sought using tape-playback at sites where the species has not already been reported:

Table 1: Selected Species for tape playback

1.	sharp-shinned hawk	11.	pied-billed grebe
2.	Cooper's hawk	12.	least bittern
3.	broad-winged hawk	13.	American bittern
4.	red-shouldered hawk	14.	Virginia rail
5.	Northern goshawk	15.	sora
6.	whip-poor-will	16.	American coot
7.	northern saw-whet owl	17.	common moorhen
8.	eastern screech-owl	18.	yellow-billed cuckoo
9.	long-eared owl	19.	black-billed cuckoo
10.	barred owl	20.	scarlet tanager

When using tape-playback for hawks and owls a strict sequence is adhered to for the order of playback: smaller species must be played first, with the larger species played last in the sequence. The correct order within each suite of species (hawks and owls) is as shown in the list above (species numbered 1. to 5. and 7. to 10.).

The situation in which to use playback is left to the judgement and skill of the biologist, who should be able to identify the optimal habitat for each of the species in the list above. However, it is important not to bias the use of playback to particular sites: once optimal habitat has been identified then playback should be conducted wherever such habitat occurs throughout the region. A 1-minute duration for play-back at reasonable volume should suffice to elicit a response from any bird that is likely to respond. Once a response has been elicited and identification has been confirmed the playback should cease.

Tape-playback is also used to re-locate individuals during the second round of visits. In most instances this should be unnecessary, but for species that have a very sparse distribution within the TRCA jurisdiction such a process may provide the surveyor with the only opportunity to confirm the species as a breeding species for that site.

Breeding Codes for Birds and Amphibians:

Breeding codes are derived as follows (as per Ontario Breeding Bird Atlas, 2001):

1. Breeding – Possible (PO):

   H = species observed in its breeding season in suitable nesting habitat
   S = singing male present, or breeding calls heard, in suitable nesting habitat in breeding season.

   Note that two consecutive "possible" records ("S" or "H") – separated by at least a week – will be upgraded to a "probable" record (reflecting the presence of a persisting territory, "T"). Note that

the second site visit must be made some time after the end of the 3rd week of June in order for breeding status to be upgraded. Site visits made in early to mid-June are likely to encounter migrants that may be designated by the previous two codes ("H" or "S") but these individuals will have moved on by the time of the repeat site-visits and thus will not be incorrectly identified as probable breeders.

2. Breeding – Probable (PR):

   P = pair observed in suitable nesting habitat in nesting season
   T = permanent territory presumed through the registration of territorial behaviour on at least two dates, a week or more apart, at the same location.
   D = courtship or display, including interaction between a male and a female or two males, including courtship feeding or copulation.
   V = visiting probable nest site.
   A = agitated behaviour or anxiety calls of an adult
   N = nest-building or excavation of a nest-hole

3. Breeding – Confirmed (CO):

   DD = distraction display or injury feigning
   NU = used nest or egg shells found (occupied or within the period of the survey).
   FY = downy young (nidifugous species), including those incapable of sustained flight. In the case of frogs, new froglets are observed.
   AE = adult leaving or entering nest site in circumstances indicating occupied nest; the parent bird is seen to enter and remain at nest (as opposed to the code "V").
   FS = adult carrying fecal sac
   CF = adult carrying food for young
   NE = nest containing eggs; for frogs, egg masses observed
   NY = nest with young seen or heard; for frogs, tadpoles present

Reporting:

The following technical information should be included in the report:

1. Number, date, time, and weather conditions during surveys;
2. Names of surveyors and qualifications;
3. A full list of bird species present and on-site abundance;
4. The global, national, provincial, regional, and local priority ranks for each species;
5. The location of each species of conservation concern mapped to the appropriate vegetation communities;
6. An annotated assessment of confirmed, probable or possible breeding birds (based on breeding codes) and the number of territories;
7. Geo-referenced digital data should be provided using UTM Zone 17 NAD83 ESRI Native File data (shapefiles).

Amphibian Surveys

Survey Protocol:

A salamander survey may be required given the habitat conditions of the site. However, only MNR and/or TRCA staff will be permitted to conduct salamander surveys. Please consult with agency staff for further detail.

A frog and toad survey should be carried out according to either the Marsh Monitoring Protocol or the North American Amphibian Protocol. Three surveys should be conducted in spring at least 15 days apart in order to capture the full range of possible amphibians using the site. The first survey should generally occur between April 15-30, the second between May 15-30 and the third survey should occur between June 15-30. Early breeding species include chorus frog, spring peeper and wood frog. Peak calling activity for these species is very temperature dependent as illustrated in Table: 2; visits can be made throughout April when the appropriate temperature is reached. Surveys are started ½ hour after sunset.

During the course of the frog surveys in early spring, the surveyor should record all other breeding fauna sightings. For this purpose, surveyors should follow the tape-playback protocol outlined above under breeding bird surveys.

Table 2: Peak Breeding Times for Amphibians

	Early Breeders	Middle Breeders	Late Breeders
Times	mid Apr. To mid May	mid May to mid June	mid June to late July
Nighttime Air Temperature	greater than 5^0C	greater than 10^0C	greater than 17^0C

Early Breeders: Wood Frog, Chorus Frog, Spring Peeper, Northern Leopard Frog
Middle Breeders: American Toad, Northern Leopard Frog, Grey Treefrog
Late Breeders: Green Frog, Bullfrog

Population abundance should be reported using the following call codes. Both call codes and abundance estimates should be reported (ex. Code 2, 5 individuals).

- Code 1 – indicates that there are only a few frogs present and their calls tend not to overlap
- Code 2 – more frogs calling and are starting to overlap
- Code 3 – full chorus, number of individuals is impossible to accurately estimate

See Breeding Codes section under Bird Surveys for amphibian breeding codes.

Reporting:

The following information is required to be reported:

1. Date and time of each survey;
2. Names of surveyors and qualifications;
3. A description of local weather conditions, including wind (use Beaufort scale), cloud cover, air temperature, and precipitation;
4. List of all species recorded and include the call codes, abundance codes and breeding codes;
5. Priority ranks for all species, including TRCA local ranks;
6. Map the location of all frogs and toads on aerial photos;
7. Geo-referenced digital data should be provided using UTM Zone 17 NAD83 ESRI Native File data (shapefiles).

Incidental Observations:

Unless evidence of breeding exists, overwintering, migrating, loafing, foraging, and feeding species should be recorded as incidental observations. Although these species may not be breeding on-site, recording their presence on the site is important as they are utilizing the habitat to complete their life cycle.

Aquatic communities and habitats survey and Reporting

A survey of aquatic communities and habitats should be completed at the most appropriate times for sampling various species over the course of a year. Aquatic surveys must follow the Ontario Stream Assessment Protocol. A scientific collector's permit must be obtained from MNR for most surveys. The following technical information may include, but is not limited to the following:

Fisheries and Habitat Inventory

The following techniques can be employed to collect fisheries information: Electrofishing, Seines, Minnow Traps and Dip Nets.

The preferred method for conducting fisheries inventories in wadable streams is the method outlined in the Ontario Stream Assessment Protocol (OSAP). The Site Identification Form, Site Features Form and the Fish Sampling Form must be fully completed at a minimum. All fisheries information must be forwarded to MNR and TRCA.

Electrofishing must be conducted in wadable streams and should employ the single-pass method with block nets. In non-wadable sections of streams, seines, gill nets, or boat electrofishing should be employed if possible. Additional supplementary sampling can include gill nets, angling, minnow traps and dip netting to identify the presence of species.

For wetland habitats a variety of methods should be employed in the various habitat types. Spawning surveys may be required to determine areas of spawning activity.

Fish Habitat Assessment and Stream Analysis

Habitat information would ideally be collected using the OSAP protocols, however if other methods are employed, the following information should be included:

- The identification of in-stream barriers to fish passage
- channel morphology measurements
- bank undercuts
- point source impacts
- base flow (water velocity, stream order, discharge, water depth, stream width, bankfull width and morphology)
- water chemistry (dissolved oxygen, temperature, pH, conductivity, water colour and clarity)
- substrates (texture, presence of aquatic vegetation, odours/discolouration of the sediments)
- in-stream riparian cover (presence and extent) and shading
- critical habitats (spawning, nursery or rearing grounds)
- groundwater discharge and upwellings (e.g. presence of watercress or iron floc)
- surrounding land uses
- other measurements that indicate the quality of the habitat such as entrenchment, erosion,
- degradation, debris, barriers, sources of pollution, etc.
- rehabilitation opportunities

Fish Community and Habitat Assessment Requirements for Headwater Drainage Features

For smaller order streams which may be considered to be headwater drainage features please utilize the latest version of the Evaluation, Classification and Management of Headwater Drainage Features Guidelines.

Reporting:

The following information should be collected in the fish and fish habitat surveys and included in the report:

1. Date and time of each survey;
2. Names of surveyors and qualifications;
3. List and abundance of all species recorded;
4. Status of any species of conservation concern;
5. Locations and abundance of any observed spawning redds and relevant species;
6. A description of aquatic sensitivities and critical habitats;
7. Length of surveyed site and an indication of the catch per unit effort;
8. Survey methodology employed;
9. A description and analysis of the existing habitat and any restoration or enhancement opportunities;
10. All fisheries sampling locations should be geo-referenced, and digital data should be provided using UTM Zone 17 NAD83 ESRI Native File data (shapefiles).

Benthic Survey

The Benthic Surveys should follow a defined protocol, preferably the Traveling Kick and Sweep Technique across defined transects as outlined in OSAP. However, the Ontario Benthic Biomonitoring Network protocols are also acceptable. Specific targeted sampling will need to be conducted to properly assess the numbers and species of crayfish present at a given site. Unknown specimens may need to be preserved. It is also critical to identify crayfish to a species level to identify Alien Invasive Species.

Samples are collected using a traveling kick and sweep-transect method (OMNR, 2005). This method maximizes reproducibility between years and provides a more complete community assessment as sampling is conducted in all stream microhabitats (e.g. riffles, pools, glides). In brief, sampling is carried out along a number of transects established across the entire stream width and perpendicular to the flow. The number of transects is determined by the minimum stream width measured at the site with narrower streams requiring a larger number of transects. Starting at the transect furthest downstream, the sample is collected in a 500 micron mesh screen D-net by kicking the stream bottom with the flow forcing the disturbed stream material (with invertebrates) into the net. This process is continued across the entire transect, moving upstream along the stream margins to the next transect until all transects have been sampled. The sample is a composite of all transects with a minimum of 300 invertebrates identified to the lowest practical level (i.e. typically genus or species).

Detailed Procedure:

a) Site definition

To define a site, locate a riffle that can also be recognized as a "cross-over" point in the stream; that is, an area where the banks on either side of the stream are level with each other AND the flow is fastest in the middle of the stream (for more detail see OMNR, 2005). This starting point (*i.e.* riffle/cross-over) will mark the downstream limit of the site. Next, walk upstream at least 40m. Continue walking until another

cross-over is found. In practice, another cross-over may not be found for some distance past the 40m point. If this distance is prohibitive to getting sampling done, simply return to the 40m mark, again walk upstream and locate the nearest riffle (Important: not all riffles are cross-overs). The upstream limit will be this second cross-over and/or next riffle upstream of the 40m mark.

b) Transects: Number and spacing

Once the sampling site has been defined with an upstream and downstream marker, measure the distance between the markers by following the path of the stream (ideally, with minimal impact, along the center of the channel). This measurement is called the site length. Then, find and measure the minimum stream width within the site to determine the number of transects to be sampled (see table below).

Stream width (m)	Number of Transects
> 3	10
1.5 - 3.0	12
1.0 - 1.5	15
< 1.0	20

To determine the longitudinal spacing of the transects, simply divide the length of the site by the number of transects required minus one (*i.e.* transect spacing = site length / (# of transects - 1))
This spacing must now be measured down the center of the stream from one transect to the next beginning from the first downstream marker. Each transect is set up perpendicular to the stream. It helps to have someone on the banks of the stream marking out transects using flagging tape as people in the stream are measuring the spacing.

c) Sample collection

Avoid walking in the stream as much as possible except along the prescribed transects. Also note that benthic invertebrates are not collected at a site that has been electro-shocked within the previous two weeks. Invertebrate sampling is carried out as follows:

1. One person with the D-net (500 micron) enters the stream (on the left bank, looking upstream) at the first transect/marker. The D-net is positioned so that the current is flowing into the net.
2. If sampling in pairs (recommended), another person stands slightly upstream of the D-net.
3. The surface of the substrate, upstream of the D-net, is disturbed to a depth of no more than 5 cm for several seconds to dislodge any invertebrates present. This is accomplished by shuffling your feet back and forth across the stream bottom. The D-net is placed firmly on the bottom of the stream-bed ensuring no invertebrates can pass underneath.
4. In slower moving streams/habitats, it may be necessary to move the D-net through the water towards the area where the substrate was disturbed but ensuring no material becomes dislodged from the D-net.
5. Capture only the material that is "kicked" from the stream bottom and moving downstream (this helps to reduce the amount of material collected, which can become large). It may be necessary to periodically use the Dnet as a sieve in the stream to prevent clogging. Continue to kick and sweep the substrate along the entire length of the transect by moving slowly across the stream.
6. In some instances, the stream site will be very wide (greater than 10m). In these cases, use "point-sampling" along the established transects within the site. At these points, carry out the kick and sweep technique at equal distances along the transect. As a rule of thumb, try to space each point approximately 1m from each other.

7. Unembedded rocks or logs are picked up and carefully brushed/scraped to dislodge any invertebrates from their surface.
8. Once the first transect has been sampled, walk upstream along the right bank to the second transect and again begin the same process, continuing until all transects have been sampled. Again, use alternating banks to walk up and then across in order to get to the next transect.

d) Sample Sorting and Preserving

Once the sample has been collected in the D-net; set up on the stream bank to preserve the sample. Initially remove all large rocks and wood debris from the net after rinsing them down with a water bottle over top of the D-net to ensure that all invertebrates are captured. Once completed, use the water bottle to rinse down the sides of the D-net to ensure all the material and invertebrates are at the bottom of the D-net. Transfer all of the collected material from the D-net to 1 (or more) 1 liter containers to no more than 2/3 full (use your fingers to pack the material, if necessary). Once emptied, re-examine the D-net for any remaining invertebrates and left over material and add to the container (a pair of tweezers may help). Add 10% buffered formalin to the container to no more than ¾ full. Seal the container tightly (with tape) and gently invert to ensure all the sample gets mixed with the preservative. Each container is labeled with a stream name, site code, the number of sample jars taken (1 of x), the date, and the kind of preserving agent used. Place a label on the lid of the jar and on the jar itself. As a preservative, 80% ethanol can be used in place of 10% buffered formalin. However, in cases where detailed taxonomy is required, particularly on Oligochaetes (aquatic worms), formalin must be used. If buffered formalin is used, replace it with alcohol after a couple of days to prevent hard body parts (e.g., clam and snail shells) from dissolving.

Reporting:

The following information should be provided for benthic surveys. The absolute minimum for taxonomic resolution is "Major Groups" (i.e. order/family), however identification to genus and/or species (where possible) is typically required. A qualified taxonomist should undertake the identification. TRCA are able to accommodate "lowest practical level" (*i.e.* genus/species) taxonomy and this level of detail is encouraged as it will afford greater opportunity to detect more specific impacts.

1. Date and time of each survey;
2. Names of surveyors, qualifications, and contact information;
3. Stream name;
4. All benthic sampling locations should be geo-referenced, and digital data should be provided using UTM Zone 17 NAD83 ESRI Native File data (shapefiles). *Note: Record these geodata from the first transect (i.e. furthest downstream) where the collection is taken. If the planned benthos collection is from habitats other than wadeable streams, collection technique must be reviewed by TRCA technical staff and habitat type must be recorded.*
5. Site Length (m), number of transects, and transect spacing (m);
6. Collection method used;
7. Sample Size - total (mL or gm). Sample Size – not picked (mL or gm). Minimum number of individuals in a given sample can be 100+, however 300+ is recommended;
8. Taxonomist Name(s) and contact information (phone, email, address, affiliation);
9. Taxonomy according to the following table:

Freshwater Mussels

In general because freshwater mussels lack motility and are often found below the substrate surface, special attention needs to be paid to their presence at a given location. Particular attention should be

paid to smaller sized species that are less obvious and are not identified as readily in timed searches and require more intensive quadrat surveys.

Surveys should be conducted during summer low flow conditions from July-September when there has been a minimum of two days without rain, and when there is a maximum visibility of the stream bottom. Mussel surveys should be conducted in areas where there are plans for physical alteration to the stream bed, where dewatering is proposed, where significant sediment accumulation may occur or where there are significant changes to water velocity. Surveys should also be conducted in the area immediately downstream of the impact site for a minimum distance of 100m. As freshwater mussel beds are federally protected and individuals may need to be relocated upstream from the impact site to protect them from harm. Where SARA listed species are located special permits from DFO will need to be obtained to allow for the collection and transport of individuals.

It is recommended that both qualitative and quantitative search methods be employed;

Qualitative Methods:
Shoreline Searches for Shells
Snorkeling

Quantitative Methods:
Visual or Tactile Searches within quadrats or along transect lines. See Strayer and Smith (2003) for sample design.

1) Timed Surveys – 4.5 Man Hours for the survey site.
2) Quadrats – A systematic sampling design using $1m^2$ quadrat

Reporting:

The following information should be collected in the surveys and included in the report:

1. Species Present;
2. Status of species present;
3. Mussel Densities by Species;
4. Size of Individuals;
5. Substrate type;
6. Water depth;
7. Velocity of flow;
8. Clarity (NTU's);
9. Live Mussel Beds, Dead Shells;
10. Geo-referenced digital data should be provided using UTM Zone 17 NAD83 ESRI Native File data (shapefiles).

Data Collection Summary Table

Table 4: Summary of Guidelines for Field Data Collection. A description of methods should be included in appendices

Feature		Optimal Inventory Period	Secondary Source	Scoped Field Inventory	Detailed Field Inventory
Soil types by texture/grain size and drainage characteristics			●	●	May require hydraulic conductivity to assess infiltration
Overburden and bedrock geology			●		Borehole data
Areas of high water table			●	●	Borehole data
Areas of groundwater recharge and discharge			●		●
Inventory of existing man-made features and archaeological potential			●	●	
Locations and usage of wells			●	●	
Drainage patterns, basin boundaries and watercourses			●	●	Include identification of intermittent and ephemeral streams
Existing erosion sites			●	●	
Areas of shallow soil			●	●	
Description of ecological communities (ELC)		Mid-April to Mid-May for Deciduous Woodland (ephemerals), otherwise June to September	Acceptable if completed within the previous 5 years	Using ELC (include limits of the unit beyond subject lands), classified to community series. Identify corridors and potential linkages.	Using ELC, classified to vegetation type
Assessment of condition of vegetation communities with reference to successional state, degree of disturbance, and extent of invasive species		May to October		●	●
Location of wildlife species and their habitats					
	Birds	**Breeding birds:** twice between May 24 to July 10 Between dawn and 5 hours after dawn **Migrants and over wintering birds**: site specific	●		Using Ontario Breeding Bird Atlas protocols
	Fish Survey	Late April to October	●		Using Ontario Stream Assessment Protocol and/or the Evaluation, Classification and Management of Headwater Drainage Features Guidelines

	Fish habitat	In snow/ice-free conditions	●	Observations (mapping) should include the following: flow, channel form, riparian characteristics, anthropogenic and other disturbances, enhancement opportunities, substrate, instream habitat features and structures.	Using Ontario Stream Assessment Protocol, if applicable and/or the Evaluation, Classification and Management of Headwater Drainage Features Guidelines
	Benthos	Spring or fall	●		Using Ontario Stream Assessment Protocol, Ontario Benthos Biomonitoring Network Protocol
	Mussels	July to September, min. 2 days without rain	●		Qualitative and Quantitative (using Strayer and Smith, 2003)
	Mammals	Species dependent	●		Sightings and tracking
	Flora	Site specific: Spring ephemerals– mid-April to mid-May; Woodland Sedges-mid-May to early July; forbs-June to October	●		Botanical inventory
	Amphibians	Early spring – summer (species dependent)	●		Marsh Monitoring Protocol
	Reptiles	April – June	●		●
Location of subject lands in relation to components of the Natural Heritage System			●	●	
Locally, Regionally, and Provincially significant areas			●	●	
Ecologically functional natural linkages and potential linkages				●	●
Other natural features and functions (migration routes, deer yards, snake hibernacula etc)				●	●
Other development applications known to be in progress in the area that would affect the natural heritage				●	●

APPENDIX B

TRCA'S MASTER ENVIRONMENTAL SERVICING PLAN GUIDELINE

(DATED MARCH 2015)

TRCA Master Environmental Servicing Plan Guideline
March 2015

Master Environmental Servicing Plans (MESPs) are generally required by municipalities to support new blocks of development, or comprehensive re-development, within a secondary plan area. TRCA is responsible for technical clearance of MESPs in accordance with its roles as a conservation authority (CA): CAs are public commenting bodies under the *Planning Act* and *Environmental Assessment Act* (and represent the Provincial interest for natural hazards – s.3.1 of the Provincial Policy Statement), service providers to municipalities as outlined in Memorandums of Understanding, resource management agencies, and regulators under the *Conservation Authorities Act*. In concert with the municipality, TRCA reviews both the terms of reference for MESPs, and MESPs themselves, to ensure that the inter-connected matters of water management, natural hazards and natural heritage are adequately addressed.

This guideline outlines the components of an MESP that are to be completed to TRCA's satisfaction prior to municipal approval. An MESP is procured by the municipality, and its Terms of Reference developed in consultation with the municipality and TRCA. The Terms of Reference should then be approved by the municipality prior to the proponent's commencement of the MESP.

Although there may be some overlap, the following study components are separate from any of the municipality's MESP requirements. They are generic and are to be refined in consultation with TRCA and the municipality for each individual MESP. Indeed, field work and data gathering may reveal that additional items to those in this list should be studied. It should also be noted that the prior completion of a Subwatershed Study for the MESP study area may not require the same level of detail outlined below in the "Phase 1" items, if these items have already been satisfactorily addressed in the subwatershed study.

In all cases, pre-consultation with the municipality and TRCA is important to clarify and confirm the MESP study components, with a view to streamlining and shortening the review process.

The following are required for TRCA's review of an MESP:

Executive Summary

- A description of why the MESP is being completed and how it relates to the broader planning process, as well as any applicable master planning or environmental assessment processes for the area;
- Key findings of the MESP, including a high-level summary of how the subject areas/disciplines of the MESP are integrated, i.e., describe how the different components of the Natural System within the study area rely on or affect one another (to be described in more detail in the latter part of Phase 1), and a list of studies to be completed at future stages in the planning process.

Planning Context, Project Timelines and Phasing

- Study Area – map of area under study in a watershed context with property boundaries of participating and non-participating landowners identified.
- Purpose – the general development concept for the subject area.
- Planning Background – summary of directions from existing legislation, policies, and designations affecting the subject area; previous approvals; planning stage and status of the proposal and approvals required; timing of phases of approval and construction.

PHASE 1 - Characterization of the Natural System

Existing Studies and Projects affecting the study area, e.g., watershed plans, subwatershed studies, ecological or hydrological monitoring programs, fish management plans, natural heritage inventories or strategies, flooding and erosion remediation projects, etc.

Baseline Monitoring Plan - Minimum period of 1 to 3 years of continuous monitoring; consult with TRCA staff for appropriate duration and locations of monitoring stations.

Monitoring locations and parameters should provide the appropriate baseline data necessary to characterize the Natural System as outlined in 1A. to 1E. below. Monitoring locations should be strategic in terms of choosing areas that may be affected by the proposed development; this will facilitate completion of more detailed analysis or modelling in Phase 2 of the MESP and in future planning stages.

1A. Surface Water

- Watershed Hydrology
  - Identify available hydrologic information (i.e. TRCA Hydrology Reports/Models)
  - In accordance with provincial and municipal requirements and TRCA's Stormwater Management Criteria document, define applicable stormwater management criteria (unit flow rates, Regional Storm control, water quality, erosion control and *water balance*) for the subject area. *For water balance, see Section 1E. of this MESP Guideline*.
  - Assess watershed, sub-watershed, catchment location and size
  - Provide location mapping for the subject lands in a watershed context
  - Confirm, and refine as required, TRCA's assumptions for hydrologic and hydraulic modeling
  - Based on results above, update TRCA's model and re-confirm stormwater management quantity control requirements.
- Flood Plain Mapping/Hydraulics
  - Review TRCA's existing flood plain mapping, and identify areas of additional mapping requirements.
  - If required (based on hydrology requirements, and review of existing flood plain mapping) complete and/or update flood plain mapping (scope of work shall be defined by TRCA).

1B. Erosion

- Fluvial Geomorphology
  - Complete a detailed Erosion Assessment, as described in TRCA's Stormwater Management Criteria document; establish the required level of stormwater management (SWM) erosion control, including release rates, and volume control requirements (as established in the water balance analysis noted below).
- Geotechnical
  - Mapping and cross-sections of steep, or long, or unstable slopes in valley corridors (see TRCA Geotechnical Guideline) that may warrant geotechnical analysis for erosion hazards, including top of slope and toe of slope erosion.

1C. Groundwater

- Hydrogeological Investigations (see Conservation Authority Guidelines for Hydrogeological Assessment Submissions, Conservation Ontario, June 2013)
  - Existing groundwater levels, flow direction and gradients
  - Aquifer extents (vertical and horizontal) and vulnerability

- Identification of major groundwater resources and groundwater users in the area
- Identification of vulnerable aquifer(s) and areas of flowing artesian conditions that could affect underground infrastructure and foundation designs (borehole depths should be aligned with anticipated depth of construction/excavation)

1D. Natural Heritage

- Natural Feature Identification
  - Identify valley and stream corridors, woodlands, wetlands, watercourses and headwater drainage features (see TRCA's Evaluation, Classification and Management of Headwater Drainage Features Guidelines, for identifying HDFs)
  - Identify aquatic habitat and management objectives from the Fisheries Management Plan or other documents that may contain aquatic management objectives for the watershed
  - Identify existing vegetation communities (ELC)
  - Conduct flora/fauna species inventory using accepted protocols and seasonal sensitivities
  - Identify species or communities of conservation concern as per the TRCA rankings
  - Identify areas that have federal and/or provincial designations such as federally designated aquatic species, provincially significant wetlands (PSWs), Areas of Natural and Scientific Interest (ANSIs), significant wildlife habitat and endangered species, etc.
  - Identify the natural heritage system for the subject lands and document sensitivities to changes in land uses. This includes the identification of the habitats that support species that have designations under the *Endangered Species Act* or the *Species At Risk Act*; and provincially significant areas under the Provincial Policy Statement (2014) such as valley lands, woodlands, wildlife habitat and wetlands (PSWs). In addition, the natural heritage system will include species and communities of concern as ranked by TRCA, as well as Locally Significant Features and Areas pursuant to applicable municipal and TRCA policies.
  - Arrange for staking of all natural features with TRCA and the municipality (and MNRF if PSWs or ANSIs).
  - Provide a survey copy of the staked lines stamped by an Ontario Land Surveyor
- Enhancement Areas/Buffering
  - Identify minimum buffers for natural features and natural hazards (flooding and erosion) required by any applicable provincial plans, municipal policies and/or TRCA policies.
  - Identify restoration/enhancement opportunities using municipal official plan mapping and policies, TRCA's Terrestrial Natural Heritage System Strategy, and the applicable watershed plan(s).

1E. Water Balance

- Identification of groundwater recharge and discharge zones, using Section 6.0 and Appendix C of the TRCA SWM Criteria document
- Identification of surface and groundwater contributions to natural features (wetlands, woodlands, watercourses and headwater drainage features) and existing hydroperiods, using Section 6.0 and Appendix D of the TRCA SWM Criteria document
- Prepare an overall water balance analysis for the study area on the basis of local surface drainage, groundwater conditions, soil, and existing land use characteristics using Appendix D of the TRCA SWM Criteria document.

- Set targets to meet the hydroperiods for specific natural features and determine the targets for meeting overall site water balance for groundwater recharge and specific contributions to maintain the hydroperiod of specific features.

Conclusions
In table/matrix form, draw conclusions from all of the information obtained in Sections 1A. to 1E. that explain how all of the elements are interconnected, by:

- providing a summary of the overall SWM criteria for quantity, quality, erosion and water balance;
- identifying the extent of natural hazards (flooding and erosion), and the extent of natural features and enhancement areas/buffers for inclusion within the Natural System (the non-developable area);
- List the criteria, targets, and protection and management requirements for Phase 2 of the MESP and the subdivision stage that will follow the MESP;
- Identify any additional studies/monitoring to be done at later planning stages.

PHASE 2 – Impact of the proposed development

Introduction

- Using the chart from Phase 1, provide a summary description of the proposal and how it will achieve the recommendations (targets, etc.) from Phase 1. This section analyzes the results and conclusions of each component section from Phase 1 and identifies or highlights the connections between them. This section should be completed by a multi-disciplinary team, exploring all interactions between the features and functions to provide an integrated summary of the results. A chart is also useful to provide overall recommendations for specific areas with respect to each of the technical disciplines.
- Provide a map that can be used to identify non-developable areas (the Natural System) and developable areas (layout of land uses and alignments of servicing, roads, and trails).

2A. Natural System Protection and Enhancement

- As per the Phase 1 report, summarize how the Natural System will be protected and enhanced from the impacts of the development, through buffering, enhancement areas and restoration plans – identify locations and general descriptions of restoration plans.

2B. Stormwater Management Servicing Plan/Low Impact Development Strategy

- As per the Phase 1 report, summarize SWM criteria and targets
- Using the appropriate model(s), carry out an assessment for the proposed development that includes a water balance and peak flow assessment in accordance with the TRCA SWM Criteria document.
- Screen potential SWM best management practices (BMPs) including conventional, low impact development (LID) and green infrastructure measures using TRCA's LID SWM Planning and Design Guide, provincial and municipal BMP documents.
- A treatment train approach using source (i.e. harvesting and reuse of rain/stormwater), conveyance (i.e. grassed swales and filter strips), and end-of-pipe facilities (i.e. stormwater management ponds, constructed wetlands), in combination with LID practices, compatible with the urban design objectives of the development, should be considered to meet the design criteria associated with water quantity, quality, erosion, and water balance (as outlined in the SWM Criteria document).
- Select a suite of SWM practices from those screened that will achieve all of the SWM criteria defined through Phase 1. The types of SWM practices selected will be dependent on local soil

types, percolation rates, and generic design conditions, all with consideration for the Natural System and the long term maintenance requirements of these BMPs.
- Assess geotechnical, and hydrogeological conditions associated with the preferred SWM strategy, including slope stability assessments for facilities adjacent to significant slopes and borehole assessments for each SWM facility.
- Using the appropriate computer models, confirm that the selected SWM plan meets the targets identified in Phase 1, as described in the TRCA SWM Criteria document.
- Provide a constructability assessment for BMPs including defining requirements and mitigation for dewatering.
- Identifiy requirements for maintenance of SWM facilities and if any access is needed within the Natural System, e.g., permanent access routes for pond and outfall maintenance

2C. Underground Servicing and Above Ground Servicing Facilities
- Identify linear alignments, pipe sizes, and maximum invert elevations
- Identify any pumping station locations
- Identify underground infrastructure valley and stream crossing requirements and mitigation
- Describe SWM for servicing (should be consistent with overall SWM plan in 2B.)
- Identify water-taking (surface or ground) requirements, including locations, mitigation, and an assessment of proximity to High Volume Recharge Areas (HVRAs), Ecologically Significant Recharge Areas (EGRAs), Significant Groundwater Recharge Areas (SGRAs) and Well Head Protection Areas (WHPAs) – see Appendix C of the SWM Criteria document for mapping of these areas.
- Identify dewatering requirements, including locations and mitigation

2D. Valley and Stream Corridor Crossings
- Identify the proposed locations and preliminary design of valley and watercourse crossings in accordance with the Transportation Infrastructure policies of The Living City Policies for Planning and Development in the Watersheds of the Toronto and Region Conservation Authority and TRCA's Crossings Guideline for Valley and Stream Corridors (draft, March 2015)

2E. Trails
- Identify trail locations and types of trails affecting the Natural System, especially where proposed to traverse watercourses or other components of the Natural System (e.g., buffers and enhancement areas).
- Identify linear alignments, crossing locations, trail widths, elevations and surfaces.
- Identify relationship to any applicable municipal or TRCA trails master plans.

2F. Preliminary Grading Plans
- Provide a plan of existing and proposed grades
- Demonstrate how municipal standards for grading, servicing and drainage can be met while respecting the limits of the Natural System; for example, no grading in buffers or enhancement areas.

2G. Use of TRCA-owned lands

- TRCA-owned or managed lands – if any of the subject lands are owned or managed by TRCA, and those lands are proposed to be used (temporarily or permanently) to facilitate development (e.g., infrastructure), an archaeological assessment and other requirements of TRCA's Property Services section (e.g., permission to enter, easements) may be required. Consult TRCA staff for details.

2H. Implementation Strategy

- Prepare a Comprehensive Fill Management and Site Development Phasing Strategy that has the effect of ensuring that terrestrial and aquatic systems in the subwatershed(s) shall not be negatively impacted due to uncoordinated site stripping between the various landowners. The Strategy shall consider the volume of soil disturbance within the MESP Study Area at any given time, and the effects of wind, precipitation and other environmental or human factors on the exposed soils, and provide for an implementable phasing of development to avoid negative impacts. Address TRCA and municipal regulation/by-law requirements including topsoil stripping, stockpiling, grading within and between neighbourhoods, temporary drainage and SWM, haulage routes and any fill removal off site.
- Provide a scope of work for a comprehensive erosion and sediment control strategy that defines ESC principles and methodologies to be used during construction for each phase of the development (stabilize between phases) and identify TRCA and municipal ESC criteria; demonstrate consistency with the Greater Golden Horseshoe Conservation Authorities' Erosion and Sediment Control Guideline for Urban Construction (December 2006)
- Demonstrate that the interim strategy for SWM will protect the hydroperiods of natural features during construction (i.e., after grading has commenced, but prior to the installation of mitigation measures).
- Demonstrate that topsoil management is consistent with TRCA's Preserving and Restoring Healthy Soil: Best Practices for Urban Construction (June 2012)

2I. Monitoring Plan

- Provide a post-construction environmental monitoring plan that ensures mitigation is implemented correctly and that the mitigation measures proposed are effective in maintaining and enhancing the Natural System; the plan should include recommendations for maintaining a monitoring database so that monitoring results can be tracked, lessons can be learned from effective and ineffective mitigation techniques, and actions taken to improve mitigation in the course of development.
- The costs and responsibilities for the monitoring should also be outlined, including a plan to address identified impacts and deficiencies, by proposing other mitigation measures, as per an adaptive management plan.

2J. Future Study Requirements

- Provide a summary that describes and confirms that the MESP fulfills all of the study requirements for the MESP stage.
- Provide a list of all study requirements to be fulfilled at future stages of the development (e.g.s, at draft plan of subdivision stage, at detailed design/permit stage).

Other Elements of Sustainable Communities

Complementary to the TRCA interests of natural heritage, natural hazards and water management, TRCA supports its municipal partners in encouraging development that reduces the amount of greenhouse gas emissions, adapts for the potential impacts of climate change, and other land use strategies and BMPs for building sustainable communities. Therefore, an MESP may have elements that demonstrate how the proposal for the subject lands will use:

- Green technologies for the buildings and infrastructure in the development, such as,
    - water conservation measures
    - energy conservation measures
    - waste diversion and composting strategy
- And how the proposal for the subject lands will,
    - Enhance the interface between development and the Natural System (Urban Design/Ecological Design)
    - Preserve and celebrate cultural heritage
    - Promote active transportation
    - Promote near-urban agriculture
    - Promote environmental education to residents and/or tenants

Digital Review of MESP Submissions

TRCA is moving towards digital review of files. To facilitate this review in a timely and efficient manner, MESP submissions should follow the stipulations below:

- In addition to providing one hard copy of the main document, it should also be provided digitally, formatted and bookmarked so that reviewers can easily move between the various sections.
- Where files are larger than 10MB, do not email as attachments; send by “DropBox” or other acceptable data transfer method.
- Plans with a lot of detail or that cover a large area (e.g., conceptual grading plans) should be provided in large scale hard copy.
- Appendices, including borehole logs, should also be bookmarked as part of the document. If they are not searchable then hard copies should be provided.
- A GIS-based “portable mapping file” that contains all the various data layers referenced in the MESP should be provided; this should allow reviewers to turn various layers on or off as needed to facilitate their review. (It is TRCA’s experience that this information is also a valuable tool to assist in the review of the more detailed subdivision plans, etc. that will follow in the process, so the time spent in developing this tool will be beneficial throughout the planning process and will improve the comprehensiveness, efficiency of the review and streamline the time for review).

Note: Although some weblinks are provided herein, most of the TRCA documents referred to in this guideline can be found on the “Developers and Consultants Information” page of TRCA’s website: http://www.trca.on.ca/planning-services-permits/developers-and-consultants-information; for further information, please contact TRCA staff.

APPENDIX C

TRCA COMMENT LETTERS

DATED: FEBRUARY 5, 2016 AND OCTOBER 6, 2016

February 5, 2016

CFN: 49137

Adrian Smith
Manager, Policy Development Team
Integrated Planning Division
Region of Peel

By Email Only

Dear Mr. Smith:

Re: Request for Comments
Proposed Amendment to the Regional Official Plan
Boundary Expansion to Bolton Rural Service Centre
Region File: ROP 14-002 (Bolton Residential Expansion Area)

TRCA staff are in receipt of your letter of January 13, 2016, in which you requested comments from TRCA on the above.

TRCA staff understand that The Region's consideration of the ROPA application will evaluate potential options for the expansion of Bolton's Rural Service Centre including the six candidate land areas and the "rounding out areas" identified during Caledon's planning process, as well as a small area of land between the ROPA 28 area and Mayfield Road.

In your letter of January 13, 2016, you requested that TRCA staff determine whether any additional comments, beyond those which were provided in our March, 2015 letter, should be provided to assist the Region in your review of this ROPA application.

In providing our response, TRCA staff have examined: our previous letter; the terms of reference for the CEISMP (which included the Region's MCR requirements in 7.9.2.12 e) and p); and the environmental criteria that were utilized by the Town of Caledon's consultants in their evaluation of alternatives. Accordingly, we provide the following comments for your consideration.

TRCA's Letter of March, 2015
TRCA staff have been involved at various points in the Town's BRES study process. In order to assist the Town with determining the requisite scope of analysis that would be required to meet the Region's MCR requirements, relating to ROP Policies 7.9.2.12 e) and p), TRCA and Regional Planning staff jointly prepared a terms of reference for the environmental studies. This terms of reference identifies the environmental study requirements to enable a ROPA

application to proceed, as well as additional more detailed study (CEISMP) which will be required in support of the future LOPA application.

In support of the ROPA application, the Town submitted the "Bolton Residential Expansion Study" which was produced by a consulting team led by Meridian Consulting, on behalf of the Town. One component of the work that was completed in this Study was an environmental component, completed by Dougan and Associates. In our March, 2015 letter, TRCA staff identified that there were deficiencies in the level of information provided in the supporting environmental studies. Specifically, TRCA staff requested that additional information pertaining to Floodplain Mapping, Preliminary Natural Heritage System mapping, Feature Based Water Balance and Groundwater Assessment be provided.

The environmental analysis completed by the Town's consultants in support of the ROPA was scoped to allow for a high-level assessment and screening of the natural heritage interests for all 6 candidate expansion areas, as well as the "Rounding Out" areas, followed by a more detailed analysis of the preferred location(s). The previous TRCA comments pertained primarily to deficiencies in the detailed analysis for the preferred locations, and were appropriate for the process that the Town followed at that time.

Two technical memos and one report were produced by Dougan and Associates, and one report produced by Aquafor Beech was completed in 2013 and 2014 in support of the Town's analysis of the candidate expansion areas. Of these, only one of the letter reports produced by Dougan – (June 19, 2013 Phase 2 Technical Memorandum) which was only 6 pages long, analysed all 6 of the candidate areas. The subsequent reports "Technical Memorandum - Development of a Preliminary Natural Heritage System" (June, 2014), and "Background Environmental Study" (October, 2014) only analysed the preferred candidate sites 1 and 3. Similarly, the Headwater Feature Assessment report completed by Aquafor Beech (June, 2014) only analysed the preferred candidate sites 1 and 3.

We understand that the Region is re-examining all of the candidate areas at this time, and as a result the detailed comments provided in our previous letter are only partially applicable at this stage of the process. Specifically, our recommendations 2-4 (Preliminary NHS, Feature Based Water Balance and Groundwater Assessment) are more applicable once a preferred site has been selected. Our recommendation #1, with respect to the need for Regulatory Floodplain Mapping is applicable to all candidate areas, as the areas subject to natural hazards will be take-outs from the land base of the effected candidate areas. As identified in the reports produced by Meridian Planning, the candidate areas have been selected in order to amount to the 185 hectares of additional land area allotted to Bolton. Their calculations have made assumptions with respect to the net developable area within the candidate areas, for the purposes of ensuring that the population allocation targets are met. At present, the anticipated density targets for these greenfield areas are already high in comparison to surrounding areas of the community. Further unanticipated take-outs would for obvious reasons have an impact on the densities, and available land base. Since the time of the last reports, TRCA has completed our Humber Watershed floodplain mapping update. As such additional mapping resources are likely available to assist with this determination.

Screening Criteria Utilized in the Existing Environmental Studies

The consulting team for the Town of Caledon produced evaluation criteria for weighing the relative merits of each candidate area. These criteria considered a broad spectrum of key requirements and constraints. One component of these 'global' criteria was the potential impact of natural heritage features on the candidate areas; two (and in the end one) of the criteria were

environmental. To arrive at the ranking for the candidate areas specific to the environmental criteria, the environmental consultant (Dougan) created & utilized their own screening criteria to evaluate the potential impact of the environmental 'constraints' on the candidate areas. From there they ranked the candidate areas on the basis of potential environmental constraint levels. This is reflected in the June 19, 2013, Dougan Technical Memo. These screening criteria applied to all of the candidate areas, remain applicable to the evaluation of options that the Region is completing as part of your review of the ROPA application.

In response to your current request for comments, TRCA staff have again reviewed the screening criteria that were utilized by Dougan and Associates, to determine whether updates or modifications to the approach would be recommended at this time. Our conclusion is that the approach taken by Dougan and Associates is largely appropriate, however, there are a few areas in which modifications to the screening process are recommended. Our recommendations are as follows:

1. The overall BRES criteria pertaining to natural heritage need to make more specific reference to natural systems and connectivity.

2. The screening approach utilized by Dougan was primarily based upon the significance of natural **features**, and their potential to act as constraints to development. Current environmental planning practice, which is reflected in the 2014 PPS, utilizes a natural systems based approach, which considers not only the component features, but the connections between features and associated functions.

   As a predominantly features-based approach, there is no evidence that existing natural heritage systems planning has been considered. Already defined systems would include those identified in the Humber Watershed Plan, West Humber Subwatershed Study, the environmental system policies and guidance from the 2014 PPS and associated Natural Heritage Reference Manual (the site-specific implications of which would need to be identified) as well as the Region's Greenlands System. Additionally, connectivity (both existing and potential future) between the terrestrial and aquatic systems within and adjacent to the study areas should be considered in the analysis. There is no evidence of consideration of the broader role (existing and potential) that the candidate areas are playing within the natural heritage systems in the very scoped work that Dougan completed.

3. Dougan identified in their memo that Criterion 6 was dropped from the screening as it cancelled out the differentiation. However, in doing so, Criterion 6, which was the only systems-based (and water based) criterion of the two was eliminated. Dougan identified that the reason for this was that the two criteria were could not be utilized together. However, It would appear that the issue is really one of having more than one environmental criterion to balance. It appears that a more appropriate approach would have been to have reframed the criterion 5 and 6 into one all encompassing, more cohesive criterion.

4. Components of the workplan, such as headwater feature analysis, were only completed for the preferred sites, and not for all of the sites. In this area of the subwatersheds, headwater features may be critical to the function of the natural heritage systems. While an in-depth analysis of headwater features across the candidate areas is likely not required, a high level screening of the density of headwater features may provide useful information with respect to whether (and the extent to which) the headwater features can

be modified within the study areas, and how much of a constraint to development that they pose.

5. The constraints screening should go beyond just features and systems that are recognized in the PPS as significant. Both the Region of Peel and the Town of Caledon have policies in their official plans for the protection of features and systems that go beyond the minimum requirements prescribed in the PPS.

6. Redside Dace is identified in Criterion 5, however, it is not clear that other Endangered Species Act (ESA) listed species (such as Bobolink, among others) have been considered. The ESA screening needs to be comprehensive for all study areas, so that the extent of the constraint that it may pose can be adequately represented.

7. Significant Habitat of Endangered and Threatened Species is identified as one of the screening criterion. Through the 2014 PPS, these are now considered under the ESA.

8. Wetlands are identified as a screening criterion. For unevaluated wetlands, the 2014 PPS identified that not all wetlands of Provincial interest have been identified, and that site-specific assessments are required by MNR. Where wetlands are unevaluated, the Province has indicated that consistency with Section 2.1.4 of the PPS cannot be determined unless the wetlands are evaluated. In the absence of this, the wetlands should be considered to be Provincially Significant for planning purposes, and the connections between aquatic systems and the wetlands considered (as the wetlands may be complexed).

9. The Province has come out with new guidelines on Significant Wildlife Habitat, as well as criteria applicable to this ecoregion. These should be considered and taken into account as part of the screening of this sub-criterion.

10. For the purposes of the “Fish Habitat” criterion as well as for consideration of headwater features, seeps and springs should be identified and delineated where possible

11. The Regulated Area sub-criterion should also include wetlands and valley lands, which are also Regulated features.

12. The options screening assessment appears to have weighting to some of the natural heritage features over others, which may be appropriate. However, the weighting scheme that has been utilized is not clear in the memo, making it very difficult to determine how the options were ranked.

13. Note that some of the criteria utilized are not fully mapped features – i.e. significant valleylands. The analysis should clearly identify the sources and methodology that has been employed to delineate significant valleylands. Note that based upon the PPS definitions significant stream corridors, which may lack topographic definition would also fit in this category.

Terms of Reference for the CEISMP

Further to our March, 2015 letter, please note that TRCA staff are of the opinion that the technical environmental submissions that have been completed to date have not fully met the requirements for Region’s MCR requirements relating to ROP Policies 7.9.2.12 e) and p). The MCR requirements were specifically identified in the first part of the terms of reference for the

CEISMP, and components identified therein are missing in the submission that accompanies the ROPA application. Further, much of the environmental analysis that has been completed to date has been specific to the Town's preferred option areas – Area 1 and 3, and is not applicable to the other candidate areas. As such, should the Region's process identify a different preferred area, significant additional environmental analysis will be required to fulfil the environmental study requirements for the ROPA.

Floodplain Mapping and Stormwater Management

At the point at which the environmental reports were being completed for Caledon, TRCA's Humber Watershed floodplain mapping update was not complete. This mapping has now been completed, and should be considered in the screening process for the purposes of assessing 'take out' areas, and to evaluate potential impacts on the available land base within the candidate areas. Additionally, please note that the potential need for Regional Storm stormwater management ponds was previously identified, and needs to be further evaluated. Should it be determined that Regional Storm control stormwater management ponds are required, it would result in further take-outs from the net available land base within the candidate areas. Please note that to date this has been identified as a potential requirement for the candidate areas that are within the West Humber subwatershed – candidate areas 3,4,5 and 6. This is not anticipated to be a requirement for Areas 1 and 2, which are within the Main Humber subwatershed.

We trust this is of assistance. Should you have any further questions, please do not hesitate to contact the undersigned.

Yours truly,

Quentin Hanchard, MES, MCIP, RPP
Associate Director, Development Planning and Regulation
Planning and Development
416-661-6600 x 5324

Toronto and Region Conservation
for The Living City

CFN 49137

October 6, 2016

Andrea Warren
Manager, Development Services
Region of Peel
10 Peel Centre Dr., Suite A
Brampton, ON
L6T 4B9

By Email Only: andrea.warren@peelregion.ca

Dear Ms. Warren:

Re: Proposed Amendment to the Region of Peel Official Plan
Residential Boundary Expansion to the Bolton Rural Service Centre
Town of Caledon
File Number: ROP 14-002

On August 17, 2016, Toronto and Region Conservation Authority (TRCA) staff received circulation of the Regional Official Plan Amendment (ROPA) for the residential expansion of the Bolton Rural Service Centre boundary (i.e. ROP-14-002). The ROPA application was made by the Town of Caledon to the Region of Peel on September 23, 2014, and is intended to be consistent with and implement ROPA 24, which was approved by the Ontario Municipal Board (OMB) on June 25, 2012; and the Town of Caledon's OPA 226, which was approved by the OMB on Oct. 15, 2013. ROPA 24 and OPA 226 establish the population and employment forecasts for the Town of Caledon up to 2031.The purpose of this particular amendment is to implement ROPA 24 and OPA 226 by identifying 185 hectares of additional urban land in Bolton that is required to accommodate 10,350 additional people and 2,520 population-related jobs prior to 2031.

As per TRCA's "Living City Policies for Planning and Development within the Watersheds of the Toronto and Region Conservation Authority" (LCP), staff provides the following comments as part of TRCA's delegated responsibility of representing the provincial interest on natural hazards encompassed by Section 3.1 of the *Provincial Policy Statement, 2014*; and TRCA's Regulatory Authority under the *Conservation Authorities Act* and O. Reg. 166/06, *Development, Interference with Wetlands, and Alterations to Shorelines and Watercourses (as amended)*; our role as a Resource Management Agency; and our Memoranda of Understanding (MOU) with the Town of Caledon and Region of Peel, wherein we provide technical environmental advice.

Background

Section 7.9.2.12 of the Peel Regional Official Plan (ROP) outlines the requirements for a ROPA to facilitate a Rural Service Centre Boundary expansion, which is based on a Municipal Comprehensive Review. Of particular interest to the TRCA are Subsections 7.9.2.12 e), o) and p), all of which relate to the identification of a natural heritage system; conformity with the Greenbelt Plan, Niagara Escarpment Plan, Lake Simcoe Protection Plan and the Oak Ridges Moraine Conservation Plan; and conformity with Sections 2 (Wise Use and Management of Resources) and 3 (Protecting Public Health and Safety) of the *Provincial Policy Statement, 2014* (PPS).

The Town of Caledon initiated the Bolton Residential Expansion Study (BRES) to complete a Municipal Comprehensive Review to address the requirements of the PPS, the Growth Plan for the Greater Golden Horseshoe, the Region of Peel Official Plan and the Town of Caledon Official Plan for the proposed Bolton Rural Service Centre settlement boundary expansion. To select a preferred study area, the consultant team for the Town of Caledon produced evaluation criteria for weighing the relative merits of each candidate area (i.e. Options 1 to 6 with rounding out areas).

To arrive at a ranking for the candidate areas specific to the environmental criteria, the environmental consultant (Dougan and Associates) created and utilized their own screening criteria to evaluate the potential impact of the environmental "constraints" on the candidate areas. From there they ranked the candidate areas on the basis of potential environmental constraint levels. While this high level screening process assisted the Town with their decision to choose a preferred boundary expansion area to study in further detail, it is not an appropriate level of analysis to meet the requirements of the Municipal Comprehensive Review, specifically Subsections 7.9.2.12 e), o) and p) of the ROP.

As a component of the Municipal Comprehensive Review, the Town of Caledon initiated a Comprehensive Environmental Impact Study and Management Plan (CEISMP) to conduct an impact assessment and develop a management plan for the natural environment potentially affected by urban development associated with the expansion of the Bolton Rural Service Centre. The management plan will inform planning and decision making so that changes in land use are compatible with natural systems and consistent with the *Provincial Policy Statement, 2014* (PPS) and applicable Region of Peel and Town of Caledon Official Plan policies.

The Town retained consultants to complete a CEISMP for their preferred Option 3 and a Terms of Reference for the CEISMP were established in partnership with staff from the Region of Peel, Town of Caledon and TRCA. The more detailed information that has to-date been produced from the CEISMP is not applicable to the Region of Peel's preferred Option 6 and the Triangle Lands. Therefore, a new CEISMP will be required for the preferred Option 6 and Triangle Lands.

Section 1.1 of the CEISMP Terms of Reference provided specific guidance to the Town of Caledon for sufficiently completing part of the CEISMP that would satisfy the Municipal Comprehensive Review. The section identified requirements to enable a ROPA to proceed by completing the following components of the larger CEISMP study:

1. Completion of all the Part A Existing Conditions and Characterization;
2. Substantial completion of the Part B Impact Assessment and Detailed Studies components of the CEISMP terms of reference;
3. Identification of Core Areas of the Greenlands System, if any; and
4. Identification of a conceptual natural heritage system to the satisfaction of the Region of Peel and Town of Caledon, in consultation with the TRCA and other agency staff (e.g. Ministry of Natural Resources and Forestry).

While it is the expectation of TRCA staff that at a minimum these components of a new CEISMP are completed in support of the proposed ROPA for Option 6 and the Triangle Lands, staff are available to meet with staff from the Region and the Town to discuss and scope the CEISMP requirements for the ROPA.

Recommendations

Therefore, it is TRCA staff's recommendation that ROPA 14-002 **is premature** until such time that:

1. At a minimum, "Phase A: Existing Conditions and Characterization" of a CEISMP is completed for Option 6 and Triangle Lands; and "Part B: Detailed Studies and Impact Assessment" is sufficiently completed to the satisfaction of the TRCA in order to establish the baseline conditions and preliminary limits of development to effectively inform the boundary expansion and form the basis for future studies. Specifically, the natural heritage system, including any Core Areas of the Region of Peel Greenlands System must be identified.

   The Terms of Reference for the Option 3 CEISMP is included as Appendix I, and is applicable for studying Option 6 and the Triangle Lands. It is recommended that staff from the Region, Town, TRCA and any relevant Provincial ministries meet to establish a Terms of Reference for the new CEISMP and establish the threshold for meeting the ROPA Municipal Comprehensive Review requirements;

2. Should the CEISMP conclude that there are new Core Areas of the Region of Peel Greenlands System (e.g. Provincially Significant Wetlands), that Schedule A of the ROP be updated to reflect the new Core Areas. It is TRCA staff's expectation that any new Core Areas and associated buffers are conveyed into the appropriate public ownership as per the Region of Peel and Town of Caledon Official Plan policies, and TRCA's LCP.

Key Environmental Issues

In the absence of a CEISMP for the Option 6 and Triangle Lands, TRCA staff have reviewed our in-house information, and based on our understanding of the area, have identified several key environmental issues related to the Option 6 and Triangle Lands that will need to be studied further as part of the CEISMP and would affect the proposed ROPA:

1. Regulatory Floodplain Mapping: Regulatory Floodplain mapping must be provided as part of the ROPA submission to identify potential flood hazards within the development area. The hydraulic model for the existing downstream TRCA floodplain map sheet will need to be extended upstream through to the study area using our updated hydrology model as per TRCA's standards.

2. Stormwater Management: The proposed boundary expansion area was not included in the Humber River hydrology update. As such, future development in this area may have an impact on downstream river flows, which will need to be mitigated. It will need to be determined whether Regional Storm Control is required for the boundary expansion area, which may result in stormwater management ponds larger than the conventional 100-year storm ponds and/or other management measures.

3. Preliminary Natural Heritage System Map: At a minimum, a preliminary natural heritage system map must show:
    a. All headwater drainage features;
    b. The Regulatory Floodplain;
    c. All appropriate buffers to the Regulatory Floodplain and natural heritages features and areas.

4. Feature-Based Water Balance: It is our understanding that there are tributaries, woodlands and unevaluated wetlands within the preferred Option 6 and Triangle Lands. The CESIMP needs to include a discussion and direction for feature-based water balance assessments for the natural heritage features.

5. Coordination with Other Environmental Studies: The Region's preferred Option 6 and Triangle Lands are adjacent to the Coleraine West Employment Lands in Caledon, for which a comprehensive planning process is underway in support of a Draft Plan of Subdivision. Also, the proposed boundary expansion area is located north of Secondary Plan Area 47 in the City of Brampton, for which comprehensive studies have been completed in support of the Secondary Plan. The TRCA has been working with the Town of Caledon and City of Brampton and their consultants on environmental studies to inform the future development within these growth areas. TRCA staff has also been involved with the Region of Peel on the review and approval of the Mayfield Rd Environmental Assessment (EA) and subsequent permits. It is important that the CEISMP for Option 6 and the Triangle Lands consider and where appropriate incorporate the findings of these studies and plans, particularly as it relates to the identification of a natural heritage system, floodplain mapping and stormwater management. Coordination between municipal partners and their consultants will be necessary to ensure the most current information is used and broader watershed issues are understood and addressed.

In addition, TRCA staff has provided previous comments on the proposed ROPA as it relates to Option 3 and the reconsideration of the preferred option by the Region of Peel. These comments are provided Appendices II and III.

I trust that the above comments are of assistance. As a service provider, TRCA staff is committed to assisting the Town of Caledon and Region of Peel with reviewing the environmental information in support of the ROPA and for satisfying the Municipal Comprehensive Review. Staff is available to meet with the Region, the Town and their consultants to discuss our expectations for the CEISMP in a collaborative effort to meet the municipalities' objectives and timelines for the ROPA and subsequent LOPA.

Please do not hesitate to contact me should you have any questions.

Sincerely,

Leilani Lee-Yates, RPP
Senior Planner
Planning and Development
Tel: (416) 661-6600, Ext. 5370
Email: llee-yates@trca.on.ca

Encl: *Appendix I – Bolton Residential Boundary Expansion Recommended Terms of Reference for Phase 3 Comprehensive Environmental Impact Study and Management Plan (CEISMP) Prepared by TRCA and Region of Peel Staff August 20, 2013.*

Appendix II – TRCA Comment Letter Re: Request for Comments Proposed Amendment to the Regional Official Plan Boundary Expansion to Bolton Rural Service Centre Region File: ROP 14-002 (Bolton Residential Expansion Area, dated February 5, 2016.

Appendix III – TRCA Comment Letter Re: Proposed Amendment to the Region of Peel Official Plan Residential Boundary Expansion to the Bolton Rural Service Centre Town of Caledon File Number: ROP-14-002, dated March 31, 2015.

cc: ***Email Only***
Haiqing Xu, Town of Caledon
Learie Miller, Region of Peel
Mark Head, Region of Peel
Quentin Hanchard, TRCA
Maria Parish, TRCA
Dilnesaw Chekol, TRCA
Jehan Zeb, TRCA
Sharon Lingertat, TRCA

B.2. Correspondence with Toronto and Region Conservation Authority

Buckton, George

From: Maria Parish <Maria.Parish@trca.ca>
Sent: Monday, June 17, 2024 3:24 PM
To: Buckton, George
Cc: Jason Wagler
Subject: [EXT] RE: Humber Station Village, Town of Caledon - Wetland Meeting Summary

EXTERNAL EMAIL

Hi George

The meeting minutes capture all of my comments. Thanks!

Regards

Maria Parish, B.Sc., M.A., CAN-CISEC
Senior Ecologist
Planning Ecology | Policy Planning

T: 437-880-1969
E: maria.parish@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

Toronto and Region Conservation Authority

From: Buckton, George <gbuckton@geiconsultants.com>
Sent: Monday, June 17, 2024 12:52 PM
To: Maria Parish <Maria.Parish@trca.ca>
Subject: FW: Humber Station Village, Town of Caledon - Wetland Meeting Summary

EXTERNAL SENDER
Hi Maria,

Hope you're doing well. Just following up on this request before I forget 😊

Thanks,
George

GEI
GEORGE BUCKTON, M.F.C.
Senior Ecologist
416.816.2246
650 Woodlawn Road West, Block C, Unit 2, Guelph, ON N1K 1B8

From: Buckton, George
Sent: Friday, May 31, 2024 9:30 AM
To: Maria Parish <Maria.Parish@trca.ca>
Cc: Jason Wagler - TRCA (jason.wagler@trca.ca) <jason.wagler@trca.ca>
Subject: Humber Station Village, Town of Caledon - Wetland Meeting Summary

Hi Maria,

I hope you are well and looking forward to the weekend.

I realize I did not provide a summary of our Humber Station meeting on January 26, 2024. Could you please review and revise as needed. I am looking for your written confirmation that I've captured everything correctly. I realize it's been a while since the meeting so happy to answer any questions you might have.

1. **Wetland Risk Evaluation**

GEI shared their Wetland Sensitivity mapping as part of the Wetland Risk Evaluation which included Schaeffers' 2-year floodline along the riparian corridors (attached for your reference).
GEI/Schaeffers/Arcadis explained that for the wetlands that they are proposing to retain, none of the wetlands are fully within the 2-year floodline. However, the majority of the wetlands are part of the riparian floodplain, and it will be demonstrated they will be maintained through fluvial geomorphology /SWM exercises.
TRCA acknowledged that all retained wetlands are within the 2-year floodline and will receive a larger volume of water post-development.
TRCA agreed that FBWB modeling is not required for the site. Instead, the consultant team will demonstrate that erosion thresholds are not exceeded, and flows are contained within the channel corridor.

2. **Wetlands within Buffers**

TRCA suggested created wetlands within degraded areas in the valley could help reduce the volume of water directed to the SWM ponds. This approach was carried out by the warehouse owners east of the valley.
TRCA agreed that created wetland pockets within the proposed drainage alignment corridor could help provide LID infiltration as well as enhanced ecological functions.

3. **MAS2-1 Relocation**

GEI described the desire to relocate a small MAS2-1 slightly west (see markup green arrow on attached).
Schaeffers noted the MAS2-1 could be moved to the bank of channel provided it was demonstrated adequate water inputs were received.
TRCA confirmed the MAS2-1 could be relocated west, and suggested that use of sod mats be explored, and that the wetland be made slightly larger.
Shaeffers asked if the wetland needs to be offline or can be online.
TRCA stated as long as the function is replicated, they are okay either way.

4. **SAS Online Pond Wetland (Near Humber Stn Road)**

Schaeffers noted they expect a lot of water to be directed here.
TRCA requested monitoring for changes in the vegetation community and expressed concern about blowing out the culvert at Humber Station Road.
TRCA requested the monitoring plan include vegetation and water levels here.
TRCA agreed that FBWB modeling is not required for this wetland.

5. **Southern Wetland Compensation Area**

Schaeffers noted a wetland compensation area at the south end of the Study Area is proposed and will be fed clean roof water. Water from here will be directed to the central existing headwater drainage feature, and a SWM Pond will outlet treated water to the floodplain of the east valley.
TRCA confirmed they are okay with this approach, and suggested trees and shrubs be planted along the wetland edge for shading.
GEI noted that thicket swamp communities provide attenuation, shading, and can endure variable water levels (silver maple, cedar, dogwood, willows).
TRCA noted they are okay shifting the wetland east into the buffer.
Schaeffers asked if the sanitary and water infrastructure can be placed in the outer most edge of the valley buffer.
TRCA requested further information be provided.

Thanks Maria,
George

GEI
GEORGE BUCKTON, M.F.C.
Senior Ecologist
416.816.2246
650 Woodlawn Road West, Block C, Unit 2, Guelph, ON N1K 1B8



Appendix C Tables

C.1. Tables – GEI Consultants Canada Ltd.

C.2. Tables – Arcadis

C.3. Tables – Schaeffers

C.1. Tables – GEI Consultants Canada Ltd.

Table 1: **Headwater Drainage Feature Assessment**

Drainage Feature Segment	Step 1. Hydrology		Step 2. Riparian	Step 3. Fish Habitat	Step 4. Terrestrial Habitat	Management Recommendation per HDF Guidelines	Interpreted Management Recommendation – Humber Station Consultant Team
	Function	Modifiers					
HDF-1a	FT – 8 FC – 4 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by agricultural activities surrounding upstream reach.	Limited – Riparian area consists of lawn, cropped land a road.	Contributing – No direct fish habitat	Limited – No terrestrial habitat present	**Mitigation**	**Mitigation**
HDF-1b	FT – 7 FC – 4 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by agricultural activities in surrounding fields.	Limited – Riparian area consists of agricultural crops.	Contributing – No direct fish habitat	Limited – No terrestrial habitat present	**Mitigation**	**Mitigation**
HDF-2a	FT – 2 FC – 4 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent agricultural activities – feature is an excavated channel.	Valued – Riparian area consists of meadow and cropped land.	Contributing – No direct fish habitat	Limited – No terrestrial habitat present	**Mitigation**	**Mitigation**
HDF-2-1a	FT – 2 FC – 2 (Round 1) FC – 1 (Round 2) Limited – Standing water (no downstream hydrological contributions observed)	Feature consists of an excavated channel adjacent to farm buildings.	N/A	N/A	N/A	**No Management Required**	**No Management Required**
HDF-2-2a	FT – 2 FC – 2 (Round 1) FC – 1 (Round 2) Limited – Standing water (no downstream hydrological contributions observed)	Feature consists of an excavated channel adjacent to farm buildings.	N/A	N/A	N/A	**No Management Required**	**No Management Required**
HDF-3a	FT – 9 FC – 5 (Round 1, 2017) FC – 4 (Round 1, 2023) FC – 4 (Round 2, 2017) FC – 3 (Round 2, 2023) FC – 4 (Round 3, 2017) FC – 1 (Round 3, 2023) Valued - Intermittent – Permanent flow observed in 2017 however the feature was dry in Round 3, 2023.	Hydrology modified by upstream man-made online pond, as well as agricultural activities in surrounding fields. Beaver dam observed at immediate upstream end in 2023.	Valued – Riparian area consists of meadow	Valued – No fish observed in reach but could be present. Fish observed upstream in early summer in 2017, although assessment in 2022 and/or 2023 in upstream reaches showed that they were dry. Therefore, this reach is assessed as providing potential seasonal fish habitat.	Contributing – Feature could provide terrestrial habitat corridor to facilitate movement to/from pond breeding area	**Protection* (wetland upstream)**	**Conservation**

Table 1: **Headwater Drainage Feature Assessment**

Drainage Feature Segment	Step 1. Hydrology		Step 2. Riparian	Step 3. Fish Habitat	Step 4. Terrestrial Habitat	Management Recommendation per HDF Guidelines	Interpreted Management Recommendation – Humber Station Consultant Team
	Function	Modifiers					
HDF-3b	FT – 6 FC – 2 (Round 1) FC – 2 (Round 2) FC – 4 (Round 3, 2017) FC – 2 (Round 3, 2023) Important – wetland with standing water or flow in summer.	Hydrology modified by feature, which is a man-made online pond, as well as agricultural activities in surrounding fields.	Important – Feature is a wetland.	Important – Fish present in the pond throughout summer	Important – Pond provides amphibian breeding habitat	**Protection**	**Protection**
HDF-3c	FT – 6 FC – 5 (Round 1) FC – 2 (Round 2) FC – 4 (Round 3) Important – Wetland with flowing water in summer	Hydrology modified by adjacent and upstream agricultural activities.	Important – Feature is a wetland.	Valued – No fish observed in reach but could be present. Fish observed upstream in early summer in 2017, although assessment in 2022 and/or 2023 in upstream reaches showed that they were dry. Therefore, this reach is assessed as providing potential seasonal fish habitat.	Valued – General amphibian habitat	**Protection**	**Protection**
HDF-3d	FT – 2 FC – 5 (Round 1) FC – 4 (Round 2, 2017) FC – 1 (Round 2, 2022 and 2023) FC – 4 (Round 3, 2017) Contributing- Ephemeral– Permanent flow observed in 2017; however, the feature was dry in Round 2 for 2022 and 2023.	Hydrology modified by adjacent and upstream agricultural activities.	Limited – Riparian area consists of agricultural crops.	Valued– Fish observed in reach in summer 2017. However, studies in 2022 and 2023 showed that the reach was dry by late spring. Therefore, based on two consecutive years of more recent data, this feature is assessed as providing seasonal fish habitat only.	Limited – No terrestrial habitat present	**Protection* (wetland upstream)**	**Conservation**
HDF-3e	FT – 6 FC – 4 (Round 1) FC – 2 (Round 2) FC – 4 (Round 3) Important – Wetland with flow in summer	Hydrology modified by adjacent and upstream agricultural activities.	Important – Feature is a wetland.	Valued– Fish observed upstream and downstream from reach in early summer in 2017. However, studies in 2022 and 2023 showed that the upstream and downstream reaches were dry by late spring.	Valued – General amphibian habitat	**Protection**	**Protection**

Table 1: Headwater Drainage Feature Assessment

Drainage Feature Segment	Step 1. Hydrology		Step 2. Riparian	Step 3. Fish Habitat	Step 4. Terrestrial Habitat	Management Recommendation per HDF Guidelines	Interpreted Management Recommendation – Humber Station Consultant Team
	Function	Modifiers					
				Therefore, based on two consecutive years of more recent data, this feature is assessed as providing seasonal fish habitat only.			
HDF-3g	FT – 2 FC – 5 (Round 1) FC – 4 (Round 2, 2017) FC – 1 (Round 2, 2023) FC – 4 (Round 3, 2017) Valued - Intermittent – Permanent flow observed in 2017 however the feature was dry during Round 2 in 2023	Feature has been channelized for agricultural purposes. Hydrology modified by adjacent agricultural activities.	Limited – Riparian area consists of agricultural crops.	Valued– Fish observed in reach in summer 2017. However, studies in 2023 showed that the reach was dry by late spring. Therefore, based on this more recent data, this feature is assessed as providing seasonal fish habitat only.	Limited – No terrestrial habitat present	**Protection* (wetland upstream)**	**Conservation**
HDF-3h	FT – 6 FC – 5 (Round 1) FC – 4 (Round 2, 2017) FC – 2 (Round 2, 2023) FC – 4 (Round 3, 2017) Important – Wetland with standing water throughout summer	None	Important – Feature is a wetland.	Valued – Suitable habitat for migration. Fish observed downstream.	Important – Wetland provides amphibian breeding habitat	**Protection**	**Protection**
HDF-3i	FT – 1 FC – 5 (Round 1) FC – 4 (Round 2, 2017) FC – 3 (Round 2, 2023) FC – 4 (Round 3, 2017) FC – 2 (Round 3, 2023) Important – Water throughout summer	Hydrology modified by adjacent agricultural activities.	Limited – Riparian area consists of agricultural crops.	Valued – Suitable habitat for migration. Fish observed downstream.	Limited – No terrestrial habitat present	**Protection* (wetland upstream)**	**Conservation**
HDF-3-1a	FT – 4 FC – 2 (Round 1) FC – 1 (Round 2) Limited – Standing water (no downstream hydrological contributions observed)	Hydrology modified by adjacent agricultural activities.	N/A	N/A	N/A	**No Management Required**	**No Management Required**

Table 1: **Headwater Drainage Feature Assessment**

Drainage Feature Segment	Step 1. Hydrology		Step 2. Riparian	Step 3. Fish Habitat	Step 4. Terrestrial Habitat	Management Recommendation per HDF Guidelines	Interpreted Management Recommendation – Humber Station Consultant Team
	Function	Modifiers					
HDF-3-2a	FT – 7 FC – 2 (Round 1) FC – 1 (Round 2) Limited – Standing water (no downstream hydrological contributions observed)	Hydrology modified by adjacent agricultural activities.	N/A	N/A	N/A	**No Management Required**	**No Management Required**
HDF-4a	FT – 7 FC – 2 (Round 1, 2017) FC – 3 (Round 1, 2023) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent agricultural activities.	Limited – Riparian area consists of agricultural crops.	Contributing – No direct fish habitat	Limited – No terrestrial habitat present	**Mitigation**	**Mitigation**
HDF-5a	FT – 7 FC – 2 (Round 1) FC – 1 (Round 2) Limited – Standing water in discontinuous pools in early spring and dry in late spring.	Hydrology modified by adjacent agricultural activities.	N/A	N/A	N/A	**No Management Required**	**No Management Required**
HDF-6a	FT – 7 FC – 2 (Round 1) FC – 1 (Round 2) Limited – Standing water in discontinuous pools in early spring and dry in late spring.	Hydrology modified by adjacent agricultural activities.	N/A	N/A	N/A	**No Management Required**	**No Management Required**
HDF-7a	FT – 7 FC – 4 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent agricultural activities.	Limited – Riparian area consists of agricultural crops and lawn.	Contributing – No direct fish habitat.	Limited – No terrestrial habitat present	**Mitigation**	**Mitigation**
HDF-7-1a	FT – 7 FC – 2 (Round 1) FC – 1 (Round 2) Limited – Standing water in one discontinuous pool in early spring and dry in late spring.	Hydrology modified by adjacent agricultural activities.	N/A	N/A	N/A	**No Management Required**	**No Management Required**
HDF-8-a	FT – 1 FC – 4 (Round 1, 2017) FC – 1/2 (Round 1, 2023) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent and upstream agricultural activities.	Limited – Riparian area consists of agricultural crops.	Contributing - No direct fish habitat	Limited – No terrestrial habitat present	**Mitigation**	**Mitigation**

Table 1: **Headwater Drainage Feature Assessment**

Drainage Feature Segment	Step 1. Hydrology		Step 2. Riparian	Step 3. Fish Habitat	Step 4. Terrestrial Habitat	Management Recommendation per HDF Guidelines	Interpreted Management Recommendation – Humber Station Consultant Team
	Function	Modifiers					
HDF-8-a1 (non-participating property)	Valued or Contributing (non-participating lands)	Hydrology modified by adjacent and upstream agricultural activities.	Limited – Riparian area consists of agricultural crops.	Unknown – non-participating lands	Unknown – non-participating lands	**Conservation**	**Conservation**
HDF-8-a2 (non-participating property)	Valued or Contributing (non-participating lands)	Hydrology modified by adjacent residential lands and upstream agricultural activities.	Limited – Riparian area consists of agricultural crops and meadow.	Unknown – non-participating lands	Unknown – non-participating lands	**Conservation**	**Conservation**
HDF-8-a3 (non-participating property)	FT – 1 FC – 4 (Round 1, 2017) FC – 3 (Round 1, 2023) FC – 1 (Round 2) Contributing - ephemeral	Hydrology modified by adjacent residential lands and upstream agricultural activities.	Limited – Riparian area consists of agricultural crops and meadow.	Unknown – non-participating lands	Unknown – non-participating lands	**Conservation**	**Conservation**
HDF-8-b	FT – 7 FC – 4 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent and upstream agricultural activities.	Limited – Riparian area consists of agricultural crops.	Contributing – no direct fish habitat	Limited – No terrestrial habitat present	**Mitigation**	**Mitigation**
HDF-8-c	GEI Assessment (2017): FT – 7 FC – 3 (Round 1) FC – 1 (Round 2) SLR Assessment (2023): FC – 1 (Round 1) FC – 1 (Round 2) Assessment of Function: Limited – Dry or standing water	Hydrology modified by adjacent and upstream agricultural activities.	Limited – Riparian area consists of agricultural crops.	Contributing - no direct fish habitat	Limited – No terrestrial habitat present	**No Management Required**	**No Management Required**
HDF-8-c-1	FT – 4 FC – 2 (Round 1) FC – 1 (Round 2) Limited – Standing water (no downstream hydrological contributions observed)	Hydrology modified by adjacent and upstream agricultural activities.	N/A	N/A	N/A	**No Management Required**	**No Management Required**
HDF-8-c-2	GEI Assessment (2017) FT – 7 FC – 3 (Round 1) FC – 1 (Round 2) SLR Assessment (2023): FC – 1 (Round 1) FC – 1 (Round 2) Assessment of Function: Limited – Dry or standing water	Hydrology modified by adjacent and upstream agricultural activities.	Limited – Riparian area consists of agricultural crops.	Contributing – no direct fish habitat	Limited – No terrestrial habitat present	**No Management Required**	**No Management Required**

Table 1: **Headwater Drainage Feature Assessment**

Drainage Feature Segment	Step 1. Hydrology		Step 2. Riparian	Step 3. Fish Habitat	Step 4. Terrestrial Habitat	Management Recommendation per HDF Guidelines	Interpreted Management Recommendation – Humber Station Consultant Team
	Function	Modifiers					
HDF-8-d	GEI Assessment (2017): FT – 7 FC – 3 (Round 1) FC – 1 (Round 2) SLR Assessment (2023): FC – 1 (Round 1) FC – 1 (Round 2) Assessment of Function: Limited – Dry or standing water	Hydrology modified by adjacent and upstream agricultural activities.	Limited – Riparian area consists of agricultural crops.	Contributing – no direct fish habitat	Limited – No terrestrial habitat present	**No Management Required**	**No Management Required**
HDF-9a	FT – 2 FC – 4 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent agricultural activities.	Limited – Riparian area consists of agricultural crops and a disturbed area.	Contributing – no direct fish habitat	Limited – No terrestrial habitat present	**Mitigation**	**Mitigation**
HDF-9b	FT – 2 FC – 4 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent agricultural activities.	Limited – Riparian area consists of agricultural crops and a disturbed area.	Contributing – no direct fish habitat	Limited – No terrestrial habitat present	**Mitigation**	**Mitigation**
HDF-10a	FT – 7 FC – 3 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent agricultural activities.	Limited – Riparian area consists of agricultural crops.	Contributing – no direct fish habitat	Limited – No terrestrial habitat present	**Mitigation**	**Mitigation**
HDF-11a	FT – 7 FC – 3 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent agricultural activities.	Limited – Riparian area consists of agricultural crops.	Contributing – no direct fish habitat	Limited – No terrestrial habitat present	**Mitigation**	**Mitigation**
HDF-12a	FT – 7 FC – 3 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent agricultural activities.	Limited – Riparian area consists of agricultural crops.	Contributing – no direct fish habitat	Limited – No terrestrial habitat present	**Mitigation**	**Mitigation**
HDF-13a	FT – 7 FC – 3 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent agricultural activities.	Limited – Riparian area consists of agricultural crops.	Contributing – no direct fish habitat	Limited – No terrestrial habitat present	**Mitigation**	**Mitigation**

Table 1: **Headwater Drainage Feature Assessment**

Drainage Feature Segment	Step 1. Hydrology		Step 2. Riparian	Step 3. Fish Habitat	Step 4. Terrestrial Habitat	Management Recommendation per HDF Guidelines	Interpreted Management Recommendation – Humber Station Consultant Team
	Function	Modifiers					
HDF-14a	FT – 7 FC – 2 (Round 1) FC – 1 (Round 2) Limited – Standing water (no downstream hydrological contributions observed)	Hydrology modified by adjacent agricultural activities.	N/A	N/A	N/A	**No Management Required**	**No Management Required**
HDF-15a	FT – 7 FC – 4 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent agricultural activities.	Limited – Riparian area consists of agricultural crops.	Contributing – no direct fish habitat	Limited – No terrestrial habitat present	**Mitigation**	**Mitigation**

LEGEND

FT Feature Types (1-defined natural channel, 2-channelized, 3-multi-thread, 4-no defined feature, 5-tiled drainage, 6-wetland, 7-swale, 8-roadside ditch, 9-online pond outlet)
FC Flow Conditions (1-no surface water (dry), 2-standing water, 3-interstitial flow, 4-surface flow minimal, 5-surface flow substantial)

Note: Codes correspond with Ontario Stream Assessment Protocol (OSAP) guidelines

*The management recommendation per HDF Guidelines differs from the interpreted management recommendation from the Humber Station consultant team based on one or more of the following:

1. Historical straightening/realignment for agricultural purposes and expected ability to provide an improvement via realignment with natural channel design.
2. Ongoing expected impairment occurring due to existing agricultural activities. This includes use of fertilizers and ploughing to the edge of the feature, expected to result in pollution and siltation of fish habitat. It is anticipated that fish habitat can be improved by ending agricultural activities as well as natural channel design with riparian plantings.
3. Capacity for replication of Redside Dace contributing habitat functions for the Humber Station lands through natural channel design and/or wetland compensation.

Table 2: GEI Field Studies and Natural Inventories (2017, 2018, 2021, 2022, 2023, and 2024)

FIELD DATE	NATURE OF INVESTIGATION	SURVEYOR
2017		
April 5	Headwater Drainage Feature Assessment Round 1	G. Buckton O. Park
April 12	Headwater Drainage Feature Assessment Round 1	N. Boucher L. Williamson
April 21	Bat Snag Density Survey	O. Park E. Lee
April 24	Amphibian Call Count Survey Round 1	O. Park L. Williamson
May 17	Amphibian Call Count Survey Round 2	O. Park L. Williamson
June 8	Acoustic Bat Surveys Round 1 Turtle Nesting Survey Round 1	J. Leslie O. Park L. Williamson
June 12	SM3 Bat Recorder Deployment Headwater Drainage Feature Assessment Round 2 Breeding Bird Survey Round 1 Insect Survey Round 1	O. Park L. Williamson N. Boucher G. Buckton P. Burke
June 14	Turtle Nesting Survey Round 2 Site Visit Spring Botanical Surveys Breeding Bird Surveys Round 1	O. Park M. Green G. Buckton C. Zoladeski P. Burke
June 21	Acoustic Bat Surveys Round 2	M. Green G. Buckton
June 22	SM3 Bat Recorder Retrieval Amphibian Call Count Survey Round 3	O. Park C. Zoladeski
June 26	Acoustic Bat Surveys Round 3	O. Park S. Male
June 28	Breeding Bird Survey Round 2 Insect Survey Round 2	P. Burke
July 4	Fish Community Survey	N. Boucher G. Buckton
July 19	Aquatic Habitat Assessment	G. Buckton

FIELD DATE	NATURE OF INVESTIGATION	SURVEYOR
July 26	Insect Survey Round 3	P. Burke
August 15	Summer Vegetation and Botanical Surveys	C. Zoladeski
August 29	Headwater Drainage Feature Assessment Round 3	G. Buckton
September 12	Fall Reptile Surveys Round 1	O. Park M. Tibor-McMahon
September 20	Road Mortality and Snake Survey Round 2	O. Park C. Zoladeski
September 29	Site Visit	R. Hubbard
October 4	Fall Botanical Survey	C. Zoladeski
November 17	Woodland Survey	C. Zoladeski
November 28	Thicket Survey	C. Zoladeski
2018		
March 6	Survey of Road Crossing Areas Wildlife Camera Deployment	C. Zoladeski R. Lee O. Park
March 16	Wildlife Camera SD Card Retrieval	O. Park L. Williamson
March 29	Wildlife Camera SD Card Retrieval	O. Park L. Williamson
April 11	Wildlife Camera Retrieval	O. Park L. Williamson
April 20	Barn Swallow Structure Placement Staking	P. Burke
April 27	Headwater Drainage Feature Assessment Round 1	G. Buckton
May 1	Reptile Surveys Round 1	M. Green O. Park
May 2	Turtle Basking Surveys	M. Green O. Park
May 16	Snake Transects Round 2 Turtle Basking Surveys	M. Green O. Park
May 17	Snake Transects Round 3	M. Green O. Park
May 23	Snake Transects Round 4	R. Lee M. Green
June 13	Headwater Drainage Feature Assessment Round 2	G. Buckton

FIELD DATE	NATURE OF INVESTIGATION	SURVEYOR
2021		
October 19	Feature staking (dripline, top of bank, wetlands) with TRCA and the Town	C. Zoladeski G. Buckton
November 1	Terrestrial Crayfish Survey	M. Nieroda
November 19	Wetland drainage assessment	J. Leslie
2022		
August 19	Invasive Species Distribution Survey	J. Leslie
August 22	Barn Swallow Nest Survey Bat Habitat Structure Assessment	E. Lee M. Balsdon
2023		
April 13	Headwater Drainage Feature Assessment Round 1	G. Buckton A. Siddiqui
May 18	Geomorphic Assessment Headwater Drainage Feature Assessment Round 2	A. Siddiqui L. Mueller
June 29	Wetland survey	J. Leslie
July 27	Wetland survey	P. Burke
August 11	Headwater Drainage Feature Assessment Round 3	S. Martin
2024		
April 9	Wetland Soil Assessment	J. Leslie
August 14	Review Summer Conditions of Headwater Drainage Feature	M.Neiroda

Table 3: Natural Heritage Information Centre (NHIC) Database

COMMON NAME	SCIENTIFIC NAME	S-RANK	G-RANK	COSSARO	COSEWIC	LAST OBSERVED*	EXTIRPATED
Birds							
Bobolink	*Dolichonyx oryzivorus*	S4B	G5	THR	SC		N
Eastern Meadowlark	*Sturnella magna*	S4B, S3N	G5	THR	THR		N
Eastern Wood-pewee	*Contopus virens*	S4B	G5	SC	SC		N
Wood Thrush	*Hylocichla mustelina*	S4B	G4	SC	THR		N
Insects							
Yellow-banded Bumble Bee	*Bombus terricola*	S3S5	G3G5	SC	SC		N
Plants							
Butternut	*Juglans cinerea*	S2?	G3	END	END		N
Fish							
American Brook Lamprey	*Lethenteron appendix*	S3	G4	-	-		N
Reptiles							
Midland Painted Turtle	*Chrysemys picta marginata*	S4	G5T5	-	SC		N

*Note: A "Last Observed" date is not provided in the NHIC database search.

Table 4: Ontario Breeding Bird Atlas (OBBA) Database.

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
Acadian Flycatcher	*Empidonax virescens*	S1B	G5	END	END	2002	N
Alder Flycatcher	*Empidonax alnorum*	S5B	G5	-	-	2004	N
American Crow	*Corvus brachyrhynchos*	S5	G5	-	-	2025	N
American Goldfinch	*Spinus tristis*	S5	G5	-	-	2025	N
American Kestrel	*Falco sparverius*	S4	G5	-	-	2022	N
American Redstart	*Setophaga ruticilla*	S5B	G5	-	-	2025	N
American Robin	*Turdus migratorius*	S5	G5	-	-	2025	N
American Woodcock	*Scolopax minor*	S4B	G5	-	-	2022	N
Baltimore Oriole	*Icterus galbula*	S4B	G5	-	-	2025	N
Bank Swallow	*Riparia riparia*	S4B	G5	THR	THR	2024	N
Barn Swallow	*Hirundo rustica*	S4B	G5	THR	SC	2025	N
Belted Kingfisher	*Megaceryle alcyon*	S5B, S4N	G5	-	-	2024	N
Black-and-white Warbler	*Mniotilta varia*	S5B	G5	-	-	2002	N
Black-billed Cuckoo	*Coccyzus erythropthalmus*	S4S5B	G5	-	-	2021	N
Blackburnian Warbler	*Setophaga fusca*	S5B	G5	-	-	2022	N
Black-capped Chickadee	*Poecile atricapillus*	S5	G5	-	-	2025	N
Black-throated Green Warbler	*Setophaga virens*	S5B	G5	-	-	2004	N
Blue Jay	*Cyanocitta cristata*	S5	G5	-	-	2025	N
Blue-gray Gnatcatcher	*Polioptila caerulea*	S4B	G5	-	-	2022	N
Blue-winged Warbler	*Vermivora cyanoptera*	S4B	G5	-	-	2023	N
Bobolink	*Dolichonyx oryzivorus*	S4B	G5	THR	THR	2025	N
Brown Creeper	*Certhia americana*	S5	G5	-	-	2023	N
Brown Thrasher	*Toxostoma rufum*	S4B	G5	-	-	2023	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
Brown-headed Cowbird	*Molothrus ater*	S5	G5	-	-	2025	N
Canada Goose	*Branta canadensis*	S5	G5	-	-	2024	N
Carolina Wren	*Thryothorus ludovicianus*	S4	G5	-	-	2024	N
Cedar Waxwing	*Bombycilla cedrorum*	S5	G5	-	-	2024	N
Chestnut-sided Warbler	*Setophaga pensylvanica*	S5B	G5	-	-	2025	N
Chimney Swift	*Chaetura pelagica*	S3B	G5	THR	THR	2025	N
Chipping Sparrow	*Spizella passerina*	S5B, S3N	G5	-	-	2025	N
Clay-colored Sparrow	*Spizella pallida*	S4B	G5	-	-	2023	N
Cliff Swallow	*Petrochelidon pyrrhonota*	S4S5B	G5	-	-	2022	N
Common Grackle	*Quiscalus quiscula*	S5	G5	-	-	2025	N
Common Nighthawk	*Chordeiles minor*	S4B	G5	SC	THR	2001	N
Common Raven	*Corvus corax*	S5	G5	-	-	2025	N
Common Yellowthroat	*Geothlypis trichas*	S5B, S3N	G5	-	-	2023	N
Cooper's Hawk	*Accipiter cooperii*	S4	G5	-	-	2023	N
Downy Woodpecker	*Dryobates pubescens*	S5	G5	-	-	2025	N
Eastern Bluebird	*Sialia sialis*	S5B, S4N	G5	-	-	2025	N
Eastern Kingbird	*Tyrannus tyrannus*	S4B	G5	-	-	2025	N
Eastern Meadowlark	*Sturnella magna*	S4B, S3N	G5	THR	THR	2025	N
Eastern Phoebe	*Sayornis phoebe*	S5B	G5	-	-	2023	N
Eastern Screech-Owl	*Megascops asio*	S4	G5	NAR	NAR	2004	N
Eastern Towhee	*Pipilo erythrophthalmus*	S4B, S3N	G5	-	-	2025	N
Eastern Wood-Pewee	*Contopus virens*	S4B	G5	SC	SC	2025	N
European Starling	*Sturnus vulgaris*	SNA	G5	-	-	2025	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
Field Sparrow	*Spizella pusilla*	S4B, S3N	G5	-	-	2025	N
Golden-crowned Kinglet	*Regulus satrapa*	S5	G5	-	-	2001	N
Gray Catbird	*Dumetella carolinensis*	S5B, S3N	G5	-	-	2025	N
Great Blue Heron	*Ardea herodias*	S4	G5	-	-	2022	N
Great Crested Flycatcher	*Myiarchus crinitus*	S5B	G5	-	-	2025	N
Great Horned Owl	*Bubo virginianus*	S4	G5	-	-	2004	N
Green Heron	*Butorides virescens*	S4B	G5	-	-	2022	N
Hairy Woodpecker	*Dryobates villosus*	S5	G5	-	-	2025	N
Hooded Merganser	*Lophodytes cucullatus*	S5	G5	-	-	2022	N
Horned Lark	*Eremophila alpestris*	S4	G5	-		2024	N
House Finch	*Carpodacus mexicanus*	SNA	G5	-	-	2023	N
House Sparrow	*Passer domesticus*	SNA	G5	-	-	2025	N
House Wren	*Troglodytes aedon*	S5B	G5	-	-	2025	N
Indigo Bunting	*Passerina cyanea*	S5B	G5	-	-	2025	N
Killdeer	*Charadrius vociferus*	S4B	G5	-	-	2025	N
Least Flycatcher	*Empidonax minimus*	S5B	G5	-	-	2023	N
Mallard	*Anas platyrhynchos*	S5	G5	-	-	2025	N
Merlin	*Falco columbarius*	S5	G5	-	-	2024	N
Mourning Dove	*Zenaida macroura*	S5	G5	-	-	2025	N
Mourning Warbler	*Geothlypis philadelphia*	S5B	G5	-	-	2025	N
Nashville Warbler	*Leiothlypis ruficapilla*	S5B	G5	-	-	2005	N
Northern Cardinal	*Cardinalis cardinalis*	S5	G5	-	-	2025	N
Northern Flicker	*Colaptes auratus*	S5	G5	-	-	2025	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
Northern Harrier	*Circus cyaneus*	S5B, S4N	G5	-	-	2004	N
Northern Mockingbird	*Mimus polyglottos*	S4	G5	-	-	2024	N
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	S4B	G5	-	-	2025	N
Northern Saw-whet Owl	*Aegolius acadicus*	S5	G5	-	-	2001	N
Northern Waterthrush	*Parkesia noveboracensis*	S5B	G5	-	-	2002	N
Orchard Oriole	*Icterus spurius*	S4B	G5	-	-	2023	N
Osprey	*Pandion haliaetus*	S5B	G5	-	-	2024	N
Ovenbird	*Seiurus aurocapilla*	S5B	G5	-	-	2023	N
Pileated Woodpecker	*Dryocopus pileatus*	S5	G5	-	-	2022	N
Pine Warbler	*Setophaga pinus*	S5B, S3N	G5	-	-	2023	N
Purple Finch	*Carpodacus purpureus*	S5	G5	-	-	2025	N
Red-bellied Woodpecker	*Melanerpes carolinus*	S5	G5	-	-	2023	N
Red-breasted Nuthatch	*Sitta canadensis*	S5	G5	-	-	2023	N
Red-eyed Vireo	*Vireo olivaceus*	S5B	G5	-	-	2025	N
Red-headed Woodpecker	*Melanerpes erythrocephalus*	S3	G5	END	END	2022	N
Red-necked Grebe	*Podiceps grisegena*	S3	G5	-	-	2023	N
Red-tailed Hawk	*Buteo jamaicensis*	S5	G5	-	-	2025	N
Red-winged Blackbird	*Agelaius phoeniceus*	S5	G5	-	-	2025	N
Rock Pigeon	*Columbia livia*	SNA	G5			2025	N
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	S5B	G5	-	-	2025	N
Ruby-throated Hummingbird	*Archilochus colubris*	S5B	G5	-	-	2023	N
Ruffed Grouse	*Bonasa umbellus*	S5	G5	-	-	2025	N
Savannah Sparrow	*Passerculus sandwichensis*	S5B, S3N	G5	-	-	2025	N
Scarlet Tanager	*Piranga olivacea*	S5B	G5	-	-	2025	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
Sharp-shinned Hawk	*Accipiter striatus*	S5	G5	-	-	2003	N
Song Sparrow	*Melospiza melodia*	S5	G5	-	-	2025	N
Sora	*Porzana carolina*	S5B	G5	-	-	2005	N
Spotted Sandpiper	*Actitus macularius*	S5B	G5	-	-	2024	N
Swamp Sparrow	*Melospiza georgiana*	S5B, S4N	G5	-	-	2023	N
Tree Swallow	*Tachycineta bicolor*	S4S5B	G5	-	-	2025	N
Trumpeter Swan	*Cygnus buccinator*	S4	G4	-	-	2022	N
Turkey Vulture	*Cathartes aura*	S5B, S3N	G5	-	-	2025	N
Upland Sandpiper	*Bartramia longicauda*	S2B	G5	-	-	2021	N
Veery	*Catharus fuscescens*	S5B	G5	-	-	2023	N
Vesper Sparrow	*Pooecetes gramineus*	S4B	G5	-	-	2025	N
Virginia Rail	*Rallus limicola*	S4S5B	G5	-	-	2001	N
Warbling Vireo	*Vireo gilvus*	S5B	G5	-	-	2025	N
White-breasted Nuthatch	*Sitta carolinensis*	S5	G5	-	-	2023	N
Wild Turkey	*Meleagris gallopavo*	S5	G5	-	-	2025	N
Willow Flycatcher	*Empidonax traillii*	S4B	G5	-	-	2023	N
Wilson's Snipe	*Gallinago delicata*	S5B	G5	-	-	2003	N
Winter Wren	*Troglodytes hiemalis*	S5B, S4N	G5	-	-	2022	N
Wood Duck	*Aix sponsa*	S5B, S3N	G5	-	-	2023	N
Wood Thrush	*Hylocichla mustelina*	S4B	G4	SC	THR	2025	N
Yellow Warbler	*Setophaga petechia*	S5B	G5	-	-	2025	N
Yellow-bellied Sapsucker	*Sphyrapicus varius*	S5B, S3N	G5	-	-	2023	N
Yellow-billed Cuckoo	*Coccyzus americanus*	S4B	G5	-	-	2022	N

Table 5: Ontario Reptile and Amphibian Atlas (ORRA) Database

COMMON NAME	SCIENTIFIC NAME	S-RANK	G-RANK	COSSARO	COSEWIC	LAST OBSERVED	EXTIRPATED
Midland Painted Turtle	*Chrysemys picta marginata*	S4	G5T5	-	SC	2018	N
Snapping Turtle	*Chelydra serpentina*	S4	G5	SC	SC	2019	N
Eastern Gartersnake	*Thamnophis sirtalis*	S5	G5	-	-	2016	N
Northern Ribbonsnake	*Thamnophis sauritus*	S4	G5	SC	SC	1984	N
Eastern Milksnake	*Lampropeltis triangulum*	S4	G5	NAR	SC	2012	N
Northern Red-bellied Snake	*Storeria occipitomaculata*	S5	G5	-	-	2012	N
American Bullfrog	*Lithobates catesbeiana*	S4	G5	-	-	2012	N
Gray Treefrog	*Hyla versicolor*	S5	G5	-	-	2017	N
Northern Green Frog	*Lithobates clamitans*	S5	G5	-	-	2017	N
Northern Leopard Frog	*Lithobates pipiens*	S5	G5	-	NAR	2008	N
Spring Peeper	*Pseudacris crucifer*	S5	G5	-	-	2018	N
Western Chorus Frog (Great Lakes / St. Lawrence - Canadian Shield popoulation)	*Pseudacris triseriata*	S4	G5	NAR	THR	2011	N
Wood Frog	*Lithobates sylvatica*	S5	G5	-	-	2016	N
American Toad	*Anaxyrus americanus*	S5	G5	-	-	2018	N
Red-spotted Newt	*Notophthalmus viridescens*	S5	G5T5	-	-	2014	N
Eastern Red-backed Salamander	*Plethodon cinereus*	S5	G5	-	-	2016	N
Spotted Salamander	*Ambystoma maculatum*	S4	G5	-	-	2016	N

Table 6: Ontario Butterfly and Moth Atlases Database

COMMON NAME	SCIENTIFIC NAME	S-RANK	G-RANK	COSSARO	COSEWIC	LAST OBSERVED	EXTIRPATED
Silver-spotted Skipper	*Epargyreus clarus*	S4	G5	-	-	2024	N
Northern Cloudywing	*Thorybes pylades*	S5	G5	-	-	2024	N
Dreamy Duskywing	*Erynnis icelus*	S5	G5	-	-	2020	N
Juvenal's Duskywing	*Erynnis juvenalis*	S5	G5	-	-	2023	N
Wild Indigo Duskywing	*Erynnis baptisiae*	S4	G5	-	-	2024	N
Arctic Skipper	*Carterocephalus palaemon*	S5	G5	-	-	2024	N
Least Skipper	*Ancyloxypha numitor*	S5	G5	-	-	2024	N
European Skipper	*Thymelicus lineola*	SNA	G5	-	-	2024	N
Fiery Skipper	*Hylephila phyleus*	SNA	G5	-	-	(year not recorded)	N
Peck's Skipper	*Polites peckius*	S5	G5	-	-	2022	N
Tawny-edged Skipper	*Polites themistocles*	S5	G5	-	-	2024	N
Long Dash Skipper	*Polites mystic*	S5	G5	-	-	2023	N
Northern Broken-Dash	*Wallengrenia egermet*	S5	G5	-	-	2024	N
Little Glassywing	*Pompeius verna*	S4	G5	-	-	2024	N
Delaware Skipper	*Anatrytone logan*	S4	G5	-	-	2024	N
Hobomok Skipper	*Poanes hobomok*	S5	G5	-	-	2024	N
Dun Skipper	*Euphyes vestris*	S5	G5	-	THR	2023	N
Black Swallowtail	*Papilio polyxenes*	S5	G5	-	-	2024	N
Eastern Giant Swallowtail	*Papilio cresphontes*	S4	G5	-	-	2024	N
Eastern Tiger Swallowtail	*Papilio glaucus*	S5	G5	-	-	2024	N
Midsummer Tiger Swallowtail	*Papilio canadensis X glaucus*	-	-	-	-	2022	N

COMMON NAME	SCIENTIFIC NAME	S-RANK	G-RANK	COSSARO	COSEWIC	LAST OBSERVED	EXTIRPATED
Canadian Tiger Swallowtail	*Papilio canadensis*	S5	G5	-	-	2024	N
Tiger Swallowtail Complex	*Papilio glaucus complex*	-	-	-	-	2023	N
Cabbage White	*Pieris rapae*	SNA	G5	-	-	2024	N
Clouded Sulphur	*Colias philodice*	S5	G5	-	-	2024	N
Orange Sulphur	*Colias eurytheme*	S5	G5	-	-	2024	N
Bronze Copper	*Lycaena hyllus*	S5	G5	-	-	2021	N
Acadian Hairstreak	*Satyrium acadicum*	S4	G5	-	-	2023	N
Coral Hairstreak	*Harkenclenus titus*	S5	G5	-	-	2023	N
Banded Hairstreak	*Satyrium calanus*	S4	G5	-	-	2022	N
Hickory Hairstreak	*Satyrium caryaevorum*	S4	G4	-	-	2017	N
Striped Hairstreak	*Satyrium liparops*	S5	G5	-	-	2022	N
Eastern Pine Elfin	*Callophrys niphon*	S5	G5	-	-	2024	N
Eastern Tailed Blue	*Cupido comyntas*	S5	G5	-	-	2024	N
Northern Azure	*Celastrina lucia*	S5	G5	-	-	2024	N
Summer Azure	*Celastrina neglecta*	S5	G5	-	-	2024	N
Azure sp.	*Celastrina sp.*	-	-	-	-	2022	N
European Common Blue	*Polyommatus icarus*	SNA	G5	-	-	2024	N
Silvery Blue	*Glaucopsyche lygdar*	S5	G5	-	-	2024	N
Great Spangled Fritillary	*Speyeria cybele*	S5	G5	-	-	2024	N
Atlantis Fritillary	*Speyeria atlantis*	S5	G5	-	-	1964	N
Pearl Crescent	*Phyciodes tharos*	S4	G5	-	-	2024	N
Northern Crescent	*Phycoides pascoensis*	S5	G5	-	-	2024	N
Cresent sp.	*Phyciodes sp.*	-	-	-	-	2024	N

COMMON NAME	SCIENTIFIC NAME	S-RANK	G-RANK	COSSARO	COSEWIC	LAST OBSERVED	EXTIRPATED
Baltimore Checkerspot	*Euphydryas phaeton*	S4	G5	-	-	2024	N
Question Mark	*Polygonia interrogationis*	S5	G5	-	-	2024	N
Eastern Comma	*Polygonia comma*	S5	G5	-	-	2024	N
Gray Comma	*Polygonia progne*	S5	G5	-	-	2024	N
Compton Tortoiseshell	*Nymphalis l-album*	S5	G5	-	-	2024	N
Mourning Cloak	*Nymphalis antiopa*	S5	G5	-	-	2024	N
Milbert's Tortoiseshell	*Aglais milberti*	S5	G5	-	-	2020	N
American Lady	*Vanessa virginiensis*	S5	G5	-	-	2024	N
Painted Lady	*Vanessa cardui*	S5B	G5	-	-	2020	N
Common Buckeye	*Junonia coenia*	SNA	G5	-	-	2024	
Red Admiral	*Vanessa atalanta*	S5B	G5	-	-	2024	N
White Admiral	*Limenitis arthemis*	S5	G5	-	-	2024	N
Red-spotted Purple	*Limenitis arthemis astyanax*	S5	G5T5	-	-	2024	N
Red-spotted Admiral Intergrade	*Limenitis arthemis arthemis x astyanax*	-	-	-	-	2024	N
Viceroy	*Limenitis archippus*	S5	G5	-	-	2024	N
Northern Pearly-Eye	*Lethe anthedon*	S5	G5	-	-	2024	N
Little Wood-Satyr	*Megisto cymela*	S5	G5	-	-	2024	N
Common Ringlet	*Coenonympha tullia*	S5	G5	-	-	2024	N
Common Wood-Nymph	*Cercyonis pegala*	S5	G5	-	-	2024	N
Monarch	*Danaus plexippus*	S4B, S2N	G4	SC	END	2024	N

No.	x	Species Common Name	Species Scientific Name	Provincial Status (ESA)	S-Rank	Federal Status (SARA Sched. 1)	Ontario Range and Occurrences	Description of Suitable Habitat in Ontario	Habitat Suitability Assessment of Study Area	Species Presence
	x	**VASCULAR PLANTS**								
13	X	Butternut	*Juglans cinerea*	END	S2?	END	The range of butternut extends through most of the southern and eastern mixed deciduous forests in Ontario except the Bruce Peninsula and Manitoulin Island (MECP 2022)	Found in well-drained, rich soils in valleys or on slopes. Prefers full sun and moist to moderately dry conditions (MECP 2022)	Yes - potentially suitable habitat for the species (i.e., moist woodlands and woodland edges) were present within the Study Area.	No - The species was not identified within the Study Area during the detailed vegetation surveys that were undertaken.
125	x	**BIRDS**								
126	x	Acadian Flycatcher	*Empidonax virescens*	END	S1B	END	In Ontario, the Acadian Flycatcher primarily lives in the warmer climate of southern Ontario's Carolinian forests. It needs large, undisturbed forests, often more than 40 hectares in size. It has also been known to nest at a few sites in the Greater Toronto Area but this is unusual. The Acadian Flycatcher population in Ontario is very small, with 25 to 75 breeding pairs recorded in 2010 (MECP 2022).	Typically found in mature, shady forests with ravines, or in forested swamps with a lot of maple and beech trees. Nests are placed at the tip of lower limbs on a tree and formed by loosely woven plant material. Acadian Flycatchers nest only in southwestern Ontario, mostly in large forests and forested ravines near the shore of Lake Erie (MECP 2022).	No - Suitably sized woodlands are not present within the Study Area.	No - The species was not identifed though the breeding bird surveys completed within the Study Area.
130	x	Bank Swallow	*Riparia riparia*	THR	S4B	THR	Found across southern Ontario, with sparcer populations scattered across northern Ontario. The largest populations are found along the Lake Erie and Lake Ontario shorelines, and the Saugeen River (MECP 2022)	Bank swallows nest in burrows in natural and human-made settings where there are vertical faces in silt and sand deposits. Many nests are on banks of rivers and lakes, but they are also found in active sand and gravel pits or former ones where the banks remain suitable (MECP 2022)	No - Suitable nesting habitat of highly erodible vertical faces in sand and silt (i.e., banks, sand and/or gravel piles) were not present within the Study Area.	No - The species was not identifed though the breeding bird surveys completed within the Study Area.
131	x	Barn Swallow	*Hirundo rustica*	SC	S4B	THR	The Barn Swallow may be found throughout southern Ontario and can range as far north as Hudson Bay, wherever suitable locations for nests exist (MECP 2022).	Barn Swallows often live in close association with humans, building their cup-shaped mud nests almost exclusively on human-made structures such as open barns, under bridges and in culverts. The species is attracted to open structures that include ledges where they can build their nests, which are often re-used from year to year. They prefer unpainted, rough-cut wood, since the mud does not adhere as well to smooth surfaces (MECP 2022).	Yes - Suitable nesting habitat of anthropogenic structures were present in the Study Area a total of 12 intact nests were found in five different structures at three locations on the Study Area. All five structures held active nests in 2017. A Notice of Activity (NOA) was submitted to MECP and Replacement Habitat Structures were installed before the structures were removed.	No- All suitable nesting structures have been removed within the Study Area.
133	x	Bobolink	*Dolichonyx oryzivorus*	THR	S4B	THR	Bobolink is widespread in Ontario and is found throughout the province, generally south of the boreal forest (MECP 2022).	Historically, Bobolinks lived in North American tallgrass prairie and other open meadows. With the clearing of native prairies, Bobolinks moved to living in hayfields. Bobolinks often build their small nests on the ground in dense grasses. Both parents usually tend to their young, sometimes with a third Bobolink helping (MECP 2022).	No - Suitable habitat of large grasslands and pastures were not present within the Study Area.	No - The species was not identifed though the breeding bird surveys completed within the Study Area.
135	x	Cerulean Warbler	*Dendroica cerulea*	THR	S2B	END	There are two distinct bands of Cerulean Warbler: one band range is from southern Lake Huron to western Lake Ontario and a bit further north; the second band range is from the Bruce Peninsula/Georgian Bay to the Ottawa River (MECP 2022).	Cerulean Warblers breed in mature deciduous forests that contain large, tall trees with an open understorey (MECP 2022).	Yes - A potentially suitable deciduous forest was present in the Study Area.	No - The species was not identifed though the breeding bird surveys completed within the Study Area.

No.	x	Species Common Name	Species Scientific Name	Provincial Status (ESA)	S-Rank	Federal Status (SARA Sched. 1)	Ontario Range and Occurrences	Description of Suitable Habitat in Ontario	Habitat Suitability Assessment of Study Area	Species Presence
136	x	Chimney Swift	*Chaetura pelagica*	THR	S3B	THR	In Ontario, the species is most widely distributed in the Carolinian zone in the south and southwest of the province, but has been detected throughout most of the province south of the 49th parallel (MECP 2022).	They are more likely to be found in and around urban settlements where they nest and roost (rest or sleep) in chimneys and other manmade structures. They also tend to stay close to water as this is where the flying insects they eat congregate (MECP 2022).	No -While potentially anthropogenic structures were present within the Study Area, none had suitable chimneys which would support nesting of the speices.	No - The species was not identifed though the breeding bird surveys completed within the Study Area.
138	x	Eastern Meadowlark	*Sturnella magna*	THR	S4B,S3N	THR	Eastern Meadowlark is widespread in Ontario and found mostly south of the Canadian Shield (MECP 2022).	Eastern Meadowlarks breed primarily in moderately tall grasslands, such as pastures and hayfields, but are also found in alfalfa fields, weedy borders of croplands, roadsides, orchards, airports, shrubby overgrown fields, or other open areas. Small trees, shrubs or fence posts are used as elevated song perches (MECP 2022).	No - Suitable habitat of large grasslands and pastures were not present within the Study Area.	No - The species was not identifed though the breeding bird surveys completed within the Study Area.
140	x	Eastern Whip-poor-will	*Caprimulgus vociferus*	THR	S4B	THR	In Ontario they breed as far north as the shore of Lake Superior. Although Eastern Whip-poor-wills were once widespread throughout the central Great Lakes region of Ontario, their distribution in this area is now fragmented (MECP 2022).	The Eastern Whip-poor-will is usually found in areas with a mix of open and forested areas, such as savannahs, open woodlands or openings in more mature, deciduous, coniferous and mixed forests (MECP 2022)	No - The Study Area does not provide suitable habitat (i.e., woodldnss with gaps) for the species.	No - The species was not identifed though the breeding bird surveys completed within the Study Area.
147	x	Least Bittern	*Ixobrychus exilis*	THR	S4B	THR	Least Bittern are mostly found in central and eastern Ontario, south of the Canadian Shield (MECP 2022).	In southern Ontario, Least Bittern inhabit wetlands but strongly prefer cattail marshes with open water and channels (MECP 2022).	No - While cattail marshes were present within the Study Area, they were small and lacked open water with channels preferred by the species.	No - The species was not identifed though the breeding bird surveys completed within the Study Area.
156	x	Red-headed Woodpecker	*Melanerpes erythrocephalus*	END	S3	THR	The Red-headed Woodpecker is found across southern Ontario, where it is widespread but rare (MECP 2022).	The Red-headed Woodpecker lives in open woodland and woodland edges and is often found in parks, golf courses and cemeteries that contain many dead trees, which the bird uses for nesting and perching (MECP 2022).	Yes - Potentially suitable woodlands were present within the Study Area	No - The species was not identifed though the breeding bird surveys completed within the Study Area.
161	x	**MAMMALS**								
	x	Eastern Red Bat	*Lasiurus borealis*	END	S3	END^	Eastern red bat spans most of Ontario and is widespread from the boreal forest to the Gulf of Mexico (COSSARO 2024).	Long distance migrants that overwinter in leaf litter in the southern US. Eastern red bat shows often returns to small roosting areas within their summer home ranger and roost primarily among foliage of large diameter trees.	Yes - Potentially suitable habitat for forests with cavity trees were present within the Study Area (FOD8-3)	Yes- through acoustic monitoring in FOD8-3, species were confirmed present in Study Area. Habitat may be present within the northwestern FOD and southern FOD7-6 on non-participating lands
164	x	Eastern Small-footed Myotis	*Myotis leibii*	END	S2S3		The eastern small-footed bat has been found from south of Georgian Bay to Lake Erie and east to the Pembroke area. There are also records from the Bruce Peninsula, the Espanola area, and Lake Superior Provincial Park (MECP 2022)	In the spring and summer, eastern small-footed bats will roost in a variety of habitats, including in or under rocks, in rock outcrops, in buildings, under bridges, or in caves, mines, or hollow trees. In the winter, these bats hibernate, most often in caves and abandoned mines. They seem to choose colder and drier sites than similar bats and will return to the same spot each year (MECP 2022)	Yes - Potentially suitable habitat for forests with cavity trees were present within the Study Area (FOD8-3)	Potential - Through acoustic monitoring in FOD8-3 these species were confirmed absent from the Study Area. However, It is acknowledged that this species may be present within the northwestern FOD and southern FOD7-6 on non-participating lands.
	x	Hoary Bat	*Lasiurus cinereus*	END	S3	END^	Hoary at is widespread across Canada and within Ontario, covering most of the province except for northern most edge of Hudson's Bay (COSSARO 2024).	Migratory species that may use relatively small summer home range and exhibit roost site fidelity between years and within a single breeding season (COSSARO 2024).	Yes - Potentially suitable habitat for forests with cavity trees were present within the Study Area (FOD8-3)	Yes- through acoustic monitoring in FOD8-3, species were confirmed present in Study Area. Habitat may be present within the northwestern FOD and southern FOD7-6 on non-participating lands

No.	x	Species Common Name	Species Scientific Name	Provincial Status (ESA)	S-Rank	Federal Status (SARA Sched. 1)	Ontario Range and Occurrences	Description of Suitable Habitat in Ontario	Habitat Suitability Assessment of Study Area	Species Presence
167	x	Little Brown Myotis	*Myotis lucifugus*	END	S4	END	Widespread in southern Ontario and found as far north as Moose Factory and Favourable Lake (MECP 2022)	Bats are nocturnal. During the day they roost in trees and buildings. They often select attics, abandoned buildings and barns for summer colonies where they can raise their young. Little brown bats hibernate from October or November to March or April, most often in caves or abandoned mines that are humid and remain above freezing (MECP 2022).	Yes - Potentially suitable habitat for forests with cavity trees were present within the Study Area (FOD8-3)	Potential - Through acoustic monitoring in FOD8-3 these species were confirmed absent from the Study Area. However, It is acknowledged that this species may be present within the northwestern FOD and southern FOD7-6 on non-participating lands.
169	x	Northern Myotis	*Myotis septentrionalis*	END	S3	END	The northern long-eared bat is found throughout forested areas in southern Ontario, to the north shore of Lake Superior and occasionally as far north as Moosonee, and west to Lake Nipigon (MECP 2022)	Northern long-eared bats are associated with boreal forests, choosing to roost under loose bark and in the cavities of trees. These bats hibernate from October or November to March or April, most often in caves or abandoned mines (MECP 2022).	Yes - Potentially suitable habitat for forests with cavity trees were present within the Study Area (FOD8-3)	Potential - Through acoustic monitoring in FOD8-3 these species were confirmed absent from the Study Area. However, It is acknowledged that this species may be present within the northwestern FOD and southern FOD7-6 on non-participating lands.
	x	Silver-haired Bat	*Lasionycteris noctivagans*	END	S3	END^	In Ontario, the species is found across the province extending north to the edge of the Hudson Bay Lowlands (COSSARO 2023)	Silver-haired bats roost primarily under the bark and in tree cavities and will roost in variety of large diameter coniferous or deciduous trees. These bats are migrants, and riparian zones may provide important stopover habitat and migration corridors (COSSARO 2023).	Yes - Potentially suitable habitat for forests with cavity trees were present within the Study Area (FOD8-3)	Yes- through acoustic monitoring in FOD8-3, species were confirmed present in Study Area. Habitat may be present within the northwestern FOD and southern FOD7-6 on non-participating lands
	x	Tri-colored Bat	*Perimyotis subflavus*	END	S3?	END	This bat is found in southern Ontario and as far north as Espanola near Sudbury. Because it is very rare, it has a scattered distribution (MECP 2022).	During the summer, the Tri-colored Bat is found in a variety of forested habitats. It forms day roosts and maternity colonies in older forest and occasionally in barns or other structures. They overwinter in caves where they typically roost by themselves rather than part of a group (MECP 2022).	Yes - Potentially suitable habitat for forests with cavity trees were present within the Study Area (FOD8-3)	Potential - Through acoustic monitoring in FOD8-3 these species were confirmed absent from the Study Area. However, It is acknowledged that this species may be present within the northwestern FOD and southern FOD7-6 on non-participating lands.
	x	**FISH**								
	x	Redside Dace	*Clinostomus elongatus*	END	S1	END	Redside dace are found in a few tributaries of Lake Huron, in streams flowing into western Lake Ontario, the Holland River (which flows into Lake Simcoe), and Irvine Creek of the Grand River system (which flows into Lake Erie).	The Redside dace is found in pools and slow-moving areas of small streams and headwaters with a gravel bottom. They are generally found in areas with overhanging grasses and shrubs, and can leap up to 10 cm out of the water to catch insects.During spawning, they can be found in shallow parts of streams, which are also popular spawning areas for other minnow species.	Yes- The West Humber River is identified as occupied Redside Dace habitat.	No- occupied Redside Dace habitat not present within Study Area

x **Last Updated**
x S Rank: NHIC Biodiversity Explorer 2025
x Provinicial Status: 2025
x COSSARO Priority Species: January 2017
x Federal Status: Februray 2023
x ^no schedule or status in SARA, but listed in COSEWIC

x **Source**
x Bickerton, H.J. 2013. DRAFT Recovery Strategy for the American Columbo (Frasera caroliniensis) in Ontario. Ontario Recovery Strategy
x Boland, G.J., J. Ambrose, B. Husband, K.A. Elliott and M.S. Melzer. 2012. Recovery Strategy for the American Chestnut (Castanea dentata)
x Hoary Mountain-mint Recovery Team (HMRT). 2011. Recovery Strategy for Hoary Mountain-mint (*Pycnanthemum incanum*) in Ontario.
x MNR (2013). What's at Risk in Peel? On-line:
x SARO (2022). Species at Risk in Ontario List. Ontario Regulation 230/08. Consolidation Period January 24, 2013.

