GEI Consultants

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 Ltd.
Schaeffers Consulting Engineers
Arcadis Professional Services (Canada) Inc.

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SCHAEFFERS CONSULTING ENGINEERS
SCHAEFFER & ASSOCIATES LTD.

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Issues and Revisions Registry

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Table of Contents

Appendices

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Executive Summary

The Humber Station Employment Area is a new Employment Area in the Town of Caledon which will accommodate population growth to 2031. According to the Peel Region Official Plan, 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 236 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 Peel Region Official Plan identifies the lands as part of the Urban System, within the Bolton Residential Settlement Area. The Peel Region Official Plan designates the Study Area as an Employment Area.

The in-force Caledon Official Plan designates the majority of the Study Area as Prime Agricultural Area, as well as Environmental Policy Area, while the new Caledon Official Plan is being updated to align with the new Regional Official Plan it will continue to defer to the in-force OP (1978, 2024 consolidation) for lands within the Bolton Settlement Area.

In 2023, OPA 274 was approved which outlined that Secondary Plan requirements are to be inclusive of a local Subwatershed Study (SWS) or a CEISMP, in accordance with an approved Town Terms of Reference. The Terms of Reference for this CEISMP was submitted to the TRCA and the Town in January 2022 and approved in August 2022.

Similar to a SWS, The CEISMP is a comprehensive planning framework that describes how a wide range of elements of development will be addressed. This CEISMP will align with OPA 274 inclusive of an Environmental Impact Study 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 Policy Statement (PPS; MMAH 2020) and applicable Region of Peel and Town of Caledon Official Plan policies.

This Phase 1 report fulfils the first of three phases of the CIESMP in support of the 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 ccomprehensive implementation plan, monitoring plan, and adaptive management plan.

The Study Area is predominantly active agriculture, with scattered residential estates fronting onto the bordering roads, and a tributary of the West Humbe River (Clarkway Drive Tributary) and its associated valley along the east boundary.

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 end of the Study Area boundary. The Tributary exhibits permanent flow, while other drainage features present are Headwater Drainage Features (HDFs) that generally flow intermittently or ephemerally.
- Numerous field investigations were completed to characterize existing conditions. **Tables 8** (**Appendix C1**) and **C2-1** (**Appendix C2**) include an extensive list of fieldwork undertaken from 2017 to 2023 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.
- 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 help 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 determine sizing for the proposed drainage realignment and wetland compensation areas, as well as water elevations and extent of the floodplain mapping.
- Vegetation (Ecological Land Classification) mapping 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 majority of the tablelands are dominated by active agricultural uses and residential uses that have been present on the landscape for decades.
- Three wetlands in the Study Area were determined by GEI to meet the criteria for significance as per the Ontario Wetland Evaluation System as identified on **Figure 4a** (**Appendix A1**). Two significant wetlands are located in the valley of the Clarkway Drive Tributary, and the third 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.
- Six small tableland wetlands occur in the Study Area, which GEI determined to not meet the criteria for significance (**Figure 4a**, **Appendix A1**). All of these wetlands are associated with HDF-3, with the exception of a small historical agricultural pond (MAS2-1) in the north portion of the Study Area. For the participating lands, these wetlands were determined to have common and secure species present.

- Two forest communities in the Study Area are considered to be significant woodlands. The northwest woodlot, located within non-participating lands, is a deciduous forest and includes a 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. Surveys of natural features, including top-of-bank, wetlands, and dripline of woodland communities were staked 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 partially confined valley corridor containing two significant wetlands. The tributary and associated wetlands are considered to provide contributing habitat for Redside Dace.
- 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 and none of the feature has riparian habitat. No fish were captured or observed in HDF-8, however it provides contributing habitat for Redside Dace.
- 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 of 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 3.5** of the CEISMP. The wildlife species occurring in the Study Area were generally found to consist of common and secure species (ranked S5).
- Two Endangered or Threatened species or their habitat have been identified within or adjacent to the Study Area: Redside Dace and Bank Swallow. Redside Dace contributing habitat occurs within the Clarkway Drive Tributary, its associated riparian wetland communities and HDF-8. Bank Swallow foraging habitat occurs 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.
- 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. Headwater drainage features (HDFs) within the Study Area were assessed using the CVC/TRCA Evaluation, Classification, and Management of Headwater Drainage Features 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**).

- The CEISMP has 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/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 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) provided input and review of the policy components of the CEISMP.

The Study Area is approximately 236 ha, located in the West Humber River watershed, and generally bound by Healey Road to the west, 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 surrounds 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 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, and the identification of the 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 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 Peel Region Official Plan identifies the lands as part of the Urban System, within the Bolton Residential Settlement Area. The Peel Region Official Plan designates the Study Area as an Employment Area.

The Study Area is located within the Bolton Settlement Area, as per the in-force Caledon Official Plan (1978, consolidated 2024), and is designated as New Employment Area and Highway 413 Transportation Corridor towards the southwest and has Environmental Policy Area 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")., T While a Future Caledon Official Plan has been drafted, it states that the 1978 Official Plan, as per the last consolidation, provides the policy framework for the Bolton Settlement Area including this Secondary Plan Area.

Reflective of the Caledon Official Plan (2024 consolidation) 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). The lands will be rezoned to permit employment uses though the proceeding development process.

1.2 Purpose

The CEISMP characterizes the biophysical environment and identifies constraints and opportunities to 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 the Provincial Policy Statement (PPS; MMAH 2020) and applicable Region of Peel and Town of Caledon Official Plan policies.

The CEISMP serves to:

- Provide characterization of existing environmental conditions;
- Address the relevant natural features and functions identified in the PPS, 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;
- 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's Official Plan 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 Humber Station lands (i.e., 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 4b** (**Appendix A1**).

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);
- 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 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;
- Final Report Humber River Hydrology Update (TRCA, 2018b) for Future Condition;
- 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);
- TRCA/CVC Low Impact Development Stormwater Management Planning and Design Guide (2010);
- Geotechnical Engineering Design and Submission Requirements (TRCA, November 2007);
- Technical Guide for River & Stream Systems: Erosion Hazard Limit (MNRF, 2002);
- Ministry of the Environment Water Well Records;
- Consolidated Linear Infrastructure Environmental Compliance Approval for the Corporation of the Town of Caledon (ECA No. 324-S701);
- Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under and Environmental Compliance Approval (MECP, v.2.0, May 31, 2023);
- 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); and
- 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)

2. Planning and Environmental Policy Context

2.1 Existing Policies, Guidelines, and Legislation

The Humber Station Study Area is subject to the planning policy framework, including direction related to environmental matters, established by the Province, the Region and the Town under the *Planning Act.* As well, consideration was given to *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 requirements of the following regulatory agencies, local municipality, and/or legislation:

- Provincial Policy Statement (PPS; MMAH 2020);
- A Place to Grow: Growth Plan for the Greater Golden Horseshoe (and Amendment No. 1 2020) (The Growth Plan for the Greater Golden Horseshoe 2019 was prepared and approved under the Places to Grow Act, 2005.);
- *Conservation Authorities Act*, Ontario Regulation (O. Reg.) 41/24 and Toronto and Region Conservation Authority (TRCA) The Living City Policies (2014);
- Peel Region's Official Plan (2022);
- Town of Caledon Official Plan (Consolidation 2018);
- *Endangered Species Act* (ESA; 2021 Consolidation of S.O. 2007, c. 6);
- *Fisheries Act* (R.S.C., 1985, c. F-14);
- *Migratory Birds Convention Act* (1994);
- *Federal Species at Risk Act* (2002);
- *Fish and Wildlife Conservation Act* (1997);
- Significant Wildlife Habitat Technical Guide (2000); and
- Redside Dace Development Guidance (2016) and Thermal Mitigation Checklist for Stormwater Management Ponds Discharging into Redside Dace Habitat (MNRF, 2014)

<u>Provincial Policy Framework</u>

Provincial Policy Statement (2020)

The Provincial Policy Statement 2020 (PPS) provides direction related to the creation of "efficient land use and development patterns which support sustainability by promoting strong, liveable, healthy and resilient communities, protecting the environment and public health and safety and economic growth" (PPS Section 1.0).

This report addresses those policies that are specific to Natural Heritage (section 2.1) 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 1.1; Sewage, Water and Stormwater, section 1.6.6; Water, section 2.2; Natural Hazards, section 3.1).

Eight types of significant natural heritage features are defined in the PPS, as follows:

- Significant wetlands;
- Significant coastal wetlands;
- Significant woodlands;
- Significant valleylands;
- Significant wildlife habitat;
- Fish habitat;
- Habitat of endangered and threatened species; and
- Significant areas of natural and scientific interest (ANSIs).

Development and site alteration shall not be permitted in significant wetlands, or in significant coastal wetlands. Development and site alteration shall not be permitted in significant woodlands, significant valleylands, significant wildlife habitat or significant ANSIs, unless it is demonstrated that there will be no negative impacts on the natural features or their ecological functions.

Development and site alteration shall not be permitted in the habitat of endangered and threatened species or in fish habitat, except in accordance with provincial and federal requirements. Development and site alteration may be permitted on lands adjacent to fish habitat provided it has been demonstrated that there will be no negative impacts on the natural feature or their ecological functions.

The Province released a draft Provincial Planning Statement (draft PPS) on April 10, 2024; while this has not been adopted to-date, the intention for this document is to replace both the current PPS (2020) and *A Place to Grow: Growth* Plan *for the Greater Golden Horseshoe (*2020*).* The April 10th 2024 draft does not propose any changes to natural heritage policies in the PPS (2020) as identified above. There are some minor definition changes proposed in the draft PPS including the following:

- “Habitat of Endangered Species and Threatened Species”” definition was added to describe “habitat within the meaning of Section 2 of the *Endangered Species Act*, 2007”;
- “Negative Impacts” are defined in the context of specific ecological or natural heritage provisions;
- “Significant” has be redefined to remove references to the MNRF, and instead refers to “*evaluation criteria and procedures established by the Province, as amended from time to time*”; and
- Wetlands are redefined to exclude “*periodically soaked or wetlands being used for agricultural purposes which no longer exhibit wetland characteristics are not considered to be wetlands for the purposes of this definition*.”

These above changes are not in force and effect as of the date of submission; however, consideration of these changes will be considered throughout the SWS to ensure the SWS addresses all relevant PPS provisions should it be approved during the Secondary Plan application process.

A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2020)

A Place to Grow (2020) provides guidelines for sustainable growth and development for the geographic Greater Golden Horseshoe (GGH) area in southern Ontario into 2051. This area of Ontario has diverse ecological and hydrological environments as well as fertile farmland; *A Place To Grow* provides a framework guiding where and how communities will grow in the GGH with the goal of doing so while encouraging economic prosperity and environmental protection. This Plan builds on the policies within the *PPS* with an emphasis on more specific policies for the GGH.

A Place To Grow identifies a “Natural Heritage System for the Growth Plan” which is based on extending the NHS within the *Greenbelt Act* to include natural heritage features (core areas) and natural corridors (linkages) for the entire GGH area; this is required to be included in all Official Plans and has been integrated into the existing and future Town of Caledon’s Official Plan (2024 Consolidation; Draft Future Caledon 2024). In general, development/site alteration is not permitted in key natural heritage or key hydrologic features (Section 4.2.3.1). A VPZ of 30 m is also required for KHFs, fish habitat, and significant woodlands (Section 4.2.4.1). There is no Growth Plan NHS or VPZ that overlaps with the Study Area.

In addition to the “Natural Heritage System for the Growth Plan”, municipalities are expected to protect other natural heritage features and areas in a manner that is consistent with the PPS. Of note, the Draft PPS (2024, discussed previously) is expected to replace the existing *PPS* and *A Place to Grow*.

Toronto and Region Conservation Authority

Effective April 1, 2024, Ontario Regulation (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. O. Reg. 41/24 allows Conservation Authorities to implement Section 28 *Conservation Authorities Act, 1990* (amended 2024), which states under Section 28(1) that:

> 28 (1) *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. 2017, c. 23, Sched. 4, s. 25.

Pursuant to O. Reg. 41/24, any interference with or development in or on areas stated in the *Conservation Authorities Act* (e.g., hazardous lands, wetlands, river or stream valleys) 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 hazardous lands, wetlands, shorelines and areas susceptible to flooding, and associated allowances were found within, or adjacent to, the boundaries of the Study Area. Pursuant O. Reg 41/24, any development in or on areas defined in the Regulation requires permission from TRCA. Regulated areas occur within the Study Area and are associated with several drainages of the West Humber River (Refer to **Figure 3**, **Appendix A1**) as well as Clarkway Drive Tributary.

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; 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.

The Region of Peel Official Plan

The Region of Peel Official Plan (RPOP; 2022) outlines strategies to guide growth and development in the Region.

The Study Area is designated as 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, 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 Greenland System are defined as:

a) significant wetlands;
b) significant coastal wetlands;
c) woodlands meeting one or more of the criteria for Core Area woodland in Table 1 of the Region of Peel OP;
d) ESA;
e) Provincial Life Science ANSI;
f) Escarpment Natural Areas of the Niagara Escarpment Plan; and
g) valley and stream corridors meeting one or more of the criteria for Core Area valley and stream corridors in Table 2 of the Region of Peel OP.

NAC are defined as:

a) evaluated non-provincially significant wetlands and coastal wetlands;
b) woodlands meeting one or more of the criteria for NAC woodland in Table 1 1 of the RPOP;
c) significant wildlife habitat;
d) fish habitat;
e) habitat of aquatic species at risk;
f) habitat of endangered and threatened species;
g) regionally significant life science ANSI;
h) provincially significant earth science ANSI;
i) Escarpment Protection Areas of the Niagara Escarpment Plan;
j) the Lake Ontario shoreline and littoral zone and other natural lakes and their shorelines;
k) any other valley and stream corridors that have not been defined as part of the Core Areas;
l) sensitive headwater areas and sensitive ground water discharge areas; and
m) any other natural features and functional areas interpreted as part of the Greenlands System Natural Areas and Corridors.

PNAC are defined as:

a) unevaluated wetlands and coastal wetlands;
b) 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;
c) any other woodlands greater than 0.5 hectares;
d) regionally significant earth science ANSI;
e) sensitive ground water recharge areas;
f) portions of Historic shorelines;
g) open space portions of the Parkway Belt West Plan Area;
h) enhancement areas, buffers and linkages; and
i) any other natural features and functional areas interpreted as part of the Greenlands System Potential Natural Areas and Corridors, 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.

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 include:

i. inventory components and refine the boundaries of the Greenlands System features and areas;
ii. establish limits of development and site alteration in relation to the Greenlands System's natural heritage features and areas requiring protection;
iii. assess the potential environmental impacts of the development and site alteration;
iv. make recommendations to avoid, minimize, and mitigate impacts; and
v. 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 Peel OP ("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.

<u>The Town of Caledon Official Plan</u>

Under the Town of Caledon Official Plan (TCOP; Consolidation 2018), the Study Area is located within the Bolton Settlement Area and is designated as New Employment Area, contains a Highway 413 Transportation Corridor towards the southwest, and has Environmental Policy Area 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 Environmental Policy Areas (EPA) as per Schedule C-7 (“Coleraine West Employment Area Land Use Plan”). EPAs includes all Natural Core Areas and Natural Corridors as outlined in Table 3.1 (“Ecosystem Framework”) in Section 3.2 of the OP including:

- Woodlands;
- Wetlands;
- Niagara Escarpment Natural Areas;
- Areas of Natural and Scientific Interest (ANSIs);
- Environmentally Significant Area's (ESAs);
- Threatened and Endangered Species;
- Wildlife Habitat;
- Fisheries;
- Valley and Stream Corridors;
- All Oak Ridges Moraine Key Natural Heritage Features and Hydrologically Sensitive Features; and
- All Greenbelt Key Natural Heritage Features and Key Hydrologic Features.

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. Minor refinements to the limits of lands designated EPA, may be permitted without an amendment to the OP, provided they are satisfactory to the Town and other relevant agencies. Major modifications to the limits of lands designated EPA shall only occur through an amendment to the OP. Proposed new development adjacent to EPA will be required to complete an EIS and MP.

In general, the EIS and MP shall:

a) Identify existing ecosystem forms, functions and integrity within EPA, and further refine the limits of EPA;
b) 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;
c) Assess the anticipated immediate and longer-term environmental impacts of the proposal and to identify all mitigation measures;
d) Demonstrate how the proposed development satisfies the environmental policies and performance measures contained in the OP;
e) Recommend site-specific protection, enhancement, restoration and management programs, and recommend appropriate mechanisms for implementing such programs; and
f) Provide base line environmental data which will support environmental monitoring programs.

Endangered Species Act

The provincial *Endangered Species Act, 2007* (ESA; October 2021 Consolidation) was developed to:

- Identify Species at Risk (SAR), based upon best available science;
- Protect SAR and their habitats and to promote the recovery of the SAR; and
- Promote stewardship activities that would support those protection and recovery efforts.

The ESA protects all threatened, endangered and extirpated species listed on the Species at Risk in Ontario (SARO) list. These species are legally protected from harm or harassment, and their associated habitats are legally protected from damage or destruction, as defined under the ESA.

Fish and Wildlife Conservation Act (1997)

The provincial *Fish and Wildlife Conservation Act* (1997) 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 conflict with the *Endangered Species Act,* the Act that provides provisions offering the most protection prevail.

Fisheries Act

Fisheries and Oceans Canada (DFO) administers the federal *Fisheries Act,* 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).

Migratory Birds Convention Act

Environment and Climate Change Canada (ECCC) administers the *Migratory Birds Convention Act,* 1994 (amended 2017), 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 *Migratory Birds Convention Act* 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 there are no bird nests present within the work area rests with the proponent of the activity.

Species at Risk Act

The *Species at Risk Act* (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 identified in Schedule 1 of SARA. SARA is administered by Fisheries and Oceans Canada for aquatic species. Where Species at Risk are listed on Schedule 1 of the Federal SARA and are also listed on the Species At Risk in Ontario (SARO) List as Threatened or Endangered, they are offered provincial protection under the Ontario *Endangered Species Act* (ESA).

Significant Wildlife Habitat Technical Guide (2000)

The Significant Wildlife Habitat Technical Guide (2000) was established in response to the original PPS to support the identification of significant wildlife habitat as one of the natural heritage features and areas that is to be protected. This reference manual provides technical guidance to facilitate the “identification, description, and prioritisation of significant wildlife habitat (SWH)” for consideration in *Planning Act* applications. Where candidate SWH is identified within the Study Area, this technical guide will be used for the evaluation of the habitat and to support subsequent natural heritage planning decisions in alignment with the PPS.

Redside Dace Development Guidance (2016)

The MNRF prepared the Redside Dace Development Guide (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. It is expected that these guidelines will be referenced for relevant Redside Dace habitat within the Study Area.

Thermal Mitigation Checklist for Stormwater Management Ponds Discharging into Redside Dace Habitat (MNRF, 2014)

In addition to the development guidance document for areas with Redside Dace habitat, the MNRF also prepared a Thermal Mitigation Checklist for Stormwater Management Ponds Discharging into Redside Dace Habitat. 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 occupied habitat maintain adequate temperatures and water quality. The thermal checklist should be used to ensure appropriate stormwater management design elements are incorporated.

3. Characterization of Existing Conditions

Existing conditions fieldwork was completed as part of the CEISMP on participating lands. This included extensive inventories and assessments listed in **Table C2-1** (**Appendix C2**). This data base provides all necessary fieldwork to characterize existing conditions and provide inputs to the CEISMP and 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 Oak Ridges Morane Groundwater Program (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)**. Relevant 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 was 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 was 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;
- Arcadis completed additional monitoring in 2022 and 2023 as part of the current study;
- In 2022 and 2023, Pinchin and DS Consultants were retained by the Landowner Group and Prologis, respectively, to complete geotechnical studies in different portions of the Study Area. Available water level data from these studies have been incorporated in the current study; and

- Palmer Environmental, on behalf of Prologis, completed additional groundwater monitoring of accessible monitoring wells installed by Pinchin across the Study Area in 2022 and 2023.

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 to the 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 a riparian meadow marsh and meadow shallow marsh vegetation communities.

Two other incised Headwater Feature Drainages occur within the Study area.

- One headwater drainage feature (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 was dry by late spring.
- One headwater drainage feature (HDF-3) is located extending 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 tributary and headwater drainage features are illustrated on **Figure A2-1** (**Appendix A2**).

3.1.2 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 has been 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 correspond 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 deposits are provided as **Figure A2-2** and **Figure A2-3** (**Appendix A2**).

A narrow area of modern (i.e., post-glacial) 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.

3.1.3 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.

3.1.4 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.

3.1.5 Overburden Thickness

In general, overburden thickness is interpreted to range from approximately 3 m to 30 m. Ministry of the Environment, Conservation and Parks (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 3.1.4** indicates that the overburden thickness may be up to 70 m thick within the potential valley feature across the Study Area. As noted above, the buried bedrock valley would need to be confirmed through additional drilling within the Study Area.

3.1.6 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 the 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.

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 deposits consist mainly of sand and gravel. The unit is water bearing and occurs at elevations between typically between approximately 230 masl and 260 masl. Locally, it may exist as a confined aquifer unit underlying the surficial Halton Till aquitard. 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 3.1.4**.

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.

3.1.7 Local Geology and Hydrostratigraphy

Borehole logs from the drilling programs were reviewed to interpret the local geological and hydrostratigraphic conditions across the Study Area.

- 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 8 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 12 m. This dense silt to sandy silt till layer may represent the lower portion of the Halton Till or the Newmarket Till.
- 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.

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 Site using Arcadis and RJB borehole data and is presented as **Figure A2-5** (**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 3.1.6** may be present within the deeper buried bedrock valley feature. This would need to be confirmed through additional drilling investigations.

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.

3.1.8 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 on 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. 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 not completed. It is noted that hydraulic conductivity testing for ORM deposits from for IWA Site C-34B (Golder, 1994) ranged from 2 x 10^{-8} m/s to 6 x 10^{-7} m/s, which may be considered relatively low for a potential aquifer. Similarly, Golder (1994) indicated the hydraulic conductivity in the Georgian Bay Formation ranged from 3 x 10^{-8} m/s to 2 x 10^{-7} m/s. The upper portions of the Georgian Bay Formation at the overburden contact tend to be fractured giving rise to relatively greater hydraulic conductivities.

3.2 Local Hydrogeology

3.2.1 Monitoring Well Groundwater Levels and Vertical Hydraulic Gradients

Location and depth details of the available monitoring wells used in this study are provided in **Table C2-2** (**Appendix C2**) and illustrated on **Figure A2-6** (**Appendix A2**).

- RJB installed three monitoring wells (MW7, MW8, MW9) to depths up to approximately 5 metres below ground surface (mbgs) as part of that investigation.
- Five monitoring wells (MW1-17, MW2-17S/D, MW3-17, MW4-17S/D, and MW5-17S/D) at the Study Area were installed 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, BH23-7A/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.

Available monitoring well water level data collected by Arcadis or others is presented in **Table C2-3** (**Appendix C2**). It should be noted that water level data is not available from all the Pinchin monitoring wells. 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 (244.7 masl) was measured in MW1-17 near the northeastern corner of the Site on April 23, 2018. The lowest water level (227.6 masl) was measured in MW7 near the southwestern corner of the Site on September 22, 2017. 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 A2-7** (**Appendix A2**).

Based on available water level data, depths to water level were generally shallow and ranged from 0.6 m above ground surface at MW5-17D to 3.8 mbgs at BH23-7A. An interpolated depth to groundwater map is provided as **Figure A2-8 (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 or Thorncliffe Formation. As such, artesian conditions may also be present in other areas of the Site where the overlying till unit is thin.

Vertical hydraulic gradients were estimated at seven monitoring well nests (MW2-17S/D, MW4-17S/D, MW5-17S/D, BH23-1A/B, BH23-2A/B, BH23-7A/B, and BH23-11/AB). 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, and BH23-1A/B, located in the north, central and south portions of the Study Area, respectively. Conversely, MW5-17S/D and BH23-11A/B had upward hydraulic gradients, with artesian conditions being observed at MW5-17S/D. Both MW5-17S/D and BH23-11A/B are in proximity to the Clarkway Drive Tributary. Monitoring well nest BH23-2A/B was noted to show variable hydraulic gradients further south of MW5-17S/D along the Clarkway Drive Tributary.

Table C2-4 (**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 on **Figure A2-9** (**Appendix A2**).

3.2.2 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. Given the likelihood that construction dewatering discharge (if required) will be directed to the on-site watercourse, the analytical results were compared with the Ontario Provincial Water Quality Objectives (PWQO). Various groundwater exceedances of the PWQO were identified from each monitoring well as summarized in **Table C2-5** (**Appendix C2**).

3.2.3 Mini-Piezometer Groundwater Levels and Vertical Hydraulic Gradients

Nested mini-piezometers were installed by Arcadis in 2017 within riparian wetlands and headwater drainage features to measure groundwater levels and evaluate groundwater levels, vertical hydraulic gradients, and possible groundwater-surface water interactions. Surface water monitoring locations are illustrated on **Figure A2-10 (Appendix A2)**.

The mini-piezometers were installed as part of a surface water monitoring program, discussed in **Section 3.2.4**. All mini-piezometers consisted of 1.9 cm diameter galvanized steel pipe with an 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 C2-6** (**Appendix C2**). Streambed dataloggers were also installed at the 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 monitoring piezometer data collected by Arcadis and others is presented in **Tables C2-7** and **C2-8** (**Appendix C2**). Water levels, where available, range from depths of 0.2 m above ground surface to 1.1 m. It should be noted that a number of mini-piezometers installed within headwater drainage features were commonly dry including SF2-17 (HDF-8) 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.

- Mini-piezometer nest SF3-17 located in the Clarkway Drive Tributary at the southeast portion of the Study Area showed predominantly upward gradients during the monitoring event. The feature is in the unevaluated wetland and drainage feature along the eastern boundary of the Study Area (Clarkway Drive Tributary). Monitoring well MW5-17, which also has upward gradients is also located nearby within the Clarkway Drive Tributary valley and associated riparian wetland. Groundwater discharge is interpreted to be occurring in this area.
- Station SF6-17, 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. This may represent a permanent stream classification in these areas.
- SF5-17 located in the HDF-3 drainage feature on the west side of the Study Area has upward gradients during the spring and may also receive groundwater discharge for a portion of the year. WL1-17 within a wetland 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.
- SF-4D was dry during all but one monitoring event during 2018 and 2018. This is interpreted to be representative of an overall downward gradient. The lack of groundwater in the deeper piezometer is disconnected from the groundwater table during that time and groundwater would not have been discharging to HDF-3 at that time.

Table C2-9 (**Appendix C2**) summarizes the calculated vertical hydraulic gradients at the piezometer nests for the water level monitoring events.

3.2.4 Groundwater Surface Water Interactions

3.2.4.1 Surface Water Flow and Baseflow

A surface water monitoring network was set up across the Study Area by Arcadis to measure surface water flow under baseflow conditions. Arcadis installed nine (9) 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 Site. Surface water monitoring locations are illustrated on **Figure A2-10 (Appendix A2).**

Baseflow conditions were analyzed to further understand groundwater contribution to the on-site features. Baseflow can be described as 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 (Stanfield, 2010) indicates 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.
- **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.

Nine (9) surface water monitoring stations (i.e., stream flow and staff gauges) were installed in July 2017, in coordination with the mini-piezometer installations. These included seven stream flow stations (SF1-17, SF2-17, SF3-17, SF4-17, SF5 17, SF6-17, and SF7-17) installed along the Clarkway Drive Tributary, HDF-3, and HDF-8, and two wetland monitoring stations (WL1-17 and WL2-17). The locations of the surface water monitoring stations are illustrated on **Figure A2-10** (**Appendix A2**).

Based on the analysis of meteorological data obtained from Environment Canada Toronto International Airport Climate Station (ID No. 71624) 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 the on-site headwater drainage features (HDF-3 and 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 the Ontario Stream Assessment Protocol Version 8 (Stanfield, 2010).

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) were generally lower.

Table C2-10 (**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 on **Figure A2-11** (**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 (SF3-17), and downstream (SF6-17). 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
- 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 (SF3-17) 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.

Flow was observed within this tributary during each monitoring event and upward gradients indicative of groundwater discharge were noted at the three 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, the estimated stream water levels and stream flows show a response to precipitation events, which indicates that storm flows (surface water runoff) provide for 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 Site: up-stream (SF1-17); mid-stream (SF417), 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 determined 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 the headwater drainage feature at SF4-17 and SF5-17 may be losing water through infiltration or discharge to other receivers (e.g., riparian wetlands) across the Site before reaching SF5-17.

Duringduring the September 2023 monitoring event, stations SF1-17, SF417, 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 based on the upward gradients noted in the mini-piezometer during spring (see **Section 3.2.3**).

Based on the streamflow observations presented above and the vertical hydraulic gradient data, presented in **Section 3.2.3**, 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 the headwater drainage feature.

Additional monitoring data may be required to assess the impact of the beaver dam on flow conditions.

Also, based on the streambed datalogger data available from 2017 and 2018, 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 the drainage feature.

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 was dry or had standing water by May/June (depending on the year). It was then completely dry in the summer. Two additional observational stations (SF9-22 and SF11-22) were established in 2022 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. Based on recorded precipitation events with >5 mm/day on May 2, 2023, May 3, 2023, and minor precipitation on May 5, 2023, this flow is interpreted to represent runoff and not baseflow. GEI ecologists similarly recorded that much of this feature is ploughed through and none of the feature has riparian habitat.

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

3.2.4.2 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. The analytical results were compared with PWQOs to identify potential exceedances of water quality criteria. Results of the comparative analysis identified an exceedance of the PWQO for total phosphorus in all three samples. Water samples from SF5-17 and SF6-17 exceeded PWQO criteria for phenols-4AAP and total iron.

All other analyzed parameters met the applicable standards. Various surface water exceedances of the PWQO were identified from each monitoring well as summarized in **Table C2-11** (**Appendix C2**). A summary of the analytical results and laboratory certificates of analysis are provided in **Appendix C2**.

3.2.5 Areas of Groundwater Recharge and Discharge

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 3.2.6.**

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 may occur where stream reaches have incised through the Halton Till and into the ORM sediments or where the Halton Till is fractured, and the underlying ORM aquifer is pressurized. This discharge can be variable and is subject to the quantity of water being recharged from up-gradient. ORMGP regional mapping of potential discharge suggested a portion of the Clarkway Drive Tributary along the middle section of the eastern Study Area boundary was interpreted as a groundwater discharge area. Portions of the Clarkway Drive Tributary south of Mayfield Road were also interpreted to be groundwater discharge areas.

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 located adjacent to the Clarkway Drive Tributary in the southern portion of Study Areas is an artesian well with consistent upward hydraulic gradients. This may be representative of pressurized conditions from the ORM aquifer, in an area where the overlying Halton Till is thin.
- The other nested monitoring wells (MW2-17S/D, and MW4-17S/D) were observed with downward vertical hydraulic gradients, indicating groundwater recharge conditions.
- Downward hydraulic gradients observed in most of the mini-piezometer nests suggest that the wetland and the stream features on-site are not receiving groundwater discharge and are unlikely to be groundwater dependent.
- Mini-piezometer SF3-17 in the southeast portion of the Study Area within the Clarkway Drive Tributary showed predominantly upward gradients during the monitoring events. Station SF6-17, 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, which is located within the Clarkway Drive Tributary further north in the Study Area showed predominantly downward gradients.
- Mini-piezometer SF5-17 located in the HDF-3 drainage feature upward gradients during the spring and may also receive groundwater discharge for a portion of the year. Mini-piezometer WL1-17 within a wetland 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.

3.2.6 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 time period. Any difference between the inflows to the system and the outflows from the system during this time 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, which indicates that most of the Study Area is considered a groundwater rechange area with annual average recharge rates varying from approximately 100 mm/year to 120 mm/year. This is a low to moderate recharge rate and reflects 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 with 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.

3.2.6.1 Methodology

A site scale water balance analysis for each area 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, topography.

The Albion Field Centre station (ID# 6150103) is the closest meteorological station to the Site. The 30-year climate normal is considered as the dataset most representative of Site conditions. 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 pre-development pervious area are based current conditions at 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 a building or paved lands in the future. The lands to be occupied by roadways, including the future highway expansion, are also considered to be impervious.

In both the pre-development and post-development scenario, evapotranspiration from impervious surfaces has been assumed to be 20% of 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).

3.2.6.2 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 existing Study Area is currently covered by mostly agricultural land or natural vegetated land cover. Scattered residential land use is currently present, usually inclusive of a driveway, along with a few storage yards consisting of worked dirt ground cover. The predevelopment recharge was estimated to be approximately 100 mm/year (per unit area), which reflects fine-grained soil, gently rolling hills and agricultural land.

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 subject lands. It is understood that approximately 88% of the Study Area may be considered impervious based on the current proposed land use. This was calculated to significantly reduce recharge to approximately 14 mm/year per unit area. Runoff would commensurately be increased from approximately 165 mm/year in the pre-development scenario to 595 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 to hydrologic form and function of groundwater-dependent features and ecosystems. This could also negatively impact existing groundwater users.

Evapotranspiration decreases from approximately 555 mm in the predevelopment scenario to 213mm in the post development scenario due to an increase in impervious surface, which represents an approximate 62% reduction in evapotranspiration.

Impacts to infiltration and evapotranspiration could be reduced or mitigated through the implementation of Low Impact Development (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**).

3.2.7 Potential Surface Water Infiltration Opportunities

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

Areas within the Clarkway Drive Tributary displayed 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 upwellings and potential for groundwater contribution is interpreted to be a result of the high potentiometric levels in the underlying confined ORM aquifer.

On a regional scale, most aquifer recharge occurs in the ORM or in areas where coarse-grained units are found at shallow depth. The Site 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 3.1.8**, 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.

As noted in the LID SWM Planning and Design Guide, Sustainable Technologies Evaluation Program, 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 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 Best Management Practices (BMPs) could be incorporated into the proposed development that would promote infiltration and decrease runoff to help preserve the existing groundwater flow regime.

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 detailed design 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 assess infiltration rates in potential stormwater management facilities, a preliminary infiltration testing program was completed. Details are discussed in **Section 3.2.8**.

Preliminary Infiltration Testing Program

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. 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 1.5 m below the proposed bottom elevation. Therefore, a minimum of two 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 mbgs and 3.5 mbgs.

Five test pits were excavated on June 6 and June 7, 2024 at the Site at locations shown on **Figure A2-12**. Infiltration testing was completed using a Guelph Permeameter. The soil encountered at each of the test pit locations consisted of 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 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. 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 design infiltration rate, incorporating a safey factor as outlined in the TRCA and CVC, 2012 ranged from 1.4 mm/hour to 7.8 mm/hour, which is considered low and consistent with the observed soil types. The results are presented in **Table C2-15** in **Appendix C2**.

Additional details regarding the methodology, analysis, and results are provided in the Arcadis June 2024 memorandum provided in **Appendix G**.

It should be noted that infiltration tests are not feasible when excavations extend below the groundwater level.

3.3 Desktop Assessment of Existing Water Supply Wells

An updated search of the MECP well records database was conducted in September 2023 within a 500 m radius of the Site. The search returned a total of 98 records for the area of the Site (**Figure A2-13, Appendix A2**). Well usage details are summarized in Error! Reference s ource not found.(**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 are summarized in **Table C2-17** (**Appendix C2**).

The Village of Bolton now relies on a lake-based municipal water supply derived from Lake Ontario. Prior to 2002, Bolton obtained its potable water from several municipal groundwater wells, which were all 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 permit 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 water features within the Study Area. HDF-3 enters the subject Block by crossing Healey Road. The feature crosses the Study Area with diagonal alignment and eventually exits the site by crossing Humber Station Road. This headwater drainage feature (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.

There is another HDF flowing north-south through the middle of the site area (HDF-8). This HDF is connected with the Clarkway Drive Tributary Reach 2 on the south side of Mayfield Road just outside of the Study Area. This HDF is having discharge from about 72.71 ha of land north of Mayfield Road and does not have any external drainage area, as shown on **Figure 2** (**Appendix A3**). The drainage area to this HDF, north of the proposed Highway 413 corridor, is approximately 52 ha.

Gore Road Tributary 1 is draining 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 site 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 the 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 Humber Station, and as such, the Humber River Hydrology Model has been modified where directly influenced by the subject development to assess any changes to the peak flow and flood plain. The Humber Station Study Area 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 as 41.06, 41.07 and 41.08 in the hydrology model, covers 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, named as Humber Station Reach 1, which connects with Gore Road Tributary Reach 1. The Eastern six catchments named as 43.03, 43.10, 43.06, 43.05, 43.04, and 43.02 in the model, drains 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 3.4.1.2** the TRCA future model has been revised to reflect the ultimate imperviousness proposed within the site 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 these discretizations, some of the parameters such as imperviousness were refined. Therefore, the modified existing model was calibrated to provide similar peak flows as 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 as 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

An HDF 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 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, the regulatory floodplain has been characterized downstream of a 50 ha drainage limit. The total length of this HDF 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 this HDF 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 result 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 Humber Station area as part of the Humber Station CEISMP (Phase 1) Report. The existing condition 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** in the Floodplain Analysis Report provided in **Appendix D**).

The floodplain analysis has been conducted along all drainage features within and around the Humber Station 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 drainage features and one watercourse. The drainage features 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 drainage to the southwest direction and leaves the subject area via an existing culvert at Humber Station Road. The feature is 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 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 in sizing and alignment of the proposed channel in Phase 2 of the CEISMP. The proposed channel in Phase 2 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 were identified and will be considered to the next level proposed condition channel realignment design.

- Mid-Headwater Feature (HDF-8): It is an HDF draining southward across the 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 headwater feature water elevation, channel storage volume and flood lines were estimated. By estimating the existing condition storage volume, it will be input for estimating the required wetland compensation and flood attenuation in the proposed wetland compensation design that will be analyzed in the Phase 2 CEISMP. For further detailed information, please see the Floodplain Report (**Appendix D**).
- Clarkway Trib A: is a perennial watercourse draining in the south direction following the east boundary of the Study Area. There is an engineered channel coming from the east direction from Colerain Drive and connected 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 confluent 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 the 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.

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 determined to be classified as a headwater drainage feature (HDF). The results of the Headwater Drainage Feature assessments are provided in **Section 3.7.5**. HDF management recommendations should take into account the flow conveyance and sediment supply functions that the feature currently provides.

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 a headwater drainage feature, and we defer to the results of the Headwater Drainage Feature assessments. Management recommendations should take into account the flow conveyance and sediment supply functions that the feature currently provides.

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 rapid 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 of 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 determined to be headwater drainage features, a meander belt width was not delineated for these features. As WHT-1 was determined 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 determined to be 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 determined 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 determined 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 on **Figure 6** (**Appendix A1**).

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 2023 (**Table 8**, **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 on the Study Area:

- MNRF's Land Information Ontario (LIO) database (2023);
- Ministry of Natural Resources and Forestry's (MNRF) Natural Heritage Information Centre (NHIC) database (2023);
- 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 (2023); 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 2**, **Appendix A1**):

- Headwater Drainage Feature 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 2023) 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):
- 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 (17PJ05). 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 162 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);
- Cerulean Warbler (*Setophaga cerulea*; Threatened);
- Chimney Swift (*Chaetura pelagica;* Threatened);
- Eastern Meadowlark (Threatened);
- Eastern Whip-poor-will (*Antrostomus vociferus*; Threatened); and
- Least Bittern (*Ixobrychus exilis*; Threatened).

- Species of Conservation Concern (i.e., listed as Special Concern on the SARO list, or identified as an S1-S3 species):
  - Black Tern (*Chlidonias niger*; Special Concern);
  - Canada Warbler (*Cardellina canadensis*; Special Concern);
  - Common Nighthawk (*Chordeiles minor*; Special Concern);
  - Eastern Wood-Pewee (Special Concern);
  - Evening Grosbeak (*Coccothraustes vespertinus;* Special Concern);
  - Golden-winged Warbler (*Vermivora chrysoptera*; Special Concern);
  - Grasshopper Sparrow (*Ammodramus savannarum*; Special Concern);
  - Short-eared Owl (*Asio flammeus*; Special Concern);
  - Wood Thrush (Special Concern);
  - American Coot (*Fulica americana*; S3B, S4N);
  - Blue-winged Teal (*Anas discors*; S3B, S4M);
  - Caspian Tern (*Hydroprogne caspia*; S3B, S5M);
  - Great Egret (*Ardea alba*; S2B);
  - Purple Martin (*Progne subis*; S3B);
  - Ruddy Duck (*Oxyura jamaicensis*; S3B, S4N, S5M); 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 73 species were recorded in the atlas squares that overlap with the Study Area, of which 61 are butterfly species and 12 are moth 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 for 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 within a 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 there is potential for the above noted species to still persist within the subwatershed.

As illustrated on Figure 2 of the FMP (Stream Order for the Humber River Watershed), first and second order streams are found on 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 located 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 on the Study Area.

A SAR Assessment was completed by GEI in 2023 and is shown on **Table 7**, **Appendix C1**.

An Information Gathering Form (IGF) will be submitted to MECP on behalf of the proponent once Phase 2 of the CEISMP has been finalized.

3.7.3 Existing Natural Heritage Conditions

Ecological field investigations were completed for the Study Area in 2017, 2018, 2021, 2022, and 2023, as detailed in **Table 8 (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:

- Ecological Land Classification (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. A 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 until Castlemore Road, where it becomes surrounded by residential developments 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 headwater drainage features (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). Headwater drainage features 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 outletting 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. HDF-8 originates in the north-central portion of the Study Area, bisecting the site flowing north to south, and outletting to the Clarkway Drive Tributary at Mayfield Road. Several smaller HDFs (1, 2, 7 and 9) along the west edge of the Study Area drain to the Humber Station Road ditch, which outlets to the feature downstream of HDF-3.

<u>Classification</u>

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 the 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.

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 determine management recommendations. All HDF reaches and their management recommendations are depicted on **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 Redside Dace contributing habitat functions, 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. HDFs that are contributing habitat for Redside would have a management recommendation of Conservation or 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 of their functions expected to be achieved through natural channel design.

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.

- 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 stormwater management 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.

- 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

All of the 'Mitigation' management recommendations are made for reaches on the 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-8a, 8b, 8c, 8c2, 8d, 9a, 9b, 10a, 11a, 12a, 13a and 15a have an Interpreted Management Recommendation of 'Mitigation', based on the anticipated ability to replicate Redside Dace contributing habitat functions through natural channel design and/or other compensation such as wetland 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 Low Impact Development (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 determined at the MESP stage and may include LID measures.

3.7.6 Aquatic Habitat Assessment

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

<u>AHA-1</u>

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.

<u>AHA-2</u>

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). 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 on **Figure 4a** (**Appendix A1**). A detailed list and description of ELC units is provided in **Table 9** (**Appendix C1**). No provincially rare vegetation communities were present in the Study Area (NHIC 2023).

3.7.8 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 10 (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 2023).

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 the 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.

3.7.9 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 on **Figures 4a** and **6** (**Appendix A1**).

3.7.10 Ontario Wetland Evaluation System

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

One wetland polygon 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 met criteria due to wetland rarity within the landscape, use by provincially significant animal species, and habitat features for waterfowl and fish.

A second wetland polygon is associated with the downstream extent of the Clarkway Drive Tributary. This feature 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.

Wetlands SAS1-1/SWT2-2 located just east of Humber Station Road are 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 on **Figure 4a** (**Appendix A1**).

3.7.11 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 on **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 11 and Table 12 (Appendix C1)**, respectively. All of the amphibian species are provincially ranked S5 (common and secure) or S4 (apparently common and secure).

3.7.12 Breeding Bird Surveys

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

A total of 56 bird species were observed within the Study Area. Of this total, ten 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 13** (**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 on **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 determined 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.

3.7.13 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 were on non-participating properties, and surveys were not conducted in those locations. It is assumed that they provide bat habitat.

<u>Bat Habitat Assessment Results</u>

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 on **Table 14 (Appendix C1)**.

<u>Acoustic Bat Monitoring Results</u>

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 to species. Calls recorded during a bat's search phase are the most reliable for an 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 15, Appendix C1**). Of the high frequency calls, 5 calls were confirmed to be Eastern Red bat. No Myotis species were recorded within this feature.

3.7.13.1 Bat Transects and Bat Points

Bat transects and bat point stations were completed at structures and along hedgerows throughout the Study Area to determine 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 15**, **Appendix C1**). It should be noted that these transect and point surveys can only confirm bat presence and potential foraging within the Study Area. A habitat assessment and acoustic monitoring in woodlands and/or bat exit surveys for structures are required to confirm habitat use.

3.7.14 Reptile Surveys

<u>2017 Results</u>

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 on site 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 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 16 (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 17 (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 18 (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 16** (**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 17** (**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 18** (**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 associated with HDF-3 (TB3). The observation occurred in July which suggests the individual was foraging.

3.7.15 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 on **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 20** (**Appendix C1**).

3.7.16 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 21** (**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*).

3.7.17 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 22 (Appendix C1)**.

All of the headwater drainage features were determined to be intermittent or ephemeral and therefore provide seasonal fish habitat. Reaches that contain water year-round (i.e., the Clarkway Drive Tributary and HDF-3 [2017 only]) and maintain a downstream connection provide permanent direct fish habitat. Direct fish habitat is limited to the Clarkway Drive Tributary and HDF-3 (**Figure 4b**, **Appendix A1**).

3.8 Key Ecological Features and Functions

3.8.1 Significant Wetlands

GEI assessed the provincial significance of three wetlands using current Ontario Wetland Evaluation System (OWES) protocol (MNRF 2022), and determined 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.

<u>Clarkway Drive Tributary</u>

Two riparian wetlands of the Clarkway Drive Tributary 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 part of 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.

<u>Online Pond</u>

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).

3.8.2 Significant Woodlands

Significant woodlands are identified by the planning authority in consideration of criteria established by the NDMNRF. 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 Peel OP. The Region of Peel considers NAC and Core woodlands to be significant.

The woodlands within the Study Area were assessed using these criteria and 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 significance of these features are presented in the NHRM (MNR 2010) for Policy 2.1 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 significant wildlife habitat. 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 2023), 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 23 (**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 24** (**Appendix C1)**. However, the regional criteria predate the provincial criteria and has 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 HDF-3 (**Figure 4b, Appendix A1**). The remaining 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 22**, **Appendix C1**), and reflects 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 with the exception of 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). In order 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 SAR could potentially be present within the Study Area. In order 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 confirmed present within the Study Area. The Clarkway Drive Tributary, its associated riparian wetland communities and HDF-8 are identified as contributing habitat for Redside Dace.

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.

While no bat SAR [Eastern Small-footed Myotis (*Myotis leibii*), Little Brown Myotis (*Myotis lucifugus*), Tri-coloured Bat (*Perimyotis subflavus*) and Northern Myotis (*Myotis septentrionalis*)] were identified within the FOD8-3 on the Study Area, it is acknowledged that bat SAR may be present within the non-participating northwestern FOD and southern FOD7-6.

Species at Risk will be addressed with MECP through an Information Gathering Form, to be submitted at the Phase 2 Impact Assessment portion of the CEISMP work once potential impact to SAR are better understood.

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 are 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 Peel Region OP (2022) and the NHRM (MNR 2010).

These analyses identified the following natural heritage features as present, on, or within 120 m, of the Study Area:

- Significant wetlands;
- Significant woodlands;
- Habitat of endangered and threatened species (Bank Swallow foraging habitat and Redside Dace contributing habitat);
- Fish habitat (HDF-3 and the Clarkway Drive Tributary);
- Significant wildlife habitat
  - Seasonal Concentration Areas of Animals (Candidate Bat Maternity Colonies within FOD habitats; Candidate Over-Wintering Turtle 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 woodland, 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 the natural features and ecological functions in association with the 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 Official Plan and Region of Peel Official Plan.

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 Region of Peel OP (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).

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 5 (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 Natural Heritage System is to establish a healthy and diverse ecosystem that enhances and complements the 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 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 determine 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 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 determined by SCE.

Channel dimensions are determined 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 determined 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, and with sections that were poorly defined. Therefore, hydrologic modelling completed by SCE was used to determine 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 determine 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 25** (**Appendix C1**) which suggest that the recommended corridor widths for the upstream and downstream portions of the reach are 13 m and 15 m, respectively.

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

3.9.5 Proposed Wetland Relocation and Compensation

The proposed relocation of one tableland wetland (MAS2-1) totals 0.077 ha in area of Cattail mineral shallow marsh, as illustrated on **Figure 6** (**Appendix A1**). The feature is proposed to be relocated slightly west to accommodate the drainage feature realignment. A water availability assessment will be developed in Phase 2/3 to demonstrate that suitable hydrological conditions are provided within this realigned corridor to support a wetland community. Wetland encroachment of a tableland wetland (MAM2-2) totals 0.098 ha of Reed-canary grass mineral meadow marsh is proposed to accommodate the drainage feature realignment.

Wetland relocation/compensation is proposed to occur within or close to the existing wetlands, within the preliminary NHS. Compensation will meet a 1:1 removal to compensation ratio (**Figure 6, Appendix A1**). Because the 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 portion of the drainage at the south end of the Study Area will be directed to a proposed created wetland that will receive flows before outletting to reach HDF-8a1. This wetland will also serve to compensate for the proposed removal of HDF8, which is considered Redside Dace contributing habitat, and will include buffer plantings of native trees and/or shrubs. SCE's preliminary analysis has indicated that a floodplain volume of approx. 2,200 m^3 is proposed to be removed. At an assumed depth of 0.7 m, the required wetland surface area is 0.31 ha. Protecting for any grading associated with the construction of the wetland, a total compensation area of 0.35 ha is required, 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 determine the need for and type of feature-based wetland water balance analysis for all wetlands (**Figure 4a, Appendix A1**; **Table 2, Appendix C1**) in the Study Area, including those associated with watercourses and drainages. 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 wetlands (9 of 15) were evaluated as low risk. One wetland was evaluated as medium risk: the MAM2-2 at the eastern side of the FOD8-3. Five wetlands were evaluated as high risk: the SWT2-2 and SAS1-1 in the center of the Study Area towards Humber Station Road, the two MAM2-2 communities near the northwest corner of the Study Area, and the MAS2-1 near the northwest corner of the Study Area.

GEI attended a virtual meeting with TRCA, Arcadis, and Schaeffers 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 to be created wetlands within riparian channels. Post-development, the retained riparian wetlands will receive the same if not more water from stormwater outputs. While riparian wetlands 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 the 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 area and the recommended buffers for those features.

The preliminary NHS limits are shown on **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 Terms of Reference that were 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 feature-based water balance requirements, which is part of Phase 2 of the CEISMP.

The next component of the CEISMP (Phase 2) includes the analysis, impact assessment, mitigation, and 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 Ltd.

George Buckton
Senior Ecologist
416-816-2246
gbuckton@geiconsultants.com

Prepared By:

GEI Consultants Ltd.

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

Prepared By:

GEI Consultants 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 Ltd.

Rick Hubbard
Project Director
647-280-5200
rhubbard@geiconsultants.com

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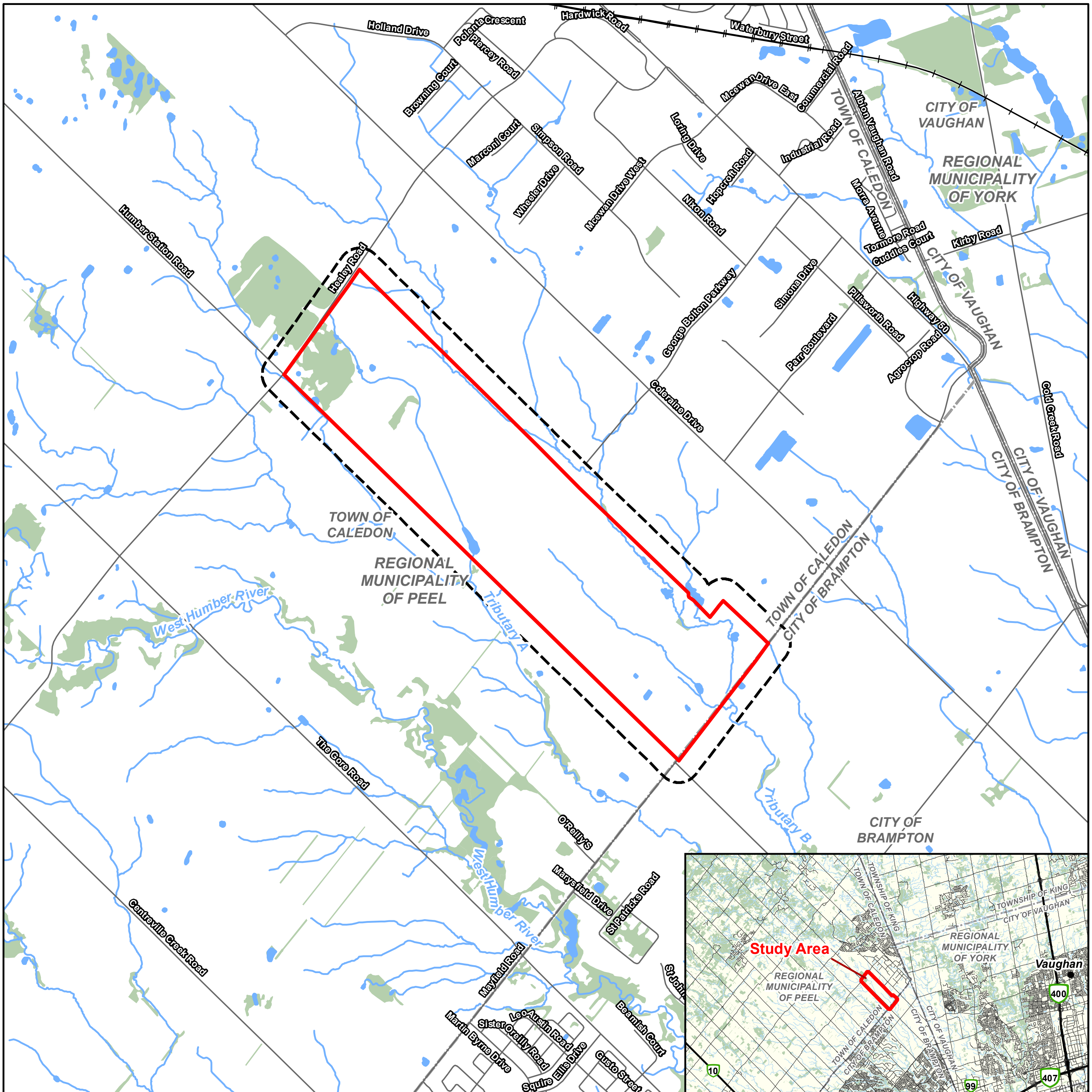
Appendix A1

Figures – GEI Consultants Ltd.



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

Project 1901485

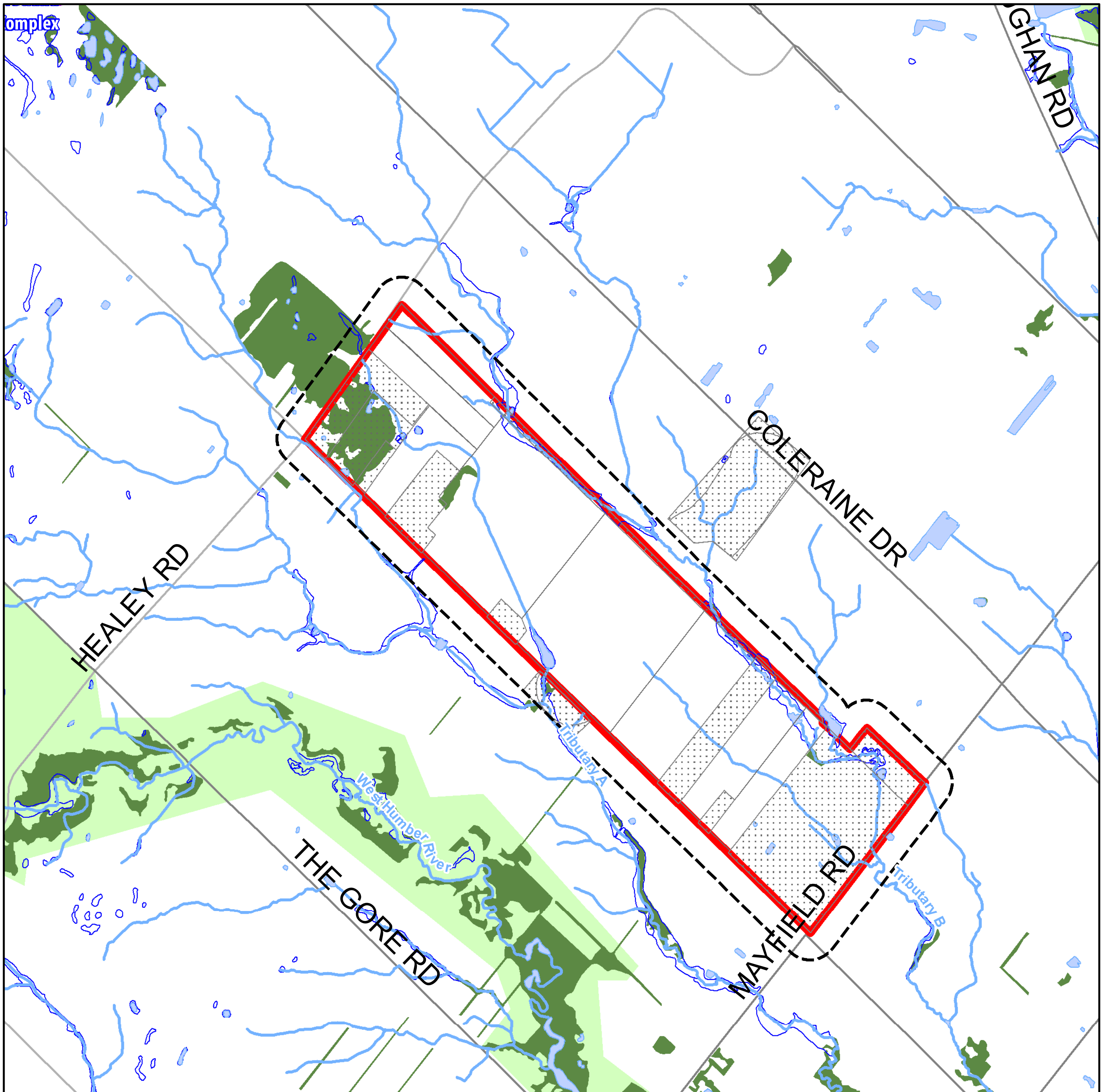
Humber Station, Town of Caledon, ON

Figure 1
Location of Study Area

0 500 m
1:30,000

N

GEI Consultants



NOTES:
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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

Project 1901485

Humber Station, Town of Caledon, ON

Figure 2
Landscape Setting

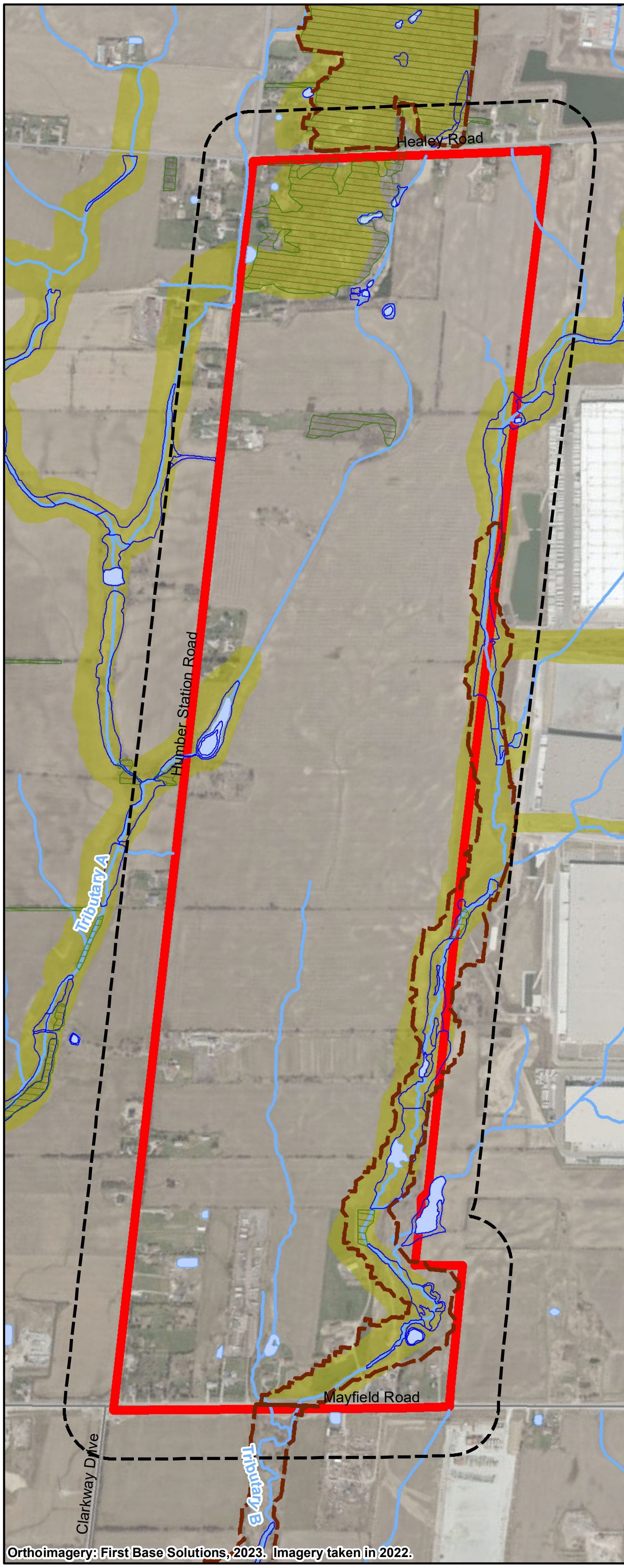
0 500 Meters

1:25,000

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_fig02_landscape_setting.mxd REVISED: Thursday, July 4, 2024



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)

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Humber Station, Town of Caledon, ON

Figure 3
Designated Natural Features

0 200 Meters

1:15,000

N

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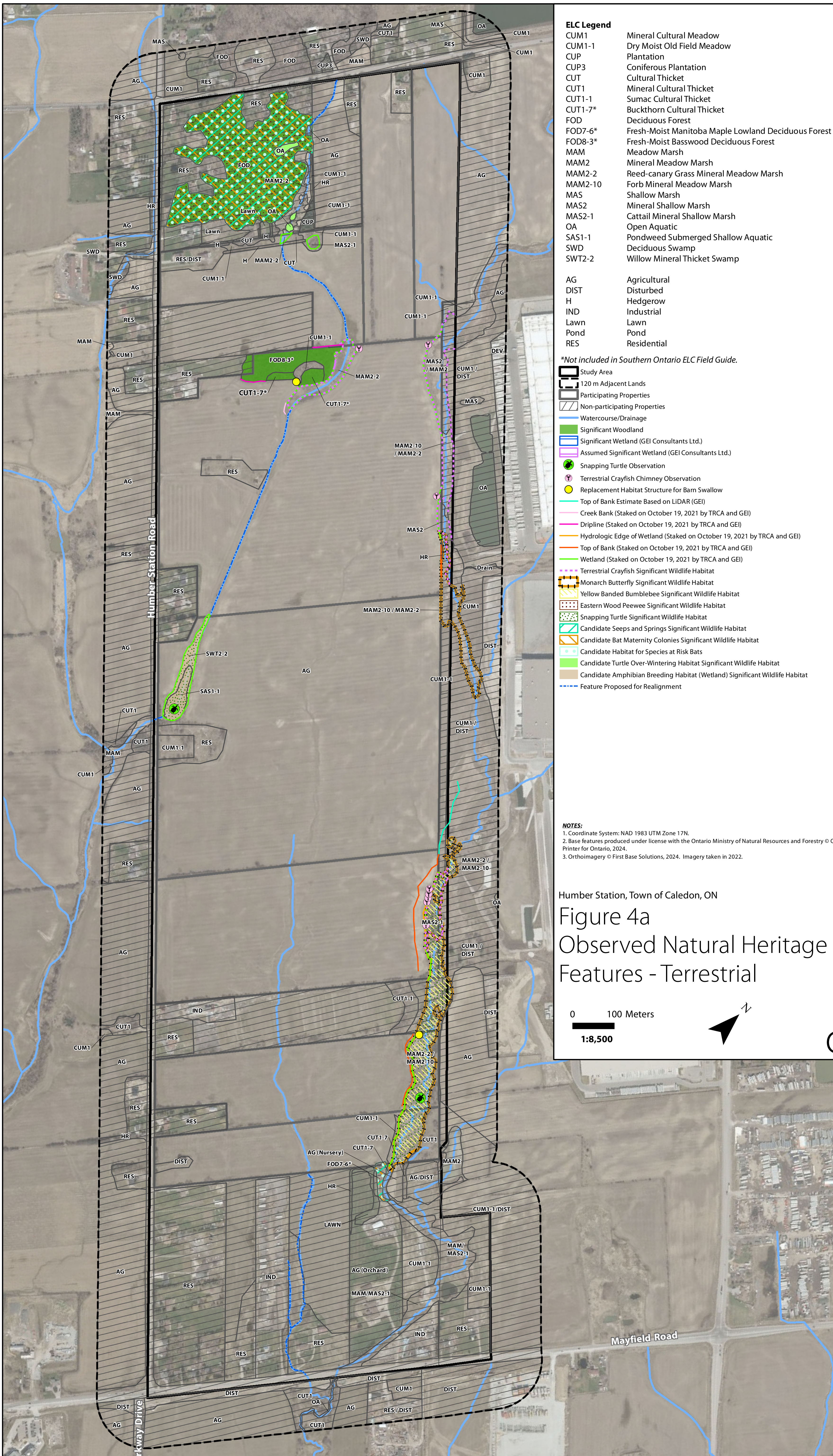

ELC Legend

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
- Watercourse/Drainage
- Significant Woodland
- Significant Wetland (GEI Consultants Ltd.)
- Assumed 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)
- 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

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Humber Station, Town of Caledon, ON

Figure 4a
Observed Natural Heritage Features - Terrestrial

0 100 Meters

1:8,500

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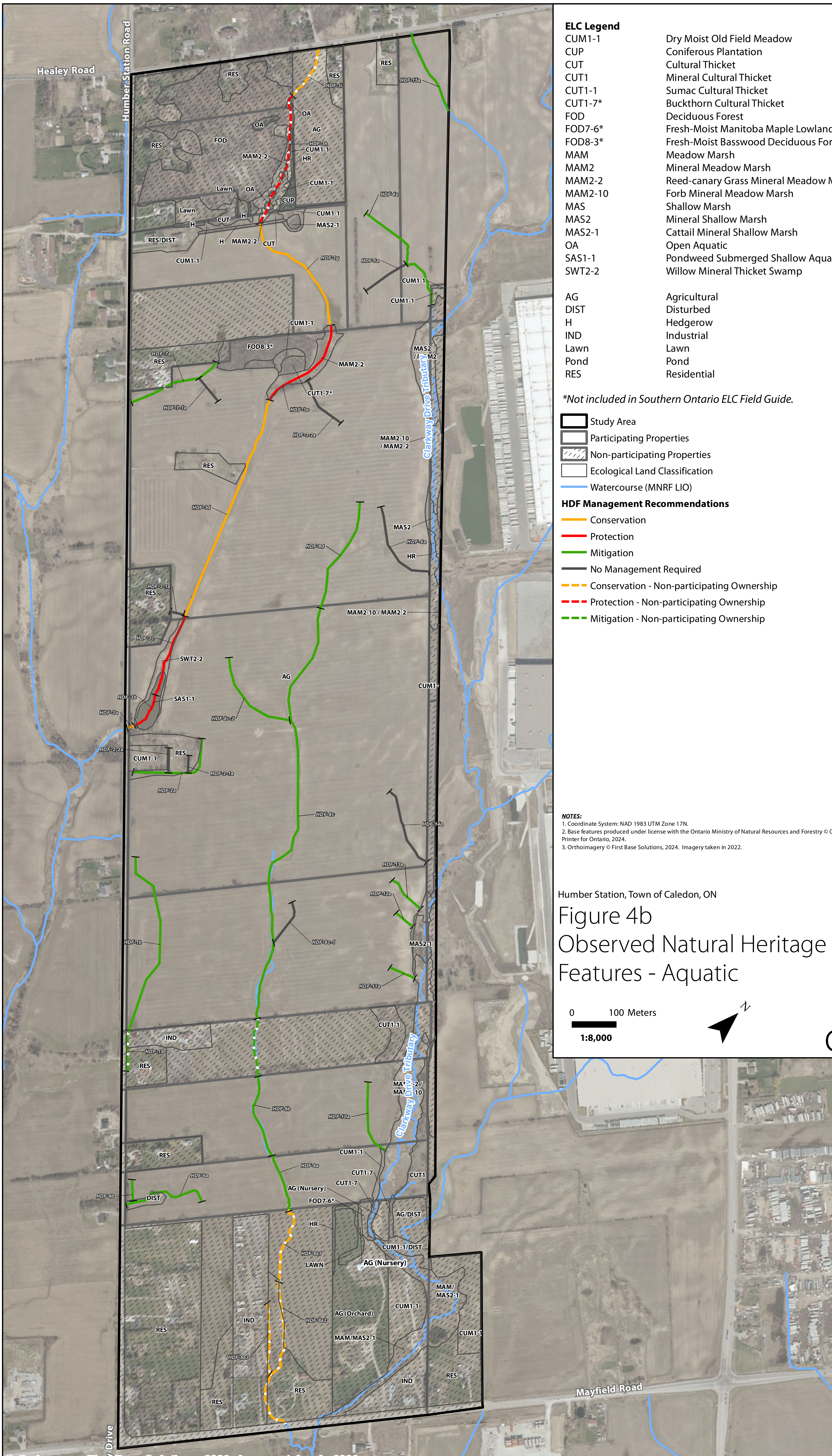

ELC Legend

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:
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Project 1901485

Humber Station, Town of Caledon, ON

Figure 4b
Observed Natural Heritage Features - Aquatic

0 100 Meters

1:8,000

N

GEI Consultants

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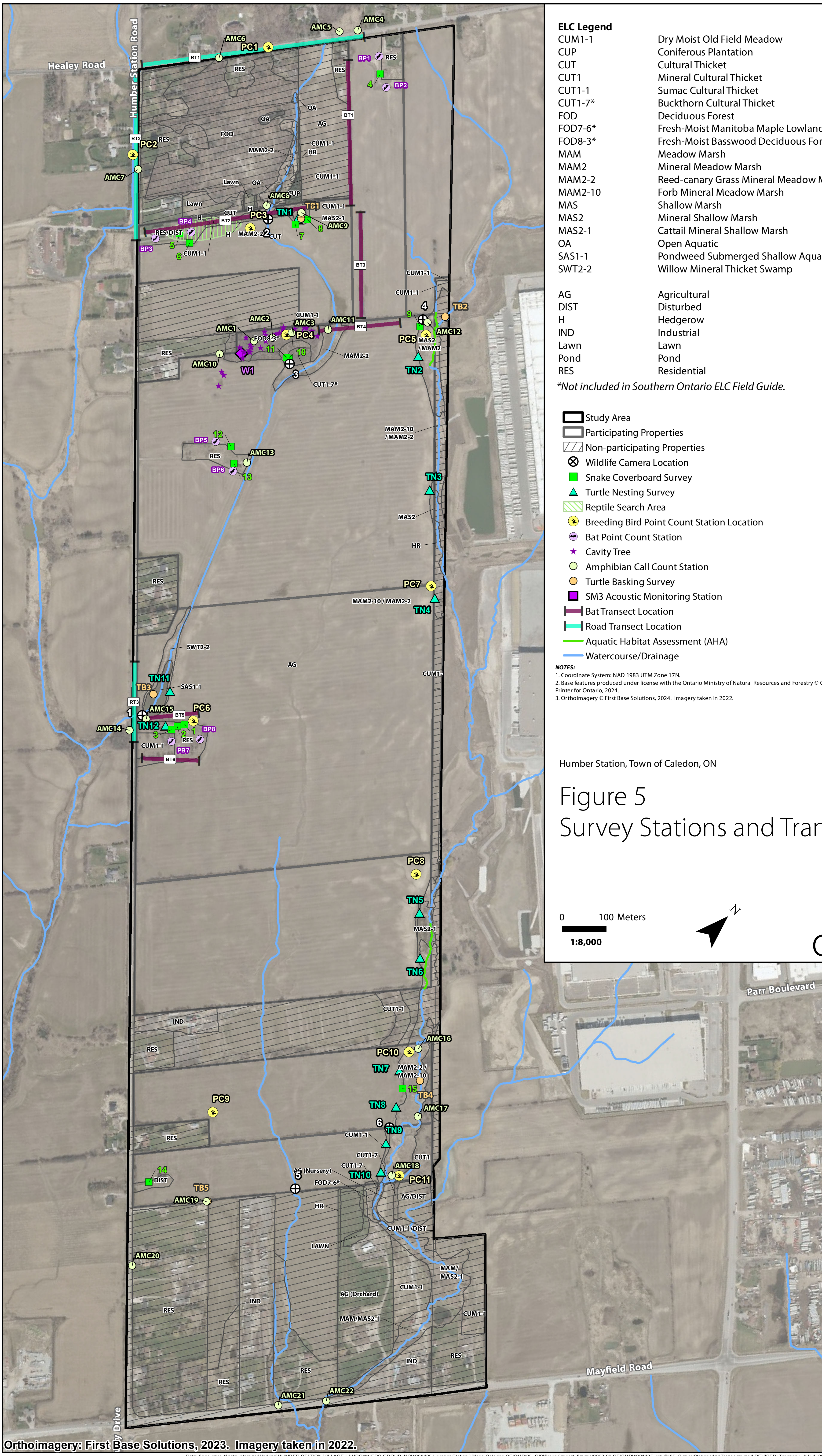

ELC Legend

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
- 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:

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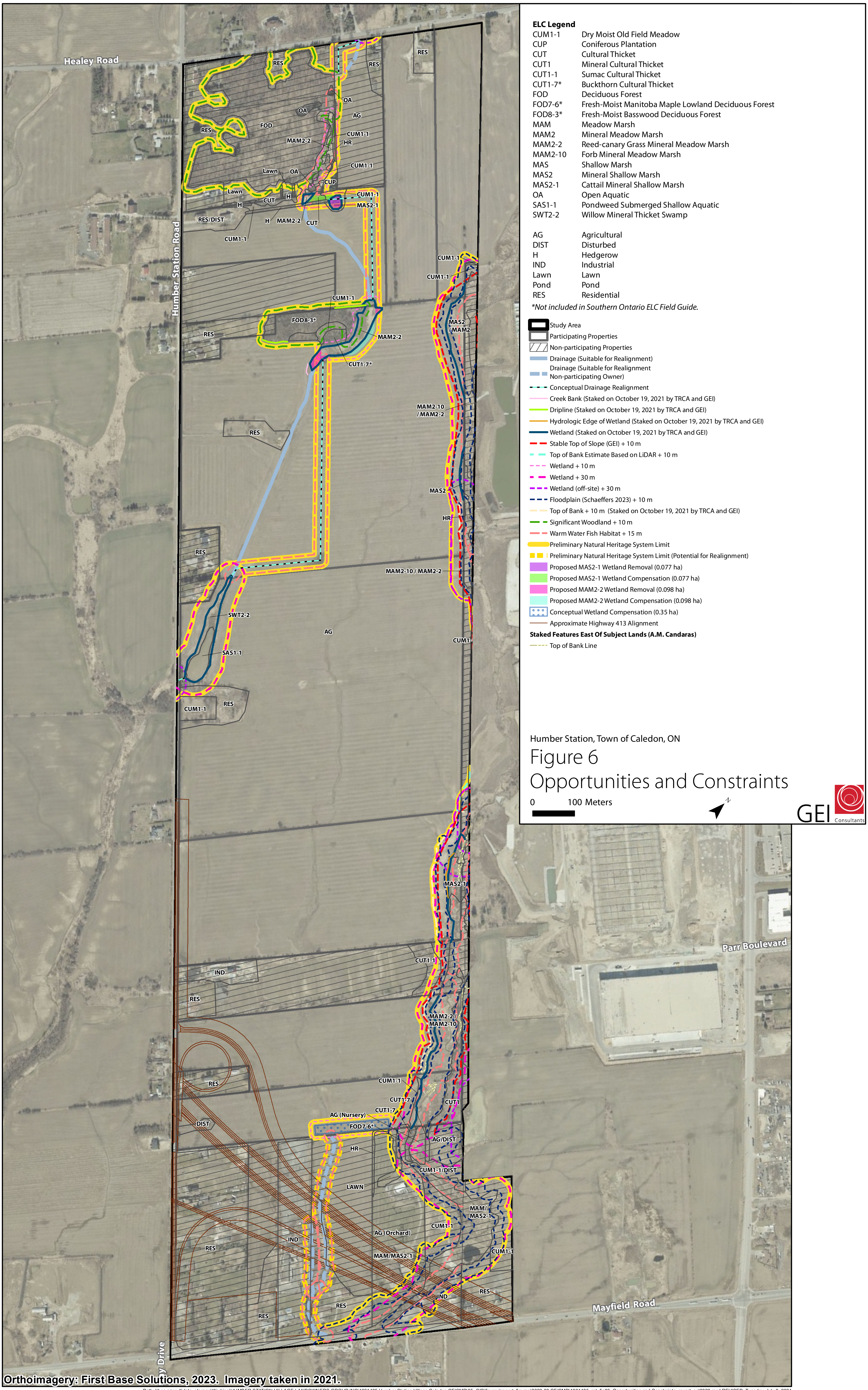
Humber Station, Town of Caledon, ON

Figure 5
Survey Stations and Transects

0 100 Meters

1:8,000

GEI Consultants



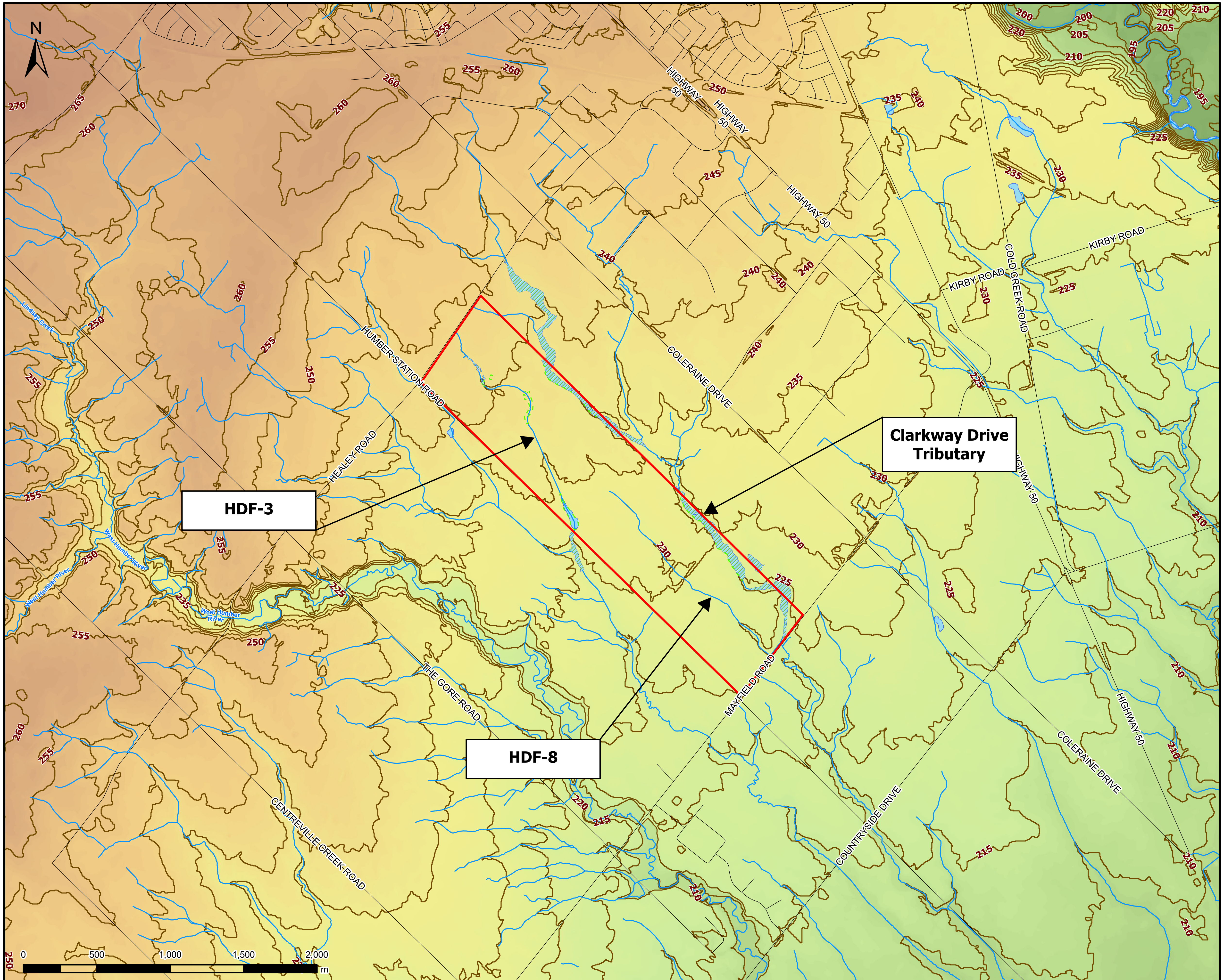
Humber Station, Town of Caledon, ON

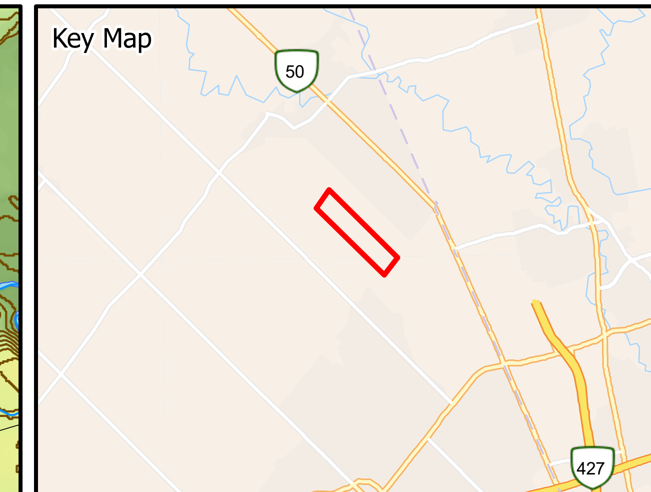
Figure 6
Opportunities and Constraints

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_fig06_Opportunities and Constraints_revert_oct2023.mxd REVISED: Tuesday, July 9, 2024

Appendix A2

Figures – Arcadis Professional Services (Canada) Inc.





Legend

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

Ground Surface Elevation (masl)

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

Note: Unevaluated wetlands are not shown on this figure. Ecological Land Classification of wetlands are referenced in GEI figures.

Figure A2-1

Regional Topography

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

ARCADIS

Project #:	141438
Date:	July 2024

Path: J:\141438_HumberVil\7.0_Production\7.07_Spatial_Design\Humber Station Village Option 6\Humber Station Village Option 6.aprx (Humber Station Village Option 6 - Fig A2-1)

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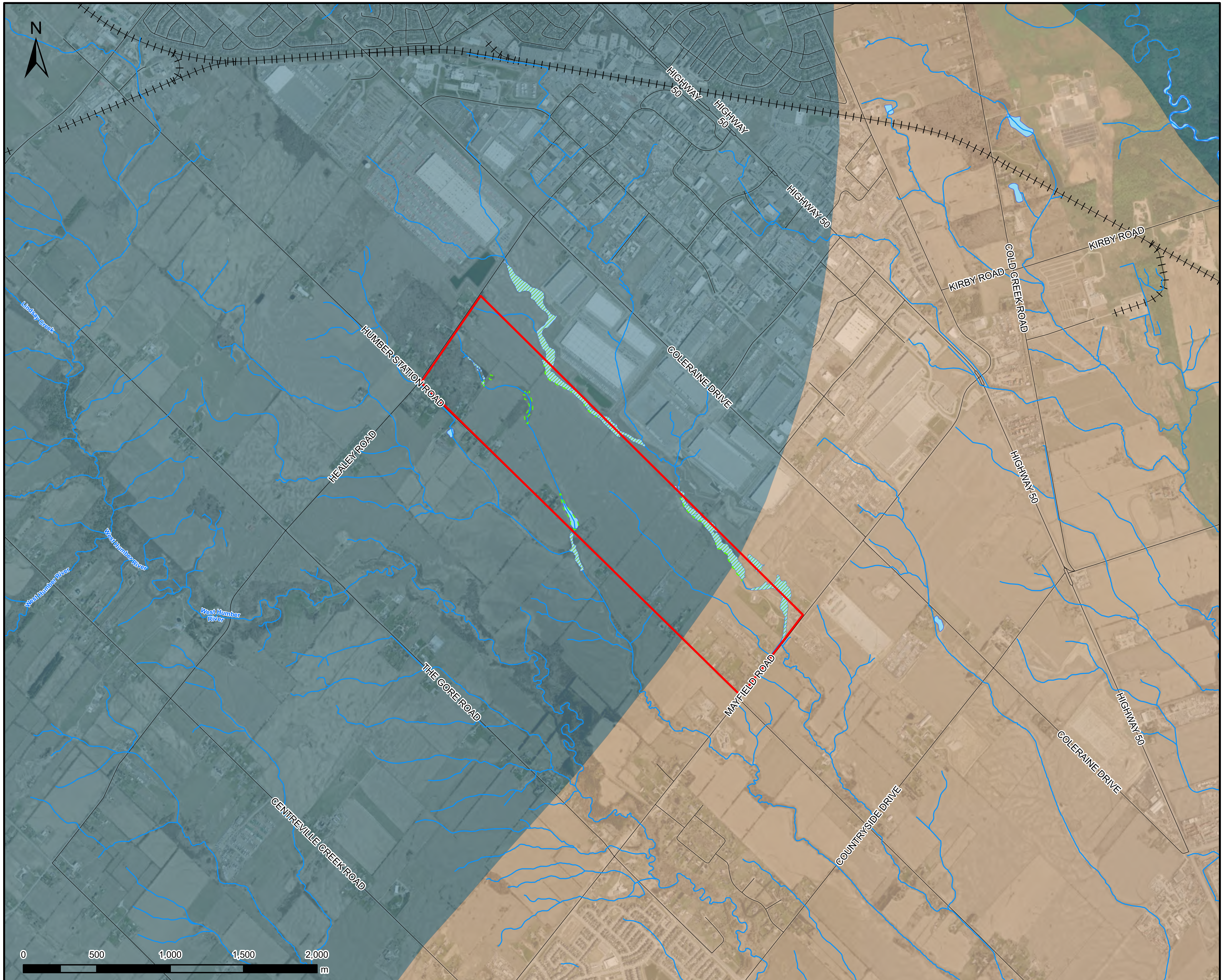

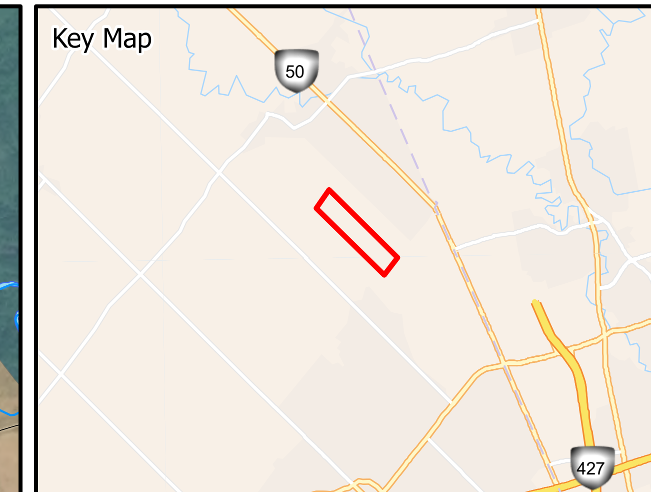

Legend

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

Physiographic Region

- Peel Plain
- South Slope

Note: Unevaluated wetlands are not shown on this figure. Ecological Land Classification of wetlands are referenced in GEI figures.

Figure A2-2

Regional Physiography

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

ARCADIS

Project #:	141438
Date:	July 2024

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

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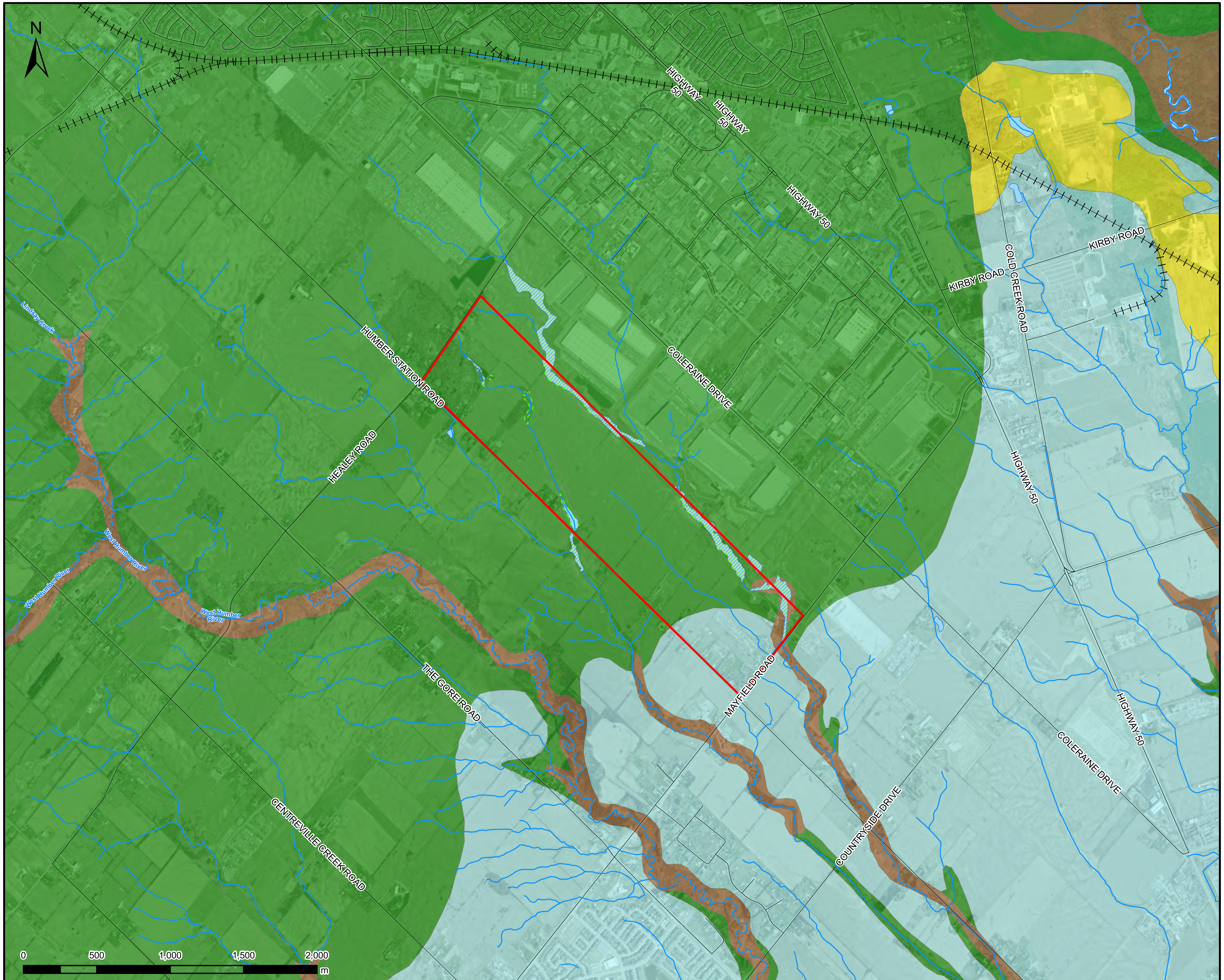

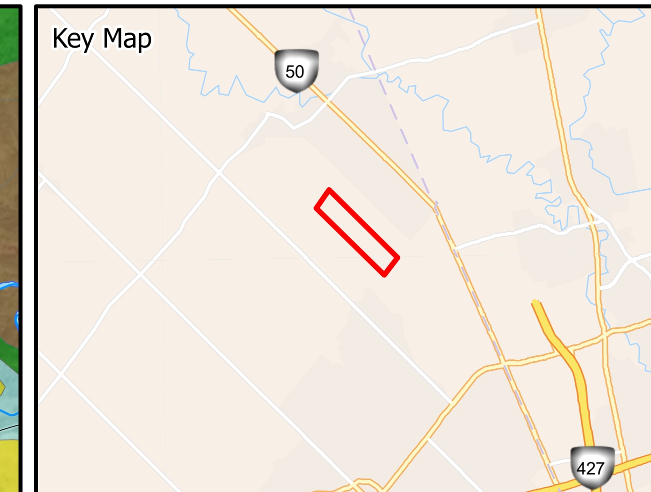

Legend

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

Quaternary Geology

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

Note: Unevaluated wetlands are not shown on this figure. Ecological Land Classification of wetlands are referenced in GEI figures.

Figure A2-3

Quaternary Geology

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

ARCADIS

Project #: 141438

Date: July 2024

Path: J:\141438_HumberVil\7.0_Production\7.07_Spatial_Design\Humber Station Village Option 6\Humber Station Village Option 6.aprx (Humber Station Village Option 6 - Fig A2-3)

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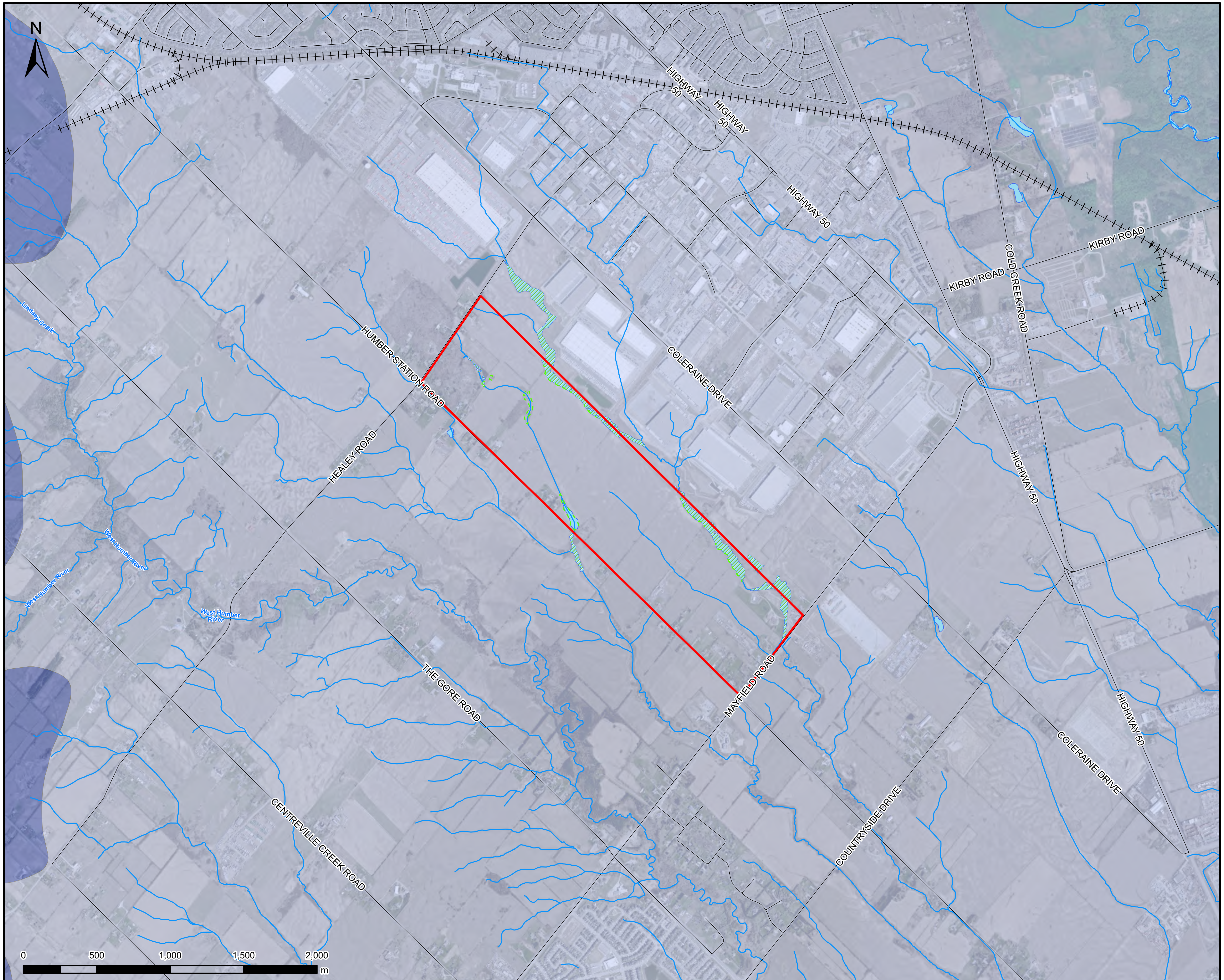
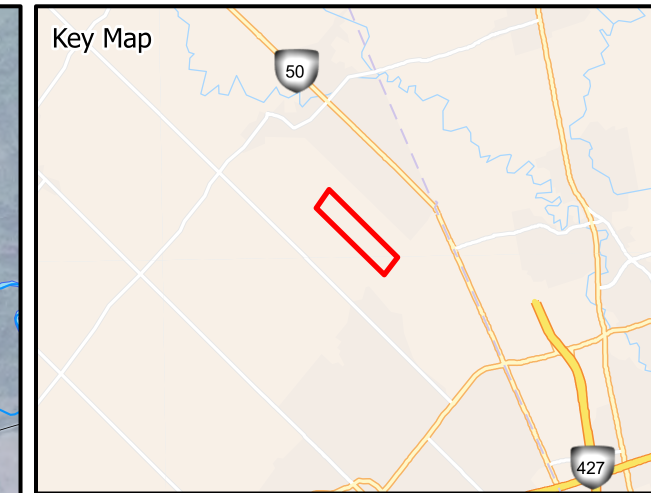




Legend

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

Bedrock Formation

- Georgian Bay Formation
- Queenston Formation

Note: Unevaluated wetlands are not shown on this figure. Ecological Land Classification of wetlands are referenced in GEI figures.