Table 8: Ecological Landscape Characterization (ELC) Community Descriptions

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK / G-RANK (NHIC, 2013)
FOREST		
Deciduous Forest		
FOD8-3* Fresh-Moist Basswood Deciduous Forest	• A young regenerating community of Basswood (*Tilia americana*), originating mostly from stump resprouts. • Thick tall shrub layer of Common Buckthorn (*Rhamnus cathartica*), with occasional Choke Cherry (*Prunus virginiana*). • Moderately developed herb layer, dominated by Virginia Strawberry (*Fragaria virginiana*).	NA
FOD7-6* Fresh-Moist Manitoba Maple Lowland Deciduous Forest	• Canopy with abundance of Manitoba Maple (*Acer negundo*) and subcanopy/understory with abundance of Common Buckthorn. • Ground cover generally composed of Garlic Mustard (*Alliaria petiolata*), Bull Thistle (*Cirsium vulgare*), Smooth Brome (*Bromus inermis*), Field Horsetail (*Equisetum arvense*), and Common Bedstraw (*Galium aparine*).	NA
CULTURAL		
Cultural Meadow		
CUM1-1 Dry-Moist Old Field Meadow	• A diverse community of native species and exotics. • The main species are Smooth (Awnless) Brome (*Bromus inermis*), Tall Goldenrod (*Solidago altissima*) and Canada Thistle (*Cirsium arvense*). • Occasional presence of Quack Grass (*Elymus repens*), Common Milkweed (*Asclepias syriaca*), New England Aster (*Symphyotrichum novae-angliae*), Chickory (*Cichorium intybus*), Orchard Grass (*Dactylis glomerata*), and several others.	NA
Cultural Thicket		
CUT1-1 Sumac Cultural Thicket	• Upland shrub thicket with abundance of Staghorn Sumac (*Rhus typhina*) • Herbaceous composition similar to that of Old Field Meadow vegetation types.	N/A
CUT1-7* Buckthorn Cultural Thicket	• Open to dense community of Common Buckthorn, with occasional presence of young trees of Green Ash (*Fraxinus pennsylvanica*) and Basswood. • Ground cover of mostly old field meadow grasses and forbs.	NA

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK / G-RANK (NHIC, 2013)
MARSH		
Meadow Marsh		
MAM2-2 Reed-canary Grass Mineral Meadow Marsh	• The majority of this community is dominated by Reed-canary Grass (*Phalaris arundinacea*), but smaller vegetation types (i.e., inclusions) are present, such as Narrow Leaved Cattail (*Typha angustifolia*) marsh, and forb marsh composed primarily of Panicled Aster (*Symphyotrichum lanceolatum)*	S5
MAM2-10 Forb Mineral Meadow Marsh	• These are diverse meadows, mostly associated with watercourses, of many graminoid and forb species. • The dominants are usually Panicled Aster (*Symphyotrichum lanceolatum*), Rice Cut Grass (*Leersia oryzoides*), Reed-canary Grass, Bentgrass (*Agrostis stolonifera*), Purple Loosestrife (*Lythrum salicarua*) and Small-flowered Willow-herb (*Epilobium parviflorum*).	S4S5
Shallow Marsh		
MAS2-1 Cattail Mineral Shallow Marsh	• The tall herb layer dominants include Glaucous Cattail (*Typha* x *glauca*) and Narrow-leaved Cattail (*Typha angustifolia*). • In the medium layer grow Reed-canary Grass, Panicled Aster and Cursed Buttercup (*Ranunculus sceleratus*).	S5
Shallow Water		
SAS1-1 Pondweed Submerged Shallow Aquatic	• This community is dominated by Sago Pondweed (*Stuckenia pectinata*), with additional occurrences of Small Pondweed (*Potamogeton pusillus*), and Lesser Duckweed (*Lemna minor*).	S5
Swamp		
SWT2-2 Willow Mineral Thicket Swamp	• Shrub thicket bordering a shallow aquatic community, composed primarily of Sandbar Willow (*Salix interior*), and Peach-leaved Willow (*Sallix amygdaloides*) • Herbaceous species consisted primarily of Reed Canary Grass, Purple Loosestrife, Narrow-leaved Cattail, Red-stemmed Spikerush (*Eleocharis erythropoda*), and Panicled Aster.	S5

*Denotes a type not listed in the Southern Ontario ELC Guide

Table 9: Wetland A1-North MAM2-2 (south of OA within drainage)-Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Wetland Size (agency staking)	• 0.08 ha
Wetland Type	• Riverine
Contributing Drainage Area (including wetland area)	• 0.69 ha
Underlying Geology	• Relatively low permeability silty clay till underlain by sandy silt till to an approximate depth of 10 m (MW2-17D). The upper till unit is interpreted to be the Halton Till. A silt unit was noted at 10 m depth. The underlying upper bedrock unit is interpreted to be the Georgian Bay Formation. The depth to bedrock is estimated to be >30-35 m based on regional mapping. The Georgian Bay Formation consists of dark blue grey to black shale with interbeds of limestone. The Georgian Bay Formation shale is not typically considered an aquifer.
Wetland Soil Conditions (organics, mottles, gley)	• Wetland soil sampled on April 9, 2024 • Soil saturated with little pooling. • 0-40 cm+=SiC • g=12 cm • G=19 cm • Augered depth=40 cm
Groundwater Conditions	• Groundwater was observed to range from slightly above proximate ground surface (-0.2m) to 2 m below ground surface based on monitoring station SF-17. Predominantly downward gradients were observed suggesting recharge conditions.

Table 9: Wetland A1-North MAM2-2 (south of OA within drainage)-Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Hydroperiod/Surface Water Conditions	• Amphibian Call Count Survey station 8 water was present during all three rounds of surveys (April 24, 2017, May 17, 2017, and June 22, 2017). The water level was 100 cm.
Surface Water Inputs and Inlet Conditions	• HDF-3 originates at Healey Road. HDF-3i is upstream from the MAM2-2 with an OA. Water was present throughout the summer. • HDF-3g is a channel with flow throughout the summer and is located downstream from the MAM2-2 with an OA.
Outlet Conditions	• HDF-3 originates at Healey Road flowing across the northwest portion of the Study Area towards an online pond and outletting to The Gore Road Tributary located immediately west of Humber Station Road.
ELC Vegetation Types	• Reed Canary Grass Mineral Meadow Marsh (MAM2-2) and Open Aquatic (OA)
Dominant Vegetation Species Per Strata	• This community is dominated almost entirely by Reed-canary Grass (*Phalaris arundinacea*). The open water has no obvious aquatic species.

Table 9: Wetland A1-North MAM2-2 (south of OA within drainage)-Summary of Existing Conditions

Fish and Wildlife Use	• Fish were observed in HDF-3g in early summer. • Terrestrial crayfish observed in HDF-3g. • Common Hop Sedge (*Salix lupulina*) • Gray Treefrog (*Hyla versicolor*) • Canada Goose (*Branta canadensis*) • Rock Pigeon (*Columba livia*) • Ring-billed Gull (*Larus delawarensis*) • Great Blue Heron (*Ardea herodias*) • Northern Flicker (*Colaptes auratus*) • Eastern Wood-Pewee (*Contopus virens*) • Red-eyed Vireo (*Vireo olivaceus*) • Horned Lark (*Eremophila alpestris*) • Barn Swallow (*Hirundo rustica*) • American Robin (*Turdus migratorius*) • Brown Thrasher (*Toxostoma rufum*) • Cedar Waxwing (*Bombycilla cedrorum*) • American Goldfinch (*Spinus tristis*) • Savannah Sparrow (*Passerculus sandwichensis*) • Song Sparrow (*Melospiza melodia*) • Swamp Sparrow (*Melospiza georgiana*) • Northern Cardinal (*Cardinalis cardinalis*) • Red-winged Blackbird (*Agelaius phoeniceus*)

Table 9: Wetland A1-North MAM2-2 (south of OA within drainage)-Summary of Existing Conditions

ATTRIBUTE	COMMENTS
	• Brown-headed Cowbird (*Molothrus ater*) • Baltimore Oriole (*Icterus galbula*)
Special Features/Other (i.e., hibernacula, vernal pools)	• N/A
Evaluation Status and Significance (OWES)	• Not evaluated – did not meet size criteria • Non-Significant
Management Recommendations	• N/A

Table 10: Wetland B1-MAS2-1 (southeast corner of FOD)-Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Wetland Size (agency staking)	• 0.08 ha
Wetland Type	• Isolated
Contributing Drainage Area (including wetland area)	• 0.20 ha
Underlying Geology	• Relatively low permeability silty clay till underlain by sandy silt till to an approximate depth of 10 m (MW2-17D). The upper till unit is interpreted to be the Halton Till. A silt unit was noted at 10 m depth. The underlying upper bedrock unit is interpreted to be the Georgian Bay Formation. The depth to bedrock is estimated to be >30-35 m based on regional mapping. The Georgian Bay Formation consists of dark blue grey to black shale with interbeds of limestone. The Georgian Bay Formation shale is not typically considered an aquifer.
Wetland Soil Conditions (organics, mottles, gley)	• Wetland soil sampled on April 15, 2024. • Surface water 39 cm deep at auger (~2.5 m from the wet/up boundary) • Wood Frog and Chorus Frog heard calling. • 0-2 cm=Of • ≥3 cm=SiC • G=6 cm • g=10 cm • Augered depth=30 cm

Table 10: Wetland B1-MAS2-1 (southeast corner of FOD)-Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Groundwater Conditions	• Groundwater approximately to range from slightly above ground surface (-0.2 m) to 0.7 m below ground surface based on monitoring station WL1-17. Predominantly downward vertical hydraulic gradients were observed; however upward gradients have been noted in late fall / early winter 2017/2018 indicating periodic groundwater discharge.
Hydroperiod/Surface Water Conditions	• Amphibian Call Count Surveys all three rounds had 100 cm of water (April 24, 2017, May 17, 2017, and June 22, 2017. • Wetland Survey the water depth was >35cm on June 29, 2023.
Surface Water Inputs and Inlet Conditions	• This feature is considered isolated, and no flow observed in round 1 of HDFA. • Direct precipitation and surface water runoff are interpreted to provide the majority of the water supply to this feature.
Outlet Conditions	• No observed outlet.
ELC Vegetation Types	• Cattail Mineral Shallow Marsh (MAS2-1)
Dominant Vegetation Species Per Strata	• The tall herb layer dominants include Glaucous Cattail (*Typha x glauca*) and Narrow-leaved Cattail (*Typha angustifolia*). • In the medium layer grow Reed-canary Grass, Panicled Aster and Cursed Buttercup (*Ranunculus sceleratus*).

Table 10: Wetland B1-MAS2-1 (southeast corner of FOD)-Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Fish and Wildlife Use	• Peachleaf Willow (*Salix amygdaloides*) • Northern Leopard Frog (*Lithobates pipiens*) • Green Frog (*Lithobates clamitans*) • Gray Treefrog (*Hyla versicolor*) • No turtles or snakes • Downy Woodpecker (*Picoides pubescens*) • Northern Flicker (*Colaptes auratus*) • Great Crested Flycatcher (*Myiarchus crinitus*) • American Crow (*Corvus brachyrhynchos*) • Black-capped Chickadee (*Poecile atricapillus*) • House Wren (*Troglodytes aedon*) • American Robin (*Turdus migratorius*) • Song Sparrow (*Melospiza melodia*) • Red-winged Blackbird (*Agelaius phoeniceus*) • American Woodcock (*Scolopax minor*)
Special Features/Other (i.e., hibernacula, vernal pools)	• N/A
Evaluation Status and Significance (OWES)	• Not evaluated – did not meet size criteria • Non-Significant
Sensitivity to Water Budget Change	• N/A

Table 10: Wetland B1-MAS2-1 (southeast corner of FOD)-Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Management Recommendations	• N/A

Table 11: Wetland C-MAM2-2 (east side of FOD8-3 with drainage)-Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Wetland Size (agency staking)	• 0.61 ha
Wetland Type	• Riverine
Contributing Drainage Area (including wetland area)	• 2.29 ha
Underlying Geology	• Relatively low permeability silty clay till underlain by sandy silt till to an approximate depth of 10 m (MW2-17D). The upper till unit is interpreted to be the Halton Till. A silt unit was noted at 10 m depth. The underlying upper bedrock unit is interpreted to be the Georgian Bay Formation. The depth to bedrock is estimated to be >30-35 m based on regional mapping. The Georgian Bay Formation consists of dark blue grey to black shale with interbeds of limestone. The Georgian Bay Formation shale is not typically considered an aquifer.
Wetland Soil Conditions (organics, mottles, gley)	• Wetland soil sampled on April 15, 2024. • Surface water 1 cm deep • 0-40 cm =SiC • g=15 cm • G=15 cm • Augered depth=40 cm

Table 11: Wetland C-MAM2-2 (east side of FOD8-3 with drainage)-Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Groundwater Conditions	• Groundwater was observed to range from slightly above ground surface (-0.2 m) to 2.2 m below ground surface based on monitoring station WL2-17. Downward vertical hydraulic gradients were noted indicating recharge conditions. HDF3 crosses Wetland C and stream flow measurements were noted in WL3-17 was observed to range from 0 (dry) (Sept. 2023) to 5.2 L/s (April 2018). Flow measurements interpreted to represent runoff and not related to groundwater discharge.
Hydroperiod/Surface Water Conditions	• Amphibian Call Count Survey Round 1 April 24, 2017, water was present at station 3 with 10cm of water. At station 11 there was 15 cm of water. • Station 3 and 11 were dry during round 2 of Amphibian Call Count Surveys on May 17, 2017. • Wetland Survey- <5cm of water present on June 22, 2023.
Surface Water Inputs and Inlet Conditions	• Wetland with flow in summer (HDF-3e), standing water (no downstream hydrological contributions observed) HDF-3-2a.
Outlet Conditions	• HDF-3 originates at Healey Road flowing across the northwest portion of the Study Area towards an online pond and outletting to The Gore Road Tributary located immediately west of Humber Station Road.
ELC Vegetation Types	• Reed Canary Grass Mineral Meadow Marsh (MAM2-2)
Dominant Vegetation Species Per Strata	• The majority of this community is dominated by Reed-canary Grass (*Phalaris arundinacea*), but smaller vegetation types (i.e.,inclusions) are present, such as Narrow Leaved Cattail (*Typha angustifolia*) marsh, and forb marsh composed primarily of Panicled Aster (*Symphyotrichum lanceolatum*)

Table 11: Wetland C-MAM2-2 (east side of FOD8-3 with drainage)-Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Fish and Wildlife Use	• No amphibians were heard calling from the feature. • Fish observed upstream and downstream from HDF-3e in summer. • Marsh seedbox (*Ludwigia palustris*) • Common Spikerush (Eleocharis palustris) • Upland Sandpiper (*Bartramia longicauda*) • Ring-billed Gull (*Larus delawarensis*) • Blue Jay (*Cyanocitta cristata*) • Horned Lark (*Eremophila alpestris*) • Barn Swallow (*Hirundo rustica*) • American Robin (*Turdus migratorius*) • Cedar Waxwing (*Bombycilla cedrorum*) • American Goldfinch (*Spinus tristis*) • Song Sparrow (*Melospiza melodia*) • Northern Cardinal (*Cardinalis cardinalis*) • Red-winged Blackbird (*Agelaius phoeniceus*) • Common Grackle (*Quiscalus quiscula*) • Killdeer (*Charadrius vociferus*) • Downy Woodpecker (*Picoides pubescens*) • Savannah Sparrow (*Passerculus sandwichensis*) • Brown-headed Cowbird (*Molothrus ater*) • Baltimore Oriole (*Icterus galbula*)

Table 11: Wetland C-MAM2-2 (east side of FOD8-3 with drainage)-Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Special Features/Other (i.e., hibernacula, vernal pools)	• N/A
Evaluation Status and Significance (OWES)	• Not evaluated – did not meet size criteria • Non-Significant
Management Recommendations	• N/A

Table 12: Wetland D1-MAS2-1/MAM2-2 (eastern watercourse) Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Wetland Size (agency staking)	• 5.13 ha
Wetland Type	• Riverine
Contributing Drainage Area (including wetland area)	• 12.78 ha
Underlying Geology	• Relatively low permeability silty clay till underlain by silt, with some clay and trace clay at an approximate depth of 3.5 m (MW3-17). The upper till unit is interpreted to be the Halton Till. The underlying upper bedrock unit is interpreted to be the Georgian Bay Formation. The depth to bedrock is estimated to be >35 m based on regional mapping. The Georgian Bay Formation consists of dark blue grey to black shale with interbeds of limestone. The Georgian Bay Formation shale is not typically considered an aquifer.
Wetland Soil Conditions (organics, mottles, gley)	• Wetland soil sampled on April 15, 2024. • Surface water=2 cm • 0-5 cm= SiCL • 6 cm+=SiC • g= 5 cm • G=5 cm • Augered depth= 42 cm

Table 12: Wetland D1-MAS2-1/MAM2-2 (eastern watercourse) Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Groundwater Conditions	• Wetland D1 is located within the Clarkway Drive Tributary valley. Groundwater was observed to range from 0.01m to 1.1 m below ground surface at SF2-17. Downward vertical hydraulic gradients were at SF2-17 indicating local recharge conditions. Streamflow at SF2-17 was noted between 0.4 L/s and 41.1 L/s. Flow measurements may represent groundwater discharge within Clarkway Drive Tributary valley.
Hydroperiod/Surface Water Conditions	• Amphibian Call Count Survey station 12 water was absent (April 24, 2017). • HDF-15a and HDF-4a are located north of the wetland and have contributing-ephemeral.
Surface Water Inputs and Inlet Conditions	• The Clarkway Drive Tributary flows from Healey Road and Coleraine Drive into the northeast corner of the Subject Lands.HDF-15a and HDF-4a are contributing-ephemeral.
Outlet Conditions	• The Clarkway Drive Tributary flows from the northeast corner of the Subject Lands and continues south past Mayfield Road until it reaches the West Humber River.
ELC Vegetation Types	• Reed Canary Grass Mineral Meadow Marsh (MAM2-2), Cattail Mineral Shallow Marsh (MAS2-1).
Dominant Vegetation Species Per Strata	• This community is dominated almost entirely by Reed-canary Grass (*Phalaris arundinacea*), but smaller vegetation types (i.e.,inclusions) are present, such as Narrow Leaved Cattail (*Typha angustifolia*) marsh, and forb marsh composed primarily of Panicled Aster (*Symphyotrichum lanceolatum).* • The tall herb layer dominants include Glaucous Cattail (*Typha x glauca*) and Narrow-leaved Cattail (*Typha angustifolia*). • In the medium layer grow Reed-canary Grass, Panicled Aster and Cursed Buttercup (*Ranunculus sceleratus*).

Table 12: Wetland D1-MAS2-1/MAM2-2 (eastern watercourse) Summary of Existing Conditions

Fish and Wildlife Use	• Gray Treefrog (*Hyla versicolor*) • Fowl Blue Grass (*Poa palustris*) • Northern Green Frog (Lithobates *clamitans*) • HDF-15a is contributing Redside Dace habitat • Terrestrial Crayfish observed. • Mallard (*Anas platyrhynchos*) • Virginia Rail (*Rallus limicola*) • Killdeer (*Charadrius vociferus*) • Rock Pigeon (*Columba livia*) • Spotted Sandpiper (*Actitus macularius*) • Ring-billed Gull (*Larus delawarensis*) • Willow Flycatcher (*Empidonax traillii*) • Horned Lark (*Eremophila alpestris*) • Barn Swallow (*Hirundo rustica*) • Black-capped Chickadee (*Poecile atricapillus*) • American Robin (*Turdus migratorius*) • Brown Thrasher (*Toxostoma rufum*) • European Starling (Sturnus vulgaris) • Song Sparrow (*Melospiza melodia*) • Swamp Sparrow (*Melospiza georgiana*) • Red-winged Blackbird (*Agelaius phoeniceus*) • American Mink (*Mustela vison*)

Table 12: Wetland D1-MAS2-1/MAM2-2 (eastern watercourse) Summary of Existing Conditions

ATTRIBUTE	COMMENTS
	• Norway Rat (*Rattus norvegicus*)
Special Features/Other (i.e., hibernacula, vernal pools)	• N/A
Evaluation Status and Significance (OWES)	• Evaluated as Provincially Significant Wetland
Management Recommendations	• N/A

Table 13: Wetland E1-SWT2-2 (surrounds SAS1-1) Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Wetland Size (agency staking)	• 0.36 ha SWT2-2, SAS1-1 0.39 ha
Wetland Type	• Riverine
Contributing Drainage Area (including wetland area)	• 4.59 ha
Underlying Geology	• Relatively low permeability silty clay till underlain by silt, with some clay and trace clay at an approximate depth of 3.6 m (MW4-17D). The upper till unit is interpreted to be the Halton Till. The underlying upper bedrock unit is interpreted to be the Georgian Bay Formation. The depth to bedrock is estimated to be between 20 m – 25 m based on regional mapping. The Georgian Bay Formation consists of dark blue grey to black shale with interbeds of limestone. The Georgian Bay Formation shale is not typically considered an aquifer.
Wetland Soil Conditions (organics, mottles, gley)	• Wetland soil sampled on April 15, 2024. • Surface soil moist • Ground water at 8 cm • 0-25 cm= SiC • 26cm +=C • g=10 cm • G=30 cm • Auger depth=45 cm

Table 13: Wetland E1-SWT2-2 (surrounds SAS1-1) Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Groundwater Conditions	• Wetland E1 is located within the HDF-3 valley. Groundwater was observed to range from slightly above ground surface (-0.2 m) to 0.3 m below ground surface at SF5-17. Variable vertical hydraulic gradients were observed at SF6-17 indicating occasional groundwater discharge to surface. Streamflow station SF5-17 was noted to flow between 3.3 L/s and 143.7 L/s. Flow measurements may represent groundwater discharge within the HDF-3 valley.
Hydroperiod/Surface Water Conditions	• Amphibian Call Count Survey station 14 and 15 water was present during all three rounds of surveys (April 24, 2017, May 17, 2017, and June 22, 2017). The water level was 100cm at station 15.
Surface Water Inputs and Inlet Conditions	• HDF-3 originates at Healey Road. • HDF-3b is a wetland with flowing water in the summer.
Outlet Conditions	• HDF-3 originates at Healey Road flowing across the northwest portion of the Study Area towards an online pond and outletting to The Gore Road Tributary located immediately west of Humber Station Road.
ELC Vegetation Types	• Willow Mineral Thicket Swamp (SWT2-2), Pondweed Submerged Shallow Aquatic (SAS1-1)
Dominant Vegetation Species Per Strata	• SWT2-2 • This community is dominated by Small Pondweed (*Potamogeton pusillus*), with occasional floating patches of Lesser Duckweed (*Lemna minor*).

Table 13: Wetland E1-SWT2-2 (surrounds SAS1-1) Summary of Existing Conditions

Fish and Wildlife Use	• American Toad (*Anaxyrus americanus*) • Gray Treefrog (*Hyla versicolor*) • Northern Green Frog (*Lithobates clamitans*) • Northern Leopard Frog (*Lithobates pipiens*) • Peachleaf Willow (*Salix amygdaloides*) • Fish present in the pond throughout the summer and provides amphibian breeding habitat. • Mallard (*Anas platyrhynchos*) • Mourning Dove (*Zenaida macroura*) • Killdeer (*Charadrius vociferus*) • Ring-Billed Gull (*Larus delawarensis*) • Eastern Wood-Pewee (*Contopus virens*) • Willow Flycatcher (*Empidonax traillii*) • American Crow (*Corvus brachyrhynchos*) • Horned Lark (*Eremophila alpestris*) • Barn Swallow (*Hirundo rustica*) • American Robin (*Turdus migratorius*) • European Starling (*Sturnus vulgaris*) • American Goldfinch (*Spinus tristis*) • Common Yellowthroat (*Geothlypis trichas*) • Vesper Sparrow (*Pooecetes gramineus*) • Song Sparrow (*Melospiza melodia*) • Swamp Sparrow (*Melospiza georgiana*)

Table 13: Wetland E1-SWT2-2 (surrounds SAS1-1) Summary of Existing Conditions

ATTRIBUTE	COMMENTS
	• Red-winged Blackbird (*Agelaius phoeniceus*) • Common Grackle (*Quiscalus quiscula*) • Baltimore Oriole (*Icterus galbula*)
Special Features/Other (i.e., hibernacula, vernal pools)	• N/A
Evaluation Status and Significance (OWES)	• Evaluated as Provincially Significant Wetland
Management Recommendations	• N/A

Table 14: Wetland F1-Northeast MAM2-10/ MAM2-2/MAS2-1 Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Wetland Size (agency staking)	• 0.46 ha
Wetland Type	• Riverine
Contributing Drainage Area (including wetland area)	• 1.60 ha
Underlying Geology	• Relatively low permeability silty clay overlying silt at an approximate depth of 2.1 m (MW5-17D). The upper unit may represent glaciolacustrine deposits mapped slightly to the south on OGS mapping and the upper Halton Till unit may be absent. The underlying upper bedrock unit is interpreted to be the Georgian Bay Formation. The depth to bedrock is estimated may be > 20 m based on regional mapping. The Georgian Bay Formation consists of dark blue grey to black shale with interbeds of limestone. The Georgian Bay Formation shale is not typically considered an aquifer.
Wetland Soil Conditions (organics, mottles, gley)	• Wetland soil sampled on April 15, 2024. • Surface water=3 cm • 0-45 cm+=SiC • G=10 cm • No g • Auger depth=45 cm
Groundwater Conditions	• Wetland F1 is located within the Clarkway Drive Tributary valley. Groundwater was observed to range in depth from ground surface (0.0 m) to 1.1 m below ground surface at SF2-17. Predominantly upward gradients were observed at SF3-17 indicating groundwater discharge conditions. Streamflow at SF2-17 was noted between 0.4 L/s and 41.1 L/s. Flow measurements may represent groundwater discharge within Clarkway Drive Tributary valley.

Table 14: Wetland F1-Northeast MAM2-10/ MAM2-2/MAS2-1 Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Hydroperiod/Surface Water Conditions	• HDF-11a,12a,13a are contributing-ephemeral.
Surface Water Inputs and Inlet Conditions	• The Clarkway Drive Tributary flows from Healey Road and Coleraine Drive into the northeast corner of the Subject Lands. HDF-11a,12a,13a are contributing-ephemeral.
Outlet Conditions	• The Clarkway Drive Tributary flows from the northeast corner of the Subject Lands and continues south past Mayfield Road until it reaches the West Humber River.
ELC Vegetation Types	• Forb Mineral Meadow Marsh (MAM2-10),Reed Canary Grass Mineral Meadow Marsh (MAM2-2), Cattail Mineral Shallow Marsh (MAS2-1).
Dominant Vegetation Species Per Strata	• These are diverse meadows, mostly associated with watercourses, of many graminoid and forb species. • The dominants are usually Panicled Aster (Symphyotrichum lanceolatum), Rice Cut Grass (Leersia oryzoides), Reed-canary Grass, Bentgrass (Agrostis stolonifera), Purple Loosestrife (Lythrum salicarua) and Small-flowered Willow—herb (Epilobium parviflorum). • This community is dominated almost entirely by Reed-canary Grass (Phalaris arundinacea), but smaller vegetation types (i.e.,inclusions) are present, such as Narrow Leaved Cattail (Typha angustifolia) marsh, and forb marsh composed primarily of Panicled Aster (Symphyotrichum lanceolatum). • The tall herb layer dominants include Glaucous Cattail (Typha x glauca) and Narrow-leaved Cattail (Typha angustifolia). • In the medium layer grow Reed-canary Grass, Panickled Aster and Cursed Buttercup (Ranunculus sceleratus).

Table 14: Wetland F1-Northeast MAM2-10/ MAM2-2/MAS2-1 Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Fish and Wildlife Use	• Midland Painted Turtle (*Chrysemys picta maginata*) • HDF-11a,12a,13a are contributing Redside Dace habitat • Terrestrial crayfish observed.
Special Features/Other (i.e., hibernacula, vernal pools)	• N/A
Evaluation Status and Significance (OWES)	• Evaluated as Provincially Significant Wetland
Management Recommendations	• N/A

Table 15: Wetland F2-Northeast MAM2-2/MAM2-10 Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Wetland Size (agency staking)	• 0.31 ha
Wetland Type	• Riverine
Contributing Drainage Area (including wetland area)	• 1.59 ha
Underlying Geology	• Relatively low permeability silty clay overlying silt at an approximate depth of 2.1 m (MW5-17D). The upper unit may represent glaciolacustrine deposits mapped slightly to the south on OGS mapping and the upper Halton Till unit may be absent. The underlying upper bedrock unit is interpreted to be the Georgian Bay Formation. The depth to bedrock is estimated may be > 20 m based on regional mapping. The Georgian Bay Formation consists of dark blue grey to black shale with interbeds of limestone. The Georgian Bay Formation shale is not typically considered an aquifer.
Wetland Soil Conditions (organics, mottles, gley)	• Wetland soil sampled on April 15, 2024. • Surface moist, no water • 0-62 cm+=SiC • g=18 cm • No G • Augered to 62 cm • Ground water=20 cm

Table 15: Wetland F2-Northeast MAM2-2/MAM2-10 Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Groundwater Conditions	• Wetland F2 is located within the Clarkway Drive Tributary valley. Groundwater was observed to range in depth from slightly above ground surface (-0.1 m) to 2.2 m below ground surface at SF6-17. Variable hydraulic gradients were observed at SF6-17 and streamflow at SF6-17 was noted between 3.3L/s and 143.7L/s. Flow measurements may represent groundwater discharge within Clarkway Drive Tributary valley.
Hydroperiod/Surface Water Conditions	• HDF-10a is contributing-ephemeral. • Clarkway Drive Tributary provides perennial flow.
Surface Water Inputs and Inlet Conditions	• The Clarkway Drive Tributary flows from Healey Road and Coleraine Drive into the northeast corner of the Subject Lands.
Outlet Conditions	• The Clarkway Drive Tributary flows from the northeast corner of the Subject Lands and continues south past Mayfield Road until it reaches the West Humber River.
ELC Vegetation Types	• Reed Canary Grass Mineral Meadow Marsh (MAM2-2), Cattail Mineral Shallow Marsh (MAS2-1).
Dominant Vegetation Species Per Strata	• These are diverse meadows, mostly associated with watercourses, of many graminoid and forb species. • The dominants are usually Panickled Aster (*Symphyotrichum lanceolatum*), Rice Cut Grass (*Leersia oryzoides*), Reed-canary Grass, Bentgrass (*Agrostis stolonifera*), Purple Loosestrife (*Lythrum salicarua*) and Small-flowered Willow—herb (*Epilobium parviflorum*). • The majority of this community is dominated by Reed-canary Grass (*Phalaris arundinacea*), but smaller vegetation types (i.e.,inclusions) are present, such as Narrow Leaved Cattail (*Typha angustifolia*) marsh, and forb marsh composed primarily of Panicled Aster (*Symphyotrichum lanceolatum).*

Table 15: Wetland F2-Northeast MAM2-2/MAM2-10 Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Fish and Wildlife Use	• No turtles observed. • Killdeer (*Charadrius vociderus*) • Spotted Sandpiper (Actitus macularius) • Willow Flycatcher (*Empidonax traillii*) • Horned Lark (*Eremophila alpestris*) • American Robin (*Turdus migratorius*) • European Starling (*Sturnus vulgaris*) • Cedar Waxwing (*Bombycilla cedrorum*) • American Goldfinch (*Spinus tristis*) • Common Yellowthroat (Geothlypis trichas) • Yellow Warbler (*Setophaga petechia*) • Vesper Sparrow (*Pooecetes gramineus*) • Song Sparrow (*Melospiza melodia*) • Swamp Sparrow (*Melospiza georgiana*) • Red-winged Blackbird (*Agelaius phoeniceus*) • Common Grackle (*Quiscalus quiscula*)
Special Features/Other (i.e., hibernacula, vernal pools)	• N/A
Evaluation Status and Significance (OWES)	• Evaluated as Provincially Significant Wetland

Table 15: Wetland F2-Northeast MAM2-2/MAM2-10 Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Management Recommendations	• N/A

Table 16: Wetland G1-Southeast MAS2-1/MAM2-2 Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Wetland Size (agency staking)	• 0.75 ha
Wetland Type	• Riverine
Contributing Drainage Area (including wetland area)	• 3.24 ha
Underlying Geology	• Relatively low permeability silty clay overlying silt at an approximate depth of 2.1 m (MW5-17D). The upper unit may represent glaciolacustrine deposits mapped slightly to the south on OGS mapping and the upper Halton Till unit may be absent. The underlying upper bedrock unit is interpreted to be the Georgian Bay Formation. The depth to bedrock is estimated may be > 20 m based on regional mapping. The Georgian Bay Formation consists of dark blue grey to black shale with interbeds of limestone. The Georgian Bay Formation shale is not typically considered an aquifer.
Wetland Soil Conditions (organics, mottles, gley)	• Wetland G1 located on non-participating lands and soils were not sampled. Soil conditions are assumed to be similar to Wetland F1, located to the north but also within the Clarkway Drive Tributary valley. At Wetland F2, soils sampled in April 2024 were surface moist with no standing water. SiC: 0-62cm; g=18cm.
Groundwater Conditions	• Wetland G1 is located within the Clarkway Drive Tributary valley. No monitoring stations are located within the wetland, and groundwater conditions are assumed to be similar to Wetland F2, located slightly to the north but also within the Clarkway Drive Tributary valley. At Wetland F2, groundwater was observed to range in depth from slightly above ground surface (-0.1 m) to 2.2 m below ground surface at SF6-17. Variable hydraulic gradients were observed at SF6-17 and streamflow at SF6-17 was noted between 3.3L/s and 143.7L/s. Flow measurements may represent groundwater discharge within Clarkway Drive Tributary valley.

Table 16: Wetland G1-Southeast MAS2-1/MAM2-2 Summary of Existing Conditions

ATTRIBUTE	COMMENTS
Hydroperiod/Surface Water Conditions	• Amphibian Call Count Survey stations 16,17 and 18 water was present (April 24, 2017, May 17, 2017, and June 22, 2017). The water level at station 17 was 100cm. • HDF-10a is contributing ephemeral to the wetland.
Surface Water Inputs and Inlet Conditions	• The Clarkway Drive Tributary flows from Healey Road and Coleraine Drive into the northeast corner of the Subject Lands. HDF-10a are contributing-ephemeral.
Outlet Conditions	• The Clarkway Drive Tributary flows from the northeast corner of the Subject Lands and continues south past Mayfield Road until it reaches the West Humber River.
ELC Vegetation Types	• Reed Canary Grass Mineral Meadow Marsh (MAM2-2), Cattail Mineral Shallow Marsh (MAS2-1).
Dominant Vegetation Species Per Strata	• These are diverse meadows, mostly associated with watercourses, of many graminoid and forb species. • The dominants are usually Panickled Aster (*Symphyotrichum lanceolatum*), Rice Cut Grass (*Leersia oryzoides*), Reed-canary Grass, Bentgrass (*Agrostis stolonifera*), Purple Loosestrife (*Lythrum salicarua*) and Small-flowered Willow—herb (*Epilobium parviflorum*). • This community is dominated almost entirely by Reed-canary Grass (*Phalaris arundinacea*). • The tall herb layer dominants include Glaucous Cattail (*Typha x glauca*) and Narrow-leaved Cattail (*Typha angustifolia*). • In the medium layer grow Reed-canary Grass, Panickled Aster and Cursed Buttercup (*Ranunculus sceleratus*).

Table 16: Wetland G1-Southeast MAS2-1/MAM2-2 Summary of Existing Conditions

Fish and Wildlife Use	• American Toad (*Anaxyrus americanus*) • Gray Treefrog (*Hyla versicolor*) • Northern Green Frog (*Lithobates clamitans*) • Northern Leopard Frog (*Lithobates pipiens*) • HDF-10a is contributing Redside Dace habitat. • Mallard (*Anas platyrhynchos*) • Rock Pigeon (*Columba livia*) • Mourning Dove (*Zenaida macroura*) • Killdeer (*Charadrius vociferus*) • Spotted Sandpiper (*Actitus macularius*) • Ring-Billed Gull (*Larus delawarensis*) • Great Blue Heron (*Ardea herodias*) • Red-tailed Hawk (*Buteo jamaicensis*) • Northern Flicker (*Colaptes auratus*) • Willow Flycatcher (*Empidonax traillii*) • American Crow (*Corvus brachyrhynchos*) • Horned Lark (*Eremophila alpestris*) • Tree Swallow (*Tachycineta biscolor*) • Barn Swallow (*Hirundo rustica*) • American Robin (*Turdus migratorius*) • Gray Catbird (*Dumetella carolinensis*) • Brown Thrasher (*Toxostoma rufum*)

Table 16: Wetland G1-Southeast MAS2-1/MAM2-2 Summary of Existing Conditions

ATTRIBUTE	COMMENTS
	• European Starling (*Sturnus vulgaris*) • Cedar Waxwing (*Bombycilla cedrorum*) • American Goldfinch (*Spinus tristis*) • Yellow Warbler (*Setophaga petechia*) • Vesper Sparrow (*Pooecetes gramineus*) • Song Sparrow (*Melospiza melodia*) • Swamp Sparrow (*Melospiza georgiana*) • Northern Cardinal (*Cardinalis cardinalis*) • Bobolink (*Dolichonyx oryzivorus*) • Red-winged Blackbird (*Agelaius phoeniceus*) • Common Grackle (*Quiscalus quiscula*) • Brown-headed Cowbird (*Molothrus ater*) • Baltimore Oriole (*Icterus galbula*)
Special Features/Other (i.e., hibernacula, vernal pools)	• N/A
Evaluation Status and Significance (OWES)	• Not evaluated – located on non-participating lands • Assumed to be Provincially Significant Wetland based on assessment of adjacent wetlands (F1/F2)
Management Recommendations	• N/A

Latin Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status S-Rank	OMNR Status	COSEWIC Status	Global Status (G-Rank)	Local Status Area	Local Status Peel	Local Staus CVC/Peel	Local Status Peel
									Local Status Source	Varga 2005	CVC 2002	
Equisetaceae	**Horsetail Family**											
Equisetum arvense	Field Horsetail	0	0		S5			G5		X	X	X
Cupressaceae	**Cedar Family**											
Thuja occidentalis	Eastern White Cedar	4	-3		S5			G5		X	X	X
Pinaceae	**Pine Family**											
Picea abies	Norway Spruce		5	-1	SNA			G5		X	I	I
Picea glauca	White Spruce	6	3		S5			G5		R3	L	L
Aceraceae	**Maple Family**											
Acer negundo	Manitoba Maple	0	-2		S5			G5		X	X	X
Acer saccharum ssp. saccharum	Sugar Maple	4	3		S5			G5T5		X	X	X
Amaranthaceae	**Amaranth Family**											
Amaranthus retroflexus	Red-root Amaranth		2	-1	SNA			G5		X	X	I
Anacardiaceae	**Sumac or Cashew Family**											
Rhus typhina	Staghorn Sumac	1	5		S5			G5		X	X	X
Toxicodendron rydbergii	Rydberg's Poison Ivy	0	0		S5			G5T		X	X	X
Apiaceae	**Carrot or Parsley Family**											
Daucus carota	Wild Carrot		5	-2	SNA			GNR		X	X	I
Asclepiadaceae	**Milkweed Family**											
Asclepias syriaca	Common Milkweed	0	5		S5			G5		X	X	X
Asteraceae	**Composite or Aster Family**											
Achillea millefolium	Yarrow		3	-1	S5			G5		X	X	I
Ambrosia artemisiifolia	Annual Ragweed	0	3		S5			G5		X	X	X
Arctium lappa	Greater Burdock				SNA			GNR		X	X	I
Arctium minus	Common Burdock		5	-2	SNA			GNR		X	X	I
Artemisia biennis	Biennial Wormwood		-2	-1	SNA			G5		X	X	I
Bidens frondosa	Devil's Beggaticks	3	-3		S5			G5		X	X	X
Bidens vulgata	Tall Beggarticks	5	-3		S5			G5		R1	R	L
Carduus crispus	Curled Plumless Thistle		5	-1	SNA			GNR		X	X	I
Cichorium intybus	Chicory		5	-1	SNA			GNR		X	X	I
Cirsium arvense	Canada Thistle		3	-1	SNA			GNR		X	X	I
Cirsium vulgare	Bull Thistle		4	-1	SNA			GNR		X	X	I
Erigeron annuus	Annual Fleabane				S5			G5		X	X	
Erigeron strigosus	Daisy Fleabane	0	1		S5			G5		X	X	X
Eurybia macrophylla	Large-leaved Aster	5	5		S5			G5		X	X	X
Euthamia graminifolia	Grass-leaved Goldenrod	2	-2		S5			G5		X	X	X
Gnaphalium uliginosum	Low Cudweed		0	-1	SNA			G5		X	I	I
Inula helenium	Elecampane Flower		5	-2	SNA			GNR		X	I	I
Lactuca serriola	Prickly Lettuce		0	-1	SNA			GNR		X	I	I
Leucanthemum vulgare	Oxeye Daisy		5	-1	SNA			GNR		X	X	I
Matricaria perforata	Scentless Chamomile		5	-1	SNA			GNR		X	I	I
Pilosella caespitosa	Field Hawkweed		5	-2	SNA			GNR		X	I	I
Solidago altissima	Tall Goldenrod	1	3		S5			G5		X	X	X
Sonchus arvensis ssp. *arvensis*	Field Sow-thistle				SNA			GNRTNR		X	I	I
Sonchus asper	Prickly Sow-thistle		0	-1	SNA			GNR		X	I	I
Sonchus oleraceus	Common Sow-thistle		3	-1	SNA			GNR		X	I	I
Symphyotrichum lanceolatum var. lanceolatum	White Panicled Aster	3	-3		S5			G5T5		X	X	X
Symphyotrichum novae-angliae	New England Aster	2	-3		S5			G5		X	X	X
Taraxacum officinale	Common Dandelion		3	-2	SNA			G5		X	I	I
Balsaminaceae	**Touch-me-not Family**											
Impatiens capensis	Spotted Jewelweed	4	-3		S5			G5		X	X	X

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Berberidaceae	**Barberry Family**											
Podophyllum peltatum	May Apple	5	3		S5			G5		X	X	X
Brassicaceae	**Mustard Family**											
Alliaria petiolata	Garlic Mustard		0	-3	SNA			GNR		X	X	I
Barbarea vulgaris	Yellow Rocket		0	-1	SNA			GNR		X	X	I
Capsella bursa-pastoris	Common Shepherd's Purse		1	-1	SNA			GNR		X	X	I
Erysimum cheiranthoides	Worm-seed Mustard		3	-1	SNA			G5		X	X	X
Hesperis matronalis	Dame's Rocket		5	-3	SNA			G4G5		X	I	I
Lepidium densiflorum	Dense-flower Pepper-grass		0	-2	SNA			G5		X	X	X
Rorippa palustris ssp. *hispida*	Hispid Marsh Yellowcress				S5			G5T5		X	X	X
Sinapis arvensis	Corn Mustard		5	-1	SNA			GNR		X	I	I
Thlaspi arvense	Field Penny-cress		5	-1	SNA			GNR		X	I	I
Campanulaceae	**Bellflower Family**											
Lobelia inflata	Indian Tobacco	3	4		S5			G5		X	X	X
Caprifoliaceae	**Honeysuckle Family**											
Lonicera tatarica	Tartarian Honeysuckle		3	-3	SNA			GNR		X	I	I
Caryophyllaceae	**Pink Family**											
Cerastium fontanum	Common Mouse-ear Chickweed		3	-1	SNA			GNR		X	X	I
Stellaria graminea	Little Starwort		5	-2	SNA			GNR		X	I	I
Chenopodiaceae	**Goosefoot Family**											
Atriplex patula	Halberd-leaf Saltbush	0	-2		S5			G5		X	X	X
Cucurbitaceae	**Gourd Family**											
Echinocystis lobata	Wild Mock-cucumber	3	-2		S5			G5		X	X	X
Elaeagnaceae	**Oleaster Family**											
Elaeagnus angustifolia	Russian Olive		4	-1	SNA			GNR		X	I	I
Fabaceae	**Pea Family**											
Lotus corniculatus	Bird's-foot Trefoil		1	-2	SNA			GNR		X	I	I
Medicago lupulina	Black Medic		1	-1	SNA			GNR		X	I	I
Melilotus albus	White Sweetclover		3	-3	SNA			G5		X	I	I
Trifolium pratense	Red Clover		2	-2	SNA			GNR		X	I	I
Vicia cracca	Tufted Vetch		5	-1	SNA			GNR		X	I	I
Fagaceae	**Beech Family**											
Quercus macrocarpa	Bur Oak	5	1		S5			G5		X	X	X
Guttiferae	**St. John's-wort Family**											
Hypericum perforatum	Common St. John's-wort		5	-3	SNA			GNR		X	I	I
Hydrophyllaceae	**Water-leaf Family**											
Hydrophyllum virginianum	Virginia Waterleaf	6	-2		S5			G5		X	X	X
Juglandaceae	**Walnut Family**											
Carya ovata	Shagbark Hickory	6	3		S5			G5		X	X	X
Lamiaceae	**Mint Family**											
Leonurus cardiaca	Common Motherwort		5	-2	SNA			GNR		X	I	I
Mentha arvensis	Corn Mint	3	-3		S5			G5		X	X	X
Nepeta cataria	Catnip		1	-2	SNA			GNR		X	I	I
Lythraceae	**Loosestrife Family**											
Lythrum salicaria	Purple Loosestrife		-5	-3	SNA			G5		X	I	I

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Oleaceae	**Olive Family**											
Fraxinus americana	White Ash	4	3		S4?			G5		X	X	X
Fraxinus pennsylvanica	Red Ash	3	-3		S5			G5		X	X	X
Syringa vulgaris	Common Lilac		5	-2	SNA			GNR		X	I	I
Onagraceae	**Evening-primrose Family**											
Circaea lutetiana	Enchanter's Nightshade	3	3		S5			G5		X	X	X
Epilobium parviflorum	Small-flower Willow-herb		3	-1	SNA			GNR		X	X	I
Ludwigia palustris	Marsh Seedbox	5	-5		S5			G5		R5	RL	RL
Oenothera biennis	Common Evening-primrose	0	3		S5			G5		U	X	X
Papaveraceae	**Poppy Family**											
Sanguinaria canadensis	Bloodroot	5	4		S5			G5		X	X	X
Plantaginaceae	**Plantain Family**											
Plantago major	Common Plantain		-1	-1	SNA			G5		X	I	I
Polygonaceae	**Smartweed Family**											
Fallopia convolvulus	Black Bindweed		1	-1	SNA			GNR		X	I	I
Persicaria hydropiper	Marshpepper Smartweed	4	-5		SNA			GNR		X	I	I
Persicaria maculosa	Lady's-thumb		-3	-1	SNA			G3G5		X	I	I
Persicaria pensylvanica	Pennsylvania Smartweed	3	-4		S5			G5		R3	RL	RL
Polygonum aviculare ssp. aviculare	Prostrate Knotweed		1	-1	SNA			GNR		X	I	I
Rumex crispus	Curly Dock		-1	-2	SNA			GNR		X	I	I
Primulaceae	**Primrose Family**											
Anagallis arvensis	Scarlet Pimpernel		4	-1	SNA			GNR		X	X	I
Lysimachia ciliata	Fringed Loosestrife	4	-3		S5			G5		X	X	X
Ranunculaceae	**Buttercup Family**											
Ranunculus acris	Tall Buttercup			-2	SNA			G5		X	I	I
Ranunculus sceleratus var. sceleratus	Cursed Buttercup	2	-5		SU			G5T5			X	X
Rhamnaceae	**Buckthorn Family**											
Rhamnus cathartica	Common Buckthorn		3	-3	SNA			GNR		X	I	I
Rosaceae	**Rose Family**											
Crataegus species	Hawthorn species											
Fragaria virginiana	Virginia Strawberry	2	1		S5			G5		X	X	X
Geum aleppicum	Yellow Avens	2	-1		S5			G5		X	X	X
Geum canadense	White Avens	3	0		S5			G5		X	X	X
Potentilla argentea	Silvery Cinquefoil		3	-2	SNA			GNR		X	I	I
Potentilla recta	Sulphur Cinquefoil		5	-2	SNA			GNR		X	I	I
Prunus virginiana	Choke Cherry	2	1		S5			G5		X	X	X
Rubus idaeus ssp. *strigosus*	Red Raspberry	0	-2		S5			G5T5		X	X	X
Rubiaceae	**Madder Family**											
Galium aparine	Catchweed Bedstraw	4	3		S5			G5		R4	L	L
Galium mollugo	White Bedstraw		5	-2	SNA			GNR		X		I
Galium palustre	Marsh Bedstraw	5	-5		S5			G5		X	X	X
Salicaceae	**Willow Family**											
Populus alba	White Poplar		5	-3	SNA			G5		X	I	I
Populus tremuloides	Trembling Aspen		0		S5			G5		X	X	X
Salix amygdaloides	Peach-leaved Willow	6	-3		S5			G5		R6	L	L
Salix bebbiana	Bebb's Willow	4	-4		S5			G5		X	X	X
Salix eriocephala	Heart-leaved Willow	4	-3		S5			G5		X	X	X
Salix interior	Sandbar Willow	3	-5		S5			GNR		R5	L	L
Salix x rubens	Reddish Willow		-4	-3	SNA			GNA		XSR		

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Scrophulariaceae	**Figwort Family**											
Mimulus ringens	Square-stemmed Monkey-flower	6	-5		S5			G5		U	X	X
Verbascum thapsus	Common Mullein		5	-2	SNA			GNR		X	I	I
Veronica serpyllifolia	Thyme-leaved Speedwell	0	-3		SNA			G5TNR		X	I	I
Solanaceae	**Nightshade Family**											
Solanum dulcamara	Climbing Nightshade		0	-2	SNA			GNR		X	I	I
Tiliaceae	**Linden Family**											
Tilia americana	American Basswood	4	3		S5			G5		X	X	X
Ulmaceae	**Elm Family**											
Ulmus americana	White Elm	3	-2		S5			G5		X	X	X
Violaceae	**Violet Family**											
Viola sororia	Woolly Blue Violet				S5			G5		X	X	X
Vitaceae	**Grape Family**											
Parthenocissus inserta	Inserted Virginia-creeper	3	3		S5			G5		X	X	X
Vitis riparia	Riverbank Grape	0	-2		S5			G5		X	X	X
Alismataceae	**Water-plantain Family**											
Alisma subcordatum	Southern Water-plantain				S4?			G5		X		
Cyperaceae	**Sedge Family**											
Carex cristatella	Crested Sedge	3	-4		S5			G5		X	X	X
Carex lupulina	Hop Sedge	6	-5		S5			G5		X	X	X
Carex radiata	Eastern Star Sedge	4	5		S5			G5		X	X	X
Carex species	Sedge species											
Carex spicata	Spiked Sedge		5	-1	SNA			GNR		X	X	X
Carex vulpinoidea	Fox Sedge	3	-5		S5			G5		X	X	X
Cyperus esculentus	Yellow Nut-grass	1	-3		S5			G5		X	X	X
Eleocharis obtusa	Blunt Spike-rush	5	-5		S5			G5		U	X	X
Eleocharis palustris	Small's Spike-rush	6	-5		S5			G5?		R4	L	L
Schoenoplectus tabernaemontani	American Great Bulrush	5	-5		S5			G5		X	X	X
Juncaceae	**Rush Family**											
Juncus bufonius	Toad Rush	1	-4		S5			G5		X	X	X
Juncus effusus var. effusus	Soft Rush	4	-5		SNA			GNR		X	X	X
Lemnaceae	**Duckweed Family**											
Lemna minor	Lesser Duckweed	2	-5		S5			G5		X	X	X
Poaceae	**Grass Family**											
Agrostis gigantea	Redtop		0	-2	SNA			G4G5		X	I	I
Agrostis stolonifera	Redtop		-3		S5			G5		X	X	X
Bromus inermis	Awnless Brome		5	-3	SNA			G5TNR		X	I	I
Bromus tectorum	Downy Chess		5	-2	SNA			GNR		X	I	I
Dactylis glomerata	Orchard Grass		3	-1	SNA			GNR		X	I	I
Digitaria sanguinalis	Hairy Crabgrass		3	-1	SNA			G5		X	I	I
Echinochloa crus-galli	Common Barnyard Grass		-3	-1	SNA			GNR		X	I	I
Elymus repens	Quack Grass		3	-3	SNA			GNR		X	I	I
Eragrostis pectinacea var. *miserrima*	Tufted Love Grass				SNA			G5T4T5		X		
Glyceria striata	Fowl Meadow Grass	3	-5		S5			G5		X	X	X
Leersia oryzoides	Rice Cut Grass	3	-5		S5			G5		X	X	X
Lolium perenne	English Rye Grass		3	-1	SNA			GNR		X	I	I
Panicum dichotomiflorum	Spreading Panic Grass		-2	-1	SNA			G5		X	I	I
Phalaris arundinacea var. arundinacea	Reed Canary Grass	0	-4		S5			GNR		X	X	X
Phleum pratense	Timothy		3	-1	SNA			GNR		X	I	I
Poa annua	Annual Blue Grass		1	-2	SNA			GNR		X	I	I
Poa palustris	Fowl Meadow Grass	5	-4		S5			G5		X	X	X
Poa pratensis ssp. pratensis	Kentucky Bluegrass	0	1		SNA			G5T5		X	X	X

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Puccinellia distans	Spreading Goose Grass		-5	-1	SNA			G5		X	I	I
Schedonorus pratensis	Meadow Fescue		4	-1	SNA			G5		X	I	I
Setaria pumila	Yellow Foxtail		0	-1	SNA			GNR		X	I	I
Potamogetonaceae	**Pondweed Family**											
Potamogeton pusillus ssp. pusillus	Small Pondweed	5	-5		SU			G5T5		R3	R	RL
Typhaceae	**Cattail Family**											
Typha angustifolia	Narrow-leaved Cattail	3	-5		SNA			G5		X	X	X
Typha latifolia	Broad-leaved Cattail	3	-5		S5			G5		X	X	X
Typha x glauca	Glaucous Cattail	3	-5		SNA			GNA		X	X	X
STATISTICS												
Species Richness												
Total Number of Species:	153											
Native Species:	74	48%										
Exotic Species:	79	52%										
S1-S3 Species:	0	0%										
S4 Species:	2	3%										
S5 Species:	70	97%										
Floristic Quality Indices												
Mean Co-efficient of Conservatism (CC)	3.0											
CC 0 - 3 = lowest sensitivity	41	58%										
CC 4 - 6 = moderate sensitivity	30	42%										
CC 7 - 8 = high sensitivity	0	0%										
CC 9 - 10 = highest sensitivity	0	0%										
Floristic Quality Index (FQI)	26											
Weedy and Invasive Species												
Mean Weediness Index:	-1.6											
-1 = low potential invasiveness	39	54%										
-2 = moderate potential invasiveness	22	31%										
-3 = high potential invasivenss	11	15%										
Wetland Species												
Mean Wetness Index	0.5											
upland	28	19%										
facultative upland	36	25%										
facultative	28	19%										
facultative wetland	33	23%										
obligate wetland	19	13%										

SURVEY ROUND	STATION ID	SPECIES CODE												WATER	
		NOAM	AMTO	SPPE	CHFR	WOFR	MIFR	PIFR	NLFR	GRFR	GRTR	BULL	FOTO	Present (Y/N)	Depth (CM)
1	1	X												Y	10
2	1													N	Dry
1	2	X												Y	15
2	2													N	Dry
1	3	X												Y	10
2	3													N	Dry
1	4	X												Y	No Access
2	4		X INC								1(1)			Y	No Access
3	4	X												Y	No Access
1	5	X												Y	No Access
2	5	X												Y	No Access
3	5	X												Y	No Access
1	6	X												Y	No Access
2	6	X												Y	No Access
3	6									1(2)				Y	No Access
1	7	X												Y	100
2	7		X INC								1(1)			Y	100
3	7									1(1)	2(6)			Y	100
1	8	X												Y	100
2	8										1(1)			Y	100
3	8									1(2)				Y	100
1	9	X												Y	100
2	9		X INC						1(1)	1(1)	1(4)			Y	100
3	9									2(7)	1(1)			Y	20
1	10	X												Y	100
2	10	X	X INC											Y	100
3	10									1(5)				Y	100
1	11	X												Y	15
2	11													N	Dry
1	12	X												Y	No Access
2	12													N	Dry
1	13	X												Y	10
2	13													N	Dry
1	14		1(2)											Y	No Access
2	14		1(3)											Y	No Access
3	14	X	X INC								X INC			Y	No Access
1	15	X												Y	100
2	15		1(1)						1(1)					Y	100
3	15									1(4)				Y	100
1	16		1(3)											Y	No Access
2	16	X												Y	No Access
3	16	X												Y	No Access
1	17								1(1)					Y	100
2	17		1(3)								1(1)			Y	100
3	17	X												Y	100
1	18		1(1)											Y	No Access
2	18	X												Y	No Access
3	18									1(3)	1(1)			Y	No Access

1	19	X												Y	100
2	19	X	X INC								X INC			Y	100
3	19									1(3)				Y	100
1	20	X												Y	No Access
2	20	X												Y	No Access
3	20										1(1)			Y	No Access
1	21	X												Y	No Access
2	21	X												Y	No Access
3	21	X												Y	No Access
1	22	X													No Access
2	22		1(1)								1(2)			Y	No Access
3	22	X												Y	No Access
1	23	X												Y	No Access
2	23										1(1)			Y	No Access
3	23	X												Y	No Access

Glossary

NOAM	No amphibians
AMTO	American Toad
SPPE	Spring Peeper
CHFR	Western Chorus Frog
WOFR	Wood Frog
MIFR	Mink Frog
PIFR	Pickerel Frog
NLFR	Northern Leopard Frog
GRFR	Green Frog
GRTR	Gray Treefrog
BULL	Bull Frog
FOTO	Fowler's Toad

Table 19: Amphibian Egg Mass Survey Results

SURVEY ROUND	STATION NUMBER	SPECIES CODE												WATER	
		NOAM	AMTO	FOTO	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
1	AMC1	X												Y	15
1	AMC2	X												Y	20
1	AMC3	X												Y	15

Note: The quantity reported in each cell is the cumulative count of all life stages (egg mass, tadpole, adult) of the individuals observed of that species during each egg mass survey round

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOAM	No Amphibians	No amphibians despite survey effort
AMTO	American Toad	*Anaxyrus americanus*
FOTO	Fowler's Toad	*Anaxyrus fowleri*
GRTR	Gray Treefrog	*Hyla versicolor*
CHFR	Western Chorus Frog	*Pseudacris triseriata*
WOFR	Wood Frog	*Lithobates sylvaticus*
NLRF	Northern Leopard Frog	*Lithobates pipiens*
PIFR	Pickerel Frog	*Lithobates palustris*
GRFR	Green Frog	*Lithobates clamitans*
BULL	American Bullfrog	*Lithobates catesbeianus*
MIFR	Mink Frog	*Lithobates septentrionalis*
SPPE	Spring Peeper	*Pseudacris crucifer*

Common Name	Scientific Name	Provincial Status (S Rank)	Global Status (G Rank)	COSSARO (MNRF)	COSEWIC (Federal)	SWH Indicator Species	Highest Breeding Evidence	Round 1 PC PC1	Round 1 PC PC2	Round 1 PC PC3	Round 1 PC PC4	Round 1 PC PC5	Round 1 PC PC6	Round 1 PC PC7	Round 1 PC PC8	Round 1 PC PC9	Round 1 PC PC10	Round 1 PC PC11	Incidental Round 1	Off Site Round 1	Round 2 PC PC4	Round 2 PC PC5	Round 2 PC PC6	Round 2 PC PC7	Round 2 PC PC8	Round 2 PC PC9	Round 2 PC PC10	Round 2 PC PC11	Incidental Round 2	Off Site Round 2
Canada Goose	Branta canadensis	S5	G5			X	OB-X			2																				
Wood Duck	Aix sponsa	S5	G5			X	PO-H									5			4											
Mallard	Anas platyrhynchos	S5	G5			X	PR-P					1	7			132	13	6	9	1		1								
Rock Pigeon	Columba livia	SNA	G5				PO-H								3	14		2	5			2			2	4				
Mourning Dove	Zenaida macroura	S5	G5				CO-FY	1		1					53			2					2							
Yellow-billed Cuckoo	Coccyzus americanus	S4B	G5				PO-S	1																						
Ruby-throated Hummingbird	Archilochus colubris	S5B	G5				PO-S												1											
Virginia Rail	Rallus limicola	S5B	G5			X	PR-T					1										2								
Killdeer	Charadrius vociferus	S5B, S5N	G5				CO-DD									1		1	5	1	1		1	1			1		1	
Upland Sandpiper	Bartramia longicauda	S4B	G5			X	PO-S				1									1										
Spotted Sandpiper	Actitus macularius	S5	G5				PR-T					1		1			1		1									2		1
Ring-billed Gull	Larus delawarensis	S5B,S4N	G5			X	OB-X			4	2		3			8	13		117		22	33								
Common Loon	Gavia immer	S5B,S5N	G5			X	OB-X												1											
Great Blue Heron	Ardea herodias	S4	G5			X	OB-X			1									1									1		
Turkey Vulture	Cathartes aura	S5B	G5				PO-H												2											
Red-tailed Hawk	Buteo jamaicensis	S5	G5			X	CO-NU													2					2					1
Downy Woodpecker	Picoides pubescens	S5	G5				PR-T		1												1									
Northern Flicker	Colaptes auratus	S4B	G5				PR-T			1																		1		
Eastern Wood-Pewee	Contopus virens	S4B	G5	SC	SC	X	PO-S	1	1	1																				
Willow Flycatcher	Empidonax traillii	S5B	G5			X	PR-P							3	1		2	2	1	2		1		2	1		1	2		1
Eastern Phoebe	Sayornis phoebe	S5B	G5				CO-AE						1						1	1										
Great Crested Flycatcher	Myiarchus crinitus	S4B	G5				PO-H		2											1										
Warbling Vireo	Vireo gilvus	S5B	G5				PR-T													1										
Red-eyed Vireo	Vireo olivaceus	S5B	G5				PR-P	2		1																				
Blue Jay	Cyanocitta cristata	S5	G5				PR-T				1																			
American Crow	Corvus brachyrhynchos	S5B	G5				PO-H	3	2				1		2															1
Horned Lark	Eremophila alpestris	S4B	G5				PR-P			1	2		1	1	1	1			2	1	1	1			1	1	1			
Tree Swallow	Tachycineta bicolor	S4B	G5				CO-FY											1	9											
Barn Swallow	Hirundo rustica	S4B	G5	SC	SC		CO-NE			1	5		4		2				6				4							
Black-capped Chickadee	Poecile atricapillus	S5	G5				PR-T	1	2			1																		
White-breasted Nuthatch	Sitta carolinensis	S5	G5				PO-H	1																						
House Wren	Troglodytes aedon	S5B	G5				PR-T	1	1																					
Blue-gray Gnatcatcher	Polioptila caerulea	S4B	G5				PO-S	2																						
American Robin	Turdus migratorius	S5B	G5				CO-CF	1	3	2	1		5	2		3	2		1		2		2	2	1	2				
Gray Catbird	Dumetella carolinensis	S4B	G5				PR-T	1									1	1	1	1							1			
Brown Thrasher	Toxostoma rufum	S4B	G5			X	PR-P			1		1				1		2									1			
European Starling	Sturnus vulgaris	SNA	G5				PO-H					2	3		3	10	2							2			1			
Cedar Waxwing	Bombycilla cedrorum	S5B	G5				PR-T			4	1						1	1						1						
House Sparrow	Passer domesticus	SNA	G5				PR-P									4			1							12				
House Finch	Carpodacus mexicanus	SNA	G5				PO-H												1											
American Goldfinch	Spinus tristis	S5B	G5				PR-P			1	1	1		1		1	4				1	1	1	1						
Common Yellowthroat	Geothlypis trichas	S5B	G5				PR-T					2	1	1							1	1	1							
Yellow Warbler	Setophaga petechia	S5B	G5				PR-P							3	1		2	2						1			1	1		
Chipping Sparrow	Spizella passerina	S5B	G5				PR-T									1			2											
Vesper Sparrow	Pooecetes gramineus	S4B	G5			X	PR-T						1		1	1			1		2			1		1				1
Savannah Sparrow	Passerculus sandwichensis	S4B	G5			X	PR-T			1						1			2	2	1									
Song Sparrow	Melospiza melodia	S5B	G5				CO-CF	1	2	3	2	1	3	4	4	2	4	4			3	X	2	5	5	1	4			
Swamp Sparrow	Melospiza georgiana	S5B	G5				PR-T			1		1			1		1	1		1		2		1						
Northern Cardinal	Cardinalis cardinalis	S5	G5				PR-T	1		1	1								1	1	1				1			1		
Rose-breasted Grosbeak	Pheucticus ludovicianus	S4B	G5				PO-S													1										
Indigo Bunting	Passerina cyanea	S4B	G5				PR-T													1										
Bobolink	Dolichonyx oryzivorus	S4B	G5	THR	THR		OB-X																		2					
Red-winged Blackbird	Agelaius phoeniceus	S4	G5				CO-FS	2	1	4	2	X	8	3	4		6	7		3	2	X	5	4			1	7		
Common Grackle	Quiscalus quiscula	S5B	G5				CO-FY	1			3		2		3	10	3	3	17	7	5		2		2			2		
Brown-headed Cowbird	Molothrus ater	S4B	G5				PR-P	1		1				2			1	3	1		2				2	4		2		
Baltimore Oriole	Icterus galbula	S4B	G5				PR-T	1		2			1								1									

Table 21: Bat Habitat Survey Results from the Study Area

AREA IDENTIFICATION	COMMUNITY TYPE	AREA SIZE (ha)	# OF CAVITY TREES OBSERVED	# OF CAVITY TREES/HA
Polygon 1	FOD8-3*	0.79	30	37.97

Table 22: Bat Acoustic Survey Results (2017)

SURVEY DATES	SURVEY ROUND	TRANSECT/ POINT COUNT/SM3BAT	SPECIES CODE								
			NOBA	LACI	LANO	EPFU	LABO	PESU	MYLU	MYSE	MYLE
JU-08-2017	1	BT1	X								
JU-08-2017	1	BT2	X								
JU-08-2017	1	BT3	X								
JU-08-2017	1	BT4	X								
JU-08-2017	1	BT5	X								
JU-08-2017	1	BT6	X								
JU-08-2017	1	BP1	X								
JU-08-2017	1	BP2	X								
JU-08-2017	1	BP3	X								
JU-08-2017	1	BP4	X								
JU-08-2017	1	BP5					X				
JU-08-2017	1	BP6				X					
JU-08-2017	1	BP7	X								
JU-08-2017	1	BP8				X					
JU-12-2017	2	WOOD1		X	X	X					
JU-13-2017	3	WOOD1			X	X	X				
JU-14-2017	4	WOOD1			X						
JU-15-2017	5	WOOD1	X								
JU-16-2017	6	WOOD1	X								

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOBA	No Bats	No recorded despite survey effort
LACI	Hoary bat	*Lasiurus cinereus*
LANO	Silver-haired bat	*Lasionycteris noctivagans*
EPFU	Big Brown bat	*Eptesicus fuscus*
LABO	Eastern Red bat	*Lasiurus borealis*
PESU	Tri-coloured bat	*Perimyotis subflavus*
MYLU	Little Brown Myotis	*Myotis lucifugus*
MYSE	Northern Myotis	*Myotis septentrionalis*
MYLE	Eastern Small-footed Myotis	*Myotis leibii*

Table 22: Bat Acoustic Survey Results (2017)

SURVEY DATES	SURVEY ROUND	TRANSECT/ POINT COUNT/SM3BAT	SPECIES CODE								
			NOBA	LACI	LANO	EPFU	LABO	PESU	MYLU	MYSE	MYLE
JU-17-2017	7	WOOD1	X								
JU-18-2017	8	WOOD1	X								
JU-21-2017	9	BT1	X								
JU-21-2017	9	BT2	X								
JU-21-2017	9	BT3	X								
JU-21-2017	9	BT4	X								
JU-21-2017	9	BT5				X					
JU-21-2017	9	BT6				X					
JU-21-2017	9	BP1	X								
JU-21-2017	9	BP2	X								
JU-21-2017	9	BP3				X					
JU-21-2017	9	BP4	X								
JU-21-2017	9	BP5			X	X	X				
JU-21-2017	9	BP6				X					
JU-21-2017	9	BP7	X								
JU-21-2017	9	BP8			X						
JU-26-2017	10	BT1	X								
JU-26-2017	10	BT2			X	X					

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOBA	No Bats	No recorded despite survey effort
LACI	Hoary bat	*Lasiurus cinereus*
LANO	Silver-haired bat	*Lasionycteris noctivagans*
EPFU	Big Brown bat	*Eptesicus fuscus*
LABO	Eastern Red bat	*Lasiurus borealis*
PESU	Tri-coloured bat	*Perimyotis subflavus*
MYLU	Little Brown Myotis	*Myotis lucifugus*
MYSE	Northern Myotis	*Myotis septentrionalis*
MYLE	Eastern Small-footed Myotis	*Myotis leibii*

Table 22: Bat Acoustic Survey Results (2017)

SURVEY DATES	SURVEY ROUND	TRANSECT/ POINT COUNT/SM3BAT	SPECIES CODE								
			NOBA	LACI	LANO	EPFU	LABO	PESU	MYLU	MYSE	MYLE
JU-26-2017	10	BT3	X								
JU-26-2017	10	BT4	X								
JU-26-2017	10	BT5				X					
JU-26-2017	10	BT6				X					
JU-26-2017	10	BP1	X								
JU-26-2017	10	BP2	X								
JU-26-2017	10	BP3	X								
JU-26-2017	10	BP4	X								
JU-26-2017	10	BP5			X	X	X				
JU-26-2017	10	BP6	X								
JU-26-2017	10	BP7	X								
JU-26-2017	10	BP8				X					

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOBA	No Bats	No recorded despite survey effort
LACI	Hoary bat	*Lasiurus cinereus*
LANO	Silver-haired bat	*Lasionycteris noctivagans*
EPFU	Big Brown bat	*Eptesicus fuscus*
LABO	Eastern Red bat	*Lasiurus borealis*
PESU	Tri-coloured bat	*Perimyotis subflavus*
MYLU	Little Brown Myotis	*Myotis lucifugus*
MYSE	Northern Myotis	*Myotis septentrionalis*
MYLE	Eastern Small-footed Myotis	*Myotis leibii*

Table 23: Turtle Nesting Survey Results (2017)

- Soil sampling was completed on the sites at all turtle nesting stations (TN1 to TN12);
- TN1 to TN11 had clay dominated soils that were not suitable for nesting;
- TN12 was gravel dominated though no evidence of nesting was present. The station was designated unsuitable due to the activity along the driveway resulting in high mortality; and
- No nesting evidence (i.e., test digs, claw marks, predated nests) were observed on site.

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE								
			NOTU	MPTU	SNTU	MATU	BLTU	SSTU	WOTU	STIN	SPTU
08-JU-17	1	TN1	X								
08-JU-17	1	TN2	X								
08-JU-17	1	TN3	X								
08-JU-17	1	TN4	X								
08-JU-17	1	TN5	X								
08-JU-17	1	TN6	X								
08-JU-17	1	TN7	X								
08-JU-17	1	TN8	X								
08-JU-17	1	TN9	X								
08-JU-17	1	TN10	X								
08-JU-17	1	TN11	X								
08-JU-17	1	TN12	X								

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOTU	No Turtles	No turtles despite survey effort
MPTU	Midland Painted Turtle	*Chrysemys picta marginata*
SNTU	Snapping Turtle	*Chelydra serpentina*
MATU	Northern Map Turtle	*Graptemys geographica*
BLTU	Blanding's Turtle	*Emydoidea blandingii*
SSTU	Spiny Soft-shelled Turtle	*Apalone spinifera*
WOTU	Wood Turtle	*Glyptemys insculpta*
STIN	Stinkpot Turtle	*Stemotherus odoratus*
SPTU	Spotted Turtle	*Clemmys guttata*

DATE	
MONTH	CODE
January	JA
February	FE
March	MR
April	AP
May	MA
June	JN
July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 24: Reptile Area Search and Cover Board Results

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
2017																	
12-SE-2017	1	T1	X														
12-SE-2017	1	T2	X														
12-SE-2017	1	T3	X														
12-SE-2017	1	T4	X														
12-SE-2017	1	T5	X														
12-SE-2017	1	T6	X														
12-SE-2017	1	T7	X														
12-SE-2017	1	T8	X														
12-SE-2017	1	T9	X														
12-SE-2017	1	T10	X														
12-SE-2017	1	T11	X														
12-SE-2017	1	T12	X														
12-SE-2017	1	T13	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
MISN	Eastern Milksnake	*Lampropeltis triangulum*
BRSN	DeKay's Brownsnake	*Storeria dekayi*
RBSN	Northern Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*
NWSN	Northern Watersnake	*Nerodia sipedon sipedon*
RASN	Gray Ratsnake	*Pantherophis spiloides*
RISN	Eastern Ribbonsnake	*Thamnophis sauritus*
BLRA	Blue Racer	*Coluber constrictor foxii*
BUGA	Butler's Gartersnake	*Thamnophis butleri*
FOSN	Eastern Foxsnake	*Pantherophis gloyd*
HOSN	Eastern Hog-nosed Snake	*Heterodon platirhinos*
MASS	Massassauga	*Sistrusus catenatus catenatus*
RNSN	Ring-necked Snake	*Diadophis punctatus*
SGSN	Smooth Greensnake	*Opheodrys vernalis*
QUSN	Queensnake	*Regina septemvittata*

DATE	
MONTH	CODE
January	JA
February	FE
March	MR
April	AP
May	MA
June	JN
July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 24: Reptile Area Search and Cover Board Results

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
12-SE-2017	1	Area Search 1	X														
12-SE-2017	1	Area Search 2	X														
12-SE-2017	1	Area Search 3	X														
20-SE-2017	2	T1	X														
20-SE-2017	2	T2	X														
20-SE-2017	2	T3	X														
20-SE-2017	2	T4	X														
20-SE-2017	2	T5	X														
20-SE-2017	2	T6	X														
20-SE-2017	2	T7	X														
20-SE-2017	2	T8	X														
20-SE-2017	2	T9	X														
20-SE-2017	2	T10	X														
20-SE	2	T11	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
MISN	Eastern Milksnake	*Lampropeltis triangulum*
BRSN	DeKay's Brownsnake	*Storeria dekayi*
RBSN	Northern Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*
NWSN	Northern Watersnake	*Nerodia sipedon sipedon*
RASN	Gray Ratsnake	*Pantherophis spiloides*
RISN	Eastern Ribbonsnake	*Thamnophis sauritus*
BLRA	Blue Racer	*Coluber constrictor foxii*
BUGA	Butler's Gartersnake	*Thamnophis butleri*
FOSN	Eastern Foxsnake	*Pantherophis gloyd*
HOSN	Eastern Hog-nosed Snake	*Heterodon platirhinos*
MASS	Massassauga	*Sistrusus catenatus catenatus*
RNSN	Ring-necked Snake	*Diadophis punctatus*
SGSN	Smooth Greensnake	*Opheodrys vernalis*
QUSN	Queensnake	*Regina septemvittata*

DATE	
MONTH	CODE
January	JA
February	FE
March	MR
April	AP
May	MA
June	JN
July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 24: Reptile Area Search and Cover Board Results

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
20-SE	2	T12	X														
20-SE	2	T13	X														
20-SE	2	Area Search 1	X														
20-SE	2	Area Search 2	X														
20-SE	2	Area Search 3	X														
2018																	
02-MA	1	T1	X														
02-MA	1	T2	X														
02-MA	1	AS1	X														
02-MA	1	T3	X														
02-MA	1	T4	X														
02-MA	1	T5	X														
02-MA	1	T6	X														
02-MA	1	AS2	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
MISN	Eastern Milksnake	*Lampropeltis triangulum*
BRSN	DeKay's Brownsnake	*Storeria dekayi*
RBSN	Northern Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*
NWSN	Northern Watersnake	*Nerodia sipedon sipedon*
RASN	Gray Ratsnake	*Pantherophis spiloides*
RISN	Eastern Ribbonsnake	*Thamnophis sauritus*
BLRA	Blue Racer	*Coluber constrictor foxii*
BUGA	Butler's Gartersnake	*Thamnophis butleri*
FOSN	Eastern Foxsnake	*Pantherophis gloyd*
HOSN	Eastern Hog-nosed Snake	*Heterodon platirhinos*
MASS	Massassauga	*Sistrusus catenatus catenatus*
RNSN	Ring-necked Snake	*Diadophis punctatus*
SGSN	Smooth Greensnake	*Opheodrys vernalis*
QUSN	Queensnake	*Regina septemvittata*

DATE	
MONTH	CODE
January	JA
February	FE
March	MR
April	AP
May	MA
June	JN
July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 24: Reptile Area Search and Cover Board Results

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
02-MA	1	AS3	X														
02-MA	1	T7	X														
02-MA	1	T8	X														
02-MA	1	T9	X														
02-MA	1	T10	X														
02-MA	1	T11	X														
02-MA	1	T12	X														
02-MA	1	T13	X														
02-MA	1	CB1	X														
02-MA	1	CB2	X														
02-MA	1	CB3	X														
02-MA	1	CB4	X														
02-MA	1	CB6	X														
02-MA	1	CB7	X														
02-MA	1	CB8	X														
02-MA	1	CB9	X														
02-MA	1	CB10	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
MISN	Eastern Milksnake	*Lampropeltis triangulum*
BRSN	DeKay's Brownsnake	*Storeria dekayi*
RBSN	Northern Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*
NWSN	Northern Watersnake	*Nerodia sipedon sipedon*
RASN	Gray Ratsnake	*Pantherophis spiloides*
RISN	Eastern Ribbonsnake	*Thamnophis sauritus*
BLRA	Blue Racer	*Coluber constrictor foxii*
BUGA	Butler's Gartersnake	*Thamnophis butleri*
FOSN	Eastern Foxsnake	*Pantherophis gloyd*
HOSN	Eastern Hog-nosed Snake	*Heterodon platifhinos*
MASS	Massassauga	*Sistrusus catenatus catenatus*
RNSN	Ring-necked Snake	*Diadophis punctatus*
SGSN	Smooth Greensnake	*Opheodrys vernalis*
QUSN	Queensnake	*Regina septemvittata*

DATE	
MONTH	CODE
January	JA
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Table 24: Reptile Area Search and Cover Board Results

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
02-MA	1	CB12	X														
02-MA	1	CB13	X														
02-MA	1	CB14	X														
02-MA	1	CB15	X														
16-MA	2	T1	X														
16-MA	2	T2	X														
16-MA	2	AS1	X														
16-MA	2	T3	X														
16-MA	2	T4	X														
16-MA	2	T5	X														
16-MA	2	T6	X														
16-MA	2	AS2	X														
16-MA	2	AS3	X														
16-MA	2	T7	X														
16-MA	2	T8	X														
16-MA	2	T9	X														
16-MA	2	T10	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
MISN	Eastern Milksnake	*Lampropeltis triangulum*
BRSN	DeKay's Brownsnake	*Storeria dekayi*
RBSN	Northern Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*
NWSN	Northern Watersnake	*Nerodia sipedon sipedon*
RASN	Gray Ratsnake	*Pantherophis spiloides*
RISN	Eastern Ribbonsnake	*Thamnophis sauritus*
BLRA	Blue Racer	*Coluber constrictor foxii*
BUGA	Butler's Gartersnake	*Thamnophis butleri*
FOSN	Eastern Foxsnake	*Pantherophis gloyd*
HOSN	Eastern Hog-nosed Snake	*Heterodon platirhinos*
MASS	Massassauga	*Sistrusus catenatus catenatus*
RNSN	Ring-necked Snake	*Diadophis punctatus*
SGSN	Smooth Greensnake	*Opheodrys vernalis*
QUSN	Queensnake	*Regina septemvittata*

DATE	
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January	JA
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Table 24: Reptile Area Search and Cover Board Results

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
16-MA	2	T11	X														
16-MA	2	T12	X														
16-MA	2	T13	X														
16-MA	2	CB1	X														
16-MA	2	CB2	X														
16-MA	2	CB3	X														
16-MA	2	CB4	X														
16-MA	2	CB6	X														
16-MA	2	CB7	X														
16-MA	2	CB8	X														
16-MA	2	CB9	X														
16-MA	2	CB10	X														
16-MA	2	CB12	X														
16-MA	2	CB13	X														
16-MA	2	CB14	X														
16-MA	2	CB15	X														
17-MA	3	T1	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
MISN	Eastern Milksnake	*Lampropeltis triangulum*
BRSN	DeKay's Brownsnake	*Storeria dekayi*
RBSN	Northern Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*
NWSN	Northern Watersnake	*Nerodia sipedon sipedon*
RASN	Gray Ratsnake	*Pantherophis spiloides*
RISN	Eastern Ribbonsnake	*Thamnophis sauritus*
BLRA	Blue Racer	*Coluber constrictor foxii*
BUGA	Butler's Gartersnake	*Thamnophis butleri*
FOSN	Eastern Foxsnake	*Pantherophis gloyd*
HOSN	Eastern Hog-nosed Snake	*Heterodon platirhinos*
MASS	Massassauga	*Sistrusus catenatus catenatus*
RNSN	Ring-necked Snake	*Diadophis punctatus*
SGSN	Smooth Greensnake	*Opheodrys vernalis*
QUSN	Queensnake	*Regina septemvittata*

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November	NO
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DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
17-MA	3	T2	X														
17-MA	3	AS1	X														
17-MA	3	T3	X														
17-MA	3	T4	X														
17-MA	3	T5	X														
17-MA	3	T6	X														
17-MA	3	AS2	X														
17-MA	3	AS3	X														
17-MA	3	T7	X														
17-MA	3	T8	X														
17-MA	3	T9	X														
17-MA	3	T10	X														
17-MA	3	T11	X														
17-MA	3	T12	X														
17-MA	3	T13	X														
17-MA	3	CB1	X														
17-MA	3	CB2	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
MISN	Eastern Milksnake	*Lampropeltis triangulum*
BRSN	DeKay's Brownsnake	*Storeria dekayi*
RBSN	Northern Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*
NWSN	Northern Watersnake	*Nerodia sipedon sipedon*
RASN	Gray Ratsnake	*Pantherophis spiloides*
RISN	Eastern Ribbonsnake	*Thamnophis sauritus*
BLRA	Blue Racer	*Coluber constrictor foxii*
BUGA	Butler's Gartersnake	*Thamnophis butleri*
FOSN	Eastern Foxsnake	*Pantherophis gloyd*
HOSN	Eastern Hog-nosed Snake	*Heterodon platirhinos*
MASS	Massassauga	*Sistrusus catenatus catenatus*
RNSN	Ring-necked Snake	*Diadophis punctatus*
SGSN	Smooth Greensnake	*Opheodrys vernalis*
QUSN	Queensnake	*Regina septemvittata*

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October	OC
November	NO
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Table 24: Reptile Area Search and Cover Board Results

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
17-MA	3	CB3	X														
17-MA	3	CB4	X														
17-MA	3	CB6	X														
17-MA	3	CB7	X														
17-MA	3	CB8	X														
17-MA	3	CB9	X														
17-MA	3	CB10	X														
17-MA	3	CB12	X														
17-MA	3	CB13	X														
17-MA	3	CB14	X														
17-MA	3	CB15	X														
23-MA	4	T1	X														
23-MA	4	T2	X														
23-MA	4	AS1	X														
23-MA	4	T3	X														
23-MA	4	T4	X														
23-MA	4	T5	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
MISN	Eastern Milksnake	*Lampropeltis triangulum*
BRSN	DeKay's Brownsnake	*Storeria dekayi*
RBSN	Northern Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*
NWSN	Northern Watersnake	*Nerodia sipedon sipedon*
RASN	Gray Ratsnake	*Pantherophis spiloides*
RISN	Eastern Ribbonsnake	*Thamnophis sauritus*
BLRA	Blue Racer	*Coluber constrictor foxii*
BUGA	Butler's Gartersnake	*Thamnophis butleri*
FOSN	Eastern Foxsnake	*Pantherophis gloyd*
HOSN	Eastern Hog-nosed Snake	*Heterodon platirhinos*
MASS	Massassauga	*Sistrusus catenatus catenatus*
RNSN	Ring-necked Snake	*Diadophis punctatus*
SGSN	Smooth Greensnake	*Opheodrys vernalis*
QUSN	Queensnake	*Regina septemvittata*

DATE	
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January	JA
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June	JN
July	JL
August	AU
September	SE
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November	NO
December	DE

Table 24: Reptile Area Search and Cover Board Results

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
23-MA	4	T6	X														
23-MA	4	AS2	X														
23-MA	4	AS3	X														
23-MA	4	T7	X														
23-MA	4	T8	X														
23-MA	4	T9	X														
23-MA	4	T10	X														
23-MA	4	T11	X														
23-MA	4	T12	X														
23-MA	4	T13	X														
23-MA	4	CB1	X														
23-MA	4	CB2	X														
23-MA	4	CB3	X														
23-MA	4	CB4	X														
23-MA	4	CB6	X														
23-MA	4	CB7	X														
23-MA	4	CB8	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
MISN	Eastern Milksnake	*Lampropeltis triangulum*
BRSN	DeKay's Brownsnake	*Storeria dekayi*
RBSN	Northern Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*
NWSN	Northern Watersnake	*Nerodia sipedon sipedon*
RASN	Gray Ratsnake	*Pantherophis spiloides*
RISN	Eastern Ribbonsnake	*Thamnophis sauritus*
BLRA	Blue Racer	*Coluber constrictor foxii*
BUGA	Butler's Gartersnake	*Thamnophis butleri*
FOSN	Eastern Foxsnake	*Pantherophis gloyd*
HOSN	Eastern Hog-nosed Snake	*Heterodon platirhinos*
MASS	Massassauga	*Sistrusus catenatus catenatus*
RNSN	Ring-necked Snake	*Diadophis punctatus*
SGSN	Smooth Greensnake	*Opheodrys vernalis*
QUSN	Queensnake	*Regina septemvittata*

DATE	
MONTH	CODE
January	JA
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December	DE

Table 24: Reptile Area Search and Cover Board Results

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
23-MA	4	CB9	X														
23-MA	4	CB10	X														
23-MA	4	CB12	X														
23-MA	4	CB13	X														
23-MA	4	CB14	X														
23-MA	4	CB15	X														
04-OC	1	T14	X														
04-OC	1	AS4	X														
09-OC	2	T14	X														
09-OC	2	AS4	X														
11-OC	3	T14	X														
11-OC	3	AS4	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
MISN	Eastern Milksnake	*Lampropeltis triangulum*
BRSN	DeKay's Brownsnake	*Storeria dekayi*
RBSN	Northern Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*
NWSN	Northern Watersnake	*Nerodia sipedon sipedon*
RASN	Gray Ratsnake	*Pantherophis spiloides*
RISN	Eastern Ribbonsnake	*Thamnophis sauritus*
BLRA	Blue Racer	*Coluber constrictor foxii*
BUGA	Butler's Gartersnake	*Thamnophis butleri*
FOSN	Eastern Foxsnake	*Pantherophis gloyd*
HOSN	Eastern Hog-nosed Snake	*Heterodon platirhinos*
MASS	Massassauga	*Sistrusus catenatus catenatus*
RNSN	Ring-necked Snake	*Diadophis punctatus*
SGSN	Smooth Greensnake	*Opheodrys vernalis*
QUSN	Queensnake	*Regina septemvittata*

DATE	
MONTH	CODE
January	JA
February	FE
March	MR
April	AP
May	MA
June	JN
July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 25: Wildlife Road Crossing Survey Results

SURVEY DATE	SURVEY ROUND	TRANSECT NO.	SPECIES OBSERVED	UTM OF OBSERVATION		INDIVIDUALS	
				EASTING	NORTHING	QTY	STATUS
2017							
08-JN	1	RT1	Midland Painted Turtle	601079	4855930	1	Dead
08-JN	1	RT1	Midland Painted Turtle	601294	4855652	1	Dead
08-JN	1	RT2	No Species Observed				
14-JN	2	RT1	No Species Observed				
14-JN	2	RT2	No Species Observed				
12-SE	3	RT1	Midland Painted Turtle	601273	4856243	1	Dead
12-SE	3	RT1	Midland Painted Turtle	601069	4855925	1	Dead
12-SE	3	RT2	No Species Observed				
12-SE	3	RT3	No Species Observed				
20-SE	4	RT3	Shadow Darner	601986	4854909	1	Dead
20-SE	4	RT3	Green Frog	602012	4854893	1	Dead
20-SE	4	RT3	American Toad	602012	4854880	1	Dead
20-SE	4	RT3	American Toad	602041	4854845	1	Dead
20-SE	4	RT3	American Toad	602042	4854846	1	Dead
20-SE	4	RT3	American Toad	602050	4854839	1	Dead
20-SE	4	RT3	American Toad	602053	4854843	1	Dead
20-SE	4	RT3	American Toad	602054	4854842	1	Dead
20-SE	4	RT3	American Toad	602055	4854840	1	Dead
20-SE	4	RT3	Frog sp.	602060	4854833	1	Dead
20-SE	4	RT3	American Toad	602080	4854829	1	Dead
20-SE	4	RT1	Eastern Gartersnake	601126	4856031	1	Dead

LEGEND:

MONTH	
JA	January
FE	February
MR	March
AL	April
MA	May
JN	June
JL	July
AU	August
SE	September
OC	October
NO	November
DE	December

Table 25: Wildlife Road Crossing Survey Results

SURVEY DATE	SURVEY ROUND	TRANSECT NO.	SPECIES OBSERVED	UTM OF OBSERVATION		INDIVIDUALS	
				EASTING	NORTHING	QTY	STATUS
20-SE	4	RT2	Frog sp.	601118	4855753	1	Dead
20-SE	4	RT2	Eastern Gartersnake	601072	4855796	1	Dead
2018							
02-MA	1	RT1	Turtle sp.	601037	4855896	1	Dead
02-MA	1	RT1	Turtle sp.	601044	4855918	1	Dead
02-MA	1	RT1	Turtle sp.	601044	4855919	1	Dead
02-MA	1	RT1	Eastern Gartersnake	601171	4856085	1	Dead
02-MA	1	RT1	Bird sp.	601315	4856283	1	Dead
02-MA	1	RT1	Eastern Gartersnake	601315	4856308	2	Alive
02-MA	1	RT2	No Species Observed				
02-MA	1	RT3	Northern Leopard Frog	602064	4854826	1	Dead
16-MA	2	RT1	Midland Painted Turtle	601036	4855889	1	Dead
16-MA	2	RT1	Northern Raccoon	601231	4856150	1	Dead
16-MA	2	RT2	No Species Observed				
16-MA	2	RT3	Amphibian sp.	602028	4854875	1	Dead
17-MA	3	RT1	No Species Observed				
17-MA	3	RT2	No Species Observed				
17-MA	3	RT3	No Species Observed				
24-MA	4	RT1	Turtle sp.	601030	4855889	1	Dead
24-MA	4	RT1	Unknown Rodent Species	601231	4856185	1	Dead
24-MA	4	RT1	Norway Rat	601299	4856270	1	Dead
24-MA	4	RT2	Bird sp.	601066	4855818	1	Dead

LEGEND:

MONTH	
JA	January
FE	February
MR	March
AL	April
MA	May
JN	June
JL	July
AU	August
SE	September
OC	October
NO	November
DE	December

Table 25: Wildlife Road Crossing Survey Results

SURVEY DATE	SURVEY ROUND	TRANSECT NO.	SPECIES OBSERVED	UTM OF OBSERVATION		INDIVIDUALS	
				EASTING	NORTHING	QTY	STATUS
24-MA	4	RT3	American Toad	602026	4854876	1	Dead
04-OC	1	RT4	Northern Leopard Frog	603930	4854671	1	Dead
04-OC	1	RT4	Northern Leopard Frog	604021	4854754	1	Dead
04-OC	1	RT4	Northern Leopard Frog	603895	4854586	1	Dead
04-OC	1	RT4	Northern Leopard Frog	603874	4854566	1	Dead
09-OC	2	RT4	No Species Observed				
11-OC	3	RT4	No Species Observed				

LEGEND:

MONTH	
JA	January
FE	February
MR	March
AL	April
MA	May
JN	June
JL	July
AU	August
SE	September
OC	October
NO	November
DE	December

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE								
			NOTU	MPTU	SNTU	MATU	BLTU	SSTU	WOTU	STIN	SPTU
02-MA-18	1	TBS1	X								
02-MA-18	1	TBS2	X								
02-MA-18	1	TBS3	X								
02-MA-18	1	TBS4	X								
02-MA-18	1	TBS5	X								
16-MA-18	2	TBS1	X								
16-MA-18	2	TBS2	X								
16-MA-18	2	TBS3		1							
16-MA-18	2	TBS4	X								
16-MA-18	2	TBS5	X								
04-OC-18	1	TBS6	X								
09-OC-18	2	TBS6	X								
11-OC-18	3	TBS6	X								

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOTU	No Turtles	No turtles despite survey effort
MPTU	Midland Painted Turtle	*Chrysemys picta marginata*
SNTU	Snapping Turtle	*Chelydra serpentina*
MATU	Northern Map Turtle	*Graptemys geographica*
BLTU	Blanding's Turtle	*Emydoidea blandingii*
SSTU	Spiny Soft-shelled Turtle	*Apalone spinifera*
WOTU	Wood Turtle	*Glyptemys insculpta*
STIN	Stinkpot Turtle	*Stemotherus odoratus*
SPTU	Spotted Turtle	*Clemmys guttata*

DATE	
MONTH	CODE
January	JA
February	FE
March	MR
April	AP
May	MA
June	JN
July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 27: Wildlife Camera Results

Date (2018)	Camera Trap	Common Name	Scientific Name	Quantity Observed	Comments
March 6 – March 16	1	-	-	-	No Species Obs.
	2	American Woodcock	*Scolopax minor*	1	
	3	American Robin	*Turdus migratorius*	2	
		Eastern Grey Squirrel	*Sciurus carolinensis*	1	
	4	American Robin	*Turdus migratorius*	1	
		American Mink	*Mustela vison*	1	
	5	House Cat	*Felis catus*	1	
	6	-	-	-	No Species Obs.
March 16 – March 26	1	-	-	-	No Species Obs.
	2	-	-	-	
	3	Eastern Grey Squirrel	*Sciurus carolinensis*	1	
	4	Norway Rat	*Rattus norvegicus*	1	
	5	-	-	-	No Species Obs.
	6	-	-	-	No Species Obs.
March 26 – April 11	1	-	-	-	No Species Obs.
	2	-	-	-	No Species Obs.
	3	-	-	-	No Species Obs.
	4	American Robin	*Turdus migratorius*	2	
		Killdeer	*Charadrius vociferus*	1	
		Red-winged Blackbird	*Agelaius phoeniceus*	1	
		European Starling	*Sturnus vulgaris*	1	
	5	-	-	-	No Species Obs.
	6	-	-	-	No Species Obs.

Inside Study Area	Outside Study Area	COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	SARO (MECP)	COSEWIC (Federal)	Local Status Halton	Local Status Hamilton	Local Status TRCA	Regional Status Region of Waterloo	Local Status CVC	Niagara Region CA Status	SWH Indicator Species 6E	SWH Indicator Species 7E
X	X	**ODONATA**													
x		Ebony Jewelwing	*Calopteryx maculata*	S5	G5				m				U		
x		Slender Spreadwing	*Lestes rectangularis*	S5	G5								R		
x		Violet Dancer	*Argia fumipennis violacea*	S5	G5T5			HU					C		
x		Familiar Bluet	*Enallagma civile*	S5	G5										
x		Marsh Bluet	*Enallagma ebrium*	S5	G5										
x		Stream Bluet	*Enallagma exsulans*	S5	G5			HR					U		
x		Eastern Forktail	*Ischnura verticalis*	S5	G5								C		
x		Shadow Darner	*Aeshna umbrosa*	S5	G5			HU							
x		Common Green Darner	*Anax junius*	S5	G5										
x		Common Baskettail	*Epitheca cynosura*	S5	G5			HU							
x		Halloween Pennant	*Celithemis eponina*	S4	G5			HU	m				U		
x		Eastern Pondhawk	*Erythemis simplicicollis*	S5	G5										
x		Dot-tailed Whiteface	*Leucorrhinia intacta*	S5	G5										
x		Widow Skimmer	*Libellula luctuosa*	S5	G5										
x		Twelve-Spotted Skimmer	*Libellula pulchella*	S5	G5								C		
x		Wandering Glider	*Pantala flavescens*	S4	G5			HU	m				C		
x		Common Whitetail	*Plathemis lydia*	S5	G5								C		
x		White-faced Meadowhawk	*Sympetrum obtrusum*	S5	G5								R		
x		Ruby Meadowhawk	*Sympetrum rubicundulum*	S5	G5								C		
x		Band-winged Meadowhawk	*Sympetrum semicinctum*	S4	G5			HU					C		
x		Black Saddlebags	*Tramea lacerata*	S4	G5										
X	X														
		BUTTERFLIES													
x		Least Skipper	*Ancyloxypha numitor*	S5	G5										
x		European Skipper	*Thymelicus lineola*	SNA	G5										
x		Black Swallowtail	*Papilio polyxenes*	S5	G5								H		
x		Cabbage White	*Pieris rapae*	SNA	G5										
x		Clouded Sulphur	*Colias philodice*	S5	G5										
x		Eastern Tailed Blue	*Cupido comyntas*	S5	G5										
x		Silvery Blue	*Glaucopsyche lygdar*	S5	G5								C		
x		Pearl Crescent	*Phyciodes tharos*	S4	G5										
x		Question Mark	*Polygonia interrogationis*	S5	G5								C		
x		American Lady	*Vanessa virginiensis*	S5	G5								C		
x		Red Admiral	*Vanessa atalanta*	S5B	G5								U	X	X
x		Common Ringlet	*Coenonympha tullia*	S5	G5								R		
x		Common Wood-Nymph	*Cercyonis pegala*	S5	G5								C		
x		Monarch	*Danaus plexippus*	S4B, S2N	G4	SC	END							X	X
X	X														
		BUMBLE BEES													
x		Yellow-banded Bumble Bee	*Bombus terricola*	S3S5	G3G4	SC	SC								
x		Common Eastern Bumble Bee	*Bombus impatiens*	S5	G5										
X	X														
		CRAYFISH													
x		Digger Crayfish	*Creaserinus fodiens*	S3	G5					L2				X	X
X	X														
		AMPHIBIANS													
x		American Toad	*Anaxyrus americanus*	S5	G5					L4	X		W	X	X
x		Gray Treefrog	*Hyla versicolor*	S5	G5					L2	X		L	X	X
x		American Bullfrog	*Lithobates catesbeiana*	S4	G5			HU	m	L2	X		W	X	X
x		Northern Green Frog	*Lithobates clamitans*	S5	G5					L4	X		W	X	X
x		Northern Leopard Frog	*Lithobates pipiens*	S5	G5		NAR			L3	X		W	X	X
		REPTILES													
x		Snapping Turtle	*Chelydra serpentina*	S4	G5	SC	SC			L3				X	X
x		Midland Painted Turtle	*Chrysemys picta marginat*	S4	G5T5		SC			L3			L	X	X
x		Eastern Gartersnake	*Thamnophis sirtalis*	S5	G5					L4				X	X

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X	X														
		BIRDS											L		
x		Canada Goose	*Branta canadensis*	S5	G5					L5				X	X
x		Wood Duck	*Aix sponsa*	S5B, S3N	G5			m	m	L4	X			X	X
x		Mallard	*Anas platyrhynchos*	S5	G5					L5			U	X	X
x		Rock Pigeon	*Columba livia*	SNA	G5										
x		Mourning Dove	*Zenaida macroura*	S5	G5					L5					
x		Yellow-billed Cuckoo	*Coccyzus americanus*	S4B	G5			HR	H	L3	X		C		
x		Ruby-throated Hummingbird	*Archilochus colubris*	S5B	G5				m	L4	X		U		
x		Virginia Rail	*Rallus limicola*	S4S5B	G5				m	L3	X		R	X	X
x		Killdeer	*Charadrius vociferus*	S4B	G5					L4					
x		Upland Sandpiper	*Bartramia longicauda*	S2B	G5			HR	H	L2	X			X	X
x		American Woodcock	*Scolopax minor*	S4B	G5					L3					
x		Spotted Sandpiper	*Actitus macularius*	S5B	G5								U		
x		Ring-billed Gull	*Larus delawarensis*	S5	G5					L4				X	X
x		Common Loon	*Gavia immer*	S5	G5						X			X	X
x		Great Blue Heron	*Ardea herodias*	S4	G5				m	L3	X		R	X	X
x		Turkey Vulture	*Cathartes aura*	S5B, S3N	G5				m	L5	X		R		
x		Red-tailed Hawk	*Buteo jamaicensis*	S5	G5					L5				X	X
x		Downy Woodpecker	*Dryobates pubescens*	S5	G5					L5					
x		Northern Flicker	*Colaptes auratus*	S5	G5					L4			U		
x		Great Crested Flycatcher	*Myiarchus crinitus*	S5B	G5					L4			R		
x		Eastern Wood-Pewee	*Contopus virens*	S4B	G5	SC	SC			L4				X	X
x		Willow Flycatcher	*Empidonax traillii*	S4B	G5			HU		L4	X		U	X	X
x		Eastern Phoebe	*Sayornis phoebe*	S5B	G5				m	L5			U		
x		Warbling Vireo	*Vireo gilvus*	S5B	G5					L5	X				
x		Red-eyed Vireo	*Vireo olivaceus*	S5B	G5					L4			C		
x		Blue Jay	*Cyanocitta cristata*	S5	G5					L5					
x		American Crow	*Corvus brachyrhynchos*	S5	G5					L5			C		
x		Horned Lark	*Eremophila alpestris*	S4	G5			HU		L3					
x		Bank Swallow	*Riparia riparia*	S4B	G5	THR	THR		m	L3			C		
x		Tree Swallow	*Tachycineta bicolor*	S4S5B	G5					L4			C		
x		Barn Swallow	*Hirundo rustica*	S4B	G5	SC	SC			L4			U		
x		Black-capped Chickadee	*Poecile atricapillus*	S5	G5					L5			C		
x		White-breasted Nuthatch	*Sitta carolinensis*	S5	G5					L4			R		
x		House Wren	*Troglodytes aedon*	S5B	G5					L5			U		
x		Blue-gray Gnatcatcher	*Polioptila caerulea*	S4B	G5			HU	m	L4	X				
x		American Robin	*Turdus migratorius*	S5	G5					L5			U		
x		Gray Catbird	*Dumetella carolinensis*	S5B, S3N	G5					L4			C		
x		Brown Thrasher	*Toxostoma rufum*	S4B	G5				m	L3	X		C	X	X
x		European Starling	*Sturnus vulgaris*	SNA	G5				E	L+			U		
x		Cedar Waxwing	*Bombycilla cedrorum*	S5	G5					L5					
x		House Sparrow	*Passer domesticus*	SNA	G5				E	L+			C		
x		House Finch	*Carpodacus mexicanus*	SNA	G5				E	L+			O		
x		American Goldfinch	*Spinus tristis*	S5	G5					L5					
x		Chipping Sparrow	*Spizella passerina*	S5B, S3N	G5					L5			U		
x		Vesper Sparrow	*Pooecetes gramineus*	S4B	G5			HU	m	L3	X			X	X
x		Savannah Sparrow	*Passerculus sandwichensi*	S5B, S3N	G5					L4				X	X
x		Song Sparrow	*Melospiza melodia*	S5	G5					L5			C		
x		Swamp Sparrow	*Melospiza georgiana*	S5B, S4N	G5					L4	X		O		
x		Bobolink	*Dolichonyx oryzivorus*	S4B	G5	THR	THR			L2					
x		Baltimore Oriole	*Icterus galbula*	S4B	G5					L5			U		
x		Red-winged Blackbird	*Agelaius phoeniceus*	S5	G5					L5			C		
x		Brown-headed Cowbird	*Molothrus ater*	S5	G5					L5			C		
x		Common Grackle	*Quiscalus quiscula*	S5	G5					L5					
x		Common Yellowthroat	*Geothlypis trichas*	S5B, S3N	G5					L4					
x		Yellow Warbler	*Setophaga petechia*	S5B	G5					L5					

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x		Northern Cardinal	*Cardinalis cardinalis*	S5	G5					L5			U		
x		Rose-breasted Grosbeak	*Pheucticus ludovicianus*	S5B	G5					L4			C		
x		Indigo Bunting	*Passerina cyanea*	S5B	G5					L4					
X	X														
		MAMMALS													
x		Virginia Opossum	*Didelphis virginiana*	S4	G5					L4					
x		Eastern Cottontail	*Sylvilagus floridanus*	S5	G5					L4					
x		Eastern Gray Squirrel	*Sciurus carolinensis*	S5	G5					L5					
x		Beaver	*Castor canadensis*	S5	G5					L4					
x		Coyote	*Canis latrans*	S5	G5					L4					
x		Northern Raccoon	*Procyon lotor*	S5	G5					L5					
x		American Mink	*Mustela vison*	S4	G5					L4					
x		White-tailed Deer	*Odocoileus virginianus*	S5	G5					L4				X	X
		SUMMARY													
		Total Odonata:	*0*												
		Total Butterflies:	*0*												
		Total Other Arthropods	*0*												
		Total Amphibians:	***0***												
		Total Reptiles:	*0*												
		Total Birds:	*0*												
		Total Breeding Birds:	*0*												
		Total Mammals:	*0*												
		SIGNIFICANT SPECIES													
		Global:	*0*												
		National:	*0*												
		Provincial:	*0*												
		Regional:	*0*												
		Local:													
		Explanation of Status and Acronymns													
		COSSARO: Committee on the Status of Species at Risk in Ontario													
		COSEWIC: Committee on the Status of Endangered Wildlife in Canada													
		S1: Critically Imperiled—Critically imperiled in the province (often 5 or fewer occurrences)													
		S2: Imperiled—Imperiled in the province, very few populations (often 20 or fewer),													
		S3: Vulnerable—Vulnerable in the province, relatively few populations (often 80 or fewer)													
		S4: Apparently Secure—Uncommon but not rare													
		S5: Secure—Common, widespread, and abundant in the province													
		SX: Presumed extirpated													
		SH: Possibly Extirpated (Historical)													
		SNR: Unranked													
		SU: Unrankable—Currently unrankable due to lack of information													
		SNA: Not applicable—A conservation status rank is not applicable because the species is not a suitable target for conservation activities.													
		S#S#: Range Rank—A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species													
		S#B- Breeding status rank													
		S#N- Non Breeding status rank													
		?: Indicates uncertainty in the assigned rank													
		G1: Extremely rare globally; usually fewer than 5 occurrences in the overall range													
		G1G2: Extremely rare to very rare globally													
		G2: Very rare globally; usually between 5-10 occurrences in the overall range													
		G2G3: Very rare to uncommon globally													
		G3: Rare to uncommon globally; usually between 20-100 occurrences													
		G3G4: Rare to common globally													

Inside Study Area	Outside Study Area	COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	SARO (MECP)	COSEWIC (Federal)	Local Status Halton	Local Status Hamilton	Local Status TRCA	Regional Status Region of Waterloo	Local Status CVC	Niagara Region CA Status	SWH Indicator Species 6E	SWH Indicator Species 7E
		G4: Common globally; usually more than 100 occurrences in the overall range													
		G4G5: Common to very common globally													
		G5: Very common globally; demonstrably secure													
		GU: Status uncertain, often because of low search effort or cryptic nature of the species; more data needed.													
		T: Denotes that the rank applies to a subspecies or variety													
		Q: Denotes that the taxonomic status of the species, subspecies, or variety is questionable.													
		END: Endangered													
		THR: Threatened													
		SC: Special Concern													
		NAR: Not At Risk													
		IND: Indeterminant, insufficient information to assign status													
		DD: Data Deficient													
		6: Rare in Site Region 6													
		7: Rare in Site Region 7													
		Area: Minimum patch size for area-sensitive species (ha)													
		H- highly significant in Hamilton Region (i.e. rare)													
		m- moderately significant in Hamilton Region (i.e. uncommon)													
		L1- extremely rare locally (Toronto Region)													
		L2- very rare locally (Toronto Region)													
		L3- rare to uncommon locally (Toronto Region)													
		HR- rare in Halton Region, highly significant													
		HU- uncommon in Halton Region, moderately significant													
		REFERENCES													
		COSSARO Status													
		Endangered Species Act, 2007 (Bill 184). Species at Risk in Ontario List (O. Reg. 230/08). Accessed October 7, 2016.													
		COSEWIC Status													
		COSEWIC. 2016. Canadian Species at Risk. Committee on the Status of Endangered Wildlife in Canada.													
		Local Status													
		Dwyer, Jill K. 2003. Nature Counts Project Hamilton Natural Areas Inventory 2003. Species Checklists. Hamilton Naturalists Club.													
		Halton Natural Areas Inventory. 2006. Volume 2 Species Checklists (ISBN 0-9732488-7-4).													
		Region of Waterloo. 1996. Regionally Significant Breeding Birds.													
		Toronto and Region Conservation Authority (TRCA). 2016. Revised Fauna Scores and Ranks, February 2016													
		Hamilton Conservation Authority (HCA). 2014. Hamilton Natural Areas Inventory Project (3rd Edition).													
		Significant Wildlife Habitat (SWH) Indicator Species													
		Ministry of Natural Resources and Forestry (MNRF). 2015. Significant wildlife habitat criteria schedules for ecoregion 6E. Available at: https://dr6j45jk9xcmk.cloudfront.net/documents/4775/schedule-6e-jan-2015-access-ver-final-s.pdf.													
		Ministry of Natural Resources and Forestry (MNRF). 2015. Significant wildlife habitat criteria schedules for ecoregion 7E. Available at: https://dr6j45jk9xcmk.cloudfront.net/documents/4776/schedule-7e-jan-2015-access-vers-final-s.pdf.													
		Natural Heritage Information Center (NHIC). 2016. Onatrio Species List: All Species.													

Table 22: Fish Community Sampling Results (July 4, 2017)

Species	HDF-3d	HDF-3g	Clarkway Drive Trib (Upstream)	Clarkway Drive Trib (Downstream)	HDF-3i
Brook Stickleback (*Culaea inconstans)*	X	X	X		X
Bluntnose Minnow (*Pimephales notatus)*				X	
Creek Chub (*Semotilus atromaculatus)*				X	
Eastern Blacknose Dace (*Rhinichthys atratulus*)				X	
Fathead Minnow (*Pimephales promelas)*	X	X		X	X
Pumpkinseed (*Lepomis gibbosus)*				X	

Table 30: Ecoregions 6E & 7E Significant Wildlife Habitat Assessment

SIGNIFICANT WILDLIFE HABITAT (SWH) TYPE	ELC ECOSITE(S) PRESENT	HABITAT CRITERIA MET	TARGETED FIELD STUDIES REQUIRED	DEFINING CRITERIA MET (MINIMUM ABUNDANCES AND/OR DIVERSITY REQUIRED TO CONFIRM SWH)	SWH TYPE PRESENT
1. SEASONAL CONCENTRATION AREAS OF ANIMALS					
Waterfowl Stopover and Staging Areas (Terrestrial)	Yes – CUM1 and CUT1 vegetation communities are present in the Study Area.	No - Features are not large enough to attract or support significant numbers. This area does not have historical waterfowl stopover use and is not an area known for sheet water use.	No	N/A	Not Present
Waterfowl Stopover and Staging Areas (Aquatic)	Yes – MAS and SAS communities are present within the Study Area.	No – While ponds, watercourses and marshes are present within and adjacent to the Study Area, the features are not large enough to attract or support significant numbers. This area does not have historical waterfowl stopover use.	No	N/A	Not Present
Shorebird Migratory Stopover Areas	No – Suitable shoreline ecosites are not present within the Study Area.	No	No	N/A	Not Present
Raptor Wintering Areas	Yes – Forest (FOD) and Upland (CUM, CUT) vegetation communities are present within the Study Area.	No – Forest and upland vegetation communities do not meet the minimum size criteria (>20 ha).	No	N/A	Not Present
Bat Hibernacula	No – Suitable ecosites are not present within the Study Area.	No	No	N/A	Not Present
Bat Maternity Colonies	Yes – FOD vegetation communities are present within the Study Area. Two other FOD communities are identified on non-participating properties.	Yes – A small Fresh-Moist Basswood Deciduous Forest (FOD8-3) is located on a participating property within the north central portion of the Study Area. This feature meets the habitat criteria threshold of >10/ha large diameter (>25cm DBH) trees. The remainder of treed habitats within the Study Area are located on lands owned by non-participating landowners and are assumed to provide suitable habitat.	Yes	No- A Bat Habitat Assessment was completed for the participating lands in the Study Area (see **Figure 5**, **Appendix A1** for survey dates and conditions). The FOD8-3 surveyed in the Study Area met the minimum density criteria for significance (>10 suitable roosting trees/ha) (**Table 14**, **Appendix C1**). Bat acoustic monitoring completed within this feature did identify SWH indicator species, the Big Brown Bat and the Silver-haired Bat. However, the low number of calls did not meet the threshold for the criteria to be met (**Table 15**, **Appendix C1**). It is likely that both species are not using the FOD8-3 as maternity roosting but rather as foraging/passing by.	Not present on participating properties within the Study Area however, candidate habitats are present in the forest communities (FOD and FOD7-6) within the non-participating lands.