Figure A2-4

Bedrock Geology

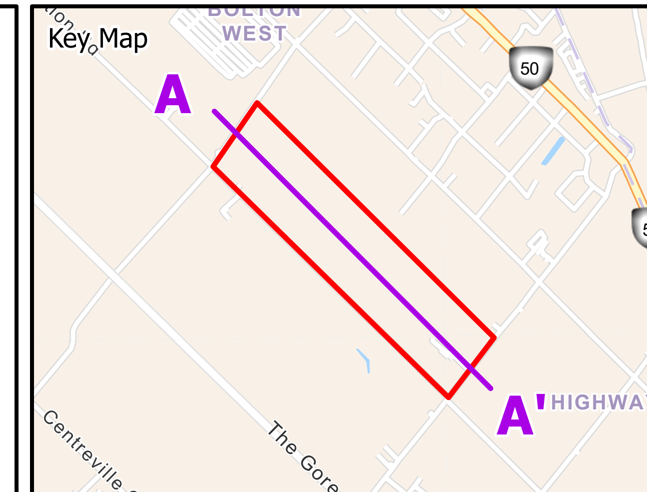
CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

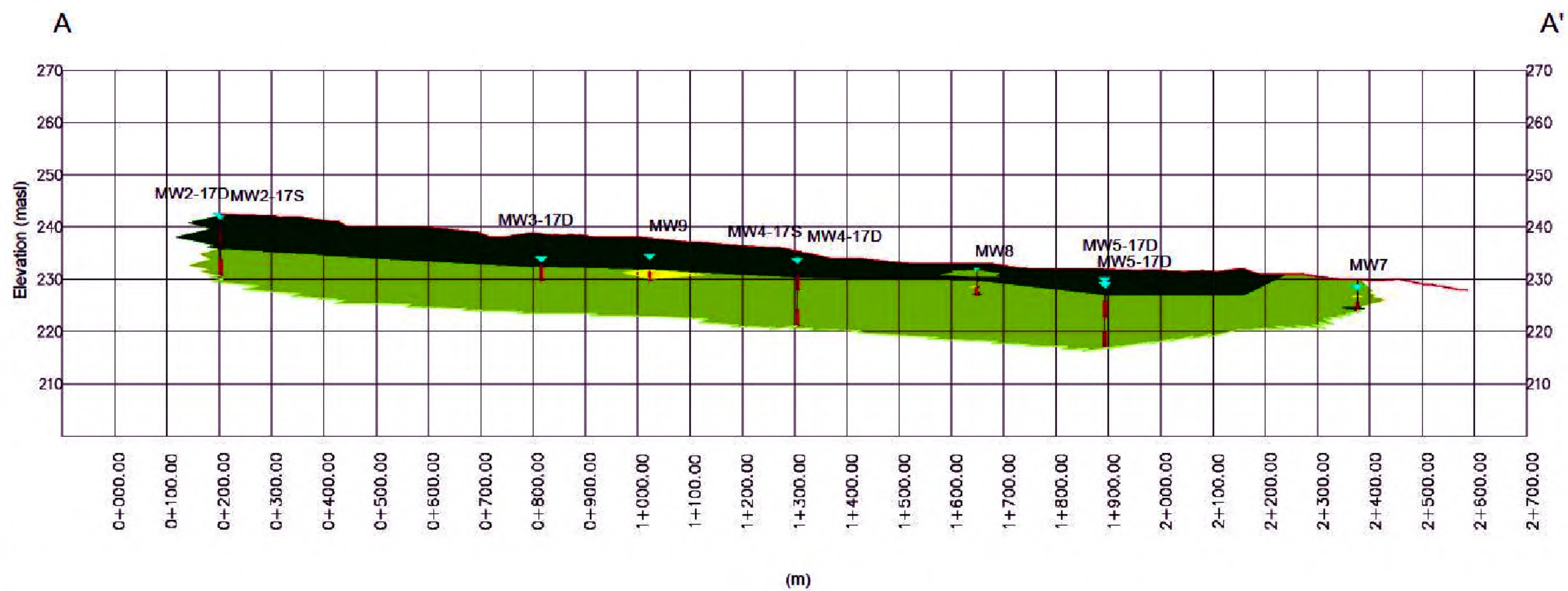
ARCADIS

Project #:	141438
Date:	July 2024

Path: J:\141438_HumberVil\7.0_Production\7.07_Spatial_Design\Humber Station Village Option 6\Humber Station Village Option 6.aprx (Humber Station Village Option 6 - Fig A2-4)

Last updated on 2024-07-05 by BRADLEY.TRINH





Legend

Figure A2-5

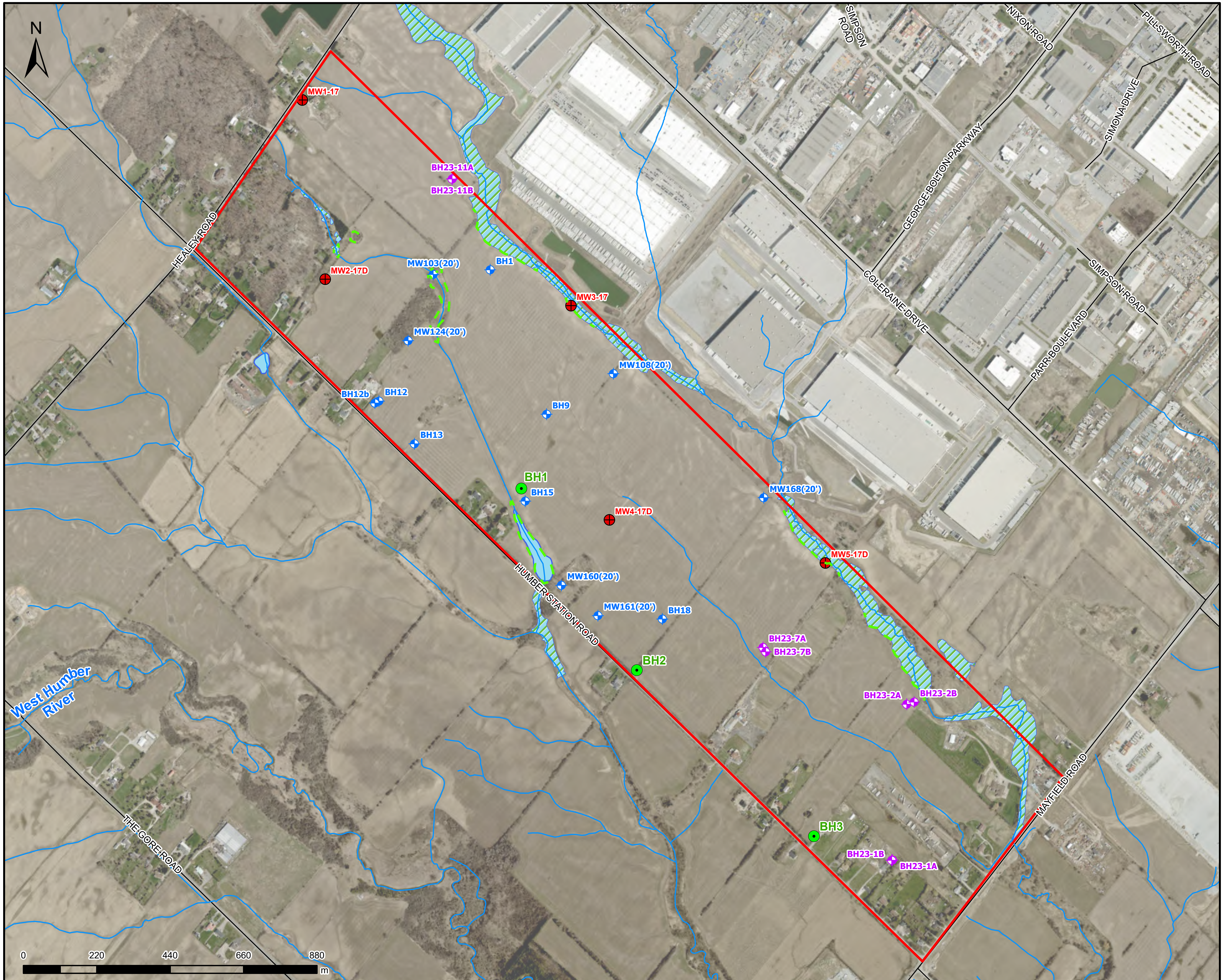
Local Cross-Section

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

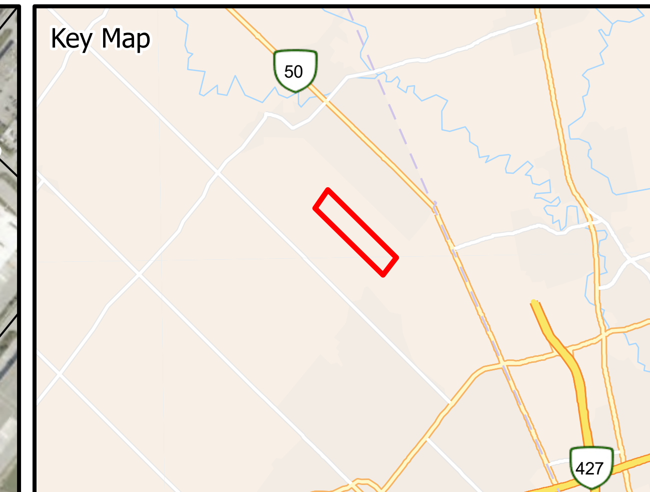
ARCADIS

Project #: 141438

Date: July 2024



Key Map



Legend

- Study Area
- Waterbody
- Wetland
- RJB Monitoring Well
- Arcadis Monitoring Well (formerly COLE)
- Pinchin Monitoring Wells
- DS Consultant Monitoring Wells
- Roads
- Watercourse/Drainage
- Wetland (Staked on October 19, 2021 by TRCA and GEI)

Note: Unevaluated wetlands are not shown on this figure. Ecological Land Classification of wetlands are referenced in GEI figures.

Figure A2-6

Monitoring Well Locations

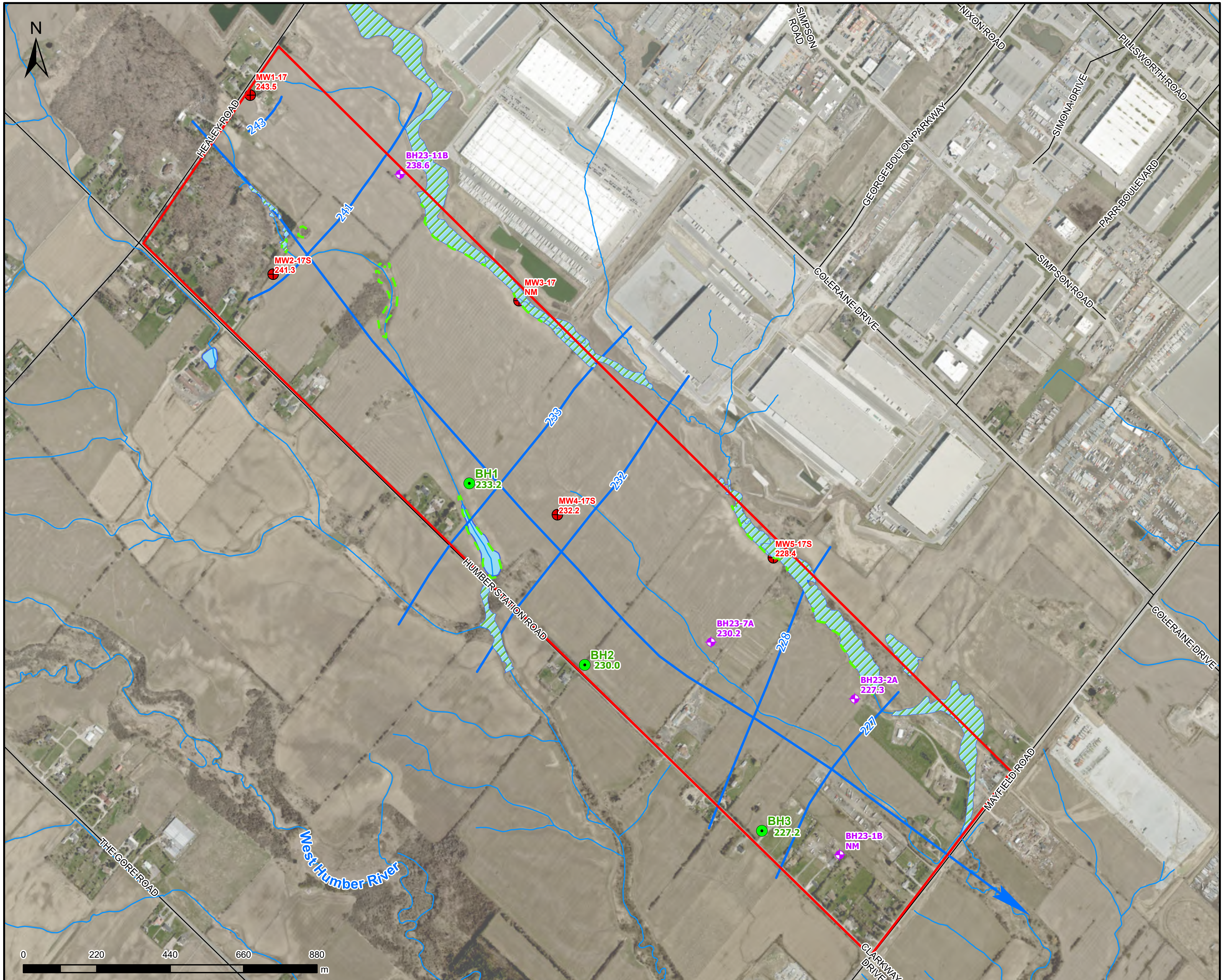
CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

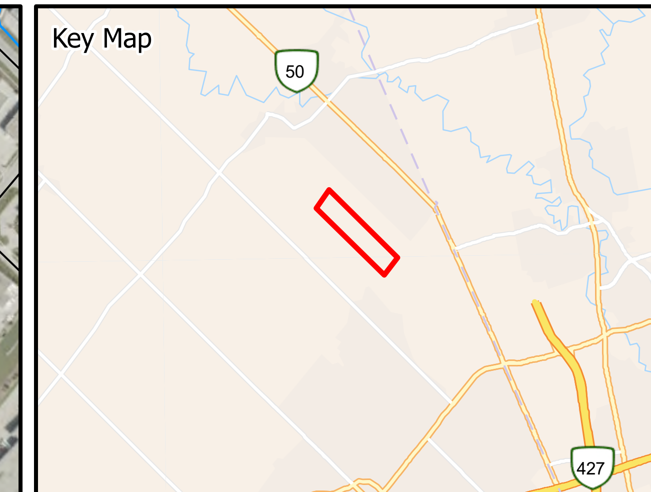
ARCADIS

Project #:	141438
Date:	July 2024

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

Last updated on 2024-07-05 by BRADLEY.TRINH





Legend

- Study Area
- Wetland
- Waterbody
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- DS Consultant Monitoring Wells
- RJB Monitoring Well
- Arcadis Monitoring Well (formerly COLE)
- Watercourse/Drainage
- Roads
- Interpreted Groundwater Flow Direction
- Interpreted Groundwater Contour Line

Note: Unevaluated wetlands are not shown on this figure. Ecological Land Classification of wetlands are referenced in GEI figures.

Figure A2-7
Shallow Groundwater Flow Direction Based on September Readings

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

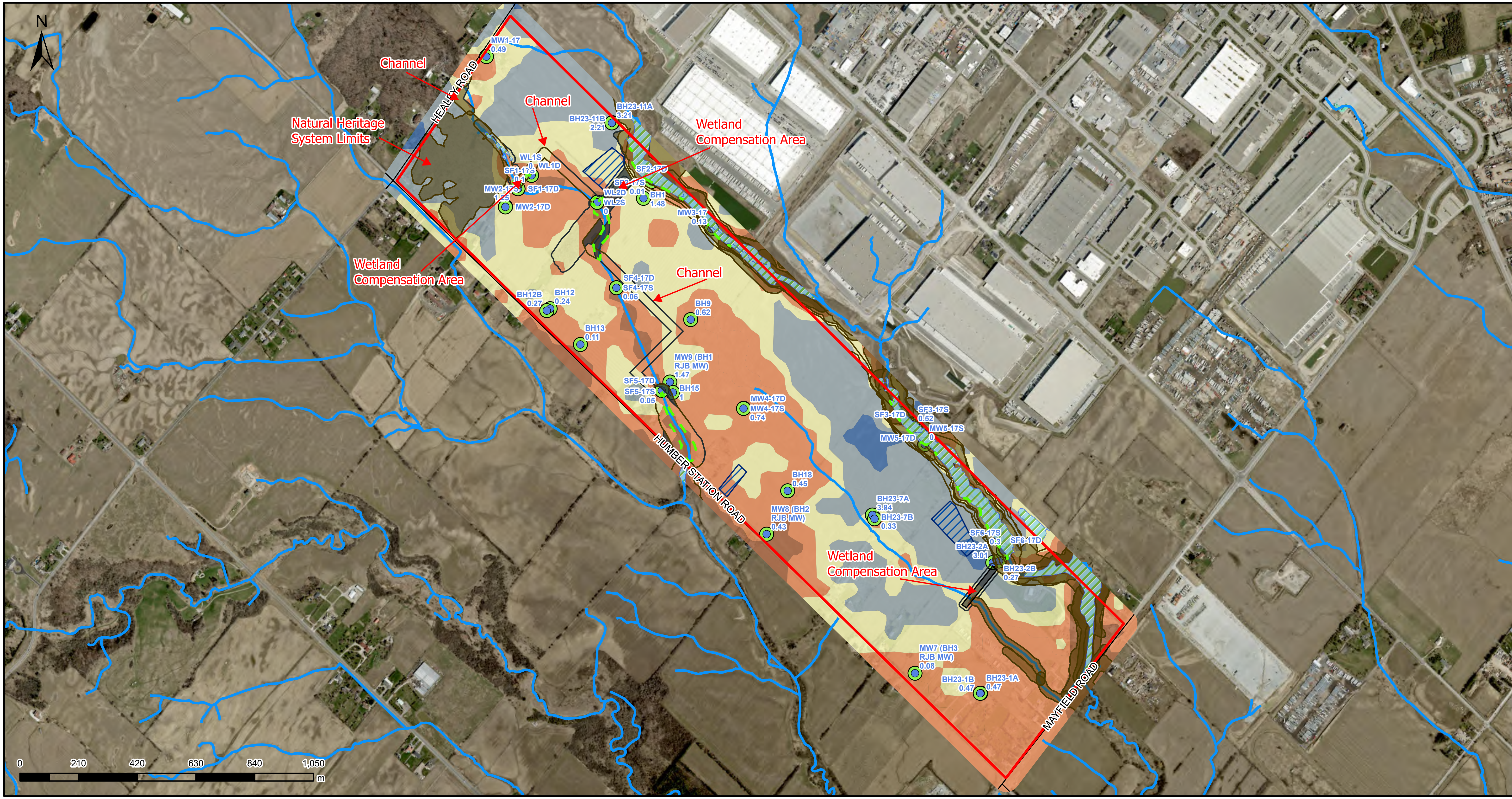
ARCADIS

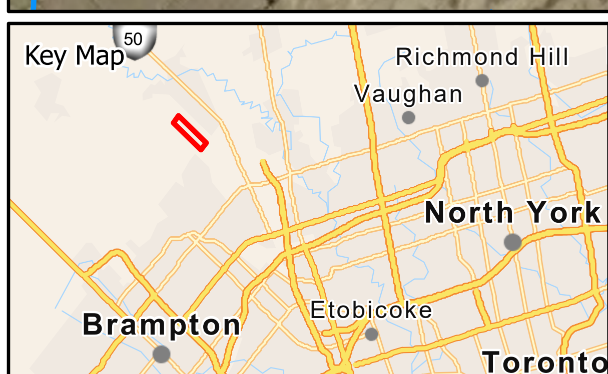
Project #: 141438

Date: July 2024

Path: J:\141438_HumberVil\7.0_Production\7.07_Spatial_Design\Humber Station Village Option 6\Humber Station Village Option 6.aprx (Humber Station Village Option 6 - Fig A2-7)

Last updated on 2024-07-05 by BRADLEY.TRINH





Legend

- Study Area
- Proposed SWM Facility
- Wetland
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Watercourse/Drainage
- Groundwater level (Mar 22 - June 21, 2023)
- Monitoring Well

Groundwater Depth

- 0m or above the grade
- 0 - 1m below grade
- 1 - 2m below grade
- 2 - 4m below grade
- >4m below grade
- Roads

Note: Unevaluated wetlands are not shown on this figure. Ecological Land Classification of wetlands are referenced in GEI figures.

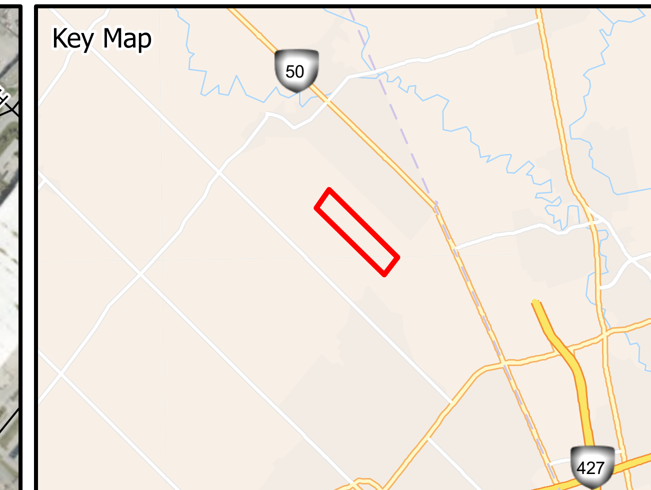
ARCADIS

Figure A2-8

Interpreted Depth to Groundwater (Mar 22 - June 21, 2023)

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

Project #:	141438
Date:	July 2024



Legend

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

Vertical Hydraulic Gradient

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

Note: Unevaluated wetlands are not shown on this figure. Ecological Land Classification of wetlands are referenced in GEI figures.

Figure A2-9

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

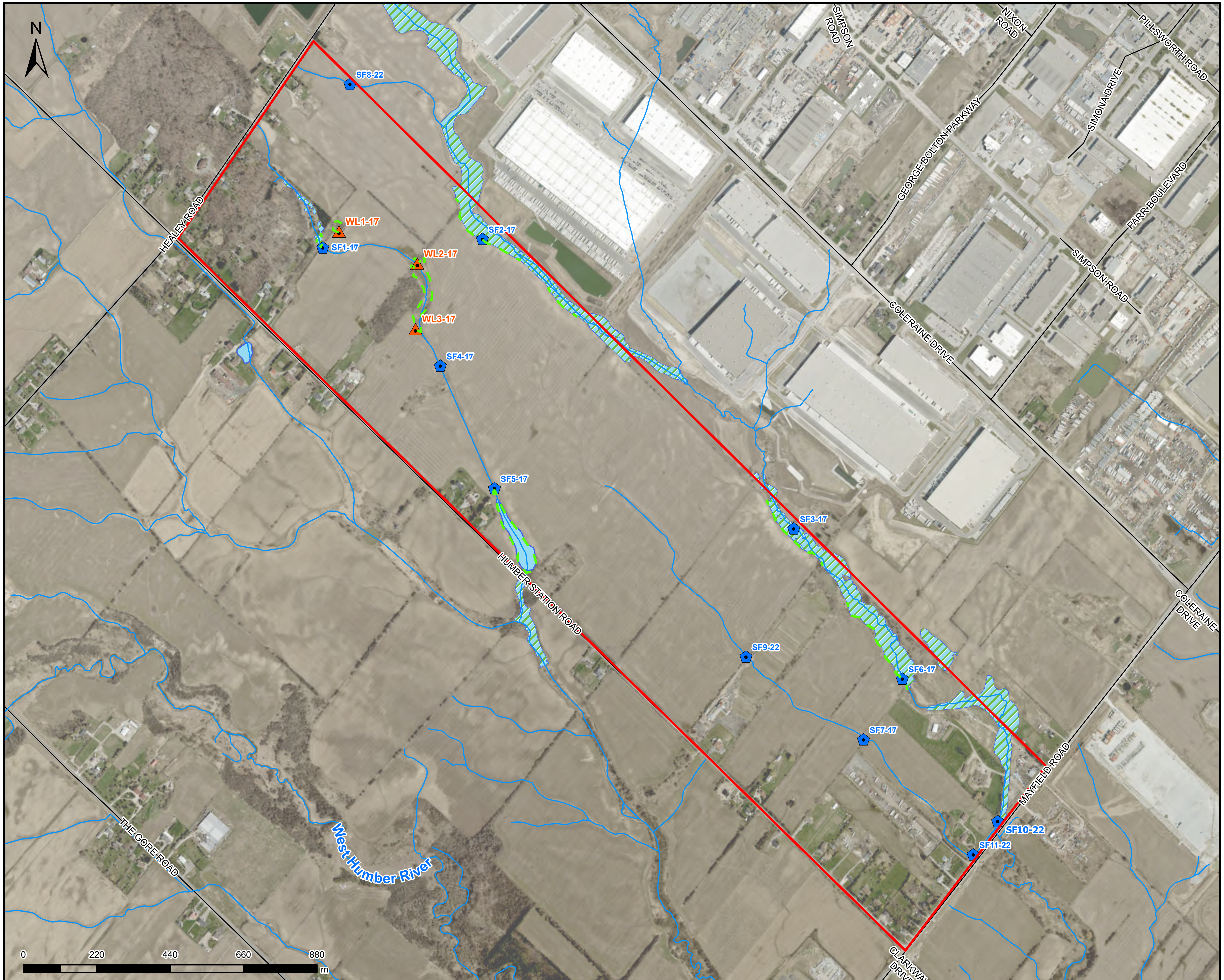
CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

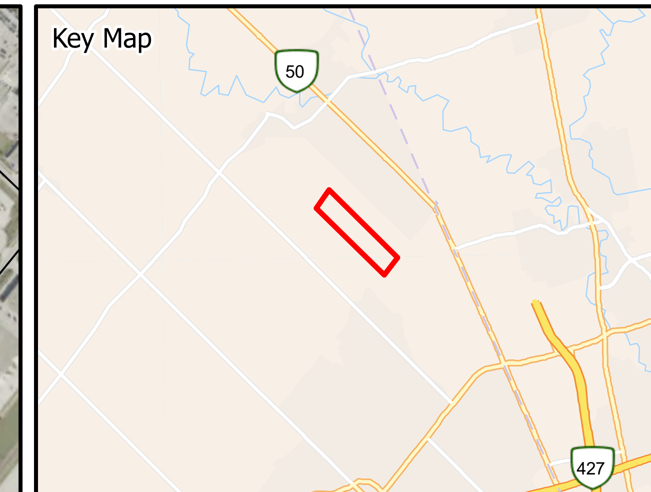
ARCADIS

Project #:	141438
Date:	July 2024

Path: J:\141438_HumberVil\7.0_Production\7.07_Spatial_Design\Humber Station Village Option 6\Humber Station Village Option 6.aprx (Humber Station Village Option 6 - Fig A2-9)

Last updated on 2024-07-05 by BRADLEY.TRINH





Legend

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

Note: Unevaluated wetlands are not shown on this figure. Ecological Land Classification of wetlands are referenced in GEI figures.

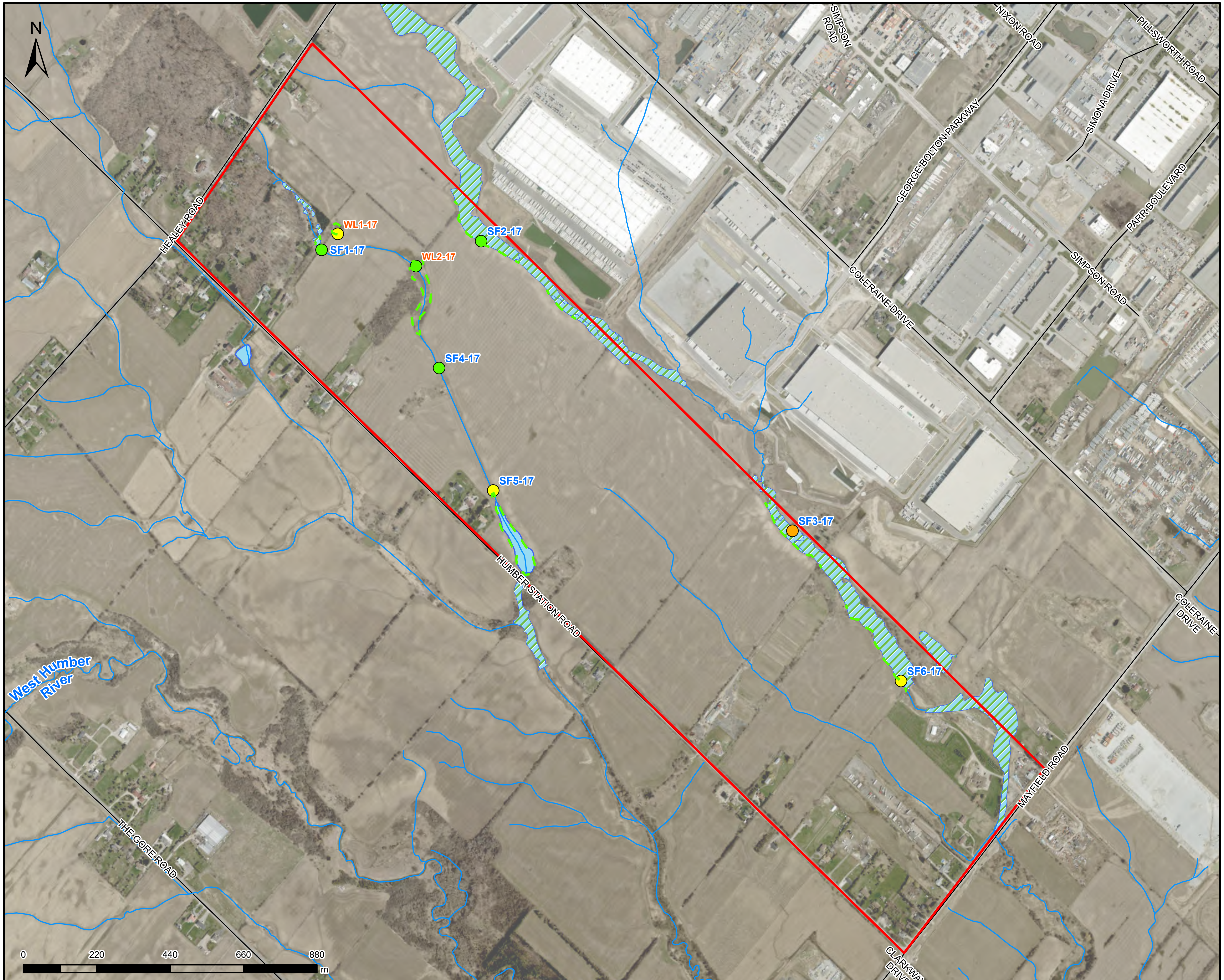
Figure A2-10

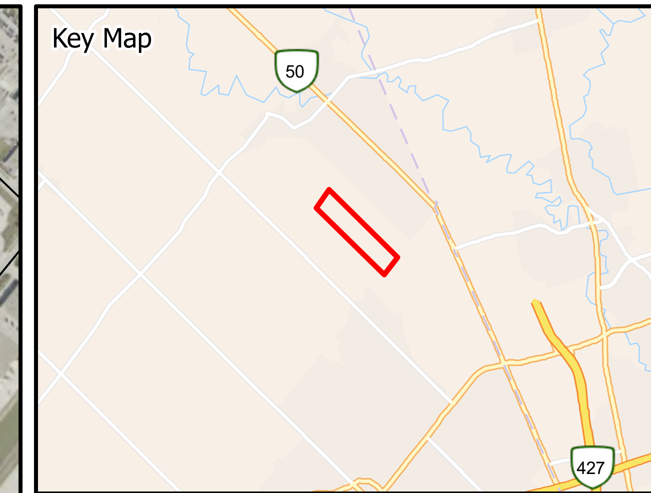
Surface Water Monitoring Locations

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

ARCADIS

Project #:	141438
Date:	July 2024





Legend

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

Vertical Hydraulic Gradient

- Downward Gradient
- Predominantly Upward Gradient
- Variable Gradient

Note: Unevaluated wetlands are not shown on this figure. Ecological Land Classification of wetlands are referenced in GEI figures.

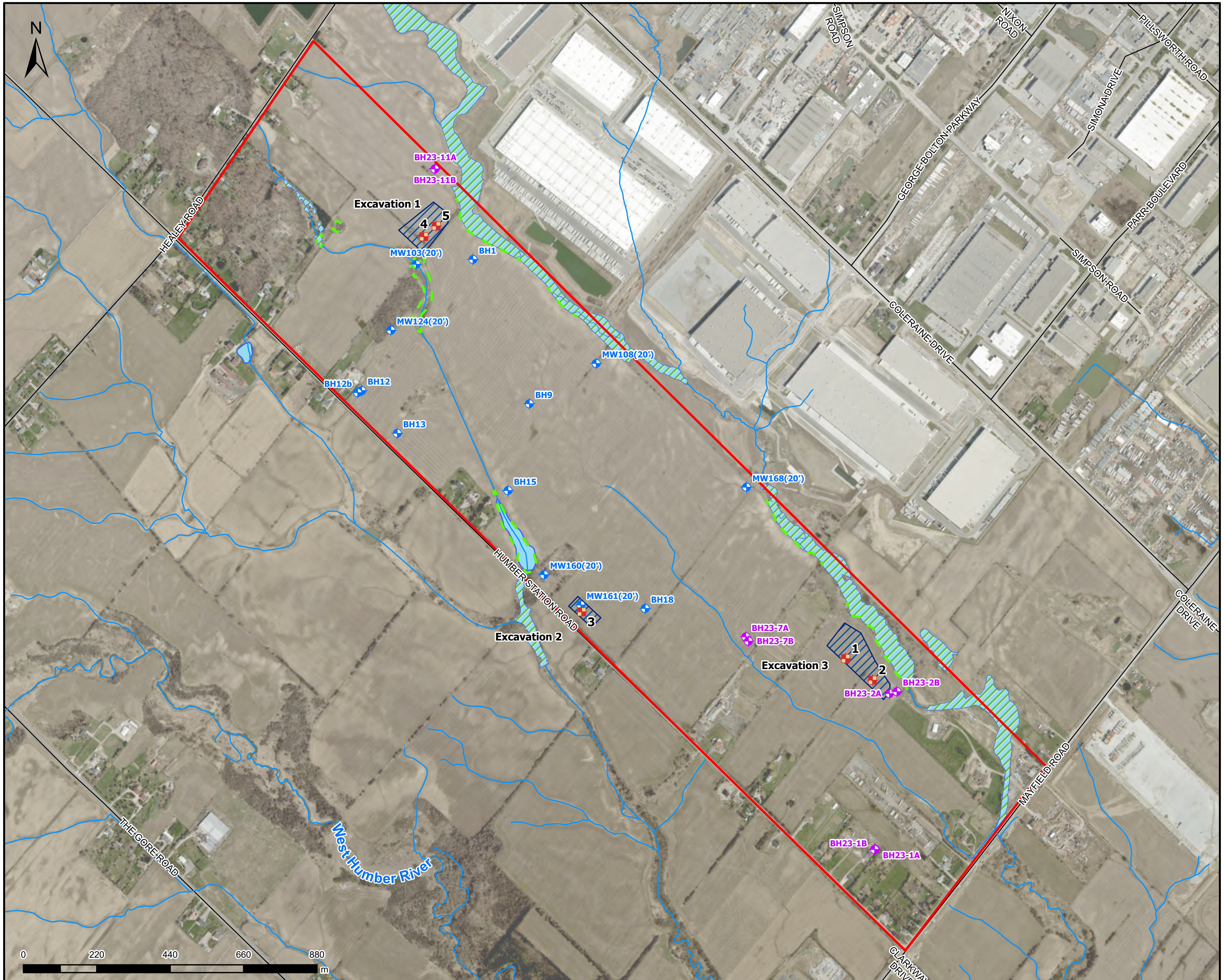
Figure A2-11

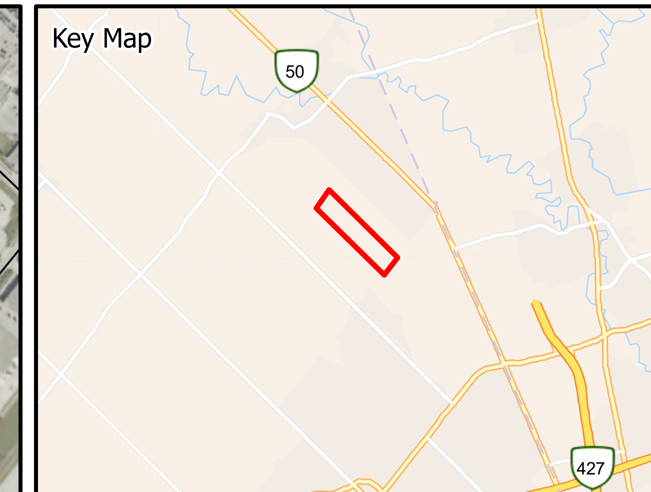
Piezometers Vertical Hydraulic Gradients (Summer 2017 to Spring 2018 & Winter 2022 / Summer 2023)

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

ARCADIS

Project #:	141438
Date:	July 2024





Legend

- Study Area
- Wetland
- Waterbody
- Proposed SWM Facility
- Wetland (Staked on October 19, 2021 by TRCA and GEI)
- Test Pit
- DS Consultant Monitoring Wells
- Pinchin Monitoring Wells
- Watercourse/Drainage
- Roads

Note: Unevaluated wetlands are not shown on this figure. Ecological Land Classification of wetlands are referenced in GEI figures.

Figure A2-12

Infiltration Test Pit Location Map

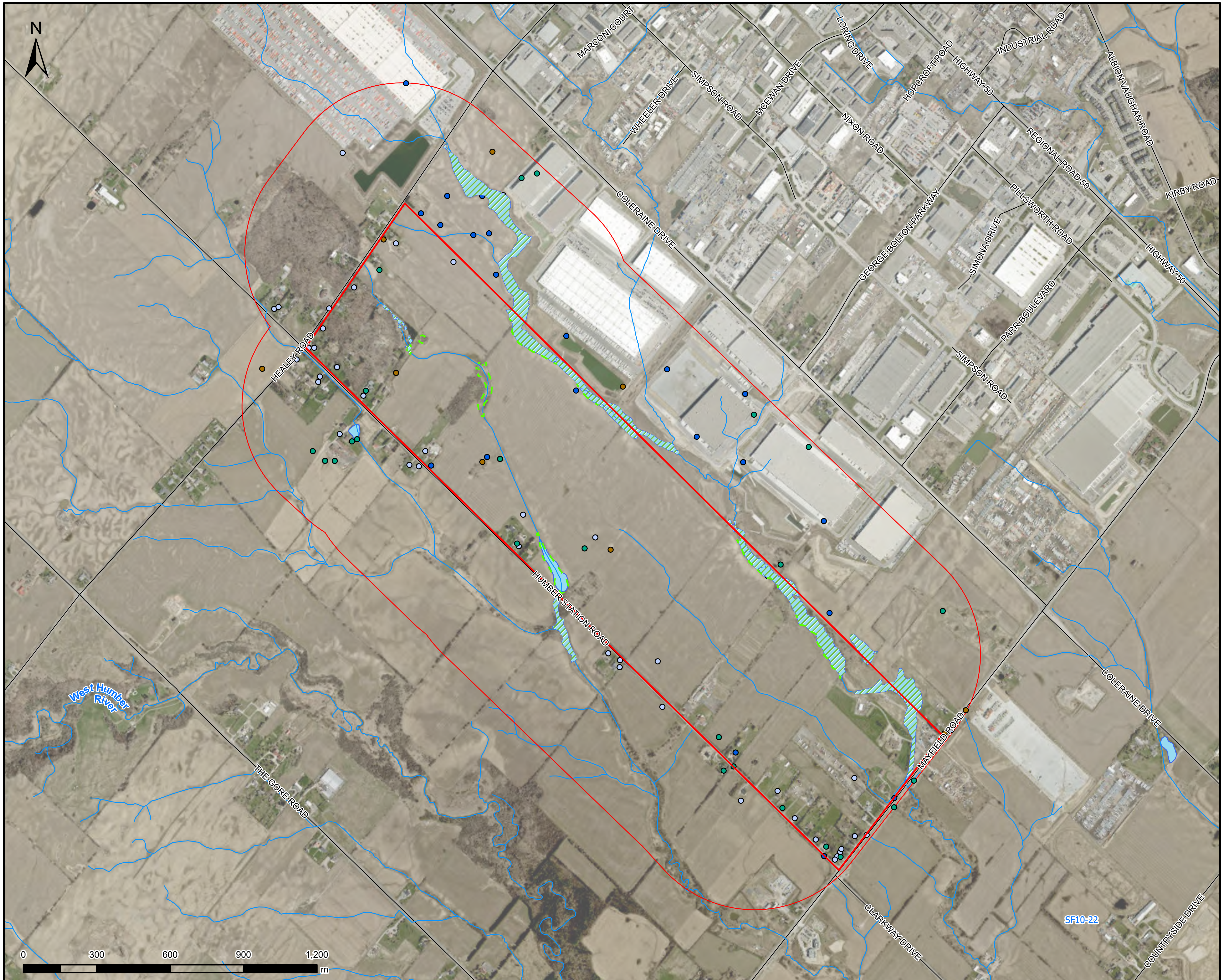
CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

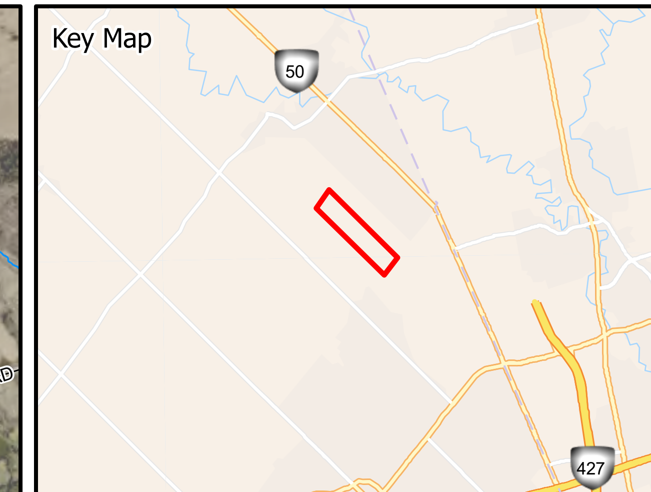
ARCADIS

Project #:	141438
Date:	July 2024

Path: J:\141438_HumberVil\7.0_Production\7.07_Spatial_Design\Humber Station Village Option 6\Humber Station Village Option 6.aprx (Humber Station Village Option 6 - Fig A2-12)

Last updated on 2024-07-05 by BRADLEY.TRINH





Legend

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

Final Status

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

Note: Unevaluated wetlands are not shown on this figure. Ecological Land Classification of wetlands are referenced in GEI figures.

Figure A2-13

MECP Well Records

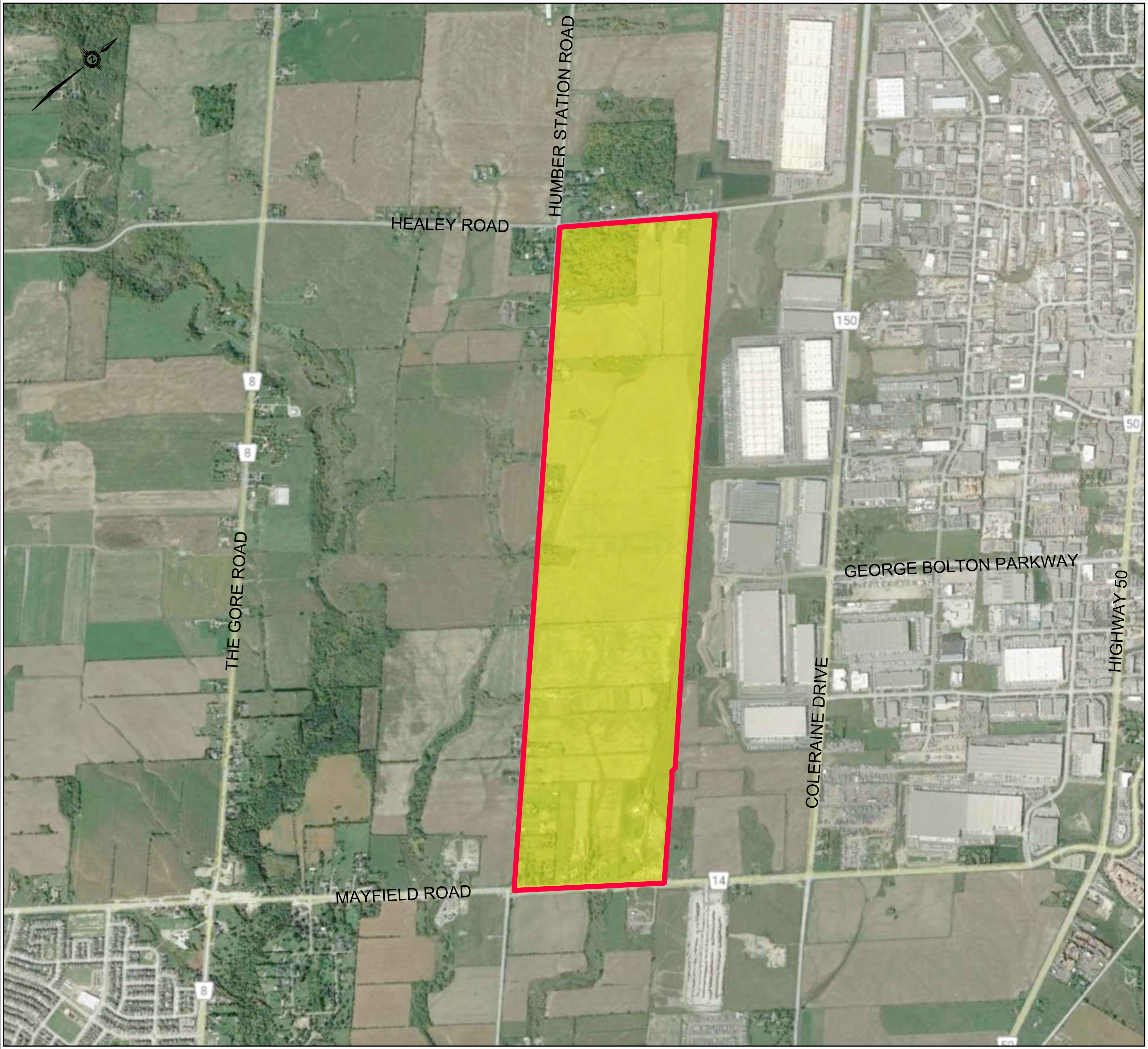
CEISMP - Phase 1 Characterization / Existing Conditions and Baseline Inventory
Bolton Residential Expansion Site Option 6 Lands

ARCADIS

Project #:	141438
Date:	July 2024

Appendix A3

Figures – Schaeffers Consulting Engineers



HUMBER STATION VILLAGES
TOWN OF CALEDON

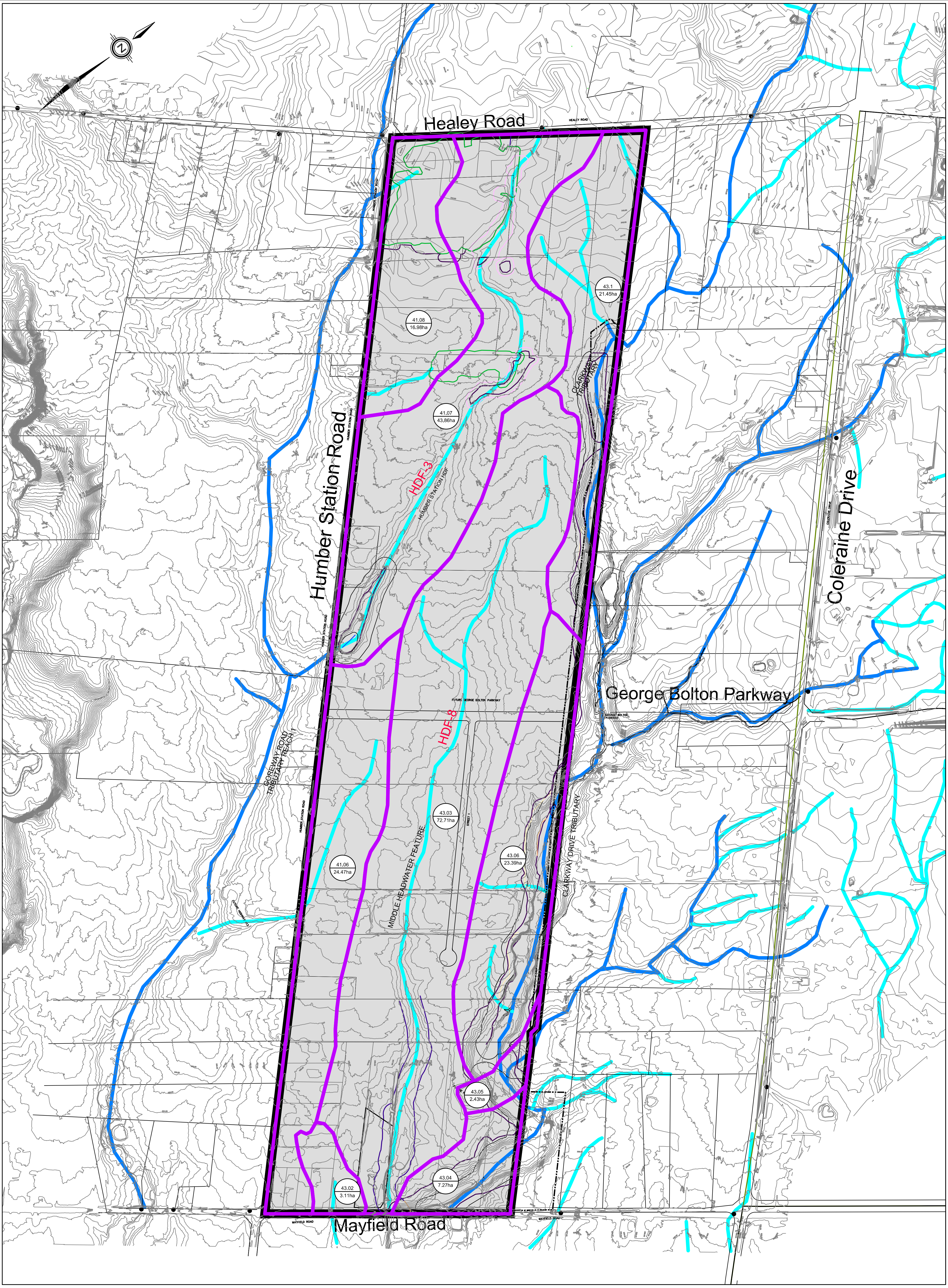
LEGEND

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	OCTOBER 2023	SCALE: N.T.S.



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

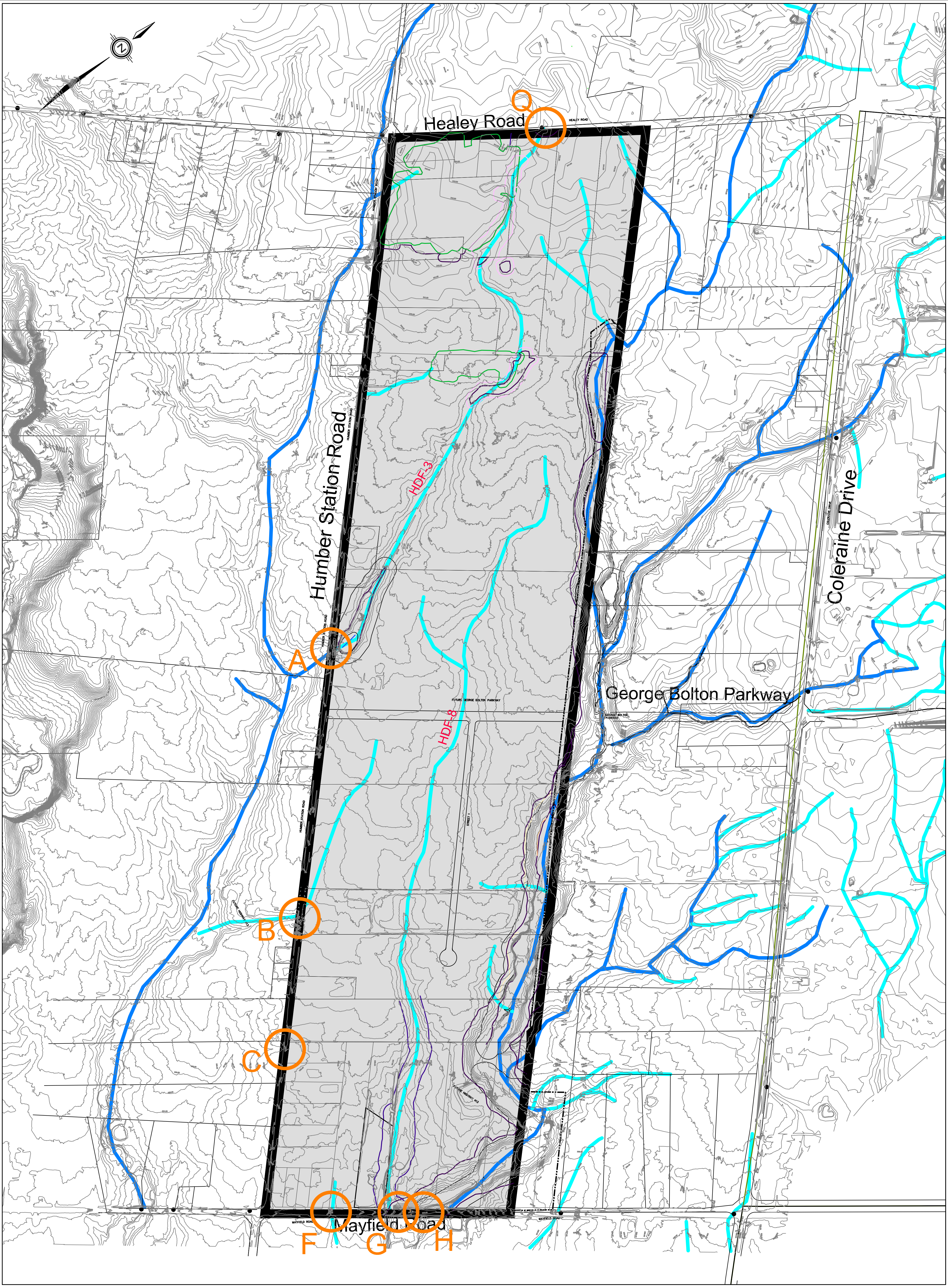
- SUBJECT LOCATION
- PRE DEVELOPMENT DRAINAGE BOUNDARY
- 43.02 / 3.11ha — TRCA CATCHMENT ID / TRCA AREA IN HECTARES
- WATERCOURSE
- HDF

FIGURE 2
PRE-DEVELOPMENT
DRAINAGE PLAN

2021-5139	OCTOBER 2023	SCALE: N.T.S.

W:\5100's\5139 - Humber Station Village\Drawings\Drainage\2023-10-23-5139-Pre-Dev Drainage.dwg

Phil Gotfried



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LEGEND
SUBJECT LOCATION
WATERCOURSE
EXISTING CULVERT LOCATION
HDF

FIGURE 3
EXISTING
CULVERT LOCATION

2021-5139	OCTOBER 2023	SCALE: N.T.S.

Appendix B1

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.

CONTENTS

LIST OF FIGURES

APPENDICES

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.

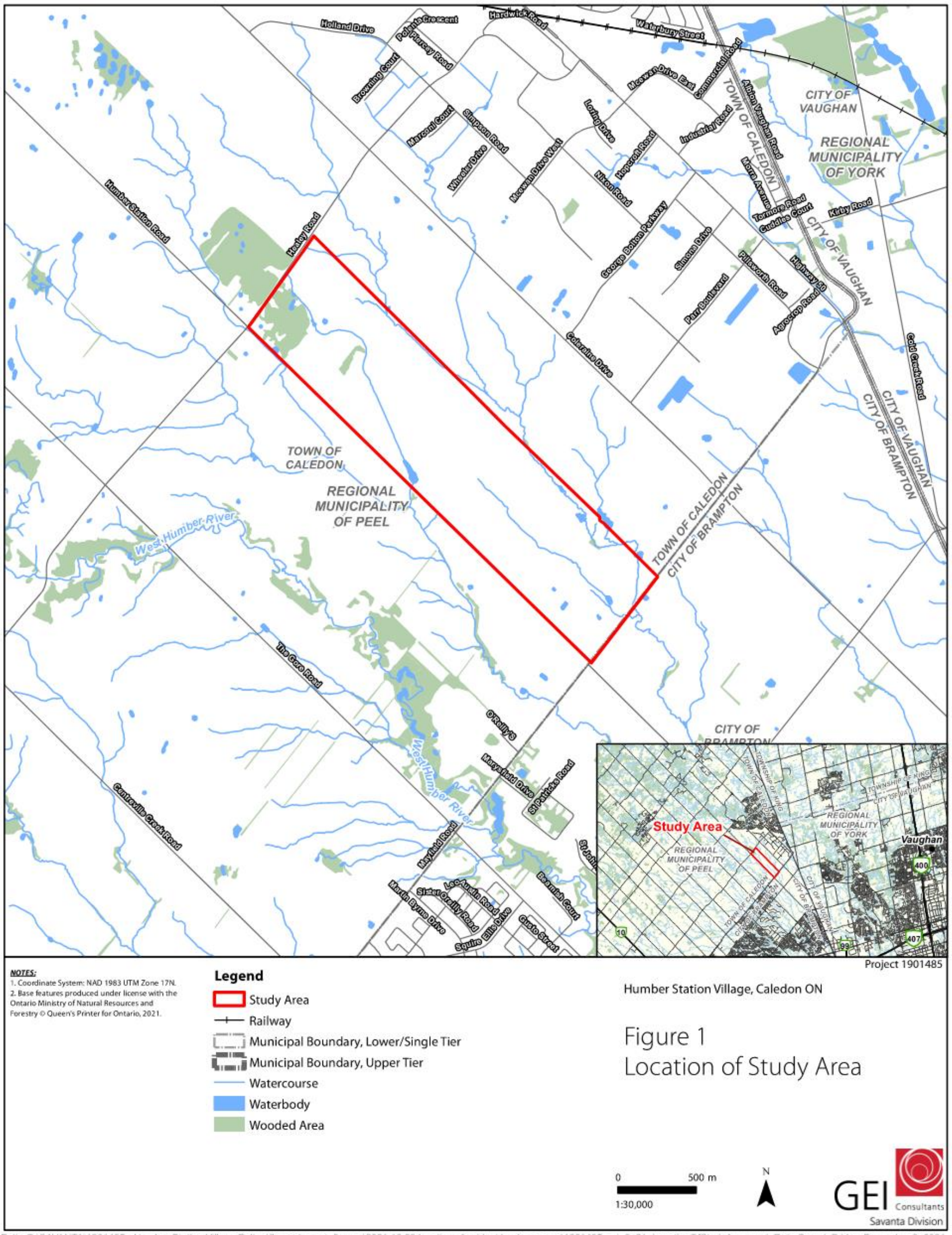
1.4 Official Plan and Zoning

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



Path: C:\SAVANTA\1901485 - Humber Station Village Bolton\figures\report_figures\2021 12 03 location of subject lands - memo\1901485_rpt_fig01_LocationOfStudyArea.mxd Date Saved: Friday, December 3, 2021

SCHAEFFERS

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.

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.

<u>Reporting:</u>

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).

<u>Incidental Observations:</u>

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.

<u>Reporting:</u>

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

<u>Reporting:</u>

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)

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

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

Appendix B2

TRCA Correspondence

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

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 C1

Tables – GEI Consultants 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) 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	Important – No fish observed in reach but could be present. Fish observed upstream in early summer.	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.	Important – No fish observed in reach but could be present. Fish observed upstream in early summer.	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) Intermittent – 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.	Important – Fish observed in reach.	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.	Important – Fish observed upstream and downstream from reach in early summer.	Valued – General amphibian habitat	**Protection**	**Protection**
HDF-3g	FT – 2 FC – 5 (Round 1) FC – 4 (Round 2, 2017) FC – 1 (Round 2, 2023) FC – 4 (Round 3, 2017) 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.	Important – Fish observed within reach in early summer.	Limited – No terrestrial habitat present	**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-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**
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**

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-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.	Valued – Redside Dace contributing habitat.	Limited – No terrestrial habitat present	**Conservation***	**Mitigation**
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.	Valued – Redside Dace contributing habitat.	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.	Valued – Redside Dace contributing habitat.	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) Intermittent	Hydrology modified by adjacent residential lands and upstream agricultural activities.	Limited – Riparian area consists of agricultural crops and meadow.	Valued – Redside Dace contributing habitat.	Unknown – non-participating lands	**Conservation**	**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-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.	Valued – Redside Dace contributing habitat.	Limited – No terrestrial habitat present	**Conservation***	**Mitigation**
HDF-8-c	FT – 7 FC – 3 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent and upstream agricultural activities.	Limited – Riparian area consists of agricultural crops.	Valued – Redside Dace contributing habitat.	Limited – No terrestrial habitat present	**Conservation***	**Mitigation**
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	FT – 7 FC – 3 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent and upstream agricultural activities.	Limited – Riparian area consists of agricultural crops.	Valued – Redside Dace contributing habitat.	Limited – No terrestrial habitat present	**Conservation***	**Mitigation**
HDF-8-d	FT – 1/7 FC – 3 (Round 1) FC – 1 (Round 2) Contributing – Ephemeral	Hydrology modified by adjacent and upstream agricultural activities.	Limited – Riparian area consists of agricultural crops.	Valued – Redside Dace contributing habitat.	Limited – No terrestrial habitat present	**Conservation***	**Mitigation**
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.	Valued – Redside Dace contributing habitat.	Limited – No terrestrial habitat present	**Conservation***	**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.	Valued – Redside Dace contributing habitat.	Limited – No terrestrial habitat present	**Conservation***	**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.	Valued – Redside Dace contributing habitat.	Limited – No terrestrial habitat present	**Conservation***	**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-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.	Valued – Redside Dace contributing habitat.	Limited – No terrestrial habitat present	**Conservation***	**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.	Valued – Redside Dace contributing habitat.	Limited – No terrestrial habitat present	**Conservation***	**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.	Valued – Redside Dace contributing habitat.	Limited – No terrestrial habitat present	**Conservation***	**Mitigation**
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.	Valued – Redside Dace contributing habitat.	Limited – No terrestrial habitat present	**Conservation***	**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.

Wetland	IC	C*dev*	C	S	Water Taking
MAM2-2 (north of CUM1--1, within drainage)	90.0	3.65	33.01	9.95	Low
MAM2-2 (south of OA, within drainage)	90.0	3.78	35.96	9.46	Low
MAS2-1 (southeast corner of FOD)	90.0	4.14	36.28	10.27	Low
MAM2-2 (east side of FOD8-3, within drainage)	90.0	12.01	44.15	24.48	Low
SWT2-2 (surrounds SAS1-1)	90.0	25.46	57.60	39.78	Low
SAS1-1	90.0	25.46	57.60	39.78	Low
MAS2/MAM2 (eastern watercourse)	90.0	13.53	169.57	7.18	Low
MAM2-10/MAM2-2 (eastern watercourse)	90.0	13.65	172.79	7.11	Low
MAS2 (eastern watercourse)	90.0	13.65	173.79	7.07	Low
MAM2-10/MAM2-2 (eastern watercourse)	90.0	15.48	176.30	7.90	Low
MAM2-2/MAM2-10 (eastern watercourse)	90.0	19.98	506.94	3.55	Low
MAS2-1 (eastern watercourse)	90.0	20.87	508.28	3.70	Low
MAM2-2/MAM2-10 (eastern watercourse)	90.0	26.87	559.92	4.32	Low
MAM/MAS2-1 (eastern watercourse)	90.0	26.87	563.98	4.29	Low
MAM/MAS2-1 (eastern watercourse)	90.0	26.87	580.75	4.16	Low

IC - Proportion of impervious cover (as a percentage between 0 and 100) proposed within the area of wetland catchment this is within the proponent's holdings
C*dev* - Total development area of the catchment (ha)
C - size of the total recharge area in the drainage boundary
S - Impervious Cover Score

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	THR		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*),	*Juglans cinerea*	S2?	G3	END	END		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	2001-2005	N
Alder Flycatcher	*Empidonax alnorum*	S5B	G5	-	-	2001-2005	N
American Bittern	*Botaurus lentiginosus*	S5B	G4	-	-	2001-2005	N
American Black Duck	*Anas rubripes*	S4	G5	-	-	2001-2005	N
American Coot	*Fulica americana*	S3B, S4N	G5	-	-	2001-2005	N
American Crow	*Corvus brachyrhynchos*	S5	G5	-	-	2001-2005	N
American Goldfinch	*Spinus tristis*	S5	G5	-	-	2001-2005	N
American Kestrel	*Falco sparverius*	S4	G5	-	-	2001-2005	N
American Redstart	*Setophaga ruticilla*	S5B	G5	-	-	2001-2005	N
American Robin	*Turdus migratorius*	S5	G5	-	-	2001-2005	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
American Wigeon	*Anas americana*	S4B, S4N, S5M	G5	-	-	2001-2005	N
American Woodcock	*Scolopax minor*	S4B	G5	-	-	2001-2005	N
Baltimore Oriole	*Icterus galbula*	S4B	G5	-	-	2001-2005	N
Bank Swallow	*Riparia riparia*	S4B	G5	THR	THR	2001-2005	N
Barn Swallow	*Hirundo rustica*	S4B	G5	THR	SC	2001-2005	N
Barred Owl	*Strix varia*	S5	G5	-	-	2001-2005	N
Belted Kingfisher	*Megaceryle alcyon*	S5B, S4N	G5	-	-	2001-2005	N
Black Tern	*Chlidonias niger*	S3B, S4M	G4	SC	NAR	2001-2005	N
Black-and-white Warbler	*Mniotilta varia*	S5B	G5	-	-	2001-2005	N
Black-billed Cuckoo	*Coccyzus erythropthalmus*	S4S5B	G5	-	-	2001-2005	N
Blackburnian Warbler	*Setophaga fusca*	S5B	G5	-	-	2001-2005	N
Black-capped Chickadee	*Poecile atricapillus*	S5	G5	-	-	2001-2005	N
Black-throated Blue Warbler	*Setophaga caerulescens*	S5B	G5	-	-	2001-2005	N
Black-throated Green Warbler	*Setophaga virens*	S5B	G5	-	-	2001-2005	N
Blue Jay	*Cyanocitta cristata*	S5	G5	-	-	2001-2005	N
Blue-gray Gnatcatcher	*Polioptila caerulea*	S4B	G5	-	-	2001-2005	N
Blue-headed Vireo	*Vireo solitarius*	S5B	G5	-	-	2001-2005	N
Blue-winged Teal	*Anas discors*	S3B, S4M	G5	-	-	2001-2005	N
Blue-winged Warbler	*Vermivora cyanoptera*	S4B	G5	-	-	2001-2005	N
Bobolink	*Dolichonyx oryzivorus*	S4B	G5	THR	THR	2001-2005	N
Broad-winged Hawk	*Buteo platypterus*	S5B	G5	-	-	2001-2005	N
Brown Creeper	*Certhia americana*	S5	G5	-	-	2001-2005	N
Brown Thrasher	*Toxostoma rufum*	S4B	G5	-	-	2001-2005	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
Brown-headed Cowbird	*Molothrus ater*	S5	G5	-	-	2001-2005	N
Canada Goose	*Branta canadensis*	S5	G5	-	-	2001-2005	N
Canada Warbler	*Cardellina canadensis*	S5B	G5	SC	SC	2001-2005	N
Carolina Wren	*Thryothorus ludovicianus*	S4	G5	-	-	2001-2005	N
Caspian Tern	*Hydroprogne caspia*	S3B, S5M	G5	-	-	2001-2005	N
Cedar Waxwing	*Bombycilla cedrorum*	S5	G5	-	-	2001-2005	N
Cerulean Warbler	*Setophaga cerulea*	S2B	G4	THR	END	2001-2005	N
Chestnut-sided Warbler	*Setophaga pensylvanica*	S5B	G5	-	-	2001-2005	N
Chimney Swift	*Chaetura pelagica*	S3B	G5	THR	THR	2001-2005	N
Chipping Sparrow	*Spizella passerina*	S5B, S3N	G5	-	-	2001-2005	N
Clay-colored Sparrow	*Spizella pallida*	S4B	G5	-	-	2001-2005	N
Cliff Swallow	*Petrochelidon pyrrhonota*	S4S5B	G5	-	-	2001-2005	N
Common Grackle	*Quiscalus quiscula*	S5	G5	-	-	2001-2005	N
Common Merganser	*Mergus merganser*	S5	G5	-	-	2001-2005	N
Common Nighthawk	*Chordeiles minor*	S4B	G5	SC	THR	2001-2005	N
Common Raven	*Corvus corax*	S5	G5	-	-	2001-2005	N
Common Tern	*Sterna hirundo*	S4B	G5	-	-	2001-2005	N
Common Yellowthroat	*Geothlypis trichas*	S5B, S3N	G5	-	-	2001-2005	N
Cooper's Hawk	*Accipiter cooperii*	S4	G5	-	-	2001-2005	N
Dark-eyed Junco	*Junco hyemalis*	S5	G5	-	-	2001-2005	N
Double-crested Cormorant	*Phalacrocorax auritus*	S5B, S4N	G5	-	-	2001-2005	N
Downy Woodpecker	*Dryobates pubescens*	S5	G5	-	-	2001-2005	N
Eastern Bluebird	*Sialia sialis*	S5B, S4N	G5	-	-	2001-2005	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
Eastern Kingbird	*Tyrannus tyrannus*	S4B	G5	-	-	2001-2005	N
Eastern Meadowlark	*Sturnella magna*	S4B, S3N	G5	THR	THR	2001-2005	N
Eastern Phoebe	*Sayornis phoebe*	S5B	G5	-	-	2001-2005	N
Eastern Screech-Owl	*Megascops asio*	S4	G5	NAR	NAR	2001-2005	N
Eastern Towhee	*Pipilo erythrophthalmus*	S4B, S3N	G5	-	-	2001-2005	N
Eastern Whip-poor-will	*Antrostomus vociferus*	S4B	G5	THR	THR	2001-2005	N
Eastern Wood-Pewee	*Contopus virens*	S4B	G5	SC	SC	2001-2005	N
European Starling	*Sturnus vulgaris*	SNA	G5	-	-	2001-2005	N
Evening Grosbeak	*Coccothraustes vespertinus*	S4	G5	SC	SC	2001-2005	N
Field Sparrow	*Spizella pusilla*	S4B, S3N	G5	-	-	2001-2005	N
Gadwall	*Anas strepera*	S4B, S4N, S5M	G5	-	-	2001-2005	N
Golden-crowned Kinglet	*Regulus satrapa*	S5	G5	-	-	2001-2005	N
Golden-winged Warbler	*Vermivora chrysoptera*	S3B	G4	SC	THR	2001-2005	N
Grasshopper Sparrow	*Ammodramus savannarum*	S4B	G5	SC	SC	2001-2005	N
Gray Catbird	*Dumetella carolinensis*	S5B, S3N	G5	-	-	2001-2005	N
Great Blue Heron	*Ardea herodias*	S4	G5	-	-	2001-2005	N
Great Crested Flycatcher	*Myiarchus crinitus*	S5B	G5	-	-	2001-2005	N
Great Egret	*Ardea alba*	S2B	G5	-	-	2001-2005	N
Great Horned Owl	*Bubo virginianus*	S4	G5	-	-	2001-2005	N
Green Heron	*Butorides virescens*	S4B	G5	-	-	2001-2005	N
Green-winged Teal	*Anas crecca*	S4B, S4N, S5M	G5	-	-	2001-2005	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
Hairy Woodpecker	*Dryobates villosus*	S5	G5	-	-	2001-2005	N
Hermit Thrush	*Catharus guttatus*	S5B, S4N	G5	-	-	2001-2005	N
Herring Gull	*Larus argentatus*	S4B,S5N	G5	-	-	2001-2005	N
Hooded Merganser	*Lophodytes cucullatus*	S5	G5	-	-	2001-2005	N
Hooded Warbler	*Setophaga citrina*	S4B	G5	NAR	NAR	2001-2005	N
Horned Lark	*Eremophila alpestris*	S4	G5	-		2001-2005	N
House Finch	*Carpodacus mexicanus*	SNA	G5	-	-	2001-2005	N
House Sparrow	*Passer domesticus*	SNA	G5	-	-	2001-2005	N
House Wren	*Troglodytes aedon*	S5B	G5	-	-	2001-2005	N
Indigo Bunting	*Passerina cyanea*	S5B	G5	-	-	2001-2005	N
Killdeer	*Charadrius vociferus*	S4B	G5	-	-	2001-2005	N
Least Bittern	*Ixobrychus exilis*	S4B	G5	THR	THR	2001-2005	N
Least Flycatcher	*Empidonax minimus*	S5B	G5	-	-	2001-2005	N
Long-eared Owl	*Asio otus*	S4	G5	-	-	2001-2005	N
Magnolia Warbler	*Setophaga magnolia*	S5B	G5	-	-	2001-2005	N
Mallard	*Anas platyrhynchos*	S5	G5	-	-	2001-2005	N
Marsh Wren	*Cistothorus palustris*	S4B, S3N	G5	-	-	2001-2005	N
Mourning Dove	*Zenaida macroura*	S5	G5	-	-	2001-2005	N
Mourning Warbler	*Geothlypis philadelphia*	S5B	G5	-	-	2001-2005	N
Mute Swan	*Cygnus olor*	SNA	G5	-	-	2001-2005	N
Nashville Warbler	*Leiothlypis ruficapilla*	S5B	G5	-	-	2001-2005	N
Northern Cardinal	*Cardinalis cardinalis*	S5	G5	-	-	2001-2005	N
Northern Flicker	*Colaptes auratus*	S5	G5	-	-	2001-2005	N
Northern Goshawk	*Accipiter gentilis*	S4	G5	-	-	2001-2005	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
Northern Harrier	*Circus cyaneus*	S5B, S4N	G5	-	-	2001-2005	N
Northern Mockingbird	*Mimus polyglottos*	S4	G5	-	-	2001-2005	N
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	S4B	G5	-	-	2001-2005	N
Northern Saw-whet Owl	*Aegolius acadicus*	S5	G5	-	-	2001-2005	N
Northern Shoveler	*Anas clypeata*	S4B, S4N, S5M	G5	-	-	2001-2005	N
Northern Waterthrush	*Parkesia noveboracensis*	S5B	G5	-	-	2001-2005	N
Orchard Oriole	*Icterus spurius*	S4B	G5	-	-	2001-2005	N
Osprey	*Pandion haliaetus*	S5B	G5	-	-	2001-2005	N
Ovenbird	*Seiurus aurocapilla*	S5B	G5	-	-	2001-2005	N
Pied-billed Grebe	*Podilymbus podiceps*	S4B,S2N	G5	-	-	2001-2005	N
Pileated Woodpecker	*Dryocopus pileatus*	S5	G5	-	-	2001-2005	N
Pine Siskin	*Spinus pinus*	S5	G5	-	-	2001-2005	N
Pine Warbler	*Setophaga pinus*	S5B, S3N	G5	-	-	2001-2005	N
Purple Finch	*Carpodacus purpureus*	S5	G5	-	-	2001-2005	N
Purple Martin	*Progne subis*	S3B	G5	-	-	2001-2005	N
Red Crossbill	*Loxia curvirostra*	S5	G5	-	-	2001-2005	N
Red-bellied Woodpecker	*Melanerpes carolinus*	S5	G5	-	-	2001-2005	N
Red-breasted Nuthatch	*Sitta canadensis*	S5	G5	-	-	2001-2005	N
Red-eyed Vireo	*Vireo olivaceus*	S5B	G5	-	-	2001-2005	N
Red-headed Woodpecker	*Melanerpes erythrocephalus*	S3	G5	END	END	2001-2005	N
Red-shouldered Hawk	*Buteo lineatus*	S4B, S2N	G5	NAR	NAR	2001-2005	N
Red-tailed Hawk	*Buteo jamaicensis*	S5	G5	-	-	2001-2005	N
Red-winged Blackbird	*Agelaius phoeniceus*	S5	G5	-	-	2001-2005	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
Ring-billed Gull	*Larus delawarensis*	S5	G5	-	-	2001-2005	N
Ring-necked Pheasant	*Phasianus colchicus*	SNA	G5	-	-	2001-2005	N
Rock Pigeon	*Columba livia*	SNA	G5	-	-	2001-2005	N
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	S5B	G5	-	-	2001-2005	N
Ruby-crowned Kinglet	*Regulus calendula*	S5B, S3N	G5	-	-	2001-2005	N
Ruby-throated Hummingbird	*Archilochus colubris*	S5B	G5	-	-	2001-2005	N
Ruddy Duck	*Oxyura jamaicensis*	S3B, S4N, S5M	G5	-	-	2001-2005	N
Ruffed Grouse	*Bonasa umbellus*	S5	G5	-	-	2001-2005	N
Savannah Sparrow	*Passerculus sandwichensis*	S5B, S3N	G5	-	-	2001-2005	N
Scarlet Tanager	*Piranga olivacea*	S5B	G5	-	-	2001-2005	N
Sedge Wren	*Cistothorus platensis*	S4B	G5	-	-	2001-2005	N
Sharp-shinned Hawk	*Accipiter striatus*	S5	G5	-	-	2001-2005	N
Short-eared Owl	*Asio flammeus*	S4?B, S2S3N	G5	SC	THR	2001-2005	N
Song Sparrow	*Melospiza melodia*	S5	G5	-	-	2001-2005	N
Sora	*Porzana carolina*	S5B	G5	-	-	2001-2005	N
Spotted Sandpiper	*Actitus macularius*	S5B	G5	-	-	2001-2005	N
Swamp Sparrow	*Melospiza georgiana*	S5B, S4N	G5	-	-	2001-2005	N
Tree Swallow	*Tachycineta bicolor*	S4S5B	G5	-	-	2001-2005	N
Turkey Vulture	*Cathartes aura*	S5B, S3N	G5	-	-	2001-2005	N
Upland Sandpiper	*Bartramia longicauda*	S2B	G5	-	-	2001-2005	N
Veery	*Catharus fuscescens*	S5B	G5	-	-	2001-2005	N
Vesper Sparrow	*Pooecetes gramineus*	S4B	G5	-	-	2001-2005	N
Virginia Rail	*Rallus limicola*	S4S5B	G5	-	-	2001-2005	N
Warbling Vireo	*Vireo gilvus*	S5B	G5	-	-	2001-2005	N

COMMON NAME	SCIENTIFIC NAME	S-RANK	G-RANK	COSSARO	COSEWIC	LAST OBSERVED	EXTIRPATED
White-breasted Nuthatch	*Sitta carolinensis*	S5	G5	-	-	2001-2005	N
White-throated Sparrow	*Zonotrichia albicollis*	S5	G5	-	-	2001-2005	N
White-winged Crossbill	*Loxia leucoptera*	S5	G5	-	-	2001-2005	N
Wild Turkey	*Meleagris gallopavo*	S5	G5	-	-	2001-2005	N
Willow Flycatcher	*Empidonax traillii*	S4B	G5	-	-	2001-2005	N
Wilson's Snipe	*Gallinago delicata*	S5B	G5	-	-	2001-2005	N
Winter Wren	*Troglodytes hiemalis*	S5B, S4N	G5	-	-	2001-2005	N
Wood Duck	*Aix sponsa*	S5B, S3N	G5	-	-	2001-2005	N
Wood Thrush	*Hylocichla mustelina*	S4B	G4	SC	THR	2001-2005	N
Yellow Warbler	*Setophaga petechia*	S5B	G5	-	-	2001-2005	N
Yellow-bellied Sapsucker	*Sphyrapicus varius*	S5B, S3N	G5	-	-	2001-2005	N
Yellow-billed Cuckoo	*Coccyzus americanus*	S4B	G5	-	-	2001-2005	N
Yellow-rumped Warbler	*Setophaga coronata*	S5B, S4N	G5	-	-	2001-2005	N
Yellow-throated Vireo	*Vireo flavifrons*	S4B	G5	-	-	2001-2005	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
Eastern Ribbonsnake	*Thamnophis sauritus*	S4	G5	SC	SC	1984	N
Eastern Milksnake	*Lampropeltis triangulum*	S4	G5	NAR	SC	2012	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
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
Eastern Tent Caterpillar Moth	*Malacosoma americana*	S5	G5	-	-	2016	N
Modest Sphinx	*Pachysphinx modesta*	S5	G5	-	-	2017	N
Hummingbird Clearwing	*Hemaris thysbe*	S5	G5	-	-	2018	N
Snowberry Clearwing	*Hemaris diffinis*	S4S5	G5	-	-	2017	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
Agreeable Tiger Moth	*Spilosoma congrua*	S5?	G5	-	-	2019	N
Virginian Tiger Moth	*Spilosoma virginica*	S5	G5	-	-	2019	N
Fall Webworm Moth	*Hyphantria cunea*	S5	G5	-	-	2019	N
Isabella Tiger	*Pyrrharctia isabella*	S5	G5	-	-	2019	N
Banded Tussock Moth	*Halysidota tessellaris*	S5	G5	-	-	2019	N
Hickory Tussock Moth	*Lophocampa caryae*	S5	G5	-	-	2019	N
Milkweed Tussock Moth	*Euchaetes egle*	S4	G5	-	-	2018	N
Virginia Ctenucha	*Ctenucha virginica*	S5	G5	-	-	2019	N
Silver-spotted Skipper	*Epargyreus clarus*	S4	G5	-	-	2021	N
Northern Cloudywing	*Thorybes pylades*	S5	G5	-	-	2021	N
Dreamy Duskywing	*Erynnis icelus*	S5	G5	-	-	2020	N
Juvenal's Duskywing	*Erynnis juvenalis*	S5	G5	-	-	2019	N
Wild Indigo Duskywing	*Erynnis baptisiae*	S4	G5	-	-	2021	N
Arctic Skipper	*Carterocephalus palaemon*	S5	G5	-	-	2021	N
Least Skipper	*Ancyloxypha numitor*	S5	G5	-	-	2020	N
European Skipper	*Thymelicus lineola*	SNA	G5	-	-	2021	N
Fiery Skipper	*Hylephila phyleus*	SNA	G5	-	-	(year not recorded)	N
Peck's Skipper	*Polites peckius*	S5	G5	-	-	2021	N
Tawny-edged Skipper	*Polites themistocles*	S5	G5	-	-	2021	N
Long Dash Skipper	*Polites mystic*	S5	G5	-	-	2021	N
Northern Broken-Dash	*Wallengrenia egermet*	S5	G5	-	-	2021	N
Little Glassywing	*Pompeius verna*	S4	G5	-	-	2021	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
Delaware Skipper	*Anatrytone logan*	S4	G5	-	-	2021	N
Hobomok Skipper	*Poanes hobomok*	S5	G5	-	-	2021	N
Dun Skipper	*Euphyes vestris*	S5	G5	-	THR	2021	N
Black Swallowtail	*Papilio polyxenes*	S5	G5	-	-	2021	N
Eastern Giant Swallowtail	*Papilio cresphontes*	S4	G5	-	-	2018	N
Eastern Tiger Swallowtail	*Papilio glaucus*	S5	G5	-	-	2020	N
Midsummer Tiger Swallowtail	*Papilio canadensis X glaucus*	-	-	-	-	2021	N
Canadian Tiger Swallowtail	*Papilio canadensis*	S5	G5	-	-	2016	N
Tiger Swallowtail Complex	*Papilio glaucus complex*	-	-	-	-	2021	N
Cabbage White	*Pieris rapae*	SNA	G5	-	-	2021	N
Clouded Sulphur	*Colias philodice*	S5	G5	-	-	2021	N
Orange Sulphur	*Colias eurytheme*	S5	G5	-	-	2021	N
Bronze Copper	*Lycaena hyllus*	S5	G5	-	-	2021	N
Acadian Hairstreak	*Satyrium acadicum*	S4	G5	-	-	2021	N
Coral Hairstreak	*Harkenclenus titus*	S5	G5	-	-	2020	N
Banded Hairstreak	*Satyrium calanus*	S4	G5	-	-	2021	N
Hickory Hairstreak	*Satyrium caryaevorum*	S4	G4	-	-	2017	N
Striped Hairstreak	*Satyrium liparops*	S5	G5	-	-	2021	N
Eastern Pine Elfin	*Callophrys niphon*	S5	G5	-	-	2020	N
Eastern Tailed Blue	*Cupido comyntas*	S5	G5	-	-	2021	N
Northern Azure	*Celastrina lucia*	S5	G5	-	-	2021	N
Summer Azure	*Celastrina neglecta*	S5	G5	-	-	2017	N
Azure sp.	*Celastrina sp.*	-	-	-	-	2020	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
Silvery Blue	*Glaucopsyche lygdar*	S5	G5	-	-	2021	N
Great Spangled Fritillary	*Speyeria cybele*	S5	G5	-	-	2021	N
Aphrodite Fritillary	*Speyeria aphrodite*	S5	G5	-	-	2016	N
Atlantis Fritillary	*Speyeria atlantis*	S5	G5	-	-	1964	N
Pearl Crescent	*Phyciodes tharos*	S4	G5	-	-	2021	N
Northern Crescent	*Phycoides pascoensis*	S5	G5	-	-	2021	N
Baltimore Checkerspot	*Euphydryas phaeton*	S4	G5	-	-	2021	N
Question Mark	*Polygonia interrogationis*	S5	G5	-	-	2021	N
Eastern Comma	*Polygonia comma*	S5	G5	-	-	2021	N
Gray Comma	*Polygonia progne*	S5	G5	-	-	2020	N
Compton Tortoiseshell	*Nymphalis l-album*	S5	G5	-	-	2021	N
Mourning Cloak	*Nymphalis antiopa*	S5	G5	-	-	2021	N
Milbert's Tortoiseshell	*Aglais milberti*	S5	G5	-	-	2020	N
American Lady	*Vanessa virginiensis*	S5	G5	-	-	2019	N
Painted Lady	*Vanessa cardui*	S5B	G5	-	-	2020	N
Red Admiral	*Vanessa atalanta*	S5B	G5	-	-	2021	N
White Admiral	*Limenitis arthemis*	S5	G5	-	-	2021	N
Red-spotted Purple	*Limenitis arthemis astyanax*	S5	G5T5	-	-	2021	N
Viceroy	*Limenitis archippus*	S5	G5	-	-	2021	N
Northern Pearly-Eye	*Lethe anthedon*	S5	G5	-	-	2021	N
Little Wood-Satyr	*Megisto cymela*	S5	G5	-	-	2021	N
Common Ringlet	*Coenonympha tullia*	S5	G5	-	-	2021	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
Common Wood-Nymph	*Cercyonis pegala*	S5	G5	-	-	2021	N
Monarch	*Danaus plexippus*	S4B, S2N	G4	SC	END	2021	N
Mourning Cloak	*Nymphalis antiopa*	S5	G5	-	-	2021	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	S2S3B	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*	THR	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	S3B	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.
136	x	Chimney Swift	*Chaetura pelagica*	THR	S4B,S4N	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.

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
138	x	Eastern Meadowlark	*Sturnella magna*	THR	S4B	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*	SC	S4B	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**								
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.
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	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**								

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	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. Tributaries of the West Humber River are identified as contributing habitat	Yes- The Clarkway Drive Tributary and HDF-8 are identified as contributing Redside Dace habitat

x **Last Updated**
x S Rank: NHIC Biodiversity Explorer 2023
x Provinicial Status: 2023
x COSSARO Priority Species: January 2017 (http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/MNR_SAR_CSSR_MTNG_RSLTS_EN.html)
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 Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 23 pp.
x Boland, G.J., J. Ambrose, B. Husband, K.A. Elliott and M.S. Melzer. 2012. Recovery Strategy for the American Chestnut (Castanea dentata) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 43 pp.
x Hoary Mountain-mint Recovery Team (HMRT). 2011. Recovery Strategy for Hoary Mountain-mint (*Pycnanthemum incanum*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. Ii + 6 pp. + Apendix vii + 22 pp.
x MNR (2013). What's at Risk in Peel? On-line: http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/MNR_SAR_WHTS_RSK_PEEL_EN.html Accessed August 2013
x SARO (2022). Species at Risk in Ontario List. Ontario Regulation 230/08. Consolidation Period January 24, 2013.

Table 8: GEI Field Studies and Natural Inventories (2017, 2018, 2021, 2022, and 2023)

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

FIELD DATE	NATURE OF INVESTIGATION	SURVEYOR
July 19	Aquatic Habitat Assessment	G. Buckton
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

FIELD DATE	NATURE OF INVESTIGATION	SURVEYOR
June 13	Headwater Drainage Feature Assessment Round 2	G. Buckton
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

Table 9: 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

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
Oleaceae	**Olive Family**											
Fraxinus americana	White Ash	4	3		S4?			G5		X	X	X

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									Local Status Source	Varga 2005	CVC 2002	
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		
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

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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
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

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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 12: 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 14: 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 15: 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						

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 15: 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-15-2017	5	WOOD1	X								
JU-16-2017	6	WOOD1	X								
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								

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 15: 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-21-2017	9	BP8			X						
JU-26-2017	10	BT1	X								
JU-26-2017	10	BT2			X	X					
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 16: 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 17: 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 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
February	FE
March	MR
April	AP
May	MA
June	JN
July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 17: 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														

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
February	FE
March	MR
April	AP
May	MA
June	JN
July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 17: 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	T11	X														
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														

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
February	FE
March	MR
April	AP
May	MA
June	JN
July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 17: 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	T6	X														
02-MA	1	AS2	X														
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														

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
February	FE
March	MR
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May	MA
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July	JL
August	AU
September	SE
October	OC
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December	DE

Table 17: 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	CB8	X														
02-MA	1	CB9	X														
02-MA	1	CB10	X														
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														

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
February	FE
March	MR
April	AP
May	MA
June	JN
July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 17: 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	T7	X														
16-MA	2	T8	X														
16-MA	2	T9	X														
16-MA	2	T10	X														
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														

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	
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November	NO
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Table 17: 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	CB12	X														
16-MA	2	CB13	X														
16-MA	2	CB14	X														
16-MA	2	CB15	X														
17-MA	3	T1	X														
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														

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*

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January	JA
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September	SE
October	OC
November	NO
December	DE

Table 17: 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	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														
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														

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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August	AU
September	SE
October	OC
November	NO
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Table 17: 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	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														
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														

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	
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January	JA
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December	DE

Table 17: 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	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														
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														

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*
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QUSN	Queensnake	*Regina septemvittata*

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Table 17: 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
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 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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September	SE
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December	DE

Table 18: 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 18: 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

LEGEND:

MONTH	
JA	January
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NO	November
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Table 18: Wildlife Road Crossing Survey Results

SURVEY DATE	SURVEY ROUND	TRANSECT NO.	SPECIES OBSERVED	UTM OF OBSERVATION		INDIVIDUALS	
				EASTING	NORTHING	QTY	STATUS
24-MA	4	RT2	Bird sp.	601066	4855818	1	Dead
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

Table 19: Turtle Basking Survey Results (2018)

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 20: 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
X	X														

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		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					
x		Northern Cardinal	*Cardinalis cardinalis*	S5	G5					L5			U		
x		Rose-breasted Grosbeak	*Pheucticus ludovicianus*	S5B	G5					L4			C		

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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													
		G4: Common globally; usually more than 100 occurrences in the overall range													
		G4G5: Common to very common globally													
		G5: Very common globally; demonstrably secure													

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
		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 23: 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 23: 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.

Table 23: 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
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
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

Table 23: 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
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
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

Table 23: 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 (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
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

Table 23: 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
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
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

Table 23: 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
(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
(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

Table 23: 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
(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
(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

Table 23: 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
(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
(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

Table 23: 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
(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
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 24: 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 24: 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 24: 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 24: 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).

Table 24: Significant Wildlife Habitat Review (Peel ROP Peel-Caledon Significant Wildlife Habitat Study 2009)

SWH Type	SWH Analysis
B15. Mineral Licks	**Not applicable.** Mineral licks are not recommended as an SWH type for the Region of Peel 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	**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 24: Significant Wildlife Habitat Review (Peel ROP Peel-Caledon Significant Wildlife Habitat Study 2009)

SWH Type	**SWH Analysis**
Region of Peel/ Town of Caledon	
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.

Table 25: 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]

Appendix C2

Tables – Arcadis Professional Services (Canada) Inc.