Table 30: Ecoregions 6E & 7E Significant Wildlife Habitat Assessment

SIGNIFICANT WILDLIFE HABITAT (SWH) TYPE	ELC ECOSITE(S) PRESENT	HABITAT CRITERIA MET	TARGETED FIELD STUDIES REQUIRED	DEFINING CRITERIA MET (MINIMUM ABUNDANCES AND/OR DIVERSITY REQUIRED TO CONFIRM SWH)	SWH TYPE PRESENT
Turtle Wintering Areas	Yes – SA and MA vegetation communities are present within the Study Area.	Yes- Presence of ponds, watercourses and surrounding wetlands may provide turtle wintering areas.	Yes	Potentially- Since Turtle Wintering Areas occur in the same general area as their core habitat, turtle nesting and basking surveys were completed within the Study Area (see **Figure 5**, **Appendix A1** for locations and **Tables 16 and 17, Appendix C1** for survey dates). No suitable turtle nesting sites were identified in the Study Area. However, one Midland Painted Turtle was observed in the pond near Humber Station Road during turtle basking surveys (TB3; **Table 16**, **Appendix C1**). This is an insufficient number of Midland Painted Turtles to be considered SWH. One Snapping Turtle was observed incidentally at this pond in July 2023 which is outside of the basking window. Within the Clarkway Drive Tributary, one Snapping Turtle was observed in June 2017, which is outside of the basking window. Road morality surveys completed along RT1 on Healy Road, identified nine deceased Midland Painted Turtles or unidentifiable turtles (**Table 18**, **Appendix C1**). As a result of this high-density roadkill crossing, it is acknowledged that turtles are crossing Healey Road between the woodlands on each side of the road which contain OA and wetland habitats as per MNFR LIO mapping. Therefore, candidate overwintering habitat is identified in the OA ponds associated with the northwest FOD community on non-participating lands.	Candidate SWH within ponds in northwestern FOD on non-participating lands.
Reptile Hibernacula	Yes – Ecosites may be present within the Study Area.	Yes– Natural/naturalized or anthropogenic features were identified within the Study Area that provide subsurface access below the frost line.	Yes	No- Snake transect and coverboard surveys were completed in the Study Area (see **Table 8**, **Appendix C1** for survey dates and conditions). No snake species were recorded during these surveys (**Table 17**, **Appendix C1**).	Not Present

Table 30: Ecoregions 6E & 7E Significant Wildlife Habitat Assessment

SIGNIFICANT WILDLIFE HABITAT (SWH) TYPE	ELC ECOSITE(S) PRESENT	HABITAT CRITERIA MET	TARGETED FIELD STUDIES REQUIRED	DEFINING CRITERIA MET (MINIMUM ABUNDANCES AND/OR DIVERSITY REQUIRED TO CONFIRM SWH)	SWH TYPE PRESENT
Colonially-Nesting Bird Breeding Habitat (Bank and Cliff)	Yes – CUM1 and CUT1 vegetation communities are present within the Study Area.	No – Presence of exposed or eroding banks, hills, steep slopes and sand piles are not present within the Study Area.	No	N/A	Not Present
Colonially-Nesting Bird Breeding Habitat (Tree and Shrub)	No – Suitable ecosites are not present within the Study Area.	No	No	N/A	Not Present
Colonially-Nesting Bird Breeding Habitat (Ground)	No – No rocky islands or peninsulas are present within the Study Area.	No	No	N/A	Not Present
Migratory Butterfly Stopover Areas	Yes- Forest (FOD, CUP) and field (CUM, CUT) vegetation communities are present in the Study Area.	No-The Study Area is not within 5 km of Lake Ontario or Lake Erie and ecosites do not meet the minimum size criteria of 10 ha.	No	N/A	Not Present
Landbird Migratory Stopover Areas	Yes- FOD vegetation communities are present within the Study Area.	No- The Study Area is not within 5 km of Lake Ontario or Lake Erie and the ecosite do not meet the minimum size criteria of >5 ha.	No	N/A	Not Present
Deer Winter Congregation Areas	Yes –FOD vegetation communities are present within the Study Area.	No - Habitat features do not meet the size criteria (> 100 ha). LIO mapping does not identify any Deer Yards in the Study Area.	No	N/A	Not Present
2. RARE VEGETATION COMMUNITIES OR SPECIALIZED HABITAT FOR WILDLIFE					
2a. Rare Vegetation Communities					
Rare Vegetation Types (cliffs, talus slopes, sand barrens, alvars, old-growth forests, savannahs, and tallgrass prairies)	No – Rare vegetation types are not present within the Study Area.	No	No	N/A	Not Present
Other Rare Vegetation Types (S1 to S3 communities)	No – Other rare vegetation types are not present within the Study Area.	No	No	N/A	Not Present
2b. Specialized Wildlife Habitat					
Waterfowl Nesting Areas	Yes – Upland habitat (CUM, CUT) is located adjacent to MAS and MAM vegetation communities within the Study Area	No- While wetland features do meet the size criteria (>0.5 ha) adjacent upland habitat is not 120 m wide.	No	N/A	Not Present

Table 30: Ecoregions 6E & 7E Significant Wildlife Habitat Assessment

SIGNIFICANT WILDLIFE HABITAT (SWH) TYPE	ELC ECOSITE(S) PRESENT	HABITAT CRITERIA MET	TARGETED FIELD STUDIES REQUIRED	DEFINING CRITERIA MET (MINIMUM ABUNDANCES AND/OR DIVERSITY REQUIRED TO CONFIRM SWH)	SWH TYPE PRESENT
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat	Yes –FOD vegetation communities are adjacent to wetland communities within the Study Area.	Yes- Wetlands are adjacent to forested features.	Yes	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). SWH indicator species were not identified despite survey effort (see **Table 13**, **Appendix C1** for breeding bird survey results).	Not Present
Woodland Raptor Nesting Habitat	Yes – FOD and CUP vegetation communities are present within the Study Area.	No – Forested habitat features do not meet the minimum size criteria (> 30 ha with >4 ha of interior forest habitat).	No	N/A	Not Present
Turtle Nesting Areas	Yes- MAS and SAS vegetation communities are present within the Study Area.	Yes- Potentially suitable substrate was observed adjacent to wetlands in the Study Area.	Yes	No- Turtle nesting surveys were completed in the Study Area (see **Figure 8**, **Appendix C1** for survey dates and conditions). No suitable turtle nesting sites were identified within the Study Area (**Table 16**, **Appendix C1**). No nesting evidence (i.e., test digs, claw marks, predated nests) were observed on site.	Not Present
Seeps and Springs	Yes – Forested vegetation communities (FOD) are present within the Study Area.	Yes– Forested vegetation communities are associated with flowing headwater drainage features.	Yes	No – Surveys completed within the forested vegetation communities on the participating properties identified no seeps or springs. Potential seeps or springs may be located within a non-participating property. Surveys were not able to be completed on non-participating properties.	Candidate within FOD and FOD7-6 communities located within the non-participating property
Amphibian Breeding Habitat (Woodland)	Yes – FOD vegetation communities are present within the Study Area.	Yes – Wetlands and ponds are adjacent to woodlands.	Yes	No- Amphibian Call Count Surveys were completed within the Study Area (see **Table 8**, **Appendix C1** for survey dates and conditions). SWH indicator species with suitable calling thresholds were not identified despite survey effort (see **Table 11**, **Appendix C1** for amphibian survey results).	Not Present

Table 30: Ecoregions 6E & 7E Significant Wildlife Habitat Assessment

SIGNIFICANT WILDLIFE HABITAT (SWH) TYPE	ELC ECOSITE(S) PRESENT	HABITAT CRITERIA MET	TARGETED FIELD STUDIES REQUIRED	DEFINING CRITERIA MET (MINIMUM ABUNDANCES AND/OR DIVERSITY REQUIRED TO CONFIRM SWH)	SWH TYPE PRESENT
Amphibian Breeding Habitat (Wetland)	Yes- MA and SA vegetation communities are present within the Study Area and isolated from woodlands.	Yes- Wetlands meet the size criteria (>500 m^2).	Yes	Yes- Amphibian Call Count Surveys were completed (see **Table 8**, **Appendix C1** for survey dates and conditions). SWH indicator species with suitable calling thresholds were not identified despite survey effort (see **Table 11**, **Appendix C1** for amphibian survey results). However, one Bullfrog was incidentally heard calling from the pond near Humber Station Road (AMC15) during Breeding Bird Surveys in June 2017. This meets the threshold to be considered SWH.	Candidate habitat within pond near Humber Station Road.
Woodland Area-Sensitive Bird Breeding Habitat	Yes- FOD vegetation communities are present within the Study Area.	No – Forested vegetation communities are not identified as mature (>60 years old) and do not meet the minimum size criteria (> 30 ha with interior forest habitat at least 200 m from forest edge).	No	N/A	Not Present
3. SPECIES OF CONSERVATION CONCERN					
Marsh Bird Breeding Habitat	Yes – MAM and SAS vegetation communities are present within the Study Area. In addition, CUM1, preferred by the Green Heron, is also present in the Study Area.	Yes –Ponds and wetlands with shallow water and emergent aquatic vegetation are present within the Study Area.	Yes	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Although SWH indicator species, Virginia Rail and Common Loon were observed, minimum criteria thresholds were not met (see **Table 13**, **Appendix C1** for breeding bird survey results).	Not Present
Open Country Bird Breeding Habitat	Yes – CUM1 vegetation communities are present within the Study Area.	No – Meadow community does not meet the size criteria (> 30 ha).	No	N/A	Not Present
Shrub/Early Successional Bird Breeding Habitat	Yes – CUT vegetation communities are present within the Study Area.	No -The shrub thicket habitat does not meet the minimum size criteria of >10 ha.	No	N/A	Not Present

Table 30: Ecoregions 6E & 7E Significant Wildlife Habitat Assessment

SIGNIFICANT WILDLIFE HABITAT (SWH) TYPE	ELC ECOSITE(S) PRESENT	HABITAT CRITERIA MET	TARGETED FIELD STUDIES REQUIRED	DEFINING CRITERIA MET (MINIMUM ABUNDANCES AND/OR DIVERSITY REQUIRED TO CONFIRM SWH)	SWH TYPE PRESENT
Terrestrial Crayfish	Yes –MAM, MAS, and CUM1 vegetation communities are present within the Study Area.	Yes- Wetlands with potentially suitable habitat are present within the Study Area.	Yes	Yes- Terrestrial Crayfish surveys were completed within the Study Area (see **Table 8**, **Appendix C1** for survey dates and conditions). Four wetland areas were observed as Terrestrial Crayfish habitat.	Present
Special Concern and Rare Wildlife Species					
(i) American Coot (*Fulica americana*)	N/A	Yes- Ponds and marshes are present within the Study Area.	Yes	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). American Coot was not identified despite survey effort (see **Table 13**, **Appendix C1** for breeding bird survey results).	Not Present
(ii) Barn Swallow (*Hirundo rustica*)	N/A	Possible- Anthropogenic structures suitable for nesting are present within the Study Area however, they are highly degraded.	Yes	Yes- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Barn Swallows and their nests were identified within several structures (see **Table 13**, **Appendix C1** for breeding bird survey results). A Notice of Activity (NOA) was submitted to MECP and Replacement Habitat Structures were installed before the structures were removed.	Not Present
(iii) Black Tern (*Chlidonias niger*)	N/A	Yes- Suitable cattail marshes are present within the Study Area.	Yes	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Black Tern was not identified despite survey effort (see **Table 13**, **Appendix C1** for breeding bird survey results).	Not Present
(iv) Blue-winged Teal (Anas discors)	N/A	Yes- Ponds and marshes are present within the Study Area.	Yes	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Blue-winged Teal was not identified despite survey effort (see **Table 13**, **Appendix C1** for breeding bird survey results).	Not Present

Table 30: Ecoregions 6E & 7E Significant Wildlife Habitat Assessment

SIGNIFICANT WILDLIFE HABITAT (SWH) TYPE	ELC ECOSITE(S) PRESENT	HABITAT CRITERIA MET	TARGETED FIELD STUDIES REQUIRED	DEFINING CRITERIA MET (MINIMUM ABUNDANCES AND/OR DIVERSITY REQUIRED TO CONFIRM SWH)	SWH TYPE PRESENT
(v) Canada Warbler (Cardellina canadensis)	N/A	Yes- Suitable wet forest communities are present within the Study Area.	Yes	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Canada Warbler was not identified despite survey effort (see **Table 13**, **Appendix C1** for breeding bird survey results).	Not Present
(vi) Caspian Tern (*Hydroprogne caspia*)	N/A	No- Coastlines, beach and islands are not present within the Study Area.	No	N/A	Not Present
(vii) Common Nighthawk (*Chordeiles minor*)	N/A	Unlikely – Suitable vegetation communities (open areas with little to no ground vegetation) are not present within the Study Area.	Yes	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Common Nighthawk was not identified despite survey effort (see **Table 13**, **Appendix C1** for breeding bird survey results).	Not Present
(viii) Eastern Wood-Pewee (*Contopus virens)*	N/A	Yes – Suitable forest habitat is present within the Study Area.	Yes	Yes- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Eastern Wood-Pewee was identified at PC1, PC2 and PC3 surrounding the northern FOD community on non-participating land (see **Table 13**, **Appendix C1** for breeding bird survey results).	Present
(ix) Evening Grosbeak (*Coccothraustes vespertinus*)	N/A	No- Mixed forested communities are not present within the Study Area.	No	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Evening Grosbeak was not identified despite survey effort (see **Table 13**, **Appendix C1** for breeding bird survey results).	Not Present
(x) Golden-winged Warbler (*Vermivora chrysoptera*)	N/A	Yes- FOD vegetation communities with field edges are present within the Study Area.	Yes	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Golden-winged Warbler was not identified despite survey effort (see **Table 13**, **Appendix C1** for breeding bird survey results).	Not Present

Table 30: Ecoregions 6E & 7E Significant Wildlife Habitat Assessment

SIGNIFICANT WILDLIFE HABITAT (SWH) TYPE	ELC ECOSITE(S) PRESENT	HABITAT CRITERIA MET	TARGETED FIELD STUDIES REQUIRED	DEFINING CRITERIA MET (MINIMUM ABUNDANCES AND/OR DIVERSITY REQUIRED TO CONFIRM SWH)	SWH TYPE PRESENT
(xi) Grasshopper Sparrow (*Ammodramus savannarum*)	N/A	Unlikely – Suitable vegetation communities (grasslands) are not present within the Study Area.	Yes	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Grasshopper Sparrow was not identified despite survey effort (see **Table 13**, **Appendix C1** for breeding bird survey results).	Not Present
(xii) Great Egret (*Ardea alba*)	N/A	Yes- Wetlands are present within the Study Area.	Yes	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Great Egret was not identified despite survey effort (see **Table 13**, **Appendix C1** for breeding bird survey results).	Not Present
(xiii) Short-eared Owl (*Asio flammeus*)	N/A	No- Study Area is not located within distribution range.	No	N/A	Not Present
(xiv) Purple Martin (*Progne subis*)	N/A	Unlikely- While the Study Area does contain open areas near marshes and ponds, the site is predominantly a highly disturbed agricultural field and suitable habitat is unlikely.	No	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Purple Martin was not identified despite survey effort (see **Table 13**, **Appendix C1** for breeding bird survey results).	Not Present
(xv) Ruddy Duck (*Oxyura jamaicensis*)	N/A	Yes- Ponds and marshes are present within the Study Area.	Yes	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Ruddy Duck was not identified despite survey effort (see **Table 13**, **Appendix C1** for breeding bird survey results).	Not Present
(xvi) Upland Sandpiper (*Bartramia longicauda*)	N/A	Yes- CUM communities are present within the Study Area.	Yes	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Upland Sandpiper was identified at PC4 and off-site (see **Table 13**, **Appendix C1** for breeding bird survey results). This observation was made in an agricultural field which is not typically considered SWH. The species was not recorded during the second round of breeding bird surveys, which indicates the species was not likely breeding onsite.	Not Present

Table 30: Ecoregions 6E & 7E Significant Wildlife Habitat Assessment

SIGNIFICANT WILDLIFE HABITAT (SWH) TYPE	ELC ECOSITE(S) PRESENT	HABITAT CRITERIA MET	TARGETED FIELD STUDIES REQUIRED	DEFINING CRITERIA MET (MINIMUM ABUNDANCES AND/OR DIVERSITY REQUIRED TO CONFIRM SWH)	SWH TYPE PRESENT
(xvii) Wood Thrush (*Hylocichla mustelina)*	N/A	Yes-Suitable Forest habitat is present within the Study Area.	Yes	No- Breeding bird surveys were completed in 2017 (see **Table 8**, **Appendix C1** for survey dates and conditions). Wood Thrush was not identified despite survey effort (see **Table 13**, **Appendix C1** for breeding bird survey results).	Not Present
(xviii) Snapping Turtle (*Chelydra serptentina)*	N/A	Yes – Suitable aquatic communities may be present within the Study Area.	Yes	Yes- Turtle nesting and basking surveys were completed in the Study Area (see **Table 8**, **Appendix C1** for survey dates and conditions). Snapping Turtles were incidentally observed at the pond associated with HDF-3 and within the MAS2-1/MAM2-2 community associated with the Clarkway Drive Tributary	Present
(xix) Eastern Ribbonsnake (*Thamnophis sauritus*)	N/A	Yes- CUM and MAS are present within the Study Area.	Yes	No- Snake transect and coverboard surveys were completed in the Study Area (see **Table 8**, **Appendix C1** for survey dates and conditions). Eastern Ribbonsnake was not observed despite survey effort (see **Table 17**, **Appendix C1** for snake survey results).	Not Present
(xx) Monarch Butterfly (*Danaus plexippus*)	N/A	Yes- CUM vegetation communities with Common Milkweed (*Asclepias syriaca*) are present within the Study Area.	Yes	Yes-Insect surveys were completed in the Study Area (see **Table 8**, **Appendix C1** for survey dates and conditions). Monarch Butterflies were observed during the two rounds of surveying at various old field/meadow locations with peak numbers (three individuals). Common Milkweed is widespread along the eastern watercourse, and some hedgerows, providing areas for reproduction of this species.	Present
(xxi) Yellow-banded Bumble Bee (*Bombus terricola*)	N/A	Yes- Forested and wetland habitats are present within the Study Area. The species forages on a variety of flowers including Sweet Clover (*Melilotus sp.)* and Dandelions (*Taraxacum sp.*) which are present in the field edges.	Yes	Yes-Insect surveys were completed in the Study Area (see **Table 8**, **Appendix C1** for survey dates and conditions). Yellow-banded Bumble Bee was observed along the eastern watercourse/Agricultural hard edge between PC 10 and PC 11.	Present

Table 30: Ecoregions 6E & 7E Significant Wildlife Habitat Assessment

SIGNIFICANT WILDLIFE HABITAT (SWH) TYPE	ELC ECOSITE(S) PRESENT	HABITAT CRITERIA MET	TARGETED FIELD STUDIES REQUIRED	DEFINING CRITERIA MET (MINIMUM ABUNDANCES AND/OR DIVERSITY REQUIRED TO CONFIRM SWH)	SWH TYPE PRESENT
4. ANIMAL MOVEMENT CORRIDORS					
Amphibian Movement Corridors	N/A	No – Candidate wetland amphibian breeding habitat was identified for the pond at AMC15 (incidental Bullfrog observation). However, HDF-3 does not consist of 15 m of vegetation on both sides and is highly disturbed due to being ploughed to the edge of the feature. Therefore, HDF-3 is not considered a suitable amphibian movement corridor.	No	N/A	Not Present

Table 31: Significant Wildlife Habitat Review (Peel ROP Peel-Caledon Significant Wildlife Habitat Study 2009)

SWH Type	SWH Analysis
Seasonal Concentrations of Animals	
A1. Deer Wintering Area	**Not Present**
A2. Colonial Bird Nesting Sites	**Not Present**
A3. Waterfowl Nesting Habitat	**Not Present** While wetland and upland habitat is present within and adjacent to the Study Area, no nesting pairs of indicator species were observed during Breeding Bird Surveys.
A4i. Migratory Landbird Stopover Areas	**Not Present** The Study Area is not located within 2 km of Lake Ontario.
A4ii. Migratory Bat Stopover Areas	**Not applicable.** This is not considered a SWH type under the Province's ecoregional criteria (MNRF 2015).
A4iii. Migratory Butterfly Stopover Areas	**Not Present** As noted in **Table 23 (Appendix C1)**, this SWH type was not met.
A4iv. Migratory Waterfowl Stopover and/or Staging (Terrestrial)	**Not Present** No evidence of flooded fields was identified on or in the vicinity of the Study Area. No aggregations of indicator species were observed on the Study Area.
A4v. Migratory Waterfowl Stopover and/or Staging (Aquatic)	**Not Present** No aquatic habitat was identified on or adjacent to the Study Area that is considered suitable to support large numbers of migratory waterfowl.
A4vi. Migratory Shorebird Stopover Areas	**Not Present**

Table 31: Significant Wildlife Habitat Review (Peel ROP Peel-Caledon Significant Wildlife Habitat Study 2009)

SWH Type	SWH Analysis
A5. Raptor Wintering Areas	**Not Present** Open field habitat on the Study Area do not meet minimum size criteria (>20 ha). No abandoned agricultural fields are present.
A6. Snake Hibernacula	**Not Present** The threshold for snake indicator species was not met during snake surveys or any other ecological investigations
A7. Bat Maternal Roosts and Hibernacula	**Candidate within FOD Communities** Candidate bat maternity colonies have the potential to occur within the FOD vegetation community located within the northwest corner of the Study Area (non-participating property) and within the FOD7-6 vegetation community within the south-central portion of the Study Area. No bat hibernacula habitat (caves) is present.
A8. Bullfrog Concentration Areas	**Not applicable.** The Peel-Caledon SWH Study (2009) incorporated this SWH type into criterion B8ii. This is not considered a SWH type under the Province's ecoregional criteria (MNRF 2015).
A9. Wild Turkey Winter Range	**Not applicable.** No threshold recommended, as Wild Turkey is no longer of conservation concern in Ontario, the Region of Peel or Town of Caledon. This is not considered a SWH type under the Province's ecoregional criteria (MNRF 2015).
A10. Turkey Vulture Summer Roosting Areas	**None detected.** Insufficient information to suggest specific threshold for this criterion; most preferred roosting areas would be protected through SWH Criteria B1 (rare vegetation communities) and B6 (cliffs and caves). This is not considered a SWH type under the Province's ecoregional criteria (MNRF 2015).
Rare vegetation communities or specialized habitat for wildlife	
B1. Rare Vegetation Communities	**None detected.**

Table 31: Significant Wildlife Habitat Review (Peel ROP Peel-Caledon Significant Wildlife Habitat Study 2009)

SWH Type	SWH Analysis
B2. Forests Providing a High Diversity of Habitats	**Not applicable.** It is assumed that all forests providing a high diversity of habitats will be captured by the suite of significant woodland criteria. This is not considered a SWH type under the Province's ecoregional criteria (MNRF 2015).
B3. Old-Growth or Mature Forest Stands	**Not applicable.** It is assumed that all old-growth and mature forests will be captured by the significant woodlands criteria.
B4. Foraging Areas with Abundant Mast	**None detected.** This is not considered a SWH type under the Province's ecoregional criteria (MNRF 2015).
B5. Highly Diverse Areas	**None detected.** This is not considered a SWH type under the Province's ecoregional criteria (MNRF 2015).
B6. Cliffs and Caves	**None detected.**
B7. Seeps and Springs	**Candidate within FOD Communities** Candidate seeps and springs have the potential to occur within the FOD vegetation community located in the northwest corner of the Study Area, and the FOD7-6 vegetation community in the south-central portion of the Study Area. Both are located within non-participating properties. No evidence of seepages was identified on the participating properties within the Study Area.
B8i. Amphibian Breeding Habitat (Forested Sites)	**Not Present** The threshold for amphibian indicator species was not met during amphibian call count surveys.
B8ii. Amphibian Breeding Habitat (Non-Forested Sites)	**Not Present** The threshold for amphibian indicator species was not met during amphibian call count surveys. However, a Bullfrog was heard calling from the pond associated with HDF-3 (AMC15) during Breeding Bird Surveys in June 2017. This meets the threshold to be considered SWH. Therefore, this pond will be identified as candidate habitat.

Table 31: Significant Wildlife Habitat Review (Peel ROP Peel-Caledon Significant Wildlife Habitat Study 2009)

SWH Type	SWH Analysis
B9. Turtle Nesting Habitat and Turtle Overwintering Areas	**Not Present** The threshold for turtle indicator species (Snapping Turtle and Midland Painted Turtle) was not met during turtle basking surveys. However, road morality surveys completed along RT1 on Healy Road, identified nine deceased Midland Painted Turtles or unidentifiable turtles (Table 18, Appendix C1). Due to this high-density roadkill crossing, turtles are crossing Healey Road between the woodlands on each side of the road which contain OA and wetland habitats as per MNFR LIO mapping. Therefore, potential overwintering habitat can be present in the OA ponds associated with the northwest FOD community on non-participating land.
B10. Habitat for Area-Sensitive Forest Interior Breeding Bird Species	**None detected.** Mature forests (>60 years) with interior patch size greater than or equal to 4 ha are not present within the Study Area.
B11. Habitat for Open Country and Early Successional Breeding Bird Species	**None detected.** Minimum size criteria was not met (greater than or equal to 10 ha in size).
B12. Habitat for Wetland Breeding Bird Species	**Not Present**
B13i. Raptor Nesting Habitat (Raptors associated with wetlands, ponds, and rivers)	**None detected.** The habitat size criteria (MNRF 2015) is not met (i.e., woodland > 30 ha with > 10 ha interior that is 200m from the woodland edge).
B13ii. Raptor Nesting Habitat (Raptors associated with woodland habitats)	**Not Present** No active nests from the raptor indicator species were observed within the Study Area.
B14. Mink, River Otter, Marten and Fisher Denning Sites	**None detected.** Suitable habitat for these species is not present on, or adjacent to, the Study Area. This is not considered a SWH type under the Province's ecoregional criteria (MNRF 2015).
B15. Mineral Licks	**Not applicable.** Mineral licks are not recommended as an SWH type for the Region of Peel

Table 31: Significant Wildlife Habitat Review (Peel ROP Peel-Caledon Significant Wildlife Habitat Study 2009)

SWH Type	SWH Analysis
	or the Town of Caledon. This is not considered an SWH type under the Province's ecoregional criteria (MNRF 2015).
Species of Conservation Concern	
C1. Species Identified as Nationally Endangered or Threatened by COSEWIC which are not listed as Endangered or Threatened under Ontario's *Endangered Species Act*	**None detected.** Thorough review of SAR and SAR habitat potential within the Study Area is provided within **Table 7** (**Appendix C1**). This is not considered a SWH type under the Province's ecoregional criteria (MNRF 2015).
C2. Species Identified as Special Concern based on Species at Risk in Ontario List that is Periodically updated by OMNR	**None detected.** Thorough review of SAR and SAR habitat potential within the Study Area is provided within **Table 7** (**Appendix C1**). Special Concern species were also considered within **Table 23** (**Appendix C1**).
C3. Species that are listed as Rare (S1-S3) or Historical in Ontario based on NHIC	**None detected.** American Brook Lamprey (*Lethenteron appendix*) was identified as a rare species (S3) based on the NHIC background search of the Study Area. This species was not observed in the Study Area.
C4. Species whose populations appear to be experiencing substantial declines in Ontario	**Not applicable.** The Peel-Caledon SWH Study (2009) does not provide a threshold for this criterion due to insufficient information. This is not considered a SWH type under the Province's ecoregional criteria (MNRF 2015).
C5. Species that have a high percentage of their global population in Ontario and are Rare or Uncommon in the Region of Peel/ Town of Caledon	**Not applicable.** The Peel-Caledon SWH Study (2009) does not provide a threshold for this criterion due to insufficient information. This is not considered a SWH type under the Province's ecoregional criteria (MNRF 2015).

Table 31: Significant Wildlife Habitat Review (Peel ROP Peel-Caledon Significant Wildlife Habitat Study 2009)

SWH Type	SWH Analysis
C6. Species that are Rare within the Region of Peel or Town of Caledon, even though they may not be Provincially Rare	The locally rare species identified within the Study Area are: • White Spruce (*Picea glauca*) – planted; • Tall Beggarticks (*Bidens vulgata*) – occasional at edges of meadows along the watercourse and drainages; • Marsh Seedbox (*Ludwigia palustris*) – occasional in MAM2-2; • Pennsylvania Smartweed (*Persicaria pensylvanica*) – occasional on the shore of SAS1-1; • Catchweed Bedstraw (*Galium aparine*) – occasional in unit FOD8-3; • Peach-leaved Willow (*Salix amygdaloides*) – local along the watercourse, drainages, and SAS1-1; • Sandbar Willow (*Salix interior*) – local along the watercourse, drainages, and SAS1-1; • Small's Spike-rush (*Eleocharis palustris*) – local in MAM2-2 and along exposed banks of the tributary; and • Small Pondweed (*Potamogeton pusillus*) – common in SAS1-1.
C7. Species that are subjects of Recovery Programs	**None detected.** This is not considered a SWH type under the Province's ecoregional criteria (MNRF 2015).
C8. Species considered important to the Region of Peel/ Town of Caledon, based on recommendations from a Local Conservation Advisory Committee	**Not applicable.** No Conservation Advisory Committee currently exists in the Region. This is not considered a SWH type under the Province's ecoregional criteria (MNRF 2015).
Animal Movement Corridors	
D. Animal Movement Corridors	**Present along the Clarkway Drive Tributary** The Clarkway Drive Tributary within the Study Area is a valleyland with an associated wetland riparian area. This Tributary provides a south to north movement corridor across the landscape connecting to larger continuous woodlands and the Humber River.

Wetland Name	Wetland Vegetation Type	Magnitude of Hydrological Change	Sensitivity of Wetland	Risk Assessment
N/A (Above Wetland A1)	MAM2-2 (north of CUM1--1, within drainage)	Medium	High	High
Wetland A1	MAM2-2 (south of OA, within drainage)	Medium	High	High
Wetland B1	MAS2-1 (southeast corner of FOD)	Medium	High	High
Wetland C1	MAM2-2 (east side of FOD8-3, within drainage)	Medium	Medium	Medium
Wetland E1	SWT2-2 (surrounds SAS1-1)	High	High	High
Wetland E1	SAS1-1	High	High	High
Wetland D1	MAS2/MAM2 (eastern watercourse)	Low	High	Low
Wetland D1	MAM2-10/MAM2-2 (eastern watercourse)	Low	Low	Low
Wetland D1	MAS2 (eastern watercourse)	Low	High	Low
Wetland D1	MAM2-10/MAM2-2 (eastern watercourse)	Low	Low	Low
Wetland F1	MAM2-2/MAM2-10 (eastern watercourse)	Low	Medium	Low
Wetland F1	MAS2-1 (eastern watercourse)	Low	High	Low
Wetland F1	MAM2-2/MAM2-10 (eastern watercourse)	Low	High	Low
Wetland G1	MAM/MAS2-1 (eastern watercourse)	Low	Medium	Low
Wetland G1	MAM/MAS2-1 (eastern watercourse)	Low	Medium	Low

Table 39: Results of Empirical Approach for Drainage Realignment Meander Belt Width

Reach	Bankfull width (m)	Meander Belt Width (m)				
		Williams (1986)	Ward (2002)	Lorenz et al. (1985)	Howett (2017)	Average
Upstream	1.60	11	13	14	13	13
Downstream	1.90	13	16	16	15	15

The methods include those outlined by Williams involving bankfull width (W_b), (1986 – equation 1), Ward et al. involving bankfull width (2002 – equation 2), Lorenz et al. (1985 – equation 3), and a linear model presented by Howett (2017 – equation 4).

$B_w = 4.3 \times {W_b}^{1.12}$ [Eq. 1]
$B_w = 6 \times {W_b}^{1.12}$ [Eq. 2]
$B_w = 7.53 \times {W_b}^{1.01}$ [Eq. 3]
$B_w = 6.89 \times W_b$ [Eq. 4]

C.2. Tables – Arcadis

Table C2-1 - Summary of Previous Hydrogeology and Geotechnical Studies							
Company	Study	Report Date	Purpose	Boreholes (no.)	Monitoring Wells		Years Monitored
					(no.)	ID	
RJ Burnside	Humber Station Villages -Solmar Development Corp.	2007	Hydrogeology	3	3	MW7, MW8, MW9	N/A
COLE (now Arcadis IBI Group)	Bolton Residential Expansion Study, Option 6 Lands - Solmar Development Corp.	2017	Hydrogeology	9	9	MW1-17, MW2-17S, MW2-17D, MW3-17, MW4-17S, MW4-17D, MW5-17S, MW5-17D	2017, 2018
Arcadis IBI Group (now Arcadis)	Humber Station CEISMP Phase 1 - Humber Station Village Landowner Group	2023	Hydrogeology	No new monitoring wells installed, monitored existing wells			2022, 2023
Pinchin	Supplemental Geotechnical Investigation - Proposed Industrial Development, 12519-12713 Humber Station Road - Prologis	2023	Geotechncial	82	6	BH1, BH9, BH12, BH12B, BH13, BH15, BH18, BH103, BH108, BH124, BH160, BH161, BH168	No groundwater monitoring data available
DS Consultants	Preliminary Geotechnical Investigation Proposed Employment Land, Southeast of Humber Station Road and Healy Road - - Humber Station Village Landowner Group	2023	Geotechnical	13	4	BH23-2b, BH23-7, BH23-11	2023
Palmer Environmental (now SLR Consulting)	12519 & 12713 Humber Station Road, Bolton - Mainline Planning Services Inc.	2024	Hydrogeology	No new monitoring wells installed, monitored existing wells from Pinchin, MW8 and MW9 from RJB, MW3-17, MW4-17S/D from Arcadis			2022, 2023
PNJ Engineering Inc. (subconsultant to Arcadis)	Supplementary Geotechnical Investigation - Humber Station Village Landowner Group	2025	Geotechnical	7	10	MW25-1A, MW25-1B, MW25-02, MW25-3A, MW25-3B, MW25-SWM1, MW25-SWM2, MW25-SWM3, MW25-CR1, MW25-CR2	2025

Table C2-2: Monitoring Well Information

Consultant's Study	Years Monitored	Well ID	UTM Coordinates		Ground Elevation (masl)	Stick-up (m)	Well Depth (mbtoc)	Well Depth (mbgs)
			Northing	Easting				
Arcadis IBI Group (formerly COLE)	2017-2018, 2022-2024, 2025	MW1-17	4856301	601346	245.2	0.71	6.64	5.93
		MW2-17D	4855764	601415	242.4	0.63	12.26	11.63
		MW2-17S	4855763	601414	242.4	0.72	6.79	6.07
		MW3-17	4855685	602151	235.8	0.65	6.66	6.01
		MW4-17D	4855042	602267	234.0	0.67	12.84	12.17
		MW4-17S	4855042	602266	234.0	0.66	6.72	6.06
		MW5-17D	4854913	602914	229.0	0.68	12.74	12.06
		MW5-17S	4854913	602915	228.9	0.74	6.85	6.11
RJ Burnside (RJB)	2017-2018, 2022-2024, 2025	MW9 (BH1)	4855137	602003	235.6	0.90	6.18	5.28
		MW8 (BH2)	4854592	602349	231.9	0.89	6.00	5.11
		MW7 (BH3)	4854094	602880	228.6	1.00	5.45	4.45
Pinchin	2023	MW103(20')	4855778	601739	238.8	0.80	6.87	6.07
		MW108(20')	4855481	602279	236.9	0.80	6.90	6.10
		MW124(20')	4855580	601663	239.0	0.80	7.03	6.23
		MW160(20')	4854847	602123	234.4	0.80	7.03	6.23
		MW161(20')	4854756	602232	232.8	0.80	7.09	6.29
		MW168(20')	4855103	602738	231.9	0.80	6.83	6.03
DS Consultants Ltd.	2023-2025	BH23-1A	4854023	603115	227.9	1.00	8.80	7.80
		BH23-1B	4854022	603113	227.9	0.83	5.43	4.60
		BH23-2A	4854490	603158	228.0	0.85	5.45	4.60
		BH23-2B	4854496	603180	226.1	0.97	9.07	8.10
		BH23-7A	4854660	602727	230.9	0.81	7.41	6.60
		BH23-7B	4854647	602735	230.6	1.00	8.90	7.90
		BH23-11A	4856065	601796	239.9	0.80	8.80	8.00
		BH23-11B	4856064	601795	239.9	0.88	4.68	3.80
Palmer Environmental (now SLR Consulting)	2022-2025	BH1	4855794	601908	239.3	0.97	7.07	6.10
		BH9	4855360	602077	235.6	0.93	7.03	6.10
		BH12	4855399	601574	237.2	0.89	6.99	6.10
		BH12B	4855392	601562	237.2	0.95	6.26	5.31
		BH13	4855099	602013	237.4	0.94	7.04	6.10
		BH15	4855099	602013	234.0	0.93	7.03	6.10
		BH18	4854747	602424	232.6	0.93	7.03	6.10

Table C2-3: Hydraulic Conductivities				
Well ID	**Shallow/Deep Well**	**Screen Interval (mbgs)**	**Estimated K Value (m/s)**	**Reported Screened Stratum as per BH Logs**
BH9	Shallow	3-6	6.6x10-7	Silt
BH12	Shallow	3-6	5.7x10-9	Silt
BH15	Shallow	3-6	5.3x10-8	Silt
BH18	Shallow	3-6	7.7x10-8	Silt
MW1-17	Shallow	3-6	8.0x10-9	Silty Clay Till
MW2-17S	Shallow	3-6	5.5x10-9	Silty Clay Till
MW2-17D	Deep	8.6-11.6	1.1x10-7	Sandy Silt Till / Silt
MW3-17	Shallow	3-6	7.2x10-8	Silty Clay Till / Silt
MW4-17S	Shallow	3-6	1.4x10-7	Silty Clay Till / Silt
MW4-17D	Deep	9-12	2.9x10-7	Silt
MW5-17S	Shallow	3.1-6.1	5.0x10-9	Silt
MW5-17D	Deep	9-12	4.7x10-8	Silt
MW8	Shallow	3.5-5	5.6x10-7	Silt Till / Clay
MW9	Shallow	3.7-5.2	7.1x10-7	Sand
MW25-1A	Deep	15.6-18.6	3.1x10-10	Silty Clay/Clayey Silt (Till) / Silty Sand
MW25-1B	Shallow	2-5	7.6x10-8	Silty Clay/Clayey Silt (Till)
MW25-3A	Deep	9.2-12.2	6.1x10-7	Silt
MW25-3B	Shallow	2-5	6.8x10-7	Silty Clay/Clayey Silt (Till)
MW25-SWM1	Shallow	0.8-3.8	1.9x10-8	Fill/Reworked Native / Silty Clay/Clayey Silt (Till)
MW25-SWM2	Shallow	0.81-3.81	1.3x10-8	Fill/Reworked Native / Silty Clay/Clayey Silt (Till)
MW25-SWM3	Shallow	3.1-6.1	7.8x10-8	Silty Clay/Clayey Silt (Till)

Table C2-4: Monitoring Well Water Levels

Well ID	UTM Coordinates		Ground Elevation (masl)	Stick-up (m)	Well Depth (mbtoc)	Well Depth (mbgs)	2017																	
							14-Jul-17			26-Jul-17			31-Aug-17			22-Sep-17			10-Nov-17			05-Dec-17		
	Northing	Easting					Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)
MW1-17	4856301	601346	245.2	0.71	6.64	5.93	DNE	DNE	DNE	DNE	DNE	DNE	1.82	1.11	244.08	2.03	1.32	243.87	1.53	0.82	244.37	1.54	0.83	244.36
MW2-17D	4855764	601415	242.4	0.63	12.26	11.63	DNE	DNE	DNE	DNE	DNE	DNE	1.64	1.01	241.38	1.81	1.18	241.20	2.23	1.60	240.78	2.13	1.50	240.89
MW2-17S	4855763	601414	242.4	0.72	6.79	6.07	DNE	DNE	DNE	DNE	DNE	DNE	1.75	1.03	241.39	1.93	1.21	241.20	2.30	1.58	240.84	2.27	1.55	240.86
MW3-17	4855685	602151	235.8	0.65	6.66	6.01	DNE	DNE	DNE	DNE	DNE	DNE	3.26	2.61	233.19	1.10	0.45	235.35	0.95	0.30	235.50	0.79	0.14	235.65
MW4-17D	4855042	602267	234.0	0.67	12.84	12.17	DNE	DNE	DNE	DNE	DNE	DNE	1.62	0.95	233.03	1.94	1.27	232.72	2.34	1.67	232.32	2.11	1.44	232.55
MW4-17S	4855042	602266	234.0	0.66	6.72	6.06	DNE	DNE	DNE	DNE	DNE	DNE	1.72	1.06	232.96	2.03	1.37	232.65	2.42	1.76	232.26	2.06	1.40	232.62
MW5-17D	4854913	602914	229.0	0.68	12.74	12.06	DNE	DNE	DNE	DNE	DNE	DNE	0.40	-0.28	229.24	0.18	-0.50	229.46	0.07	-0.61	229.57	-	-	-
MW5-17S	4854913	602915	228.9	0.74	6.85	6.11	DNE	DNE	DNE	DNE	DNE	DNE	1.48	0.74	228.20	1.53	0.79	228.15	1.16	0.42	228.52	0.90	0.16	228.79
MW9 (BH1 RJB MW)	4855137	602003	235.6	0.90	6.18	5.28	2.55	1.65	233.96	2.51	1.61	234.00	2.79	1.89	233.72	3.01	2.11	233.51	3.14	2.24	233.37	2.82	1.92	233.69
MW8 (BH2 RJB MW)	4854592	602349	231.9	0.89	6.00	5.11	1.79	0.90	231.04	1.75	0.86	231.08	1.29	0.40	231.54	2.75	1.86	230.08	2.65	1.76	230.18	2.01	1.12	230.82
MW7 (BH3 RJB MW)	4854094	602880	228.6	1.00	5.45	4.45	1.51	0.51	228.05	1.47	0.47	228.09	1.83	0.83	227.73	2.00	1.00	227.55	1.51	0.51	228.05	1.15	0.15	228.41
MW103(20')*	4855778	601739	238.8	0.8	6.87	6.07	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW108(20')*	4855481	602279	236.9	0.8	6.90	6.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW124(20')*	4855580	601663	239.0	0.8	7.03	6.23	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW160(20')*	4854847	602123	234.4	0.8	7.03	6.23	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW161(20')*	4854756	602232	232.8	0.8	7.09	6.29	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW168(20')*	4855103	602738	231.9	0.8	6.83	6.03	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-1A	4854023	603115	227.9	1.00	8.80	7.80	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-1B	4854022	603113	227.9	0.83	5.43	4.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-2A	4854490	603158	228.0	0.85	5.45	4.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-2B	4854496	603180	226.1	0.97	9.07	8.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-7A	4854660	602727	230.9	0.81	7.41	6.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-7B	4854647	602735	230.6	1.00	8.90	7.90	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-11A	4856065	601796	239.9	0.80	8.80	8.00	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-11B	4856064	601795	239.9	0.88	4.68	3.80	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH1	4855794	601908	239.3	0.97	7.07	6.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH9	4855360	602077	235.6	0.93	7.03	6.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH12	4855399	601574	237.2	0.89	6.99	6.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH12B	4855392	601562	237.2	0.95	6.26	5.31	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH13	4855099	602013	237.4	0.94	7.04	6.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH15	4855099	602013	234.0	0.93	7.03	6.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH18	4854747	602424	232.6	0.93	7.03	6.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-1A	4854779	602203	233.0	0.74	19.37	18.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-1B	4854777	602202	233.0	0.69	5.83	5.00	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-02	4855162	602710	234.1	0.84	17.69	16.85	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-3A	4855088	602720	232.1	0.6	12.80	12.20	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-3B	4855089	602719	232.2	0.62	5.61	5.00	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-SWM1	4855875	601713	239.4	0.83	4.63	3.80	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-SWM2	4855796	601626	239.9	0.86	4.67	3.81	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-SWM3	4854538	603071	229.8	0.83	6.93	6.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-CR1	4855363	602710	235.2	0.82	8.42	7.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-CR2	4855290	602660	231.5	0.91	5.02	4.11	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE

-*: Unable to physically open
n*: Well packer
-**: Located within non-participating property
NM': Not measured
DNE': Did not exist

Table C2-4: Monitoring Well Water Levels

Well ID	UTM Coordinates		Ground Elevation (masl)	Stick-up (m)	Well Depth (mbtoc)	Well Depth (mbgs)	2018						2022														
							07-Feb-18			23-Apr-18			25-Apr-22			08-Nov-22			21-Nov-22			29-Nov-22			08-Dec-22		
	Northing	Easting					Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)
MW1-17	4856301	601346	245.2	0.71	6.64	5.93	1.75	1.04	244.15	1.17	0.46	244.73	NM	NM	NM	NM	NM	NM	NM	NM	NM	N/A	NM	NM	1.50	0.79	244.40
MW2-17D	4855764	601415	242.4	0.63	12.26	11.63	2.15	1.52	240.86	1.71	1.08	241.30	NM	NM	NM	NM	NM	NM	NM	NM	NM	N/A	NM	NM	3.24	2.61	239.77
MW2-17S	4855763	601414	242.4	0.72	6.79	6.07	2.29	1.57	240.84	1.85	1.13	241.28	NM	NM	NM	NM	NM	NM	NM	NM	NM	N/A	NM	NM	3.38	2.66	239.75
MW3-17	4855685	602151	235.8	0.65	6.66	6.01	-	-	-	0.75	0.10	235.70	NM	NM	NM	1.00	0.35	235.45	1.22	0.57	235.23	N/A	NM	NM	NM	NM	NM
MW4-17D	4855042	602267	234.0	0.67	12.84	12.17	2.11	1.44	232.54	1.28	0.61	233.37	NM	NM	NM	2.90	2.23	231.75	2.79	2.12	231.86	2.84	2.12	231.86	NM	NM	NM
MW4-17S	4855042	602266	234.0	0.66	6.72	6.06	2.14	1.48	232.54	1.14	0.48	233.54	NM	NM	NM	2.90	2.24	231.78	2.93	2.27	231.75	3.0	2.1	232.0	NM	NM	NM
MW5-17D	4854913	602914	229.0	0.68	12.74	12.06	-	-	-	-	-	-	NM	NM	NM	NM	NM	NM	NM	NM	NM	N/A	NM	NM	NM	NM	NM
MW5-17S	4854913	602915	228.9	0.74	6.85	6.11	0.93	0.19	228.75	0.61	-0.13	229.07	NM	NM	NM	NM	NM	NM	NM	NM	NM	N/A	NM	NM	1.03	0.29	228.65
MW9 (BH1 RJB MW)	4855137	602003	235.6	0.90	6.18	5.28	3.01	2.11	233.50	2.28	1.38	234.23	NM	NM	NM	3.88	2.98	232.63	3.77	2.87	232.74	N/A	NM	NM	NM	NM	NM
MW8 (BH2 RJB MW)	4854592	602349	231.9	0.89	6.00	5.11	1.86	0.97	230.97	1.20	0.31	231.63	NM	NM	NM	2.67	1.78	230.16	NM	NM	NM	2.70	1.84	230.10	2.02	1.13	230.81
MW7 (BH3 RJB MW)	4854094	602880	228.6	1.00	5.45	4.45	1.21	0.21	228.35	1.01	0.01	228.55	NM	NM	NM	NM	NM	NM	NM	NM	NM	N/A	NM	NM	1.3	0.3	228.3
MW103(20')*	4855778	601739	238.8	0.8	6.87	6.07	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW108(20')*	4855481	602279	236.9	0.8	6.90	6.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW124(20')*	4855580	601663	239.0	0.8	7.03	6.23	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW160(20')*	4854847	602123	234.4	0.8	7.03	6.23	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW161(20')*	4854756	602232	232.8	0.8	7.09	6.29	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW168(20')*	4855103	602738	231.9	0.8	6.83	6.03	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-1A	4854023	603115	227.9	1.00	8.80	7.80	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-1B	4854022	603113	227.9	0.83	5.43	4.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-2A	4854490	603158	228.0	0.85	5.45	4.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-2B	4854496	603180	226.1	0.97	9.07	8.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-7A	4854660	602727	230.9	0.81	7.41	6.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-7B	4854647	602735	230.6	1.00	8.90	7.90	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-11A	4856065	601796	239.9	0.80	8.80	8.00	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH23-11B	4856064	601795	239.9	0.88	4.68	3.80	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
BH1	4855794	601908	239.3	0.97	7.07	6.10	DNE	DNE	DNE	DNE	DNE	DNE	6.47	5.50	233.78	3.48	2.51	236.77	3.59	2.62	236.66	3.69	2.72	236.56	NM	NM	NM
BH9	4855360	602077	235.6	0.93	7.03	6.10	DNE	DNE	DNE	DNE	DNE	DNE	2.73	1.80	233.77	3.19	2.26	233.31	3.09	2.16	233.41	3.23	2.30	233.27	NM	NM	NM
BH12	4855399	601574	237.2	0.89	6.99	6.10	DNE	DNE	DNE	DNE	DNE	DNE	2.09	1.20	235.95	1.42	0.53	236.62	1.33	0.44	236.71	N/A	NM	NM	NM	NM	NM
BH12B	4855392	601562	237.2	0.95	6.26	5.31	DNE	DNE	DNE	DNE	DNE	DNE	NM	NM	NM	1.8	0.85	236.30	NM	NM	NM	N/A	NM	NM	NM	NM	NM
BH13	4855099	602013	237.4	0.94	7.04	6.10	DNE	DNE	DNE	DNE	DNE	DNE	2.34	1.40	236.02	3.12	2.18	235.24	NM	NM	NM	3.20	2.26	235.16	NM	NM	NM
BH15	4855099	602013	234.0	0.93	7.03	6.10	DNE	DNE	DNE	DNE	DNE	DNE	2.93	2.00	232.02	3.87	2.94	231.08	3.76	2.83	231.19	N/A	NM	NM	NM	NM	NM
BH18	4854747	602424	232.6	0.93	7.03	6.10	DNE	DNE	DNE	DNE	DNE	DNE	2.43	1.50	231.11	2.76	1.83	230.78	NM	NM	NM	2.78	1.85	230.76	NM	NM	NM
MW25-1A	4854779	602203	233.0	0.74	19.37	18.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-1B	4854777	602202	233.0	0.69	5.83	5.00	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-02	4855162	602710	234.1	0.84	17.69	16.85	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-3A	4855088	602720	232.1	0.6	12.80	12.20	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-3B	4855089	602719	232.2	0.62	5.61	5.00	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-SWM1	4855875	601713	239.4	0.83	4.63	3.80	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-SWM2	4855796	601626	239.9	0.86	4.67	3.81	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-SWM3	4854538	603071	229.8	0.83	6.93	6.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-CR1	4855363	602710	235.2	0.82	8.42	7.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-CR2	4855290	602660	231.5	0.91	5.02	4.11	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE

-*: Unable to physically open
n*: Well packer
-**: Located within non-participating property
NM': Not measured
DNE': Did not exist

Table C2-4: Monitoring Well Water Levels

Year							2023																	
Well ID	UTM Coordinates		Ground Elevation (masl)	Stick-up (m)	Well Depth (mbtoc)	Well Depth (mbgs)	08-Feb-23			05-May-23			12-May-23			02-Jun-23			31-Jul-23			21-Sep-23		
	Northing	Easting					Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)
MW1-17	4856301	601346	245.2	0.71	6.64	5.93	NM	NM	NM	1.2	0.49	244.70	NM	NM	NM	NM	NM	NM	NM	NM	NM	2.35	1.64	243.55
MW2-17D	4855764	601415	242.4	0.63	12.26	11.63	NM	NM	NM	1.9	1.25	241.14	NM	NM	NM	NM	NM	NM	NM	NM	NM	1.88	1.25	241.13
MW2-17S	4855763	601414	242.4	0.72	6.79	6.07	NM	NM	NM	2.0	1.26	241.15	NM	NM	NM	NM	NM	NM	NM	NM	NM	1.80	1.08	241.33
MW3-17	4855685	602151	235.8	0.65	6.66	6.01	0.92	0.27	235.53	0.7	0.05	235.74	0.9	0.21	235.59	NM	NM	NM	0.7	0.01	235.79	NM	NM	NM
MW4-17D	4855042	602267	234.0	0.67	12.84	12.17	1.69	1.02	232.96	1.2	0.54	233.45	1.3	0.58	233.40	NM	NM	NM	1.3	0.59	233.39	2.09	1.42	232.56
MW4-17S	4855042	602266	234.0	0.66	6.72	6.06	1.80	1.14	232.88	1.3	0.60	233.41	1.5	0.87	233.15	NM	NM	NM	1.5	0.81	233.21	2.45	1.79	232.23
MW5-17D	4854913	602914	229.0	0.68	12.74	12.06	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW5-17S	4854913	602915	228.9	0.74	6.85	6.11	NM	NM	NM	0.5	-0.20	229.14	NM	NM	NM	NM	NM	NM	NM	NM	NM	1.29	0.55	228.39
MW9 (BH1 RJB MW)	4855137	602003	235.6	0.90	6.18	5.28	2.80	1.90	233.71	2.28	1.38	234.23	2.45	1.55	234.06	NM	NM	NM	2.4	1.49	234.12	3.29	2.39	233.22
MW8 (BH2 RJB MW)	4854592	602349	231.9	0.89	6.00	5.11	1.38	0.49	231.45	1.20	0.31	231.63	1.45	0.56	231.38	NM	NM	NM	1.5	0.63	231.31	2.83	1.94	230.00
MW7 (BH3 RJB MW)	4854094	602880	228.6	1.00	5.45	4.45	NM	NM	NM	1.1	0.1	228.5	NM	NM	NM	NM	NM	NM	NM	NM	NM	2.40	1.40	227.16
MW103(20')*	4855778	601739	238.8	0.8	6.87	6.07	DNE	DNE	DNE	N/A	N/A	N/A	N/A	N/A	N/A	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW108(20')*	4855481	602279	236.9	0.8	6.90	6.10	DNE	DNE	DNE	N/A	N/A	N/A	N/A	N/A	N/A	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW124(20')*	4855580	601663	239.0	0.8	7.03	6.23	DNE	DNE	DNE	N/A	N/A	N/A	N/A	N/A	N/A	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW160(20')*	4854847	602123	234.4	0.8	7.03	6.23	DNE	DNE	DNE	N/A	N/A	N/A	N/A	N/A	N/A	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW161(20')*	4854756	602232	232.8	0.8	7.09	6.29	DNE	DNE	DNE	N/A	N/A	N/A	N/A	N/A	N/A	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW168(20')*	4855103	602738	231.9	0.8	6.83	6.03	DNE	DNE	DNE	N/A	N/A	N/A	N/A	N/A	N/A	NM	NM	NM	NM	NM	NM	NM	NM	NM
BH23-1A	4854023	603115	227.9	1.00	8.80	7.80	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	N/A	0.47	227.43	NM	NM	NM	NM	NM	NM
BH23-1B	4854022	603113	227.9	0.83	5.43	4.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	N/A	0.47	227.43	NM	NM	NM	NM	NM	NM
BH23-2A	4854490	603158	228.0	0.85	5.45	4.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	N/A	3.01	224.99	NM	NM	NM	1.6	0.73	227.27
BH23-2B	4854496	603180	226.1	0.97	9.07	8.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	N/A	0.27	225.83	NM	NM	NM	1.6	0.65	225.45
BH23-7A	4854660	602727	230.9	0.81	7.41	6.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	N/A	3.84	227.06	NM	NM	NM	1.5	0.73	230.17
BH23-7B	4854647	602735	230.6	1.00	8.90	7.90	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	N/A	0.33	230.27	NM	NM	NM	1.4	0.40	230.20
BH23-11A	4856065	601796	239.9	0.80	8.80	8.00	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	N/A	3.21	236.69	NM	NM	NM	3.3	2.51	237.39
BH23-11B	4856064	601795	239.9	0.88	4.68	3.80	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	N/A	2.21	237.69	NM	NM	NM	2.2	1.28	238.62
BH1	4855794	601908	239.3	0.97	7.07	6.10	3.71	2.74	236.54	NM	NM	NM	2.5	1.49	237.79	NM	NM	NM	2.1	1.14	238.14	NM	NM	NM
BH9	4855360	602077	235.6	0.93	7.03	6.10	2.47	1.54	234.03	NM	NM	NM	1.6	0.62	234.95	NM	NM	NM	1.5	0.56	235.01	NM	NM	NM
BH12	4855399	601574	237.2	0.89	6.99	6.10	1.12	0.23	236.92	NM	NM	NM	1.1	0.24	236.91	NM	NM	NM	1.0	0.13	237.02	NM	NM	NM
BH12B	4855392	601562	237.2	0.95	6.26	5.31	1.35	0.40	236.75	NM	NM	NM	1.2	0.27	236.88	NM	NM	NM	1.2	0.27	236.88	NM	NM	NM
BH13	4855099	602013	237.4	0.94	7.04	6.10	2.07	1.13	236.29	NM	NM	NM	1.3	0.33	237.09	NM	NM	NM	1.2	0.31	237.12	NM	NM	NM
BH15	4855099	602013	234.0	0.93	7.03	6.10	2.50	1.57	232.45	NM	NM	NM	1.9	1.00	233.02	NM	NM	NM	NM	NM	NM	NM	NM	NM
BH18	4854747	602424	232.6	0.93	7.03	6.10	1.72	0.79	231.82	NM	NM	NM	1.4	0.45	232.16	NM	NM	NM	1.4	0.42	232.19	NM	NM	NM
MW25-1A	4854779	602203	233.0	0.74	19.37	18.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-1B	4854777	602202	233.0	0.69	5.83	5.00	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-02	4855162	602710	234.1	0.84	17.69	16.85	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-3A	4855088	602720	232.1	0.6	12.80	12.20	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-3B	4855089	602719	232.2	0.62	5.61	5.00	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-SWM1	4855875	601713	239.4	0.83	4.63	3.80	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-SWM2	4855796	601626	239.9	0.86	4.67	3.81	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-SWM3	4854538	603071	229.8	0.83	6.93	6.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-CR1	4855363	602710	235.2	0.82	8.42	7.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE
MW25-CR2	4855290	602660	231.5	0.91	5.02	4.11	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE

-*: Unable to physically open
n*: Well packer
-**: Located within non-participating property
NM': Not measured
DNE': Did not exist

Table C2-4: Monitoring Well Water Levels

Well ID	UTM Coordinates		Ground Elevation (masl)	Stick-up (m)	Well Depth (mbtoc)	Well Depth (mbgs)	2024									2025					
							18-Feb-24			20-May-24			25-Jul-24			09-May-25			09-Jun-25		
	Northing	Easting					Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)
MW1-17	4856301	601346	245.2	0.71	6.64	5.93	NM	NM	NM	NM	NM	NM	1.70	0.99	244.20	1.48	0.77	244.41	1.62	0.91	244.28
MW2-17D	4855764	601415	242.4	0.63	12.26	11.63	NM	NM	NM	NM	NM	NM	1.37	0.74	241.64	1.82	1.19	241.19	1.54	0.91	241.47
MW2-17S	4855763	601414	242.4	0.72	6.79	6.07	NM	NM	NM	NM	NM	NM	1.45	0.73	241.68	1.91	1.19	241.22	1.67	0.95	241.46
MW3-17	4855685	602151	235.8	0.65	6.66	6.01	2.59	1.94	233.86	0.84	0.19	235.61	0.96	0.31	235.49	0.85	0.20	235.60	0.89	0.24	235.55
MW4-17D	4855042	602267	234.0	0.67	12.84	12.17	1.22	0.55	233.43	1.19	0.52	233.46	1.25	0.58	233.41	1.56	0.89	233.10	1.13	0.46	233.53
MW4-17S	4855042	602266	234.0	0.66	6.72	6.06	1.25	0.59	233.43	1.30	0.64	233.38	1.61	0.95	233.07	-*	-*	-*	-*	-*	-*
MW5-17D	4854913	602914	229.0	0.68	12.74	12.06	NM	NM	NM	NM	NM	NM	n*	n*	n*	n*	n*	n*	n*	n*	n*
MW5-17S	4854913	602915	228.9	0.74	6.85	6.11	NM	NM	NM	NM	NM	NM	1.11	0.37	228.57	1.22	0.48	228.47	1.33	0.59	228.35
MW9 (BH1 RJB MW)	4855137	602003	235.6	0.90	6.18	5.28	2.50	1.60	234.01	2.52	1.62	233.99	2.43	1.53	234.08	2.49	1.59	234.02	2.24	1.34	234.27
MW8 (BH2 RJB MW)	4854592	602349	231.9	0.89	6.00	5.11	1.41	0.52	231.42	1.55	0.66	231.28	1.76	0.87	231.07	1.58	0.69	231.25	1.71	0.82	231.12
MW7 (BH3 RJB MW)	4854094	602880	228.6	1.00	5.45	4.45	NM	NM	NM	NM	NM	NM	1.57	0.57	227.99	1.45	0.45	228.11	1.63	0.63	227.93
MW103(20')*	4855778	601739	238.8	0.8	6.87	6.07	1.84	1.04	237.75	1.17	0.37	238.42	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW108(20')*	4855481	602279	236.9	0.8	6.90	6.10	1.62	0.82	236.07	1.43	0.63	236.26	NM	NM	NM	NM	NM	NM	1.21	0.41	236.48
MW124(20')*	4855580	601663	239.0	0.8	7.03	6.23	2.30	1.50	237.54	1.42	0.62	238.42	NM	NM	NM	NM	NM	NM	1.90	1.10	237.94
MW160(20')*	4854847	602123	234.4	0.8	7.03	6.23	1.81	1.01	233.35	1.85	1.05	233.31	NM	NM	NM	NM	NM	NM	1.12	0.32	234.05
MW161(20')*	4854756	602232	232.8	0.8	7.09	6.29	1.25	0.45	232.39	1.33	0.53	232.31	NM	NM	NM	NM	NM	NM	1.51	0.71	232.13
MW168(20')*	4855103	602738	231.9	0.8	6.83	6.03	NM	NM	NM	1.47	0.67	231.20	NM	NM	NM	NM	NM	NM	1.96	1.16	230.71
BH23-1A	4854023	603115	227.9	1.00	8.80	7.80	NM	NM	NM	NM	NM	NM	-**	-**	-**	-**	-**	-**	-**	-**	-**
BH23-1B	4854022	603113	227.9	0.83	5.43	4.60	NM	NM	NM	NM	NM	NM	-**	-**	-**	-**	-**	-**	-**	-**	-**
BH23-2A	4854490	603158	228.0	0.85	5.45	4.60	NM	NM	NM	NM	NM	NM	1.25	0.40	227.60	1.37	0.52	227.48	1.71	0.86	227.14
BH23-2B	4854496	603180	226.1	0.97	9.07	8.10	NM	NM	NM	NM	NM	NM	1.05	0.08	226.02	1.30	0.33	225.77	1.21	0.24	225.86
BH23-7A	4854660	602727	230.9	0.81	7.41	6.60	NM	NM	NM	NM	NM	NM	1.22	0.41	230.49	1.42	0.61	230.29	1.41	0.60	230.30
BH23-7B	4854647	602735	230.6	1.00	8.90	7.90	NM	NM	NM	NM	NM	NM	1.10	0.10	230.50	1.75	0.75	229.85	1.55	0.55	230.06
BH23-11A	4856065	601796	239.9	0.80	8.80	8.00	NM	NM	NM	NM	NM	NM	2.74	1.94	237.96	3.11	2.31	237.59	3.01	2.21	237.69
BH23-11B	4856064	601795	239.9	0.88	4.68	3.80	NM	NM	NM	NM	NM	NM	1.51	0.63	239.27	1.64	0.76	239.14	1.60	0.72	239.18
BH1	4855794	601908	239.3	0.97	7.07	6.10	NM	NM	NM	2.15	1.18	238.10	2.00	1.03	238.25	NM	NM	NM	2.89	1.92	237.37
BH9	4855360	602077	235.6	0.93	7.03	6.10	1.65	0.72	234.85	1.51	0.58	234.99	1.48	0.55	235.02	1.58	0.65	234.92	1.65	0.72	234.85
BH12	4855399	601574	237.2	0.89	6.99	6.10	1.06	0.17	236.98	1.15	0.26	236.89	1.59	0.70	236.45	1.14	0.25	236.90	1.18	0.29	236.87
BH12B	4855392	601562	237.2	0.95	6.26	5.31	1.16	0.21	236.94	1.30	0.35	236.80	Not located	Not located	Not located	1.30	0.35	236.80	1.29	0.34	236.82
BH13	4855099	602013	237.4	0.94	7.04	6.10	1.37	0.43	236.99	1.34	0.40	237.02	1.21	0.27	237.15	1.54	0.60	236.82	2.34	1.40	236.02
BH15	4855099	602013	234.0	0.93	7.03	6.10	1.93	1.00	233.02	1.91	0.98	233.04	1.93	1.00	233.02	2.14	1.21	232.81	1.60	0.67	233.35
BH18	4854747	602424	232.6	0.93	7.03	6.10	1.42	0.49	232.12	1.38	0.45	232.16	1.39	0.46	232.15	1.68	0.75	231.86	1.66	0.73	231.88
MW25-1A	4854779	602203	233.0	0.74	19.37	18.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	1.26	0.52	232.45	1.21	0.47	232.50
MW25-1B	4854777	602202	233.0	0.69	5.83	5.00	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	1.27	0.58	232.41	1.29	0.60	232.39
MW25-02	4855162	602710	234.1	0.84	17.69	16.85	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	2.22	1.38	232.69	2.22	1.38	232.69
MW25-3A	4855088	602720	232.1	0.6	12.80	12.20	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	1.66	1.06	231.09	1.62	1.02	231.13
MW25-3B	4855089	602719	232.2	0.62	5.61	5.00	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	1.96	1.34	230.82	1.52	0.90	231.26
MW25-SWM1	4855875	601713	239.4	0.83	4.63	3.80	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	1.97	1.14	238.25	1.39	0.56	238.83
MW25-SWM2	4855796	601626	239.9	0.86	4.67	3.81	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	2.72	1.86	238.07	1.67	0.81	239.11
MW25-SWM3	4854538	603071	229.8	0.83	6.93	6.10	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	1.98	1.15	228.67	1.60	0.77	229.05
MW25-CR1	4855363	602710	235.2	0.82	8.42	7.60	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	1.95	1.13	234.07
MW25-CR2	4855290	602660	231.5	0.91	5.02	4.11	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	1.90	0.99	230.46

-*: Unable to physically open
n*: Well packer
-**: Located within non-participating property
NM': Not measured
DNE': Did not exist

Table C2-5: Monitoring Well/Mini-Piezometer Vertical Hydraulic Gradients

Nested Well Set	Vertical Hydraulic Gradients (m/m)																		
	31-Aug-17	22-Sep-17	10-Nov-17	05-Dec-17	07-Feb-18	23-Apr-18	08-Nov-22	21-Nov-22	29-Nov-22	08-Dec-22	08-Feb-23	05-May-23	12-May-23	02-Jun-23	31-Jul-23	21-Sep-23	25-Jul-24	09-May-25	09-Jun-25
MW2-17S/D	0.002	0.000	0.011	-0.005	-0.004	-0.004	NM	NM	NM	-0.004	NM	0.002	NM	NM	NM	0.036	0.007	0.005	-0.002
MW4-17S/D	-0.011	-0.011	-0.010	0.011	0.000	0.028	0.005	-0.018	0.023	NM	-0.013	-0.007	-0.041	NM	-0.029	-0.054	-0.056	NM	NM
MW5-17S/D	-0.178	-0.224	-0.179	NM	NM	NM	NM	NM	NM	-	NM	-	NM	NM	NM	-	-	-	-
BH23-1A/B	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	0.000	NM	NM	NM	NM	NM
BH23-2A/B	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	-0.153	NM	0.331	0.287	0.311	0.233
BH23-7A/B	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	-1.783	NM	-0.017	-0.006	0.244	0.133
BH23-11A/B	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	0.244	NM	0.300	0.320	0.378	0.363
MW25-1A/B	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	-0.003	-0.008
MW25-3A/B	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	-0.037	0.018

	upward vertical hydraulic gradient
	downward vertical hydraulic gradient
NM	Not measured due to access or freezing conditions
-	Well packer in deep well
DNE	Did not exist

Table C2-6. Groundwater/Surface Water Quality Exceedances

Parameters	Unit	Peel Sanitary Criteria	Peel Storm Criteria	PWQO Criteria	Sample Date									
					09-21-2017			09-22-2017				04-09-2025	05-12-2025	06-09-2025
					Water Type (GW / SW)									
					SW	SW	SW	GW	GW	GW	GW	SW	GW	GW
					Sample ID									
					SF1-17	SF5-17	SF6-17	MW1-17	MW5-17S	MW3-17	MW4-17D	CWT-25	MW25-1B	MW25-CR1
Fecal Coliform	CFU/100mL	0	0	0	-	-	-	-	-	-	-	-	0	**10**
Field pH	pH	5.5-10	6.0-9.0	6.5-8.5	8.03	8.23	8.29	7.98	**8.56**	8.17	**8.58**	7.12	7.86	7.17
Phenols-4AAP	mg/L	1	0.008	0.001	ND	**0.0017**	**0.0033**	ND	ND	ND	ND	<0.001	<0.001	**0.002**
Total Phosphorus	mg/L	10	0.4	0.01	**0.037**	**0.10**	**0.08**	**0.36**	***0.80***	***1.40***	***3.30***	-	-	***1.33***
Total Boron	ug/L	-	-	200	27	29	41	110	**420**	**260**	110	28	-	-
Total Cobalt	ug/L	5000	-	0.9	ND	ND	0.54	ND	ND	ND	**2.5**	<0.5	1	**17.3**
Total Copper	ug/L	3000	50	5	ND	ND	2.2	1.6	1.3	ND	**5.5**	<2	3	**26**
Total Iron	ug/L	-	-	300	ND	**320**	**1300**	ND	ND	ND	**5400**	**345**	-	-
Total Manganese	ug/L	5000	50	-	-	-	-	-	-	-	-	245	*130*	**6930**
Total Nickel	ug/L	3000	80	25	ND	ND	1.6	2.6	ND	1.9	5.2	<3	<3	**27**
Total Supsended Solids	ug/L	350000	15000	-	-	-	-	-	-	-	-	-	<10000	**662000**
Total Uranium	ug/L	-	-	5	0.22	0.22	0.6	**9.20**	1.20	3.40	1.20	0.80	-	-
Total Vanadium	ug/L	-	-	6	ND	0.59	1.4	ND	0.74	2.1	**7.4**	<2	-	-
Total Zinc	ug/L	3000	40	30	ND	ND	ND	ND	ND	ND	21	<20	<20	***92***

Bold: exceeds the PWQO criteria
Italicized : exceeds the Peel Storm criteria
Bold and italicized : exceeds the Peel Storm and PWQO criteria
GW: Groundwater
SW: Surface water
ND: Non-detect

Table C2-7: Mini-Piezometer Information

Consultant's Study	Years Monitored	Station Location	Well ID	Equipment Installed	Type (Shallow/Deep)	UTM Coordinates		Ground Elevation (masl)	Stick-up (m)	Well Depth (mbtoc)	Well Depth (mbgs)
						Northing	Easting				
Arcadis IBI Group (formerly COLE)	2017-2018, 2022-2023	HDF-3	SF1-17S	PZ, SG, Flow Station	Shallow	4855829	601459	240.2	1.1	2.1	1.1
			SF1-17D		Deep	4855828	601459	240.2	1.2	3.4	2.2
	2017-2018, 2022-2023	Clarkway Drive Tributary	SF2-17S	PZ, SG, Flow Station	Shallow	4855854	601937	237.0	1.8	2.4	0.6
			SF2-17D		Deep	4855854	601937	236.8	1.3	2.4	1.1
	2017-2018	Clarkway Drive Tributary	SF3-17S	PZ, SG, Flow Station	Shallow	4854985	602871	228.1	1.5	2.4	0.9
			SF3-17D		Deep	4854985	602871	228.1	1.1	2.4	1.3
	2017-2018	HDF-3	SF4-17S	PZ, SG, Flow Station	Shallow	4855474	601811	236.5	1.1	2.4	1.3
			SF4-17D		Deep	4855474	601811	236.5	0.7	2.4	1.8
	2017-2018, 2022-2023	HDF-3	SF5-17S	PZ, SG, Flow Station	Shallow	4855106	601973	233.6	0.5	1.2	0.7
			SF5-17D		Deep	4855106	601973	233.6	1.1	2.1	1.1
	2017-2018, 2022-2023	Clarkway Drive Tributary	SF6-17S	PZ, SG, Flow Station	Shallow	4854534	603196	224.9	1.0	1.8	0.8
			SF6-17D		Deep	4854535	603196	225.0	0.6	1.8	1.2
	2017-2018, 2022-2023	Approximately north of HDF-3	WL1S	PZ, SG	Shallow	4855876	601508	241.1	0.5	1.2	0.7
			WL1D		Deep	4855876	601507	241.1	0.8	2.4	1.6
	2017-2018, 2022-2023	HDF-3	WL2S	PZ, SG	Shallow	4855780	601743	238.7	0.9	2.4	1.6
			WL2D		Deep	4855780	601742	238.7	1.0	3.4	2.4
Arcadis (formerly Arcadis IBI Group)	2025	HDF-8-b	HDF-8-b	PZ	Shallow	4854413	602977	228.0*	1.0	1.6	0.6
		HDF-8-c	HDF-8-c	PZ	Shallow	4854821	602536	231.5*	1.1	1.6	0.5
		Clarkway Drive Tributary	PZS-CW-2025	PZ, SG	Shallow	4855351	602624	230.5	0.6	1.3	0.7
			PZD-CW-2025		Deep	4855351	602623	230.5	0.8	1.9	1.1

PZ: Mini-piezometer nest comprised of shallow and deep piezometers
SG: Staff gauge
*: Approximate elevation based on 2025 Topographic CAD File shared by GEI

Table C2-8: Piezometer Water Level Measurements (mbgs)

Year	2017				2018		2022			2023					2024	2025		
Piezometer ID	26-Jul-17	21-Sep-17	10-Nov-17	05-Dec-17	07-Feb-18	23-Apr-18	09-Nov-22	29-Nov-22	08-Dec-22	08-Feb-23	05-May-23	12-May-23	31-Jul-23	21-Sep-23	25-Jul-24	2025-04-09*	09-May-25	09-Jun-25
SF1-17S	0.15	0.29	0.20	0.10	0.10	-0.10	-	-	0.24	-	0.10	-	-	dry	0.55	-	-	0.44
SF1-17D	Dry	Dry	2.20	2.20	2.20	1.00	-	-	1.04	-	0.92	-	-	dry	0.74	-	-	0.69
SF2-17S	Dry	Dry	Dry	0.70	0.60	0.50	-	-	-*	-	-	0.01	0.06	-	-	-	-	0.01
SF2-17D	Dry	Dry	Dry	1.10	1.10	1.00	0.20	-	-*	0.20	-	0.10	0.00	-	-	-	-	0.48
SF3-17S	0.60	0.75	0.60	0.70	0.00	0.50	-	-	-	-	-	-	-	-	-	-	-	-
SF3-17D	0.00	0.67	0.50	0.60	0.50	0.40	-	-	-	-	-	-	-	-	-	-	-	-
SF4-17S	0.05	0.05	0.10	0.10	0.00	0.00	-	-	-*	-	-	-	-	-	-	-	-	-
SF4-17D	Dry	Dry	Dry	Dry	0.50	1.80	-	-	-*	-	-	-	-	-	-	-	-	-
SF5-17S	0.24	0.04	0.00	0.10	0.10	0.10	dry	-	-*	0.00	-0.03	0.10	0.00	dry	0.47	-	-	0.11
SF5-17D	0.25	0.11	0.00	0.20	0.20	-0.20	dry	-	-*	0.00	-0.10	0.10	0.10	dry	0.49	-	-	dry
SF6-17-S	0.42	0.55	0.50	0.50	-0.10	0.10	-	-	0.08	-	0.28	-	-	-	-0.05	-	-	-0.58
SF6-17D	Dry	0.75	0.60	0.60	0.40	0.00	-	-	0.85	-	0.40	-	-	-	0.87	-	-	0.78
WL1-17S	NM	0.04	0.70	0.10	0.00	-0.20	-	-	0.70	-	-0.23	-	-	0.20	-0.08	-	-	0.29
WL1-17D	NM	0.71	0.50	0.40	0.40	0.20	-	-	0.25	-	0.41	-	-	0.20	0.03	-	-	-0.44
WL2-17S	NM	-0.15	-0.10	0.00	0.00	-0.10	-	-	0.10	-	-0.10	-	-	N/A	0.22	-	-	-
WL2-17D	NM	Dry	2.20	1.20	2.10	1.90	-	-	0.30	-	0.30	-	-	0.20	0.25	-	-	-
HDF-8-b	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	0.09	-	-0.016
HDF-8-c	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	0.21	-	0.017
PZS-CW-2025	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	0.65	0.42	0.44
PZD-CW-2025	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	1.11	0.40	0.39

Table C2-9: Piezometer Water Level Measurements (masl)

Year	2017				2018		2022			2023					2024	2025		
Piezometer ID	26-Jul-17	21-Sep-17	10-Nov-17	05-Dec-17	07-Feb-18	23-Apr-18	09-Nov-22	29-Nov-22	08-Dec-22	08-Feb-23	05-May-23	12-May-23	31-Jul-23	21-Sep-23	25-Jul-24	2025-04-09*	09-May-25	09-Jun-25
SF1-17S	240.08	239.94	240.03	240.13	240.13	240.33	-	-	239.99	-	240.14	-	-	-	239.68	-	-	239.79
SF1-17D	Dry	Dry	238.05	238.05	238.05	239.25	-	-	239.20	-	239.33	-	-	-	239.51	-	-	239.56
SF2-17S	Dry	Dry	Dry	236.32	236.42	236.52	-	-	-*	-	-	238.60	238.50	-	-	-	-	237.01
SF2-17D	Dry	Dry	Dry	235.71	235.71	235.81	236.60	-	-*	236.60	-	236.70	236.80	-	-	-	-	236.33
SF3-17S	227.51	227.36	227.51	227.41	228.11	227.61	-	-	-	-	-	-	-	-	-	-	-	-
SF3-17D	228.07	227.40	227.57	227.47	227.57	227.67	-	-	-	-	-	-	-	-	-	-	-	-
SF4-17S	236.46	236.46	236.41	236.41	236.51	236.51	-	-	-*	-	-	-	-	-	-	-	-	-
SF4-17D	Dry	Dry	Dry	Dry	235.99	234.69	-	-	-*	-	-	-	-	-	-	-	-	-
SF5-17S	233.33	233.53	233.57	233.47	233.47	233.47	-	-	-*	233.60	233.59	233.50	233.60	-	233.10	-	-	233.46
SF5-17D	233.36	233.50	233.61	233.41	233.41	233.81	-	-	-*	233.60	233.70	233.50	233.50	-	233.12	-	-	-
SF6-17-S	224.45	224.33	224.37	224.37	224.97	224.77	-	-	224.80	-	224.59	-	-	-	224.93	-	-	225.45
SF6-17D	Dry	224.21	224.37	224.37	224.57	224.97	-	-	224.12	-	224.57	-	-	-	224.10	-	-	224.19
WL1-17S	NM	241.11	240.45	241.05	241.15	241.35	-	-	240.50	-	241.37	-	-	241.00	241.23	-	-	240.85
WL1-17D	NM	240.43	240.64	240.74	240.74	240.94	-	-	240.89	-	240.73	-	-	241.00	241.11	-	-	241.57
WL2-17S	NM	238.86	238.81	238.71	238.71	238.81	-	-	238.66	-	238.80	-	-	237.60	238.49	-	-	-
WL2-17D	NM	Dry	236.53	237.53	236.63	236.83	-	-	238.26	-	238.33	-	-	238.50	238.48	-	-	-
HDF-8-b	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	227.91	-	228.016
HDF-8-c	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	231.29	-	231.48
PZS-CWT-2025	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	229.85	230.08	230.06
PZD-CWT-2025	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	229.37	230.08	230.09

Note: Stations SF3-17 and SF4-17 were observed destroyed since 2022

-': Not measured

-*: Not measured due to restricted access to the parcel lands

DNE: Did not exist

2025-04-09*: Data collected shortly after mini-piezometer installation and is not considered representative

Table C2-10: Mini-Piezometer Vertical Hydraulic Gradients

Nested Well Set	Vertical Hydraulic Gradients (m/m)																Overall Interpretation	Location
	26-Jul-17	21-Sep-17	10-Nov-17	05-Dec-17	07-Feb-18	23-Apr-18	08-Dec-22	08-Feb-23	05-May-23	12-May-23	31-Jul-23	21-Sep-23	25-Jul-24	2025-04-09*	09-May-25	09-Jun-25		
SF1-17	-	-	1.84	1.86	1.87	1.01	0.69	-	0.74	-	-	-	0.16	-	-	0.22	Downward	HDF-3
SF2-17	-	-	-	0.98	0.98	1.01	-	-	-	2.66	2.38	-	-	-	-	-	Downward	Clarkway Drive Tributary
SF3-17	-1.25	-0.09	-0.14	0.01	1.27	-0.14	-	-	-	-	-	-	-	-	-	-	Predominantly upward	Clarkway Drive Tributary
SF4-17	-	-	-	-	1.17	3.62	-	-	-	-	-	-	-	-	-	-	Downward	HDF-3
SF5-17	-0.09	0.08	-0.16	0.13	-0.06	-0.84	-	0.00	-0.35	0.00	0.32	-	-0.06	-	-	-	Variable	HDF-3
SF6-17	-	0.35	0.07	-0.09	1.29	-0.54	2.21	-	0.07	-	-	-	1.95	-	-	3.88	Variable	Clarkway Drive Tributary
WL1-17	-	0.70	-0.16	0.33	0.44	0.50	-0.46	-	0.71	-	-	0.00	0.13	-	-	-0.79	Variable	Approximately north of HDF-3
WL2-17	-	-	2.81	1.48	2.56	2.46	0.22	-	0.58	-	-	N/A	0.01	-	-	-	Downward	HDF-3
HDF-8-b	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	0.40	-	0.15	Downward	HDF-8
HDF-8-c	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	-1.21	-	0.03	Downward	HDF-8
PZ-CWT-2025	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	1.14	0.00	-0.09	Upward	Clarkway Drive Tributary

Note: Vertical hydraulic gradient calculated on April 9, 2025 is not considered representative as water levels were measured shortly after mini-piezometer installation

upward vertical hydraulic gradient

downward vertical hydraulic gradient

\- Vertical hydraulic gradient could not be estimated due to one or both piezometers being dry

Table C2-11: Stream Flow Measurements

Location	Monitoring Site	Equipment Installed	Measurement	Date													
				26-Jul-17	21-Sep-17	10-Nov-17	05-Dec-17	07-Feb-18	23-Apr-18	08-Dec-22	2023-05-05*	21-Sep-23	25-Jul-24	09-Apr-25	09-May-25	09-Jun-25
HDF-3	SF1-17	PZ, SG, Flow Station	SGR (cm)	23.8	22	25	21.5	21	18	19	23	Dry	Dry	NM	NM	NM
			EFR (L/s)	2.9	2.5	2.7	1.2	N/A	6.3	1.4	Slow to Intermediate	Dry	Dry	NM	NM	Stagnant
Clarkway Drive Tributary	SF2-17	PZ, SG, Flow Station	SGR (cm)	14.5	10	13	17.5	54	26	No Access	Unlocated	Unlocated	No SG	No SG	No SG	No SG
			EFR (L/s)	7.1	0.4	5.5	17.8	N/A	41.1	No Access	Unlocated	Unlocated	1.62	NM	NM	Stagnant
Clarkway Drive Tributary	SF3-17	PZ, SG, Flow Station	SGR (cm)	19	15	13.5	31	34	32	Beaver Dam	Beaver Dam	Beaver Dam	No SG	No SG	No SG	No SG
			EFR (L/s)	18.9	3.3	14.7	123.4	N/A	144.3	Beaver Dam	Slow	Slow to intermediate	169.8	NM	NM	Slow to intermediate
HDF-3	SF4-17	PZ, SG, Flow Station	SGR (cm)	23	26	25.5	24	44	30	No Access	25.5	Dry	Dry	NM	NM	Dry
			EFR (L/s)	4.6	2.8	5.0	6.0	N/A	16.3	No Access	Slow to Intermediate	Dry	Dry	NM	NM	Dry
HDF-3	SF5-17	PZ, SG, Flow Station	SGR (cm)	11	12.5	14.5	14.5	8	20	No Access	SG missing	Dry	Dry	NM	NM	Dry
			EFR (L/s)	1.2	0.51	0.48	1.94	N/A	5.4	No Access	Fast	Dry	Dry	NM	NM	Dry
Clarkway Drive Tributary	SF6-17	PZ, SG, Flow Station	SGR (cm)	30.5	20	22.5	37.5	35	40	13	SG missing	SG missing	No SG	No SG	No SG	No SG
			EFR (L/s)	22.4	3.3	12.0	92.2	N/A	143.6	20.2	Fast	434	3.49	NM	NM	Fast
HDF-3	WL3-17	SG, Flow Station	SGR (cm)	NM	6	6.5	6	23.5	7	No Access	Slow to Intermediate	Dry	Dry	NM	NM	Dry
			EFR (L/s)	NM	0.8	0.8	0.7	N/A	5.2	No Access	NM	Dry	Dry	NM	NM	Dry
HDF-8	SF7-17	SG	SGR (cm)	NM	NM	NM	NM	NM	NM	Dry	36.5	54.6	No SG	No SG	No SG	No SG
			EFR (L/s)	Dry	Dry	Dry	Dry	Dry	Dry	0	Low to Intermediate	Stagnant	Stagnant	NM	NM	Dry
Clarkway Drive Tributary	SF8-22	None	SGR (cm)	-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			EFR (L/s)	-	-	-	-	-	-	0.15	Slow	NM	Dry	NM	NM	Dry
HDF-8	SF9-22	None	SGR (cm)	-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			EFR (L/s)	-	-	-	-	-	-	Dry	Slow	Dry	Dry	NM	NM	Dry
Clarkway Drive Tributary	SF10-22	None	SGR (cm)	-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			EFR (L/s)	-	-	-	-	-	-	1.9	Intermediate	NM	5.6	NM	NM	Intermediate
HDF-8	SF11-22	None	SGR (cm)	-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			EFR (L/s)	-	-	-	-	-	-	NM	Fast	NM	Dry	NM	NM	Dry
HDF-8-b	HDF-8-b	Single PZ	SGR (cm)	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	Stagnant	NM	Dry
HDF-8-c	HDF-8-c	Single PZ	EFR (L/s)	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	Stagnant	NM	Dry
Clarkway Drive Tributary	CWT-25	PZ, SG	SGR (cm)	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	26.67	22.86	22.86
			EFR (L/s)	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	Flowing	Flowing	Flowing

SGR = Staff Gauge Reading
EFR = Estimated Flow Rate
PZ = Mini-piezometer nest comprised of shallow and deep piezometers
SG = Staff Gauge
*': No stream flow measurements were conducted. Stream flow observations were recorded instead
-': Did not exist

Table C2-12. Pre- and Post-Development Water Balance Summary				
Element (m^3/year)	Pre-Development (m^3/year)	Post-Development (m^3/year)	Change (m^3/year)	Change (%)
Precipitation	1,749,705	1,749,705	-	-
Storage	0	0	0	-
Evapotranspiration	1,180,868	463,955	-716,913	-60.7%
Infiltration	217,910	33,030	-184,880	-84.8%
Runoff	350,927	1,253,904	902,977	257.3%

Monthly Water Balance Analysis - Thornthwaite and Mather model
Humber Station Village, Bolton, Ontario
Comprehensive Environmental Impact Statement and Management Plan

Table C2-13: Pre-Development Site Water Balance

Total Site Area (ha) 213.02

Land Description Factors	Area A (Agricultural / NHS)	Sub-Area B (Dirt Yard)	Sub-Area C (Building / Driveway)
Topography	0.15	0.15	N/A
Soils	0.10	0.10	N/A
Cover	0.15	0.05	N/A
Sum (Infiltration Factor)	0.40	0.30	No Infiltration
Soil Moisture Capacity (mm)	200	75	0
Site Area	202.55	7.67	2.79
Percentage of Total Site Area	95%	4%	1%

100%

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Climate Data (Data from Albion Field Centre Climate Station, Ontario via Environment Canada Website - 1981-2010 Climate Normals)													
Average Daily Temperature (°C)	-7.0	-5.9	-1.4	6.1	12.4	17.3	19.9	19.1	14.3	8.1	2.1	-3.9	**6.8**
Precipitation (mm)	60.4	50.2	50.3	67.0	76.1	75.5	81.8	77.4	75.0	68.3	81.7	57.7	**821.4**
Evapotranspiration Analysis (Sub-Area A)													
Heat Index	0.0	0.0	0.0	1.4	4.0	6.5	8.1	7.6	4.9	2.1	0.3	0.0	**35**
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	28.8	60.6	85.9	99.4	95.3	70.3	38.8	9.4	0.0	**488**
Potential Evapotranspiration Adjusting Factor for Latitude	0.75	0.79	1.02	1.14	1.32	1.35	1.36	1.24	1.06	0.93	0.77	0.71	
Adjusted Potential Evapotranspiration (mm)	0	0	0	33	80	116	135	118	74	36	7	0	**599**
PET (Malstrom, 1969) (mm/month)	0	0	0	33	80	116	135	118	74	36	7	0	**599**
Precipitation - PET (mm)	60	50	50	34	-4	-40	-53	-41	1	32	74	58	**222**
Accumulated Potential Water Loss (APWL)	0	0	0	0	-4	-44	-97	-138	-137	-105	-30	0	**-555**
Storage (S)	200	200	200	200	196	161	123	100	101	133	200	200	
Change in Storage	0	0	0	0	-4	-36	-37	-22.7	1	32	67	0	**0**
Actual Evapotranspiration (mm)	**0**	**0**	**0**	**33**	**80**	**111**	**119**	**100**	**74**	**36**	**7**	**0**	561
Recharge/Runoff Analysis													
Water Surplus (mm)	60	50	50	34	0	0	0	0	0	0	8	58	**261**
Potential Infiltration (I)	24	20	20	14	0	0	0	0	0	0	3	23	**104**
Potential Direct Surface Water Runoff (R)	**36**	**30**	**30**	**20**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**35**	**156**
Evapotranspiration (m^3)	0	0	0	66,793	161,715	225,134	241,642	202,819	150,649	72,638	14,671	0	1,136,061
Runoff (m^3)	73,404	61,008	61,130	41,349	0	0	0	0	0	0	9,597	70,123	316,611
Infiltration (m^3)	48,936	40,672	40,753	27,566	0	0	0	0	0	0	6,398	46,749	211,074

Evapotranspiration Analysis (Sub-Area B)													
Accumulated Potential Water Loss (APWL)	0	0	0	0	-4	-44	-97	-138	-134	-38	0	0	
Storage (S)	75	75	75	75	71	42	21	12	13	45	75	75	
Change in Storage	0	0	0	0	-4	-30	-21	-9	1	32	30	0	**0**
Actual Evapotranspiration (mm)	**0**	**0**	**0**	**33**	**80**	**105**	**103**	**86**	**74**	**36**	**7**	**0**	524
Recharge/Runoff Analysis													
Water Surplus (mm)	60	50	50	34	0	0	0	0	0	0	44	58	**297**
Potential Infiltration (I)	18	15	15	10	0	0	0	0	0	0	13	17	**89**
Potential Direct Surface Water Runoff (R)	**42**	**35**	**35**	**24**	**0**	**0**	**0**	**0**	**0**	**0**	**31**	**40**	208
Evapotranspiration (m^3)	0	0	0	2529	6119	8056	7902	6599	5705	2751	556	0	40,216
Runoff (m^3)	3243	2695	2701	1827	0	0	0	0	0	0	2387	3098	15,950
Infiltration (m^3)	1390	1155	1157	783	0	0	0	0	0	0	1023	1328	6,836

Evaporation Analysis (Sub-Area C - Impervious)													
Evaporation Facotr (assume 20% of precipitation is evaporated from Impervious surfaces)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
Actual Evaporation (mm)	**12**	**10**	**10**	**13**	**15**	**15**	**16**	**15**	**15**	**14**	**16**	**12**	164
Recharge/Runoff Analysis													
Potential Infiltration (I)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Potential Direct Surface Water Runoff (R)	**48**	**40**	**40**	**54**	**61**	**60**	**65**	**62**	**60**	**55**	**65**	**46**	657
Evaporation (m^3)	338	281	281	375	425	422	457	433	419	382	457	323	4,592
Runoff (m^3)	1351	1122	1125	1498	1702	1688	1829	1731	1677	1527	1827	1290	18,367
Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	0

Water Balance Total	Inputs	Outputs
Precipitation (mm)	821.4	
Soil Storage (mm)		0.0
Evapotranspiration+Evaporation (mm)		554
Infiltration (mm)		102
Runoff (mm)		165
Total	**821.4**	**821.4**

Water Balance Total	Inputs	Outputs
Precipitation (m^3)	1,749,705.21	
Soil Storage (m^3)		0.00
Evapotranspiration+Evaporation (m^3)		1,180,868.03
Infiltration (m^3)		217,909.71
Runoff (m^3)		350,927.47
Total	**1,749,705.21**	**1,749,705.21**

Monthly Water Balance Analysis - Thornthwaite and Mather model
Humber Station Village, Bolton, Ontario
Comprehensive Environmental Impact Statement and Management Plan

Table C2-14: Post-Development Site Water Balance

Total Site Area (ha) 213.02

Land Description Factors	Area A (Agricultural / NHS)	Sub-Area B (Stormwater Management Ponds)	Sub-Area C (Impervious)
Topography	0.15	0.30	N/A
Soils	0.10	0.10	N/A
Cover	0.15	0.10	N/A
Sum (Infiltration Factor)	0.40	0.50	No Infiltration
Soil Moisture Capacity (mm)	200	150	0
Site Area	22.06	6.91	184.05
Percentage of Total Site Area	10%	3%	86%

100%

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Climate Data (Data from Albion Field Centre Climate Station, Ontario via Environment Canada Website - 1981-2010 Climate Normals)													
Average Daily Temperature (°C)	-7.0	-5.9	-1.4	6.1	12.4	17.3	19.9	19.1	14.3	8.1	2.1	-3.9	**6.8**
Precipitation (mm)	60.4	50.2	50.3	67.0	76.1	75.5	81.8	77.4	75.0	68.3	81.7	57.7	**821.4**
Evapotranspiration Analysis (Sub-Area A)													
Heat Index	0.0	0.0	0.0	1.4	4.0	6.5	8.1	7.6	4.9	2.1	0.3	0.0	**35**
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	28.8	60.6	85.9	99.4	95.3	70.3	38.8	9.4	0.0	**488**
Potential Evapotranspiration Adjusting Factor for Latitude	0.75	0.79	1.02	1.14	1.32	1.35	1.36	1.24	1.06	0.93	0.77	0.71	
Adjusted Potential Evapotranspiration (mm)	0	0	0	33	80	116	135	118	74	36	7	0	**599**
PET (Malstrom, 1969) (mm/month)	0	0	0	33	80	116	135	118	74	36	7	0	**599**
Precipitation - PET (mm)	60	50	50	34	-4	-40	-53	-41	1	32	74	58	**222**
Accumulated Potential Water Loss (APWL)	0	0	0	0	-4	-44	-97	-138	-137	-105	-30	0	**-555**
Storage (S)	200	200	200	200	196	161	123	100	101	133	200	200	
Change in Storage	0	0	0	0	-4	-36	-37	-22.7	1	32	67	0	**0**
Actual Evapotranspiration (mm)	**0**	**0**	**0**	**33**	**80**	**111**	**119**	**100**	**74**	**36**	**7**	**0**	560
Recharge/Runoff Analysis													
Water Surplus (mm)	60	50	50	34	0	0	0	0	0	0	8	58	**261**
Potential Infiltration (I)	24	20	20	14	0	0	0	0	0	0	3	23	**104**
Potential Direct Surface Water Runoff (R)	**36**	**30**	**30**	**20**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**35**	**156**
Evapotranspiration (m^3)	0	0	0	7,274	17,611	24,517	26,315	22,087	16,406	7,910	1,598	0	123,719
Runoff (m^3)	7,994	6,644	6,657	4,503	0	0	0	0	0	0	1,045	7,636	34,479
Infiltration (m^3)	5,329	4,429	4,438	3,002	0	0	0	0	0	0	697	5,091	22,986

Evapotranspiration Analysis (Sub-Area B)													
Accumulated Potential Water Loss (APWL)	0	0	0	0	-4	-44	-97	-138	-136	-70	0	0	
Storage (S)	150	150	150	150	146	112	79	60	61	116	150	150	
Change in Storage	0	0	0	0	-4	-34	-33	-19	2	55	34	0	**0**
Actual Evapotranspiration (mm)	**0**	**0**	**0**	**33**	**80**	**110**	**115**	**96**	**74**	**36**	**7**	**0**	551
Recharge/Runoff Analysis													
Water Surplus (mm)	60	50	50	34	0	0	0	0	0	0	41	58	**293**
Potential Infiltration (I)	30	25	25	17	0	0	0	0	0	0	20	29	**146**
Potential Direct Surface Water Runoff (R)	**30**	**25**	**25**	**17**	**0**	**0**	**0**	**0**	**0**	**0**	**20**	**29**	146
Evapotranspiration (m^3)	0	0	0	2279	5532	7580	7954	6648	5140	2478	501	0	38,113
Runoff (m^3)	2087	1735	1738	1176	0	0	0	0	0	0	1413	1994	10,142
Infiltration (m^3)	2087	1735	1738	1176	0	0	0	0	0	0	1413	1994	10,142

Evaporation Analysis (Sub-Area C - Impervious)													
Evaporation Facotr (assume 20% of precipitation is evaporated from Impervious surfaces)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
Actual Evaporation (mm)	**12**	**10**	**10**	**13**	**15**	**15**	**16**	**15**	**15**	**14**	**16**	**12**	164
Recharge/Runoff Analysis													
Potential Infiltration (I)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Potential Direct Surface Water Runoff (R)	**48**	**40**	**40**	**54**	**61**	**60**	**65**	**62**	**60**	**55**	**65**	**46**	657
Evaporation (m^3)	22233	18478	18515	24662	28012	27791	30110	28490	27607	25141	30073	21239	302,351
Runoff (m^3)	88931	73913	74060	98649	112047	111164	120440	113961	110428	100563	120292	84956	1,209,403
Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	0

Water Balance Total	Inputs	Outputs
Precipitation (mm)	821.4	
Soil Storage (mm)		0.0
Evapotranspiration+Evaporation (mm)		218
Infiltration (mm)		16
Runoff (mm)		589
Total	**821.4**	**821.4**

Water Balance Total	Inputs	Outputs
Precipitation (m^3)	1,749,705.21	
Soil Storage (m^3)		0.00
Evapotranspiration+Evaporation (m^3)		463,955.18
Infiltration (m^3)		33,030.38
Runoff (m^3)		1,253,903.62
Total	**1,749,705.21**	**1,750,889.17**

Table C2-15. Estimated Infiltration Rates				
Test ID	Geometric Mean Infiltration / Percolation (mm/hour)	Ratio of Measured Mean Infiltration Rates	Safety Factor (TRCA, 2012)	Design Infiltration / Percolation Rate (mm/hour)
Test Pit 1	19	0.0067	2.5	7.8
Test Pit 2	8	0.003	2.5	3
Test Pit 3	12	16600	8.5	1.4
Test Pit 4	6	1	2.5	2.3
Test Pit 5	5	1.74	3.5	1.5

Table C2-16. Summary of MECP Water Well Record Search Results		
Well Usage	**Number of Wells**	**Percentage of Total Wells**
Water Supply	46	36%
Abandoned Wells	31	24%
Observation, Monitoring and Test Wells / Holes	42	33%
Other or Unknown Status	9	7%
Total	**128**	**100%**

Note: Water Well Record Search does not include monitoring wells installed in recent investigations (i.e. 2025)

Table C2-17. Private Water Well Survey				
Address	**Spoke to Owner (Y/N)**	**Well Survey Form Given to Owner (Y/N/NA)**	**Well Survey Form Dropped Off (Y/N/NA)**	**Misc. Comments**
Humber Station Road				
12792 Humber Station Road	N	N	Y	Form dropped in mailbox
12627 Humber Station Road	Y	Y	Y	Form given to owner. She said she is on city water afterwards
12615 Humber Station Road	N	N	N	Form dropped in mailbox
12591 Humber Station Road	Y	N	N	Spoke to owner; said property is on city water
12424 Humber Station Road	Y	Y	Y	Spoke to owner; said property is on well water
12402 Humber Station Road	N	N	Y	Form dropped in mailbox
12285 Humber Station Road	N	N	N	Form dropped in mailbox
12236 Humber Station Road	Y	N	N	Spoke to owner; said property is on city water
12224 Humber Station Road	Y	Y	Y	Spoke to wife, doesn't know and will ask her husband
12209 Humber Station Road	N	N	Y	Form dropped in mailbox
12202 Humber Station Road	N	N	Y	Form dropped in mailbox
12168 Humber Station Road	Y	Y	Y	Spoke to tenants and will pass information to owner but they are on well water
12159 Humber Station Road	N	N	Y	Form dropped in mailbox
12133 Humber Station Road	N	N	Y	Form dropped in mailbox
12121 Humber Station Road	N	N	Y	Form dropped in mailbox
12089 Humber Station Road	N	N	Y	Form dropped in mailbox
12069 Humber Station Road	N	N	Y	Form dropped in mailbox
12055 Humber Station Road	N	N	Y	Form dropped in mailbox
12954 Humber Station Road	N	N	N	Spoke to tenants, owner leases property, wife's # is 416-995-3374 -> ask for Tony
12951 Humber Station Road	N	N	Y	Form dropped in mailbox
12944 Humber Station Road	N	N	Y	Form dropped in mailbox
12895 Humber Station Road	N	N	Y	Form dropped in mailbox

Table C2-17. Private Water Well Survey				
Address	**Spoke to Owner (Y/N)**	**Well Survey Form Given to Owner (Y/N/NA)**	**Well Survey Form Dropped Off (Y/N/NA)**	**Misc. Comments**
12880 Humber Station Road	N	N	Y	Form dropped in mailbox
12877 Humber Station Road	N	N	Y	Form dropped in mailbox
12828 Humber Station Road	Y	N	N	Spoke to owner; said property is on city water
12780 Humber Station Road	Y	N	N	Spoke to owner; said property is on city water
12779 Humber Station Road	Y	N	N	Spoke to owner; said property is on city water
12791 Humber Station Road	N	N	Y	Form dropped in mailbox
Healey Road				
8208 Healey Road	N	N	Y	Form dropped in mailbox
8223 Healey Road	N	N	Y	Left on door handle, house appeared abandoned
8228 Healey Road	N	N	Y	Form dropped in mailbox; entrance was gated
8240 Healey Road	N	N	Y	Form dropped in mailbox; entrance was gated
8226 Healey Road	N	N	Y	Form dropped in mailbox

Note: Private Well Survey Completed on September 21, 2023

C.3. Tables – Schaeffers

Table 2.1: Existing Culvert Size

Culvert ID	Location	Size
A	Humber Station Road	⌀750 mm PVC, length=16.7m
B	Humber Station Road	⌀450 mm PVC, length=15m
C	Humber Station Road	⌀400 mm PVC, length=10.2m
F	Mayfield Road	⌀500 mm PVC, length=18.5m
G	Mayfield Road	⌀900 mm PVC, length=30.2m
H	Mayfield Road	5100*2200 mm BOX, length=21.5m
Q	Healey Road	⌀600 mm PVC, length=12.2m

Table 2.2: Differences in the catchments in Existing and future scenarios in TRCA model

Catchment Name	Area, ha	Model Parameters	Regional Model Uncontrolled		2year to 100year Model Controlled	
			Existing*	Future**	Existing*	Future**
43.10	202.72	Impervious percentage	22%	75%	17.5%	78%
43.06	35.79	Curve Number	96	96	80	92
43.05	39.74	Land Use Type	NasHyd	StandHyd	NasHyd	StandHyd
		Curve Number	99	99	86	85
		Impervious percentage	-	64%	-	90.90%
43.03	63.04	Curve Number	97	98	82	94
43.04	24.96	Land Use Type	NasHyd	NasHyd	NasHyd	StandHyd
		Curve Number	98	99	83	83
		Impervious percentage	-	-	-	59.7%
43.02	129.13	Land Use Type	NasHyd	StandHyd	NasHyd	StandHyd
		Curve number	99	98	85	83
		Impervious percentage	-	65%	-	77.2%
41.06	127.87	Curve number	97	97	81	93
41.07	101.08	Curve number	96	96	80	80
41.08	362.27	Curve number	97	97	82	94

* Final Report Humber River Hydrology Update (TRCA, 2015) for Existing Condition;
**Final Report Humber River Hydrology Update (TRCA, 2018) for Future Condition;

Table 2.3: Summary of Parameter Update in the Existing and Future Scenario of TRCA's Model

Catchment Name	Existing Area, ha	Study Area, ha	External Area, ha	Model Parameters	Regional		Design	
					External Area	Study Area	External Area	Study Area
43.10	202.72	21.45	179.67	Land Use Type	StandHyd	NasHyd	StandHyd	NasHyd
				Tp	-	1.75	-	1.75
				Impervious percentage	24%	-	19%	-
43.06	35.79	23.39	11.59	Tp	1.17	1.17	1.17	1.17
43.05	39.74	2.43	38.25	Tp	1.63	1.63	1.63	1.63
43.03	63.04	72.71	0.00	Tp	2.76	2.76	2.76	2.76
43.04	24.96	7.27	17.96	Tp	1	1	1	1
43.02	129.13	3.11	126.03	Tp	2.15	2.15	2.15	2.15
41.06	127.87	24.47	103.26	Tp	1.9	1.9	1.9	1.9
41.07	101.08	43.86	52.08	Tp	2.53	2.53	2.53	2.53
41.08	362.27	16.98	342.09	Tp	3.09	3.09	3.09	3.09

Table 2.4: Flow Comparison of the Existing Scenario of TRCA and Updated model (m^3/s)

Catchment Name	2yr		5yr		10yr		25yr		50yr		100yr		Regional	
	Existing TRCA Model	SCE Modified Existing Model	Existing TRCA Model	SCE Modified Existing Model	Existing TRCA Model	SCE Modified Existing Model	Existing TRCA Model	SCE Modified Existing Model	Existing TRCA Model	SCE Modified Existing Model	Existing TRCA Model	SCE Modified Existing Model	Existing TRCA Model	SCE Modified Existing Model
43.10	5.03	4.78	8.77	8.22	11.36	10.62	15.83	14.69	18.79	17.41	21.82	20.20	28.66	27.37
43.06	0.25	0.25	0.48	0.47	0.66	0.64	0.90	0.88	1.09	1.07	1.29	1.26	3.67	3.59
43.05	0.30	0.31	0.54	0.56	0.73	0.74	0.97	0.99	1.16	1.19	1.35	1.38	3.59	3.68
43.03	0.26	0.30	0.48	0.55	0.64	0.74	0.87	1.00	1.05	1.21	1.23	1.42	4.46	5.15
43.04	0.23	0.23	0.42	0.43	0.57	0.58	0.78	0.79	0.94	0.95	1.10	1.11	2.70	2.73
43.02	0.75	0.75	1.36	1.36	1.82	1.82	2.44	2.44	2.92	2.92	3.41	3.41	10.36	10.36
41.06	0.67	0.67	1.26	1.26	1.71	1.71	2.32	2.32	2.80	2.80	3.30	3.30	10.78	10.76
41.07	0.40	0.38	0.76	0.72	1.03	0.98	1.40	1.33	1.70	1.61	2.00	1.90	7.44	7.06
41.08	1.34	1.33	2.48	2.46	3.35	3.33	4.53	4.49	5.45	5.41	6.40	6.35	24.16	23.94
Total	9.23	8.98	16.56	16.02	21.87	21.16	30.02	28.91	35.90	34.55	41.91	40.32	95.83	94.65
Changes		-0.25		-0.53		-0.71		-1.11		-1.35		-1.59		-1.18
Changes %		-0.03		-0.03		-0.03		-0.04		-0.04		-0.04		-0.01

Table 2.5: Flow Comparison for the Future Development Scenarios with Regional Storm Event

Tributary	Scenario	TRCA Future Model		Modified Future Model			Post-development Model	
		Area, ha	Peakflow, m^3/s	Area, ha	Peakflow, m^3/s	Change %	Peakflow, m^3/s	Change %
	Nodes	A	B	C	D	(D-B)/B	E	(E-B)/B
Clarkway Tributary	J124	646	76.14	655	76.49	0%	85.11	12%
	J4200.683	775	90.29	784	90.64	0%	100.21	11%
	J1700.594	1002	110.62	1010	111.01	0%	119.08	8%
	J5620.381	1236	133.39	1244	133.81	0%	141.09	6%
	J4609.957	1274	136.46	1282	136.96	0%	144.74	6%
	J2807.784	1473	153.43	1481	154.14	0%	162.91	6%
	J2013.96	1515	155.87	1524	156.60	0%	165.56	6%
Gore Road Tributary	J120	591	40.85	583	40.24	-1%	36.46	-11%
	J3878.409	654	40.24	646	39.64	-1%	40.36	0%
	J43	821	51.49	812	51.08	-1%	57.17	11%
	J615.6105	984	71.33	975	70.99	0%	75.51	6%
	J76	1080	80.01	1071	79.71	0%	84.11	5%
	J6818.632	1141	86.77	1133	86.48	0%	90.69	5%
	J5042.243	1148	86.93	1139	86.63	0%	91.19	5%
	J3830.563	1298	102.31	1289	102.00	0%	106.61	4%
	J5042.133	1317	104.36	1308	104.05	0%	108.55	4%
	J75	1404	113.35	1395	113.04	0%	116.84	3%
Combined	14	3030	275.81	3030	276.26	0%	288.93	5%
	1	3067	277.82	3067	278.27	0%	291.00	5%
	j4045.633	17974	1041.49	17974	1041.66	0%	1049.66	1%
	J9359.973	18169	1049.98	18169	1050.20	0%	1060.68	1%
	J7731.412	18900	1078.33	18900	1078.58	0%	1087.37	1%
	J18	20159	1125.09	20159	1125.38	0%	1135.24	1%

Table 3.1: Summary of Volume Calculation for the Middle Tributary Channel with in the Subject Area

River Sta	Profile	Q Total (m^3/s)	Min Ch El (m)	W.S. Elev (m)	Flood storage Volume ($1000m^3$) Cumulative*	Between Station #36 and #31**	Incremental Storage Volume Between Successive Storm Events ($1000m^3$) Profile	Incremental Volume
36	2-year	0.25	229.5	229.55	0.63			
36	5-year	0.45	229.5	229.57	1.04			
36	10-year	0.61	229.5	229.58	1.69			
36	25-year	0.83	229.5	229.61	2.22			
36	50-year	1	229.5	229.61	2.78			
36	100-year	1.17	229.5	229.62	3.71			
36	Regional	4.25	229.5	229.78	12.39			
31	2-year	0.3	226.96	227.01	0.42	0.21	2-Yr	0.21
31	5-year	0.55	226.96	227.03	0.71	0.33	2Yr - 5Yr	0.12
31	10-year	0.74	226.96	227.04	1.28	0.41	5Yr -10Yr	0.08
31	25-year	1	226.96	227.05	1.7	0.52	10Yr - 25Yr	0.11
31	50-year	1.21	226.96	227.06	2.21	0.57	25Yr - 50Yr	0.05
31	100-year	1.42	226.96	227.09	3.06	0.65	50Yr - 100Yr	0.08
31	Regional	5.15	226.96	227.22	10.64	1.75	100Yr - Regional	1.1

*Note: * Total Commulative Channel Storage Volume starting from the downstream end of the watercourse to the to the specified Station # 36 and #31. Please refer to HEC-RAS analysis results presented in Appendix B-1.*
*** Storage volume between Station #36 and #31. For example, channel storage volume corresponding to the regional flow = (Cumulative Volume @ Station #36(i.e.,12.39*1000) – (Volume @ Station # 31(i.,e., 10.64*1000) = 1.75*1000m^3).*

Appendix D Floodplain Analysis Report

FLOODPLAIN ANALYSIS REPORT (PHASE-1)

HUMBER STATION VILLAGE
COMPREHENSIVE ENVIRONMENTAL IMPACT STUDY & MANAGEMENT PLAN (CEISMP)

TOWN OF CALEDON

PROJECT:2021-5139 **OCTOBER 2023**

Revision	Description	Prepared		Checked	
		By	Date	By	Date
0	First Submission	D.Y	October 2023	K.S.	October 2023

SCHAEFFERS
CONSULTING ENGINEERS
6 Ronrose Drive
Concord, Ontario L4K 4R3

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Appendix B-3: Supporting Documents
Appendix B-4: Digital Copy of HEC-RAS Model

1.0 Introduction

Schaeffers & Associates Ltd (SCE) has been retained by the Humber Station Village Landowners Group Inc., to prepare floodplain mapping for reaches of the watercourses within the Humber Station Village in the City of Caledon. Floodplain analyses have been done to identify the extent of the existing floodplain through completion of HEC-RAS modeling and mapping of the regulatory flood line along various drainage features in the Humber Station Village area as part of the Humber Station Village Comprehensive Environmental Impact Study & Management Plan (CEISMP) (Phase 1) Report. Existing condition channel storage volume was also estimated as needed. The regulatory floodplain map will be considered to define the development limit of the subject area as well as an input to the conceptual channel design.

This report presents floodplain analysis results including a review of the hydraulic modelling parameters and approaches for the subject area. The floodplain analysis has been conducted along all drainage features within and around the Humber Station Village. It should be noted that TRCA has an approved hydraulic model for the area.

We have received two hydraulic models (i.e., for the west and east tributaries). The hydraulic model for the west tributaries was labeled as "Final-West_Humber" and for the east tributaries was labeled as "Clarkway_Trib". SCE has combined the two models and created a combined HEC-RAS model. In addition to this, SCE has created two new Head Water Drainage Features (HDF) with in the subject area. One of the HDF is created following the existing drainage features along the north east corner of the subject area (defined as "Humber Station HDF") and the other one is created around the south end of the subject area (defined as "Mid-HDF"). Please refer to the Floodplain Map in **Appendix B-1** and Digital Hydraulic Model in **Appendix B-4**.

1.1 Background Information Review

The following reports, drawings, and information were reviewed in the preparation of this report:

- TRCA Stormwater Management Criteria (August 2012);

- Ministry of Transportation (MTO) Drainage Management Manual (1997);
- TRCA Stream Crossing Guideline (2015);
- Detailed topographic survey conducted by R-PE Surveying Ltd. (dated December 17th, 2021);
- TRCA approved Hydraulic (HEC-RAS) Model for the west tributary defined as "Final-West_Humber", received from TRCA on January 30th, 2023;
- TRCA approved Hydraulic (HEC-RAS) Model for the east tributary defined as "Clarkway Trib", received from TRCA on July 11th, 2023;
- TRCA approved Floodplain Mapping labeled as "hum_145", "hum_171", and "hum_172", received from TRCA on July 11th, 2023;
- TRCA approved Floodplain Mapping labeled as "1409-TRCA Floodlines_A1300237", received from TRCA on July 11th, 2023;

1.2 Study Area and Subject Site

The Humber Station Village Area (hereon referred to as Study Area) is bounded by Healey Road to the northwest, Coleraine Drive to the northeast, Mayfield Road to the southeast, and Humber Station Road to the southwest as shown in **Figure 1**. The site is generally characterized by agricultural land and drainage into the West Humber River.

The Study Area mainly consists of agricultural lands, with some estate residential properties and woodlots. The majority of the topography of the subject site slopes in a south and southwesterly direction following the drainage pattern of the West Humber River. Within the subject lands, there are three drainage features. These drainage features are defined in the current HEC-RAS

Model as "Humber Station HDF", "Mid-HDF" and "Clarkway Trib A". These watercourses are further discussed as follows:

- Humber Station HDF: It was defined along the existing drainage feature that starts around Healy Road and drainage to the southwest direction and leaves the subject area via an existing culvert at Humber Station Road. The drainage feature can be classified as HDF. The drainage line is aligned across farmland on which the area is farmed until the edge of the banks. There is no significant riverbank plantation observed in most of the watercourse reaches. It should be noted that there are two wetland features observed along the watercourse around the middle and end of the watercourse reach as depicted in the (Natural Heritage Figure, Prepared by GEI, in Appendix B-3). Humber Station HWF joins the major watercourse defined as "Gore Road Tributary" after crossing Humber Station Road.

- Mid-HDF: It is an HDF draining southward across the farmland. The flow of this feature is generated fully from the subject area. Since the watercourse drainage area is small and has a narrow drainage channel, after discussing with TRCA we concluded that the first 50ha drainage area of the watercourse is not a regulatory floodplain. Hence, in the current analysis, the watercourse was analyzed after the drainage area was nearly higher than 47.38ha (See Node "A" in Figure 2). The watercourse length is approximately 900m, of which the first 340m length (i.e., between Node "A" and "B") is within the subject area and the remaining watercourse reach falls within the proposed Highway 413 corridor. The channel storage volume of the watercourse within the subject area (i.e., between Node "A" and Node "B") was approximated to be 1,750m^3. This will be further discussed in detail in *Section 3.3*.

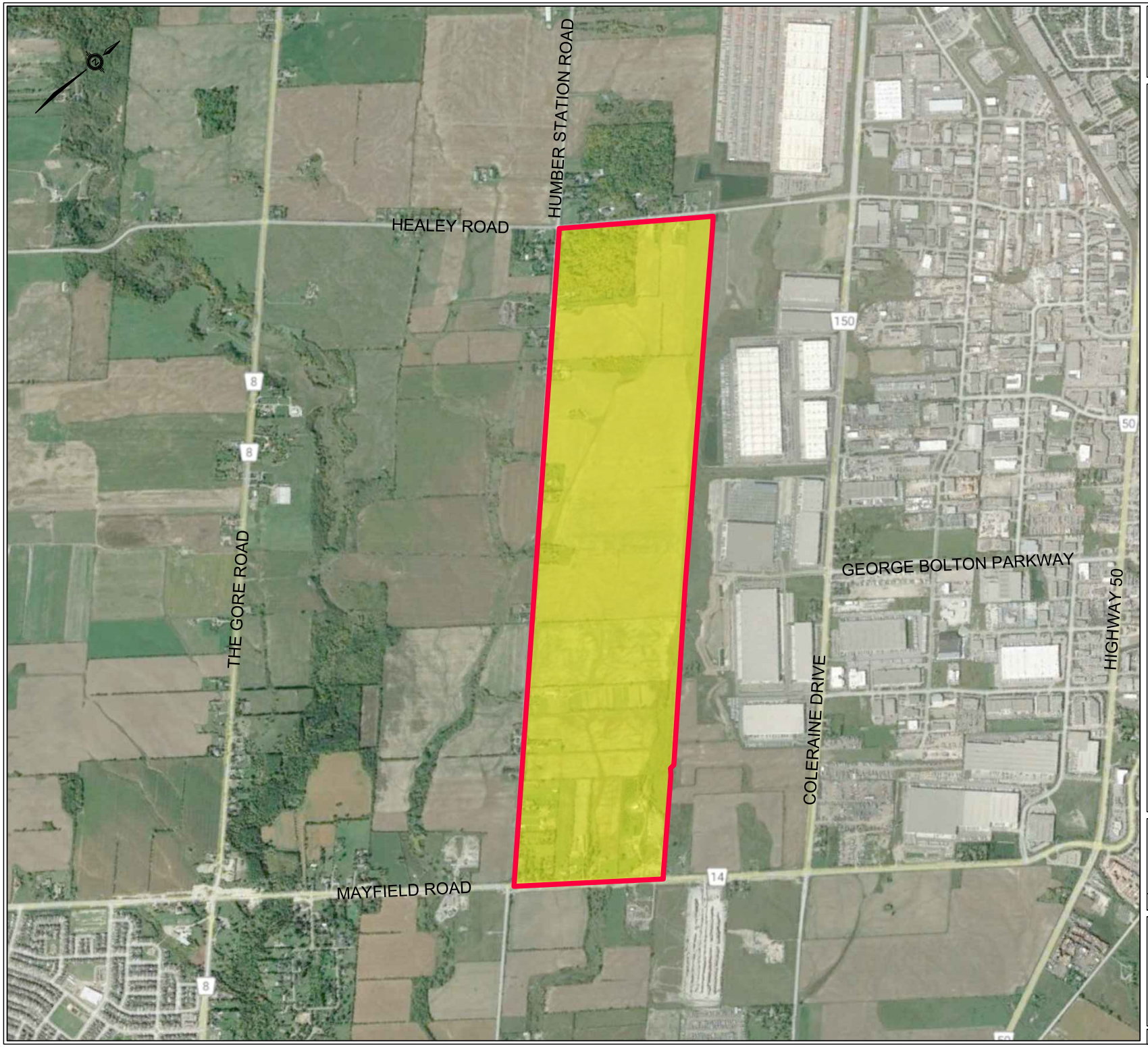
- Clarkway Trib A: is a major watercourse draining in the south direction following the east boundary of the subject area. There is an engineered channel coming from the east direction and connected to this watercourse. It should be noted that the two major

tributaries (i.e., Clarkway and Gore Road Tributaries) drain parallelly for more than 10km downstream of the subject area before the confluent at West Humber River.