Table C2-1 - Summary of Previous Hydrogeology and Geotechnical Studies

Company	Study	Report Date	Purpose	Boreholes (no.)	Monitoring Wells (no.)	Monitoring Wells ID	Years Monitored
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, MW5-17sd	2017, 2018
Arcadis IBI Group	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	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	12519 & 12713 Humber Station Road, Bolton - Mainline Planning Services Inc.	na	Hydrogeology	No new monitoring wells installed, monitored existing wells			2022, 2023

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, 2022-2023	MW1-17	4856301	601346	245.2	0.71	6.6	5.93
		MW2-17D	4855764	601415	242.4	0.63	12.3	11.63
		MW2-17S	4855763	601414	242.4	0.72	6.8	6.07
		MW3-17	4855685	602151	235.8	0.65	6.7	6.01
		MW4-17D	4855042	602267	234.0	0.67	12.8	12.17
		MW4-17S	4855042	602266	234.0	0.66	6.7	6.06
		MW5-17D	4854913	602914	229.0	0.68	12.7	12.06
		MW5-17S	4854913	602915	228.9	0.74	6.8	6.11
RJ Burnside (RJB)	2017-2018, 2022-2023	MW9 (BH1)	4855137	602003	235.6	0.9	6.2	5.28
		MW8 (BH2)	4854592	602349	231.9	0.89	6.0	5.11
		MW7 (BH3)	4854094	602880	228.6	1	5.5	4.45
DS Consultants Ltd.	2023	BH23-1A	4854023	603115	227.9	1.0	8.8	7.8
		BH23-1B	4854022	603113	227.9	0.8	5.4	4.6
		BH23-2A	4854490	603158	228.0	0.9	5.5	4.6
		BH23-2B	4854496	603180	226.1	1.0	9.1	8.1
		BH23-7A	4854660	602727	230.9	0.8	7.4	6.6
		BH23-7B	4854647	602735	230.6	1.0	8.9	7.9
		BH23-11A	4856065	601796	239.9	0.8	8.8	8.0
		BH23-11B	4856064	601795	239.9	0.9	4.7	3.8
Palmer Environmental	2022-2023	BH1	4855794	601908	239.3	1.0	7.1	6.2
		BH9	4855360	602077	235.6	0.9	7.1	6.1
		BH12	4855399	601574	237.2	0.9	5.2	4.3
		BH12B	4855392	601562	237.2	1.0	6.3	5.3
		BH13	4855099	602013	237.4	0.9	7.0	6.0
		BH15	4855099	602013	234.0	0.9	7.2	6.3
		BH18	4854747	602424	232.6	0.9	7.3	6.4

Table C2-3: Monitoring Well Water Levels

Year		2022								2023											
Well ID		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	
	Water Level (mbtoc)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)
MW1-17	NM	NM	NM	NM	NM	NM	NM	0.8	244.4	NM	NM	0.5	244.7	NM	NM	NM	NM	NM	NM	1.6	243.5
MW2-17D	NM	NM	NM	NM	NM	NM	NM	2.6	239.8	NM	NM	1.2	241.1	NM	NM	NM	NM	NM	NM	1.3	241.1
MW2-17S	NM	NM	NM	NM	NM	NM	NM	2.7	239.8	NM	NM	1.3	241.2	NM	NM	NM	NM	NM	NM	1.1	241.3
MW3-17	1	0.4	235.4	0.6	235.2	NM	NM	NM	NM	0.3	235.5	0.1	235.7	0.2	235.6	NM	NM	0.0	235.8	NM	NM
MW4-17D	2.9	2.2	231.8	2.1	231.9	2.1	231.9	NM	NM	1.0	233.0	0.5	233.4	0.6	233.4	NM	NM	0.6	233.4	1.4	232.6
MW4-17S	2.9	2.2	231.8	2.3	231.7	2.1	232.0	NM	NM	1.1	232.9	0.6	233.4	0.9	233.1	NM	NM	0.8	233.2	1.8	232.2
MW5-17D	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW5-17S	NM	NM	NM	NM	NM	NM	NM	0.3	228.7	NM	NM	-0.2	229.1	NM	NM	NM	NM	NM	NM	0.6	228.4
MW9 (BH1 RJB MW)	3.88	3.0	232.6	2.9	232.7	NM	NM	NM	NM	1.9	233.7	1.4	234.2	1.6	234.1	NM	NM	1.5	234.1	2.4	233.2
MW8 (BH2 RJB MW)	2.67	1.8	230.2	NM	NM	1.8	230.1	1.1	230.8	0.5	231.4	0.3	231.6	0.6	231.4	NM	NM	0.6	231.3	1.9	230.0
MW7 (BH3 RJB MW)	NM	NM	NM	NM	NM	NM	NM	0.3	228.3	NM	NM	0.1	228.5	NM	NM	NM	NM	NM	NM	1.4	227.2
BH23-1A	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	0.5	227.4	NM	NM	NM	NM
BH23-1B	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	0.5	227.4	NM	NM	NM	NM
BH23-2A	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	3.0	225.0	NM	NM	0.7	227.3
BH23-2B	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	0.3	225.8	NM	NM	0.7	225.5
BH23-7A	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	3.8	227.1	NM	NM	0.7	230.2
BH23-7B	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	0.3	230.3	NM	NM	0.4	230.2
BH23-11A	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	3.2	236.7	NM	NM	2.5	237.4
BH23-11B	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	2.2	237.7	NM	NM	1.3	238.6
BH1	3.48	2.5	236.8	2.6	236.7	2.7	236.6	NM	NM	2.7	236.5	NM	NM	1.5	237.8	NM	NM	1.1	238.1	NM	NM
BH9	3.19	2.3	233.3	2.2	233.4	2.3	233.3	NM	NM	1.5	234.0	NM	NM	0.6	235.0	NM	NM	0.6	235.0	NM	NM
BH12	1.42	0.5	236.6	0.4	236.7	NM	NM	NM	NM	0.2	236.9	NM	NM	0.2	236.9	NM	NM	0.1	237.0	NM	NM
BH12B	1.8	0.9	236.3	NM	NM	NM	NM	NM	NM	0.4	236.8	NM	NM	0.3	236.9	NM	NM	0.3	236.9	NM	NM
BH13	3.12	2.2	235.2	NM	NM	2.3	235.2	NM	NM	1.1	236.3	NM	NM	0.3	237.1	NM	NM	0.3	237.1	NM	NM
BH15	3.87	2.9	231.1	2.8	231.2	NM	NM	NM	NM	1.6	232.5	NM	NM	1.0	233.0	NM	NM	NM	NM	NM	NM
BH18	2.76	1.8	230.8	NM	NM	1.9	230.8	NM	NM	0.8	231.8	NM	NM	0.5	232.2	NM	NM	0.4	232.2	NM	NM

NM': Not measured
DNE': Did not exist

Table C2-4: Mini-Piezometer Information

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
MW2-17S/D	-0.002	0	-0.01	0.004	0.004	0.004	NM	NM	NM	0.004	NM	-0.002	NM	NM	NM	-0.036
MW4-17S/D	0.01	0.01	0.0098	-0.01	0	-0.03	0	0.033	-0.02	NM	0.013	0.007	0.041	NM	0.029	0.065
MW5-17S/D	-0.18	-0.22	-0.18	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	NM	NM
BH23-2A/B	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	0.145	NM	-0.327
BH23-7A/B	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	1.778	NM	0
BH23-11A/B	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	DNE	-0.244	NM	-0.293

	upward vertical hydraulic gradient
	downward vertical hydraulic gradient
NM	Not measured due to parcel access or freezing conditions
-	Well packer in deep well
DNE	Did not exist

Table C2-5. Groundwater Quality Exceedances

Parameters	PWQO Criteria	Results (Sept 22, 2017)			
		MW1-17	MW5-17S	MW3-17	MW4-17D
Field pH	6.5-8.5	7.98	**8.56**	8.17	**8.58**
Total Phosphorus (mg/L)	0.01 mg/L	**0.36**	**0.8**	**1.4**	**3.3**
Total Boron (ug/L)	200 ug/L	110	**420**	**260**	110
Total Cobalt (ug/L)	0.9 ug/L	ND	ND	ND	**2.5**
Total Copper (ug/L)	5 ug/L	1.6	1.3	ND	**5.5**
Total Iron (ug/L)	300 ug/L	ND	ND	ND	**5400**
Total Uranium (ug/L)	5 ug/L	**9.2**	1.2	3.4	1.2
Total Vanadium (ug/L)	6 ug/L	ND	0.74	2.1	**7.4**

Bold: exceeds the PWQO criteria

ND: Non-detect

Table C2-6: 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

Table C2-7: Piezometer Water Level Measurements (mbgs)

Year	2017				2018		2022			2023				
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
SF1-17S	0.2	0.3	0.2	0.1	0.1	-0.1	-	-	0.2	-	0.1	-	-	dry
SF1-17D	Dry	Dry	2.2	2.2	2.2	1.0	-	-	1.0	-	0.9	-	-	dry
SF2-17S	Dry	Dry	Dry	0.7	0.6	0.5	-	-	-*	-	-	0.01	0.06	-
SF2-17D	Dry	Dry	Dry	1.1	1.1	1.0	0.2	-	-*	0.2	-	0.1	0	-
SF3-17S	0.6	0.7	0.6	0.7	0.0	0.5	-	-	-	-	-	-	-	-
SF3-17D	0.0	0.7	0.5	0.6	0.5	0.4	-	-	-	-	-	-	-	-
SF4-17S	0.1	0.1	0.1	0.1	0.0	0.0	-	-	-*	-	-	-	-	-
SF4-17D	Dry	Dry	Dry	Dry	0.5	1.8	-	-	-*	-	-	-	-	-
SF5-17S	0.2	0.0	0.0	0.1	0.1	0.1	dry	-	-*	0.0	0.0	0.1	0.0	dry
SF5-17D	0.3	0.1	0.0	0.2	0.2	-0.2	dry	-	-*	0.0	-0.1	0.1	0.1	dry
SF6-17-S	0.4	0.5	0.5	0.5	-0.1	0.1	-	-	0.1	-	0.3	-	-	-
SF6-17D	Dry	0.8	0.6	0.6	0.4	0.0	-	-	0.9	-	0.4	-	-	-
WL1-17S	NM	0.0	0.7	0.1	0.0	-0.2	-	-	0.7	-	-0.2	-	-	0.2
WL1-17D	NM	0.7	0.5	0.4	0.4	0.2	-	-	0.3	-	0.4	-	-	0.2
WL2-17S	NM	-0.2	-0.1	0.0	0.0	-0.1	-	-	0.1	-	-0.1	-	-	N/A
WL2-17D	NM	Dry	2.2	1.2	2.1	1.9	-	-	0.3	-	0.3	-	-	0.2

Table C2-8: Piezometer Water Level Measurements (masl)

Year	2017				2018		2022			2023				
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
SF1-17S	240.1	239.9	240.0	240.1	240.1	240.3	-	-	240.0	-	240.1	-	-	-
SF1-17D	Dry	Dry	238.0	238.0	238.0	239.2	-	-	239.2	-	239.3	-	-	-
SF2-17S	Dry	Dry	Dry	236.3	236.4	236.5	-	-	-*	-	-	238.6	238.5	-
SF2-17D	Dry	Dry	Dry	235.7	235.7	235.8	236.6	-	-*	236.6	-	236.7	236.8	-
SF3-17S	227.5	227.4	227.5	227.4	228.1	227.6	-	-	-	-	-	-	-	-
SF3-17D	228.1	227.4	227.6	227.5	227.6	227.7	-	-	-	-	-	-	-	-
SF4-17S	236.5	236.5	236.4	236.4	236.5	236.5	-	-	-*	-	-	-	-	-
SF4-17D	Dry	Dry	Dry	Dry	236.0	234.7	-	-	-*	-	-	-	-	-
SF5-17S	233.3	233.5	233.6	233.5	233.5	233.5	-	-	-*	233.6	233.6	233.5	233.6	-
SF5-17D	233.4	233.5	233.6	233.4	233.4	233.8	-	-	-*	233.6	233.7	233.5	233.5	-
SF6-17-S	224.5	224.3	224.4	224.4	225.0	224.8	-	-	224.8	-	224.6	-	-	-
SF6-17D	Dry	224.2	224.4	224.4	224.6	225.0	-	-	224.1	-	224.6	-	-	-
WL1-17S	NM	241.1	240.4	241.0	241.1	241.3	-	-	240.5	-	241.4	-	-	241
WL1-17D	NM	240.4	240.6	240.7	240.7	240.9	-	-	240.9	-	240.7	-	-	241.0
WL2-17S	NM	238.9	238.8	238.7	238.7	238.8	-	-	238.7	-	238.8	-	-	237.6
WL2-17D	NM	Dry	236.5	237.5	236.6	236.8	-	-	238.3	-	238.3	-	-	238.5

-': Not measured
-*: Not measured due to restricted access to the parcel lands

Table C2-9: 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		
SF1-17	-	-	1.84	1.86	1.87	1.01	0.69	-	0.69	-	-	-	Downward	HDF-3
SF2-17	-	-	-	0.98	0.98	1.01	-	-	-	2.57	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	-	0.04	-0.38	-0.06	0.13	-	Variable	HDF-3
SF6-17	-	0.35	0.07	-0.09	1.29	-0.54	2.21	-	0.06	-	-	-	Variable	Clarkway Drive Tributary
WL1-17	-	0.70	-0.16	0.33	0.44	0.50	-0.46	-	0.64	-	-	0.02	Variable	Approximately north of HDF-3
WL2-17	-	-	2.81	1.48	2.56	2.46	0.22	-	0.47	-	-	N/A	Downward	HDF-3

(orange) upward vertical hydraulic gradient
(green) downward vertical hydraulic gradient
\- Vertical hydraulic gradient could not be estimated due to one or both piezometers being dry

Table C2-10: 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
HDF-3	SF1-17	PZ, SG, Flow Station	SGR (cm)	23.8	22	25	21.5	21	18	19	23	Dry
			EFR (L/s)	2.9	2.5	2.7	1.2	#N/A	6.3	1.4	Slow to Intermediate	Dry
Clarkway Drive Tributary	SF2-17	PZ, SG, Flow Station	SGR (cm)	14.5	10	13	17.5	54	26	No Access	Unlocated	Unlocated
			EFR (L/s)	7.1	0.4	5.5	17.8	#N/A	41.1	No Access	Unlocated	Unlocated
Clarkway Drive Tributary	SF3-17	PZ, SG, Flow Station	SGR (cm)	19	15	13.5	31	34	32	Beaver Dam	Beaver Dam	Beaver Dam
			EFR (L/s)	18.9	3.3	14.7	123.4	#N/A	144.3	Beaver Dam	Slow	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
			EFR (L/s)	4.6	2.8	5.0	6.0	#N/A	16.3	No Access	Slow to Intermediate	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
			EFR (L/s)	1.2	0.51	0.48	1.94	#N/A	5.4	No Access	Fast	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
			EFR (L/s)	22.4	3.3	12.0	92.2	#N/A	143.6	20.2	Fast	434
HDF-3	WL3-17	SG, Flow Station	SGR (cm)	NM	6	6.5	6	23.5	7	No Access	Slow to Intermediate	Dry
			EFR (L/s)	NM	0.8	0.8	0.7	#N/A	5.2	No Access	NM	Dry
HDF-8	SF7-17	SG	SGR (cm)	NM	NM	NM	NM	NM	NM	Dry	36.5	54.6
			EFR (L/s)	Dry	Dry	Dry	Dry	Dry	Dry	0	Low to Intermediate	Stagnant
Clarkway Drive Tributary	SF8-22	None	SGR (cm)	-	-	-	-	-	-	N/A	N/A	N/A
			EFR (L/s)	-	-	-	-	-	-	0.15	Slow	NM
HDF-8	SF9-22	None	SGR (cm)	-	-	-	-	-	-	N/A	N/A	N/A
			EFR (L/s)	-	-	-	-	-	-	Dry	Slow	Dry
Clarkway Drive Tributary	SF10-22	None	SGR (cm)	-	-	-	-	-	-	N/A	N/A	N/A
			EFR (L/s)	-	-	-	-	-	-	1.9	Intermediate	NM
HDF-8	SF11-22	None	SGR (cm)	-	-	-	-	-	-	N/A	N/A	N/A
			EFR (L/s)	-	-	-	-	-	-	NM	Fast	NM

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 C2-11. Surface Water Quality Exceedances

Parameters	PWQO Criteria	Results (Sept 22, 2017)		
		SF1-17 (HDF-3)	SF5-17 (HDF-3)	SF6-17 (Clarkway Drive Tributary)
Total Phosphorus (mg/L)	0.01 mg/L	**0.037**	**0.1**	**0.08**
Phenols-4AAP	0.001 mg/L	ND	**0.0017**	**0.0033**
Total Iron (ug/L)	300 ug/L	ND	**320**	**1300**

Bold: exceeds the PWQO criteria
ND: Non-detect

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	453,057	-727,811	-61.6%
Infiltration	217,910	30,481	-187,429	-86.0%
Runoff	350,927	1,266,167	915,240	260.8%

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
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 (NHS)	Sub-Area B (Impervious)	
Topography	0.20	N/A	
Soils	0.10	N/A	
Cover	0.15	N/A	
Sum (Infiltration Factor)	0.45	No Infiltration	
Soil Moisture Capacity (mm)	200	200	
Site Area	26.00	187.02	
Percentage of Total Site Area	12%	88%	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	-23	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)	27	23	23	15	0	0	0	0	0	0	4	26	**117**
Potential Direct Surface Water Runoff (R)	**33**	**28**	**28**	**19**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**32**	**143**
Evapotranspiration (m^3)	0	0	0	8,574	20,758	28,899	31,018	26,035	19,338	9,324	1,883	0	145,829
Runoff (m^3)	8,637	7,179	7,193	4,865	0	0	0	0	0	0	1,129	8,251	37,254
Infiltration (m^3)	7,067	5,873	5,885	3,981	0	0	0	0	0	0	924	6,751	30,481
Evaporation Analysis (Sub-Area B - 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)	22591	18776	18814	25060	28464	28239	30596	28950	28052	25546	30558	21582	307,228
Runoff (m^3)	90366	75105	75255	100240	113855	112957	122383	115800	112209	102185	122233	86326	1,228,913
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)		0.00
Evapotranspiration+Evaporation (mm)		213
Infiltration (mm)		14
Runoff (mm)		594
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)		453,056.81
Infiltration (m^3)		30,480.95
Runoff (m^3)		1,266,167.46
Total	**1,749,705.21**	**1,749,705.21**

Table C2-15. 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**
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	42	43%
Abandoned Wells	24	25%
Observation, Monitoring and Test Wells / Holes	22	22%
Other or Unknown Status	10	10%
Total	**98**	**100%**

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 city 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 C2-16. 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

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

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 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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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

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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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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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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
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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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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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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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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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

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	2017/09/25	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

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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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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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

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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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
A Bureau Veritas Group Company

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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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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

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	2017/09/26	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

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
A Bureau Veritas Group Company

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

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

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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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

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.

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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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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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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	2017/09/27	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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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

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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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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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
A Bureau Veritas Group Company

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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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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).

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

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: 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.

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

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

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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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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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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).

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

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

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

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

Maxxam
A Bureau Veritas Group Company

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

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

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

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		

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).

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 A Bureau Veritas Group Company BOD

Maxxam Analytics International Corporation o/a Maxxam Analytics
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:		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	Address:		Project:	2017-0293	COC #:	Project Manager:
	Markham ON L3R 4T5			Project Name:	[illegible] Solmar/ Bolton	C#629279-01-01	Jolanta Goralczyk
Tel:	(416) 987-6161 x Fax: (905) 940-2064 x	Tel:	(416) 987-6161 x243 Fax:	Site #:			
Email:	accountspayable@coleengineering.ca	Email:	AHejazi@coleengineering.ca	Sampled By:	AH, AO		

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 ______
- [x] 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											

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: [x]
(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 #)*

22-Sep-17 14:25
Jolanta Goralczyk
B7K8760
GK1 ENV-1359

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Time Sensitive	Laboratory Use Only: Temperature (°C) on Recei	Custody Seal	Yes	No
Andrew O'Rourke Andrew O'Rourke	22/09/17	14:20	Tanvir Tanvirstan	2017/09/22	14:25			13/12/15	Present		
									Intact		✓

* 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: Maxxam Yellow: Client

Ojica

Maxxam Analytics International Corporation o/a Maxxam Analytics

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.

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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		
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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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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Maxxam Job #: B7K8768
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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**
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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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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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.

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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.

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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**
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

Maxxam Job #: B7K8768
Report Date: 2017/09/29

Cole Engineering Group Ltd
Client Project #: 2017-0293
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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
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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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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.

Maxxam
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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).

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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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:

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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
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CERTIFICATE OF ANALYSIS

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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.
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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

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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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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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.

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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
==
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Maxxam
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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

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
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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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.

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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Maxxam Job #: B7K8768
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

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
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.

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.

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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.

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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
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
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

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

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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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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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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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Client Project #: 2017-0293
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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 #:
Attention: Accounts Payable	Attention: Alireza Hejazi	P.O. #:	Bottle Order #: 629279
Address: 70 Valleywood Dr	Address:	Project: 2017-0293	COC #: C#629279-02-01
Markham ON L3R 4T5		Project Name:	Project Manager: Jolanta Goralczyk
Tel: (416) 987-6161 x Fax: (905) 940-2064 x	Tel: (416) 987-6161 x243 Fax:	Site #:	
Email: accountspayable@coleengineering.ca	Email: AHejazi@coleengineering.ca	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)
- [ ] 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 ______
- [x] PWQO
- [ ] Other

Special Instructions

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: [x]
(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	" "	1030	" "	" "	X		temp: 18.69 pH: 8.23
3		SF6-17	" "	1535	" "	" "	X		temp: 24.99 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
Gordon McCready	17-9-22	0900	Tanvir Tanvirstnu	2017/09/22	14:30	
G-Mc	"	" "				

Laboratory Use Only

Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
	5/4/5	Present	✓	
		Intact	✓	

White: Maxxa Yellow: Client

* 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

Maxxam Analytics International Corporation o/a Maxxam Analytics

Appendix C3

Tables – Schaeffers Consulting Engineers

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*	Flood storage Volume ($1000m^3$) Between Station #36 and #31**	Incremental Storage Volume Between Successive Storm Events ($1000m^3$) Profile	Incremental Storage Volume Between Successive Storm Events ($1000m^3$) 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

TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

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.

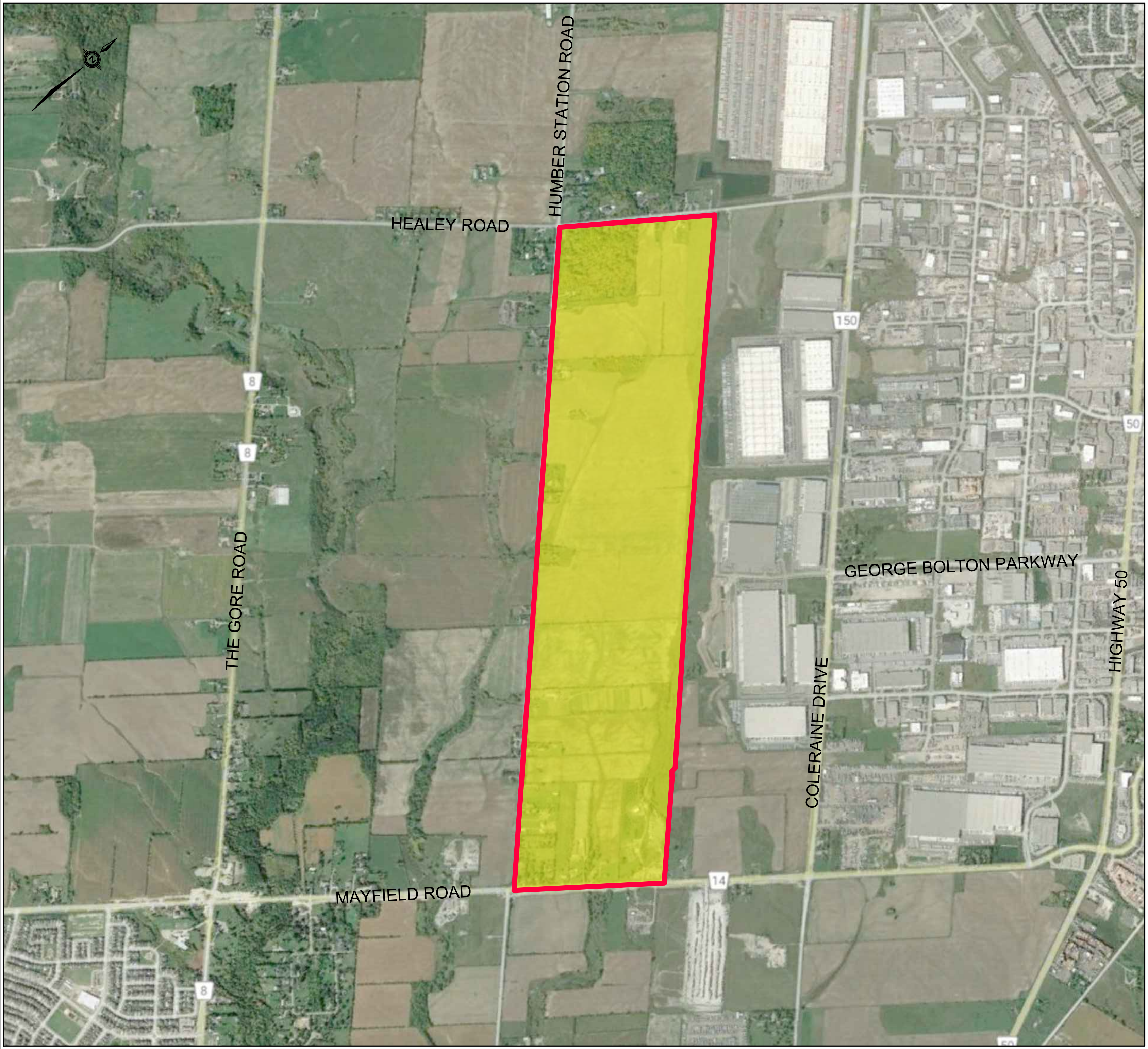
- Mid-HDF: It is an HDF draining southward across the farmland. The flow of this feature is generated fully from the subject area. Since the watercourse drainage area is small and has a narrow drainage channel, after discussing with TRCA we concluded that the first 50ha drainage area of the watercourse 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

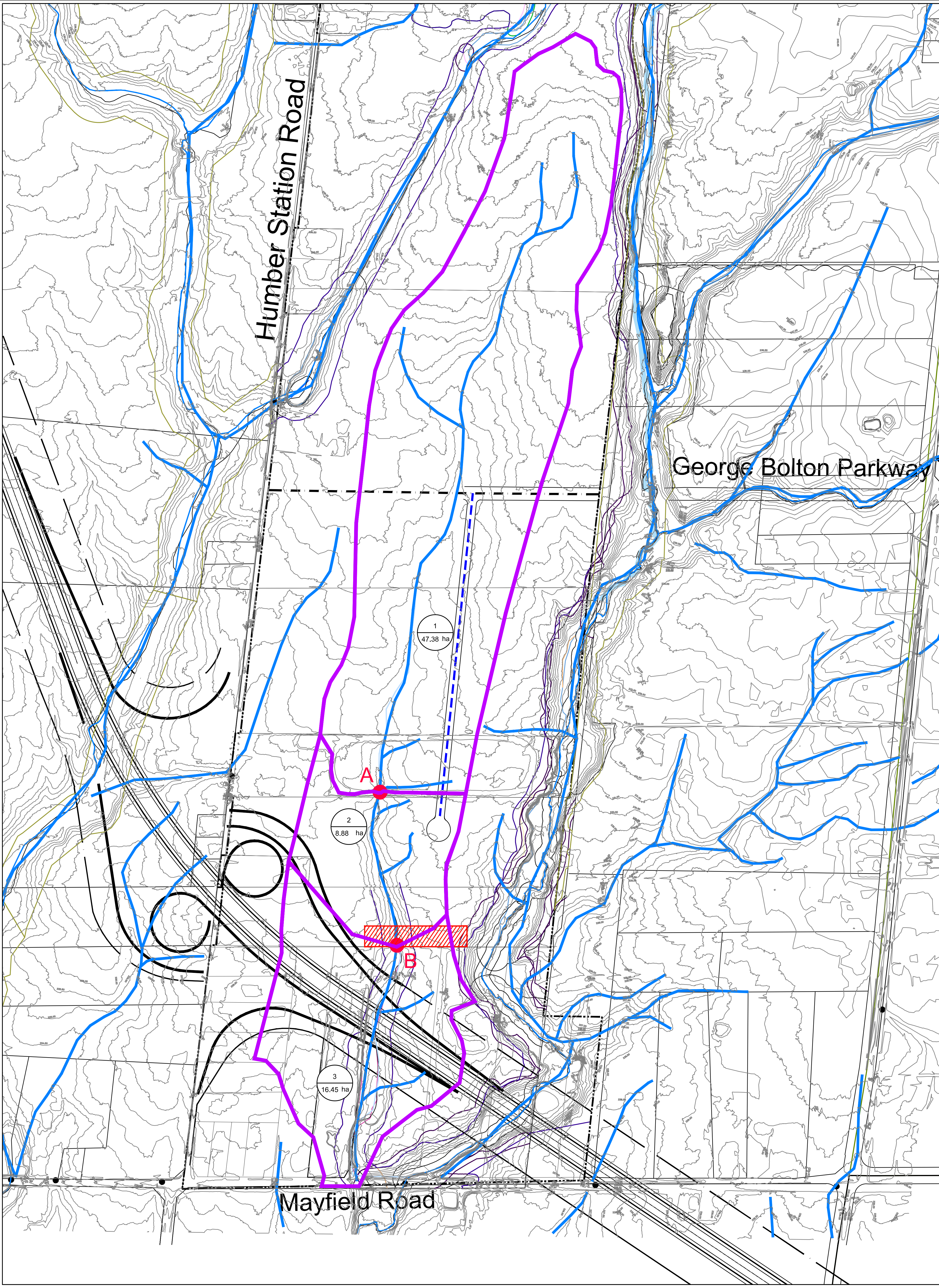
SCHAEFFERS
CONSULTING ENGINEERS
6 Ronrose Drive, Concord, Ontario L4K 4R3
Tel: (905) 738-6100 Email: general@schaeffers.com
www.schaeffers.com

FIGURE 1
LOCATION PLAN

2021-5139	JULY 2023	SCALE: N.T.S.

W:\5100's\5139 - Humber Station Village\Drawings\Drainage\2023-08-01-5139-Pre-Dev Drainage Middle.dwg

Maxim Zemlyanoy



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

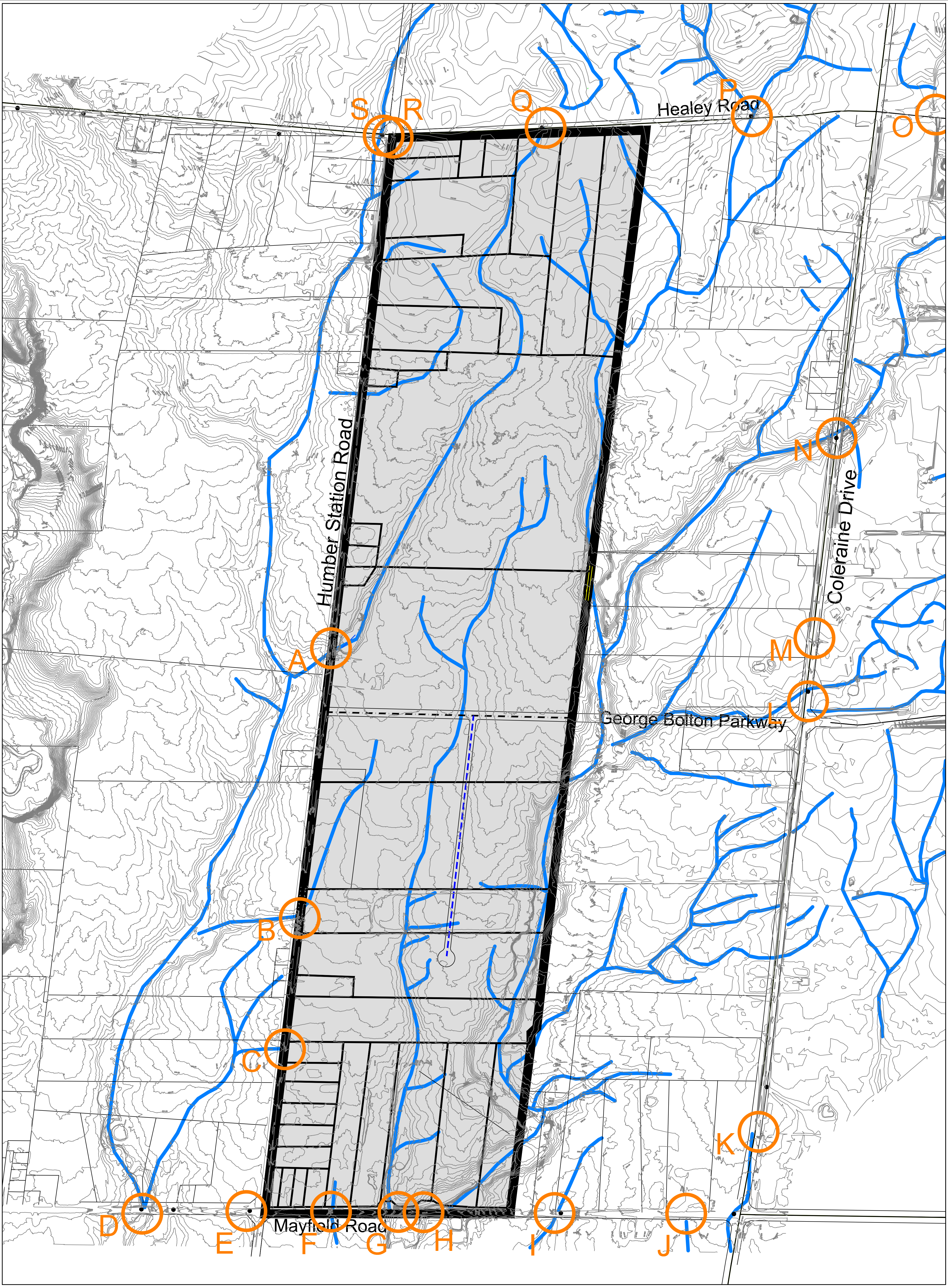
2.2.3 Existing Road Crossings in and Around the Subject Area

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

		Q Total	Min Ch El	W.S. Elev	Flood Storage Volume (1000m^3)		Incremental Storage Volume Between Successive Storm Events (1000m^3)	
River Sta	Profile	(m^3/s)	(m)	(m)	Cumulative*	Between Station #36 and #31**	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

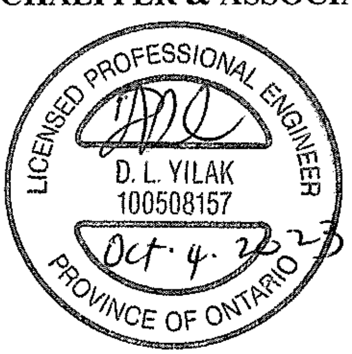
This report presents hydraulic modelling, calculated water surface elevations, and associated flood lines with the existing condition flows along the drainage features in the Humber Station Village area in the City of Caledon. The results of the floodplain analysis can be summarized as;

- 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

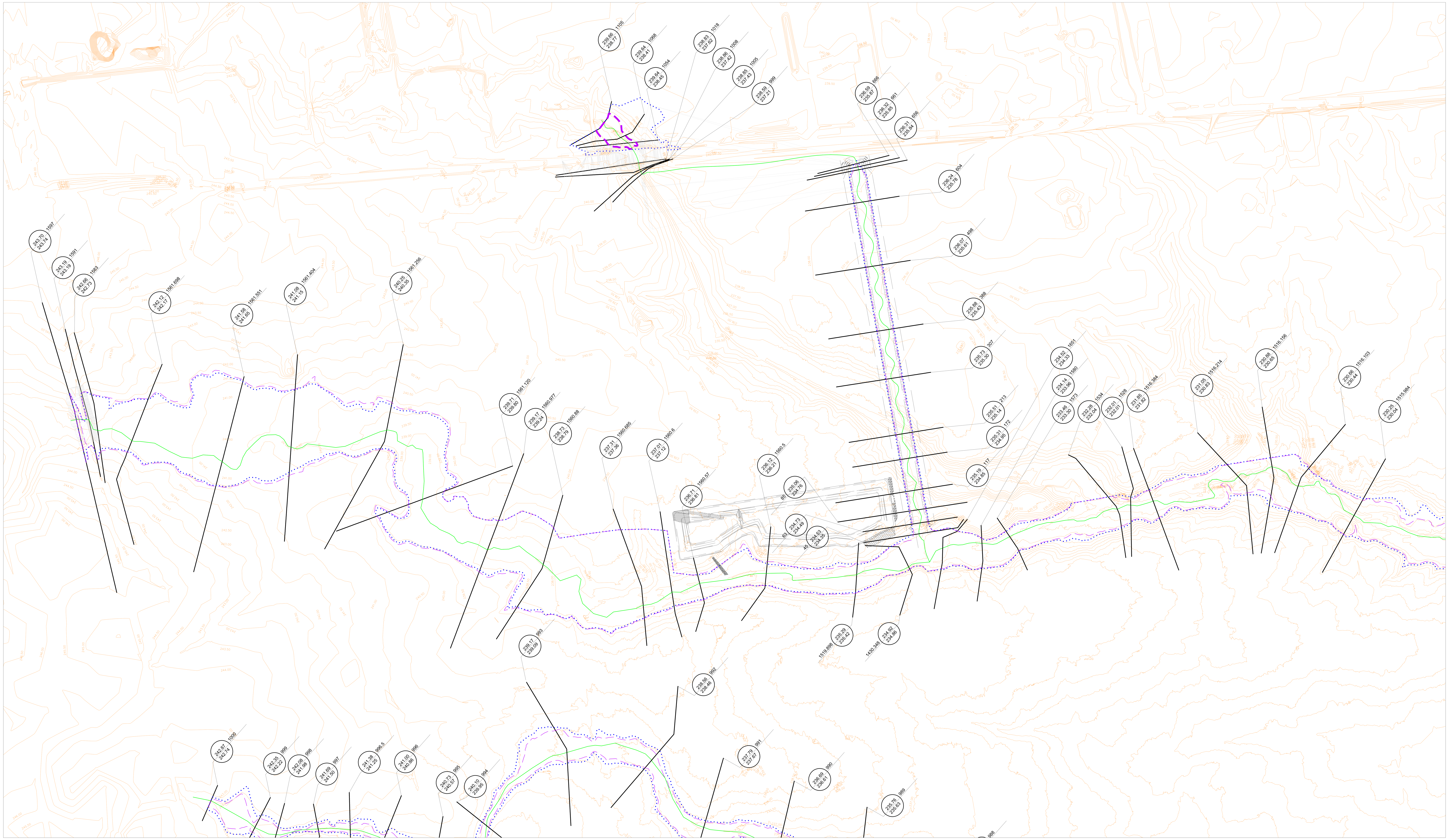
SCE Existing HEC-RAS Analysis Results						TRCA Original Model HEC-RAS Results								Difference (SCE - TRCA)				
			Min Ch El	W.S. Elev (m)					Peak Flow (m^3/s)		Min Ch El	W.S. Elev (m)		Peak Flow (m^3/s)		Min Ch El	W.S. Elev (m)	
River	Reach	River Sta	(m)	100Yr	Regional	River	Reach	River Sta	100 Year	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

<u>FLOODPLAIN MAPPING</u>



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; Split; 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

LICENSED PROFESSIONAL ENGINEER
K. SHAHBIKIAN
PROVINCE OF ONTARIO

PLEASE NOTE:
THE PROFESSIONAL ENGINEER'S STAMP VERIFIES THE FLOOD LINE AND ASSOCIATED DATA NOT THE MAP DATA UNLESS OTHERWISE NOTED

FLOOD PLAIN MAPPING PROGRAM

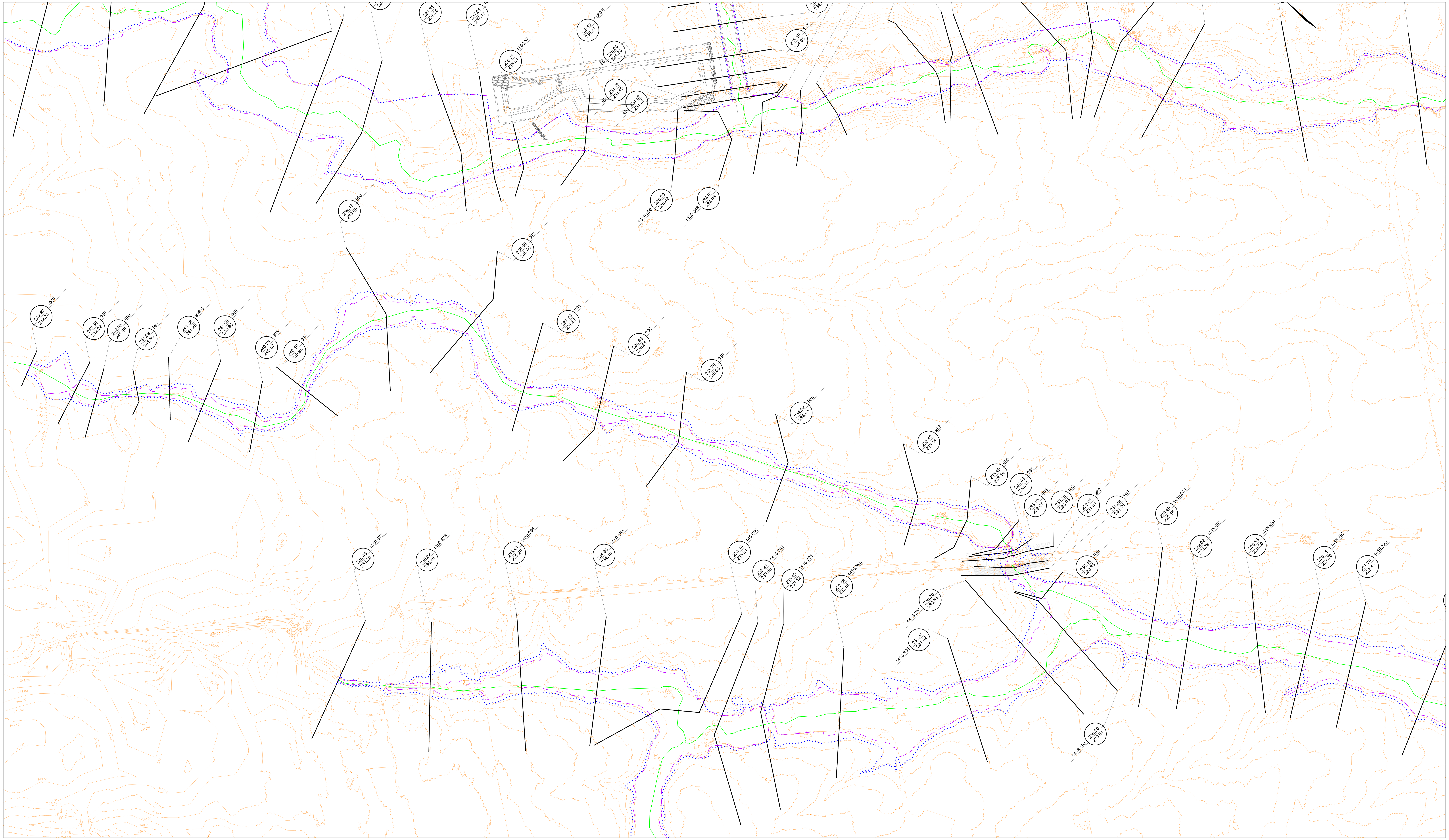
FLOODLINE APPROVED DATE: ____________

TORONTO AND REGION Conservation
for The Living City
5 Shoreham Drive Downsview Ontario M3N 1S4 (416) 661-6600

Scale 1:2000
CONTOUR INTERVAL 1.0 METRES

HUMBER RIVER

SHEET No. EX-1



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
,Split
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 photograpy exposed in April 1977.

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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.

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SCHAEFFERS
CONSULTING ENGINEERS

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LICENSED PROFESSIONAL ENGINEER
K. SHAHBIKIAN
PROVINCE OF ONTARIO

FLOOD PLAIN MAPPING PROGRAM

FLOODLINE APPROVED DATE: ____________

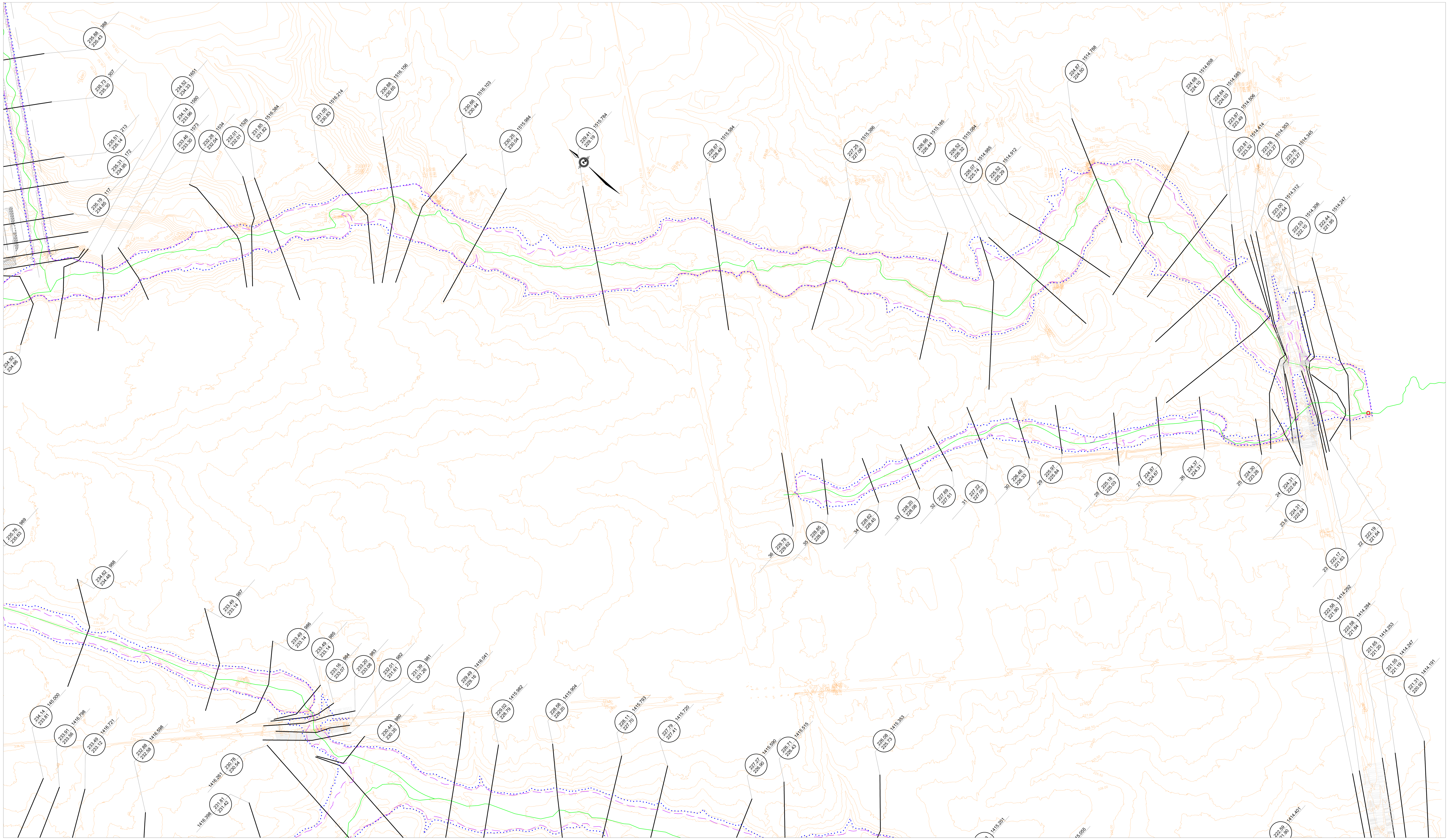
TORONTO AND REGION Conservation
for The Living City
5 Shoreham Drive Downsview Ontario M3N 1S4 (416) 661-6600

Scale 1:2000

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
,Split
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 photograhy exposed in April 1977.

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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.

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SCHAEFFERS
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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

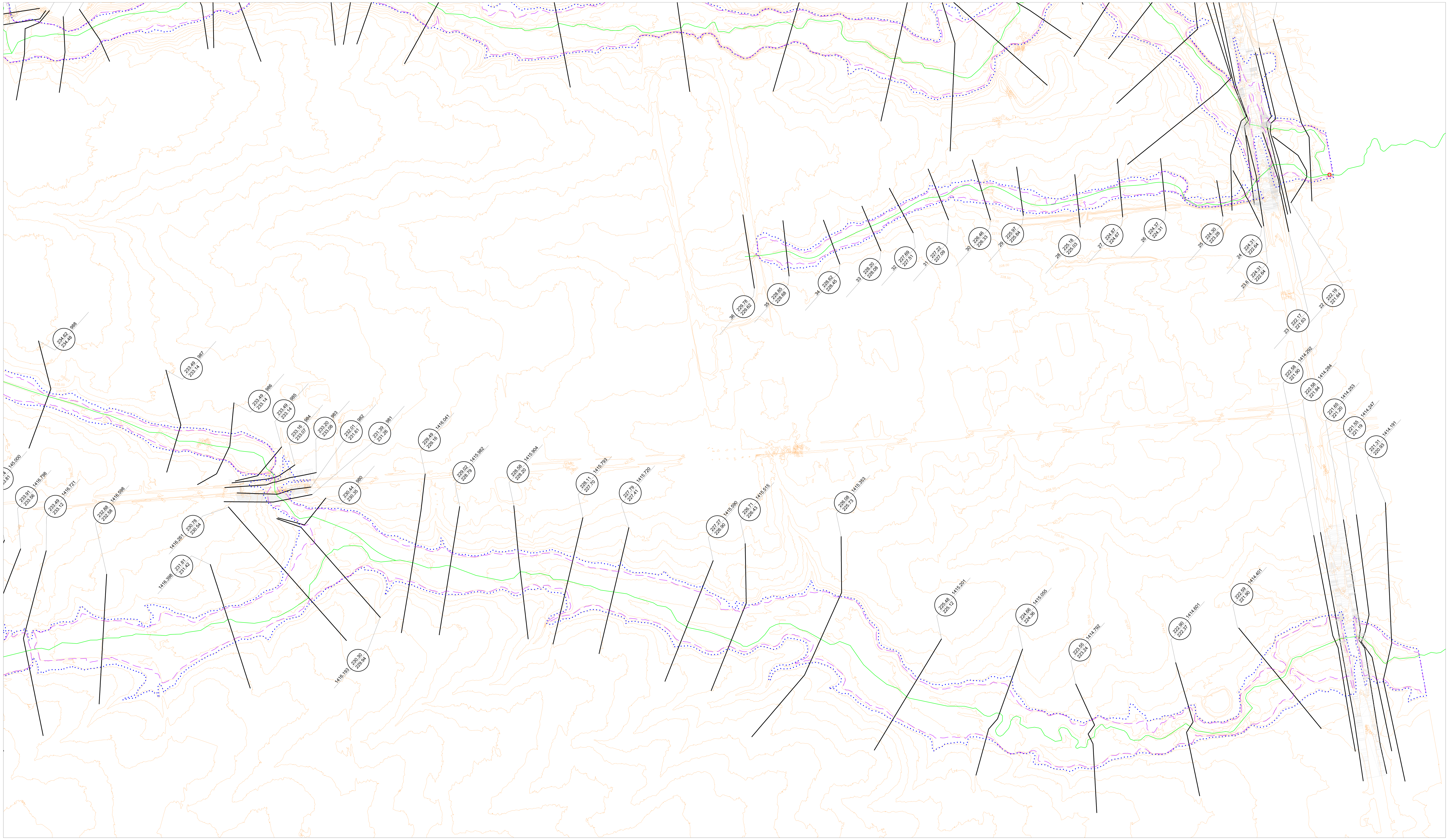
100 Metres 0 100 200 Metres

200 Feet 0 200 400 600 800 1000 Feet

CONTOUR INTERVAL 1.0 METRES:

HUMBER RIVER

SHEET No. EX-3



REVISIONS

NO.	DESCRIPTION	BY	DATE

LEGEND

Cross-Section Label

Regional Flood Elevation (m)

Cross-Section Number 19.8600 235.96 235.96

100 Year Flood Elevation (m)

Cross-Section Leader Line

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
,Split
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
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Cliff, Cut and Fill
Culvert
Dam, Beaver Dam
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Airport Runway
Power Transmission Line, with Poles, with Pylons
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Regional Flood Line
100 Year Flood Line

This map was compiled photogrammetrically from 1/10 000 aerial photograhy exposed in April 1977.

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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.

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SCHAEFFERS
CONSULTING ENGINEERS

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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

CONTOUR INTERVAL 1.0 METRES:

HUMBER RIVER

SHEET No. EX-4

APPENDIX C

<u>SUPPORTING DOCUMENTS</u>

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.

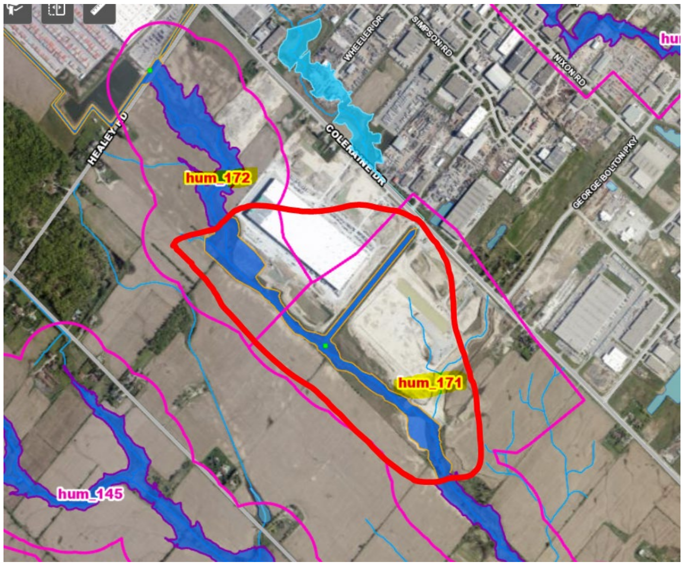
Healey_Coleraine_HumberStation_Mayfield(Debebe)

Please note the following.

1. Floodplain mapping sheets

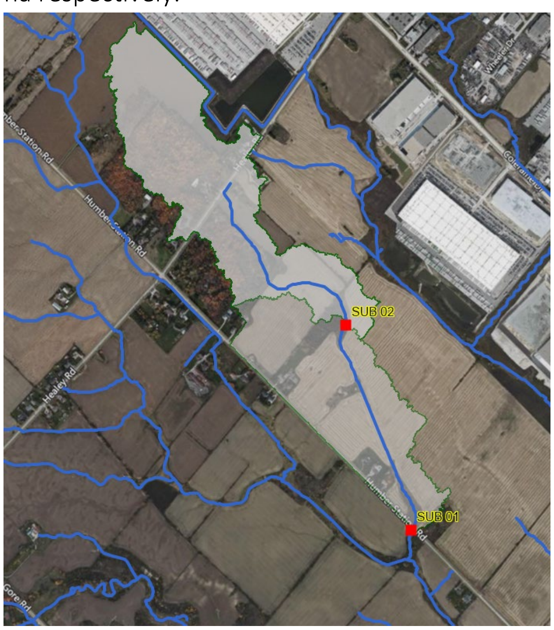
   Areas within the RED Circle shown below.

   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.

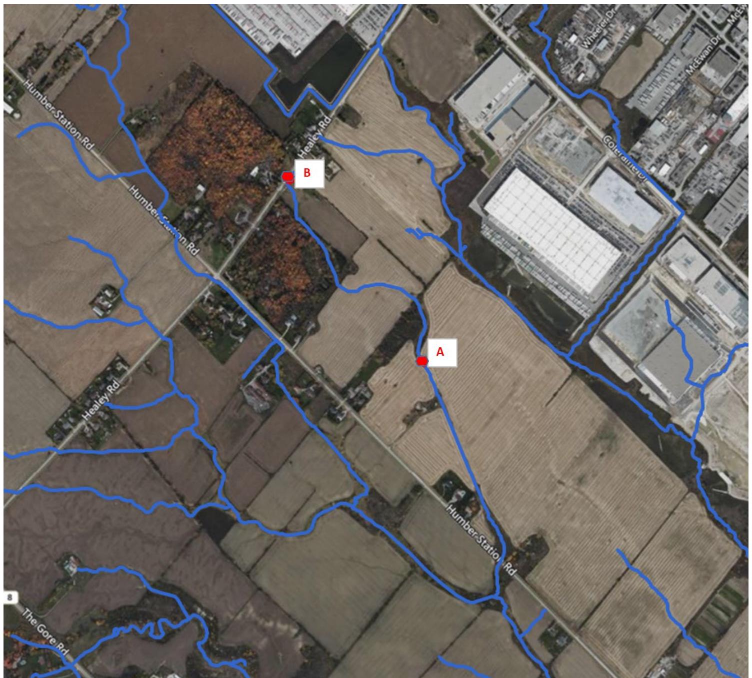


2. HEC-RAS modeling
   Please do not use the WEST HUMBER HEC-RAS model for the Area circled in RED above (Channel Realignment Area). I will provide the HEC-RAS model for the realignment area later.

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

SCHAEFFERS
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

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

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 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

SCHAEFFERS
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

Toronto and Region Conservation Authority

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

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CONSULTING ENGINEERS

6 Ronrose Drive, Concord, Ontario, L4K4R3
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SKETCH SHOWING TOPOGRAPHIC INFORMATION

SCALE 1:2000

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THIS IS NOT A PLAN OF SURVEY AND SHALL NOT TO BE USED EXCEPT FOR THE PURPOSE INDICATED IN THE TITLE BLOCK.

NOTES

BOUNDARIES ARE NOT CERTIFIED BY THIS PLAN, AND ARE SUBJECT TO CLARIFICATION UPON THE INCORPORATION OF ADDITIONAL DOCUMENTARY AND FIELD SURVEY EVIDENCE.BOUNDARIES HAVE BEEN TAKEN FROM R–PE CAD FILE NO.s 07032R01a, 07033R02, 07035R03A, 07035R02 AND, 15107R01a,

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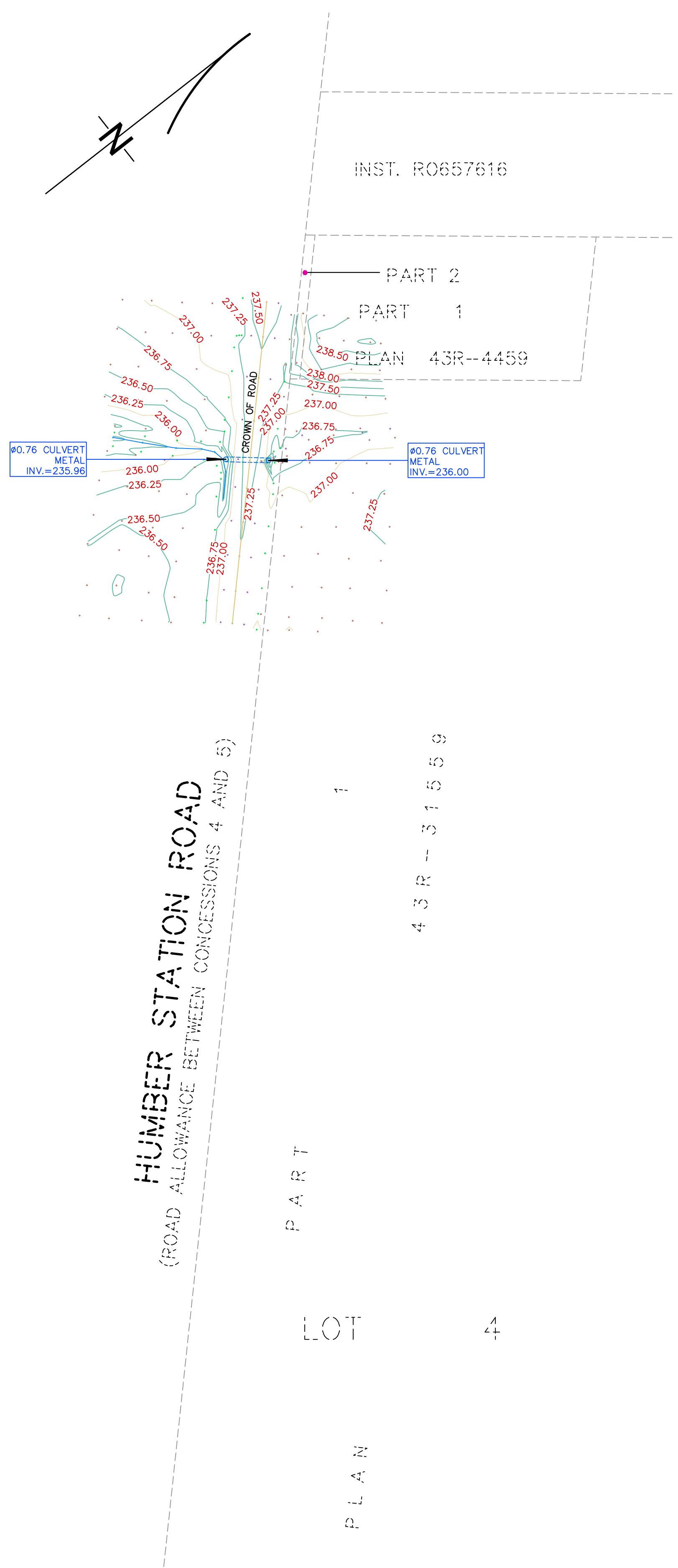
	DENOTES OVERHEAD WIRE
	DENOTES HYDRO–GUY
SIGN	DENOTES SIGN
UP ○	DENOTES UTILITY POLE

FIELD OBSERVATIONS:

THE FIELD OBSERVATIONS REPRESENTED ON THIS PLAN WERE COMPLETED ON THE 17th DAY OF DECEMBER , 2021



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DRAWN: K.M.

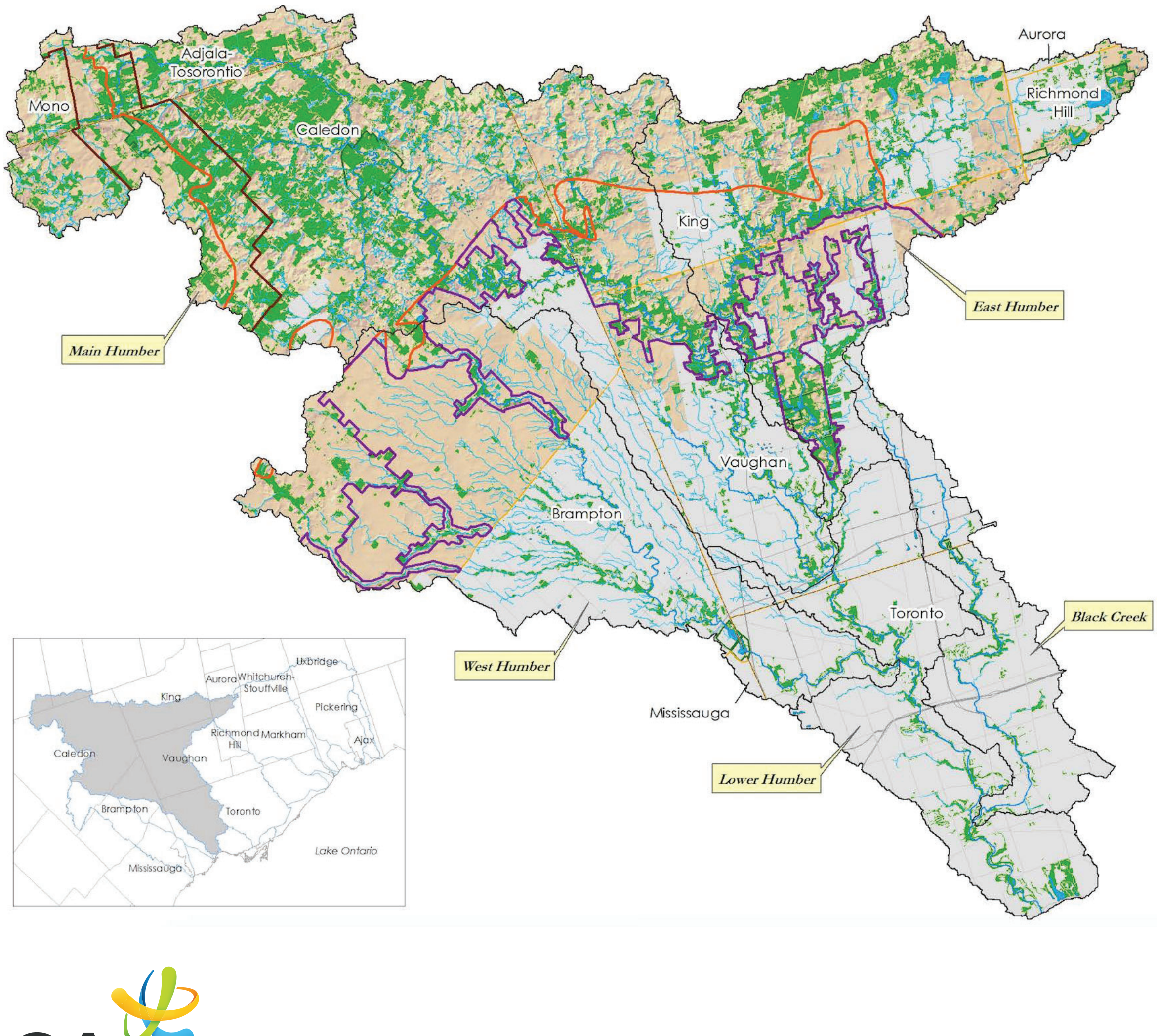
JOB No. 07–031 CAD FILE No.07031tp01

April 2018

CIVICA
Waste Management Solutions

Prepared for: Toronto and Region Conservation Authority (TRCA)

Final Report:
Humber River Hydrology Update



CIVICA
Waste Management Solutions

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)

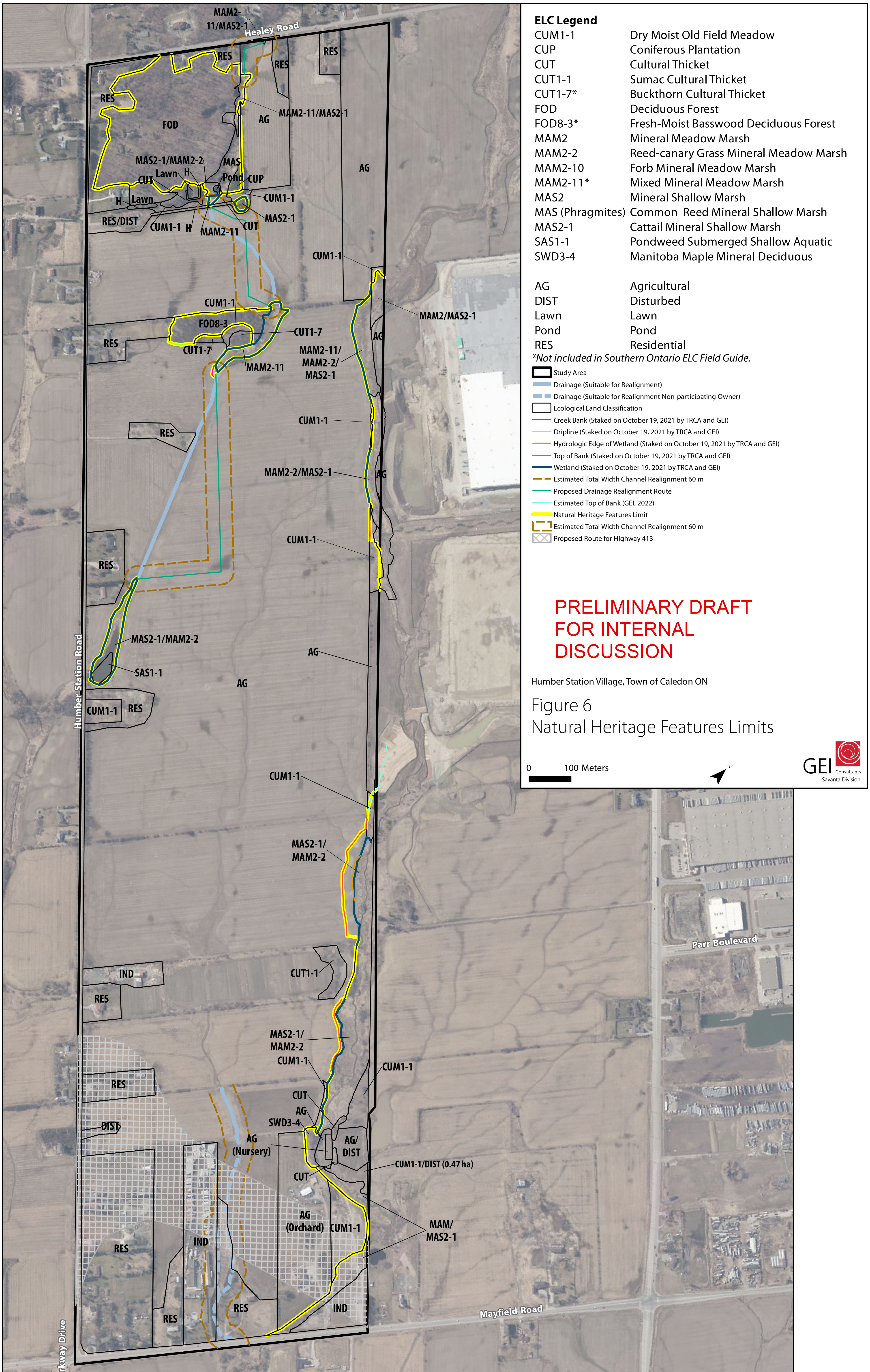
NHYD	Catchment ID	DT [min]	AREA [ha]	DWF [cms]	N	TP [hr]	IA [mm]	CN AMC II *	CN AMC III*
597	40.04	5	5.39	0	3	0.41	10	83	92
598	40.05	5	13.19	0	3	0.72	10	81	91
600	40.07	5	21.83	0	2.5	0.71	10	83	92
601	40.08	5	10.02	0	2.5	0.67	10	81	91
612	41.06	5	127.87	0	3	1.9	10	93	97
613	41.07	5	101.08	0	3	2.53	10	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	



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APPENDIX D

DIGITAL COPY OF HECRAS MODEL

Appendix E

GEI 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

SOIL ENGINEERING MONITORING WELLS INSTALLATION REPORT

Soil Engineers Ltd.
CONSULTING ENGINEERS
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September 12, 2017 Reference No. 1707-S200

Humber Station Villages Landowners Group Inc.
c/o Solmar Inc.
122 Romina Drive
Concord, Ontario
L4K 4Z7

Attention: Mr. Maurizio Rogato

Re: Monitoring Wells Installation
Humber Station Villages
East side of Humber Station Road, south of Healey Road
Town of Caledon

Dear Sir:

As per your instructions, we have completed the monitoring well installation within the captioned site in the Town of Caledon to support a hydrogeological assessment to be completed by Cole Engineering Group Inc. We provide herewith our findings and records.

SITE CONDITION

The investigation was carried out in agricultural lands located on the east side of Humber Station Road, south of Healey Road, in the Town of Caledon.

FIELD WORK

The field work, consisting of five (5) sampled boreholes, was performed between August 15 and 18, 2017, at the locations shown on the Borehole and Monitoring Well Location Plan, Drawing No. 1.

Monitoring wells, 50 mm in diameter, were installed at all borehole locations. Each location consisted of a single well, except Boreholes MW2-17, MW4-17 and MW5-17, where 2-well clusters (a shallow well at 6.0 m and a deep well at 12 m or 12.2 m) were installed. A suffix of 'S' or 'D', representing the shallow and deep wells, was used to differentiate the well depths at these locations. The depth and details of the monitoring wells are shown on the enclosed corresponding Borehole Logs, Figures 1 to 8, inclusive.

The boreholes were advanced at intervals to the sampling depths by a track-mounted, continuous-flight power-auger machine, equipped with hollow-stem augers for soil sampling. Standard Penetration Tests, using the procedures described on the enclosed "List of Abbreviations and Terms", were performed at the sampling depths. The test results are recorded as the Standard Penetration Resistance (or 'N' values) of the subsoil.

The relative density of the granular strata and the consistency of the cohesive strata are inferred from the 'N' values. Split-spoon samples were recovered for soil classification and laboratory testing.

The field work was supervised and the findings were recorded by a Geotechnical Technician.

The elevation at the borehole locations was surveyed using a hand-held Global Navigation Satellite System (Trimble Geoexplorer 6000 series), which has a vertical accuracy of up to 1 m, and horizontal accuracy of up to 10 cm.

Detailed descriptions of the encountered subsurface conditions are presented on the Borehole Logs, Figures 1 to 8, inclusive.

The Atterberg Limits of 3 representative samples of the silty clay till and silty clay were determined and grain size analyses were performed on selected soil samples; the results are plotted on Figures 9 to 12, inclusive.

We trust this Letter Report satisfies your present requirements.

Yours very truly,
SOIL ENGINEERS LTD.

LICENSED PROFESSIONAL ENGINEER
B. P. Y. LEE
100104568
Sept 12, 2017
PROVINCE OF ONTARIO

Kelvin Hung, B.A.Sc.

Bernard Lee, P.Eng.

KH/BL:dd

ENCLOSURES

Borehole Logs	Figures 1 to 8
Grain Size Distribution Graphs	Figures 9 to 12
Borehole and Monitoring Well Location Plan	Drawing No. 1

c. Cole Engineering Group Inc.
Attn.: Mr. Daniel Banks, P.Geo.

Soil Engineers Ltd. (Mississauga)
Attn.: Mr. Benjamin Lee, P.Eng.

LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

The abbreviations and terms commonly employed on the borehole logs and figures, and in the text of the report, are as follows:

SAMPLE TYPES

AS	Auger sample
CS	Chunk sample
DO	Drive open (split spoon)
DS	Denison type sample
FS	Foil sample
RC	Rock core (with size and percentage recovery)
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

PENETRATION RESISTANCE

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows for each foot of penetration of a 2-inch diameter, 90° point cone driven by a 140-pound hammer falling 30 inches.

Plotted as '—•—'

Standard Penetration Resistance or 'N' Value:

The number of blows of a 140-pound hammer falling 30 inches required to advance a 2-inch O.D. drive open sampler one foot into undisturbed soil.

Plotted as '○'

WH	Sampler advanced by static weight
PH	Sampler advanced by hydraulic pressure
PM	Sampler advanced by manual pressure
NP	No penetration

SOIL DESCRIPTION

Cohesionless Soils:

'N' (blows/ft)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

Cohesive Soils:

Undrained Shear Strength (ksf)	'N' (blows/ft)	Consistency
less than 0.25	0 to 2	very soft
0.25 to 0.50	2 to 4	soft
0.50 to 1.0	4 to 8	firm
1.0 to 2.0	8 to 16	stiff
2.0 to 4.0	16 to 32	very stiff
over 4.0	over 32	hard

Method of Determination of Undrained Shear Strength of Cohesive Soils:

x 0.0 Field vane test in borehole; the number denotes the sensitivity to remoulding

△ Laboratory vane test

□ Compression test in laboratory

For a saturated cohesive soil, the undrained shear strength is taken as one half of the undrained compressive strength

METRIC CONVERSION FACTORS

1 ft = 0.3048 metres	1 inch = 25.4 mm
1lb = 0.454 kg	1ksf = 47.88 kPa

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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	Sample Number	Type	N-Value	Depth Scale (m)	Penetration Resistance (blows/30 cm)	Moisture Content (%)	WATER LEVEL
244.9	Ground Surface							
0.0	**20 cm TOPSOIL**	1A			0		19	Dry on completion and August 16, 2017
	Firm to hard	1B	DO	5			19	
	weathered	2	AS	21	1		19	
	SILTY CLAY TILL	3	DO	29			14	
		4	DO	30	2		15	
		5	DO	42	3		14	
	some sand to sandy, a trace of gravel	6	DO	50	4		12	
	occ. wet sand and silt seams and layers, cobbles and boulders (brown / grey)	7	DO	36			12	
		8	DO	32	5		9	
		9	DO	32	6		10	
238.3 / 6.6	**END OF BOREHOLE**							

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

Legend: • 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

Depth Scale (m): 0 1 2 3 4 5 6 7 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

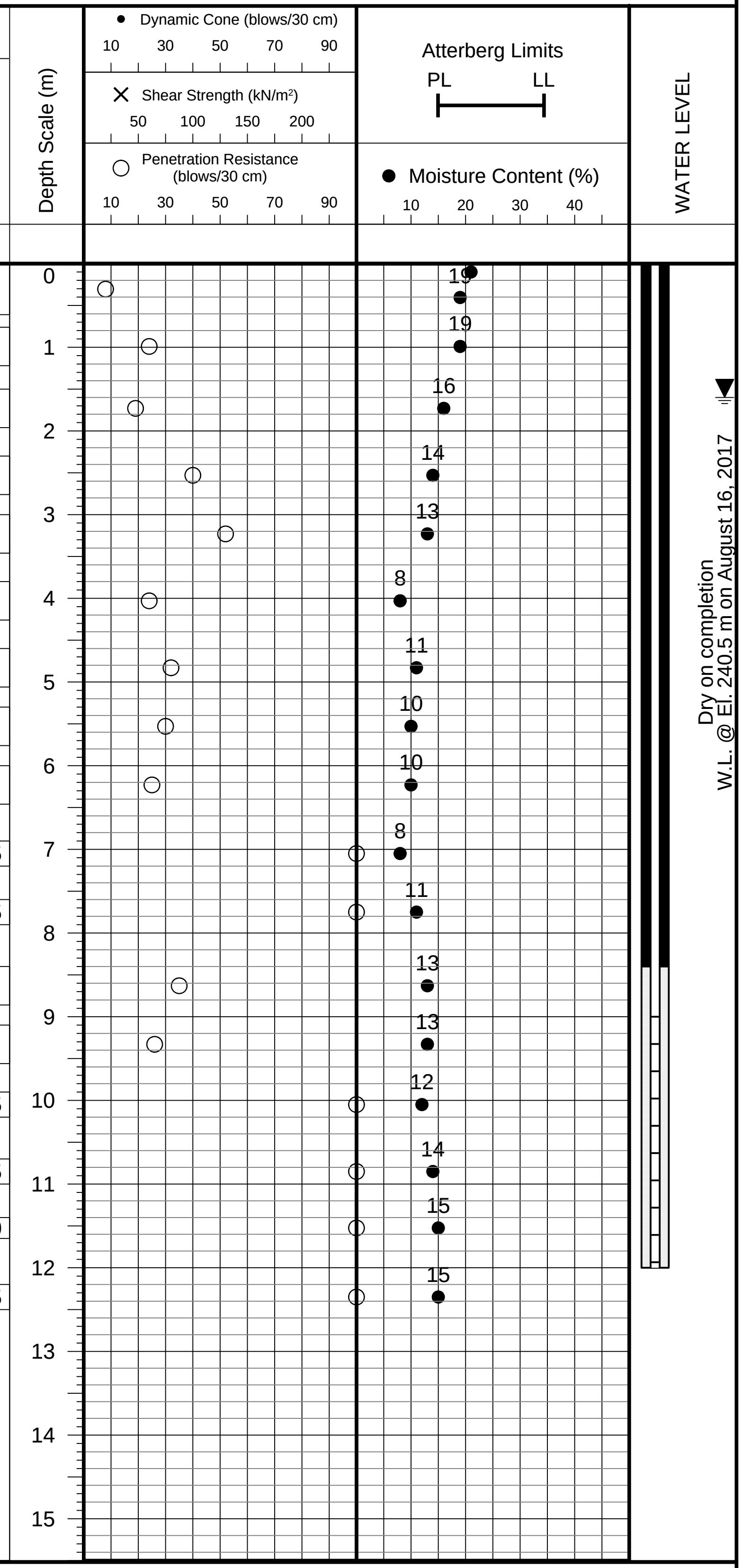
METHOD OF BORING: Hollow-Stem

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	Sample Number	Type	N-Value
242.1	Ground Surface			
0.0	**20 cm TOPSOIL**	1A		
	Firm to hard	1B	DO	8
	weathered	2	DO	24
	boulder	3	DO	19
	SILTY CLAY TILL	4	DO	40
		5	DO	52
	brown / grey	6	DO	24
	some sand to sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders	7	DO	32
		8	DO	30
		9	DO	25
235.4 6.7	Grey, very dense	10	DO	50/15
	SANDY SILT TILL	11	DO	52/15
	some clay, a trace of gravel occ. sand seams and layers, cobbles and boudlers; silt layer	12	DO	35
	water seepage	13	DO	26
232.3 9.8	Grey, very dense	14	DO	55/15
	SILT	15	DO	50/15
	some clay, a trace of sand occ. clay layers	16	DO	50/10
229.6		17	DO	55/15
12.5	**END OF BOREHOLE**			

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



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	Type	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				1, 2, 3			
	brown / grey				4			
	some sand to sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders				5			Dry on completion
236.1 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			

Soil Engineers Ltd.

JOB NO.: 1707-S200

LOG OF BOREHOLE NO.: MW3-17

FIGURE NO.: 4

PROJECT DESCRIPTION: Monitoring Wells Installation

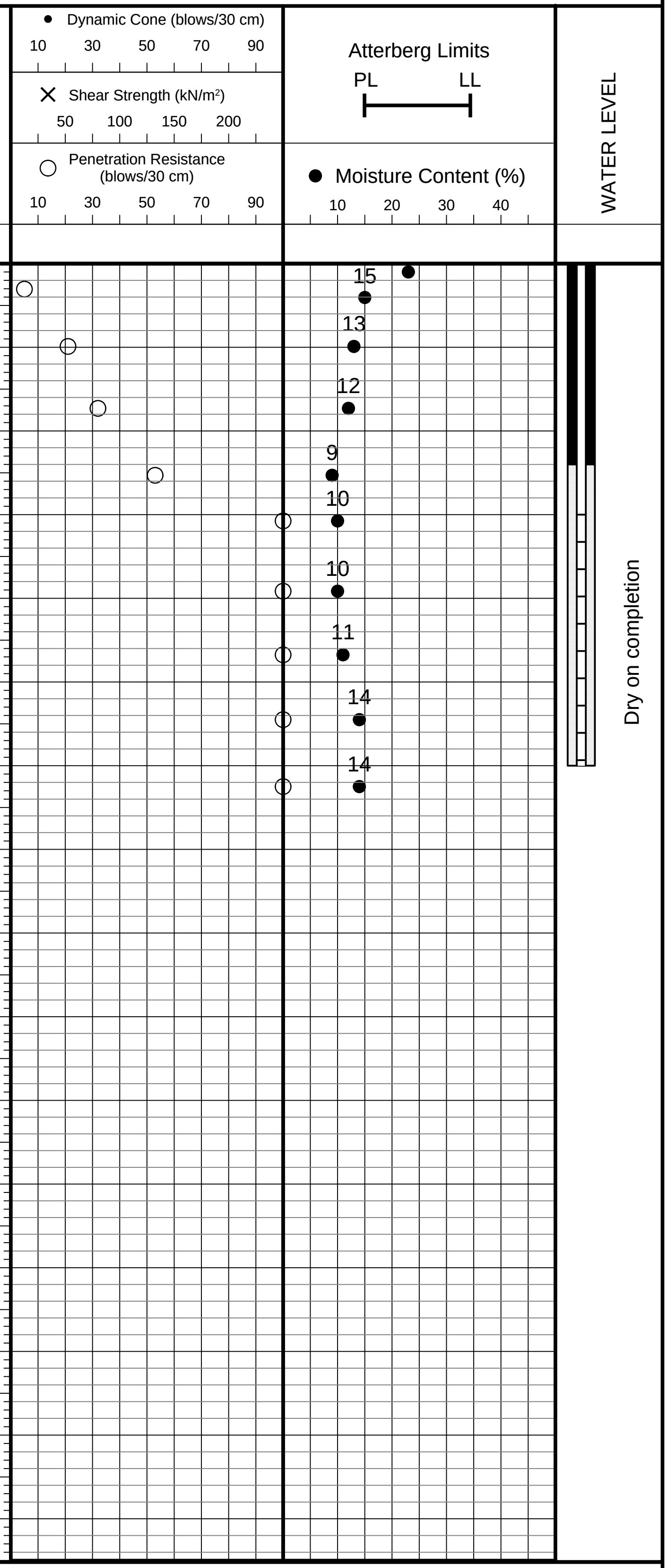
METHOD OF BORING: Hollow-Stem

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	Sample Number	Type	N-Value	Depth Scale (m)
235.5	Ground Surface				
0.0	**20 cm TOPSOIL**	1A	DO	5	0
	Brown, firm to hard	1B			
	weathered	2	AS	21	1
	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	4	DO	53	2
	boulder	5	DO	55/15	3
232.0 / 3.5	Grey, very dense	6	DO	50/8	4
	SILT	7	DO	50/15	
	some clay, a trace of sand occ. clay layers	8	DO	50/15	5
		9	DO	70/15	6
229.1 / 6.4	**END OF BOREHOLE**				

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

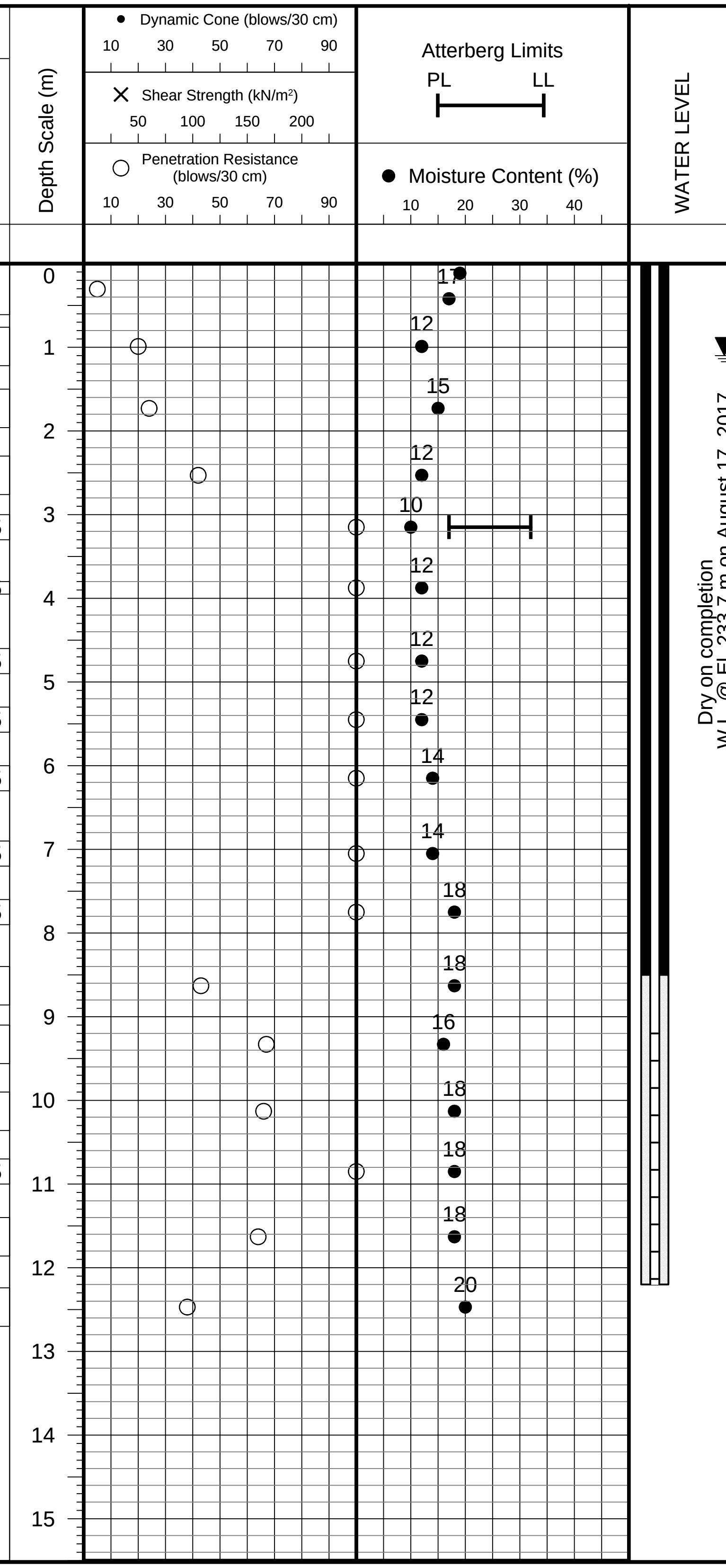
METHOD OF BORING: Hollow-Stem

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	Number	Type	N-Value
234.8	Ground Surface			
0.0	**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		17	DO	38
12.7	**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



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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	Type	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 **SILTY CLAY TILL** some sand to sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders				1 2 3			Dry on completion W.L. @ El. 233.6 m on August 17, 2017
231.2 3.6	Grey brown / grey **SILT** some clay, a trace of sand occ. clay layers				4 5			
228.8 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			

Soil Engineers Ltd.

JOB NO.: 1707-S200

LOG OF BOREHOLE NO.: MW5-17D

FIGURE NO.: 7

PROJECT DESCRIPTION: Monitoring Wells Installation

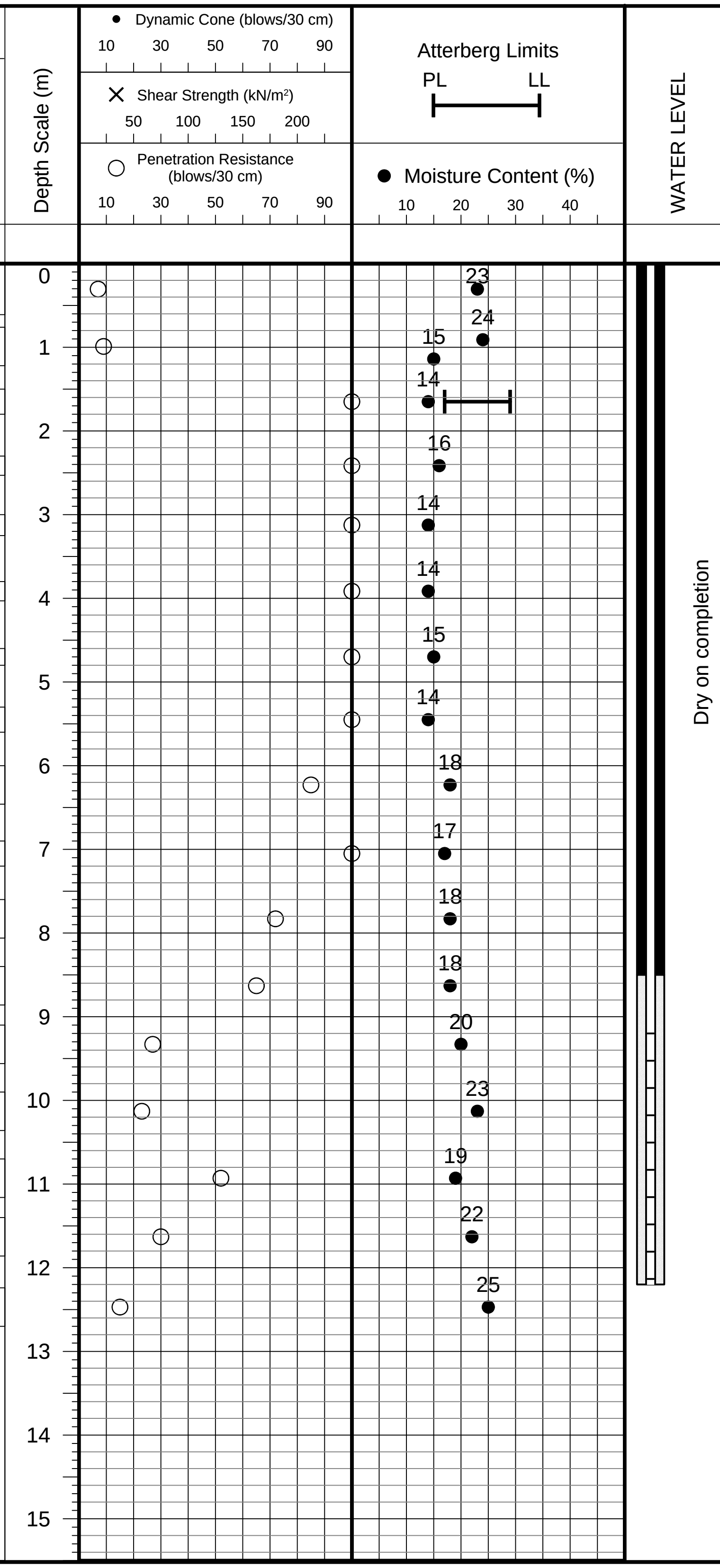
METHOD OF BORING: Hollow-Stem

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	Moisture Content (%)
228.7	Ground Surface				
0.0	**1.1 cm FLOOD DEPOSIT** mixed with silty clay	1	DO	7	23
		2A	DO	9	24
227.6 / 1.1	Brown, hard **SILTY CLAY** a trace of sand (weathered)	2B			15
		3	DO	50/15	14
226.6 / 2.1	occ. wet silt seams and layers				
	Grey, compact to very dense **SILT**	4	DO	50/8	16
		5	DO	70/10	14
		6	DO	50/8	14
		7	DO	50/5	15
		8	DO	50/15	14
		9	DO	85	18
		10	DO	50/15	17
	some clay, a trace of sand occ. clay layers	11	DO	72	18
	water seepage	12	DO	65	18
		13	DO	27	20
		14	DO	23	23
		15	DO	52	19
		16	DO	30	22
216.0		17	DO	15	25
12.7	**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



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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	Type	N-Value	Depth Scale (m)
228.7	Ground Surface				
0.0	**1.1 cm FLOOD DEPOSIT** mixed with silty clay				0
227.6 1.1	Brown **SILTY CLAY** a trace of sand occ. wet silt seams and layers				1
226.6 2.1	Grey **SILT** some clay, a trace of sand occ. clay layers				2–5
222.7 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				6–15

● 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. 222.9 m on August 18, 2017

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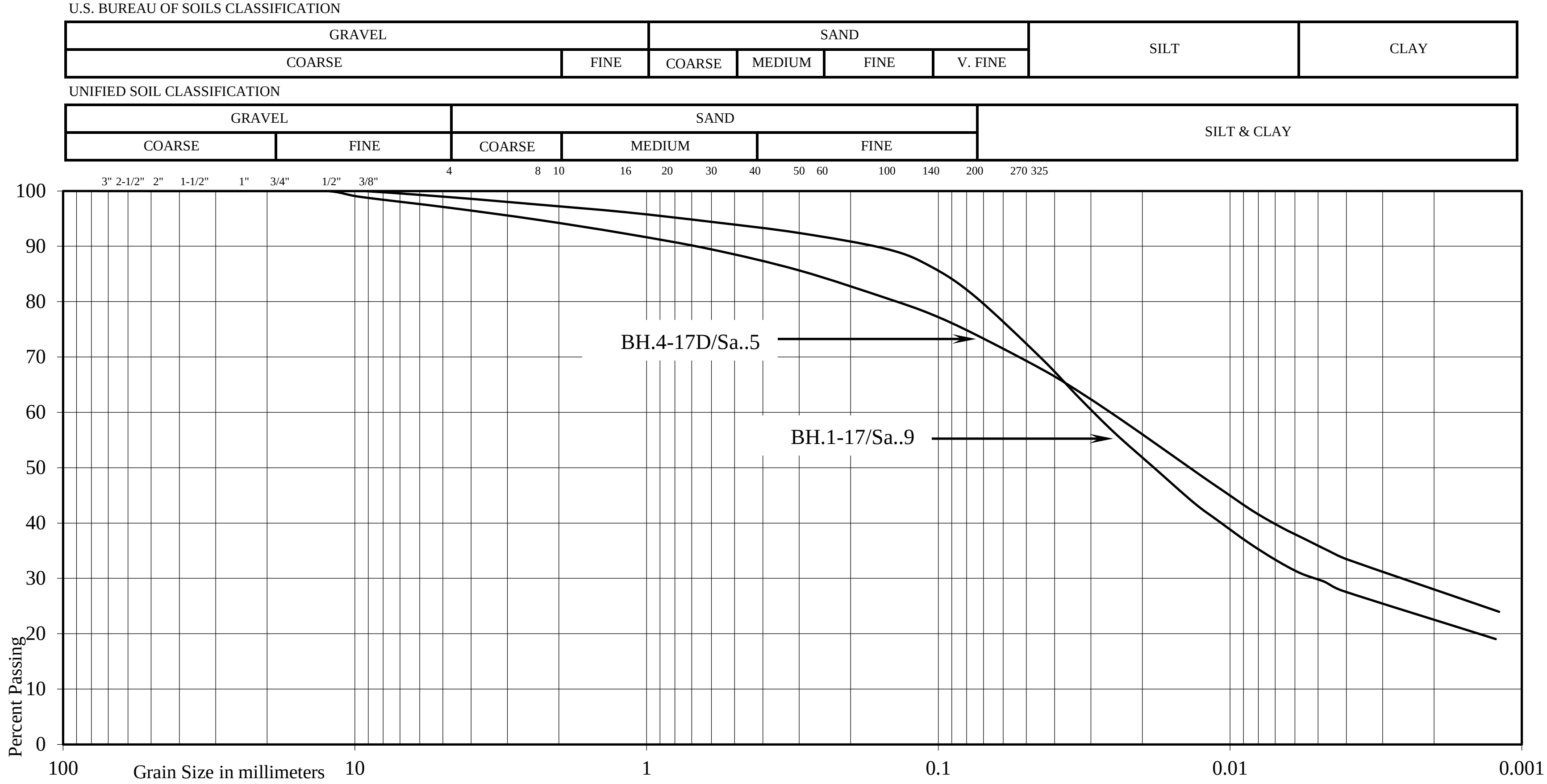
GRAIN SIZE DISTRIBUTION

Reference No: 1707-S200



Project:	Monitoring Wells Installation		BH./Sa.	1-17/9	4-17D/5
Location:	East side of Humber Station Road, south of Healey Road, Town of Caledon		Liquid Limit (%) =	26	32
			Plastic Limit (%) =	16	17
Borehole No:	1-17	4-17D	Plasticity Index (%) =	10	15
Sample No:	9	5	Moisture Content (%) =	-	-
Depth (m):	6.4	3.2	Estimated Permeability		
Elevation (m):	238.5	231.6	(cm./sec.) =	10^{-3}	10^{-4}

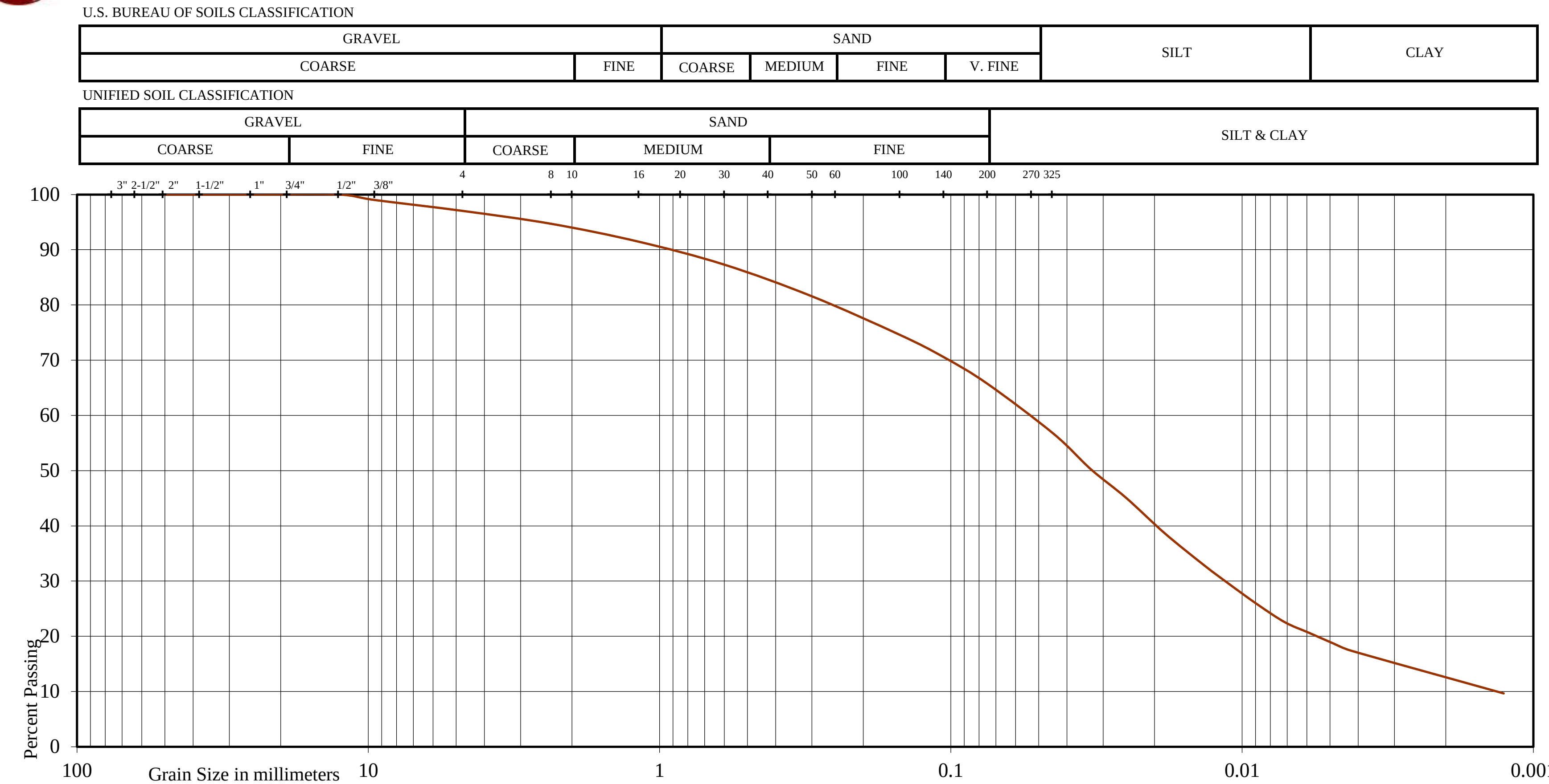
Classification of Sample [& Group Symbol]: SILTY CLAY TILL, some sand to sandy, a trace of gravel

Figure: 9

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 1707-S200



Project: Monitoring Wells Installation

Location: East side of Humber Station Road, south of Healey Road, Town of Caledon

Liquid Limit (%) = -

Plastic Limit (%) = -

Borehole No: 2-17D

Plasticity Index (%) = -

Sample No: 10

Moisture Content (%) = 8

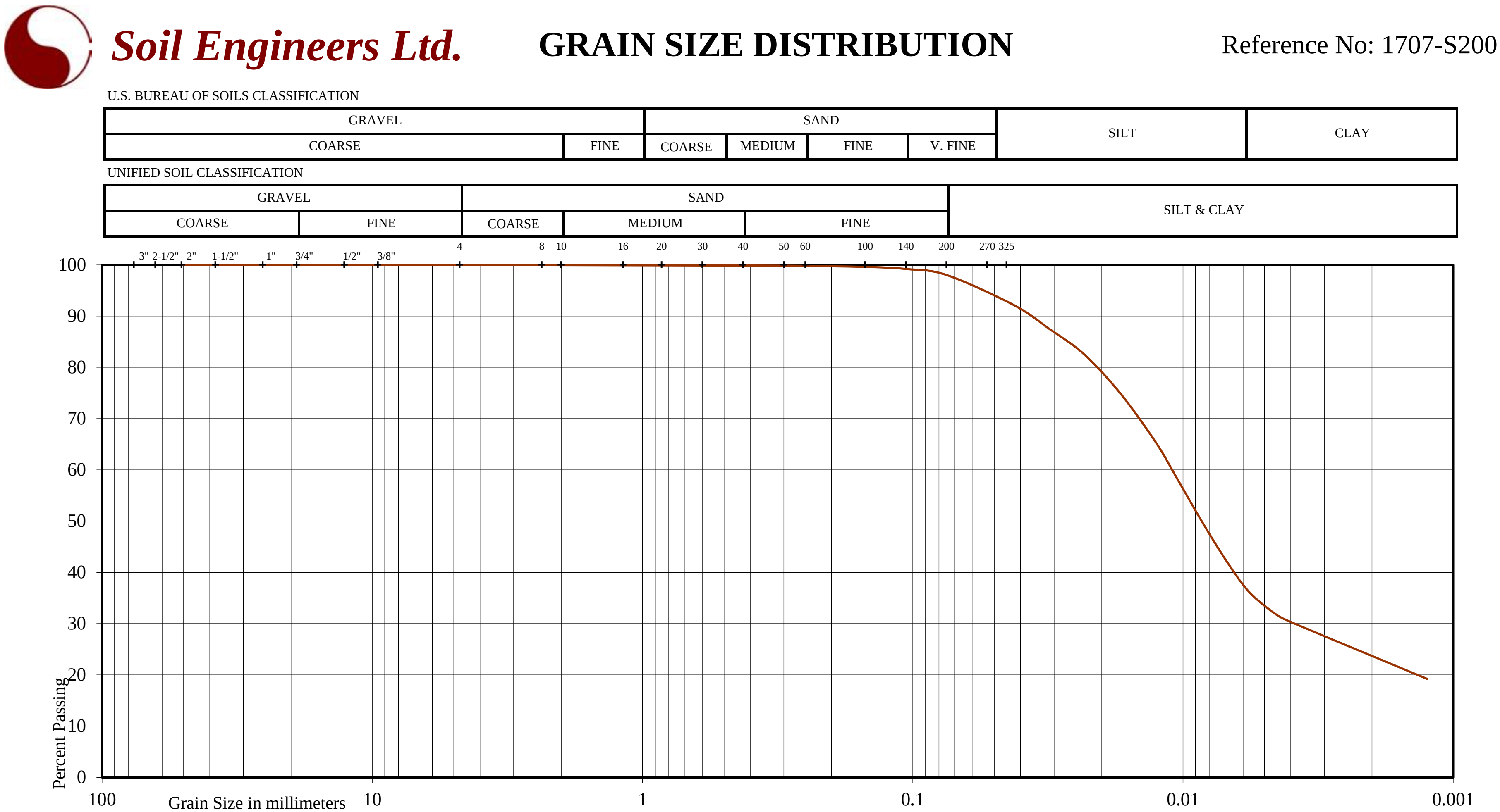
Depth (m): 7.1

Estimated Permeability (cm./sec.) = 10^{-6}

Elevation (m): 235.0

Classification of Sample [& Group Symbol]: SANDY SILT TILL, some clay, a trace of gravel

Figure: 10



Project: Monitoring Wells Installation

Location: East side of Humber Station Road, south of Healey Road, Town of Caledon

Liquid Limit (%) = 29

Plastic Limit (%) = 17

Borehole No: 5-17D

Plasticity Index (%) = 12

Sample No: 3

Moisture Content (%) = 14

Depth (m): 1.7

Estimated Permeability

Elevation (m): 227.0

(cm./sec.) = 10^{-7}

Classification of Sample [& Group Symbol]: SILTY CLAY, a trace of fine sand

Figure: 11

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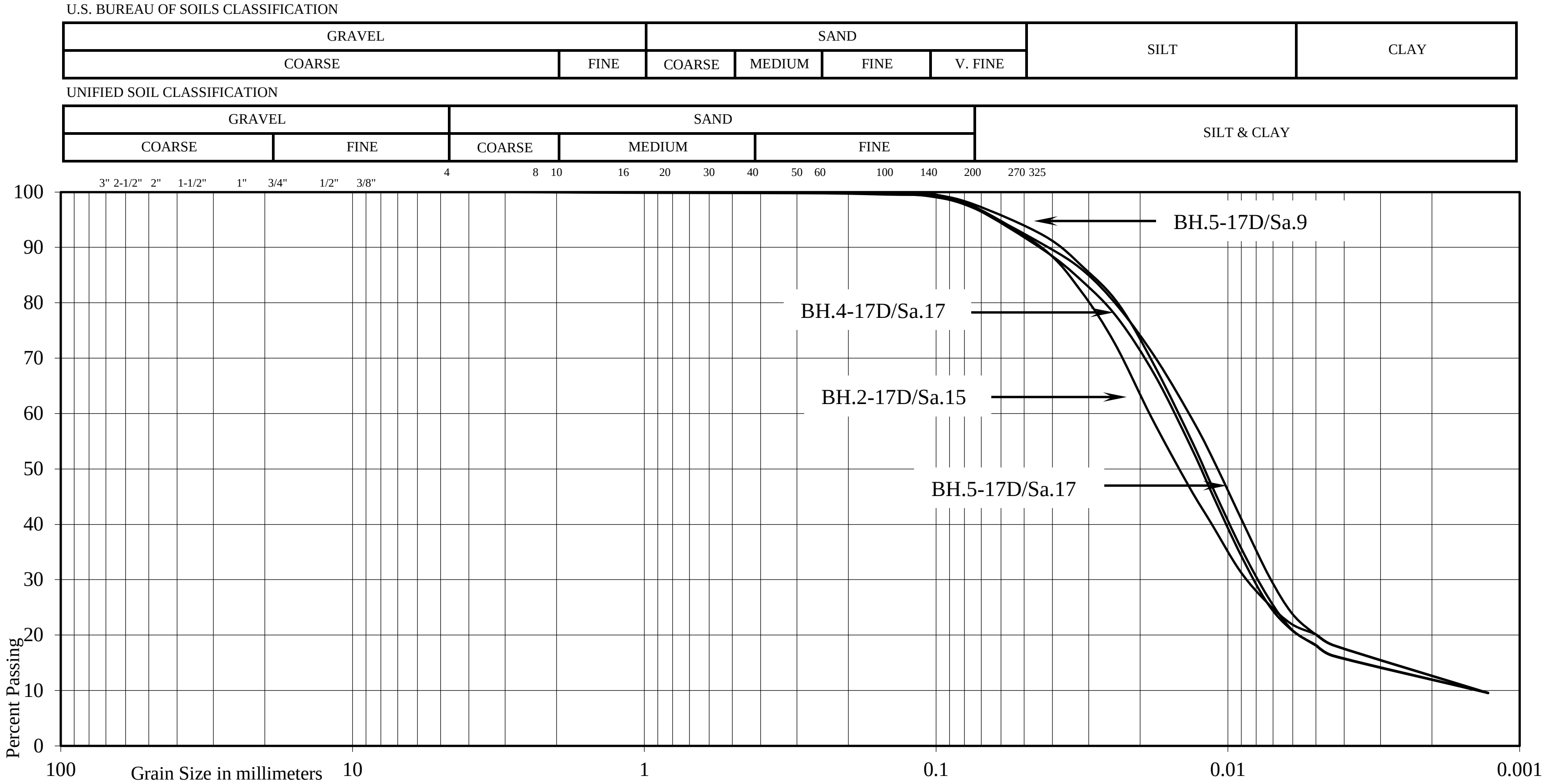
GRAIN SIZE DISTRIBUTION

Reference No: 1707-S200

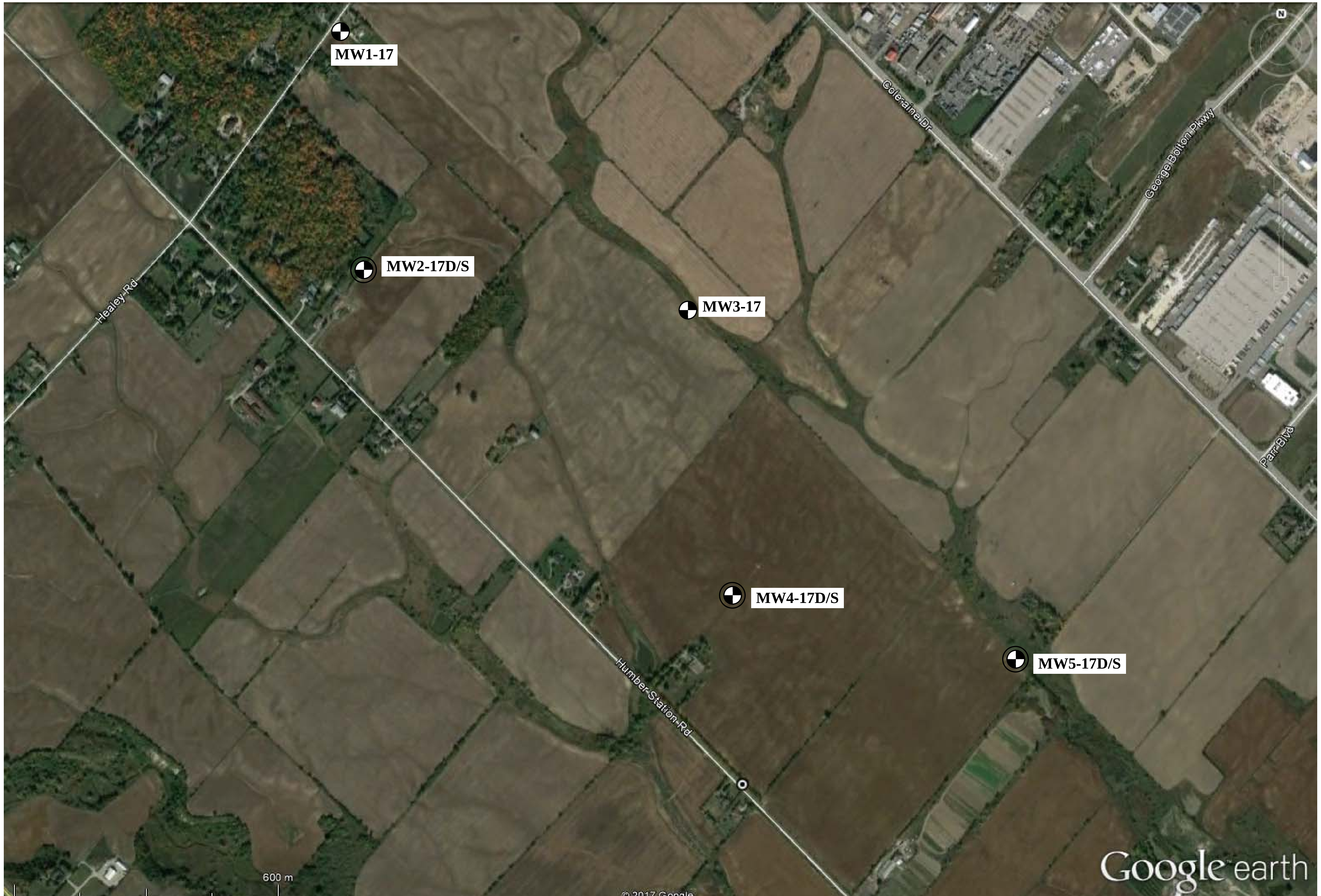


Project:	Monitoring Wells Installation				
Location:	East side of Humber Station Road, south of Healey Road, Town of Caledon				
Borehole No:	2-17D	4-17D	5-17D	5-17D	
Sample No:	15	17	9	17	
Depth (m):	10.9	12.5	6.2	12.5	
Elevation (m):	231.2	222.3	222.5	216.2	

BH./Sa.	2-17D/15	4-17D/17	5-17D/9	5-17D/17
Liquid Limit (%) =	-	-	-	-
Plastic Limit (%) =	-	-	-	-
Plasticity Index (%) =	-	-	-	-
Moisture Content (%) =	14	20	18	25
Estimated Permeability (cm./sec.) =	10^{-6}	10^{-6}	10^{-6}	10^{-6}

Classification of Sample [& Group Symbol]: SILT, some clay, a trace of fine sand

Figure: 12



Borehole No.	Northing (m)	Easting (m)
MW1-17	601346	4856301
MW2-17D/S	601415	4855763
MW3-17	602151	4855685
MW4-17D/S	602267	4855042
MW5-17D/S	602916	4854912

* Northing and easting coordinates accuracy up to 10 cm

LEGEND

- Borehole with monitoring well

- Borehole with nested monitoring well

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CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | HYDROGEOLOGICAL | BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 TEL: (416) 754-8515 · FAX: (905) 881-8335

BOREHOLE AND MONITORING WELL LOCATION PLAN

SITE: East side of Humber Station Road, south of Healey Road, Town of Caledon

DESIGNED BY: - **CHECKED BY:** - **DWG NO.:** 1

SCALE: 1:10000 **REF. NO.:** 1707-S200 **DATE:** September 2017 **REV** -

ARCADIA IBI GROUP

ARCADIS IBI GROUP
300 – 8133 Warden Avenue
Markham ON L6G 1B3 Canada
tel 905 763 2322
ibigroup.com

Memorandum

To/Attention	Mustafa Ghassan	**Date**	June 23, 2023
From	Bradley Trinh, Steve Davies, P.Geo.Bradley Trinh, Steve Davies, P.Geo.	**Project No**	141438
Subject	Bolton Residential Expansion Site - Option 6 Lands Hydrogeological Investigation - Additional Groundwater and Surface Water Monitoring		

1 Introduction

1.1 Project Background

A Hydrogeological Investigation draft report, entitled *"Bolton Residential Expansion Site – Option 6 Lands, Hydrogeological Investigation Report"*, dated June 7, 2018, was reviewed and updated in 2022 by Arcadis IBI Group; however no new data or analysis was incorporated into the report. It is understood that that the proposed development plans have changed since the completion of the previous study and now consists predominantly of Employment Lands.