1.3 Topographic Surveying

Detailed topographic ground survey along the Humber Station Road of the study area was conducted by R-PE Surveying Ltd. (dated December 17th, 2021). Please refer to **Appendix B-3** for survey information. Topographic information for the areas which are not covered by detailed survey were obtained using aerial topographic data.

In this study, the available detailed topographic field data and aerial topographic data (where the detailed survey was not available) were used to produce a high-resolution Triangulated Irregular Network (TIN) for generating digital terrain layers. Furthermore, major road crossings have been surveyed. Please refer to **Appendix B-3** for the topographic map information.



HUMBER STATION VILLAGES
TOWN OF CALEDON

LEGEND

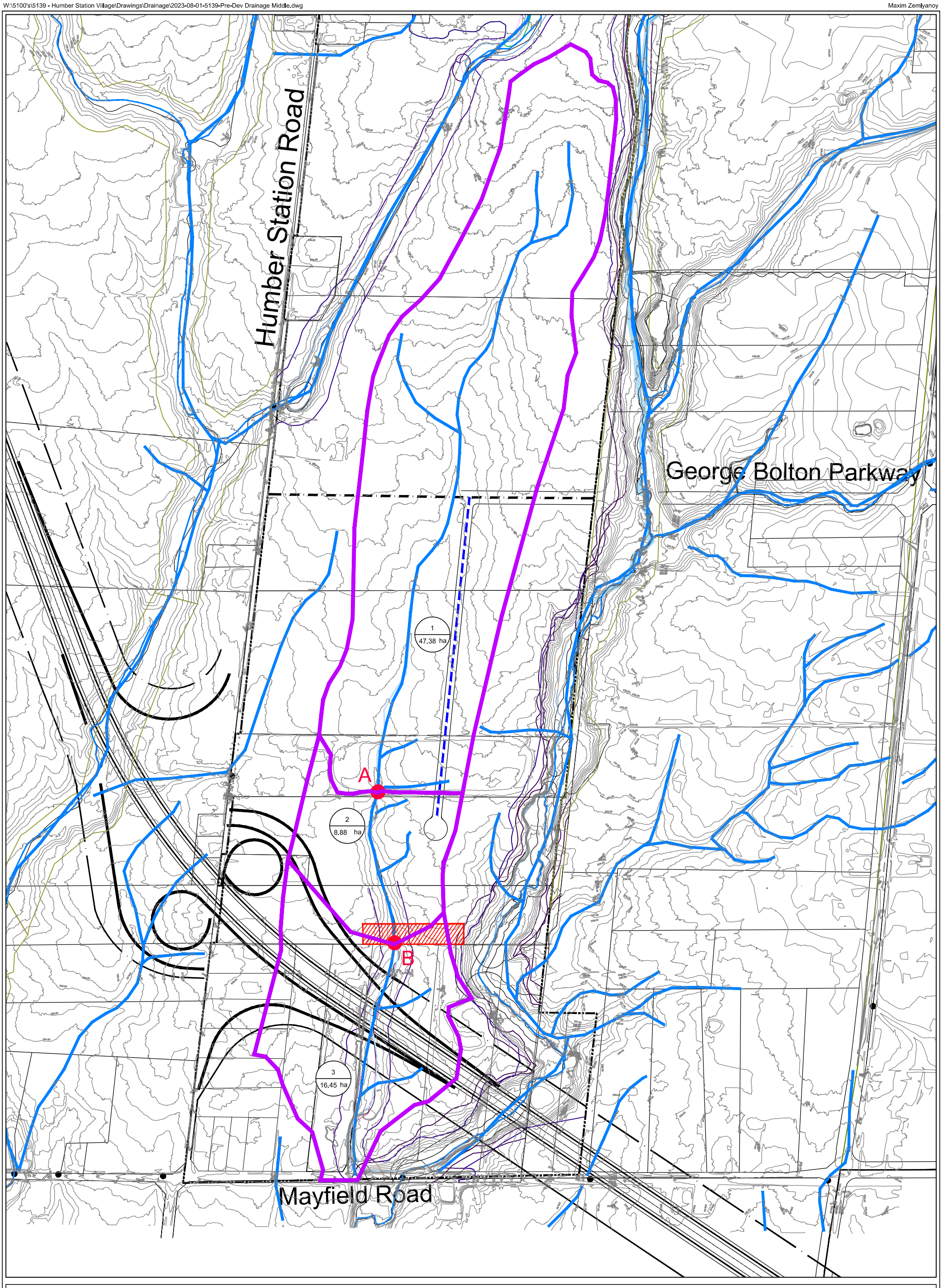
SUBJECT LOCATION

SCHAEFFERS
CONSULTING ENGINEERS
6 Ronrose Drive, Concord, Ontario L4K 4R3
Tel: (905) 738-6100 Email: general@schaeffers.com
www.schaeffers.com

FIGURE 1
LOCATION PLAN

2021-5139	JULY 2023	SCALE: N.T.S.

Maxim Zemlyanoy



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TOWN OF CALEDON

SCHAEFFERS
CONSULTING ENGINEERS
6 Ronrose Drive, Concord, Ontario L4K 4R3
Tel: (905) 738-6100 Email: general@schaeffers.com
www.schaeffers.com

LEGEND

- PRE DEVELOPMENT DRAINAGE BOUNDARY
- 13 / 3.11 ha — TRCA CATCHMENT ID / TRCA AREA IN HECTARES
- NODE
- CREEK ALIGNMENT RE-CONFIGURATION

FIGURE 2

MIDDLE HDF AREA FOR FLOODPLAIN ANALSIS

2021-5139	JULY 2023	SCALE: N.T.S.

2.0 Methodology of HEC-RAS Modelling and Floodplain Analysis

2.1 SCE Modified Existing Conditions HEC-RAS Model

SCE has started the hydraulic (HEC-RAS) modelling using HEC-RAS 6.2 based on the latest TRCA-approved hydraulic model of the subject site. Detailed topographic survey data were reviewed for the subject area. Bank location, watercourse center lines, cross-section geometries, hydraulic structures information, and all related information have been updated based on the detailed topographic survey data. Additional HEC-RAS cross-sections and crossing structures were added to the TRCA model to better reflect existing conditions. Please see **Figure 3** for the location map of existing culverts within and around the subject area.

This condition of the model will be referred to as the "SCE Modified Existing HEC-RAS Model" for the remainder of the report. The following table depicts the major changes made to the original TRCA HEC-RAS model in order to establish the SCE Modified Existing HEC-RAS Model.

Table 2-1: Summary of Modifications Applied to Establish SCE Modified Existing HEC-RAS Model

Drainage Feature	Description	Changes Made	TRCA Original Model	SCE Existing Revised Model
Humber Station	New drainage feature defined	Humber Station HDF defined	N/A	New drainage feature defined as "Humber Station HDF" created in HEC-RAS following the existing drainage feature from Healey Road towards southwest direction.
Humber Station	Culvert	Existing culvert at Humber Station Rd crossing	N/A	Existing Ø 0.76m and 16.5m long PVC pipe culvert located at Humber Station Road crossing was modelled.
Mid-HDF	New drainage feature defined	Mid-HDF drainage feature defined	N/A	New drainage feature defined as "Mid-HDF" created in HEC-RAS following the existing drainage feature around 900m north of Mayfield Road.
Mid-HDF	Culvert	Existing culvert at Mayfield Road	N/A	Existing Ø 0.9m and 31m long CSP culvert located at May Field Road crossing was modelled.

Drainage Feature	Description	Changes Made	TRCA Original Model	SCE Existing Revised Model
Clarkway Trib A	Merge the east tributary engineered channel	The east site (i.e., "Clarkway Trib" HEC-RAS Model) merged to the west (i.e., "Final-West_Humber" HEC-RAS Model	The east "Clarkway Trib" HEC-RAS Model and the west "Final-West_Humber" HEC-RAS Model presented separately.	The east site engineered channel (i.e., "Clarkway Trib" HEC-RAS Model) merged to west (i.e., "Final-West Humber" HEC-RAS Model. Accordingly, HEC-RAS Cross-Section # 1560.977 - # 1515.784 modified to attain the cross-section geometry of the "Clarkway Trib" model.
Clarkway Trib A	Culvert	Existing culvert at Healey Rd	N/A	Existing Ø 1.60m, and 14.0m long CSP Culvert located at Healey Road crossing was modelled.
Clarkway Trib A	Culvert	Existing culvert at Mayfield Rd	N/A	Existing culvert (2.2mx5.5m), and 21.80m long Box Culvert located at May Field Road crossing was modelled.

2.2 Hydraulic Model Development

2.2.1 General Modelling Procedure

The general modelling procedure and development of the hydraulic model can be summarized as follows:

- Determine georeferenced alignment of the reach (NAD83 / UTM zone 17N);
- Generate surface terrain layer based on the elevation data source;
- Determine cross-section locations considering the hydraulic characteristics of the study area and HEC-RAS Hydraulic Reference Manual criteria;
- Generate geo-referenced cross-sections using a digital terrain layer along a watercourse reach;
- Add hydraulic structures data to the model and calculate Ineffective Flow Areas;
- Determine key model parameters (e.g., Loss Coefficients and Manning's 'n' values, Flow

lengths, and Ineffective Flow Areas);

- Add simulated storm flows data to the model;
- Determine boundary conditions for hydraulic modelling;
- Conduct Steady Flow analysis and Water Surface Profile calculation; and
- Generate required floodplains for different storm events.

2.2.2 Hydraulic Modelling

Hydraulic model development in HEC-RAS software includes creating proper HEC-RAS cross-section, modelling crossing structures, properly defining Manning's roughness coefficient, Contraction and Expansion coefficients, and ineffective areas.

In the current hydraulic modelling, HEC-RAS cross-sections are coded left to right looking downstream and alignment of the cross-sections is considered perpendicular to the flow direction and is extended to contain the entire floodplain. Overbank flow lengths were also determined considering Flow Mass centerlines.

Manning's 'n' values at cross-sections for the main channel as well as for the left and the right over banks were coded according to TRCA requirements and HEC-RAS Hydraulic Reference Manual. Manning's 'n' values were selected for various stream reaches through subject area based on TRCA standards. In most of the reaches, Manning's 'n' values of 0.035 and 0.08 were chosen for the channel and overbank flow sections respectively. It should be noted that the Manning's 'n' parameters for the small tributaries of Humber Station HDF and Mid HDF were assumed to be 0.03 and 0.05 for the channel and over bank flows respectively. The parameter was assigned by considering the land cover and channel features. These headwater drainage features mainly drains across a farm land and the banks are not well covered with vegetations.

It should be noted that, in the current model, where changes in river cross-sections are small, and the flow is subcritical (HEC-RAS Hydraulic Reference Manual, Table 3.3), Contraction and Expansion Coefficients were set to 0.1 and 0.3 respectively for gradual transitions. The Contraction and Expansion Coefficients of 0.6 and 0.8 were respectively adopted for the Pipe

and box culvert crossings. According to the HEC-RAS modelling recommendations, upstream and downstream boundary conditions are required at the upstream and downstream ends of all reaches that are not connected to other reaches or storage areas. In the current hydraulic modelling, boundary conditions are set to be consistent with the original TRCA approved hydraulic model. The downstream boundary conditions are assigned at junctions. Upstream boundary conditions for along drainage features are assigned as critical depth.

To define Ineffective Flow Areas at the boundary cross-sections of the culverts, the Contraction reach upstream of the culvert was calculated based on a 1:1 contraction rate and the Expansion reach downstream of the culvert was calculated considering a 1.5:1 expansion rate. The elevation of Ineffective Flow areas at the upstream road crossings was set to the lowest elevation of the high chord of the subject crossings and for the downstream cross-section was set to the average elevation of the obvert of crossing and lowest cord elevation of the road.

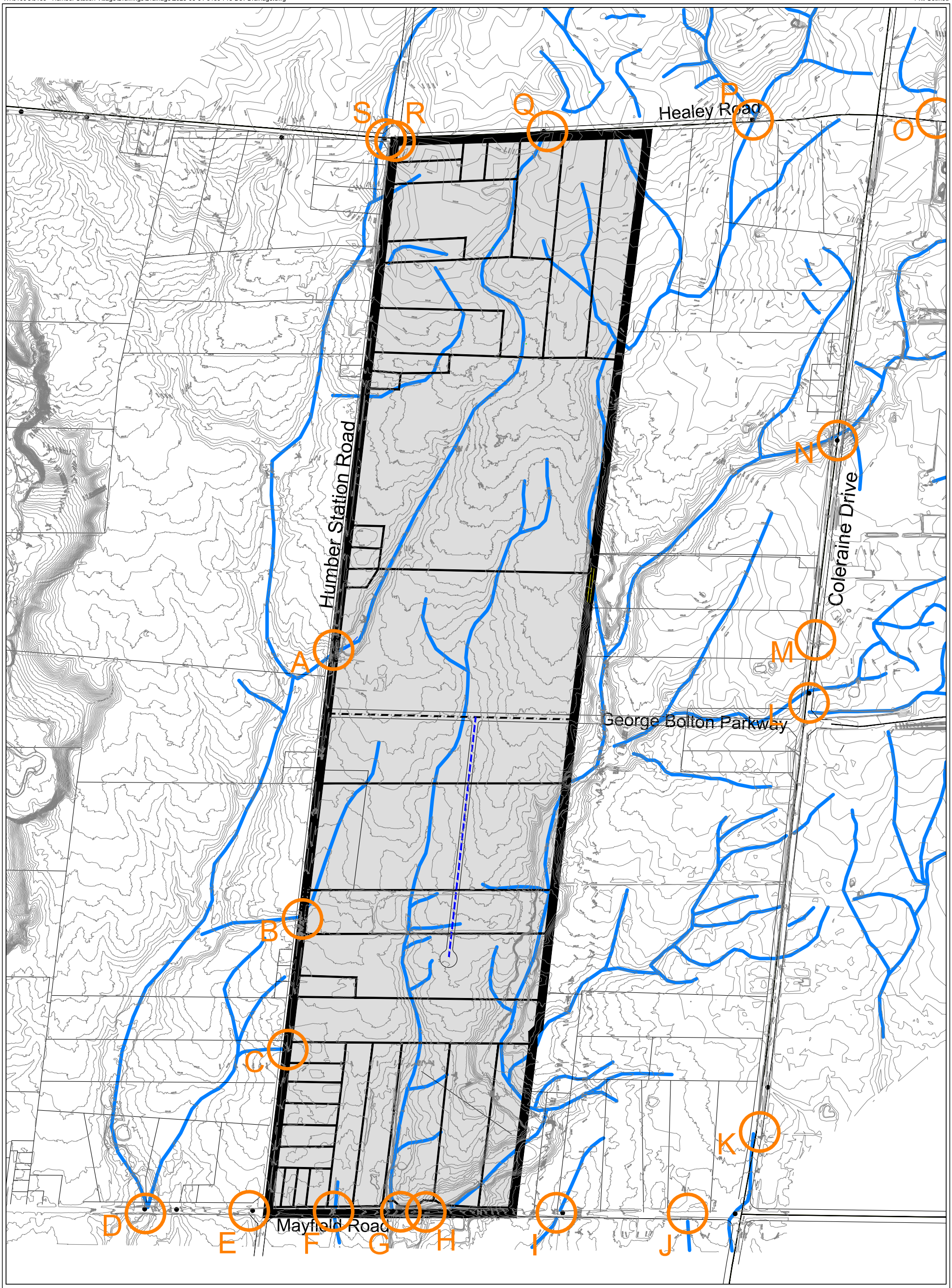
2.2.3 Existing Road Crossings in and Around the Subject Area

There are three existing culverts with in the subject area (i.e., at Humber Station Rd crossing and Mayfield Rd crossings) that are considered in the current HEC-RAS modelling. There are also a couple of more culverts out side of the subject area (i.e., at Coleraine Drive crossings and Mayfield Rd crossings) that are considered in the current modelling. Culvert information was acquired either from the approved Hydraulic Model or from detailed survey.

Please see **Figure 3** for the location of existing culverts with in and around the subject area. It should be noted that “Culvert ID” depicted in the following table was adopted from **Figure 3**. Existing watercourse crossings structures are summarized in **Table 2.2** below.

Table 2-2: Summary of Existing Road Crossing Data

Street Name	Reach	HEC-RAS Cross Section	Type of Culvert	Culvert Dimensions (m)		Invert Elevation (m)		Culv ID*
				Depth x Span	Length	U/S	D/S	
Humber Station Rd	Humber Station HDF	982.58	PVC Pipe	Ø 0.76	16.5	231.16	230.82	A
Mayfield Rd	Mid-HDF	23.4	CSP	Ø 0.90	30.0	221.17	220.36	G
Mayfield Rd	Clarkway Trib A	1514.331	Box	2.2 x 5.5	21.8	219.71	219.72	H
Healey Rd	Clarkway Trib A	1594	CSP	Ø 1.60	14.0	241.48	241.25	P
Coleraine Dr	Reach 2	1027	Box	2.40 x 3.40	19.0	236.65	236.60	N
Side Ditch Coleraine Dr	Reach 2	951	Pipe	3.0	325.91	235.33	234.56	N



HUMBER STATION VILLAGES
TOWN OF CALEDON

SCHAEFFERS
CONSULTING ENGINEERS
6 Ronrose Drive, Concord, Ontario L4K 4R3
Tel: (905) 738-6100 Email: general@schaeffers.com
www.schaeffers.com

LEGEND
SUBJECT LOCATION
EXISTING CULVERT LOCATION

FIGURE 3
EXISTING
CULVERT LOCATION

2021-5139	JULY 2023	SCALE: N.T.S.

2.3 Hydrologic Data

In the current floodplain analysis, peak flows are computed based on the TRCA (December 2018) Virtual OTTHYMO (VO5) Hydrology model as well as flows considered in the TRCA approved Hydraulic Model. For the newly defined watercourses (i.e., for the Humber Station HDF and Mid-HDF), peak flows were computed using the VO5 Model and delivered from TRCA (Please see the email communications in **Appendix B-3**). For the watercourses that were defined in the TRCA approved HEC-RAS Model, the flows mentioned in the Model were directly adopted in the current hydraulic Model. It should be noted that the current floodplain analysis has been prepared to analyze the existing condition floodplain of the subject area. Hence, the existing condition peak flows are considered at this level of the analysis.

Peak flows were determined at required nodes located along the reach for the 2 year to 100 year storms (AES 6hr and AES distributions) and the Regional uncontrolled storm (Hurricane Hazel, Last 12 hours distribution) event. It should be noted that uncontrolled regional and 100 year flows are considered to generate the floodplain maps.

Peak flows were calculated at the outlets of the subcatchments. The subcatchment areas were overlaid on top of the hydraulic model to identify the peak flow nodes for the corresponding HEC-RAS cross-sections. It should be noted that the peak flows calculated for each of the outlets of the catchments were used for the HEC-RAS cross-section corresponding to the top of the respective catchment.

For those subcatchments which have relatively large subcatchment area, the Ministry of Transportation (MTO) flow proration equation was used to estimate peak flows within subcatchment. Please refer to **Appendix B-3** (for the MTO reference document). The following **Table 2-3** depicts the flow proration calculation adopted for the Mid-HDF. It should be noted that the catchment area of the Mid-HDF was defined as catchment ID (43.03) in the Existing condition VO5 Model. The total catchment area at the headwater drainage feature was estimated to be 72.71ha. Please refer to the Hydrology Model presented in the current CEISMP Phase-1

Report submission package. The 2year – 100 year and Regional peakflows corresponding to the total catchment area was computed at chament Node 43.03. These flow has been prorated to Node "A" and Node "B" using the MTO Flow Proration equation. Please refer **Figure 2** for the drainage area breakdown and locations of Node "A" and Node "B". As it was discussed in *Section 1.2*, the Mid-HDF channel upstream of Node "A" was not regulatory floodplain. The total drainage area upto Node "A" was estimated to be 47.38ha. Hence, the regulatory floodplain reach of the Mid-HDF channel starts from Node "A". To be more conservative, the peak flow computed at Node "B" were applied to the HEC-RAS Cross-section located at the most upstream of the channel (i.e., HEC-RAS Cross-Section # 36) and the peakflow computed at the outlet of the channel were applied to HEC-RAS cross-section located around Node "B" (i.e., HEC-RAS Cross-Section # 31). It should be noted that the total drainage area upto Node "B" is 56.26ha (i.e., 47.38ha + 8.88ha = 56.26ha) and the drainage area up to the end of the Mid-HDF channel was estimated to be 72.71ha (i.e., 56.26 + 16.45ha = 72.71ha). **Table 2-4** summarizes peak flows applied to all drainage features considered in the current modelling.

Table 2-3: Peak Flow Proration for the Mid-HDF Channel

Node	Total 43.03*	A**	B**
Catchment Area (ha)	**72.71**	**47.38**	**56.26**
2yr	0.3	0.22	0.25
5yr	0.55	0.40	0.45
10yr	0.74	0.54	0.61
25yr	1	0.73	0.83
50yr	1.21	0.88	1.00
100yr	1.42	1.03	1.17
Regional	5.15	3.74	4.25

*Note: *: 43.03 is the VO5 Node that define the Mid-Headwater Feature in the Existing Hydrology Model.*
***: For the Location of Node"A" and Node "B", please refer to Figure 2*

Table 2-4: Peak Flows Applied for SCE Modified Existing Condition HEC-RAS Modelling

River	Reach	Flow Changing Nod (HEC-RAS Station)	Peak Flows (m^3/s)	
			100 Year	Regional
Humber Station HDF	1	1000	1.65	4.21
		991	2.53	6.45
Mid- HDF	1	36	1.17	4.25
Mid- HDF	1	31	1.42	5.15
Clarkway Trib A	1	1597	30.2	24.21
	1-DS-0	1651	37.88	52.86
		1516.384	37.88	54.06
		1514.912	39.34	65.98
Reach 2	2	1105	11.9	24.36
		661	11.9	25.34
Gore Road Trib	1	1416.721	12.23	31.51
	1-DS-0	1416.041	15.08	40.85
		1414.253	15.53	39.9

3.0 Hydraulic Modelling and Floodplain Analysis Results

Steady State Flow Analysis in HEC-RAS has been completed to perform hydraulic modelling of the subject development under existing conditions. Hydraulic modelling has been completed for the 100-year (AES 6hr and AES 12hr distributions) and Regional (Hurricane Hazel) storm events. The SCE Modified Existing HECRAS model is based on existing flows and existing channel geometry conditions. The complete HEC-RAS outputs have been provided in **Appendix B-1** of this report and are summarized in subsequent sections below.

The water surface elevations for the existing is summarized for each drainage features. Detailed results can be referred to in detailed summary tables provided in **Appendix B-1**. The Existing condition Floodplain Mapping drawings (**Sheet No. Ex-1, Ex-2, ex-3, and Ex-4**) are also provided in **Appendix B-2**. The digital HEC-RAS models are provided in **Appendix B-4**.

3.1 Existing Conditions Hydraulic Analysis of the Drainage Feature

The existing conditions hydraulic analysis results for the drainage features have been summarized in **Table 3.1**. As it is depicted in the summary tables, the regional flows are greater than 100 year flows in most of the reaches and therefore the Regional Storm is the regulatory event.

Table 3-1: Existing Condition Hydraulic Analysis Results Summary Table

River	Reach	River Sta	Min Ch El (m)	W.S. Elev, (m)		
				100 Yr	Regional	Regulatory
Humber Station HDF	1	1000	242.5	242.74	242.87	242.87
Humber Station HDF	1	999	241.91	242.22	242.35	242.35
Humber Station HDF	1	998	241.84	241.98	242.08	242.08
Humber Station HDF	1	997	240.98	241.5	241.69	241.69
Humber Station HDF	1	996.5	240.96	241.25	241.38	241.38
Humber Station HDF	1	996	240.55	240.86	241	241
Humber Station HDF	1	995	240.22	240.57	240.73	240.73
Humber Station HDF	1	994	239.74	239.95	240.1	240.1
Humber Station HDF	1	993	238.93	239.09	239.17	239.17
Humber Station HDF	1	992	238.3	238.46	238.56	238.56

River	Reach	River Sta	Min Ch El (m)	W.S. Elev, (m)		
				100 Yr	Regional	Regulatory
Humber Station HDF	1	991	237.47	237.67	237.79	237.79
Humber Station HDF	1	990	236.49	236.61	236.69	236.69
Humber Station HDF	1	989	235.25	235.63	235.76	235.76
Humber Station HDF	1	988	234.23	234.48	234.62	234.62
Humber Station HDF	1	987	232.48	233.14	233.49	233.49
Humber Station HDF	1	986	231.9	233.14	233.49	233.49
Humber Station HDF	1	985	231.75	233.14	233.49	233.49
Humber Station HDF	1	984	232.04	233.07	233.16	233.16
Humber Station HDF	1	983	231.48	233.08	233.2	233.2
Humber Station HDF	1	982.58	(Existing Culvert @ Humber Station Rd)			
Humber Station HDF	1	982	231.06	231.61	232.01	232.01
Humber Station HDF	1	981	231.01	231.26	231.39	231.39
Humber Station HDF	1	980	230.22	230.35	230.44	230.44
Mid-HDF	1	36	229.5	229.62	229.78	229.78
Mid-HDF	1	35	228.5	228.68	228.85	228.85
Mid-HDF	1	34	228.24	228.45	228.62	228.62
Mid-HDF	1	33	227.98	228.08	228.2	228.2
Mid-HDF	1	32	227.25	227.51	227.69	227.69
Mid-HDF	1	31	226.96	227.09	227.22	227.22
Mid-HDF	1	30	226.13	226.33	226.46	226.46
Mid-HDF	1	29	225.72	225.84	225.97	225.97
Mid-HDF	1	28	224.75	225.03	225.18	225.18
Mid-HDF	1	27	224.49	224.67	224.87	224.87
Mid-HDF	1	26	224.16	224.31	224.37	224.37
Mid-HDF	1	25	223	223.28	224.3	224.3
Mid-HDF	1	24	221.76	222.64	224.31	224.31
Mid-HDF	1	23.6	221.2	222.64	224.31	224.31
Mid-HDF	1	23.3	(Existing Culvert @ Mayfield Rd)			
Mid-HDF	1	23	220.91	221.63	222.17	222.17
Mid-HDF	1	22	220.99	221.64	222.19	222.19
Clarkway Trib A	Reach1	1597	241.79	243.74	243.7	243.74
Clarkway Trib A	Reach1	1594	(Existing Culvert @ Healey Rd)			
Clarkway Trib A	Reach1	1591	241.48	243.19	243.19	243.19
Clarkway Trib A	Reach1	1583	241.24	242.73	242.66	242.66
Clarkway Trib A	Reach1	1561.698	241.38	242.17	242.12	242.12
Clarkway Trib A	Reach1	1561.551	240.81	241.65	241.58	241.58

River	Reach	River Sta	Min Ch El (m)	W.S. Elev, (m)		
				100 Yr	Regional	Regulatory
Clarkway Trib A	Reach1	1561.404	239.94	241.15	241.08	241.08
Clarkway Trib A	Reach1	1561.256	239.1	240.35	240.25	240.25
Clarkway Trib A	Reach1	1561.12	238.71	239.8	239.71	239.71
Clarkway Trib A	Reach1	1560.977	238.59	239.24	239.17	239.17
Clarkway Trib A	Reach1	1560.88	238.14	238.79	238.73	238.73
Clarkway Trib A	Reach1	1560.685	236.75	237.36	237.31	237.31
Clarkway Trib A	Reach1	1560.6	236.68	237.12	237.01	237.01
Clarkway Trib A	Reach1	1560.57	236.22	236.81	236.71	236.71
Clarkway Trib A	Reach1	1560.5	235.35	236.21	236.12	236.12
Clarkway Trib A	Reach1	1519.898	234.63	235.42	235.29	235.29
Clarkway Trib A	Reach1	1430.348	233.99	234.86	234.92	234.92
Clarkway Trib A	Reach1-DS-0	1651	233.37	234.33	234.52	234.52
Clarkway Trib A	Reach1-DS-0	1580	232.34	233.96	234.14	234.14
Clarkway Trib A	Reach1-DS-0	1573	232.16	233.3	233.46	233.46
Clarkway Trib A	Reach1-DS-0	1534	230.44	232.04	232.28	232.28
Clarkway Trib A	Reach1-DS-0	1528	229.7	231.82	232.01	232.01
Clarkway Trib A	Reach1-DS-0	1516.384	230.28	231.64	231.85	231.85
Clarkway Trib A	Reach1-DS-0	1516.214	229.35	230.83	231.05	231.05
Clarkway Trib A	Reach1-DS-0	1516.156	229.11	230.65	230.88	230.88
Clarkway Trib A	Reach1-DS-0	1516.103	228.87	230.44	230.66	230.66
Clarkway Trib A	Reach1-DS-0	1515.984	228.6	230.04	230.25	230.25
Clarkway Trib A	Reach1-DS-0	1515.784	227.73	229.19	229.41	229.41
Clarkway Trib A	Reach1-DS-0	1515.584	226.41	228.48	228.67	228.67
Clarkway Trib A	Reach1-DS-0	1515.386	226.38	227.06	227.25	227.25
Clarkway Trib A	Reach1-DS-0	1515.185	224.64	226.44	226.66	226.66
Clarkway Trib A	Reach1-DS-0	1515.084	224.37	226.32	226.52	226.52
Clarkway Trib A	Reach1-DS-0	1514.985	224.01	225.74	226.07	226.07
Clarkway Trib A	Reach1-DS-0	1514.912	224.1	225.29	225.52	225.52
Clarkway Trib A	Reach1-DS-0	1514.788	223.95	224.5	224.87	224.87
Clarkway Trib A	Reach1-DS-0	1514.658	222.72	224.1	224.68	224.68
Clarkway Trib A	Reach1-DS-0	1514.585	221.73	224.03	224.64	224.64
Clarkway Trib A	Reach1-DS-0	1514.506	221.43	223.49	223.87	223.87
Clarkway Trib A	Reach1-DS-0	1514.414	220.83	223.32	223.81	223.81
Clarkway Trib A	Reach1-DS-0	1514.353	220.8	223.27	223.76	223.76
Clarkway Trib A	Reach1-DS-0	1514.345	220.68	223.27	223.76	223.76
Clarkway Trib A	Reach1-DS-0	1514.331	(Existing Culvert @ Healey Rd)			

River	Reach	River Sta	Min Ch El (m)	W.S. Elev, (m)		
				100 Yr	Regional	Regulatory
Clarkway Trib A	Reach1-DS-0	1514.312	220.59	222.54	223	223
Clarkway Trib A	Reach1-DS-0	1514.306	220.5	222.1	222.53	222.53
Clarkway Trib A	Reach1-DS-0	1514.247	220.38	221.95	222.44	222.44
Reach 2	Reach 2	1105	237.49	238.77	239.66	239.66
Reach 2	Reach 2	1068	237.41	238.41	239.64	239.64
Reach 2	Reach 2	1054	236.65	238.45	239.64	239.64
Reach 2	Reach 2	1027	(Existing Culvert @ Coleraine Rd)			
Reach 2	Reach 2	1018	236.6	237.62	238.83	238.83
Reach 2	Reach 2	1008	235.58	237.42	238.86	238.86
Reach 2	Reach 2	1005	235.57	237.43	238.85	238.85
Reach 2	Reach 2	999	235.55	237.21	238.59	238.59
Reach 2	Reach 2	951	(Existing Culvert @ Coleraine Rd)			
Reach 2	Reach 2	666	234.65	235.87	236.59	236.59
Reach 2	Reach 2	661	234.62	235.85	236.32	236.32
Reach 2	Reach 2	656	234.66	235.84	236.31	236.31
Reach 2	Reach 2	604	234.65	235.78	236.24	236.24
Reach 2	Reach 2	498	234.51	235.61	236.07	236.07
Reach 2	Reach 2	388	234.38	235.43	235.88	235.88
Reach 2	Reach 2	307	234.11	235.3	235.73	235.73
Reach 2	Reach 2	213	233.98	235.14	235.51	235.51
Reach 2	Reach 2	172	234.11	234.95	235.31	235.31
Reach 2	Reach 2	117	233.8	234.85	235.19	235.19
Reach 2	Reach 2	85	233.83	234.76	235.06	235.06
Reach 2	Reach 2	63	233.87	234.49	234.73	234.73
Reach 2	Reach 2	45	233.72	234.35	234.53	234.53
Gore Road Trib	Reach2	1450.572	237.54	238.25	238.48	238.48
Gore Road Trib	Reach2	1450.428	235.83	236.46	236.82	236.82
Gore Road Trib	Reach2	1450.284	234.78	235.2	235.41	235.41
Gore Road Trib	Reach2	1450.168	233.73	234.16	234.36	234.36
Gore Road Trib	Reach2	1450	233.28	233.81	234.14	234.14
Gore Road Trib	Reach1	1416.798	232.98	233.56	233.91	233.91
Gore Road Trib	Reach1	1416.721	232.59	233.12	233.49	233.49
Gore Road Trib	Reach1	1416.598	231.99	232.58	232.88	232.88
Gore Road Trib	Reach1	1416.398	230.73	231.42	231.81	231.81
Gore Road Trib	Reach1	1416.261	229.56	230.54	230.78	230.78
Gore Road Trib	Reach1	1416.193	229.05	229.94	230.3	230.3

River	Reach	River Sta	Min Ch El (m)	W.S. Elev, (m)		
				100 Yr	Regional	Regulatory
Gore Road Trib	Reach1-DS-0	1416.041	228.39	229.16	229.49	229.49
Gore Road Trib	Reach1-DS-0	1415.982	228.33	228.79	229.02	229.02
Gore Road Trib	Reach1-DS-0	1415.904	227.4	228.2	228.58	228.58
Gore Road Trib	Reach1-DS-0	1415.793	226.47	227.7	228.11	228.11
Gore Road Trib	Reach1-DS-0	1415.72	226.47	227.41	227.79	227.79
Gore Road Trib	Reach1-DS-0	1415.59	225.93	226.9	227.27	227.27
Gore Road Trib	Reach1-DS-0	1415.515	225.78	226.43	226.71	226.71
Gore Road Trib	Reach1-DS-0	1415.353	225.06	225.73	226.08	226.08
Gore Road Trib	Reach1-DS-0	1415.201	224.34	225.12	225.48	225.48
Gore Road Trib	Reach1-DS-0	1415.055	223.77	224.36	224.66	224.66
Gore Road Trib	Reach1-DS-0	1414.792	222.48	223.24	223.55	223.55
Gore Road Trib	Reach1-DS-0	1414.601	221.55	222.37	222.9	222.9
Gore Road Trib	Reach1-DS-0	1414.401	220.38	221.9	222.59	222.59
Gore Road Trib	Reach1-DS-0	1414.292	220.38	221.9	222.58	222.58
Gore Road Trib	Reach1-DS-0	1414.284	220.38	221.84	222.58	222.58
Gore Road Trib	Reach1-DS-0	1414.268	(Existing Culvert @ Mayfield Rd)			
Gore Road Trib	Reach1-DS-0	1414.253	220.41	221.2	221.65	221.65
Gore Road Trib	Reach1-DS-0	1414.247	220.32	221.19	221.55	221.55
Gore Road Trib	Reach1-DS-0	1414.191	219.93	220.93	221.31	221.31

3.2 Comparison of the TRCA Original Model and SCE Existing Condition Hydraulic Analysis Results.

As it was mentioned in the previous sections, SCE has received two separate hydraulic models from TRCA (i.e., for the west tributary and for the east tributaries). The east tributary one represents the channel realignment works. SCE has combined the two models and established one combined HEC-RAS Model. It should be noted that for the engineered channel areas, SCE adopted both culvert and HEC-RAS cross-section geometries as defined in the original TRCA approved HEC-RAS model. SCE has adopted HEC-RAS geometry data as it was defined in the TRCA approved model because it was already approved model and there is limitation of grading information data for the proposed realigned channel.

The SCE revised Existing HEC-RAS model and the Original TRCA approved Model Hydraulic Analysis Results are computed separately and result comparison was performed. Detailed comparison table is presented in **Appendix B-1**. It should be noted that the comparison table was prepared only for "Clarkway Trib A", "Reach 2", and "Gore Road Trib" watercourse. The "Humber Station HDF" and "Mid-HDF" were defined only in the SCE Existing Condition model; hence, these drainage features were not considered in the comparison table.

The results in the comparison table depicts that there are no variations in channel bed level and water surface elevations in most of the channel routes. However, there is minor as well as some significant difference observed on the channel bed level over the Clarkway Tributary. The waterlevel difference seems reasonable. Moreover, the regulatory floodlevel is within the valley in both the original TRCA model and the SCE revised Model results.

The cause of the difference on channel bed level was resulted in the realignment process. It should be noted that the original TRCA model was not geo referenced. It was done in a HEC-RAS model which is not georeferenced. The only reference were the HEC-RAS locations over the floodplain mapping. Hence, when we try to georeferenced those cross-sections, some of them may not overlayed properly. However, the overall flood level computed was found in a reasonable range.

3.3 Mid-Headwater Feature (HDF) Analysis

As it was mentioned previously, the last 900m length of the drainage feature was found regulatory floodplain. Hence, detailed hydraulic analysis was performed for this portion of the reach. It should be noted that, out of the total 900m lenth of the Mid-HDF, only the first 340m length of the drainage feature falls with in the subject area (i.e, between Node "A" and Node "B") in the **Figure 2**. This portion of the HDF was found between HEC-RAS Cross-Section # 36 and #31 in the Floodplain mapping (See **Appendix B-2**).

The channel storage volume between HEC-RAS Cross-Section # 36 and #31 was computed using HEC-RAS Model. Accordingly, the regional storm channel storage between Station #31

and #36 was estimated to be 1,750m^3. Please see the total channel storage volume in the HEC-RAS results summary table in **Appendix B-1**.

Table 3-2: Summary of Volume Calculation for the Mid-HDF Channel with in the Subject Area

River Sta	Profile	Q Total (m^3/s)	Min Ch El (m)	W.S. Elev (m)	Flood Storage Volume ($1000m^3$) Cumulative*	Flood Storage Volume ($1000m^3$) Between Station #36 and #31**	Incremental Storage Volume Between Successive Storm Events ($1000m^3$) Profile	Incremental Volume
36	2-year	0.25	229.5	229.55	0.63			
36	5-year	0.45	229.5	229.57	1.04			
36	10-year	0.61	229.5	229.58	1.69			
36	25-year	0.83	229.5	229.61	2.22			
36	50-year	1	229.5	229.61	2.78			
36	100-year	1.17	229.5	229.62	3.71			
36	Regional	4.25	229.5	229.78	12.39			
31	2-year	0.3	226.96	227.01	0.42	0.21	2-Yr	0.21
31	5-year	0.55	226.96	227.03	0.71	0.33	2Yr - 5Yr	0.12
31	10-year	0.74	226.96	227.04	1.28	0.41	5Yr -10Yr	0.08
31	25-year	1	226.96	227.05	1.7	0.52	10Yr - 25Yr	0.11
31	50-year	1.21	226.96	227.06	2.21	0.57	25Yr - 50Yr	0.05
31	100-year	1.42	226.96	227.09	3.06	0.65	50Yr - 100Yr	0.08
31	Regional	5.15	226.96	227.22	10.64	1.75	100Yr - Regional	1.1

*Note: * Total Commulative Channel Storage Volume starting from the downstream end of the watercourse to the to the specified Station # 36 and #31. Please refer to HEC-RAS analysis results presented in Appendix B-1.*
*** Storage volume between Station #36 and #31. For example, channel storage volume corresponding to the regional flow = (Cumulative Volume @ Station #36(i.e.,12.39*1000) – (Volume @ Station # 31(i.,e., 10.64*1000) = 1.75*1000m^3).*

4.0 Summary and Conclusion

This report presents hydraulic modelling, calculated water surface elevations, and associated flood lines with the existing condition flows along the drainage features in the Humber Station Village area in the City of Caledon. The results of the floodplain analysis can be summarized as;

- The Study Area falls under the jurisdiction of the TRCA and hydraulic modelling was performed using HEC-RAS software;
- In this study, the available detailed topographic field data and aerial topographic data (where the detailed survey was not available) were used to produce a high-resolution Triangulated Irregular Network (TIN) for generating digital terrain layers;
- Peak flows adopted as shown in the TRCA approved HEC-RAS Models. The peak flows computed for 100 year and regional storm events were used to delineate flood lines;
- SCE Combined two TRCA approved HEC-RAS approved models and created one combined SCE existing HEC-RAS Model. Since the Original TRCA Model was not georeferenced, in the process of georeferencing the original TRCA Model, there was some channel bed level variations from the original model. However, the overall water level result was reasonably defined;

We trust that you will find this analysis satisfactory. If you have any questions or comments concerning hydraulic analysis, please do not hesitate to contact us.

Respectfully Submitted,

SCHAEFFER & ASSOCIATES LTD.



Debebe Yilak, M.Sc., P.Eng.,
Water Resources Engineer

APPENDICES

APPENDIX A

HYDRAULIC ANALYSIS RESULTS

APPENDIX A-1

TRCA – ORIGINAL MODEL RESULTS

(EAST TRIBUTARIES)

HEC-RAS Plan: Plan 01 Locations: User Defined Profile: REGIONAL

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Vel Left	Vel Right	Vel Total	Volume
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)	(m/s)	(m/s)	(1000 m3)
West Humber	Reach 9_2	13843	REGIONAL	24.21	247.70	248.60	248.44	248.66	0.021089	2.53	24.19	60.90	0.91	0.99	0.95	1.00	72.42
West Humber	Reach 9_2	13667	REGIONAL	24.21	244.70	246.36		246.41	0.007793	2.42	31.68	59.01	0.62	0.69	0.77	0.76	67.19
West Humber	Reach 9_2	13448	REGIONAL	24.21	242.70	244.15	243.97	244.27	0.019683	3.47	19.64	36.28	0.96	1.21	1.04	1.23	62.56
West Humber	Reach 9_2	13318	REGIONAL	24.21	241.50	244.06	243.65	244.06	0.000277	0.62	122.35	142.27	0.13	0.20	0.18	0.20	51.84
West Humber	Reach 9_2	13302		Culvert													
West Humber	Reach 9_2	13285	REGIONAL	24.21	241.47	242.72	242.68	242.86	0.020351	3.22	21.10	48.21	0.94	1.01	0.99	1.15	51.40
West Humber	Reach 9_2	13207	REGIONAL	24.21	240.70	241.83		241.86	0.007607	1.81	36.19	77.56	0.57	0.64	0.67	0.67	49.04
West Humber	Reach 9_2	12805	REGIONAL	24.21	238.70	240.19		240.21	0.003280	1.45	51.80	104.07	0.40	0.49	0.39	0.47	34.00
West Humber	Reach 9_2	12487	REGIONAL	24.21	237.70	238.82	238.51	238.84	0.005517	1.52	46.31	112.42	0.49	0.51	0.51	0.52	17.77
West Humber	Reach 9_2	12315	REGIONAL	24.21	236.78	237.38	237.38	237.53	0.009797	1.87	23.34	107.35	0.81	0.43	0.34	1.04	11.38
West Humber	Reach 9_2	12132	REGIONAL	24.21	235.14	235.98	235.80	236.10	0.004605	1.59	19.12	35.16	0.59	0.41	0.36	1.27	7.67
West Humber	Reach 9_2	11990	REGIONAL	24.21	234.13	235.19		235.35	0.005963	2.14	21.69	41.86	0.70	0.52	0.55	1.12	4.74
West Humber	Clarkway Trib 2	11848	REGIONAL	52.86	233.41	234.52		234.64	0.005098	2.05	50.67	71.14	0.65	0.73	0.60	1.04	84.84
West Humber	Clarkway Trib 2	11732	REGIONAL	52.86	231.93	233.33	233.33	233.70	0.016301	4.04	30.24	39.46	1.16	1.36	0.93	1.75	80.48
West Humber	Clarkway Trib 2	11577	REGIONAL	52.86	230.53	232.35	231.53	232.37	0.000989	1.29	116.09	109.05	0.31	0.39	0.41	0.46	71.05
West Humber	Clarkway Trib 2	11559	REGIONAL	52.86	230.37	232.12		232.32	0.005693	3.01	42.42	41.18	0.74	0.84	0.98	1.25	69.63
West Humber	Clarkway Trib 2	11455	REGIONAL	54.06	230.03	231.33		231.55	0.010099	3.05	39.46	50.59	0.93	0.98	1.04	1.37	65.43
West Humber	Clarkway Trib 2	11313	REGIONAL	54.06	228.92	230.36		230.55	0.005976	2.54	53.47	104.55	0.72	0.48	0.72	1.01	59.61
West Humber	Clarkway Trib 2	11133	REGIONAL	54.06	228.45	229.78		229.88	0.002369	1.61	54.09	64.54	0.46	0.54	0.32	1.00	49.83
West Humber	Clarkway Trib 2	10878	REGIONAL	54.06	227.70	229.02		229.05	0.004660	1.95	71.55	89.74	0.57	0.77	0.67	0.76	34.14
West Humber	Clarkway Trib 2	10743	REGIONAL	54.06	225.70	227.91		228.07	0.008448	3.80	43.79	45.03	0.84	1.13	1.06	1.23	25.03
West Humber	Clarkway Trib 2	10673	REGIONAL	54.06	225.70	227.65		227.69	0.003516	2.24	65.29	58.79	0.53	0.81	0.77	0.83	21.45
West Humber	Clarkway Trib 2	10565	REGIONAL	65.98	225.70	227.23		227.27	0.003871	1.98	76.39	67.70	0.53	0.85	0.65	0.86	13.43
West Humber	Clarkway Trib 2	10515	REGIONAL	65.98	224.80	227.02		227.09	0.004149	2.87	74.74	71.63	0.63	0.88	0.76	0.88	9.99
West Humber	Clarkway Trib 2	10392	REGIONAL	65.98	224.70	226.64	226.01	226.67	0.002849	2.01	92.43	87.48	0.48	0.69	0.68	0.71	
North Channel	9b	1069	REGIONAL	24.36	237.70	239.80	238.61	239.80	0.000310	0.57	108.04	107.65	0.13	0.20	0.24	0.23	30.86
North Channel	9b	1005	REGIONAL	24.36	236.65	239.24	238.39	239.63	0.002634	2.77	8.81	86.42	0.55			2.77	23.02
North Channel	9b	0980		Culvert													
North Channel	9b	975	REGIONAL	24.36	236.60	238.59	238.34	239.25	0.003264	3.60	6.77	3.40	0.81			3.60	22.88
North Channel	9b	970	REGIONAL	24.36	235.58	238.85	237.32	239.14	0.001737	2.39	10.20		0.42			2.39	22.88
North Channel	9b	850	REGIONAL	24.36	235.57	238.75	237.46	239.12	0.002419	2.71	9.00		0.48			2.71	22.82
North Channel	9b	825	REGIONAL	24.36	235.55	238.73	237.44	239.11	0.002420	2.71	9.00		0.48			2.71	22.77
North Channel	9b	750		Culvert													
North Channel	9b	700	REGIONAL	24.36	234.56	236.44	236.44	237.39	0.009773	4.31	5.65	26.83	1.00			4.31	20.67
North Channel	9b	690	REGIONAL	25.34	234.56	236.41	235.65	236.47	0.001686	1.63	33.80	27.09	0.40	0.57	0.57	0.75	20.45
North Channel	9b	650	REGIONAL	25.34	234.46	236.28		236.35	0.001787	1.67	33.12	26.93	0.41	0.58	0.58	0.77	18.08
North Channel	9b	550	REGIONAL	25.34	234.29	236.10		236.17	0.001838	1.68	32.80	26.86	0.42	0.58	0.58	0.77	14.79
North Channel	9b	450	REGIONAL	25.34	234.12	235.91		235.98	0.001925	1.71	32.26	26.74	0.42	0.59	0.59	0.79	11.54
North Channel	9b	400	REGIONAL	25.34	233.99	235.76		235.83	0.002018	1.73	31.74	26.62	0.43	0.60	0.60	0.80	9.14
North Channel	9b	350	REGIONAL	25.34	233.86	235.60		235.67	0.002197	1.78	30.80	26.41	0.45	0.62	0.62	0.82	6.75
North Channel	9b	300	REGIONAL	25.34	233.78	235.47		235.55	0.002435	1.84	29.71	26.16	0.47	0.64	0.64	0.85	5.24
North Channel	9b	250	REGIONAL	25.34	233.69	235.34		235.42	0.002745	1.92	28.49	25.88	0.50	0.66	0.66	0.89	3.78
North Channel	9b	200	REGIONAL	25.34	233.61	235.16		235.27	0.003528	2.08	26.10	25.32	0.56	0.72	0.72	0.97	2.42
North Channel	9b	150	REGIONAL	25.34	233.52	234.69	234.61	234.95	0.012695	3.19	16.72	22.99	1.01	1.08	1.08	1.52	1.35

APPENDIX A-2

TRCA – ORIGINAL MODEL RESULTS

(WEST TRIBUTARIES)

HEC-RAS Plan: Default Scenario Locations: User Defined Profile: Regional

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Gore Road Trib	Reach2	1450.572 41.08-05	Regional	10.74	237.54	238.48	238.48	238.73	0.015495	2.22	4.87	10.47	1.00
Gore Road Trib	Reach2	1450.428 41.08-04	Regional	10.74	235.83	236.82	236.82	236.99	0.007948	2.02	9.50	33.15	0.76
Gore Road Trib	Reach2	1450.284 41.08-03	Regional	10.74	234.78	235.41		235.45	0.006546	1.22	16.76	48.69	0.50
Gore Road Trib	Reach2	1450.168 41.08-02	Regional	10.74	233.73	234.36	234.36	234.49	0.010563	1.99	12.38	47.31	0.85
Gore Road Trib	Reach2	1450.000 41.08-01	Regional	10.74	233.28	234.14		234.14	0.000246	0.38	64.96	98.45	0.14
Gore Road Trib	Reach1	1416.798 41.07-06	Regional	31.51	232.98	233.91		233.95	0.007724	0.96	35.37	56.49	0.33
Gore Road Trib	Reach1	1416.721 41.07-05	Regional	31.51	232.59	233.49		233.52	0.004238	0.74	43.05	51.62	0.25
Gore Road Trib	Reach1	1416.598 41.07-04	Regional	31.51	231.99	232.88		232.93	0.005703	1.93	43.82	74.13	0.67
Gore Road Trib	Reach1	1416.398 41.07-03	Regional	31.51	230.73	231.81		231.85	0.005109	0.90	38.26	56.28	0.29
Gore Road Trib	Reach1	1416.261 41.07-02	Regional	31.51	229.56	230.78		230.91	0.009631	2.47	32.94	68.95	0.85
Gore Road Trib	Reach1	1416.193 41.07-01	Regional	31.51	229.05	230.30		230.33	0.006801	1.09	44.84	90.19	0.33
Gore Road Trib	Reach1	1416.041 41.06-16	Regional	40.85	228.39	229.49		229.60	0.003878	1.69	39.64	62.06	0.56
Gore Road Trib	Reach1	1415.982 41.06-15	Regional	40.85	228.33	229.02		229.12	0.024935	1.48	29.85	66.74	0.59
Gore Road Trib	Reach1	1415.904 41.06-14	Regional	40.85	227.40	228.58		228.64	0.002642	1.44	41.99	67.10	0.46
Gore Road Trib	Reach1	1415.793 41.06-13	Regional	40.85	226.47	228.11	227.87	228.23	0.005317	2.23	42.04	61.60	0.66
Gore Road Trib	Reach1	1415.720 41.06-12	Regional	40.85	226.47	227.79		227.87	0.004384	2.07	52.93	78.81	0.61
Gore Road Trib	Reach1	1415.590 41.06-11	Regional	40.85	225.93	227.27		227.29	0.004121	0.88	65.42	99.36	0.26
Gore Road Trib	Reach1	1415.515 41.06-10	Regional	40.85	225.78	226.71		226.84	0.008798	2.30	39.09	72.86	0.82
Gore Road Trib	Reach1	1415.353 41.06-09	Regional	40.85	225.06	226.08		226.10	0.002606	0.58	71.17	111.60	0.20
Gore Road Trib	Reach1	1415.201 41.06-08	Regional	40.85	224.34	225.48		225.53	0.005014	2.02	51.73	73.34	0.64
Gore Road Trib	Reach1	1415.055 41.06-07	Regional	40.85	223.77	224.66		224.69	0.006808	0.93	54.69	101.84	0.32
Gore Road Trib	Reach1	1414.792 41.06-06	Regional	40.85	222.48	223.55		223.58	0.006198	0.93	54.10	81.22	0.31
Gore Road Trib	Reach1	1414.601 41.06-05	Regional	40.85	221.55	222.90		222.98	0.002258	1.57	51.08	61.50	0.45
Gore Road Trib	Reach1	1414.401 41.06-04	Regional	40.85	220.38	222.59		222.66	0.001237	1.47	61.46	74.84	0.35
Gore Road Trib	Reach1	1414.292 41.06-03	Regional	40.85	220.38	222.58	221.46	222.59	0.000225	0.69	151.21	123.11	0.15
Gore Road Trib	Reach1	1414.284 41.06-02	Regional	40.85	220.38	222.58	221.65	222.59	0.000208	0.67	151.62	132.40	0.15
Gore Road Trib	Reach1	1414.268 x-124 (41.06-01)		Culvert									
Gore Road Trib	Reach1	1414.253 41.05-13	Regional	39.90	220.41	221.65	221.65	222.10	0.011501	3.21	16.47	88.84	0.98
Gore Road Trib	Reach1	1414.247 41.05-12	Regional	39.90	220.32	221.55		221.57	0.002518	0.62	75.54	98.29	0.20
Gore Road Trib	Reach1	1414.191 41.05-11	Regional	39.90	219.93	221.31		221.42	0.005758	2.43	44.54	65.48	0.71

APPENDIX A-3

SCE REVISED EXISTING CONDITION HEC-RAS MODEL RESULTS

HEC-RAS Plan: SCE Existing Revised Locations: User Defined Profile: Regional

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Vel Left	Vel Right	Vel Total	Volume
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)	(m/s)	(m/s)	(1000 m3)
Humber Stn HDF	1	1000	Regional	4.21	242.50	242.87	242.87	242.98	0.013080	1.93	4.16	21.19	1.03	0.65	0.73	1.01	21.51
Humber Stn HDF	1	999	Regional	4.21	241.91	242.35		242.38	0.003096	1.03	8.04	36.33	0.51	0.38	0.36	0.52	21.03
Humber Stn HDF	1	998	Regional	4.21	241.84	242.08	242.08	242.17	0.014681	1.58	4.13	24.95	1.02	0.65	0.63	1.02	20.81
Humber Stn HDF	1	997	Regional	4.21	240.98	241.69		241.76	0.003037	1.39	5.30	14.43	0.55	0.50	0.46	0.79	20.50
Humber Stn HDF	1	996.5	Regional	4.21	240.96	241.38	241.38	241.49	0.011471	1.93	4.16	19.61	0.98	0.69	0.68	1.01	20.27
Humber Stn HDF	1	996	Regional	4.21	240.55	241.00		241.05	0.004696	1.14	5.31	26.93	0.61	0.34	0.35	0.79	20.01
Humber Stn HDF	1	995	Regional	4.21	240.22	240.73		240.76	0.002530	1.02	7.85	30.65	0.47	0.37	0.35	0.54	19.45
Humber Stn HDF	1	994	Regional	4.21	239.74	240.10	240.10	240.22	0.011877	1.80	3.53	16.00	0.97	0.66	0.65	1.19	18.82
Humber Stn HDF	1	993	Regional	4.21	238.93	239.17		239.18	0.002713	0.66	10.40	60.51	0.44	0.31	0.28	0.40	17.59
Humber Stn HDF	1	992	Regional	4.21	238.30	238.56		238.60	0.007442	1.12	5.86	37.24	0.73	0.41	0.47	0.72	16.46
Humber Stn HDF	1	991	Regional	6.45	237.47	237.79	237.68	237.82	0.004937	1.05	9.68	39.80	0.61	0.43	0.55	0.67	15.40
Humber Stn HDF	1	990	Regional	6.45	236.49	236.69	236.69	236.78	0.017904	1.51	5.87	35.95	1.09	0.78	0.60	1.10	14.46
Humber Stn HDF	1	989	Regional	6.45	235.25	235.76	235.69	235.81	0.003946	1.12	9.50	46.57	0.57	0.38	0.32	0.68	13.45
Humber Stn HDF	1	988	Regional	6.45	234.23	234.62	234.62	234.75	0.010678	1.71	5.11	22.39	0.92	0.34	0.67	1.26	12.19
Humber Stn HDF	1	987	Regional	6.45	232.48	233.49		233.49	0.000101	0.34	28.12	37.65	0.11	0.15	0.15	0.23	8.71
Humber Stn HDF	1	986	Regional	6.45	231.90	233.49		233.49	0.000024	0.22	48.67	43.57	0.06	0.09	0.11	0.13	5.57
Humber Stn HDF	1	985	Regional	6.45	231.75	233.49		233.49	0.000010	0.15	56.66	42.07	0.04	0.07	0.08	0.11	1.91
Humber Stn HDF	1	984	Regional	6.45	232.04	233.16	233.05	233.37	0.005050	2.21	4.31	41.47	0.72	0.70	0.59	1.50	1.16
Humber Stn HDF	1	983	Regional	6.45	231.48	233.20	232.16	233.20	0.000023	0.23	61.50	82.04	0.06	0.08	0.07	0.10	0.91
Humber Stn HDF	1	982.58		Culvert													
Humber Stn HDF	1	982	Regional	6.45	231.06	232.01	232.01	232.42	0.012857	2.92	2.46	37.20	1.00	1.03		2.62	0.69
Humber Stn HDF	1	981	Regional	6.45	231.01	231.39	231.29	231.43	0.009844	1.46	10.12	36.65	0.77	0.56	0.49	0.64	0.49
Humber Stn HDF	1	980	Regional	6.45	230.22	230.44	230.44	230.53	0.027660	1.71	7.10	43.79	1.18	0.60	0.56	0.91	
Mid HDF	1	36	Regional	4.25	229.50	229.78	229.78	229.87	0.010199	1.41	3.88	28.65	0.86	0.36	0.41	1.09	12.39
Mid HDF	1	35	Regional	4.25	228.50	228.85		228.88	0.002799	0.85	7.81	37.41	0.47	0.27	0.33	0.54	12.05
Mid HDF	1	34	Regional	4.25	228.24	228.62		228.65	0.002774	0.90	6.45	25.20	0.47	0.29	0.38	0.66	11.48
Mid HDF	1	33	Regional	4.25	227.98	228.20	228.20	228.29	0.015824	1.49	3.74	21.88	1.03	0.58	0.70	1.14	11.15
Mid HDF	1	32	Regional	4.25	227.25	227.69		227.75	0.004014	1.09	4.47	17.02	0.57	0.29	0.29	0.95	10.93
Mid HDF	1	31	Regional	5.15	226.96	227.22	227.22	227.30	0.012421	1.47	4.89	26.39	0.94	0.65	0.53	1.05	10.64
Mid HDF	1	30	Regional	5.15	226.13	226.46		226.51	0.005894	1.15	6.79	34.48	0.67	0.44	0.44	0.76	10.22
Mid HDF	1	29	Regional	5.15	225.72	225.97	225.93	226.02	0.009556	1.25	6.20	34.37	0.82	0.55	0.59	0.83	9.78
Mid HDF	1	28	Regional	5.15	224.75	225.18	225.15	225.26	0.007482	1.38	4.84	24.50	0.76	0.46	0.37	1.06	9.29
Mid HDF	1	27	Regional	5.15	224.49	224.87	224.77	224.91	0.003622	1.03	7.24	29.51	0.54	0.34	0.41	0.71	8.88
Mid HDF	1	26	Regional	5.15	224.16	224.37	224.37	224.45	0.017087	1.50	4.95	30.04	1.07	0.70	0.76	1.04	8.47
Mid HDF	1	25	Regional	5.15	223.00	224.30		224.32	0.000219	0.50	11.99	13.98	0.15	0.19		0.43	7.58
Mid HDF	1	24	Regional	5.15	221.76	224.31		224.31	0.000034	0.26	25.52	25.55	0.06	0.05	0.12	0.20	6.81
Mid HDF	1	23.6	Regional	5.15	221.20	224.31	222.14	224.31	0.000001	0.05	153.78	89.65	0.01	0.03		0.03	3.98
Mid HDF	1	23.3		Culvert													
Mid HDF	1	23	Regional	5.15	220.91	222.17	221.69	222.26	0.001505	1.33	3.87	43.92	0.41			1.33	3.24
Mid HDF	1	22	Regional	5.15	220.99	222.19		222.19	0.000007	0.10	90.43	91.66	0.03	0.05	0.03	0.06	
Clarkway Trib A	Reach1	1597	Regional	24.21	241.79	243.70	242.79	243.70	0.000170	0.54	102.95	116.55	0.13	0.16	0.12	0.24	62.04
Clarkway Trib A	Reach1	1594		Culvert													
Clarkway Trib A	Reach1	1591	Regional	24.21	241.48	243.19	243.19	243.21	0.000716	0.82	66.25	84.83	0.24	0.26	0.28	0.37	61.11
Clarkway Trib A	Reach1	1583	Regional	24.21	241.24	242.66	242.50	242.76	0.004661	1.75	28.26	60.26	0.60	0.43	0.52	0.86	60.00
Clarkway Trib A	Reach1	1561.698	Regional	24.21	241.38	242.12	242.12	242.24	0.018733	2.89	26.01	83.18	1.14	0.73	0.85	0.93	58.33
Clarkway Trib A	Reach1	1561.551	Regional	24.21	240.81	241.58		241.59	0.001799	0.73	73.38	164.89	0.31	0.31	0.31	0.33	51.21
Clarkway Trib A	Reach1	1561.404	Regional	24.21	239.94	241.08		241.16	0.005498	1.96	40.65	121.03	0.64	0.45	0.33	0.60	42.73
Clarkway Trib A	Reach1	1561.256	Regional	24.21	239.10	240.25	240.08	240.33	0.005738	1.99	32.13	70.54	0.66	0.43	0.66	0.75	37.32
Clarkway Trib A	Reach1	1561.120	Regional	24.21	238.71	239.71	239.42	239.79	0.003061	1.35	27.23	48.21	0.48	0.30	0.46	0.89	33.35
Clarkway Trib A	Reach1	1560.977	Regional	24.21	238.53	239.17	238.93	239.22	0.005281	1.43	35.65	78.58	0.58	0.54	0.49	0.68	28.85
Clarkway Trib A	Reach1	1560.88	Regional	24.21	237.95	238.73	238.57	238.78	0.003575	1.38	44.18	110.95	0.52	0.40	0.37	0.55	24.77
Clarkway Trib A	Reach1	1560.685	Regional	24.21	236.78	237.31	237.31	237.44	0.013274	1.72	19.34	96.84	0.89	0.32	0.13	1.25	18.00
Clarkway Trib A	Reach1	1560.6	Regional	24.21	236.23	237.01		237.03	0.001532	0.88	53.54	93.84	0.34	0.33	0.27	0.45	16.28
Clarkway Trib A	Reach1	1560.57	Regional	24.21	235.97	236.71		236.88	0.009692	2.22	19.25	38.47	0.85	0.62	0.73	1.26	14.61
Clarkway Trib A	Reach1	1560.5	Regional	24.21	235.24	236.12	235.86	236.22	0.004215	1.68	25.01	36.58	0.58	0.51	0.66	0.97	12.31
Clarkway Trib A	Reach1	1519.898	Regional	24.21	234.49	235.29	235.17	235.41	0.007289	1.97	23.08	45.00	0.74	0.64	0.62	1.05	8.76
Clarkway Trib A	Reach1	1430.348	Regional	24.21	234.00	234.92		234.99	0.003488	1.56	31.87	52.92	0.53	0.50	0.34	0.76	6.46
Clarkway Trib A	Reach1-DS-0	1651	Regional	52.86	233.59	234.52		234.57	0.003236	1.54	70.27	82.69	0.51	0.65	0.61	0.75	168.79
Clarkway Trib A	Reach1-DS-0	1580	Regional	52.86	232.98	234.14		234.29	0.005844	2.30	42.80	47.53	0.71	0.51	0.90	1.24	165.29
Clarkway Trib A	Reach1-DS-0	1573	Regional	52.86	232.49	233.46	233.46	233.84	0.017046	3.42	26.98	38.38	1.17	0.82	1.31	1.96	163.70
Clarkway Trib A	Reach1-DS-0	1534	Regional	52.86	230.44	232.28		232.33	0.001031	1.26	90.46	103.76	0.32	0.36	0.34	0.58	153.38
Clarkway Trib A	Reach1-DS-0	1528	Regional	52.86	229.70	232.01		232.26	0.006602	2.67	33.95	38.09	0.74	0.53	0.91	1.56	152.00
Clarkway Trib A	Reach1-DS-0	1516.384 43.06-11	Regional	54.06	230.28	231.85		231.95	0.008458	1.36	39.85	45.95	0.38	0.86	1.56	1.36	150.69
Clarkway Trib A	Reach1-DS-0	1516.214 43.06-10	Regional	54.06	229.35	231.05		231.18	0.003135	2.09	57.60	68.58	0.54	0.58	0.55	0.94	143.14
Clarkway Trib A	Reach1-DS-0	1516.156 43.06-09	Regional	54.06	229.11	230.88	230.38	230.92	0.005987	1.30	65.65	90.03	0.33	0.81	0.71	0.82	139.85
Clarkway Trib A	Reach1-DS-0	1516.103 43.06-08	Regional	54.06	228.87	230.66		230.73	0.002268	1.86	71.73	73.53	0.46	0.63	0.50	0.75	136.23
Clarkway Trib A	Reach1-DS-0	1515.984 43.06-07	Regional	54.06	228.60	230.25	230.00	230.36	0.004492	2.51	56.27	61.23	0.65	0.72	0.80	0.96	128.64
Clarkway Trib A	Reach1-DS-0	1515.784 43.06-06	Regional	54.06	227.73	229.41		229.44	0.004375	1.06	65.27	67.61	0.28	0.61	0.83	0.83	116.37
Clarkway Trib A	Reach1-DS-0	1515.584 43.06-05	Regional	54.06	226.41	228.67	228.18	228.71	0.003511	0.98	68.62	65.51	0.25	0.69	0.37	0.79	103.60
Clarkway Trib A	Reach1-DS-0	1515.386 43.06-04	Regional	54.06	226.38	227.25	227.12	227.42	0.018767	3.45	36.76	53.98	1.21	1.15	1.41	1.47	93.86
Clarkway Trib A	Reach1-DS-0	1515.185 43.06-03	Regional	54.06	224.64	226.66		226.72	0.001571	1.50	79.80	82.91	0.38	0.47	0.42	0.68	83.79
Clarkway Trib A	Reach1-DS-0	1515.084 43.06-02	Regional	54.06	224.37	226.52		226.57	0.001224	1.52	97.80	105.69	0.35	0.38	0.43	0.55	74.84
Clarkway Trib A	Reach1-DS-0	1514.985 43.06-01	Regional	54.06	224.01	226.07		226.32	0.006473	3.12	44.66	58.90	0.77	0.72	0.96	1.21	67.79
Clarkway Trib A	Reach1-DS-0	1514.912 43.04-11	Regional	65.98	224.10	225.52		225.79	0.008860	3.24	45.05	51.78	0.89	1.02	0.98	1.46	64.81
Clarkway Trib A	Reach1-DS-0	1514.788 43.04-10	Regional	65.98	223.95	224.87		224.92	0.005961	0.90	68.76	69.46	0.30	0.87	1.00	0.96	58.61
Clarkway Trib A	Reach1-DS-0	1514.658 43.04-09	Regional	65.98	222.72	224.68	223.92	224.71	0.000928	1.31	137.32	112.54	0.31	0.41	0.45	0.48	47.50
Clarkway Trib A	Reach1-DS-0	1514.585 43.04-08	Regional	65.98	221.73	224.64		224.66	0.000576	1.28	141.24	83.69	0.25	0.42	0.42	0.47	38.58
Clarkway Trib A	Reach1-DS-0	1514.506 43.04-07	Regional	65.98	221.43	223.87	223.84	224.49	0.008326	3.54	22.59	27.25	0.86	0.17	0.52	2.92	32.09
Clarkway Trib A	Reach1-DS-0	1514.414 43.04-06	Regional	65.98	220.83	223.81		223.86	0.003277	1.28	71.65	52.91	0.26	0.63	0.81	0.92	27.74
Clarkway Trib A	Reach1-DS-0	1514.353 43.04-05	Regional	65.98	220.80	223.76	222.28	223.77	0.000762	0.65	136.04	86.26	0.13	0.51	0.36	0.49	22.40
Clarkway Trib A	Reach1-DS-0	1514.345 43.04-04	Regional	65.98	220.68	223.76	222.61	223.76	0.000505	0.58	174.65	124.81	0.11	0.41	0.29	0.38	21.22
Clarkway Trib A	Reach1-DS-0	1514.331 x-80 (43.04-03)		Culvert													
Clarkway Trib A	Reach1-DS-0	1514.312 43.04-02	Regional	65.98	220.59	223.00	223.00	223.75	0.010224	4.59	24.01	111.04	1.00	1.63	1.43	2.75	18.56
Clarkway Trib A	Reach1-DS-0	1514.306 43.04-01	Regional	65.98	220.50	222.53		222.56	0.003196	1.03	96.08	101.45	0.24	0.63	0.67	0.69	17.88
Clarkway Trib A	Reach1-DS-0	1514.247 43.02-13	Regional	65.98	220.38	222.44		222.46	0.001288	0.71	121.29	91.03	0.16	0.45	0.54	0.54	12.32
Reach 2	Reach 2	1105	Regional	24.36	237.49	239.66		239.68	0.000359	0.86	51.95	60.00	0.21	0.38	0.32	0.47	22.90
Reach 2	Reach 2	1068	Regional	24.36	237.41	239.64		239.67	0.000456	0.94	61.82	67.55	0.21	0.21	0.26	0.39	20.77
Reach 2	Reach 2	1054	Regional	24.36	236.65	239.64	238.10	239.66	0.000246	0.81	77.79	78.24	0.16	0.16	0.19	0.31	19.78
Reach 2	Reach 2	1027		Culvert													
Reach 2	Reach 2	1018	Regional	24.36	236.60	238.83	238.22	239.21	0.008110	2.73	8.91	4.40	0.61			2.73	18.36
Reach 2	Reach 2	1008	Regional	24.36	235.58	238.86	237.31	239.06	0.003608	1.98	12.32	4.21	0.37			1.98	18.24
Reach 2	Reach 2	1005	Regional	24.36	235.57	238.85	237.19	239.05	0.005832	1.98	12.33		0.35			1.98	18.21
Reach 2	Reach 2	999	Regional	24.36	235.55	238.59	237.44	238.97	0.005227	2.71	9.00		0.50			2.71	18.15
Reach 2	Reach 2	951		Culvert													
Reach 2	Reach 2	666	Regional	24.36	234.65	236.59	236.59	237.53	0.009737	4.30	5.66	24.40	1.00			4.30	15.96
Reach 2	Reach 2	661	Regional	25.34	234.62	236.32		236.37	0.000720	1.08	32.29	25.38	0.27	0.33	0.28	0.78	15.78
Reach 2	Reach 2	656	Regional	25.34	234.66	236.31		236.37	0.000736	1.08	32.36	25.96	0.27	0.32	0.30	0.78	15.63
Reach 2	Reach 2	604	Regional	25.34	234.65	236.24		236.31	0.001466	1.28	26.91	26.06	0.36	0.44	0.32	0.94	14.06
Reach 2	Reach 2	498	Regional	25.34	234.51	236.07		236.15	0.001547	1.35	27.55	26.25	0.37	0.48	0.33	0.92	11.15
Reach 2	Reach 2	388	Regional	25.34	234.38	235.88		235.96	0.001828	1.52	28.07	25.88	0.41	0.49	0.52	0.90	8.04
Reach 2	Reach 2	307	Regional	25.34	234.11	235.73		235.81	0.001766	1.52	27.37	25.76	0.41	0.52	0.35	0.93	5.76
Reach 2	Reach 2	213	Regional	25.34	233.98	235.51		235.62	0.002379	1.69	23.65	23.64	0.46	0.56	0.43	1.07	3.35
Reach 2	Reach 2	172	Regional	25.34	234.11	235.31	235.10	235.47	0.005108	1.86	16.35	22.74	0.63	0.56	0.41	1.55	2.52
Reach 2	Reach 2	117	Regional	25.34	233.80	235.19	234.70	235.28	0.002004	1.46	22.74	23.60	0.42	0.44	0.24	1.11	1.44
Reach 2	Reach 2	85	Regional	25.34	233.83	235.06	234.78	235.19	0.003927	1.66	18.10	23.25	0.56	0.55	0.44	1.40	0.76
Reach 2	Reach 2	63	Regional	25.34	233.87	234.73	234.73	235.03	0.013556	2.49	11.86	21.82	0.98	0.71	0.42	2.14	0.44
Reach 2	Reach 2	45	Regional	25.34	233.72	234.53		234.57	0.004319	1.51	39.47	71.31	0.57	0.56	0.36	0.64	
Gore Road Trib	Reach2	1450.572 41.08-05	Regional	10.74	237.54	238.48	238.48	238.73	0.015495	2.22	4.87	10.47	1.00	0.14	0.14	2.21	16.45
Gore Road Trib	Reach2	1450.428 41.08-04	Regional	10.74	235.83	236.82	236.82	236.99	0.007948	2.02	9.50	33.15	0.76	0.34	0.41	1.13	15.41
Gore Road Trib	Reach2	1450.284 41.08-03	Regional	10.74	234.78	235.41		235.45	0.006470	1.21	16.83	48.74	0.50	0.51	0.42	0.64	13.53
Gore Road Trib	Reach2	1450.168 41.08-02	Regional	10.74	233.73	234.36	234.36	234.49	0.010983	2.02	12.17	47.05	0.87	0.47	0.49	0.88	11.85
Gore Road Trib	Reach2	1450.000 41.08-01	Regional	10.74	233.28	234.14		234.14	0.000243	0.38	65.24	98.64	0.14	0.16	0.13	0.16	5.83
Gore Road Trib	Reach1	1416.798 41.07-06	Regional	31.51	232.98	233.91		233.95	0.007724	0.96	35.37	56.49	0.33	0.71	0.97	0.89	30.32
Gore Road Trib	Reach1	1416.721 41.07-05	Regional	31.51	232.59	233.49		233.52	0.004238	0.74	43.04	51.62	0.25	0.14	0.30	0.73	27.35
Gore Road Trib	Reach1	1416.598 41.07-04	Regional	31.51	231.99	232.88		232.93	0.005700	1.93	43.82	74.13	0.67	0.67	0.65	0.72	22.07
Gore Road Trib	Reach1	1416.398 41.07-03	Regional	31.51	230.73	231.81		231.85	0.005112	0.90	38.25	56.27	0.29	0.61	0.88	0.82	13.88
Gore Road Trib	Reach1	1416.261 41.07-02	Regional	31.51	229.56	230.78		230.91	0.009619	2.47	32.95	68.96	0.85	0.74	0.43	0.96	9.01

HEC-RAS Plan: SCE Existing Revised Locations: User Defined Profile: Regional (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Vel Left	Vel Right	Vel Total	Volume
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)	(m/s)	(m/s)	(1000 m3)
Gore Road Trib	Reach1	1416.193 41.07-01	Regional	31.51	229.05	230.30		230.33	0.006818	1.09	44.81	90.19	0.33	0.47	0.76	0.70	6.38
Gore Road Trib	Reach1-DS-0	1416.041 41.06-16	Regional	40.85	228.39	229.49		229.60	0.003878	1.69	39.64	62.06	0.56	0.42	0.54	1.03	1436.84
Gore Road Trib	Reach1-DS-0	1415.982 41.06-15	Regional	40.85	228.33	229.02		229.12	0.024935	1.48	29.85	66.74	0.59	1.09	1.47	1.37	1434.79
Gore Road Trib	Reach1-DS-0	1415.904 41.06-14	Regional	40.85	227.40	228.58		228.64	0.002642	1.44	41.99	67.10	0.46	0.89	0.89	0.97	1432.01
Gore Road Trib	Reach1-DS-0	1415.793 41.06-13	Regional	40.85	226.47	228.11	227.87	228.23	0.005317	2.23	42.04	61.60	0.66	0.74	0.52	0.97	1427.40
Gore Road Trib	Reach1-DS-0	1415.720 41.06-12	Regional	40.85	226.47	227.79		227.87	0.004384	2.07	52.93	78.81	0.61	0.57	0.67	0.77	1423.93
Gore Road Trib	Reach1-DS-0	1415.590 41.06-11	Regional	40.85	225.93	227.27		227.29	0.004121	0.88	65.42	99.36	0.26	0.62	0.50	0.62	1416.21
Gore Road Trib	Reach1-DS-0	1415.515 41.06-10	Regional	40.85	225.78	226.71		226.84	0.008798	2.30	39.09	72.86	0.82	0.77	0.52	1.05	1412.28
Gore Road Trib	Reach1-DS-0	1415.353 41.06-09	Regional	40.85	225.06	226.08		226.10	0.002606	0.58	71.17	111.60	0.20	0.64	0.37	0.57	1403.35
Gore Road Trib	Reach1-DS-0	1415.201 41.06-08	Regional	40.85	224.34	225.48		225.53	0.005014	2.02	51.73	73.34	0.64	0.77	0.63	0.79	1393.66
Gore Road Trib	Reach1-DS-0	1415.055 41.06-07	Regional	40.85	223.77	224.66		224.69	0.006808	0.93	54.69	101.84	0.32	0.61	0.85	0.75	1386.10
Gore Road Trib	Reach1-DS-0	1414.792 41.06-06	Regional	40.85	222.48	223.55		223.58	0.006198	0.93	54.10	81.22	0.31	0.76	0.71	0.76	1376.93
Gore Road Trib	Reach1-DS-0	1414.601 41.06-05	Regional	40.85	221.55	222.90		222.98	0.002258	1.57	51.08	61.50	0.45	0.51	0.45	0.80	1368.26
Gore Road Trib	Reach1-DS-0	1414.401 41.06-04	Regional	40.85	220.38	222.59		222.66	0.001237	1.47	61.46	74.84	0.35	0.33	0.36	0.66	1357.55
Gore Road Trib	Reach1-DS-0	1414.292 41.06-03	Regional	40.85	220.38	222.58	221.46	222.59	0.000225	0.69	151.21	123.11	0.15	0.24	0.19	0.27	1345.94
Gore Road Trib	Reach1-DS-0	1414.284 41.06-02	Regional	40.85	220.38	222.58	221.65	222.59	0.000208	0.67	151.62	132.40	0.15	0.24	0.20	0.27	1344.77
Gore Road Trib	Reach1-DS-0	1414.268 x-124 (41.06-01)		Culvert													
Gore Road Trib	Reach1-DS-0	1414.253 41.05-13	Regional	39.90	220.41	221.65	221.65	222.10	0.011501	3.21	16.47	88.84	0.98	1.10	1.01	2.42	1343.08
Gore Road Trib	Reach1-DS-0	1414.247 41.05-12	Regional	39.90	220.32	221.55		221.57	0.002518	0.62	75.54	98.29	0.20	0.48	0.53	0.53	1342.63
Gore Road Trib	Reach1-DS-0	1414.191 41.05-11	Regional	39.90	219.93	221.31		221.42	0.005758	2.43	44.54	65.48	0.71	0.71	0.71	0.90	1340.47

HEC-RAS Plan: SCE Existing Revised Locations: User Defined Profile: 100-year

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Vel Left	Vel Right	Vel Total	Volume
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)	(m/s)	(m/s)	(1000 m3)
Humber Stn HDF	1	1000	100-year	1.65	242.50	242.74	242.74	242.81	0.013510	1.46	1.92	14.01	0.97	0.53	0.54	0.86	12.47
Humber Stn HDF	1	999	100-year	1.65	241.91	242.22	242.13	242.24	0.002665	0.74	3.98	25.53	0.44	0.27	0.25	0.41	12.23
Humber Stn HDF	1	998	100-year	1.65	241.84	241.98	241.98	242.04	0.018339	1.22	1.89	18.17	1.04	0.52	0.50	0.87	12.13
Humber Stn HDF	1	997	100-year	1.65	240.98	241.50		241.53	0.002111	0.91	2.85	10.57	0.43	0.32	0.29	0.58	11.97
Humber Stn HDF	1	996.5	100-year	1.65	240.96	241.25	241.25	241.32	0.011943	1.48	1.89	13.12	0.93	0.51	0.51	0.87	11.86
Humber Stn HDF	1	996	100-year	1.65	240.55	240.86		240.89	0.005209	0.86	2.27	16.63	0.59	0.21	0.21	0.73	11.74
Humber Stn HDF	1	995	100-year	1.65	240.22	240.57	240.46	240.59	0.002474	0.77	3.67	20.92	0.44	0.27	0.25	0.45	11.49
Humber Stn HDF	1	994	100-year	1.65	239.74	239.95	239.95	240.03	0.013776	1.37	1.61	11.07	0.96	0.50	0.50	1.03	11.20
Humber Stn HDF	1	993	100-year	1.65	238.93	239.09		239.10	0.002332	0.46	5.71	52.08	0.37	0.21	0.19	0.29	10.55
Humber Stn HDF	1	992	100-year	1.65	238.30	238.46	238.44	238.49	0.010275	0.93	2.48	26.96	0.78	0.30	0.34	0.67	9.98
Humber Stn HDF	1	991	100-year	2.53	237.47	237.67	237.58	237.68	0.004425	0.71	5.31	33.53	0.53	0.29	0.39	0.48	9.45
Humber Stn HDF	1	990	100-year	2.53	236.49	236.61	236.61	236.66	0.021992	1.13	2.93	30.59	1.09	0.61	0.45	0.86	8.95
Humber Stn HDF	1	989	100-year	2.53	235.25	235.63	235.56	235.66	0.003744	0.83	4.23	30.74	0.52	0.25	0.18	0.60	8.48
Humber Stn HDF	1	988	100-year	2.53	234.23	234.48	234.48	234.56	0.013035	1.32	2.29	16.11	0.93	0.12	0.40	1.10	7.92
Humber Stn HDF	1	987	100-year	2.53	232.48	233.14		233.14	0.000072	0.21	16.28	30.59	0.08	0.10	0.09	0.16	5.97
Humber Stn HDF	1	986	100-year	2.53	231.90	233.14		233.14	0.000010	0.12	34.33	38.21	0.03	0.05	0.06	0.07	3.90
Humber Stn HDF	1	985	100-year	2.53	231.75	233.14		233.14	0.000003	0.08	43.30	36.90	0.02	0.03	0.04	0.06	1.21
Humber Stn HDF	1	984	100-year	2.53	232.04	233.07	232.68	233.11	0.001112	0.98	3.62	30.09	0.33	0.31	0.29	0.70	0.64
Humber Stn HDF	1	983	100-year	2.53	231.48	233.08	231.85	233.08	0.000005	0.10	52.19	74.69	0.03	0.04	0.03	0.05	0.44
Humber Stn HDF	1	982.58		Culvert													
Humber Stn HDF	1	982	100-year	2.53	231.06	231.61	231.61	231.84	0.015416	2.15	1.28	26.41	0.99	0.58		1.97	0.34
Humber Stn HDF	1	981	100-year	2.53	231.01	231.26	231.19	231.28	0.008830	1.02	5.52	32.10	0.67	0.41	0.32	0.46	0.25
Humber Stn HDF	1	980	100-year	2.53	230.22	230.35	230.35	230.40	0.031148	1.27	3.48	34.88	1.14	0.47	0.43	0.73	
Mid HDF	1	36	100-year	1.17	229.50	229.62	229.62	229.67	0.018609	1.04	1.18	11.97	1.00	0.38	0.20	0.99	3.71
Mid HDF	1	35	100-year	1.17	228.50	228.68		228.69	0.004105	0.63	2.40	22.32	0.50	0.15	0.22	0.49	3.61
Mid HDF	1	34	100-year	1.17	228.24	228.45		228.46	0.002253	0.53	2.69	17.97	0.38	0.14	0.22	0.43	3.40
Mid HDF	1	33	100-year	1.17	227.98	228.08	228.08	228.12	0.021581	1.01	1.41	17.18	1.05	0.41	0.50	0.83	3.27
Mid HDF	1	32	100-year	1.17	227.25	227.51		227.53	0.003215	0.62	1.91	11.12	0.46	0.10	0.08	0.61	3.18
Mid HDF	1	31	100-year	1.42	226.96	227.09	227.09	227.12	0.014616	0.95	1.88	19.32	0.90	0.47	0.32	0.76	3.06
Mid HDF	1	30	100-year	1.42	226.13	226.33		226.35	0.004360	0.67	2.84	24.72	0.52	0.26	0.23	0.50	2.89
Mid HDF	1	29	100-year	1.42	225.72	225.84	225.84	225.87	0.014474	0.90	2.20	26.26	0.88	0.41	0.41	0.64	2.72
Mid HDF	1	28	100-year	1.42	224.75	225.03		225.06	0.005064	0.76	1.96	14.46	0.57	0.21	0.09	0.72	2.54
Mid HDF	1	27	100-year	1.42	224.49	224.67		224.70	0.005323	0.74	2.35	19.27	0.58	0.20	0.27	0.61	2.39
Mid HDF	1	26	100-year	1.42	224.16	224.31		224.33	0.005865	0.68	3.03	29.55	0.58	0.27	0.32	0.47	2.21
Mid HDF	1	25	100-year	1.42	223.00	223.28	223.28	223.36	0.016252	1.25	1.14	7.14	1.00			1.25	1.99
Mid HDF	1	24	100-year	1.42	221.76	222.64		222.66	0.001400	0.65	2.17	5.41	0.33			0.65	1.92
Mid HDF	1	23.6	100-year	1.42	221.20	222.64	221.78	222.64	0.000084	0.26	5.36	72.56	0.09			0.26	1.42
Mid HDF	1	23.3		Culvert													
Mid HDF	1	23	100-year	1.42	220.91	221.63	221.35	221.66	0.001183	0.74	1.92	22.79	0.32			0.74	1.31
Mid HDF	1	22	100-year	1.42	220.99	221.64		221.64	0.000007	0.07	40.02	90.35	0.03	0.03	0.02	0.04	
Clarkway Trib A	Reach1	1597	100-year	30.20	241.79	243.74	242.92	243.75	0.000233	0.64	108.28	119.44	0.15	0.19	0.15	0.28	70.58
Clarkway Trib A	Reach1	1594		Culvert													
Clarkway Trib A	Reach1	1591	100-year	30.20	241.48	243.19	243.19	243.22	0.001114	1.02	66.25	84.83	0.30	0.32	0.35	0.46	69.54
Clarkway Trib A	Reach1	1583	100-year	30.20	241.24	242.73	242.58	242.85	0.005185	1.94	32.54	63.91	0.64	0.49	0.58	0.93	68.38
Clarkway Trib A	Reach1	1561.698	100-year	30.20	241.38	242.17	242.16	242.30	0.019180	3.07	30.18	85.58	1.17	0.82	0.90	1.00	66.45
Clarkway Trib A	Reach1	1561.551	100-year	30.20	240.81	241.65		241.66	0.001802	0.78	84.54	167.80	0.31	0.33	0.33	0.36	58.23
Clarkway Trib A	Reach1	1561.404	100-year	30.20	239.94	241.15		241.23	0.005315	2.02	49.60	137.57	0.64	0.50	0.31	0.61	48.25
Clarkway Trib A	Reach1	1561.256	100-year	30.20	239.10	240.35	240.16	240.43	0.005376	2.07	39.55	77.32	0.65	0.47	0.69	0.76	41.63
Clarkway Trib A	Reach1	1561.120	100-year	30.20	238.71	239.80	239.50	239.89	0.003233	1.49	31.62	51.23	0.51	0.34	0.50	0.96	36.84
Clarkway Trib A	Reach1	1560.977	100-year	30.20	238.53	239.24	238.99	239.30	0.005304	1.55	41.73	83.00	0.59	0.58	0.52	0.72	31.58
Clarkway Trib A	Reach1	1560.88	100-year	30.20	237.95	238.79	238.62	238.84	0.003760	1.50	51.19	115.40	0.54	0.43	0.42	0.59	26.83
Clarkway Trib A	Reach1	1560.685	100-year	30.20	236.78	237.36	237.36	237.51	0.012189	1.80	25.07	114.37	0.88	0.36	0.19	1.20	18.71
Clarkway Trib A	Reach1	1560.6	100-year	30.20	236.23	237.12		237.14	0.001437	0.94	63.77	98.73	0.33	0.35	0.28	0.47	16.61
Clarkway Trib A	Reach1	1560.57	100-year	30.20	235.97	236.81		236.99	0.008783	2.32	23.46	40.76	0.83	0.65	0.78	1.29	14.61
Clarkway Trib A	Reach1	1560.5	100-year	30.20	235.24	236.21	235.93	236.32	0.004667	1.88	28.09	37.40	0.62	0.58	0.74	1.07	11.93
Clarkway Trib A	Reach1	1519.898	100-year	30.20	234.49	235.42	235.24	235.54	0.006073	2.00	29.01	48.13	0.69	0.65	0.64	1.04	7.71
Clarkway Trib A	Reach1	1430.348	100-year	30.20	234.00	234.86		234.99	0.007054	2.12	28.94	51.43	0.74	0.67	0.46	1.04	5.28
Clarkway Trib A	Reach1-DS-0	1651	100-year	37.88	233.59	234.33		234.37	0.003649	1.40	54.68	79.75	0.52	0.60	0.56	0.69	120.14
Clarkway Trib A	Reach1-DS-0	1580	100-year	37.88	232.98	233.96		234.08	0.005851	2.03	34.25	45.46	0.68	0.43	0.79	1.11	117.38
Clarkway Trib A	Reach1-DS-0	1573	100-year	37.88	232.49	233.30	233.30	233.61	0.018445	3.10	20.81	35.74	1.17	0.69	1.20	1.82	116.13
Clarkway Trib A	Reach1-DS-0	1534	100-year	37.88	230.44	232.04		232.08	0.001075	1.15	67.93	86.56	0.31	0.32	0.30	0.56	108.33
Clarkway Trib A	Reach1-DS-0	1528	100-year	37.88	229.70	231.82		232.02	0.006184	2.33	27.00	35.58	0.70	0.39	0.78	1.40	107.28
Clarkway Trib A	Reach1-DS-0	1516.384 43.06-11	100-year	37.88	230.28	231.64		231.73	0.008595	1.22	30.53	43.26	0.37	0.72	1.44	1.24	106.26
Clarkway Trib A	Reach1-DS-0	1516.214 43.06-10	100-year	37.88	229.35	230.83		230.94	0.003122	1.89	43.25	62.81	0.52	0.50	0.48	0.88	100.51
Clarkway Trib A	Reach1-DS-0	1516.156 43.06-09	100-year	37.88	229.11	230.65	230.27	230.69	0.006262	1.20	47.48	69.99	0.33	0.71	0.72	0.80	98.08
Clarkway Trib A	Reach1-DS-0	1516.103 43.06-08	100-year	37.88	228.87	230.44		230.51	0.002192	1.66	56.07	69.42	0.45	0.54	0.43	0.68	95.35
Clarkway Trib A	Reach1-DS-0	1515.984 43.06-07	100-year	37.88	228.60	230.04	230.00	230.14	0.004509	2.28	43.66	57.71	0.63	0.64	0.69	0.87	89.43
Clarkway Trib A	Reach1-DS-0	1515.784 43.06-06	100-year	37.88	227.73	229.19		229.22	0.004394	0.95	50.92	62.34	0.27	0.53	0.74	0.74	79.87
Clarkway Trib A	Reach1-DS-0	1515.584 43.06-05	100-year	37.88	226.41	228.48	227.88	228.51	0.003157	0.85	56.24	63.86	0.23	0.57	0.27	0.67	69.64
Clarkway Trib A	Reach1-DS-0	1515.386 43.06-04	100-year	37.88	226.38	227.06	226.99	227.23	0.024836	3.34	26.68	51.66	1.33	1.08	1.35	1.42	61.95
Clarkway Trib A	Reach1-DS-0	1515.185 43.06-03	100-year	37.88	224.64	226.44		226.49	0.001533	1.34	62.16	79.66	0.37	0.39	0.36	0.61	54.26
Clarkway Trib A	Reach1-DS-0	1515.084 43.06-02	100-year	37.88	224.37	226.32		226.36	0.001068	1.32	77.49	94.84	0.32	0.32	0.37	0.49	47.22
Clarkway Trib A	Reach1-DS-0	1514.985 43.06-01	100-year	37.88	224.01	225.74	225.59	226.09	0.009999	3.36	27.11	48.68	0.92	0.69	0.95	1.40	42.04
Clarkway Trib A	Reach1-DS-0	1514.912 43.04-11	100-year	39.34	224.10	225.29	225.15	225.47	0.006923	2.53	33.62	47.42	0.76	0.78	0.75	1.17	40.01
Clarkway Trib A	Reach1-DS-0	1514.788 43.04-10	100-year	39.34	223.95	224.50		224.55	0.009360	0.80	43.34	67.49	0.35	0.78	0.96	0.91	35.81
Clarkway Trib A	Reach1-DS-0	1514.658 43.04-09	100-year	39.34	222.72	224.10	223.79	224.13	0.002052	1.51	73.98	100.99	0.43	0.42	0.49	0.53	29.49
Clarkway Trib A	Reach1-DS-0	1514.585 43.04-08	100-year	39.34	221.73	224.03		224.05	0.000711	1.20	92.46	76.78	0.27	0.39	0.36	0.43	24.20
Clarkway Trib A	Reach1-DS-0	1514.506 43.04-07	100-year	39.34	221.43	223.49	223.22	223.88	0.006905	2.80	14.54	15.04	0.76		0.23	2.71	19.96
Clarkway Trib A	Reach1-DS-0	1514.414 43.04-06	100-year	39.34	220.83	223.32		223.36	0.003173	1.09	48.61	42.93	0.25	0.50	0.69	0.81	17.04
Clarkway Trib A	Reach1-DS-0	1514.353 43.04-05	100-year	39.34	220.80	223.27	222.10	223.28	0.000714	0.55	96.34	75.86	0.12	0.42	0.29	0.41	13.35
Clarkway Trib A	Reach1-DS-0	1514.345 43.04-04	100-year	39.34	220.68	223.27	222.24	223.27	0.000529	0.53	109.38	106.13	0.11	0.35	0.32	0.36	12.53
Clarkway Trib A	Reach1-DS-0	1514.331 x-80 (43.04-03)		Culvert													
Clarkway Trib A	Reach1-DS-0	1514.312 43.04-02	100-year	39.34	220.59	222.54	222.54	223.09	0.009569	3.79	17.11	100.89	0.93	1.23	1.01	2.30	11.29
Clarkway Trib A	Reach1-DS-0	1514.306 43.04-01	100-year	39.34	220.50	222.10		222.13	0.006251	1.21	54.68	90.97	0.32	0.66	0.68	0.72	10.87
Clarkway Trib A	Reach1-DS-0	1514.247 43.02-13	100-year	39.34	220.38	221.95		221.96	0.001928	0.72	77.49	87.67	0.19	0.47	0.50	0.51	7.49
Reach 2	Reach 2	1105	100-year	11.90	237.49	238.77	238.57	238.87	0.002757	1.51	11.66	31.48	0.51	0.34	0.55	1.02	12.07
Reach 2	Reach 2	1068	100-year	11.90	237.41	238.41	238.41	238.67	0.010668	2.32	6.42	17.81	0.88	0.43	0.32	1.85	11.73
Reach 2	Reach 2	1054	100-year	11.90	236.65	238.45	237.62	238.51	0.001011	1.13	15.69	24.89	0.29	0.18	0.20	0.76	11.58
Reach 2	Reach 2	1027		Culvert													
Reach 2	Reach 2	1018	100-year	11.90	236.60	237.62	237.62	238.10	0.019480	3.08	3.86	3.97	1.00			3.08	11.21
Reach 2	Reach 2	1008	100-year	11.90	235.58	237.42	236.66	237.59	0.004460	1.82	6.55	3.81	0.44			1.82	11.15
Reach 2	Reach 2	1005	100-year	11.90	235.57	237.43	236.59	237.57	0.003317	1.63	7.29	4.23	0.40			1.63	11.13
Reach 2	Reach 2	999	100-year	11.90	235.55	237.21	236.72	237.50	0.003532	2.38	4.99	3.68	0.59			2.38	11.10
Reach 2	Reach 2	951		Culvert													
Reach 2	Reach 2	666	100-year	11.90	234.65	235.87	235.87	236.45	0.011489	3.40	3.50	19.87	1.00			3.40	9.75
Reach 2	Reach 2	661	100-year	11.90	234.62	235.85		235.87	0.000513	0.73	21.07	21.99	0.21	0.22	0.20	0.56	9.65
Reach 2	Reach 2	656	100-year	11.90	234.66	235.84		235.87	0.000536	0.74	21.00	22.70	0.22	0.21	0.21	0.57	9.55
Reach 2	Reach 2	604	100-year	11.90	234.65	235.78		235.82	0.001555	0.98	15.59	23.05	0.35	0.34	0.20	0.76	8.58
Reach 2	Reach 2	498	100-year	11.90	234.51	235.61		235.66	0.001575	1.03	16.13	23.05	0.35	0.36	0.23	0.74	6.89
Reach 2	Reach 2	388	100-year	11.90	234.38	235.43		235.48	0.001659	1.11	17.13	22.94	0.37	0.36	0.38	0.69	5.03
Reach 2	Reach 2	307	100-year	11.90	234.11	235.30		235.35	0.001449	1.09	17.06	22.60	0.35	0.36	0.24	0.70	3.62
Reach 2	Reach 2	213	100-year	11.90	233.98	235.14		235.20	0.001686	1.16	15.50	21.54	0.37	0.36	0.29	0.77	2.08
Reach 2	Reach 2	172	100-year	11.90	234.11	234.95	234.85	235.07	0.006941	1.53	8.75	19.96	0.68	0.41	0.27	1.36	1.58
Reach 2	Reach 2	117	100-year	11.90	233.80	234.85	234.42	234.90	0.001390	0.98	15.12	21.99	0.33	0.27	0.14	0.79	0.92
Reach 2	Reach 2	85	100-year	11.90	233.83	234.76	234.54	234.83	0.003641	1.21	11.26	21.60	0.50	0.40	0.30	1.06	0.48
Reach 2	Reach 2	63	100-year	11.90	233.87	234.49	234.49	234.67	0.014732	1.92	6.84	19.99	0.95	0.43	0.18	1.74	0.29
Reach 2	Reach 2	45	100-year	11.90	233.72	234.35		234.37	0.003144	1.06	26.82	68.74	0.46	0.37	0.22	0.44	
Gore Road Trib	Reach2	1450.572 41.08-05	100-year	4.17	237.54	238.25		238.36	0.008860	1.45	2.87	7.03	0.73			1.45	7.92
Gore Road Trib	Reach2	1450.428 41.08-04	100-year	4.17	235.83	236.46	236.46	236.64	0.017187	1.89	2.27	7.90	1.00	0.20	0.15	1.83	7.55
Gore Road Trib	Reach2	1450.284 41.08-03	100-year	4.17	234.78	235.20		235.22	0.006000	0.87	8.31	32.34	0.45	0.38	0.57	0.50	6.80
Gore Road Trib	Reach2	1450.168 41.08-02	100-year	4.17	233.73	234.16	234.16	234.26	0.011772	1.57	4.69	27.37	0.83	0.32	0.36	0.89	6.04
Gore Road Trib	Reach2	1450.000 41.08-01	100-year	4.17	233.28	233.81		233.81	0.000276	0.28	34.04	90.95	0.13	0.12	0.09	0.12	2.99
Gore Road Trib	Reach1	1416.798 41.07-06	100-year	12.23	232.98	233.56		233.59	0.009633	0.75	17.52	48.22	0.34	0.62	0.73	0.70	15.05
Gore Road Trib	Reach1	1416.721 41.07-05	100-year	12.23	232.59	233.12		233.13	0.004071	0.50	24.38	48.72	0.23		0.12	0.50	13.46
Gore Road Trib	Reach1	1416.598 41.07-04	100-year	12.23	231.99	232.58		232.60	0.004840	1.32	23.31	58.51	0.57	0.43	0.51	0.52	10.56
Gore Road Trib	Reach1	1416.398 41.07-03	100-year	12.23	230.73	231.42		231.45	0.007035	0.77	18.06	47.30	0.31	0.48	0.71	0.68	6.43
Gore Road Trib	Reach1	1416.261 41.07-02	100-year	12.23	229.56	230.54		230.59	0.005497	1.50	18.98	50.35	0.61	0.48	0.13	0.64	3.89

HEC-RAS Plan: SCE Existing Revised Locations: User Defined Profile: 100-year (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Vel Left	Vel Right	Vel Total	Volume
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)	(m/s)	(m/s)	(1000 m3)
Gore Road Trib	Reach1	1416.193 41.07-01	100-year	12.23	229.05	229.94		229.99	0.017033	1.33	15.36	55.86	0.49	0.35	0.70	0.80	2.73
Gore Road Trib	Reach1-DS-0	1416.041 41.06-16	100-year	15.08	228.39	229.16		229.21	0.002782	1.07	20.81	49.99	0.44	0.21	0.34	0.72	482.63
Gore Road Trib	Reach1-DS-0	1415.982 41.06-15	100-year	15.08	228.33	228.79		228.84	0.022460	1.05	15.71	56.33	0.52	0.72	1.04	0.96	481.55
Gore Road Trib	Reach1-DS-0	1415.904 41.06-14	100-year	15.08	227.40	228.20		228.24	0.003791	1.24	18.34	55.35	0.51	0.51	0.78	0.82	480.23
Gore Road Trib	Reach1-DS-0	1415.793 41.06-13	100-year	15.08	226.47	227.70	227.49	227.77	0.004860	1.58	19.66	46.61	0.59	0.53	0.24	0.77	478.14
Gore Road Trib	Reach1-DS-0	1415.720 41.06-12	100-year	15.08	226.47	227.41		227.45	0.003813	1.48	26.38	61.01	0.53	0.40	0.44	0.57	476.46
Gore Road Trib	Reach1-DS-0	1415.590 41.06-11	100-year	15.08	225.93	226.90		226.91	0.004366	0.70	32.27	82.01	0.25	0.44	0.34	0.47	472.63
Gore Road Trib	Reach1-DS-0	1415.515 41.06-10	100-year	15.08	225.78	226.43		226.50	0.007104	1.56	20.22	60.28	0.69	0.49	0.31	0.75	470.66
Gore Road Trib	Reach1-DS-0	1415.353 41.06-09	100-year	15.08	225.06	225.73		225.74	0.003233	0.46	33.55	104.44	0.20	0.49	0.19	0.45	466.30
Gore Road Trib	Reach1-DS-0	1415.201 41.06-08	100-year	15.08	224.34	225.12		225.15	0.004349	1.41	27.34	64.39	0.56	0.54	0.38	0.55	461.48
Gore Road Trib	Reach1-DS-0	1415.055 41.06-07	100-year	15.08	223.77	224.36		224.37	0.006964	0.70	27.20	81.28	0.30	0.47	0.61	0.55	457.60
Gore Road Trib	Reach1-DS-0	1414.792 41.06-06	100-year	15.08	222.48	223.24		223.25	0.005945	0.69	29.25	76.81	0.28	0.51	0.47	0.52	452.77
Gore Road Trib	Reach1-DS-0	1414.601 41.06-05	100-year	15.08	221.55	222.37		222.45	0.003661	1.38	19.30	57.08	0.52	0.34	0.23	0.78	448.71
Gore Road Trib	Reach1-DS-0	1414.401 41.06-04	100-year	15.08	220.38	221.90		221.97	0.001676	1.26	19.40	52.15	0.37	0.17	0.18	0.78	444.98
Gore Road Trib	Reach1-DS-0	1414.292 41.06-03	100-year	15.08	220.38	221.90	221.21	221.91	0.000198	0.49	75.44	95.49	0.13	0.15	0.13	0.20	439.80
Gore Road Trib	Reach1-DS-0	1414.284 41.06-02	100-year	15.08	220.38	221.84	221.16	221.88	0.000874	1.03	20.47	89.47	0.28	0.37	0.34	0.74	439.24
Gore Road Trib	Reach1-DS-0	1414.268 x-124 (41.06-01)		Culvert													
Gore Road Trib	Reach1-DS-0	1414.253 41.05-13	100-year	15.53	220.41	221.20	221.20	221.45	0.011992	2.31	8.44	79.48	0.92	0.62	0.49	1.84	438.61
Gore Road Trib	Reach1-DS-0	1414.247 41.05-12	100-year	15.53	220.32	221.19		221.20	0.002625	0.47	40.92	91.10	0.19	0.32	0.38	0.38	438.39
Gore Road Trib	Reach1-DS-0	1414.191 41.05-11	100-year	15.53	219.93	220.93		221.03	0.006616	2.02	21.20	57.16	0.71	0.49	0.49	0.73	437.27

Table: Summary and Comparison of Hydraulic Analysis Results

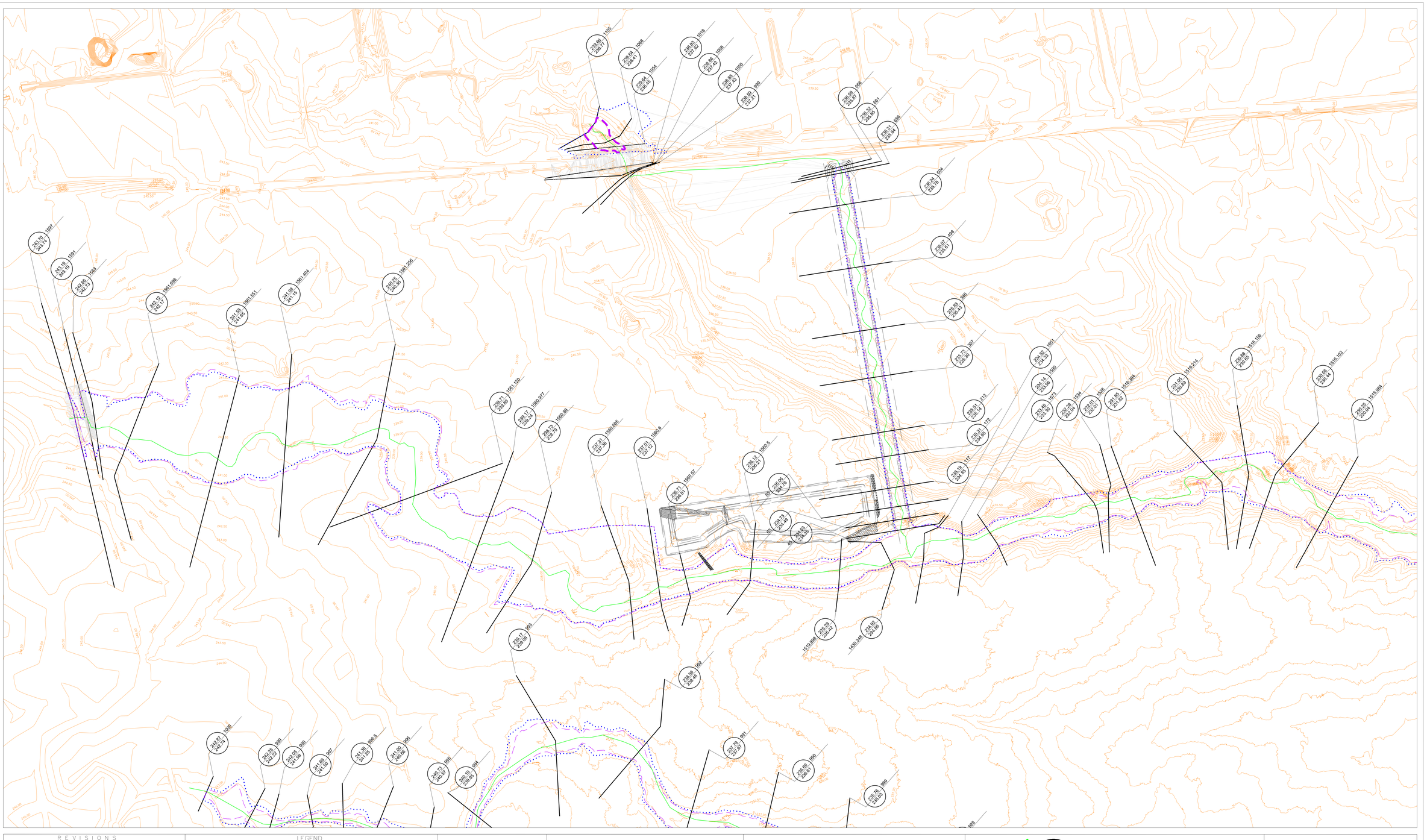
SCE Existing HEC-RAS Analysis Results						TRCA Original Model HEC-RAS Results								Difference (SCE - TRCA)				
			Min Ch El	W.S. Elev (m)					Peak Flow (m^3/s)		Min Ch El	W.S. Elev (m)		Peak Flow (m^3/s)		Min Ch El	W.S. Elev (m)	
River	Reach	River Sta	(m)	100Yr	Regional	River	Reach	River Sta	100 Year	Regional	(m)	100Yr	Regional	100 Year	Regional	(m)	100Yr	Regional
Humber Stn HDF	1	1000	242.5	242.74	242.87									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	999	241.91	242.22	242.35									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	998	241.84	241.98	242.08									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	997	240.98	241.5	241.69									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	996.5	240.96	241.25	241.38									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	996	240.55	240.86	241									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	995	240.22	240.57	240.73									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	994	239.74	239.95	240.1									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	993	238.93	239.09	239.17									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	992	238.3	238.46	238.56									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	991	237.47	237.67	237.79									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	990	236.49	236.61	236.69									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	989	235.25	235.63	235.76									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	988	234.23	234.48	234.62									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	987	232.48	233.14	233.49									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	986	231.9	233.14	233.49									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	985	231.75	233.14	233.49									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	984	232.04	233.07	233.16									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	983	231.48	233.08	233.2									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	982.58												N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	982	231.06	231.61	232.01									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	981	231.01	231.26	231.39									N/A	N/A	N/A	N/A	N/A
Humber Stn HDF	1	980	230.22	230.35	230.44									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	36	229.5	229.62	229.78									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	35	228.5	228.68	228.85									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	34	228.24	228.45	228.62									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	33	227.98	228.08	228.2									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	32	227.25	227.51	227.69									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	31	226.96	227.09	227.22									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	30	226.13	226.33	226.46									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	29	225.72	225.84	225.97									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	28	224.75	225.03	225.18									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	27	224.49	224.67	224.87									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	26	224.16	224.31	224.37									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	25	223	223.28	224.3									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	24	221.76	222.64	224.31									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	23.6	221.2	222.64	224.31									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	23.3												N/A	N/A	N/A	N/A	N/A
Mid HDF	1	23	220.91	221.63	222.17									N/A	N/A	N/A	N/A	N/A
Mid HDF	1	22	220.99	221.64	222.19									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1	1597	241.79	243.74	243.7	West Humber	Reach 9_2	13843		24.21	247.7		248.6	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1	1594				West Humber	Reach 9_2	13667		24.21	244.7		246.36	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1	1591	241.48	243.19	243.19	West Humber	Reach 9_2	13448		24.21	242.7		244.15	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1	1583	241.24	242.73	242.66	West Humber	Reach 9_2	13318		24.21	241.5		244.06	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1	1561.698	241.38	242.17	242.12	West Humber	Reach 9_2	13302		Culvert	0		0	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1	1561.551	240.81	241.65	241.58	West Humber	Reach 9_2	13285		24.21	241.47		242.72	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1	1561.404	239.94	241.15	241.08	West Humber	Reach 9_2	13207		24.21	240.7		241.83	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1	1561.256	239.1	240.35	240.25	West Humber	Reach 9_2	12805		24.21	238.7		240.19	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1	1561.12	238.71	239.8	239.71									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1	1560.977	238.53	239.24	239.17									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1	1560.88	237.95	238.79	238.73	West Humber	Reach 9_2	12487		24.21	237.7		238.82	30.2	0	0.25	238.79	-0.09
Clarkway Trib A	Reach1	1560.685	236.78	237.36	237.31	West Humber	Reach 9_2	12315		24.21	236.78		237.38	30.2	0	0	237.36	-0.07
Clarkway Trib A	Reach1	1560.6	236.23	237.12	237.01									N/A	N/A	N/A	N/A	N/A

SCE Existing HEC-RAS Analysis Results						TRCA Original Model HEC-RAS Results								Difference (SCE - TRCA)				
			Min Ch El	W.S. Elev (m)					Peak Flow (m^3/s)		Min Ch El	W.S. Elev (m)		Peak Flow (m^3/s)		Min Ch El	W.S. Elev (m)	
River	Reach	River Sta	(m)	100Yr	Regional	River	Reach	River Sta	100 Year	Regional	(m)	100Yr	Regional	100 Year	Regional	(m)	100Yr	Regional
Clarkway Trib A	Reach1	1560.57	235.97	236.81	236.71									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1	1560.5	235.24	236.21	236.12	West Humber	Reach 9_2	12132		24.21	235.14		235.98	30.2	0	0.1	236.21	0.14
Clarkway Trib A	Reach1	1519.898	234.49	235.42	235.29	West Humber	Reach 9_2	11990		24.21	234.13		235.19	30.2	0	0.36	235.42	0.1
Clarkway Trib A	Reach1	1430.348	234	234.86	234.92									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1651	233.59	234.33	234.52	West Humber	Clarkway Trib 2	11848		52.86	233.41		234.52	37.88	0	0.18	234.33	0
Clarkway Trib A	Reach1-DS-0	1580	232.98	233.96	234.14									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1573	232.49	233.3	233.46	West Humber	Clarkway Trib 2	11732		52.86	231.93		233.33	37.88	0	0.56	233.3	0.13
Clarkway Trib A	Reach1-DS-0	1534	230.44	232.04	232.28	West Humber	Clarkway Trib 2	11577		52.86	230.53		232.35	37.88	0	-0.09	232.04	-0.07
Clarkway Trib A	Reach1-DS-0	1528	229.7	231.82	232.01	West Humber	Clarkway Trib 2	11559		52.86	230.37		232.12	37.88	0	-0.67	231.82	-0.11
Clarkway Trib A	Reach1-DS-0	1516.384 43.06-11	230.28	231.64	231.85	West Humber	Clarkway Trib 2	11455		54.06	230.03		231.33	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1516.214 43.06-10	229.35	230.83	231.05	West Humber	Clarkway Trib 2	11313		54.06	228.92		230.36	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1516.156 43.06-09	229.11	230.65	230.88	West Humber	Clarkway Trib 2	11133		54.06	228.45		229.78	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1516.103 43.06-08	228.87	230.44	230.66	West Humber	Clarkway Trib 2	10878		54.06	227.7		229.02	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1515.984 43.06-07	228.6	230.04	230.25	West Humber	Clarkway Trib 2	10743		54.06	225.7		227.91	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1515.784 43.06-06	227.73	229.19	229.41	West Humber	Clarkway Trib 2	10673		54.06	225.7		227.65	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1515.584 43.06-05	226.41	228.48	228.67	West Humber	Clarkway Trib 2	10565		65.98	225.7		227.23	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1515.386 43.06-04	226.38	227.06	227.25	West Humber	Clarkway Trib 2	10515		65.98	224.8		227.02	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1515.185 43.06-03	224.64	226.44	226.66	West Humber	Clarkway Trib 2	10392		65.98	224.7		226.64	N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1515.084 43.06-02	224.37	226.32	226.52									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1514.985 43.06-01	224.01	225.74	226.07									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1514.912 43.04-11	224.1	225.29	225.52									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1514.788 43.04-10	223.95	224.5	224.87									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1514.658 43.04-09	222.72	224.1	224.68									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1514.585 43.04-08	221.73	224.03	224.64									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1514.506 43.04-07	221.43	223.49	223.87									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1514.414 43.04-06	220.83	223.32	223.81									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1514.353 43.04-05	220.8	223.27	223.76									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1514.345 43.04-04	220.68	223.27	223.76									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1514.331 x-80 (43.04-03)												N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1514.312 43.04-02	220.59	222.54	223									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1514.306 43.04-01	220.5	222.1	222.53									N/A	N/A	N/A	N/A	N/A
Clarkway Trib A	Reach1-DS-0	1514.247 43.02-13	220.38	221.95	222.44									N/A	N/A	N/A	N/A	N/A
Reach 2	Reach 2	1105	237.49	238.77	239.66	North Channel	9b	1069		24.36	237.7		239.8	11.9	0	-0.21	238.77	-0.14
Reach 2	Reach 2	1068	237.41	238.41	239.64	North Channel	9b	1005		24.36	236.65		239.24	11.9	0	0.76	238.41	0.4
Reach 2	Reach 2	1054	236.65	238.45	239.64									N/A	N/A	N/A	N/A	N/A
Reach 2	Reach 2	1027				North Channel	9b	980		Culvert				N/A	N/A	N/A	N/A	N/A
Reach 2	Reach 2	1018	236.6	237.62	238.83	North Channel	9b	975		24.36	236.6		238.59	11.9	0	0	237.62	0.24
Reach 2	Reach 2	1008	235.58	237.42	238.86	North Channel	9b	970		24.36	235.58		238.85	11.9	0	0	237.42	0.01
Reach 2	Reach 2	1005	235.57	237.43	238.85	North Channel	9b	850		24.36	235.57		238.75	11.9	0	0	237.43	0.1
Reach 2	Reach 2	999	235.55	237.21	238.59	North Channel	9b	825		24.36	235.55		238.73	11.9	0	0	237.21	-0.14
Reach 2	Reach 2	951				North Channel	9b	750		Culvert				N/A	N/A	N/A	N/A	N/A
Reach 2	Reach 2	666	234.65	235.87	236.59	North Channel	9b	700		24.36	234.56		236.44	11.9	0	0.09	235.87	0.15
Reach 2	Reach 2	661	234.62	235.85	236.32	North Channel	9b	690		25.34	234.56		236.41	11.9	0	0.06	235.85	-0.09
Reach 2	Reach 2	656	234.66	235.84	236.31									N/A	N/A	N/A	N/A	N/A
Reach 2	Reach 2	604	234.65	235.78	236.24	North Channel	9b	650		25.34	234.46		236.28	11.9	0	0.19	235.78	-0.04
Reach 2	Reach 2	498	234.51	235.61	236.07	North Channel	9b	550		25.34	234.29		236.1	11.9	0	0.22	235.61	-0.03
Reach 2	Reach 2	388	234.38	235.43	235.88	North Channel	9b	450		25.34	234.12		235.91	11.9	0	0.26	235.43	-0.03
Reach 2	Reach 2	307	234.11	235.3	235.73	North Channel	9b	400		25.34	233.99		235.76	11.9	0	0.12	235.3	-0.03
Reach 2	Reach 2	213	233.98	235.14	235.51	North Channel	9b	350		25.34	233.86		235.6	11.9	0	0.12	235.14	-0.09
Reach 2	Reach 2	172	234.11	234.95	235.31	North Channel	9b	300		25.34	233.78		235.47	11.9	0	0.33	234.95	-0.16
Reach 2	Reach 2	117	233.8	234.85	235.19	North Channel	9b	250		25.34	233.69		235.34	11.9	0	0.11	234.85	-0.15
Reach 2	Reach 2	85	233.83	234.76	235.06									N/A	N/A	N/A	N/A	N/A
Reach 2	Reach 2	63	233.87	234.49	234.73	North Channel	9b	200		25.34	233.61		235.16	11.9	0	0.26	234.49	-0.43
Reach 2	Reach 2	45	233.72	234.35	234.53	North Channel	9b	150		25.34	233.52		234.69	11.9	0	0.2	234.35	-0.16

SCE Existing HEC-RAS Analysis Results						TRCA Original Model HEC-RAS Results								Difference (SCE - TRCA)				
			Min Ch El	W.S. Elev (m)					Peak Flow (m^3/s)		Min Ch El	W.S. Elev (m)		Peak Flow (m^3/s)		Min Ch El	W.S. Elev (m)	
River	Reach	River Sta	(m)	100Yr	Regional	River	Reach	River Sta	100 Year	Regional	(m)	100Yr	Regional	100 Year	Regional	(m)	100Yr	Regional
Gore Road Trib	Reach2	1450.572 41.08-05	237.54	238.25	238.48	Gore Road Trib	Reach2	1450.572 41.08-05	4.17	10.74	237.54	238.25	238.48	0	0	0	0	0
Gore Road Trib	Reach2	1450.428 41.08-04	235.83	236.46	236.82	Gore Road Trib	Reach2	1450.428 41.08-04	4.17	10.74	235.83	236.46	236.82	0	0	0	0	0
Gore Road Trib	Reach2	1450.284 41.08-03	234.78	235.2	235.41	Gore Road Trib	Reach2	1450.284 41.08-03	4.17	10.74	234.78	235.2	235.41	0	0	0	0	0
Gore Road Trib	Reach2	1450.168 41.08-02	233.73	234.16	234.36	Gore Road Trib	Reach2	1450.168 41.08-02	4.17	10.74	233.73	234.16	234.36	0	0	0	0	0
Gore Road Trib	Reach2	1450.000 41.08-01	233.28	233.81	234.14	Gore Road Trib	Reach2	1450.000 41.08-01	4.17	10.74	233.28	233.81	234.14	0	0	0	0	0
Gore Road Trib	Reach1	1416.798 41.07-06	232.98	233.56	233.91	Gore Road Trib	Reach1	1416.798 41.07-06	12.23	31.51	232.98	233.56	233.91	0	0	0	0	0
Gore Road Trib	Reach1	1416.721 41.07-05	232.59	233.12	233.49	Gore Road Trib	Reach1	1416.721 41.07-05	12.23	31.51	232.59	233.12	233.49	0	0	0	0	0
Gore Road Trib	Reach1	1416.598 41.07-04	231.99	232.58	232.88	Gore Road Trib	Reach1	1416.598 41.07-04	12.23	31.51	231.99	232.58	232.88	0	0	0	0	0
Gore Road Trib	Reach1	1416.398 41.07-03	230.73	231.42	231.81	Gore Road Trib	Reach1	1416.398 41.07-03	12.23	31.51	230.73	231.42	231.81	0	0	0	0	0
Gore Road Trib	Reach1	1416.261 41.07-02	229.56	230.54	230.78	Gore Road Trib	Reach1	1416.261 41.07-02	12.23	31.51	229.56	230.54	230.78	0	0	0	0	0
Gore Road Trib	Reach1	1416.193 41.07-01	229.05	229.94	230.3	Gore Road Trib	Reach1	1416.193 41.07-01	12.23	31.51	229.05	229.94	230.3	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1416.041 41.06-16	228.39	229.16	229.49	Gore Road Trib	Reach1	1416.041 41.06-16	15.08	40.85	228.39	229.16	229.49	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1415.982 41.06-15	228.33	228.79	229.02	Gore Road Trib	Reach1	1415.982 41.06-15	15.08	40.85	228.33	228.79	229.02	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1415.904 41.06-14	227.4	228.2	228.58	Gore Road Trib	Reach1	1415.904 41.06-14	15.08	40.85	227.4	228.2	228.58	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1415.793 41.06-13	226.47	227.7	228.11	Gore Road Trib	Reach1	1415.793 41.06-13	15.08	40.85	226.47	227.7	228.11	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1415.720 41.06-12	226.47	227.41	227.79	Gore Road Trib	Reach1	1415.720 41.06-12	15.08	40.85	226.47	227.41	227.79	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1415.590 41.06-11	225.93	226.9	227.27	Gore Road Trib	Reach1	1415.590 41.06-11	15.08	40.85	225.93	226.9	227.27	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1415.515 41.06-10	225.78	226.43	226.71	Gore Road Trib	Reach1	1415.515 41.06-10	15.08	40.85	225.78	226.43	226.71	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1415.353 41.06-09	225.06	225.73	226.08	Gore Road Trib	Reach1	1415.353 41.06-09	15.08	40.85	225.06	225.73	226.08	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1415.201 41.06-08	224.34	225.12	225.48	Gore Road Trib	Reach1	1415.201 41.06-08	15.08	40.85	224.34	225.12	225.48	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1415.055 41.06-07	223.77	224.36	224.66	Gore Road Trib	Reach1	1415.055 41.06-07	15.08	40.85	223.77	224.36	224.66	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1414.792 41.06-06	222.48	223.24	223.55	Gore Road Trib	Reach1	1414.792 41.06-06	15.08	40.85	222.48	223.24	223.55	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1414.601 41.06-05	221.55	222.37	222.9	Gore Road Trib	Reach1	1414.601 41.06-05	15.08	40.85	221.55	222.37	222.9	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1414.401 41.06-04	220.38	221.9	222.59	Gore Road Trib	Reach1	1414.401 41.06-04	15.08	40.85	220.38	221.9	222.59	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1414.292 41.06-03	220.38	221.9	222.58	Gore Road Trib	Reach1	1414.292 41.06-03	15.08	40.85	220.38	221.9	222.58	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1414.284 41.06-02	220.38	221.84	222.58	Gore Road Trib	Reach1	1414.284 41.06-02	15.08	40.85	220.38	221.84	222.58	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1414.268 x-124 (41.06-01)				Gore Road Trib	Reach1	1414.268 x-124 (41.06-01)	Culvert									
Gore Road Trib	Reach1-DS-0	1414.253 41.05-13	220.41	221.2	221.65	Gore Road Trib	Reach1	1414.253 41.05-13	15.53	39.9	220.41	221.2	221.65	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1414.247 41.05-12	220.32	221.19	221.55	Gore Road Trib	Reach1	1414.247 41.05-12	15.53	39.9	220.32	221.19	221.55	0	0	0	0	0
Gore Road Trib	Reach1-DS-0	1414.191 41.05-11	219.93	220.93	221.31	Gore Road Trib	Reach1	1414.191 41.05-11	15.53	39.9	219.93	220.93	221.31	0	0	0	0	0

APPENDIX B

FLOODPLAIN MAPPING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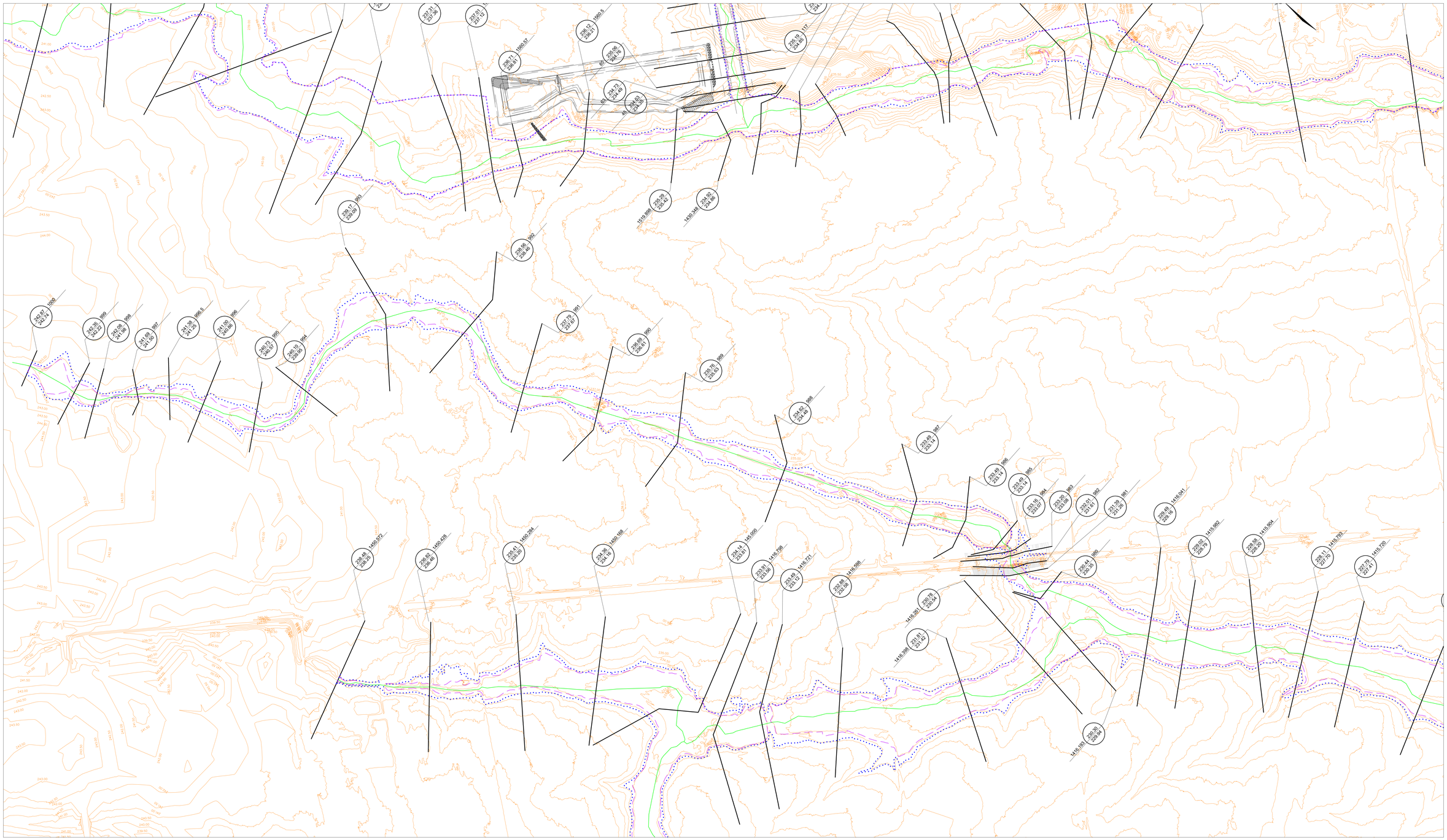


REVISIONS

NO.	DESCRIPTION	BY	DATE

LEGEND

Contour, Index
- Intermediate
- Supplementary
- Approximate
- Depression

Spot Elevation, Water Level

River, Stream, Canal
- Approximate Alignment
- Disappearing
- Spit

Lake

Flooded Land

Marsh, Swamp

Ditch, Drain

Rapids

Reservoir

Falls

Building, Garage, Shed
- Under Construction, Foundation
- Ruins

Road, Hard Surface, with Median
- Driveway, or Loose Surface
- Farm Lane, Cart Track, Wagon Road
- Footpath, Trail

Bridge, Footbridge

Fence

Cliff, Cut and Fill

Culvert

Dam, Beaver Dam

Pipeline

Airport Runway
- Power Transmission Line, with Poles, with Pylons

Railway

Wooded Area

Chimney

Hedge

Wall

Regional Flood Line

100 Year Flood Line

This map was compiled photogrammetrically from 1/10 000 aerial photography exposed in April 1977.