The purpose of the additional groundwater and surface water monitoring is to build upon the data accumulated in the previous investigation and collect pertinent hydrogeological data required to support Phase 1 of the Comprehensive Impact Study and Management Plan (CEISMP).

1.2 Objectives

Arcadis IBI Group personnel collected additional data monitoring data from the existing groundwater and surface water stations in December 2022 and May 2023 with the understanding that the data may be used to help integrate the older 2017 / 2018 data into an ongoing monitoring data set. The following information was obtained from part of the monitoring program:

- A condition survey of each monitoring station, along with photographic documentation
- Manual water level measurements from all piezometers, staff gauges and monitoring wells
- Surface water flow measurements from all surface water monitoring features

2 Monitoring Network

Existing monitoring wells, mini-piezometers and stream flow monitoring stations installed as part of the previous hydrogeological investigation were assessed on December 8, 2022 and December 9, 2022 and on May 5, 2023. The conditions of each station during these visits were photo logged and are appended to the end of this memorandum. Additional stream flow areas were also assessed for surface water flow. The locations are illustrated on Figure 1 in **Appendix A** at the end of this memorandum.

2.1 Monitoring Well Groundwater Levels and Vertical Hydraulic Gradients

Water level measurements were measured on December 8 and 9, 2022 and on May 5, 2023. The measurements are summarized with the 2017 / 2018 data as Table 1 provided in **Appendix B**. No significant changes were observed with the additional data collected. Water levels were observed to fluctuate on a seasonal basis, with water levels generally lower in the fall and higher in the spring. The highest groundwater level occurred on April 23, 2018 in MW1-17 near the northwestern corner of the Site, where the water level was monitored to be 244.73masl. The lowest water level was 227.55masl measured in MW7 near the southwestern corner of the Site on September 22, 2017.

Water levels in the shallow monitoring wells screened to depths ranging from 3.1mbgs to 6mbgs) ranged from 227.55masl (1.00mbgs) in MW7 to 244.73masl (0.46mbgs) in MW1-17. For the deeper wells (screened to depths ranging from 9mbgs to 12.2mbgs), the water levels ranged from 229.24masl (-0.28mbgs) in MW5-17D to 241.38masl (1.01mbgs) in MW2-17D.

Vertical hydraulic gradients were also estimated at three (3) monitoring well nests to characterize the general vertical groundwater flow at the Site. **Table 2.1**, below, summarizes the calculated vertical hydraulic gradients at the three (3) monitoring well nests for the water level monitoring events.

Table 2.1 Estimated Vertical Hydraulic Gradients at on-Site Monitoring Wells

WELL NEST	VERTICAL HYDRAULIC GRADIENTS (M/M)							
	31-AUG-17	22-SEP-17	10-NOV-17	5-DEC-18	7-FEB-18	23-APR-18	08-DEC-22	05-MAY-23
MW2-17S/D	-0.001	-0.0004	-0.01	0.004	0.002	0.002	0.004	-0.002
MW4-17S/D	0.01	0.01	0.009	-0.01	0.0003	-0.02	NM	0.007
MW5-17S/D	-0.1	-0.2	-0.1	NM	NM	NM	-	-

NM: Not measured due to freezing conditions or access to parcel land
'-' : Not measured due to observed well packer in MW5-17 D
Negative values indicate an upward gradient; positive values indicate a downward gradient

Updated hydraulic gradients at the above nested wells continue to show near neutral hydraulic gradients at MW2-17S/D and MW4-17S/D. Conversely, MW5-17S/D has shown a consistent upward hydraulic gradient based on the measurements obtained and observations of artesian conditions at that well.

2.2 Piezometer Groundwater Levels and Vertical Hydraulic Gradients

Water level measurements in the mini-piezometers were measured on December 8, 2022 and December 9, 2022 and on May 5, 2023. The measurements are summarized with the 2017 / 2018 data and are provided Table 2 and Table 3 in **Appendix B** at the end of this memorandum. Hydrographs for the mini-piezometers that still exist and that were not damaged are provided in **Appendix C**. Additional details regarding which stations were damaged are provided in **Section 3**. The rain gauge data presented on the hydrographs is from the Toronto Pearson Airport Environment Canada meteorological station.

Based on the updated data, recent water levels in both shallow and deep piezometers were observed to be in range of the previous data and no anomalies were noted. However, surface water monitoring stations SF2-17S/D, SF3-17S/D, and SF4-17S/D were observed to be damaged and unusable in 2022 and 2023.

Vertical hydraulic gradients were also estimated at each piezometer nest to assess potential groundwater-surface water interactions, as shown in **Table 2.2**, below.

Table 2.2 Estimated Vertical Hydraulic Gradients at Stream Bank Mini-Piezometers

WELL NEST	VERTICAL HYDRAULIC GRADIENTS (M/M)									
	26-JUL-17	21-SEP-17	10-NOV-17	05-DEC-17	7-FEB-18	23-APR-18	08-DEC-22	05-MAY-23	OVERALL INTERPRETATION	LOCATION
SF1-17	-	-	1.84	1.86	1.87	1.01	0.69	0.69	Downward	West Tributary
WL1-17	-	0.70	-0.16	0.33	0.44	0.50	-0.46	0.64	Predominantly Downward	West Tributary
WL2-17	-	-	2.81	1.48	2.56	2.46	0.22	0.47	Downward	West Tributary
SF2-17	-	-	-	0.98	0.98	1.01	-	-	Downward	East Tributary
SF3-17	-1.25	-0.09	-0.14	0.01	1.27	-0.14	-	-	Predominantly Upward	East Tributary
SF4-17	-	-	-	-	1.17	3.62	-	-	Downward	West Tributary
SF5-17	-0.09	0.08	-0.16	0.13	-0.06	-0.84	-	-0.38	Variable	West Tributary
SF6-17	-	0.35	0.07	-0.09	1.29	-0.54	2.21	0.06	Variable	East Tributary

'-' : Indicates that the vertical hydraulic gradient could not be estimated due to one or both piezometers being dry
Negative values indicate an upward gradient; positive values indicate a downward gradient

The downward hydraulic gradients observed in most of the mini-piezometer nests suggest that the wetland and the stream features on-Site are not receiving groundwater discharge. However, SF3-17 in the southeast portion of the Site showed predominantly upward gradients during the monitoring event. The feature is in the unevaluated wetland and drainage feature along eastern boundary of the Site (East Tributary). Monitoring well MW5-17, which also has upward gradients is also located nearby within the wetland. Groundwater discharge is interpreted to be occurring in this area. Station SF6-17, which is located downstream of SF3-17 within the East Tributary floodplain showed predominantly upward gradients in the spring, which suggests that this area may be receiving groundwater discharge during a portion of the year. Similarly, SF5-17 located in the drainage feature on the west side of the Site (West Tributary) has upward gradients during the spring and may receive groundwater discharge for a portion of the year. This may represent an intermittent stream classification in these areas.

A map depicting the hydraulic gradients at each nest are provided on **Figure 2** and **Figure 3** appended to the memorandum.

3 Stream Water Level and Flow

Stream flow measurements were measured on December 8, 2022 and December 9, 2022 and stream flow observations were recorded on May 5, 2023. The measurements are summarized with the 2017 / 2018 data as Table 4 included in **Appendix B**. Based on the recent observations, several stations were damaged and as such, limited data could be collected. Stations SF2-17 and SF3-17 were observed with no mini-piezometers and staff gauge. Whereas station SF4-17 was observed with a damaged mini-piezometer nest and stations SF5-17 and SF6-17 were observed with missing staff gauges. Additional areas of interest (SF8-22 to SF11-22) were observed for flow as well. It should be noted that beaver dams were observed in areas of SF3-17 and SF10-22. A photolog is provided as **Appendix C**.

However, all stations were observed with flow, except for SF7-17 and SF9-22 along the Centre Channel.

With the limited data collected, previous hydrographs of the stations SF1-17, SF5-17, SF6-17, WL1-17 and WL2-17 were updated and are provided in **Appendix D**. No changes in hydraulic gradient were noted at the above stations from the previous interpretations.

4 Recommendations

Based on the results of this study, the following recommendations are provided to augment the recommendations provided in the 2022 Draft Hydrogeology Report:

1. Assess the need for additional groundwater monitoring stations in areas of the Ste that have previously not been investigated.
2. Assess the need to continue monitoring the stations at the East Tributary and West Tributary where groundwater discharge has been identified to satisfy the requirements of the TRCA or other commenting agencies.
3. Delineate upstream zone of potential groundwater contributions in the Western Tributary
4. Repair and/or reinstall damaged stations with mini-piezometers and/or staff gauge.
5. Assess the necessity of removing the beaver dams.
6. Complete a residential water well survey should still be conducted within a 500m radius of the Site to better understand local use of groundwater resources in the area.
7. Conduct a site-specific water balance based on the latest proposed plan for development.

Appendix A – Figures

.H\ 0DS
/HJHQG
3DUFHO 3DUWLFLSDWLQJ
5-% 0RQLWRULQJ :HOO
,%, 0RQLWRULQJ :HOO IRU
6WUHDPIORZ 6WDWLRQ
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:DWHUFRXUVH
:DWHUERG\
8QHYDOXDWHG :HWODQGV
5RDGV
(DVW 7ULEXWDU\
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1
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ARCADIS
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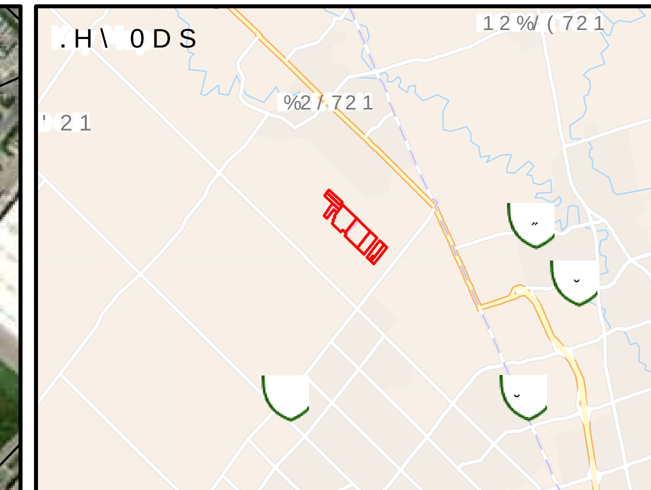

/HJHQG

3DUFHO 3DUWLFLSDWLQJ

:DWHUFRXUVH

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8QHYDOXDWHG :HWODQGV

5RDGV

9HUWLFDO +\GUDXOLF *UD

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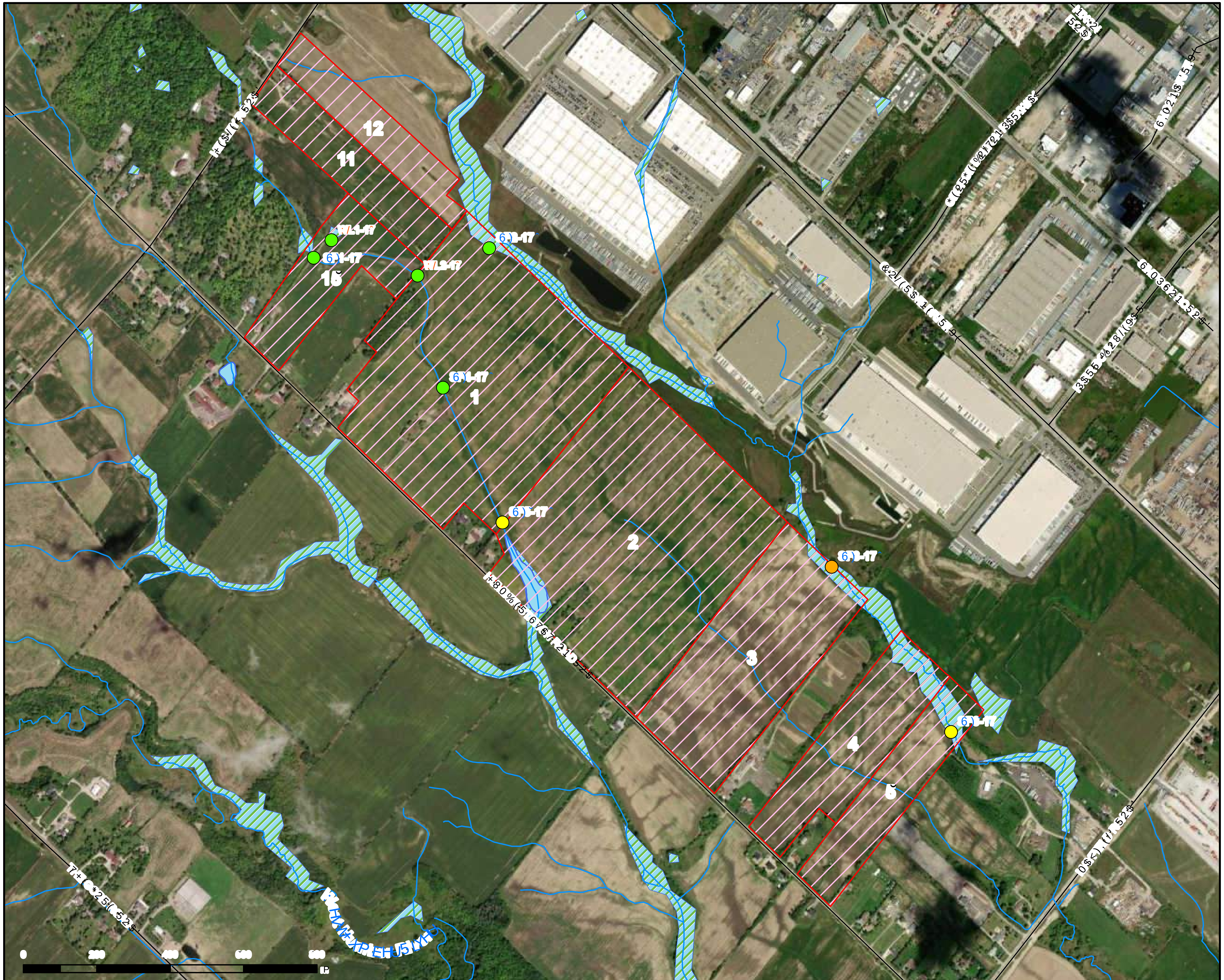

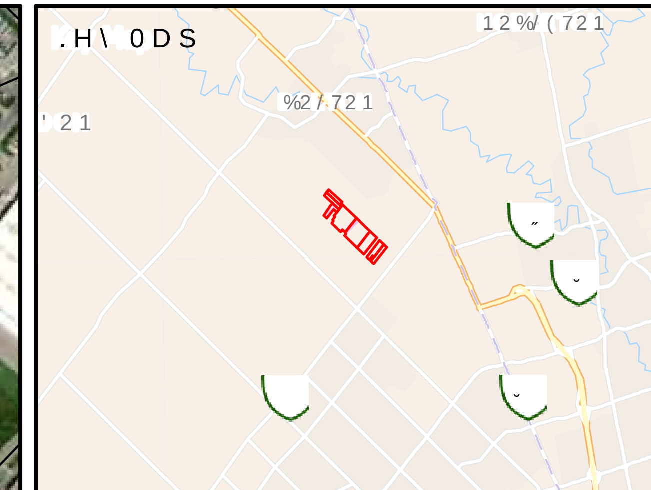

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3DUFHO 3DUWLFLSDWLQJ

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8QHYDOXDWHG :HWODQGV

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Appendix B – Tables

Table 1: Monitoring Well Water Levels

Well ID	Ground Elevation (masl)	Well Depth (mbgs)	31-Aug-17		22-Sep-17		10-Nov-17		05-Dec-17		07-Feb-18		23-Apr-18		08-Dec-22		05-May-23	
			Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)
MW1-17	245.2	5.93	1.11	244.08	1.32	243.87	0.82	244.37	0.83	244.36	1.04	244.15	0.46	244.73	0.79	244.40	0.49	244.70
MW2-17D	242.4	11.63	1.01	241.38	1.18	241.20	1.6	240.78	1.5	240.89	1.52	240.86	1.08	241.3	2.61	239.77	1.25	241.14
MW2-17S	242.4	6.07	1.03	241.39	1.21	241.20	1.58	240.84	1.55	240.86	1.57	240.84	1.13	241.28	2.66	239.75	1.26	241.15
MW3-17	235.8	6.01	2.61	233.19	0.45	235.35	0.3	235.5	0.14	235.65	-	-	0.1	235.7	n	n	0.05	235.74
MW4-17D	234.0	12.17	0.95	233.03	1.27	232.72	1.67	232.32	1.44	232.55	1.44	232.54	0.61	233.37	n	n	0.54	233.45
MW4-17S	234.0	6.06	1.06	232.96	1.37	232.65	1.76	232.26	1.4	232.62	1.48	232.54	0.48	233.54	n	n	0.60	233.41
MW5-17D	229.0	12.06	-0.28	229.24	-0.50	229.46	-0.61	229.57	-	-	-	-	-	-	n*	n*	n*	n*
MW5-17S	228.9	6.11	0.74	228.20	0.79	228.15	0.42	228.52	0.16	228.79	0.19	228.75	-0.13	229.07	0.29	228.65	-0.20	229.14
MW9	235.6	5.28	1.89	233.72	2.11	233.51	2.24	233.37	1.92	233.69	2.11	233.5	1.38	234.23	n	n	1.38	234.23
MW8	231.9	5.11	0.40	231.54	1.86	230.08	1.76	230.18	1.12	230.82	0.97	230.97	0.31	231.63	1.13	230.81	0.31	231.63
MW7	228.6	4.45	0.83	227.73	1.00	227.55	0.51	228.05	0.15	228.41	0.21	228.35	0.01	228.55	0.27	228.29	0.08	228.48

'-': Not measured due to freezing conditions
n: Not accessible
n*: Not accessible - Well packer observed

Table 2: Piezometer Water Level Measurements (mbgs)								
Piezometer ID	**26-Jul-17**	**21-Sep-17**	**10-Nov-17**	**05-Dec-17**	**07-Feb-18**	**23-Apr-18**	**08-Dec-22**	**05-May-23**
SF1-17S	0.2	0.3	0.2	0.1	0.1	-0.1	0.2	0.1
SF1-17D	Dry	Dry	2.2	2.2	2.2	1.0	1.0	0.9
SF2-17S	Dry	Dry	Dry	0.7	0.6	0.5	-*	-
SF2-17D	Dry	Dry	Dry	1.1	1.1	1.0	-*	-
SF3-17S	0.6	0.7	0.6	0.7	0.0	0.5	-	-
SF3-17D	0.0	0.7	0.5	0.6	0.5	0.4	-	-
SF4-17S	0.1	0.1	0.1	0.1	0.0	0.0	-*	-
SF4-17D	Dry	Dry	Dry	Dry	0.5	1.8	-*	-
SF5-17S	0.2	0.0	0.0	0.1	0.1	0.1	-*	0.0
SF5-17D	0.3	0.1	0.0	0.2	0.2	-0.2	-*	0.0
SF6-17-S	0.4	0.5	0.5	0.5	-0.1	0.1	0.1	0.3
SF6-17D	Dry	0.8	0.6	0.6	0.4	0.0	0.9	0.4
WL1-17S	NM	0.0	0.7	0.1	0.0	-0.2	0.6	-0.2
WL1-17D	NM	0.7	0.5	0.4	0.4	0.2	0.3	0.4
WL2-17S	NM	-0.2	-0.1	0.0	0.0	-0.1	0.0	-0.1
WL2-17D	NM	Dry	2.2	1.2	2.1	1.9	0.5	0.4

Table 3: Piezometer Water Level Measurements (masl)								
Piezometer ID	**26-Jul-17**	**21-Sep-17**	**10-Nov-17**	**05-Dec-17**	**07-Feb-18**	**23-Apr-18**	**08-Dec-22**	**05-May-23**
SF1-17S	240.1	239.9	240.0	240.1	240.1	240.3	240.0	240.1
SF1-17D	Dry	Dry	238.0	238.0	238.0	239.2	239.2	239.3
SF2-17S	Dry	Dry	Dry	236.3	236.4	236.5	-*	-
SF2-17D	Dry	Dry	Dry	235.7	235.7	235.8	-*	-
SF3-17S	227.5	227.4	227.5	227.4	228.1	227.6	-	-
SF3-17D	228.1	227.4	227.6	227.5	227.6	227.7	-	-
SF4-17S	236.5	236.5	236.4	236.4	236.5	236.5	-*	-
SF4-17D	Dry	Dry	Dry	Dry	236.0	234.7	-*	-
SF5-17S	233.3	233.5	233.6	233.5	233.5	233.5	-*	233.6
SF5-17D	233.4	233.5	233.6	233.4	233.4	233.8	-*	233.6
SF6-17-S	224.5	224.3	224.4	224.4	225.0	224.8	224.8	224.6
SF6-17D	Dry	224.2	224.4	224.4	224.6	225.0	224.1	224.6
WL1-17S	NM	241.1	240.4	241.0	241.1	241.3	240.5	241.4
WL1-17D	NM	240.4	240.6	240.7	240.7	240.9	240.9	240.7
WL2-17S	NM	238.9	238.8	238.7	238.7	238.8	238.7	238.8
WL2-17D	NM	Dry	236.5	237.5	236.6	236.8	238.3	238.3

-: Not measured due to station damage or unlocatable

-*: Not measured due to restricted access to the parcel lands

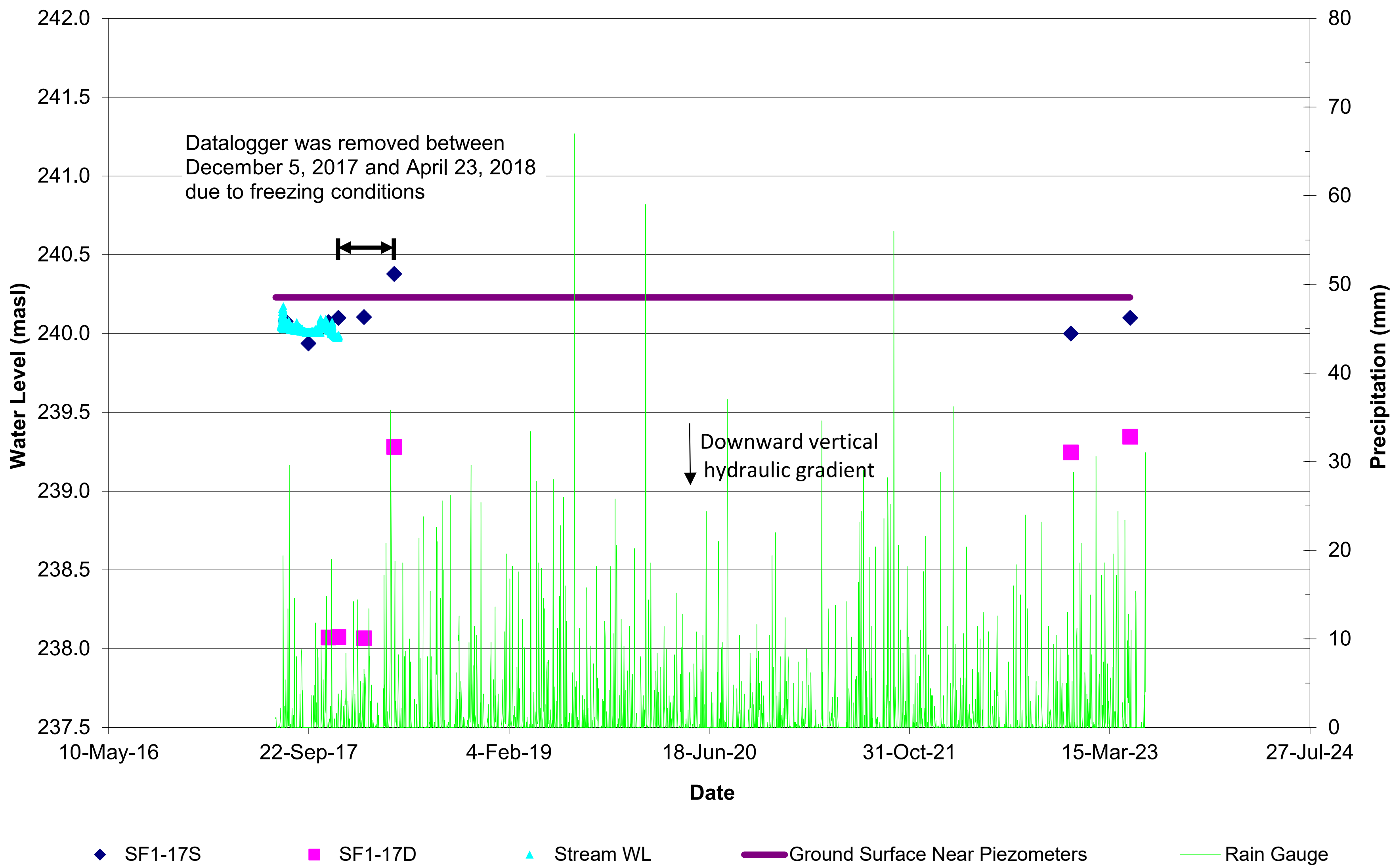
Table 4: Stream Flow Measurements

Monitoring Site	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*
SF1-17	SGR (cm)	23.8	22	25	21.5	21	18	19	23
	EFR (L/s)	2.93	2.45	2.65	1.2	#N/A	6.32	1.4	Slow to Intermediate
SF2-17	SGR (cm)	14.5	10	13	17.5	54	26	No Access	Unlocated
	EFR (L/s)	7.14	0.35	5.53	17.77	#N/A	41.12	No Access	Unlocated
SF3-17	SGR (cm)	19	15	13.5	31	34	32	Beaver Dam	Beaver Dam
	EFR (L/s)	18.9	3.25	14.67	123.4	#N/A	144.28	Beaver Dam	Slow
SF4-17	SGR (cm)	23	26	25.5	24	44	30	No Access	25.5
	EFR (L/s)	4.6	2.84	4.99	5.99	#N/A	16.3	No Access	Slow to Intermediate
SF5-17	SGR (cm)	11	12.5	14.5	14.5	8	20	No Access	SG missing
	EFR (L/s)	1.2	0.51	0.48	1.94	#N/A	5.42	No Access	Fast
SF6-17	SGR (cm)	30.5	20	22.5	37.5	35	40	13	SG missing
	EFR (L/s)	22.42	3.3	11.99	92.15	#N/A	143.58	20.197	Fast
WL3-17	SGR (cm)	NM	6	6.5	6	23.5	7	No Access	Slow to Intermediate
	EFR (L/s)	NM	0.83	0.79	0.7	#N/A	5.19	No Access	NM
SF7-17	SGR (cm)	NM	NM	NM	NM	NM	NM	Dry	36.5
	EFR (L/s)	NM	NM	NM	NM	NM	NM	0	Low to Intermediate
SF8-22	SGR (cm)	DNE	DNE	DNE	DNE	DNE	DNE	N/A	N/A
	EFR (L/s)	DNE	DNE	DNE	DNE	DNE	DNE	0.15	Slow
SF9-22	SGR (cm)	DNE	DNE	DNE	DNE	DNE	DNE	N/A	N/A
	EFR (L/s)	DNE	DNE	DNE	DNE	DNE	DNE	Dry	Slow
SF10-22	SGR (cm)	DNE	DNE	DNE	DNE	DNE	DNE	N/A	N/A
	EFR (L/s)	DNE	DNE	DNE	DNE	DNE	DNE	1.85	Intermediate
SF11-22	SGR (cm)	DNE	DNE	DNE	DNE	DNE	DNE	N/A	N/A
	EFR (L/s)	DNE	DNE	DNE	DNE	DNE	DNE	NM	Fast

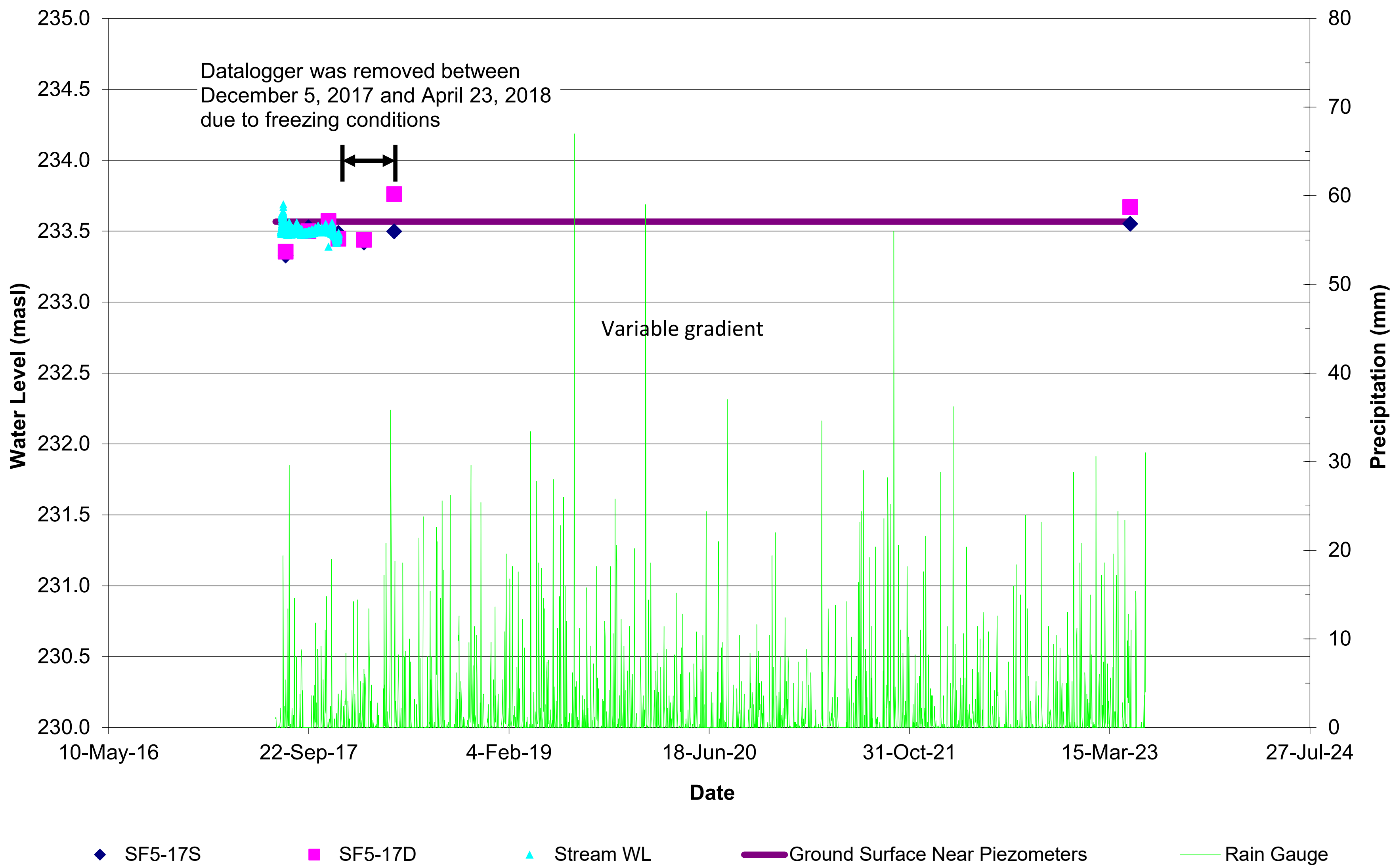
SGR = Stream Gauge Reading
EFR = Estimated Flow Rate
*': No stream flow measurements were conducted. Stream flow observations were recorded instead

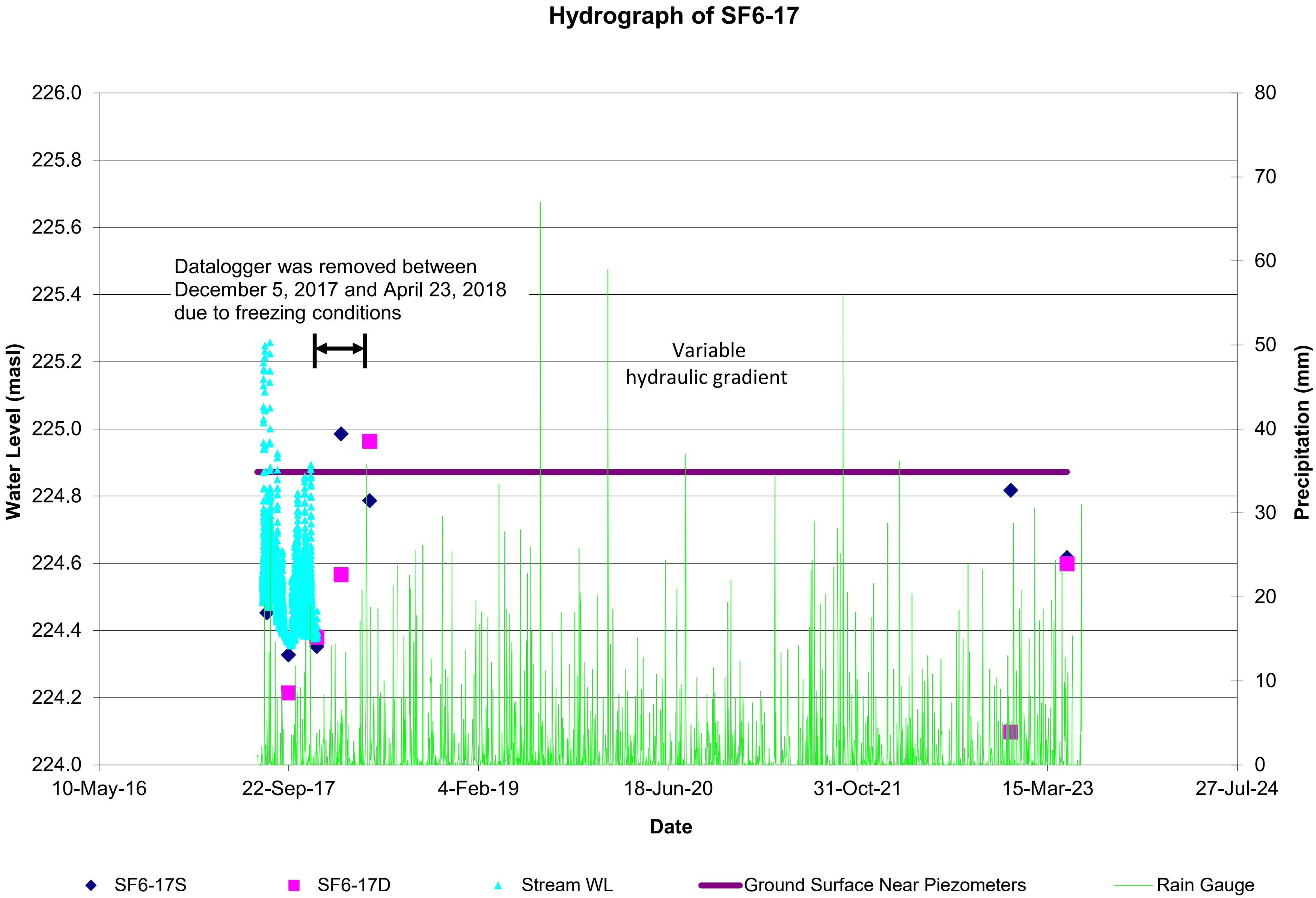
Appendix C – Hydrographs

Hydrograph of SF1-17



Hydrograph of SF5-17

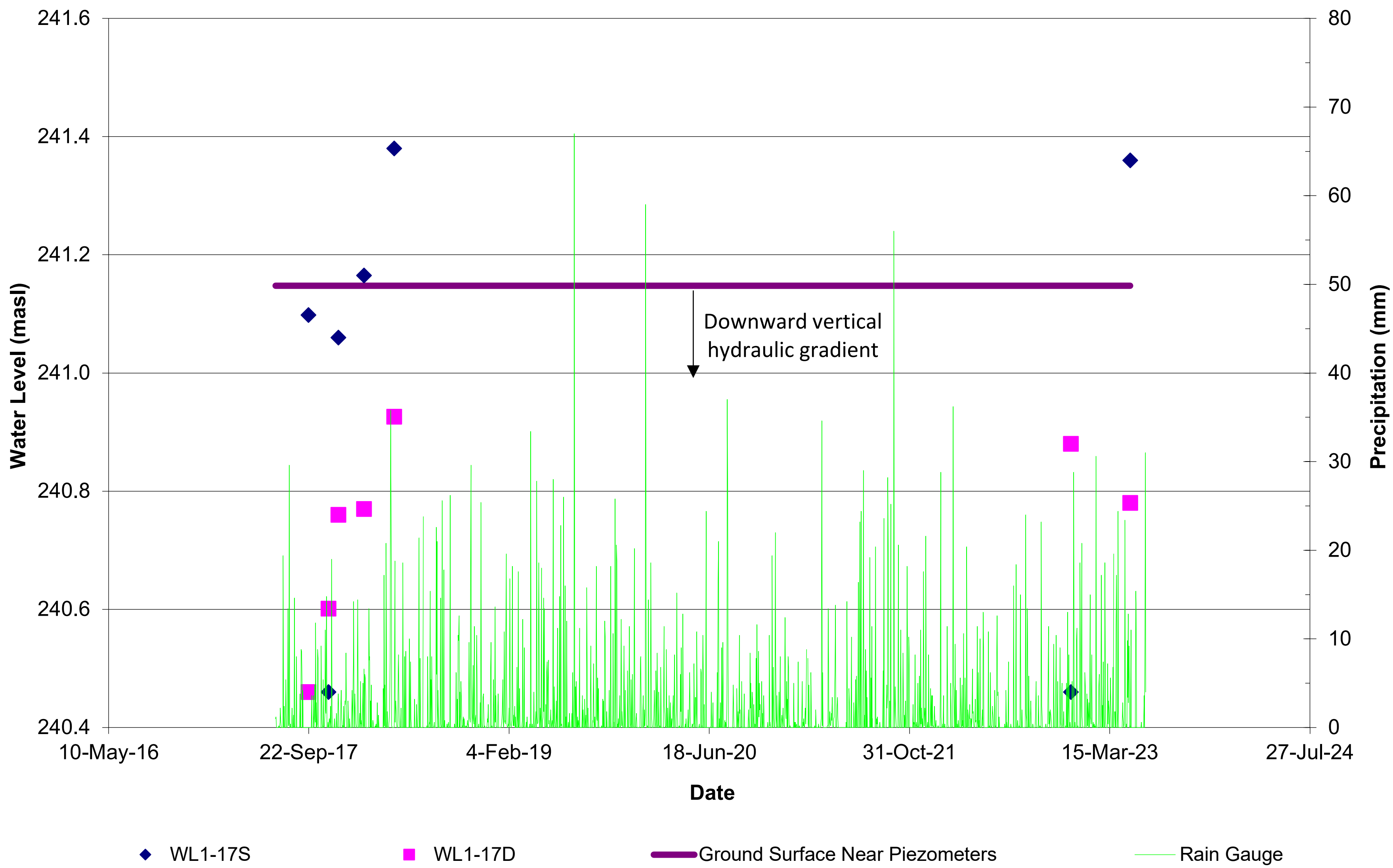



Hydrograph of SF6-17
Water Level (masl)
226.0
225.8
225.6
225.4
225.2
225.0
224.8
224.6
224.4
224.2
224.0
Precipitation (mm)
80
70
60
50
40
30
20
10
0
Datalogger was removed between
December 5, 2017 and April 23, 2018
due to freezing conditions
Variable
hydraulic gradient
10-May-16
22-Sep-17
4-Feb-19
18-Jun-20
31-Oct-21
15-Mar-23
27-Jul-24
Date
SF6-17S
SF6-17D
Stream WL
Ground Surface Near Piezometers
Rain Gauge

Solmar Development Corp.

Hydrogeological Investigation - Additional Groundwater and Surface Monitoring

Hydrograph of WL1-17



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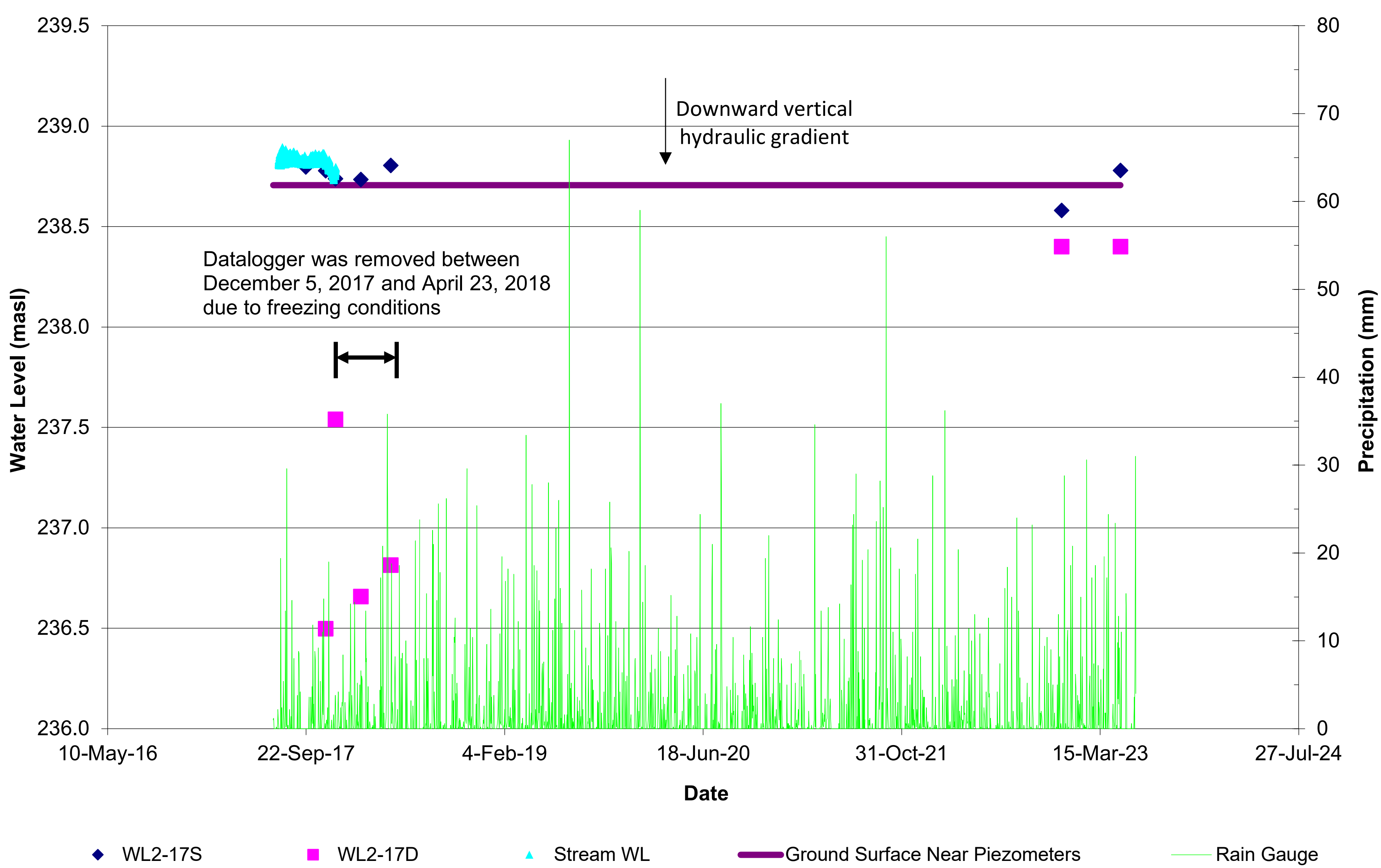
Stream Monitoring: Hydrgraphs of Mini-Piezometers and Stream Monitoring Stations

Hydrograph of WL2-17



Appendix D – Photo Log

Site Investigation PhotoLog

Streamflow Stations SF1-17 to SF7-17 and SF8-22 to SF11-22

Photo 1: A view of streamflow station SF1-17 taken on December 9, 2022. Piezometers and staff gauge were observed in good condition.

Photo 2: Another view of streamflow station SF1-17 taken on December 9, 2022.

Photo 3: A view of streamflow station SF1-17 taken on May 5, 2023. Piezometers and staff gauge were observed in good condition.

Photo 4: A view of streamflow station SF1-17, facing downstream, taken on May 5, 2023. Stream flow observed was observed to be slow to intermediate at this area.

Photo 5: Streamflow station SF2-17 was unable to be located due to dense population of cattails. A view of the general area where SF2-17 was installed taken on May 5, 2023, is shown above. It should be noted that access to this area was not available on December 2022 site visit.

Photo 6: A view of the drainage feature, facing upstream, in the general area of SF2-17. Flow was observed to be intermediate to fast at this area. It should be noted that access to this area was not available on the December 2022 site visit.

Photo 7: A view of the drainage feature, facing downstream, in the general area of SF2-17. Flow was observed to be intermediate to fast at this area. It should be noted that access to this area was not available on the December 2022 site visit.

Photo 8: A general view of streamflow station SF3-17 taken on December 9, 2022. Evidence of a beaver dam was observed in the area. The streamflow station was not located and likely destroyed, as result of the beaver dam.

Photo 9: Another general view of streamflow station SF3-17 taken on December 9, 2022. Water levels were observed noticeably higher (~3ft) upstream the dam then downstream.

Photo 10: Evidence supporting beaver presence in the area of SF3-17 taken on May 5, 2023. Wood chips and sharp cuts on the tree stump can be observed.

Photo 11: A view of SF3-17, facing upstream, taken on May 5, 2023. The beaver dam was observed further upstream behind the tree. Stream flow was observed slow.

Photo 12: A view of SF4-17 taken on May 5, 2023. A damaged piezometer nest is observed behind the staff gauge. Stream flow was observed slow to intermediate at this area. It should be noted that access to this area was not available on December 2022 site visit.

Photo 13: A view of streamflow station SF5-17, facing downstream, taken on May 5, 2023. Piezometers and staff gauge were observed in good condition. Stream flow was observed to be fast in the area.

Photo 14: A view of streamflow station SF5-17, facing upstream, taken on May 5, 2023. Stream flow was observed to be fast in the area.

Photo 15: A view of the staff gauge at stream flow station SF6-17 taken on December 9, 2022.

Photo 16: A view of the piezometers at SF6-17 taken on December 9, 2022. A missing cap was observed on of them, but remaining conditions were noted to be in good condition.

Photo 17: A view of the piezometers at streamflow station SF6-17 taken on May 5, 2023. A replacement cap was provided. Piezometer conditions were noted to be in good condition.

Photo 18: Another view of SF6-17, facing downstream, taken on May 5, 2023. The staff gauge was not located at the time and stream flow was observed to be fast in the area.

Photo 19: A view of the staff gauge at streamflow station SF7-17 taken on December 9, 2022. A piezometer nest was not located in the area.

Photo 19: A closer view of the staff gauge at streamflow station SF7-17 taken on December 9, 2022. Very low water levels were observed.

Photo 20: A closer view of the staff gauge at streamflow station SF7-17 taken on May 5, 2023. Higher water levels compared to December's visit were observed.

Photo 21: A view of the staff gauge at streamflow station SF7-17, facing upstream, taken on May 5, 2023.

Photo 22: A view downstream of station SF7-17 taken on May 5, 2023. Stream flow was observed slow to moderate.

Photo 23: A close up view of the streamflow station at a new location, SF8-22, taken on December 9, 2022 for additional observations. Streamflow was observed to be slow at this area. No piezometers or staff gauge were installed.

Photo 24: A view of the general area conditions in the vicinity of SF8-22 taken on December 9, 2022. Dense population of cattails was observed.

Photo 25: A view of the streamflow station at a new location, SF8-22, taken on May 5, 2023 for additional observations. Shallow water levels (~3cm) were observed at the edge and streamflow was observed to be slow at this area.

Photo 26: A view of the streamflow station at a new location, SF9-22, taken on December 9, 2022 for additional observations. No stream or a defined drainage feature were observed at this area. No piezometers or staff gauge were installed.

Photo 27: Another view of the area around streamflow station SF9-22 taken on December 9, 2022.

Photo 28: A view of the streamflow station at SF9-22, facing southwest, taken on May 5, 2023 for additional observations. No stream or a defined drainage feature were observed at this area but ponding with very slow flow towards the fence area was observed.

Photo 29: An extended view of the area around streamflow station SF9-22, facing southwest, taken on May 5, 2023.

Photo 30: A view of the streamflow station at a new location, SF10-22 facing downstream, taken on December 9, 2022 for additional observations. Moderate flow was observed.

Photo 31: Another view of the streamflow station at SF10-22, taken on December 9, 2022. A beaver dam was observed. No piezometers or staff gauge were installed.

Photo 32: A view of the streamflow station at SF10-22, facing upstream, taken on May 5, 2023 for additional observations. A beaver dam was observed. Moderate flow was observed.

Photo 33: An extended view of the area around streamflow station SF10-22, facing upstream, taken on May 5, 2023. The stream converges with another drainage feature, located southwest, at the culvert observed.

Photo 34: A view of the streamflow station at a new location, SF11-22, taken on December 9, 2022 for additional observations. Flow was observed in the narrow channel

Photo 35: A view of the streamflow station SF11-22 located downstream, taken on May 5, 2023. The flow continues further down and converges with a stream, where SF10-22 was observed, into a larger-sized culvert.

Photo 36: A view of the drainage feature located upstream of station at SF11-22, facing northwest, taken on May 5.

Wetland Stations WL1-17 to WL3-17

Photo 37: A view of the wetland station at WL1-17 taken on December 9, 2022. Piezometers were observed in fair condition.

Photo 38: A view of the wetland station at WL1-17 taken on May 5, 2023. Stagnant water was recorded.

Photo 39: **A view of the wetland station at WL2-17 taken on December 9, 2022. Piezometers were observed in fair condition. Staff gauge is observed behind the piezometers.**

Photo 40: A view of the wetland station at WL2-17 taken on May 5, 2023. Stream flow was observed as slow.

Photo 41: A view of the wetland station at WL3-17 taken on May 5, 2023. No piezometers were observed in the vicinity. Staff gauge is observed to be in poor condition. Stream flow was observed from slow to intermediate.

Photo 42: Another view of the wetland station at WL3-17, taken on May 5, 2023, facing downstream southeast.

Draft Report

Hydrogeological Investigation

Bolton Residential Expansion Site – Option 6 Lands

Prepared for Humber Station Landowners Group Inc.
by IBI Group
300 – 8133 Warden Avenue, Markham ON L6G 1B3 Canada | tel 905 763 2322 | **ibigroup.com**
March 2022

IBI GROUP
300 – 8133 Warden Avenue
Markham ON L6G 1B3 Canada
tel 905 763 2322
ibigroup.com

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Mustafa Ghassan
Humber Station Landowners Group Inc.
c/o Delta Urban Inc.
8800 Dufferin Street, suite 104
Vaughan, ON L4K 0C5

BOLTON RESIDENTIAL EXPANSION SITE - OPTION 6 LANDS
HYDROGEOLOGICAL INVESTIGATION REPORT UPDATE

IBI Group Professional Services (Canada) Inc. (IBI Group) is pleased to submit the enclosed draft Hydrogeological Investigation Report for the Bolton Residential Expansion Study – Option 6 (the "Site"). This investigation includes a review of existing hydrogeological information for the Site, characterization of the geological and hydrogeological setting, assessment of potential impacts due to the proposed development, and proposed mitigation measures.

The findings of our study are summarized in the following report. Should you have any questions or comments, please do not hesitate to contact the undersigned.

Best Regards,
IBI GROUP PROFESSIONAL SERVICES (CANADA) INC.

Ahmad Sarwar, P.Geo.
Hydrogeologist

Steve Davies, M.Sc., P.Geo.
Senior Hydrogeologist

Document Control Page

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ORIGINATOR:	Ahmad Sarwar, P.Geo, Hydrogeologist
REVIEWER:	Steve Davies, M.Sc., P.Geo., Senior Hydrogeologist
AUTHORIZATION:	Steve Davies, M.Sc., P.Geo., Senior Hydrogeologist
CIRCULATION LIST:	Mustafa Ghassan, Delta Urban
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Table of Contents

Table of Contents (continued)

List of Tables

List of Figures

Appendices

1 Introduction

1.1 Project Background

Provincial planning objectives (Places to Grow: The Growth Plan for the Greater Golden Horseshoe and Greenbelt Plan, 2006) to manage growth in Ontario, particularly within the Greater Golden Horseshoe area, laid a framework to encourage growth in communities with an increased emphasis on higher population density to reduce urban sprawl and to promote greater use of existing infrastructure. In response to this, The Town of Caledon undertook a growth forecast study to review population and employment forecasts to the 2021 planning horizon, as well as to develop forecasts for the 2031 planning horizon. As a result of this study, it was found that additional residential/commercial lands would be required to accommodate these future needs in several locations including Bolton. The Town of Caledon commissioned the Bolton Residential Expansion Study (BRES) to assess the most suitable locations for growth allocation.

The BRES identified six (6) “primary” expansion areas and three (3) “rounding out” areas as potential locations for planned expansion. IBI Group Professional Services (Canada) Inc. (IBI Group) is investigating Option 6 (the “Site”) as part of this study. The Site is located on the east side of Humber Station Road, approximately 650m north of its intersection with Mayfield Road, in the Town of Caledon, Ontario. The Site location plan is provided on **Figure 1**.

A Hydrogeological Investigation at the Site was previously completed by IBI Group in July 2018. Based on review of the Master Concept Plan entitled *“Humber Station Community Master Plan, Master Concept Plan, Bolton, Town of Caledon”*, dated April 2021 (Master Concept Plan), we understand that the area of the Site has since increased due to participation of additional landowner groups within the site area. This report provides a preliminary desktop update to the previous Hydrogeological Investigation, including recommendation for further work to eliminate the presence of any data gaps from the revised concept plans.

1.2 Objectives

This hydrogeological investigation was conducted to assess hydrogeological conditions at the Site. This study included the review of existing hydrogeological information of the Site, characterization of the geological and hydrogeological setting, and an assessment of potential impacts to the local aquifer and nearby well users.

1.3 Applicable Regulations and Agencies

1.3.1 Town of Caledon Official Plan

According to Town of Caledon Official Plan, Option 6 lands are wholly within the 2021 Settlement boundary area and are zoned as Prime Agricultural Area. Three (3) tributaries of the Humber River exist within the Site and are zoned as Environmental Policy Areas.

1.3.2 O.Reg. 166/06 Conservation Authorities Act

Under Section 28 of the *Conservation Authorities Act*, the local conservation authorities are mandated to protect the health and integrity of the regional greenspace system and to maintain or improve the hydrological and ecological functions performed by valley and stream corridors. Toronto and Region Conservation Authority (TRCA), through its regulatory mandate, is responsible for issuing permits under Ontario Regulation (O.Reg.) 160/06, Development, Interference with Wetlands and Alterations to Shorelines and Watercourses for development proposal or Site alteration work within the regulated areas.

1.3.3 O.Reg. 140/02 Oak Ridges Moraine Conservation Plan

The Town of Caledon supports the objectives of the Oak Ridges Moraine Conservation Plan (ORMCP) O.Reg. 140/02 and The Greenbelt Plan (2005), which protects lands located within the ORMCP Area and Greenbelt Area, respectively. The Site is not located within the ORMCP and Greenbelt Areas. However, it is adjacent to land identified as Protected Countryside under the Greenbelt Plan.

1.3.4 Clean Water Act, 2006

The MECP mandates the protection of existing and future sources of drinking water under the Clean Water Act, 2006 (CWA). Initiatives undertaken under the CWA include the delineation of Wellhead Protection Areas (WHPAs), significant groundwater recharge areas (SGRAs) and areas of highly vulnerable aquifer (HVA), as well as the assessment of drinking water quality and quantity threats within Source Protection Regions. Source Protection Plans that are developed under the CWA include the restriction and prohibition of certain types of activities and land uses within WHPAs. Based on a review of the mapping from the TRCA and York Region, the Site is partly located within an HVA, but is not located within a WHPA or SGRA. Therefore, the CWA may be applicable.

1.3.5 O.Reg. 387/04 Water Taking

Based on recent regulatory changes, a Permit to Take Water (PTTW) is required under Section 34 of the *Ontario Water Resources Act* (OWRA) if water takings are greater than 400,000L/day. Otherwise, construction dewatering takings require registration on the Environmental Activity Sector Registry (EASR) for takings between 50,000L/day and 400,000L/day. A detailed review of Site conditions and proposed infrastructure design will need to be undertaken to assess the need for dewatering during construction. This additional study typically includes a comprehensive characterization of the geological and hydrogeological setting of the Site, assessment of the potential dewatering rates required and delineation of the associated zone of influence, assessment of the potential adverse impacts associated with the construction dewatering, and establishment of a set of mitigation measures to address potential adverse impacts. The well records in the vicinity of the expansion area have been reviewed to assess local groundwater usage.

2 Existing Site Conditions

2.1 Topography and Drainage

The regional topography in the region of the Site generally slopes in southeasterly direction. Ground elevations at the Site range from about 245 metres above sea level (masl) in the northern portion of the Site to approximately 230masl in the southern portion of the Site. There are also two (2) incised watercourse valleys associated with tributaries of the West Humber River. A branch of the main Humber River passes through the centre of Bolton, northeast of the Site. As such, regional drainage is generally directed to the south/southeast into the Humber River, and eventually into Lake Ontario. The regional topography of the area is provided on **Figure 2**.

2.2 Physiography

Most of the Site is situated within the South Slope physiographic region. The South Slope represents the southern slope of the Oak Ridges Moraine (ORM). This area is a gently sloping glacial till plain that is drumlinized and consists of thin mainly glacial till deposits (Chapman and Putnam, 1984). A small portion at the south end of the Site is located within the Peel Plain physiographic region. This region is characterized as relatively flat to gently rolling that slopes towards Lake Ontario. The surficial deposits generally consist of, silty clay glaciolacustrine deposits (TRCA, 2008a).

A physiography map of the Site and the surrounding area is provided on **Figure 3**.

2.3 Regional Geology and Hydrogeology

The understanding of the geological and hydrogeological environment presented in this report is based on work conducted by the Geological Survey of Canada (GSC), the Ontario Geological Survey (OGS), and the TRCA (TRCA, 2008b). Additional insights were gained from York, Peel, Durham, Toronto and the Conservation Authorities Moraine Coalition (YPDT-CAMC) Oak Ridges Moraine Groundwater Program (ORMGP) and associated mapping.

The surficial Quaternary deposits in the Site consist of Halton Till deposits, which consist of clayey silt till with shale and siltstone clasts. South of the Site is an area of glaciolacustrine deposits. In general, all these glacial deposits are primarily fine grained, composed mainly of silts and clays. The Quaternary geology of the Site and surrounding area is presented on **Figure 4.**

In general, overburden thickness is interpreted to range from approximately 5m to 80m. The greater overburden thickness is associated with an interpreted buried bedrock valley that traverses the Site. Halton Till deposits range from approximately 5m to 20m across the Site. Halton Till may be underlain locally by ORM aquifer deposits (ORAC) and the Newmarket Till, although borehole logs and regional cross sections suggest that, ORAC deposits may be thin and discontinuous at the Site.

A regional north to south geological cross-section developed by the ORMGP along West Humber River sub-watershed and traversing the Site is provided on **Figure 5.** Based on a review of the regional cross section, the following units overlie the bedrock (with oldest layers at the bottom, and recent layers near the surface) include the following.

- Halton Till
- Oak Ridges Moraine Aquifer
- Newmarket Till
- Thorncliffe Formation
- Sunnybrook Aquitard
- Scarborough Formation
- Bedrock.

Halton Till – The Halton Till was deposited approximately 13,000 years before present (B.P.) during the last glacial advance in the area. The Halton Till consists of silt to silty clay with occasional gravel. This till acts as an aquitard of regional extent. Based on the regional scale geologic cross-section, the Halton Till is approximately 5-10m thick locally.

Oak Ridges Moraine – The Oak Ridges Moraine (ORM) Aquifer is an extensive stratified sediment complex, 160km long and 5km to 20km wide, located to the north of the Site. The deposits consist mainly of sand and gravel. The ORM is a major groundwater recharge area. ORM Aquifer sediments are approximately 100m thick beneath the crest of the moraine but thins markedly towards its margins. The unit is water bearing and occurs at elevations between typically between approximately 230masl and 260masl.

The ORM is unconfined near the crest of the moraine, while it is confined by the till units both to the north and south of the highland. This unit serves as the main source of water for creeks as nearly 90% of the recharge via the ORM Aquifer sediments discharges to the stream networks flowing north and south from the regional topographic divide. The M aquifer is a regionally extensive aquifer and is commonly used for water supply.

Newmarket Till – The Newmarket Till is regionally extensive and is typically a massive, frequently over-consolidated, stony and dense silty sand till deposited approximately 18,000 to 20,000 years B.P., when the Laurentide ice sheet was at its maximum extent. It acts as a regional aquitard separating the ORM Aquifer from the underlying Thorncliffe Aquifer. The thickness of Newmarket Till typically varies between 20m to 30m but locally can exceed 60m in thickness.

Thorncliffe Formation – The Thorncliffe Formation was deposited approximately 45,000 years B.P. and 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 5m to 10m in thickness. 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 10m to 20m, although locally it can reach a thickness of 30m. It was deposited approximately 45,000 B.P. (Earthfx and Gerber, 2008).

Scarborough Formation – The Scarborough Formation marks the beginning of the Wisconsin glaciation, approximately 100,000 years B.P. It is composed of graduated materials that vary from fine silts and clays to sand in a deltaic sequence. However, within the East and West Holland subwatersheds, the Scarborough Formation is mainly comprised of sand. This unit is mostly found within bedrock valleys and thins laterally away from the valleys (Earthfx and Gerber, 2008). It acts as an aquifer of regional extent.

Bedrock – Underlying the unconsolidated sedimentary material is bedrock from the Upper Ordovician period, primarily the Georgian Bay Formation and Queenston Formation. Locally, the Site is underlain by the Georgian Bay Formation while the Queenston Formation is located approximately 3km to the northwest. The Georgian Bay Formation consists of dark blue-grey to black shale with interbeds of limestone. The Queenston Formation is characterized by red shale, however, also contains red siltstone, minor green shale and siltstone with variable calcareous siltstone to sandstone and limestone interbeds (Ontario Geological Survey, 2005). The bedrock surface in the area is expected to be at approximately 150-220masl (ORMGP, 2018). **Figure 6** shows the bedrock in the area.

2.4 Assessment of MECP Water Well Record Search Results

2.4.1 Water Well Use

A search of the Ministry of the Environment, Conservation and Parks (MECP) well records database was conducted (Accessed: March 1, 2022) within a 1km radius of the

Site. The search returned a total of 204 records for the area of the Site (**Figure 7**). Well usage details are summarized in **Table 2.1**.

Table 2.1 Summary of MECP Water Well Record Search Results

WELL USAGE	NUMBER OF WELLS	PERCENTAGE OF TOTAL WELLS
Water Supply	85	42%
Abandoned Wells	41	20%
Observation, Monitoring and Test Wells / Holes	65	32%
Other or Unknown Status	13	6%
Total	**204**	**100%**

Based on the records reviewed, the primary well usage in the area is for water supply purposes. A water well survey would need to be completed 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. The Village of Bolton relies on a lake-based municipal water supply derived from Lake Ontario.

2.5 Previously Completed Hydrogeological Investigations

A Hydrogeological investigation was completed by RJ Burnside (RJB) as part of an overall environmental review (Savanta, 2007) for a large parcel of land that includes the current Site and additional areas to the east and west. As part of this investigation, RJB undertook a subsurface investigation that included installing ten (10) monitoring wells across the Site, including two (2) monitoring well nest locations. This study included a 1-year long groundwater and surface water monitoring program. Stream flow measurements from the tributaries of the West Humber River that traverses the Site were collected as part of the surface water monitoring program.

Based on the results of the hydrogeological investigation, RJB noted the following:

- The subsurface soil at the Site generally consisted of fine-grained silt, clay and silty clay material.
- The shallow groundwater levels at the Site were found to be less than 2 metres below ground surface (mbgs). The vertical hydraulic gradients at the two (2) well nest locations were estimated to be downward, indicating groundwater recharge conditions.
- Hydraulic conductivities were estimated to range from 1.6×10^{-9}m/sec to 6.5×10^{-10}m/sec based on the results of the in-situ single well response testing (SWRT) completed at several monitoring well locations.

3 Environmental Features

3.1 Source Water Protection

The Site is located within the Source Protection Area (SPA) of the TRCA and, as such, governed by the TRCA's Source Protection Plan (SPP). Based on review of the source water protection mapping, the following is noted:

- The Site is not located within a wellhead protection (WHPA) or a significant groundwater recharge area (SGRA).

- There are small pockets within and near the Site that are identified as Highly Vulnerable Aquifer (HVA).

The Village of Bolton receives water supply from the Region of Peel's municipal supply system, which is drawing drinking water from Lake Ontario. Although direct source protection impacts due to the proposed plans for development are not expected, it will be important to store, manage and make use of any contaminants during the construction period using industry best management practices (BMPs) to ensure any such contaminants do not runoff, spill or enter the groundwater flow systems via the HVAs.

3.2 Natural Heritage Setting

The Site is located within the West Humber River Subwatershed. The surrounding area is predominantly under agricultural land use with some parcels also used for residential purposes. Based on correspondence with GEI Consultants Limited (GEI) (formerly Savanta Inc.), there are two tributaries of the West Humber River that traverses the Site in a north-south direction along the eastern and western Site boundary and are described below.

- The tributary along the eastern area of the Site (Eastern Tributary) is located within a valley surrounded by a riparian meadow marsh and meadow shallow marsh vegetation communities.
- The tributary along the western area of the Site (Western Tributary) appears to have historically been realigned for farming purposes

There is one (1) headwater drainage feature that has been mapped as an on-site tributary in the southern portion of the Site and was found to be dry during all monitoring events and is hereinafter referred to as the 'Centre Channel'. Based on review of the Ministry of Natural Resources and Forestry (MNRF) Natural Heritage Mapping (Accessed: March 1, 2022), there are woodland areas in the northwestern portion of the Site, and all wetlands in the area and within the Site are noted to be unevaluated. The Greenbelt Plan identifies some Protected Country aligning with a branch of the West Humber River within 1km west of the Site.

A Master Environmental Servicing Plan (MESP) for the proposed Option 6 lands was prepared by GEI, which included a fluvial geomorphology assessment and a natural heritage assessment of the watercourses on site (Savanta, 2007). In January 2021, GEI updated an Ecological Constraints map. The following summarizes the major findings.

- The two (2) tributaries on the west and east side of the Site are identified as being intermittent with potential to support "very tolerant warm water fish community."
- These intermittent drainage features are considered "simple contributing habitat" and contain barriers (either natural obstructions or culvert placements) that effectively limit any upstream movement of fish. The proposed development plan will be designed to retain the primary functions of flow conveyance to downstream reaches.
- Portions of the watercourse/drainage features were deemed to support "permanent" or "seasonal" fish habitat.
- Streamflow data from the tributaries demonstrated intermittent flow conditions with only minor groundwater contributions to these watercourses.

A site-specific natural heritage map is provided on **Figure 8**.

4 Monitoring Network

Monitoring wells, mini-piezometers and stream flow monitoring stations were installed as part of the hydrogeological investigation to establish groundwater and surface water monitoring networks, as detailed in the following sections.

Soil Engineers Ltd. was retained to install five (5) monitoring well nests at the Site under the supervision of IBI Group field staff (MW1-17, MW2-17S/D, MW3-17, MW4-17S/D, and MW5-17S/D) to depths ranging from 6mbgs to 12.2mbgs between August 15 and March 8, 2017. The boreholes were advanced using a track mounted drill rig with hollow stem augers to establish three (3) monitoring well nests across the Site. All five (5) boreholes were instrumented with monitoring wells constructed with 5cm (2 inch) diameter PVC casing and a 3m long screen. In addition, a packer was installed on one of the deep monitoring wells (MW5-17D) due to flowing artesian conditions observed at the well. Following installation, the wells were developed by purging three (3) well volumes.

The three (3) existing monitoring wells (MW7, MW8, and MW9) previously installed by RJB were used to measure the groundwater table on Site. Monitoring well locations are shown on **Figure 9.**

As part of the current desktop Hydrogeological Investigation update, the Master Concept Plan and the following documents were reviewed:

- *“Preliminary Constraints, Humber Station Village Option 6 Bolton”* by Savanta, dated December 15, 2017
- *“Sketch to Illustrate Wetlands and Driplines”* by R-PE Surveying Ltd., dated September 23, 2021, File No.: 07-031

As identified in the above documents, the area of the Site has increased due to the participation of additional landowner groups. As noted in the preliminary constraints mapping by Savanta (2017), several additional wetlands have been identified at the Site.

4.1 Local Geology and Hydrogeology

4.1.1 Local Geology

Borehole logs from the drilling programs were reviewed and used to construct a north-south oriented geological cross-section across the Site (**Figure 10**). The location of the cross section is shown on **Figure 9**. The geological cross-section was used to develop the conceptual understanding of the Site stratigraphy and hydrogeological conditions. Borehole logs are provided as **Appendix A**.

In general, the Site is covered by a thin layer of topsoil or fill, with approximate thickness of 0.2m. A silty clay till layer was encountered across the Site underlying the topsoil/fill layer. This silty clay till layer is interpreted to be the Halton Till, which has been mapped across the Site. The thickness of the silty clay till is interpreted to range from approximately 1.8m to 6.4m. Sandy silt till was also encountered underneath the silty clay till layer at borehole MW2-17D located at the northwestern portion of the Site between depths of 6.7m and 9.8m. The silty clay till layer was also underlain by a very dense, silt till layer at many of the borehole locations. The dense silt till layer ranged from approximately 2.7m to at least 10.6m in thickness. The upper silty clay till layer is interpreted to be the Halton Till, whereas the underlying dense silt to sandy silt till layer may be the Newmarket Till.

4.1.2 Local Hydrogeology

4.1.2.1 Groundwater Levels

Groundwater levels were measured manually at on-site monitoring wells between August 31, 2017 and April 23, 2018. The water level monitoring data are summarized in **Table 4.1.** Additionally, data loggers were installed in five (5) monitoring wells (MW1-17, MW3-17, MW4-17S, MW4-17D, and MW5-17S) to allow for continuous monitoring of groundwater levels on an hourly basis. The hydrographs from the monitoring program for each monitoring well location are provided in **Appendix B**.

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 0.3m (MW2-17S/D) to 1.5m (MW8). The highest groundwater level (244.7masl) was measured in MW1-17 near the northwestern corner of the Site on April 23, 2018. The lowest water level (227.6masl) was measured in MW7 near the southwestern corner of the Site on September 22, 2017.

Water levels in the shallow monitoring wells (screened to depths ranging from 3.1mbgs to 6mbgs) ranged from 227.6masl (1.04mbgs) in MW7 to 244.7masl (0.46mbgs) in MW1-17. For the deeper wells (screened to depths ranging from 9mbgs to 12.2mbgs), the water levels ranged from 229.2masl (-0.28mbgs) in MW5-17D to 241.4masl (1.01mbgs) in MW2-17D.

Based on the understanding of the local hydrogeology, the shallow monitoring wells are generally interpreted to be screened within the unconfined overburden. However, as previously mentioned, based on the conceptual understanding of the Site and measured water levels, MW5-17D is believed to be an artesian well representative of pressurized conditions from the ORM or Thorncliffe Formation. It should be noted that groundwater levels at MW5-17D were primarily observed to rise above the existing ground surface, which indicates artesian conditions at these locations. As such, artesian conditions may also be present in other areas of the Site.

Groundwater flow in this aquitard is generally vertically downward, except for localized areas where the underlying aquifers are artesian. Although the borehole log for MW5-17D indicates that the monitoring well is screened in silty deposits, water level measurements taken at the well between August 31, 2017 and November 10, 2017 indicate pressurized conditions in the screened overburden. This suggest that the water level in the well may be representative of the potentiometric surface from either the ORM or Thorncliffe Formation. It was interpreted that the ORM aquifer is thin or discontinuous across much of the Site; however, the on-Site boreholes were not drilled to sufficient depths to fully document the local hydrostratigraphy and aquifer(s) responsible for the pressurized conditions.

4.1.2.2 Groundwater Flow

At a regional scale, shallow groundwater generally flows in a southeasterly direction towards Lake Ontario. The groundwater flow pattern in the shallow zone was interpreted using the water levels measured from shallow on-site monitoring wells on April 23, 2018 and is illustrated on **Figure 11**. The interpreted shallow groundwater flow direction generally follows the Site topography and flows in a southeasterly direction. This suggests some degree of groundwater contribution to the watercourse.

Vertical hydraulic gradients were also estimated at three (3) monitoring well nests to characterize the general vertical groundwater flow at the Site. **Table 4.2** below summarizes the calculated vertical hydraulic gradients at the three (3) well nests for the water level monitoring events.

Table 4.1 Groundwater Levels at On-site Monitoring Wells (April 5, 2016 – April 27, 2017)

WELL ID	GROUND ELEVATION (MASL)	DEPTH TO BOTTOM (MBGS)	31-AUG-17		22-SEP-17		10-NOV-17		5-DEC-17		7-FEB-18		23-APR-18	
			DEPTH TO WATER (MBGS)	WATER LEVEL (MASL)	DEPTH TO WATER (MBGS)	WATER LEVEL (MASL)	DEPTH TO WATER (MBGS)	WATER LEVEL (MASL)	DEPTH TO WATER (MBGS)	WATER LEVEL (MASL)	DEPTH TO WATER (MBGS)	WATER LEVEL (MASL)	DEPTH TO WATER (MBGS)	WATER LEVEL (MASL)
MW1-17	245.2	5.93	1.11	244.08	1.32	243.87	0.82	244.37	0.83	244.36	1.04	244.15	0.46	244.73
MW2-17D	242.4	11.63	1.01	241.38	1.18	241.20	1.60	240.78	1.50	240.89	1.52	240.86	1.08	241.30
MW2-17S	242.4	6.07	1.03	241.39	1.21	241.20	1.58	240.84	1.55	240.86	1.57	240.84	1.13	241.28
MW3-17	235.8	6.01	2.61	233.19	0.45	235.35	0.30	235.50	0.14	235.65	-	-	0.10	235.70
MW4-17D	234.0	12.17	0.95	233.03	1.27	232.72	1.67	232.32	1.44	232.55	1.44	232.54	0.61	233.37
MW4-17S	234.0	6.06	1.06	232.96	1.37	232.65	1.76	232.26	1.40	232.62	1.48	232.54	0.48	233.54
MW5-17D	229.0	12.06	-0.28	229.24	-0.50	229.46	-0.61	229.57	-	-	-	-	-	-
MW5-17S	228.9	6.11	0.74	228.20	0.79	228.15	0.42	228.52	0.16	228.79	0.19	228.75	-0.13	229.07
MW9	235.6	5.28	1.89	233.72	2.10	233.51	2.24	233.37	1.92	233.69	2.11	233.50	1.38	234.23
MW8	231.9	5.10	0.39	231.55	1.85	230.09	1.76	230.18	1.12	230.82	0.97	230.97	0.31	231.63
MW7	228.6	4.45	0.82	227.74	1.04	227.52	0.51	228.05	0.15	228.41	0.21	228.35	0.01	228.55

Notes:

- \- Not Measured due to freezing conditions
- mbgs Metres below ground surface
- masl Metres above sea level

Table 4.2 Estimated Vertical Hydraulic Gradients at on-Site Monitoring Wells

WELL NEST	VERTICAL HYDRAULIC GRADIENTS (M/M)					
	31-AUG-17	22-SEP-17	10-NOV-17	5-DEC-18	7-FEB-18	23-APRIL-18
MW2-17S/D	-0.001	-0.0004	-0.01	0.004	0.002	0.002
MW4-17S/D	0.01	0.01	0.009	-0.01	0.0003	-0.02
MW5-17S/D	-0.17	-0.22	-0.17	NM	NM	NM

Note:
NM: Not Measured due to freezing conditions
Negative values indicate an upward gradient; positive values indicate a downward gradient.

Groundwater level measurements collected from MW5-17D and MW5-17S over the course of the monitoring period generally indicate trends of upward hydraulic gradients. As noted in **Table 4.1**, groundwater levels from the deep well at this nested location were above ground surface during the monitoring period. Conversely, the estimated vertical hydraulic gradients observed at MW2-17S/D and MW4-17S/D are near neutral. As mentioned previously, the upward vertical hydraulic gradients at MW5-17D and MW5-17S likely indicate pressurized conditions from the confined ORM or Thorncliffe Formation at these locations.

4.1.2.3 Hydraulic Conductivity

Single-well rising head tests were conducted in August 2017 by IBI Group field staff in select monitoring wells. These tests were carried out to estimate the in-situ hydraulic conductivity (K) of the screened geological units. A known volume of water was removed from the well and the recovery was measured manually or electronically using a data logger until a minimum of 80% recovery was achieved. Hydraulic conductivity estimates were obtained using the Hvorslev method (1951). A summary of the estimated K values is provided in **Table 4.3**, below.

Table 4.3 Estimated Hydraulic Conductivity (Hvorslev Analysis)

WELL ID	SCREEN LENGTH	K (M/S)	TESTED MATERIAL
MW1-17	3	8×10^{-9}	Silty clay till
MW2-17S	3	5.5×10^{-9}	Silty clay till
MW2-17D	3	1.1×10^{-7}	Sandy silt till, Silt till
MW3-17	3	2.2×10^{-9}	Silty clay till, Silt till
MW4-17S	3	6.8×10^{-8}	Silty clay till, Silt till
MW4-17D	3	5.8×10^{-8}	Silt till
MW5-17S	3	5×10^{-9}	Silt till
MW5-17D	3	4.7×10^{-8}	Silt till

The in-situ K values estimated using the Hvorslev method range from 2.2×10^{-9} m/s to 1.1×10^{-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 (Freeze and Cherry, 1979).

The results of the single well response testing are provided in **Appendix C**.

4.1.2.4 Groundwater Quality

Groundwater samples were collected from three (3) shallow wells (MW1-17, MW3-17, and MW5-17S) and one (1) deep well (MW4-17D) on September 22, 2017. Prior to collecting the samples, the monitoring wells were developed by pumping three (3) well volumes from each well or pumping the well dry three (3) times. A manual inertial pump was used. The purging process typically removes stagnant water from the well, thereby ensuring the groundwater samples collected are representative of the groundwater in the geological formation adjacent to the screen.

The collected 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 Site. Given the likelihood that construction dewatering discharge (if required) will be directed to the on-site watercourse, the analytical results were compared with the Ontario Provincial Water Quality Objectives (PWQO). Various groundwater exceedances were identified as summarized in **Table 4.4**, below.

Table 4.4 Groundwater Quality Exceedance

PARAMETERS	PWQO CRITERIA	RESULTS (SEPT 17, 2022)			
		MW1-17	MW5-17S	MW3-17	MW4-17D
Field pH	6.5-8.5	7.98	**8.56**	8.17	**8.58**
Total Phosphorus (mg/L)	0.01 mg/L	**0.36**	**0.8**	**1.4**	**3.3**
Total Boron (ug/L)	200 ug/L	110	**420**	**260**	110
Total Cobalt (ug/L)	0.9 ug/L	ND	ND	ND	**2.5**
Total Copper (ug/L)	5 ug/L	1.6	1.3	ND	**5.5**
Total Iron (ug/L)	300 ug/L	ND	ND	ND	**5400**
Total Uranium (ug/L)	5 ug/L	**9.2**	1.2	3.4	1.2
Total Vanadium (ug/L)	6 ug/L	ND	0.74	2.1	**7.4**

Notes:
Bold – exceeds the PWQO criteria
ND – non-detect

The results of the analytical testing indicated that the quality of groundwater exceeded the PWQO for various parameters for samples collected from each monitoring well.

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

4.2 Surface Water Monitoring

A surface water monitoring network was set up across the Site by IBI Group to assess interactions between the groundwater system and the on-site tributaries of the Humber River. IBI Group installed nine (9) surface water monitoring stations at the Site in July 2017. These included seven (7) stream flow stations (SF1, SF2, SF3-17, SF4-17, SF5-17, SF6-17, and SF7-17) installed along tributaries of the Humber River, and two (2) wetland monitoring stations (WL1-17, WL2-17) at two (2) locations at the Site. The locations of the surface water monitoring stations are illustrated on **Figure 12**.

Each stream flow monitoring station included a stream bank mini-piezometer nest to allow for monitoring of vertical hydraulic gradients near the tributaries. A stream gauge was installed in the creek at select locations to allow for manual and continuous monitoring (using pre-programmed dataloggers) of the stream stage level. The continuous monitoring at these stations was accomplished using a pressure transducer, which was pre-programmed to collect level and temperature readings at 1-hour intervals. A rebar was also installed on both banks of the stream that was used to establish a consistent cross-section during each flow monitoring event. A mini–piezometer nest was not installed at SF7-17.

It should be noted that it was originally planned to also equip wetland WL2-17 with a staff gauge and nested piezometer set, however standing water was not observed at the time of site instrumentation and until the completion of this hydrogeological investigation.

Each mini-piezometer consists of a 1.9cm diameter galvanized steel pipe with a 0.3m screened drive point. The piezometers were driven manually into the stream bank using a slide hammer. The shallow piezometers (denoted by “S” after the piezometer ID) were driven to depths ranging from 0.6mbgs to 1.6mbgs. The deep piezometers (denoted by “D” after the piezometer ID) were driven to depths ranging from 1.1mbgs to 2.4mbgs. The surface water monitoring station details are provided in **Table 4.5**, below**.**

Table 4.5 Surface Water Monitoring Station Details

MONITORING STATION ID	PIEZOMETER ID	GROUND ELEVATION AT PIEZOMETER (MASL)	PIEZOMETER DEPTH TO BOTTOM (MBGS)	PIEZOMETER TOP OF RISER ABOVE GRADE (M)	PIEZOMETER DIAMETER (M)	PIEZOMETER SCREEN LENGTH (M)	TOP OF STREAM / STAFF GAUGE ELEVATION (MASL)	DATA LOGGER ELEVATION (MASL)
SF1-17	PZ-1S	240.2301	1.1	1.1	0.02	0.3	240.9	239.8
	PZ-1D	240.2458	2.2	1.2	0.02	0.3		
SF2-17	PZ-1S	237.0181	0.6	1.8	0.02	0.3	237.5	236.5
	PZ-1D	236.8129	1.1	1.3	0.02	0.3		
SF3-17	PZ-1S	228.1054	0.9	1.5	0.02	0.3	228.5	227.2
	PZ-1D	228.0723	1.3	1.1	0.02	0.3		
SF4-17	PZ-1S	236.5145	1.3	1.2	0.02	0.3	237.3	236.2
	PZ-1D	236.4885	1.8	0.7	0.02	0.3		
SF5-17	PZ-1S	233.5677	0.7	0.5	0.02	0.3	234.5	233.4
	PZ-1D	233.6061	1.1	1.1	0.02	0.3		
SF6-17	PZ-1S	224.8723	0.8	1.1	0.02	0.3	225.5	224.2
	PZ-1D	224.9682	1.2	0.6	0.02	0.3		
WL17-1	PZ-1S	241.1477	0.7	0.5	0.02	0.3	-	-
	PZ-1D	241.1356	1.6	0.8	0.02	0.3		
WL17-2	PZ-1S	238.7066	1.6	0.9	0.02	0.3	239.7	238.6
	PZ-1D	238.7254	2.4	1.0	0.02	0.3		

Notes:
masl = metre above sea level
mbgs = metre below ground surface
‘-’ indicates that no staff gauge or data logger was installed at WL1-17 due to lack of standing water over the course of the monitoring events.

5 Surface Water/Groundwater Interactions

5.1 Piezometer Groundwater Levels and Vertical Hydraulic Gradients

Water levels at the mini-piezometers were measured over six (6) monitoring events from July 2017 to April 2018. Water levels in both shallow and deep piezometers generally exhibited low seasonal fluctuation and muted response to precipitation events. The piezometer water level monitoring data are presented in **Table 5.1** and **Table 5.2**. Hydrographs generated for the piezometer nests are included in **Appendix E**. Vertical hydraulic gradients were also estimated at each piezometer nest to assess potential groundwater-surface water interactions, as shown in **Table 5.3**.

Table 5.1 Piezometer Water Level Measurements (mbgs)

PIEZOMETER ID	26-JUL-17	21-SEP-17	10-NOV-17	05-DEC-17	07-FEB-18	23-APR-18
SF1-17S	0.2	0.3	0.2	0.1	0.1	-0.1
SF1-17D	dry	dry	2.2	2.2	2.2	1.0
SF2-17S	dry	dry	dry	0.7	0.6	0.5
SF2-17D	dry	dry	dry	1.1	1.1	1.0
SF3-17S	0.6	0.7	0.6	0.7	0.0	0.5
SF3-17D	0.0	0.7	0.5	0.6	0.5	0.4
SF4-17S	0.1	0.1	0.1	0.1	0.0	0.0
SF4-17D	dry	dry	dry	dry	0.5	1.8
SF5-17S	0.2	0.0	0.0	0.1	0.1	0.1
SF5-17D	0.3	0.1	0.0	0.2	0.2	-0.2
SF6-17S	0.4	0.5	0.5	0.5	-0.1	0.1
SF6-17D	dry	0.8	0.6	0.6	0.4	0.0
WL1-17S	NM	0.0	0.7	0.1	0.0	-0.2
WL1-17D	NM	0.7	0.5	0.4	0.4	0.2
WL2-17S	NM	-0.1	-0.1	0.0	0.0	-0.1
WL2-17D	NM	dry	2.2	1.2	2.1	1.9

Table 5.2 Piezometer Water Level Measurements (masl)

PIEZOMETER ID	26-JUL-17	21-SEP-17	10-NOV-17	05-DEC-17	07-FEB-18	23-APR-18
SF1-17S	240.1	239.9	240.1	240.1	240.1	240.4
SF1-17D	dry	dry	238.1	238.1	238.1	239.3
SF2-17S	dry	dry	dry	236.4	236.4	236.5
SF2-17D	dry	dry	dry	235.7	235.7	235.8
SF3-17S	227.5	227.4	227.5	227.4	228.1	227.6
SF3-17D	228.1	227.4	227.6	227.4	227.5	227.7
SF4-17S	236.5	236.5	236.4	236.4	236.5	236.5
SF4-17D	dry	dry	dry	dry	235.9	234.7
SF5-17S	233.3	233.5	233.5	233.5	233.4	233.5
SF5-17D	233.4	233.5	233.6	233.4	233.4	233.8
SF6-17S	224.5	224.3	224.4	224.4	225.0	224.8
SF6-17D	dry	224.2	224.4	224.4	224.6	225.0
WL1-17S	NM	241.1	240.5	241.1	241.2	241.4
WL1-17D	NM	240.5	240.6	240.8	240.8	240.9
WL2-17S	NM	238.8	238.8	238.7	238.7	238.8
WL2-17D	NM	dry	236.5	237.5	236.7	236.8

Notes:
NM: Not Measured

Table 5.3 Estimated Vertical Hydraulic Gradients at Stream Bank Mini-Piezometers

WELL NEST	VERTICAL HYDRAULIC GRADIENTS (M/M)						
	26-JUL-17	21-SEP-17	10-NOV-17	05-DEC-17	07-FEB-18	23-APR-18	OVERAL INTERPRETATION
SF1-17	-	-	1.84	1.86	1.87	1.01	Downward
SF2-17	-	-	-	0.98	0.98	1.01	Downward
SF3-17	-1.25	-0.09	-0.14	0.01	1.27	-0.14	Upward / Variable
SF4-17	-	-	-	-	1.17	3.62	Downward
SF5-17	-0.09	0.08	-0.16	0.13	-0.06	-0.84	Variable
SF6-17	-	0.35	0.07	-0.09	1.29	-0.54	Variable
WL1-17	-	0.70	-0.16	0.33	0.44	0.50	Downward
WL2-17	-	-	2.81	1.48	2.56	2.46	Downward

Notes:
Negative values indicate an upward gradient; positive values indicate a downward gradient.
'-' indicates that the vertical hydraulic gradient could not be estimated due to one or both piezometers being dry

During the monitoring period, most of the nested mini-piezometers (SF1-17, SF2-17, SF4-17, SF6-17, WL1-17, and WL2-17) showed a downward or near neutral vertical hydraulic gradient during the monitoring period. Conversely, nests SF3-17 and SF5-17 showed a generally upward vertical hydraulic gradient; these nests are located in the west and southeast portion of the Site, along downstream sections of the tributaries.

The downward hydraulic gradients observed in most of mini-piezometer nests and monitoring well nests suggest that the wetland and the stream features on-site are unlikely to be groundwater-dependent (i.e., not areas of groundwater discharge). However, several monitoring well nests and mini-piezometer nests (SF3-17, SF5-17, SF6-17) in the west and southeast portion of the Site (along downstream on-site tributaries) showed upward gradients during the spring period, and at these locations there may be a groundwater contribution to the adjacent surface water features. In addition, as indicated in **Section 4.1.2**, an upward hydraulic gradient was observed at the groundwater monitoring well MW5-17S/D located in the southeast portion of the Site.

A map depicting the hydraulic gradients at each surface water monitoring station is provided on **Figure 13**.

5.2 Stream Water Level and Flow

Five (5) rounds of stream flow monitoring were conducted at stream flow monitoring stations along the on-site tributaries from July 2017 to April 2018. 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 the *Ontario Stream Assessment Protocol Version 8* (Stanfield, 2010). The stream cross-sections were divided into multiple panels with a consistent width. The stream depth and average velocity at each panel was measured using a wading rod and a Marsh McBirney FLOMATE velocity meter. The cross-sectional area of each panel was calculated (product of the stream depth and the panel width), and the flow through each panel was estimated by taking the product of the velocity and cross-sectional area. Finally, the flow of each individual panel was summed to obtain the total flow at each location. In addition, during each monitoring event, the stream gauge reading was recorded, monumented photos were taken and data loggers installed on the streambed were downloaded.

A summary of data obtained for each stream flow monitoring event is presented in **Table 5.4**. Measured stream flow and the corresponding stream gauge readings were used to develop stream water level versus flow rating curves (stage versus discharge curves), which are presented in **Appendix F**. Stage versus discharge curves were used to estimate the flow at each location based on hourly stream water level measurements collected using data loggers. Stream water level hydrographs and the associated estimated stream flow hydrographs are presented in **Appendix G**.