The vertical datum is mean sea level as established by the Geodetic Survey of Canada.

North American Datum 1927, U.T.M. 6° projection Zone 17, Central Meridian 81° W.

Transformed to North American Datum 1983 Zone 17, Central Meridian 81° W. in 2007

Grid Interval 100 metres.

PLEASE NOTE:
FLOODLINE ELEVATIONS ARE SUBJECT TO CHANGE DUE TO REVISED INFORMATION.

SCHAEFFERS
CONSULTING ENGINEERS

PLEASE NOTE:
THE PROFESSIONAL ENGINEER'S STAMP VERIFIES THE FLOOD LINE AND ASSOCIATED DATA NOT THE MAP DATA UNLESS OTHERWISE NOTED

LICENSED PROFESSIONAL ENGINEER
K. SHAHBIKIAN
PROVINCE OF ONTARIO

FLOOD PLAIN MAPPING PROGRAM

FLOODLINE APPROVED DATE:

TORONTO AND REGION Conservation
for The Living City

5 Shoreham Drive Downsview Ontario M3N 1S4 (416) 661-6600

Scale 1: 2000

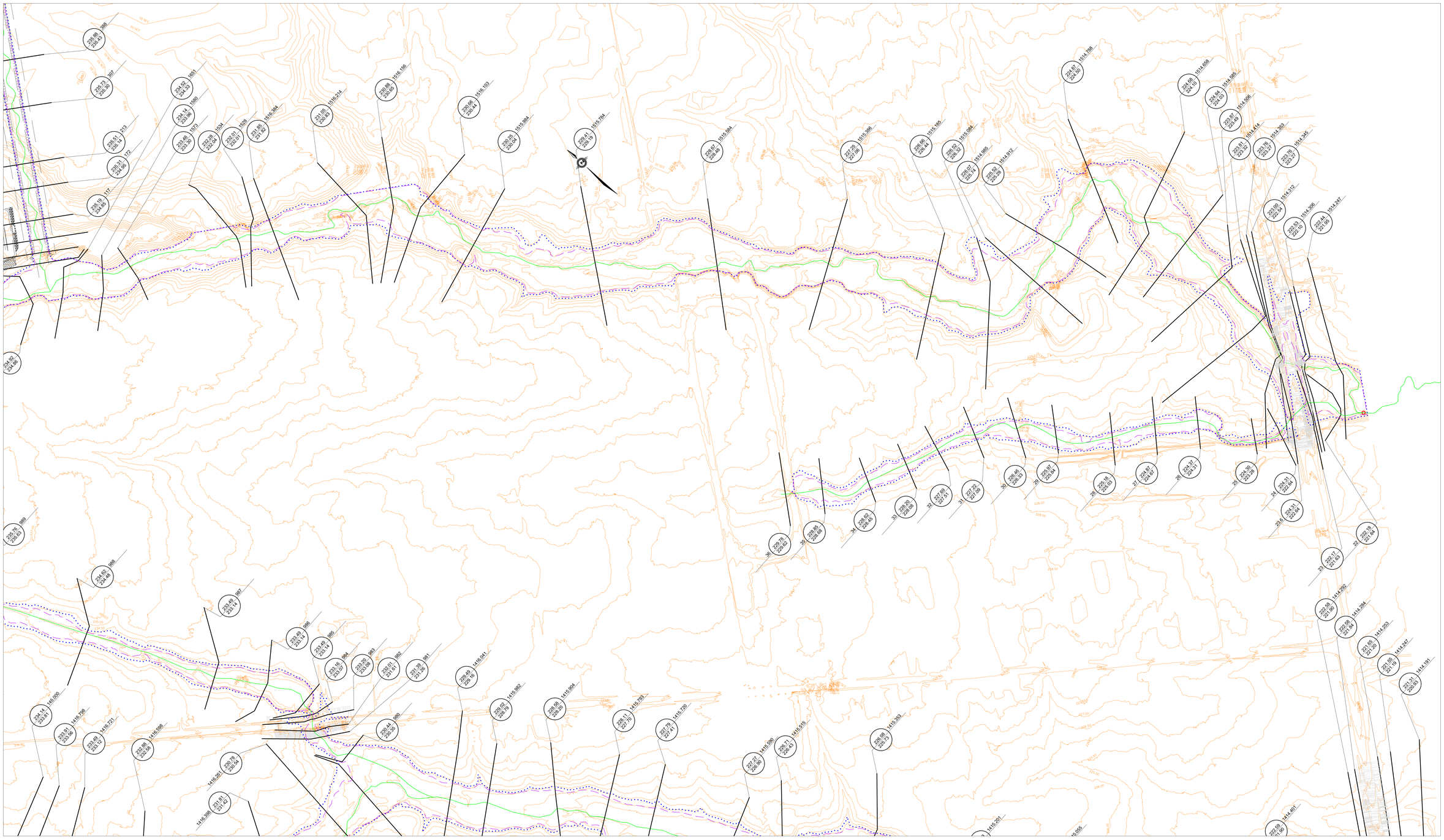
100 0 100 200 Metres

200 0 200 400 600 800 1000 Feet

CONTOUR INTERVAL 1.0 METRES:

HUMBER RIVER

SHEET No. EX-2



REVISIONS			
NO.	DESCRIPTION	BY	DATE

LEGEND
Cross-Section Label
Cross-Section Leader Line
Regional Flood Elevation (m)
Cross-Section Number
19.8600
235.96
235.96
100 Year Flood Elevation (m)
Cross-Section Length
REGULATORY FLOOD ELEVATION IS THE HIGHER OF THE TWO ELEVATIONS DISPLAYED

LEGEND

Contour, Index
Intermediate
Supplementary
Approximate
Depression
Spot Elevation, Water Level
River, Stream, Canal
Approximate Alignment
Disappearing
Spit
Lake
Flooded Land
Marsh, Swamp
Ditch, Drain
Rapids
Reservoir
Falls
Building, Garage, Shed
Under Construction, Foundation
Ruins

Road, Hard Surface, with Median
Driveway, or Loose Surface
Farm Lane, Cart Track, Wagon Road
Footpath, Trail
Bridge, Footbridge
Fence
Cliff, Cut and Fill
Culvert
Dam, Beaver Dam
Pipeline
Airport Runway
Power Transmission Line, with Poles, with Pylons
Railway
Wooded Area
Chimney
Hedge
Wall
Regional Flood Line
100 Year Flood Line

This map was compiled photogrammetrically from 1/10 000 aerial photography exposed in April 1977.
The vertical datum is mean sea level as established by the Geodetic Survey of Canada.
North American Datum 1927, U.T.M. 6° projection Zone 17, Central Meridian 81° W.
Transformed to North American Datum 1983 Zone 17, Central Meridian 81° W. in 2007
Grid Interval 100 metres.

PLEASE NOTE:
FLOODLINE ELEVATIONS ARE SUBJECT TO CHANGE DUE TO REVISED INFORMATION.

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LICENSED PROFESSIONAL ENGINEER
K. SHAHBIKIAN
PROVINCE OF ONTARIO

FLOOD PLAIN MAPPING PROGRAM

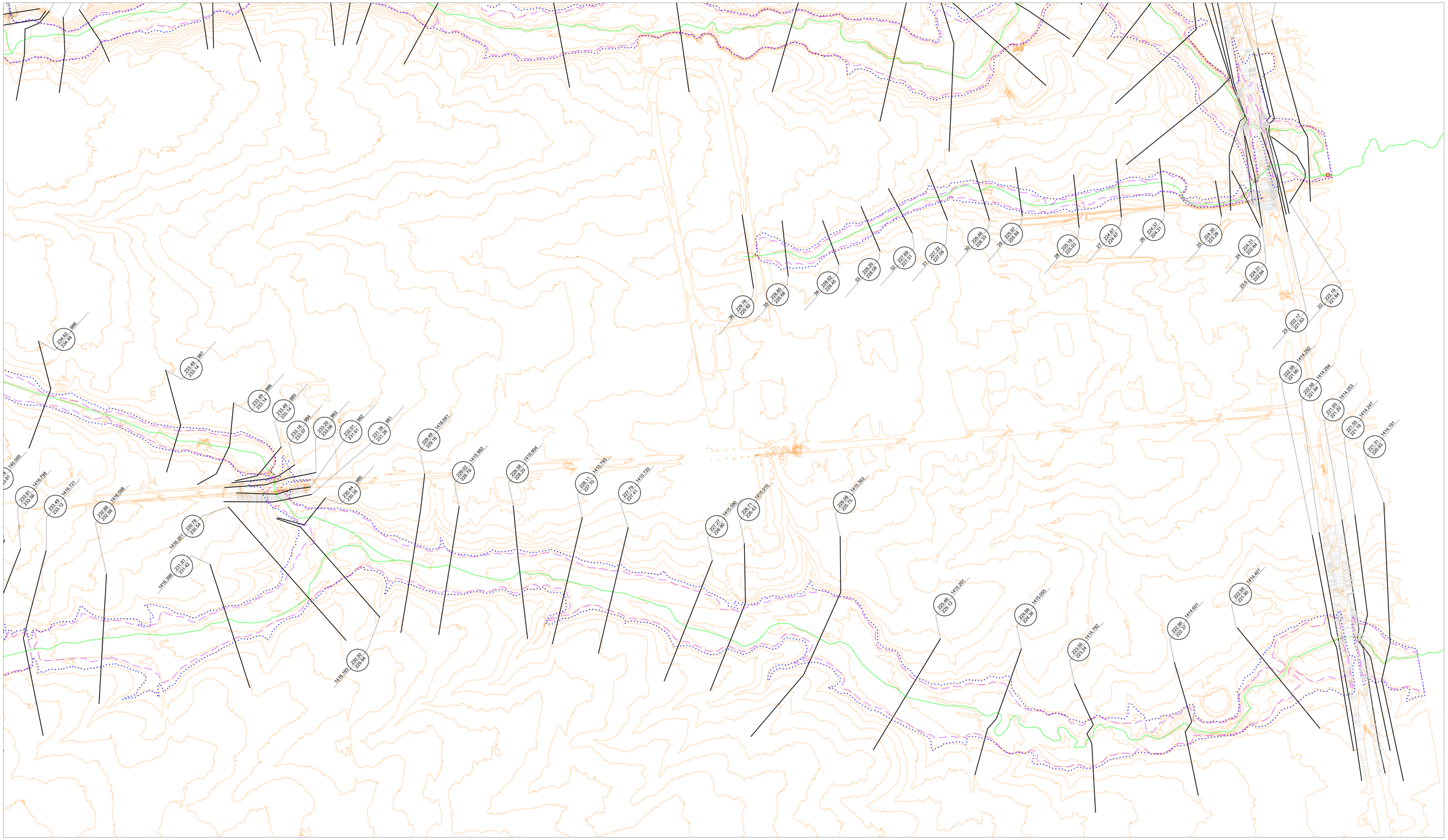
FLOODLINE APPROVED DATE:

TORONTO AND REGION Conservation
for The Living City
5 Shoreham Drive Downsview Ontario M3N 1S4 (416) 661-6600

Scale 1: 2000
100 0 100 200 Metres
200 0 200 400 600 800 1000 Feet
CONTOUR INTERVAL 1.0 METRES:

HUMBER RIVER

SHEET No. EX-3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228.62
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227.97
227.84

APPENDIX C

SUPPORTING DOCUMENTS

From: Priyantha Hunukumbura
To: Debebe Yilak
Cc: Dilnesaw Chekol; Anthony Syhlonyk; Koryun Shahbikian
Subject: RE: Request for Hydraulic Model
Date: February 3, 2023 11:05:28 AM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png
image006.png
image007.png

Hi Debebe,
Please use the flowing flow values in the HEC-RAS model that you are going to create for the watercourse shown below.

	Flow at Flow Change Location(m3/s)	
Storm Event	**A**	**B**
Regional	6.45	4.21
100-Year	2.53	1.65
50-Year	2.22	1.45
25-Year	1.92	1.25
10-Year	1.52	0.99
5-Year	0.73	0.48
2-Year	0.42	0.28



If you need any further clarification, please let me know.

Thanks,

Priyantha Hunukumbura, Ph.D., P.Eng.
Technologist, Water Resources
Engineering Services | Development and Engineering Services

T: +1 647-426-4554
E: priyantha.hunukumbura@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

Toronto and Region Conservation Authority

From: Debebe Yilak <dyilak@schaeffers.com>
Sent: February 1, 2023 1:36 PM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Cc: Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>; Anthony Syhlonyk <Anthony.Syhlonyk@trca.ca>; Koryun Shahbikian <kshahbikian@schaeffers.com>
Subject: RE: Request for Hydraulic Model

Hi Priyantha;
The model contains prorated flow for the regional storm for our interest catchment area. Could you please share with us the estimated flows for the 2-year – 100 Year storm events as well?

Kind Regards;

Debebe Yilak, M.Sc., P.Eng.,
Water Resources Analyst

SCHAEFFERS
CONSULTING ENGINEERS
6 Ronrose Drive, Concord, Ontario, L4K4R3
(905) 738-6100 – Ext. 234
www.schaeffers.com

From: Debebe Yilak
Sent: January 30, 2023 1:34 PM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Cc: Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>; Anthony Syhlonyk <Anthony.Syhlonyk@trca.ca>; Koryun Shahbikian <kshahbikian@schaeffers.com>
Subject: RE: Request for Hydraulic Model

Hello Priyantha;

Thank you very much for sharing the data and detailed information.

Kind Regards;

Debebe Yilak, M.Sc., P.Eng.,
Water Resources Analyst

SCHAEFFERS
CONSULTING ENGINEERS

6 Ronrose Drive, Concord, Ontario, L4K4R3
(905) 738-6100 – Ext. 234
www.schaeffers.com

From: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Sent: January 30, 2023 12:10 PM
To: Debebe Yilak <dyilak@schaeffers.com>
Cc: Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>; Anthony Syhlonyk <Anthony.Syhlonyk@trca.ca>; Koryun Shahbikian <kshahbikian@schaeffers.com>
Subject: RE: Request for Hydraulic Model

Hi Debebe,
Thanks for completing the online payment.
Please access the following link to download the requested data.

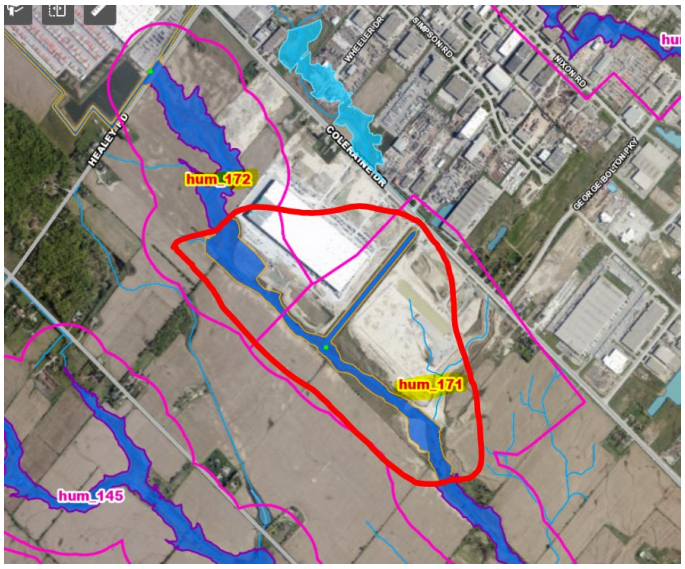
Healey_Coleraine_HumberStation_Mayfield(Debebe)

Please note the following.

1. Floodplain mapping sheets

   Areas within the RED Circle shown below.

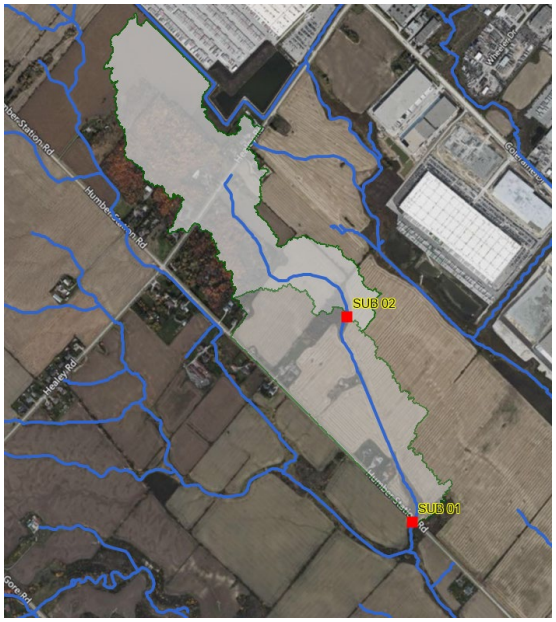
   Please do not use the floodplain mapping sheet **hum_171** and **hum_172** for the area circled in RED below. Instead, please use the floodplain information in the “For the realignment Area” folder for the circled area in RED.



2. HEC-RAS modeling

   Please do not use the WEST HUMBER HEC-RAS model for the Area circled in RED above (Channel Realignment Area). I will provide the HEC-RAS model for the realignment area later.

3. The regional Peak flow values and flow change locations for the tributary shown in the figure below. Catchment area for the sub catchments SUB01 and SUB02 shown below are 83.467 ha and 47.274 ha respectively.



   Peak flows at SUB01 and SUB02 were calculated using the approved Humber hydrology model and with the MTO transposition equation.

   TRCA typically apply downstream peak flows at the upstream location for floodplain mapping. Therefore, please use the locations showing below as the flow change location in the HEC-RAS model that you are planning to develop.



Flow change Locations	Flow (CMS)
A	6.45
B	4.21

If you need any further clarification, please let me know.

Thanks,

Priyantha Hunukumbura, Ph.D., P.Eng.
Technologist, Water Resources
Engineering Services | Development and Engineering Services

T: +1 647-426-4554
E: priyantha.hunukumbura@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

Toronto and Region Conservation Authority

From: Debebe Yilak <dyilak@schaeffers.com>
Sent: January 27, 2023 9:19 AM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Cc: Koryun Shahbikian <kshahbikian@schaeffers.com>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>
Subject: RE: Request for Hydraulic Model

Hi Priyantha;

We have paid the payment. Please find the attached receipt.

Let me know if you need more information;

Kind Regards;

Debebe Yilak, M.Sc., P.Eng.,
Water Resources Analyst

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CONSULTING ENGINEERS

6 Ronrose Drive, Concord, Ontario, L4K4R3
(905) 738-6100 – Ext. 234
www.schaeffers.com

From: Debebe Yilak
Sent: January 20, 2023 10:43 AM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Cc: Koryun Shahbikian <kshahbikian@schaeffers.com>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>
Subject: RE: Request for Hydraulic Model

Hi Priyantha;

Thank you for sharing the data-sharing agreement. Please find the signed data-sharing agreement.

Let me know if you need more information;

Kind Regards;

Debebe Yilak, M.Sc., P.Eng.,
Water Resources Analyst

SCHAEFFERS
CONSULTING ENGINEERS

6 Ronrose Drive, Concord, Ontario, L4K4R3
(905) 738-6100 – Ext. 234
www.schaeffers.com

From: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Sent: January 20, 2023 9:42 AM
To: Debebe Yilak <dyilak@schaeffers.com>
Cc: Koryun Shahbikian <kshahbikian@schaeffers.com>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>
Subject: RE: Request for Hydraulic Model

Hi Debebe,
My apologies for not attaching the data sharing agreement in the previous email. If the data is for the same project, one data sharing agreement is fine. Please include everything in the attached data sharing agreement.
If you need any other clarification, please let me know.

Thanks,

Priyantha Hunukumbura, Ph.D., P.Eng.
Technologist, Water Resources
Engineering Services | Development and Engineering Services

T: +1 647-426-4554
E: priyantha.hunukumbura@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

Toronto and Region Conservation Authority

From: Debebe Yilak <dyilak@schaeffers.com>
Sent: January 20, 2023 9:38 AM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Cc: Koryun Shahbikian <kshahbikian@schaeffers.com>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>
Subject: RE: Request for Hydraulic Model

Hi Priyantha;
Thank you for the detailed email. I think the data-sharing agreement is missing. Could you please attach it? Regarding the eastern portion of the model, it belongs to the same project as the western portion but we are planning to use it for a different level of study. Hence, I think both parts of the model can be done with one data-sharing agreement. It could be easy for us if we could get both in one model. I am not sure how long would it take to you to combine both models in one and share it with us.

Please let me know if you need more information;

Kind Regards;

Debebe Yilak, M.Sc., P.Eng.,
Water Resources Analyst

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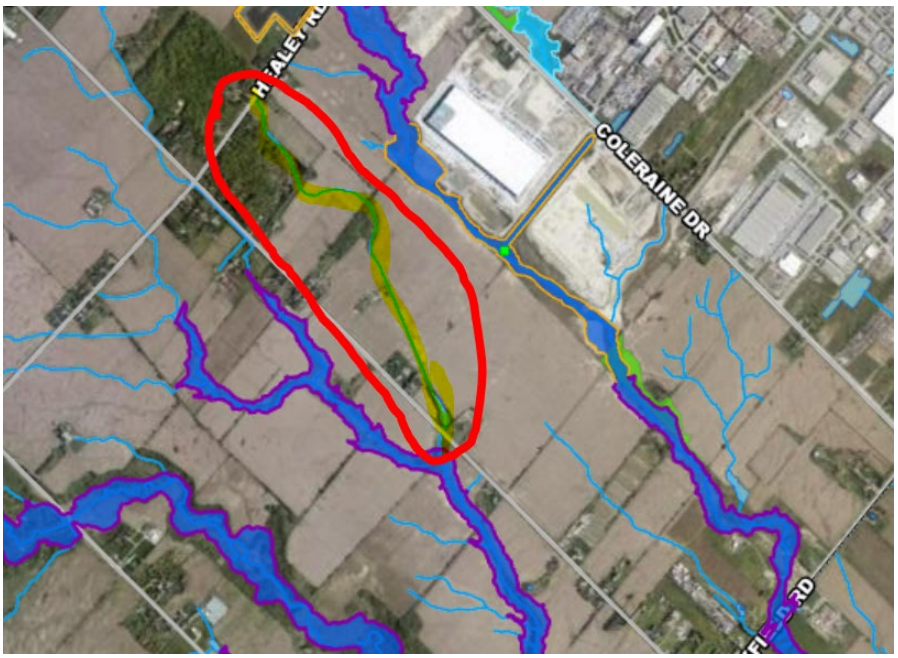
CONSULTING ENGINEERS

6 Ronrose Drive, Concord, Ontario, L4K4R3
(905) 738-6100 – Ext. 234
www.schaeffers.com

From: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Sent: January 19, 2023 6:59 PM
To: Debebe Yilak <dyilak@schaeffers.com>
Cc: Koryun Shahbikian <kshahbikian@schaeffers.com>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>
Subject: RE: Request for Hydraulic Model

Hi Debebe,
Herewith I attached the TRCA's data sharing agreement. Can you please send me back the signed data sharing agreement.
As Discussed, I am preparing the floodplain mapping sheet "**hum_145**" in CAD format, corresponding engineered HEC-RAS model and the regional peak flow data to be used in developing the HEC-RASA model for the watercourse circled in RED below.



I will prepare the data you requested for the eastern watercourse located close to Coleraine Dr. My understanding is that this data is for another project. If so, please send me a separate data sharing agreement.

If you need any clarification, please let me know.

Thanks,

Priyantha Hunukumbura, Ph.D., P.Eng.
Technologist, Water Resources
Engineering Services | Development and Engineering Services

T: +1 647-426-4554
E: priyantha.hunukumbura@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

Toronto and Region Conservation Authority

From: Debebe Yilak <dyilak@schaeffers.com>
Sent: January 17, 2023 12:03 PM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Cc: Koryun Shahbikian <kshahbikian@schaeffers.com>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>
Subject: RE: Request for Hydraulic Model

Hi Priyantha;
Hope you are doing well. This is to follow up on our previous request for a hydraulic model for a subject area located in the attached map.

Let me know if you need more information.

Kind Regards;

Debebe Yilak, M.Sc., P.Eng.,
Water Resources Analyst

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CONSULTING ENGINEERS
6 Ronrose Drive, Concord, Ontario, L4K4R3
(905) 738-6100 – Ext. 234
www.schaeffers.com

From: Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>
Sent: January 5, 2023 1:25 PM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>; Debebe Yilak <dyilak@schaeffers.com>
Cc: Koryun Shahbikian <kshahbikian@schaeffers.com>
Subject: FW: Request for Hydraulic Model

Hi Debebe and Koryun

Happy New Year to all of you!

Priyantha will take care of your requests.

Regards,

Dilnesaw Chekol, Ph.D, P.Eng
Senior Engineer, Water Resources
Engineering Services | Development and Engineering Services

T: (437) 880-1979
C: (416) 624-7683
E: dilnesaw.chekol@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

From: Debebe Yilak <dyilak@schaeffers.com>
Sent: Thursday, January 5, 2023 1:15 PM
To: Alwish Gnanaraj <Alwish.Gnanaraj@trca.ca>
Cc: Koryun Shahbikian <kshahbikian@schaeffers.com>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>
Subject: Request for Hydraulic Model

Hi Alwish and Dilnesaw .. Happy New Year!!

We are working floodplain analysis for a project described in the attached location map. The site is bounded by:

- Healey Rd to the North
- Coleraine Dr to the east
- Humber Station Rd to the west, and
- Mayfield Rd to the south.

Could you please check the availability of the latest TRCA-approved hydraulic model and share the data-sharing agreement?

Kind Regards;

Debebe Yilak, M.Sc., P.Eng.,
Water Resources Analyst

SCHAEFFERS
CONSULTING ENGINEERS

6 Ronrose Drive, Concord, Ontario, L4K4R3
(905) 738-6100 – Ext. 234
www.schaeffers.com

SKETCH SHOWING TOPOGRAPHIC INFORMATION

SCALE 1:2000

0m 20m 40m 80m 120m 160 metres

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LEGEND

ø	DENOTES DIAMETER
	DENOTES FENCE
	DENOTES OVERHEAD WIRE
	DENOTES HYDRO-GUY
SIGN	DENOTES SIGN
UP	DENOTES UTILITY POLE

FIELD OBSERVATIONS:

THE FIELD OBSERVATIONS REPRESENTED ON THIS PLAN WERE COMPLETED ON THE 17th DAY OF DECEMBER , 2021

INST. RO657616

PART 2

PART 1

PLAN 43R-4459

HUMBER STATION ROAD

(ROAD ALLOWANCE BETWEEN CONCESSIONS 4 AND 5)

PART

PLAN

LOT 4

PART 4

PART 3

PLAN 43R-4459

INST. RO657616

INST. RO818037

HUMBER STATION ROAD

(ROAD ALLOWANCE BETWEEN CONCESSIONS 4 AND 5)

43R-1868

43R-1868

TOP OF BANK

WATERS EDGE

LOT 3

PART

PLAN

TOP OF BANK

TOP OF BANK

PART 1 43R-14264

PART 2 43R-14264

PART 1, PLAN 43R-33800

HUMBER STATION ROAD

(ROAD ALLOWANCE BETWEEN CONCESSIONS 4 AND 5)

43R-32040

43R-32040

CONCESSION 4

PART

PLAN

TOP OF BANK

EDGE OF PAVEMENT

TOP OF BANK

DRIPLINE

CHAIN LINK FENCE

PART

PLAN

43R-32040

LOT

CONCESSION 4

HUMBER STATION ROAD

(ROAD ALLOWANCE BETWEEN CONCESSIONS 4 AND 5)

INST. RO1721035

INST. RO1140460

INST. RO852828

INST. RO577179

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Website: www.r-pe.ca

DRAWN: K.M.

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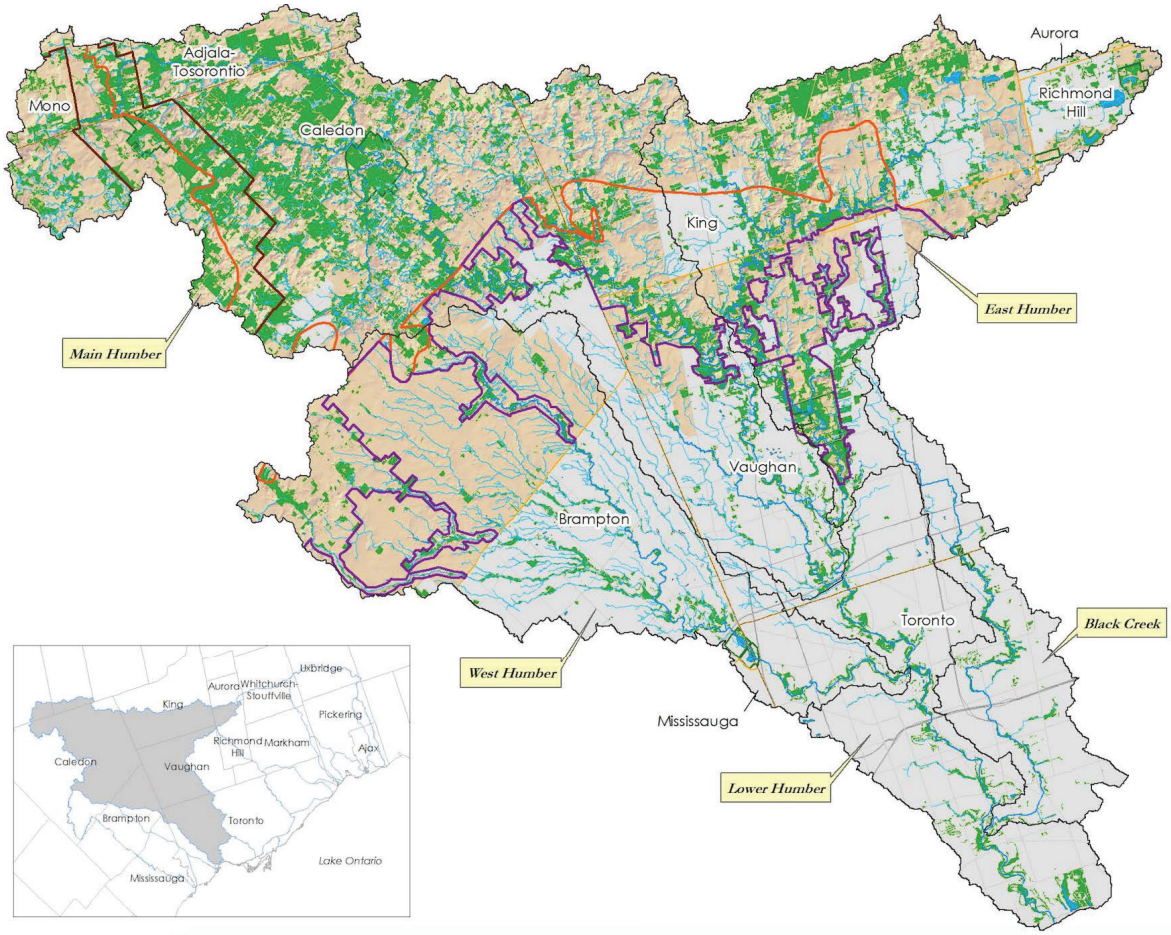
April 2018

CIVICA
Waste Management Solutions

Prepared for: Toronto and Region Conservation Authority (TRCA)

Final Report:
Humber River Hydrology Update



CIVICA
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330 Rodinea Rd., Unit 3
Vaughan, ON L6A 4P5
905.417.9792
info@civi.ca

www.civi.ca

Appendix I

Initial Model Parameters
(Existing Conditions)

Initial Model Parameters (NasHyd)

NHYD	Catchment ID	DT [min]	AREA [ha]	DWF [cms]	N	TP [hr]	IA [mm]	CN AMC II *
581	39.01	5	12.89	0	3	0.68	10	78
582	39.02	5	26.29	0	3	0.80	10	77
584	39.04	5	38.49	0	3	1.96	10	80
589	39.09	5	35.59	0	3	1.59	10	80
590	39.10	5	25.19	0	3	0.94	10	85
591	39.11	5	21.4	0	3	0.72	10	87
593	39.13	5	108.88	0	3	2.96	10	81
594	40.01	5	265.88	0	3	3.20	10	67
595	40.02	5	14.17	0	3	0.46	10	76
597	40.04	5	5.39	0	3	0.41	10	72
598	40.05	5	13.19	0	3	0.72	10	69
600	40.07	5	21.83	0	3	0.79	10	73
601	40.08	5	10.02	0	3	0.74	10	73
602	40.09	5	20.88	0	3	0.68	10	87
607	41.01	5	163.14	0	3	2.89	10	83
608	41.02	5	47.19	0	3	1.68	10	78
609	41.03	5	73.72	0	3	1.90	10	81
611	41.05	5	62.92	0	3	1.71	10	83
612	41.06	5	127.87	0	3	1.90	10	81
613	41.07	5	101.08	0	3	2.53	10	80
614	41.08	5	362.27	0	3	3.09	10	82
615	42.01	5	47.19	0	3	1.58	10	85
616	42.02	5	23.03	0	3	1.01	10	81
624	42.10	5	15.77	0	3	0.87	10	77
626	42.12	5	6.62	0	3	0.41	10	71
631	42.17	5	25.55	0	3	1.11	10	86
632	43.01	5	226.69	0	3	3.45	10	83
633	43.02	5	129.13	0	3	2.15	10	85
634	43.03	5	63.04	0	3	2.76	10	82
635	43.04	5	24.96	0	3	1.00	10	83
636	43.05	5	39.74	0	3	1.63	10	86
637	43.06	5	35.79	0	3	1.17	10	80
638	43.07	5	35.71	0	3	0.93	10	87
643	44.01	5	63.55	0	3	1.88	10	80
647	44.05	5	7.7	0	3	0.51	10	97
649	44.07	5	8.59	0	3	0.49	10	73
667	45.10	5	211.65	0	3	2.37	10	92
670	45.13	5	26.2	0	3	0.66	10	76
671	45.14	5	12.18	0	3	0.52	10	87
693	47.05	5	15.74	0	3	0.74	10	73

Appendix II

Calibrated Model Parameters
(Existing Conditions)

Calibrated Model Parameters (NasHyd)

NHYD	Catchment ID	DT [min]	AREA [ha]	DWF [cms]	N	TP [hr]	IA [mm]	CN AMC II *	CN AMC III*
575	38.02	5	135.85	0	2.5	1.93	10	94	97
577	38.04	5	142.38	0	2.5	1.99	10	91	96
578	38.05	5	47.43	0	2.5	0.82	10	91	96
579	38.06	5	173.74	0	2.5	2.11	10	90	95
580	38.07	5	293.26	0	2.5	4.55	10	86	93
581	39.01	5	12.89	0	2.5	0.61	10	86	93
582	39.02	5	26.29	0	2.5	0.72	10	85	93
584	39.04	5	38.49	0	2.5	1.76	10	88	94
589	39.09	5	35.59	0	2.5	1.43	10	88	94
590	39.10	5	25.19	0	2.5	0.85	10	94	97
591	39.11	5	21.4	0	2.5	0.65	10	96	98
593	39.13	5	108.88	0	2.5	2.66	10	89	95
594	40.01	5	265.88	0	3	3.2	10	77	89
595	40.02	5	14.17	0	3	0.46	10	87	94
597	40.04	5	5.39	0	3	0.41	10	83	92
598	40.05	5	13.19	0	3	0.72	10	79	90
600	40.07	5	21.83	0	2.5	0.71	10	80	90
601	40.08	5	10.02	0	2.5	0.67	10	80	90
602	40.09	5	20.88	0	3	0.68	10	99	99
607	41.01	5	163.14	0	3	2.89	10	95	98
608	41.02	5	47.19	0	3	1.68	10	90	95
609	41.03	5	73.72	0	3	1.9	10	93	97
611	41.05	5	62.92	0	3	1.71	10	95	98
612	41.06	5	127.87	0	3	1.9	10	93	97
613	41.07	5	101.08	0	3	2.53	10	92	96
614	41.08	5	362.27	0	3	3.09	10	94	97
615	42.01	5	47.19	0	3	1.58	10	98	99
616	42.02	5	23.03	0	3	1.01	10	93	97
624	42.10	5	15.77	0	3	0.87	10	89	95
626	42.12	5	6.62	0	3	0.41	10	82	91
631	42.17	5	25.55	0	3	1.11	10	99	99
632	43.01	5	226.69	0	3	3.45	10	95	98
633	43.02	5	129.13	0	3	2.15	10	98	99
634	43.03	5	63.04	0	3	2.76	10	94	97
635	43.04	5	24.96	0	3	1	10	95	98
636	43.05	5	39.74	0	3	1.63	10	99	99
637	43.06	5	35.79	0	3	1.17	10	92	96
638	43.07	5	35.71	0	3	0.93	10	99	99
643	44.01	5	63.55	0	3	1.88	10	92	96
647	44.05	5	7.7	0	3	0.51	10	99	99
649	44.07	5	8.59	0	3	0.49	10	84	92
667	45.10	5	211.65	0	3	2.37	10	99	99
670	45.13	5	26.2	0	3	0.66	10	87	94
671	45.14	5	12.18	0	3	0.52	10	99	99
693	47.05	5	15.74	0	3	0.74	10	73	86

Appendix IV

Design Storm Model Results

Estimated Peak Flow - Existing Condition (with ponds)

Flow Node #	Hyd #	6hr						12hr						24hr						350yr	500yr
		2yr	5yr	10yr	25yr	50yr	100yr	2yr	5yr	10yr	25yr	50yr	100yr	2yr	5yr	10yr	25yr	50yr	100yr		
39.50	1776	6.94	11.37	54.85	73.86	88.74	104.49	6.95	10.87	63.82	83.47	98.43	114.43	6.37	9.76	65.37	83.47	97.56	112.36	167.72	180.19
39.60	7603	2.20	4.30	37.79	51.04	61.33	72.12	3.15	5.53	43.52	56.90	66.93	77.94	3.92	6.49	43.85	56.04	65.31	75.16	116.47	125.47
40.10	7590	14.57	21.66	94.16	127.33	154.41	181.57	16.95	24.24	113.59	149.08	176.58	206.16	17.35	24.17	119.98	154.65	181.05	209.28	308.24	332.48
40.20	1469	13.21	19.38	95.23	129.85	156.84	183.67	15.10	21.21	114.26	150.17	176.64	205.02	15.08	20.56	119.79	153.94	179.29	206.24	307.90	332.10
40.25	7593	13.36	18.91	28.73	35.09	40.49	48.18	9.57	13.22	19.23	23.09	26.64	30.60	6.32	8.47	11.97	14.25	16.16	18.18	46.34	49.33
40.30	1373	17.31	25.47	95.67	130.20	157.29	184.23	16.82	23.83	115.17	151.43	178.18	206.67	17.17	23.61	121.41	156.12	181.81	209.15	309.76	334.03
41.00	1819	2.36	4.96	12.04	15.95	18.85	21.92	3.22	6.01	13.48	17.22	20.05	23.05	3.56	6.18	13.14	16.51	18.99	21.62	32.89	35.36
41.20	1393	1.75	3.72	8.70	11.46	13.44	15.53	2.40	4.34	9.55	12.15	14.08	16.11	2.58	4.35	9.18	11.53	13.19	14.94	22.94	24.60
41.30	846	1.92	3.71	8.60	11.11	13.07	15.08	2.50	4.28	9.24	11.66	13.52	15.43	2.58	4.20	8.78	10.91	12.53	14.18	21.57	23.06
42.10	7591	3.39	5.53	12.95	17.46	20.41	23.57	3.85	6.81	15.26	19.79	22.74	25.94	4.41	7.52	15.84	20.19	23.10	26.11	36.41	39.09
42.20	1690	3.21	5.41	13.06	17.47	20.27	23.33	3.78	6.83	15.08	19.36	22.22	25.40	4.32	7.37	15.31	19.39	22.15	25.04	35.65	38.25
43.00	1012	6.05	10.12	20.05	25.36	29.49	34.20	7.08	10.78	20.63	25.60	29.27	33.29	6.77	10.13	18.77	23.05	26.26	29.52	48.30	51.82
43.20	857	6.05	10.27	21.38	28.31	33.40	39.22	6.20	9.81	19.87	25.30	29.73	34.13	5.80	8.83	16.52	20.46	23.62	27.21	50.28	54.44
44.10	7592	5.34	9.53	19.65	24.76	28.96	33.58	6.98	11.39	21.76	27.01	31.28	35.74	7.62	11.82	21.59	26.35	30.21	34.04	51.34	55.39
44.20	1307	5.52	9.68	19.57	24.63	28.80	33.17	7.05	11.29	21.32	26.55	30.61	34.66	7.53	11.52	20.96	25.60	29.15	32.68	49.41	53.88
45.00	7569	39.00	58.30	117.94	157.55	189.90	221.80	35.39	50.73	141.38	184.37	217.38	251.60	29.38	43.00	151.70	194.79	227.10	260.98	367.04	395.61
45.10	1028	43.58	64.74	118.13	157.78	190.21	222.18	35.46	50.18	141.60	184.63	217.69	251.88	29.27	42.84	151.67	194.77	227.06	260.63	367.32	395.81
45.20	7572	34.21	50.32	78.26	96.57	109.79	123.98	26.20	36.23	53.87	64.49	72.34	80.60	17.65	24.25	33.85	40.07	44.79	49.59	107.88	114.38
45.30	7573	19.95	32.16	117.33	156.65	188.65	220.33	25.20	38.42	140.46	182.89	215.57	249.28	28.01	41.15	149.32	191.27	222.93	255.69	362.15	389.88
45.40	2074	20.14	32.76	119.08	158.43	190.45	222.99	25.49	38.99	142.33	184.59	217.61	251.31	27.75	40.86	149.91	191.14	223.31	255.79	363.79	391.12
46.00	1503	12.76	19.18	34.87	46.85	55.91	65.46	12.29	18.00	30.07	39.75	47.59	55.47	10.78	15.03	26.37	34.98	41.46	47.53	91.05	100.46
46.10	681	18.34	26.01	35.52	42.95	49.12	56.14	12.65	16.98	22.94	27.44	30.84	34.14	7.69	10.15	13.44	15.84	17.61	19.39	45.16	48.00
46.30	1532	19.26	27.62	39.67	48.65	55.90	64.31	14.37	19.69	28.74	34.52	39.30	44.06	10.00	13.46	19.50	23.43	26.39	29.34	60.66	65.02
47.10	968	27.68	42.36	74.16	96.25	113.93	127.48	25.36	36.15	62.65	77.56	89.98	103.66	20.99	29.45	49.42	61.55	71.67	83.42	155.99	168.24
47.20	1559	22.31	32.74	50.18	64.07	73.79	83.65	17.13	24.25	41.51	54.34	64.50	75.28	14.71	20.71	35.78	45.24	53.42	62.99	119.52	132.23
48.10	7561	53.79	81.08	144.98	179.37	208.32	240.80	54.00	77.17	133.96	162.05	183.74	209.18	48.59	65.48	113.02	135.65	151.76	169.26	302.04	327.53
48.20	1544	64.12	95.29	155.84	189.63	218.38	251.25	57.24	81.86	136.19	160.98	181.44	198.99	48.09	67.11	109.25	128.48	139.00	153.14	286.59	311.67
48.30	1593	39.90	57.37	90.09	112.19	128.28	149.38	34.38	49.10	80.95	99.32	116.61	134.39	30.72	42.34	71.38	83.15	95.10	110.48	206.16	223.33
48.40	1612	26.06	38.95	80.86	109.77	129.93	152.46	27.01	38.23	74.05	94.59	112.45	129.43	24.38	33.95	60.83	76.62	90.14	105.52	197.25	211.83
49.10	1957	64.07	97.35	200.20	260.65	305.75	362.39	75.91	113.07	235.71	300.71	357.75	416.67	83.75	121.91	261.03	326.52	385.10	443.37	605.18	666.90
49.20	1319	76.14	111.98	203.82	265.56	311.29	370.49	73.86	108.86	240.32	304.52	364.58	424.55	79.06	113.01	261.98	325.12	386.33	444.32	610.79	672.49
49.30	975	63.41	96.56	201.07	261.17	306.46	363.81	75.31	112.30	236.31	301.45	358.33	417.68	82.88	119.91	260.76	326.18	385.46	443.39	606.75	667.72
49.40	7565	27.25	42.86	52.57	65.18	77.05	90.31	22.63	33.25	40.25	49.27	55.56	62.27	16.48	22.60	27.39	33.40	37.43	41.89	88.72	95.09
49.50	1631	59.53	93.85	202.12	261.72	307.28	364.82	74.32	109.75	237.29	302.01	359.00	418.39	80.85	116.37	260.56	325.76	385.61	442.67	606.31	668.11
49.70	1005	60.33	94.43	202.97	263.23	308.68	366.23	74.09	109.51	238.34	303.01	361.10	419.79	80.36	115.15	260.69	325.45	385.27	442.80	607.79	669.39
49.80	7568	21.94	31.12	47.43	58.82	68.04	77.19	17.52	24.74	35.96	42.79	47.78	53.14	11.87	16.23	22.99	26.98	29.87	32.79	74.13	78.64
49.90	7616	59.22	93.52	202.97	263.23	308.68	366.23	73.42	108.14	238.34	303.00	361.09	419.77	79.01	113.07	260.15	324.82	384.56	441.99	607.76	669.36
50.00	1649	113.74	170.59	277.15	353.06	413.37	478.05	125.72	178.16	282.25	357.43	414.34	479.90	121.33	171.87	274.59	342.86	403.98	465.66	709.00	768.57
50.10	1000	109.30	160.98	265.49	340.58	397.61	464.10	122.38	174.40	280.04	354.20	410.87	475.72	121.19	172.40	273.50	342.55	403.63	464.13	701.85	763.04
50.20	770	113.06	169.14	273.55	348.44	407.50	472.33	123.06	174.06	277.01	353.21	408.77	473.05	118.40	169.13	274.20	342.23	403.71	465.00	697.37	755.54
51.10	1442	22.31	33.71	121.59	161.86	195.53	228.17	26.12	40.26	145.25	189.03	222.71	258.10	28.36	41.95	152.71	195.54	227.98	261.27	379.92	410.23

Appendix VIII

Model Parameters (Future Conditions)

Funture Model Parameters (NasHyd)

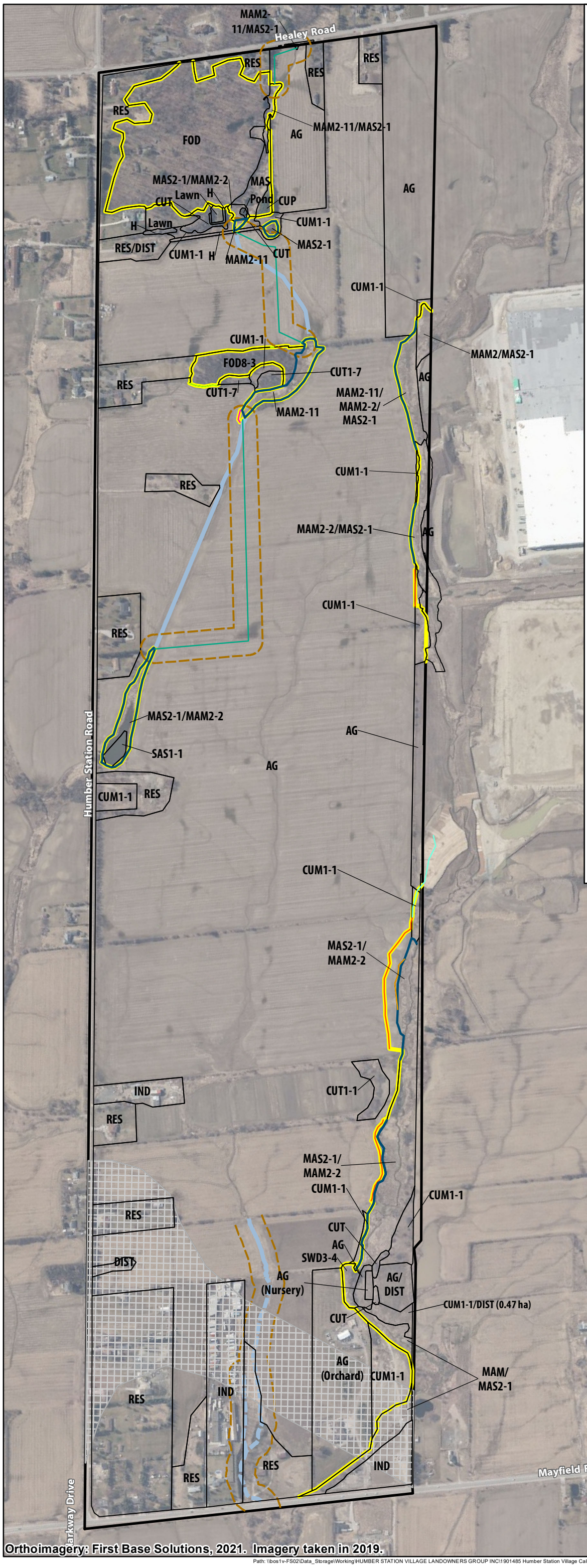
NHYD	Catchment ID	DT [min]	AREA [ha]	DWF [cms]	N	TP [hr]	IA [mm]	CN AMC II *	CN AMC III*
597	40.04	5	5.39	0	3	0.41	10	83	92
598	40.05	5	13.19	0	3	0.72	10	81	91
600	40.07	5	21.83	0	2.5	0.71	10	83	92
601	40.08	5	10.02	0	2.5	0.67	10	81	91
612	41.06	5	127.87	0	3	1.9	10	93	97
613	41.07	5	101.08	0	3	2.53	10	91	96
614	41.08	5	362.27	0	3	3.09	10	94	97
615	42.01	5	47.19	0	3	1.58	10	97	99
616	42.02	5	23.03	0	3	1.01	10	94	97
624	42.10	5	15.77	0	3	0.87	10	89	95
626	42.12	5	6.62	0	3	0.41	10	81	91
634	43.03	5	63.04	0	3	2.76	10	96	98
635	43.04	5	24.96	0	3	1	10	99	99
637	43.06	5	35.79	0	3	1.17	10	91	96
643	44.01	5	63.55	0	3	1.88	10	93	97
649	44.07	5	8.59	0	3	0.49	10	89	95
670	45.13	5	26.2	0	3	0.66	10	89	95
693	47.05	5	15.74	0	3	0.74	10	75	87
7663	04.01B	5	374.161	0	1.5	2.94	43.4	69	84
7620	06.04B	5	36.255	0	1.5	0.92	10	87	94
7614	06.17B	5	71.299	0	1.5	1.55	10	78	89
7602	07.15B	5	145.847	0	1.5	0.49	23.1	75	87
7657	08.05B	5	102.491	0	3	1.39	43.4	71	85
7658	08.06B	5	131.151	0	3	2.1	43.4	86	93
7654	10.17B	5	125.348	0	1.75	1.28	37.4	86	93
7650	10.22B	5	79.807	0	1.75	0.23	43.4	68	83
7651	10.22C	5	46.08	0	1.75	0.76	43.4	87	94
7640	13.13B	5	107.971	0	3	1.38	10	83	92
7628	15.01B	5	43.872	0	1.5	1.98	12	63	80
7623	15.04B	5	83.182	0	1.5	1.25	12	65	81
7661	15.05B	5	91.055	0	1.5	0.51	21.3	65	81
7626	15.06B	5	31.85	0	1.5	2.02	32.7	44	64
7632	15.10B	5	63.862	0	1.5	1.76	22.4	46	66
7630	16.19B	5	90.985	0	1.5	2.9	12	61	78
7633	19.05B	5	15.337	0	1.5	0.94	12	59	77
7636	20.01B	5	90.8	0	1.5	3.97	12	55	74
7638	20.04B	5	62.392	0	1.5	1.98	12	60	78
7642	22.05B	5	68.059	0	1.5	1.63	10	68	83
7643	22.15B	5	24.643	0	1.5	0.8	10	87	94
7647	29.12B	5	7.112	0	2.5	0.36	10	82	91
7646	36.04B	5	16.638	0	2.5	1.04	10	72	86

Appendix X

Results (Regional Storm)

Peak Flow at Flow Nodes (Regional Storm)

Flow Node #	Hyd #	Areal Reduction Factor	Existing (m^3/s)	Future (m^3/s)	Difference (m^3/s)	Difference (%)	Comments
36.00	7606	99.2%	74.11	69.81	-4.29	**-0.06**	Timing of the Hydrographs Catchments 36.04 split into 36.04B (NasHyd) and 36.04A (StandHyd)
36.10	724	100.0%	72.83	68.11	-4.72	**-0.06**	Timing of the Hydrographs Catchments 36.04 split into 36.04B (NasHyd) and 36.04A (StandHyd)
36.20	7608	100.0%	32.36	31.47	-0.88	**-0.03**	Timing of the Hydrographs Catchments 36.04 split into 36.04B (NasHyd) and 36.04A (StandHyd)
36.40	7609	100.0%	40.59	36.69	-3.90	**-0.10**	Timing of the Hydrographs Catchments 36.05 change from NasHyd to StandHyd
37.00	729	99.2%	145.52	145.62	0.10	0.00	
37.10	7610	99.2%	48.22	48.22	0.00	0.00	
37.20	7611	99.2%	98.53	98.63	0.10	0.00	
37.30	1477	100.0%	77.67	77.78	0.10	0.00	
37.40	1025	100.0%	41.91	41.91	0.00	0.00	
37.50	7612	100.0%	36.20	36.31	0.11	0.00	
38.10	7607	95.4%	175.51	168.10	-7.41	**-0.04**	Timing of the Hydrographs Catchments 38.02 change from NasHyd to StandHyd
38.30	1940	97.1%	163.60	163.72	0.11	0.00	
39.00	726	92.0%	639.79	671.56	31.77	0.05	
39.10	590	100.0%	2.71	3.66	0.95	0.35	
39.20	1796	92.7%	341.47	331.61	-9.85	**-0.03**	Timing of the Hydrographs Catchments 35.14 change from NasHyd to StandHyd
39.30	1456	95.4%	237.83	224.74	-13.09	**-0.06**	Timing of the Hydrographs Catchments 35.14 change from NasHyd to StandHyd
39.50	1776	94.2%	344.80	329.16	-15.64	**-0.05**	Timing of the Hydrographs Catchments 35.14 change from NasHyd to StandHyd
39.60	7603	94.8%	241.59	228.44	-13.15	**-0.05**	Timing of the Hydrographs Catchments 35.14 change from NasHyd to StandHyd
40.10	7590	89.4%	647.44	675.78	28.34	0.04	
40.20	1469	92.0%	642.64	676.69	34.04	0.05	
40.25	7593	100.0%	49.93	49.96	0.03	0.00	
40.30	1373	89.4%	636.63	675.74	39.12	0.06	
41.00	1819	97.1%	64.03	68.92	4.90	0.08	
41.20	1393	99.2%	44.41	39.90	-4.50	**-0.10**	Timing of the Hydrographs Catchments 41.05 change from NasHyd to StandHyd
41.30	846	100.0%	40.85	40.85	0.00	0.00	
42.10	7591	94.2%	82.83	109.59	26.76	0.32	
42.20	1690	95.4%	73.21	99.29	26.08	0.36	
43.00	1012	97.1%	84.94	107.49	22.55	0.27	
43.20	857	100.0%	71.33	76.14	4.81	0.07	
44.10	7592	94.2%	111.87	149.67	37.80	0.34	
44.20	1307	94.8%	106.43	144.88	38.45	0.36	
45.00	7569	84.0%	799.79	890.93	91.15	0.11	
45.10	1028	84.0%	795.81	886.84	91.03	0.11	
45.20	7572	98.2%	120.32	135.03	14.71	0.12	
45.30	7573	84.0%	767.80	850.84	83.04	0.11	
45.40	2074	89.4%	829.09	955.23	126.14	0.15	
46.00	1503	98.2%	151.03	153.79	2.76	0.02	
46.10	681	100.0%	48.43	49.22	0.79	0.02	
46.30	1532	99.2%	87.48	88.78	1.30	0.01	
47.10	968	95.4%	276.69	279.30	2.61	0.01	
47.20	1559	96.3%	216.59	217.90	1.31	0.01	
48.10	7561	89.4%	532.74	534.95	2.21	0.00	
48.20	1544	92.0%	518.30	521.30	3.00	0.01	
48.30	1593	94.2%	407.10	409.92	2.82	0.01	
48.40	1612	94.2%	359.31	361.72	2.40	0.01	
49.10	1957	71.7%	1209.19	1432.17	222.99	0.18	
49.20	1319	74.4%	1232.81	1471.58	238.77	0.19	
49.30	975	71.7%	1203.68	1430.19	226.51	0.19	
49.40	7565	99.2%	103.49	103.49	0.00	0.00	
49.50	1631	71.7%	1184.83	1412.63	227.80	0.19	
49.70	1005	73.3%	1197.26	1449.68	252.43	0.21	
49.80	7568	100.0%	77.43	77.43	0.00	0.00	
49.90	7616	73.3%	1178.40	1434.42	256.02	0.22	
50.00	1649	70.2%	1553.63	1770.59	216.96	0.14	
50.10	1000	69.0%	1497.36	1702.08	204.72	0.14	
50.20	770	71.7%	1585.26	1808.21	222.95	0.14	
51.10	1442	89.4%	822.47	988.84	166.37	0.20	



ELC Legend

CUM1-1	Dry Moist Old Field Meadow
CUP	Coniferous Plantation
CUT	Cultural Thicket
CUT1-1	Sumac Cultural Thicket
CUT1-7*	Buckthorn Cultural Thicket
FOD	Deciduous Forest
FOD8-3*	Fresh-Moist Basswood Deciduous Forest
MAM2	Mineral Meadow Marsh
MAM2-2	Reed-canary Grass Mineral Meadow Marsh
MAM2-10	Forb Mineral Meadow Marsh
MAM2-11*	Mixed Mineral Meadow Marsh
MAS2	Mineral Shallow Marsh
MAS (Phragmites)	Common Reed Mineral Shallow Marsh
MAS2-1	Cattail Mineral Shallow Marsh
SAS1-1	Pondweed Submerged Shallow Aquatic
SWD3-4	Manitoba Maple Mineral Deciduous

AG	Agricultural
DIST	Disturbed
Lawn	Lawn
Pond	Pond
RES	Residential

**Not included in Southern Ontario ELC Field Guide.*

- Study Area
- Drainage (Suitable for Realignment)
- Drainage (Suitable for Realignment Non-participating Owner)
- Ecological Land Classification
- Creek Bank (Staked on October 19, 2021 by TRCA and GEI)
- Dripline (Staked on October 19, 2021 by TRCA and GEI)
- Hydrologic Edge of Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Top of Bank (Staked on October 19, 2021 by TRCA and GEI)
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Estimated Total Width Channel Realignment 60 m
- Proposed Drainage Realignment Route
- Estimated Top of Bank (GEI, 2022)
- Natural Heritage Features Limit
- Estimated Total Width Channel Realignment 60 m
- Proposed Route for Highway 413

PRELIMINARY DRAFT
FOR INTERNAL
DISCUSSION

Humber Station Village, Town of Caledon ON

Figure 6
Natural Heritage Features Limits

0 100 Meters

GEI Consultants
Savanta Division

Orthoimagery: First Base Solutions, 2021. Imagery taken in 2019.

APPENDIX D

DIGITAL COPY OF HECRAS MODEL

Certificates of Analyses

Maxxam
A Bureau Veritas Group Company

Your Project #: 2017-0293
Site#: BOLTON
Site Location: SOLMAR
Your C.O.C. #: 629279-01-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4745503
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8760
Received: 2017/09/22, 14:25

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Dissolved Aluminum (0.2 u, clay free)	1	N/A	2017/09/25	CAM SOP-00447	EPA 6020B m
Alkalinity	1	N/A	2017/09/26	CAM SOP-00448	SM 22 2320 B m
Chromium (VI) in Water	1	N/A	2017/09/28	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	1	N/A	2017/09/27	CAM SOP-00457	OMOE E3015 m
Dissolved Oxygen	1	2017/09/23	2017/09/23	CAM SOP-00427	SM 22 4500 O G m
Hardness (calculated as CaCO3)	1	N/A	2017/09/27	CAM SOP 00102/00408/00447	SM 2340 B
Mercury	1	2017/09/26	2017/09/27	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2017/09/28	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	1	N/A	2017/09/28	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (1)	1	N/A	2017/09/26	CAM SOP-00440	SM 22 4500-NO3I/NO2B
pH	1	N/A	2017/09/26	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/09/27	CAM SOP-00444	OMOE E3179 m
Field pH (2)	1	N/A	2017/09/28		Field pH Meter
Sulphide	1	N/A	2017/09/26	CAM SOP-00455	SM 22 4500-S G m
Field Temperature (2)	1	N/A	2017/09/28		Field Thermometer
Total Phosphorus (Colourimetric)	1	2017/09/27	2017/09/27	CAM SOP-00407	SM 22 4500 P B H m
Turbidity	1	N/A	2017/09/24	CAM SOP-00417	SM 22 2130 B m
Un-ionized Ammonia	1	2017/09/23	2017/09/29		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam
A Bureau Veritas Group Company

Your Project #: 2017-0293
Site#: BOLTON
Site Location: SOLMAR
Your C.O.C. #: 629279-01-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4745503
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8760
Received: 2017/09/22, 14:25
agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(2) This is a field test, therefore, the results relate to items that were not analysed at Maxxam Analytics Inc.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jolanta Goralczyk, Project Manager
Email: JGoralczyk@maxxam.ca
Phone# (905)817-5751
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK656		
Sampling Date			2017/09/22 12:45		
COC Number			629279-01-01		
	UNITS	**Criteria**	**MW1-17 Lab-Dup**	**RDL**	**QC Batch**
Inorganics					
Dissolved Oxygen	mg/L	-	5.82		5179915
Metals					
Chromium (VI)	ug/L	1	ND	0.50	5184085

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK656
Sample ID: MW1-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK656 Dup
Sample ID: MW1-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya

Maxxam ID: FEK657
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/25	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/25	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK657
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK657 Dup
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5179872	N/A	2017/09/25	Surinder Rai
pH	AT	5179875	N/A	2017/09/25	Surinder Rai

Maxxam ID: FEK658
Sample ID: MW3-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/26	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5185563	N/A	2017/09/28	Chandra Nandlal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK659
Sample ID: MW4-17D
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK659
Sample ID: MW4-17D
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181239	N/A	2017/09/25	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	13.3°C

Results relate only to the items tested.

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5179395	Turbidity	2017/09/24			101	85 - 115	ND, RDL=0.1	NTU	2.8	20		
5179872	Alkalinity (Total as CaCO3)	2017/09/25			97	85 - 115	ND, RDL=1.0	mg/L	0.70	20		
5179875	pH	2017/09/25			101	98 - 103			0.63	N/A		
5179909	Dissolved (0.2u) Aluminum (Al)	2017/09/25	110	80 - 120	102	80 - 120	ND,RDL=5	ug/L	NC	20		
5181226	Sulphide	2017/09/26	109	80 - 120	98	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5181239	Sulphide	2017/09/25	96	80 - 120	105	80 - 120	ND, RDL=0.020	mg/L	3.8	20		
5181316	Nitrate (N)	2017/09/26	100	80 - 120	101	80 - 120	ND, RDL=0.10	mg/L	NC	20		
5181316	Nitrite (N)	2017/09/26	101	80 - 120	100	80 - 120	ND, RDL=0.010	mg/L				
5182547	WAD Cyanide (Free)	2017/09/27	103	80 - 120	101	80 - 120	ND,RDL=1	ug/L	NC	20		
5182709	Total Ammonia-N	2017/09/28	99	80 - 120	99	85 - 115	ND, RDL=0.050	mg/L	6.1	20		
5183039	Mercury (Hg)	2017/09/27	100	75 - 125	102	80 - 120	ND, RDL=0.1	ug/L	NC	20		
5183116	Phenols-4AAP	2017/09/26	94	80 - 120	96	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5184085	Chromium (VI)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5184483	Total Phosphorus	2017/09/27	96	80 - 120	92	80 - 120	ND, RDL=0.004	mg/L	NC	20	93	80 - 120
5185031	Phenols-4AAP	2017/09/27	97	80 - 120	99	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5185563	Nitrate (N)	2017/09/28	84	80 - 120	98	80 - 120	ND, RDL=0.10	mg/L	NC	20		
5185563	Nitrite (N)	2017/09/28	103	80 - 120	103	80 - 120	ND, RDL=0.010	mg/L				
5186729	Total Antimony (Sb)	2017/09/28	110	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Arsenic (As)	2017/09/28	104	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	10	20		
5186729	Total Beryllium (Be)	2017/09/28	106	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Boron (B)	2017/09/28	102	80 - 120	98	80 - 120	ND, RDL=10	ug/L	5.1	20		
5186729	Total Cadmium (Cd)	2017/09/28	105	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Chromium (Cr)	2017/09/28	104	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Cobalt (Co)	2017/09/28	107	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	5.4	20		
5186729	Total Copper (Cu)	2017/09/28	108	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	9.7	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5186729	Total Iron (Fe)	2017/09/28	105	80 - 120	101	80 - 120	ND, RDL=100	ug/L	2.3	20		
5186729	Total Lead (Pb)	2017/09/28	102	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.80	20		
5186729	Total Molybdenum (Mo)	2017/09/28	108	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.14	20		
5186729	Total Nickel (Ni)	2017/09/28	100	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	8.1	20		
5186729	Total Selenium (Se)	2017/09/28	103	80 - 120	101	80 - 120	ND, RDL=2.0	ug/L	NC	20		
5186729	Total Silver (Ag)	2017/09/28	101	80 - 120	96	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Thallium (Tl)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.050	ug/L	NC	20		
5186729	Total Tungsten (W)	2017/09/28	112	80 - 120	108	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5186729	Total Uranium (U)	2017/09/28	106	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	7.8	20		
5186729	Total Vanadium (V)	2017/09/28	101	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L	0.15	20		
5186729	Total Zinc (Zn)	2017/09/28	105	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Zirconium (Zr)	2017/09/28	106	80 - 120	95	80 - 120	ND, RDL=1.0	ug/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Brad Newman, Scientific Service Specialist

Cristina Carriere, Scientific Service Specialist

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Your Project #: 2017-0293
Site#: BOLTON
Site Location: SOLMAR
Your C.O.C. #: 629279-01-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4745503
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8760
Received: 2017/09/22, 14:25

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Dissolved Aluminum (0.2 u, clay free)	1	N/A	2017/09/25	CAM SOP-00447	EPA 6020B m
Alkalinity	1	N/A	2017/09/25	CAM SOP-00448	SM 22 2320 B m
Chromium (VI) in Water	1	N/A	2017/09/28	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	1	N/A	2017/09/27	CAM SOP-00457	OMOE E3015 m
Dissolved Oxygen	1	2017/09/23	2017/09/23	CAM SOP-00427	SM 22 4500 O G m
Hardness (calculated as CaCO3)	1	N/A	2017/09/27	CAM SOP 00102/00408/00447	SM 2340 B
Mercury	1	2017/09/26	2017/09/27	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2017/09/28	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	1	N/A	2017/09/28	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (1)	1	N/A	2017/09/26	CAM SOP-00440	SM 22 4500-NO3I/NO2B
pH	1	N/A	2017/09/25	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/09/27	CAM SOP-00444	OMOE E3179 m
Field pH (2)	1	N/A	2017/09/28		Field pH Meter
Sulphide	1	N/A	2017/09/26	CAM SOP-00455	SM 22 4500-S G m
Field Temperature (2)	1	N/A	2017/09/28		Field Thermometer
Total Phosphorus (Colourimetric)	1	2017/09/27	2017/09/27	CAM SOP-00407	SM 22 4500 P B H m
Turbidity	1	N/A	2017/09/24	CAM SOP-00417	SM 22 2130 B m
Un-ionized Ammonia	1	2017/09/23	2017/09/29		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise

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Your Project #: 2017-0293
Site#: BOLTON
Site Location: SOLMAR
Your C.O.C. #: 629279-01-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4745503
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8760
Received: 2017/09/22, 14:25
agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(2) This is a field test, therefore, the results relate to items that were not analysed at Maxxam Analytics Inc.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jolanta Goralczyk, Project Manager
Email: JGoralczyk@maxxam.ca
Phone# (905)817-5751
==========
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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK657		
Sampling Date			2017/09/22 11:50		
COC Number			629279-01-01		
	UNITS	Criteria	MW5-17S	RDL	QC Batch
Calculated Parameters					
Hardness (CaCO3)	mg/L	-	230	1.0	5179429
Total Un-ionized Ammonia	mg/L	-	0.11	0.0054	5179420
Field Measurements					
Field Temperature	Celcius	-	14.7	N/A	ONSITE
Field pH	pH	6.5:8.5	**8.56**		ONSITE
Inorganics					
Total Ammonia-N	mg/L	-	1.0	0.050	5182709
Dissolved Oxygen	mg/L	-	3.94		5179915
pH	pH	6.5:8.5	8.06		5179875
Phenols-4AAP	mg/L	0.001	ND	0.0010	5185031
Total Phosphorus	mg/L	0.01	**0.8**	0.1	5184483
Sulphide	mg/L	0.02	ND	0.020	5181226
Turbidity	NTU	-	28	0.1	5179395
WAD Cyanide (Free)	ug/L	5	ND	1	5182547
Alkalinity (Total as CaCO3)	mg/L	-	110	1.0	5179872
Metals					
Dissolved (0.2u) Aluminum (Al)	ug/L	15	6	5	5179909
Chromium (VI)	ug/L	1	ND	0.50	5184085
Mercury (Hg)	ug/L	0.2	ND	0.1	5183039
Total Antimony (Sb)	ug/L	20	0.58	0.50	5186729
Total Arsenic (As)	ug/L	100	ND	1.0	5186729
Total Beryllium (Be)	ug/L	11	ND	0.50	5186729
Total Boron (B)	ug/L	200	**420**	10	5186729
Total Cadmium (Cd)	ug/L	0.2	ND	0.10	5186729
Total Chromium (Cr)	ug/L	-	ND	5.0	5186729
Total Cobalt (Co)	ug/L	0.9	ND	0.50	5186729
Total Copper (Cu)	ug/L	5	1.3	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected
N/A = Not Applicable

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK657		
Sampling Date			2017/09/22 11:50		
COC Number			629279-01-01		
	UNITS	Criteria	MW5-17S	RDL	QC Batch
Total Iron (Fe)	ug/L	300	ND	100	5186729
Total Lead (Pb)	ug/L	5	ND	0.50	5186729
Total Molybdenum (Mo)	ug/L	40	5.9	0.50	5186729
Total Nickel (Ni)	ug/L	25	ND	1.0	5186729
Total Selenium (Se)	ug/L	100	ND	2.0	5186729
Total Silver (Ag)	ug/L	0.1	ND	0.10	5186729
Total Thallium (Tl)	ug/L	0.3	ND	0.050	5186729
Total Tungsten (W)	ug/L	30	ND	1.0	5186729
Total Uranium (U)	ug/L	5	1.2	0.10	5186729
Total Vanadium (V)	ug/L	6	0.74	0.50	5186729
Total Zinc (Zn)	ug/L	30	ND	5.0	5186729
Total Zirconium (Zr)	ug/L	4	ND	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

RESULTS OF ANALYSES OF WATER

Maxxam ID		FEK657		
Sampling Date		2017/09/22 11:50		
COC Number		629279-01-01		
	UNITS	MW5-17S	RDL	QC Batch
Inorganics				
Nitrite (N)	mg/L	0.013	0.010	5181316
Nitrate (N)	mg/L	ND	0.10	5181316
Nitrate + Nitrite (N)	mg/L	ND	0.10	5181316

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK656
Sample ID: MW1-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK656 Dup
Sample ID: MW1-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya

Maxxam ID: FEK657
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/25	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/25	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK657
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK657 Dup
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5179872	N/A	2017/09/25	Surinder Rai
pH	AT	5179875	N/A	2017/09/25	Surinder Rai

Maxxam ID: FEK658
Sample ID: MW3-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/26	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5185563	N/A	2017/09/28	Chandra Nandlal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK659
Sample ID: MW4-17D
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK659
Sample ID: MW4-17D
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181239	N/A	2017/09/25	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	13.3°C

Results relate only to the items tested.

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5179395	Turbidity	2017/09/24			101	85 - 115	ND, RDL=0.1	NTU	2.8	20		
5179872	Alkalinity (Total as CaCO3)	2017/09/25			97	85 - 115	ND, RDL=1.0	mg/L	0.70	20		
5179875	pH	2017/09/25			101	98 - 103			0.63	N/A		
5179909	Dissolved (0.2u) Aluminum (Al)	2017/09/25	110	80 - 120	102	80 - 120	ND,RDL=5	ug/L	NC	20		
5181226	Sulphide	2017/09/26	109	80 - 120	98	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5181239	Sulphide	2017/09/25	96	80 - 120	105	80 - 120	ND, RDL=0.020	mg/L	3.8	20		
5181316	Nitrate (N)	2017/09/26	100	80 - 120	101	80 - 120	ND, RDL=0.10	mg/L	NC	20		
5181316	Nitrite (N)	2017/09/26	101	80 - 120	100	80 - 120	ND, RDL=0.010	mg/L				
5182547	WAD Cyanide (Free)	2017/09/27	103	80 - 120	101	80 - 120	ND,RDL=1	ug/L	NC	20		
5182709	Total Ammonia-N	2017/09/28	99	80 - 120	99	85 - 115	ND, RDL=0.050	mg/L	6.1	20		
5183039	Mercury (Hg)	2017/09/27	100	75 - 125	102	80 - 120	ND, RDL=0.1	ug/L	NC	20		
5183116	Phenols-4AAP	2017/09/26	94	80 - 120	96	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5184085	Chromium (VI)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5184483	Total Phosphorus	2017/09/27	96	80 - 120	92	80 - 120	ND, RDL=0.004	mg/L	NC	20	93	80 - 120
5185031	Phenols-4AAP	2017/09/27	97	80 - 120	99	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5185563	Nitrate (N)	2017/09/28	84	80 - 120	98	80 - 120	ND, RDL=0.10	mg/L	NC	20		
5185563	Nitrite (N)	2017/09/28	103	80 - 120	103	80 - 120	ND, RDL=0.010	mg/L				
5186729	Total Antimony (Sb)	2017/09/28	110	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Arsenic (As)	2017/09/28	104	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	10	20		
5186729	Total Beryllium (Be)	2017/09/28	106	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Boron (B)	2017/09/28	102	80 - 120	98	80 - 120	ND, RDL=10	ug/L	5.1	20		
5186729	Total Cadmium (Cd)	2017/09/28	105	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Chromium (Cr)	2017/09/28	104	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Cobalt (Co)	2017/09/28	107	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	5.4	20		
5186729	Total Copper (Cu)	2017/09/28	108	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	9.7	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5186729	Total Iron (Fe)	2017/09/28	105	80 - 120	101	80 - 120	ND, RDL=100	ug/L	2.3	20		
5186729	Total Lead (Pb)	2017/09/28	102	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.80	20		
5186729	Total Molybdenum (Mo)	2017/09/28	108	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.14	20		
5186729	Total Nickel (Ni)	2017/09/28	100	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	8.1	20		
5186729	Total Selenium (Se)	2017/09/28	103	80 - 120	101	80 - 120	ND, RDL=2.0	ug/L	NC	20		
5186729	Total Silver (Ag)	2017/09/28	101	80 - 120	96	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Thallium (Tl)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.050	ug/L	NC	20		
5186729	Total Tungsten (W)	2017/09/28	112	80 - 120	108	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5186729	Total Uranium (U)	2017/09/28	106	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	7.8	20		
5186729	Total Vanadium (V)	2017/09/28	101	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L	0.15	20		
5186729	Total Zinc (Zn)	2017/09/28	105	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Zirconium (Zr)	2017/09/28	106	80 - 120	95	80 - 120	ND, RDL=1.0	ug/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Brad Newman, Scientific Service Specialist

Cristina Carriere, Scientific Service Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam
A Bureau Veritas Group Company

Your Project #: 2017-0293
Site#: BOLTON
Site Location: SOLMAR
Your C.O.C. #: 629279-01-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4745503
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8760
Received: 2017/09/22, 14:25

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Dissolved Aluminum (0.2 u, clay free)	1	N/A	2017/09/25	CAM SOP-00447	EPA 6020B m
Alkalinity	1	N/A	2017/09/25	CAM SOP-00448	SM 22 2320 B m
Chromium (VI) in Water	1	N/A	2017/09/28	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	1	N/A	2017/09/27	CAM SOP-00457	OMOE E3015 m
Dissolved Oxygen	1	2017/09/23	2017/09/23	CAM SOP-00427	SM 22 4500 O G m
Hardness (calculated as CaCO3)	1	N/A	2017/09/27	CAM SOP 00102/00408/00447	SM 2340 B
Mercury	1	2017/09/26	2017/09/27	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2017/09/28	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	1	N/A	2017/09/28	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (1)	1	N/A	2017/09/26	CAM SOP-00440	SM 22 4500-NO3I/NO2B
pH	1	N/A	2017/09/25	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/09/27	CAM SOP-00444	OMOE E3179 m
Field pH (2)	1	N/A	2017/09/28		Field pH Meter
Sulphide	1	N/A	2017/09/26	CAM SOP-00455	SM 22 4500-S G m
Field Temperature (2)	1	N/A	2017/09/28		Field Thermometer
Total Phosphorus (Colourimetric)	1	2017/09/27	2017/09/27	CAM SOP-00407	SM 22 4500 P B H m
Turbidity	1	N/A	2017/09/24	CAM SOP-00417	SM 22 2130 B m
Un-ionized Ammonia	1	2017/09/23	2017/09/29		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise

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A Bureau Veritas Group Company

Your Project #: 2017-0293
Site#: BOLTON
Site Location: SOLMAR
Your C.O.C. #: 629279-01-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4745503
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8760
Received: 2017/09/22, 14:25
agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(2) This is a field test, therefore, the results relate to items that were not analysed at Maxxam Analytics Inc.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jolanta Goralczyk, Project Manager
Email: JGoralczyk@maxxam.ca
Phone# (905)817-5751
==========
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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK657		
Sampling Date			2017/09/22 11:50		
COC Number			629279-01-01		
	UNITS	Criteria	MW5-17S Lab-Dup	RDL	QC Batch
Inorganics					
pH	pH	6.5:8.5	8.12		5179875
Alkalinity (Total as CaCO3)	mg/L	-	110	1.0	5179872

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK656
Sample ID: MW1-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK656 Dup
Sample ID: MW1-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya

Maxxam ID: FEK657
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/25	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/25	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK657
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK657 Dup
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5179872	N/A	2017/09/25	Surinder Rai
pH	AT	5179875	N/A	2017/09/25	Surinder Rai

Maxxam ID: FEK658
Sample ID: MW3-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/26	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5185563	N/A	2017/09/28	Chandra Nandlal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK659
Sample ID: MW4-17D
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK659
Sample ID: MW4-17D
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181239	N/A	2017/09/25	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	13.3°C

Results relate only to the items tested.

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5179395	Turbidity	2017/09/24			101	85 - 115	ND, RDL=0.1	NTU	2.8	20		
5179872	Alkalinity (Total as CaCO3)	2017/09/25			97	85 - 115	ND, RDL=1.0	mg/L	0.70	20		
5179875	pH	2017/09/25			101	98 - 103			0.63	N/A		
5179909	Dissolved (0.2u) Aluminum (Al)	2017/09/25	110	80 - 120	102	80 - 120	ND,RDL=5	ug/L	NC	20		
5181226	Sulphide	2017/09/26	109	80 - 120	98	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5181239	Sulphide	2017/09/25	96	80 - 120	105	80 - 120	ND, RDL=0.020	mg/L	3.8	20		
5181316	Nitrate (N)	2017/09/26	100	80 - 120	101	80 - 120	ND, RDL=0.10	mg/L	NC	20		
5181316	Nitrite (N)	2017/09/26	101	80 - 120	100	80 - 120	ND, RDL=0.010	mg/L				
5182547	WAD Cyanide (Free)	2017/09/27	103	80 - 120	101	80 - 120	ND,RDL=1	ug/L	NC	20		
5182709	Total Ammonia-N	2017/09/28	99	80 - 120	99	85 - 115	ND, RDL=0.050	mg/L	6.1	20		
5183039	Mercury (Hg)	2017/09/27	100	75 - 125	102	80 - 120	ND, RDL=0.1	ug/L	NC	20		
5183116	Phenols-4AAP	2017/09/26	94	80 - 120	96	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5184085	Chromium (VI)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5184483	Total Phosphorus	2017/09/27	96	80 - 120	92	80 - 120	ND, RDL=0.004	mg/L	NC	20	93	80 - 120
5185031	Phenols-4AAP	2017/09/27	97	80 - 120	99	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5185563	Nitrate (N)	2017/09/28	84	80 - 120	98	80 - 120	ND, RDL=0.10	mg/L	NC	20		
5185563	Nitrite (N)	2017/09/28	103	80 - 120	103	80 - 120	ND, RDL=0.010	mg/L				
5186729	Total Antimony (Sb)	2017/09/28	110	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Arsenic (As)	2017/09/28	104	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	10	20		
5186729	Total Beryllium (Be)	2017/09/28	106	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Boron (B)	2017/09/28	102	80 - 120	98	80 - 120	ND, RDL=10	ug/L	5.1	20		
5186729	Total Cadmium (Cd)	2017/09/28	105	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Chromium (Cr)	2017/09/28	104	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Cobalt (Co)	2017/09/28	107	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	5.4	20		
5186729	Total Copper (Cu)	2017/09/28	108	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	9.7	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5186729	Total Iron (Fe)	2017/09/28	105	80 - 120	101	80 - 120	ND, RDL=100	ug/L	2.3	20		
5186729	Total Lead (Pb)	2017/09/28	102	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.80	20		
5186729	Total Molybdenum (Mo)	2017/09/28	108	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.14	20		
5186729	Total Nickel (Ni)	2017/09/28	100	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	8.1	20		
5186729	Total Selenium (Se)	2017/09/28	103	80 - 120	101	80 - 120	ND, RDL=2.0	ug/L	NC	20		
5186729	Total Silver (Ag)	2017/09/28	101	80 - 120	96	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Thallium (Tl)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.050	ug/L	NC	20		
5186729	Total Tungsten (W)	2017/09/28	112	80 - 120	108	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5186729	Total Uranium (U)	2017/09/28	106	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	7.8	20		
5186729	Total Vanadium (V)	2017/09/28	101	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L	0.15	20		
5186729	Total Zinc (Zn)	2017/09/28	105	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Zirconium (Zr)	2017/09/28	106	80 - 120	95	80 - 120	ND, RDL=1.0	ug/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Brad Newman, Scientific Service Specialist

Cristina Carriere, Scientific Service Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam
A Bureau Veritas Group Company

Your Project #: 2017-0293
Site#: BOLTON
Site Location: SOLMAR
Your C.O.C. #: 629279-01-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4745503
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8760
Received: 2017/09/22, 14:25

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Dissolved Aluminum (0.2 u, clay free)	1	N/A	2017/09/25	CAM SOP-00447	EPA 6020B m
Alkalinity	1	N/A	2017/09/26	CAM SOP-00448	SM 22 2320 B m
Chromium (VI) in Water	1	N/A	2017/09/28	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	1	N/A	2017/09/27	CAM SOP-00457	OMOE E3015 m
Dissolved Oxygen	1	2017/09/23	2017/09/23	CAM SOP-00427	SM 22 4500 O G m
Hardness (calculated as CaCO3)	1	N/A	2017/09/26	CAM SOP 00102/00408/00447	SM 2340 B
Mercury	1	2017/09/26	2017/09/27	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2017/09/28	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	1	N/A	2017/09/28	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (1)	1	N/A	2017/09/28	CAM SOP-00440	SM 22 4500-NO3I/NO2B
pH	1	N/A	2017/09/26	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/09/26	CAM SOP-00444	OMOE E3179 m
Field pH (2)	1	N/A	2017/09/28		Field pH Meter
Sulphide	1	N/A	2017/09/26	CAM SOP-00455	SM 22 4500-S G m
Field Temperature (2)	1	N/A	2017/09/28		Field Thermometer
Total Phosphorus (Colourimetric)	1	2017/09/27	2017/09/27	CAM SOP-00407	SM 22 4500 P B H m
Turbidity	1	N/A	2017/09/24	CAM SOP-00417	SM 22 2130 B m
Un-ionized Ammonia	1	2017/09/23	2017/09/29		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise

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Maxxam
A Bureau Veritas Group Company

Your Project #: 2017-0293
Site#: BOLTON
Site Location: SOLMAR
Your C.O.C. #: 629279-01-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4745503
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8760
Received: 2017/09/22, 14:25
agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(2) This is a field test, therefore, the results relate to items that were not analysed at Maxxam Analytics Inc.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jolanta Goralczyk, Project Manager
Email: JGoralczyk@maxxam.ca
Phone# (905)817-5751
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK658		
Sampling Date			2017/09/22 10:15		
COC Number			629279-01-01		
	UNITS	Criteria	MW3-17	RDL	QC Batch
Calculated Parameters					
Hardness (CaCO3)	mg/L	-	560	1.0	5179429
Total Un-ionized Ammonia	mg/L	-	0.019	0.0022	5179420
Field Measurements					
Field Temperature	Celcius	-	13.79	N/A	ONSITE
Field pH	pH	6.5:8.5	8.17		ONSITE
Inorganics					
Total Ammonia-N	mg/L	-	0.44	0.050	5182709
Dissolved Oxygen	mg/L	-	4.47		5179915
pH	pH	6.5:8.5	8.05		5179875
Phenols-4AAP	mg/L	0.001	ND	0.0010	5183116
Total Phosphorus	mg/L	0.01	**1.4**	0.2	5184483
Sulphide	mg/L	0.02	ND	0.020	5181226
Turbidity	NTU	-	12	0.1	5179395
WAD Cyanide (Free)	ug/L	5	ND	1	5182547
Alkalinity (Total as CaCO3)	mg/L	-	250	1.0	5179872
Metals					
Dissolved (0.2u) Aluminum (Al)	ug/L	15	7	5	5179909
Chromium (VI)	ug/L	1	ND	0.50	5184085
Mercury (Hg)	ug/L	0.2	ND	0.1	5183039
Total Antimony (Sb)	ug/L	20	ND	0.50	5186729
Total Arsenic (As)	ug/L	100	2.2	1.0	5186729
Total Beryllium (Be)	ug/L	11	ND	0.50	5186729
Total Boron (B)	ug/L	200	**260**	10	5186729
Total Cadmium (Cd)	ug/L	0.2	ND	0.10	5186729
Total Chromium (Cr)	ug/L	-	ND	5.0	5186729
Total Cobalt (Co)	ug/L	0.9	ND	0.50	5186729
Total Copper (Cu)	ug/L	5	ND	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected
N/A = Not Applicable

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK658		
Sampling Date			2017/09/22 10:15		
COC Number			629279-01-01		
	UNITS	Criteria	MW3-17	RDL	QC Batch
Total Iron (Fe)	ug/L	300	ND	100	5186729
Total Lead (Pb)	ug/L	5	ND	0.50	5186729
Total Molybdenum (Mo)	ug/L	40	11	0.50	5186729
Total Nickel (Ni)	ug/L	25	1.9	1.0	5186729
Total Selenium (Se)	ug/L	100	ND	2.0	5186729
Total Silver (Ag)	ug/L	0.1	ND	0.10	5186729
Total Thallium (Tl)	ug/L	0.3	ND	0.050	5186729
Total Tungsten (W)	ug/L	30	ND	1.0	5186729
Total Uranium (U)	ug/L	5	3.4	0.10	5186729
Total Vanadium (V)	ug/L	6	2.1	0.50	5186729
Total Zinc (Zn)	ug/L	30	ND	5.0	5186729
Total Zirconium (Zr)	ug/L	4	ND	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

RESULTS OF ANALYSES OF WATER

Maxxam ID		FEK658		
Sampling Date		2017/09/22 10:15		
COC Number		629279-01-01		
	UNITS	MW3-17	RDL	QC Batch
Inorganics				
Nitrite (N)	mg/L	ND	0.010	5185563
Nitrate (N)	mg/L	ND	0.10	5185563
Nitrate + Nitrite (N)	mg/L	ND	0.10	5185563

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK656
Sample ID: MW1-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK656 Dup
Sample ID: MW1-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya

Maxxam ID: FEK657
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/25	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/25	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK657
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK657 Dup
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5179872	N/A	2017/09/25	Surinder Rai
pH	AT	5179875	N/A	2017/09/25	Surinder Rai

Maxxam ID: FEK658
Sample ID: MW3-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/26	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5185563	N/A	2017/09/28	Chandra Nandlal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK659
Sample ID: MW4-17D
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK659
Sample ID: MW4-17D
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181239	N/A	2017/09/25	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	13.3°C

Results relate only to the items tested.

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5179395	Turbidity	2017/09/24			101	85 - 115	ND, RDL=0.1	NTU	2.8	20		
5179872	Alkalinity (Total as CaCO3)	2017/09/25			97	85 - 115	ND, RDL=1.0	mg/L	0.70	20		
5179875	pH	2017/09/25			101	98 - 103			0.63	N/A		
5179909	Dissolved (0.2u) Aluminum (Al)	2017/09/25	110	80 - 120	102	80 - 120	ND,RDL=5	ug/L	NC	20		
5181226	Sulphide	2017/09/26	109	80 - 120	98	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5181239	Sulphide	2017/09/25	96	80 - 120	105	80 - 120	ND, RDL=0.020	mg/L	3.8	20		
5181316	Nitrate (N)	2017/09/26	100	80 - 120	101	80 - 120	ND, RDL=0.10	mg/L	NC	20		
5181316	Nitrite (N)	2017/09/26	101	80 - 120	100	80 - 120	ND, RDL=0.010	mg/L				
5182547	WAD Cyanide (Free)	2017/09/27	103	80 - 120	101	80 - 120	ND,RDL=1	ug/L	NC	20		
5182709	Total Ammonia-N	2017/09/28	99	80 - 120	99	85 - 115	ND, RDL=0.050	mg/L	6.1	20		
5183039	Mercury (Hg)	2017/09/27	100	75 - 125	102	80 - 120	ND, RDL=0.1	ug/L	NC	20		
5183116	Phenols-4AAP	2017/09/26	94	80 - 120	96	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5184085	Chromium (VI)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5184483	Total Phosphorus	2017/09/27	96	80 - 120	92	80 - 120	ND, RDL=0.004	mg/L	NC	20	93	80 - 120
5185031	Phenols-4AAP	2017/09/27	97	80 - 120	99	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5185563	Nitrate (N)	2017/09/28	84	80 - 120	98	80 - 120	ND, RDL=0.10	mg/L	NC	20		
5185563	Nitrite (N)	2017/09/28	103	80 - 120	103	80 - 120	ND, RDL=0.010	mg/L				
5186729	Total Antimony (Sb)	2017/09/28	110	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Arsenic (As)	2017/09/28	104	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	10	20		
5186729	Total Beryllium (Be)	2017/09/28	106	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Boron (B)	2017/09/28	102	80 - 120	98	80 - 120	ND, RDL=10	ug/L	5.1	20		
5186729	Total Cadmium (Cd)	2017/09/28	105	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Chromium (Cr)	2017/09/28	104	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Cobalt (Co)	2017/09/28	107	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	5.4	20		
5186729	Total Copper (Cu)	2017/09/28	108	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	9.7	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5186729	Total Iron (Fe)	2017/09/28	105	80 - 120	101	80 - 120	ND, RDL=100	ug/L	2.3	20		
5186729	Total Lead (Pb)	2017/09/28	102	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.80	20		
5186729	Total Molybdenum (Mo)	2017/09/28	108	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.14	20		
5186729	Total Nickel (Ni)	2017/09/28	100	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	8.1	20		
5186729	Total Selenium (Se)	2017/09/28	103	80 - 120	101	80 - 120	ND, RDL=2.0	ug/L	NC	20		
5186729	Total Silver (Ag)	2017/09/28	101	80 - 120	96	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Thallium (Tl)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.050	ug/L	NC	20		
5186729	Total Tungsten (W)	2017/09/28	112	80 - 120	108	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5186729	Total Uranium (U)	2017/09/28	106	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	7.8	20		
5186729	Total Vanadium (V)	2017/09/28	101	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L	0.15	20		
5186729	Total Zinc (Zn)	2017/09/28	105	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Zirconium (Zr)	2017/09/28	106	80 - 120	95	80 - 120	ND, RDL=1.0	ug/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Brad Newman, Scientific Service Specialist

Cristina Carriere, Scientific Service Specialist

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Maxxam
A Bureau Veritas Group Company

Your Project #: 2017-0293
Site#: BOLTON
Site Location: SOLMAR
Your C.O.C. #: 629279-01-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4745503
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8760
Received: 2017/09/22, 14:25

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Dissolved Aluminum (0.2 u, clay free)	1	N/A	2017/09/25	CAM SOP-00447	EPA 6020B m
Alkalinity	1	N/A	2017/09/26	CAM SOP-00448	SM 22 2320 B m
Chromium (VI) in Water	1	N/A	2017/09/28	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	1	N/A	2017/09/27	CAM SOP-00457	OMOE E3015 m
Dissolved Oxygen	1	2017/09/23	2017/09/23	CAM SOP-00427	SM 22 4500 O G m
Hardness (calculated as CaCO3)	1	N/A	2017/09/27	CAM SOP 00102/00408/00447	SM 2340 B
Mercury	1	2017/09/26	2017/09/27	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2017/09/28	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	1	N/A	2017/09/28	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (1)	1	N/A	2017/09/26	CAM SOP-00440	SM 22 4500-NO3I/NO2B
pH	1	N/A	2017/09/26	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/09/27	CAM SOP-00444	OMOE E3179 m
Field pH (2)	1	N/A	2017/09/28		Field pH Meter
Sulphide	1	N/A	2017/09/25	CAM SOP-00455	SM 22 4500-S G m
Field Temperature (2)	1	N/A	2017/09/28		Field Thermometer
Total Phosphorus (Colourimetric)	1	2017/09/27	2017/09/27	CAM SOP-00407	SM 22 4500 P B H m
Turbidity	1	N/A	2017/09/24	CAM SOP-00417	SM 22 2130 B m
Un-ionized Ammonia	1	2017/09/23	2017/09/29		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise

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Maxxam
A Bureau Veritas Group Company

Your Project #: 2017-0293
Site#: BOLTON
Site Location: SOLMAR
Your C.O.C. #: 629279-01-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4745503
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8760
Received: 2017/09/22, 14:25
agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(2) This is a field test, therefore, the results relate to items that were not analysed at Maxxam Analytics Inc.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jolanta Goralczyk, Project Manager
Email: JGoralczyk@maxxam.ca
Phone# (905)817-5751
==========
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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK659		
Sampling Date			2017/09/22 10:50		
COC Number			629279-01-01		
	UNITS	Criteria	MW4-17D	RDL	QC Batch
Calculated Parameters					
Hardness (CaCO3)	mg/L	-	310	1.0	5179429
Total Un-ionized Ammonia	mg/L	-	0.067	0.005	5179420
Field Measurements					
Field Temperature	Celcius	-	13.15	N/A	ONSITE
Field pH	pH	6.5:8.5	**8.58**		ONSITE
Inorganics					
Total Ammonia-N	mg/L	-	0.67	0.050	5182709
Dissolved Oxygen	mg/L	-	2.84		5179915
pH	pH	6.5:8.5	8.36		5179875
Phenols-4AAP	mg/L	0.001	ND	0.0010	5185031
Total Phosphorus	mg/L	0.01	**3.3**	0.2	5184483
Sulphide	mg/L	0.02	ND	0.020	5181239
Turbidity	NTU	-	3000	0.5	5179395
WAD Cyanide (Free)	ug/L	5	ND	1	5182547
Alkalinity (Total as CaCO3)	mg/L	-	340	1.0	5179872
Metals					
Dissolved (0.2u) Aluminum (Al)	ug/L	15	ND	5	5179909
Chromium (VI)	ug/L	1	ND	0.50	5184085
Mercury (Hg)	ug/L	0.2	ND	0.1	5183039
Total Antimony (Sb)	ug/L	20	0.94	0.50	5186729
Total Arsenic (As)	ug/L	100	2.8	1.0	5186729
Total Beryllium (Be)	ug/L	11	ND	0.50	5186729
Total Boron (B)	ug/L	200	110	10	5186729
Total Cadmium (Cd)	ug/L	0.2	ND	0.10	5186729
Total Chromium (Cr)	ug/L	-	ND	5.0	5186729
Total Cobalt (Co)	ug/L	0.9	**2.5**	0.50	5186729
Total Copper (Cu)	ug/L	5	**5.5**	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected
N/A = Not Applicable

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK659		
Sampling Date			2017/09/22 10:50		
COC Number			629279-01-01		
	UNITS	Criteria	MW4-17D	RDL	QC Batch
Total Iron (Fe)	ug/L	300	**5400**	100	5186729
Total Lead (Pb)	ug/L	5	2.5	0.50	5186729
Total Molybdenum (Mo)	ug/L	40	8.4	0.50	5186729
Total Nickel (Ni)	ug/L	25	5.2	1.0	5186729
Total Selenium (Se)	ug/L	100	ND	2.0	5186729
Total Silver (Ag)	ug/L	0.1	ND	0.10	5186729
Total Thallium (Tl)	ug/L	0.3	ND	0.050	5186729
Total Tungsten (W)	ug/L	30	ND	1.0	5186729
Total Uranium (U)	ug/L	5	1.2	0.10	5186729
Total Vanadium (V)	ug/L	6	**7.4**	0.50	5186729
Total Zinc (Zn)	ug/L	30	21	5.0	5186729
Total Zirconium (Zr)	ug/L	4	1.1	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

RESULTS OF ANALYSES OF WATER

Maxxam ID		FEK659		
Sampling Date		2017/09/22 10:50		
COC Number		629279-01-01		
	UNITS	MW4-17D	RDL	QC Batch
Inorganics				
Nitrite (N)	mg/L	ND	0.010	5181316
Nitrate (N)	mg/L	ND	0.10	5181316
Nitrate + Nitrite (N)	mg/L	ND	0.10	5181316

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK656
Sample ID: MW1-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK656 Dup
Sample ID: MW1-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya

Maxxam ID: FEK657
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/25	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/25	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK657
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK657 Dup
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5179872	N/A	2017/09/25	Surinder Rai
pH	AT	5179875	N/A	2017/09/25	Surinder Rai

Maxxam ID: FEK658
Sample ID: MW3-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/26	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5185563	N/A	2017/09/28	Chandra Nandlal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK659
Sample ID: MW4-17D
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK659
Sample ID: MW4-17D
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181239	N/A	2017/09/25	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	13.3°C

Results relate only to the items tested.

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5179395	Turbidity	2017/09/24			101	85 - 115	ND, RDL=0.1	NTU	2.8	20		
5179872	Alkalinity (Total as CaCO3)	2017/09/25			97	85 - 115	ND, RDL=1.0	mg/L	0.70	20		
5179875	pH	2017/09/25			101	98 - 103			0.63	N/A		
5179909	Dissolved (0.2u) Aluminum (Al)	2017/09/25	110	80 - 120	102	80 - 120	ND,RDL=5	ug/L	NC	20		
5181226	Sulphide	2017/09/26	109	80 - 120	98	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5181239	Sulphide	2017/09/25	96	80 - 120	105	80 - 120	ND, RDL=0.020	mg/L	3.8	20		
5181316	Nitrate (N)	2017/09/26	100	80 - 120	101	80 - 120	ND, RDL=0.10	mg/L	NC	20		
5181316	Nitrite (N)	2017/09/26	101	80 - 120	100	80 - 120	ND, RDL=0.010	mg/L				
5182547	WAD Cyanide (Free)	2017/09/27	103	80 - 120	101	80 - 120	ND,RDL=1	ug/L	NC	20		
5182709	Total Ammonia-N	2017/09/28	99	80 - 120	99	85 - 115	ND, RDL=0.050	mg/L	6.1	20		
5183039	Mercury (Hg)	2017/09/27	100	75 - 125	102	80 - 120	ND, RDL=0.1	ug/L	NC	20		
5183116	Phenols-4AAP	2017/09/26	94	80 - 120	96	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5184085	Chromium (VI)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5184483	Total Phosphorus	2017/09/27	96	80 - 120	92	80 - 120	ND, RDL=0.004	mg/L	NC	20	93	80 - 120
5185031	Phenols-4AAP	2017/09/27	97	80 - 120	99	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5185563	Nitrate (N)	2017/09/28	84	80 - 120	98	80 - 120	ND, RDL=0.10	mg/L	NC	20		
5185563	Nitrite (N)	2017/09/28	103	80 - 120	103	80 - 120	ND, RDL=0.010	mg/L				
5186729	Total Antimony (Sb)	2017/09/28	110	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Arsenic (As)	2017/09/28	104	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	10	20		
5186729	Total Beryllium (Be)	2017/09/28	106	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Boron (B)	2017/09/28	102	80 - 120	98	80 - 120	ND, RDL=10	ug/L	5.1	20		
5186729	Total Cadmium (Cd)	2017/09/28	105	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Chromium (Cr)	2017/09/28	104	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Cobalt (Co)	2017/09/28	107	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	5.4	20		
5186729	Total Copper (Cu)	2017/09/28	108	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	9.7	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5186729	Total Iron (Fe)	2017/09/28	105	80 - 120	101	80 - 120	ND, RDL=100	ug/L	2.3	20		
5186729	Total Lead (Pb)	2017/09/28	102	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.80	20		
5186729	Total Molybdenum (Mo)	2017/09/28	108	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.14	20		
5186729	Total Nickel (Ni)	2017/09/28	100	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	8.1	20		
5186729	Total Selenium (Se)	2017/09/28	103	80 - 120	101	80 - 120	ND, RDL=2.0	ug/L	NC	20		
5186729	Total Silver (Ag)	2017/09/28	101	80 - 120	96	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Thallium (Tl)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.050	ug/L	NC	20		
5186729	Total Tungsten (W)	2017/09/28	112	80 - 120	108	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5186729	Total Uranium (U)	2017/09/28	106	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	7.8	20		
5186729	Total Vanadium (V)	2017/09/28	101	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L	0.15	20		
5186729	Total Zinc (Zn)	2017/09/28	105	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Zirconium (Zr)	2017/09/28	106	80 - 120	95	80 - 120	ND, RDL=1.0	ug/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Brad Newman, Scientific Service Specialist

Cristina Carriere, Scientific Service Specialist

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Maxxam
A Bureau Veritas Group Company

Your Project #: 2017-0293
Site#: BOLTON
Site Location: SOLMAR
Your C.O.C. #: 629279-01-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4745503
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8760
Received: 2017/09/22, 14:25

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Dissolved Aluminum (0.2 u, clay free)	4	N/A	2017/09/25	CAM SOP-00447	EPA 6020B m
Alkalinity	1	N/A	2017/09/25	CAM SOP-00448	SM 22 2320 B m
Alkalinity	3	N/A	2017/09/26	CAM SOP-00448	SM 22 2320 B m
Chromium (VI) in Water	4	N/A	2017/09/28	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	4	N/A	2017/09/27	CAM SOP-00457	OMOE E3015 m
Dissolved Oxygen	4	2017/09/23	2017/09/23	CAM SOP-00427	SM 22 4500 O G m
Hardness (calculated as CaCO3)	1	N/A	2017/09/26	CAM SOP 00102/00408/00447	SM 2340 B
Hardness (calculated as CaCO3)	3	N/A	2017/09/27	CAM SOP 00102/00408/00447	SM 2340 B
Mercury	4	2017/09/26	2017/09/27	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	4	N/A	2017/09/28	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	4	N/A	2017/09/28	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (1)	3	N/A	2017/09/26	CAM SOP-00440	SM 22 4500-NO3I/NO2B
Nitrate (NO3) and Nitrite (NO2) in Water (1)	1	N/A	2017/09/28	CAM SOP-00440	SM 22 4500-NO3I/NO2B
pH	1	N/A	2017/09/25	CAM SOP-00413	SM 4500H+ B m
pH	3	N/A	2017/09/26	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/09/26	CAM SOP-00444	OMOE E3179 m
Phenols (4AAP)	3	N/A	2017/09/27	CAM SOP-00444	OMOE E3179 m
Field pH (2)	4	N/A	2017/09/28		Field pH Meter
Sulphide	1	N/A	2017/09/25	CAM SOP-00455	SM 22 4500-S G m
Sulphide	3	N/A	2017/09/26	CAM SOP-00455	SM 22 4500-S G m
Field Temperature (2)	4	N/A	2017/09/28		Field Thermometer
Total Phosphorus (Colourimetric)	4	2017/09/27	2017/09/27	CAM SOP-00407	SM 22 4500 P B H m
Turbidity	4	N/A	2017/09/24	CAM SOP-00417	SM 22 2130 B m
Un-ionized Ammonia	4	2017/09/23	2017/09/29		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

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Maxxam
A Bureau Veritas Group Company

Your Project #: 2017-0293
Site#: BOLTON
Site Location: SOLMAR
Your C.O.C. #: 629279-01-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4745503
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8760
Received: 2017/09/22, 14:25

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(2) This is a field test, therefore, the results relate to items that were not analysed at Maxxam Analytics Inc.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jolanta Goralczyk, Project Manager
Email: JGoralczyk@maxxam.ca
Phone# (905)817-5751

==========

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK656	FEK656		FEK657	FEK657		
Sampling Date			2017/09/22 12:45	2017/09/22 12:45		2017/09/22 11:50	2017/09/22 11:50		
COC Number			629279-01-01	629279-01-01		629279-01-01	629279-01-01		
	UNITS	Criteria	MW1-17	MW1-17 Lab-Dup	RDL	MW5-17S	MW5-17S Lab-Dup	RDL	QC Batch
Calculated Parameters									
Hardness (CaCO3)	mg/L	-	590		1.0	230		1.0	5179429
Total Un-ionized Ammonia	mg/L	-	0.0037		0.0016	0.11		0.0054	5179420
Field Measurements									
Field Temperature	Celcius	-	15.7		N/A	14.7		N/A	ONSITE
Field pH	pH	6.5:8.5	7.98			**8.56**			ONSITE
Inorganics									
Total Ammonia-N	mg/L	-	0.11		0.050	1.0		0.050	5182709
Dissolved Oxygen	mg/L	-	5.77	5.82		3.94			5179915
pH	pH	6.5:8.5	8.02			8.06	8.12		5179875
Phenols-4AAP	mg/L	0.001	ND		0.0010	ND		0.0010	5185031
Total Phosphorus	mg/L	0.01	**0.36**		0.02	**0.8**		0.1	5184483
Sulphide	mg/L	0.02	ND		0.020	ND		0.020	5181226
Turbidity	NTU	-	6.1		0.1	28		0.1	5179395
WAD Cyanide (Free)	ug/L	5	ND		1	ND		1	5182547
Alkalinity (Total as CaCO3)	mg/L	-	520		1.0	110	110	1.0	5179872
Metals									
Dissolved (0.2u) Aluminum (Al)	ug/L	15	ND		5	6		5	5179909
Chromium (VI)	ug/L	1	ND	ND	0.50	ND		0.50	5184085
Mercury (Hg)	ug/L	0.2	ND		0.1	ND		0.1	5183039
Total Antimony (Sb)	ug/L	20	ND		0.50	0.58		0.50	5186729
Total Arsenic (As)	ug/L	100	ND		1.0	ND		1.0	5186729
Total Beryllium (Be)	ug/L	11	ND		0.50	ND		0.50	5186729
Total Boron (B)	ug/L	200	110		10	**420**		10	5186729
Total Cadmium (Cd)	ug/L	0.2	ND		0.10	ND		0.10	5186729
Total Chromium (Cr)	ug/L	-	ND		5.0	ND		5.0	5186729
Total Cobalt (Co)	ug/L	0.9	ND		0.50	ND		0.50	5186729
Total Copper (Cu)	ug/L	5	1.6		1.0	1.3		1.0	5186729
Total Iron (Fe)	ug/L	300	ND		100	ND		100	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK656	FEK656		FEK657	FEK657		
Sampling Date			2017/09/22 12:45	2017/09/22 12:45		2017/09/22 11:50	2017/09/22 11:50		
COC Number			629279-01-01	629279-01-01		629279-01-01	629279-01-01		
	UNITS	Criteria	MW1-17	MW1-17 Lab-Dup	RDL	MW5-17S	MW5-17S Lab-Dup	RDL	QC Batch
Total Lead (Pb)	ug/L	5	ND		0.50	ND		0.50	5186729
Total Molybdenum (Mo)	ug/L	40	6.9		0.50	5.9		0.50	5186729
Total Nickel (Ni)	ug/L	25	2.6		1.0	ND		1.0	5186729
Total Selenium (Se)	ug/L	100	ND		2.0	ND		2.0	5186729
Total Silver (Ag)	ug/L	0.1	ND		0.10	ND		0.10	5186729
Total Thallium (Tl)	ug/L	0.3	ND		0.050	ND		0.050	5186729
Total Tungsten (W)	ug/L	30	ND		1.0	ND		1.0	5186729
Total Uranium (U)	ug/L	5	**9.2**		0.10	1.2		0.10	5186729
Total Vanadium (V)	ug/L	6	ND		0.50	0.74		0.50	5186729
Total Zinc (Zn)	ug/L	30	ND		5.0	ND		5.0	5186729
Total Zirconium (Zr)	ug/L	4	ND		1.0	ND		1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK658			FEK659		
Sampling Date			2017/09/22 10:15			2017/09/22 10:50		
COC Number			629279-01-01			629279-01-01		
	UNITS	Criteria	MW3-17	RDL	QC Batch	MW4-17D	RDL	QC Batch
Calculated Parameters								
Hardness (CaCO3)	mg/L	-	560	1.0	5179429	310	1.0	5179429
Total Un-ionized Ammonia	mg/L	-	0.019	0.0022	5179420	0.067	0.005	5179420
Field Measurements								
Field Temperature	Celcius	-	13.79	N/A	ONSITE	13.15	N/A	ONSITE
Field pH	pH	6.5:8.5	8.17		ONSITE	**8.58**		ONSITE
Inorganics								
Total Ammonia-N	mg/L	-	0.44	0.050	5182709	0.67	0.050	5182709
Dissolved Oxygen	mg/L	-	4.47		5179915	2.84		5179915
pH	pH	6.5:8.5	8.05		5179875	8.36		5179875
Phenols-4AAP	mg/L	0.001	ND	0.0010	5183116	ND	0.0010	5185031
Total Phosphorus	mg/L	0.01	**1.4**	0.2	5184483	**3.3**	0.2	5184483
Sulphide	mg/L	0.02	ND	0.020	5181226	ND	0.020	5181239
Turbidity	NTU	-	12	0.1	5179395	3000	0.5	5179395
WAD Cyanide (Free)	ug/L	5	ND	1	5182547	ND	1	5182547
Alkalinity (Total as CaCO3)	mg/L	-	250	1.0	5179872	340	1.0	5179872
Metals								
Dissolved (0.2u) Aluminum (Al)	ug/L	15	7	5	5179909	ND	5	5179909
Chromium (VI)	ug/L	1	ND	0.50	5184085	ND	0.50	5184085
Mercury (Hg)	ug/L	0.2	ND	0.1	5183039	ND	0.1	5183039
Total Antimony (Sb)	ug/L	20	ND	0.50	5186729	0.94	0.50	5186729
Total Arsenic (As)	ug/L	100	2.2	1.0	5186729	2.8	1.0	5186729
Total Beryllium (Be)	ug/L	11	ND	0.50	5186729	ND	0.50	5186729
Total Boron (B)	ug/L	200	**260**	10	5186729	110	10	5186729
Total Cadmium (Cd)	ug/L	0.2	ND	0.10	5186729	ND	0.10	5186729
Total Chromium (Cr)	ug/L	-	ND	5.0	5186729	ND	5.0	5186729
Total Cobalt (Co)	ug/L	0.9	ND	0.50	5186729	**2.5**	0.50	5186729
Total Copper (Cu)	ug/L	5	ND	1.0	5186729	**5.5**	1.0	5186729
Total Iron (Fe)	ug/L	300	ND	100	5186729	**5400**	100	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
N/A = Not Applicable
ND = Not detected

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK658			FEK659		
Sampling Date			2017/09/22 10:15			2017/09/22 10:50		
COC Number			629279-01-01			629279-01-01		
	UNITS	Criteria	MW3-17	RDL	QC Batch	MW4-17D	RDL	QC Batch
Total Lead (Pb)	ug/L	5	ND	0.50	5186729	2.5	0.50	5186729
Total Molybdenum (Mo)	ug/L	40	11	0.50	5186729	8.4	0.50	5186729
Total Nickel (Ni)	ug/L	25	1.9	1.0	5186729	5.2	1.0	5186729
Total Selenium (Se)	ug/L	100	ND	2.0	5186729	ND	2.0	5186729
Total Silver (Ag)	ug/L	0.1	ND	0.10	5186729	ND	0.10	5186729
Total Thallium (Tl)	ug/L	0.3	ND	0.050	5186729	ND	0.050	5186729
Total Tungsten (W)	ug/L	30	ND	1.0	5186729	ND	1.0	5186729
Total Uranium (U)	ug/L	5	3.4	0.10	5186729	1.2	0.10	5186729
Total Vanadium (V)	ug/L	6	2.1	0.50	5186729	**7.4**	0.50	5186729
Total Zinc (Zn)	ug/L	30	ND	5.0	5186729	21	5.0	5186729
Total Zirconium (Zr)	ug/L	4	ND	1.0	5186729	1.1	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

RESULTS OF ANALYSES OF WATER

Maxxam ID		FEK656	FEK657		FEK658		FEK659		
Sampling Date		2017/09/22 12:45	2017/09/22 11:50		2017/09/22 10:15		2017/09/22 10:50		
COC Number		629279-01-01	629279-01-01		629279-01-01		629279-01-01		
	UNITS	MW1-17	MW5-17S	QC Batch	MW3-17	QC Batch	MW4-17D	RDL	QC Batch
Inorganics									
Nitrite (N)	mg/L	ND	0.013	5181316	ND	5185563	ND	0.010	5181316
Nitrate (N)	mg/L	ND	ND	5181316	ND	5185563	ND	0.10	5181316
Nitrate + Nitrite (N)	mg/L	ND	ND	5181316	ND	5185563	ND	0.10	5181316

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK656
Sample ID: MW1-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK656 Dup
Sample ID: MW1-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya

Maxxam ID: FEK657
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/25	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/25	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK657
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK657 Dup
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5179872	N/A	2017/09/25	Surinder Rai
pH	AT	5179875	N/A	2017/09/25	Surinder Rai

Maxxam ID: FEK658
Sample ID: MW3-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/26	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5185563	N/A	2017/09/28	Chandra Nandlal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK659
Sample ID: MW4-17D
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK659
Sample ID: MW4-17D
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181239	N/A	2017/09/25	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	13.3°C

Results relate only to the items tested.

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5179395	Turbidity	2017/09/24			101	85 - 115	ND, RDL=0.1	NTU	2.8	20		
5179872	Alkalinity (Total as CaCO3)	2017/09/25			97	85 - 115	ND, RDL=1.0	mg/L	0.70	20		
5179875	pH	2017/09/25			101	98 - 103			0.63	N/A		
5179909	Dissolved (0.2u) Aluminum (Al)	2017/09/25	110	80 - 120	102	80 - 120	ND,RDL=5	ug/L	NC	20		
5181226	Sulphide	2017/09/26	109	80 - 120	98	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5181239	Sulphide	2017/09/25	96	80 - 120	105	80 - 120	ND, RDL=0.020	mg/L	3.8	20		
5181316	Nitrate (N)	2017/09/26	100	80 - 120	101	80 - 120	ND, RDL=0.10	mg/L	NC	20		
5181316	Nitrite (N)	2017/09/26	101	80 - 120	100	80 - 120	ND, RDL=0.010	mg/L				
5182547	WAD Cyanide (Free)	2017/09/27	103	80 - 120	101	80 - 120	ND,RDL=1	ug/L	NC	20		
5182709	Total Ammonia-N	2017/09/28	99	80 - 120	99	85 - 115	ND, RDL=0.050	mg/L	6.1	20		
5183039	Mercury (Hg)	2017/09/27	100	75 - 125	102	80 - 120	ND, RDL=0.1	ug/L	NC	20		
5183116	Phenols-4AAP	2017/09/26	94	80 - 120	96	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5184085	Chromium (VI)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5184483	Total Phosphorus	2017/09/27	96	80 - 120	92	80 - 120	ND, RDL=0.004	mg/L	NC	20	93	80 - 120
5185031	Phenols-4AAP	2017/09/27	97	80 - 120	99	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5185563	Nitrate (N)	2017/09/28	84	80 - 120	98	80 - 120	ND, RDL=0.10	mg/L	NC	20		
5185563	Nitrite (N)	2017/09/28	103	80 - 120	103	80 - 120	ND, RDL=0.010	mg/L				
5186729	Total Antimony (Sb)	2017/09/28	110	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Arsenic (As)	2017/09/28	104	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	10	20		
5186729	Total Beryllium (Be)	2017/09/28	106	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Boron (B)	2017/09/28	102	80 - 120	98	80 - 120	ND, RDL=10	ug/L	5.1	20		
5186729	Total Cadmium (Cd)	2017/09/28	105	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Chromium (Cr)	2017/09/28	104	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Cobalt (Co)	2017/09/28	107	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	5.4	20		
5186729	Total Copper (Cu)	2017/09/28	108	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	9.7	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5186729	Total Iron (Fe)	2017/09/28	105	80 - 120	101	80 - 120	ND, RDL=100	ug/L	2.3	20		
5186729	Total Lead (Pb)	2017/09/28	102	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.80	20		
5186729	Total Molybdenum (Mo)	2017/09/28	108	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.14	20		
5186729	Total Nickel (Ni)	2017/09/28	100	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	8.1	20		
5186729	Total Selenium (Se)	2017/09/28	103	80 - 120	101	80 - 120	ND, RDL=2.0	ug/L	NC	20		
5186729	Total Silver (Ag)	2017/09/28	101	80 - 120	96	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Thallium (Tl)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.050	ug/L	NC	20		
5186729	Total Tungsten (W)	2017/09/28	112	80 - 120	108	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5186729	Total Uranium (U)	2017/09/28	106	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	7.8	20		
5186729	Total Vanadium (V)	2017/09/28	101	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L	0.15	20		
5186729	Total Zinc (Zn)	2017/09/28	105	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Zirconium (Zr)	2017/09/28	106	80 - 120	95	80 - 120	ND, RDL=1.0	ug/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Brad Newman, Scientific Service Specialist

Cristina Carriere, Scientific Service Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Your Project #: 2017-0293
Site#: BOLTON
Site Location: SOLMAR
Your C.O.C. #: 629279-01-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4745503
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8760
Received: 2017/09/22, 14:25

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Dissolved Aluminum (0.2 u, clay free)	1	N/A	2017/09/25	CAM SOP-00447	EPA 6020B m
Alkalinity	1	N/A	2017/09/26	CAM SOP-00448	SM 22 2320 B m
Chromium (VI) in Water	1	N/A	2017/09/28	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	1	N/A	2017/09/27	CAM SOP-00457	OMOE E3015 m
Dissolved Oxygen	1	2017/09/23	2017/09/23	CAM SOP-00427	SM 22 4500 O G m
Hardness (calculated as CaCO3)	1	N/A	2017/09/27	CAM SOP 00102/00408/00447	SM 2340 B
Mercury	1	2017/09/26	2017/09/27	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2017/09/28	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	1	N/A	2017/09/28	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (1)	1	N/A	2017/09/26	CAM SOP-00440	SM 22 4500-NO3I/NO2B
pH	1	N/A	2017/09/26	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/09/27	CAM SOP-00444	OMOE E3179 m
Field pH (2)	1	N/A	2017/09/28		Field pH Meter
Sulphide	1	N/A	2017/09/26	CAM SOP-00455	SM 22 4500-S G m
Field Temperature (2)	1	N/A	2017/09/28		Field Thermometer
Total Phosphorus (Colourimetric)	1	2017/09/27	2017/09/27	CAM SOP-00407	SM 22 4500 P B H m
Turbidity	1	N/A	2017/09/24	CAM SOP-00417	SM 22 2130 B m
Un-ionized Ammonia	1	2017/09/23	2017/09/29		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise

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Your Project #: 2017-0293
Site#: BOLTON
Site Location: SOLMAR
Your C.O.C. #: 629279-01-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4745503
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8760
Received: 2017/09/22, 14:25
agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(2) This is a field test, therefore, the results relate to items that were not analysed at Maxxam Analytics Inc.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jolanta Goralczyk, Project Manager
Email: JGoralczyk@maxxam.ca
Phone# (905)817-5751
==========
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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK656		
Sampling Date			2017/09/22 12:45		
COC Number			629279-01-01		
	UNITS	Criteria	MW1-17	RDL	QC Batch
Calculated Parameters					
Hardness (CaCO3)	mg/L	-	590	1.0	5179429
Total Un-ionized Ammonia	mg/L	-	0.0037	0.0016	5179420
Field Measurements					
Field Temperature	Celcius	-	15.7	N/A	ONSITE
Field pH	pH	6.5:8.5	7.98		ONSITE
Inorganics					
Total Ammonia-N	mg/L	-	0.11	0.050	5182709
Dissolved Oxygen	mg/L	-	5.77		5179915
pH	pH	6.5:8.5	8.02		5179875
Phenols-4AAP	mg/L	0.001	ND	0.0010	5185031
Total Phosphorus	mg/L	0.01	**0.36**	0.02	5184483
Sulphide	mg/L	0.02	ND	0.020	5181226
Turbidity	NTU	-	6.1	0.1	5179395
WAD Cyanide (Free)	ug/L	5	ND	1	5182547
Alkalinity (Total as CaCO3)	mg/L	-	520	1.0	5179872
Metals					
Dissolved (0.2u) Aluminum (Al)	ug/L	15	ND	5	5179909
Chromium (VI)	ug/L	1	ND	0.50	5184085
Mercury (Hg)	ug/L	0.2	ND	0.1	5183039
Total Antimony (Sb)	ug/L	20	ND	0.50	5186729
Total Arsenic (As)	ug/L	100	ND	1.0	5186729
Total Beryllium (Be)	ug/L	11	ND	0.50	5186729
Total Boron (B)	ug/L	200	110	10	5186729
Total Cadmium (Cd)	ug/L	0.2	ND	0.10	5186729
Total Chromium (Cr)	ug/L	-	ND	5.0	5186729
Total Cobalt (Co)	ug/L	0.9	ND	0.50	5186729
Total Copper (Cu)	ug/L	5	1.6	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected
N/A = Not Applicable

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK656		
Sampling Date			2017/09/22 12:45		
COC Number			629279-01-01		
	UNITS	Criteria	MW1-17	RDL	QC Batch
Total Iron (Fe)	ug/L	300	ND	100	5186729
Total Lead (Pb)	ug/L	5	ND	0.50	5186729
Total Molybdenum (Mo)	ug/L	40	6.9	0.50	5186729
Total Nickel (Ni)	ug/L	25	2.6	1.0	5186729
Total Selenium (Se)	ug/L	100	ND	2.0	5186729
Total Silver (Ag)	ug/L	0.1	ND	0.10	5186729
Total Thallium (Tl)	ug/L	0.3	ND	0.050	5186729
Total Tungsten (W)	ug/L	30	ND	1.0	5186729
Total Uranium (U)	ug/L	5	**9.2**	0.10	5186729
Total Vanadium (V)	ug/L	6	ND	0.50	5186729
Total Zinc (Zn)	ug/L	30	ND	5.0	5186729
Total Zirconium (Zr)	ug/L	4	ND	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

RESULTS OF ANALYSES OF WATER

Maxxam ID		FEK656		
Sampling Date		2017/09/22 12:45		
COC Number		629279-01-01		
	UNITS	MW1-17	RDL	QC Batch
Inorganics				
Nitrite (N)	mg/L	ND	0.010	5181316
Nitrate (N)	mg/L	ND	0.10	5181316
Nitrate + Nitrite (N)	mg/L	ND	0.10	5181316

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK656
Sample ID: MW1-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK656 Dup
Sample ID: MW1-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya

Maxxam ID: FEK657
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/25	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/25	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK657
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK657 Dup
Sample ID: MW5-17S
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5179872	N/A	2017/09/25	Surinder Rai
pH	AT	5179875	N/A	2017/09/25	Surinder Rai

Maxxam ID: FEK658
Sample ID: MW3-17
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/26	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5185563	N/A	2017/09/28	Chandra Nandlal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

Maxxam ID: FEK659
Sample ID: MW4-17D
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

TEST SUMMARY

Maxxam ID: FEK659
Sample ID: MW4-17D
Matrix: Water

Collected: 2017/09/22
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5182709	N/A	2017/09/28	Sarabjit Raina
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5181316	N/A	2017/09/26	Amanpreet Sappal
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5185031	N/A	2017/09/27	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181239	N/A	2017/09/25	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5184483	2017/09/27	2017/09/27	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/29	2017/09/29	Automated Statchk

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	13.3°C

Results relate only to the items tested.

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5179395	Turbidity	2017/09/24			101	85 - 115	ND, RDL=0.1	NTU	2.8	20		
5179872	Alkalinity (Total as CaCO3)	2017/09/25			97	85 - 115	ND, RDL=1.0	mg/L	0.70	20		
5179875	pH	2017/09/25			101	98 - 103			0.63	N/A		
5179909	Dissolved (0.2u) Aluminum (Al)	2017/09/25	110	80 - 120	102	80 - 120	ND,RDL=5	ug/L	NC	20		
5181226	Sulphide	2017/09/26	109	80 - 120	98	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5181239	Sulphide	2017/09/25	96	80 - 120	105	80 - 120	ND, RDL=0.020	mg/L	3.8	20		
5181316	Nitrate (N)	2017/09/26	100	80 - 120	101	80 - 120	ND, RDL=0.10	mg/L	NC	20		
5181316	Nitrite (N)	2017/09/26	101	80 - 120	100	80 - 120	ND, RDL=0.010	mg/L				
5182547	WAD Cyanide (Free)	2017/09/27	103	80 - 120	101	80 - 120	ND,RDL=1	ug/L	NC	20		
5182709	Total Ammonia-N	2017/09/28	99	80 - 120	99	85 - 115	ND, RDL=0.050	mg/L	6.1	20		
5183039	Mercury (Hg)	2017/09/27	100	75 - 125	102	80 - 120	ND, RDL=0.1	ug/L	NC	20		
5183116	Phenols-4AAP	2017/09/26	94	80 - 120	96	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5184085	Chromium (VI)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5184483	Total Phosphorus	2017/09/27	96	80 - 120	92	80 - 120	ND, RDL=0.004	mg/L	NC	20	93	80 - 120
5185031	Phenols-4AAP	2017/09/27	97	80 - 120	99	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5185563	Nitrate (N)	2017/09/28	84	80 - 120	98	80 - 120	ND, RDL=0.10	mg/L	NC	20		
5185563	Nitrite (N)	2017/09/28	103	80 - 120	103	80 - 120	ND, RDL=0.010	mg/L				
5186729	Total Antimony (Sb)	2017/09/28	110	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Arsenic (As)	2017/09/28	104	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	10	20		
5186729	Total Beryllium (Be)	2017/09/28	106	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Boron (B)	2017/09/28	102	80 - 120	98	80 - 120	ND, RDL=10	ug/L	5.1	20		
5186729	Total Cadmium (Cd)	2017/09/28	105	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Chromium (Cr)	2017/09/28	104	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Cobalt (Co)	2017/09/28	107	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	5.4	20		
5186729	Total Copper (Cu)	2017/09/28	108	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	9.7	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5186729	Total Iron (Fe)	2017/09/28	105	80 - 120	101	80 - 120	ND, RDL=100	ug/L	2.3	20		
5186729	Total Lead (Pb)	2017/09/28	102	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.80	20		
5186729	Total Molybdenum (Mo)	2017/09/28	108	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.14	20		
5186729	Total Nickel (Ni)	2017/09/28	100	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	8.1	20		
5186729	Total Selenium (Se)	2017/09/28	103	80 - 120	101	80 - 120	ND, RDL=2.0	ug/L	NC	20		
5186729	Total Silver (Ag)	2017/09/28	101	80 - 120	96	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Thallium (Tl)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.050	ug/L	NC	20		
5186729	Total Tungsten (W)	2017/09/28	112	80 - 120	108	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5186729	Total Uranium (U)	2017/09/28	106	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	7.8	20		
5186729	Total Vanadium (V)	2017/09/28	101	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L	0.15	20		
5186729	Total Zinc (Zn)	2017/09/28	105	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Zirconium (Zr)	2017/09/28	106	80 - 120	95	80 - 120	ND, RDL=1.0	ug/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Site Location: SOLMAR

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Brad Newman, Scientific Service Specialist

Cristina Carriere, Scientific Service Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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BOD

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6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free 800-563-6266 Fax (905) 817-5777 www.maxxam.ca

CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE TO:
Company Name: #24008 Cole Engineering Group Ltd
Attention: Accounts Payable
Address: 70 Valleywood Dr, Markham ON L3R 4T5
Tel: (416) 987-6161 x Fax: (905) 940-2064 x
Email: accountspayable@coleengineering.ca

REPORT TO:
Company Name:
Attention: Alireza Hejazi
Address:
Tel: (416) 987-6161 x243 Fax:
Email: AHejazi@coleengineering.ca

PROJECT INFORMATION:
Quotation #: B02064
P.O. #:
Project: 2017-0293
Project Name: [redacted] Solmar/Bolton
Site #:
Sampled By: AH, AG

Laboratory Use Only:
Maxxam Job #:
Bottle Order #: 629279
COC #: C#629279-01-01
Project Manager: Jolanta Goralczyk

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011): ☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___
Other Regulations: ☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality ☐ ☒ PWQO ☐ Other
Special Instructions:
Include Criteria on Certificate of Analysis (Y/N)?

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	PWQO Metals and Inorganics	Nitrate	Nitrite	# of Bottles	Comments
1		MW1-17	22/09/17	12:45	GW	X	X	X	X		Temp 15.7°C, pH 7.98, Filtered
2		MW5-17s		11:50	GW	X	X	X	X		Temp 14.7°C, pH 8.56, Filtered
3		MW3-17		10:15	GW	X	X	X	X		Temp 13.79°C, pH 8.17, Filtered
4		MW4-17d		10:50	GW	X	X	X	X		Temp 13.15°C, pH 8.58, Filtered
5											
6											
7											
8											
9											
10											

22-Sep-17 14:25
Jolanta Goralczyk
B7K8760
GK1. ENV-1359

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects
Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.
Job Specific Rush TAT (if applies to entire submission)
Date Required: Time Required: ☐
Rush Confirmation Number: (call lab for #)

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time
Andrew O'Rourke Andrew O'Rourke	22/09/17	14:20	[illegible]	22/09/22	14:25

jars used and not submitted:
Time Sensitive:
Laboratory Use Only
Temperature (°C) on Receipt: 13/12/15
Custody Seal: Present ☐ Intact ☐ Yes ☐ No ☑

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.
* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.
** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT HTTP://MAXXAM.CA/WP-CONTENT/UPLOADS/ONTARIO-COC.PDF.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

White: Maxxa Yellow: Client

Duplicate

Maxxam Analytics International Corporation o/a Maxxam Analytics

Maxxam
A Bureau Veritas Group Company

Your Project #: 2017-0293
Your C.O.C. #: 629279-02-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4746655
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8768
Received: 2017/09/22, 14:30

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Dissolved Aluminum (0.2 u, clay free)	1	N/A	2017/09/25	CAM SOP-00447	EPA 6020B m
Alkalinity	1	N/A	2017/09/26	CAM SOP-00448	SM 22 2320 B m
Chromium (VI) in Water	1	N/A	2017/09/28	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	1	N/A	2017/09/27	CAM SOP-00457	OMOE E3015 m
Dissolved Oxygen	1	2017/09/23	2017/09/23	CAM SOP-00427	SM 22 4500 O G m
Hardness (calculated as CaCO3)	1	N/A	2017/09/27	CAM SOP 00102/00408/00447	SM 2340 B
Mercury	1	2017/09/26	2017/09/27	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2017/09/28	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	1	N/A	2017/09/28	CAM SOP-00441	EPA GS I-2522-90 m
pH	1	N/A	2017/09/26	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/09/26	CAM SOP-00444	OMOE E3179 m
Field pH (1)	1	N/A	2017/09/24		Field pH Meter
Sulphide	1	N/A	2017/09/26	CAM SOP-00455	SM 22 4500-S G m
Field Temperature (1)	1	N/A	2017/09/24		Field Thermometer
Total Phosphorus (Colourimetric)	1	2017/09/25	2017/09/26	CAM SOP-00407	SM 22 4500 P B H m
Turbidity	1	N/A	2017/09/24	CAM SOP-00417	SM 22 2130 B m
Un-ionized Ammonia	1	2017/09/23	2017/09/28		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Your Project #: 2017-0293
Your C.O.C. #: 629279-02-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4746655
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8768

Received: 2017/09/22, 14:30

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This is a field test, therefore, the results relate to items that were not analysed at Maxxam Analytics Inc.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Jolanta Goralczyk, Project Manager
Email: JGoralczyk@maxxam.ca
Phone# (905)817-5751

==========

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK704		
Sampling Date			2017/09/21 11:30		
COC Number			629279-02-01		
	UNITS	Criteria	SF1-17	RDL	QC Batch
Calculated Parameters					
Hardness (CaCO3)	mg/L	-	150	1.0	5179429
Total Un-ionized Ammonia	mg/L	-	0.012	0.0023	5179420
Field Measurements					
Field Temperature	Celcius	-	18.65	N/A	ONSITE
Field pH	pH	6.5:8.5	8.03		ONSITE
Inorganics					
Total Ammonia-N	mg/L	-	0.26	0.050	5181166
Dissolved Oxygen	mg/L	-	10.0		5179915
pH	pH	6.5:8.5	7.99		5179875
Phenols-4AAP	mg/L	0.001	ND	0.0010	5183116
Total Phosphorus	mg/L	0.01	**0.037**	0.004	5181037
Sulphide	mg/L	0.02	ND	0.020	5181226
Turbidity	NTU	-	0.9	0.1	5179395
WAD Cyanide (Free)	ug/L	5	ND	1	5182547
Alkalinity (Total as CaCO3)	mg/L	-	120	1.0	5179872
Metals					
Dissolved (0.2u) Aluminum (Al)	ug/L	15	ND	5	5179909
Chromium (VI)	ug/L	1	ND	0.50	5184085
Mercury (Hg)	ug/L	0.2	ND	0.1	5183039
Total Antimony (Sb)	ug/L	20	ND	0.50	5186729
Total Arsenic (As)	ug/L	100	ND	1.0	5186729
Total Beryllium (Be)	ug/L	11	ND	0.50	5186729
Total Boron (B)	ug/L	200	27	10	5186729
Total Cadmium (Cd)	ug/L	0.2	ND	0.10	5186729
Total Chromium (Cr)	ug/L	-	ND	5.0	5186729
Total Cobalt (Co)	ug/L	0.9	ND	0.50	5186729
Total Copper (Cu)	ug/L	5	ND	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected
N/A = Not Applicable

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK704		
Sampling Date			2017/09/21 11:30		
COC Number			629279-02-01		
	UNITS	Criteria	SF1-17	RDL	QC Batch
Total Iron (Fe)	ug/L	300	230	100	5186729
Total Lead (Pb)	ug/L	5	ND	0.50	5186729
Total Molybdenum (Mo)	ug/L	40	0.85	0.50	5186729
Total Nickel (Ni)	ug/L	25	ND	1.0	5186729
Total Selenium (Se)	ug/L	100	ND	2.0	5186729
Total Silver (Ag)	ug/L	0.1	ND	0.10	5186729
Total Thallium (Tl)	ug/L	0.3	ND	0.050	5186729
Total Tungsten (W)	ug/L	30	ND	1.0	5186729
Total Uranium (U)	ug/L	5	0.22	0.10	5186729
Total Vanadium (V)	ug/L	6	ND	0.50	5186729
Total Zinc (Zn)	ug/L	30	ND	5.0	5186729
Total Zirconium (Zr)	ug/L	4	ND	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

TEST SUMMARY

Maxxam ID: FEK704
Sample ID: SF1-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

Maxxam ID: FEK705
Sample ID: SF5-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5180655	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

TEST SUMMARY

Maxxam ID: FEK706
Sample ID: SF6-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5180655	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

Maxxam ID: FEK706 Dup
Sample ID: SF6-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.0°C

Results relate only to the items tested.

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B7K8768
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5179395	Turbidity	2017/09/24			101	85 - 115	ND, RDL=0.1	NTU	2.8	20		
5179872	Alkalinity (Total as CaCO3)	2017/09/25			97	85 - 115	ND, RDL=1.0	mg/L	0.70	20		
5179875	pH	2017/09/25			101	98 - 103			0.63	N/A		
5179909	Dissolved (0.2u) Aluminum (Al)	2017/09/25	110	80 - 120	102	80 - 120	ND,RDL=5	ug/L	NC	20		
5180655	Sulphide	2017/09/26	105	80 - 120	105	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5181037	Total Phosphorus	2017/09/26	99	80 - 120	94	80 - 120	ND, RDL=0.004	mg/L	NC	20	99	80 - 120
5181166	Total Ammonia-N	2017/09/28	99	80 - 120	98	85 - 115	ND, RDL=0.050	mg/L	20	20		
5181226	Sulphide	2017/09/26	109	80 - 120	98	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5182547	WAD Cyanide (Free)	2017/09/27	103	80 - 120	101	80 - 120	ND,RDL=1	ug/L	NC	20		
5183039	Mercury (Hg)	2017/09/27	100	75 - 125	102	80 - 120	ND, RDL=0.1	ug/L	NC	20		
5183116	Phenols-4AAP	2017/09/26	94	80 - 120	96	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5184085	Chromium (VI)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Antimony (Sb)	2017/09/28	110	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Arsenic (As)	2017/09/28	104	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	10	20		
5186729	Total Beryllium (Be)	2017/09/28	106	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Boron (B)	2017/09/28	102	80 - 120	98	80 - 120	ND, RDL=10	ug/L	5.1	20		
5186729	Total Cadmium (Cd)	2017/09/28	105	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Chromium (Cr)	2017/09/28	104	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Cobalt (Co)	2017/09/28	107	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	5.4	20		
5186729	Total Copper (Cu)	2017/09/28	108	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	9.7	20		
5186729	Total Iron (Fe)	2017/09/28	105	80 - 120	101	80 - 120	ND, RDL=100	ug/L	2.3	20		
5186729	Total Lead (Pb)	2017/09/28	102	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.80	20		
5186729	Total Molybdenum (Mo)	2017/09/28	108	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.14	20		
5186729	Total Nickel (Ni)	2017/09/28	100	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	8.1	20		
5186729	Total Selenium (Se)	2017/09/28	103	80 - 120	101	80 - 120	ND, RDL=2.0	ug/L	NC	20		
5186729	Total Silver (Ag)	2017/09/28	101	80 - 120	96	80 - 120	ND, RDL=0.10	ug/L	NC	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5186729	Total Thallium (Tl)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.050	ug/L	NC	20		
5186729	Total Tungsten (W)	2017/09/28	112	80 - 120	108	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5186729	Total Uranium (U)	2017/09/28	106	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	7.8	20		
5186729	Total Vanadium (V)	2017/09/28	101	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L	0.15	20		
5186729	Total Zinc (Zn)	2017/09/28	105	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Zirconium (Zr)	2017/09/28	106	80 - 120	95	80 - 120	ND, RDL=1.0	ug/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere

Cristina Carriere, Scientific Service Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam
A Bureau Veritas Group Company

Your Project #: 2017-0293
Your C.O.C. #: 629279-02-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4746655
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8768
Received: 2017/09/22, 14:30

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Dissolved Aluminum (0.2 u, clay free)	1	N/A	2017/09/25	CAM SOP-00447	EPA 6020B m
Alkalinity	1	N/A	2017/09/26	CAM SOP-00448	SM 22 2320 B m
Chromium (VI) in Water	1	N/A	2017/09/28	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	1	N/A	2017/09/27	CAM SOP-00457	OMOE E3015 m
Dissolved Oxygen	1	2017/09/23	2017/09/23	CAM SOP-00427	SM 22 4500 O G m
Hardness (calculated as CaCO3)	1	N/A	2017/09/27	CAM SOP 00102/00408/00447	SM 2340 B
Mercury	1	2017/09/26	2017/09/27	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2017/09/28	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	1	N/A	2017/09/28	CAM SOP-00441	EPA GS I-2522-90 m
pH	1	N/A	2017/09/26	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/09/26	CAM SOP-00444	OMOE E3179 m
Field pH (1)	1	N/A	2017/09/24		Field pH Meter
Sulphide	1	N/A	2017/09/26	CAM SOP-00455	SM 22 4500-S G m
Field Temperature (1)	1	N/A	2017/09/24		Field Thermometer
Total Phosphorus (Colourimetric)	1	2017/09/25	2017/09/26	CAM SOP-00407	SM 22 4500 P B H m
Turbidity	1	N/A	2017/09/24	CAM SOP-00417	SM 22 2130 B m
Un-ionized Ammonia	1	2017/09/23	2017/09/28		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Your Project #: 2017-0293
Your C.O.C. #: 629279-02-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4746655
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8768

Received: 2017/09/22, 14:30

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This is a field test, therefore, the results relate to items that were not analysed at Maxxam Analytics Inc.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Jolanta Goralczyk, Project Manager
Email: JGoralczyk@maxxam.ca
Phone# (905)817-5751

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK705		
Sampling Date			2017/09/21 10:30		
COC Number			629279-02-01		
	UNITS	Criteria	SF5-17	RDL	QC Batch
Calculated Parameters					
Hardness (CaCO3)	mg/L	-	240	1.0	5179429
Total Un-ionized Ammonia	mg/L	-	0.0089	0.0035	5179420
Field Measurements					
Field Temperature	Celcius	-	18.69	N/A	ONSITE
Field pH	pH	6.5:8.5	8.23		ONSITE
Inorganics					
Total Ammonia-N	mg/L	-	0.13	0.050	5181166
Dissolved Oxygen	mg/L	-	8.51		5179915
pH	pH	6.5:8.5	8.23		5179875
Phenols-4AAP	mg/L	0.001	**0.0017**	0.0010	5183116
Total Phosphorus	mg/L	0.01	**0.10**	0.004	5181037
Sulphide	mg/L	0.02	ND	0.020	5180655
Turbidity	NTU	-	1.3	0.1	5179395
WAD Cyanide (Free)	ug/L	5	ND	1	5182547
Alkalinity (Total as CaCO3)	mg/L	-	230	1.0	5179872
Metals					
Dissolved (0.2u) Aluminum (Al)	ug/L	15	8	5	5179909
Chromium (VI)	ug/L	1	ND	0.50	5184085
Mercury (Hg)	ug/L	0.2	ND	0.1	5183039
Total Antimony (Sb)	ug/L	20	ND	0.50	5186729
Total Arsenic (As)	ug/L	100	1.9	1.0	5186729
Total Beryllium (Be)	ug/L	11	ND	0.50	5186729
Total Boron (B)	ug/L	200	29	10	5186729
Total Cadmium (Cd)	ug/L	0.2	ND	0.10	5186729
Total Chromium (Cr)	ug/L	-	ND	5.0	5186729
Total Cobalt (Co)	ug/L	0.9	ND	0.50	5186729
Total Copper (Cu)	ug/L	5	ND	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected
N/A = Not Applicable

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK705		
Sampling Date			2017/09/21 10:30		
COC Number			629279-02-01		
	UNITS	Criteria	SF5-17	RDL	QC Batch
Total Iron (Fe)	ug/L	300	**320**	100	5186729
Total Lead (Pb)	ug/L	5	ND	0.50	5186729
Total Molybdenum (Mo)	ug/L	40	0.72	0.50	5186729
Total Nickel (Ni)	ug/L	25	ND	1.0	5186729
Total Selenium (Se)	ug/L	100	ND	2.0	5186729
Total Silver (Ag)	ug/L	0.1	ND	0.10	5186729
Total Thallium (Tl)	ug/L	0.3	ND	0.050	5186729
Total Tungsten (W)	ug/L	30	ND	1.0	5186729
Total Uranium (U)	ug/L	5	0.22	0.10	5186729
Total Vanadium (V)	ug/L	6	0.59	0.50	5186729
Total Zinc (Zn)	ug/L	30	ND	5.0	5186729
Total Zirconium (Zr)	ug/L	4	ND	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

TEST SUMMARY

Maxxam ID: FEK704
Sample ID: SF1-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

Maxxam ID: FEK705
Sample ID: SF5-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5180655	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

TEST SUMMARY

Maxxam ID: FEK706
Sample ID: SF6-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5180655	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

Maxxam ID: FEK706 Dup
Sample ID: SF6-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.0°C

Results relate only to the items tested.

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5179395	Turbidity	2017/09/24			101	85 - 115	ND, RDL=0.1	NTU	2.8	20		
5179872	Alkalinity (Total as CaCO3)	2017/09/25			97	85 - 115	ND, RDL=1.0	mg/L	0.70	20		
5179875	pH	2017/09/25			101	98 - 103			0.63	N/A		
5179909	Dissolved (0.2u) Aluminum (Al)	2017/09/25	110	80 - 120	102	80 - 120	ND,RDL=5	ug/L	NC	20		
5180655	Sulphide	2017/09/26	105	80 - 120	105	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5181037	Total Phosphorus	2017/09/26	99	80 - 120	94	80 - 120	ND, RDL=0.004	mg/L	NC	20	99	80 - 120
5181166	Total Ammonia-N	2017/09/28	99	80 - 120	98	85 - 115	ND, RDL=0.050	mg/L	20	20		
5181226	Sulphide	2017/09/26	109	80 - 120	98	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5182547	WAD Cyanide (Free)	2017/09/27	103	80 - 120	101	80 - 120	ND,RDL=1	ug/L	NC	20		
5183039	Mercury (Hg)	2017/09/27	100	75 - 125	102	80 - 120	ND, RDL=0.1	ug/L	NC	20		
5183116	Phenols-4AAP	2017/09/26	94	80 - 120	96	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5184085	Chromium (VI)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Antimony (Sb)	2017/09/28	110	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Arsenic (As)	2017/09/28	104	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	10	20		
5186729	Total Beryllium (Be)	2017/09/28	106	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Boron (B)	2017/09/28	102	80 - 120	98	80 - 120	ND, RDL=10	ug/L	5.1	20		
5186729	Total Cadmium (Cd)	2017/09/28	105	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Chromium (Cr)	2017/09/28	104	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Cobalt (Co)	2017/09/28	107	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	5.4	20		
5186729	Total Copper (Cu)	2017/09/28	108	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	9.7	20		
5186729	Total Iron (Fe)	2017/09/28	105	80 - 120	101	80 - 120	ND, RDL=100	ug/L	2.3	20		
5186729	Total Lead (Pb)	2017/09/28	102	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.80	20		
5186729	Total Molybdenum (Mo)	2017/09/28	108	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.14	20		
5186729	Total Nickel (Ni)	2017/09/28	100	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	8.1	20		
5186729	Total Selenium (Se)	2017/09/28	103	80 - 120	101	80 - 120	ND, RDL=2.0	ug/L	NC	20		
5186729	Total Silver (Ag)	2017/09/28	101	80 - 120	96	80 - 120	ND, RDL=0.10	ug/L	NC	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5186729	Total Thallium (Tl)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.050	ug/L	NC	20		
5186729	Total Tungsten (W)	2017/09/28	112	80 - 120	108	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5186729	Total Uranium (U)	2017/09/28	106	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	7.8	20		
5186729	Total Vanadium (V)	2017/09/28	101	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L	0.15	20		
5186729	Total Zinc (Zn)	2017/09/28	105	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Zirconium (Zr)	2017/09/28	106	80 - 120	95	80 - 120	ND, RDL=1.0	ug/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere

Cristina Carriere, Scientific Service Specialist

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Your Project #: 2017-0293
Your C.O.C. #: 629279-02-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4746655
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8768
Received: 2017/09/22, 14:30

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Dissolved Aluminum (0.2 u, clay free)	1	N/A	2017/09/25	CAM SOP-00447	EPA 6020B m
Alkalinity	1	N/A	2017/09/26	CAM SOP-00448	SM 22 2320 B m
Chromium (VI) in Water	1	N/A	2017/09/28	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	1	N/A	2017/09/27	CAM SOP-00457	OMOE E3015 m
Dissolved Oxygen	1	2017/09/23	2017/09/23	CAM SOP-00427	SM 22 4500 O G m
Hardness (calculated as CaCO3)	1	N/A	2017/09/27	CAM SOP 00102/00408/00447	SM 2340 B
Mercury	1	2017/09/26	2017/09/27	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2017/09/28	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	1	N/A	2017/09/28	CAM SOP-00441	EPA GS I-2522-90 m
pH	1	N/A	2017/09/26	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/09/26	CAM SOP-00444	OMOE E3179 m
Field pH (1)	1	N/A	2017/09/24		Field pH Meter
Sulphide	1	N/A	2017/09/26	CAM SOP-00455	SM 22 4500-S G m
Field Temperature (1)	1	N/A	2017/09/24		Field Thermometer
Total Phosphorus (Colourimetric)	1	2017/09/25	2017/09/26	CAM SOP-00407	SM 22 4500 P B H m
Turbidity	1	N/A	2017/09/24	CAM SOP-00417	SM 22 2130 B m
Un-ionized Ammonia	1	2017/09/23	2017/09/28		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Your Project #: 2017-0293
Your C.O.C. #: 629279-02-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
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CANADA L3R 4T5

Report Date: 2017/09/29
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CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8768

Received: 2017/09/22, 14:30

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This is a field test, therefore, the results relate to items that were not analysed at Maxxam Analytics Inc.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Jolanta Goralczyk, Project Manager
Email: JGoralczyk@maxxam.ca
Phone# (905)817-5751

==========

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK706		
Sampling Date			2017/09/21 15:35		
COC Number			629279-02-01		
	UNITS	Criteria	SF6-17	RDL	QC Batch
Calculated Parameters					
Hardness (CaCO3)	mg/L	-	250	1.0	5179429
Total Un-ionized Ammonia	mg/L	-	0.019	0.0061	5179420
Field Measurements					
Field Temperature	Celcius	-	24.99	N/A	ONSITE
Field pH	pH	6.5:8.5	8.29		ONSITE
Inorganics					
Total Ammonia-N	mg/L	-	0.16	0.050	5181166
Dissolved Oxygen	mg/L	-	9.58		5179915
pH	pH	6.5:8.5	8.18		5179875
Phenols-4AAP	mg/L	0.001	**0.0033**	0.0010	5183116
Total Phosphorus	mg/L	0.01	**0.080**	0.004	5181037
Sulphide	mg/L	0.02	ND	0.020	5180655
Turbidity	NTU	-	6.9	0.1	5179395
WAD Cyanide (Free)	ug/L	5	ND	1	5182547
Alkalinity (Total as CaCO3)	mg/L	-	240	1.0	5179872
Metals					
Dissolved (0.2u) Aluminum (Al)	ug/L	15	6	5	5179909
Chromium (VI)	ug/L	1	ND	0.50	5184085
Mercury (Hg)	ug/L	0.2	ND	0.1	5183039
Total Antimony (Sb)	ug/L	20	ND	0.50	5186729
Total Arsenic (As)	ug/L	100	1.5	1.0	5186729
Total Beryllium (Be)	ug/L	11	ND	0.50	5186729
Total Boron (B)	ug/L	200	41	10	5186729
Total Cadmium (Cd)	ug/L	0.2	ND	0.10	5186729
Total Chromium (Cr)	ug/L	-	ND	5.0	5186729
Total Cobalt (Co)	ug/L	0.9	0.54	0.50	5186729
Total Copper (Cu)	ug/L	5	2.2	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected
N/A = Not Applicable

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK706		
Sampling Date			2017/09/21 15:35		
COC Number			629279-02-01		
	UNITS	Criteria	SF6-17	RDL	QC Batch
Total Iron (Fe)	ug/L	300	**1300**	100	5186729
Total Lead (Pb)	ug/L	5	0.50	0.50	5186729
Total Molybdenum (Mo)	ug/L	40	2.1	0.50	5186729
Total Nickel (Ni)	ug/L	25	1.6	1.0	5186729
Total Selenium (Se)	ug/L	100	ND	2.0	5186729
Total Silver (Ag)	ug/L	0.1	ND	0.10	5186729
Total Thallium (Tl)	ug/L	0.3	ND	0.050	5186729
Total Tungsten (W)	ug/L	30	ND	1.0	5186729
Total Uranium (U)	ug/L	5	0.60	0.10	5186729
Total Vanadium (V)	ug/L	6	1.4	0.50	5186729
Total Zinc (Zn)	ug/L	30	ND	5.0	5186729
Total Zirconium (Zr)	ug/L	4	ND	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

TEST SUMMARY

Maxxam ID: FEK704
Sample ID: SF1-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

Maxxam ID: FEK705
Sample ID: SF5-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5180655	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

TEST SUMMARY

Maxxam ID: FEK706
Sample ID: SF6-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5180655	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

Maxxam ID: FEK706 Dup
Sample ID: SF6-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
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Sampler Initials: GM

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.0°C

Results relate only to the items tested.

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5179395	Turbidity	2017/09/24			101	85 - 115	ND, RDL=0.1	NTU	2.8	20		
5179872	Alkalinity (Total as CaCO3)	2017/09/25			97	85 - 115	ND, RDL=1.0	mg/L	0.70	20		
5179875	pH	2017/09/25			101	98 - 103			0.63	N/A		
5179909	Dissolved (0.2u) Aluminum (Al)	2017/09/25	110	80 - 120	102	80 - 120	ND,RDL=5	ug/L	NC	20		
5180655	Sulphide	2017/09/26	105	80 - 120	105	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5181037	Total Phosphorus	2017/09/26	99	80 - 120	94	80 - 120	ND, RDL=0.004	mg/L	NC	20	99	80 - 120
5181166	Total Ammonia-N	2017/09/28	99	80 - 120	98	85 - 115	ND, RDL=0.050	mg/L	20	20		
5181226	Sulphide	2017/09/26	109	80 - 120	98	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5182547	WAD Cyanide (Free)	2017/09/27	103	80 - 120	101	80 - 120	ND,RDL=1	ug/L	NC	20		
5183039	Mercury (Hg)	2017/09/27	100	75 - 125	102	80 - 120	ND, RDL=0.1	ug/L	NC	20		
5183116	Phenols-4AAP	2017/09/26	94	80 - 120	96	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5184085	Chromium (VI)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Antimony (Sb)	2017/09/28	110	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Arsenic (As)	2017/09/28	104	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	10	20		
5186729	Total Beryllium (Be)	2017/09/28	106	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Boron (B)	2017/09/28	102	80 - 120	98	80 - 120	ND, RDL=10	ug/L	5.1	20		
5186729	Total Cadmium (Cd)	2017/09/28	105	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Chromium (Cr)	2017/09/28	104	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Cobalt (Co)	2017/09/28	107	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	5.4	20		
5186729	Total Copper (Cu)	2017/09/28	108	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	9.7	20		
5186729	Total Iron (Fe)	2017/09/28	105	80 - 120	101	80 - 120	ND, RDL=100	ug/L	2.3	20		
5186729	Total Lead (Pb)	2017/09/28	102	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.80	20		
5186729	Total Molybdenum (Mo)	2017/09/28	108	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.14	20		
5186729	Total Nickel (Ni)	2017/09/28	100	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	8.1	20		
5186729	Total Selenium (Se)	2017/09/28	103	80 - 120	101	80 - 120	ND, RDL=2.0	ug/L	NC	20		
5186729	Total Silver (Ag)	2017/09/28	101	80 - 120	96	80 - 120	ND, RDL=0.10	ug/L	NC	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5186729	Total Thallium (Tl)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.050	ug/L	NC	20		
5186729	Total Tungsten (W)	2017/09/28	112	80 - 120	108	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5186729	Total Uranium (U)	2017/09/28	106	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	7.8	20		
5186729	Total Vanadium (V)	2017/09/28	101	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L	0.15	20		
5186729	Total Zinc (Zn)	2017/09/28	105	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Zirconium (Zr)	2017/09/28	106	80 - 120	95	80 - 120	ND, RDL=1.0	ug/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere

Cristina Carriere, Scientific Service Specialist

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Your Project #: 2017-0293
Your C.O.C. #: 629279-02-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4746655
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8768
Received: 2017/09/22, 14:30

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Dissolved Aluminum (0.2 u, clay free)	1	N/A	2017/09/25	CAM SOP-00447	EPA 6020B m
Alkalinity	1	N/A	2017/09/26	CAM SOP-00448	SM 22 2320 B m
Chromium (VI) in Water	1	N/A	2017/09/28	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	1	N/A	2017/09/27	CAM SOP-00457	OMOE E3015 m
Dissolved Oxygen	1	2017/09/23	2017/09/23	CAM SOP-00427	SM 22 4500 O G m
Hardness (calculated as CaCO3)	1	N/A	2017/09/27	CAM SOP 00102/00408/00447	SM 2340 B
Mercury	1	2017/09/26	2017/09/27	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2017/09/28	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	1	N/A	2017/09/28	CAM SOP-00441	EPA GS I-2522-90 m
pH	1	N/A	2017/09/26	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/09/26	CAM SOP-00444	OMOE E3179 m
Field pH (1)	1	N/A	2017/09/24		Field pH Meter
Sulphide	1	N/A	2017/09/26	CAM SOP-00455	SM 22 4500-S G m
Field Temperature (1)	1	N/A	2017/09/24		Field Thermometer
Total Phosphorus (Colourimetric)	1	2017/09/25	2017/09/26	CAM SOP-00407	SM 22 4500 P B H m
Turbidity	1	N/A	2017/09/24	CAM SOP-00417	SM 22 2130 B m
Un-ionized Ammonia	1	2017/09/23	2017/09/28		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Your Project #: 2017-0293
Your C.O.C. #: 629279-02-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
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CERTIFICATE OF ANALYSIS

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Received: 2017/09/22, 14:30

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This is a field test, therefore, the results relate to items that were not analysed at Maxxam Analytics Inc.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Jolanta Goralczyk, Project Manager
Email: JGoralczyk@maxxam.ca
Phone# (905)817-5751

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK706		
Sampling Date			2017/09/21 15:35		
COC Number			629279-02-01		
	UNITS	Criteria	SF6-17 Lab-Dup	RDL	QC Batch
Metals					
Total Antimony (Sb)	ug/L	20	ND	0.50	5186729
Total Arsenic (As)	ug/L	100	1.3	1.0	5186729
Total Beryllium (Be)	ug/L	11	ND	0.50	5186729
Total Boron (B)	ug/L	200	39	10	5186729
Total Cadmium (Cd)	ug/L	0.2	ND	0.10	5186729
Total Chromium (Cr)	ug/L	-	ND	5.0	5186729
Total Cobalt (Co)	ug/L	0.9	0.51	0.50	5186729
Total Copper (Cu)	ug/L	5	2.0	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK706		
Sampling Date			2017/09/21 15:35		
COC Number			629279-02-01		
	UNITS	Criteria	SF6-17 Lab-Dup	RDL	QC Batch
Total Iron (Fe)	ug/L	300	**1200**	100	5186729
Total Lead (Pb)	ug/L	5	ND	0.50	5186729
Total Molybdenum (Mo)	ug/L	40	2.1	0.50	5186729
Total Nickel (Ni)	ug/L	25	1.5	1.0	5186729
Total Selenium (Se)	ug/L	100	ND	2.0	5186729
Total Silver (Ag)	ug/L	0.1	ND	0.10	5186729
Total Thallium (Tl)	ug/L	0.3	ND	0.050	5186729
Total Tungsten (W)	ug/L	30	ND	1.0	5186729
Total Uranium (U)	ug/L	5	0.55	0.10	5186729
Total Vanadium (V)	ug/L	6	1.4	0.50	5186729
Total Zinc (Zn)	ug/L	30	ND	5.0	5186729
Total Zirconium (Zr)	ug/L	4	ND	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

TEST SUMMARY

Maxxam ID: FEK704
Sample ID: SF1-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

Maxxam ID: FEK705
Sample ID: SF5-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5180655	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

TEST SUMMARY

Maxxam ID: FEK706
Sample ID: SF6-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5180655	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

Maxxam ID: FEK706 Dup
Sample ID: SF6-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.0°C

Results relate only to the items tested.

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5179395	Turbidity	2017/09/24			101	85 - 115	ND, RDL=0.1	NTU	2.8	20		
5179872	Alkalinity (Total as CaCO3)	2017/09/25			97	85 - 115	ND, RDL=1.0	mg/L	0.70	20		
5179875	pH	2017/09/25			101	98 - 103			0.63	N/A		
5179909	Dissolved (0.2u) Aluminum (Al)	2017/09/25	110	80 - 120	102	80 - 120	ND,RDL=5	ug/L	NC	20		
5180655	Sulphide	2017/09/26	105	80 - 120	105	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5181037	Total Phosphorus	2017/09/26	99	80 - 120	94	80 - 120	ND, RDL=0.004	mg/L	NC	20	99	80 - 120
5181166	Total Ammonia-N	2017/09/28	99	80 - 120	98	85 - 115	ND, RDL=0.050	mg/L	20	20		
5181226	Sulphide	2017/09/26	109	80 - 120	98	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5182547	WAD Cyanide (Free)	2017/09/27	103	80 - 120	101	80 - 120	ND,RDL=1	ug/L	NC	20		
5183039	Mercury (Hg)	2017/09/27	100	75 - 125	102	80 - 120	ND, RDL=0.1	ug/L	NC	20		
5183116	Phenols-4AAP	2017/09/26	94	80 - 120	96	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5184085	Chromium (VI)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Antimony (Sb)	2017/09/28	110	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Arsenic (As)	2017/09/28	104	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	10	20		
5186729	Total Beryllium (Be)	2017/09/28	106	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Boron (B)	2017/09/28	102	80 - 120	98	80 - 120	ND, RDL=10	ug/L	5.1	20		
5186729	Total Cadmium (Cd)	2017/09/28	105	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Chromium (Cr)	2017/09/28	104	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Cobalt (Co)	2017/09/28	107	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	5.4	20		
5186729	Total Copper (Cu)	2017/09/28	108	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	9.7	20		
5186729	Total Iron (Fe)	2017/09/28	105	80 - 120	101	80 - 120	ND, RDL=100	ug/L	2.3	20		
5186729	Total Lead (Pb)	2017/09/28	102	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.80	20		
5186729	Total Molybdenum (Mo)	2017/09/28	108	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.14	20		
5186729	Total Nickel (Ni)	2017/09/28	100	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	8.1	20		
5186729	Total Selenium (Se)	2017/09/28	103	80 - 120	101	80 - 120	ND, RDL=2.0	ug/L	NC	20		
5186729	Total Silver (Ag)	2017/09/28	101	80 - 120	96	80 - 120	ND, RDL=0.10	ug/L	NC	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5186729	Total Thallium (Tl)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.050	ug/L	NC	20		
5186729	Total Tungsten (W)	2017/09/28	112	80 - 120	108	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5186729	Total Uranium (U)	2017/09/28	106	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	7.8	20		
5186729	Total Vanadium (V)	2017/09/28	101	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L	0.15	20		
5186729	Total Zinc (Zn)	2017/09/28	105	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Zirconium (Zr)	2017/09/28	106	80 - 120	95	80 - 120	ND, RDL=1.0	ug/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere

Cristina Carriere, Scientific Service Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam
A Bureau Veritas Group Company

Your Project #: 2017-0293
Your C.O.C. #: 629279-02-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4746655
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8768
Received: 2017/09/22, 14:30

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Dissolved Aluminum (0.2 u, clay free)	3	N/A	2017/09/25	CAM SOP-00447	EPA 6020B m
Alkalinity	3	N/A	2017/09/26	CAM SOP-00448	SM 22 2320 B m
Chromium (VI) in Water	3	N/A	2017/09/28	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	3	N/A	2017/09/27	CAM SOP-00457	OMOE E3015 m
Dissolved Oxygen	3	2017/09/23	2017/09/23	CAM SOP-00427	SM 22 4500 O G m
Hardness (calculated as CaCO3)	3	N/A	2017/09/27	CAM SOP 00102/00408/00447	SM 2340 B
Mercury	3	2017/09/26	2017/09/27	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	3	N/A	2017/09/28	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	3	N/A	2017/09/28	CAM SOP-00441	EPA GS I-2522-90 m
pH	3	N/A	2017/09/26	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	3	N/A	2017/09/26	CAM SOP-00444	OMOE E3179 m
Field pH (1)	3	N/A	2017/09/24		Field pH Meter
Sulphide	3	N/A	2017/09/26	CAM SOP-00455	SM 22 4500-S G m
Field Temperature (1)	3	N/A	2017/09/24		Field Thermometer
Total Phosphorus (Colourimetric)	3	2017/09/25	2017/09/26	CAM SOP-00407	SM 22 4500 P B H m
Turbidity	3	N/A	2017/09/24	CAM SOP-00417	SM 22 2130 B m
Un-ionized Ammonia	3	2017/09/23	2017/09/28		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

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Your Project #: 2017-0293
Your C.O.C. #: 629279-02-01

Attention:Alireza Hejazi

Cole Engineering Group Ltd
70 Valleywood Dr
Markham, ON
CANADA L3R 4T5

Report Date: 2017/09/29
Report #: R4746655
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7K8768

Received: 2017/09/22, 14:30

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This is a field test, therefore, the results relate to items that were not analysed at Maxxam Analytics Inc.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jolanta Goralczyk, Project Manager
Email: JGoralczyk@maxxam.ca
Phone# (905)817-5751

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK704			FEK705		FEK706		
Sampling Date			2017/09/21 11:30			2017/09/21 10:30		2017/09/21 15:35		
COC Number			629279-02-01			629279-02-01		629279-02-01		
	UNITS	Criteria	SF1-17	RDL	QC Batch	SF5-17	RDL	SF6-17	RDL	QC Batch
Calculated Parameters										
Hardness (CaCO3)	mg/L	-	150	1.0	5179429	240	1.0	250	1.0	5179429
Total Un-ionized Ammonia	mg/L	-	0.012	0.0023	5179420	0.0089	0.0035	0.019	0.0061	5179420
Field Measurements										
Field Temperature	Celcius	-	18.65	N/A	ONSITE	18.69	N/A	24.99	N/A	ONSITE
Field pH	pH	6.5:8.5	8.03		ONSITE	8.23		8.29		ONSITE
Inorganics										
Total Ammonia-N	mg/L	-	0.26	0.050	5181166	0.13	0.050	0.16	0.050	5181166
Dissolved Oxygen	mg/L	-	10.0		5179915	8.51		9.58		5179915
pH	pH	6.5:8.5	7.99		5179875	8.23		8.18		5179875
Phenols-4AAP	mg/L	0.001	ND	0.0010	5183116	**0.0017**	0.0010	**0.0033**	0.0010	5183116
Total Phosphorus	mg/L	0.01	**0.037**	0.004	5181037	**0.10**	0.004	**0.080**	0.004	5181037
Sulphide	mg/L	0.02	ND	0.020	5181226	ND	0.020	ND	0.020	5180655
Turbidity	NTU	-	0.9	0.1	5179395	1.3	0.1	6.9	0.1	5179395
WAD Cyanide (Free)	ug/L	5	ND	1	5182547	ND	1	ND	1	5182547
Alkalinity (Total as CaCO3)	mg/L	-	120	1.0	5179872	230	1.0	240	1.0	5179872
Metals										
Dissolved (0.2u) Aluminum (Al)	ug/L	15	ND	5	5179909	8	5	6	5	5179909
Chromium (VI)	ug/L	1	ND	0.50	5184085	ND	0.50	ND	0.50	5184085
Mercury (Hg)	ug/L	0.2	ND	0.1	5183039	ND	0.1	ND	0.1	5183039
Total Antimony (Sb)	ug/L	20	ND	0.50	5186729	ND	0.50	ND	0.50	5186729
Total Arsenic (As)	ug/L	100	ND	1.0	5186729	1.9	1.0	1.5	1.0	5186729
Total Beryllium (Be)	ug/L	11	ND	0.50	5186729	ND	0.50	ND	0.50	5186729
Total Boron (B)	ug/L	200	27	10	5186729	29	10	41	10	5186729
Total Cadmium (Cd)	ug/L	0.2	ND	0.10	5186729	ND	0.10	ND	0.10	5186729
Total Chromium (Cr)	ug/L	-	ND	5.0	5186729	ND	5.0	ND	5.0	5186729
Total Cobalt (Co)	ug/L	0.9	ND	0.50	5186729	ND	0.50	0.54	0.50	5186729
Total Copper (Cu)	ug/L	5	ND	1.0	5186729	ND	1.0	2.2	1.0	5186729
Total Iron (Fe)	ug/L	300	230	100	5186729	**320**	100	**1300**	100	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
N/A = Not Applicable
ND = Not detected

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK704			FEK705		FEK706		
Sampling Date			2017/09/21 11:30			2017/09/21 10:30		2017/09/21 15:35		
COC Number			629279-02-01			629279-02-01		629279-02-01		
	UNITS	Criteria	SF1-17	RDL	QC Batch	SF5-17	RDL	SF6-17	RDL	QC Batch
Total Lead (Pb)	ug/L	5	ND	0.50	5186729	ND	0.50	0.50	0.50	5186729
Total Molybdenum (Mo)	ug/L	40	0.85	0.50	5186729	0.72	0.50	2.1	0.50	5186729
Total Nickel (Ni)	ug/L	25	ND	1.0	5186729	ND	1.0	1.6	1.0	5186729
Total Selenium (Se)	ug/L	100	ND	2.0	5186729	ND	2.0	ND	2.0	5186729
Total Silver (Ag)	ug/L	0.1	ND	0.10	5186729	ND	0.10	ND	0.10	5186729
Total Thallium (Tl)	ug/L	0.3	ND	0.050	5186729	ND	0.050	ND	0.050	5186729
Total Tungsten (W)	ug/L	30	ND	1.0	5186729	ND	1.0	ND	1.0	5186729
Total Uranium (U)	ug/L	5	0.22	0.10	5186729	0.22	0.10	0.60	0.10	5186729
Total Vanadium (V)	ug/L	6	ND	0.50	5186729	0.59	0.50	1.4	0.50	5186729
Total Zinc (Zn)	ug/L	30	ND	5.0	5186729	ND	5.0	ND	5.0	5186729
Total Zirconium (Zr)	ug/L	4	ND	1.0	5186729	ND	1.0	ND	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
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Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

PWQO METALS AND INORGANICS (WATER)

Maxxam ID			FEK706		
Sampling Date			2017/09/21 15:35		
COC Number			629279-02-01		
	UNITS	Criteria	SF6-17 Lab-Dup	RDL	QC Batch
Metals					
Total Antimony (Sb)	ug/L	20	ND	0.50	5186729
Total Arsenic (As)	ug/L	100	1.3	1.0	5186729
Total Beryllium (Be)	ug/L	11	ND	0.50	5186729
Total Boron (B)	ug/L	200	39	10	5186729
Total Cadmium (Cd)	ug/L	0.2	ND	0.10	5186729
Total Chromium (Cr)	ug/L	-	ND	5.0	5186729
Total Cobalt (Co)	ug/L	0.9	0.51	0.50	5186729
Total Copper (Cu)	ug/L	5	2.0	1.0	5186729
Total Iron (Fe)	ug/L	300	**1200**	100	5186729
Total Lead (Pb)	ug/L	5	ND	0.50	5186729
Total Molybdenum (Mo)	ug/L	40	2.1	0.50	5186729
Total Nickel (Ni)	ug/L	25	1.5	1.0	5186729
Total Selenium (Se)	ug/L	100	ND	2.0	5186729
Total Silver (Ag)	ug/L	0.1	ND	0.10	5186729
Total Thallium (Tl)	ug/L	0.3	ND	0.050	5186729
Total Tungsten (W)	ug/L	30	ND	1.0	5186729
Total Uranium (U)	ug/L	5	0.55	0.10	5186729
Total Vanadium (V)	ug/L	6	1.4	0.50	5186729
Total Zinc (Zn)	ug/L	30	ND	5.0	5186729
Total Zirconium (Zr)	ug/L	4	ND	1.0	5186729

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
ND = Not detected

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

TEST SUMMARY

Maxxam ID: FEK704
Sample ID: SF1-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5181226	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

Maxxam ID: FEK705
Sample ID: SF5-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5180655	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

TEST SUMMARY

Maxxam ID: FEK706
Sample ID: SF6-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Aluminum (0.2 u, clay free)	ICP/MS	5179909	N/A	2017/09/25	Prempal Bhatti
Alkalinity	AT	5179872	N/A	2017/09/26	Surinder Rai
Chromium (VI) in Water	IC	5184085	N/A	2017/09/28	Lang Le
Free (WAD) Cyanide	SKAL/CN	5182547	N/A	2017/09/27	Louise Harding
Dissolved Oxygen	DO	5179915	2017/09/23	2017/09/23	Prakash Piya
Hardness (calculated as CaCO3)		5179429	N/A	2017/09/27	Automated Statchk
Mercury	CV/AA	5183039	2017/09/26	2017/09/27	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5181166	N/A	2017/09/28	Sarabjit Raina
pH	AT	5179875	N/A	2017/09/26	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5183116	N/A	2017/09/26	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Sulphide	ISE/S	5180655	N/A	2017/09/26	Tahir Anwar
Field pH	PH	ONSITE	N/A	2017/09/23	Adriana Smith
Total Phosphorus (Colourimetric)	LACH/P	5181037	2017/09/25	2017/09/26	Amanpreet Sappal
Turbidity	AT	5179395	N/A	2017/09/24	Neil Dassanayake
Un-ionized Ammonia	CALC/NH3	5179420	2017/09/28	2017/09/28	Automated Statchk

Maxxam ID: FEK706 Dup
Sample ID: SF6-17
Matrix: Water

Collected: 2017/09/21
Shipped:
Received: 2017/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Metals Analysis by ICPMS	ICP/MS	5186729	N/A	2017/09/28	Arefa Dabhad

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.0°C

Results relate only to the items tested.

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5179395	Turbidity	2017/09/24			101	85 - 115	ND, RDL=0.1	NTU	2.8	20		
5179872	Alkalinity (Total as CaCO3)	2017/09/25			97	85 - 115	ND, RDL=1.0	mg/L	0.70	20		
5179875	pH	2017/09/25			101	98 - 103			0.63	N/A		
5179909	Dissolved (0.2u) Aluminum (Al)	2017/09/25	110	80 - 120	102	80 - 120	ND,RDL=5	ug/L	NC	20		
5180655	Sulphide	2017/09/26	105	80 - 120	105	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5181037	Total Phosphorus	2017/09/26	99	80 - 120	94	80 - 120	ND, RDL=0.004	mg/L	NC	20	99	80 - 120
5181166	Total Ammonia-N	2017/09/28	99	80 - 120	98	85 - 115	ND, RDL=0.050	mg/L	20	20		
5181226	Sulphide	2017/09/26	109	80 - 120	98	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5182547	WAD Cyanide (Free)	2017/09/27	103	80 - 120	101	80 - 120	ND,RDL=1	ug/L	NC	20		
5183039	Mercury (Hg)	2017/09/27	100	75 - 125	102	80 - 120	ND, RDL=0.1	ug/L	NC	20		
5183116	Phenols-4AAP	2017/09/26	94	80 - 120	96	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5184085	Chromium (VI)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Antimony (Sb)	2017/09/28	110	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Arsenic (As)	2017/09/28	104	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	10	20		
5186729	Total Beryllium (Be)	2017/09/28	106	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5186729	Total Boron (B)	2017/09/28	102	80 - 120	98	80 - 120	ND, RDL=10	ug/L	5.1	20		
5186729	Total Cadmium (Cd)	2017/09/28	105	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5186729	Total Chromium (Cr)	2017/09/28	104	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Cobalt (Co)	2017/09/28	107	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	5.4	20		
5186729	Total Copper (Cu)	2017/09/28	108	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	9.7	20		
5186729	Total Iron (Fe)	2017/09/28	105	80 - 120	101	80 - 120	ND, RDL=100	ug/L	2.3	20		
5186729	Total Lead (Pb)	2017/09/28	102	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.80	20		
5186729	Total Molybdenum (Mo)	2017/09/28	108	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	0.14	20		
5186729	Total Nickel (Ni)	2017/09/28	100	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L	8.1	20		
5186729	Total Selenium (Se)	2017/09/28	103	80 - 120	101	80 - 120	ND, RDL=2.0	ug/L	NC	20		
5186729	Total Silver (Ag)	2017/09/28	101	80 - 120	96	80 - 120	ND, RDL=0.10	ug/L	NC	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5186729	Total Thallium (Tl)	2017/09/28	101	80 - 120	102	80 - 120	ND, RDL=0.050	ug/L	NC	20		
5186729	Total Tungsten (W)	2017/09/28	112	80 - 120	108	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5186729	Total Uranium (U)	2017/09/28	106	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	7.8	20		
5186729	Total Vanadium (V)	2017/09/28	101	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L	0.15	20		
5186729	Total Zinc (Zn)	2017/09/28	105	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5186729	Total Zirconium (Zr)	2017/09/28	106	80 - 120	95	80 - 120	ND, RDL=1.0	ug/L	NC	20		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
Sampler Initials: GM

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere

Cristina Carriere, Scientific Service Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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CHAIN OF CUSTODY RECORD

Page of

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#24008 Cole Engineering Group Ltd	Company Name:		Quotation #:	B02064	Maxxam Job #:	Bottle Order #:
Attention:	Accounts Payable	Attention:	Alireza Hejazi	P.O. #:			629279
Address:	70 Valleywood Dr Markham ON L3R 4T5	Address:		Project:	2017-0293 *	COC #:	Project Manager:
Tel:	(416) 987-6161 x Fax: (905) 940-2064 x	Tel:	(416) 987-6161 x243 Fax:	Project Name:		C#629279-02-01	Jolanta Goralczyk
Email:	accountspayable@coleengineering.ca	Email:	AHejazi@coleengineering.ca	Site #:			
				Sampled By:	GM		

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)	Other Regulations	Special Instructions
☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___	☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality ___ ☒ PWQO ☐ Other ___	

Include Criteria on Certificate of Analysis (Y/N)? ___

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:

Please provide advance notice for rush projects

Regular (Standard) TAT: *(will be applied if Rush TAT is not specified)* ☒

Standard TAT = 5-7 Working days for most tests.

Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)

Date Required: ___ Time Required: ___ ☐

Rush Confirmation Number: ___ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	PWQO Metals and Inorganics	# of Bottles	Comments
1		SF1-17	17-9-21	1130	SW	Y Mercury	X		temp: 18.65 pH: 8.03
2		SF5-17	" "	1080	" "	" "	X		temp: 18.69 pH: 8.23
3		SF6-17	" "	1535	" "	" "	X		temp: 24.89 pH: 8.29
4									
5									
6									
7									
8									
9									
10									

22-Sep-17 14:30
Jolanta Goralczyk
B7K8768
TSP ENV-1356

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only			
Gordon McCready (2-MC)	17.9.22	0900	Tanya Tanuiasiuk	2017/09/22	14:30		Time Sensitive	Temperature (°C) on Recei: 3/4/5	Custody Seal Present / Intact	Yes ✓ ✓ / No

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT HTTP://MAXXAM.CA/WP-CONTENT/UPLOADS/ONTARIO-COC.PDF.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

White: Maxxa Yellow: Client

Maxxam Analytics International Corporation o/a Maxxam Analytics

Appendix E Ecological Survey Methodology

GEI Ecological Survey Methodology

1.1 Ecological Land Classification

Vegetation communities were first identified on aerial imagery and then verified in the field. Vegetation community types were confirmed, sampled and revised, if necessary, using the sampling protocol of the Ecological Land Classification (ELC) for Southern Ontario (Lee at al. 1998). ELC was completed to the finest level of resolution (Vegetation Type) where feasible. Species names generally follow nomenclature from the Flora Ontario – Integrated Botanical Information System (FOIBIS; Newmaster and Ragupathy 2012).

1.2 Wetland Evaluation

A wetland evaluation following the Ontario Wetland Evaluation System (OWES) for Southern Ontario (MNRF 2022) considers a number of factors to determine significance. These factors include wetland boundaries, productivity, biodiversity, size, social and economic importance, hydrogeological function and special features. Each category has a scoring system, wherein certain points are tallied within each category. When a certain threshold of points have been reached the feature is considered provincially significant. Based on GEI's experience with other wetland evaluations in the vicinity of the Study Area, the special features category gives a strong indication as to whether wetlands are likely to be considered as provincially significant.

For the purposes of this CEISMP, an OWES certified GEI Ecologist completed a preliminary OWES evaluation including scoring of the special features component of OWES using data already collected for wetlands within the Study Area.

1.3 Botanical Inventory

The provincial status of all plant species and vegetation communities is based on NHIC (2013). Identification of potentially sensitive native plant species is based on their assigned coefficient of conservatism (CC) value, as determined by Oldham et al. (1995). This CC value, ranging from 0 (low) to 10 (high), is based on a species tolerance of disturbance and fidelity to a specific natural habitat. Species with a CC value of 9 or 10 generally exhibit a high degree of fidelity to a narrow range of habitat parameters.

1.4 Breeding Bird Surveys

Breeding bird surveys were conducted following protocol set forth by the Ontario Breeding Bird Atlas (Cadman et al. 2007), the Ontario Forest Bird Monitoring Program (Cadman et al. 1998) and the Marsh Monitoring Program (Bird Studies Canada 2014 and 2006).

Surveys were conducted between dawn and five hours after dawn with suitable wind conditions, no thick fog or precipitation (Cadman et al. 2007). Point count stations were located in various habitat types within the Study Area and combined with area searches to help determine the

presence, variety and abundance of bird species. Each point count station was surveyed for 10 minutes for birds within 100 m and outside 100 m. All species recorded on a point-count were mapped to provide specific spatial information and were observed for signs of breeding behaviour. Surveys were conducted at least 10 days apart.

During breeding bird surveys, vegetation was assessed for potential presence of Species at Risk habitat. If suitable habitat was encountered or individuals were observed standard protocols were utilized (in consultation with the Ministry of Natural Resources and Forestry; MNRF).

1.5 Amphibian Call Count and Egg Mass Surveys

1.5.1 Amphibian Call Count Survey

These surveys followed standard protocols outlined in the Great Lakes Marsh Monitoring Program (BSC 2003). Surveys were conducted on warm nights with little wind. Surveys commenced one half hour before dusk and end before midnight. Visits were 15 days apart and as per protocols. The first occurred with a minimum nighttime air temperature of 5°C, the second visit with a minimum of 10°C and the third visit with a minimum of 17°C. If noise from plane, road traffic and/or trains was present, monitoring was delayed and began during a quiet period.

Each station was surveyed for three minutes and a three-level call category system was used to identify the level and type of frog activity.

The standard call levels are:

1) Individual calls do not overlap and calling individuals can be discreetly counted;
2) Calls of individuals sometimes overlap but number of individuals can still be estimated; and
3) Overlap among calls seems continuous (full chorus) and a count estimate is impossible.

Amphibians were recorded as within the station if they were within 100 m. All other species were recorded as incidental records heard outside the station.

1.5.2 Amphibian Egg Mass Survey

An egg mass survey was conducted for pool-breeding salamanders and early spring frogs that rely on woodland habitats (namely Wood Frog and Western Chorus Frog) during daylight hours. EMS was conducted within suitable woodland amphibian breeding habitat (i.e. pools with suitable hydroperiod within woodlands and within 120 m of woodland). Survey effort includes walking the perimeter of the vernal pool/wetland while scanning for egg masses and tadpoles. Any submerged sticks or shrubs standing in the water, to which eggs might be attached, were carefully checked with minimal intrusion into the vernal pool / wetland. For each EMS station, the survey was deemed to be completed when a complete check of locations where egg masses or tadpoles had occurred or within a 30-minute allotment, whichever was less.

The number of individuals of each amphibian species was recorded and the life stage was noted (e.g., egg mass, tadpole or adult). Characteristics of the breeding habitat were also noted, including: pool shape, water depth, water temperature, canopy cover, in-feature vegetation, presence of suitable egg attachment sites, and observations of predatory fish. Logs or debris in the vicinity of each pool were also checked for presence of adult salamanders (all items were returned to their original location/position to maintain microhabitat conditions).

1.6 Reptile Surveys

1.6.1 Snake Surveys (Reptile Area Searches, Coverboard Survey and Wildlife Road Crossing Survey)

Preliminary aerial photography review was performed to identify suitable snake habitat, which may include cultural meadow, disturbed meadow, wetland edges, cultural woodland, cultural savannah, rural residence and farm buildings. Surveys focused on searching natural cover, like rocks, logs and debris (carpeting, tarps). All objects were replaced as they were found to reduce disturbance. Old barns, foundations and houses, where access was granted, were also searched.

Transects were walked along the Study Area as well as along roads for basking snakes or snake mortalities. Data recorded during snake surveys includes species observed and locations (UTM coordinates), air temperature, water temperature, start and end time, and weather conditions. Other wildlife observed during these surveys were also recorded. This survey methodology focuses on snake hibernacula features, to determine if these features occur on the Study Area. Survey methods are based on MNRF (2016) and Toronto Zoo (Caverhill et al. 2011) snake survey protocols and are also informed by specifies-specific habitat preferences.

Cover boards were deployed throughout the Study Area near potential hibernacula (e.g., old standing structures, stone foundations, rocky slopes, rock crevices) and foraging locations to understand the presence and movement of snake species on the Study Area.

1.6.2 Turtle Emergence Survey

Potentially suitable aquatic habitat for turtles was identified using aerial photography and/or site reconnaissance results (ponds, open wetlands, and riparian / lacustrine areas). Binoculars were used to scan, from a distance, for ten minutes, the edges and surface of each water body for basking turtles (COSEWIC 2008; MNRF 2015; Caverhill et al. 2011). Data recorded includes: water and air temperatures (basking prevalent when air is warmer than water), vegetation composition around the water body, and presence of basking features (logs, floating vegetation mats, floating / emergent debris such as tires).

1.6.3 Turtle Nesting Survey

These surveys occurred during peak turtle nesting period, which spans from late spring to early summer (late May - June). Candidate turtle nesting areas may include shores/beaches of wetlands, lakes or rivers; gravel trails and driveways; and farm field margins with suitable substrate and aspect in relatively close proximity to core habitat (i.e., areas where turtles are

observed basking). Potentially suitable nesting areas were searched for evidence, such as test nest dig sites, claw marks, turtle trails or predated nests. Where potential habitat was noted, soil auger samples (where permissible) or soil type mapping were reviewed for the presence of potentially suitable substrate. Data recorded included: nesting area size, % slope of the nesting area, % canopy cover over the nesting area, direction of orientation (i.e., east facing), location (UTM coordinates), soil substrate, and distance from roadways.

Species-specific habitat preferences (i.e., COSEWIC, 2008) and the survey methods of the MNRF (2015) and Toronto Zoo (Caverhill et al. 2011; Kula. 2011) were considered in the formulation of this survey protocol.

1.7 Insect Surveys

Insect surveys do not currently have a set protocol in Ontario. Species detection is dependent on repeated visits during the appropriate flight times for a given species in suitable habitat. Dragonflies and butterflies are conspicuous, easily observed and have plentiful resources to aid in identification of Ontario species and as a result, focus is on these groups during surveying.

Surveys were conducted between mid-morning and noon or late afternoon to sunset with mostly sunny skies, suitable low wind conditions, no thick fog or precipitation. Temperatures were between 22°C and 30°C such that insect activity was optimal. Area searches were conducted within all suitable habitats present within the Study Area to help determine the presence, variety and abundance of insect species. In order to provide comprehensive coverage of all insect species flight periods, three survey periods were chosen:

- Early May to mid-June;
- Mid-June to mid-July; and
- Late July to late August.

During insect surveys, vegetation and landscape features (rivers, streams, other waterbodies) were assessed for potential presence of SAR habitat. If suitable habitat or food plants (butterflies only) were encountered or individuals were observed, standard protocols were utilized (in consultation with MNRF).

1.8 Bats

1.8.1 Bat Habitat Assessment

Surveys were completed following MNRF survey guidelines as outlined in “Bats and Bat Habitats: Guidelines for Wind Power Projects” (MNR 2011), consultation with MNRF, and professional experience. Areas to be surveyed were determined using ELC mapping of the Study Area. Where present, targeted ELC communities included Deciduous Forests (FOD), Mixedwood Forests (FOM), Coniferous Forests (FOC), Deciduous Swamp (SWD), Mixedwood Swamps (SWM), and Coniferous Swamps (SWC). For the purposes of this survey, hedgerows (HR), Cultural woodlands (CUW), and residential/disturbed areas were also targeted. Surveys were conducted during the leaf-off period on days when visibility was good.

Using the above criteria, Fresh-Moist Basswood Deciduous Forest (FOD8-3) was identified to be searched on the Study Area (**Figure 5, Appendix A**). Due to the size of the woodland feature (1.20 ha), the entire woodlot was assessed using a transect approach to determine whether suitable maternity roosting habitat was present. All trees and snags greater than or equal to 10 cm diameter-at-breast height (DBH) were visually inspected using binoculars to document any cavities, leaf clusters, and loose or peeling bark that may or may not be present along the trunk or large branches. In addition, survey efforts also targeted oak and maple tree species to identify suitable maternity roost habitat for Tri-coloured Bats.

Each tree containing suitable cavities had the following information recorded: UTM, species, DBH, approximate height, decay class, canopy cover, total number of cavities and height information for the top three cavities. Each tree was also photographed.

These results were then used to assess the quality of the area to provide bat maternity roost habitat, with areas with ≥10 cavities/ha determined to provide the greatest potential bat maternity roost habitat in accordance with MNRF guidelines.

A small shed in the southwest portion of the Study Area was also assessed for suitable bat roosting habitat by identifying exit points (i.e., peak of roof, vents near roofline, under soffit or where fascia meets roofline, etc.).

1.8.2 Bat Acoustic Monitoring

Acoustic monitoring stations were selected based on results from the bat habitat assessment survey. Given the small size of the woodland community, a single monitoring station was established (**Figure 5**, **Appendix A**) in a location with suitable bat habitat features. A Wildlife Acoustics Song Meter SM3BAT was deployed for 6 nights in June. The recorder microphone was elevated approximately 2 m above the ground to reduce background noise and echo.

In addition, to assess bat occurrence within the Study Area (Refer to **Figure 5**, **Appendix A**), EchoMeter Touch recording devices were utilized for transect and point count surveys for 3 nights in June around areas with structural diversity. Transect surveys were completed by an individual steadily walking along the transect with the detector held above their heads recording the entire period. Point count surveys were completed by two individuals standing on opposite sides of the structure with the detector held above their heads for 10 minutes.

1.9 Wildlife Camera Traps

Wildlife cameras were installed in six locations to understand wildlife movement throughout the site along potential wildlife corridors. Potential wildlife corridors were identified through aerial interpretation and site reconnaissance knowledge, focusing on linkage features that connect larger natural features on the landscape (e.g., watercourses, headwater drainage features).

Wildlife cameras were deployed in spring for a total of six weeks to understand movement of terrestrial species after overwintering period as they move towards potential breeding and/or foraging areas. Wildlife cameras were secured to T-Bars or around tree trunks approximately one to two feet above the ground using a python lock.

1.10 Terrestrial Crayfish Surveys

Evidence of the presence of terrestrial crayfish (i.e., chimneys) were recorded incidentally during other wildlife surveys in 2017 and 2018. An additional survey, specifically targeting terrestrial crayfish was undertaken in November 2021. Visual observations of crayfish individuals themselves are difficult, so records of their chimneys and/or burrows were noted to confirm the presence or absence of terrestrial crayfish within the Study Area. Geographic data are collected to visually demonstrate the distribution of the terrestrial crayfish within the Study Area.

The locations of clusters (signifying the presence of a colony) or individual chimneys were recorded using a GPS unit (e.g., GPSkit, Collector). Supplementary information regarding surrounding vegetation (within approximately a 1-m radius), distance to water, as well as the number of chimneys observed was also recorded.

1.11 Headwater Drainage Feature Assessment

Per the requirements of the Headwater Drainage Feature Assessment Guidelines (CVC and TRCA 2014), GEI completed three rounds of surveys to assess HDFs on the Study Area.

During the first site visit, all areas of the Study Area were walked to identify potential headwater drainage features. Each headwater drainage feature observed was separated into specific reaches, per the guidance on reach delineation in the HDF Assessment Guidelines, and data collection was completed for each reach based on Ontario Stream Assessment Protocols for Unconstrained Headwater Sampling, Section 4: Module 11 (Stanfield, ed. 2010).

Following completion of all three-rounds, the collected data was used to classify each headwater drainage feature, based on the HDF Assessment Guidelines.

1.12 Aquatic Habitat Assessment

The Aquatic Habitat Assessment consisted of a visual survey of existing instream and riparian habitat conditions along and adjacent to the watercourse running through the Study Area. The assessment took note of any of any of the following features:

- Hydrology (e.g. flowing or standing water);
- General watercourse morphology (e.g. riffle, run, pools);
- Wetted width and depth (at time of survey);
- Bed and bank substrate;
- Instream habitat (e.g. woody debris, aquatic vegetation, undercut banks);
- Presence of obstructions to fish movement (e.g. culverts, debris dams);
- Evidence of groundwater inputs (e.g. seeps or springs, iron flocculation/staining); and,
- Riparian habitat.

1.13 Fish Community Sampling

Fish community sampling was completed to confirm the distribution and extent of direct fish habitat within watercourses and headwater drainage features on the Study Area, while also identifying species diversity and relative abundance.

GEI obtained a Licence to Collect Fish for Scientific Purposes from the MNRF to facilitate the collection efforts. During the sampling event, a Halltech HT-2000 Battery Backpack Electrofisher and two D-frame dip nets with a 500-micron mesh size was utilized to retrieve fish and semi-aquatic organisms (e.g., frogs) from the features. Sampling methodology was based off of the Ontario Stream Assessment Protocol standard single pass survey method (Stanfield 2013). Surveys were completed within a defined stretch throughout riffles, pools and runs. Fish captured were transferred into an aerated bucket for processing and then identified to species level, enumerated and weighed before returning them into the feature at a downstream location.

Appendix F HEC-RAS Model

HEC-RAS Model digital files provided via download link from Schaeffers Consulting Engineers' server.

Humber Station HEC-RAS Model - 2024-07-09

Appendix G Supporting Geotechnical and Hydrogeological Studies

APPENDIX G-1 BOREHOLE LOGS

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Notes on Borehole and Test Pit Reports

Soil description :

Each subsurface stratum is described using the following terminology. The relative density of granular soils is determined by the Standard Penetration Index ("N" value), while the consistency of clayey sols is measured by the value of undrained shear strength (Cu).

Classification (Unified system)

Clay	< 0.002 mm		
Silt	0.002 to 0.075 mm		
Sand	0.075 to 4.75 mm	fine	0.075 to 4.25 mm
		medium	0.425 to 2.0 mm
		coarse	2.0 to 4.75 mm
Gravel	4.75 to 75 mm	fine	4.75 to 19 mm
		coarse	19 to 75 mm
Cobbles	75 to 300 mm		
Boulders	>300 mm		

Terminology

"trace"	1-10%
"some"	10-20%
adjective (silty, sandy)	20-35%
"and"	35-50%

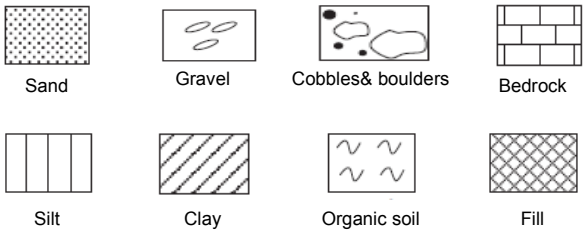
Relative density of granular soils	Standard penetration index "N" value (BLOWS/ft – 300 mm)
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Consistency of cohesive soils	Undrained shear strength (Cu) (P.S.F)	(kPa)
Very soft	<250	<12
Soft	250-500	12-25
Firm	500-1000	25-50
Stiff	1000-2000	50-100
Very stiff	2000-4000	100-200
Hard	>4000	>200

Rock quality designation

"RQD" (%) Value	Quality
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

STRATIGRAPHIC LEGEND



Samples:

Type and Number

The type of sample recovered is shown on the log by the abbreviation listed hereafter. The numbering of samples is sequential for each type of sample.

SS: Split spoon
SSE, GSE, AGE: Environmental sampling
ST: Shelby tube
PS: Piston sample (Osterberg)
AG: Auger
RC: Rock core
GS: Grab sample

Recovery

The recovery, shown as a percentage, is the ratio of length of the sample obtained to the distance the sampler was driven/pushed into the soil

RQD

The "Rock Quality Designation" or "RQD" value, expressed as percentage, is the ratio of the total length of all core fragments of 4 inches (10 cm) or more to the total length of the run.

IN-SITU TESTS:

N: Standard penetration index
R: Refusal to penetration
N_c: Dynamic cone penetration index
Cu: Undrained shear strength
Pr: Pressure meter
k: Permeability
ABS: Absorption (Packer test)

LABORATORY TESTS:

I_p: Plasticity index
W_l: Liquid limit
Wp: Plastic limit
H: Hydrometer analysis
GSA: Grain size analysis
A: Atterberg limits
w: Water content
γ: Unit weight
C: Consolidation
CS: Swedish fall cone
CHEM: Chemical analysis
O.V.: Organic vapor

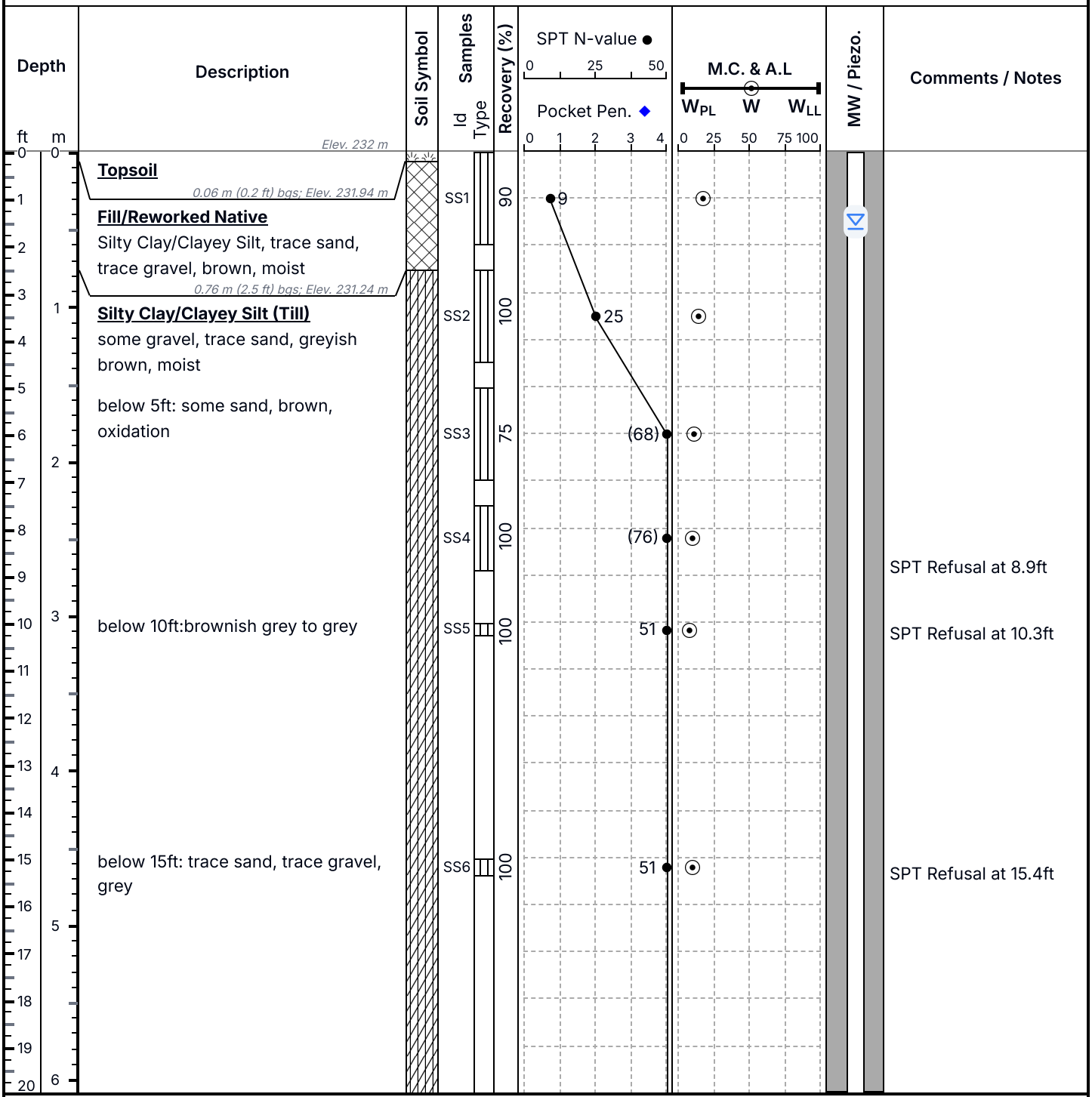
DRAFT

MONITORING WELL: MW25-1A

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-01
End Date: 2025-04-01

Elevation: 232 m AMSL
602200 E, 4854776 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 7.6 mbgs.
- Borehole was open up to depth of 17.6 mbgs immediately after drilling.
- Cave-in was observed at a depth of 17.6 mbgs.

PNJ ENGINEERING INC.
Pavement · Materials · Geo-Environmental · Engineering

Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/4

DRAFT

MONITORING WELL: MW25-1A

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-01
End Date: 2025-04-01

Elevation: 232 m AMSL
602200 E, 4854776 N (NAD83 - 17)

Depth (ft)	Depth (m)	Description	Soil Symbol	Samples Id	Samples Type	Recovery (%)	SPT N-value / Pocket Pen.	M.C. & A.L (W_{PL} W W_{LL})	MW / Piezo.	Comments / Notes
20		**...continued: Silty Clay/Clayey Silt (Till)**		SS7		100	(53)			SPT Refusal at 20.4ft
21										
22										
23	7									
24										
25		below 25ft: moist to wet		SS8		100	51			SPT Refusal at 25.4ft
26										
27	8									
28										
29										
30	9	below 30ft: Sandy, wet		SS9		100	52			SPT Refusal at 30.8ft
31										
32										
33	10									
34										
35		below 35ft: trace sand								
36	11			SS10		100	(57)			
37										
38										
39										
40	12									

Notes: - The groundwater was encountered at a depth of 7.6 mbgs.
- Borehole was open up to depth of 17.6 mbgs immediately after drilling.
- Cave-in was observed at a depth of 17.6 mbgs.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 2/4

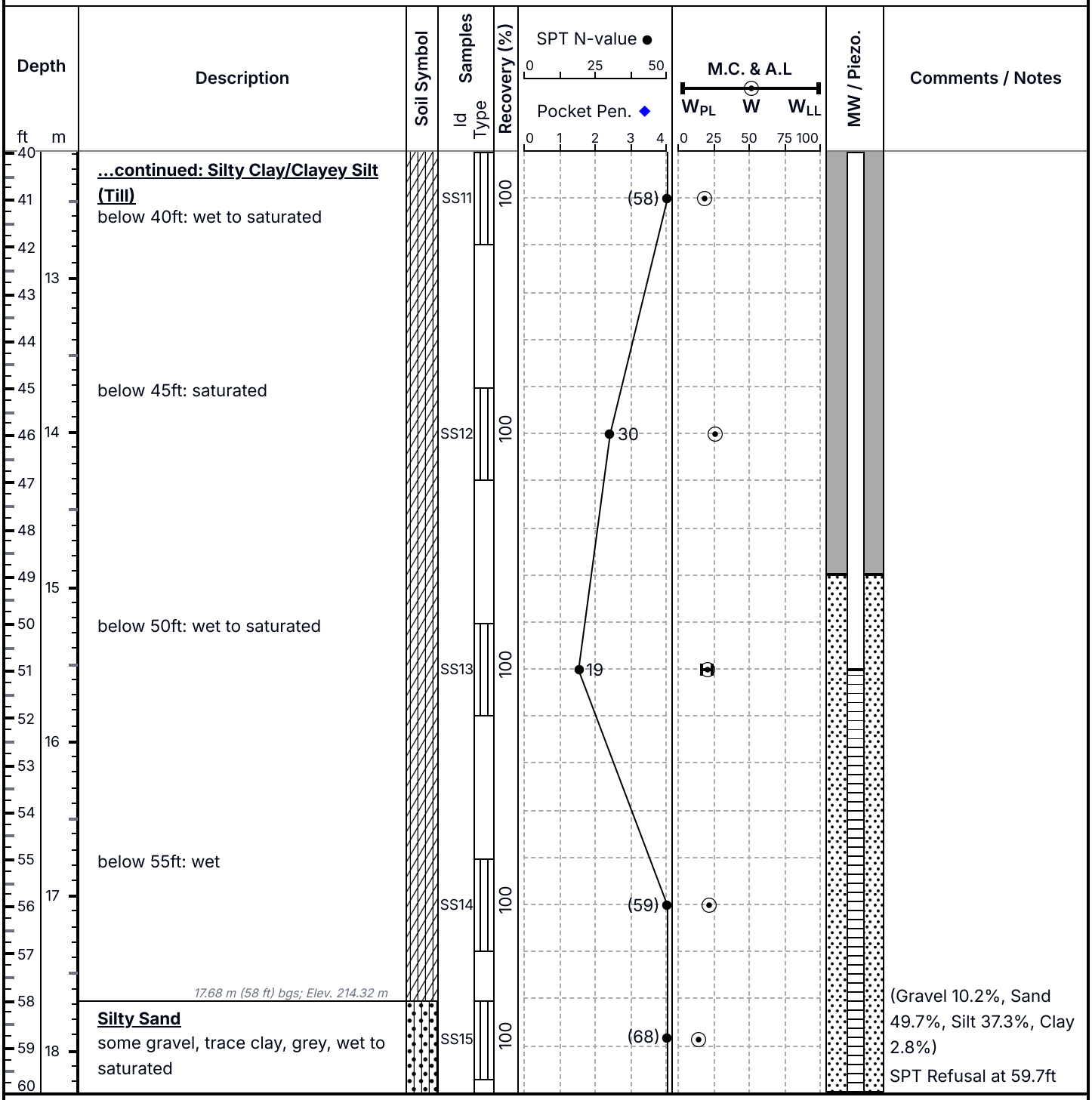
DRAFT

MONITORING WELL: MW25-1A

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-01
End Date: 2025-04-01

Elevation: 232 m AMSL
602200 E, 4854776 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 7.6 mbgs.
- Borehole was open up to depth of 17.6 mbgs immediately after drilling.
- Cave-in was observed at a depth of 17.6 mbgs.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 3/4

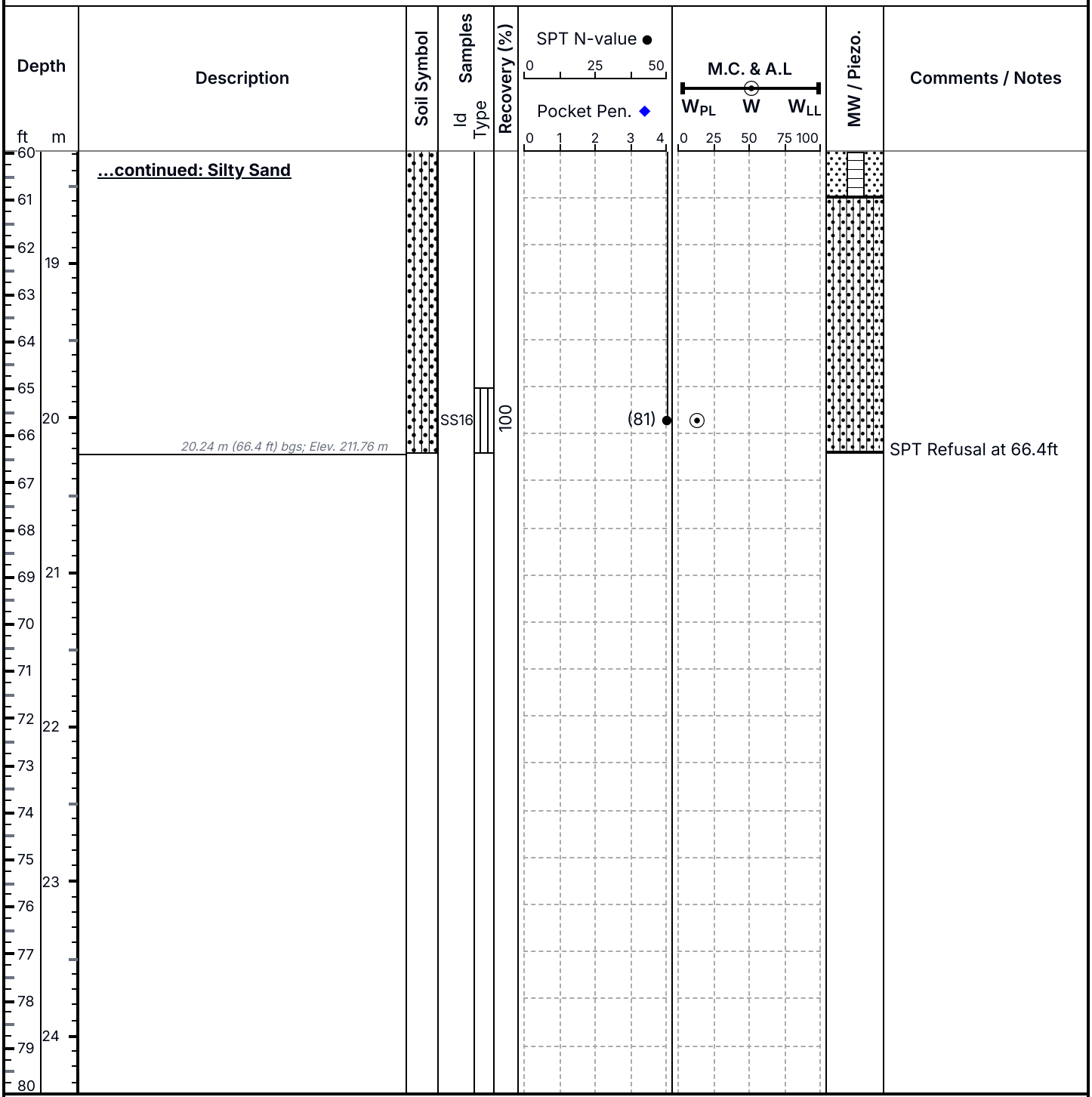
DRAFT

MONITORING WELL: MW25-1A

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-01
End Date: 2025-04-01

Elevation: 232 m AMSL
602200 E, 4854776 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 7.6 mbgs.
- Borehole was open up to depth of 17.6 mbgs immediately after drilling.
- Cave-in was observed at a depth of 17.6 mbgs.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 4/4

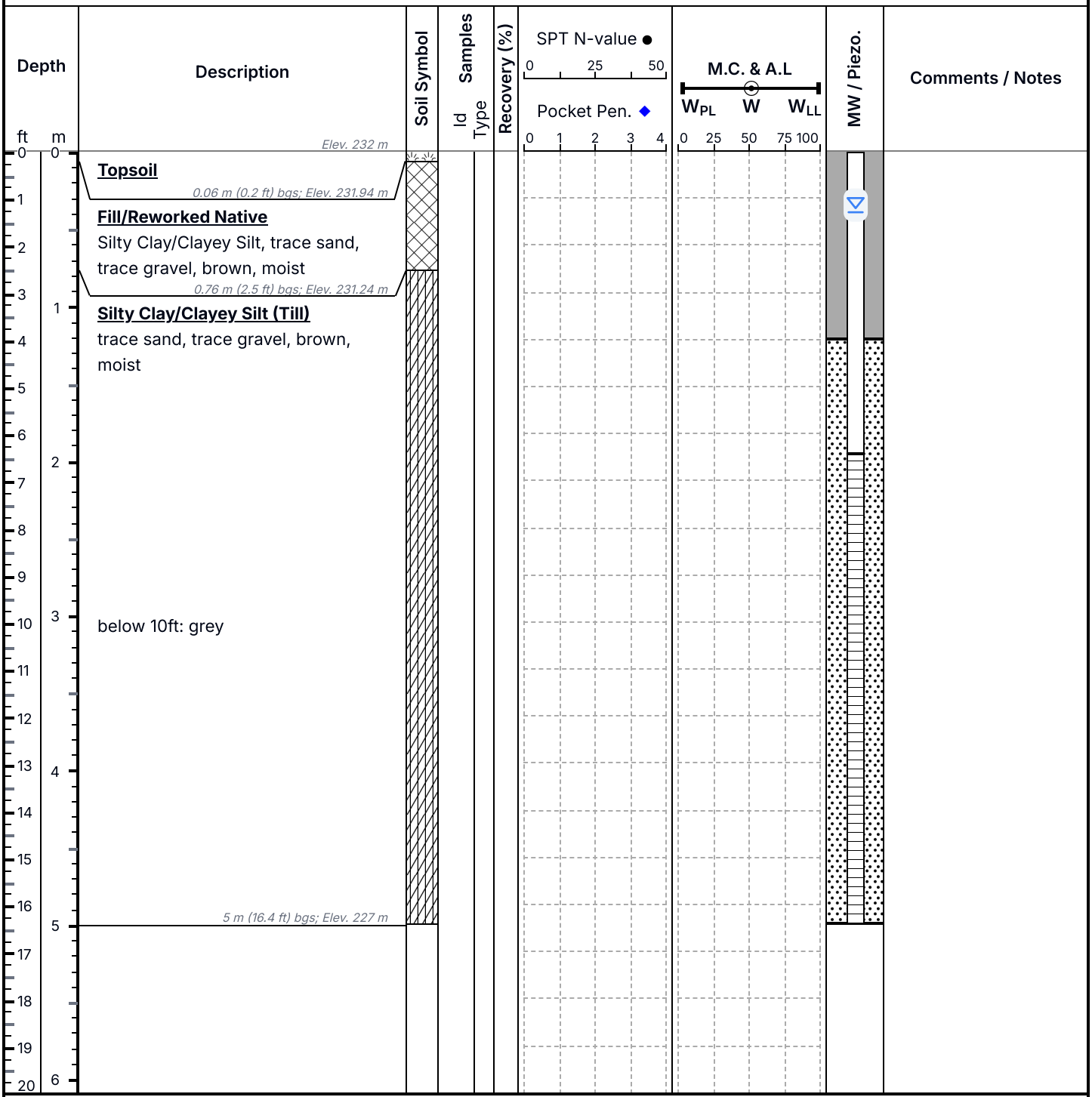
DRAFT

MONITORING WELL: MW25-1B

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-01
End Date: 2025-04-01

Elevation: 232 m AMSL
602201 E, 4854777 N (NAD83 - 17)



Notes: - Borehole was open and dry.
- This is a nested MW. No testing or sample collection was conducted; the sole purpose was to install an MW.

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Pavement · Materials · Geo-Environmental · Engineering

Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Solid Stem	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/1

PNJ ENGINEERING INC.

Notes on Borehole and Test Pit Reports

Soil description :

Each subsurface stratum is described using the following terminology. The relative density of granular soils is determined by the Standard Penetration Index ("N" value), while the consistency of clayey sols is measured by the value of undrained shear strength (Cu).

Classification (Unified system)

Clay	< 0.002 mm		
Silt	0.002 to 0.075 mm		
Sand	0.075 to 4.75 mm	fine	0.075 to 4.25 mm
		medium	0.425 to 2.0 mm
		coarse	2.0 to 4.75 mm
Gravel	4.75 to 75 mm	fine	4.75 to 19 mm
		coarse	19 to 75 mm
Cobbles	75 to 300 mm		
Boulders	>300 mm		

Terminology

"trace"	1-10%
"some"	10-20%
adjective (silty, sandy)	20-35%
"and"	35-50%

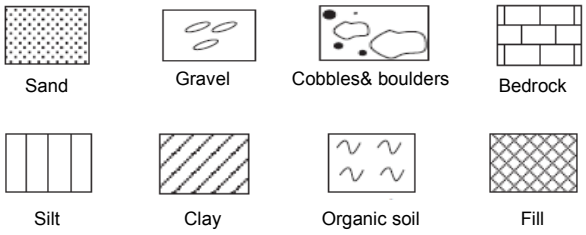
Relative density of granular soils	Standard penetration index "N" value (BLOWS/ft – 300 mm)
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Consistency of cohesive soils	Undrained shear strength (Cu) (P.S.F)	(kPa)
Very soft	<250	<12
Soft	250-500	12-25
Firm	500-1000	25-50
Stiff	1000-2000	50-100
Very stiff	2000-4000	100-200
Hard	>4000	>200

Rock quality designation

"RQD" (%) Value	Quality
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

STRATIGRAPHIC LEGEND



Samples:

Type and Number

The type of sample recovered is shown on the log by the abbreviation listed hereafter. The numbering of samples is sequential for each type of sample.

SS: Split spoon
SSE, GSE, AGE: Environmental sampling
ST: Shelby tube
PS: Piston sample (Osterberg)
AG: Auger
RC: Rock core
GS: Grab sample

Recovery

The recovery, shown as a percentage, is the ratio of length of the sample obtained to the distance the sampler was driven/pushed into the soil

RQD

The "Rock Quality Designation" or "RQD" value, expressed as percentage, is the ratio of the total length of all core fragments of 4 inches (10 cm) or more to the total length of the run.