Table 5.4 Stream Gauge Readings and Calculated Flow at Stream Flow Monitoring Stations

DATE	MEASUREMENT	26-JUL-17	21-SEP-17	10-NOV-17	05-DEC-17	07-FEB-18*	23-APR-18
SF1-17	SGR (cm)	23.8	22.0	25.0	21.5	-	18.0
	EFR (L/s)	2.9	2.5	2.7	1.2	-	6.3
SF2-17	SGR (cm)	14.5	10.0	13.0	17.5	-	26.0
	EFR (L/s)	7.1	0.4	5.5	17.8	-	41.1
SF3-17	SGR (cm)	19.0	15.0	13.5	31.0	-	32.0
	EFR (L/s)	18.9	3.3	14.7	123.4	-	144.3
SF4-17	SGR (cm)	23.0	26.0	25.5	24.0	-	30.0
	EFR (L/s)	4.6	2.8	5.0	6.0	-	16.3
SF5-17	SGR (cm)	11.0	12.5	14.5	14.5	-	20.0
	EFR (L/s)	1.2	0.5	0.5	1.9	-	5.4
SF6-17	SGR (cm)	30.5	20.0	22.5	37.5	-	40.0
	EFR (L/s)	22.4	3.3	12.0	92.2	-	143.6
WL3-17	SGR (cm)	NM	6.0	6.5	6.0	-	7.0
	EFR (L/s)	NM	0.8	0.8	0.7	-	5.2

Notes:
* No stream gauge reading on February 07, 2018 event due to freezing condition
SGR: Staff Gauge Reading
EFR: Estimated Flow Rate
'NM' indicates that no measurement was taken.

Comparison of the stream water level and piezometer water level data indicated that at SF3-17, the stream water level is generally below groundwater levels in the mini-piezometer nests, supporting the potential for groundwater contribution to the stream. A similar trend was noted at the location of SF6-17 during the spring period. At other monitoring locations, the stream water levels were observed to be higher or similar to the mini-piezometer water level, representative of downward or neutral vertical hydraulic gradient, and as such, could not clearly be interpreted as groundwater contribution to the stream.

5.2.1 Baseflow

Baseflow conditions were analyzed to further understand groundwater contribution to the onsite features. Baseflow can be described as 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* (Stanfield, 2010) indicates 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 interpreted and observations on the flow regime for each feature was determined. The flow regime for each feature was defined as one of the following:

- **Permanent –** 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.
- **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# 71624) 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 (3) consecutive days without precipitation.

Precipitation data was compared with the streamflow and it was observed that most precipitation events trigger rapid increases in the stream flow 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) were generally lower. The stream water level data was correlated with the on-site rain gauge data, and the data confirms surface water runoff due to precipitation is the dominant source of flow observed in the streams. Throughout the monitored period, flow was observed at all the monitoring locations.

The estimated base flow rates at each monitoring locations are summarized in **Table 5.4,** in the preceding section. Stream flow hydrographs were analyzed to assess baseflow conditions at the on-site tributaries of Humber River:

Western Tributary

Three (3) surface water monitoring stations were installed along the West Humber River (the west side of the Site) at up-stream (SF1-17), mid-stream (SF4-17), and downstream (SF5-17). It was determined that the estimated baseflow at the Western Tributary 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
- Station SF5-17 (Downstream) – 0.5 L/s

The hydraulic gradients appear to be predominantly downward in SF1-17 and SF4-17 with the groundwater levels in the shallow piezometer near the ground surface or slightly above. At the location of SF5-17, weak upward hydraulic gradients were observed during the spring period and neutral to near neutral hydraulic gradients were observed during the fall period. At this location, groundwater levels in the piezometer nest were observed to be at or slightly above the ground surface. Based on the estimated flow rates at each station along this tributary, it is inferred that the watercourse between the upstream (SF1-17) and midstream (SF4-17) stations is gaining baseflow (e.g., groundwater seepage zones) while there appears to be relatively less groundwater discharge between midstream (SF4-17) and downstream (SF5-17) stations.

It was also noted that 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 the tributary at SF4-17 and SF5-17 may be losing water through infiltration or discharge to other receivers (e.g., riparian wetlands) across the Site before reaching SF5-17.

Also, 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 the tributary.

Eastern Tributary

Three (3) surface water monitoring stations were installed along the Eastern Tributary at up-stream (SF2-17), mid-stream (SF3-17), and downstream (SF6-17). The baseflow at the Eastern Tributary was estimated as follows:

- Station SF2-17 (Upstream) – 0.4 L/s to 5.5 L/s
- Station SF3-17 (Mid-stream) – 3.3 L/s to 14.7 L/s
- Station SF6-17 (Downstream) – 3.3 L/s to 12 L/s

Based on the review of the hydrographs at each surface water monitoring station along this tributary, the following is noted:

- SF2-17 (Upstream) – The vertical hydraulic gradient appears to be downward and the shallow groundwater levels in the nested piezometers are below the ground surface.
- SF3-17 (Mid-stream) – The vertical hydraulic gradient appears to be predominantly upward throughout the monitoring period, with the shallow groundwater levels in the nested piezometer near or above the existing ground surface.
- SF6-17 (Downstream) – The vertical hydraulic gradient is noted to be overall variable, with an upward gradient during spring and late fall period. The shallow groundwater levels in the nested piezometers were noted to generally be below the ground surface except for during the spring period.

It was observed that the baseflow measurement obtained at the midstream station (SF3-17) 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. The baseflow measurement obtained at downstream (SF6-17) was observed to be slightly lower than that estimated at midstream (SF3-17). As such, it is inferred that the watercourse between SF3-17 and SF6-17 is a losing reach. This reach may receive some groundwater discharge during the spring and/or late fall based on the vertical hydraulic gradient data.

Also, the estimated stream water levels and stream flows show a response to precipitation events, which indicates that storm flows (surface water runoff) provide for some input to the observed flows in the tributary.

Centre Channel: One (1) monitoring station (SF7-17) was installed adjacent to the mapped headwater drainage feature. No stream flow was observed at the monitoring station during the monitoring.

5.3 Surface Water Quality

A total of three (3) surface water samples (including one (1) field duplicate) were collected on September 17, 2017 from the following two (2) stream flow monitoring locations:

- Upstream of Western Tributary (SF1-17)
- Downstream of Western Tributary (SF5-17)
- Downstream of Eastern Tributary (SF6-17)

All three (3) samples were submitted to Maxxam in Mississauga for laboratory analysis of general inorganics and metals to characterize the background water quality of the watercourses. The analytical results were compared with PWQOs to identify potential exceedances of water quality criteria. Results of the comparative analysis identified an exceedance of the PWQO for total phosphorus in all three (3) samples. Water sample from SF5-17 and SF6-17 exceeded PWQO criteria for phenols-4AAP and total iron.

All other analyzed parameters met the applicable standards. A summary of the analytical results and laboratory certificates of analysis are provided in **Appendix H**.

6 Dewatering Requirements

The proposed servicing plan for Option 6 (Schaeffers, 2016) was reviewed to assess which of the proposed alignments would have the greatest impact on the natural environment. It is understood that the Site would require servicing connections to the existing Bolton municipal infrastructure. The impact estimates below do not include any internal servicing, just the necessary connections to the existing servicing.

The 2016 proposed servicing indicated that two (2) relatively short water main connections (~1.9km total) and a slightly longer sanitary sewer connection (~2.2km) would be required to service the area. These servicing requirements were found to potentially require up to two (2) creek crossings, with one of them being in a TRCA regulated area.

While the overall dewatering requirements are currently unknown, it is assumed dewatering will be required due to the relatively shallow water table. A detailed review of Site conditions and proposed infrastructure design will need to be undertaken to assess the need for dewatering during construction once Site plans are finalized.

7 Potential Impact and Proposed Mitigation

The key receptors identified in the previous section include:

- Natural features (streams and wetlands); and,
- Other groundwater users (domestic water supply).

Potential impacts associated with the proposed development can manifest in the short term as a result of construction related activities, or in the long term, if changes that occur during the Site development alter the natural form or function of the hydrologic system.

7.1 Identification and Mitigation of Long-Term Impacts

7.1.1 Potential Long-Term Impacts to the Groundwater System

The proposed development will increase hard surface areas and as a result, reduce the amount of infiltration to the underlying aquifer units, and increase surface water run-off. Long-term impacts to the regional groundwater system may result from the reduced amount of groundwater infiltration to the aquifers. This impact is not anticipated to be significant since the Site occupies about 1% of the Humber River watershed.

The introduction of overburden material with different hydraulic properties or alterations to the local topography can affect the existing groundwater system. Installation of site services could potentially introduce preferential pathways for contaminants to the groundwater and alter the natural groundwater levels. If the proposed development will include ethe construction below-grade structures (i.e., basements) with a finished floor elevation (FFE) below the local groundwater table, impacts related to seepage of groundwater can be expected. This is expected to potentially be more prevalent in the southwest portion of the Site, where the groundwater table is inferred to be shallower.

Local groundwater quality may be affected by the application of road salt along the public roadways. The underlying overburden materials are generally fine grained and the input to the regional aquifer may be retarded to some degree.

7.1.2 Potential Long-Term Impacts to the Natural Features

As discussed above, there are two (2) on-site surface water and wetland features located on the Site. Based on the field data collected to date, most surface water features and wetlands identified on the Site are not groundwater-dependent (as indicated by downward hydraulic gradients). Areas in the southwest and southeast portion of the Site displayed 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 the natural features since the upwellings and potential for groundwater contribution is interpreted to be a result of the high potentiometric levels in the underlying confined aquifer. 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 recharge.

The increase in runoff due to reduced infiltration may increase the on-site stream flow, potentially resulting channel erosion and an increase in the sediment loading into on-site and nearby surface water features. The downstream water quantity and quality of these surface water features could potentially be affected by the proposed development and urbanization.

7.1.3 Potential Long-Term Impacts to the Other Groundwater Users

Alteration of Site grading and the introduction of preferential pathways through Site servicing could potentially reduce the quantity and quality of groundwater available to nearby groundwater users, particularly those dependent on shallow well systems. The construction of deeper services (sanitary trunk sewers) may also introduce preferential pathways particularly if they were to intercept the ORM aquifer unit.

7.1.4 Mitigation of Long-Term Impacts

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

Various Best Management Practices (BMPs) could be incorporated into the proposed development that would promote infiltration and decrease runoff to help preserve the existing groundwater flow regime. The proposed on-site SWM pond will 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 soakaway pits, grassed swales, rain gardens, enhanced grassed swales, pervious pipe systems) will be proposed and designed at the detailed design 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.

7.2 Identification and Mitigation of Short-Term Impacts

On-site grading activities would affect the Site topography and drainage. Due to the relatively shallow water table and upward vertical hydraulic gradient observed in the west and southeast parts of the Site, dewatering activities may be required to control water levels for the nominal depth sanitary services in the shallow overburden.

According to Section 34 of the *Ontario Water Resources Act* (OWRA), any groundwater taking greater than 400,000L/day will require a Category 3 Permit to Take Water (PTTW) from the MECP. If the groundwater taking is less than 400,000L/day but more than 50,000L/day, the construction related taking can instead be filed under the Environmental Activity and Sector Registry (EASR) online registry. The dewatering rate for the Site may exceed this threshold and therefore a PTTW may be required during the construction of on-site servicing. A detailed review of Site conditions and proposed infrastructure design will need to be undertaken to assess the need for dewatering during construction once Site plans are finalized.

7.2.1 Potential Short-Term Impacts to the Groundwater System

Dewatering may result in a lowering of the groundwater levels in the aquifer, thereby reducing the available groundwater for nearby groundwater takers. However, such impacts would be short-term and localized, and recovery of the groundwater system would occur following completion of the dewatering activities. An Environmental Management Plan (EMP) will need to be developed to identify and reduce possible short-term impacts during construction.

7.2.2 Potential Short-Term Impacts to the Natural Features

The lowering of the water levels in the shallow groundwater aquifer or in underlying confined aquifer units could potentially reduce the groundwater input into on-site or nearby natural ecosystem features.

A higher potential for groundwater contribution to stream baseflow was identified at streams in the southeast portion of the Site. These streams in this area are more likely to be affected by a lowering of groundwater levels due to the construction dewatering.

In addition, discharge of pumped groundwater during construction into the natural environment may potentially alter the physical, chemical and thermal regime of any receiving watercourses or surface water feature. An erosion and sediment control (ESC) plan will need to be considered in designing a groundwater discharge plan to minimize the potential for impacts. The ESC plan can include rock check dams, silt fence, sediment traps or basins and/or other suitable techniques depending on the local hydrological conditions and construction phasing.

7.2.3 Potential Short-Term Impacts to the Other Groundwater Users

Dewatering may result in a reduction of available groundwater supply in the private wells surrounding the Site. Although the residential subdivisions and commercial development to the east of the Site are serviced by municipal water, agricultural lands to the north, east, and west of the Site likely still rely on wells. An Environmental Management Plan (EMP) will need to be developed to respond to potential well interference complaints and to provide mitigation response actions during dewatering operations.

7.2.4 Mitigation of Short-Term Impacts

The zone of influence due to dewatering is expected to be localized and limited to the shallow depth due to the low hydraulic conductivity of the surficial till and the shallow depth of the servicing. However, due to the proximity to the ORM, the dewatering volume and zone of influence could increase significantly if the deeper servicing connections intercept the ORM Aquifer. A review of final design grades will be conducted to confirm the potential need for dewatering in areas where high water levels were observed. A detailed assessment of the potential drawdown and zone of influence as a result of the dewatering will need to be conducted during the PTTW application process. Additionally, an EMP will need to be designed and implemented during construction to mitigate impacts.

The northern sections of both the East Tributary and West Tributary, as well as the entire Centre Channel are not interpreted to be groundwater-dependent, therefore, the potential for impacts to these stream reaches due to the dewatering activities is not anticipated. However as discussed in **Section 5.2.1**, there may be groundwater baseflow contribution to both the East Tributary and West Tributary in their respective lower reaches (southwest and southeast part of the Site). For this reason, the proposed dewatering activities during construction has the potential to lower the local groundwater table at the Site, and if the resulting zone of influence (ZOI) intersects the tributaries, then it may cause a reduction in baseflow contribution to these tributaries. Possible mitigation measures could include redirecting dewatering discharge into the tributaries to provide baseflow supplementation. There will be a requirement to implement ESC BMPs during construction to minimize impacts related to groundwater discharge activities.

Since both on-site tributaries are classified as cool to warmwater streams (TRCA, 2008a), dewatering activities should be completed during the cool water timing window for construction (July 1st to September 15th). Prior to construction, it will be necessary to prepare a dewatering discharge plan that assesses the quantity and quality of dewatering discharge, as well as the assimilative capacity of the receiving water bodies.

A door-to-door water well survey is recommended prior to construction to establish an inventory of groundwater users, and baseline domestic groundwater levels and quality in the area.

8 Conclusions

A summary of the preliminary hydrogeological investigation is provided below:

1. The Site is located within the Humber River Watershed and falls under the jurisdiction of the TRCA.
2. The Site is partly located within an HVA but is not located within a WHPA or SGRA.
3. Most of the Site is within the South Slope physiographic region. The South Slope region is characterized by glacial till. A small portion at the south end of the Site is located within the Peel Plain physiographic region, which is characteristics of glaciolacustrine deposits of silt and clays.
4. The Site is underlain by Blue Mountain Formation bedrock. The Blue Mountain Formation consists of dark blue-grey to black shale with interbeds of limestone. The bedrock elevation regionally ranges from 150-200masl.
5. The Site is covered by a thin layer of topsoil or fill, with approximate thickness of 0.2m. A silty clay till layer was encountered across the Site underlying the topsoil/fill layer. The thickness of the silty clay till is interpreted to range from approximately 1.8m to 6.4m. The silty clay till layer was also underlain by a very dense, silt till layer at many of the borehole locations. The dense silt till layer ranged from approximately 2.7m to at least 10.6m in thickness. The upper silty clay till layer is interpreted to be the Halton Till, whereas the underlying dense silt to sandy silt till layer may be the Newmarket Till.
6. Water level measurements taken between August 31, 2017 and November 10, 2017 at MW5-17D indicate pressurized conditions in the screened overburden. This suggest that the water level in the well is likely representative of the potentiometric surface from the ORM or Thorncliffe Formation.
7. Groundwater levels were measured manually at on-site monitoring wells between August 31, 2017 and April 23, 2018. At a regional scale, groundwater generally flows southeasterly towards Lake Ontario. The interpreted groundwater flow direction in the shallow overburden generally follows the Site topography. Ground elevations at the Site range from about 245masl in the northern portion of the Site to approximately 230masl in the southern portion of the Site.
8. Single-well rising-head tests were conducted in on-site monitoring wells to determine the in-*situ* hydraulic conductivity of the screened overburden materials. The in-*situ* hydraulic conductivity values were estimated to range from 2.2×10^{-9}m/s to 1.1×10^{-7}m/s.
9. One (1) artesian flowing well (MW5-17D) was identified at the southeastern portion of the Site. Also, upward hydraulic gradients were observed at the

MW5-17S/MW5-17D monitoring well nest between August 31, 2017 and November 10, 2017.

10. Two (2) separate tributaries of the West Humber River were identified within the Site, which have been labelled the Eastern Tributary and the Western Tributary. Both tributaries include associated riparian unevaluated wetlands. Also, based on mapping available from the MNRF, unevaluated wetland areas were identified in approximately 100m west of the Site.

11. Two (2) wetland monitoring stations were installed within on-site wetlands to assess potential groundwater contributions and monitor surface water levels. A downward vertical hydraulic gradient was estimated for the wetlands, which suggests no groundwater contribution to this feature.

12. Stream flow monitoring was conducted at six (6) on-site stream flow monitoring stations. In addition, dataloggers were deployed at each of these locations on the streambed to take hourly stream water depth measurements. The stream water depth measurements were converted to stream flow at the six (6) monitoring locations using the developed stage versus discharge curve. 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) were generally lower.

13. Most of the nested monitoring wells and piezometers on the Site showed downward hydraulic gradients. The exceptions include a few nests located in the west and southeast portion of the Site (SF5-17 and SF3-17) may be influenced by groundwater contribution.

14. A majority of the stream monitoring locations did not show significant baseflow. However, based on the presence of upward hydraulic gradients, shallow groundwater levels above the ground surface, and baseflow observed in certain monitoring stations, the lower reaches (southwest and southeast part of the Site) of both the Eastern Tributary and Western Tributary are noted to be gaining streams and would receive some baseflow. Both tributaries did show a close correlation with the precipitation data, which confirms that stormflow provides for a significant amount of flow observed in the watercourse. Throughout the monitored period, flow was observed at all the surface water monitoring locations except for SF7-17 located in the Centre Channel. No stream flow was observed at this station during the monitoring events.

15. A search of the MECP well records database conducted for a 1km radius around the Site returned a total of 204 records, the majority (54%) of which are used for water supply purposes.

16. Potential long-term impacts to the groundwater system associated with the development include reduction in infiltration, lowering of the shallow perched groundwater levels in the overburden, introduction of preferential pathways for contaminants, and increase in surface water run-off.

17. The following mitigation measures are recommended to mitigate the long-term impact: implementation of BMPs to promote infiltration, the use of trench plugs, anti-seepage collars or other methods to restrict preferential

movement of groundwater in bedding, and the use of a SWM pond to provide flow retention and temperature moderation for the receiving water bodies.

18. Potential short-term impacts are mostly associated with the construction dewatering. These impacts are expected to be localized and the groundwater system is expected to recover after the completion of the dewatering activities. Groundwater taking greater than 50,000L/day will require a PTTW or EASR from the MECP. The application package will need to include a detailed study of the required dewatering rate, estimated zone of influence and an environmental management plan (EMP), outlining the proposed monitoring mitigation and contingency plan to minimize impacts associated with dewatering.

9 Recommendations

1. A residential water well survey should be conducted within a 500m radius of the Site to better understand local use of groundwater resources in the area.
2. Based on review of the Master Concept Plan entitled *“Humber Station Community Master Plan, Master Concept Plan, Bolton, town of Caledon”* dated April 2021, the area of the Site has noted to be increased. It is recommended that additional monitoring wells be installed in the newly acclimated areas of the Site to characterize existing hydrogeological conditions. This would also include installation of nested monitoring well set within the proposed Ministry of Transportation (MTO) preferred west alignment (GTA West Corridor) that traverses two (2) watercourses along the southern portion of the Subject Lands and within the area of the non-participating landowners.
3. Based on review of the documents entitled *“Preliminary Constraints, Humber Station Village Option 6 Bolton”* by Savanta, dated December 15, 2017 and *“Sketch to Illustrate Wetlands and Driplines”* by R-PE Surveying Ltd., dated September 23, 2021, File No. 07-031, several additional wetlands have been identified at the Site, which would need to be instrumented with surface water monitoring stations to further enhance the current understanding of the natural heritage system and its function at the Site. Each surface water monitoring station should be equipped with a nested piezometer set, staff gauge and/or a streamflow station (where surface water flow is observed).
4. To meet the requirements of the TRCA, the groundwater-surface water monitoring program should be continued for an additional period of 1-year, at minimum.
5. A site-specific water balance analysis should be completed based on the proposed plans for development, including a wetland water balance risk evaluation. If significant risks to existing wetland features are identified, then a feature-based water balance assessment may need to be completed, in coordination with the TRCA.
6. During the detailed design stage, it will be necessary to refine the analysis of the hydrogeological conditions along the servicing alignments to estimate dewatering rates. The anticipated zone of influence and dewatering rates as a result of construction-related dewatering could not be estimated at that

time. These findings will be used to prepare a PTTW or an EASR application to support construction dewatering activities at the Site.

7. Long-term impacts will need to be addressed by controlling the increase in runoff through the stormwater management facilities. The implementation of best management practices and/or LIDs will be able to help increase the amount of infiltration to the aquifer system and minimize the environmental impacts of the development.

8. During the detailed design stage of the proposed site stormwater management, including design of supporting LIDs, there may be a requirement to confirm existing soil infiltration rates at the Site. This may be necessary to comply with the requirements of the TRCA, and should be completed following the guideline entitled *"Low Impact Development, Stormwater Management Planning and Design Guide (Version 1.0)"* by the TRCA and Credit Valley Conservation (CVC), dated 2010 (Appendix C.

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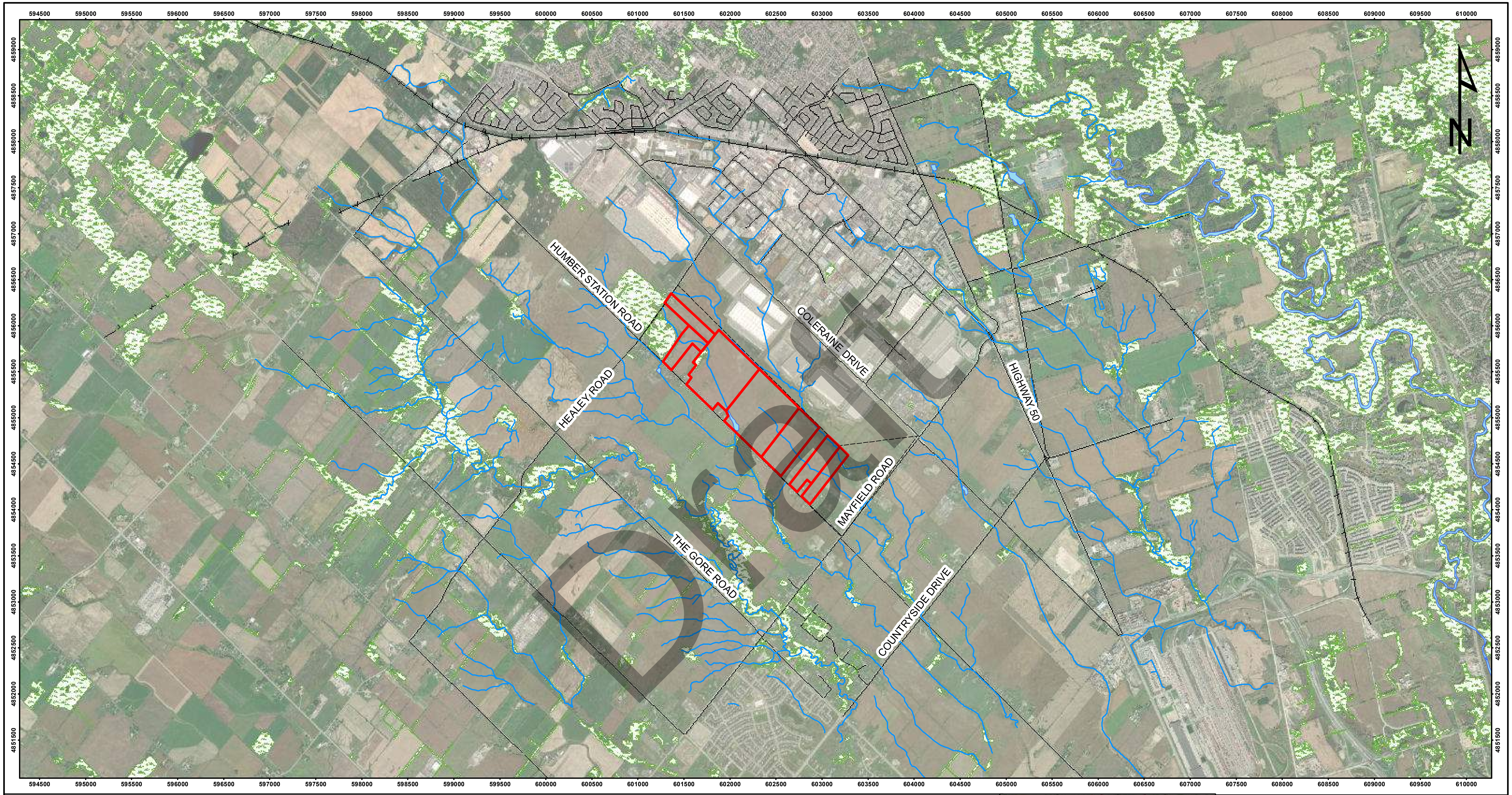
Figures



LEGEND

- Participating Properties
- Subject Lands
- Waterbody
- Watercourse
- Wooded Area
- Railway
- Roads

REFERENCE

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KEY PLAN (NTS)

SCALE 1:40,000

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PROJECT: Bolton Residential Expansion Site Option 6 Lands Hydrogeological Investigation

TITLE: **Study Area**

IBI

DATE: 03/23/2022		PROJECT: 137618
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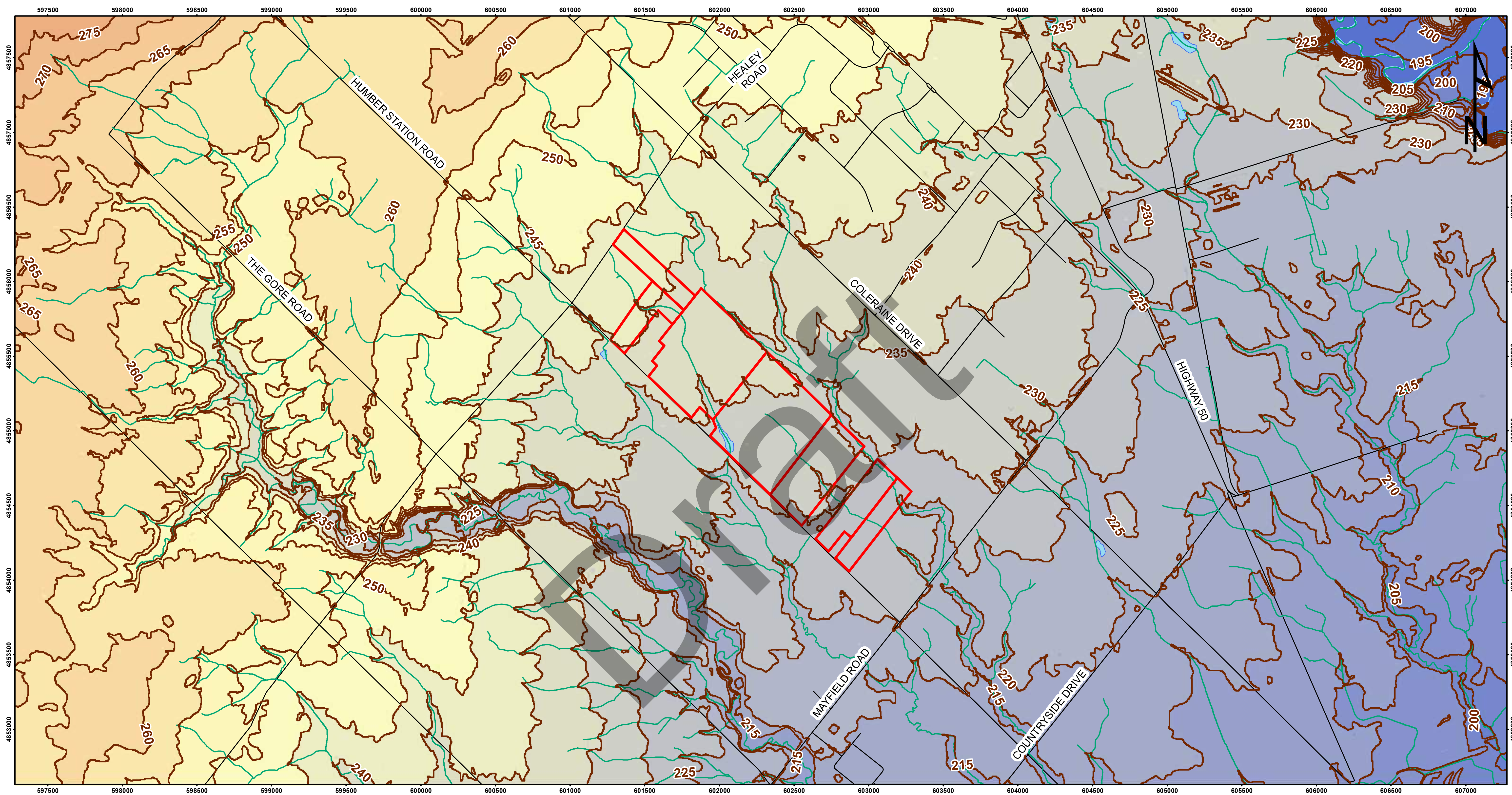

LEGEND

- Participating Properties
- Elevation Contours (m)
- Watercourse
- Waterbody
- Roads

Ground Surface Elevation (masl)

185.1 - 190	210.1 - 215	245.1 - 250
190.1 - 195	215.1 - 220	250.1 - 255
195.1 - 200	220.1 - 225	255.1 - 260
200.1 - 205	225.1 - 230	260.1 - 265
205.1 - 210	230.1 - 235	265.1 - 270
	235.1 - 240	270.1 - 275
	240.1 - 245	275.1 - 280

REFERENCE

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KEY PLAN (NTS)

SCALE 1:25,000
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PROJECT
Bolton Residential Expansion Site
Option 6 Lands
Hydrogeological Investigation

TITLE
Regional Topography

IBI

DATE: 03/23/2022		PROJECT: 137618
GIS	B.T.	03/23/2022
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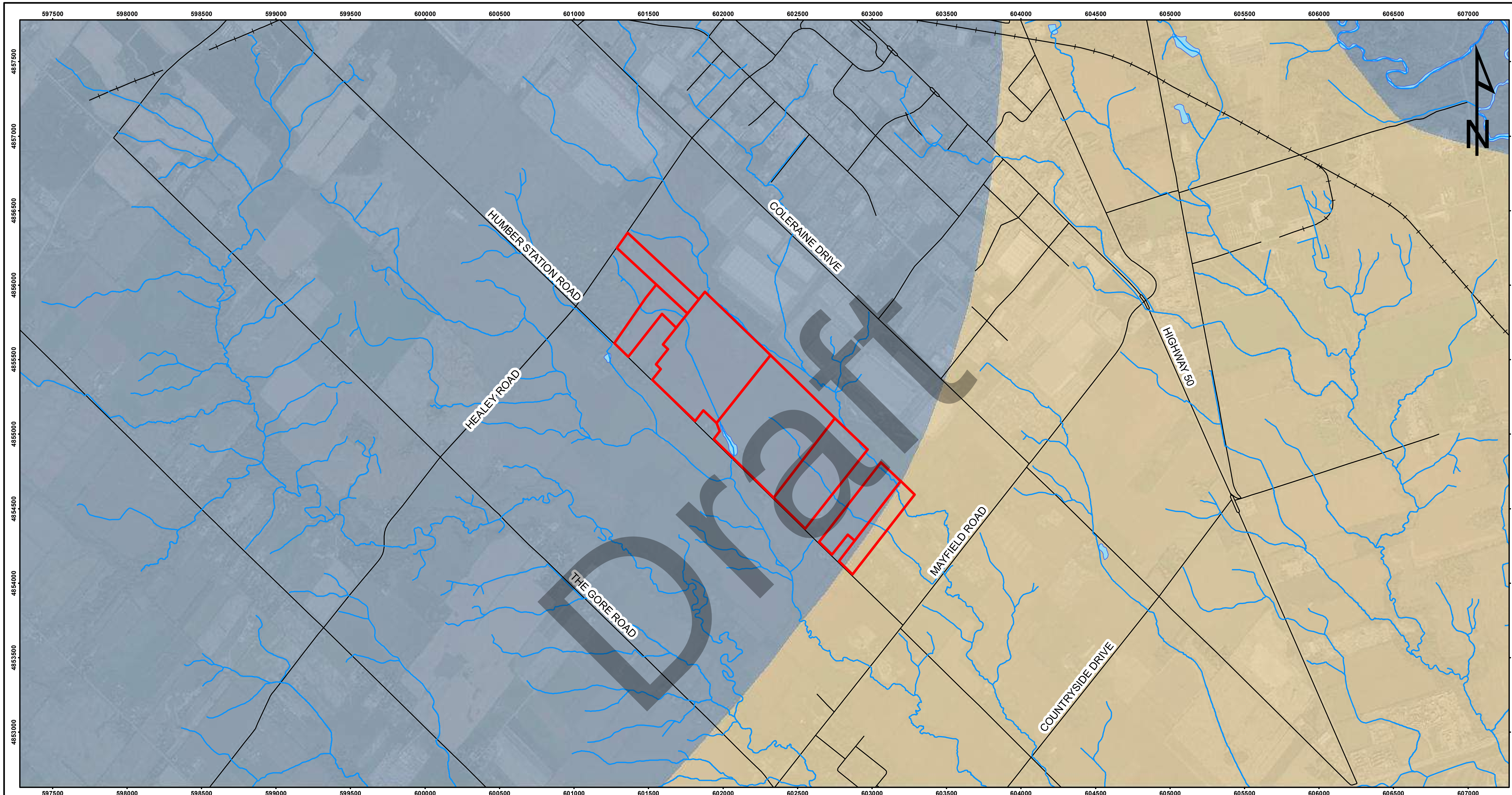
FIGURE 2



LEGEND

Participating Properties	Railway	**Physiographic Region**
Watercourse	Roads	Peel Plain
Waterbody		South Slope

REFERENCE

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SCALE 1:25,000

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PROJECT

Bolton Residential Expansion Site
Option 6 Lands
Hydrogeological Investigation

TITLE

Physiography

IBI

DATE: 03/23/2022			PROJECT: 137618
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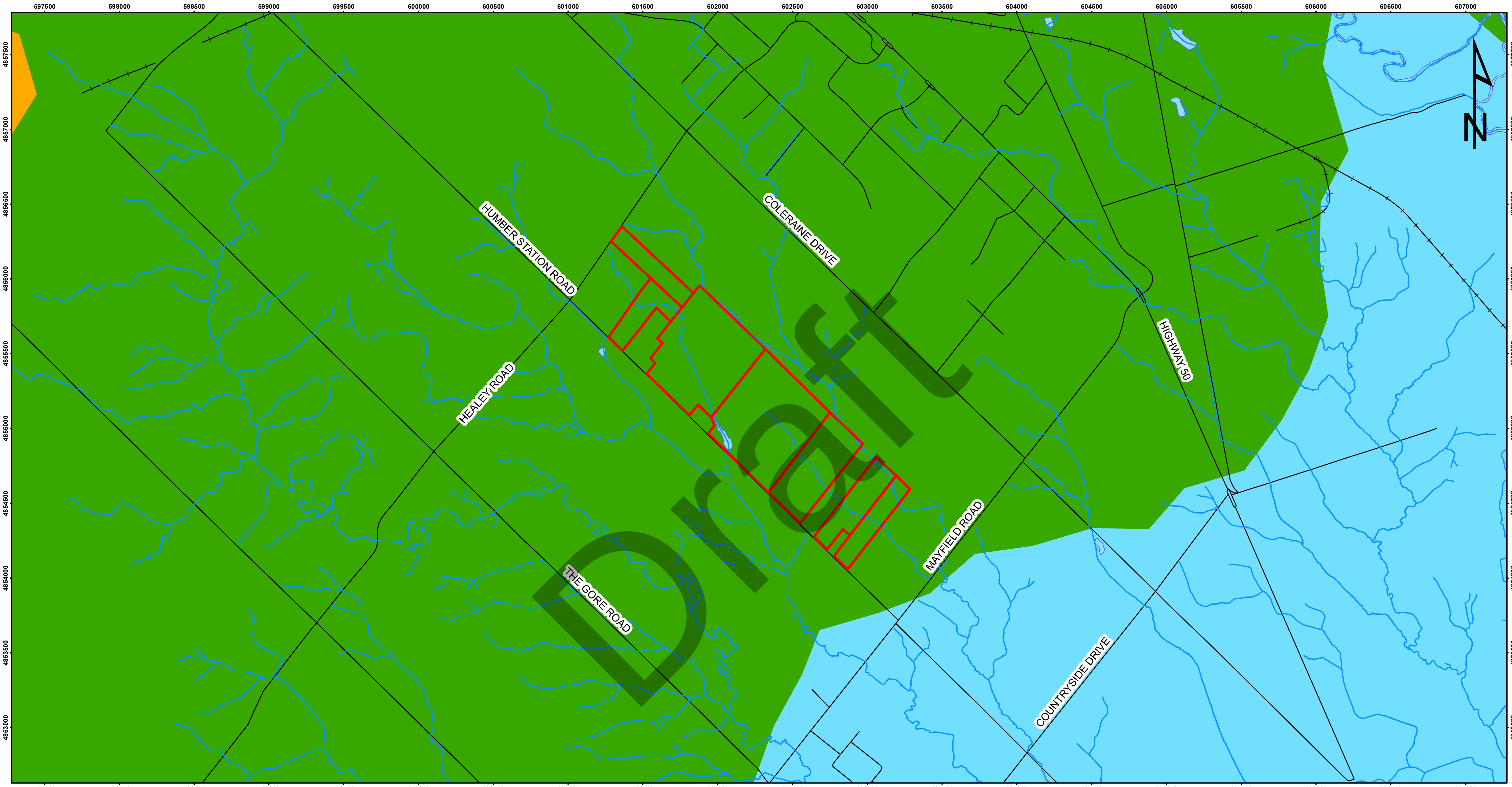

LEGEND

- Participating Properties
- Watercourse
- Waterbody
- Railway
- Roads

Quaternary Geology

- Glaciofluvial ice-contact deposits
- Glaciolacustrine deposits
- Halton Till

REFERENCE

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SCALE 1:25,000

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PROJECT: Bolton Residential Expansion Site Option 6 Lands Hydrogeological Investigation

TITLE: **Quaternary Geology**

IBI

DATE: 03/23/2022			PROJECT: 137618
GIS	B.T.	03/23/2022	REV. 0.0
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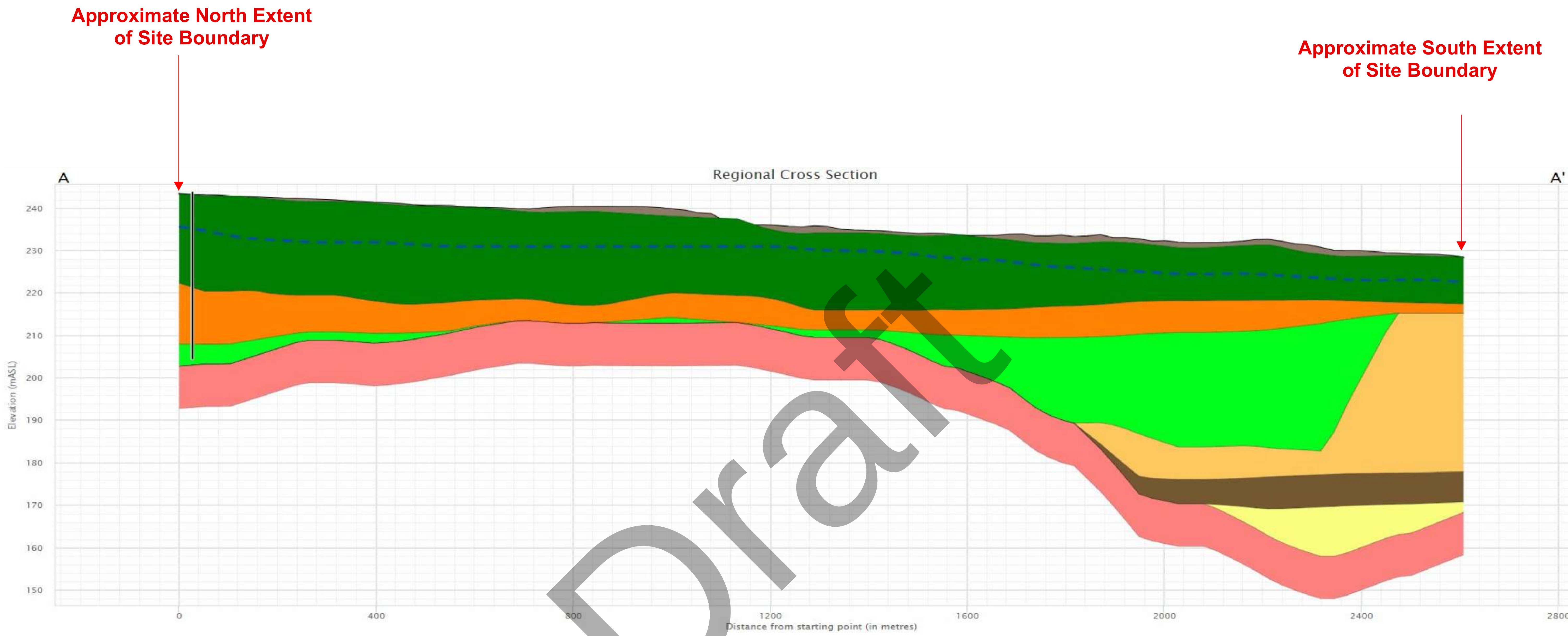

LEGEND

- Ground Surface
- Water Table
- Undifferentiated Upper Sediments
- Halton Till
- Oak Ridges Moraine
- Lower Newmarket Till
- Thorncliffe Formation
- Sunnybrook Drift
- Scarborough Formation
- Bedrock
- Wells

REFERENCE:

Oak Ridges Moraine Groundwater Program - Partner Agency Data Portal, 2022.
Accessed March, 2022 (https://partners.oakridgeswater.ca/CrossSection). (Previously referred to as York Peel Durham Toronto - Conservation Authorities Moraine Coalition (YPDT-CAMC) Groundwater Program.)

SCALE
As Shown in Figure

PROJECT
Bolton Residential Expansion Site
Option 6 Lands
Hydrogeological Investigation

TITLE
Regional Cross-Section

IBI

DATE: 03/23/2022		PROJECT: 137618
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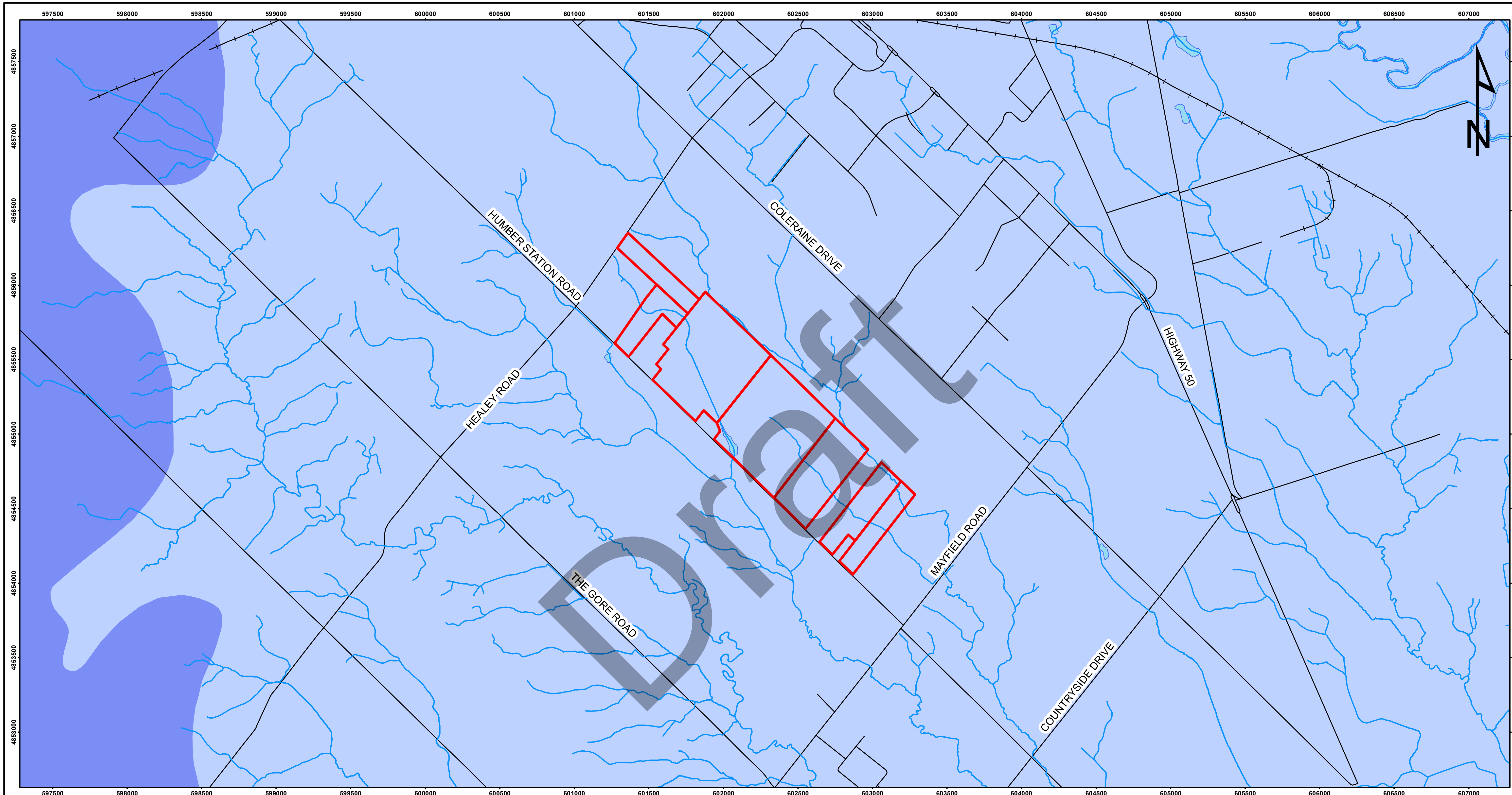
CHECK	S.D.	03/23/2022

REV. 0.0

FIGURE 5



LEGEND

- Participating Properties
- Watercourse
- Waterbody
- Railway
- Roads

Bedrock Formation

- Georgian Bay Formation
- Queenston Formation

REFERENCE

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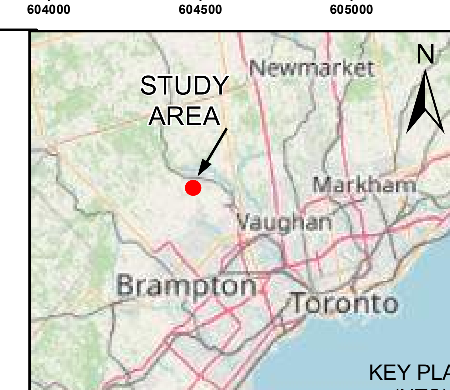

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PROJECT

Bolton Residential Expansion Site
Option 6 Lands
Hydrogeological Investigation

TITLE

Bedrock Geology

IBI

DATE: 03/23/2022		
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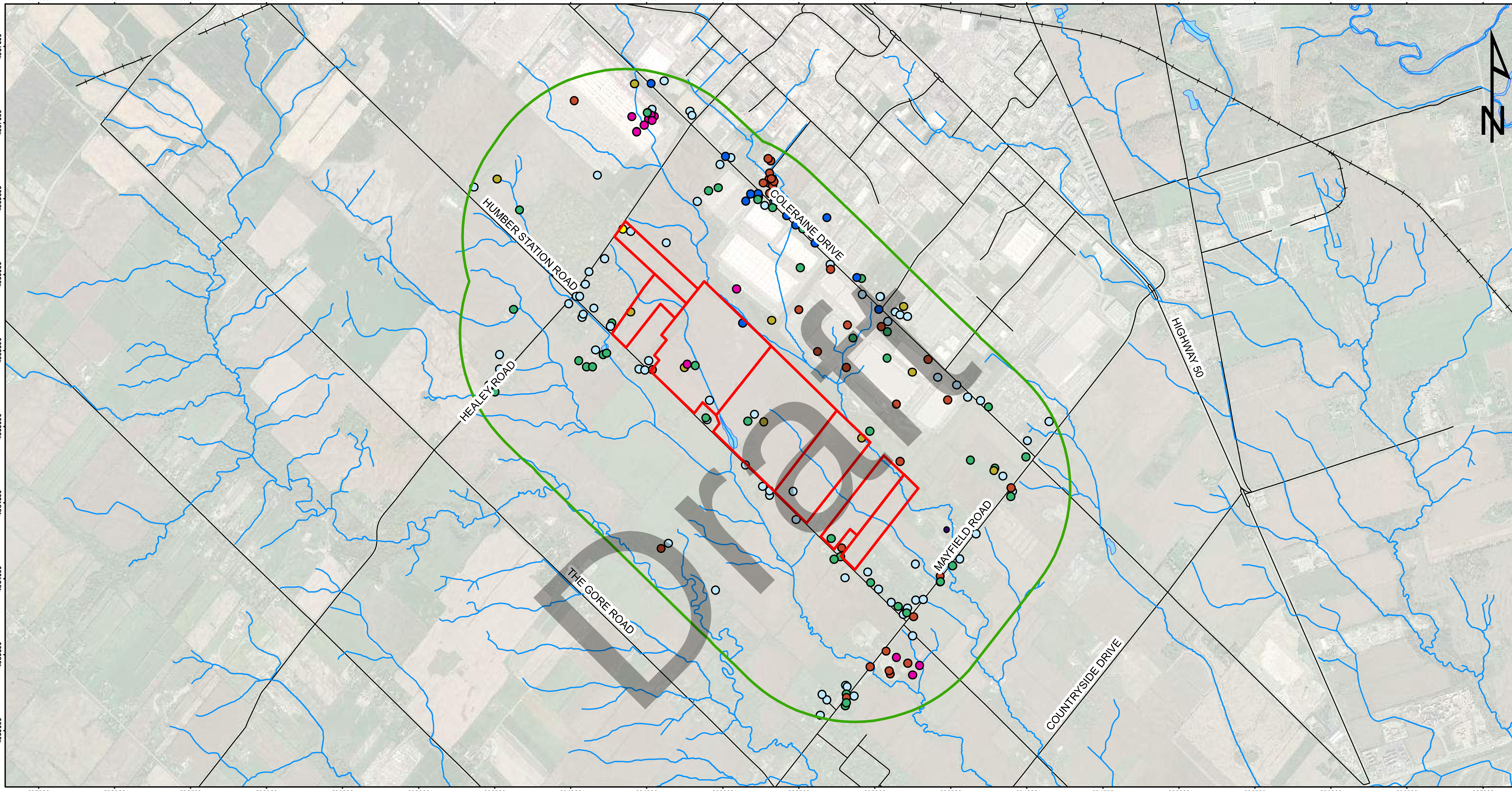
PROJECT: 137618

REV. 0.0

FIGURE 6



LEGEND

- Participating Properties
- 1 km Buffer
- PTTW
- Watercourse
- Waterbody
- Railway
- Roads

Final Status

- Abandoned
- Monitoring and Test Hole
- Observation Wells
- Other Status
- Test Hole
- Unknown
- Water Supply

REFERENCE

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KEY PLAN (NTS)

SCALE 1:25,000

500 0 500 1,000 Meters

PROJECT

Bolton Residential Expansion Site
Option 6 Lands
Hydrogeological Investigation

TITLE

MECP Water Well Records

IBI

DATE: 03/23/2022			PROJECT: 137618
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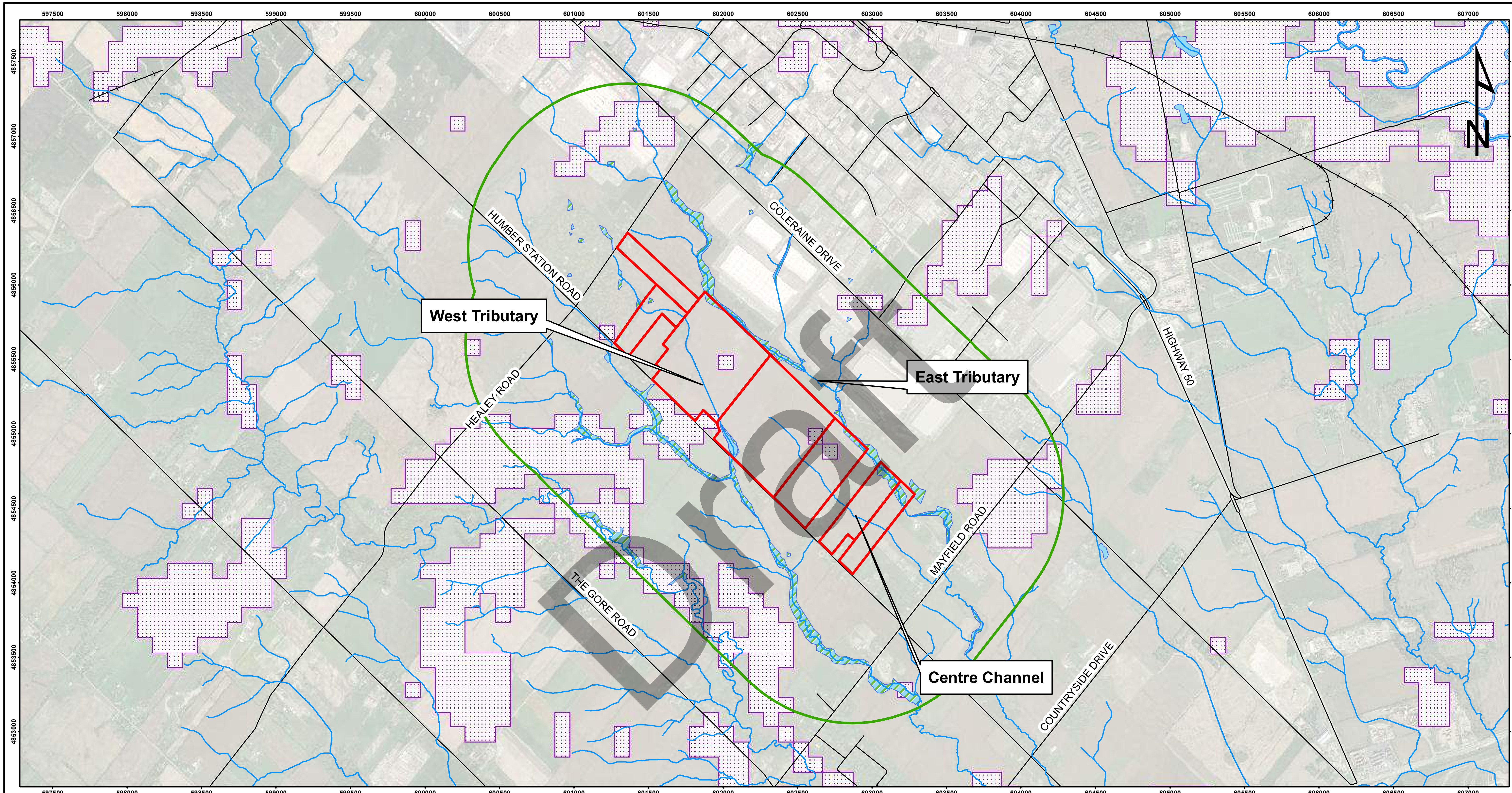

LEGEND

- Participating Properties
- 1 km Buffer
- Watercourse
- Waterbody
- Unevaluated Wetlands
- Railway
- Roads
- Highly Vulnerable Aquifer Areas

REFERENCE

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NOTE:
Unevaluated wetlands were only identified within the 1 km buffer.

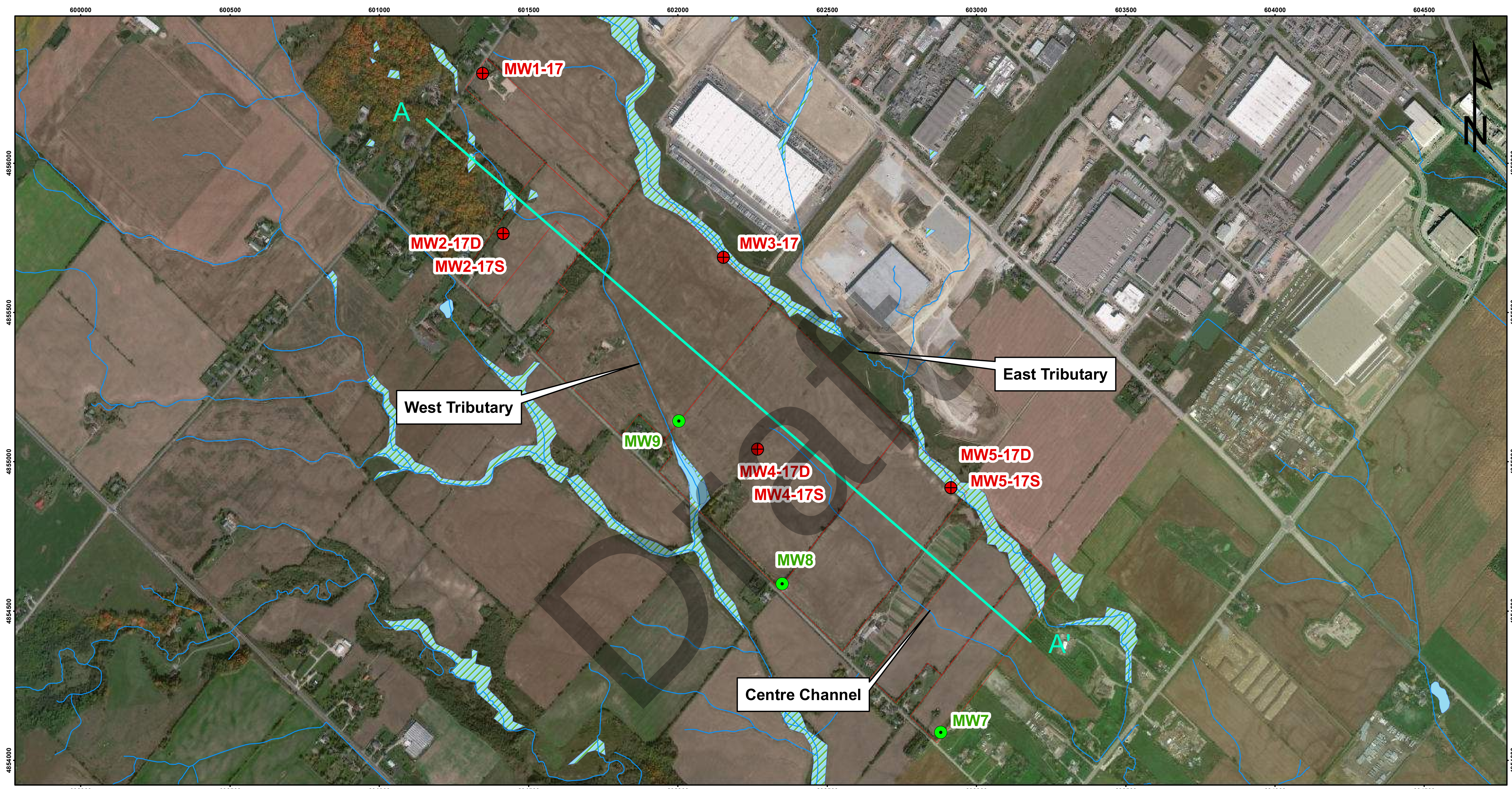
SCALE 1:25,000
500 0 500 1,000 Meters

PROJECT
Bolton Residential Expansion Site
Option 6 Lands
Hydrogeological Investigation

TITLE
Environmental Features

IBI

DATE: 03/23/2022			PROJECT: 137618
GIS	B.T.	03/23/2022	REV. 0.0
DESIGN			**FIGURE 8**
CHECK	S.D.	03/23/2022	



LEGEND

- RJB Monitoring Well
- IBI Monitoring Well (formerly COLE)
- Participating Properties
- Watercourse
- Waterbody
- Unevaluated Wetlands

REFERENCE

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SCALE 1:12,500

150 0 150 300 Meters

PROJECT

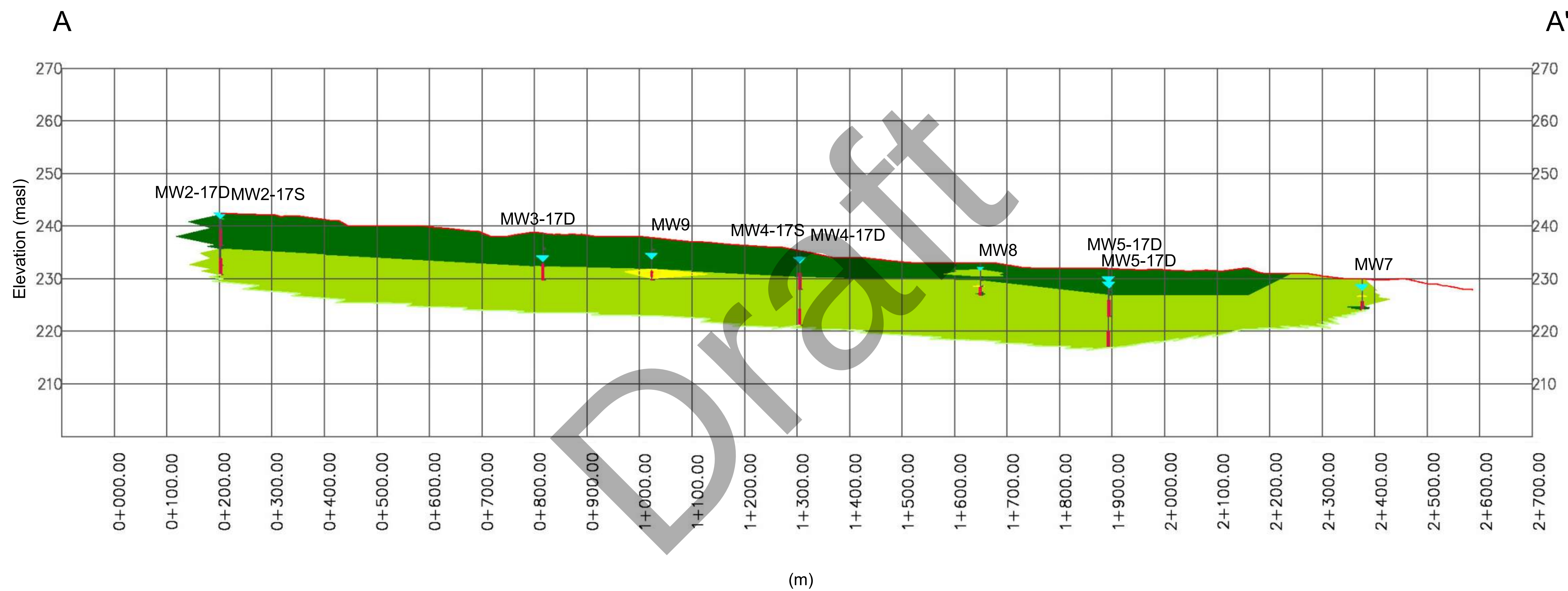
Bolton Residential Expansion Site
Option 6 Lands
Hydrogeological Investigation

TITLE

Groundwater Monitoring Locations

IBI

DATE: 03/23/2022			PROJECT: 137618
GIS	B.T.	03/23/2022	REV. 0.0
DESIGN			FIGURE 9
CHECK	S.D.	03/23/2022	



LEGEND

- Silty Clay Till (Halton Till)
- Silt Till (Newmarket Till)
- Sand
- Monitoring Well Screen
- Measured Water Level

REFERENCE

KEY PLAN (NTS)

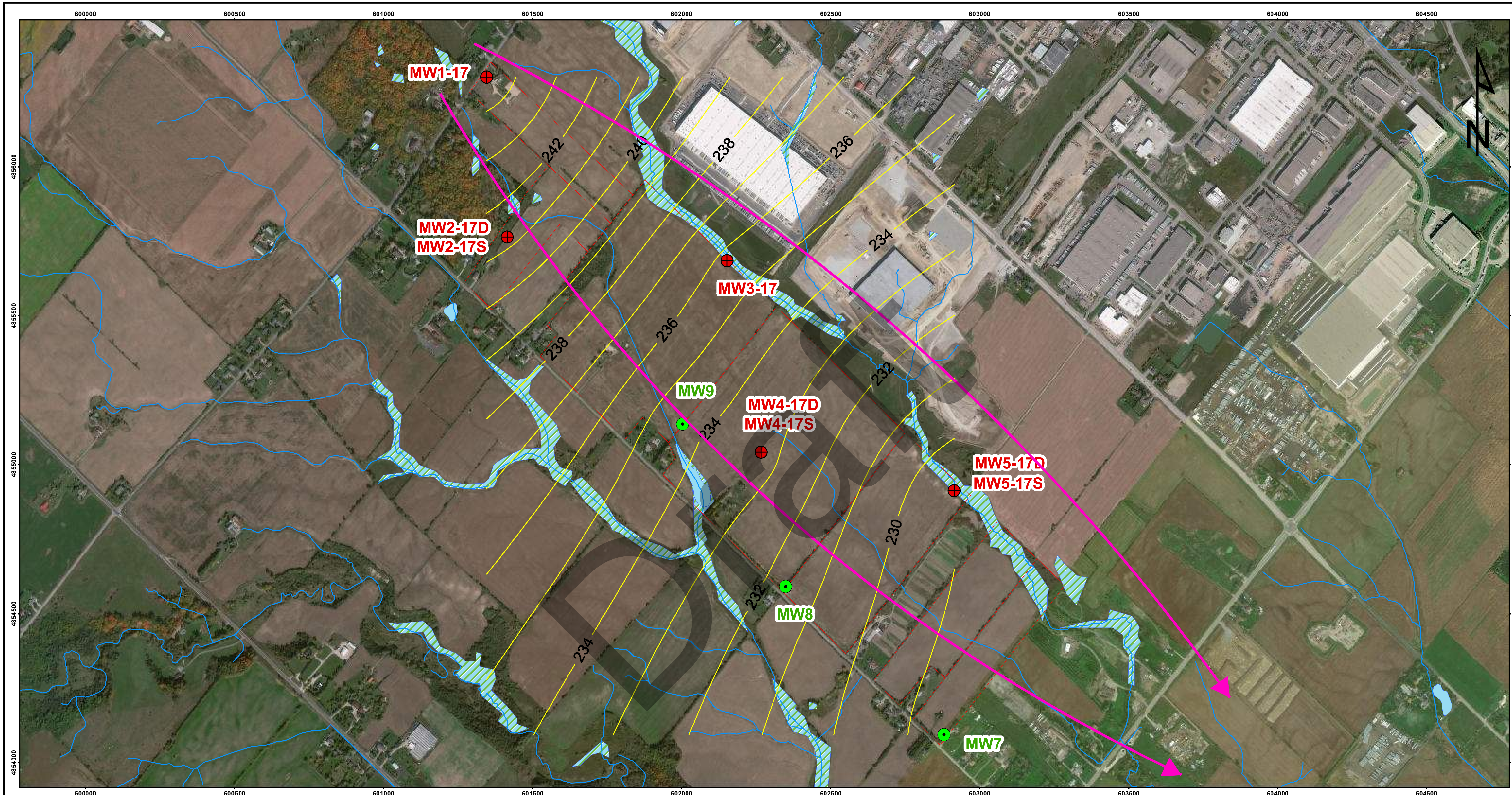
SCALE

PROJECT
Bolton Residential Expansion Site
Option 6 Lands
Hydrogeological Investigation

TITLE
Local Cross-Section

IBI

DATE: 03/23/2022		PROJECT: 137618
GIS	B.T. 03/23/2022	REV. 0.0
DESIGN		
CHECK	S.D. 03/23/2022	**FIGURE 10**



LEGEND

- RJB Monitoring Well
- IBI Monitoring Well (formerly COLE)
- Interpreted Equipotential Line (masl)
- Participating Properties
- Watercourse
- Waterbody
- Unevaluated Wetlands
- Interpreted Groundwater Flow Direction

REFERENCE

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SCALE 1:12,500

150 0 150 300 Meters

PROJECT

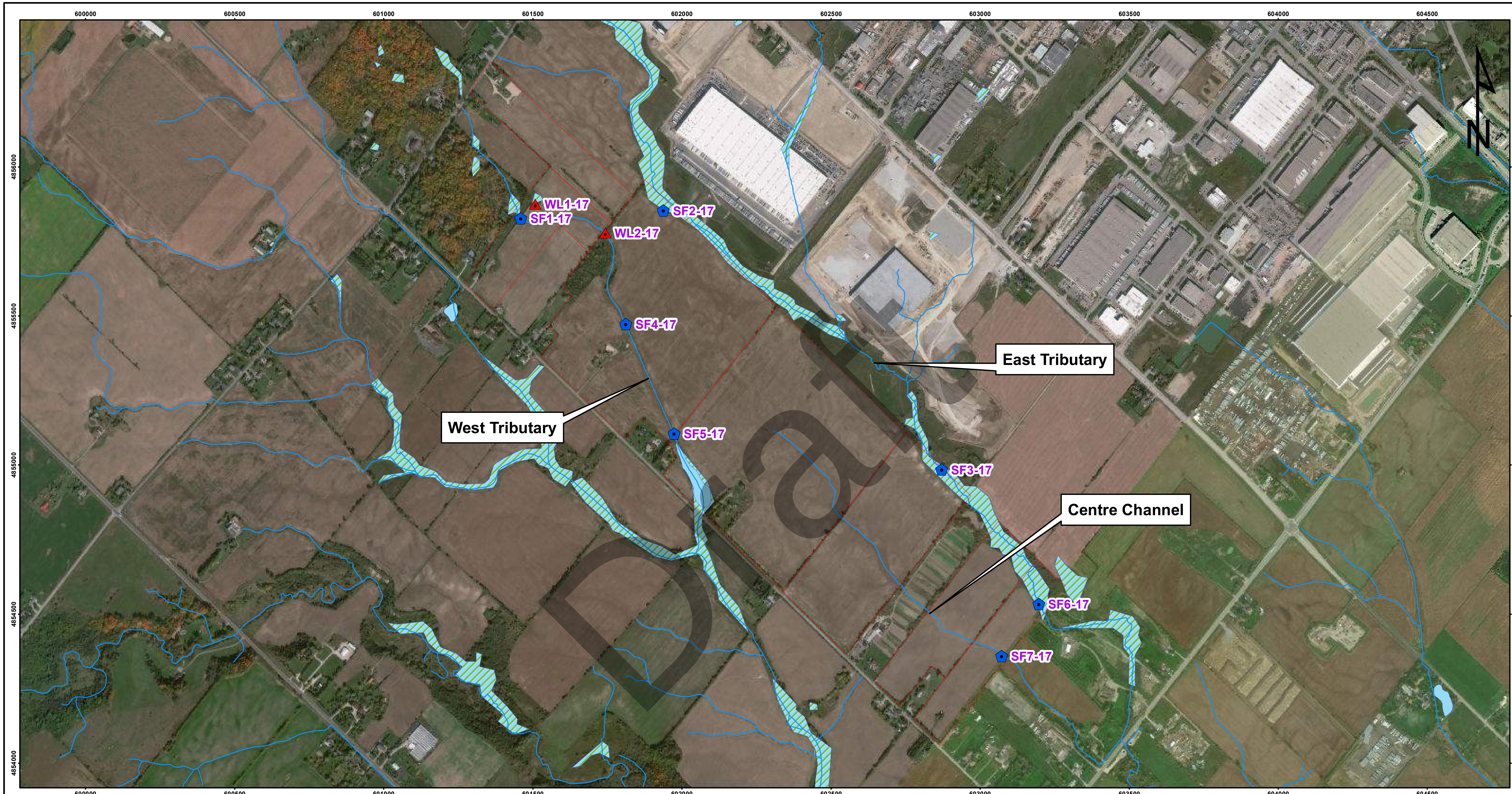
Bolton Residential Expansion Site
Option 6 Lands
Hydrogeological Investigation

TITLE

Groundwater Flow Pattern (23 April 2018)

IBI

DATE: 03/23/2022			PROJECT: 137618
GIS	B.T.	03/23/2022	REV. 0.0
DESIGN			FIGURE 11
CHECK	S.D.	03/23/2022	



LEGEND

Surface Water Monitoring

- Streamflow Station
- Wetland Station
- Participating Properties
- Watercourse
- Waterbody
- Unevaluated Wetlands

REFERENCE

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SCALE 1:12,500

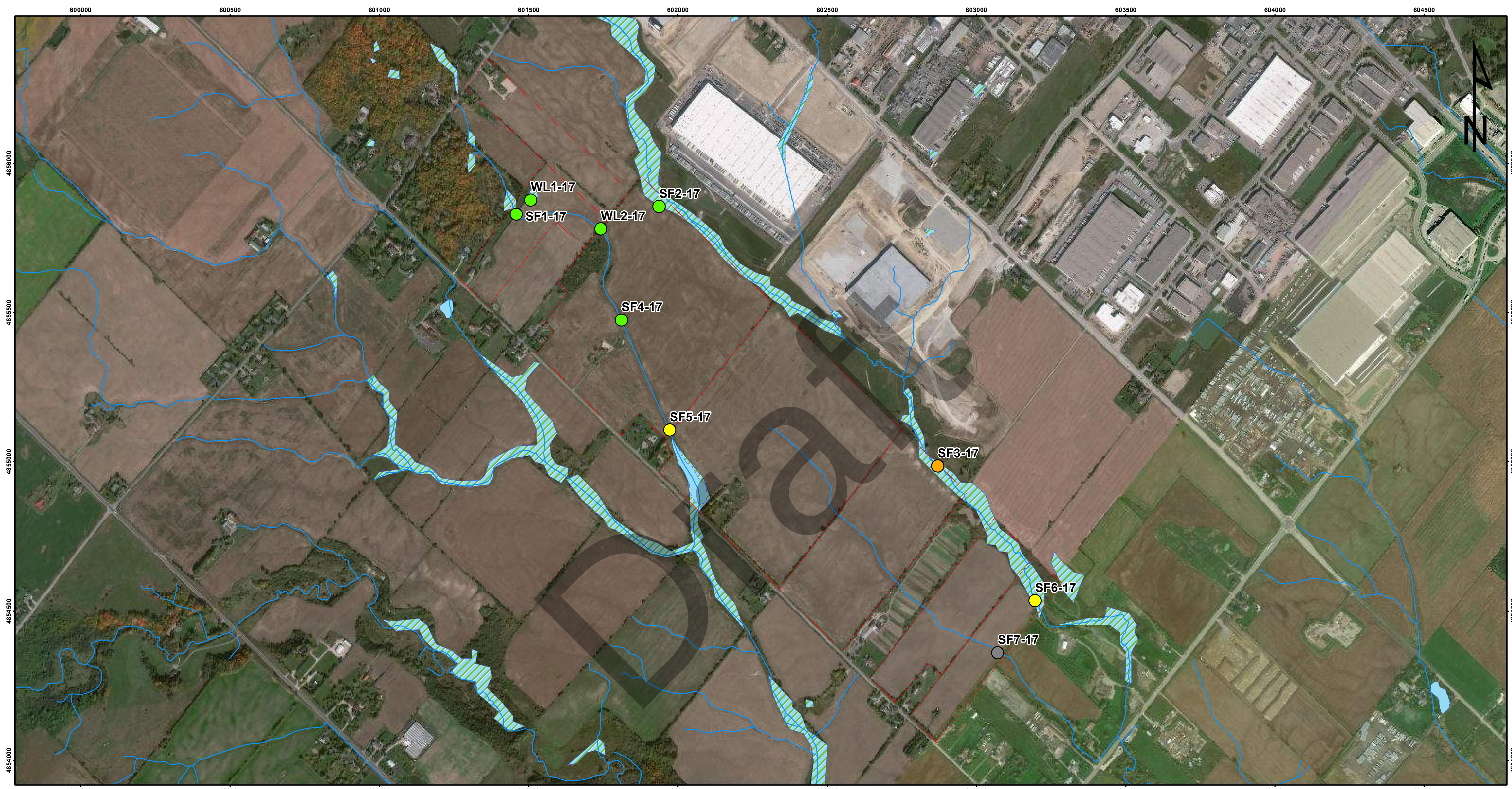
150 0 150 300 Meters

PROJECT
Bolton Residential Expansion Site
Option 6 Lands
Hydrogeological Investigation

TITLE
Surface Water Monitoring Locations

IBI

DATE: 03/23/2022			PROJECT: 137618
GIS	B.T.	03/23/2022	REV. 0.0
DESIGN			
CHECK	S.D.	03/23/2022	**FIGURE 12**



LEGEND

- Participating Properties
- Watercourse
- Waterbody
- Unevaluated Wetlands

Gradient

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

REFERENCE

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NOTE:

SF3 predominantly upward but slightly variable in the winter season.
A mini-piezometer nest was not installed at SF7-17, as such a vertical gradient could not be determined.

SCALE 1:12,500

150 0 150 300 Meters

PROJECT

Bolton Residential Expansion Site
Option 6 Lands
Hydrogeological Investigation

TITLE

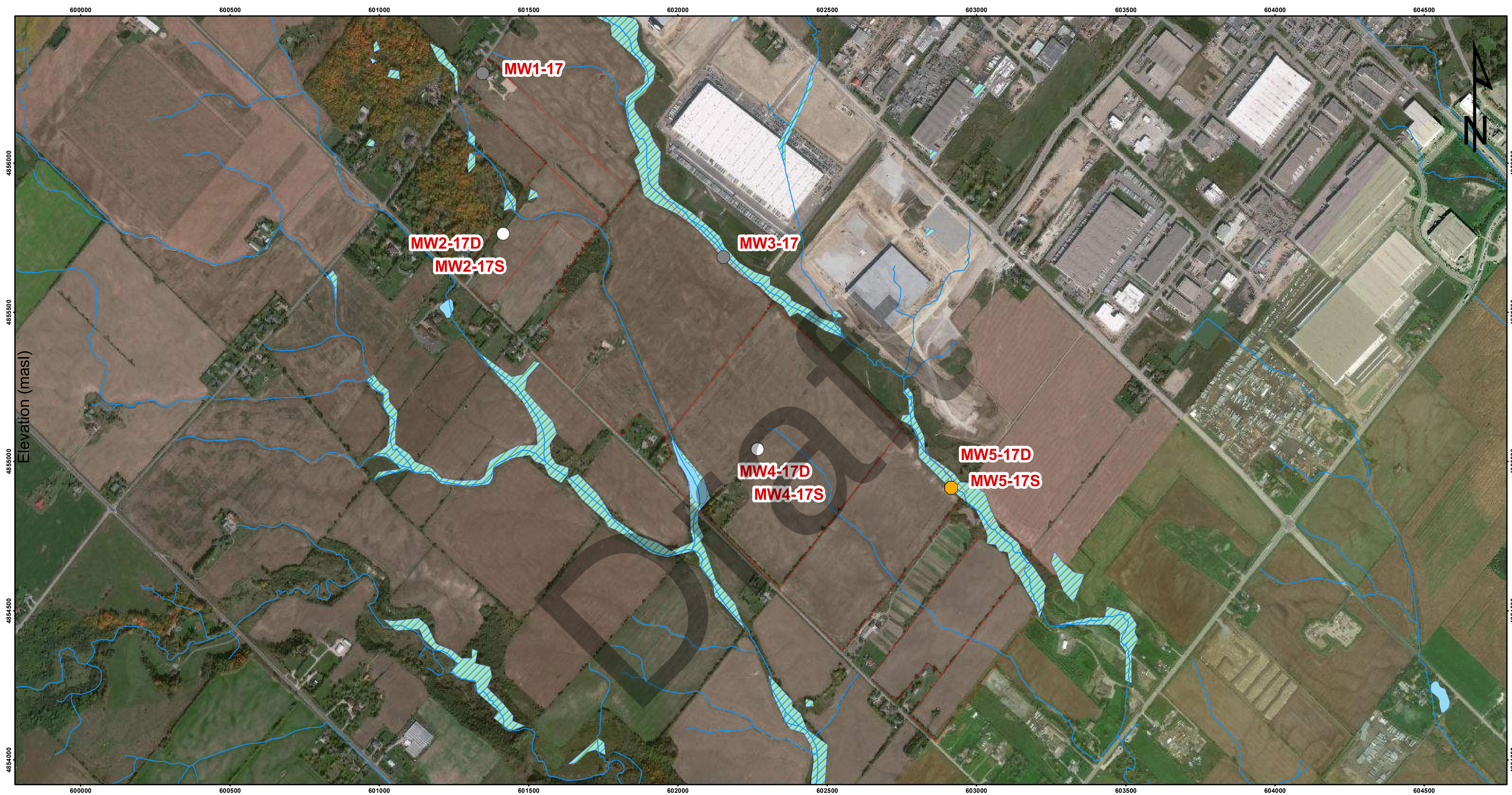
Piezometers Vertical Hydraulic Gradients (Summer 2017 to Spring 2018)

IBI

DATE: 03/23/2022		PROJECT: 137618
GIS	B.T.	03/23/2022
DESIGN		
CHECK	S.D.	03/23/2022

REV. 0.0

FIGURE 13



LEGEND

- Participating Properties
- Watercourse
- Waterbody
- Unevaluated Wetlands

Gradient

- Neutral Gradient
- Not Determined
- Upward Gradient

REFERENCE

Service Layer Credits: © OpenStreetMap (and) contributors, CC-BY-SA
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NOTE:

A monitoring well nest was not installed at MW1-17 and MW3-17, as such a vertical gradient could not be determined.

SCALE 1:12,500

150 0 150 300 Meters

PROJECT

Bolton Residential Expansion Site
Option 6 Lands
Hydrogeological Investigation

TITLE

Monitoring Well Vertical Hydraulic Gradients (Summer 2017 to Spring 2018)

IBI

DATE: 03/23/2022		PROJECT: 137618
GIS	B.T. 03/23/2022	REV. 0.0
DESIGN		**FIGURE 14**
CHECK	S.D. 03/23/2022	

Appendix A

Borehole Logs

JOB NO.: 1707-S200

LOG OF BOREHOLE NO.: MW1-17

FIGURE NO.: 1

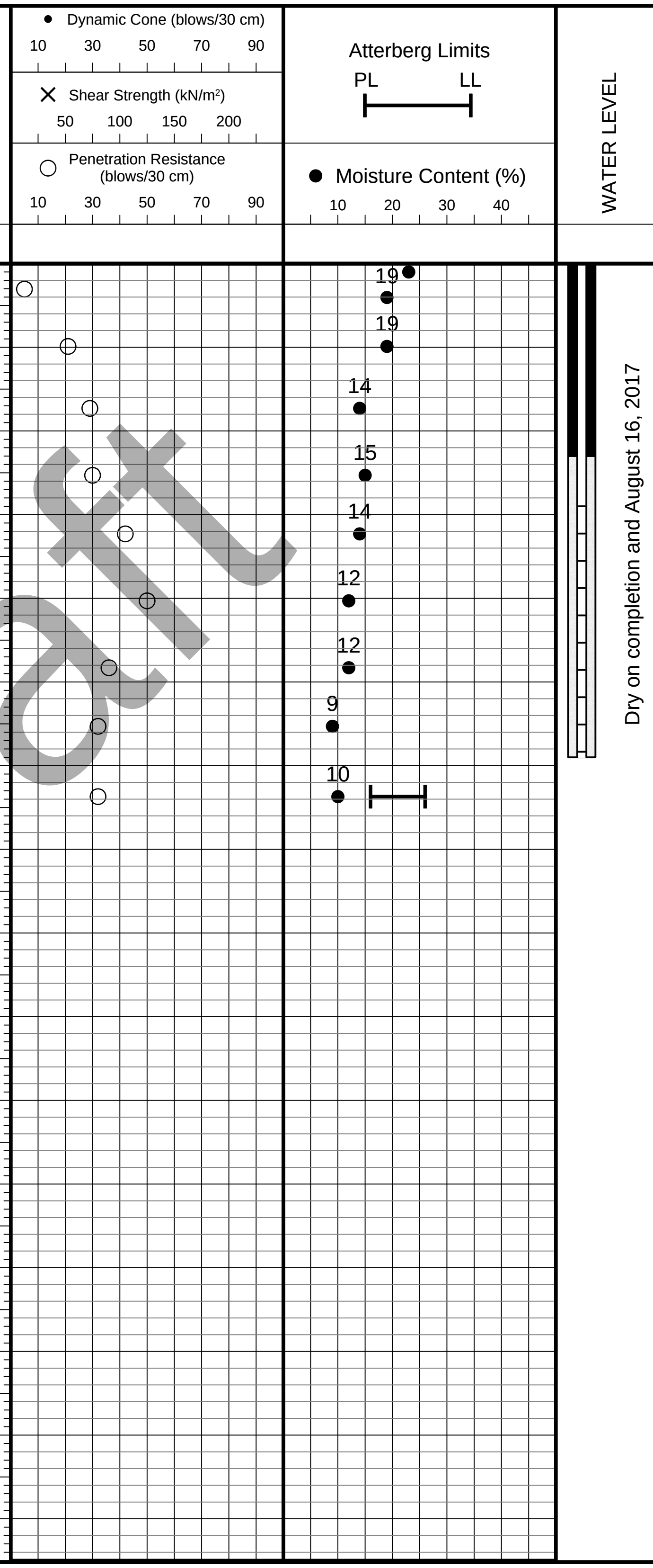
PROJECT DESCRIPTION: Monitoring Wells Installation

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
242.1	Ground Surface
0.0	**20 cm TOPSOIL**
	Firm to hard weathered boulder **SILTY CLAY TILL** brown / grey some sand to sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders
235.4 / 6.7	Grey, very dense **SANDY SILT TILL** some clay, a trace of gravel occ. sand seams and layers, cobbles and boudlers silt layer water seepage
232.3 / 9.8	Grey, very dense **SILT** some clay, a trace of sand occ. clay layers
229.6 / 12.5	**END OF BOREHOLE**

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

SAMPLES

Number	Type	N-Value	Moisture Content (%)
1A	DO	8	19
1B			
2	DO	24	19
3	DO	19	16
4	DO	40	14
5	DO	52	13
6	DO	24	8
7	DO	32	11
8	DO	30	10
9	DO	25	10
10	DO	50/15	8
11	DO	52/15	11
12	DO	35	13
13	DO	26	13
14	DO	55/15	12
15	DO	50/15	14
16	DO	50/10	15
17	DO	55/15	15

Depth Scale (m): 0–15

● 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. 240.5 m on August 16, 2017

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	Type	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				1, 2, 3			
	brown / grey				4			
	some sand to sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders				5			Dry on completion
236.1 / 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			

JOB NO.: 1707-S200

LOG OF BOREHOLE NO.: MW3-17

FIGURE NO.: 4

PROJECT DESCRIPTION: Monitoring Wells Installation

METHOD OF BORING: Hollow-Stem

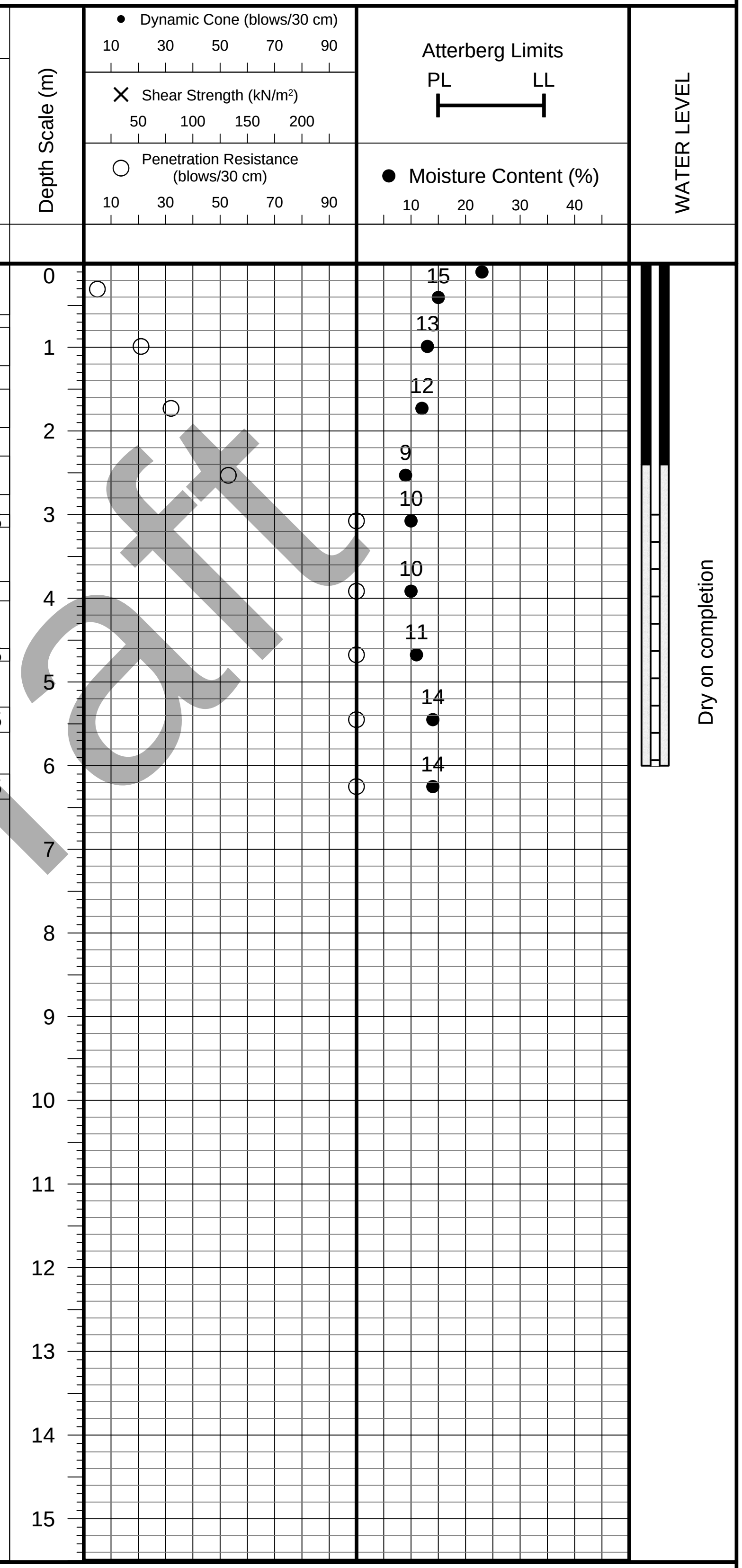
PROJECT LOCATION: East side of Humber Station Road, south of Healey Road
Town of Caledon

DRILLING DATE: August 17, 2017

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES: Number	Type	N-Value	Moisture Content (%)
235.5	Ground Surface				
0.0	**20 cm TOPSOIL**	1A	DO	5	15
	Brown, firm to hard	1B			
	weathered	2	AS	21	13
	SILTY CLAY TILL	3	DO	32	12
	some sand to sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders	4	DO	53	9
	boulder	5	DO	55/15	10
232.0 / 3.5	Grey, very dense	6	DO	50/8	10
	SILT	7	DO	50/15	11
	some clay, a trace of sand occ. clay layers	8	DO	50/15	14
229.1 / 6.4		9	DO	70/15	14

END OF BOREHOLE

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

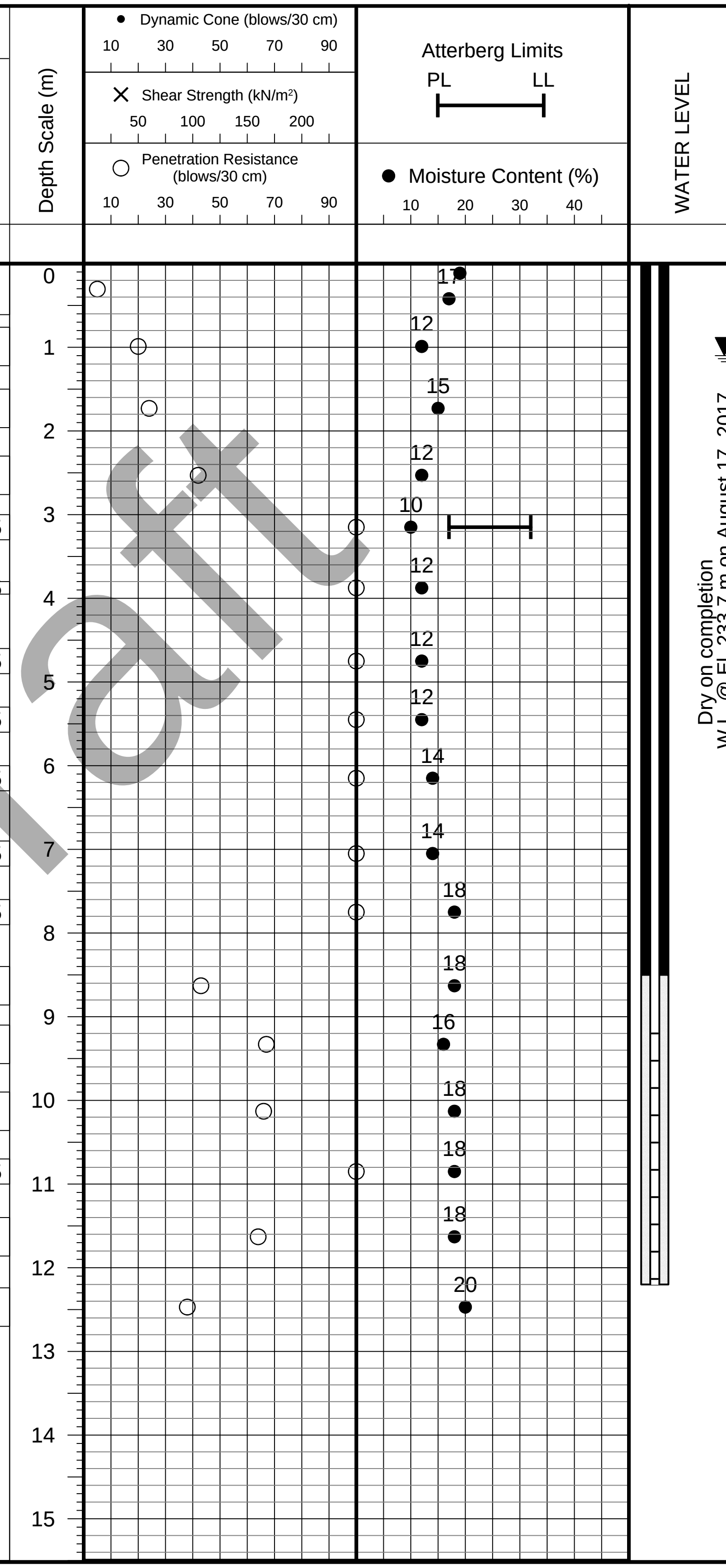
METHOD OF BORING: Hollow-Stem

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	Number	Type	N-Value
234.8	Ground Surface			
0.0	**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
		17	DO	38
222.1 12.7	**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



Draft

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	Type	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 **SILTY CLAY TILL** some sand to sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders				1 2 3			Dry on completion W.L. @ El. 233.6 m on August 17, 2017
231.2 3.6	Grey brown / grey **SILT** some clay, a trace of sand occ. clay layers				4 5			
228.8 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			

JOB NO.: 1707-S200

LOG OF BOREHOLE NO.: MW5-17D

FIGURE NO.: 7

PROJECT DESCRIPTION: Monitoring Wells Installation

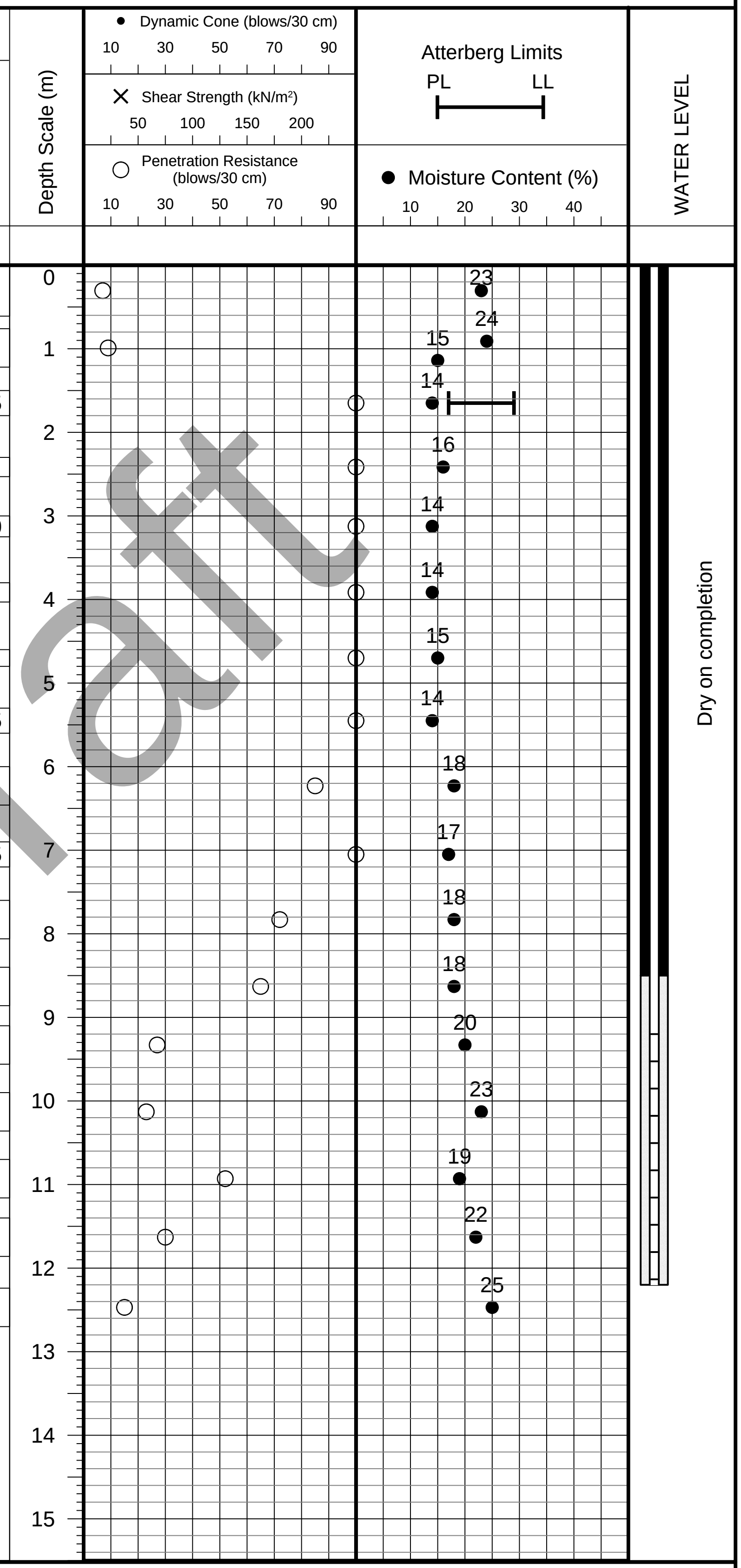
METHOD OF BORING: Hollow-Stem

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
228.7	Ground Surface
0.0	**1.1 cm FLOOD DEPOSIT** mixed with silty clay (weathered)
227.6 / 1.1	Brown, hard **SILTY CLAY** a trace of sand occ. wet silt seams and layers
226.6 / 2.1	Grey, compact to very dense **SILT** some clay, a trace of sand occ. clay layers (water seepage)
216.0 / 12.7	**END OF BOREHOLE**

Number	Type	N-Value	Moisture Content (%)
1	DO	7	23
2A / 2B	DO	9	24 / 15
3	DO	50/15	14
4	DO	50/8	16
5	DO	70/10	14
6	DO	50/8	14
7	DO	50/5	15
8	DO	50/15	14
9	DO	85	18
10	DO	50/15	17
11	DO	72	18
12	DO	65	18
13	DO	27	20
14	DO	23	23
15	DO	52	19
16	DO	30	22
17	DO	15	25



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

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	Type	N-Value	Depth Scale (m)
228.7	Ground Surface				
0.0	**1.1 cm FLOOD DEPOSIT** mixed with silty clay				0
227.6 / 1.1	Brown **SILTY CLAY** a trace of sand occ. wet silt seams and layers				1
226.6 / 2.1	Grey **SILT** some clay, a trace of sand occ. clay layers				2, 3, 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

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. 222.9 m on August 18, 2017

Soil Engineers Ltd.