IN-SITU TESTS:

N: Standard penetration index
R: Refusal to penetration
N_c: Dynamic cone penetration index
Cu: Undrained shear strength
Pr: Pressure meter
k: Permeability
ABS: Absorption (Packer test)

LABORATORY TESTS:

I_p: Plasticity index
W_l: Liquid limit
Wp: Plastic limit
H: Hydrometer analysis
GSA: Grain size analysis
A: Atterberg limits
w: Water content
γ: Unit weight
C: Consolidation
CS: Swedish fall cone
CHEM: Chemical analysis
O.V.: Organic vapor

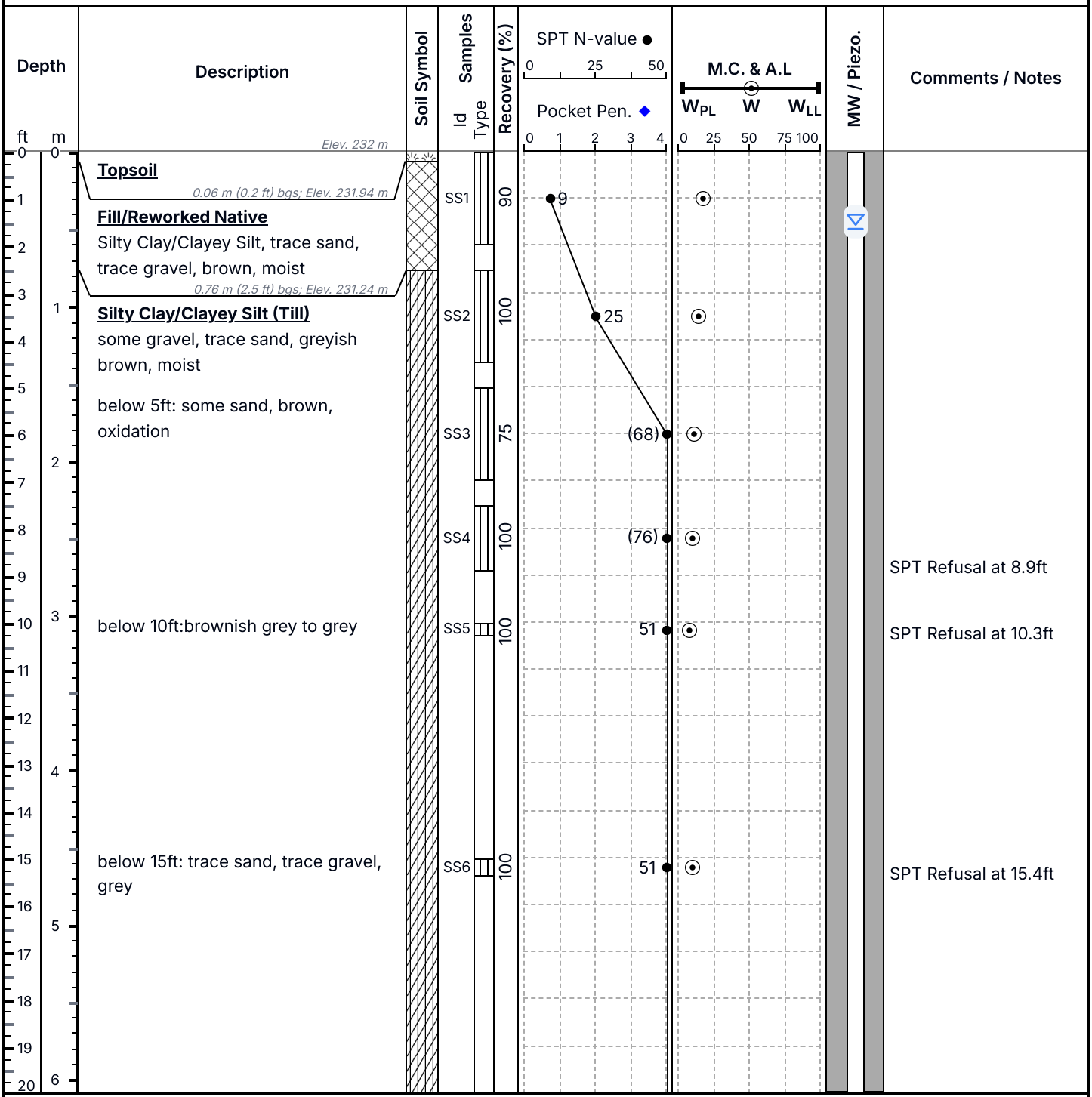
DRAFT

MONITORING WELL: MW25-1A

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-01
End Date: 2025-04-01

Elevation: 232 m AMSL
602200 E, 4854776 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 7.6 mbgs.
- Borehole was open up to depth of 17.6 mbgs immediately after drilling.
- Cave-in was observed at a depth of 17.6 mbgs.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/4

DRAFT

MONITORING WELL: MW25-1A

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-01
End Date: 2025-04-01

Elevation: 232 m AMSL
602200 E, 4854776 N (NAD83 - 17)

Depth (ft)	Depth (m)	Description	Soil Symbol	Samples Id	Samples Type	Recovery (%)	SPT N-value / Pocket Pen.	M.C. & A.L (W_{PL} W W_{LL})	MW / Piezo.	Comments / Notes
20		**...continued: Silty Clay/Clayey Silt (Till)**		SS7		100	(53)			SPT Refusal at 20.4ft
21										
22										
23	7									
24										
25		below 25ft: moist to wet		SS8		100	51			SPT Refusal at 25.4ft
26										
27	8									
28										
29										
30	9	below 30ft: Sandy, wet		SS9		100	52			SPT Refusal at 30.8ft
31										
32										
33	10									
34										
35		below 35ft: trace sand								
36	11			SS10		100	(57)			
37										
38										
39										
40	12									

Notes: - The groundwater was encountered at a depth of 7.6 mbgs.
- Borehole was open up to depth of 17.6 mbgs immediately after drilling.
- Cave-in was observed at a depth of 17.6 mbgs.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 2/4

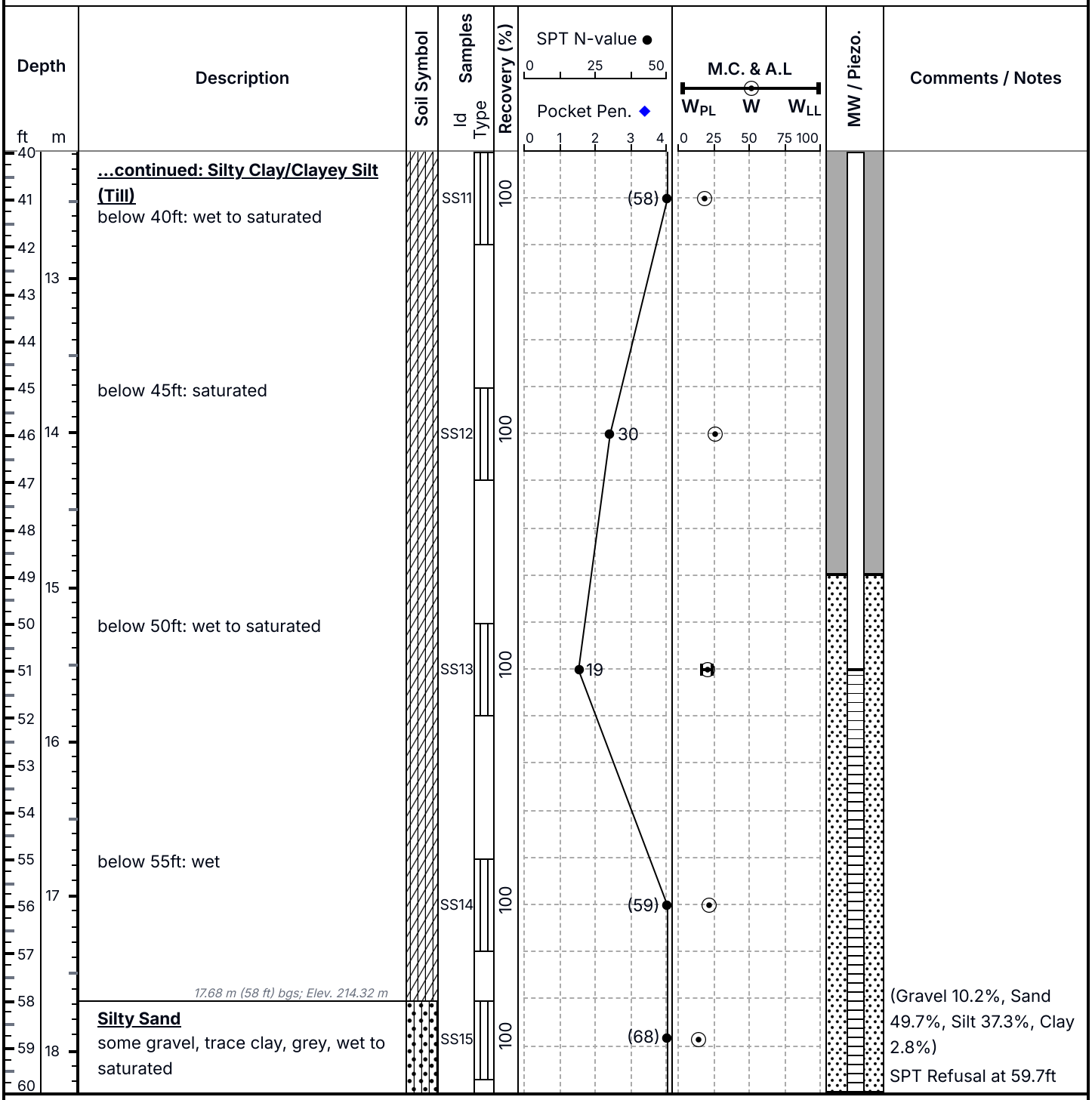
DRAFT

MONITORING WELL: MW25-1A

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-01
End Date: 2025-04-01

Elevation: 232 m AMSL
602200 E, 4854776 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 7.6 mbgs.
- Borehole was open up to depth of 17.6 mbgs immediately after drilling.
- Cave-in was observed at a depth of 17.6 mbgs.

PNJ ENGINEERING INC.
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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 3/4

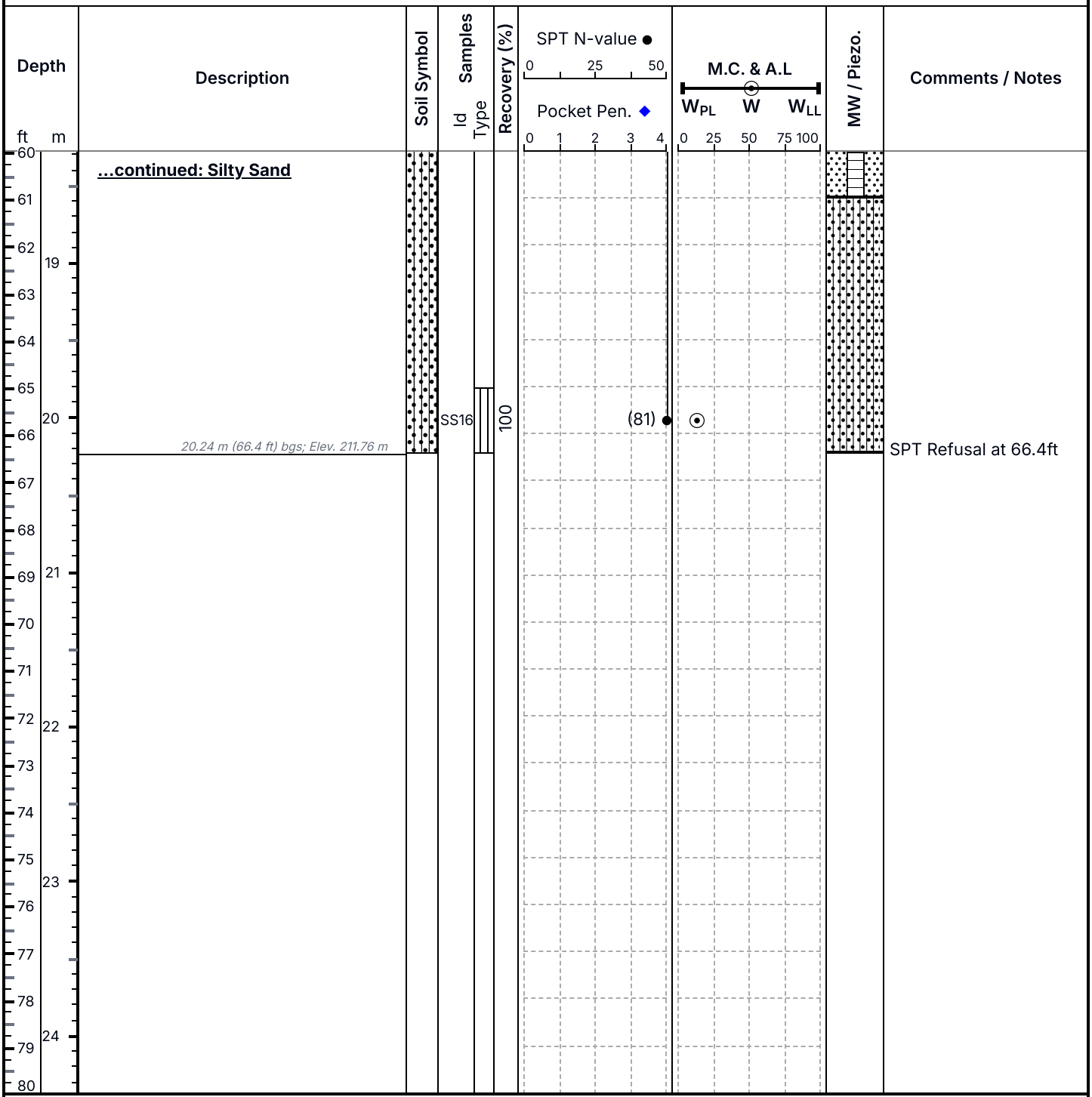
DRAFT

MONITORING WELL: MW25-1A

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-01
End Date: 2025-04-01

Elevation: 232 m AMSL
602200 E, 4854776 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 7.6 mbgs.
- Borehole was open up to depth of 17.6 mbgs immediately after drilling.
- Cave-in was observed at a depth of 17.6 mbgs.

PNJ ENGINEERING INC.
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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 4/4

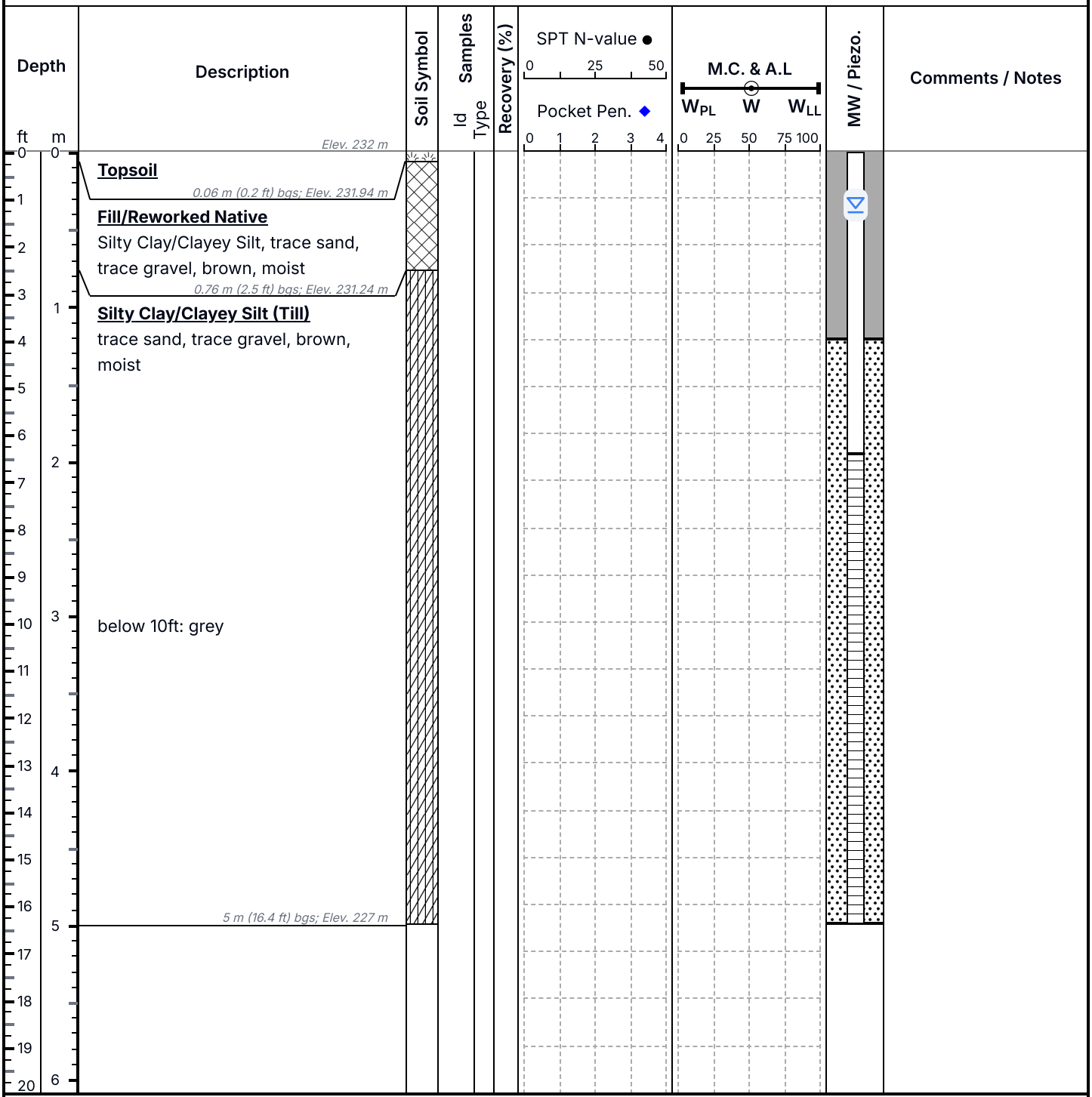
DRAFT

MONITORING WELL: MW25-1B

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-01
End Date: 2025-04-01

Elevation: 232 m AMSL
602201 E, 4854777 N (NAD83 - 17)



Notes: - Borehole was open and dry.
- This is a nested MW. No testing or sample collection was conducted; the sole purpose was to install an MW.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Solid Stem	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/1

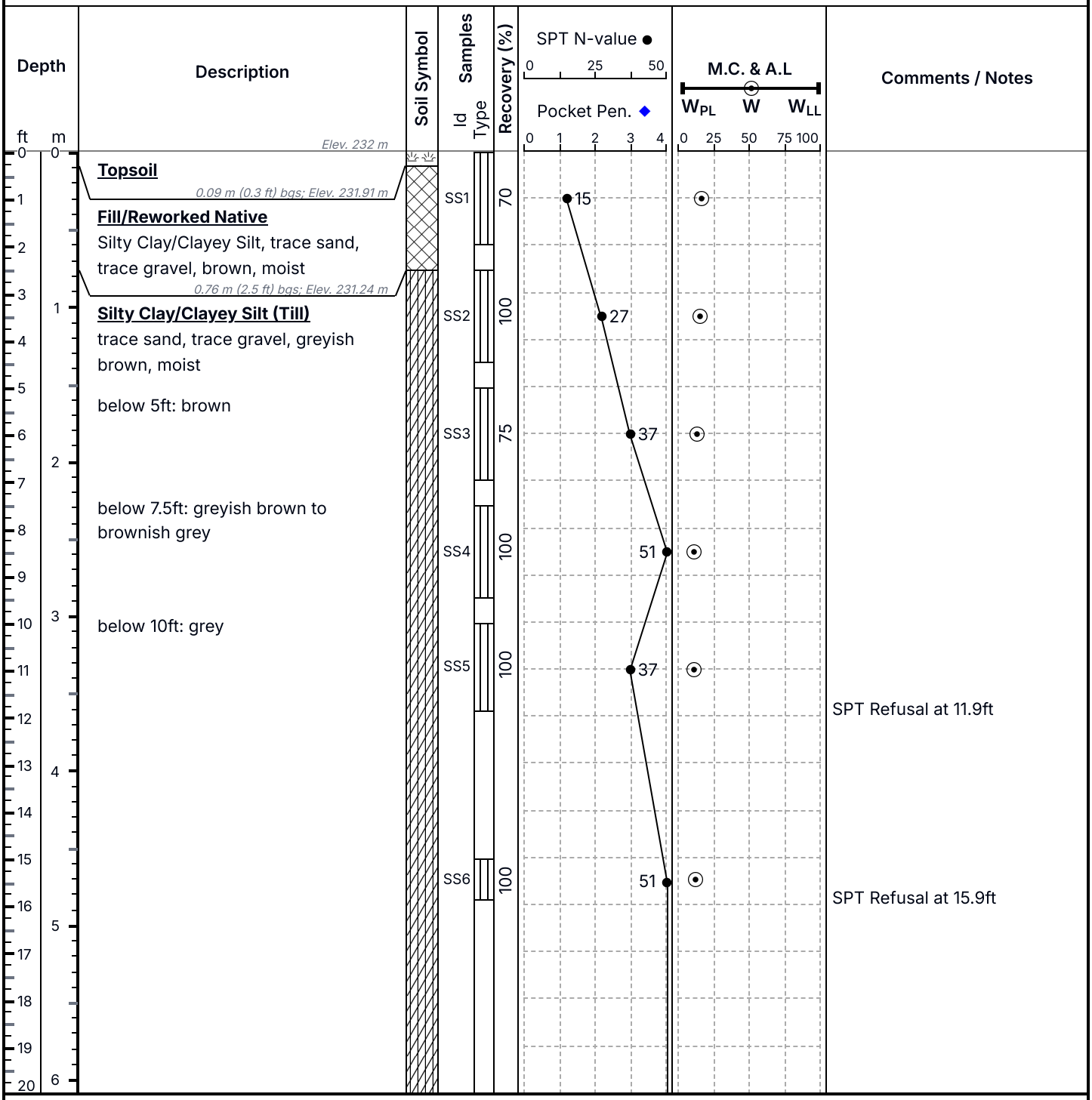
DRAFT

BOREHOLE: BH25-01

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-02
End Date: 2025-04-02

Elevation: 232 m AMSL
602311 E, 4854905 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 9.1 mbgs.
- Borehole was open immediately after drilling.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/3

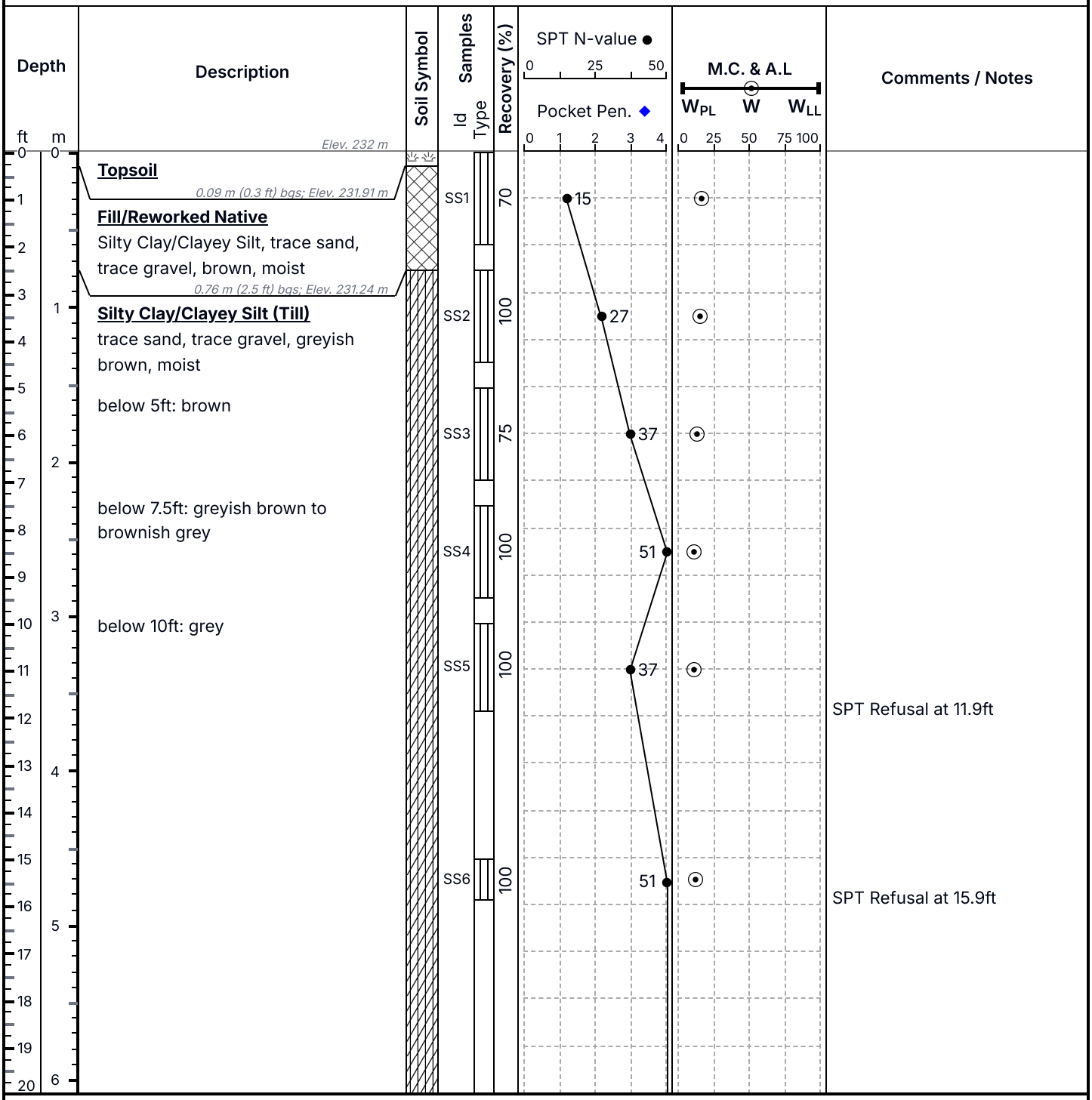
DRAFT

BOREHOLE: BH25-01

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-02
End Date: 2025-04-02

Elevation: 232 m AMSL
602311 E, 4854905 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 9.1 mbgs.
- Borehole was open immediately after drilling.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/3

DRAFT

BOREHOLE: BH25-01

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-02
End Date: 2025-04-02

Elevation: 232 m AMSL
602311 E, 4854905 N (NAD83 - 17)

Depth (ft)	Depth (m)	Description	Soil Symbol	Samples Id	Samples Type	Recovery (%)	SPT N-value / Pocket Pen.	M.C. & A.L (W_{PL} W W_{LL})	Comments / Notes
20		**...continued: Silty Clay/Clayey Silt (Till)**		SS7		100	(84)		SPT Refusal at 21.3ft
21									
22									
23	7								
24									
25				SS8		100	51		SPT Refusal at 25.4ft
26									
27	8								
28									
29									
30	9	below 30ft: moist to wet							
31				SS9		100	(61)		
32									
33	10								
34									
35									
36	11			SS10		100	(83)		SPT Refusal at 36.3ft
37									
38									
39									
40	12								

Notes: - The groundwater was encountered at a depth of 9.1 mbgs.
- Borehole was open immediately after drilling.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 2/3

DRAFT

BOREHOLE: BH25-01

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-02
End Date: 2025-04-02

Elevation: 232 m AMSL
602311 E, 4854905 N (NAD83 - 17)

Depth (ft)	Depth (m)	Description	Soil Symbol	Samples Id	Samples Type	Recovery (%)	SPT N-value ● / Pocket Pen. ◆	M.C. & A.L (W_{PL} W W_{LL})	Comments / Notes
40		**...continued: Silty Clay/Clayey Silt (Till)**		SS11		100	50		SPT Refusal at 40.9ft
41		below 40ft: some sand, wet							
42	13								
43									
44									
45		below 45ft: wet to saturated		SS12		100	(62)		SPT Refusal at 46.8ft
46	14								
47									
48									
49	15								
50		below 50ft: trace sand, wet		SS13		100	51		
51									
52	16								
53									
54									
55		below 55ft: wet to saturated		SS14		100	(61)		
56	17								
57		*17.37 m (57 ft) bgs; Elev. 214.63 m*							
58									
59	18								
60									

Notes: - The groundwater was encountered at a depth of 9.1 mbgs.
- Borehole was open immediately after drilling.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 3/3

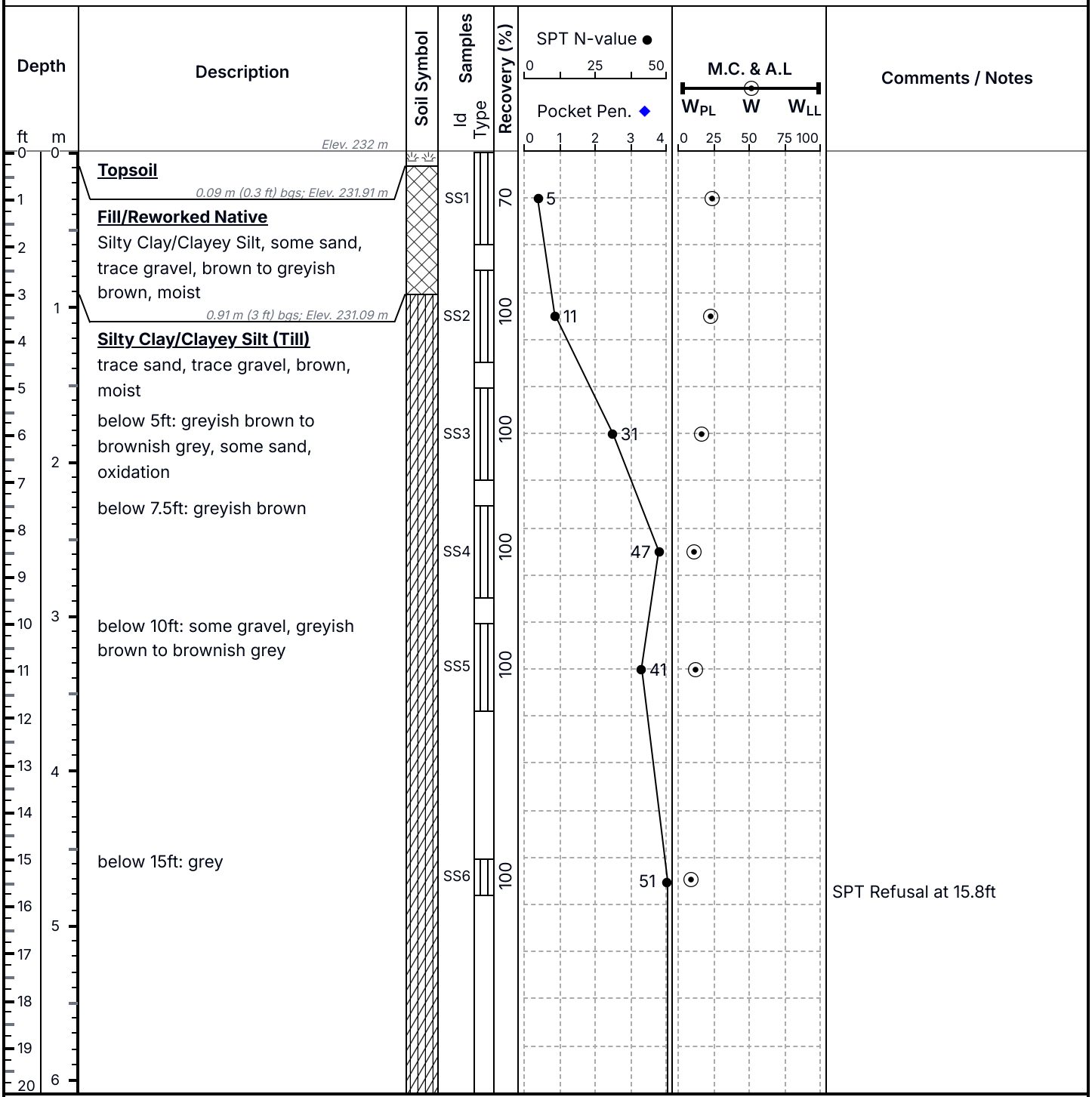
DRAFT

BOREHOLE: BH25-02

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-02
End Date: 2025-04-03

Elevation: 232 m AMSL
602437 E, 4855042 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 12.1 mbgs.
- Borehole was open immediately after drilling.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/3

DRAFT

BOREHOLE: BH25-02

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-02
End Date: 2025-04-03

Elevation: 232 m AMSL
602437 E, 4855042 N (NAD83 - 17)

Depth (ft)	Depth (m)	Description	Soil Symbol	Samples Id	Samples Type	Recovery (%)	SPT N-value / Pocket Pen.	M.C. & A.L (W_{PL} W W_{LL})	Comments / Notes
20		**...continued: Silty Clay/Clayey Silt (Till)**		SS7		100	(84)		SPT Refusal at 20.8ft
21		~~below~~ 20ft: some sand							
22									
23	7								
24									
25		below 25ft: trace sand, moist to wet		SS8		100	51		SPT Refusal at 25.8ft
26	8								
27									
28									
29									
30	9	below 30ft: moist		SS9		100	51		SPT Refusal at 30.9ft
31									
32									
33	10								
34									
35				SS10		100	51		SPT Refusal at 35.9ft
36	11								
37									
38									
39									
40	12								

SPT N-value ● (0 25 50)
Pocket Pen. ◆ (0 1 2 3 4)
M.C. & A.L (W_{PL} W W_{LL}) (0 25 50 75 100)

Notes: - The groundwater was encountered at a depth of 12.1 mbgs.
- Borehole was open immediately after drilling.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 2/3

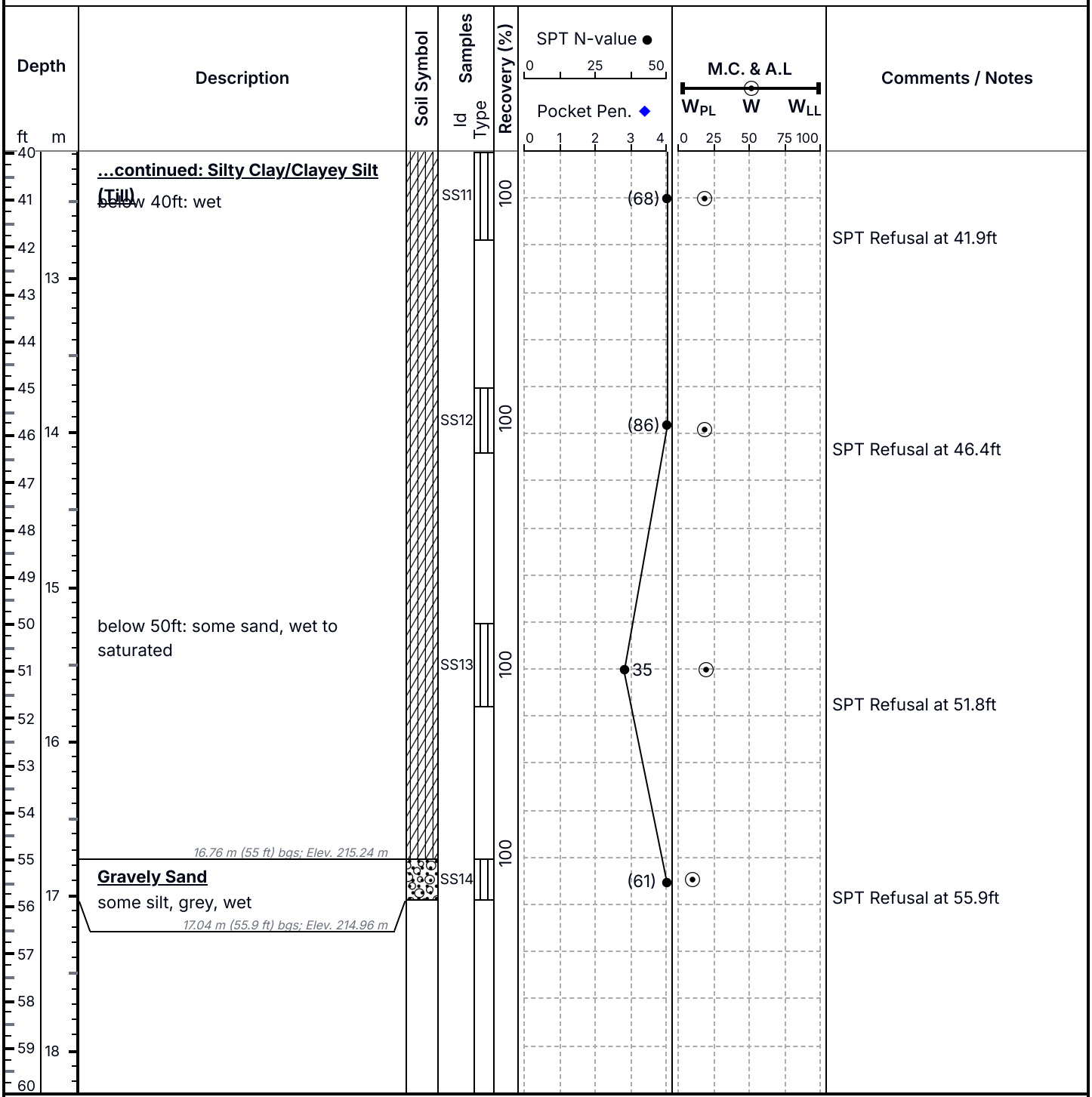
DRAFT

BOREHOLE: BH25-02

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-02
End Date: 2025-04-03

Elevation: 232 m AMSL
602437 E, 4855042 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 12.1 mbgs.
- Borehole was open immediately after drilling.

PNJ ENGINEERING INC.
Pavement · Materials · Geo-Environmental · Engineering

Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 3/3

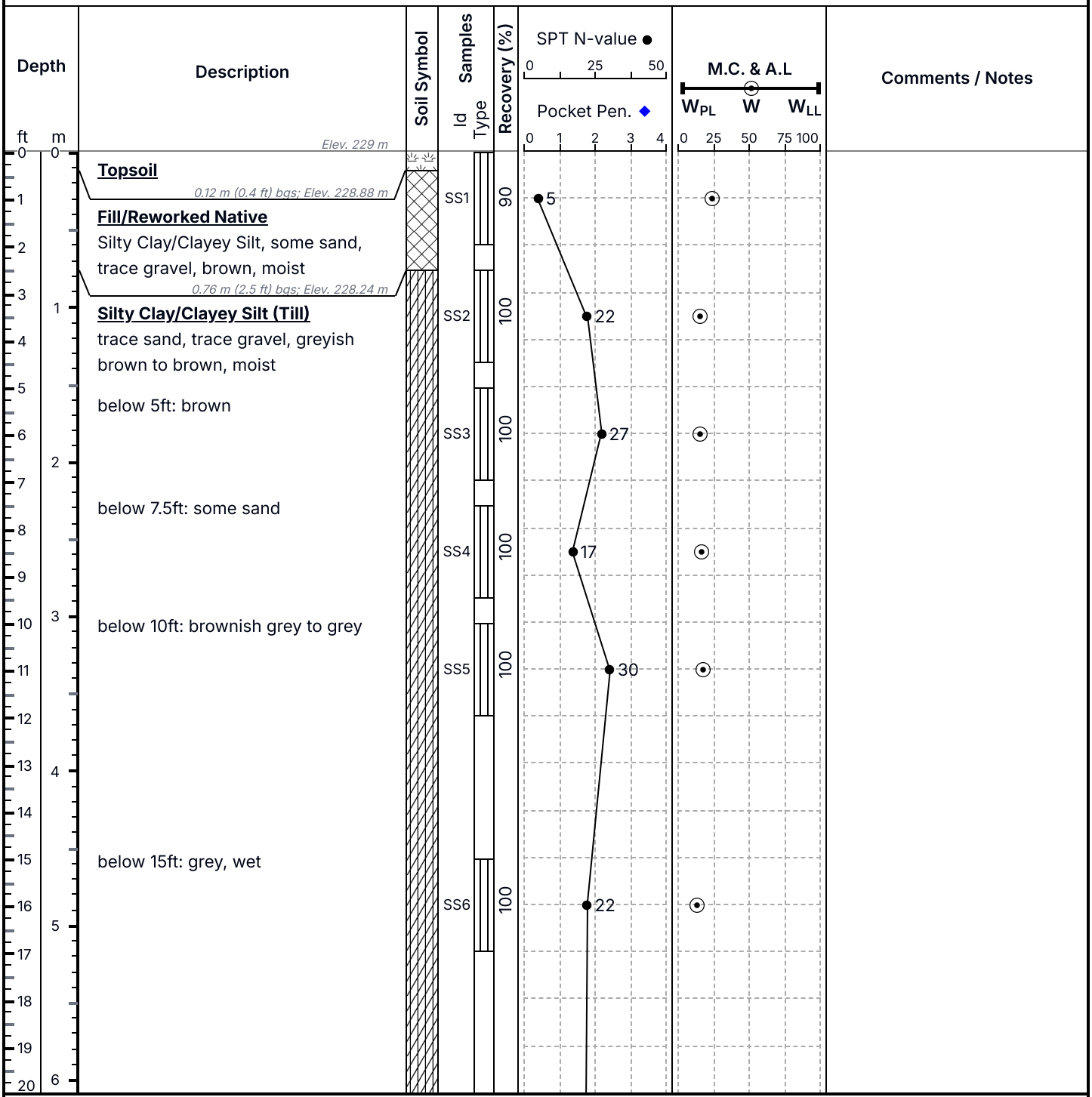
DRAFT

BOREHOLE: BH25-03

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-07
End Date: 2025-04-07

Elevation: 229 m AMSL
602791 E, 4854964 N (NAD83 - 17)



Notes: - The groundwater was measured immediately after drilling at a depth of 10.2 mbgs.
- Borehole was open immediately after drilling.

PNJ ENGINEERING INC.
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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Solid Stem	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/2

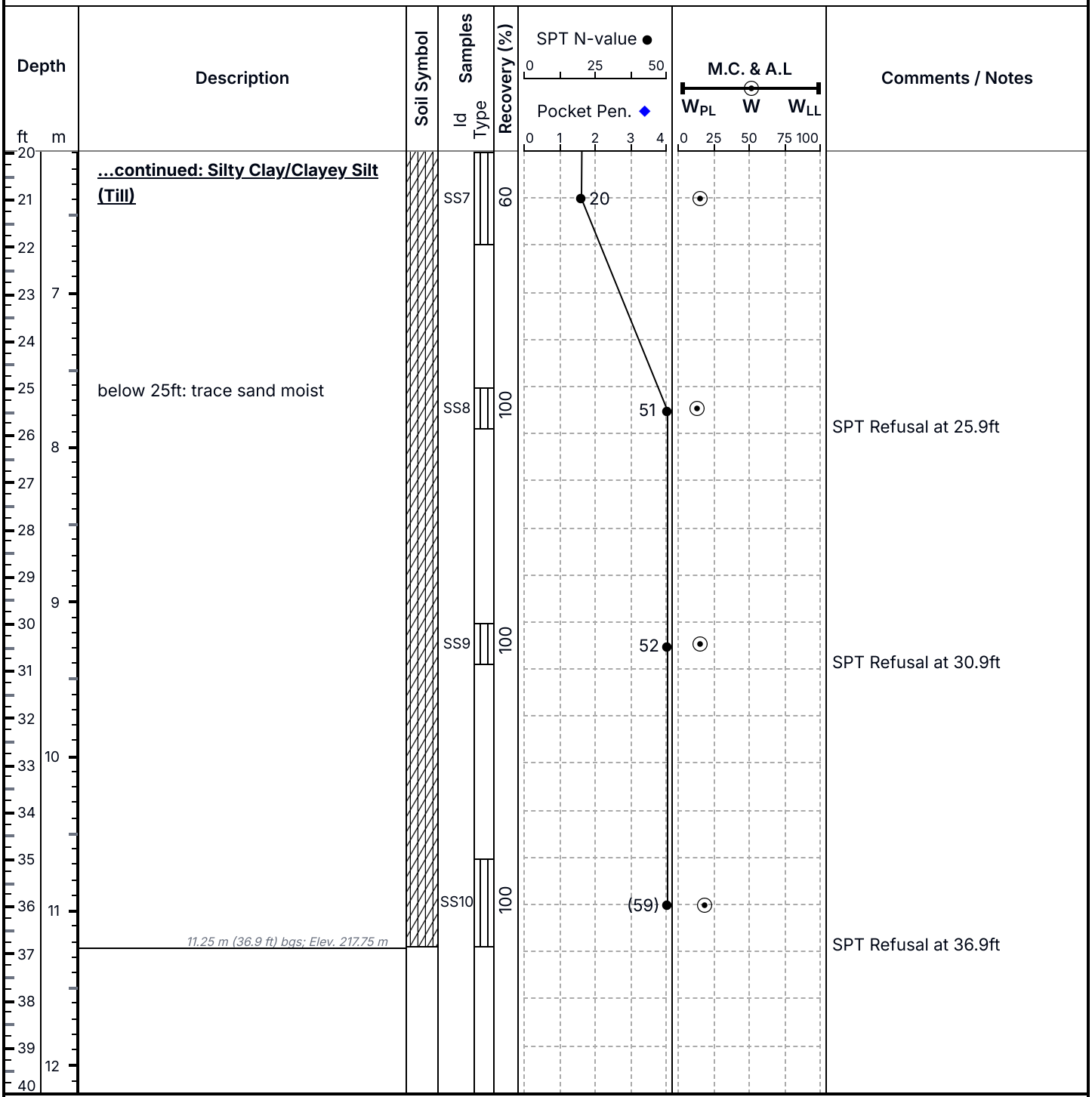
DRAFT

BOREHOLE: BH25-03

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-07
End Date: 2025-04-07

Elevation: 229 m AMSL
602791 E, 4854964 N (NAD83 - 17)



Notes: - The groundwater was measured immediately after drilling at a depth of 10.2 mbgs.
- Borehole was open immediately after drilling.

PNJ ENGINEERING INC.
Pavement · Materials · Geo-Environmental · Engineering

Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Solid Stem	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 2/2

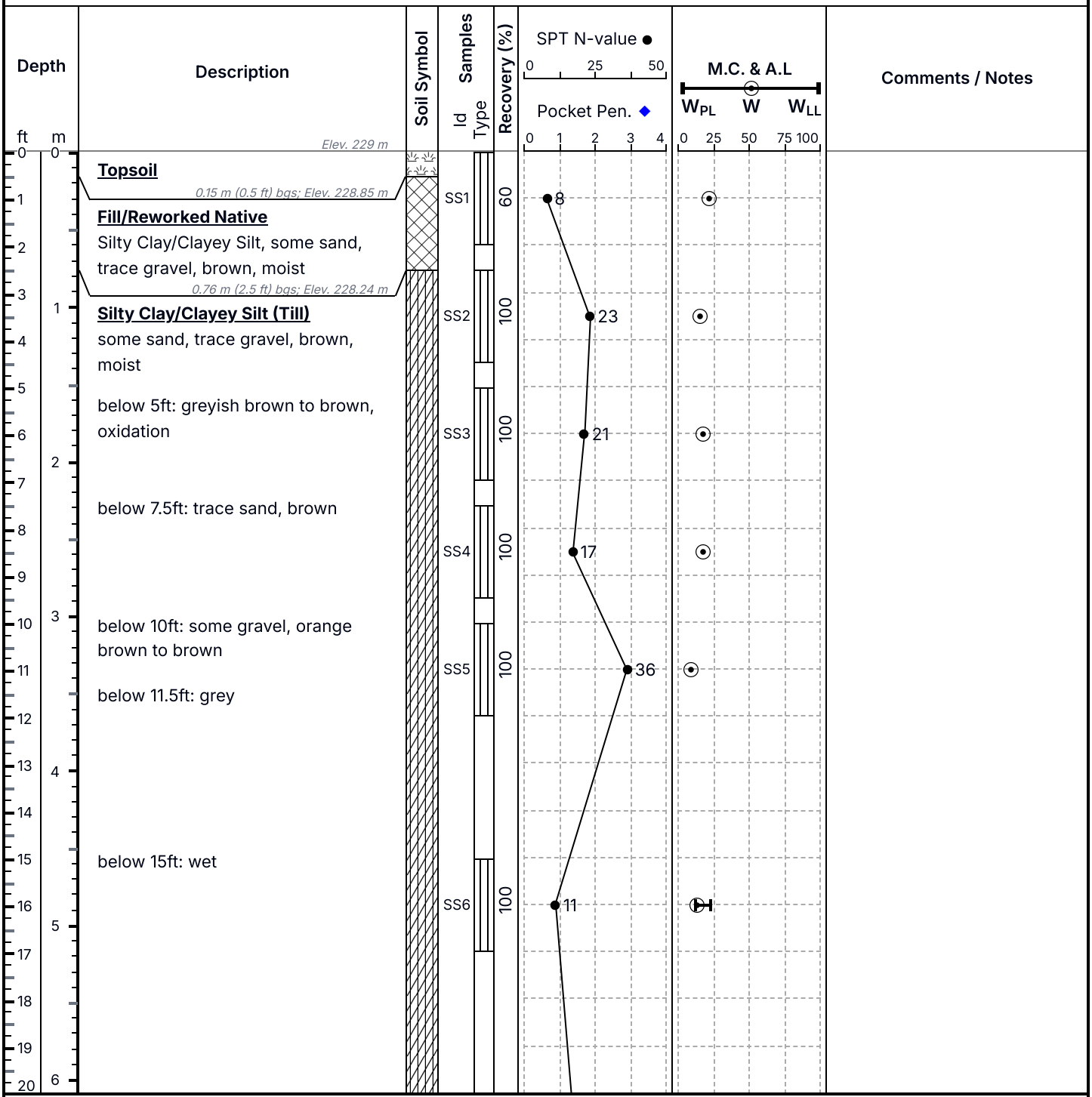
DRAFT

BOREHOLE: BH25-04

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-07
End Date: 2025-04-07

Elevation: 229 m AMSL
602890 E, 4854869 N (NAD83 - 17)



Notes: - The groundwater was measured immediately after drilling at a depth of 10.2 mbgs.
- Borehole was open immediately after drilling.

PNJ ENGINEERING INC.
Pavement · Materials · Geo-Environmental · Engineering

Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Solid Stem	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/2

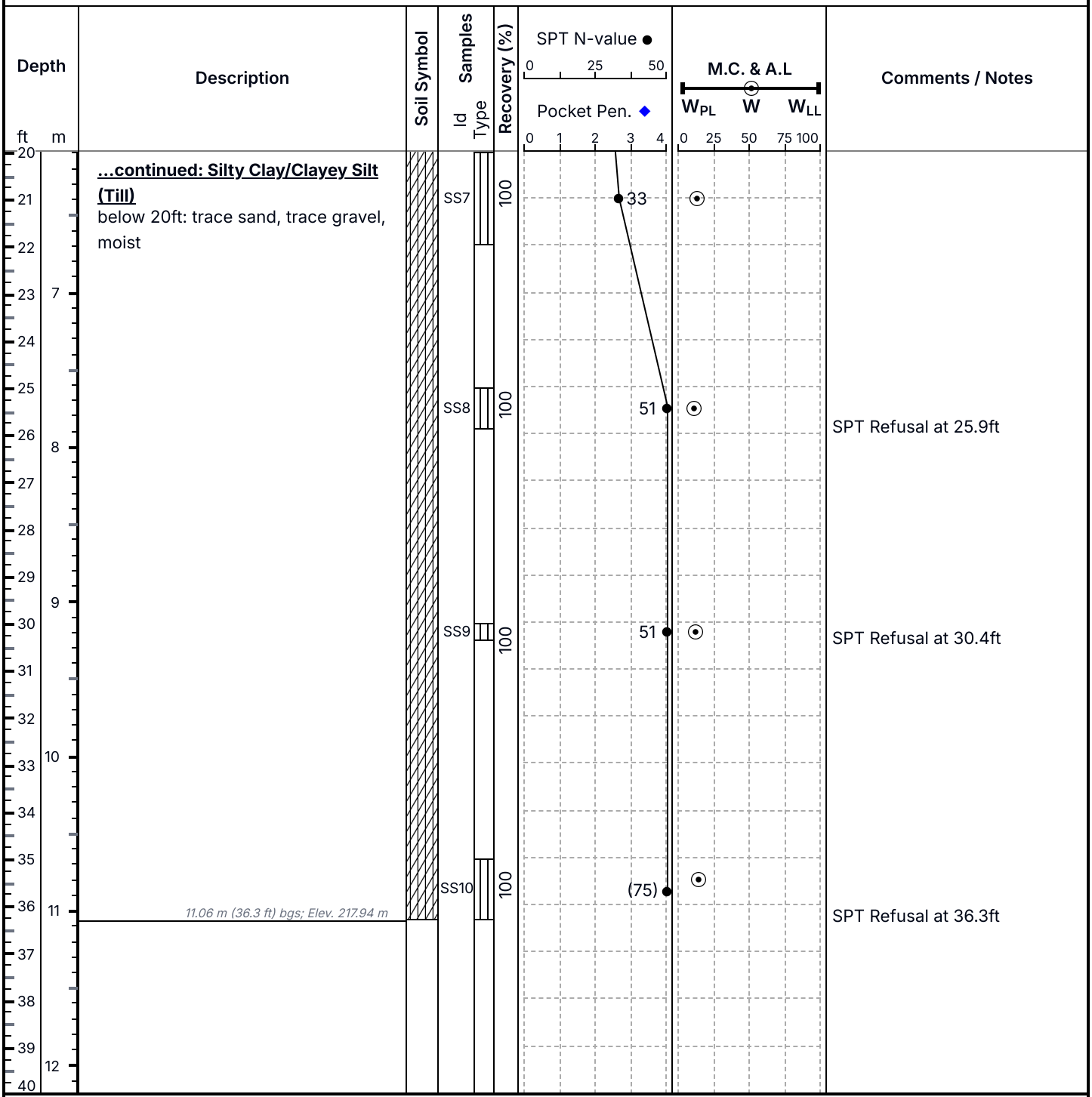
DRAFT

BOREHOLE: BH25-04

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-07
End Date: 2025-04-07

Elevation: 229 m AMSL
602890 E, 4854869 N (NAD83 - 17)



Notes: - The groundwater was measured immediately after drilling at a depth of 10.2 mbgs.
- Borehole was open immediately after drilling.

PNJ ENGINEERING INC.
Pavement · Materials · Geo-Environmental · Engineering

Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Solid Stem	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 2/2

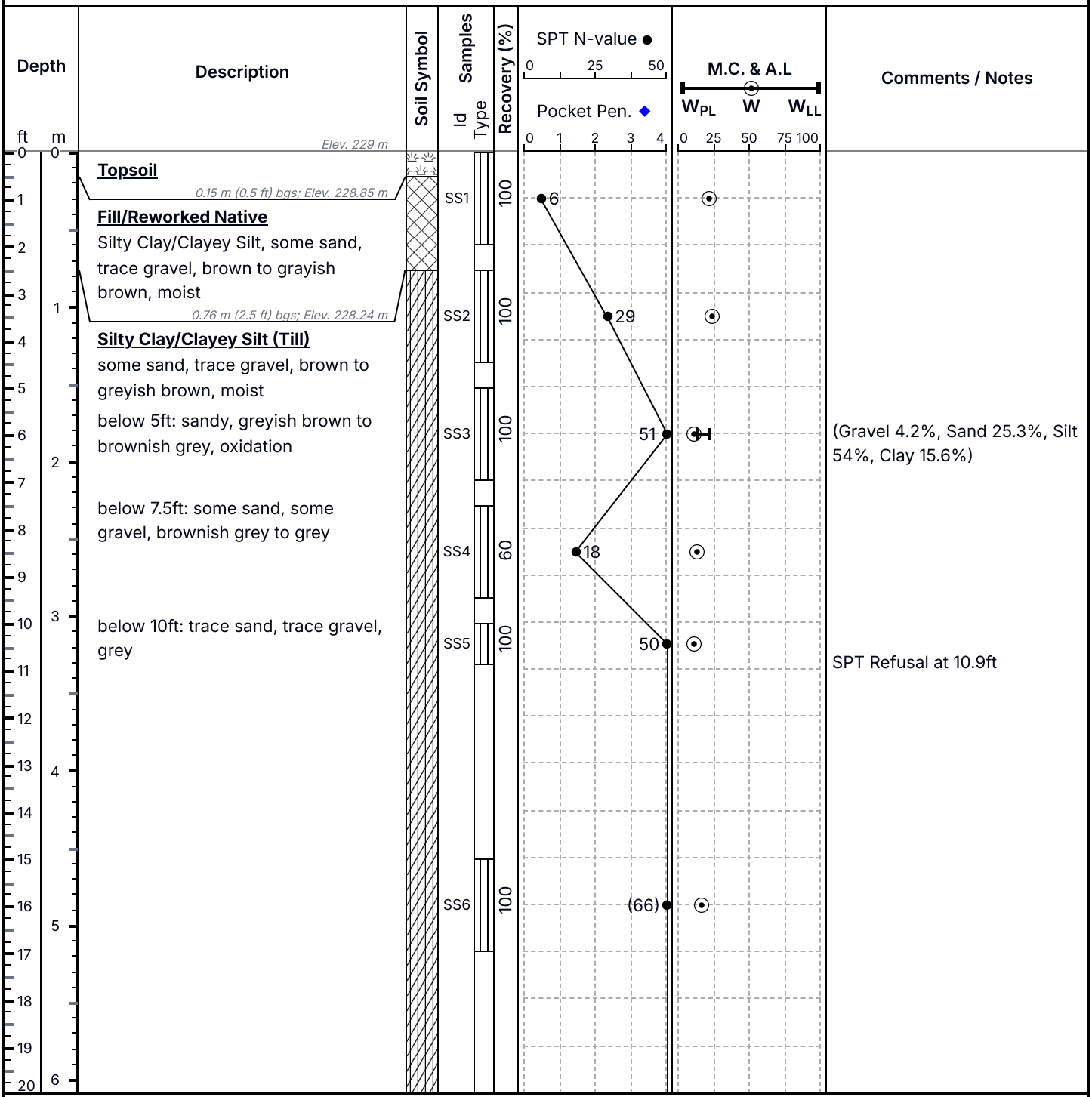
DRAFT

BOREHOLE: BH25-CR1

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-11
End Date: 2025-04-11

Elevation: 229 m AMSL
602695 E, 4855341 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 12.1 mbgs.
- Borehole was open up to depth of 18.8 mbgs immediately after drilling.
- Cave in was observed at a depth of 18.8 mbgs.

PNJ ENGINEERING INC.
Pavement · Materials · Geo-Environmental · Engineering

Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/4

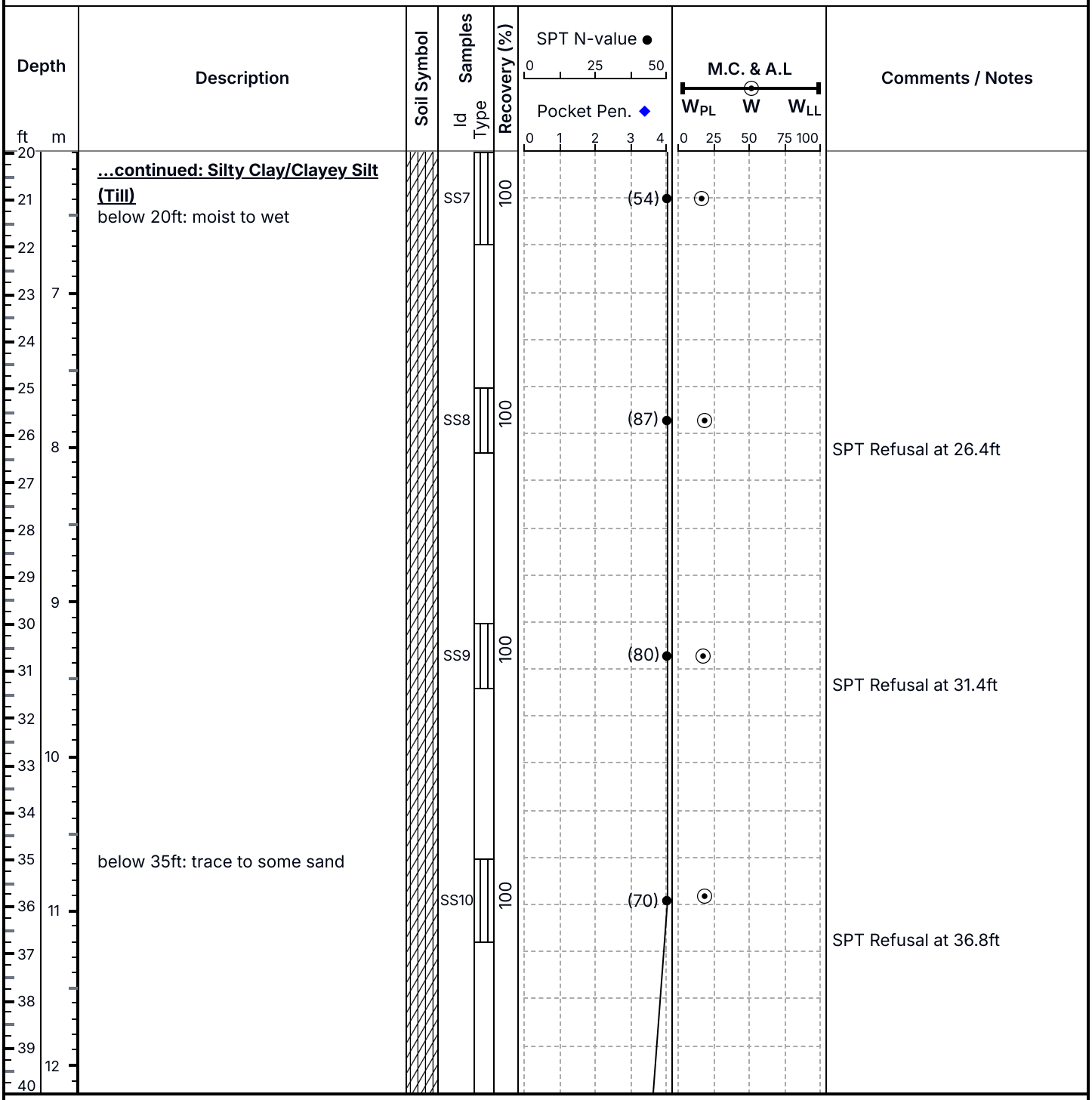
DRAFT

BOREHOLE: BH25-CR1

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-11
End Date: 2025-04-11

Elevation: 229 m AMSL
602695 E, 4855341 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 12.1 mbgs.
- Borehole was open up to depth of 18.8 mbgs immediately after drilling.
- Cave in was observed at a depth of 18.8 mbgs.

PNJ ENGINEERING INC.
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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 2/4

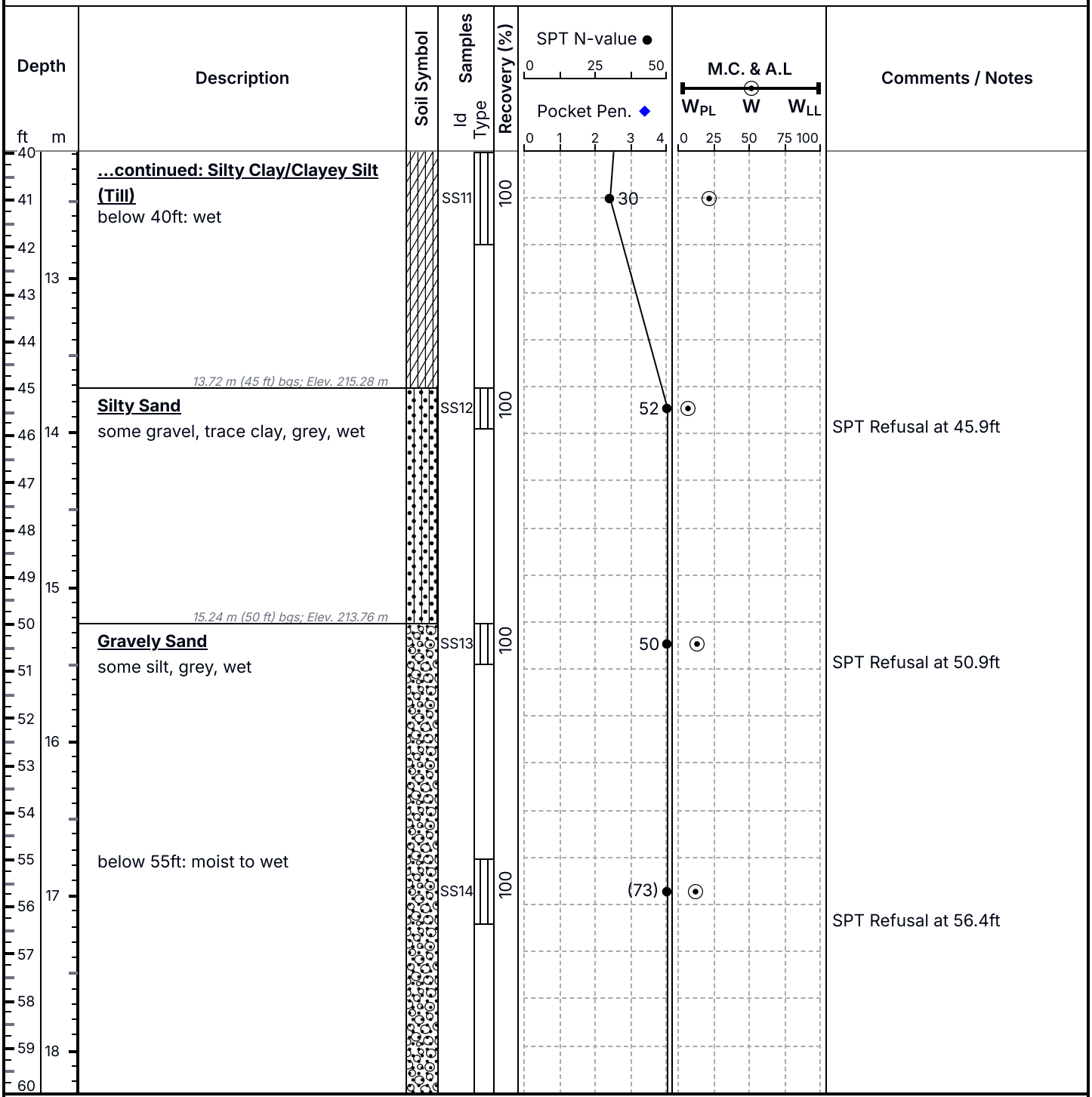
DRAFT

BOREHOLE: BH25-CR1

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-11
End Date: 2025-04-11

Elevation: 229 m AMSL
602695 E, 4855341 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 12.1 mbgs.
- Borehole was open up to depth of 18.8 mbgs immediately after drilling.
- Cave in was observed at a depth of 18.8 mbgs.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 3/4

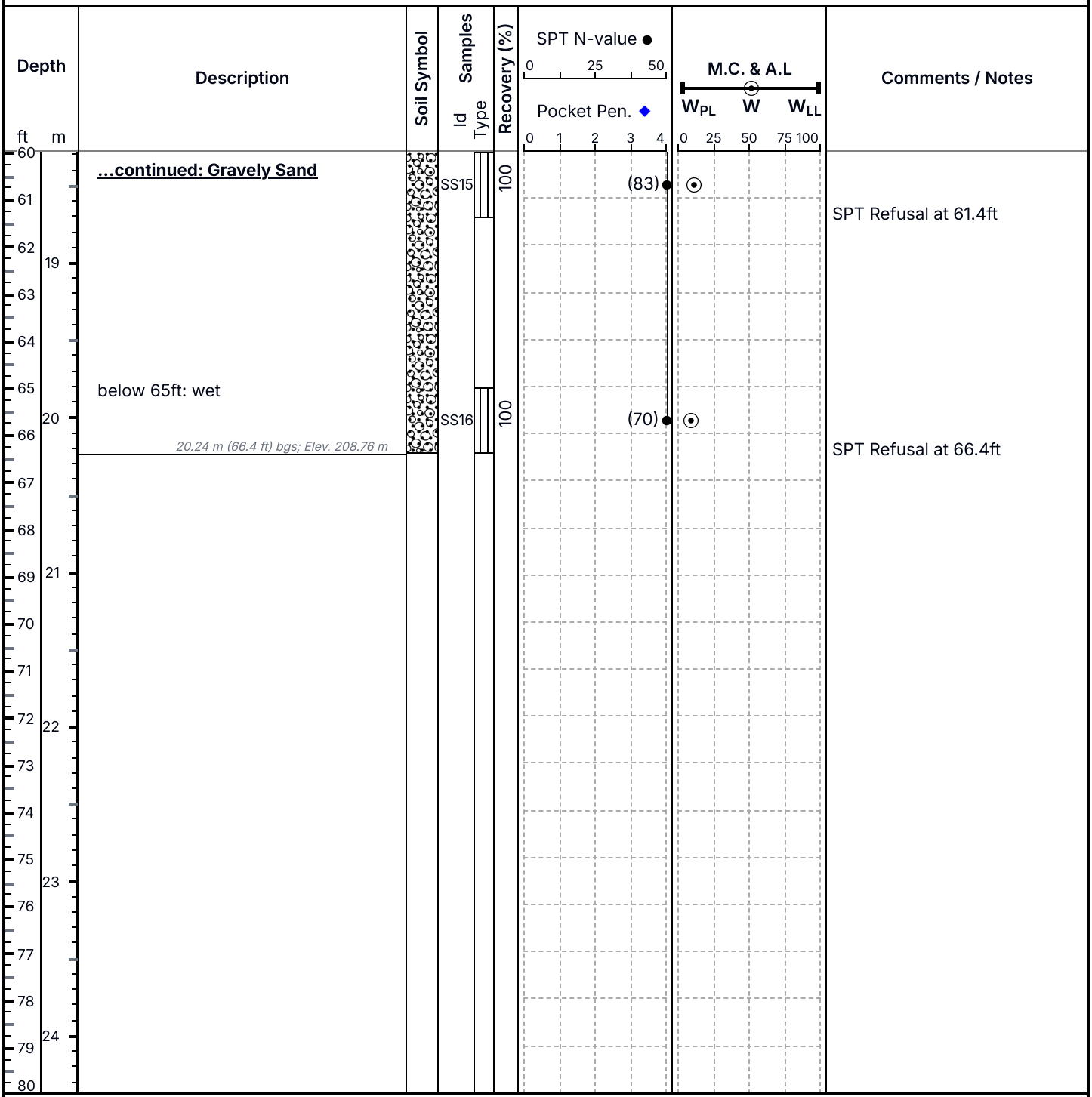
DRAFT

BOREHOLE: BH25-CR1

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-11
End Date: 2025-04-11

Elevation: 229 m AMSL
602695 E, 4855341 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 12.1 mbgs.
- Borehole was open up to depth of 18.8 mbgs immediately after drilling.
- Cave in was observed at a depth of 18.8 mbgs.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 4/4

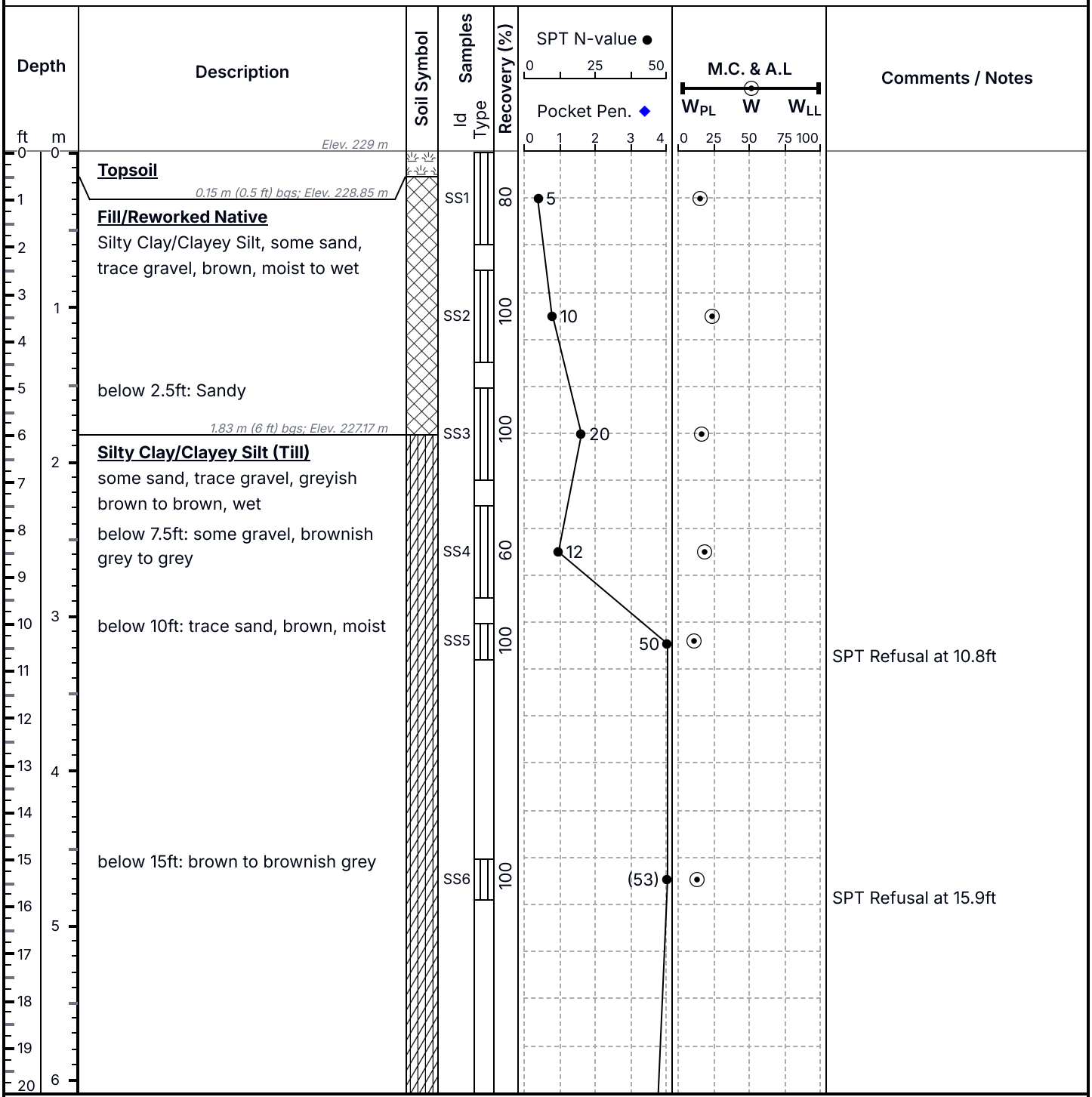
DRAFT

BOREHOLE: BH25-CR2

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-09
End Date: 2025-04-09

Elevation: 229 m AMSL
602682 E, 4855319 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 10.6 mbgs.
- Borehole was open up to depth of 19.2 mbgs immediately after drilling.
- Cave in was observed at a depth of 19.2 mbgs.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/4

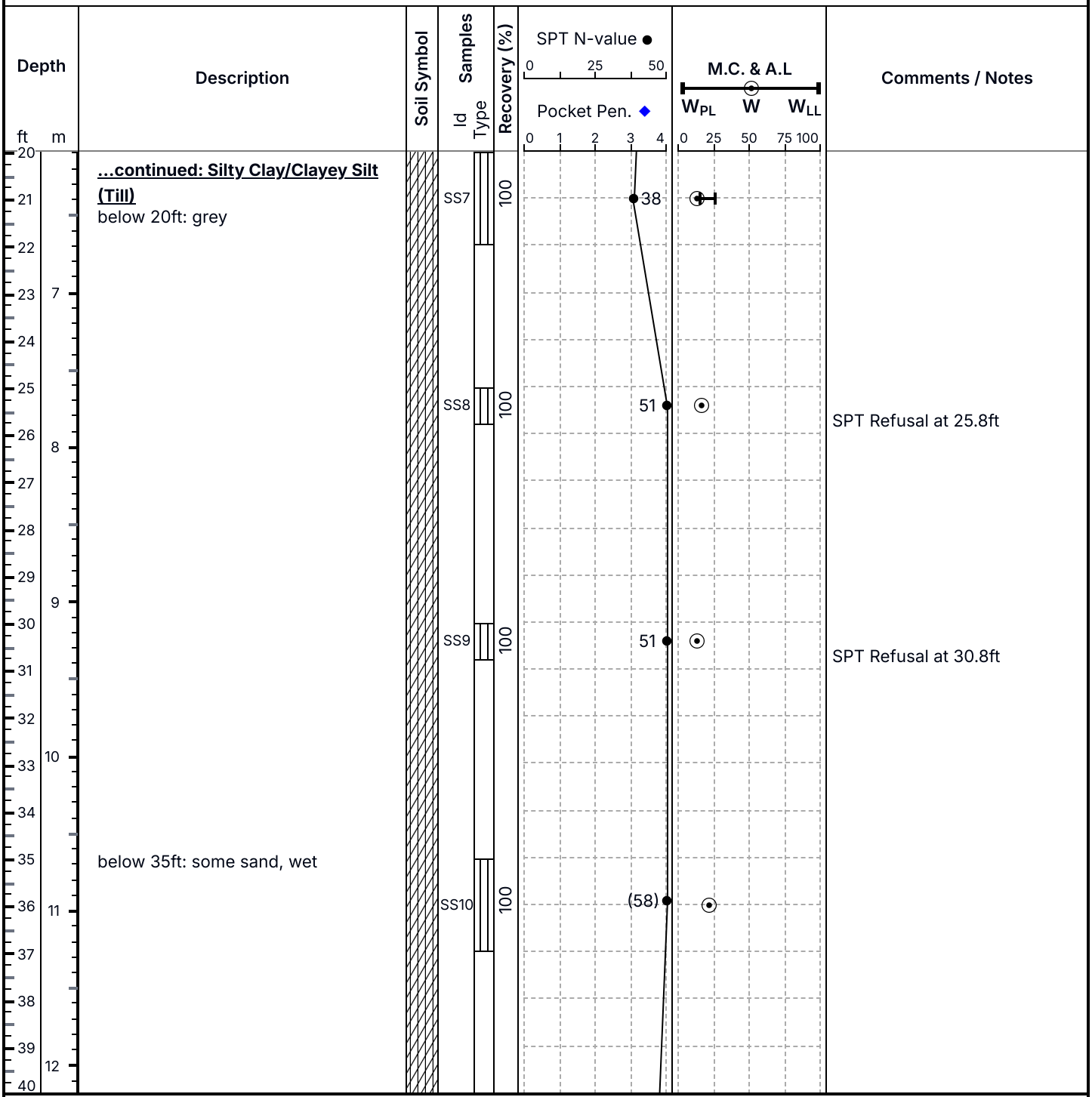
DRAFT

BOREHOLE: BH25-CR2

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-09
End Date: 2025-04-09

Elevation: 229 m AMSL
602682 E, 4855319 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 10.6 mbgs.
- Borehole was open up to depth of 19.2 mbgs immediately after drilling.
- Cave in was observed at a depth of 19.2 mbgs.

PNJ ENGINEERING INC.
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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 2/4

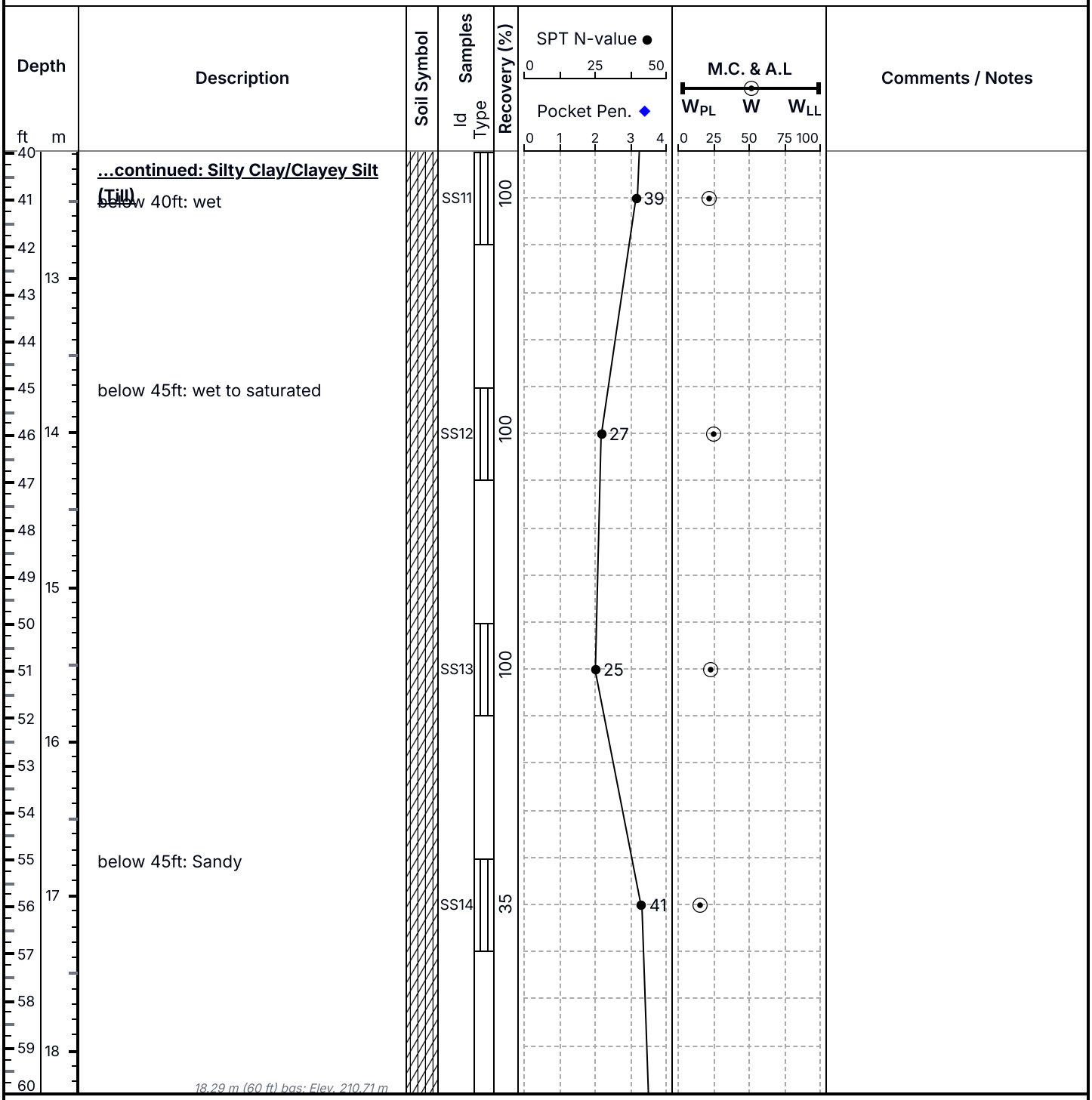
DRAFT

BOREHOLE: BH25-CR2

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-09
End Date: 2025-04-09

Elevation: 229 m AMSL
602682 E, 4855319 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 10.6 mbgs.
- Borehole was open up to depth of 19.2 mbgs immediately after drilling.
- Cave in was observed at a depth of 19.2 mbgs.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 3/4

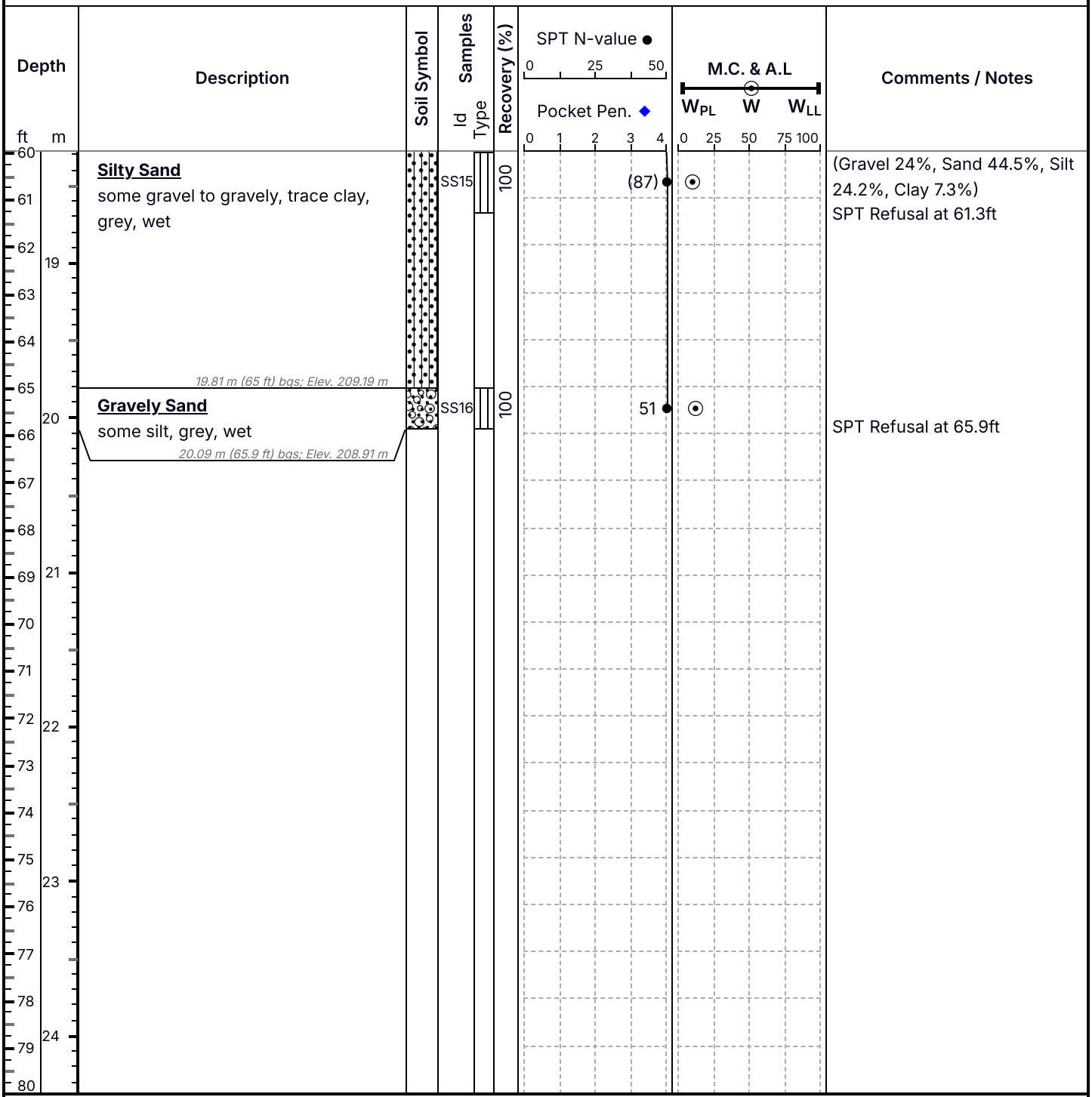
DRAFT

BOREHOLE: BH25-CR2

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-09
End Date: 2025-04-09

Elevation: 229 m AMSL
602682 E, 4855319 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 10.6 mbgs.
- Borehole was open up to depth of 19.2 mbgs immediately after drilling.
- Cave in was observed at a depth of 19.2 mbgs.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 4/4

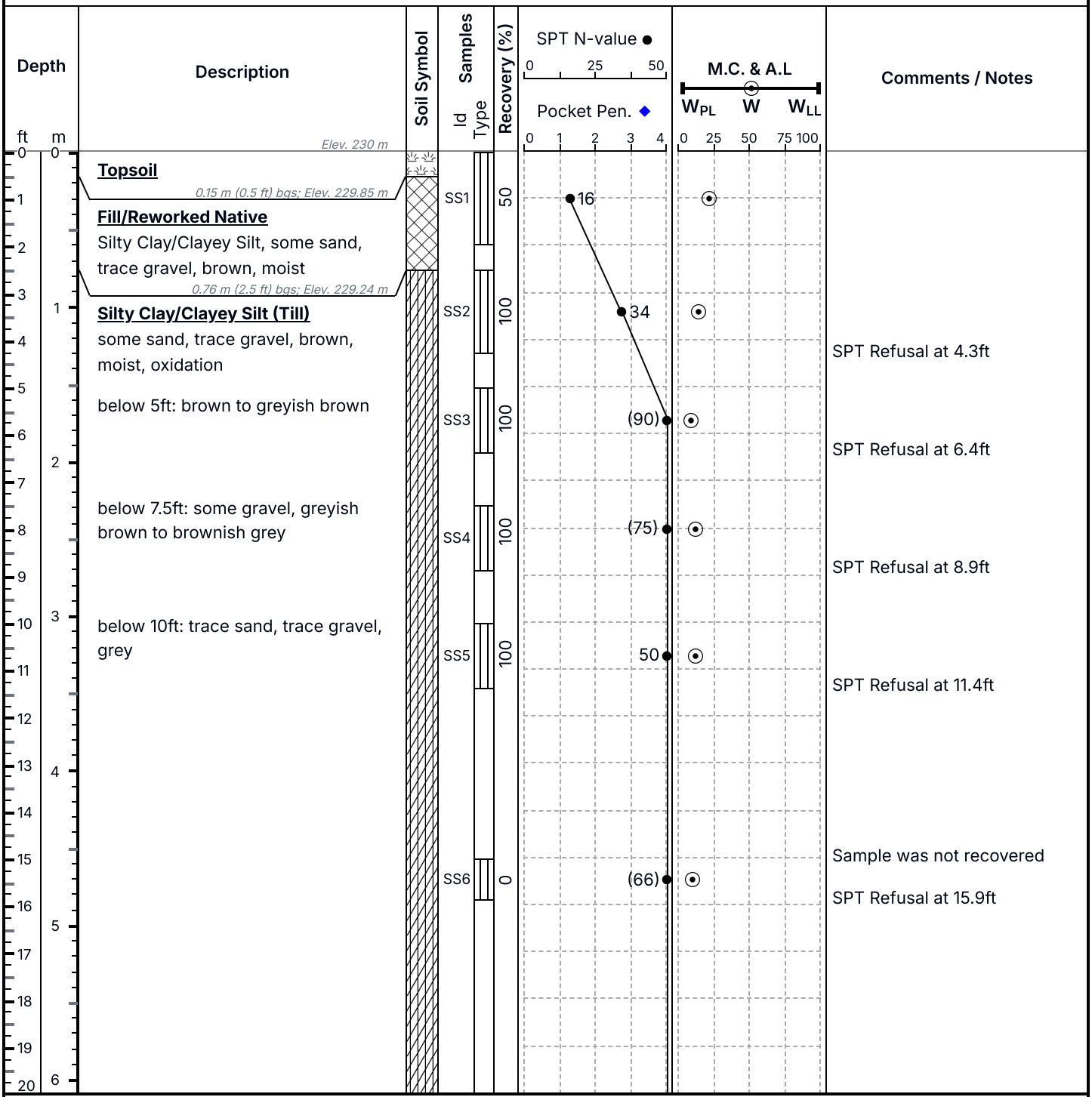
DRAFT

BOREHOLE: BH25-CR3

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-10
End Date: 2025-04-10

Elevation: 230 m AMSL
602656 E, 4855289 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 10.6 mbgs.
- Borehole was open up to depth of 18.5 mbgs immediately after drilling.
- Cave in was observed at a depth of 18.5 mbgs.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/4

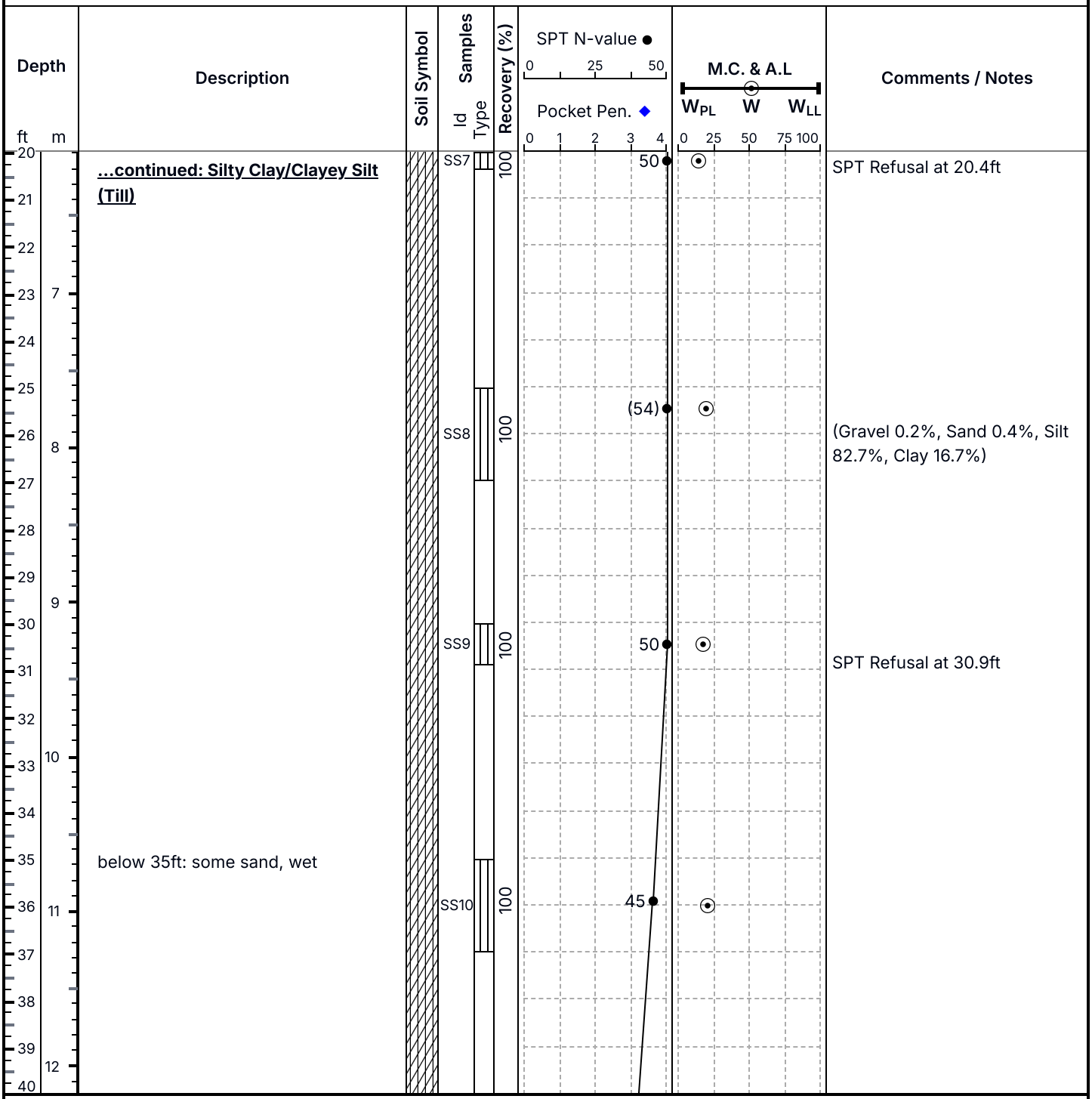
DRAFT

BOREHOLE: BH25-CR3

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-10
End Date: 2025-04-10

Elevation: 230 m AMSL
602656 E, 4855289 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 10.6 mbgs.
- Borehole was open up to depth of 18.5 mbgs immediately after drilling.
- Cave in was observed at a depth of 18.5 mbgs.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 2/4

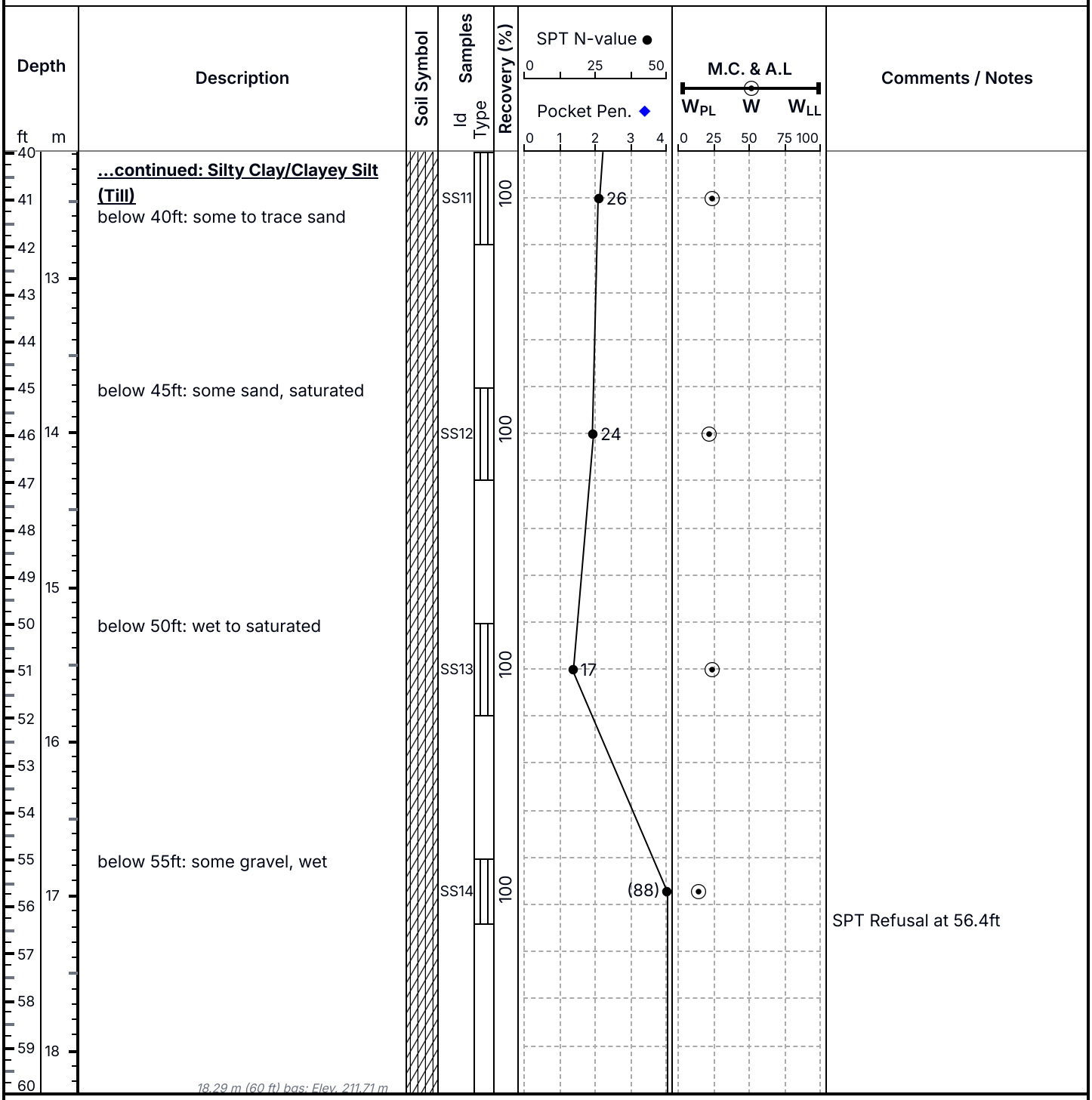
DRAFT

BOREHOLE: BH25-CR3

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-10
End Date: 2025-04-10

Elevation: 230 m AMSL
602656 E, 4855289 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 10.6 mbgs.
- Borehole was open up to depth of 18.5 mbgs immediately after drilling.
- Cave in was observed at a depth of 18.5 mbgs.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 3/4

DRAFT

BOREHOLE: BH25-CR3

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-10
End Date: 2025-04-10

Elevation: 230 m AMSL
602656 E, 4855289 N (NAD83 - 17)

Depth (ft)	Depth (m)	Description	Soil Symbol	Samples Id	Samples Type	Recovery (%)	SPT N-value / Pocket Pen.	M.C. & A.L (W_{PL} W W_{LL})	Comments / Notes
60		**Silty Sand** some gravel, trace clay, grey, wet		SS15		100	52		SPT Refusal at 60.4ft
61									
62	19								
63									
64									
65				SS16		100	50		SPT Refusal at 65.9ft
66	20	*20.09 m (65.9 ft) bgs; Elev. 209.91 m*							
67									
68									
69	21								
70									
71									
72	22								
73									
74									
75	23								
76									
77									
78									
79	24								
80									

SPT N-value ● (0, 25, 50)
Pocket Pen. ◆ (0, 1, 2, 3, 4)
M.C. & A.L (W_{PL} W W_{LL}) (0, 25, 50, 75, 100)

Notes: - The groundwater was encountered at a depth of 10.6 mbgs.
- Borehole was open up to depth of 18.5 mbgs immediately after drilling.
- Cave in was observed at a depth of 18.5 mbgs.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 4/4

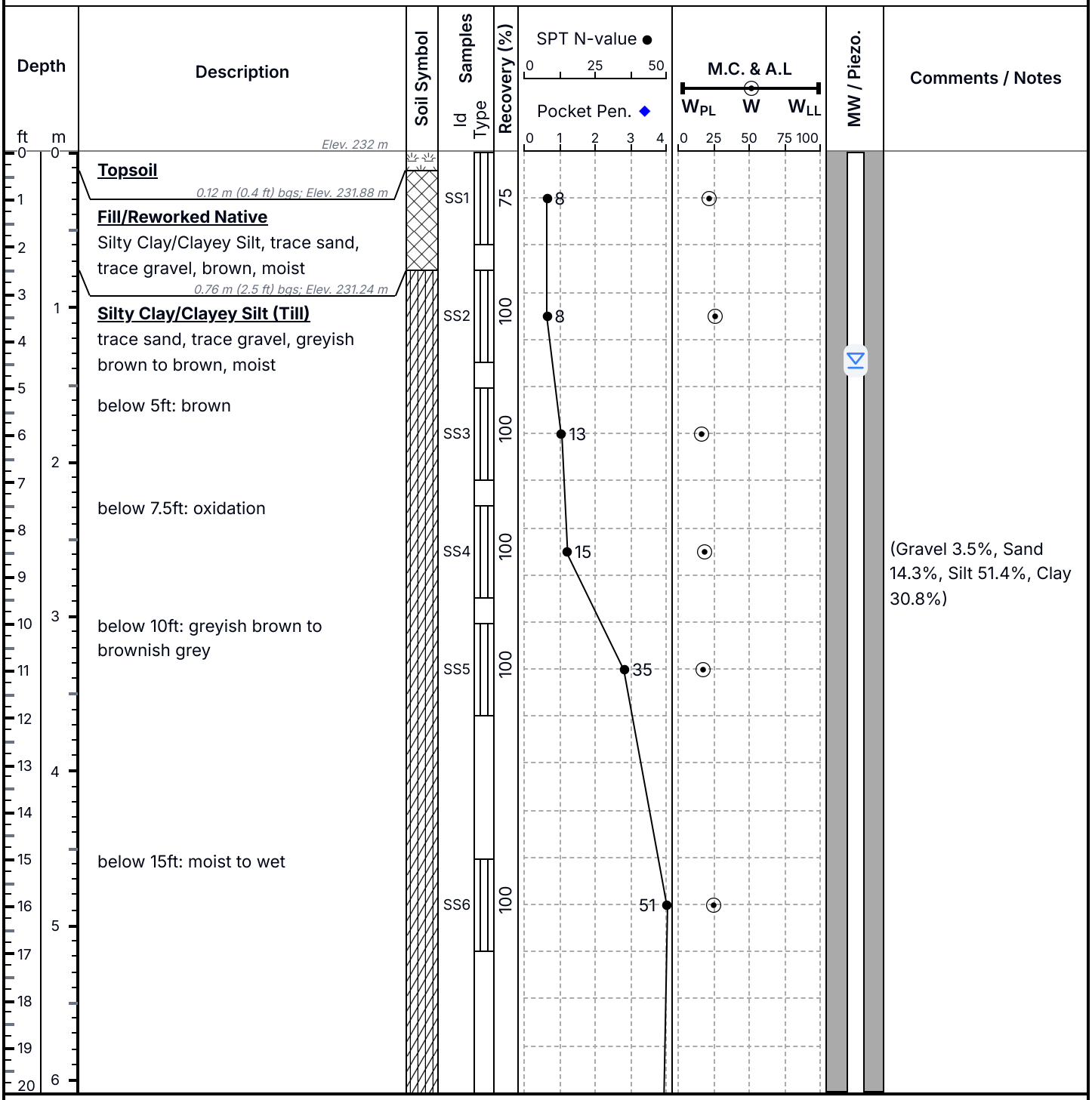
DRAFT

MONITORING WELL: MW25-02

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-07
End Date: 2025-04-07

Elevation: 232 m AMSL
602552 E, 4855162 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 4.5 mbgs.
- Borehole was open immediately after drilling.

PNJ ENGINEERING INC.
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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/3

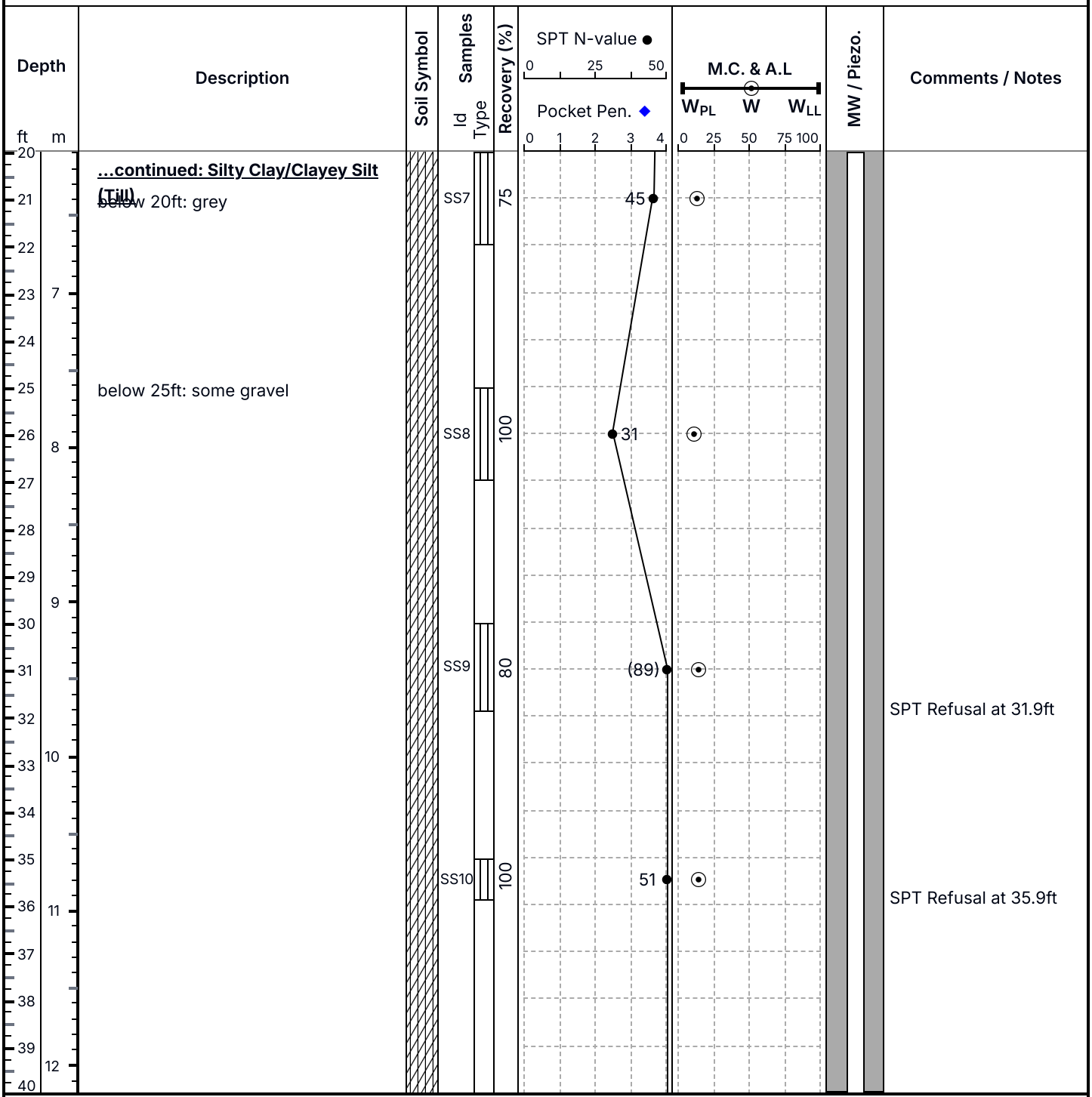
DRAFT

MONITORING WELL: MW25-02

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-07
End Date: 2025-04-07

Elevation: 232 m AMSL
602552 E, 4855162 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 4.5 mbgs.
- Borehole was open immediately after drilling.

PNJ ENGINEERING INC.
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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 2/3

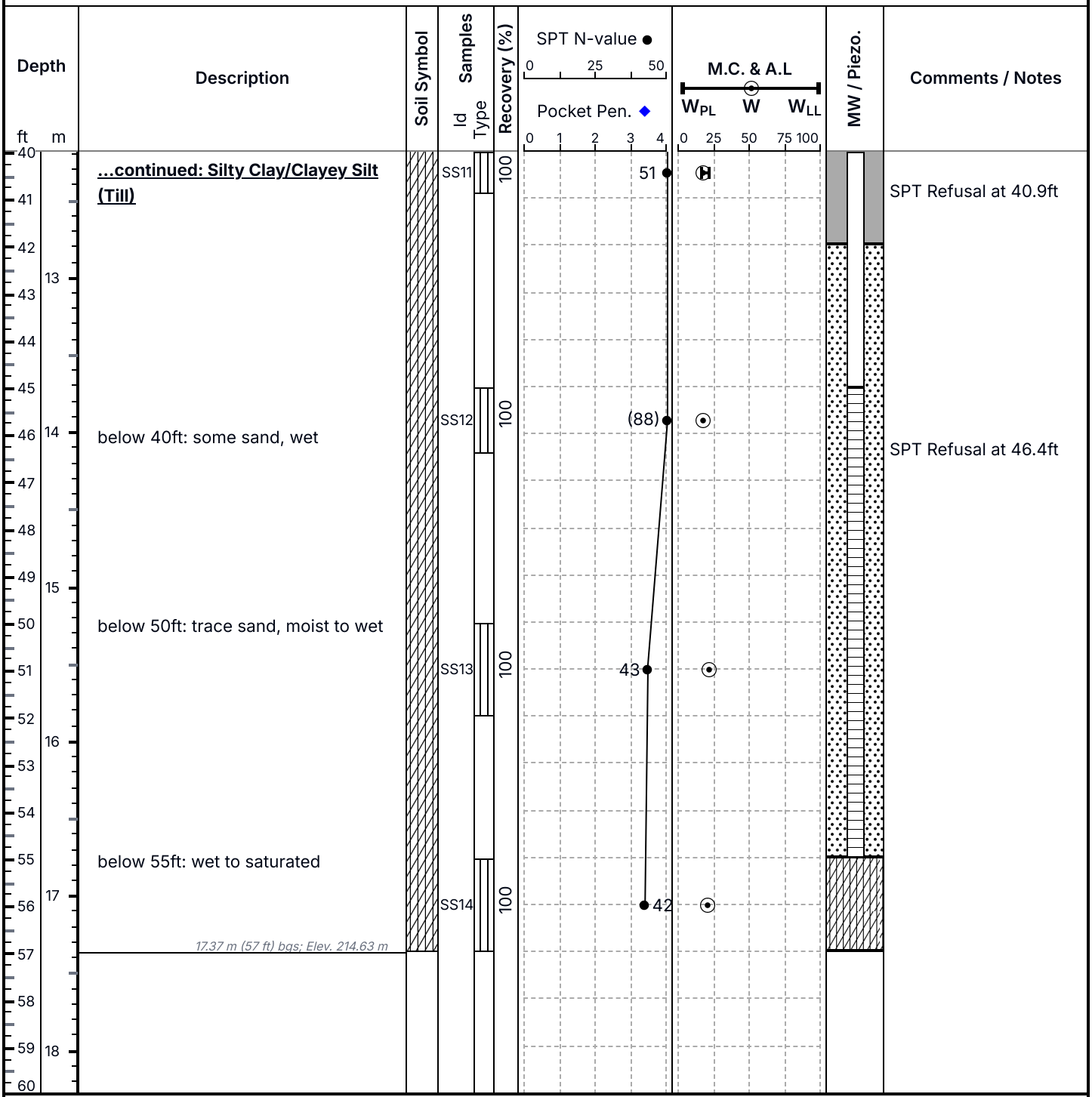
DRAFT

MONITORING WELL: MW25-02

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-07
End Date: 2025-04-07

Elevation: 232 m AMSL
602552 E, 4855162 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 4.5 mbgs.
- Borehole was open immediately after drilling.

PNJ ENGINEERING INC.
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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Mud Rotary	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 3/3

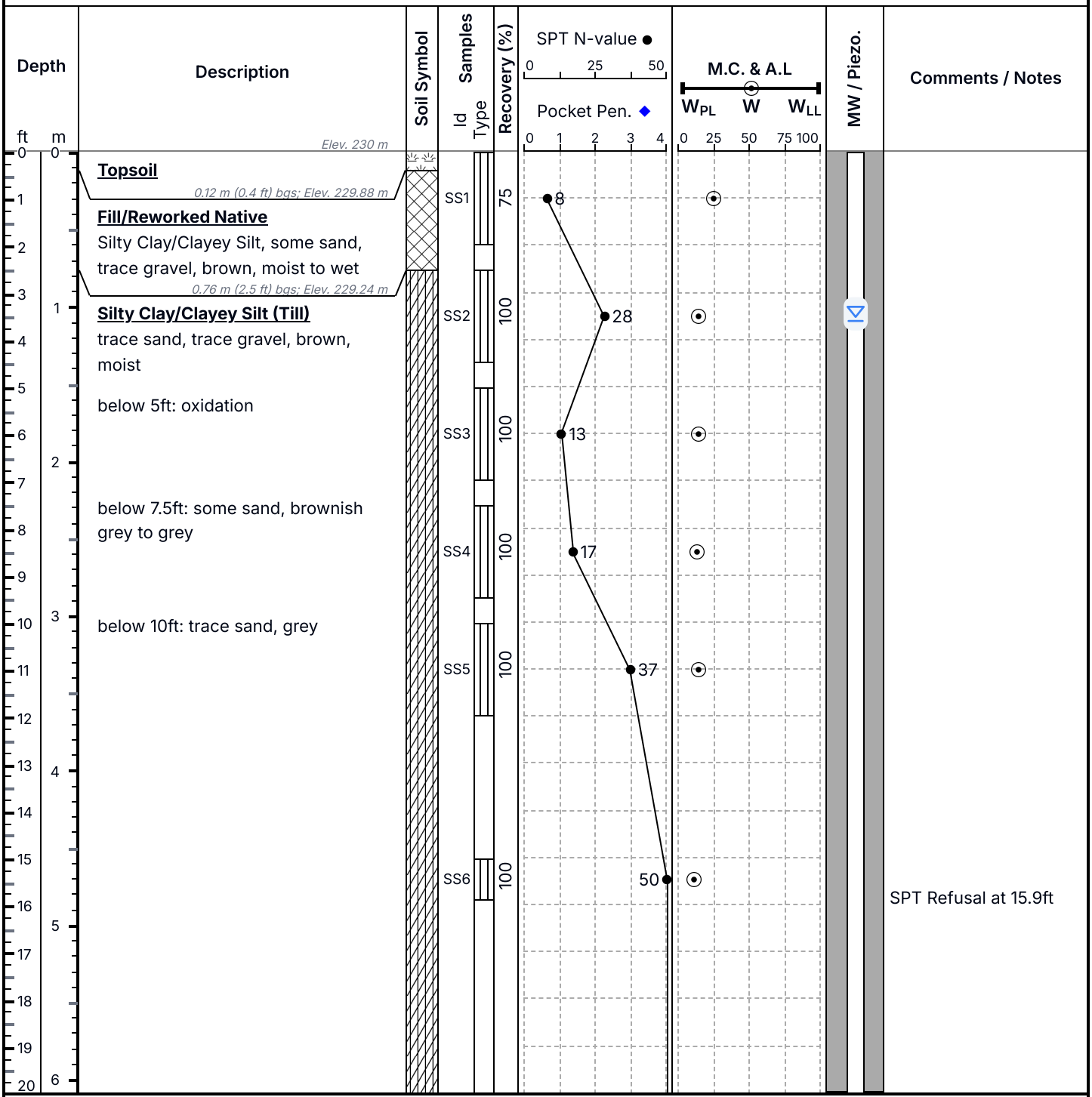
DRAFT

MONITORING WELL: MW25-3A

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-08
End Date: 2025-04-08

Elevation: 230 m AMSL
602716 E, 4855093 N (NAD83 - 17)



Notes: - The groundwater was measured immediately after drilling at a depth of 11.8 mbgs.
- Borehole was open immediately after drilling.

PNJ ENGINEERING INC.
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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Solid Stem	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/3

DRAFT

MONITORING WELL: MW25-3A

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-08
End Date: 2025-04-08

Elevation: 230 m AMSL
602716 E, 4855093 N (NAD83 - 17)

Depth (ft)	Depth (m)	Description	Soil Symbol	Samples Id	Samples Type	Recovery (%)	SPT N-value / Pocket Pen.	M.C. & A.L (W_{PL} W W_{LL})	MW / Piezo.	Comments / Notes
20		**...continued: Silty Clay/Clayey Silt (Till)**		SS7		75	51			SPT Refusal at 20.9ft
21										
22										
23	7									
24										
25										
26	8	below 26ft: wet		SS8		100	(67)			
27										
28										
29										
30	9	*9.14 m (30 ft) bgs; Elev. 220.86 m*								
31		**Silt** trace clay, trace sand, trace gravel, grey, wet to saturated		SS9		80	(69)			(Gravel 0.8%, Sand 0.3%, Silt 89.2%, Clay 9.7%)
32										
33	10									
34										
35										
36	11			SS10		100	(91)			SPT Refusal at 36.4ft
37										
38										
39										
40	12			SS11						

SPT N-value ● (0 25 50)
Pocket Pen. ◆ (0 1 2 3 4)
M.C. & A.L (0 25 50 75 100)

Notes: - The groundwater was measured immediately after drilling at a depth of 11.8 mbgs.
- Borehole was open immediately after drilling.

PNJ ENGINEERING INC.
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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Solid Stem	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 2/3

DRAFT

MONITORING WELL: MW25-3A

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-08
End Date: 2025-04-08

Elevation: 230 m AMSL
602716 E, 4855093 N (NAD83 - 17)

Depth (ft)	Depth (m)	Description	Soil Symbol	Samples Id	Samples Type	Recovery (%)	SPT N-value / Pocket Pen.	M.C. & A.L (W_{PL} W W_{LL})	MW / Piezo.	Comments / Notes
40		**...continued: Silt**		SS11		100	48			
41										
42										
		13.01 m (42.7 ft) bgs; Elev. 216.99 m								
43	13									
44										
45										
46	14									
47										
48										
49	15									
50										
51										
52	16									
53										
54										
55										
56	17									
57										
58										
59	18									
60										

Notes: - The groundwater was measured immediately after drilling at a depth of 11.8 mbgs.
- Borehole was open immediately after drilling.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Solid Stem	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 3/3

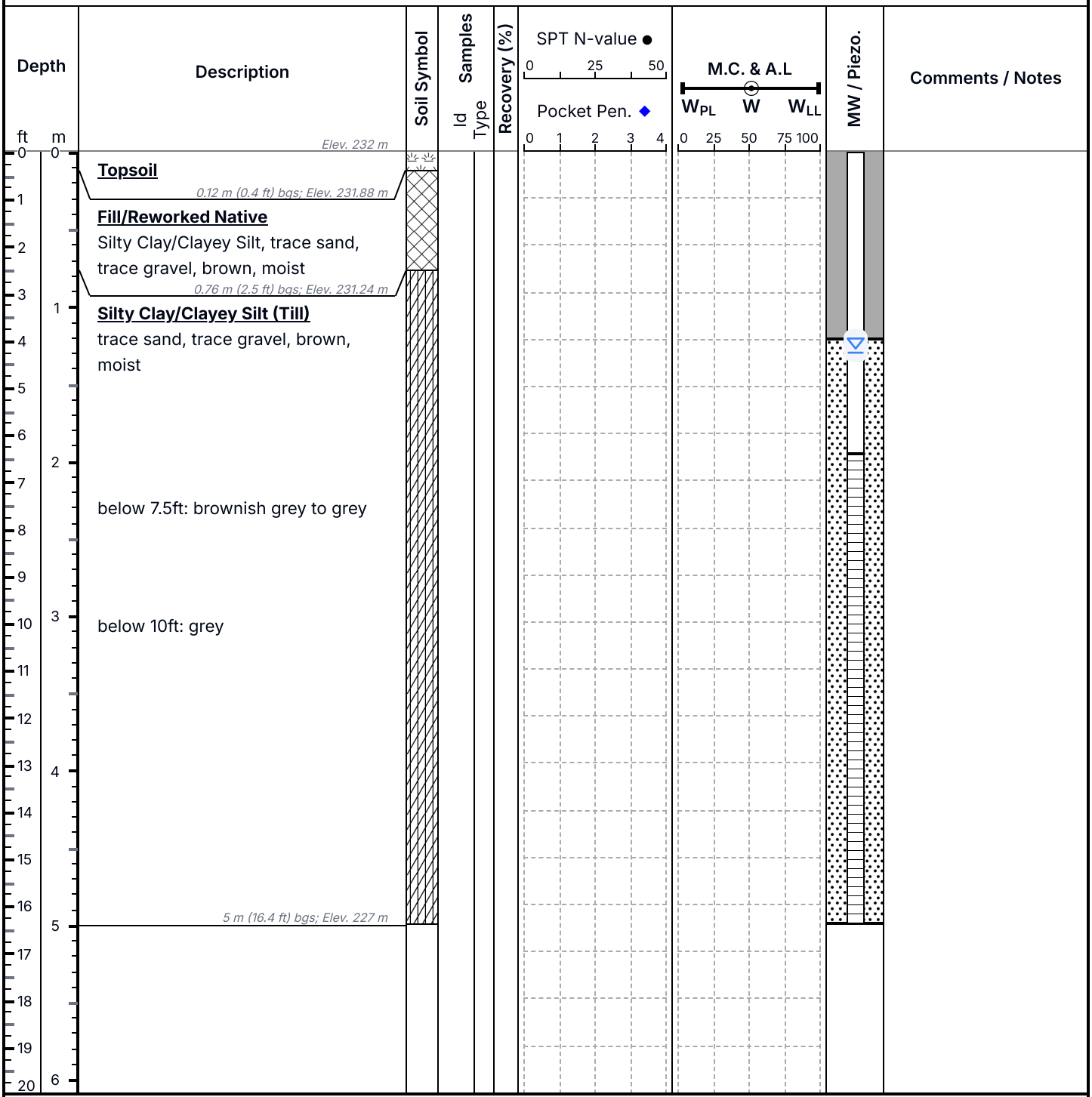
DRAFT

MONITORING WELL: MW25-3B

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-08
End Date: 2025-04-08

Elevation: 232 m AMSL
602715 E, 4855094 N (NAD83 - 17)



Notes: - Borehole was open and dry.
- This is a nested MW. No testing or sample collection was conducted; the sole purpose was to install an MW.