R.J. Burnside & Associates Limited

BURNSIDE

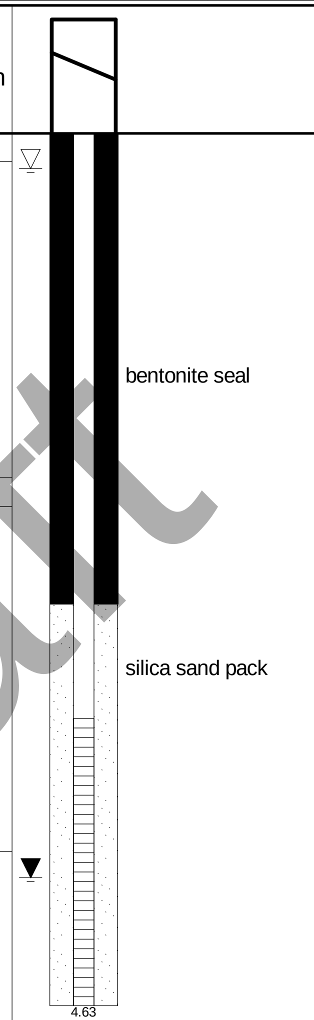
LOG OF DRILLING OPERATIONS

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**

Surface Elevation (m): **228.60**

Stratigraphic Description	Depth (m)	Sample Num.	Type	%Recov.
Light brown sandy silt TOPSOIL, moist. SS-1 (1, 2, 5, 8)		1	SS	50
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+)	0.15	2 3	SS SS	75 50
Light brown and black, medium SAND lense	1.83			
Light brown, clayey SILT TILL, with sand and stones. Fractured, loose, iron staining, moist. SS-4 (20, 50+) SS-5 (50+)	1.98	4 5	SS SS	50 25
Grey CLAY, dense, dry, friable. SS-6 (44, 50 +) SS-7 (38, 50+)	3.81	6 7	SS SS	25 25
	4.87			



Draft

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	MONITORING WELL DATA	SAMPLE TYPE
▼ Water found @ time of drilling	Pipe: **51 mm dia. PVC**	AC Auger Cutting; SS Split Spoon
▽ Static Water Level - 1/11/2007	Screen: **51 mm dia. PVC #10 slot**	CS Continuous; AR Air Rotary
		RC Rock Core; WC Wash Cuttings

LOG OF DRILLING OPERATIONS

MW8

BURNSIDE

R.J. Burnside & Associates Limited
[illegible]
[illegible]

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**

Surface Elevation (m): **231.94**

Stratigraphic Description	Depth (m)
Dark brown TOPSOIL, moist. SS-1 (2, 3, 4, 4)	
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
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
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
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
Grey CLAY, compact, parts along bedding planes. Moist. SS-7 (24, 75)	4.57
	5.18

Well construction: bentonite seal; silica sand pack; 5.08

SAMPLE Num.	Type	Int.	%Recov.
1	SS		100
2	SS		100
3	SS		90
4	SS		100
5	SS		70
6	SS		80
7	SS		100

Depth Scale (ft): 5.0, 10.0, 15.0 — (m): 1.0, 2.0, 3.0, 4.0, 5.0

Draft

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	SS	Split Spoon
CS	Continuous	AR	Air Rotary
RC	Rock Core	WC	Wash Cuttings

BHLOG GUELPH P:\GINT\PROJECTS\P\PTA11575.GPJ TEMPLATE.GDT 31/05/07

LOG OF DRILLING OPERATIONS

MW9

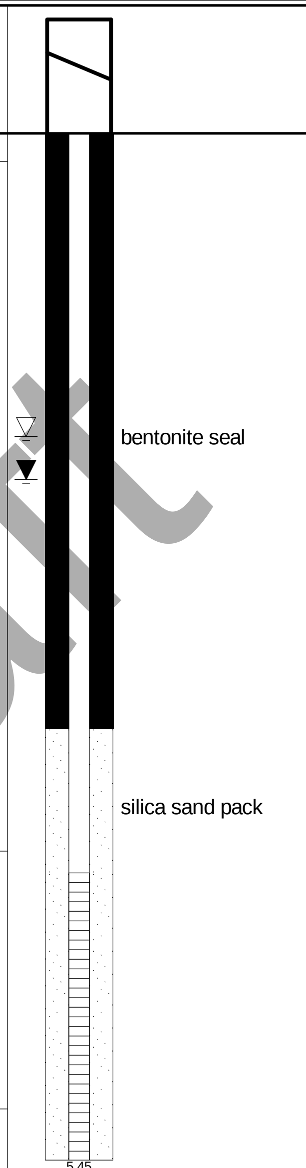
BURNSIDE

R.J. Burnside & Associates Limited
[illegible]

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**

Surface Elevation (m): **235.69**

Depth (m)	Stratigraphic Description
0.00 – 0.15	Dark brown TOPSOIL, moist. SS-1 (3, 3, 3, 8)
0.15 – 3.81	Grey brown silty CLAY TILL, with pebbles and pockets of sand. Vertical fractures, iron staining, moist. SS-2 (6, 12, 18, 22) SS-3 (6, 12, 23, 29) SS-4 (9, 22, 32, 40) SS-5 (7, 19, 41, 50)
3.81 – 5.18	Brown silty SAND, coarse to medium sand, some gravel. Wet. SS-6 (30, 97) SS-7 (2, 7, 30, 40)
5.18 – 5.56	Brown medium sand and gravel. Saturated. SS-8 (7, 18, 50)
5.56 – 5.86	Grey CLAY, uniform, wet.



SAMPLE

Num.	Type	Int.	%Recov.
1	SS		40
2	SS		100
3	SS		100
4	SS		100
5	SS		100
6	SS		100
7	SS		100
8	SS		100

Prepared By: **S. Goemans** Checked By: **D. Gevaert** Date Prepared: **11/13/2006**

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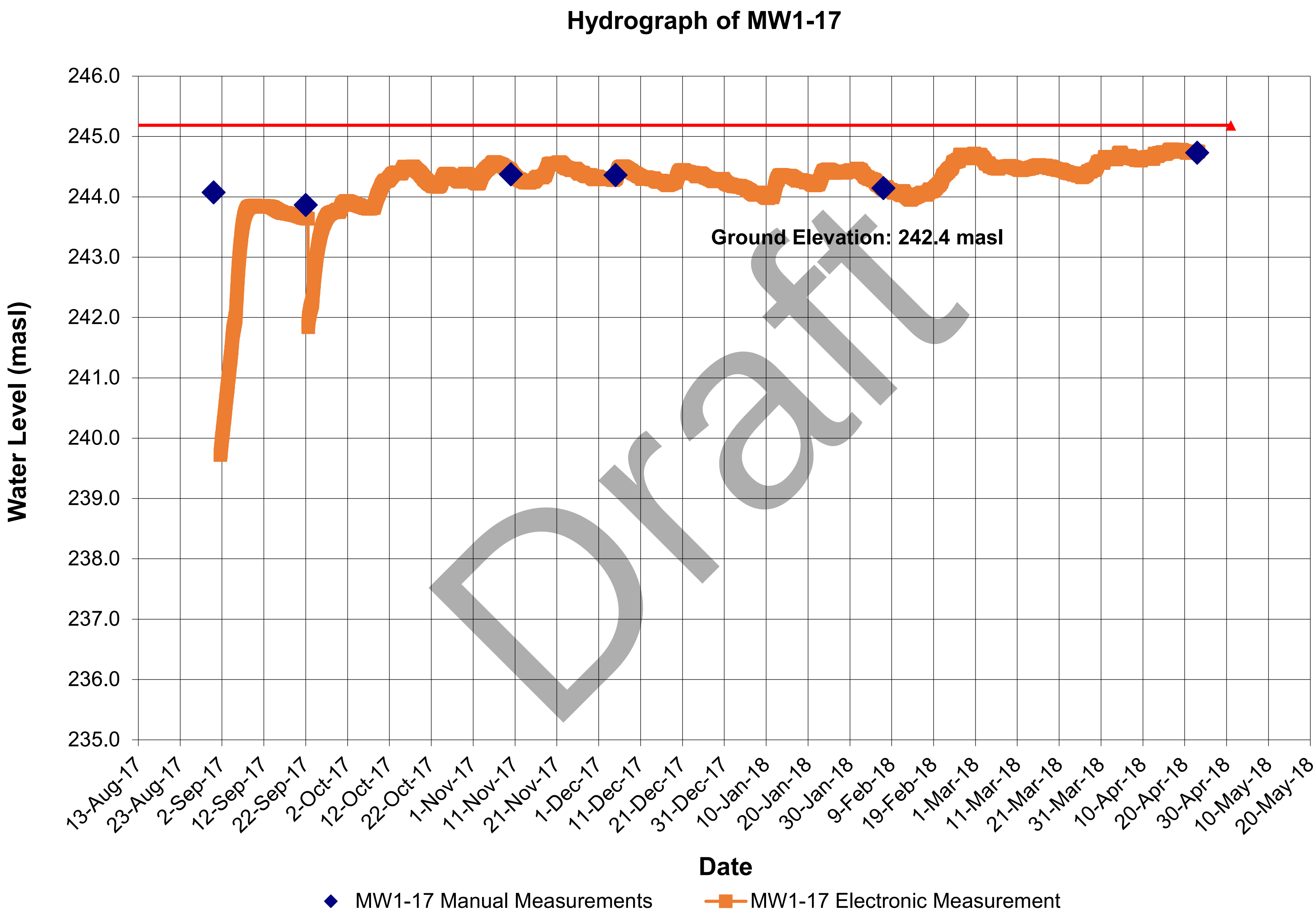
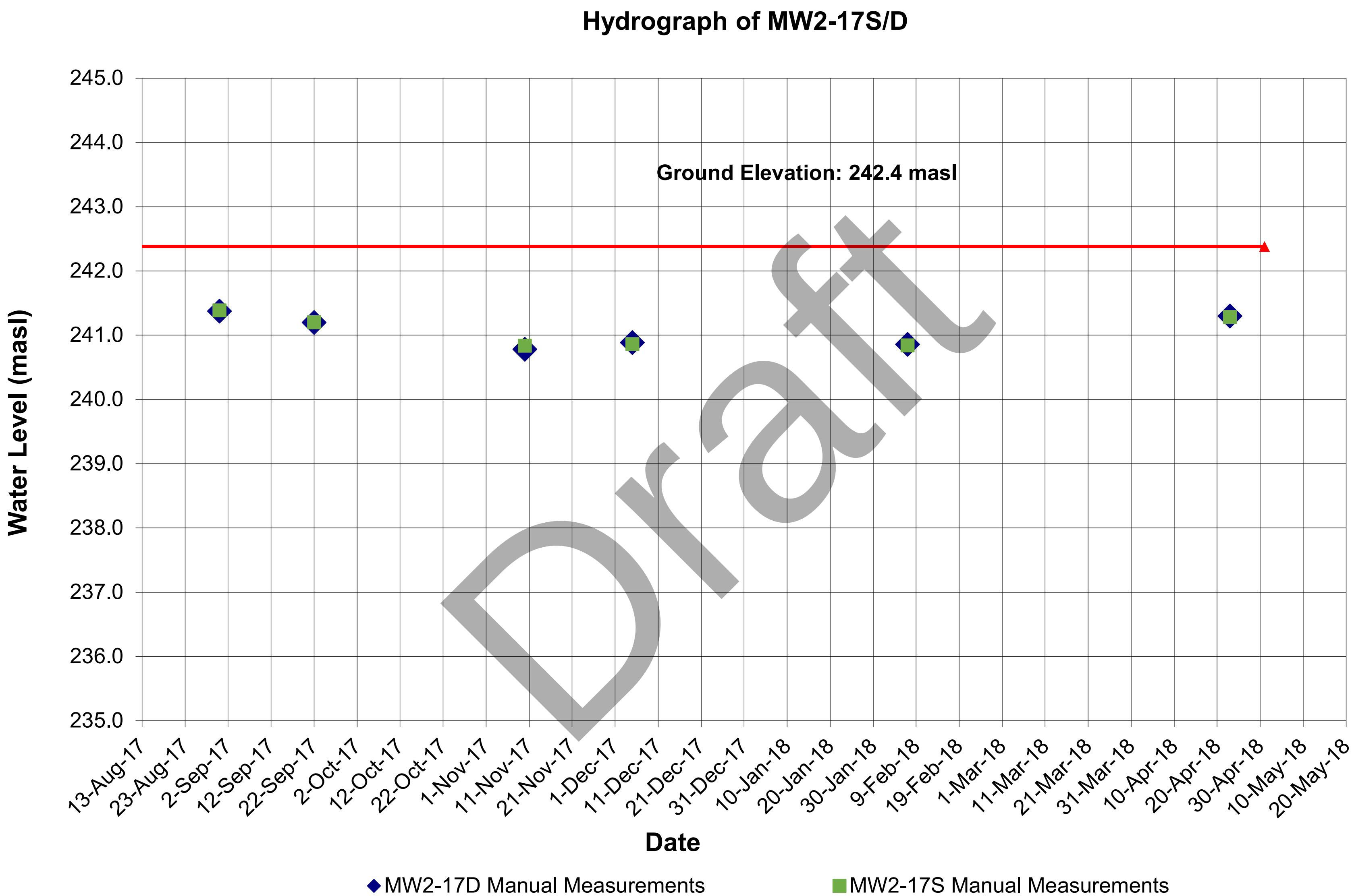
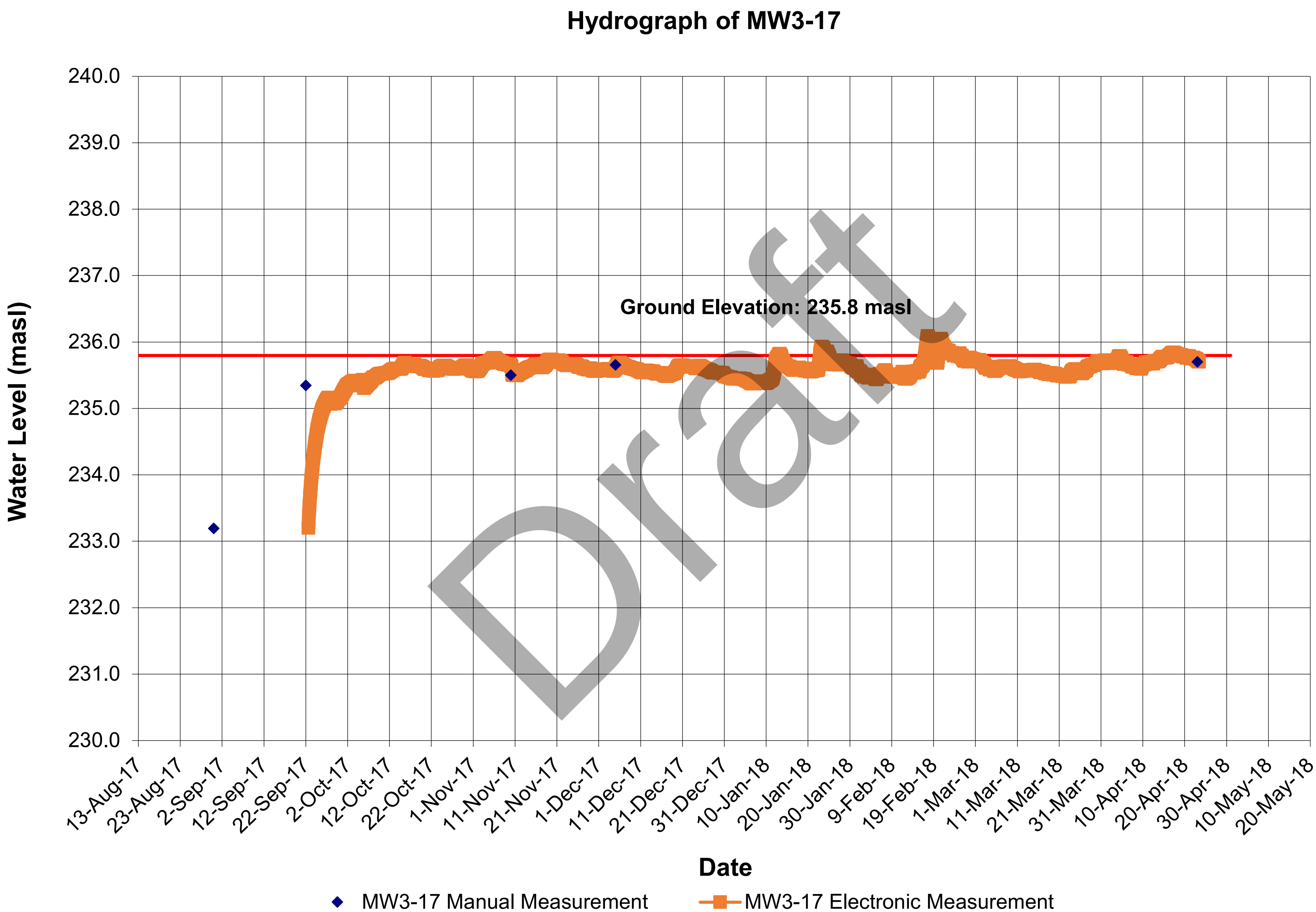
LEGEND	MONITORING WELL DATA	SAMPLE TYPE
▼ Water found @ time of drilling	Pipe: **51 mm dia. PVC**	AC Auger Cutting; SS Split Spoon
▽ Static Water Level - 1/11/2007	Screen: **51 mm dia. PVC #10 slot**	CS Continuous; AR Air Rotary
		RC Rock Core; WC Wash Cuttings

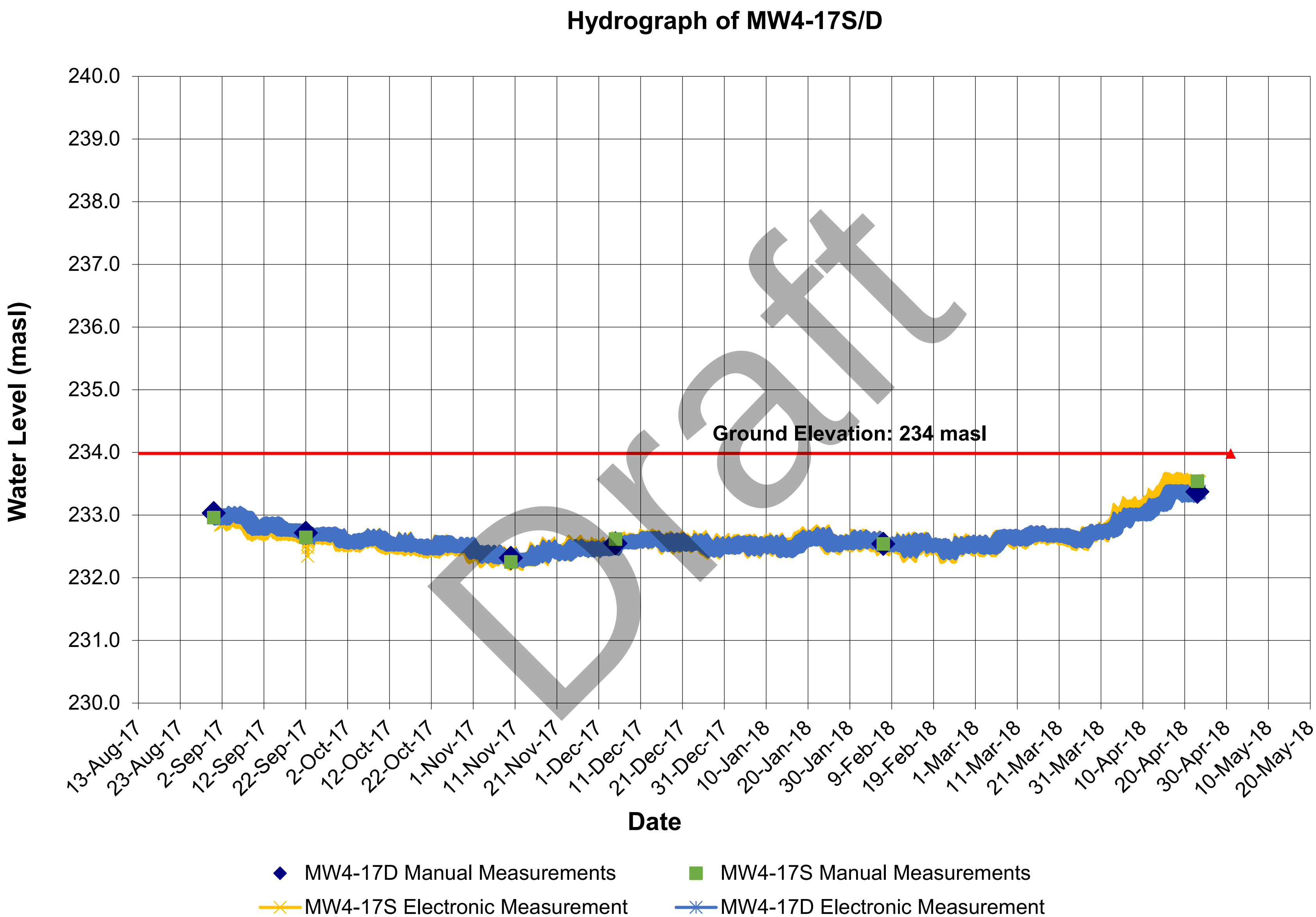
Appendix B

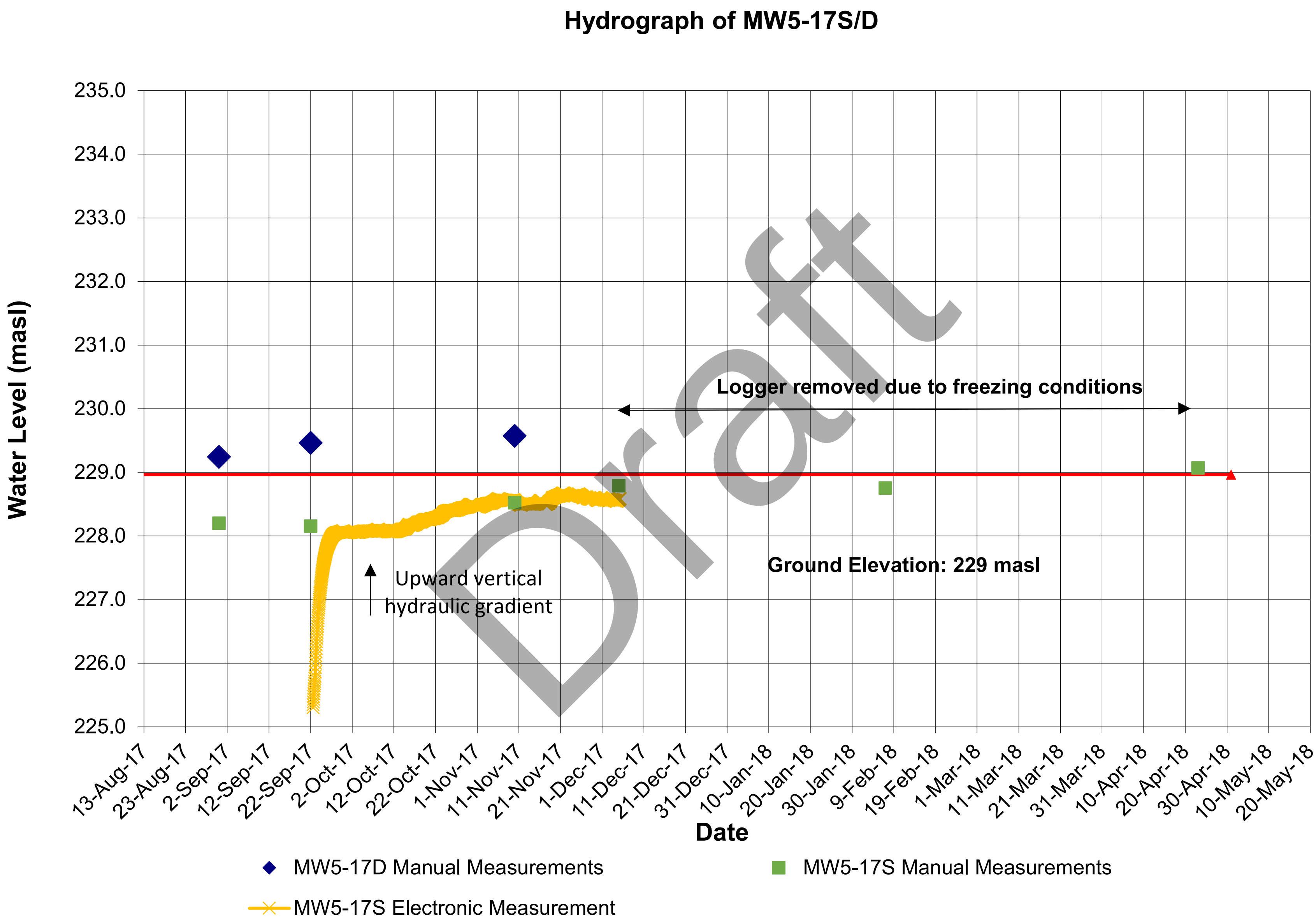
Groundwater Hydrographs

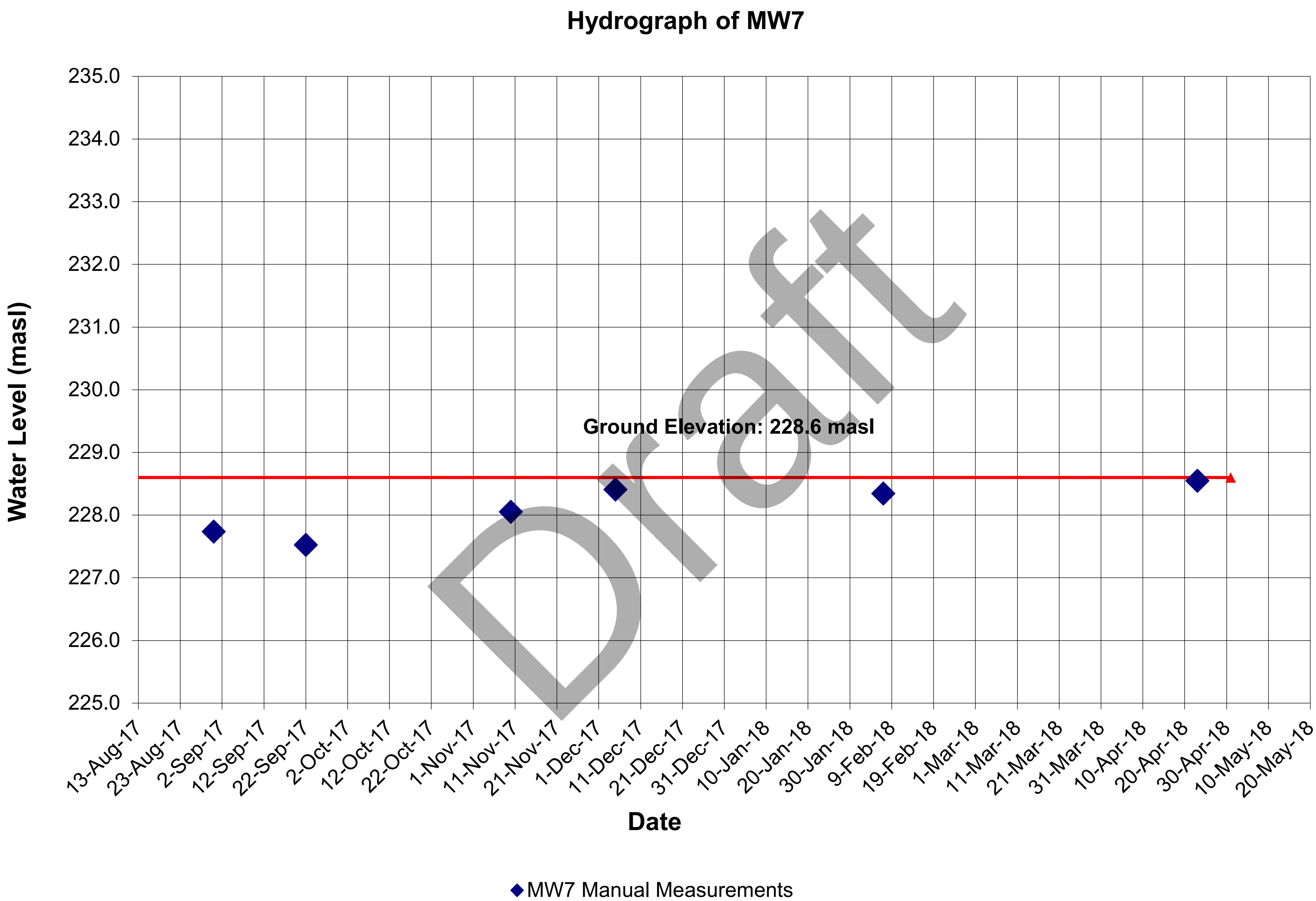

Hydrograph of MW1-17
Water Level (masl)
246.0
245.0
244.0
243.0
242.0
241.0
240.0
239.0
238.0
237.0
236.0
235.0
Ground Elevation: 242.4 masl
13-Aug-17
23-Aug-17
2-Sep-17
12-Sep-17
22-Sep-17
2-Oct-17
12-Oct-17
22-Oct-17
1-Nov-17
11-Nov-17
21-Nov-17
1-Dec-17
11-Dec-17
21-Dec-17
31-Dec-17
10-Jan-18
20-Jan-18
30-Jan-18
9-Feb-18
19-Feb-18
1-Mar-18
11-Mar-18
21-Mar-18
31-Mar-18
10-Apr-18
20-Apr-18
30-Apr-18
10-May-18
20-May-18
Date
MW1-17 Manual Measurements
MW1-17 Electronic Measurement
Draft

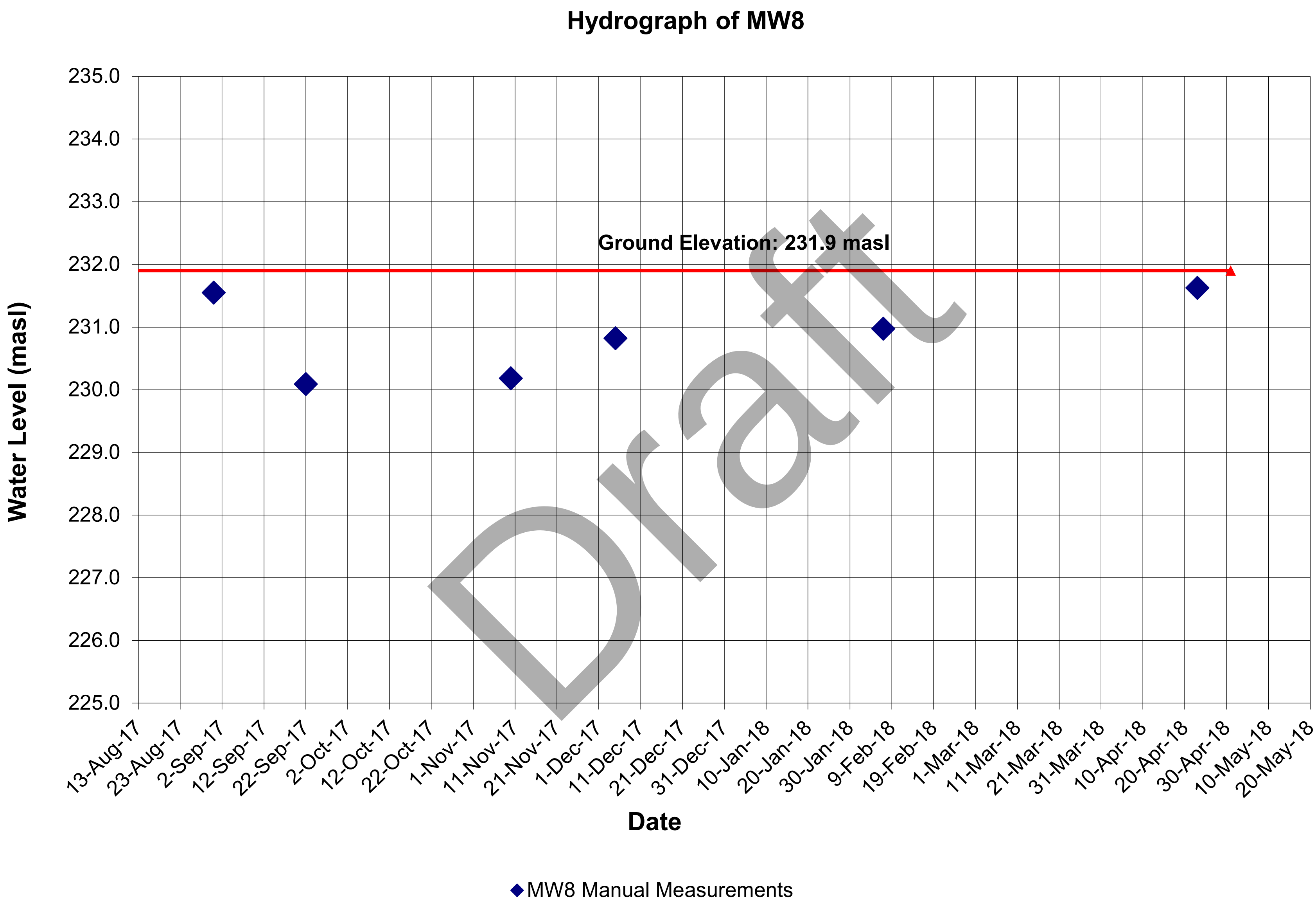

Hydrograph of MW2-17S/D
Water Level (masl)
245.0
244.0
243.0
242.0
241.0
240.0
239.0
238.0
237.0
236.0
235.0
Ground Elevation: 242.4 masl
13-Aug-17
23-Aug-17
2-Sep-17
12-Sep-17
22-Sep-17
2-Oct-17
12-Oct-17
22-Oct-17
1-Nov-17
11-Nov-17
21-Nov-17
1-Dec-17
11-Dec-17
21-Dec-17
31-Dec-17
10-Jan-18
20-Jan-18
30-Jan-18
9-Feb-18
19-Feb-18
1-Mar-18
11-Mar-18
21-Mar-18
31-Mar-18
10-Apr-18
20-Apr-18
30-Apr-18
10-May-18
20-May-18
Date
MW2-17D Manual Measurements
MW2-17S Manual Measurements
Draft

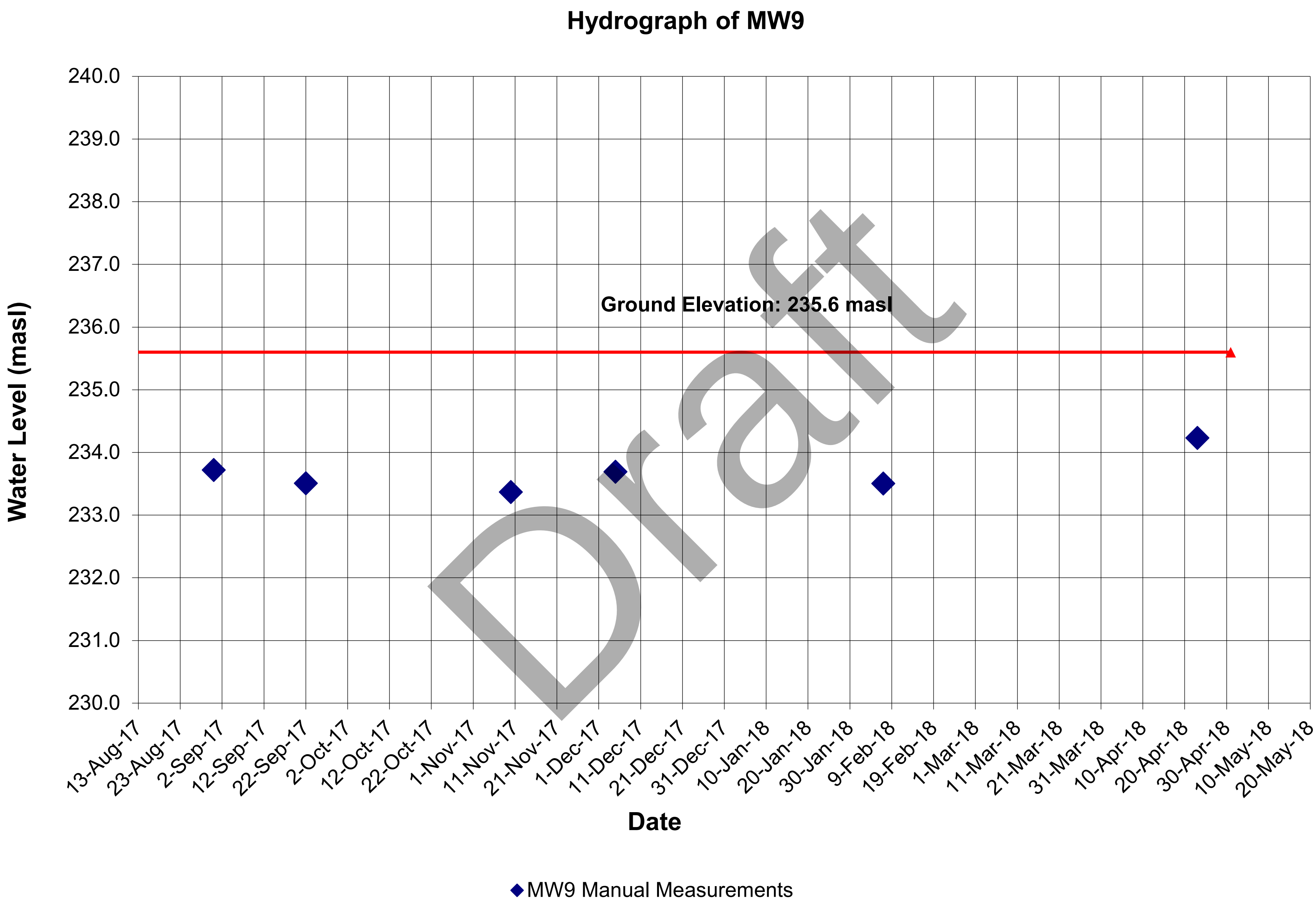

Hydrograph of MW3-17
240.0
239.0
238.0
237.0
236.0
235.0
234.0
233.0
232.0
231.0
230.0
Water Level (masl)
Ground Elevation: 235.8 masl
Draft
13-Aug-17
23-Aug-17
2-Sep-17
12-Sep-17
22-Sep-17
2-Oct-17
12-Oct-17
22-Oct-17
1-Nov-17
11-Nov-17
21-Nov-17
1-Dec-17
11-Dec-17
21-Dec-17
31-Dec-17
10-Jan-18
20-Jan-18
30-Jan-18
9-Feb-18
19-Feb-18
1-Mar-18
11-Mar-18
21-Mar-18
31-Mar-18
10-Apr-18
20-Apr-18
30-Apr-18
10-May-18
20-May-18
Date
MW3-17 Manual Measurement
MW3-17 Electronic Measurement


Hydrograph of MW4-17S/D
Water Level (masl)
240.0
239.0
238.0
237.0
236.0
235.0
234.0
233.0
232.0
231.0
230.0
Ground Elevation: 234 masl
13-Aug-17
23-Aug-17
2-Sep-17
12-Sep-17
22-Sep-17
2-Oct-17
12-Oct-17
22-Oct-17
1-Nov-17
11-Nov-17
21-Nov-17
1-Dec-17
11-Dec-17
21-Dec-17
31-Dec-17
10-Jan-18
20-Jan-18
30-Jan-18
9-Feb-18
19-Feb-18
1-Mar-18
11-Mar-18
21-Mar-18
31-Mar-18
10-Apr-18
20-Apr-18
30-Apr-18
10-May-18
20-May-18
Date
MW4-17D Manual Measurements
MW4-17S Manual Measurements
MW4-17S Electronic Measurement
MW4-17D Electronic Measurement
Draft


Hydrograph of MW5-17S/D
Water Level (masl)
235.0
234.0
233.0
232.0
231.0
230.0
229.0
228.0
227.0
226.0
225.0
Logger removed due to freezing conditions
Upward vertical hydraulic gradient
Ground Elevation: 229 masl
Draft
13-Aug-17
23-Aug-17
2-Sep-17
12-Sep-17
22-Sep-17
2-Oct-17
12-Oct-17
22-Oct-17
1-Nov-17
11-Nov-17
21-Nov-17
1-Dec-17
11-Dec-17
21-Dec-17
31-Dec-17
10-Jan-18
20-Jan-18
30-Jan-18
9-Feb-18
19-Feb-18
1-Mar-18
11-Mar-18
21-Mar-18
31-Mar-18
10-Apr-18
20-Apr-18
30-Apr-18
10-May-18
20-May-18
Date
MW5-17D Manual Measurements
MW5-17S Manual Measurements
MW5-17S Electronic Measurement

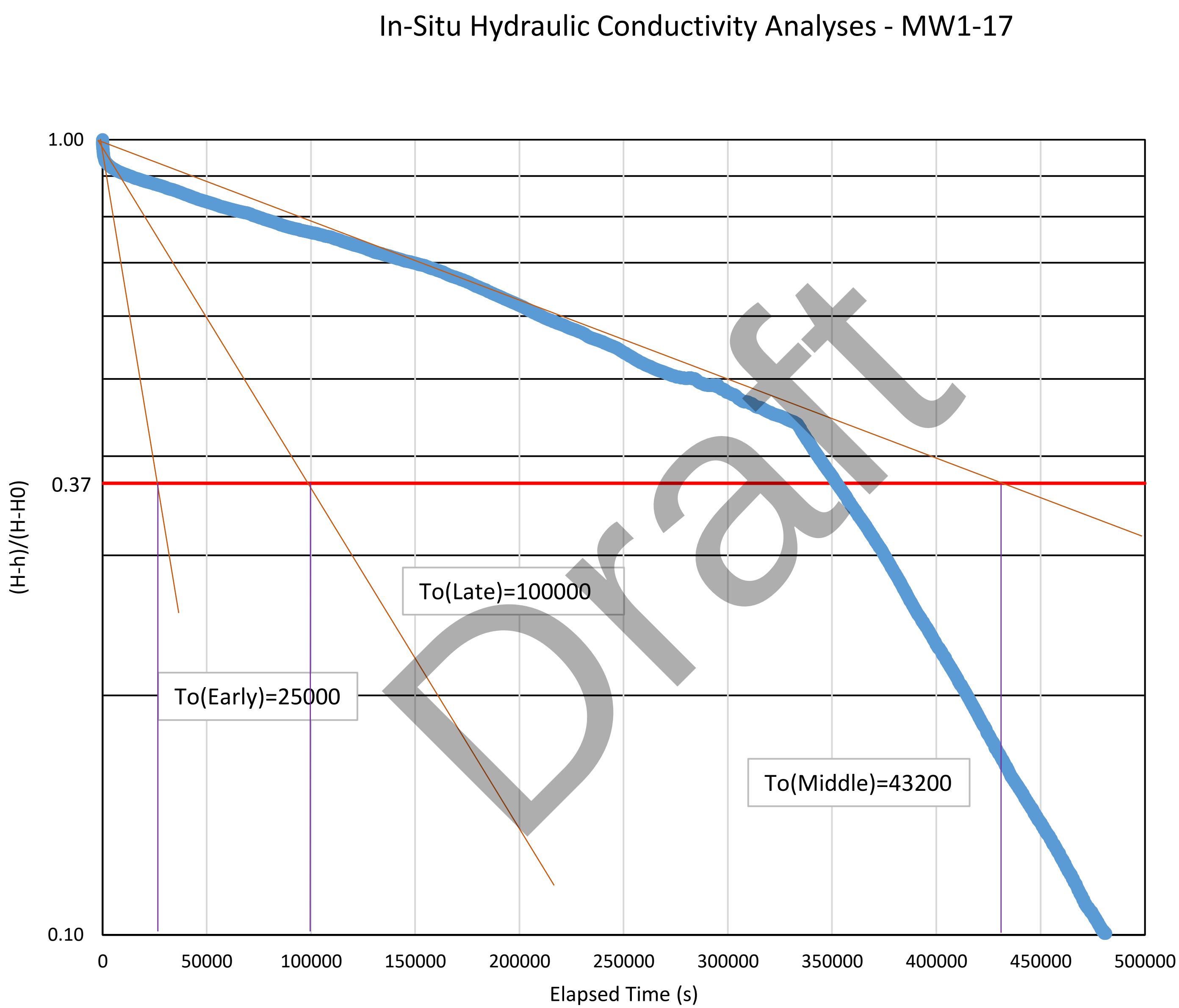

Hydrograph of MW7
Water Level (masl)
235.0
234.0
233.0
232.0
231.0
230.0
229.0
228.0
227.0
226.0
225.0
Ground Elevation: 228.6 masl
13-Aug-17
23-Aug-17
2-Sep-17
12-Sep-17
22-Sep-17
2-Oct-17
12-Oct-17
22-Oct-17
1-Nov-17
11-Nov-17
21-Nov-17
1-Dec-17
11-Dec-17
21-Dec-17
31-Dec-17
10-Jan-18
20-Jan-18
30-Jan-18
9-Feb-18
19-Feb-18
1-Mar-18
11-Mar-18
21-Mar-18
31-Mar-18
10-Apr-18
20-Apr-18
30-Apr-18
10-May-18
20-May-18
Date
MW7 Manual Measurements
Draft


Hydrograph of MW8
Water Level (masl)
235.0
234.0
233.0
232.0
231.0
230.0
229.0
228.0
227.0
226.0
225.0
Ground Elevation: 231.9 masl
13-Aug-17
23-Aug-17
2-Sep-17
12-Sep-17
22-Sep-17
2-Oct-17
12-Oct-17
22-Oct-17
1-Nov-17
11-Nov-17
21-Nov-17
1-Dec-17
11-Dec-17
21-Dec-17
31-Dec-17
10-Jan-18
20-Jan-18
30-Jan-18
9-Feb-18
19-Feb-18
1-Mar-18
11-Mar-18
21-Mar-18
31-Mar-18
10-Apr-18
20-Apr-18
30-Apr-18
10-May-18
20-May-18
Date
MW8 Manual Measurements
Draft


Hydrograph of MW9
240.0
239.0
238.0
237.0
236.0
235.0
234.0
233.0
232.0
231.0
230.0
Water Level (masl)
Ground Elevation: 235.6 masl
Draft
13-Aug-17
23-Aug-17
2-Sep-17
12-Sep-17
22-Sep-17
2-Oct-17
12-Oct-17
22-Oct-17
1-Nov-17
11-Nov-17
21-Nov-17
1-Dec-17
11-Dec-17
21-Dec-17
31-Dec-17
10-Jan-18
20-Jan-18
30-Jan-18
9-Feb-18
19-Feb-18
1-Mar-18
11-Mar-18
21-Mar-18
31-Mar-18
10-Apr-18
20-Apr-18
30-Apr-18
10-May-18
20-May-18
Date
MW9 Manual Measurements

Appendix C

Hydraulic Conductivity Analysis


In-Situ Hydraulic Conductivity Analyses - MW1-17
1.00
0.37
0.10
(H-h)/(H-H0)
0
50000
100000
150000
200000
250000
300000
350000
400000
450000
500000
Elapsed Time (s)
To(Late)=100000
To(Early)=25000
To(Middle)=43200
Draft

Bolton Option 6 Expansion Lands

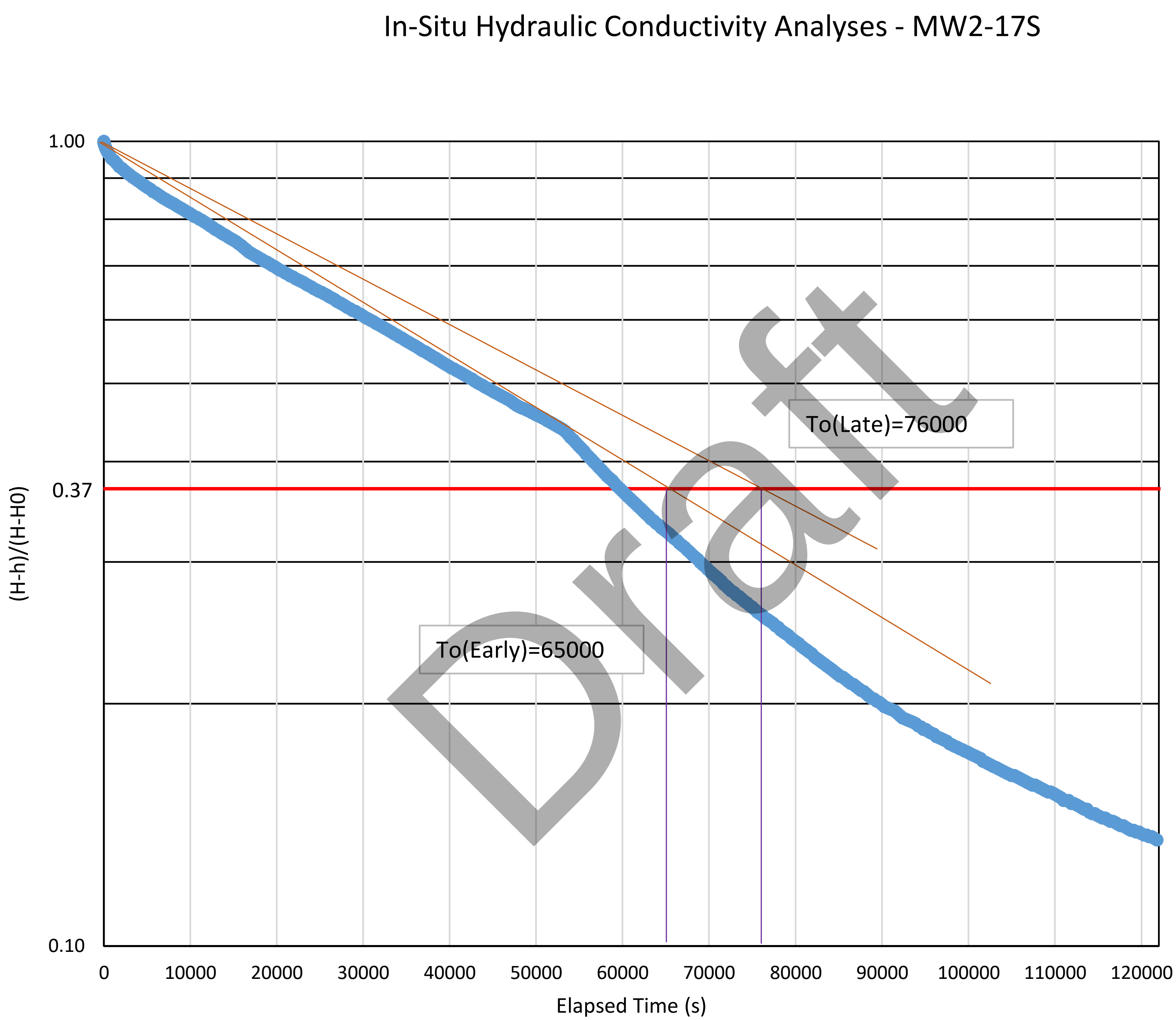
In-Situ Hydraulic Conductivity Analyses - MW1-17

Date: 1-Sep-17

Conducted By:	AH-AO	
Well Depth:	6.63	mbtor
Screened Unit:		
Initial Water Level:	1.82	mbtor
Available Drawdown (H):	4.81	m
Head at Time = 0 (Ho):	6.5	m
Screen Length (L):	3	m
Borehole Radius (R):	0.0775	m
Monitoring Well Radius (r):	0.025	m
Stick Up	0.71	m

To(early):	25000	s
K(early):	1.52E-08	m/s
To(late):	100000	s
K(late):	3.81E-09	m/s
To(middle)	43200	s
K(middle):	8.82E-09	m/s
K(average)	8.0E-09	m/s
Recovery:	90.4%	%

Elapsed Time (s)	Water Level (mtor)	H-h	H-Ho	(H-h)/(H-Ho)
0	6.500	4.680	4.680	1.000
10	6.485	4.665	4.680	0.997
20	6.475	4.655	4.680	0.995
30	6.468	4.648	4.680	0.993
40	6.460	4.640	4.680	0.991
50	6.454	4.634	4.680	0.990
60	6.446	4.626	4.680	0.988
75	6.438	4.618	4.680	0.987
90	6.430	4.610	4.680	0.985
105	6.424	4.604	4.680	0.984
120	6.415	4.595	4.680	0.982
150	6.402	4.582	4.680	0.979
180	6.390	4.570	4.680	0.976
210	6.378	4.558	4.680	0.974
240	6.365	4.545	4.680	0.971
270	6.355	4.535	4.680	0.969
300	6.345	4.525	4.680	0.967
360	6.328	4.508	4.680	0.963
420	6.315	4.495	4.680	0.960
480	6.304	4.484	4.680	0.958
540	6.292	4.472	4.680	0.956
600	6.281	4.461	4.680	0.953
900	6.242	4.422	4.680	0.945
1200	6.217	4.397	4.680	0.940
1500	6.208	4.388	4.680	0.938
1800	6.199	4.379	4.680	0.936
2100	6.190	4.370	4.680	0.934
2400	6.178	4.358	4.680	0.931
2700	6.172	4.352	4.680	0.930
3000	6.163	4.343	4.680	0.928
3300	6.157	4.337	4.680	0.927
3600	6.151	4.331	4.680	0.925
3900	6.145	4.325	4.680	0.924
4200	6.139	4.319	4.680	0.923


In-Situ Hydraulic Conductivity Analyses - MW2-17S
1.00
0.37
0.10
(H-h)/(H-H0)
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
110000
120000
Elapsed Time (s)
To(Late)=76000
To(Early)=65000
Draft

Bolton Option 6 Expansion Lands

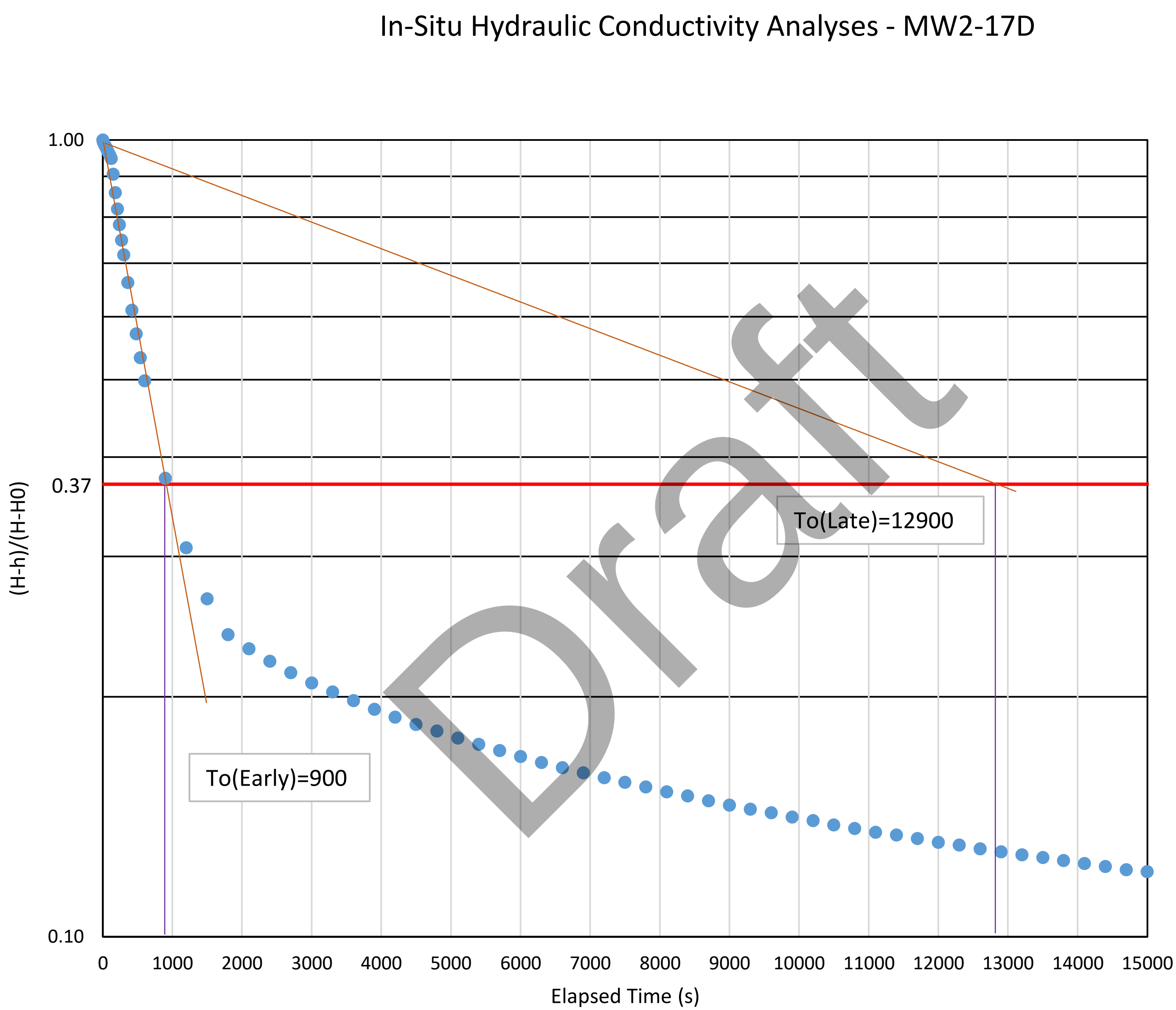
In-Situ Hydraulic Conductivity Analyses - MW2-17S

Date: 1-Sep-17

Conducted By:	AH-AO	
Well Depth:	6.79	mbtor
Screened Unit:		
Initial Water Level:	1.74	mbtor
Available Drawdown (H):	5.05	m
Head at Time = 0 (Ho):	6.6	m
Screen Length (L):	3	m
Borehole Radius (R):	0.0775	m
Monitoring Well Radius (r):	0.025	m
Stick Up	0.72	m

To(early):	65000	s
K(early):	5.86E-09	m/s
To(late):	75000	s
K(late):	5.08E-09	m/s
K(average)	5.5E-09	m/s
Recovery:	86.9%	%

Elapsed Time (s)	Water Level (mtor)	H-h	H-Ho	(H-h)/(H-Ho)
0	6.562	4.822	4.822	1.000
10	6.555	4.815	4.822	0.999
20	6.555	4.815	4.822	0.999
30	6.544	4.804	4.822	0.996
40	6.540	4.800	4.822	0.995
50	6.535	4.795	4.822	0.994
60	6.530	4.790	4.822	0.993
75	6.525	4.785	4.822	0.992
90	6.518	4.778	4.822	0.991
105	6.512	4.772	4.822	0.990
120	6.507	4.767	4.822	0.989
150	6.497	4.757	4.822	0.987
180	6.486	4.746	4.822	0.984
210	6.476	4.736	4.822	0.982
240	6.467	4.727	4.822	0.980
270	6.459	4.719	4.822	0.979
300	6.450	4.710	4.822	0.977
360	6.433	4.693	4.822	0.973
420	6.421	4.681	4.822	0.971
480	6.409	4.669	4.822	0.968
540	6.396	4.656	4.822	0.966
600	6.385	4.645	4.822	0.963
900	6.327	4.587	4.822	0.951
1200	6.302	4.562	4.822	0.946
1500	6.263	4.523	4.822	0.938
1800	6.227	4.487	4.822	0.931
2100	6.200	4.460	4.822	0.925
2400	6.173	4.433	4.822	0.919
2700	6.146	4.406	4.822	0.914
3000	6.122	4.382	4.822	0.909
3300	6.095	4.355	4.822	0.903
3600	6.074	4.334	4.822	0.899
3900	6.050	4.310	4.822	0.894
4200	6.029	4.289	4.822	0.889


In-Situ Hydraulic Conductivity Analyses - MW2-17D
1.00
0.37
0.10
(H-h)/(H-H0)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
15000
Elapsed Time (s)
To(Late)=12900
To(Early)=900
Draft

Bolton Option 6 Expansion Lands

In-Situ Hydraulic Conductivity Analyses - MW2-17D

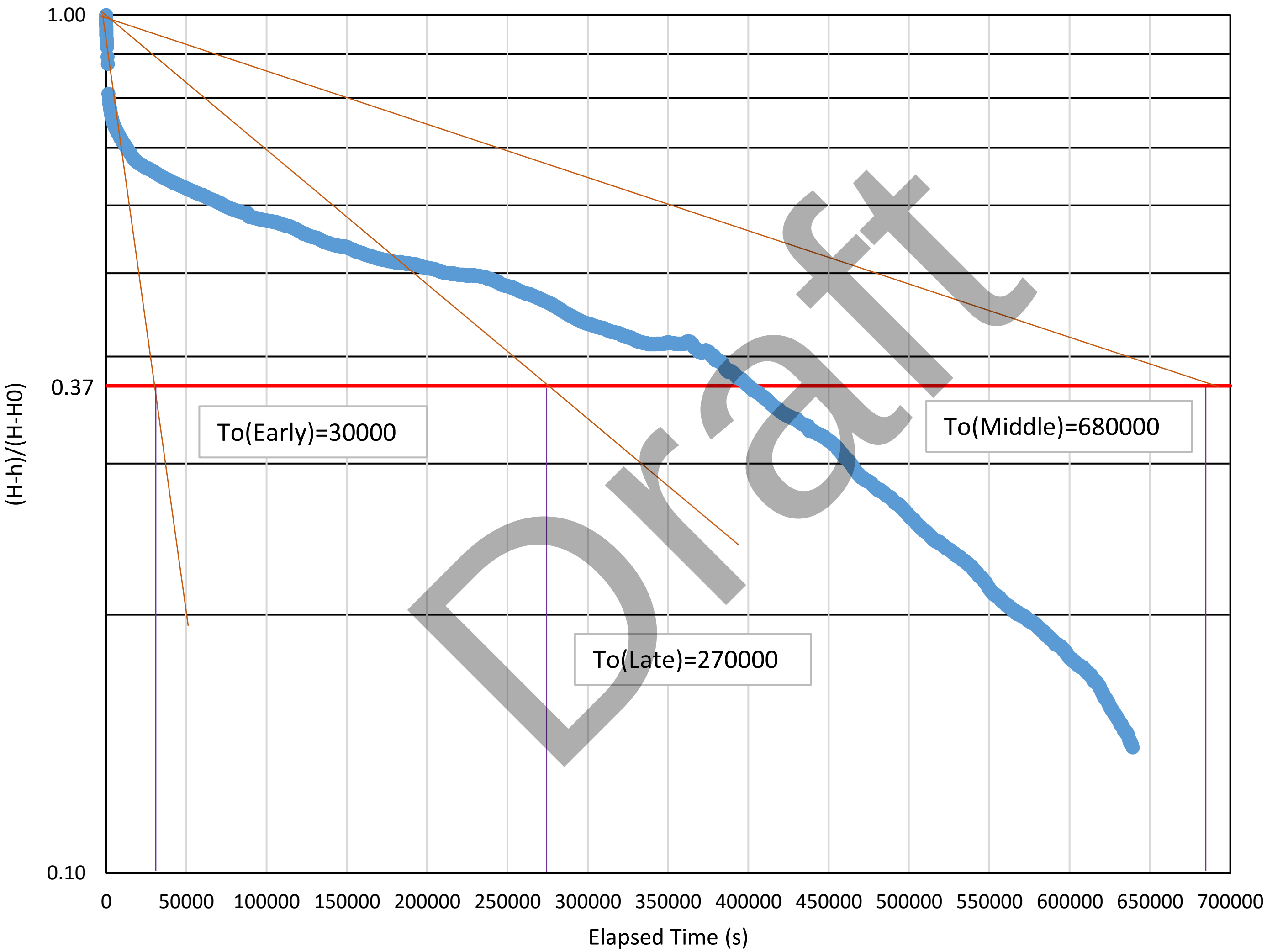
Date: 1-Sep-17

Conducted By:	AH-AO	
Well Depth:	12.26	mbtor
Screened Unit:		
Initial Water Level:	1.63	mbtor
Available Drawdown (H):	10.63	m
Head at Time = 0 (Ho):	10.1	m
Screen Length (L):	3	m
Borehole Radius (R):	0.0775	m
Monitoring Well Radius (r):	0.025	m
Stick Up	0.63	m

To(early):	900	s
K(early):	4.23E-07	m/s
To(late):	12900	s
K(late):	2.95E-08	m/s
K(average)	1.1E-07	m/s
Recovery:	92.5%	%

Elapsed Time (s)	Water Level (mtor)	H-h	H-Ho	(H-h)/(H-Ho)
0	10.065	8.435	8.435	1.000
10	10.010	8.380	8.435	0.993
20	9.975	8.345	8.435	0.989
30	9.940	8.310	8.435	0.985
40	9.905	8.275	8.435	0.981
50	9.872	8.242	8.435	0.977
60	9.836	8.206	8.435	0.973
75	9.782	8.152	8.435	0.966
90	9.735	8.105	8.435	0.961
105	9.682	8.052	8.435	0.955
120	9.623	7.993	8.435	0.948
150	9.270	7.640	8.435	0.906
180	8.875	7.245	8.435	0.859
210	8.540	6.910	8.435	0.819
240	8.233	6.603	8.435	0.783
270	7.945	6.315	8.435	0.749
300	7.682	6.052	8.435	0.717
360	7.218	5.588	8.435	0.662
420	6.789	5.159	8.435	0.612
480	6.445	4.815	8.435	0.571
540	6.125	4.495	8.435	0.533
600	5.836	4.206	8.435	0.499
900	4.802	3.172	8.435	0.376
1200	4.225	2.595	8.435	0.308
1500	3.870	2.240	8.435	0.266
1800	3.650	2.020	8.435	0.239
2100	3.569	1.939	8.435	0.230
2400	3.500	1.870	8.435	0.222
2700	3.440	1.810	8.435	0.215
3000	3.386	1.756	8.435	0.208
3300	3.341	1.711	8.435	0.203
3600	3.299	1.669	8.435	0.198
3900	3.257	1.627	8.435	0.193
4200	3.221	1.591	8.435	0.189

In-Situ Hydraulic Conductivity Analyses - MW3-17



Bolton Option 6 Expansion Lands

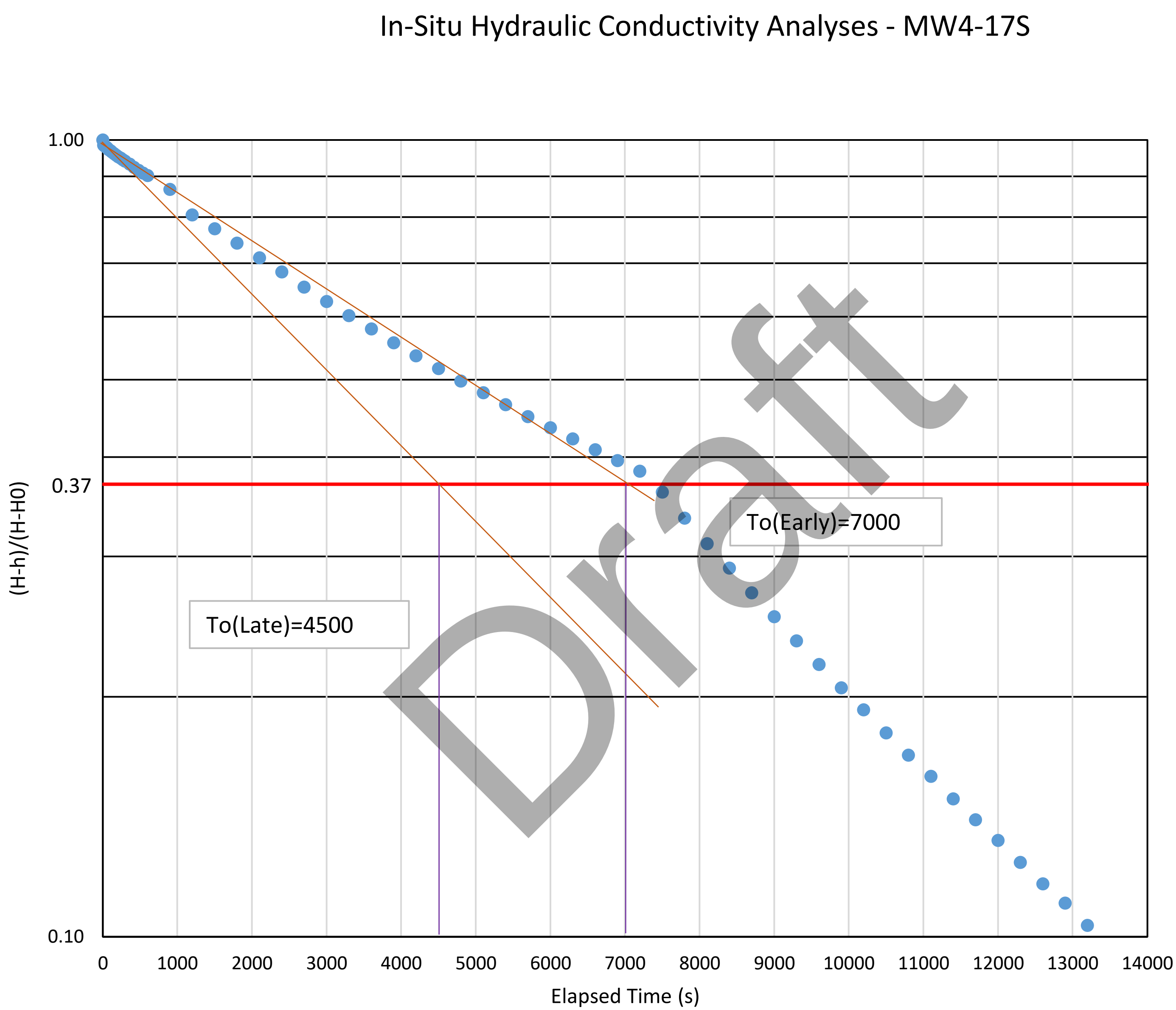
In-Situ Hydraulic Conductivity Analyses - MW3-17

Date: 1-Sep-17

Conducted By:	AH-AO	
Well Depth:	6.65	mbtor
Screened Unit:		
Initial Water Level:	3.25	mbtor
Available Drawdown (H):	3.40	m
Head at Time = 0 (Ho):	6.5	m
Screen Length (L):	3	m
Borehole Radius (R):	0.0775	m
Monitoring Well Radius (r):	0.025	m
Stick Up	0.65	m

To(early):	30000	s
K(early):	1.27E-08	m/s
To(late):	270000	s
K(late):	1.41E-09	m/s
To(middle)	680000	s
K(middle):	5.60E-10	m/s
K(average)	2.2E-09	m/s
Recovery:	90.4%	%

Elapsed Time (s)	Water Level (mtor)	H-h	H-Ho	(H-h)/(H-Ho)
0	6.534	3.284	3.284	1.000
10	6.520	3.270	3.284	0.996
20	6.515	3.265	3.284	0.994
30	6.505	3.255	3.284	0.991
40	6.495	3.245	3.284	0.988
50	6.490	3.240	3.284	0.987
60	6.482	3.232	3.284	0.984
75	6.472	3.222	3.284	0.981
90	6.464	3.214	3.284	0.979
105	6.454	3.204	3.284	0.976
120	6.445	3.195	3.284	0.973
150	6.428	3.178	3.284	0.968
180	6.410	3.160	3.284	0.962
210	6.397	3.147	3.284	0.958
240	6.382	3.132	3.284	0.954
270	6.370	3.120	3.284	0.950
300	6.358	3.108	3.284	0.946
360	6.335	3.085	3.284	0.939
420	6.317	3.067	3.284	0.934
480	6.296	3.046	3.284	0.928
540	6.280	3.030	3.284	0.923
600	6.265	3.015	3.284	0.918
900	6.185	2.935	3.284	0.894
1200	6.131	2.881	3.284	0.877
1500	5.909	2.659	3.284	0.810
1800	5.870	2.620	3.284	0.798
2100	5.837	2.587	3.284	0.788
2400	5.810	2.560	3.284	0.780
2700	5.789	2.539	3.284	0.773
3000	5.771	2.521	3.284	0.768
3300	5.756	2.506	3.284	0.763
3600	5.741	2.491	3.284	0.759
3900	5.729	2.479	3.284	0.755
4200	5.717	2.467	3.284	0.751


In-Situ Hydraulic Conductivity Analyses - MW4-17S
1.00
0.37
0.10
(H-h)/(H-H0)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
Elapsed Time (s)
To(Early)=7000
To(Late)=4500
Draft

Bolton Option 6 Expansion Lands

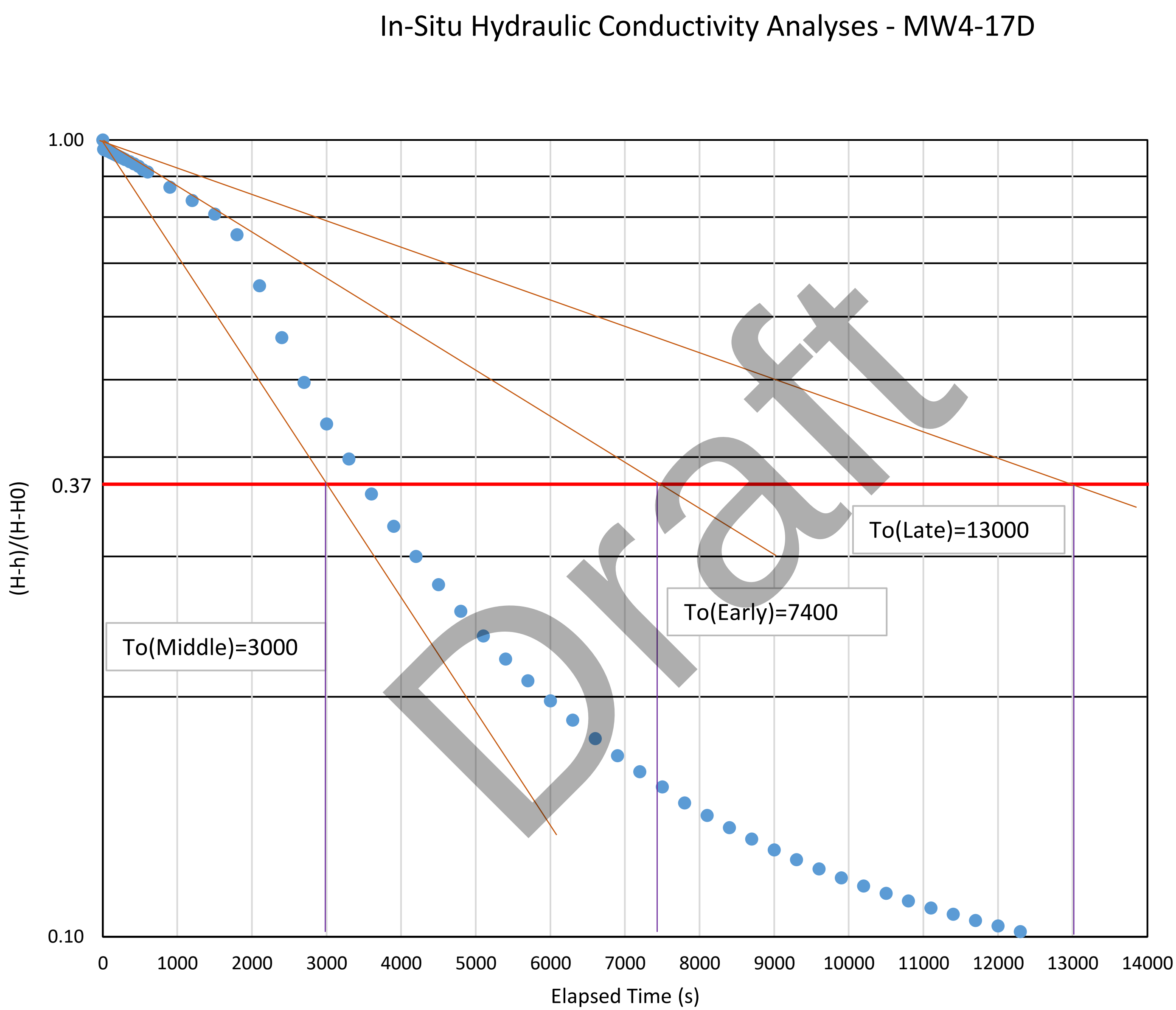
In-Situ Hydraulic Conductivity Analyses - MW4-17S

Date: 1-Sep-17

Conducted By:	AH-AO	
Well Depth:	6.72	mbtor
Screened Unit:		
Initial Water Level:	1.7	mbtor
Available Drawdown (H):	5.02	m
Head at Time = 0 (Ho):	6.5	m
Screen Length (L):	3	m
Borehole Radius (R):	0.0775	m
Monitoring Well Radius (r):	0.025	m
Stick Up	0.66	m

To(early):	7000	s
K(early):	5.44E-08	m/s
To(late):	4500	s
K(late):	8.46E-08	m/s
K(average)	6.8E-08	m/s
Recovery:	90.1%	%

Elapsed Time (s)	Water Level (mtor)	H-h	H-Ho	(H-h)/(H-Ho)
0	6.500	4.800	4.800	1.000
10	6.430	4.730	4.800	0.985
20	6.422	4.722	4.800	0.984
30	6.412	4.712	4.800	0.982
40	6.405	4.705	4.800	0.980
50	6.400	4.700	4.800	0.979
60	6.390	4.690	4.800	0.977
75	6.372	4.672	4.800	0.973
90	6.362	4.662	4.800	0.971
105	6.350	4.650	4.800	0.969
120	6.338	4.638	4.800	0.966
150	6.314	4.614	4.800	0.961
180	6.295	4.595	4.800	0.957
210	6.273	4.573	4.800	0.953
240	6.255	4.555	4.800	0.949
270	6.233	4.533	4.800	0.944
300	6.216	4.516	4.800	0.941
360	6.175	4.475	4.800	0.932
420	6.133	4.433	4.800	0.924
480	6.096	4.396	4.800	0.916
540	6.062	4.362	4.800	0.909
600	6.031	4.331	4.800	0.902
900	5.862	4.162	4.800	0.867
1200	5.565	3.865	4.800	0.805
1500	5.412	3.712	4.800	0.773
1800	5.262	3.562	4.800	0.742
2100	5.115	3.415	4.800	0.711
2400	4.977	3.277	4.800	0.683
2700	4.836	3.136	4.800	0.653
3000	4.710	3.010	4.800	0.627
3300	4.590	2.890	4.800	0.602
3600	4.479	2.779	4.800	0.579
3900	4.371	2.671	4.800	0.556
4200	4.272	2.572	4.800	0.536


In-Situ Hydraulic Conductivity Analyses - MW4-17D
1.00
0.37
0.10
(H-h)/(H-H0)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
Elapsed Time (s)
To(Middle)=3000
To(Early)=7400
To(Late)=13000
Draft

Bolton Option 6 Expansion Lands

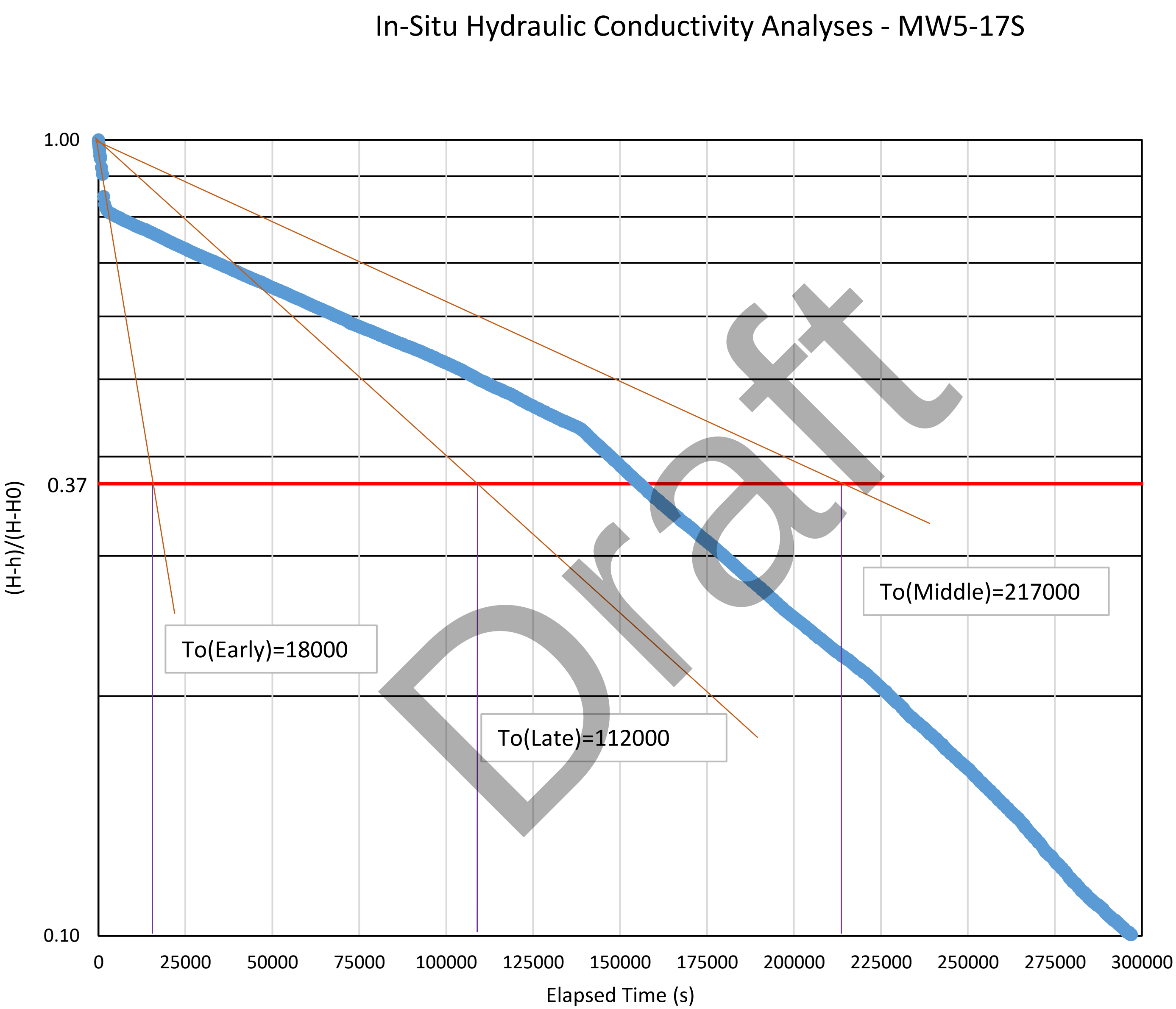
In-Situ Hydraulic Conductivity Analyses - MW4-17D

Date: 1-Sep-17

Conducted By:	AH-AO	
Well Depth:	12.84	mbtor
Screened Unit:		
Initial Water Level:	1.62	mbtor
Available Drawdown (H):	11.22	m
Head at Time = 0 (Ho):	12.5	m
Screen Length (L):	3	m
Borehole Radius (R):	0.0775	m
Monitoring Well Radius (r):	0.025	m
Stick Up	0.67	m

To(early):	7400	s
K(early):	5.15E-08	m/s
To(late):	13000	s
K(late):	2.93E-08	m/s
To(middle)	3000	s
K(middle):	1.27E-07	m/s
K(average)	5.8E-08	m/s
Recovery:	95.9%	%

Elapsed Time (s)	Water Level (mtor)	H-h	H-Ho	(H-h)/(H-Ho)
0	12.500	10.880	10.880	1.000
10	12.215	10.595	10.880	0.974
20	12.200	10.580	10.880	0.972
30	12.195	10.575	10.880	0.972
40	12.188	10.568	10.880	0.971
50	12.175	10.555	10.880	0.970
60	12.165	10.545	10.880	0.969
75	12.152	10.532	10.880	0.968
90	12.134	10.514	10.880	0.966
105	12.115	10.495	10.880	0.965
120	12.100	10.480	10.880	0.963
150	12.065	10.445	10.880	0.960
180	12.035	10.415	10.880	0.957
210	12.000	10.380	10.880	0.954
240	11.970	10.350	10.880	0.951
270	11.935	10.315	10.880	0.948
300	11.902	10.282	10.880	0.945
360	11.840	10.220	10.880	0.939
420	11.775	10.155	10.880	0.933
480	11.705	10.085	10.880	0.927
540	11.601	9.981	10.880	0.917
600	11.539	9.919	10.880	0.912
900	11.111	9.491	10.880	0.872
1200	10.753	9.133	10.880	0.839
1500	10.403	8.783	10.880	0.807
1800	9.891	8.271	10.880	0.760
2100	8.757	7.137	10.880	0.656
2400	7.767	6.147	10.880	0.565
2700	7.020	5.400	10.880	0.496
3000	6.408	4.788	10.880	0.440
3300	5.946	4.326	10.880	0.398
3600	5.532	3.912	10.880	0.360
3900	5.181	3.561	10.880	0.327
4200	4.884	3.264	10.880	0.300


In-Situ Hydraulic Conductivity Analyses - MW5-17S
1.00
0.37
0.10
(H-h)/(H-H0)
0
25000
50000
75000
100000
125000
150000
175000
200000
225000
250000
275000
300000
Elapsed Time (s)
To(Early)=18000
To(Late)=112000
To(Middle)=217000
Draft

Bolton Option 6 Expansion Lands

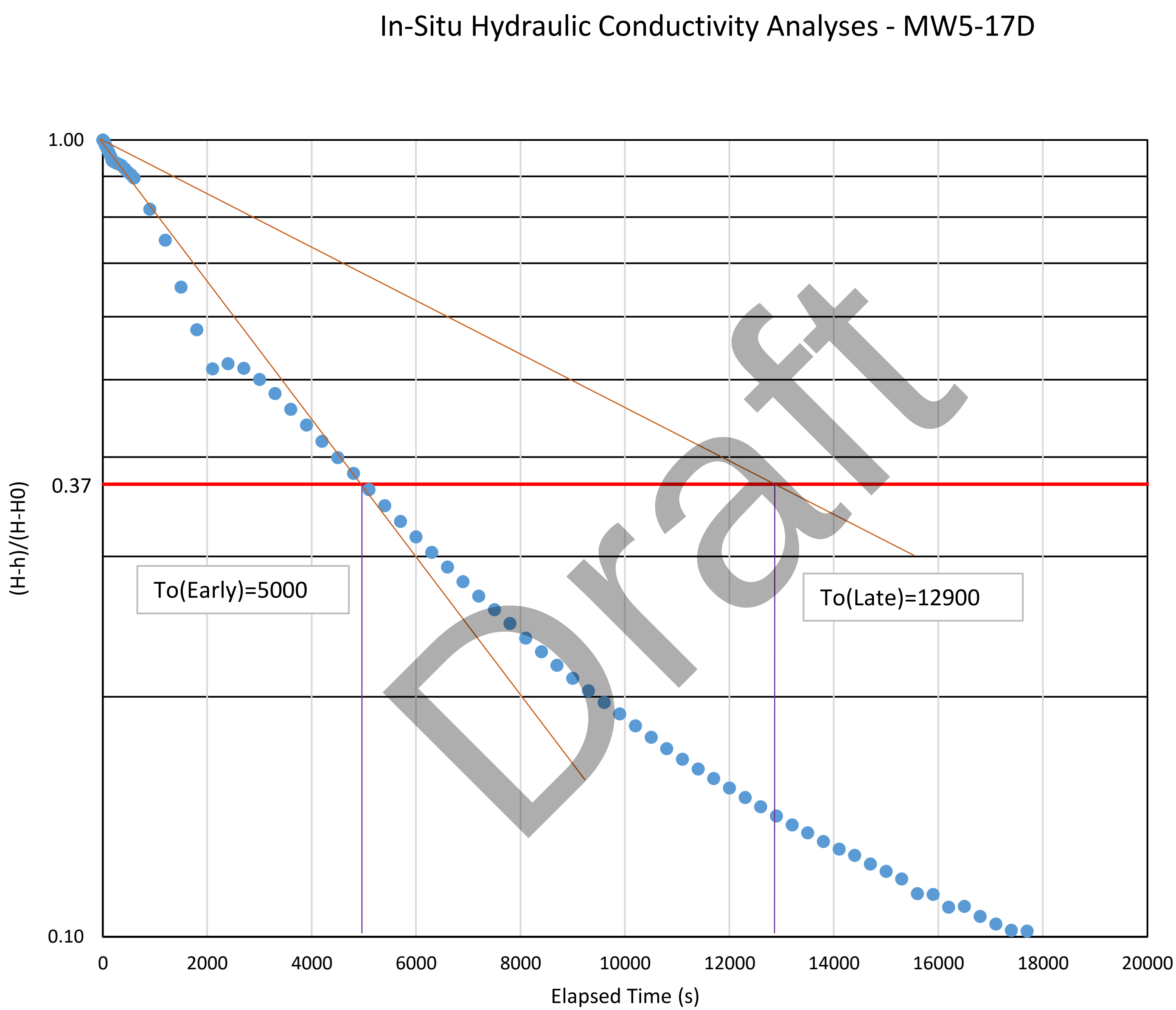
In-Situ Hydraulic Conductivity Analyses - MW5-17S

Date: 1-Sep-17

Conducted By:	AH-AO	
Well Depth:	6.84	mbtor
Screened Unit:		
Initial Water Level:	1.48	mbtor
Available Drawdown (H):	5.36	m
Head at Time = 0 (Ho):	6.5	m
Screen Length (L):	3	m
Borehole Radius (R):	0.0775	m
Monitoring Well Radius (r):	0.025	m
Stick Up	0.74	m

To(early):	18000	s
K(early):	2.12E-08	m/s
To(late):	112000	s
K(late):	3.40E-09	m/s
To(middle)	217000	s
K(middle):	1.76E-09	m/s
K(average)	5.0E-09	m/s
Recovery:	90.5%	%

Elapsed Time (s)	Water Level (mtor)	H-h	H-Ho	(H-h)/(H-Ho)
0	6.580	5.100	5.100	1.000
10	6.570	5.090	5.100	0.998
20	6.565	5.085	5.100	0.997
30	6.560	5.080	5.100	0.996
40	6.555	5.075	5.100	0.995
50	6.550	5.070	5.100	0.994
60	6.545	5.065	5.100	0.993
75	6.535	5.055	5.100	0.991
90	6.528	5.048	5.100	0.990
105	6.524	5.044	5.100	0.989
120	6.516	5.036	5.100	0.987
150	6.502	5.022	5.100	0.985
180	6.490	5.010	5.100	0.982
210	6.475	4.995	5.100	0.979
240	6.460	4.980	5.100	0.976
270	6.450	4.970	5.100	0.975
300	6.433	4.953	5.100	0.971
360	6.410	4.930	5.100	0.967
420	6.348	4.868	5.100	0.955
480	6.360	4.880	5.100	0.957
540	6.334	4.854	5.100	0.952
600	6.310	4.830	5.100	0.947
900	6.186	4.706	5.100	0.923
1200	6.096	4.616	5.100	0.905
1500	5.808	4.328	5.100	0.849
1800	5.712	4.232	5.100	0.830
2100	5.667	4.187	5.100	0.821
2400	5.643	4.163	5.100	0.816
2700	5.628	4.148	5.100	0.813
3000	5.616	4.136	5.100	0.811
3300	5.607	4.127	5.100	0.809
3600	5.598	4.118	5.100	0.807
3900	5.595	4.115	5.100	0.807
4200	5.586	4.106	5.100	0.805


In-Situ Hydraulic Conductivity Analyses - MW5-17D
1.00
0.37
0.10
(H-h)/(H-H0)
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Elapsed Time (s)
To(Early)=5000
To(Late)=12900
Draft

Bolton Option 6 Expansion Lands

In-Situ Hydraulic Conductivity Analyses - MW5-17D

Date: 1-Sep-17

Conducted By:	AH-AO	
Well Depth:	12.94	mbtor
Screened Unit:		
Initial Water Level:	0.4	mbtor
Available Drawdown (H):	12.54	m
Head at Time = 0 (Ho):	12.0	m
Screen Length (L):	3	m
Borehole Radius (R):	0.0775	m
Monitoring Well Radius (r):	0.025	m
Stick Up	0.68	m

To(early):	5000	s
K(early):	7.62E-08	m/s
To(late):	12900	s
K(late):	2.95E-08	m/s
K(average)	4.7E-08	m/s
Recovery:	90.6%	%

Elapsed Time (s)	Water Level (mtor)	H-h	H-Ho	(H-h)/(H-Ho)
0	12.000	11.600	11.600	1.000
10	11.980	11.580	11.600	0.998
20	11.960	11.560	11.600	0.997
30	11.922	11.522	11.600	0.993
40	11.880	11.480	11.600	0.990
50	11.842	11.442	11.600	0.986
60	11.805	11.405	11.600	0.983
75	11.746	11.346	11.600	0.978
90	11.693	11.293	11.600	0.974
105	11.635	11.235	11.600	0.969
120	11.575	11.175	11.600	0.963
150	11.465	11.065	11.600	0.954
180	11.332	10.932	11.600	0.942
210	11.291	10.891	11.600	0.939
240	11.270	10.870	11.600	0.937
270	11.246	10.846	11.600	0.935
300	11.223	10.823	11.600	0.933
360	11.172	10.772	11.600	0.929
420	11.073	10.673	11.600	0.920
480	10.976	10.576	11.600	0.912
540	10.890	10.490	11.600	0.904
600	10.790	10.390	11.600	0.896
900	9.892	9.492	11.600	0.818
1200	9.085	8.685	11.600	0.749
1500	7.984	7.584	11.600	0.654
1800	7.105	6.705	11.600	0.578
2100	6.388	5.988	11.600	0.516
2400	6.478	6.078	11.600	0.524
2700	6.394	5.994	11.600	0.517
3000	6.205	5.805	11.600	0.500
3300	5.974	5.574	11.600	0.481
3600	5.728	5.328	11.600	0.459
3900	5.488	5.088	11.600	0.439
4200	5.254	4.854	11.600	0.418

Appendix D

Groundwater Quality Analysis Results

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

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 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

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

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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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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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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).

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

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.

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
==
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 #: 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

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

Maxxam
A Bureau Veritas Group Company

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

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

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

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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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.

Maxxam
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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).

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.

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

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 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

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

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

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.

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

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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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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**
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).

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

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.

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

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

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

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

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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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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).

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	2017/09/25	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

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			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

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

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

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

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

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		

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

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Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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).

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.

Maxxam
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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: 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.

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

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
==
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			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

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

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

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

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

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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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

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		

Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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).

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

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.

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

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
A Bureau Veritas Group Company

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

Maxxam
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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

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

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

Maxxam
A Bureau Veritas Group Company

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

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

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.

Maxxam
A Bureau Veritas Group Company

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		

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B7K8760
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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).

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.

BOD

Maxxam Analytics International Corporation o/a Maxxam Analytics
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:		REPORT TO:		PROJECT INFORMATION:	
Company Name:	#24008 ,Cole Engineering Group Ltd	Company Name:		Quotation #:	B02064
Attention:	Accounts Payable	Attention:	Alireza Hejazi	P.O. #:	
Address:	70 Valleywood Dr	Address:		Project:	2017-0293
	Markham ON L3R 4T5			Project Name:	Solmar/ Bolton
Tel:	(416) 987-6161 x Fax: (905) 940-2064 x	Tel:	(416) 987-6161 x243 Fax:	Site #:	
Email:	accountspayable@coleengineering.ca	Email:	AHejazi@coleengineering.ca	Sampled By:	AH, AO

Laboratory Use Only:

Maxxam Job #:	Bottle Order #:
	629279
COC #:	Project Manager:
C#629279-01-01	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)

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	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

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Andrew O'Rourke Andrew O'Rourke	22/09/17	14:20	Tanvirsh Tanvirstan	2017/09/22	14:25	

Laboratory Use Only				
Time Sensitive	Temperature (°C) on Receipt	Custody Seal	Yes	No
	13/12/15	Present		✓
		Intact		✓

* 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.

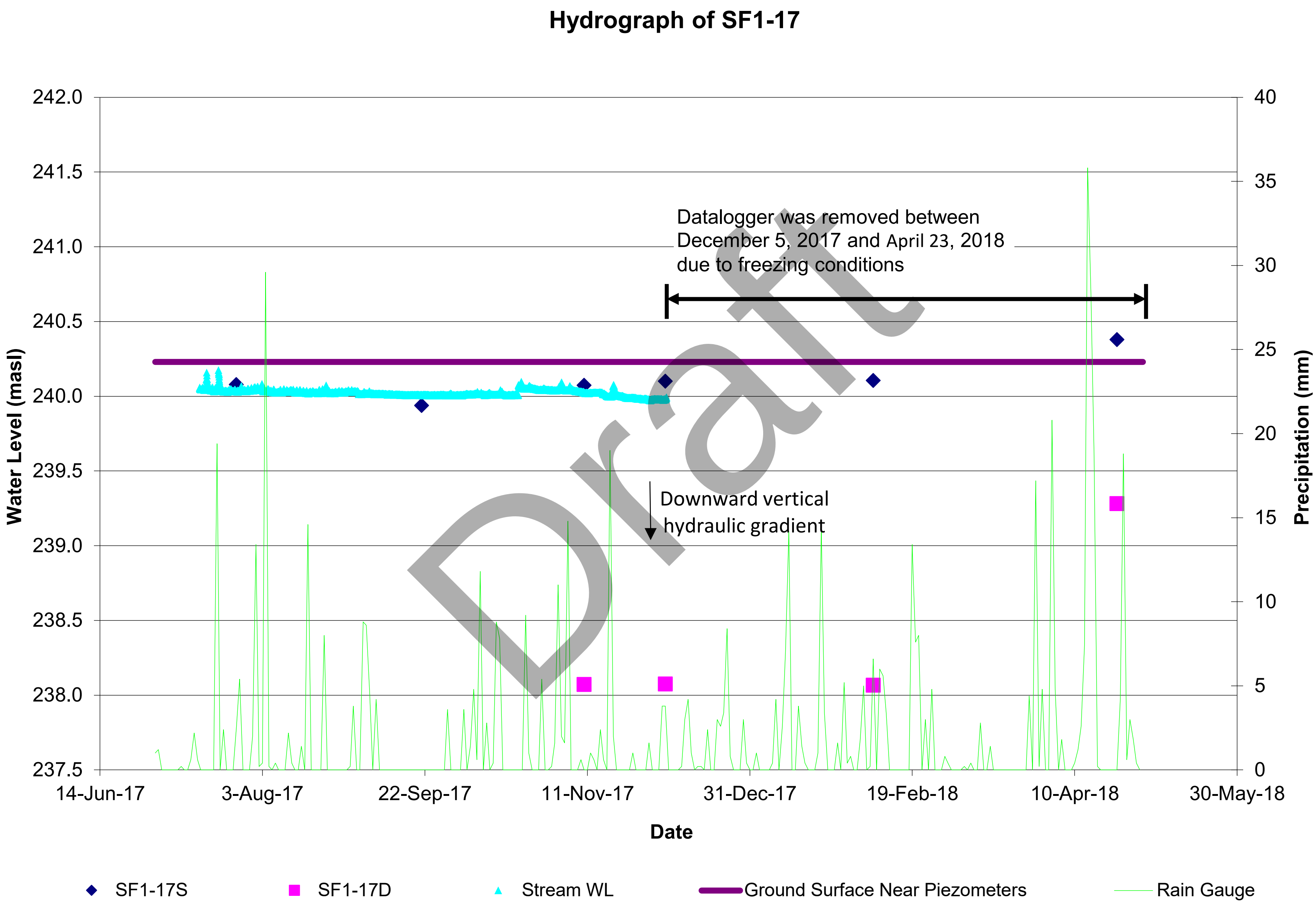
SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

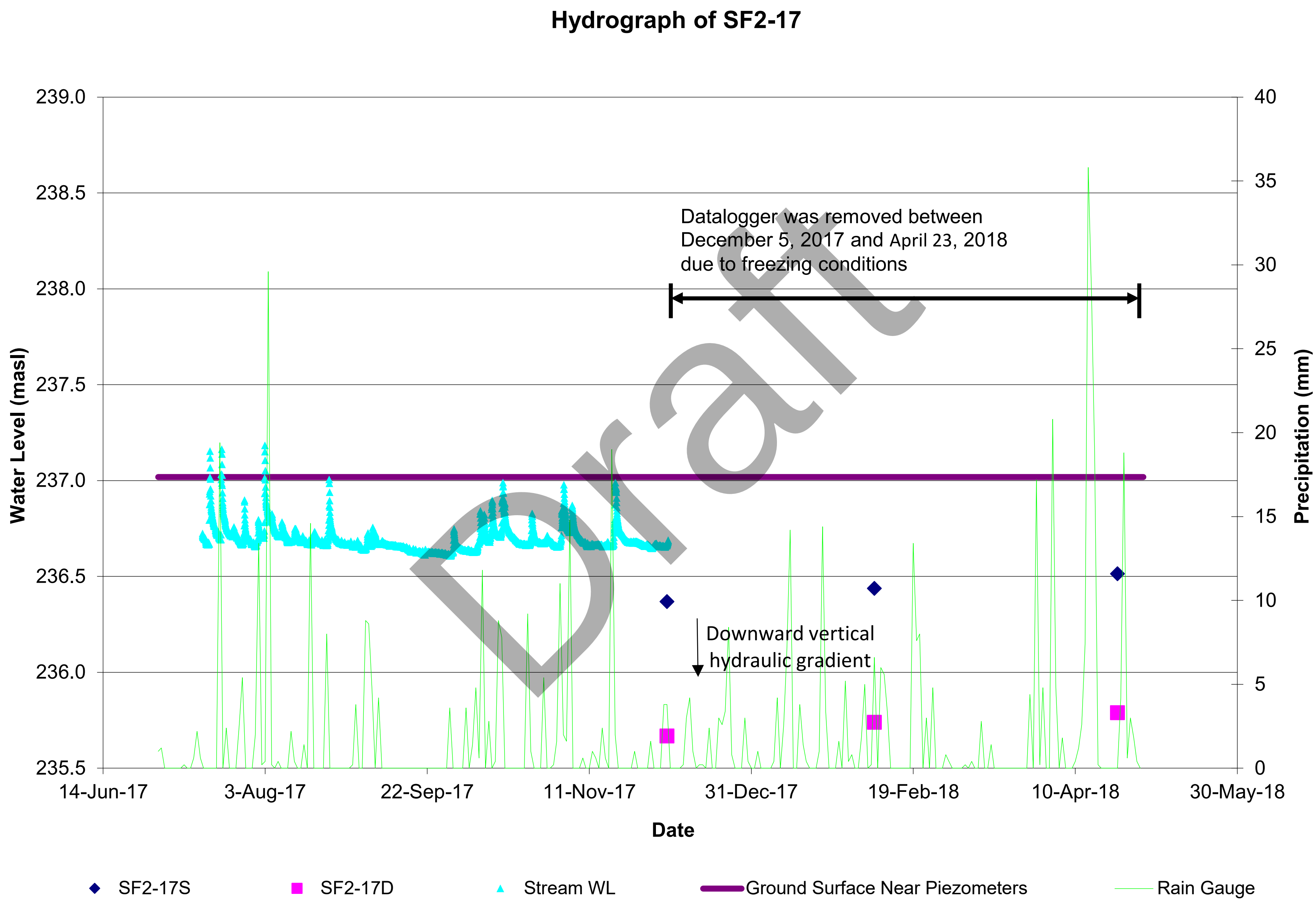
White: Maxxa Yellow: Client

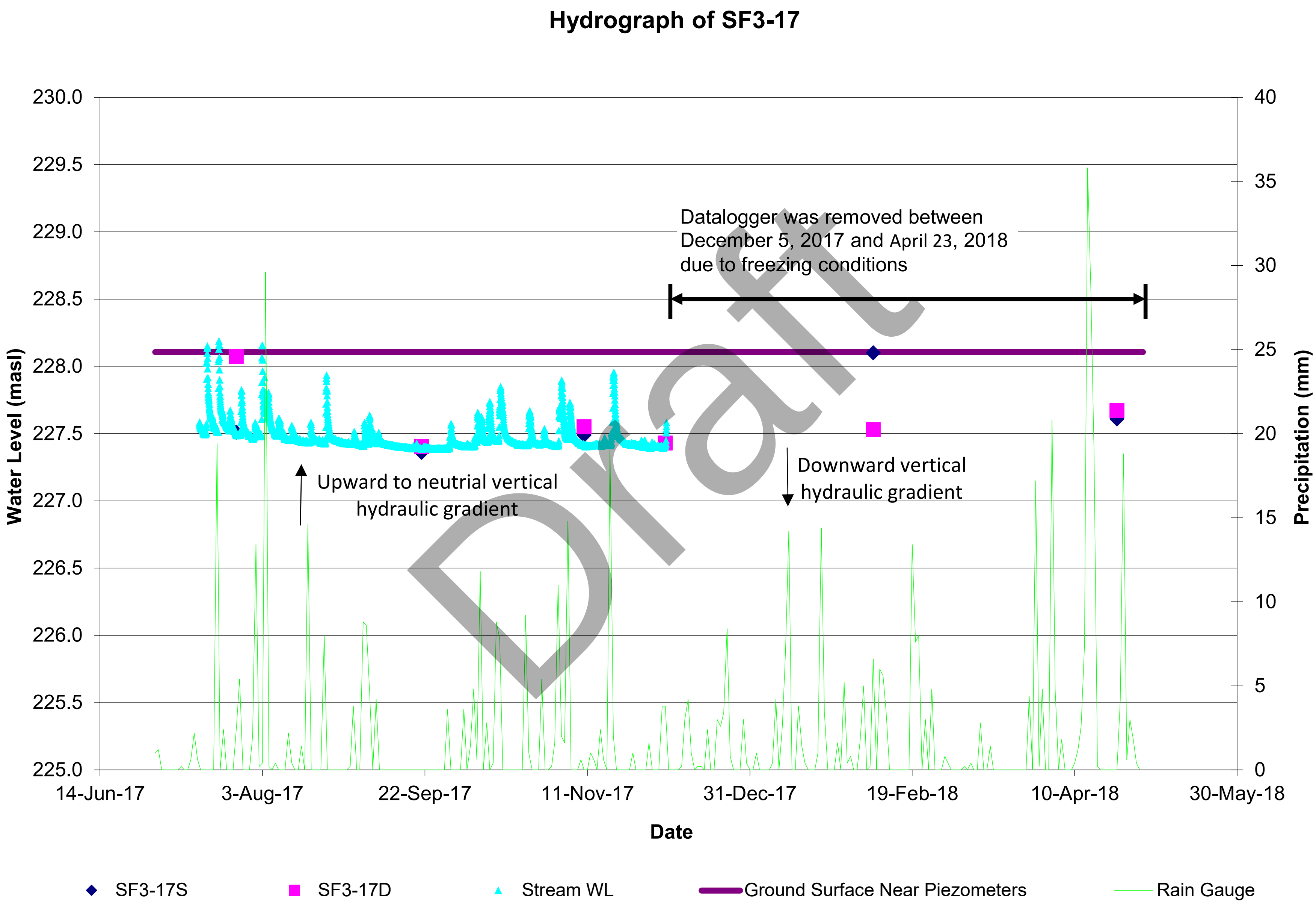
Onice

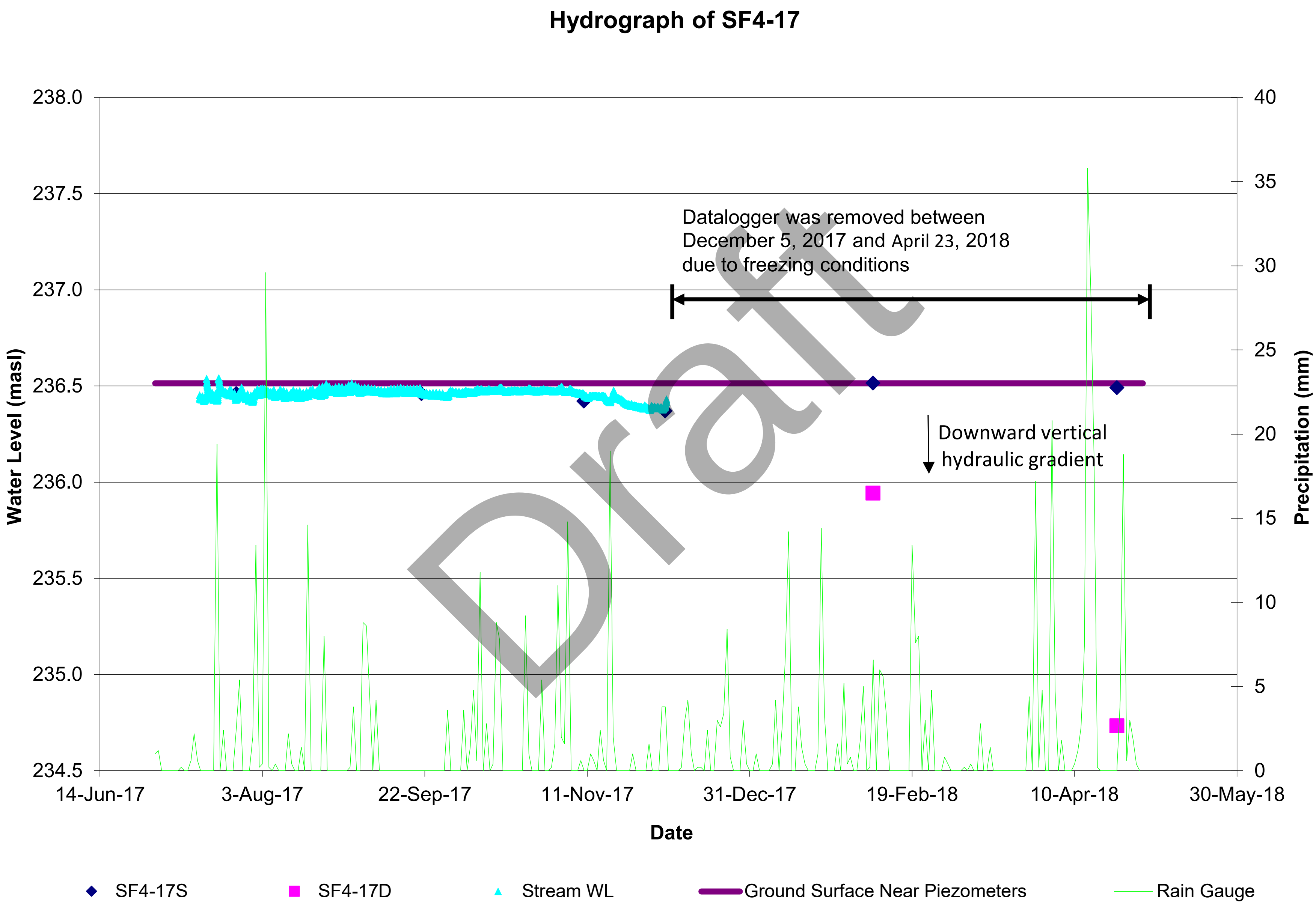
Appendix E

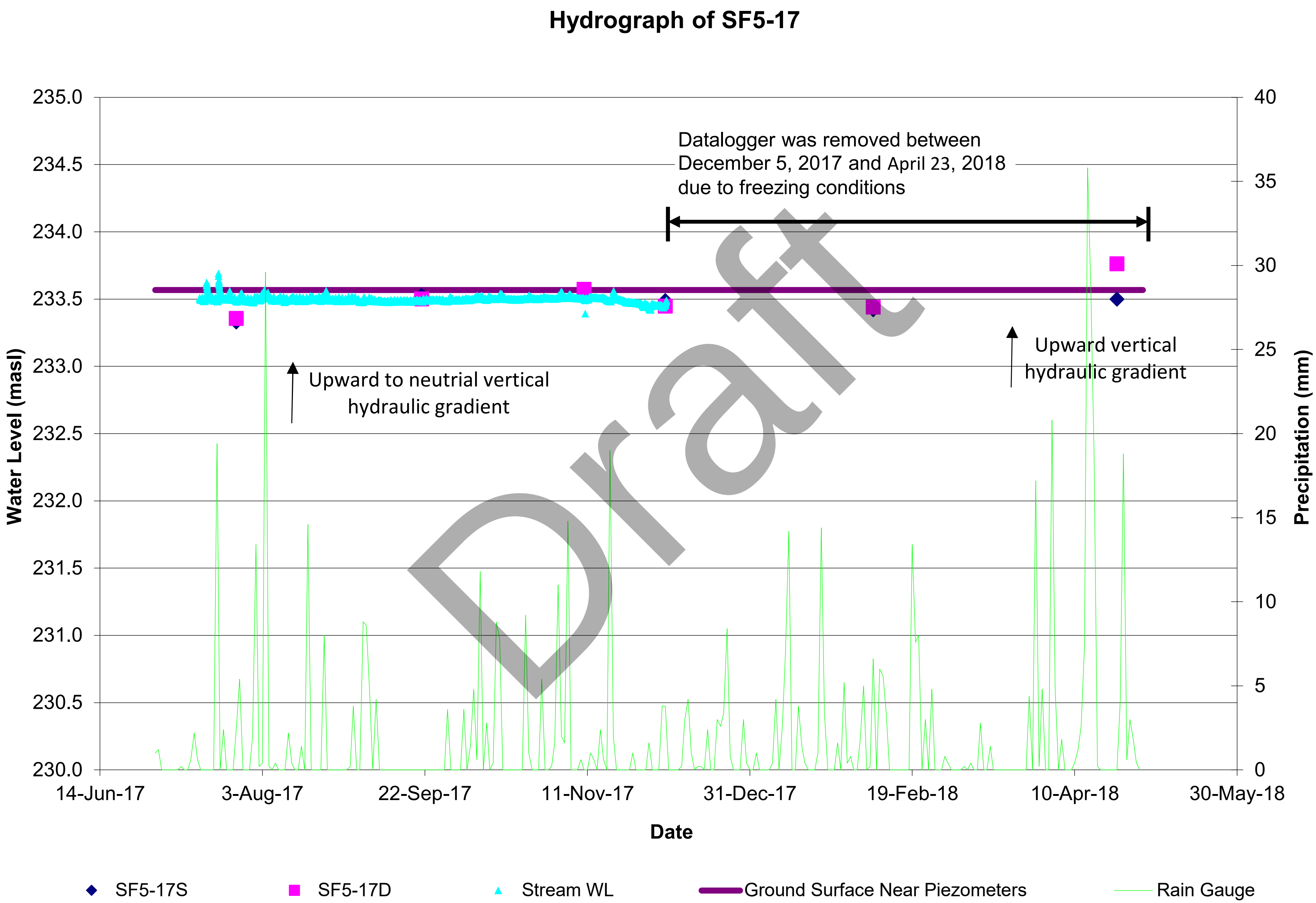
Surface Water Monitoring – Hydrographs of Mini-Piezometers

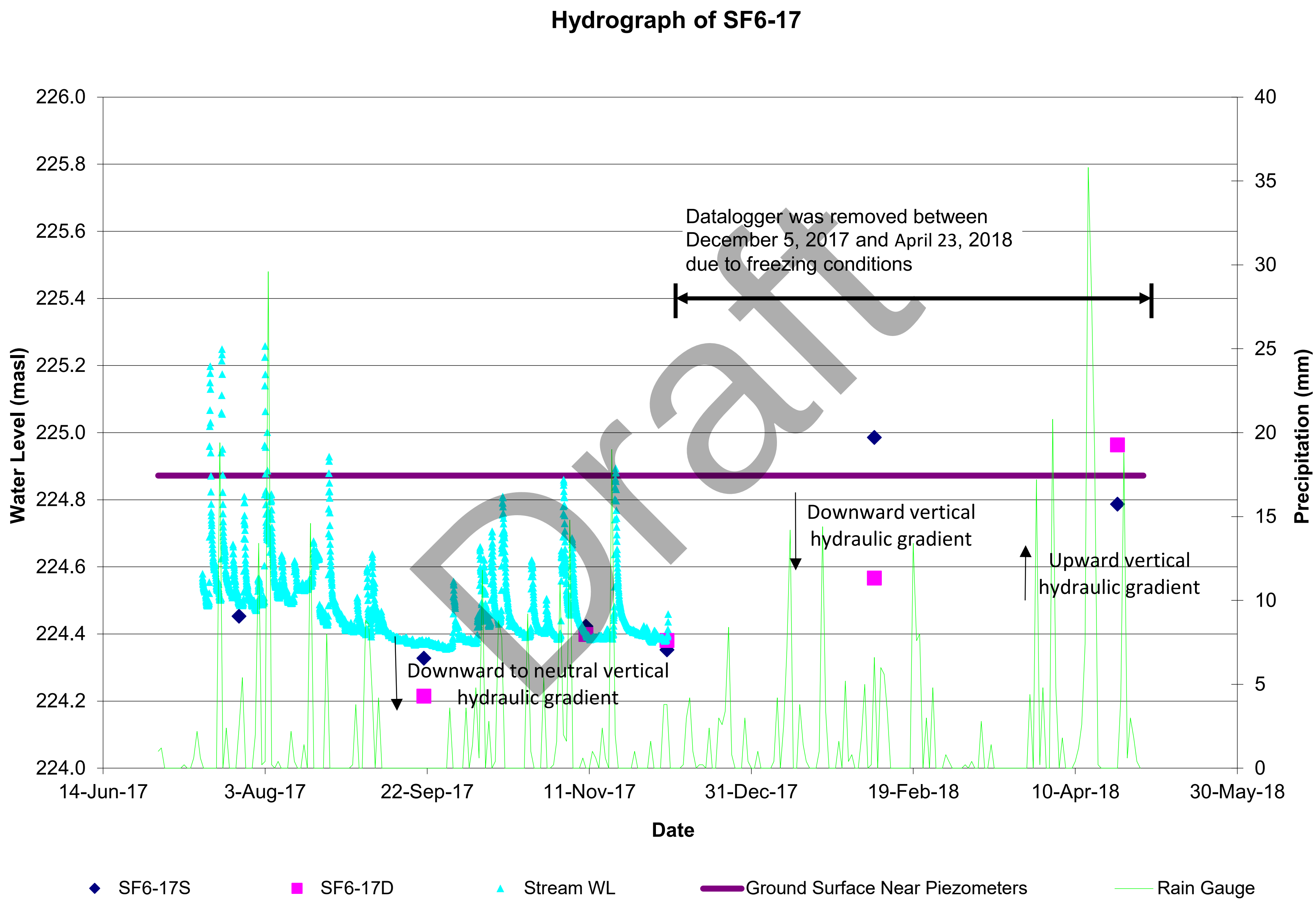

Hydrograph of SF1-17
Datalogger was removed between December 5, 2017 and April 23, 2018 due to freezing conditions
Downward vertical hydraulic gradient
Water Level (masl)
Precipitation (mm)
Date
242.0
241.5
241.0
240.5
240.0
239.5
239.0
238.5
238.0
237.5
40
35
30
25
20
15
10
5
0
14-Jun-17
3-Aug-17
22-Sep-17
11-Nov-17
31-Dec-17
19-Feb-18
10-Apr-18
30-May-18
SF1-17S
SF1-17D
Stream WL
Ground Surface Near Piezometers
Rain Gauge

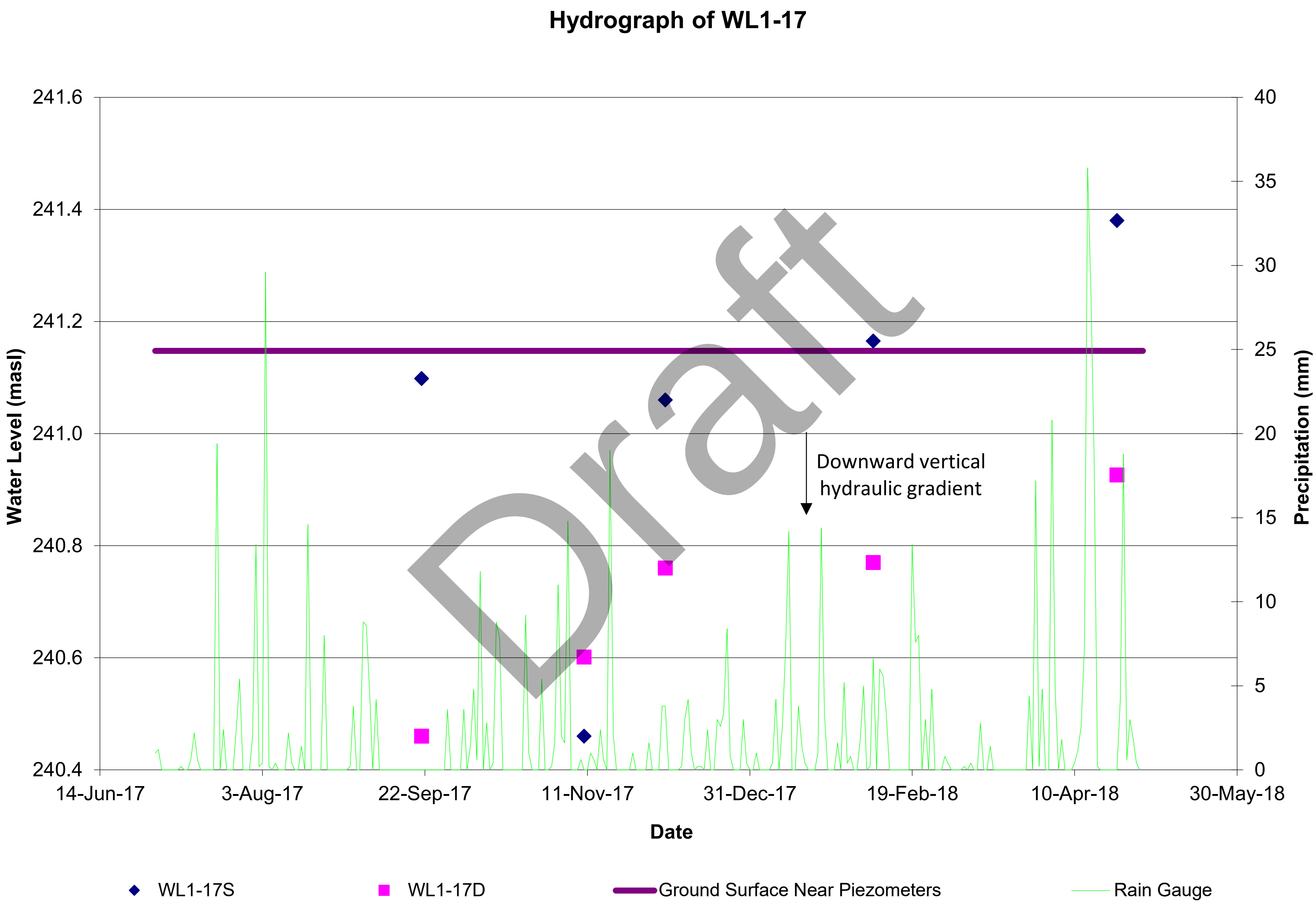

Hydrograph of SF2-17
239.0
238.5
238.0
237.5
237.0
236.5
236.0
235.5
Water Level (masl)
40
35
30
25
20
15
10
5
0
Precipitation (mm)
14-Jun-17
3-Aug-17
22-Sep-17
11-Nov-17
31-Dec-17
19-Feb-18
10-Apr-18
30-May-18
Date
Datalogger was removed between December 5, 2017 and April 23, 2018 due to freezing conditions
Downward vertical hydraulic gradient
SF2-17S
SF2-17D
Stream WL
Ground Surface Near Piezometers
Rain Gauge
Draft

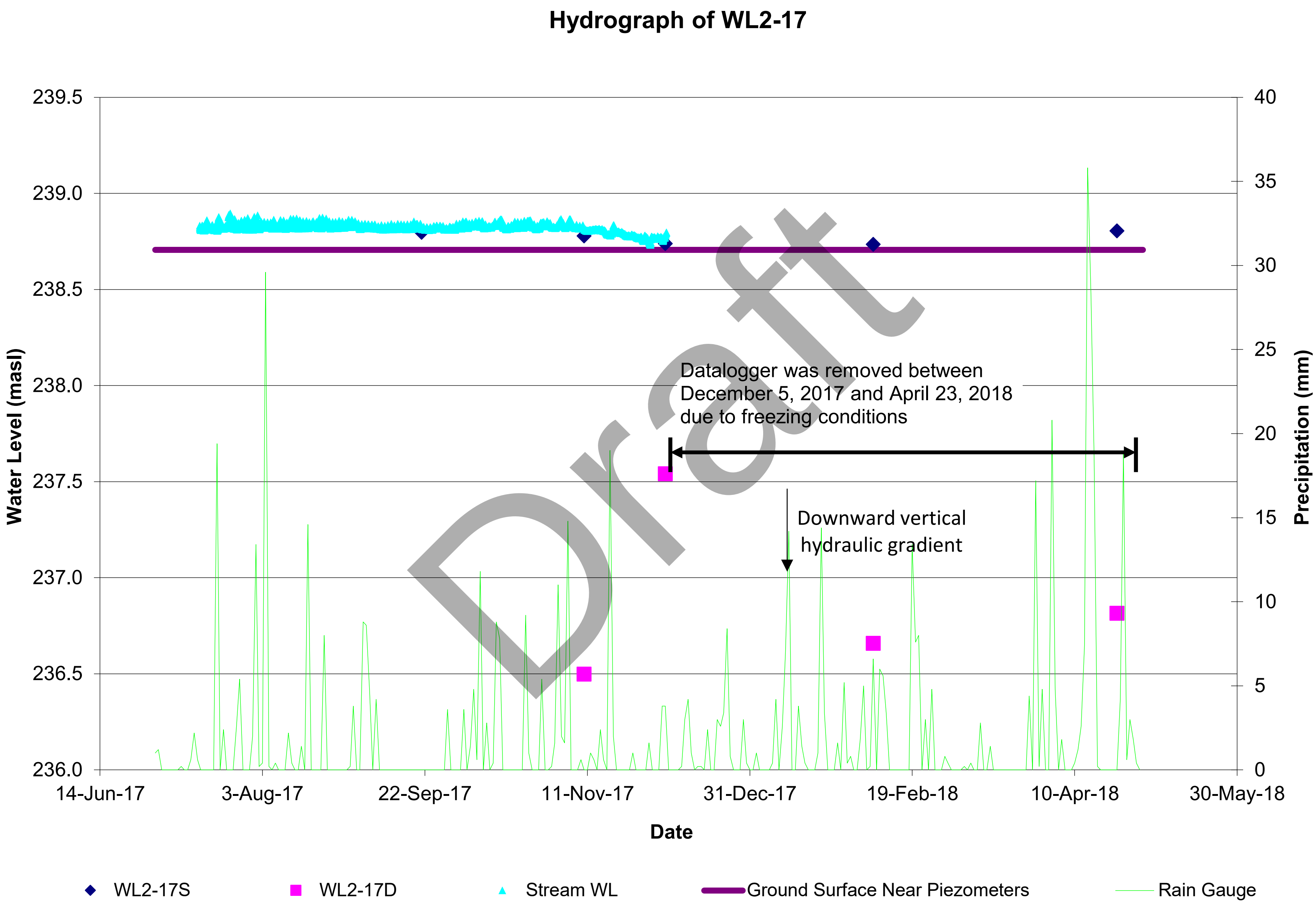

Hydrograph of SF3-17
Water Level (masl)
Precipitation (mm)
Date
230.0
229.5
229.0
228.5
228.0
227.5
227.0
226.5
226.0
225.5
225.0
40
35
30
25
20
15
10
5
0
14-Jun-17
3-Aug-17
22-Sep-17
11-Nov-17
31-Dec-17
19-Feb-18
10-Apr-18
30-May-18
Datalogger was removed between December 5, 2017 and April 23, 2018 due to freezing conditions
Upward to neutrial vertical hydraulic gradient
Downward vertical hydraulic gradient
SF3-17S
SF3-17D
Stream WL
Ground Surface Near Piezometers
Rain Gauge


Hydrograph of SF4-17
238.0
237.5
237.0
236.5
236.0
235.5
235.0
234.5
Water Level (masl)
40
35
30
25
20
15
10
5
0
Precipitation (mm)
14-Jun-17
3-Aug-17
22-Sep-17
11-Nov-17
31-Dec-17
19-Feb-18
10-Apr-18
30-May-18
Date
Datalogger was removed between December 5, 2017 and April 23, 2018 due to freezing conditions
Downward vertical hydraulic gradient
SF4-17S
SF4-17D
Stream WL
Ground Surface Near Piezometers
Rain Gauge
Draft


Hydrograph of SF5-17
Datalogger was removed between December 5, 2017 and April 23, 2018 due to freezing conditions
Upward to neutrial vertical hydraulic gradient
Upward vertical hydraulic gradient
Water Level (masl)
Precipitation (mm)
Date
235.0
234.5
234.0
233.5
233.0
232.5
232.0
231.5
231.0
230.5
230.0
40
35
30
25
20
15
10
5
0
14-Jun-17
3-Aug-17
22-Sep-17
11-Nov-17
31-Dec-17
19-Feb-18
10-Apr-18
30-May-18
SF5-17S
SF5-17D
Stream WL
Ground Surface Near Piezometers
Rain Gauge
Draft

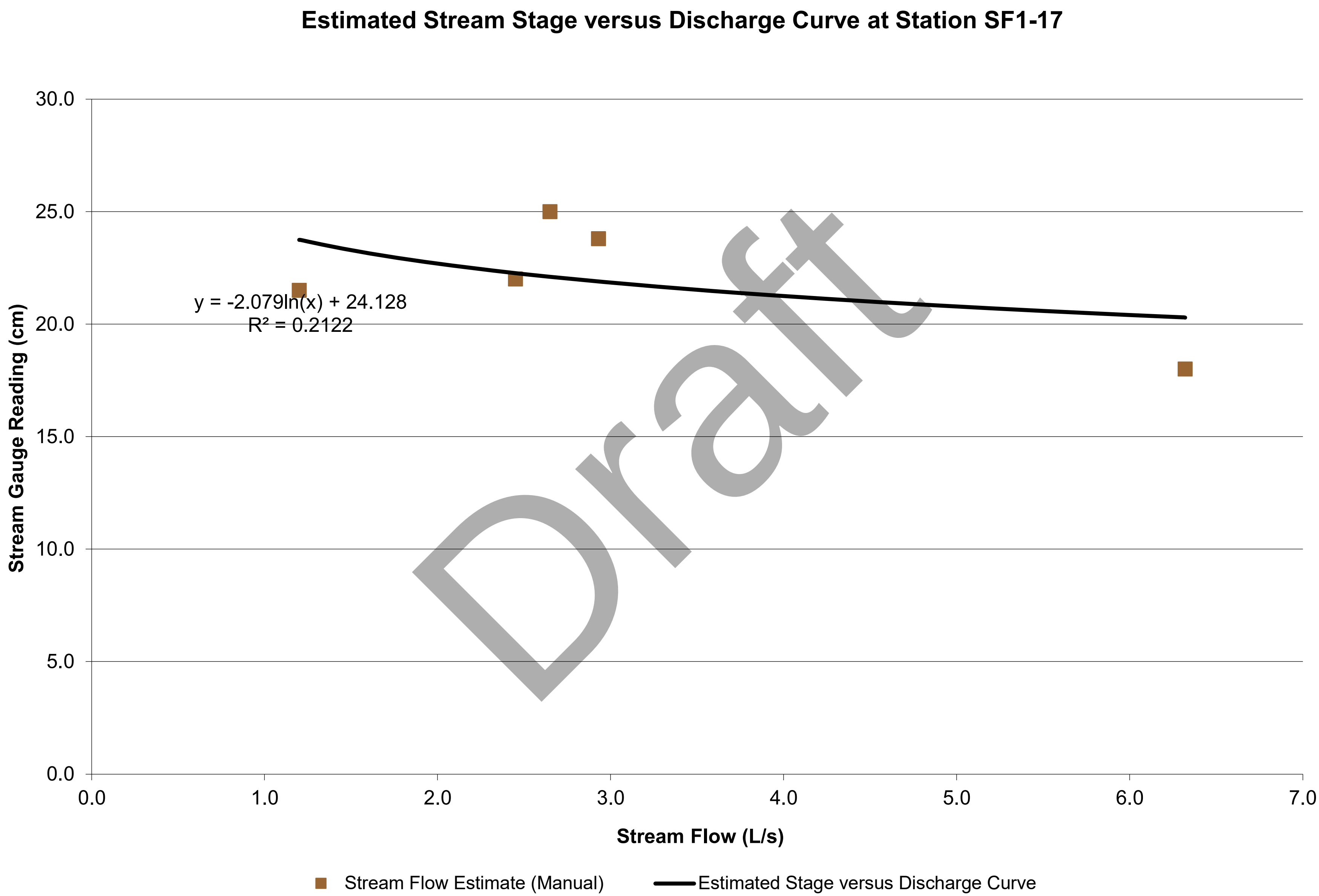

Hydrograph of SF6-17
Water Level (masl)
226.0
225.8
225.6
225.4
225.2
225.0
224.8
224.6
224.4
224.2
224.0
Precipitation (mm)
40
35
30
25
20
15
10
5
0
14-Jun-17
3-Aug-17
22-Sep-17
11-Nov-17
31-Dec-17
19-Feb-18
10-Apr-18
30-May-18
Date
Datalogger was removed between December 5, 2017 and April 23, 2018 due to freezing conditions
Downward vertical hydraulic gradient
Upward vertical hydraulic gradient
Downward to neutral vertical hydraulic gradient
Draft
SF6-17S
SF6-17D
Stream WL
Ground Surface Near Piezometers
Rain Gauge

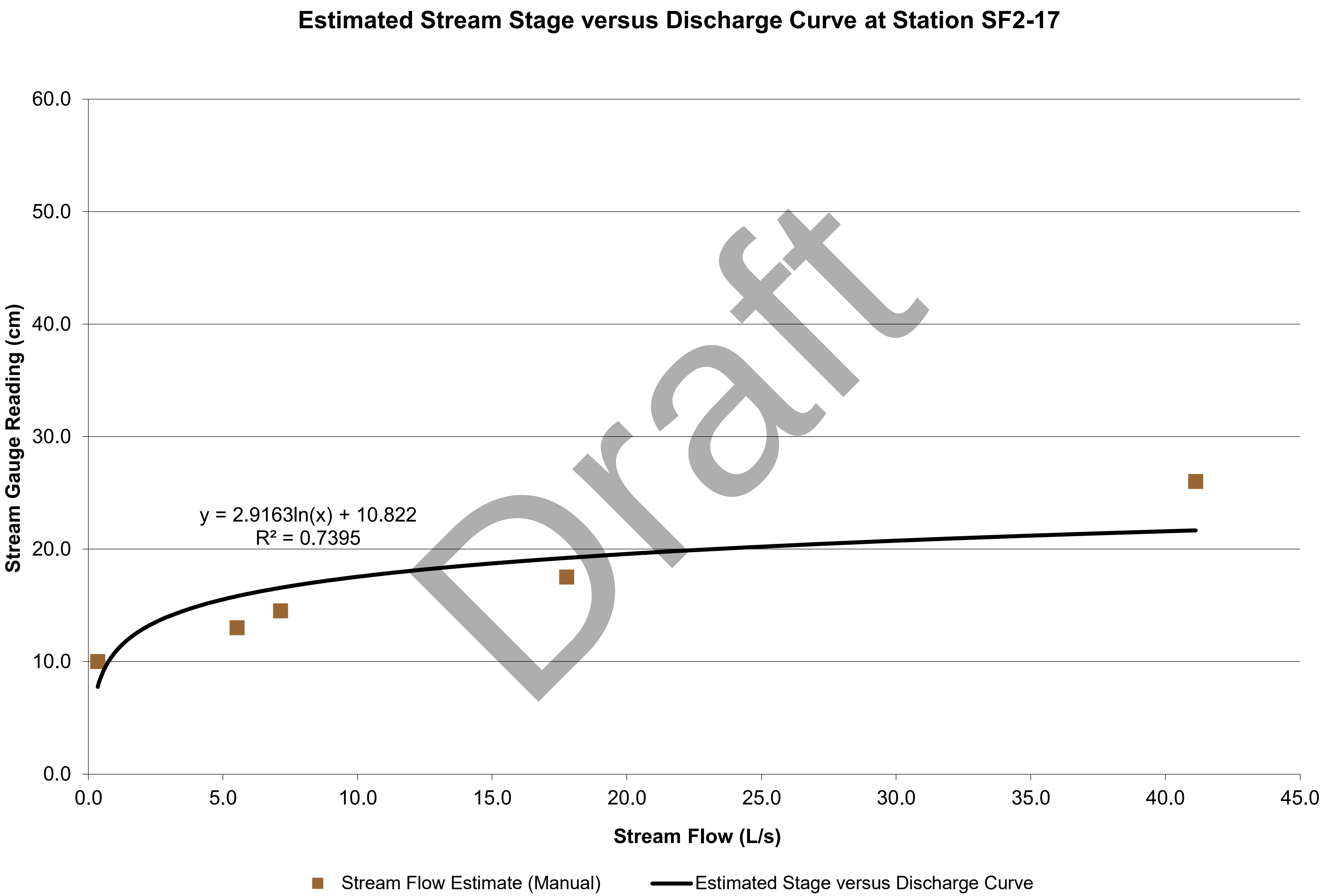

Hydrograph of WL1-17
241.6
241.4
241.2
241.0
240.8
240.6
240.4
Water Level (masl)
40
35
30
25
20
15
10
5
0
Precipitation (mm)
14-Jun-17
3-Aug-17
22-Sep-17
11-Nov-17
31-Dec-17
19-Feb-18
10-Apr-18
30-May-18
Date
Downward vertical hydraulic gradient
Draft
WL1-17S
WL1-17D
Ground Surface Near Piezometers
Rain Gauge

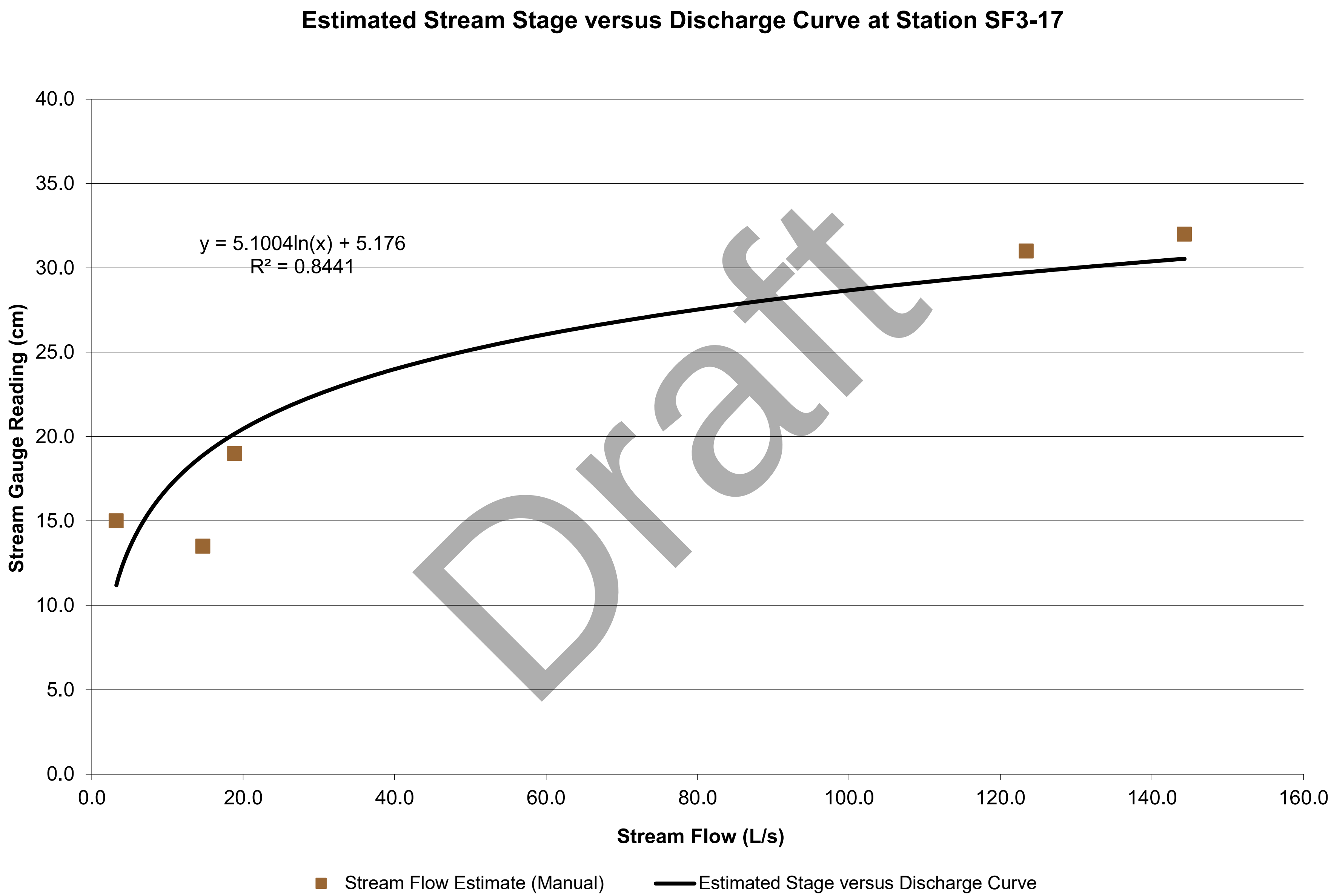

Hydrograph of WL2-17
239.5
239.0
238.5
238.0
237.5
237.0
236.5
236.0
Water Level (masl)
40
35
30
25
20
15
10
5
0
Precipitation (mm)
14-Jun-17
3-Aug-17
22-Sep-17
11-Nov-17
31-Dec-17
19-Feb-18
10-Apr-18
30-May-18
Date
Datalogger was removed between December 5, 2017 and April 23, 2018 due to freezing conditions
Downward vertical hydraulic gradient
Draft
WL2-17S
WL2-17D
Stream WL
Ground Surface Near Piezometers
Rain Gauge

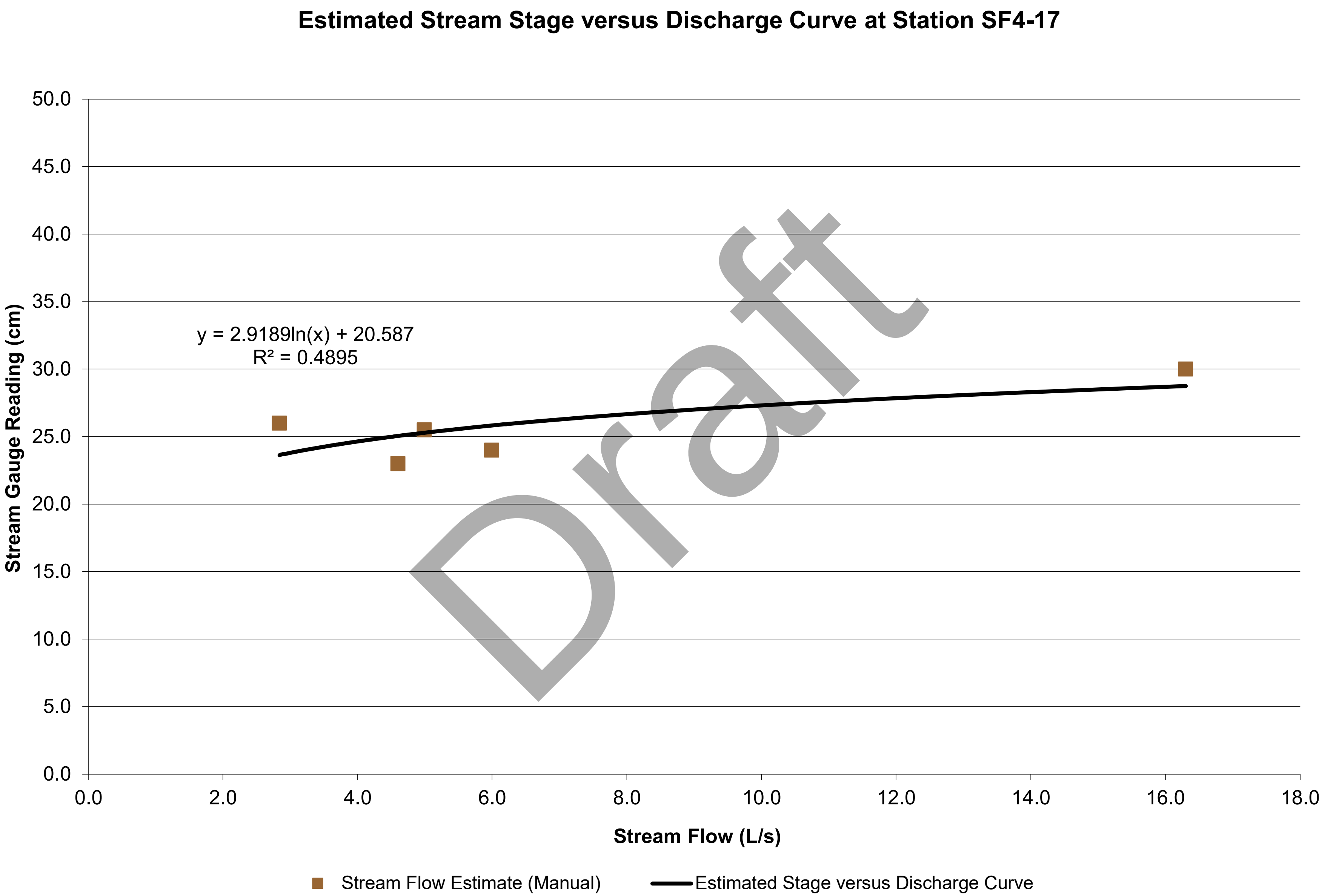
Appendix F

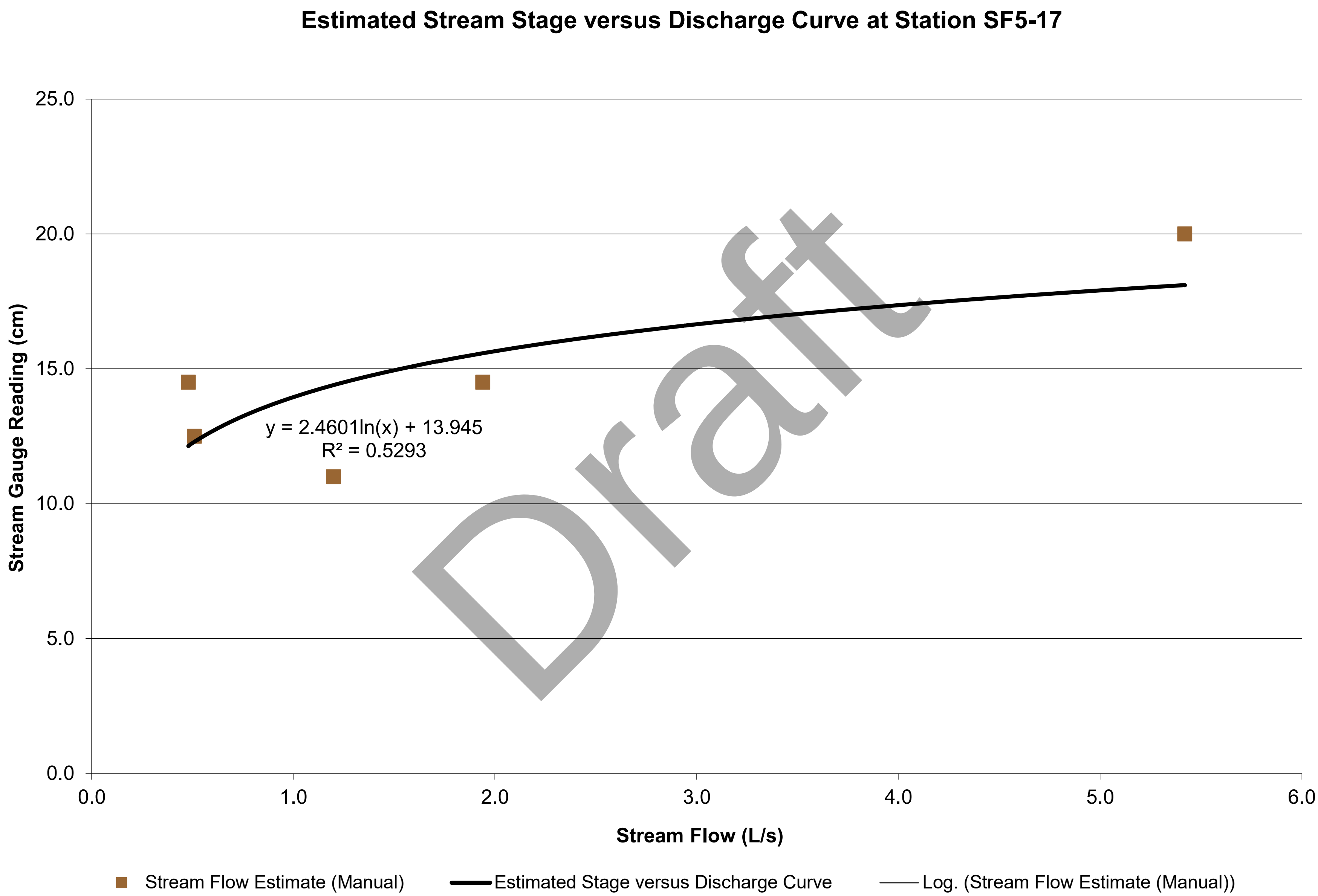
Surface Water Monitoring – Stage Versus Discharge Curves

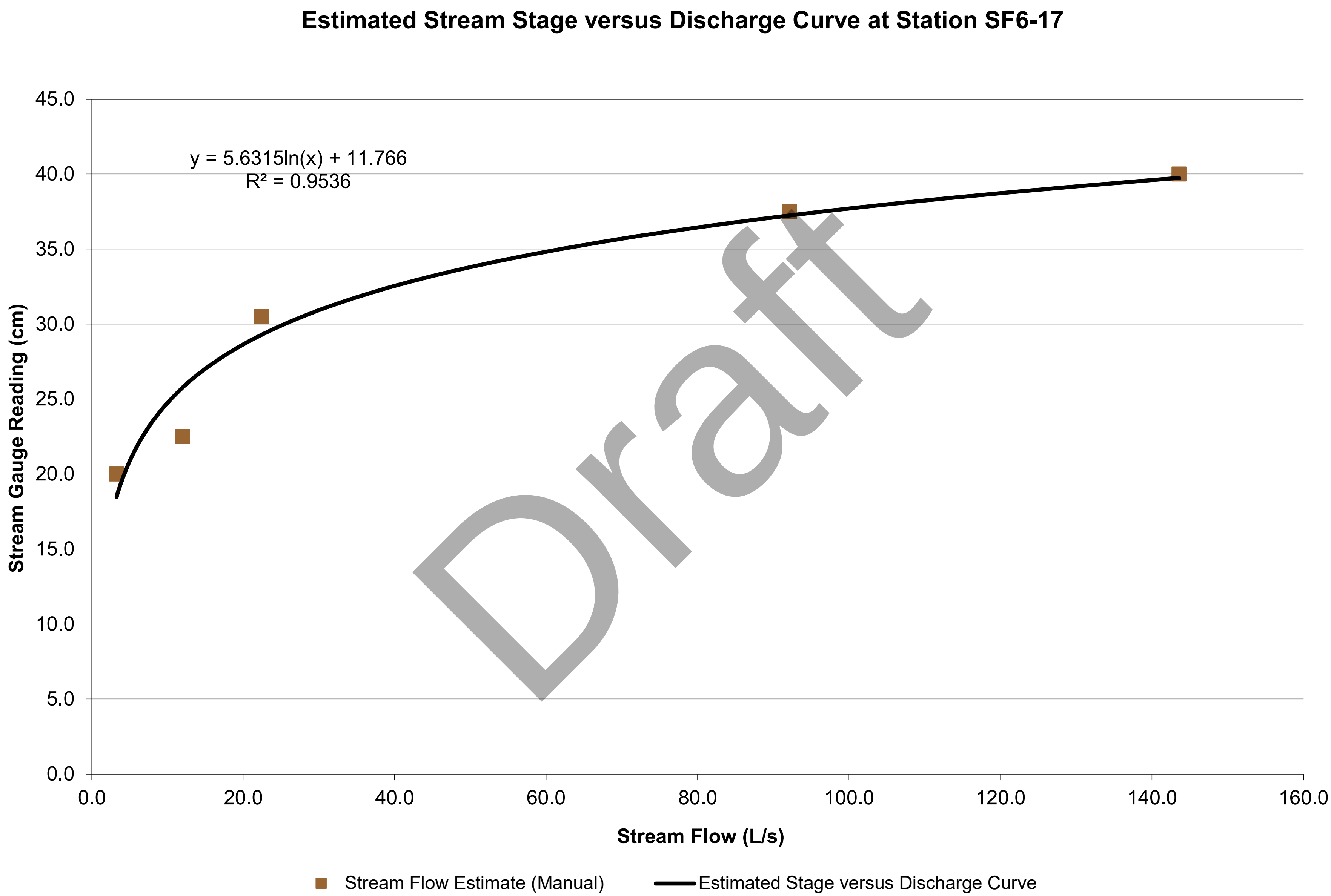

Estimated Stream Stage versus Discharge Curve at Station SF1-17
y = -2.079ln(x) + 24.128
R² = 0.2122
Stream Gauge Reading (cm)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Stream Flow (L/s)
Stream Flow Estimate (Manual)
Estimated Stage versus Discharge Curve
Draft


Estimated Stream Stage versus Discharge Curve at Station SF2-17
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Stream Gauge Reading (cm)
y = 2.9163ln(x) + 10.822
R² = 0.7395
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
Stream Flow (L/s)
Stream Flow Estimate (Manual)
Estimated Stage versus Discharge Curve
Draft


Estimated Stream Stage versus Discharge Curve at Station SF3-17
y = 5.1004ln(x) + 5.176
R² = 0.8441
Stream Gauge Reading (cm)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Stream Flow (L/s)
Stream Flow Estimate (Manual)
Estimated Stage versus Discharge Curve
Draft

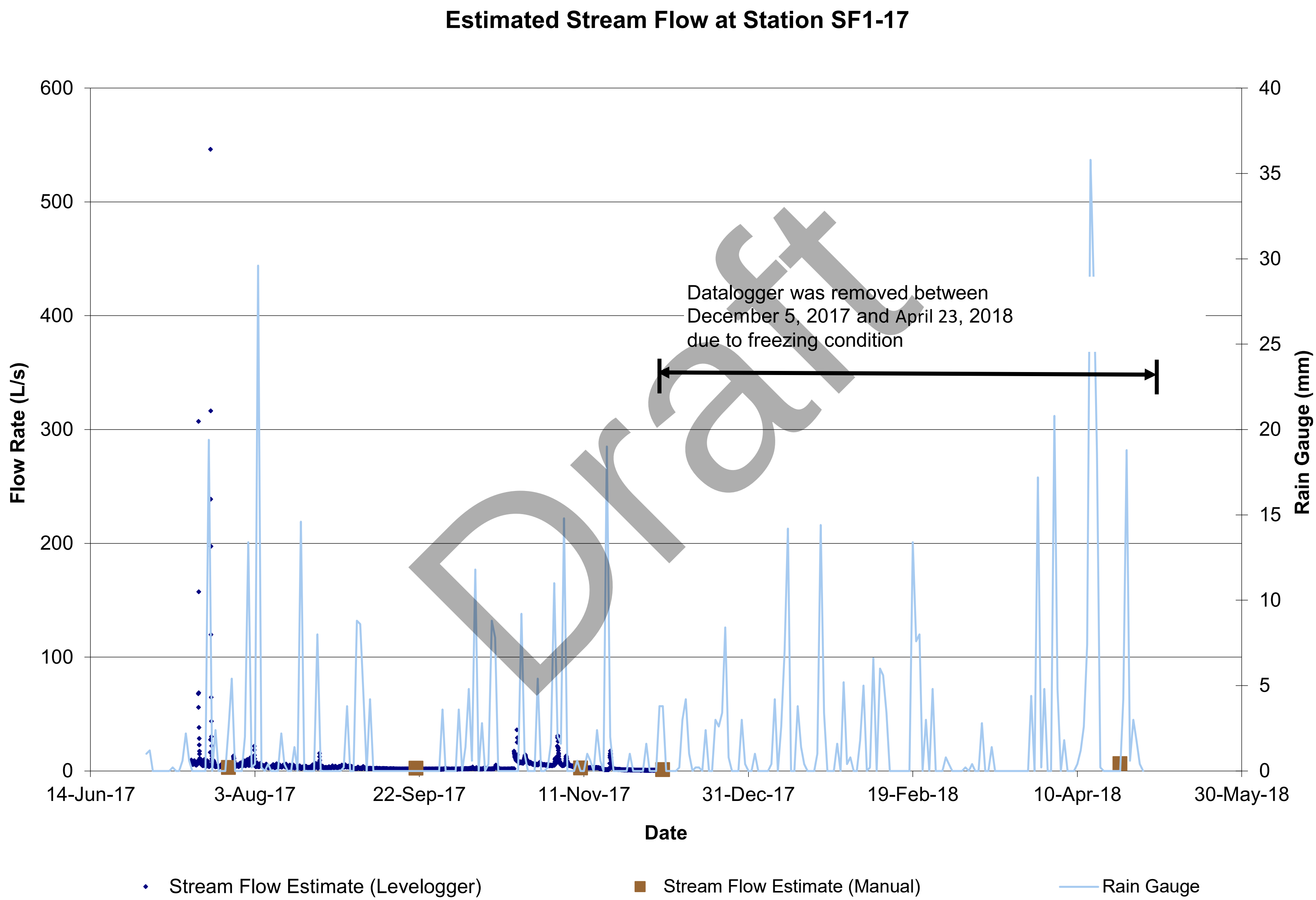

Estimated Stream Stage versus Discharge Curve at Station SF4-17
y = 2.9189ln(x) + 20.587
R² = 0.4895
Draft
Stream Gauge Reading (cm)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Stream Flow (L/s)
Stream Flow Estimate (Manual)
Estimated Stage versus Discharge Curve


Estimated Stream Stage versus Discharge Curve at Station SF5-17
25.0
20.0
15.0
10.0
5.0
0.0
Stream Gauge Reading (cm)
y = 2.4601ln(x) + 13.945
R² = 0.5293
Draft
0.0
1.0
2.0
3.0
4.0
5.0
6.0
Stream Flow (L/s)
Stream Flow Estimate (Manual)
Estimated Stage versus Discharge Curve
Log. (Stream Flow Estimate (Manual))

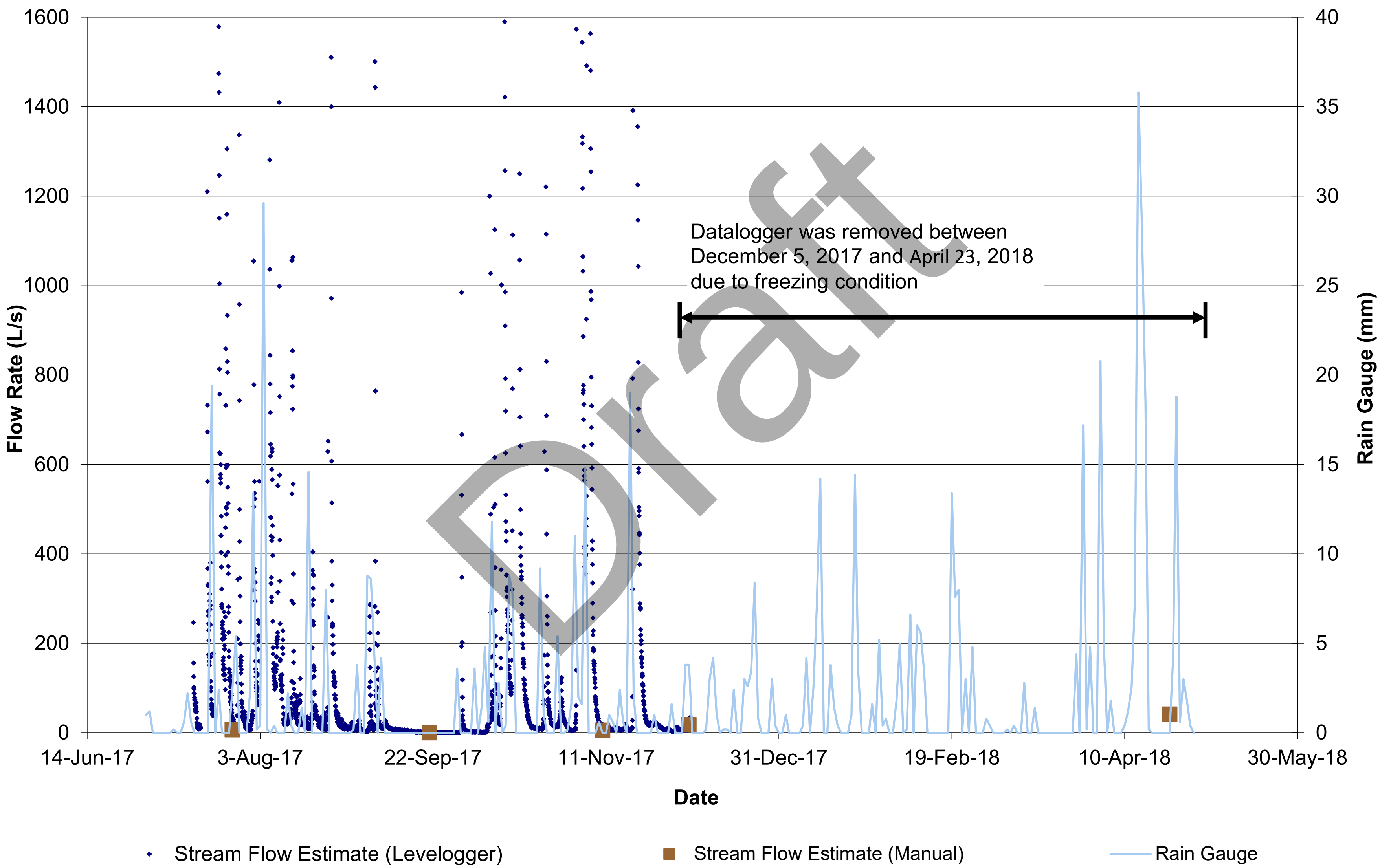

Estimated Stream Stage versus Discharge Curve at Station SF6-17
y = 5.6315ln(x) + 11.766
R² = 0.9536
Stream Gauge Reading (cm)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Stream Flow (L/s)
Stream Flow Estimate (Manual)
Estimated Stage versus Discharge Curve
Draft

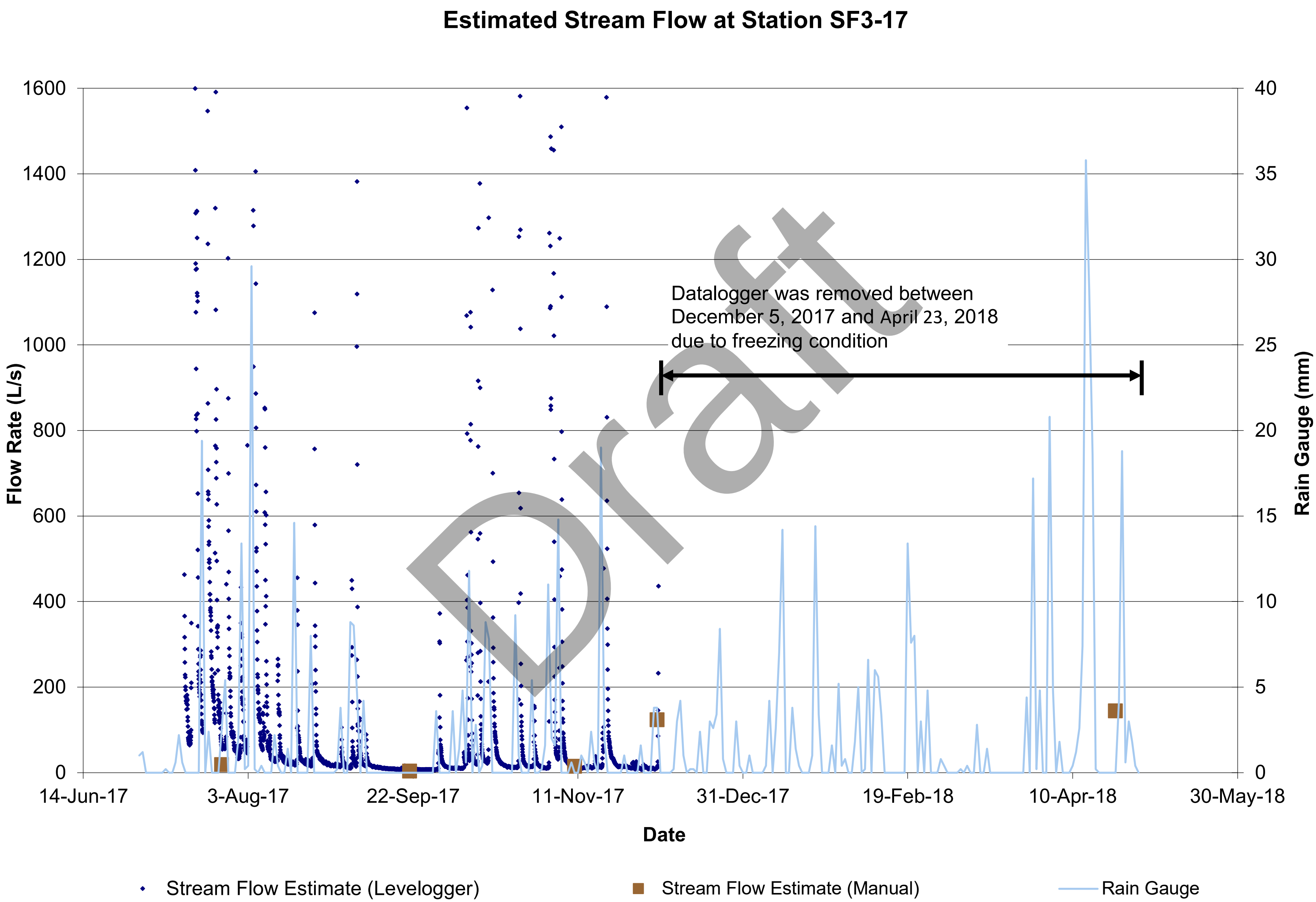
Appendix G

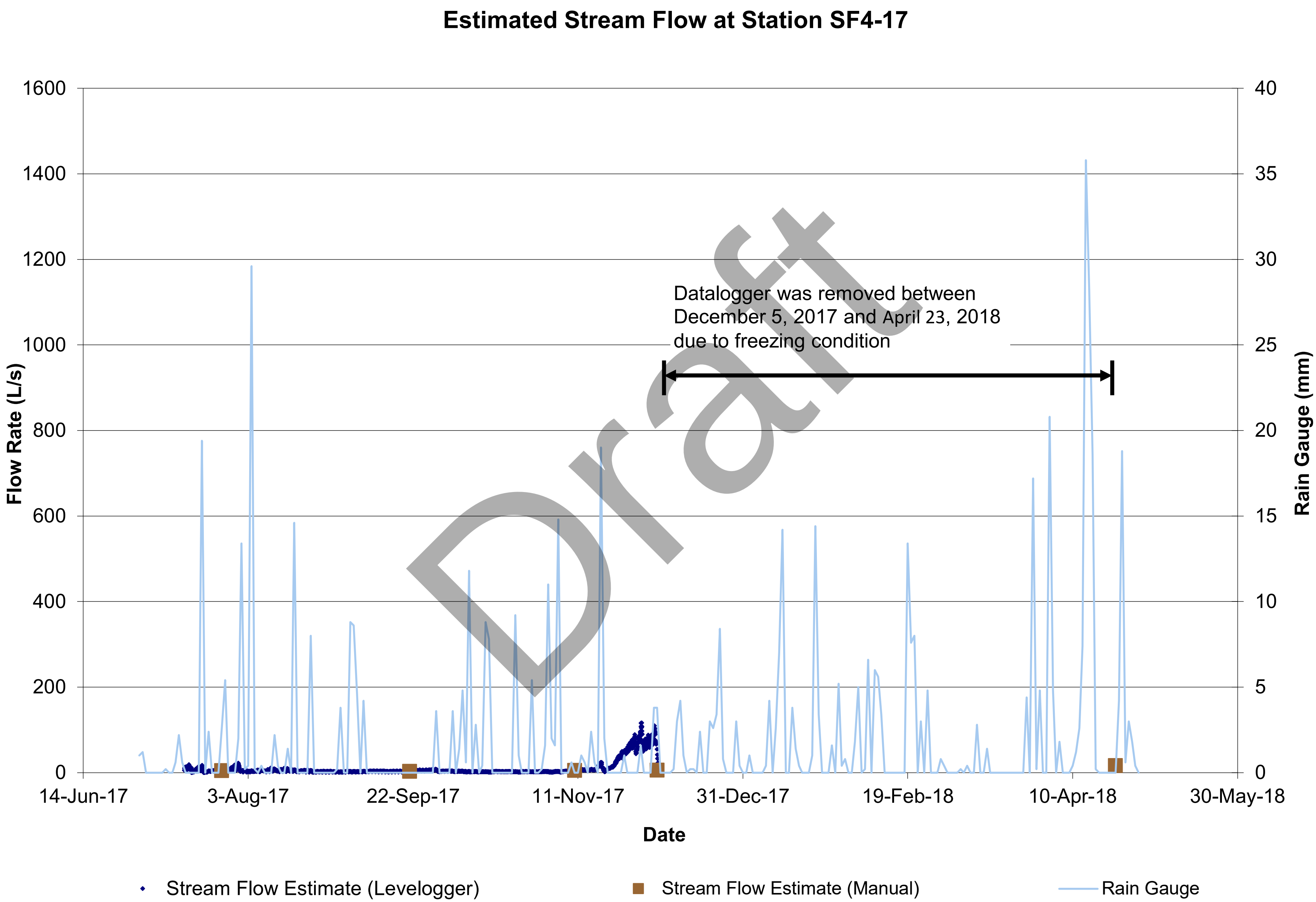
Surface Water Monitoring – Estimated Stream Flow

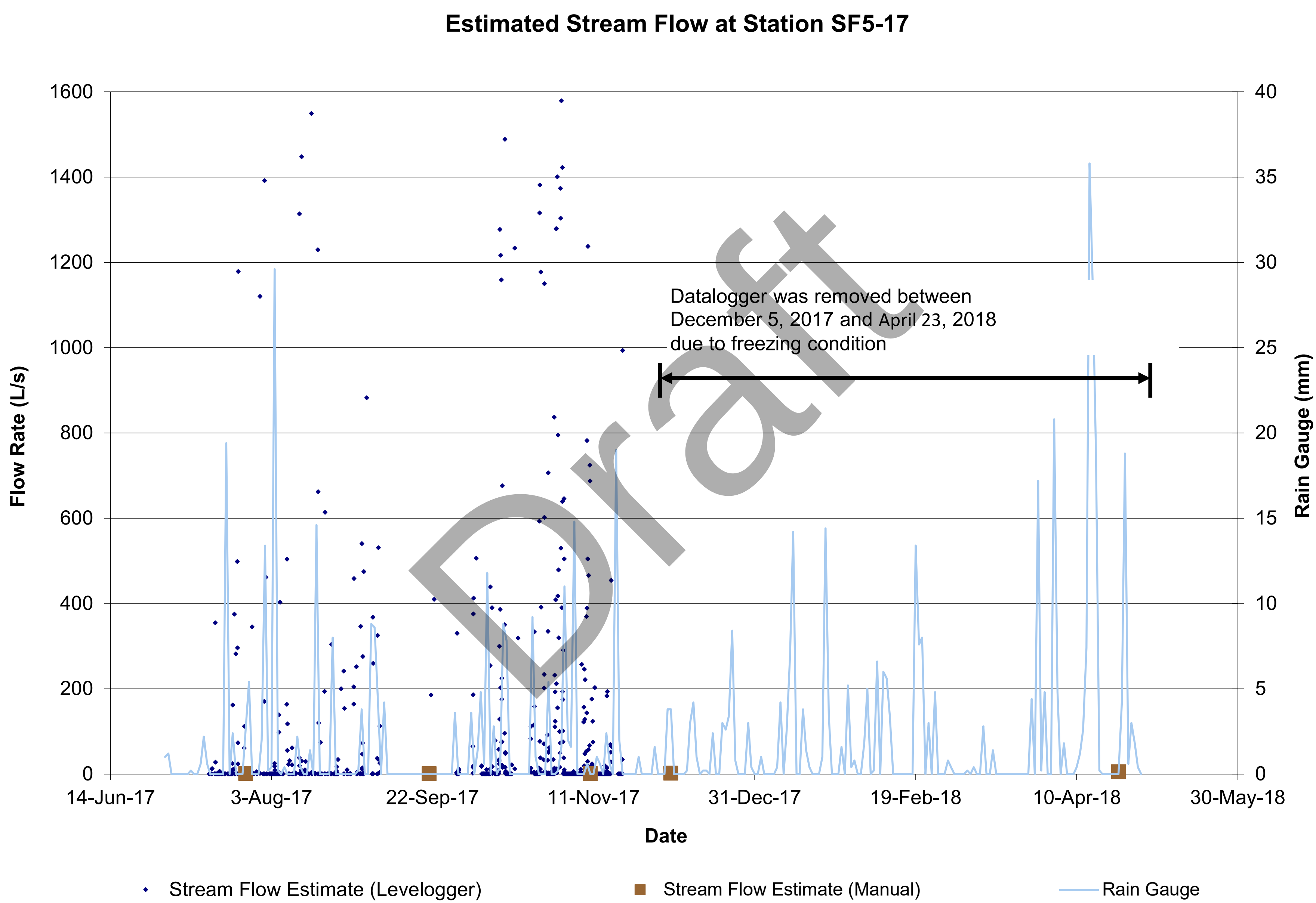

Estimated Stream Flow at Station SF1-17
Flow Rate (L/s)
Rain Gauge (mm)
Date
Datalogger was removed between December 5, 2017 and April 23, 2018 due to freezing condition
0
100
200
300
400
500
600
5
10
15
20
25
30
35
40
14-Jun-17
3-Aug-17
22-Sep-17
11-Nov-17
31-Dec-17
19-Feb-18
10-Apr-18
30-May-18
Stream Flow Estimate (Levelogger)
Stream Flow Estimate (Manual)
Rain Gauge
Draft

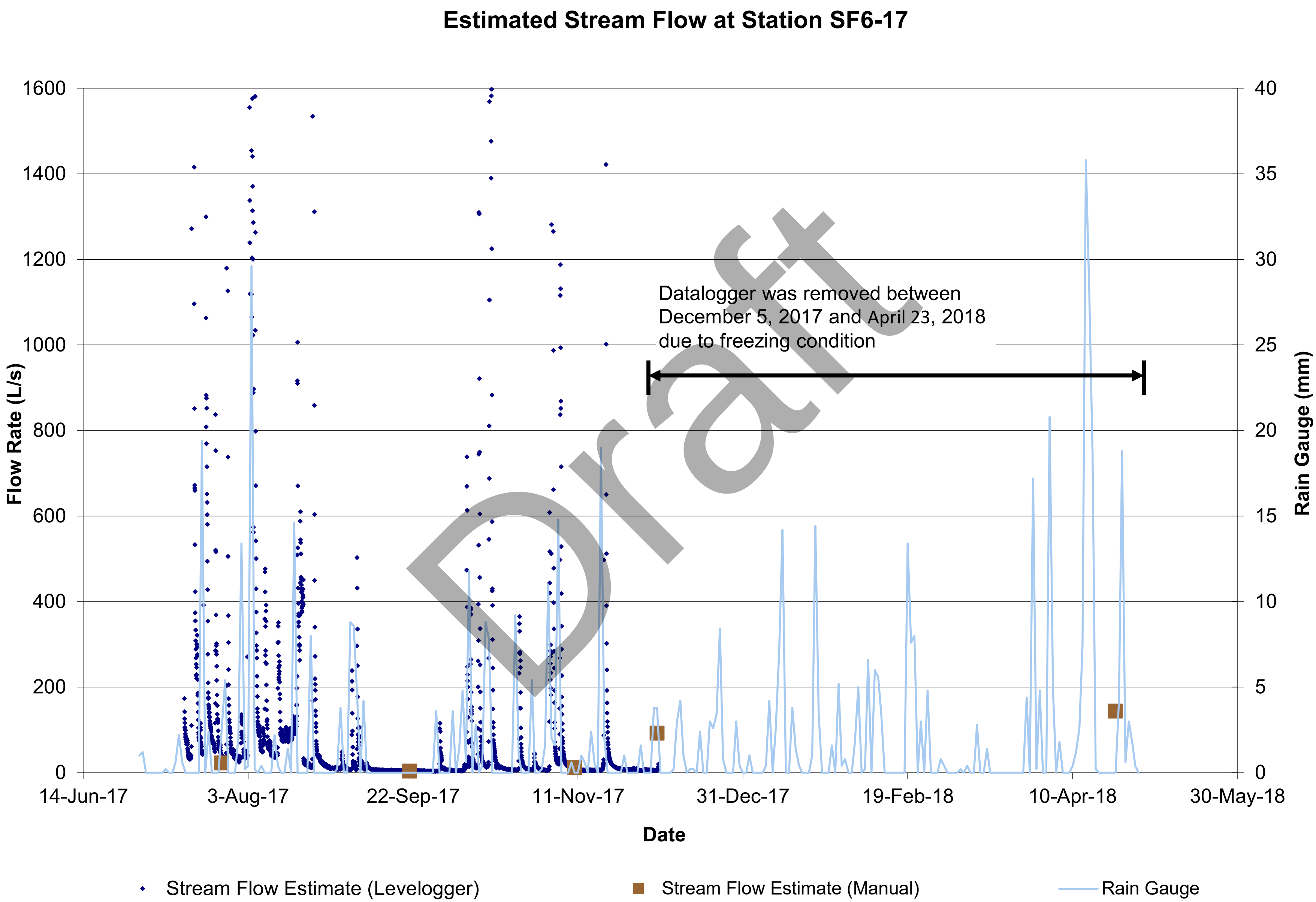
Estimated Stream Flow at Station SF2-17




Estimated Stream Flow at Station SF3-17
Flow Rate (L/s)
1600
1400
1200
1000
800
600
400
200
0
Rain Gauge (mm)
40
35
30
25
20
15
10
5
0
Datalogger was removed between December 5, 2017 and April 23, 2018 due to freezing condition
14-Jun-17
3-Aug-17
22-Sep-17
11-Nov-17
31-Dec-17
19-Feb-18
10-Apr-18
30-May-18
Date
Stream Flow Estimate (Levelogger)
Stream Flow Estimate (Manual)
Rain Gauge
Draft


Estimated Stream Flow at Station SF4-17
1600
1400
1200
1000
800
600
400
200
0
Flow Rate (L/s)
40
35
30
25
20
15
10
5
0
Rain Gauge (mm)
Datalogger was removed between
December 5, 2017 and April 23, 2018
due to freezing condition
Draft
14-Jun-17
3-Aug-17
22-Sep-17
11-Nov-17
31-Dec-17
19-Feb-18
10-Apr-18
30-May-18
Date
Stream Flow Estimate (Levelogger)
Stream Flow Estimate (Manual)
Rain Gauge


Estimated Stream Flow at Station SF5-17
Flow Rate (L/s)
Rain Gauge (mm)
1600
1400
1200
1000
800
600
400
200
0
40
35
30
25
20
15
10
5
0
Datalogger was removed between December 5, 2017 and April 23, 2018 due to freezing condition
14-Jun-17
3-Aug-17
22-Sep-17
11-Nov-17
31-Dec-17
19-Feb-18
10-Apr-18
30-May-18
Date
Stream Flow Estimate (Levelogger)
Stream Flow Estimate (Manual)
Rain Gauge
Draft


Estimated Stream Flow at Station SF6-17
Flow Rate (L/s)
1600
1400
1200
1000
800
600
400
200
0
Rain Gauge (mm)
40
35
30
25
20
15
10
5
0
14-Jun-17
3-Aug-17
22-Sep-17
11-Nov-17
31-Dec-17
19-Feb-18
10-Apr-18
30-May-18
Date
Datalogger was removed between December 5, 2017 and April 23, 2018 due to freezing condition
Draft
Stream Flow Estimate (Levelogger)
Stream Flow Estimate (Manual)
Rain Gauge

Appendix H

Surface Water Quality Analysis Results

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.

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

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		
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

Maxxam
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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

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

Maxxam
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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

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.

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 #: 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		

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).

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.

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.

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

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

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

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

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

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.

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		

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 #: B7K8768
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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).

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 #: 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.

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.

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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
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CANADA L3R 4T5

Report Date: 2017/09/29
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CERTIFICATE OF ANALYSIS

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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

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

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		

Maxxam Job #: B7K8768
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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).

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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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

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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
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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.

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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			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
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

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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Maxxam Job #: B7K8768
Report Date: 2017/09/29

QUALITY ASSURANCE REPORT(CONT'D)

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
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).

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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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.

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.

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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
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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
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

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

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

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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			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).

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 #: 629279
Attention:	Accounts Payable	Attention:	Alireza Hejazi	P.O. #:			
Address:	70 Valleywood Dr	Address:		Project:	2017-0293	COC #: C#629279-02-01	Project Manager: Jolanta Goralczyk
	Markham ON L3R 4T5			Project Name:			
Tel:	(416) 987-6161 x Fax: (905) 940-2064 x	Tel:	(416) 987-6161 x243 Fax:	Site #:			
Email:	accountspayable@coleengineering.ca	Email:	AHejazi@coleengineering.ca	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): ☐ 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)

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	" "	1030	" "	" "	X		temp: 18.69 pH: 8.23
3		SF6-17	" "	1535	" "	" "	X		temp: 24.99 pH: 8.29
4									
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7									
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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 McCreary	17-9-22	0900	Tanuth Tanuitsina	2017/09/22	14:30		Time Sensitive	Temperature (°C) on Recei: 3/4/5	Custody Seal: Present Yes ✓; Intact Yes ✓
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White: Maxxa Yellow: Client

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Maxxam Analytics International Corporation o/a Maxxam Analytics

DS CONSULTING PRELIMINARY GEOTECHNICAL REPORT

Report on

Preliminary Geotechnical Investigation
Proposed Employment Land
Southeast of Humber Station Road and Healy Road
Bolton, Ontario

Prepared For:
Humber Station Village Landowners Group

DS CONSULTANTS LTD.
6221 Highway 7, Unit 16
Vaughan, Ontario, L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project No: 23-131-100
Date: June 7, 2023

Table of Contents

1. INTRODUCTION

DS Consultants Ltd. (DS) was retained by Humber Station Village Landowners Group to undertake a preliminary geotechnical investigation for the proposed employment land development located southeast of Humber Station Road and Healy Road, Bolton, Ontario.

It is understood that the proposed development will be industrial with large manufacturing and distribution facilities. The footprints and finished floor elevations of the proposed buildings are not available to us at the time of writing of this report

The purpose of this preliminary geotechnical investigation was to obtain the subsurface conditions at thirteen (13) borehole locations and from the findings at the boreholes and provide geotechnical recommendations for the following:

1. Foundations
2. Floor slabs and permanent drainage
3. Excavations and groundwater control
4. Earth pressures
5. Earthquake considerations
6. Underground Utilities
7. Pavements

This report is provided on the basis of the terms of reference presented above and, on the assumption, that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for Humber Station Village Landowners Group and it’s architect and designers. Third party use of this report without DS consent is prohibited.

2. FIELD AND LABORATORY WORK

Boreholes were advanced at thirteen (13) locations (BH23-1 to BH23-13, see **Drawing 1** for borehole locations). Boreholes were drilled to depths ranging from 7.9 to 8.2 m below existing grade.

The boreholes were drilled with solid stem continuous flight augers equipment by a drilling sub-contractor under the direction and supervision of DS personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm in accordance with the Standard Penetration Test (SPT) method. The samples were logged in the field and returned to the DS laboratory for detailed examination by the project engineer and for laboratory testing.

In addition to visual examination in the laboratory, all soil samples were tested for water contents. Selected ten (10) soil samples were subjected to grain size analyses and three (3) samples were conducted for Atterberg Limits testing. The results of lab testing are provided on the respective borehole logs and presented on **Drawing 19** and **Drawing 20**.

Groundwater level observations were made during drilling and in the open boreholes at the completion of the drilling operations. Nested monitoring wells were installed at four (4) locations i.e. a total of eight (8) monitoring wells (BH23-1A, BH23-1B, BH23-2A, BH23-2B, BH23-7A, BH23-7B, BH23-11A and BH23-11B) were installed for the long-term groundwater level monitoring and hydrogeological study.

The elevation surveying of the borehole locations was undertaken by DS personnel, using the differential GPS unit. It should be noted that the elevations at the as-drilled borehole/well locations were not provided by a professional surveyor and should be considered to be approximate. Contractors performing any work referenced to the borehole elevations should confirm the borehole elevations for their work.

3. SUBSURFACE CONDITIONS

The site consists of six properties situated within a rural neighbourhood in the Town of Bolton, Ontario. The site is currently occupied by agricultural fields and is used for agricultural purposes.

The borehole location plan is shown on **Drawing 1**. General notes on sample description are provided on **Drawing 1A**. The subsurface conditions in the boreholes are presented in the individual borehole logs presented on **Drawings 2** to **18**.

The following is a summarized account of the subsurface conditions encountered in the boreholes, followed by more detailed descriptions of the major soil strata and the groundwater conditions encountered in the boreholes drilled at the site.

3.1 SOIL CONDITIONS

In summary, underlying the topsoil, fill/reworked (weathered/disturbed) native soils were encountered in all boreholes and extended to depths ranging from about 0.5 m to 1.5 m below existing ground surface. The native soils encountered at the site consisted mainly of clayey silt to silty clay (till) underlain by silty sand to sandy silt (till).

Topsoil:

A surficial topsoil layer, ranging in thickness from 250 to 350 mm was encountered at all borehole locations.

It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site. Shallow hand-dug test-pits in the close distance should be carried out to further explore the topsoil conditions.

Fill/Reworked (Weathered/Disturbed) Native Soils:

Fill/reworked (weathered/disturbed) native soils consisting of clayey silt to silty clay were encountered in all boreholes and extended to depths ranging from about 0.5 to 1.5 m below existing ground surface. These materials typically contain trace to some organic matter and are inferred to represent portions of the underlying native silty clay to clayey silt (till) that have been reworked (e.g., potentially as a result of farm tilling operations and weathering). Standard penetration tests carried out within these materials gave N values ranging from 5 to 13 blows per 0.3 m penetration, indicating a firm to stiff consistency.

Clayey Silt to Silty Clay (Till):

Below fill/reworked (weathered/disturbed) native soil, clayey silt to silty clay (till) deposits were encountered in all boreholes and extended to depths ranging from 2.3 to 8.2 m below existing ground surface. Boreholes BH23-2, BH23-9 and BH23-10 were terminated in the clayey silt to silty (till) deposits. The clayey silt to silty clay (till) deposits were present in a stiff to hard consistency, with measured SPT 'N' values ranging from 11 to greater than 50 blows per 300 mm of penetration. Cobbles/boulders were inferred within the till deposits during drilling. Shale pieces were encountered below a depth of 7.9 m in BH23-8.

Grain size analyses of five (5) soil samples from clayey silt to silty clay (till) (BH23-2/SS4, BH22-7/SS3, BH23-8/SS7, BH23-10/SS8 and BH23-11/SS4) were conducted and the results are provided on the respective borehole logs and on **Drawing 19**, with the following fractions:

Clay: 20 to 33%
Silt: 44 to 75%
Sand: 4 to 21%
Gravel: 0 to 4%

Atterberg limits tests of three (3) samples (BH23-2/SS4, BH23-7/SS3 and BH23-11/SS4) were conducted. The results are shown on the borehole logs and on **Drawing 20**, and are summarized as follows:

Liquid limit (W_L): 27.7 to 27.8 %
Plastic limit (W_P): 15.4 to 16.6%
Plasticity index (PI): 11.2 to 12.4

Silty Sand to Sandy Silt (Till)/Silt:

Silty sand to sandy silt (till)/silt deposits were encountered in all boreholes except for BH23-3, BH23-8 and BH23-9 and extended to depths ranging from 7.9 to 8.2 m below existing ground surface. All boreholes except for BH23-3, BH23-8, BH23-9 and BH23-10 were terminated in the silty sand to sandy silt (till)/silt. The silty sand to sandy silt (till)/silt was present in a dense to very dense state, with measured SPT 'N' values ranging from 32 to over 50 blows per 300 mm of penetration. Cobbles/boulders were inferred within the silty sand to sandy silt (till) deposits during drilling.

Grain size analyses of five (5) soil samples from silty sand to sandy silt (till) (BH23-1/SS4, BH23-1/SS7, BH23-2/SS8, BH23-6/SS6 and BH23-11/SS7) were conducted and the results are provided on the respective borehole logs and on **Drawing 19**, with the following fractions:

Clay: 3 to 15%
Silt: 29 to 87%
Sand: 2 to 68%
Gravel: 0 to 8%

3.2 GROUNDWATER CONDITIONS

Groundwater levels were recorded on June 2, 2023, at depths ranging from 0.3 to 3.8 m below the existing ground surface, corresponding to elevations Elev. 225.0 to 237.7 m. The groundwater levels measured in the monitoring wells are summarized in **Table 1**.

Table 1: Summary of Groundwater Level Measurements in Monitoring Wells

Borehole No.	Ground Surface Elev. (m)	Date of Observation	Depth of Groundwater (m)	Elevation of Groundwater (m)
BH23-1A	227.9	June 2, 2023	0.5	227.4
BH23-1B	227.9	June 2, 2023	0.5	227.4
BH23-2A	228.0	June 2, 2023	3.0	225.0
BH23-2B	226.1	June 2, 2023	0.3	225.8
BH23-7A	230.9	June 2, 2023	3.8	227.1
BH23-7B	230.6	June 2, 2023	0.3	230.3
BH23-11A	239.9	June 2, 2023	3.2	236.7
BH23-11B	239.9	June 2, 2023	2.2	237.7

Further measurements of groundwater levels in the monitoring wells are recommended.

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.

4. GEOTECHNICAL RECOMMENDATIONS FOR RESIDENTIAL DEVELOPMENT

Based on the borehole information, preliminary geotechnical discussion and recommendations for the proposed development are presented as follows.

4.1 SITE GRADING AND ENGINEERED FILL

The site is covered by topsoil and fill/reworked native soils (disturbed/weathered) followed by clayey silt to silty clay (till) and silty sand to sandy silt (till) deposits. These native deposits were generally present in a stiff to hard and compact to very dense state.

The development of the site may require cut and fill operations to meet the design grading plans. In the areas where earth fill is required for the site grading purposes, an engineered fill can be constructed below foundations, roads/driveways, parking areas, etc.

Prior to placement of engineered fill, all existing surficial topsoil, fill and reworked native materials and any other unsuitable or loose materials should be removed from planned building areas to expose competent native subgrade. The exposed subgrade should then be proof rolled with a heavy sheepsfoot roller to identify weak areas. Any weak or excessively wet zones identified during proof-rolling should be sub-excavated and replaced with compacted competent material to establish stable and uniform conditions. Prior to placement of engineered fill, the subgrade should be inspected and approved by a geotechnical engineer.

The engineered fill consisting of approved inorganic material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential. General guidelines for the placement and preparation of engineered fill are presented on **Appendix A**. Engineered fill should not be placed during the winter months.

4.2 FOUNDATIONS

It is understood that the proposed land will be industrial with large manufacturing and distribution facilities.

Based on borehole information, the proposed industrial manufacturing and distribution buildings can be supported by conventional spread/strip footings founded on undisturbed competent native soils using bearing capacities of 200 to 400 kPa at SLS (Serviceability Limit State) and 300 to 600 KPa at USL (Ultimate Limit State). The bearing capacities of the native soils for footings and the corresponding founding elevations to support the building at the borehole locations are summarized on **Table 2**.

Table 2: Bearing Values and Founding Levels of Spread Footings on Undisturbed Native Soils

BH No.	Anticipated Founding Soil	Bearing Capacity at SLS (kPa)	Bearing Capacity at ULS (kPa)	Minimum Depth below Existing Ground (m)	Founding Level at or Below Elevation (m)
BH23-1A	Silty clay till Silty sand to sandy silt	200 400	300 600	1.1 2.6	226.8 225.3
BH23-2B	Clayey silt to silty clay till	300	450	1.2	224.9
BH23-3	Clayey silt to silty clay till	200	300	1.1	229.0
BH23-4	Clayey silt to silty clay till	300	450	1.3	227.3
BH23-5	Silty clay till Silty sand	200 400	300 600	1.3 2.6	228.5 227.2
BH23-6	Silty clay till Sandy silt till	200 400	300 600	1.3 2.6	229.3 228.0
BH23-7B	Silty clay till	200	300	0.8	229.8
BH23-8	Clayey silt to silty clay till	200	300	1.3	231.1
BH23-9	Clayey silt to silty clay till	200	300	1.1	230.8
BH23-10	Silty clay till	300	450	1.1	239.6
BH23-11A	Clayey silt to silty clay till	300	450	1.2	238.7
BH23-12	Silty clay till	300	450	1.8	239.1
BH23-13	Clayey silt to silty clay till	300	450	1.2	242.0

Where the grade needs to be raised, the proposed structures can be supported by spread and strip footings founded on engineered fill for a bearing capacity value of 150 kPa at SLS (Serviceability Limit State), and for a factored geotechnical resistance of 225 kPa at ULS (Ultimate Limit State). The engineered fill supporting footings should be constructed in accordance with the guidelines presented in **Appendix A**. Other requirements of engineered fill are given in **Section 4.1**.

Variations in the soil conditions are expected in between the borehole locations, and during construction, the soil bearing pressures should be confirmed by the Geotechnical Engineer.

Foundations designed to the specified bearing capacities at the serviceability limit states (SLS) are expected to settle less than 25 mm total and 19 mm differential.

All footings exposed to seasonal freezing conditions must have at least 1.4 metres of soil cover for frost protection.

Where it is necessary to place footings at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line drawn up from the base of the lower footing. The lower footing must be installed first to help minimize the risk of undermining the upper footing.

It should be noted that the recommended bearing capacities have been calculated by DS from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of the underground conditions becomes available. For example, more specific information is available with respect to conditions between boreholes when foundation construction is underway. The interpretation between boreholes and the recommendations of this report must therefore be checked through field inspections provided by DS to validate the information for use during the construction stage.

4.3 EARTH PRESSURE

The lateral earth pressures acting on foundation and basement walls may be calculated from the following expression:

$$p = k(\gamma h + q)$$

where, p = Lateral earth pressure in kPa acting at depth h

K = Earth pressure coefficient, assumed to be 0.40 for vertical walls and horizontal backfill for permanent construction

γ = Unit weight of backfill, a value of 21 kN/m3 may be assumed

h = Depth to point of interest in metres

q = Equivalent value of surcharge on the ground surface in kPa

The above expression assumes that the perimeter drainage system prevents the build up of any hydrostatic pressure behind the wall.

4.4 FLOOR SLAB AND PERMERNENT DRAINAGE

The floor slab can be supported by competent native soil and/or engineered fill provided all topsoil, reworked (disturbed/weathered) soils and surficially disturbed native soils are removed and the base thoroughly proof rolled.

The engineered fill, to raise the grades if required, consisting of approved inorganic material must be compacted to 100% Standard Proctor Maximum Dry Density throughout.

A moisture barrier consisting of at least 200 mm of 19 mm clear crushed stone should be installed under the floor slab.

A subgrade reaction coefficient of kt = 15 MPa/m can be used for the design of the concrete slab, if required.

If the floor slab is more than 300 mm higher than the exterior grade, then perimeter drainage is not considered to be necessary. If the floor is lower, then the perimeter drainage system shown on **Drawing 21** is recommended.

4.5 EXCAVATION AND GROUNDWATER CONTROL

Excavations can be carried out with heavy hydraulic backhoe. Cobbles and boulders are present at the site as evidence of auger grinding. Provisions should be provided in the contractor documents to deal with the boulders and cobbles encountered at the site.

Groundwater levels were recorded on June 2, 2023, at depths ranging from 0.3 to 3.8 m below the existing ground surface, corresponding to elevations Elev. 225.0 to 237.7 m. Groundwater seepage within the clayey silt to silty clay (till) is expected to be slow and manageable by gravity drainage and pumping from filtered sumps. More significant groundwater seepage/inflow would be expected from the cohesionless sandy silt to silty sand (till) and zone of sandy soils within the clayey silt to silty clay (till) below groundwater table. Depending upon the actual thickness and extent of these layers/deposits and groundwater levels, more vigorous groundwater control measures could be required to maintain the stability of the base and side slopes of the excavations in these areas. Positive dewatering will be required for excavation into the cohesionless sandy silt to silty sand (till) deposits below groundwater table. The groundwater must be lowered to at least 1.0 m below the excavation bases.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, fill/reworked native soils (weathered/disturbed) and firm to stiff clayey silt to silty clay (till) can be classified as Type 3 Soil above groundwater table and Type 4 Soil below groundwater table. Very stiff to hard clayey silt to silty clay (till) deposits can be classified as Type 2 Soil above groundwater table and Type 3 Soil below groundwater table. Cohesionless sandy silt to silty sand (till) can be classified as Type 3 Soil above groundwater table and Type 4 Soil below groundwater table.

4.6 EARTHQUAKE CONSIDERATIONS

Based on the borehole information and according to Table 4.1.8.4.A of OBC 2012, the subject site for the proposed buildings with slab-on-grade construction can be classified as “Class C” for seismic site response.

4.7 UNDERGROUND UTILITIES

The boreholes show that below the existing topsoil and fill/reworked native soils, the trenches will be predominantly dug through the clayey silt to silty clay (till) and sandy silt to silty sand (till) deposits.

Comments on excavation and groundwater control are provided in **Section 4.5** of this report.

The native soils and engineered fill will provide adequate support for the sewer pipes and allow the use of normal Class B type bedding. The bedding should conform to the current Ontario Provincial Standard specifications (OPSS 401/OPSD 802) and/or standards set by the local municipality.

The recommended minimum thickness of granular bedding below the invert of the pipes is 150 mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter or in accordance with local standards or if wet or weak subgrade conditions or fill materials are encountered at the trench base level. The bedding material should consist of well graded granular material such as Granular ‘A’ or equivalent. After installing the pipe on the bedding, a granular surround of approved bedding material, which extends at least 300 mm above the obvert of the pipe, or as set out by the local Authority, should be placed.

To avoid the loss of soil fines from the subgrade, uniformly graded clear stone should not be used unless, below the granular bedding material, a suitable, approved filter fabric (geotextile) is placed. The geotextile should extend along the sides of the trench and should be wrapped all around the poorly graded bedding material.

Based on visual and tactile examination, the on-site excavated soils free from topsoil and organics are considered to be suitable for re-use as backfill in the service trenches provided their moisture contents at the time of construction are within 2 percent of their optimum moisture content. Aeration of the wet excavated soils will be required prior to their use as backfill material.

The clayey soils are likely to be excavated in cohesive chunks or blocks and will be difficult to compact in confined areas. For use as backfill, the soils will have to pulverized and placed in thin layers. The soils will have to be compacted using heavy equipment suitable for these soils which may be difficult to operate in the narrow confines of the trenches. Unless the soils are properly pulverized and compacted in sufficiently thin lifts, otherwise post-construction settlements could occur. Their use in narrow trenches such as laterals (where heavy compaction equipment cannot be operated) may not be feasible.