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Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Solid Stem	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/1

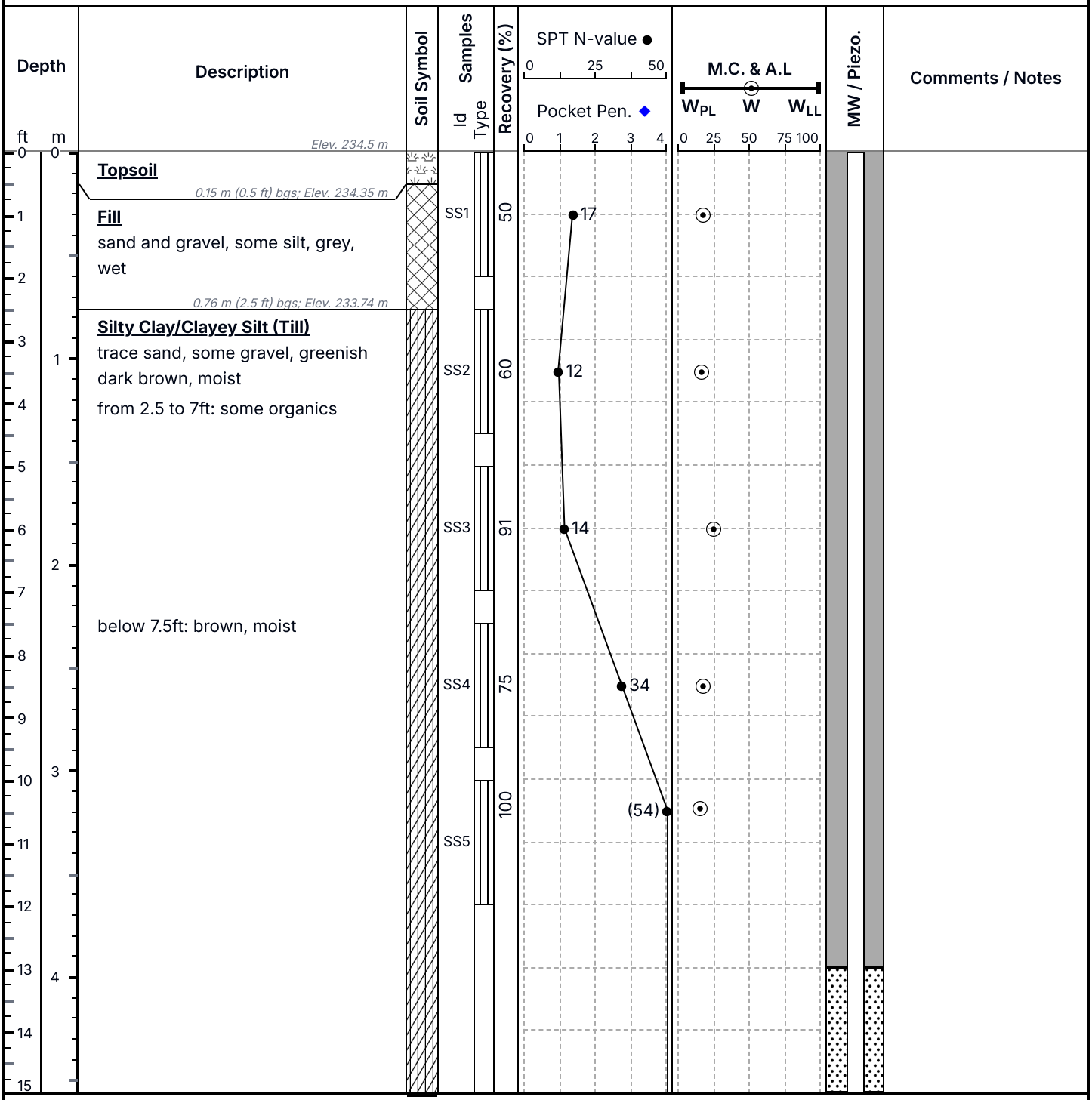
DRAFT

MONITORING WELL: MW25-CR1

George Bolton Parkway, Caledon, ON

Start Date: 2025-05-28
End Date: 2025-05-28

Elevation: 234.5 m AMSL
602710 E, 4855362 N (NAD83 - 17)



Notes: Borehole was open, no caving observed.

PNJ ENGINEERING INC.
Pavement · Materials · Geo-Environmental · Engineering

Logged By: MUH	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: SPT	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/2

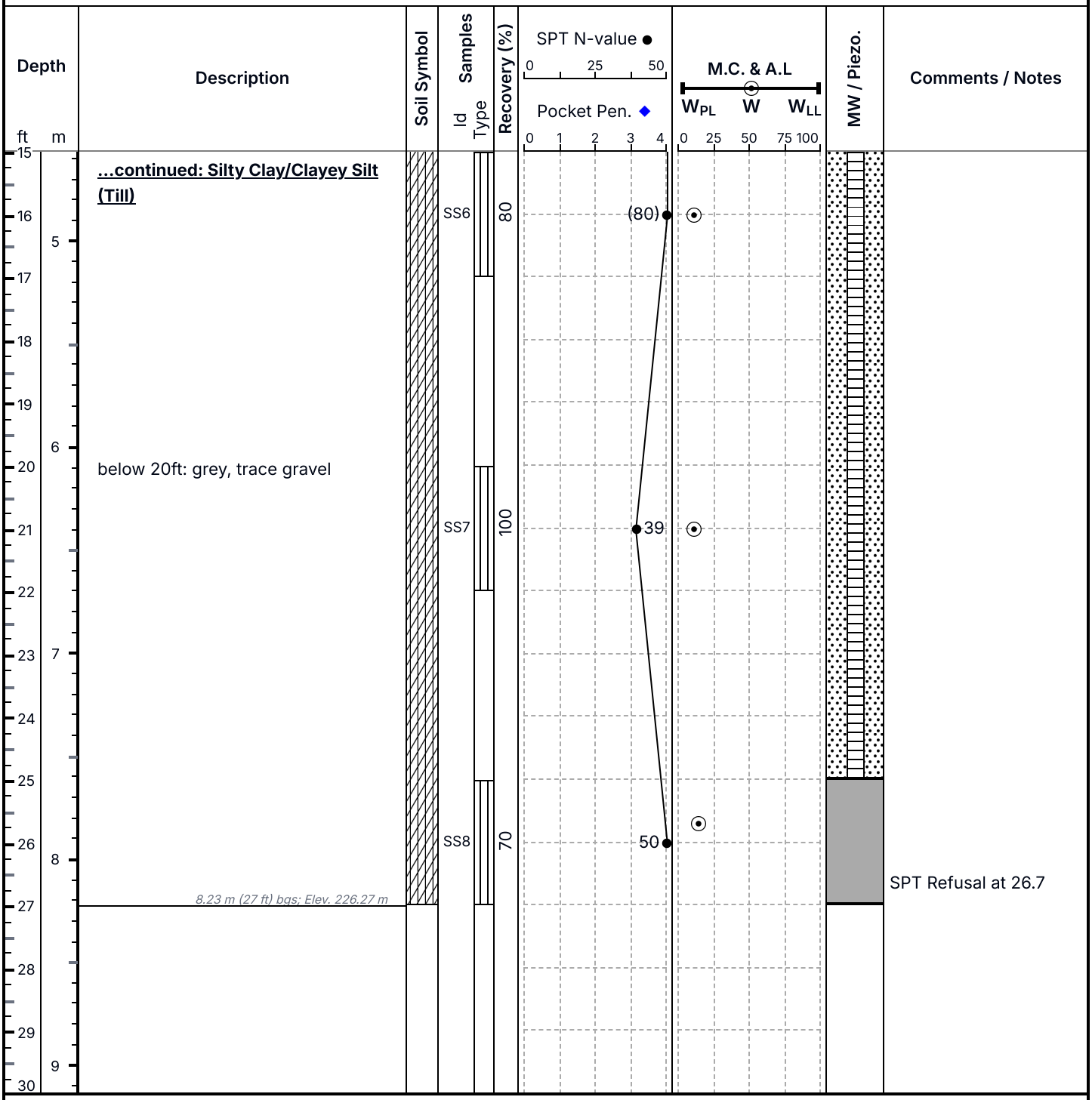
DRAFT

MONITORING WELL: MW25-CR1

George Bolton Parkway, Caledon, ON

Start Date: 2025-05-28
End Date: 2025-05-28

Elevation: 234.5 m AMSL
602710 E, 4855362 N (NAD83 - 17)



Notes: Borehole was open, no caving observed.

PNJ ENGINEERING INC.
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Logged By: MUH	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: SPT	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 2/2

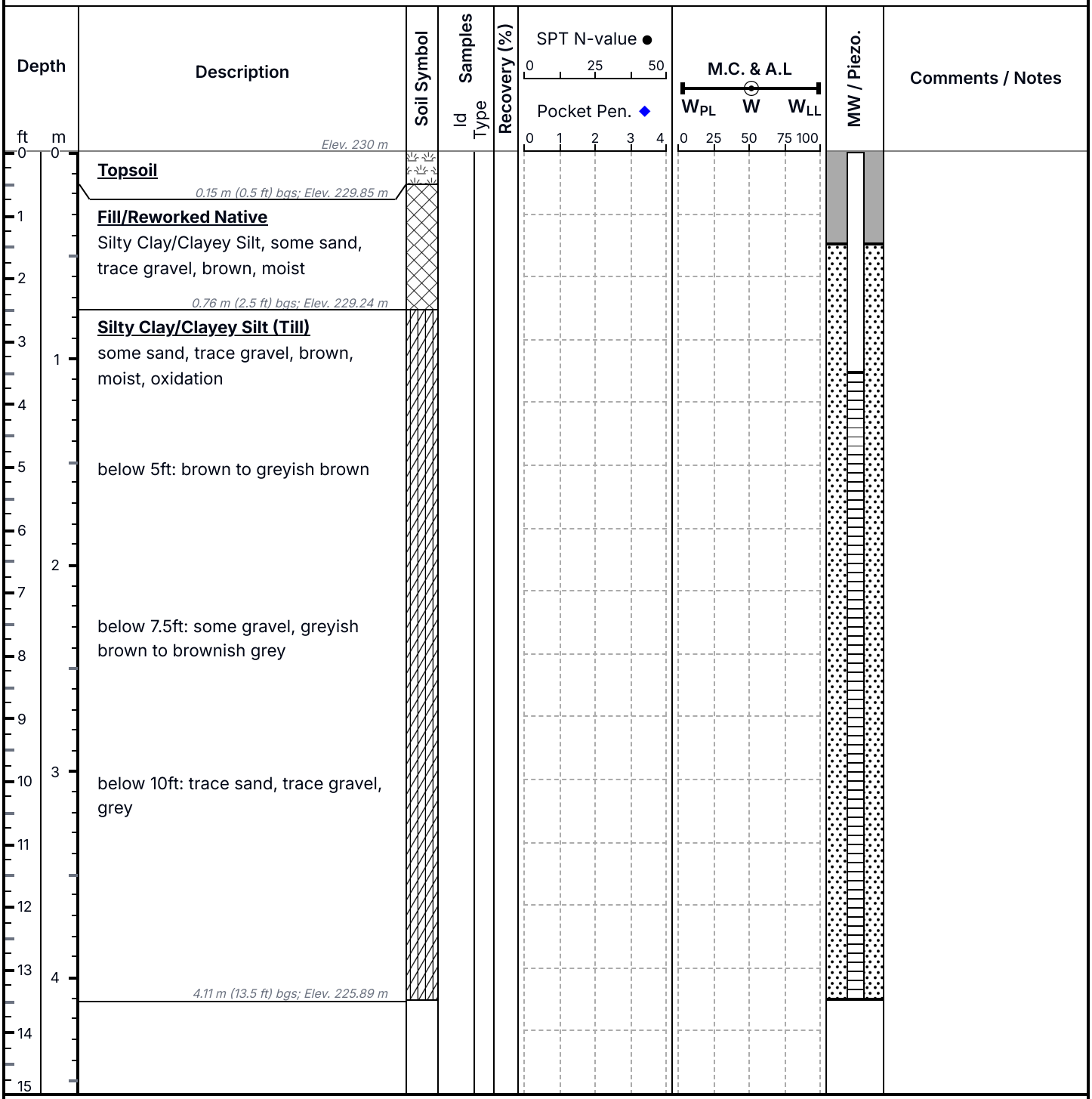
DRAFT

MONITORING WELL: MW25-CR2

George Bolton Parkway, Caledon, ON

Start Date: 2025-05-28
End Date: 2025-05-28

Elevation: 230 m AMSL
602660 E, 4855290 N (NAD83 - 17)



Notes: - This borehole was drilled solely for the installation of an MW near BH25-CR3.
Refer to BH25-CR3 for information regarding SPT and lab testing.
- Borehole was open and dry immediately after drilling

PNJ ENGINEERING INC.
Pavement · Materials · Geo-Environmental · Engineering

Logged By: MUH	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Auger	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/1

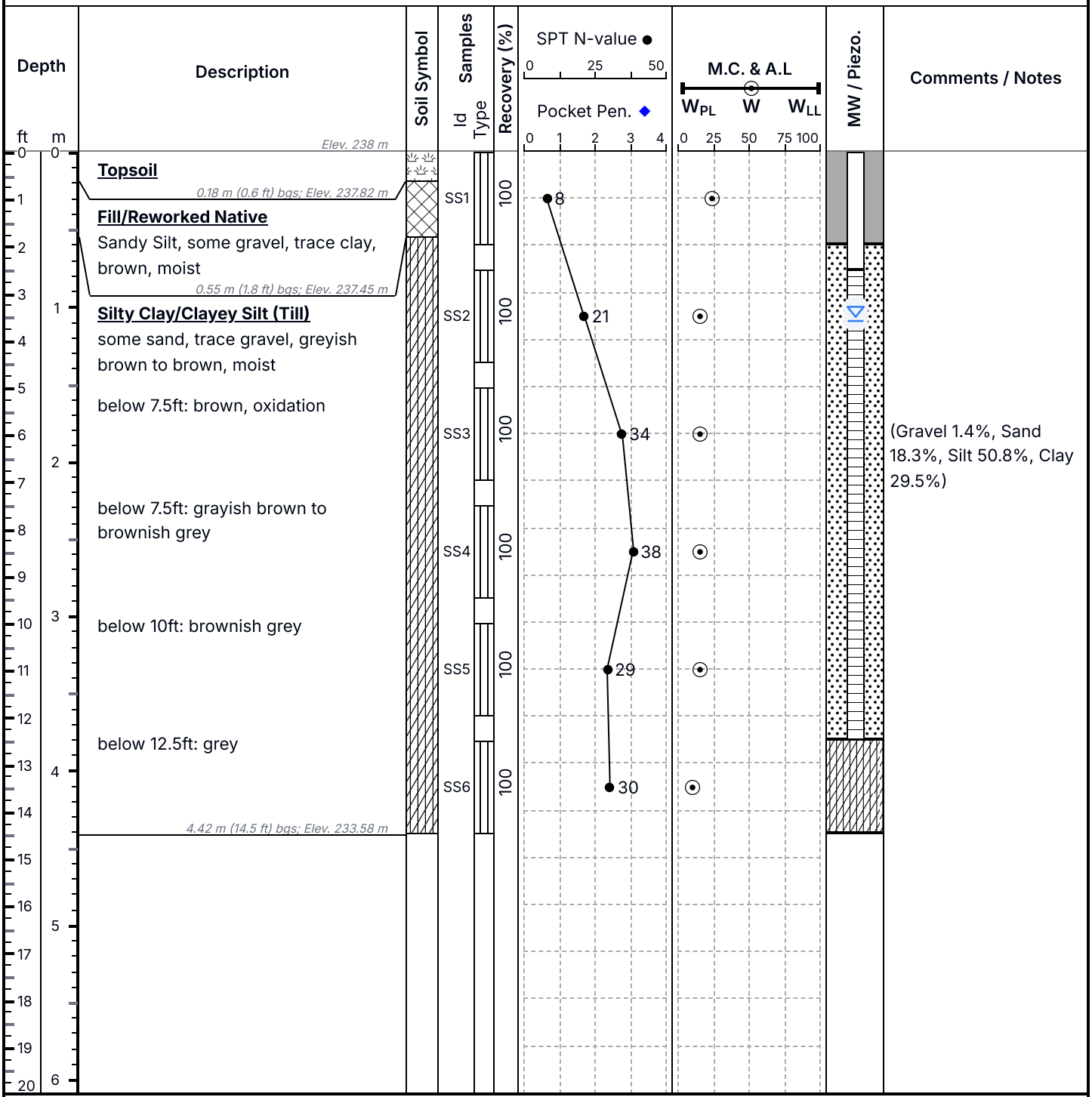
DRAFT

MONITORING WELL: MW25-SWM1

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-03
End Date: 2025-04-03

Elevation: 238 m AMSL
601716 E, 4855880 N (NAD83 - 17)



Notes: - Borehole was open and dry.

PNJ ENGINEERING INC.
Pavement · Materials · Geo-Environmental · Engineering

Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Solid Stem	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/1

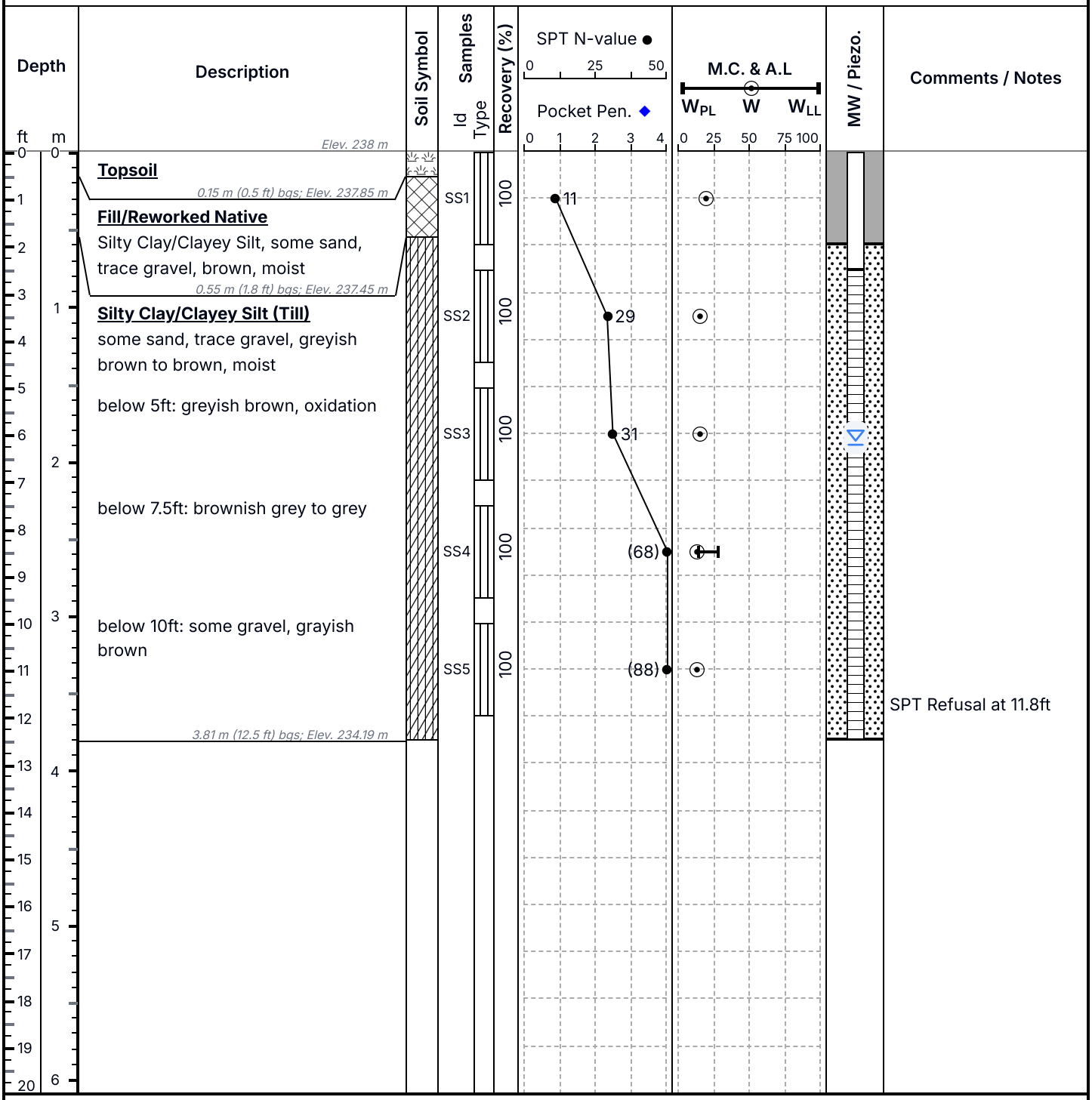
DRAFT

MONITORING WELL: MW25-SWM2

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-03
End Date: 2025-04-03

Elevation: 238 m AMSL
601626 E, 4855798 N (NAD83 - 17)



Notes: - Borehole was open and dry.

PNJ ENGINEERING INC.
Pavement · Materials · Geo-Environmental · Engineering

Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Solid Stem	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/1

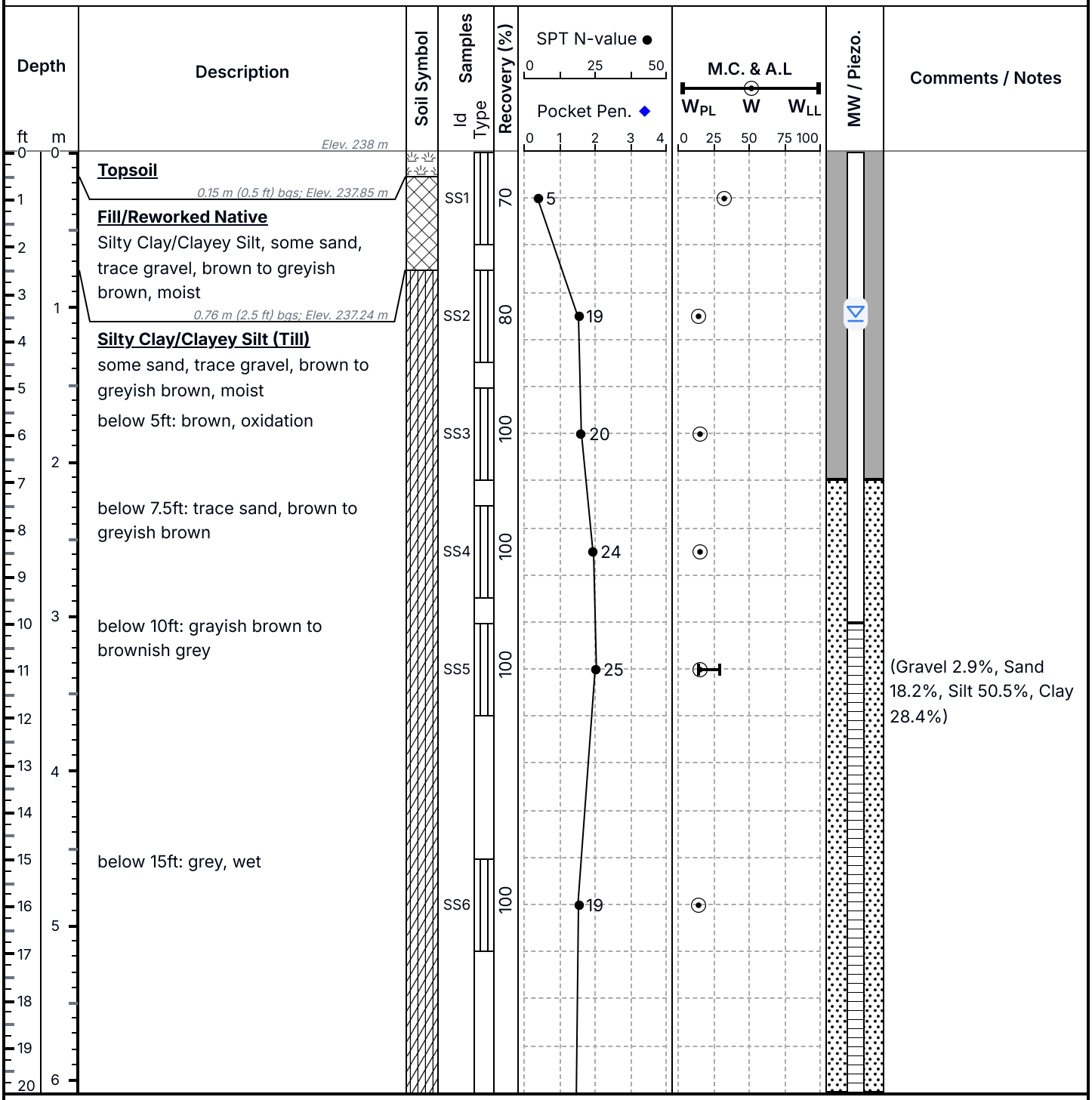
DRAFT

MONITORING WELL: MW25-SWM3

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-21
End Date: 2025-04-21

Elevation: 238 m AMSL
603072 E, 4854541 N (NAD83 - 17)



Notes: - The groundwater was encountered at a depth of 4.5 mbgs.
- Borehole was open and dry.

PNJ ENGINEERING INC.
Pavement · Materials · Geo-Environmental · Engineering

Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Solid Stem	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 1/2

DRAFT

MONITORING WELL: MW25-SWM3

George Bolton Parkway, Caledon, ON

Start Date: 2025-04-21
End Date: 2025-04-21

Elevation: 238 m AMSL
603072 E, 4854541 N (NAD83 - 17)

Depth (ft)	Depth (m)	Description	Soil Symbol	Samples Id	Samples Type	Recovery (%)	SPT N-value / Pocket Pen.	M.C. & A.L (W_{PL} W W_{LL})	MW / Piezo.	Comments / Notes
20		**...continued: Silty Clay/Clayey Silt (Till)**		SS7		100	16			
		6.71 m (22 ft) bgs; Elev. 231.29 m								
23	7									
26	8									
29	9									
33	10									
36	11									
39	12									
40										

SPT N-value ● 0 25 50
Pocket Pen. ◆ 0 1 2 3 4
M.C. & A.L 0 25 50 75 100

Notes: - The groundwater was encountered at a depth of 4.5 mbgs.
- Borehole was open and dry.

PNJ ENGINEERING INC.
Pavement · Materials · Geo-Environmental · Engineering

Logged By: MM	Contractor: DrillTech Drilling Ltd.	Client: Arcadis Professional Service	
Approved By: AS	Drilling Details: Solid Stem	Project Title: Geotechnical Investigation-George Bolton Parkway	
Project Eng.: Abid Sahi., P.Eng.		Project No.: 25-1211-04	Page 2/2

JOB NO.: 1707-S200

LOG OF BOREHOLE NO.: MW1-17

FIGURE NO.: 1

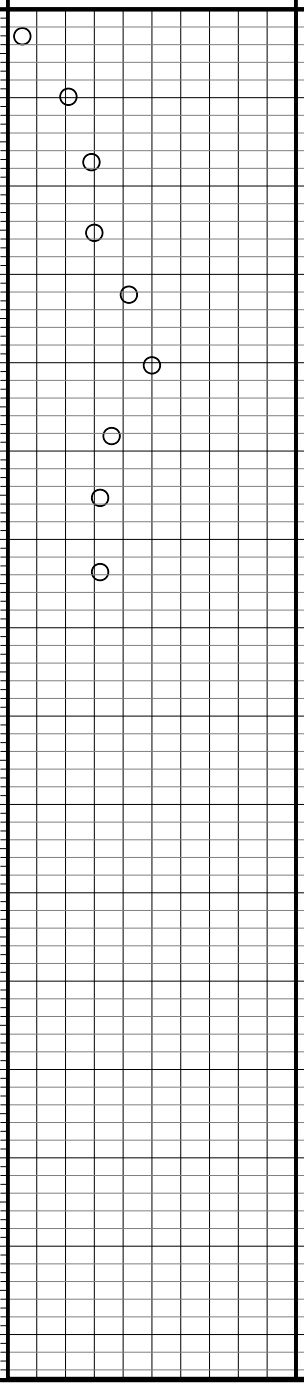
PROJECT DESCRIPTION: Monitoring Wells Installation

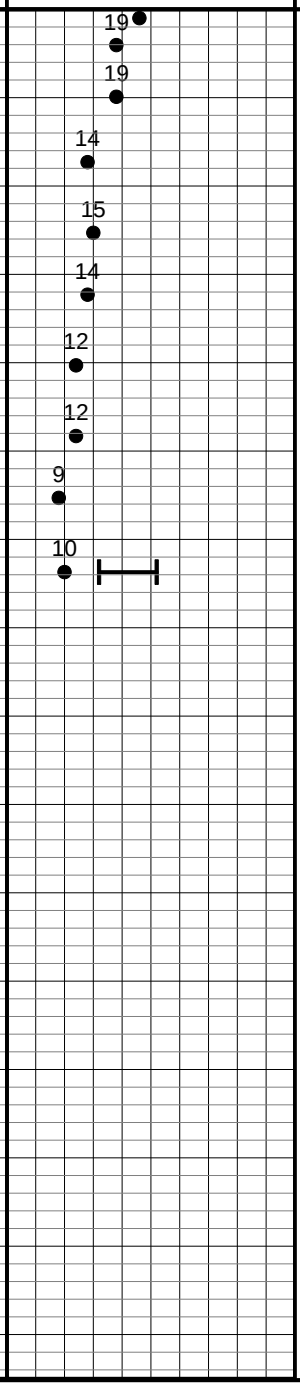
METHOD OF BORING: Hollow-Stem

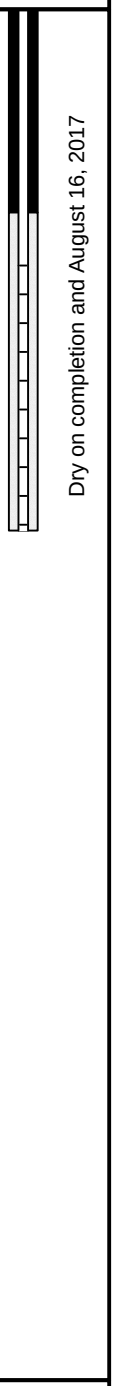
PROJECT LOCATION: East side of Humber Station Road, south of Healey Road
Town of Caledon

DRILLING DATE: August 15, 2017

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
244.9	Ground Surface				
0.0	**20 cm TOPSOIL**	1A			0
	Firm to hard	1B	DO	5	
	weathered	2	AS	21	1
		3	DO	29	
					2
	SILTY CLAY TILL	4	DO	30	
		5	DO	42	3
		6	DO	50	4
	some sand to sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders — brown grey	7	DO	36	5
		8	DO	32	6
238.3		9	DO	32	
6.6	**END OF BOREHOLE**				7
	Installed 50 mm Ø monitoring well to 5.9 m completed with 3.0 m screen Sand backfill from 2.3 m to 5.9 m Bentonite seal from 0.0 m to 2.3 m Provided with a protective steel monument casing				8
					9
					10
					11
					12
					13
					14
					15







Soil Engineers Ltd.

JOB NO.: 1707-S200

LOG OF BOREHOLE NO.: MW2-17D

FIGURE NO.: 2

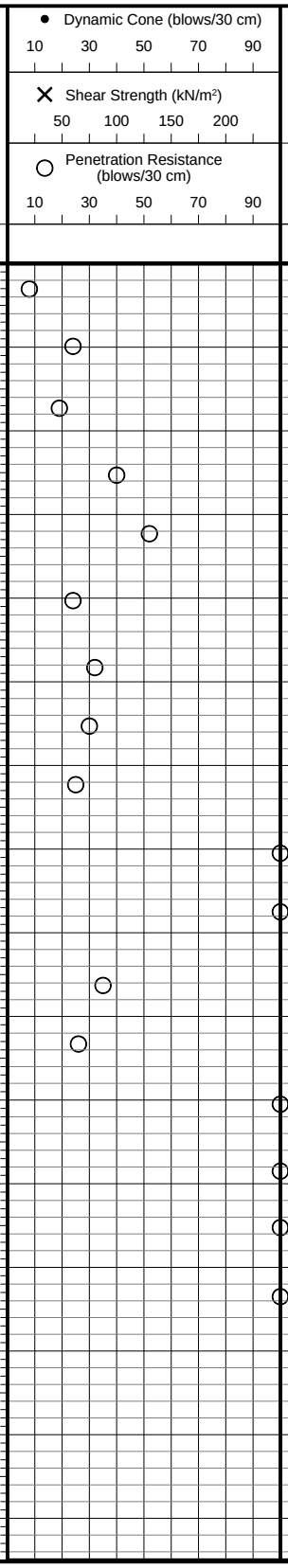
PROJECT DESCRIPTION: Monitoring Wells Installation

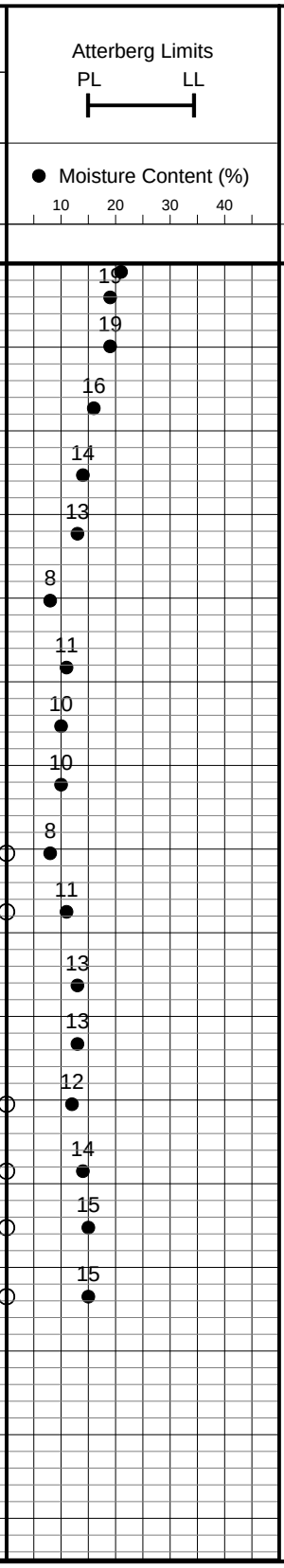
METHOD OF BORING: Hollow-Stem

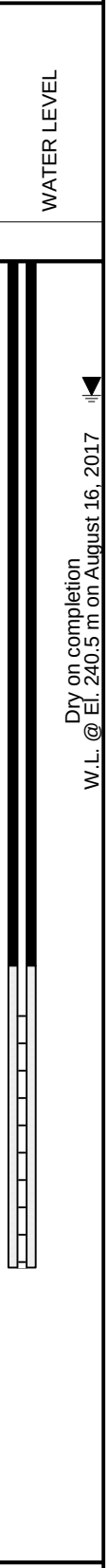
PROJECT LOCATION: East side of Humber Station Road, south of Healey Road
Town of Caledon

DRILLING DATE: August 16, 2017

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
242.1 / 0.0	Ground Surface				
	20 cm TOPSOIL	1A			0
	Firm to hard	1B	DO	8	
	weathered	2	DO	24	1
	boulder	3	DO	19	2
	SILTY CLAY TILL	4	DO	40	
	brown grey	5	DO	52	3
	some sand to sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders	6	DO	24	4
		7	DO	32	5
		8	DO	30	
235.4 / 6.7		9	DO	25	6
	Grey, very dense	10	DO	50/15	7
	SANDY SILT TILL	11	DO	52/15	8
	some clay, a trace of gravel occ. sand seams and layers, cobbles and boudlers	12	DO	35	9
	silt layer / water seepage	13	DO	26	
232.3 / 9.8	Grey, very dense	14	DO	55/15	10
	SILT	15	DO	50/15	11
	some clay, a trace of sand occ. clay layers	16	DO	50/10	
229.6 / 12.5	**END OF BOREHOLE**	17	DO	55/15	12
	Installed 50 mm Ø monitoring well to 12.0 m completed with 3.0 m screen with filter sock Sand backfill from 8.4 m to 12.0 m Bentonite seal from 0.0 m to 8.4 m Provided with a protective steel monument casing				13
					14
					15







Soil Engineers Ltd.

JOB NO.: 1707-S200

LOG OF BOREHOLE NO.: MW2-17S

FIGURE NO.: 3

PROJECT DESCRIPTION: Monitoring Wells Installation

METHOD OF BORING: Hollow-Stem

PROJECT LOCATION: East side of Humber Station Road, south of Healey Road
Town of Caledon

DRILLING DATE: August 15, 2017

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES: Number	SAMPLES: Type	SAMPLES: N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
242.1	Ground Surface							
0.0	**20 cm TOPSOIL**				0			
	SILTY CLAY TILL brown grey some sand to sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders				1 2 3 4 5			
236.1 6.0	**END OF AUGER HOLE** Installed 50 mm Ø monitoring well to 6.0 m completed with 3.0 m screen Sand backfill from 2.4 m to 6.0 m Bentonite seal from 0.0 m to 2.4 m Provided with a protective steel monument casing				6 7 8 9 10 11 12 13 14 15			Dry on completion

Soil Engineers Ltd.

JOB NO.: 1707-S200

LOG OF BOREHOLE NO.: MW3-17

FIGURE NO.: 4

PROJECT DESCRIPTION: Monitoring Wells Installation

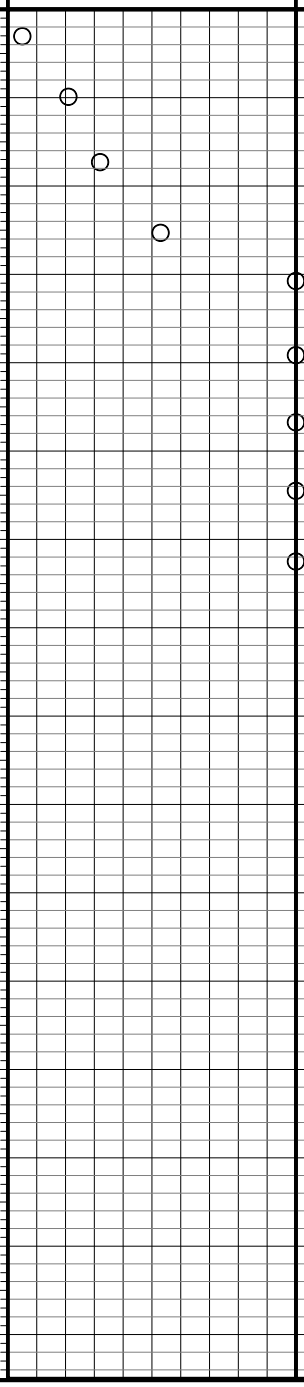
METHOD OF BORING: Hollow-Stem

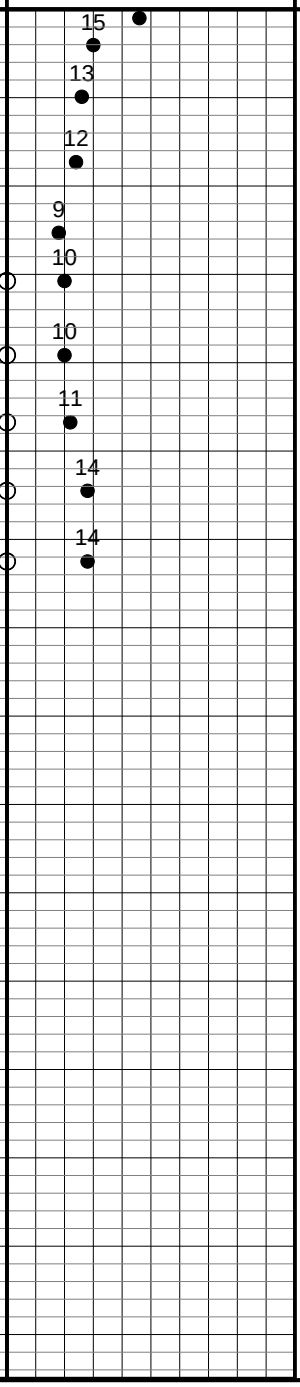
PROJECT LOCATION: East side of Humber Station Road, south of Healey Road
Town of Caledon

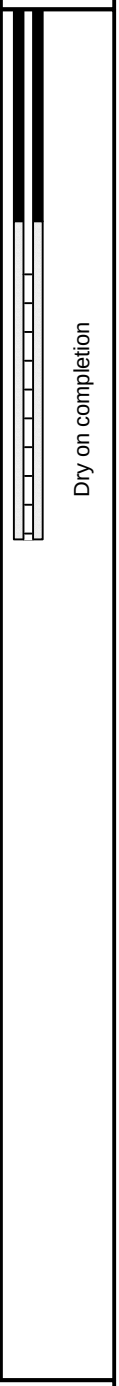
DRILLING DATE: August 17, 2017

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
235.5 / 0.0	Ground Surface			
	20 cm TOPSOIL	1A		
	Brown, firm to hard	1B	DO	5
	weathered	2	AS	21
	SILTY CLAY TILL	3	DO	32
	some sand to sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders — boulder	4	DO	53
		5	DO	55/15
232.0 / 3.5	Grey, very dense	6	DO	50/8
	SILT	7	DO	50/15
	some clay, a trace of sand occ. clay layers	8	DO	50/15
229.1 / 6.4	**END OF BOREHOLE**	9	DO	70/15

Installed 50 mm Ø monitoring well to 6.0 m
completed with 3.0 m screen
Sand backfill from 2.4 m to 6.0 m
Bentonite seal from 0.0 m to 2.4 m
Provided with a protective steel monument casing







Soil Engineers Ltd.

JOB NO.: 1707-S200

LOG OF BOREHOLE NO.: MW4-17D

FIGURE NO.: 5

PROJECT DESCRIPTION: Monitoring Wells Installation

METHOD OF BORING: Hollow-Stem

PROJECT LOCATION: East side of Humber Station Road, south of Healey Road
Town of Caledon

DRILLING DATE: August 16, 2017

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
234.8 / 0.0	Ground Surface			
	23 cm TOPSOIL	1A	DO	5
	Brown, firm to hard	1B	AS	
	weathered	2	DO	20
	SILTY CLAY TILL	3	DO	24
	some sand to sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders	4	DO	42
		5	DO	50/15
231.2 / 3.6	Grey, dense to very dense	6	DO	50/15
	brown grey	7	DO	50/15
		8	DO	55/15
		9	DO	60/15
	SILT	10	DO	58/15
		11	DO	50/15
		12	DO	43
	some clay, a trace of sand occ. clay layers	13	DO	67
		14	DO	66
		15	DO	50/15
		16	DO	64
222.1 / 12.7		17	DO	38
	END OF BOREHOLE			
	Installed 50 mm Ø monitoring well to 12.2 m completed with 3.0 m screen with filter sock Sand backfill from 8.5 m to 12.2 m Bentonite seal from 0.0 m to 8.5 m Provided with a protective steel monument casing			

Depth Scale (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Dynamic Cone (blows/30 cm) 10 30 50 70 90

Shear Strength (kN/m²) 50 100 150 200

Penetration Resistance (blows/30 cm) 10 30 50 70 90

Atterberg Limits PL LL

Moisture Content (%) 10 20 30 40

WATER LEVEL

Dry on completion
W.L. @ El. 233.7 m on August 17, 2017

Soil Engineers Ltd.

JOB NO.: 1707-S200

LOG OF BOREHOLE NO.: MW4-17S

FIGURE NO.: 6

PROJECT DESCRIPTION: Monitoring Wells Installation

METHOD OF BORING: Hollow-Stem

PROJECT LOCATION: East side of Humber Station Road, south of Healey Road
Town of Caledon

DRILLING DATE: August 16, 2017

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
234.8	Ground Surface							
0.0	**23 cm TOPSOIL**				0			
	Brown							
	weathered				1			
	SILTY CLAY TILL							
	some sand to sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders				2			
231.2					3			
3.6	Grey							
	brown grey				4			
	SILT							
	some clay, a trace of sand occ. clay layers				5			
228.8								
6.0	**END OF AUGER HOLE**				6			
	Installed 50 mm Ø monitoring well to 6.0 m completed with 3.0 m screen Sand backfill from 2.4 m to 6.0 m Bentonite seal from 0.0 m to 2.4 m Provided with a protective steel monument casing				7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			
					15			

Dry on completion
W.L. @ El. 233.6 m on August 17, 2017

Soil Engineers Ltd.

JOB NO.: 1707-S200

LOG OF BOREHOLE NO.: MW5-17D

FIGURE NO.: 7

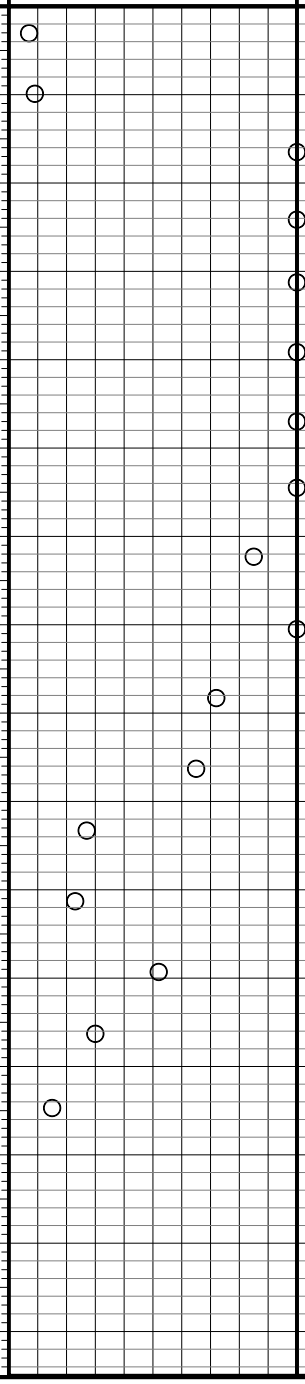
PROJECT DESCRIPTION: Monitoring Wells Installation

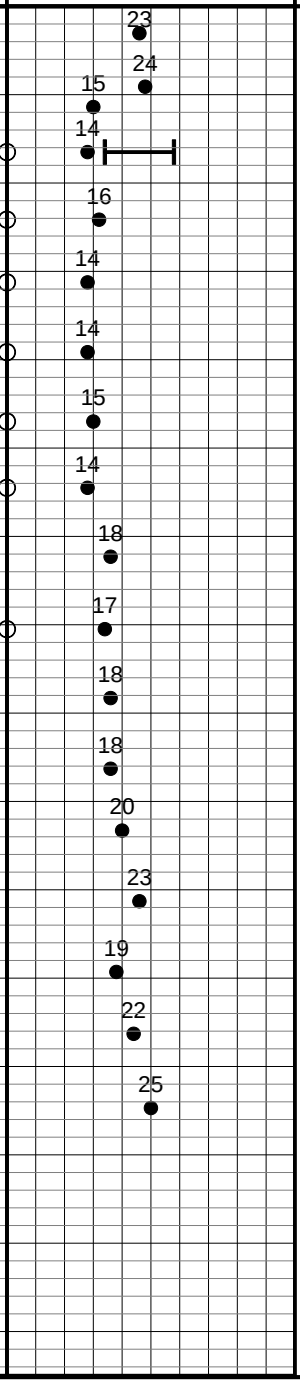
METHOD OF BORING: Hollow-Stem

PROJECT LOCATION: East side of Humber Station Road, south of Healey Road
Town of Caledon

DRILLING DATE: August 18, 2017

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
228.7	Ground Surface				
0.0	**1.1 cm FLOOD DEPOSIT**	1	DO	7	0
227.6 / 1.1	mixed with silty clay (weathered)	2A 2B	DO	9	1
	Brown, hard	3	DO	50/15	
	SILTY CLAY a trace of sand occ. wet silt seams and layers				2
226.6 / 2.1	Grey, compact to very dense	4	DO	50/8	
		5	DO	70/10	3
		6	DO	50/8	4
		7	DO	50/5	
	SILT	8	DO	50/15	5
		9	DO	85	6
		10	DO	50/15	7
	some clay, a trace of sand occ. clay layers (water seepage)	11	DO	72	8
		12	DO	65	
		13	DO	27	9
		14	DO	23	10
		15	DO	52	11
		16	DO	30	
		17	DO	15	12
216.0 / 12.7	**END OF BOREHOLE**				13
	Installed 50 mm Ø monitoring well to 12.2 m completed with 3.0 m screen with filter sock Sand backfill from 8.5 m to 12.2 m Bentonite seal from 0.0 m to 8.5 m Provided with a protective steel monument casing				14
					15







Soil Engineers Ltd.

JOB NO.: 1707-S200

LOG OF BOREHOLE NO.: MW5-17S

FIGURE NO.: 8

PROJECT DESCRIPTION: Monitoring Wells Installation

METHOD OF BORING: Hollow-Stem

PROJECT LOCATION: East side of Humber Station Road, south of Healey Road
Town of Caledon

DRILLING DATE: August 17, 2017

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
228.7	Ground Surface							
0.0	**1.1 cm FLOOD DEPOSIT**				0			
227.6	mixed with silty clay							
1.1	Brown **SILTY CLAY** a trace of sand occ. wet silt seams and layers				1			
226.6								
2.1	Grey				2			
	SILT				3			
	some clay, a trace of sand occ. clay layers				4			
					5			
222.7								
6.0	**END OF AUGER HOLE**				6			
	Installed 50 mm Ø monitoring well to 6.0 m completed with 3.0 m screen Sand backfill from 2.4 m to 6.0 m Bentonite seal from 0.0 m to 2.4 m Provided with a protective steel monument casing				7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			
					15			

Dry on completion

W.L. @ El. 222.9 m on August 18, 2017

Soil Engineers Ltd.

R.J. Burnside & Associates Limited
15 Townline, Orangeville, Ontario L9W 3R4
Telephone (519) 941-5331 Fax (519) 941-8120

LOG OF DRILLING OPERATIONS

MW7

Client: **Solmar Development Corp.**	Project Name: **Hydrogeological Investigation**	Logged by: **D. Wilson**
Project No.: **PTA 11575**	Location: **Caledon, Ontario**	Ground (m amsl): **228.60**
Drilling Co.: **Lantech Drilling Services Inc.**	Date Started: **11/7/2006**	Static Water Level (m amsl): **228.50**
Drilling Method: **Hollow Stem Auger**	Date Completed: **11/7/2006**	Sand Pack (m amsl): **226.10 - 223.00**

Depth Scale (ft)	Depth Scale (m)	Stratigraphic Description (Surface Elevation (m): **228.60**)	Strat. Plot	Depth (m)		SAMPLE Num.	Type	Int.	%Recov.	Depth Scale (ft)	Depth Scale (m)
		Light brown sandy silt TOPSOIL, moist. SS-1 (1, 2, 5, 8)		0.15		1	SS		50		
	1.0	Light brown, clayey SILT TILL with some stones. Grey halos, iron staining. Moist. SS-2 (6, 8, 13, 17) Increasing sand at 1.52 m. SS-3 (8, 24, 33, 50+)			bentonite seal	2	SS		75		1.0
5.0						3	SS		50	5.0	
	2.0	Light brown and black, medium SAND lense		1.83							2.0
		Light brown, clayey SILT TILL, with sand and stones. Fractured, loose, iron staining, moist. SS-4 (20, 50+) SS-5 (50+)		1.98		4	SS		50		
10.0	3.0				silica sand pack	5	SS		25	10.0	3.0
		Grey CLAY, dense, dry, friable. SS-6 (44, 50 +)		3.81		6	SS		25		
	4.0										4.0
15.0		SS-7 (38, 50+)			4.63	7	SS		25	15.0	
				4.87							

Prepared By: **S. Goemans** Checked By: **D. Gevaert** Date Prepared: **11/13/2006**

This borehole log was prepared for hydrogeological and/or environmental purposes and does not necessarily contain information suitable for a geotechnical assessment of the subsurface conditions. Borehole data requires interpretation by R. J. Burnside & Associates Limited personnel before use by others.

LEGEND
- Water found @ time of drilling
- Static Water Level - 1/11/2007

MONITORING WELL DATA
- Pipe: **51 mm dia. PVC**
- Screen: **51 mm dia. PVC #10 slot**

SAMPLE TYPE
- AC Auger Cutting
- CS Continuous
- RC Rock Core
- SS Split Spoon
- AR Air Rotary
- WC Wash Cuttings

BHLOG GUELPH P:\GINT\PROJECTS\PTA11575.GPJ TEMPLATE.GDT 31/05/07

LOG OF DRILLING OPERATIONS

MW8

R.J. Burnside & Associates Limited
15 Townline, Orangeville, Ontario L9W 3R4
Telephone (519) 941-5331 Fax (519) 941-8120

BURNSIDE

Client: **Solmar Development Corp.**	Project Name: **Hydrogeological Investigation**	Logged by: **S. Goemans**
Project No.: **PTA 11575**	Location: **Caledon, Ontario**	Ground (m amsl): **231.94**
Drilling Co.: **Lantech Drilling Services Inc.**	Date Started: **11/2/2006**	Static Water Level (m amsl): **231.460**
Drilling Method: **Hollow Stem Auger**	Date Completed: **11/6/2006**	Sand Pack (m amsl): **229.81 - 225.98**

Depth Scale (ft)	Depth Scale (m)	Stratigraphic Description (Surface Elevation (m): **231.94**)	Strat. Plot	Depth (m)		SAMPLE Num.	Type	Int.	%Recov.	Depth Scale (ft)	Depth Scale (m)
		Dark brown TOPSOIL, moist. SS-1 (2, 3, 4, 4)				1	SS		100		
		Yellow-brown and grey sandy SILT TILL, with pebbles and stones. Pockets of sand. Many fractures, grey along fractures, iron staining. Damp. SS-2 (8, 13, 18, 23)		0.20	bentonite seal	2	SS		100		
5.0	1.0									5.0	1.0
		Yellow brown and grey silty CLAY TILL, some pebbles and sand pockets. Dark brown iron oxidation halos, fractures, moist. SS-3 (8, 13, 15, 18)		1.52		3	SS		90		
	2.0										2.0
		Yellow brown sandy SILT TILL, lots of pebbles, pockets of sand. Vertical fractures, iron staining on fractures, moist. SS-4 (11, 16, 32, 53)		2.29		4	SS		100		
10.0	3.0				silica sand pack					10.0	3.0
						5	SS		70		
		Silty SAND lense. Wet.		3.35							
		Yellow brown sandy SILT TILL, lots of pebbles, pockets of sand. Vertical fractures with iron staining, moist. SS-5 (35, 33, 50+), SS-6 (42, 100 +)		3.42		6	SS		80		
	4.0										4.0
15.0		Grey CLAY, compact, parts along bedding planes. Moist. SS-7 (24, 75)		4.57		7	SS		100	15.0	
	5.0			5.18	5.08						5.0

Prepared By: **S. Goemans** Checked By: **D. Gevaert** Date Prepared: **11/13/2006**

This borehole log was prepared for hydrogeological and/or environmental purposes and does not necessarily contain information suitable for a geotechnical assessment of the subsurface conditions. Borehole data requires interpretation by R. J. Burnside & Associates Limited personnel before use by others.

LEGEND
- Water found @ time of drilling
- Static Water Level - 1/11/2007

MONITORING WELL DATA
- Pipe: **51 mm dia. PVC**
- Screen: **51 mm dia. PVC #10 slot**

SAMPLE TYPE
- AC Auger Cutting
- CS Continuous
- RC Rock Core
- SS Split Spoon
- AR Air Rotary
- WC Wash Cuttings

BHLOG GUELPH P:\GINT\PROJECTS\PTA11575.GPJ TEMPLATE.GDT 31/05/07

R.J. Burnside & Associates Limited
15 Townline, Orangeville, Ontario L9W 3R4
Telephone (519) 941-5331 Fax (519) 941-8120

LOG OF DRILLING OPERATIONS

MW9

Client: **Solmar Development Corp.**	Project Name: **Hydrogeological Investigation**	Logged by: **S. Goemans**
Project No.: **PTA 11575**	Location: **Caledon, Ontario**	Ground (m amsl): **235.69**
Drilling Co.: **Lantech Drilling Services Inc.**	Date Started: **11/6/2006**	Static Water Level (m amsl): **234.22**
Drilling Method: **Hollow Stem Auger**	Date Completed: **11/6/2006**	Sand Pack (m amsl): **232.53 - 229.46**

Depth Scale (ft)	Depth Scale (m)	Stratigraphic Description (Surface Elevation (m): **235.69**)	Strat. Plot	Depth (m)		SAMPLE Num.	Type	Int.	%Recov.	Depth Scale (ft)	Depth Scale (m)
		Dark brown TOPSOIL, moist. SS-1 (3, 3, 3, 8)		0.15		1	SS		40		
	1.0	Grey brown silty CLAY TILL, with pebbles and pockets of sand. Vertical fractures, iron staining, moist. SS-2 (6, 12, 18, 22)				2	SS		100		1.0
5.0		SS-3 (6, 12, 23, 29) SS-4 (9, 22, 32, 40) SS-5 (7, 19, 41, 50)			bentonite seal	3	SS		100	5.0	
	2.0					4	SS		100		2.0
10.0	3.0				silica sand pack	5	SS		100	10.0	3.0
	4.0	Brown silty SAND, coarse to medium sand, some gravel. Wet. SS-6 (30, 97)		3.81		6	SS		100		4.0
15.0		SS-7 (2, 7, 30, 40)				7	SS		100	15.0	
	5.0	Brown medium sand and gravel. Saturated. SS-8 (7, 18, 50)		5.18	5.45						5.0
		Grey CLAY, uniform, wet.		5.56		8	SS		100		
				5.86							

Prepared By: **S. Goemans** Checked By: **D. Gevaert** Date Prepared: **11/13/2006**

This borehole log was prepared for hydrogeological and/or environmental purposes and does not necessarily contain information suitable for a geotechnical assessment of the subsurface conditions. Borehole data requires interpretation by R. J. Burnside & Associates Limited personnel before use by others.

LEGEND
- Water found @ time of drilling
- Static Water Level - 1/11/2007

MONITORING WELL DATA
- Pipe: **51 mm dia. PVC**
- Screen: **51 mm dia. PVC #10 slot**

SAMPLE TYPE
- AC Auger Cutting
- CS Continuous
- RC Rock Core
- SS Split Spoon
- AR Air Rotary
- WC Wash Cuttings

BHLOG GUELPH P:\GINT\PROJECTS\PTA11575.GPJ TEMPLATE.GDT 31/05/07

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LOG OF BOREHOLE BH23-1A

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4854022.654 E 603114.946

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/18/2023

REF. NO.: 23-131-100
ENCL NO.: 2

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	ELEVATION
227.9 / 0.0	**TOPSOIL:** 250 mm	1	SS	6	
227.6 / 0.3	**FILL:** silty clay, trace gravel, some sand, brown, moist, firm (weathered/ disturbed)				
227.1 / 0.8	**SILTY CLAY TILL:** trace gravel, brown to grey, moist, very stiff cobbles/boulders	2	SS	19	
		3	SS	27	226
225.6 / 2.3	**SANDY SILT:** trace gravel, trace clay, brown to grey, moist to wet, dense to very dense	4	SS	50/ 127 mm	
		5	SS	50/ 127 mm	225
					224
222.8 / 5.1	**SILTY SAND:** grey, very moist, dense to very dense	6	SS	44	223
					222
		7	SS	50/ 127 mm	
220.1 / 7.8	cobbles/boulders at 7.6m	8	SS	50/ 76 mm	221
	END OF BOREHOLE:				

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level (mbgl) :
June 2, 2023	0.47

W. L. 227.4 m
Jun 02, 2023

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	8	39	47	6
	0	68	29	3

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

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LOG OF BOREHOLE BH23-1B

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4854022.193 E 603112.987

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/18/2023

REF. NO.: 23-131-100
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
227.9						
227.6 0.0	**TOPSOIL:** 250 mm	1	SS	6		
0.3 227.1	**FILL:** silty clay, trace gravel, some sand, brown, moist, firm (weathered/ disturbed)				W. L. 227.4 m Jun 02, 2023	
1 0.8	**SILTY CLAY TILL:** trace gravel, brown to grey, moist, very stiff cobbles/boulders	2	SS	19		
2 225.6		3	SS	27		226
2.3	**SANDY SILT:** trace gravel, trace clay, brown to grey, moist to wet, dense to very dense	4	SS	50/ 127 mm		225
3		5	SS	50/ 127 mm		
4 223.3						224
4.6	**END OF BOREHOLE:**					

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level (mbgl) :
June 2, 2023	0.47

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

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GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH23-2A

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4854489.984 E 603158.017

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/15/2023

REF. NO.: 23-131-100
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
228.0												
0.0 / 227.9	**TOPSOIL:** 350 mm											
0.4 / 227.1	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/disturbed)		1	SS	5							
0.9	**CLAYEY SILT TO SILTY CLAY TILL:** trace gravel, some sand to sandy, brown to grey, moist, stiff to very stiff		2	SS	12		227					
			3	SS	40		226					
			4	SS	25		225					
			5	SS	17	▽ W. L. 225.0 m Jun 02, 2023						
			6	SS	20		224					
223.4												
4.6	**END OF BOREHOLE:**											

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level (mbgl) :
June 2, 2023	3.01

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +³, ×³: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

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LOG OF BOREHOLE BH23-2B

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4854495.773 E 603180.461

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/15/2023

REF. NO.: 23-131-100
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GR	SA	SI	CL
226.1 / 0.0	**TOPSOIL:** 350 mm							
225.8 / 0.4	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/disturbed)	1	SS	5				
225.2 / 0.9	**SILTY CLAY TILL:** trace gravel, some sand to sandy, brown to grey, moist, stiff to hard	2	SS	12				
		3	SS	40				
		4	SS	25	4	21	46	29
		5	SS	17				
		6	SS	20				
221.3 / 4.8	**SANDY SILT TILL:** trace gravel, some clay, grey, moist, dense	7	SS	32				
220.0 / 6.1	**SILT:** some clay, trace sand, grey, very moist, very dense	8	SS	68	0	2	83	15
218.0 / 8.1	**END OF BOREHOLE:**	9	SS	73				

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level (mbgl) :
June 2, 2023	0.27

W. L. 225.9 m
Jun 02, 2023

DYNAMIC CONE PENETRATION RESISTANCE PLOT
SHEAR STRENGTH (kPa)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT
WATER CONTENT (%)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH23-3

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4854688.421 E 603023.917

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/15/2023

REF. NO.: 23-131-100
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS
230.1					
229.8 0.0	**TOPSOIL:** 300mm	1	SS	7	
0.3 229.3	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/disturbed)				
1 0.8	**CLAYEY SILT TO SILTY CLAY TILL:** trace gravel, some sand to sandy, brown to grey, moist, stiff to very stiff	2	SS	16	
2		3	SS	13	
3		4	SS	24	
		5	SS	20	
4					
5		6	SS	13	
6					
		7	SS	11	
7					
8 221.9		8	SS	19	
8.2	**END OF BOREHOLE** Notes: 1) Borehole was wet at bottom upon completion				

ELEVATION: 230, 229, 228, 227, 226, 225, 224, 223, 222

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

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LOG OF BOREHOLE BH23-4

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4854427.642 E 602975.932

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/15/2023

REF. NO.: 23-131-100
ENCL NO.: 7

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
228.6					
228.3 0.0	**TOPSOIL:** 250 mm	1	SS	6	228
0.3	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/disturbed)				
227.6 1.0	**CLAYEY SILT TO SILTY CLAY TILL:** trace gravel, some sand to sandy, brown to grey, moist, very stiff to hard	2	SS	23	227
2		3	SS	32	
3		4	SS	33	226
4		5	SS	20	225
5 223.4		6	SS	24	224
5.2	**SANDY SILT TO SILTY SAND:** trace clay, trace gravel, grey, moist to wet, very dense				
6		7	SS	82	223
7					222
8 220.6		8	SS	50/ 102 mm	221
8.0	**END OF BOREHOLE**				

Notes:
1) Borehole was wet at the bottom upon completion of drilling

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

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LOG OF BOREHOLE BH23-5

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4854258.493 E 602717.039

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/16/2023

REF. NO.: 23-131-100
ENCL NO.: 8

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
229.8 / 0.0	**TOPSOIL:** 250 mm	1	SS	7		229
0.3 / 228.8	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/disturbed)	2	SS	19		
1.0 / 227.5	**SILTY CLAY TILL:** trace gravel, sandy, brown, moist, very stiff	3	SS	25		228
2.3	**SILTY SAND:** trace to some clay, trace gravel, brown to grey, moist to wet, very dense	4	SS	81		227
		5	SS	50/ 102 mm		226
		6	SS	50/ 76 mm		225
		7	SS	50/ 102 mm		224
221.9		8	SS	50/ 150 mm		223
7.9	**END OF BOREHOLE**					222

Notes:
1) Borehole was wet at the bottom upon completion of drilling

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

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LOG OF BOREHOLE BH23-6

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4854451.62 E 602553.514

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/16/2023

REF. NO.: 23-131-100
ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
230.6												
230.4 0.0	**TOPSOIL:** 250 mm											
0.3	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/ disturbed)		1	SS	7		230					
229.6 1.0			2	SS	22							
2	**SILTY CLAY TILL:** trace gravel, sandy, brown, moist, very stiff to hard		3	SS	30		229					
228.3 2.3	**SANDY SILT TILL:** trace clay, trace to some gravel, brown, moist, very dense		4	SS	50/ 102 mm		228					
3			5	SS	89							
4							227					
226.0 4.6	**SILT:** trace to some clay, grey, moist to wet, dense to very dense		6	SS	50/ 127 mm		226					0 0 87 13
5												
6			7	SS	50/ 127 mm		225					
7							224					
8 222.4			8	SS	36		223					
8.2	**END OF BOREHOLE** Notes: 1) Borehole was wet at the bottom upon completion of drilling											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

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LOG OF BOREHOLE BH23-7A

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4854660.395 E 602727.063

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/16/2023

REF. NO.: 23-131-100
ENCL NO.: 10

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
230.9					
230.6 0.3	**TOPSOIL:** 250mm				
230.4 0.5	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/ disturbed)	1	SS	7	
1	**SILTY CLAY TILL:** trace gravel, some sand to sandy, brown to grey, moist, very stiff to hard	2	SS	19	230
2		3	SS	20	229
3		4	SS	44	228
4		5	SS	36	
5		6	SS	19	226
6					225
224.3		7	SS	50/ 102 mm	
6.6	**END OF BOREHOLE:**				

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level (mbgl) :
June 2, 2023	3.84

GROUND WATER CONDITIONS: W. L. 227.0 m Jun 02, 2023

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	2	18	48	32

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH23-7B

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4854646.705 E 602734.79

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/16/2023

REF. NO.: 23-131-100
ENCL NO.: 11

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
230.6 / 0.0	**TOPSOIL:** 250mm					
230.3 / 0.3	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/ disturbed)	1	SS	7	▽ W. L. 230.2 m Jun 02, 2023	
230.1 / 0.5	**SILTY CLAY TILL:** trace gravel, some sand to sandy, brown to grey, moist, very stiff to hard	2	SS	19		229
		3	SS	20		228
		4	SS	44		227
		5	SS	36		226
		6	SS	19		225
		7	SS	50/ 102 mm		224
223.0 / 7.6	**SILTY SAND TILL:** trace to some gravel, grey, moist, very dense	8	SS	50/ 127 mm		223
222.7 / 7.9	**END OF BOREHOLE:**					

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level (mbgl) :
June 2, 2023	0.33

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

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LOG OF BOREHOLE BH23-8

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4855013.645 E 602726.623

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/16/2023

REF. NO.: 23-131-100
ENCL NO.: 12

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
232.4					
232.0 0.0	**TOPSOIL:** 250 mm	1	SS	6	232
0.3	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/ disturbed)				
231.4 1.0	**CLAYEY SILT TO SILTY CLAY TILL:** trace gravel, sandy, brown to grey, moist, stiff to very stiff	2	SS	13	231
2		3	SS	25	
		4	SS	30	230
3		5	SS	26	229
4					
		6	SS	18	228
5					
226.3 6.1	**CLAYEY SILT:** trace sand, grey, moist, hard	7	SS	37	227
7					226
					225
8 224.2	shale pieces below 7.9 m	8	SS	47	
8.2	**END OF BOREHOLE**				

GROUND WATER CONDITIONS

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
0	4	75	21

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε_f=3% Strain at Failure

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

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LOG OF BOREHOLE BH23-9

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4854872.495 E 602606.891

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/17/2023

REF. NO.: 23-131-100
ENCL NO.: 13

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION
231.9 / 0.0	**TOPSOIL:** 250 mm		1	SS	6		
231.6 / 0.3	**CLAYEY SILT:** trace gravel, trace rootlets, trace organics, some sand, brown, moist, firm (weathered/disturbed)		2	SS	15		
231.1 / 0.8	**CLAYEY SILT TO SILTY CLAY TILL:** trace to some gravel, sandy, brown to grey, moist, very stiff to hard		3	SS	50/127 mm		
			4	SS	46		
			5	SS	27		
			6	SS	23		
			7	SS	50/127 mm		
223.9 / 8.0	**END OF BOREHOLE**		8	SS	50/127 mm		

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

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LOG OF BOREHOLE BH23-10

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4855584.585 E 601378.551

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/18/2023

REF. NO.: 23-131-100
ENCL NO.: 14

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
240.7					
240.0 0.0	**TOPSOIL:** 250 mm	1	SS	5	240
0.3 239.9	**FILL:** clayey silt, trace gravel, trace rootlets, trace organics, dark to brown, moist, firm (weathered/ disturbed)	2	SS	26	
1 0.8	**SILTY CLAY TILL:** trace gravel, some sand to sandy, brown to grey, moist, very stiff to hard	3	SS	26	239
2		4	SS	28	238
3		5	SS	40	
4					237
235.8		6	SS	50/ 102 mm	236
4.9	**SILTY SAND TILL:** some gravel, grey, moist, very dense				
6		7	SS	50/ 127 mm	235
7 233.1					234
232.8 7.9	**CLAYEY SILT:** trace sand, grey, moist, hard	8	SS	50/ 127 mm	233
	END OF BOREHOLE				

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
0	6	74	20

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

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LOG OF BOREHOLE BH23-11A

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4856064.747 E 601795.988

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/17/2023

REF. NO.: 23-131-100
ENCL NO.: 15

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
239.9							
239.8 0.0	**TOPSOIL:** 300 mm	1	SS	6			
0.3 239.0	**FILL:** clayey silt, trace gravel, trace rootlets, trace organics, brown, moist, firm (weathered/disturbed)	2	SS	17		239	
0.9	**SILTY CLAY TILL:** trace gravel, some sand to sandy, brown to grey, moist, very stiff to hard	3	SS	33		238	
		4	SS	32		237	4 19 44 33
		5	SS	46	W. L. 236.7 m Jun 02, 2023	236	
		6	SS	27		235	
233.8 6.1	**SANDY SILT TILL TO SILTY SAND TILL:** trace gravel, grey, moist, very dense	7	SS	50/ 102 mm		234	8 39 44 9
						233	
231.9 8.0	**END OF BOREHOLE:** Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water Level Readings: Date: Water Level (mbgl): June 2,2023 3.21	8	SS	50/ 127 mm		232	

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

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LOG OF BOREHOLE BH23-11B

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4856063.871 E 601794.919

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/17/2023

REF. NO.: 23-131-100
ENCL NO.: 16

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
239.9												
239.8 0.0	**TOPSOIL:** 300 mm											
0.3 239.0	**FILL:** clayey silt, trace gravel, trace rootlets, trace organics, brown, moist, firm (weathered/disturbed)		1	SS	6							
0.9	**CLAYEY SILT TO SILTY CLAY TILL:** trace gravel, some sand to sandy, brown to grey, moist, very stiff to hard		2	SS	17		239					
2			3	SS	33		238					
			4	SS	32	▽	W. L. 237.7 m Jun 02, 2023					
3			5	SS	46		237					
236.1 3.8	**END OF BOREHOLE:**											

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level (mbgl) :
June 2, 2023	2.21

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε_f=3% Strain at Failure

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

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LOG OF BOREHOLE BH23-12

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4856022.361 E 601586.587

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/18/2023

REF. NO.: 23-131-100
ENCL NO.: 17

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
240.9							
240.6 0.3	**TOPSOIL:** 250 mm		1	SS	6		
	FILL: clayey silt, trace gravel, trace organics, trace rootlets, some sand, brown, moist, firm to stiff (weathered/ disturbed)		2	SS	9		240
239.4 1.5	**SILTY CLAY TILL:** trace gravel, sandy, brown to grey, moist, very stiff to hard		3	SS	35		239
			4	SS	38		238
	trace oxidation at 3.1 m		5	SS	30		237
	trace sand at 4.6 m		6	SS	20		236
234.7 6.2	**SILTY SAND TILL:** trace to some gravel, some clay, grey, moist, very dense		7	SS	50/ 127 mm		235
							234
233.0 7.9	**END OF BOREHOLE**		8	SS	50/ 127 mm		233

Notes:
1) Borehole was wet at the bottom upon completion of drilling

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

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LOG OF BOREHOLE BH23-13

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4856241.237 E 601546.155

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/17/2023

REF. NO.: 23-131-100
ENCL NO.: 18

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
243.2 / 0.0	**TOPSOIL:** 300 mm				
242.9 / 0.3	**FILL:** clayey silt, trace gravel, trace rootlets, trace oxidation, trace organics, brown, moist, stiff	1	SS	13	243
242.3 / 0.9	**CLAYEY SILT TILL TO SILTY CLAY TILL:** trace gravel, some sand to sandy, brown to grey, moist, very stiff to hard	2	SS	23	242
		3	SS	33	
		4	SS	39	241
		5	SS	25	240
		6	SS	33	239
		7	SS	53	238
235.6 / 7.6					237
235.2 / 8.0	**SANDY SILT TILL:** trace clay, trace gravel, grey, moist to wet, very dense	8	SS	50/ 152 mm	236
	END OF BOREHOLE				

Notes:
1) Borehole was wet at the bottom upon completion of drilling

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

Log of Borehole: BH1

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE

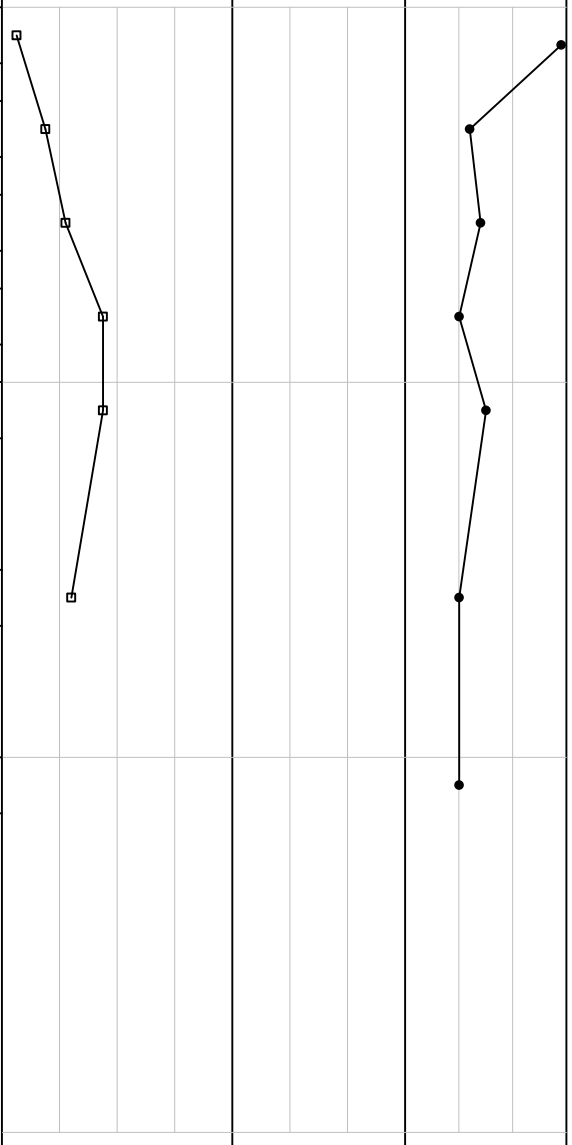
Depth (m)	Description	Elevation (m)
0	Ground Surface	239.28
	Topsoil Dark brown silt, trace sand, with organics - 150 mm	238.52
1	**Silt** Brown with some grey mottling clayey silt trace sand and gravel, with some oxidation, firm, WTPL	237.76
	Silt, some clay, trace sand and gravel, compact, moist	
2	Silt, trace sand, gravel and clay	237.00
	Brownish grey, dense	
3		236.24
	Grey, trace orange oxidation	
4		234.71
	compact	
5		
6		233.19
	Silt some sand and gravel, moist	232.73
	End of Borehole	
7	Borehole terminated at 6.6 mbgs.	
8		
9		

Monitoring Well Details: Bentonite, Riser, Silica sand, Screen

Water level = 5.47 mbgs, As measured on April 25, 2022

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value
SS	1	80	5
SS	2	100	15
SS	3	100	22
SS	4	100	35
SS	5	100	35
SS	6	100	24
SS	7	100	>50



Contractor: TEC

Grade Elevation: 239.28 masl

Drilling Method: Solid Stem Augers

Top of Casing Elevation: 240.36 masl

Well Casing Size: 51 mm

Sheet: 1 of 1

Log of Borehole: BH9

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	235.57
	Topsoil Dark brown silt, trace sand, with organics - 150 mm	234.81
1	**Silt** Brown with some grey mottling silt, some clay, trace sand with some oxidation, loose, moist	234.05
	Compact	
2	Silt, some clay, trace sand and gravel	233.28
	Dense	
3	Brownish grey silt, trace sand, gravel and clay	232.52
4		
		231.00
5	Grey, very dense	
6		229.02
7	End of Borehole	
	Borehole terminated at 6.6 mbgs.	
8		
9		

Monitoring Well Details: Riser, Bentonite, Silica sand, Screen

Water level = 1.78 mbgs, As measured on April 25, 2022

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value
SS	1	100	8
SS	2	100	25
SS	3	100	28
SS	4	100	37
SS	5	100	38
SS	6	100	56
SS	7	100	64

Standard Penetration N-Value: 20, 40, 60

Shear Strength kPa: 100, 200

Water Content %: 10, 20

Contractor: TEC **Grade Elevation:** 235.57 masl

Drilling Method: Solid Stem Augers **Top of Casing Elevation:** 236.69 masl

Well Casing Size: 51 mm **Sheet:** 1 of 1

Log of Borehole: BH12

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 16, 2022 **Project Manager:** SA

Depth (m)	Description	Elevation (m)
0	Ground Surface	237.15
	Topsoil Dark brown silt, trace sand, with organics - 150 mm	236.39
1	**Silt** Brown with some grey mottling silt, some clay, trace sand and gravel with some oxidation, loose, wet	235.63
	Reddish brown clayey silt, trace sand, very stiff, APL-WTPL	
2	Brown, silt some sand trace clay, compact, moist	234.86
	Greyish brown sandy silt, trace gravel, very dense	234.10
3	Silt some clay and sand, trace gravel, dense, moist	
4		232.58
	Wet, very dense	
5		
6		231.05
	Grey sandy silt some clay, trace gravel	230.60
	End of Borehole	
7	Borehole terminated at 6.6 mbgs.	
8		
9		

Monitoring Well Details: Bentonite, Riser, Silica sand, Screen

Water level = 1.15 mbgs, As measured on April 25, 2022

Sample Type	Sampler #	Recovery (%)	SPT N-Value
SS	1	100	8
SS	2	100	21
SS	3	100	15
SS	4	100	53
SS	5	100	30
SS	6	100	>50
SS	7	100	81

Standard Penetration N-Value: 20, 40, 60

Shear Strength: kPa, 100, 200

Water Content: %, 10, 20

Contractor: TEC **Grade Elevation:** 237.15 masl

Drilling Method: Solid Stem Augers **Top of Casing Elevation:** 238.17 masl

Well Casing Size: 51 mm **Sheet:** 1 of 1

Log of Borehole: BH13

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	237.42
	Topsoil Dark brown silt, trace sand, with organics - 150 mm	236.66
1	**Silt** Reddish brown with some grey mottling silt, some clay, trace sand, loose, wet	235.90
	Compact	
2	Silt, some clay, trace sand and gravel	
3		234.37
	Silt, trace sand, gravel and clay, dense, moist	
4		232.85
	Grey silt, trace sand and gravel	
5		
6		231.32
	End of Borehole	
7	Borehole terminated at 6.1 mbgs.	
8		
9		

Monitoring Well Details: Bentonite, Riser, Silica sand, Screen

Water level = 1.38 mbgs, As measured on April 25, 2022

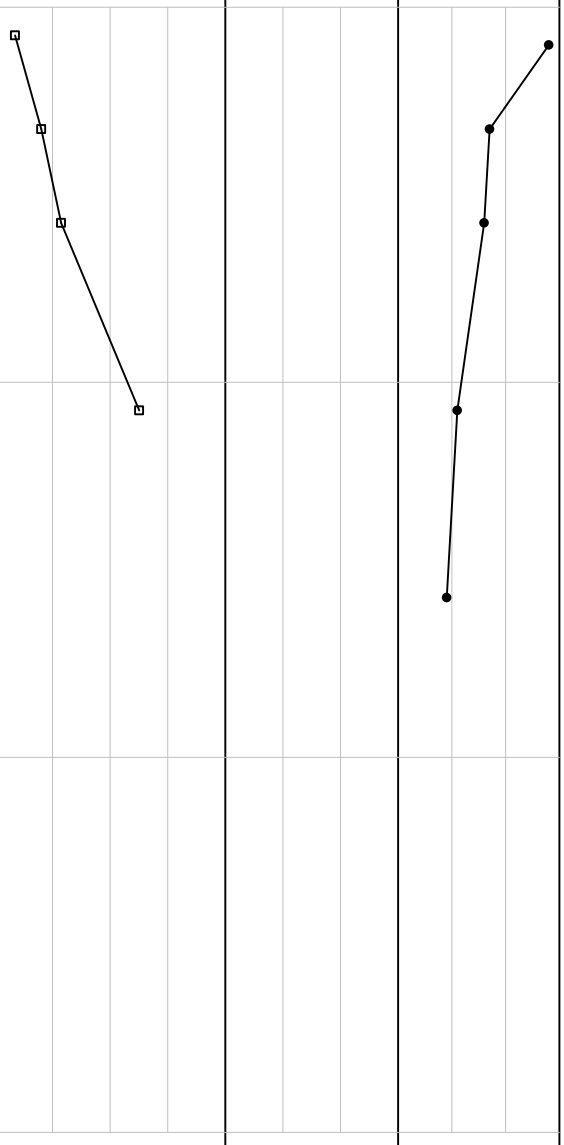
SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value
SS	1	80	7
SS	2	60	16
SS	3	50	23
SS	4	50	50
SS	5	10	>50

Standard Penetration N-Value (20, 40, 60)

Shear Strength kPa (100, 200)

Water Content % (10, 20)



Contractor: TEC **Grade Elevation:** 237.42 masl

Drilling Method: Solid Stem Augers **Top of Casing Elevation:** 238.49 masl

Well Casing Size: 51 mm **Sheet:** 1 of 1

Log of Borehole: BH15

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE

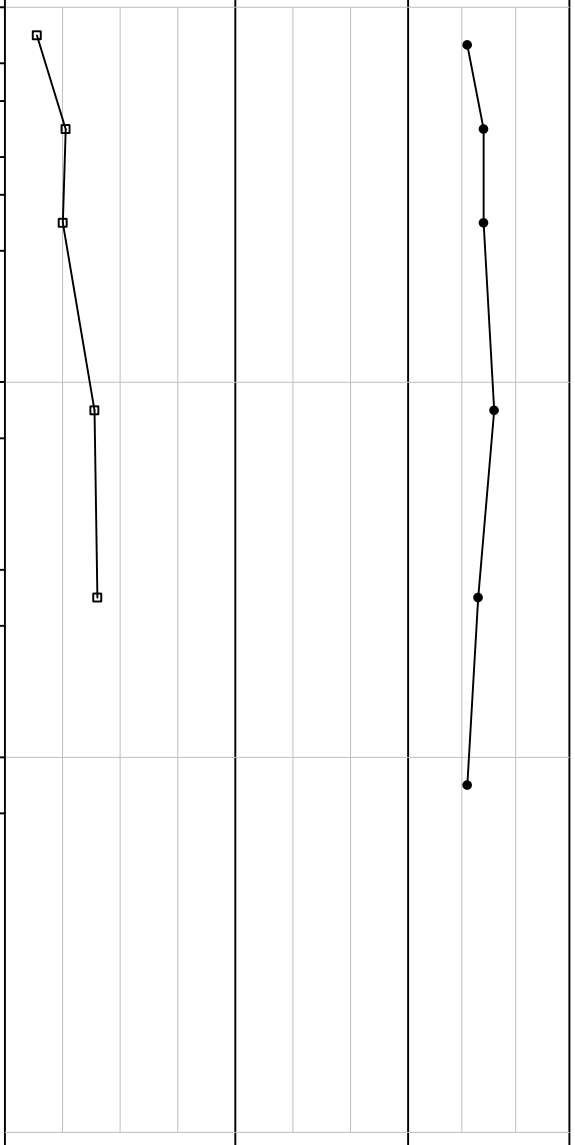
Depth (m)	Description	Elevation (m)
0	Ground Surface	234.02
	Topsoil Dark brown silt, trace sand, with organics - 150 mm	233.26
1	**Silt** Reddish brown clayey silt, trace sand and gravel, very stiff, APL	232.50
	brown silt, some clay, trace sand and gravel, compact, moist	
2	Reddish brown	
3	Greyish brown, dense	230.97
4		
5		
6	Grey silt, trace sand, very dense, moist	227.92
		227.47
	End of Borehole	
7	Borehole terminated at 6.6 mbgs.	
8		
9		

Monitoring Well Details: Bentonite, Screen, Silica Sand, Riser

Water level = 2.0 mbgs, as measured on April 25, 2022

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value
SS	1	100	11
SS	2	100	21
SS	3	100	20
SS	4	100	31
SS	5	100	32
SS	6	100	>50



Contractor: TEC

Drilling Method: Solid Stem Augers

Well Casing Size: 51 mm

Grade Elevation: 234.02 masl

Top of Casing Elevation: 235.12 masl

Sheet: 1 of 1

Log of Borehole: BH18

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	232.61
	Topsoil Dark brown silt, trace sand, with organics - 150 mm	231.85
1	**Silt** Reddish brown with some grey mottling clayey silt, firm, WTPL	231.09
	Mottled grey/brownsilt some clay, trace sand and gravel, compact, moist	
2	Silt, some clay, trace sand and gravel	
3	Dense	229.56
4		228.04
	Grey sandy silt, some clay, trace gravel	
5		
6		226.06
	End of Borehole	
7	Borehole terminated at 6.6 mbgs.	
8		
9		

Monitoring Well Details: Bentonite, Riser, Silica sand, Screen

Water level = 1.52 mbgs, As measured on April 25, 2022

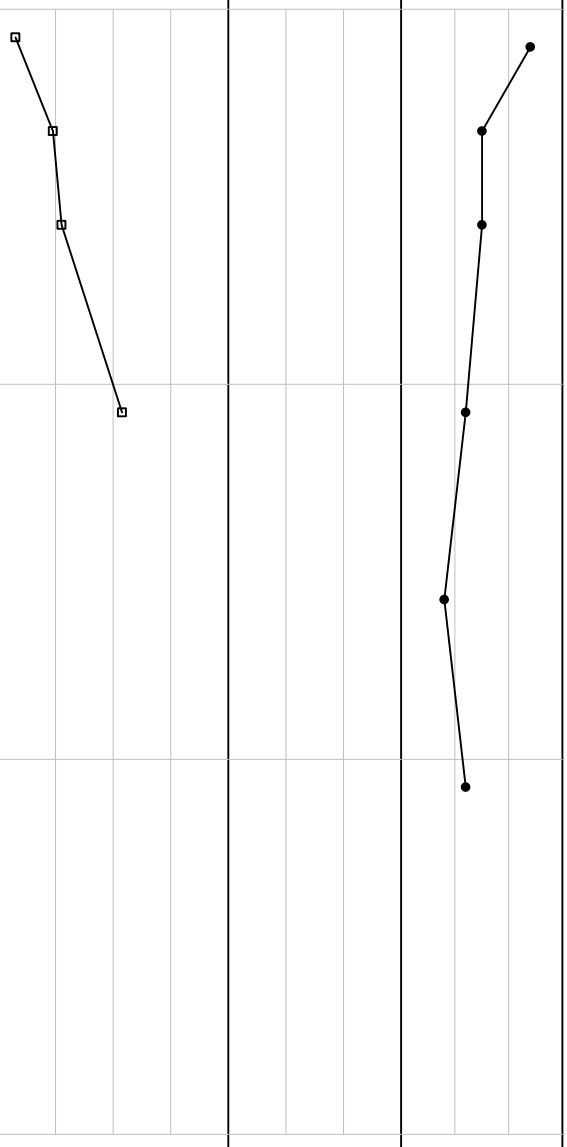
SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value
SS	1	75	6
SS	2	60	19
SS	3	80	22
SS	5	80	43
SS	6	20	>50
SS	7	10	>50

Standard Penetration N-Value (20, 40, 60)

Shear Strength kPa (100, 200)

Water Content % (10, 20)



Contractor: TEC **Grade Elevation:** 232.61 masl

Drilling Method: Solid Stem Augers **Top of Casing Elevation:** 233.66 masl

Well Casing Size: 51 mm **Sheet:** 1 of 1

Log of Borehole: BH103(MW)

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 27, 2023 **Project Manager:** JD

Depth (m)	Description	Elevation (m)	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)
0	Ground Surface	238.72					
	Topsoil Dark brown silt, trace sand, with organics - 150mm	0.00	SS	1	65	6	20.9
1	**Silty Clay Till** Brown with some grey mottling silty clay, trace gravel, firm, DTPL	237.20 1.52	SS	2	95	19	14.8
2	with black staining, trace oxidation, hard	236.44 2.29	SS	3	85	34	15.9
	trace gravel and rock, hard, APL	235.67 3.05	SS	4	80	31	13.4
3	trace orange oxidation, very stiff, DTPL		SS	5	100	27	13.1
4	Grey	234.15 4.57	SS	6	100	28	12.8
5							
6	**Silty Sand** Grey silty sand, trace gravel, very dense, moist	232.63 6.10	SS	7	100	>50	6.9
7	End of Borehole						
8	Borehole terminated at approximately 6.4 mbgs.						
9	Water Level Reading Date: May 26, 2023 Water Depth (mbgs): 0.6						
10							

Monitoring Well Details: Riser, Bentonite, Silica Sand, Screen

Standard Penetration N-Value: 20, 40, 60

Shear Strength: kPa, 100, 200

Sample ID

Soil Vapour Concentration (ppm)

Laboratory Analysis

Contractor: Geo-Environmental Drilling Inc.

Grade Elevation: 238.7 masl

Drilling Method: Split Spoon / Hollow Stem Auger

Top of Casing Elevation: N/A

Well Casing Size: 51 mm

Sheet: 1 of 1

Log of Borehole: BH108(MW)

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 31, 2023 **Project Manager:** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Description	Elevation (m)	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)
0	Ground Surface	236.71					
	Topsoil Dark brown silt, trace sand, with organics - 150mm	0.00	SS	1	55	12	16.4
1	**Silty Clay Till** Brown with some grey mottling silty clay, trace gravel, very stiff, DTPL	235.49 1.22	SS	2	55	16	16.3
2	trace layer of sand with black staining, trace orange oxidation		SS	3	75	19	15.4
			SS	4	80	16	15.4
3	trace grey mottling	233.66 3.05	SS	5	100	27	17.1
4							
5	trace rock	231.68 5.03	SS	6	100	26	15.1
6	Grey, hard, APL	230.62 6.10	SS	7	100	>50	11.1
	End of Borehole						
7	Borehole terminated at approximately 6.4 mbgs.						
	Water Level Reading Date: May 26, 2023 Water Depth (mbgs): 0.7						
8							
9							
10							

Monitoring Well Details: Riser, Bentonite, Silica Sand, Screen

Standard Penetration N-Value: 20, 40, 60

Shear Strength: kPa, 100, 200

Sample ID | Soil Vapour Concentration (ppm) | Laboratory Analysis

Contractor: Geo-Environmental Drilling Inc.

Grade Elevation: 236.7 masl

Drilling Method: Split Spoon / Hollow Stem Auger

Top of Casing Elevation: N/A

Well Casing Size: 51 mm

Sheet: 1 of 1

Log of Borehole: BH123

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 20, 2023 **Project Manager:** JD

Depth (m)	Description	Elevation (m)
0	Ground Surface	238.09
	Topsoil Dark brown silt, trace sand, with organics - 150mm	0.00 / 237.33
1	**Silty Clay Till** Brown silty clay with sand, trace gravel, firm, DTPL	0.76 / 236.57
2	with some grey mottling and black staining, trace orange oxidation, very stiff	1.52 / 235.80
	hard	2.29
3	trace black crystal	235.04
	Grey	3.05 / 234.43
	End of Borehole	3.66
4		
5	Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.	
6		
7		
8		
9		
10		

Monitoring Well Details: No Monitoring Well Installed

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value (20 40 60)	Shear Strength (kPa 100 200)	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	50	7			19.2			
SS	2	80	20			19.5			
SS	3	90	40			13.4			
SS	4	75	44			12.4			
SS	5	75	31			12.9			

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 238.1 masl

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** N/A

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH124

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 20, 2023 **Project Manager:** JD

Depth (m)	Description	Elevation (m)	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)
0	Ground Surface	239.14					
	Topsoil Dark brown silt, trace sand, with organics - 150mm	0.00 / 238.38	SS	1	50	7	23.5
1	**Silty Clay Till** Brown silty clay with sand, trace gravel, firm, DTPL	0.76 / 237.62	SS	2	75	24	16.6
2	with some grey mottling, trace rock, trace orange oxidation, very stiff	1.52 / 236.86	SS	3	100	28	16.0
	with black staining	2.29	SS	4	100	37	13.1
3	hard		SS	5	100	57	15.1
4		234.57					
	Sand Grey sand, trace silt, dense, moist	4.57	SS	6	15	40	12.7
5							
6		233.05					
	Sandy Silt Grey sandy silt, very dense, moist	6.10	SS	7	100	>50	6.3
7	End of Borehole						
8	Borehole terminated at approximately 6.4 mbgs.						
9	Water Level Reading Date — Water Depth (mbgs) May 26, 2023 — 1.5						
10							

Monitoring Well Details: Riser, Bentonite, Silica Sand, Screen

Standard Penetration N-Value: 20, 40, 60

Shear Strength: kPa, 100, 200

Sample ID

Soil Vapour Concentration (ppm)

Laboratory Analysis

Contractor: Geo-Environmental Drilling Inc.

Grade Elevation: 239.1 masl

Drilling Method: Split Spoon / Hollow Stem Auger

Top of Casing Elevation: N/A

Well Casing Size: 51 mm

Sheet: 1 of 1

Log of Borehole: BH160(MW)

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: February 8, 2023 **Project Manager:** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Description	Elevation (m)	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)
0	Ground Surface	234.19					
	Topsoil Dark brown silt, trace sand, with organics - 255mm	0.00 / 233.43	SS	1	50	4	20.2
1	**Silty Clay Till** Brown silty clay, some sand, soft, APL	0.76 / 232.67	SS	2	65	19	12.4
	trace gravel, very stiff	1.52 / 231.91	SS	3	80	28	13.3
2	with some grey mottling and black staining, trace orange oxidation	2.29	SS	4	100	28	12.0
	layer of sand	231.15					
3	hard	3.05	SS	5	100	40	9.8
4		229.62					
	Sandy Silt Grey sandy silt, trace gravel, very dense, moist	4.57	SS	6	75	>50	6.7
5							
6		228.10					
	Silt Grey silt, trace sand, very dense, moist	6.10	SS	7	100	>50	12.2
7	End of Borehole						
8	Borehole terminated at approximately 6.4 mbgs.						
9	Water Level Reading Date: May 26, 2023 — Water Depth (mbgs): 1.0						
10							

Monitoring Well Details: Riser, Bentonite, Silica Sand, Screen

Standard Penetration N-Value: 20, 40, 60

Shear Strength: kPa, 100, 200

Sample ID | Soil Vapour Concentration (ppm) | Laboratory Analysis

Contractor: Geo-Environmental Drilling Inc.

Grade Elevation: 234.2 masl

Drilling Method: Split Spoon / Hollow Stem Auger

Top of Casing Elevation: N/A

Well Casing Size: 51 mm

Sheet: 1 of 1

Log of Borehole: BH161(MW)

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: February 8, 2023 **Project Manager:** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Description	Elevation (m)	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)
0	Ground Surface	232.78					
	Topsoil Dark brown silt, trace sand, with organics - 255mm	0.00 / 232.02	SS	1	60	6	15.4
1	**Silty Clay Till** Brown silty clay, firm, APL	0.76 / 231.26	SS	2	80	17	15.1
	with some grey mottling, trace gravel, very stiff	1.52 / 230.50	SS	3	75	28	12.3
2	with black staining, trace orange oxidation	2.29 / 229.28	SS	4	40	31	11.4
	Brown, hard, DTPL	3.51 / 228.21	SS	5	65	49	9.3
3	trace rock	4.57 / 226.69	SS	6	70	20	8.4
4	Grey, very stiff	6.10 / 226.08	SS	7	100	31	17.8
5	hard	6.71					
6	End of Borehole						
7	Borehole terminated at approximately 6.7 mbgs.						
8	Water Level Reading Date: May 26, 2023 — Water Depth (mbgs): 0.6						
9							
10							

Monitoring Well Details: Riser, Bentonite, Silica Sand, Screen

Standard Penetration N-Value: 20, 40, 60

Shear Strength: kPa 100 200

Sample ID | Soil Vapour Concentration (ppm) | Laboratory Analysis

Contractor: Geo-Environmental Drilling Inc.

Drilling Method: Split Spoon / Hollow Stem Auger

Well Casing Size: 51 mm

Grade Elevation: 232.8 masl

Top of Casing Elevation: N/A

Sheet: 1 of 1

Log of Borehole: BH168(MW)

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: February 2, 2023 **Project Manager:** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Description	Elevation (m)	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)
0	Ground Surface	231.95					
	Topsoil Dark brown silt, trace sand, with organics - 150mm	0.00	SS	1	50	5	17.2
1	**Silty Clay Till** Brown with some grey mottling silty clay with sand, trace gravel, firm, APL	230.43 1.52	SS	2	50	19	14.8
2	with black staining, trace orange oxidation, very stiff	229.67 2.29	SS	3	65	24	12.3
	Brown		SS	4	100	26	14.0
3	Grey	228.91 3.05	SS	5	65	27	13.4
4							
5			SS	6	65	24	15.4
6	No recovery	225.86 6.10	SS	7	0	47	N/A
		225.25 6.71					
7	End of Borehole						
	Borehole terminated at approximately 6.7 mbgs.						
8	Water Level Reading Date Water Depth (mbgs) May 26, 2023 0.8						
9							
10							

Monitoring Well Details: Riser, Bentonite, Silica Sand, Screen

Standard Penetration N-Value: 20, 40, 60

Shear Strength: kPa 100 200

Sample ID | Soil Vapour Concentration (ppm) | Laboratory Analysis

Contractor: Geo-Environmental Drilling Inc.

Grade Elevation: 232.0 masl

Drilling Method: Split Spoon / Hollow Stem Auger

Top of Casing Elevation: N/A

Well Casing Size: 51 mm

Sheet: 1 of 1

APPENDIX G-2 GUELPH PERMEAMETER TESTING

Memo

SUBJECT
Infiltration Testing – Humber Station Village – Option 6 Lands

DATE
June 13, 2024

DEPARTMENT
Resilience

COPIES TO
Schaeffers, GEI

TO
Humber Station Village Landowner Group Inc.

OUR REF
141438

PROJECT NUMBER
141438

NAME
Mustafa Ghassan / Robert Robero
Delta Urban

Project Background and Understanding

Arcadis Professional Services (Canada) Inc. was retained by Humber Station Village Landowners Group Inc. ('Client') for completing infiltration testing in support of the design of proposed stormwater management (SWM) facilities for their site located at the northeast quadrant of Humber Station Road and Mayfield Road, in the Township of Caledon (Bolton).

Based on the August 2021 General Plans prepared by Schaeffers Consulting Engineers (Schaeffers), three (3) proposed locations of Low Impact Development (LID) / SWM facilities were identified across the Site.

Infiltration Testing

The infiltration testing work plan was designed following the requirements from the *Low Impact Development Stormwater Management Planning and Design Guide, Appendix C – Site Evaluation and Soil Testing Protocol for Stormwater Infiltration* (TRCA, 2012). The TRCA guideline indicates that at least one (1) test should be conducted at the proposed bottom elevation of the infiltration measures, plus additional tests at every other soil horizon encountered within 1.5m below the proposed bottom elevation. Therefore, a minimum of two (2) tests per test pit are recommended by TRCA. As the proposed LID / SWM facilities cover a large surface area, it is assumed that these may be large infiltration features such as a dry pond. As such, the infiltration tests were completed at depths of approximately 2.5 metres below ground surface (mbgs) and 3.5mbgs.

Testing Locations

Five (5) test pits were excavated on June 6 and June 7, 2024, using a John Deere 50G excavator at the potential infiltration LID / SWM locations to facilitate the infiltration testing at the Site. The details of each test pit are summarized in **Table 1**. The locations and approximate ground elevations of the test pits are shown on **Figure 1**. Photos of the test pits and infiltration test results are included in **Appendix E**.

Groundwater seepage was encountered at both test pits at approximately 2.5 mbgs. The groundwater levels observed in the test pits were consistent with the shallow groundwater level at nearby monitoring wells (BH14 and BH1), which ranged between 2.18 mbgs (139.18 masl) to 4.25 mbgs (136.14 masl) based on the measurements collected on June 30, 2020. It should be noted that infiltration tests are not feasible when excavations extend below the groundwater level.

Table 1 Test Pit Details

Test Pit ID	Easting	Northing	Existing Ground Elevation (masl)	Test Pit Depth and Floor Elevation	Soil Condition
Test Pit 1 – Excavation 3	603015	4854582	~228	2.5m, ~225.5 masl / 3.5m, ~224.5 masl	0.5m topsoil/fill, underlain by brown to grey clayey silt to silty clay till to 3.5m
Test Pit 2 – Excavation 3	603107	4854530	~228	2.5m, ~225.5 masl / 3.5m, ~224.5 masl	0.5m topsoil/fill, underlain by brown to grey clayey silt to silty clay till to 3.5m
Test Pit 3 – Excavation 2	602235	4854735	~231	2.5m, ~228.5 masl / 3.5m, ~227.5 masl	0.4m topsoil, underlain by brown to grey silty clay till to 3.5m
Test Pit 4 – Excavation 1	601762	4855861	~238	2.5m, ~235.5 masl / 3.5m, ~234.5 masl	0.2m topsoil, followed by 0.7m of fill, underlain by brown to grey silty clay till to 3.5m
Test Pit 5 – Excavation 1	601799	4855893	~238	2.5m, ~235.5 masl / 3.5m, ~234.5 masl	0.3m topsoil, followed by 0.6m of fill, underlain by brown to grey silty clay till to 3.5m

Test Procedure

For each infiltration test, a well hole was augured using a 6cm diameter hand auger on the floor of the test pit to a depth range between 12cm and 30cm. Infiltration tests were performed in the well hole using a Guelph Permeameter. The device maintains a constant water depth in the well hole using the Marriott Principle. The water that infiltrates into the ground is replenished by the Guelph Permeameter reservoir and the rate of water level drop in the reservoir is indicative of the infiltration rate at the well hole. Therefore, the infiltration rate is estimated by measuring the change in water level in the Guelph Permeameter reservoir until steady state is reached (minimum three (3) consecutive intervals with same, or similar change in water level). The saturated hydraulic conductivity of the soil is estimated based on the steady-state infiltration rate.

Estimated Soil Hydraulic Conductivity and Infiltration Rate

The field saturated hydraulic conductivity (K_{fs}) was calculated using the “Guelph Permeameter Calculator” spreadsheet obtained from the Soil Moisture website[1]. The calculation requires input of water height in the well hole (H), well hole radius (a), the Guelph Permeameter reservoir cross-section area, the steady state rate of water level drop in the Guelph Permeameter reservoir (R) and selection of a microscopic capillary length factor (α*) based on the soil texture-structure category.

A shape factor (C) is required to calculate the field saturated hydraulic conductivity. The shape factor for each water head is based on the microscopic capillary length factor. For all calculations, a microscopic capillary length factor of 0.04cm^{-1} was selected, which is representative of soils that are fine textured (clayey or silty),

[1] http://www.soilmoisture.com/home.php

unstructured and may include some fine sand. Based on a microscopic capillary length factor of 0.04cm^{-1}, the specific equation to calculate the shape factor is as follows:

$$C = \left(\frac{H/a}{1.992 + 0.091(H/a)}\right)^{0.683}$$

The steady state infiltration rate (Q) is also required to calculate the field saturated hydraulic conductivity. It is estimated using the steady state rate of water level drop in the Guelph Permeameter reservoir and the corresponding cross-section area of the reservoir. For tests where only the inner reservoir (cross-section area of 2.16cm^2) was used due to the low infiltration rate, the corresponding equation used to determine the steady state infiltration rate is as follows:

$$Q = R \times 2.16$$

For tests where the combined reservoirs were used (both inner and outer reservoir, with cross-section area of 35.22cm^2), the following equation was used to determine the steady state infiltration rate:

$$Q = R \times 35.22$$

Once the shape factor and steady state infiltration rate was determined, the saturated hydraulic conductivity at each well hole was calculated using the following equation:

$$K_{fs} = \frac{C \times Q}{2\pi H^2 + \pi a^2 C + 2\pi\left(\frac{H}{\alpha *}\right)}$$

The overburden at the Site consists mainly of clayey silt to silty clay till materials with estimated saturated hydraulic conductivity range between 1.48 x 10^{-9} cm/s and 2.44 x 10^{-4} cm/s, with geometric means ranging between 3.18 x 10^{-8} cm/s and 3.95 x 10^{-6} cm/s. The details of the saturated hydraulic conductivity calculation are summarized in **Table 2.**

Table 2 Summary of the Estimated Saturated Hydraulic Conductivity

Test ID	Water Height in Well Hole (cm)	Guelph Permeameter Reservoir Used	Steady State Rate of Water Level Change in Guelph Permeameter Reservoir (cm/min)	K_{fs} (cm/s)	Geometric Mean K_{fs} (cm/s)
Test Pit 1, ~2.5m	20	Inner	0.11	1.53 x 10^{-4}	3.95 x 10^{-6}
Test Pit 1, ~3.5m	5	Inner	0.001	1.02 x 10^{-7}	
Test Pit 2, ~2.5m	25	Inner	0.001	2.10 x 10^{-6}	1.15 x 10^{-7}
Test Pit 2, ~3.5m	10	Combined	0.4	6.27 x 10^{-9}	
Test Pit 3, ~2.5m	10	Combined	0.25	1.48 x 10^{-9}	6.01 x 10^{-7}
Test Pit 3, ~3.5m	5	Combined	0.001	2.44 x 10^{-4}	
Test Pit 4, ~2.5m	15	Combined	0.001	4.20 x 10^{-8}	4.20 x 10^{-8}
Test Pit 4, ~3.5m	15	Combined	0.001	4.20 x 10^{-8}	
Test Pit 5, ~2.5m	25	Combined	0.001	2.41 x 10^{-8}	3.18 x 10^{-8}
Test Pit 5, ~3.5m	15	Combined	0.001	4.20 x 10^{-8}	

The saturated hydraulic conductivity measured using the Guelph Permeameter will need to be converted to infiltration rates (T) for the purpose of designing the LID / SWM facilities. The approximate relationship presented in the *Low Impact Development Stormwater Management Planning and Design Guide* (TRCA and CVC, 2012) was used for the conversion:

$$K_{fs} = 6 \times 10^{-11} \times (1/T)^{3.7363}$$

The converted infiltration rate results are summarized in **Table 3**.

Table 3 Estimated Infiltration Rate at Each Location

Test ID	Geometric Mean Percolation (mm/hour)	Ratio of Measured Mean Infiltration Rates	Safety Factor (TRCA, 2012)	Design Infiltration Rate (mm/hour)
Test Pit 1	19	0.0067	2.5	**7.8**
Test Pit 2	8	0.003	2.5	**3.0**
Test Pit 3	12	16600	8.5	**1.4**
Test Pit 4	6	1	2.5	**2.3**
Test Pit 5	5	1.74	3.5	**1.5**

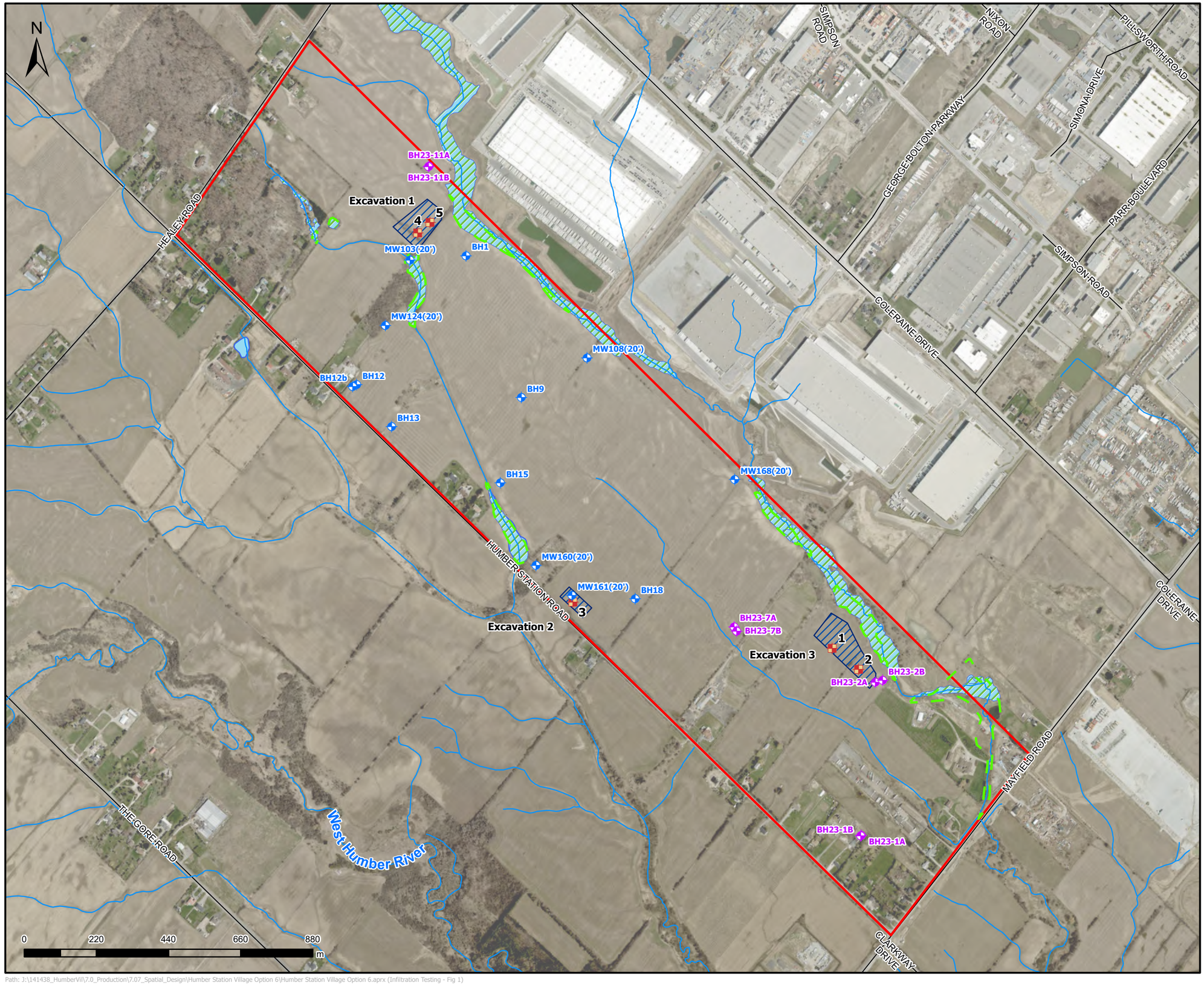
Appropriate safety factor specified in the *Low Impact Development Stormwater Management Planning and Design Guide* should also be applied to the estimated infiltration rate when designing infiltration BMPs to account for the natural variation in infiltration rate. After applying the recommended safety factors, the corresponding infiltration rate for the clayey silt to silty clay till materials ranged between 1.4mm/hour and 7.8mm/hour.

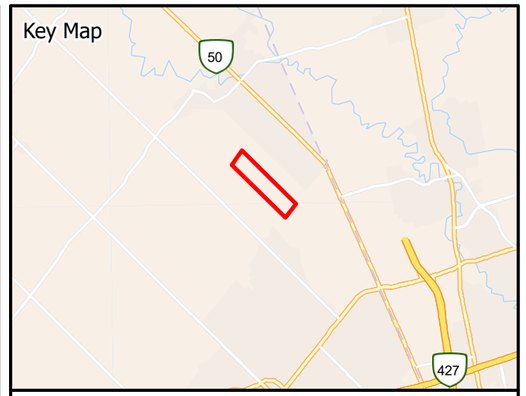
Based on the infiltration tests, the estimated infiltration rates for the clayey silt to silty clay till materials encountered at the locations of Test Pit 1 to Test Pit 5 were lower than the 15mm/hour threshold specified in the *Stormwater Management Planning and Design Manual*, which indicate the Site may not be suitable for implementation of infiltration best management practices (BMPs).

It should be noted that groundwater levels from nearby monitoring wells were also measured for further information about groundwater levels. As shown in **Figure 1**, monitoring well BH161(MW) was installed in the proposed area of the LID / SWM facility (Excavation 2) approximately 12.6m northwest of Test Pit 3. On June 7, 2024, the groundwater level measured 0.497mbgs. A nested monitoring well, BH23-2A (shallow) and BH23-2B (deep), were installed approximately 60m southeast of Test Pit 2. These monitoring wells were installed at a depth of 4.6mbgs and 7.6mbgs and groundwater levels measured 0.045mbgs and -0.031mbgs, respectively.

Based on the results of the infiltration tests and a review of the existing Site conditions, the feasibility for implementing infiltration LIDs at the Site may also be limited due to the high groundwater table observed near the test areas. Additional field infiltration tests may be required to confirm the soil infiltration rates if any alternate locations or depths for infiltration LID / SWM facilities are proposed in future.

Enc. Figure 1 – Infiltration Test Pit Location Map





Legend

- Study Area
- Test Pit
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Watercourse/Drainage
- Roads
- Wetland
- Proposed SWM Faciliry
- Waterbody
- Pinchin Borehole/Monitoring Wells
- DS Consultant Monitoring Wells

Figure 1

Infiltration Test Pit Location Map

Infiltration Testing Memo -
Humber Station Village - Option 6 Lands
Township of Caledon (Bolton) Ontario

ARCADIS

Project #: 141438

Date: June 2024