Imported granular fill, which can be compacted with handheld equipment, should be used in confined areas.

The excavated soils are not considered to be free draining. Where free draining backfill is required, imported granular fill such as OPSS Granular B should be used.

The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content and each layer should be compacted to at least 95% SPMDD. In the upper 1.5 m of subgrade, underneath the road base, the compaction should be increased to 98% SPMDD. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling.

It should be noted that the excavated soils are subject to moisture content increase during wet weather which would make these materials too wet for adequate compaction. Stockpiles should be compacted at the surface or be covered with tarpaulins to minimize moisture uptake.

4.8 PAVEMENT

The recommended pavement structures provided in **Table 3** are based upon an estimate of the subgrade soil properties determined from visual examination and textural classification of the soil samples. The values may need to be adjusted based on the city standards. Consequently, the recommended pavement structures should be considered for preliminary design purposes only. A functional design life of eight to ten years has been used to establish the pavement recommendations. This represents the number of years to the first rehabilitation, assuming regular maintenance is carried out. If required, a more refined pavement structure design can be performed based on specific traffic data and design life requirements and will involve specific laboratory tests to determine frost susceptibility and strength characteristics of the subgrade soils, as well as specific data input from the client.

Table 3: Recommended Pavement Structure Thickness

Pavement Layer	Compaction Requirements	Light Duty Parking (Cars)	Heavy Duty Parking/Driveway (Delivery Trucks)
Asphaltic Concrete	92.0 to 96.5% Maximum Relative Density (MRD)	40 mm HL 3 40 mm HL 8	40 mm HL 3 80 mm HL 8
OPSS Granular A Base (or 19mm Crusher Run Limestone)	100% SPMDD*	150 mm	150 mm
OPSS Granular B (or 50mm Crusher Run Limestone)	100% SPMDD	250 mm	350 mm

The subgrade must be compacted to 98% SPMDD for at least the upper 1.0 m unless accepted by DS Consultants Ltd.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure uniform subgrade moisture and density conditions are achieved. In addition, the need for adequate drainage cannot be over-emphasized. The finished pavement surface and underlying subgrade should be free of depressions and should be sloped (preferably at a minimum grade of two percent) to provide effective surface drainage toward catch basins. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas. Subdrains should be installed to intercept excess subsurface moisture and prevent subgrade softening. This is particularly important in heavy-duty pavement areas.

Additional comments on the construction of parking areas and access roadways are as follows:

1) As part of the subgrade preparation, proposed parking areas and access roadways should be stripped of topsoil and other obvious objectionable material. Fill required to raise the grades to design elevations should conform to backfill requirements outlined in previous sections of this

report. The subgrade should be properly shaped, crowned then proof-rolled in the full-time presence of a representative of this office. Soft or spongy subgrade areas should be sub-excavated and properly replaced with suitable approved backfill compacted to 98% SPMDD.

2) The locations and extent of sub-drainage required within the paved areas should be reviewed by this office in conjunction with the proposed lot grading. Assuming that satisfactory crossfalls in the order of two percent have been provided, subdrains extending from and between catch basins may be satisfactory. In the event that shallower crossfalls are considered, a more extensive system of sub-drainage may be necessary and should be reviewed by DS Consultants Ltd.

3) The most severe loading conditions on light-duty pavement areas and the subgrade may occur during construction. Consequently, special provisions such as restricted access lanes, half-loads during paving, etc., may be required, especially if construction is carried out during unfavourable weather.

It is recommended that DS Consultants Ltd. be retained to review the final pavement structure designs and drainage plans prior to construction to ensure that they are consistent with the recommendations of this report.

5. GENERAL COMMENTS AND LIMITATIONS OF REPORT

DS Consultants Ltd. (DS) should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, DS will assume no responsibility for interpretation of the recommendations in the report.

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to DS at the time of preparation. Unless otherwise agreed in writing by DS, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. DS accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

DS Consultants Ltd.

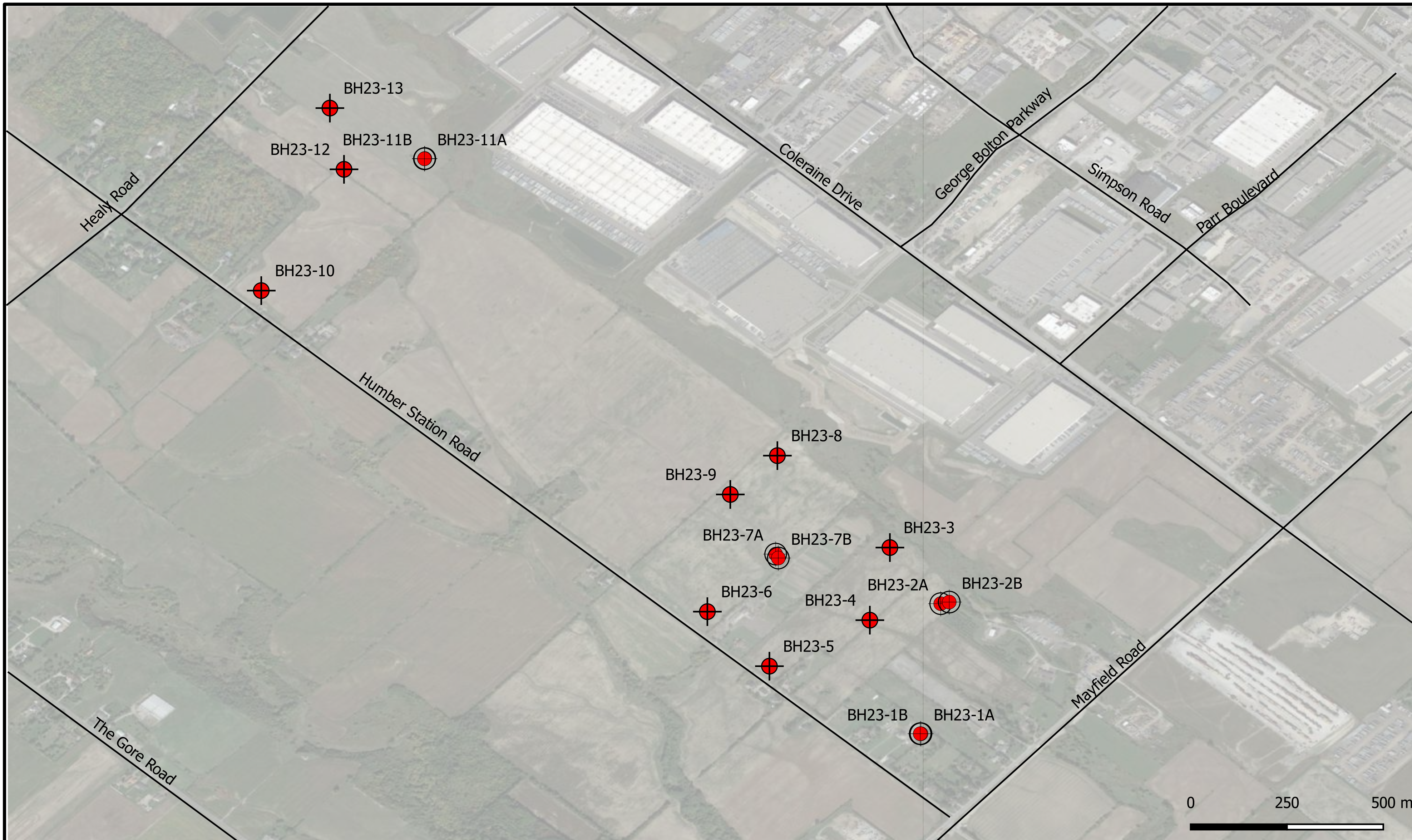
Derek Wang, P.Eng.
Senior Geotechnical Engineer

Fanyu Zhu, Ph.D., P.Eng.
Principal Engineer

Shabbir Bandukwala, M.Eng., P.Eng.
Principal Engineer

Drawings

May-29 17:18



Legend

Borehole

Monitoring Well

DS CONSULTANTS LTD.
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project:	Preliminary Geotechnical Investigation Humber Station Road, Bolton, ON				
Title:	BOREHOLE LOCATION PLAN				
Size: 8.5 x 11	Approved By: D.W	Drawn By: K.T		Date: May 2023	
Rev: 0	Scale: As Shown	Project No.: 23-131-100		Figure No.: 1	
	Image/Map Source: *Google Satellite Image*				

Client:
Humber Station Village Landowners Group
c/o Delta Urban Inc.

N

Drawing 1A: Notes On Sample Descriptions

1. All sample descriptions included in this report generally follow the Unified Soil Classification. Laboratory grain size analyses provided by DSCL also follow the same system. Different classification systems may be used by others, such as the system by the International Society for Soil Mechanics and Foundation Engineering (ISSMFE). Please note that, with the exception of those samples where a grain size analysis and/or Atterberg Limits testing have been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		

0.002 0.006 0.02 0.06 0.2 0.6 2.0 6.0 20 60 200

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

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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 (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
227.9						
227.6 / 0.3	**TOPSOIL:** 250 mm	1	SS	6		
227.1 / 0.8	**FILL:** silty clay, trace gravel, some sand, brown, moist, firm (weathered/ disturbed)	2	SS	19		
225.6 / 2.3	**SILTY CLAY TILL:** trace gravel, brown to grey, moist, very stiff cobbles/boulders	3	SS	27		
222.8 / 5.1	**SANDY SILT:** trace gravel, trace clay, brown to grey, moist to wet, dense to very dense	4	SS	50/127 mm		8 39 47 6
		5	SS	50/127 mm		
		6	SS	44		
220.1 / 7.8	**SILTY SAND:** grey, very moist, dense to very dense; cobbles/boulders at 7.6m	7	SS	50/127 mm		0 68 29 3
		8	SS	50/76 mm		

W. L. 227.4 m
Jun 02, 2023

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/m^3)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity ○ ^{8}=3% Strain at Failure

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

ELEV (m) / DEPTH	DESCRIPTION
227.9	
227.6 / 0.3	**TOPSOIL:** 250 mm
227.1 / 0.8	**FILL:** silty clay, trace gravel, some sand, brown, moist, firm (weathered/ disturbed)
225.6 / 2.3	**SILTY CLAY TILL:** trace gravel, brown to grey, moist, very stiff cobbles/boulders
223.3 / 4.6	**SANDY SILT:** trace gravel, trace clay, brown to grey, moist to wet, dense to very dense

SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m
1	SS	6
2	SS	19
3	SS	27
4	SS	50/ 127 mm
5	SS	50/ 127 mm

GROUND WATER CONDITIONS: W. L. 227.4 m Jun 02, 2023

ELEVATION: 226, 225, 224

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/m^3)
REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

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

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ^{8}=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

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION
228.0						
227.6 / 0.0	**TOPSOIL:** 350 mm	1	SS	5		
0.4	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/disturbed)					
227.1 / 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	W. L. 225.0 m Jun 02, 2023	225
		5	SS	17		
		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					

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

DS SOIL LOG /DRAFT 23-131-100.GPJ DS.GDT 6/6/23

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 BH23-2B

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

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	ELEVATION	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
226.1							
225.8 / 0.0	**TOPSOIL:** 350 mm	1	SS	5	226		
0.4	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/disturbed)						
225.2 / 0.9	**SILTY CLAY TILL:** trace gravel, some sand to sandy, brown to grey, moist, stiff to hard	2	SS	12	225		
		3	SS	40	224		
		4	SS	25			4 21 46 29
		5	SS	17	223		
		6	SS	20	222		
221.3 / 4.8	**SANDY SILT TILL:** trace gravel, some clay, grey, moist, dense	7	SS	32	221		
220.0 / 6.1	**SILT:** some clay, trace sand, grey, very moist, very dense	8	SS	68	220		0 2 83 15
					219		
218.0 / 8.1		9	SS	73			

W. L. 225.9 m
Jun 02, 2023

END OF BOREHOLE:
Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date: Water Level (mbgl) :
June 2, 2023 0.27

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/m^3)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ^{8}=3% Strain at Failure

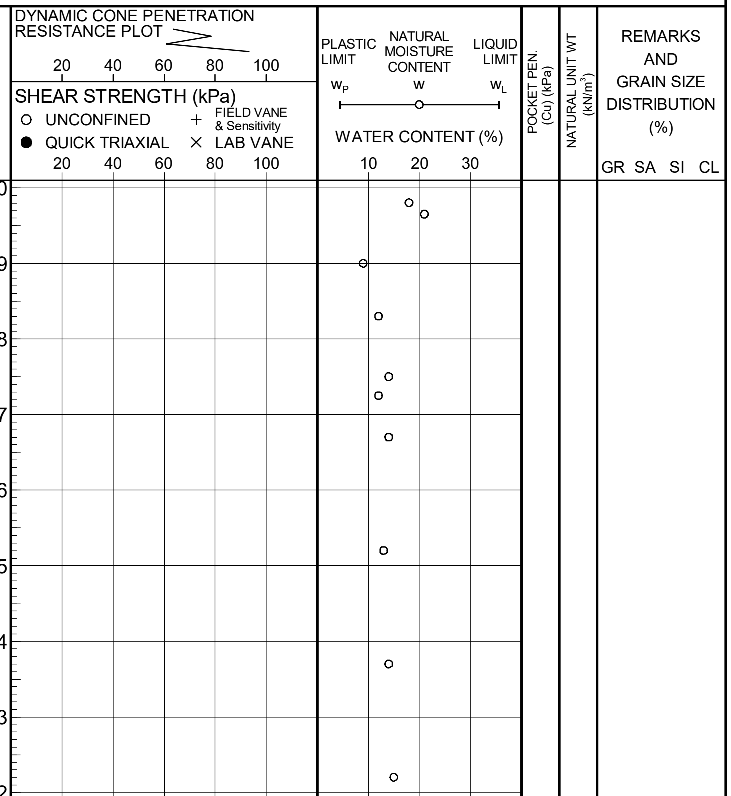
LOG OF BOREHOLE BH23-3

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

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
230.1						
229.8 / 0.0	**TOPSOIL:** 300mm	1	SS	7		
0.3	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/disturbed)					
229.3 / 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		
		3	SS	13		
		4	SS	24		
		5	SS	20		
		6	SS	13		
		7	SS	11		
221.9 / 8.2		8	SS	19		
	END OF BOREHOLE Notes: 1) Borehole was wet at bottom upon completion					



GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity ○ 8=3% Strain at Failure

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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

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	WATER CONTENT (%) (approx.)
228.6 / 0.0	**TOPSOIL:** 250 mm				
228.3 / 0.3	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/disturbed)	1	SS	6	
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	
		3	SS	32	
		4	SS	33	
		5	SS	20	
		6	SS	24	
223.4 / 5.2	**SANDY SILT TO SILTY SAND:** trace clay, trace gravel, grey, moist to wet, very dense	7	SS	82	
		8	SS	50/102 mm	
220.6 / 8.0	**END OF BOREHOLE** Notes: 1) Borehole was wet at the bottom upon completion of drilling				

Column headings: SOIL PROFILE; STRATA PLOT; SAMPLES; GROUND WATER CONDITIONS; ELEVATION; 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/m^3); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Elevation scale: 228, 227, 226, 225, 224, 223, 222, 221

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity ○ ^{8}=3% Strain at Failure

LOG OF BOREHOLE BH23-5

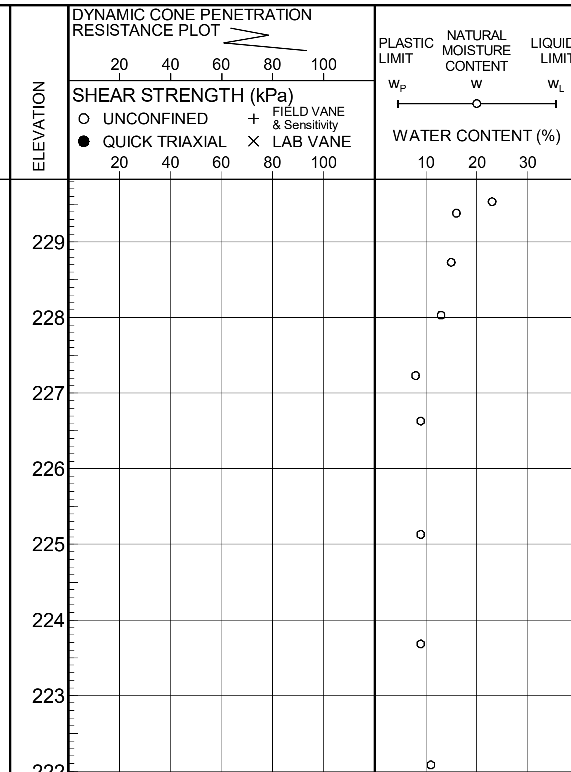
PROJECT: Preliminary Geotechnical Investigation
CLIENT: Humber Station Village Landowners Group c/o Delta Urban Inc.
PROJECT LOCATION: Southeast of Humber Station Rd. and Healy Rd.
DATUM: Geodetic
BH LOCATION: N 4854258.493 E 602717.039

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May/16/2023

REF. NO.: 23-131-100
ENCL NO.: 8

ELEV (m) / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3 m
229.8 / 0.0				
229.6 / 0.3	**TOPSOIL:** 250 mm	1	SS	7
228.8 / 1.0	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/disturbed)	2	SS	19
227.5 / 2.3	**SILTY CLAY TILL:** trace gravel, sandy, brown, moist, very stiff	3	SS	25
221.9 / 7.9	**SILTY SAND:** trace to some clay, trace gravel, brown to grey, moist to wet, very dense	4	SS	81
		5	SS	50/ 102 mm
		6	SS	50/ 76 mm
		7	SS	50/ 102 mm
		8	SS	50/ 150 mm
	END OF BOREHOLE			

Notes:
1) Borehole was wet at the bottom upon completion of drilling



Columns: STRATA PLOT | GROUND WATER CONDITIONS | POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m^3) | REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ^{8}=3% Strain at Failure

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

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
230.6 / 0.0	**TOPSOIL:** 250 mm				
230.4 / 0.3	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/disturbed)	1	SS	7	
		2	SS	22	
229.6 / 1.0	**SILTY CLAY TILL:** trace gravel, sandy, brown, moist, very stiff to hard	3	SS	30	
228.3 / 2.3	**SANDY SILT TILL:** trace clay, trace to some gravel, brown, moist, very dense	4	SS	50/102 mm	
		5	SS	89	
226.0 / 4.6	**SILT:** trace to some clay, grey, moist to wet, dense to very dense	6	SS	50/127 mm	0 0 87 13
		7	SS	50/127 mm	
222.4 / 8.2		8	SS	36	

END OF BOREHOLE
Notes:
1) Borehole was wet at the bottom upon completion of drilling

Column headings: SOIL PROFILE; SAMPLES; GROUND WATER CONDITIONS; ELEVATION (230, 229, 228, 227, 226, 225, 224, 223); 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/m^3); STRATA PLOT.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ^{8}=3% Strain at Failure

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

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
230.9						
230.6 / 0.3	**TOPSOIL:** 250mm	1	SS	7		
230.4 / 0.5	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/disturbed)	2	SS	19		
	SILTY CLAY TILL: trace gravel, some sand to sandy, brown to grey, moist, very stiff to hard	3	SS	20		2 18 48 32
		4	SS	44		
		5	SS	36		
		6	SS	19		
224.3 / 6.6		7	SS	50/102 mm		

W. L. 227.0 m
Jun 02, 2023

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

Column headings: SOIL PROFILE; SAMPLES; STRATA PLOT; GROUND WATER CONDITIONS; ELEVATION (230, 229, 228, 227, 226, 225); 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/m^3)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity ○ ^{8}=3% Strain at Failure

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

ELEV (m) / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION
230.6						
230.3 / 0.3	**TOPSOIL:** 250mm	1	SS	7	W. L. 230.2 m Jun 02, 2023	
230.1 / 0.5	**FILL:** clayey silt, trace gravel, trace organics, trace rootlets, brown, moist, firm (weathered/disturbed)					
	SILTY CLAY TILL: trace gravel, some sand to sandy, brown to grey, moist, very stiff to hard	2	SS	19		229
		3	SS	20		
		4	SS	44		228
		5	SS	36		227
						226
		6	SS	19		225
		7	SS	50/ 102 mm		224
223.0 / 7.6						223
222.7 / 7.9	**SILTY SAND TILL:** trace to some gravel, grey, moist, very dense	8	SS	50/ 127 mm		

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): ○ 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/m^3)
REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ^{8}=3% Strain at Failure

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

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
232.4 / 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)	2	SS	13		231	
231.4 / 1.0	**CLAYEY SILT TO SILTY CLAY TILL:** trace gravel, sandy, brown to grey, moist, stiff to very stiff	3	SS	25		230	
		4	SS	30		229	
		5	SS	26		228	
		6	SS	18		227	
226.3 / 6.1	**CLAYEY SILT:** trace sand, grey, moist, hard	7	SS	37		226	0 4 75 21
	shale pieces below 7.9 m	8	SS	47		225	
224.2 / 8.2	**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/m^3)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ^{8}=3% Strain at Failure

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	SOIL PROFILE DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS / 0.3 m	ELEVATION
231.9					
231.6 / 0.3	**TOPSOIL:** 250 mm	1	SS	6	
231.1 / 0.8	**CLAYEY SILT:** trace gravel, trace rootlets, trace organics, some sand, brown, moist, firm (weathered/disturbed)	2	SS	15	231
	CLAYEY SILT TO SILTY CLAY TILL: trace to some gravel, sandy, brown to grey, moist, very stiff to hard	3	SS	50/ 127 mm	230
		4	SS	46	229
		5	SS	27	228
		6	SS	23	227
					226
		7	SS	50/ 127 mm	225
223.9 / 8.0	**END OF BOREHOLE**	8	SS	50/ 127 mm	224

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
GROUND WATER CONDITIONS; POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3)
REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ^{8}=3% Strain at Failure

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

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
240.7 / 0.0	**TOPSOIL:** 250 mm	1	SS	5	
240.4 / 0.3	**FILL:** clayey silt, trace gravel, trace rootlets, trace organics, dark to brown, moist, firm (weathered/disturbed)				
239.9 / 0.8	**SILTY CLAY TILL:** trace gravel, some sand to sandy, brown to grey, moist, very stiff to hard	2	SS	26	
		3	SS	26	
		4	SS	28	
		5	SS	40	
235.8 / 4.9	**SILTY SAND TILL:** some gravel, grey, moist, very dense	6	SS	50/102 mm	
		7	SS	50/127 mm	
233.1 / 7.6	**CLAYEY SILT:** trace sand, grey, moist, hard	8	SS	50/127 mm	0 6 74 20
232.8 / 7.9	**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/m^3)
ELEVATION: 240, 239, 238, 237, 236, 235, 234, 233

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity ○ $^{\varepsilon}$=3% Strain at Failure

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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	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
239.9							
239.6 / 0.0	**TOPSOIL:** 300 mm	1	SS	6			
0.3	**FILL:** clayey silt, trace gravel, trace rootlets, trace organics, brown, moist, firm (weathered/disturbed)					239	
239.0 / 0.9	**SILTY CLAY TILL:** trace gravel, some sand to sandy, brown to grey, moist, very stiff to hard	2	SS	17			
		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, 233	8 39 44 9
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	

Chart axes: 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/m^3)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ 8=3% Strain at Failure

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

ELEV (m) / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION
239.9						
239.6 / 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)					239
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		
		3	SS	33		238
		4	SS	32	W. L. 237.7 m Jun 02, 2023	237
236.1		5	SS	46		
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					

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: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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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	SAMPLE NUMBER	TYPE	"N" BLOWS / 0.3 m	ELEVATION	WATER CONTENT (%)
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** Notes: 1) Borehole was wet at the bottom upon completion of drilling	8	SS	50/ 127 mm	233	

Column headings: SOIL PROFILE; STRATA PLOT; SAMPLES; GROUND WATER CONDITIONS; ELEVATION; 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/m^3); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ^{8}=3% Strain at Failure

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	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m
243.2				
242.9 / 0.3	**TOPSOIL:** 300 mm	1	SS	13
242.3 / 0.9	**FILL:** clayey silt, trace gravel, trace rootlets, trace oxidation, trace organics, brown, moist, stiff			
	CLAYEY SILT TILL TO SILTY CLAY TILL: trace gravel, some sand to sandy, brown to grey, moist, very stiff to hard	2	SS	23
		3	SS	33
		4	SS	39
		5	SS	25
		6	SS	33
		7	SS	53
235.6 / 7.6	**SANDY SILT TILL:** trace clay, trace gravel, grey, moist to wet, very dense	8	SS	50/152 mm
235.2 / 8.0	**END OF BOREHOLE**			

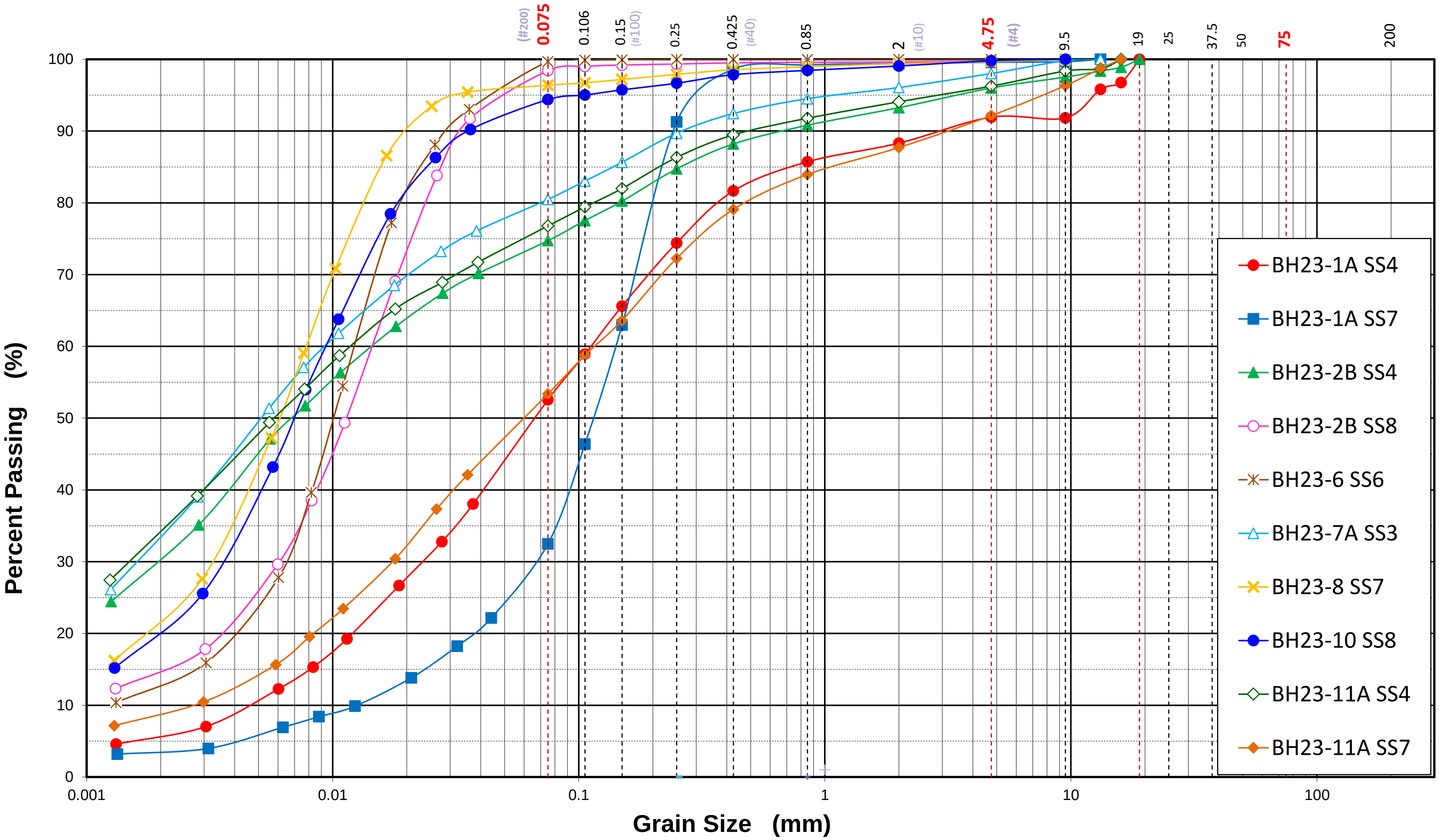
Notes:
1) Borehole was wet at the bottom upon completion of drilling

Column headings: GROUND WATER CONDITIONS; ELEVATION (243, 242, 241, 240, 239, 238, 237, 236); 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/m^3); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ^{8}=3% Strain at Failure

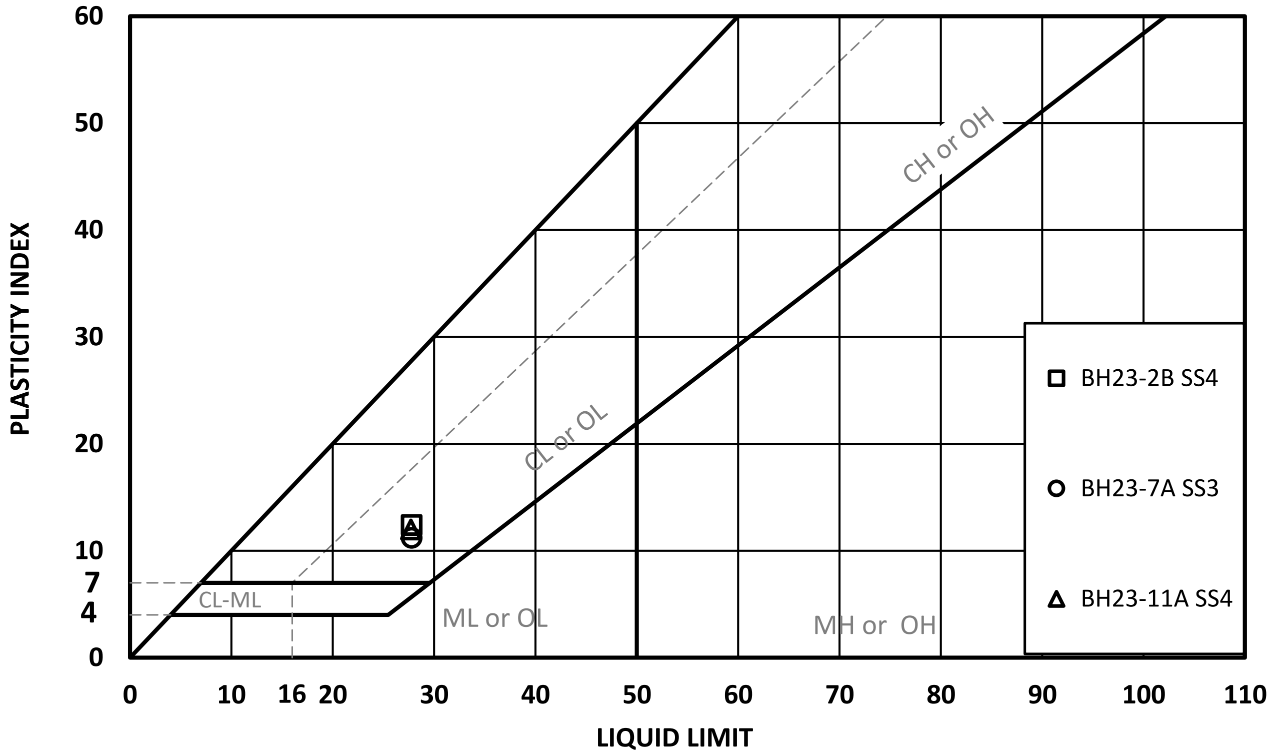
Particle Size Distribution (ASTM-D421/D422)



Silt and Clay		Sand			Gravel		Cobble +
Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	

DS CONSULTANTS LTD. 6221 Highway 7, Unit 16 Vaughan, Ontario, L4H 0K8 Telephone: (905) 264-9393 www.dsconsultants.ca	Project	**Preliminary Geotechnical Investigation for Employment Land**	Project No	**23-131-100**
	Location	**Southeast of Humber Station Road and Healy Road, Bolton**	Date	**May-24-2023**
	Client	**Humber Station Village Landowners Group c/o Delta Urban Inc.**	Figure No	**19**

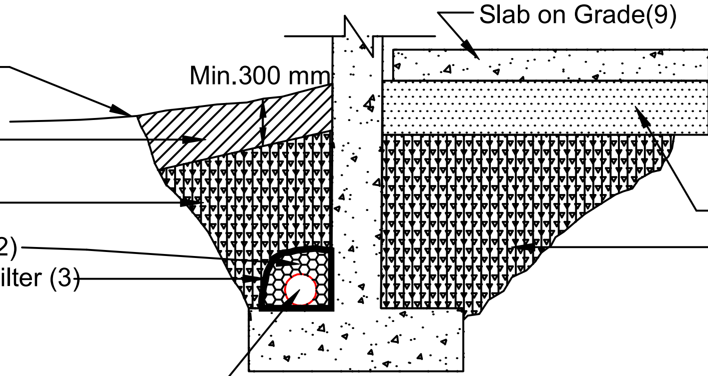
Atterberg Test (ASTM D-4318)



Code	Sample ID	Sample No.		Moisture Contant (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	**USCS Symbol**
1	□	BH23-2B	SS4	13	27.8	15.4	12.4	CL
2	○	BH23-7A	SS3	15	27.8	16.6	11.2	CL
3	△	BH23-11A	SS4	13	27.7	15.7	12	CL

DS CONSULTANTS LTD.
6221 Highway 7, Unit 16
Vaughan, Ontario, L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project	Preliminary Geotechnical Investigation for Employment Land	Project No	23-131-100
Location	Southeast of Humber Station Road and Healy Road, Bolton	Date	May-24-2023
Client	Humber Station Village Landowners Group c/o Delta Urban Inc.	Figure No	20



EXTERIOR FOOTING

Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved geotextile filter (Terrafix 270R or equivalent).
4. The on-site clayey material, if approved, can be used as backfill in the upper 300 mm.
5. The interior and exterior fill adjacent to foundation walls should be OPSS Granular 'B' Type I. Compact to at least 98% SPMDD.
6. Do not use heavy compaction equipment within 450 mm (18") of the wall. Do not fill or compact within 1.8 m (6') of the wall. Place fill on both sides simultaneously.
7. Capillary break to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors (consult with architect).
8. Exterior grade to slope away from building at min. 2%.
9. Slab on grade should not be structurally connected to the wall or footing.
10. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS
Slab on Grade Construction Without Underfloor Drainage
(not to scale)

Appendix A

General Requirements for Engineered Fill

GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted imported soil that meets specific engineering requirements and is free of organics and debris and that has been continually monitored on a full-time basis by a qualified geotechnical representative is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other sites. In general, most of Ontario soils are too wet to achieve the 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be considered for engineered fill. Imported non-cohesive granular soil is preferred for all engineered fill. For engineered fill, we recommend use of OPSS Granular 'B' sand and gravel fill material.

Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

The location of the foundations on the engineered fill pad is critical and certification by a qualified surveyor that the foundations are within the stipulated boundaries is mandatory. Since layout stakes are often damaged or removed during fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same conditions and quality control as the original pad.

To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, contractors and all parties must be aware of the requirements. The minimum requirements are as follows; however, the geotechnical report must be reviewed for specific information and requirements.

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and DS Consultants Ltd (DS). Without this confirmation no responsibility for the performance of the structure can be accepted by DS. Survey drawing of the pre and post fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a DS engineer prior to placement of fill.

5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.

6. Full-time geotechnical inspection by DS during placement of engineered fill is required. Work cannot commence or continue without the presence of the DS representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. A bearing capacity of 150 kPa at SLS (225 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

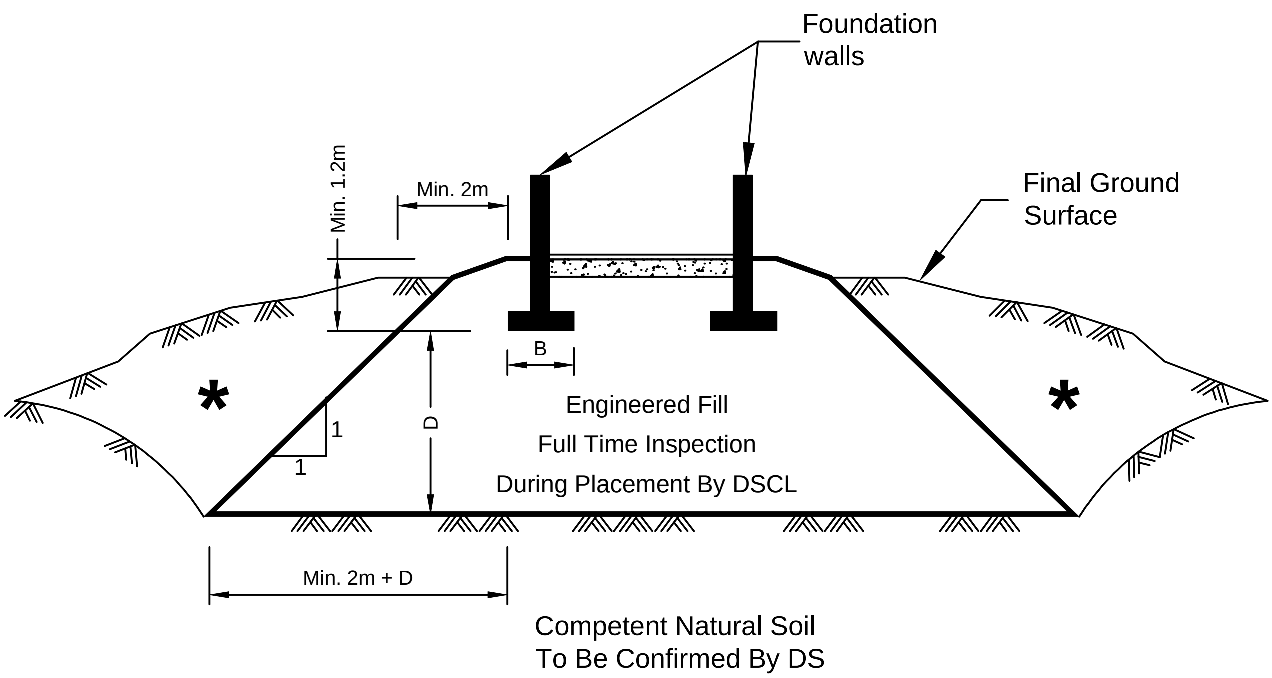
10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from DS prior to footing concrete placements. All excavations must be backfilled under full time supervision by DS to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of DS.

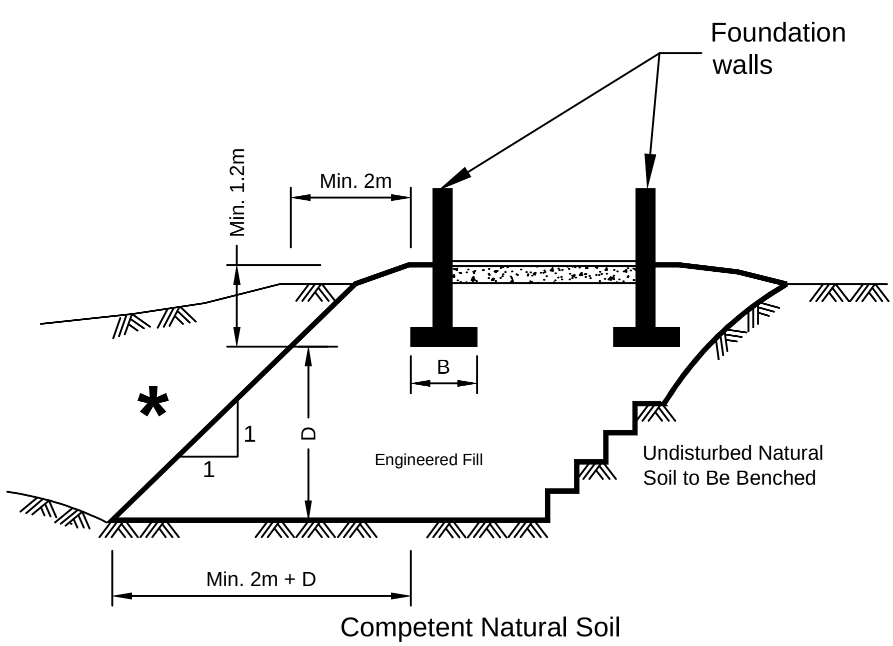
11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.

14. These guidelines are to be read in conjunction with DS Consultants Ltd report attached.





* Backfill in this area to be as per the DS report.

PINCHIN GEOTECHNICAL REPORT

DRAFT

Supplemental Geotechnical Investigation – Proposed Industrial Development

12519-12713 Humber Station Road, Caledon, Ontario

Prepared for:

Prologis
185 The West Mall, Suite 700
Toronto, Ontario, M9C 5L5

March 31, 2023

Pinchin File: 0308567.002

Issued to:	**Prologis**
Issued on:	**March 31, 2023**
Pinchin File:	**0308567.002**
Issuing Office:	**Mississauga, ON**

Author: Eric Naylor, P.Eng.
Geotechnical Project Manager
365-822-2275
enaylor@pinchin.com

Reviewer: Jeff Dietz, P.Eng.
Senior Technical Manager, Geotechnical Services
519.589.3768
jdietz@pinchin.com

TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION AND SCOPE

Pinchin Ltd. (Pinchin) was retained by Prologis (Client) to conduct a Supplemental Geotechnical Investigation and provide subsequent geotechnical design recommendations for the proposed industrial development to be located at 12519-12713 Humber Station Road, Caledon, Ontario (Site). The Site location is shown on Figure 1.

For the purposes of this report, directions are referenced to project north. Based on concept plans provided to Pinchin, project north is positioned such that Humber Station Road runs in an east-wet orientation.

Based on information provided by the Client, it is Pinchin's understanding that the development will consist of five (5) slab-on grade buildings (Buildings 1 to 6), at grade asphalt parking and loading areas, access driveways, landscaped areas, and stormwater management ponds at the west edge of site and near the southeast corner.

Pinchin's geotechnical comments and recommendations are based on the results of the current and previous Geotechnical Investigations and our understanding of the project scope.

A subsurface investigation was undertaken by Pinchin in July of 2022, during which time eighteen (18) boreholes and fourteen (14) topsoil thickness holes were advanced. This report was issued under Pinchin file number 0308567.001. The purpose of the supplemental geotechnical investigation was to provide additional information on the subsurface conditions and soil engineering characteristics by advancing a total of eighty-two (82) additional sampled boreholes (Boreholes BH101 to BH182) and twelve (12) additional topsoil thickness holes at the Site. Borehole records from the previous Pinchin investigation can be found in Appendix II.

This report should be considered supplemental to the geotechnical investigation report dated July 19 2022. Should any recommendations differ between this report and the previous investigation report, this report will supersede the previous report.

Based on a desk top review and the results of the geotechnical investigations, the following geotechnical data and engineering design recommendations are provided herein:

- A detailed description of the soil and groundwater conditions;
- Site preparation recommendations;
- Open cut excavations;
- Anticipated groundwater management;
- Site service trench design;
- Lateral earth pressure coefficients and unit densities;

- Foundation design recommendations including soil bearing resistances at Ultimate Limit States (ULS) and Serviceability Limit States (SLS) design;
- Potential total and differential settlements;
- Foundation frost protection and engineered fill specifications and installation;
- Seismic Site classification for seismic Site response;
- Concrete floor slab-on-grade support recommendations;
- Asphaltic concrete pavement structure design for parking areas and access roadways; and,
- Potential construction concerns.

Abbreviations terminology and principal symbols commonly used throughout the report, borehole logs and appendices are enclosed in Appendix I.

2.0 SITE DESCRIPTION AND GEOLOGICAL SETTING

The Site is in a primarily rural area that consists of agricultural and residential land uses. The Site consists of an approximately 200-acre/80 hectares parcel of land located on the northeast side of Humber Station Road approximately 600 metres (m) southeast of Healey Road in Caledon, Ontario. These survey data of the boreholes/test-pits indicated that the Site is at an elevation of approximately 232 to 239 m above sea level (masl). From the review of available topographic maps, it is noted that a tributary of the West Humber River is located on-Site and ranges in elevation between 230 and 240 masl with a total elevation change of up to approximately 6.0 m. This tributary enters the Site from the northwest and travels south to an on-Site pond. The pond discharges into a tributary of the West Humber River that exists on the south side of the Site. West Humber River is located approximately 12 kilometres (km) southeast of the Site.

Data obtained from the Ontario Geological Survey (OGS) Maps, as published by the Ontario Ministry of Natural Resources, indicates that the overburden soil at the Site consists of Halton till: clay to silt-textured till (young tills: clayey silt till)[1].

The underlying bedrock at this Site is shale, limestone, dolostone, siltstone of Georgian Bay Formation[2].

Based on the review of the regional geology map[3] and the available well records, the overburden soils are underlain by bedrock between 16.0 and 40.0 metres below ground surface (mbgs).

(Ontario Geological Survey 2010. Surficial geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 128 – Revised[1]).

(Liberty, B.A., Ontario Geological Survey 1991. Bedrock geology of Ontario, southern sheet; Ontario Geological Survey, Map 2544, scale 1: 1 000 000[2]).

(O.L. White and W.D. Morrison 1968. Bolton sheet, southern Ontario, bedrock topography series; Ontario Geological Survey, Map P0470, scale 1: 50,000[3]).

3.0 GEOTECHNICAL FIELD INVESTIGATION AND METHODOLOGY

Pinchin completed field investigations at the Site between January 19 and February 10, 2023, by advancing a total of eighty two (82) sampled boreholes throughout the Site. The boreholes were advanced to depths of approximately 3.4 to 6.7 metres below existing ground surface (mbgs). The approximate spatial locations of the boreholes advanced at the Site are shown on Figure 2.

Twelve (12) topsoil thickness holes are also planned for the Site. Due to the presence of frost in the ground at the time of fieldwork for this investigation, the topsoil thickness holes had not yet been completed at the time of the draft report. The topsoil thickness hole information will be provided in the finalized version of this report.

The boreholes were advanced with the use of a CME75 track-mounted drill rig which was equipped with standard soil sampling equipment. Soil samples were collected at 0.75 and 1.5 m intervals using a 51 mm outside diameter (OD) split spoon barrel in conjunction with Standard Penetration Tests (SPT) “N” values (ASTM D1586). The SPT “N” values were used to assess the compactness condition of the non-cohesive soil.

Monitoring wells were installed in six (6) boreholes to allow measurement of groundwater levels. The monitoring wells were constructed using flush-threaded 50 mm diameter Trilock pipe with 3.0 meter long 10-slot well screens, delivered to the Site in pre-cleaned individually sealed plastic bags. The screen and riser pipes were not allowed to come into contact with the ground or drilling equipment prior to installation.

A completed well record was submitted to the property owner and the Ministry of the Environment, Conservation and Parks for Ontario (MECP) as per Ontario Regulation 903, as amended. A licensed well technician must properly decommission the monitoring wells prior to construction according to Regulation 903 of the Ontario Water Resources Act.

Groundwater observations and measurements were obtained from the open boreholes during and upon completion of drilling.

The field investigation was monitored by experienced Pinchin personnel. Pinchin logged the drilling operations and identified the soil samples as they were retrieved. The recovered soil samples were sealed into plastic bags and carefully transported to Pinchin’s accredited materials testing laboratory for detailed analysis and testing. All soil samples were classified according to visual and index properties by the project engineer.

The field logging of the soil and groundwater conditions was performed to collect geotechnical engineering design information. The borehole logs include textural descriptions of the subsoil in accordance with a modified Unified Soil Classification System (USCS) and indicate the soil boundaries inferred from non-continuous sampling and observations made during the borehole advancement. These boundaries reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The modified USCS classification is explained in further detail in Appendix I. Details of the soil and groundwater conditions encountered within the boreholes are included on the Borehole Logs within Appendix II.

Select soil samples collected from the boreholes were submitted to Pinchin's material testing laboratory to determine the grain size distribution of the soil and plasticity characteristics. A copy of the laboratory analytical reports is included in Appendix III. In addition, the collected samples were compared against previous geotechnical information from the area, for consistency and calibration of results.

The borehole locations northings and eastings were determined prior to fieldwork, and were positioned using a phone app. At the time of this draft report, the ground surface elevations had not yet been surveyed by Pinchin..

4.0 SUBSURFACE CONDITIONS

4.1 Borehole Soil Stratigraphy

In general, the soil stratigraphy at the Site is comprised of surficial topsoil underlain by a low plasticity silty clay with sand to sandy silty clay till to the maximum borehole termination depths of approximately 3.4 to 6.7 mbgs. Some boreholes included non-cohesive layers comprised of sandy silt to sand to sand and gravel found below or interlayered with the till deposit. The appended borehole logs provide detailed soil descriptions and stratigraphies, results of SPTs, moisture content profiles, details of monitoring well installations, and groundwater measurements.

4.1.1 Topsoil

An approximately 150 mm to 260 mm thick layer of topsoil was found at ground surface in all boreholes advanced on site. Localized topsoil thicknesses of up to 545 mm were encountered in the topsoil thickness holes from the initial geotechnical investigation. The average thickness of topsoil in the test holes was 230 mm. This topsoil layer generally consisted of silt, trace to some sand, with some organic material.

4.1.2 Sandy Silty Clay to Silty Clay with Sand Till

A 2.9 m to at least 6.5 m thick deposit of sandy silty clay to silty clay with sand till was encountered below the topsoil in all boreholes, penetrated to depths between about 3.4 m and 6.7 m below ground surface.

Boreholes terminated in this deposit at 79 of the 100 borehole locations. All other boreholes were terminated within the interlayered or underlying non-cohesive deposits ranging from sandy silt to sand to sand and gravel.

The cohesive glacial till generally had a stiff to hard consistency based on SPT ‘N’ values ranging from 8 to greater than 50 blows per 300 mm penetration of a split spoon sampler. The results of seven (7) particle size distribution analyses completed on samples of the till deposit are provided in Appendix III and indicate that the samples contain approximately 1 per cent to 9 per cent gravel, 7 per cent to 31 per cent sand, 43 per cent to 78 per cent silt, and 14 per cent to 36 per cent clay.

Three Atterberg Limits tests were performed on select samples of the till deposit, the results of which are shown in Appendix III. These test results showed liquid limits between about 21 per cent and 28 per cent, plastic limits between about 13 per cent and 15 per cent, and corresponding plasticity indices of between about 8 per cent and 13 per cent. Combined with the results of the grain size distribution tests, the till deposit can be classified as a sandy silty clay to silty clay with sand of low plasticity. Moisture content test results typically ranging between 10 and 15% indicate Drier Than Plastic Limit (DTPL) to About Plastic Limit (APL) conditions; however, there are localized areas of higher or lower moisture, including areas that are Wetter Than Plastic Limit (WTLP).

4.2 Groundwater Conditions

Groundwater observations and measurements were obtained in the open boreholes at the completion of drilling and are summarized on the appended borehole logs. Water levels in open boreholes was generally between about 2.2 m and at least 5.5 m below ground surface. Water levels measured in the boreholes will be included in the finalized version of this report.

Typically, the grey colour of the soils noted in the boreholes between depths of about 3.0 m to 4.5 mbgs is indicative of permanent saturated conditions, and therefore, the fluctuations of the long-term groundwater should not be expected to drop below this depth. Perched groundwater may occur above these depths particularly following heavy rainfall or snowmelt.

Seasonal variations in the water table should be expected, with higher levels occurring during wet weather conditions in the spring and fall and lower levels occurring during dry weather conditions.

5.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

5.1 General Information

The recommendations presented in the following sections of this report are based on the information available regarding the proposed construction, the results obtained from the geotechnical investigation, and Pinchin’s experience with similar projects. Since the investigation only represents a portion of the subsurface conditions, it is possible that conditions may be encountered during construction that are substantially different than those encountered during the investigation. If these situations are encountered, adjustments to the design may be necessary.

A qualified geotechnical engineer should be on-Site during the foundation preparation to ensure the subsurface conditions are the same/similar to what was observed during the investigation.

It is Pinchin's understanding that the development will consist of a five slab-on-grade (i.e. no basement level) buildings, at-grade asphalt parking and loading areas, access driveways, landscaped areas and two stormwater management ponds located at the southeast and west limits of the Site. The footprints of the proposed buildings are shown in Figure 2. It is understood that the proposed grades had not been finalized at the time of this report. Should the design change significantly, the recommendations in this report may no longer apply and further consultation should be done.

5.2 Site Preparation

The existing topsoil is not considered suitable to remain below the proposed building, driveways and parking areas and will need to be removed. In calculating the approximate quantity of topsoil to be stripped, we recommend that the topsoil thicknesses provided on the individual borehole logs be increased by 50 mm to account for variations and some stripping of the mineral soil below.

Pinchin recommends that any engineered fill required at the Site be compacted in accordance with the criteria stated in the following table:

Type of Engineered Fill	Maximum Loose Lift Thickness (mm)	Compaction Requirements	Moisture Content (Percent of Optimum)
Structural fill to support foundations and floor slabs	200	100% SPMDD	Plus 2 to minus 4
Subgrade fill beneath parking lots and access roadways	300	98% SPMDD	Plus 2 to minus 4

Prior to placing any fill material at the Site, the subgrade should be inspected by a qualified geotechnical engineer and loosened/soft pockets should be sub excavated and replaced with engineered fill.

Engineered structural fill must extend at least 1 m beyond the edge of proposed footings, and then downwards and outwards to competent subgrade at 1 horizontal to 1 vertical. It is also recommended that engineered structural fill be overbuilt at least 300 mm above the design underside of footing elevations.

The native sandy silty clay to silty clay with sand should be suitable for use as engineered fill and subgrade fill provided the grading work is carried out during periods of time with warmer weather and limited precipitation. Wet portions of the native soils may need to be placed in thin lifts over large areas and allowed to dry. Placement in thin lifts is also important to ensure that any drier blocky portions of the native soils are properly broken down such that there are no air voids left in the fill. Use of heavy sheepsfoot packers will help to properly compact the fill.

It is recommended that any additional material imported to Site to raise grades below the proposed buildings comprise imported Ontario Provincial Standard Specification (OPSS) 1010 Granular 'B' Type I material. It is noted that Granular 'B' Type I material may consist of up to 100% Reclaimed Concrete Materials (RCM). RCM used as Granular 'B' shall not contain any loose reinforcing material. If the work is carried out during very dry weather, water may have to be added to the material to improve compaction. Other types of imported soil may be suitable for use on Site but should be approved by a geotechnical engineer prior to import.

A qualified geotechnical engineering technician should be on site to observe fill placement operations and perform field density tests at random locations throughout each lift, to indicate the specified compaction is being achieved.

5.3 Open Cut Excavations and Groundwater Management

It is anticipated that the foundations will be constructed at conventional frost depths, approximately 1.2 to 1.5 metres below finished floor elevation. Excavations for site services are expected at conventional depths of 2 to 3 mbgs.

Based on the subsurface information obtained from within the boreholes, it is anticipated that the excavated material will predominately consist of native sandy silty clay to silty clay with sand. Groundwater was encountered at depths ranging from 2.2 m to at least 5.5 mbgs.

Where workers must enter trench excavations deeper than 1.2 m, the trench excavations should be suitably sloped and/or braced in accordance with the Occupational Health and Safety Act (OHSA), Ontario Regulation 213/91, Construction Projects, July 1, 2011, Part III - Excavations, Section 226. Alternatively, the excavation walls may be supported by either closed shoring, bracing, or trench boxes complying with sections 235 to 239 and 241 under O. Reg. 231/91, s. 234(1). The use of trench boxes can most likely be used for temporary support of vertical side walls. The appropriate trench should be designed/confirmed for use in this soil deposit.

Based on the OHSA, the native sandy silty clay to silty clay with sand would be classified as Type 3 soil and temporary excavations in these soils must be sloped back at an inclination of 1 horizontal to 1 vertical (H to V) from the base of the excavation. Excavations extending below the groundwater table would be classified as a Type 4 soil and temporary excavations will have to be sloped back at 3H : 1V from the base of the excavation.

Alternatively, the excavation walls may be supported by either closed shoring, or bracing, complying with sections 235 to 239 and 241 under O. Reg. 231/91, s. 234(1). Pinchin would be pleased to provide further recommendations on shoring design once the building plans have been completed.

In addition to compliance with the OHSA, the excavation procedures must also comply with any potential other regulatory authorities, such as federal and municipal safety standards.

Groundwater was measured in all boreholes at depths ranging from approximately 2.2 m to at least 5.5 mbgs and is not expected to be encountered during excavations for the building foundations, but may be encountered in excavations for services. Potential for localized perched groundwater at higher elevations should be expected.

Minor to moderate groundwater inflow through the sandy silty clay is expected where the excavations extend less than 0.6 m below the groundwater table. It is believed that this groundwater inflow can be controlled using a gravity dewatering system with perimeter interceptor ditches and high-capacity pumps. It is not expected that the dewatering volumes will trigger an EASR or PTTW by exceeding 50,000 L/day or 400,000 L/day, respectively.

For excavations extending more than 0.6 m below the stabilized groundwater table, a dewatering system installed by a specialist dewatering contractor may be required to lower the groundwater level prior to excavation. The design of the dewatering system should be left to the contractor’s discretion, and the system should meet a performance specification to maintain and control the groundwater at least 0.30 m below the excavation base. It is recommended that Pinchin review the final grading plan to confirm this recommendation.

Seasonal variations in the water table should be expected, with higher levels occurring during wet weather conditions in the spring and fall and lower levels occurring during dry weather conditions. If construction commences during wet periods (typically spring or fall), there is a greater potential that the groundwater elevation could be higher and/or perched groundwater may be present. Any potential precipitation of perched groundwater should be able to be controlled from pumping from filtered sumps.

Prior to commencing excavations, it is critical that all existing surface water and potential surface water is controlled and diverted away from the Site to prevent infiltration and subgrade softening. At no time should excavations be left open for a period of time that will expose them to precipitation and cause subgrade softening.

All collected water is to discharge a sufficient distance away from the excavation to prevent re-entry. Sediment control measures, such as a silt fence should be installed at the discharge point of the dewatering system. The utmost care should be taken to avoid any potential impacts on the environment

It is the responsibility of the contractor to propose a suitable dewatering system based on the groundwater elevation at the time of construction. The method used should not adversely impact any nearby structures. Excavations to conventional design depths for the building foundations are not expected to require a Permit to Take Water or a submission to the Environmental Activity and Sector Registry (EASR). It is the responsibility of the contractor to make this application if required.

As previously mentioned, above average seasonal variations in the groundwater table should be expected, with higher levels occurring during wet weather conditions in the spring and fall and lower levels occurring during dry weather conditions. As such, depending on the groundwater at the time of the excavation works, a more involved dewatering system may be required.

5.4 Foundation Design

5.4.1 Shallow Foundations Bearing on Native Silty Clay Till or Engineered Fill

The existing sandy silty clay to silty clay with sand till deposit is considered suitable to support the proposed buildings, provided all of topsoil is removed, and the subgrade prepared as above. As grades may be raised significantly during Site Preparation, footings may also bear on engineered fill.

Conventional shallow strip footings established on the stiff to hard silty clay till, or engineered structural fill placed as described in Section 5.2 of this report, may be designed using a bearing resistance for 25 mm of settlement at Serviceability Limit States of 150 kPa, and a factored geotechnical bearing resistance of 225 kPa at Ultimate Limit States (ULS), provided the width of the footings are between 0.6 m and 2.0 m. Should the design elevations change from the current slab-on-grade design, the bearing resistance will have to be recalculated.

It is noted that the native silty clay till becomes harder with depth, and higher bearing pressures would be available from the hard silty clay till. Additional recommendations can be provided for higher design bearing pressures once more information is available on the finished floor elevation of the proposed buildings.

As the actual service loads were not known at the time of this report, these should be reviewed by the project structural engineer to determine if SLS or ULS governs the footing design.

It is noted that there is a potential for weaker subgrade soil to be encountered between the investigation locations. Pinchin presumes that any areas of weaker subgrade soil will consist of small pockets of soft/loose natural soil which can be compacted to match the density of the remainder of the Site. As such, the material must be compacted to a minimum of 100% Standard Proctor Maximum Dry Density (SPMDD) prior to installing the concrete formwork. Any soft/loose areas which are not able to achieve the recommended 100% SPMDD are to be removed and replaced with a low strength concrete.

Pinchin notes that a qualified geotechnical engineering consultant should be on-Site during the proof roll and foundation preparation activities to verify the recommended level of compaction is achieved and to verify the design assumptions and recommendations. This is especially critical with respect to the recommended soil bearing pressures. If variations occur in the soil conditions between the borehole locations, site verification and site review by Pinchin is recommended to provide appropriate recommendations at that time.

The native cohesive till is sensitive to change in moisture content and can become loose/soft if subjected to additional water or precipitation. As well, it could be easily disturbed if travelled on during construction. Once it becomes disturbed it is no longer considered adequate to support the recommended design bearing pressures. It is recommended that a working slab of lean concrete (mud slab) be placed in the footing areas immediately after excavation and inspection to protect the founding soils during placement of formwork and reinforcing steel.

In addition, to ensure and protect the integrity of the subgrade soil during construction operations, the following is recommended:

- Prior to commencing excavations, it is critical that all existing surface water, potential surface water and perched groundwater are controlled and diverted away from the work Site to prevent infiltration and subgrade softening. At no time should excavations be left open for a period of time that will expose them to inclement weather conditions and cause subgrade softening;
- The subgrade should be sloped to a sump outside the excavation to promote surface drainage and the collected water pumped out of the excavation. Any potential precipitation or seepage entering the excavations should be pumped away immediately (not allowed to pond);
- The footing areas should be cleaned of all deleterious materials such as topsoil, organics, fill, disturbed, caved materials or loosened bedrock pieces;
- Any potential large cobbles or boulders (i.e. greater than 200 mm in diameter) within the subgrade material are to be removed and replaced with a similar soil type not containing particles greater than 200 mm in diameter. It is critical that particles greater than 200 mm in diameter are not in contact with the foundation to prevent point loading and overstressing; and
- If the excavated subgrade soil remains open to weather conditions and groundwater seepage, sidewall stability and suitability of the subgrade soil will need to be verified prior to construction.

If construction proceeds during freezing weather conditions, adequate temporary frost protection for the footing bases and concrete must be provided and maintained above freezing at all times.

5.4.2 Cast-in-place Concrete Caissons

Bored piles (drilled shafts) may be considered as an alternative for the building foundations. Bored piles typically involve drilling a 0.9 to 1.5 m diameter vertical hole into the ground, and filling the hole with structural concrete and reinforcing steel.

Cast-in-place concrete caissons founded in the native deposits extending to approximately 4.0 mbgs may be used to support the building loads. For cast-in-place concrete caissons end bearing on very stiff to hard glacial till deposits, a factored geotechnical bearing resistance for 25 mm of settlement at Serviceability Limit States of 250 kPa, and a factored geotechnical bearing resistance of 350 kPa at Ultimate Limit States (ULS) may be used for the preliminary design. Higher bearing capacities may be available for caissons extending to denser soils at greater depths; however, additional deeper boreholes would be needed in order to assess the ability of deeper soils to support higher bearing pressures.

The required length of caissons will be dependant, in part, on the finished floor slab elevations of the buildings. Additional information on caisson lengths and capacities can be provided once design floor slab elevations for the buildings are known.

The caissons should be spaced at a minimum distance of 2.5 times the caisson diameter to avoid interference between caissons, and reduction of bearing capacity.

A temporary steel liner is required in order to facilitate the cleaning and inspection of the founding soils, and to prevent collapse and cave-in of the sidewalls of the shafts.

Augured cast-in-place concrete caissons are to be installed by an experienced contractor familiar with the installation process and soil conditions. The installation of the caissons should be monitored on a full time basis by a qualified geotechnical consultant.

Caisson foundations at different elevations must be designed such that the higher caissons are set below a line drawn up at one horizontal to one vertical from the closest edge of the lower caisson. For protection from frost effects, grade beams and pile cap units subject to freezing temperatures must be provided with a minimum soil cover of 1.2 metres or equivalent insulation.

Prior to auguring, it is critical that all existing and potential surface water be controlled and diverted away from the work site to prevent infiltration.

Excavation and installation of the caissons must conform to all applicable sections of the Occupational Health and Safety Act. The caisson contract must stipulate that the contractor will be responsible for the provision of all necessary equipment (including steel liner of adequate strength) and monitoring devices (as needed) for a safe access around the caissons, in accordance with the Occupational Health and Safety Act requirements.

5.4.3 Earth Pressure Parameters

The following parameters (un-factored) should be used for the design of structural elements subject to unbalanced earth pressures.

Soil Layer	Bulk Unit Weight (kN/m^3)	Angle of Internal Friction	Active Earth Pressure Coefficient	Passive Earth Pressure Coefficient
Sandy Silty Clay to Silty Clay with Sand Till	21	30°	0.33	3.00

5.4.4 Site Classification for Seismic Site Response & Soil Behaviour

The following information has been provided to assist the building designer from a geotechnical perspective only. These geotechnical seismic design parameters should be reviewed in detail by the structural engineer and be incorporated into the design as required.

The seismic site classification has been based on the 2012 OBC. The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4.A of the OBC. The site classification is based on the average shear wave velocity in the top 30 m of the site stratigraphy. If the average shear wave velocity is not known, the site class can be estimated from energy corrected Standard Penetration Resistance (N60) and/or the average undrained shear strength of the soil in the top 30 m.

The boreholes advanced at this Site extended to between approximately 5 to 7 mbgs and were generally terminated in the native till deposit. SPT "N" values within the till deposit ranged between 8 and greater than 50 blows per 300 mm. As such, based on Table 4.1.8.4.A of the OBC, this Site has been classified as Class C. A Site Class C has an average shear wave velocity (Vs) of between 360 and 760 m/s.

5.4.5 Foundation Transition Zones

Excessive differential settlements can occur where the subgrade support material types differ below the underside of continuous strip footings, (i.e., native till to imported structural fill). As such, where strip footings transition from one material to another the transition between the materials should be suitably sloped or benched to mitigate differential settlements.

Pinchin also recommends the following transition precautions to mitigate/accommodate potential differential settlements:

- For strip footings, the transition zones should be adequately reinforced with additional reinforced steel lap lengths or widened footings;
- Steel reinforced poured concrete foundation walls; and
- Control joints throughout the transition zone(s).

The above recommendations should be reviewed by the structural engineer and incorporated into the design as necessary.

Where strip footings are founded at different elevations, the subgrade soil is to have a maximum slope of 2 H to 1 V, with the concrete footing having a maximum rise of 600 mm and a minimum run of 600 mm between each step, as detailed in the 2012 Ontario Building Code (OBC). The lower footing should be installed first to mitigate the risk of undermining the upper footing.

Individual spread footings are to be spaced a minimum distance of one and a half times the largest footing width apart from each other to avoid stress bulb interaction between footings. This assumes the footings are at the same elevation.

Foundations may be placed at a higher elevation relative to one another provided that the slope between the outside face of the foundations are separated at a minimum slope of 2H: 1V with an imaginary line drawn from the underside of the foundations. The lower footing should be installed first to mitigate the risk of undermining the upper footing.

5.4.6 Estimated Settlement

All individual spread footings should be founded on uniform subgrade soils, reviewed and approved by a licensed geotechnical engineer.

Foundations installed in accordance with the recommendations outlined in the preceding sections are not expected to exceed total settlements of 25 mm and differential settlements of 19 mm.

All foundations are to be designed and constructed to the minimum widths as detailed in the 2012 OBC.

5.4.7 Building Drainage

To assist in maintaining the building dry from surface water seepage, it is recommended that exterior grades around the buildings be sloped away at a 2% gradient or more, for a distance of at least 2.0 m. Roof drains should discharge a minimum of 1.5 m away from the structure to a drainage swale or appropriate storm drainage system.

Exterior perimeter foundations drains are not required, where the finished floor elevation is established a minimum of 150 mm above the exterior final grades or that the exterior gradient is properly sloped to divert surface water away from the building.

5.4.8 Shallow Foundations Frost Protection & Foundation Backfill

In the Caledon, Ontario area, exterior perimeter foundations for heated buildings require a minimum of 1.2 m of soil cover above the underside of the footing to provide soil cover for frost protection.

Where the foundations for heated buildings do not have the minimum of 1.2 m of soil cover frost protection, they should be protected from frost with a combination of soil cover and rigid polystyrene insulation, such as Dow Styrofoam or equivalent product. If required, Pinchin can provide appropriate foundation frost protection recommendations as part of the design review.

To minimize potential frost movements from soil frost adhesion, the perimeter foundation backfill should consist of a free draining granular material, such as a Granular 'B' Type I (OPSS 1010) or an approved sand fill, extending a minimum lateral distance of 600 mm beyond the foundation. The backfill material must be brought up evenly on both sides of any walls not designed to resist lateral earth pressure. All granular material is to be placed in maximum 300 mm thick lifts compacted to a minimum of 100% SPMDD below the interior of building and exterior hard landscaping areas; and, 95% SPMDD below exterior soft landscaping areas. It is recommended that inspection and testing be carried out during construction to confirm backfill quality, thickness and to ensure compaction requirements are achieved.

5.5 Floor Slabs

Prior to the installation of any engineered fill material, all organics and deleterious materials should be removed to the underlying native till. The native till is to be proof roll compacted with a minimum 10 tonne non-vibratory steel drum roller to observe for weak/soft spots.

The in-situ sandy silty clay till material encountered within the boreholes is considered adequate for the support of the concrete floor slabs provided it is proof roll compacted as outlined above. Any soft area(s) encountered during proof rolling should be excavated and replaced with a similar soil type.

Once the subgrade soil is exposed it is to be inspected and approved by a qualified geotechnical engineering consultant to ensure that the material conforms to the soil type and consistency observed during the subsurface investigation work.

Based on the in-situ soil conditions, it is recommended to establish the concrete floor slab on a minimum 300 mm thick layer of Granular "A" (OPSS 1010) compacted to 100% SPMDD. Alternatively, consideration may also be given to using a 200 mm thick layer of uniformly compacted 19 mm clear stone placed over the approved subgrade. Any required up-fill should consist of a Granular "B" Type I or Type II (OPSS 1010).

The following table provides the unfactored modulus of subgrade reaction values:

Material Type	Modulus of Subgrade Reaction (kN/m^3)*
Granular A (OPSS 1010)	85,000
Granular "B" Type I (OPSS 1010)	75,000
Granular "B" Type II (OPSS 1010)	85,000
Native Silty Clay Deposits or Engineered Fill	25,000

*Values assuming loaded area is 0.3 m by 0.3 m.

5.6 Asphaltic Concrete Pavement Structure Design for Parking Lot and Driveways

5.6.1 Discussion

Paved areas will be constructed around the proposed buildings.

The in-situ native subgrade is going to be is considered a sufficient bearing material for an asphaltic concrete pavement structure provided all topsoil, organics, and deleterious materials are removed prior to installing the subgrade fill material.

At this time Pinchin is unaware of the proposed final grades for the parking/loading areas, and access driveways. As such, provided the pavement structure overlies the native soils, the following pavement structure is recommended.

5.6.2 Flexible Pavement Structure

The following table presents the minimum specifications for a flexible asphaltic concrete pavement structure:

Pavement Layer	Compaction Requirements	Light Duty Traffic and Parking Areas	Heavy Duty Traffic Areas and Access Roads
Surface Course: Asphaltic Concrete HL-3 (OPSS 1150)	92% MRD as per OPSS.MUNI 310	35 mm	35 mm
Binder Course: Asphaltic Concrete HL-8 (OPSS 1150)	92% MRD as per OPSS.MUNI 310	55 mm	80 mm
Base Course: Granular “A” (OPSS 1010)	100% Standard Proctor Maximum Dry Density (ASTM-D698)	150 mm	150 mm
Subbase Course: Granular “B” Type I or Type II (OPSS 1010)	100% Standard Proctor Maximum Dry Density (ASTM D698)	400 mm – Type I or 350 mm – Type II	450 mm – Type I or 400 mm – Type II

Notes:

i) Prior to placing the pavement structure, the subgrade soil is to be proof rolled with a smooth drum roller without vibration to observe weak spots and the deflection of the soil; and

ii) The recommended pavement structure may have to be adjusted according to the Town of Caledon municipal standards. Also, if construction takes place during times of substantial precipitation and the subgrade soil becomes wet and disturbed, the granular thickness may have to be increased to compensate for the weaker subgrade soil. In addition, the granular fill material thickness may have to be temporarily increased to allow heavy construction equipment to access the Site, in order to avoid the subgrade from “pumping” up into the granular material.

iii) Performance grade PG 58-28 asphaltic concrete should be specified for Marshall mixes. Consideration should be given to increasing the grade to 64-28 in areas designed for heavy truck traffic.

5.6.3 Rigid Pavement Structure

Alternatively, consideration may also be given to the use of Portland cement concrete pavement where there is intense truck use and turning of transport vehicles in conjunction with the waste handling, loading docks or delivery facilities. The following table provides the minimum recommended rigid pavement structures:

Pavement Layer	Compaction Requirements	Light Duty Pavement	Heavy Duty Pavement
Portland Cement Concrete, CAN/CSA A23.1- Class C-2	CAN/CSA A23.1	150 mm	200 mm
Base Course, OPSS MUNI 1010 Granular A	100% Standard Proctor Maximum Dry Density (ASTM-D698)	200 mm	200 mm

Note:

I. Prior to installation of the concrete pavement structure, in addition to the granular base course, it is recommended to install a granular subbase consisting of OPSS 1010 Granular "B", with a minimum thickness of 400 mm for the heavy duty apron slab areas. The purpose of the Granular "B" is to provide a stable working base for construction equipment, as well as providing a free-draining layer and added frost protection beneath the concrete.

5.6.4 Pavement Structure Subgrade Preparation and Granular up Fill

The proper placement of base and subbase fill materials becomes very important in addressing the proper load distribution to provide a durable pavement structure. The pavement subgrade materials should be thoroughly proof-rolled prior to placement of the Granular 'B' subbase course. If any unstable areas are noted, then the Granular 'B' thickness may need to be increased to support pavement construction traffic. This should be left as a field decision by a qualified geotechnical engineer at the time of construction, but it is recommended that additional Granular 'B' be carried as a provisional item under the construction contract.

Where fill material is required to increase the grade to the underside of the pavement structure, it should consist of either Granular "B" Type I or Type II (OPSS 1010), or the on-Site inorganic natural soils. The up-fill material is to be placed in maximum 300 mm thick lifts compacted to 98% SPMDD within 4% of the optimum moisture content.

Samples of both the Granular 'A' and Granular 'B' Type I or Type II aggregates should be tested for conformance to OPSS 1010 prior to utilization on Site and during construction. All stockpiled material should be protected from deleterious materials, additional moisture and be kept from freezing.

Post compaction settlement of fine-grained soil can be expected, even when placed to compaction specifications. As such, fill material should be installed as far in advance as possible before finishing the parking lot and access roadways for best grade integrity.

Where the subgrade material types differ below the underside of the pavement structure, the transition between the materials should be sloped as per frost heave taper OPSD 205.060.

5.6.5 Drainage

Control of surface water is a critical factor in achieving good pavement structure life. The pavement thickness designs are based on a drained pavement subgrade via sub-drains or ditches.

The silty clay till has poor natural drainage and, therefore, it is recommended that pavement subdrains be installed in the lower areas and be connected to the catch basins. Subdrains should comprise 150 mm diameter perforated pipe infilter sock, bedded in concrete sand. The upper limit of the concrete sand bedding should be at the lower limit of the pavement subbase, with the subgrade below the subbase sloped towards the subdrain.

The surface of the roadways should be free of depressions and be sloped at a minimum grade of 1% in order to drain to appropriate drainage areas. Subgrade soil should slope a minimum of 3% toward stormwater collection points. Positive slopes are very important for the proper performance of the drainage system. Subdrains should comprise 150 mm diameter perforated pipe in filter sock, bedded in concrete sand. The top of bedding should be located at the bottom of subbase.

5.7 Stormwater Facilities

Stormwater management (SWM) facilities are planned at the west end of the Site (in the area of BH4, BH12, MW103, MW123, and MW124); and, in the southeast end of the Site (in the area of BH17, MW160, and MW161). At the time of this report no additional details were available on the SWM facility designs. The following general comments are provided based on the proposed SWM facility locations and soil conditions encountered. The comments should be reviewed by Pinchin once additional information on the SWM facility designs is available.

The subsurface conditions at both proposed SWM facility locations generally comprise topsoil overlying native silty clay till deposits. At BH124, a deposit of sand was encountered within the silty clay glacial till. The potential for sand seams within the glacial till should be anticipated in other areas of the Site as well.

Due to the fine-textured nature of the soils, the SWM facilities will generally not be suitable for stormwater infiltration; but, will be suitable for storage. Due to the potential presence of sand layers or seams within the glacial till, a liner is recommended for the SWM facilities. The liner should comprise clay placed in three lifts of 150 mm, each compacted to at least 98% SPMDD with a sheepsfoot packer. The clay must be tested to confirm that it's hydraulic conductivity is less than 1 x 10^{-7} cm/s, with no partic. Portions of the native soils may be suitable for use as SWM facility liner.

SWM facility sides should be sloped at 5 horizontal to 1 vertical below the permanent pool level; and, 3 horizontal to 1 vertical above. Any berms required for the SWM facilities should be constructed using the on-site clayey silt till placed as structural fill as noted in Section 5.2 of this report.

6.0 SITE SUPERVISION & QUALITY CONTROL

It is recommended that all geotechnical aspects of the project be reviewed and confirmed under the appropriate geotechnical supervision, to routinely check such items. This includes but is not limited to inspection and confirmation of the undisturbed natural subgrade material prior to subgrade preparation, pouring any foundations or footings, backfilling, or engineered fill installation to ensure that the actual conditions are not markedly different than what was observed at the borehole locations and geotechnical components are constructed as per Pinchin's recommendations. Compaction quality control of engineered fill material (full-time monitoring) is recommended as standard practice, as well as regular sampling and testing of aggregates and concrete, to ensure that physical characteristics of materials for compliance during installation and satisfies all specifications presented within this report.

7.0 TERMS AND LIMITATIONS

This Geotechnical Investigation was performed for the exclusive use of Prologis (Client) in order to evaluate the subsurface conditions at 12519-12713 Humber Station Road, Caledon, Ontario. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practises in the field of geotechnical engineering for the Site. Classification and identification of soil, and geologic units have been based upon commonly accepted methods employed in professional geotechnical practice. No warranty or other conditions, expressed or implied, should be understood. Conclusions derived are specific to the immediate area of study and cannot be extrapolated extensively away from sample locations.

Performance of this Geotechnical Investigation to the standards established by Pinchin is intended to reduce, but not eliminate, uncertainty regarding the subgrade soil at the Site, and recognizes reasonable limits on time and cost.

Regardless how exhaustive a Geotechnical Investigation is performed, the investigation cannot identify all the subsurface conditions. Therefore, no warranty is expressed or implied that the entire Site is representative of the subsurface information obtained at the specific locations of our investigation. If during construction, subsurface conditions differ from then what was encountered within our test location and the additional subsurface information provided to us, Pinchin should be contacted to review our recommendations. This report does not alleviate the contractor, owner, or any other parties of their respective responsibilities.

This report has been prepared for the exclusive use of the Client and their authorized agents. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third parties. If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice.

The liability of Pinchin or our officers, directors, shareholders or staff will be limited to the lesser of the fees paid or actual damages incurred by the Client. Pinchin will not be responsible for any consequential or indirect damages. Pinchin will only be liable for damages resulting from the negligence of Pinchin. Pinchin will not be liable for any losses or damage if the Client has failed, within a period of two years following the date upon which the claim is discovered (Claim Period), to commence legal proceedings against Pinchin to recover such losses or damage unless the laws of the jurisdiction which governs the Claim Period which is applicable to such claim provides that the applicable Claim Period is greater than two years and cannot be abridged by the contract between the Client and Pinchin, in which case the Claim Period shall be deemed to be extended by the shortest additional period which results in this provision being legally enforceable.

Pinchin makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and these interpretations may change over time. Please refer to Appendix IV, Report Limitations and Guidelines for Use, which pertains to this report.

Specific limitations related to the legal and financial and limitations to the scope of the current work are outlined in our proposal, the attached Methodology and the Authorization to Proceed, Limitation of Liability and Terms of Engagement which accompanied the proposal.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

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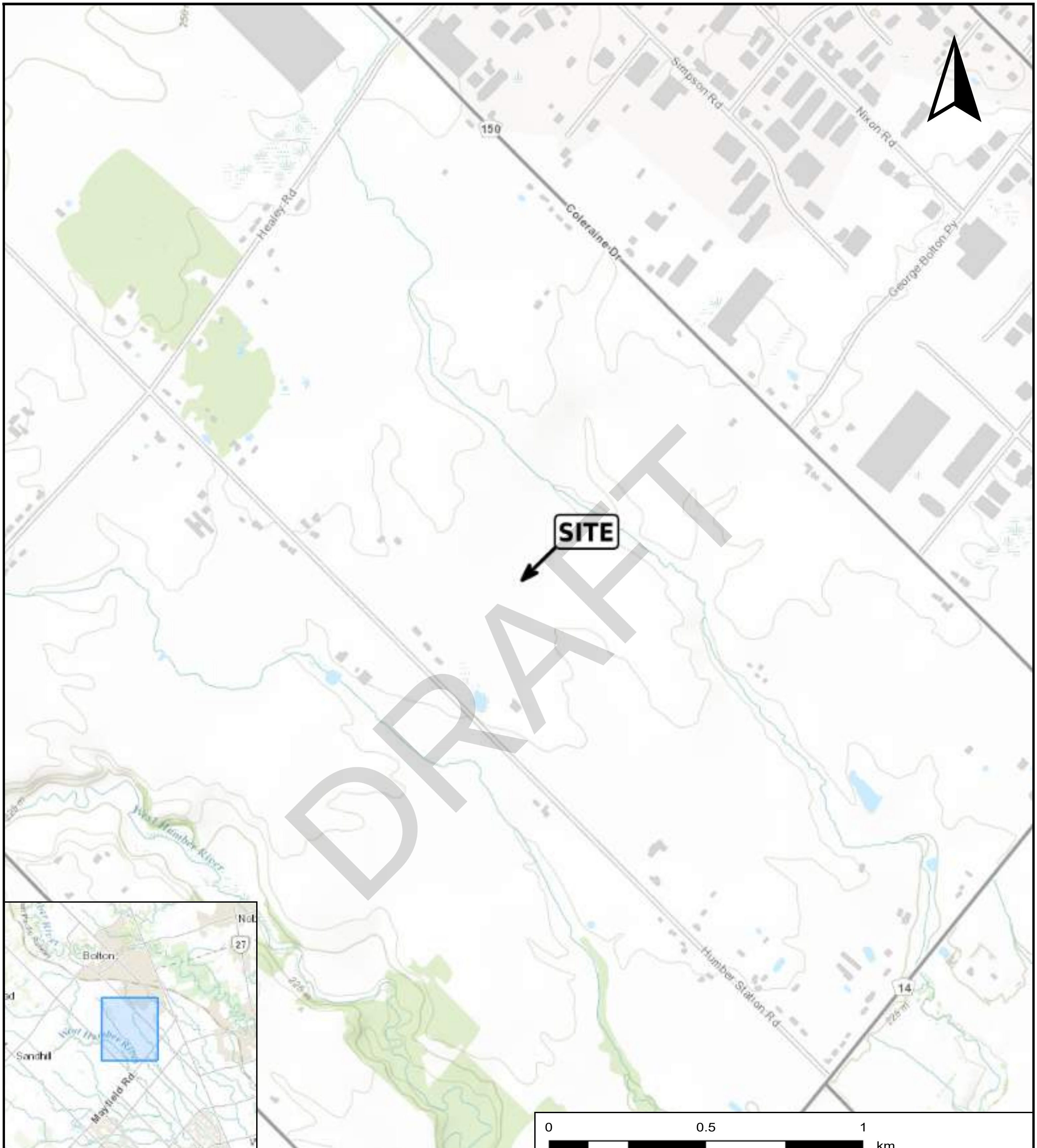
Template: Master Geotechnical Investigation Report – Ontario, GEO, September 2, 2021

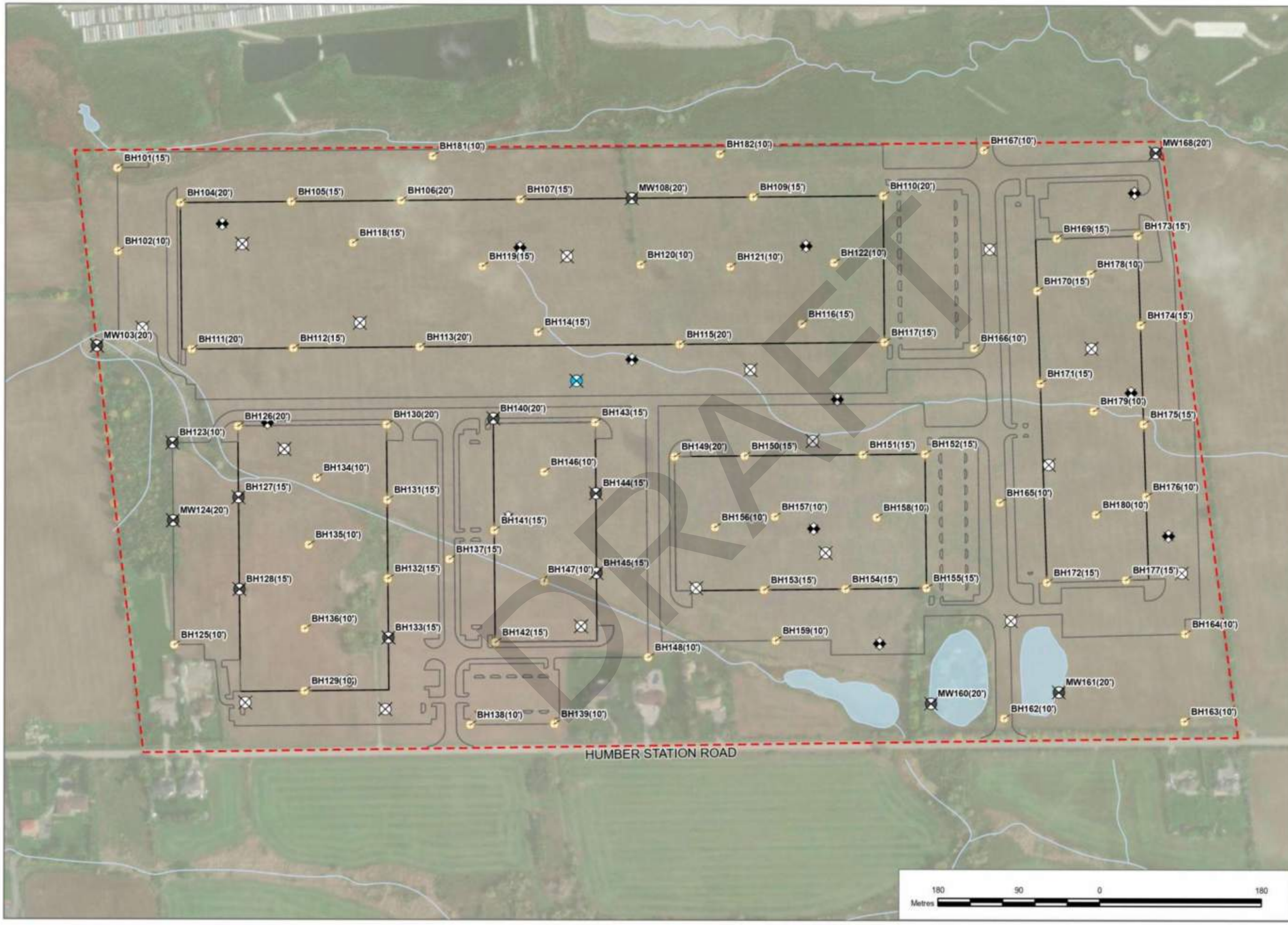
FIGURES



PINCHIN

PROJECT NAME	GEOTECHNICAL INVESTIGATION FOR PROPOSED INDUSTRIAL SUBDIVISION
CLIENT NAME	PROLOGIS
PROJECT LOCATION	12519 AND 12713 HUMBER STATION ROAD, CALEDON, ONTARIO
FIGURE NAME	KEY MAP
FIGURE NUMBER	1

PROJECT NUMBER	SCALE	DRAWN BY	REVIEWED BY	DATE
308567.001	1:22000	YS	MB	APRIL 2022



LEGEND

- BOREHOLE
- MONITORING WELL
- TEST PIT
- SUPPLEMENTAL BOREHOLES
- SUPPLEMENTAL MONITORING WELLS
- SITE BOUNDARY
- WATERCOURSE
- WATERBODY
- PROPOSED SITE BUILDING
- (20') PROPOSED DEPTH

NOTES:
1) Proprietary information may not be reproduced or divulged without prior written consent of Pinchin Ltd.
2) This drawing may have been reduced. All scale notations indicated are based on a 11"x17" format drawings.
3)Legend is color dependent. Non-colour copies may alter interpretation.
4) Coordinate system: NAD 1983 CSRS UTM Zone 17N.
5) Source: Pinchin Ltd., Maxar, Microsoft.

PINCHIN

PROJECT NAME: SUPPLEMENTAL GEOTECHNICAL INVESTIGATION - PROPOSED INDUSTRIAL DEVELOPMENT	
CLIENT NAME: PROLOGIS	
PROJECT LOCATION: 12519 AND 12713 HUMBER STATION ROAD, CALEDON, ONTARIO	
FIGURE NAME: BOREHOLE AND MONITORING WELL LOCATION PLAN	
PROJECT NUMBER: 308567.002	SCALE: AS SHOWN
DRAWN BY: CF/EN	REVIEWED BY: JD
DATE: MARCH 2023	FIGURE NUMBER: 2

APPENDIX I

Abbreviations, Terminology and Principal Symbols used in Report and Borehole Logs

ABBREVIATIONS, TERMINOLOGY & PRINCIPAL SYMBOLS USED

Sampling Method

AS	Auger Sample	**w**	Washed Sample
SS	Split Spoon Sample	**HQ**	Rock Core (63.5 mm diam.)
ST	Thin Walled Shelby Tube	**NQ**	Rock Core (47.5 mm diam.)
BS	Block Sample	**BQ**	Rock Core (36.5 mm diam.)

In-Situ Soil Testing

Standard Penetration Test (SPT), “N” value is the number of blows required to drive a 51 mm outside diameter spilt barrel sampler into the soil a distance of 300 mm with a 63.5 kg weight free falling a distance of 760 mm after an initial penetration of 150 mm has been achieved. The SPT, “N” value is a qualitative term used to interpret the compactness condition of cohesionless soils and is used only as a very approximation to estimate the consistency and undrained shear strength of cohesive soils.

Dynamic Cone Penetration Test (DCPT) is the number of blows required to drive a cone with a 60 degree apex attached to “A” size drill rods continuously into the soil for each 300 mm penetration with a 63.5 kg weight free falling a distance of 760 mm.

Cone Penetration Test (CPT) is an electronic cone point with a 10 cm2 base area with a 60 degree apex pushed through the soil at a penetration rate of 2 cm/s.

Field Vane Test (FVT) consists of a vane blade, a set of rods and torque measuring apparatus used to determine the undrained shear strength of cohesive soils.

Soil Descriptions

The soil descriptions and classifications are based on an expanded Unified Soil Classification System (USCS). The USCS classifies soils on the basis of engineering properties. The system divides soils into three major categories; coarse grained, fine grained and highly organic soils. The soil is then subdivided based on either gradation or plasticity characteristics. The classification excludes particles larger than 75 mm. To aid in quantifying material amounts by weight within the respective grain size fractions the following terms have been included to expand the USCS:

Soil Classification		Terminology	Proportion
Clay	< 0.002 mm		
Silt	0.002 to 0.06 mm	“trace”, trace sand, etc.	1 to 10%
Sand	0.075 to 4.75 mm	“some”, some sand, etc.	10 to 20%
Gravel	4.75 to 75 mm	Adjective, sandy, gravelly, etc.	20 to 35%
Cobbles	75 to 200 mm	And, and gravel, and silt, etc.	>35%
Boulders	>200 mm	Noun, Sand, Gravel, Silt, etc.	>35% and main fraction

Notes:

- Soil properties, such as strength, gradation, plasticity, structure, etcetera, dictate the soils engineering behaviour over grain size fractions; and
- With the exception of soil samples tested for grain size distribution or plasticity, all soil samples have been classified based on visual and tactile observations. The accuracy of visual and tactile observation is not sufficient to differentiate between changes in soil classification or precise grain size and is therefore an approximate description.

The following table outlines the qualitative terms used to describe the compactness condition of cohesionless soil:

Cohesionless Soil	
Compactness Condition	**SPT N-Index (blows per 300 mm)**
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

The following table outlines the qualitative terms used to describe the consistency of cohesive soils related to undrained shear strength and SPT, N-Index:

Cohesive Soil		
Consistency	**Undrained Shear Strength (kPa)**	**SPT N-Index (blows per 300 mm)**
Very Soft	<12	<2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

Note: Utilizing the SPT, N-Index value to correlate the consistency and undrained shear strength of cohesive soils is only very approximate and needs to be used with caution.

Soil & Rock Physical Properties

General

W Natural water content or moisture content within soil sample
γ Unit weight
γ' Effective unit weight
γ_d Dry unit weight
γ_{sat} Saturated unit weight
ρ Density
ρ_s Density of solid particles
ρ_w Density of Water
ρ_d Dry density
ρ_{sat} Saturated density e Void ratio
n Porosity
S_r Degree of saturation
E_{50} Strain at 50% maximum stress (cohesive soil)

Consistency

W_L Liquid limit

W_P Plastic Limit

I_P Plasticity Index

W_S Shrinkage Limit

I_L Liquidity Index

I_C Consistency Index

e_{max} Void ratio in loosest state

e_{min} Void ratio in densest state

I_D Density Index (formerly relative density)

Shear Strength

C_u, S_u Undrained shear strength parameter (total stress)

C'_d Drained shear strength parameter (effective stress)

r Remolded shear strength

τ_p Peak residual shear strength

τ_r Residual shear strength

ø' Angle of interface friction, coefficient of friction = tan ø'

Consolidation (One Dimensional)

C_C Compression index (normally consolidated range)

C_r Recompression index (over consolidated range)

C_S Swelling index

m_V Coefficient of volume change

c_V Coefficient of consolidation

T_V Time factor (vertical direction)

U Degree of consolidation

σ'_o Overburden pressure

σ'_p Preconsolidation pressure (most probable)

OCR Overconsolidation ratio

Permeability

The following table outlines the terms used to describe the degree of permeability of soil and common soil types associated with the permeability rates**:**

Permeability (k cm/s)	Degree of Permeability	Common Associated Soil Type
> 10^{-1}	Very High	Clean gravel
10^{-1} to 10^{-3}	High	Clean sand, Clean sand and gravel
10^{-3} to 10^{-5}	Medium	Fine sand to silty sand
10^{-5} to 10^{-7}	Low	Silt and clayey silt (low plasticity)
>10^{-7}	Practically Impermeable	Silty clay (medium to high plasticity)

Rock Coring

Rock Quality Designation (RQD) is an indirect measure of the number of fractures within a rock mass, Deere et al. (1967). It is the sum of sound pieces of rock core equal to or greater than 100 mm recovered from the core run, divided by the total length of the core run, expressed as a percentage. If the core section is broken due to mechanical or handling, the pieces are fitted together and if 100 mm or greater included in the total sum**.**

RQD is calculated as follows:

$$\text{RQD (\%)} = \frac{\Sigma \text{ Length of core pieces} > 100 \text{ mm x } 100}{\text{Total length of core run}}$$

The following is the Classification of Rock with Respect to RQD Value:

RQD Classification	RQD Value (%)
Very poor quality	**<25**
Poor quality	25 to 50
Fair quality	50 to 75
Good quality	75 to 90
Excellent quality	90 to 100

APPENDIX II

Pinchin's Borehole Logs

Log of Borehole: BH1

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

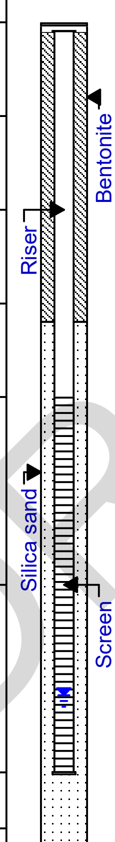
Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	239.28
0–0.15	**Topsoil** Dark brown silt, trace sand, with organics - 150 mm	238.52
	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	
	Silt, trace sand, gravel and clay	237.00
	Brownish grey, dense	236.24
	Grey, trace orange oxidation	234.71
	compact	233.19
	Silt some sand and gravel, moist	232.73
	End of Borehole	

Borehole terminated at 6.6 mbgs.

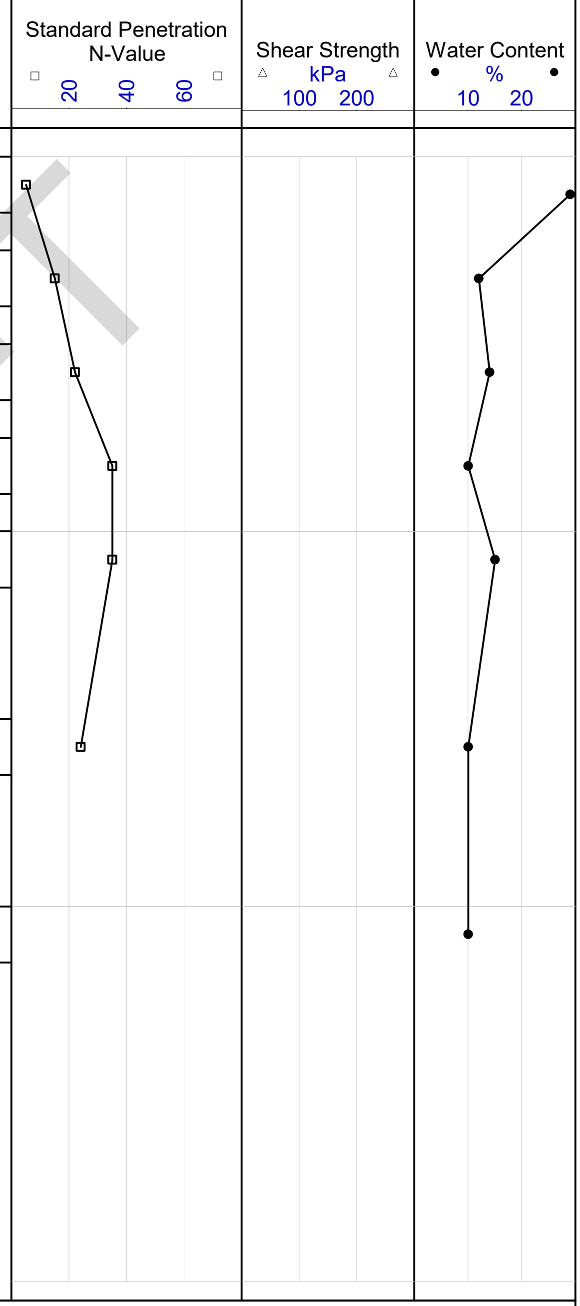
Monitoring Well Details



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: BH2

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)	Symbol	Description	Elevation (m)	Monitoring Well Details
0		Ground Surface	236.84	No Monitoring Well Installed
0–0.15		**Topsoil** Dark brown silt, trace sand, with organics - 150 mm		
0.15–1.5		**Silt** Reddish brown silt, some clay, trace sand, compact, moist	235.31	
1.5–4.6		Silt some clay, trace sand and gravel	232.27	
4.6–6.1		Greyish brown, dense	230.74	
6.1–6.6		Grey silt, trace sand, very dense, damp	230.29	
6.6		End of Borehole Borehole terminated at 6.6 mbgs.		

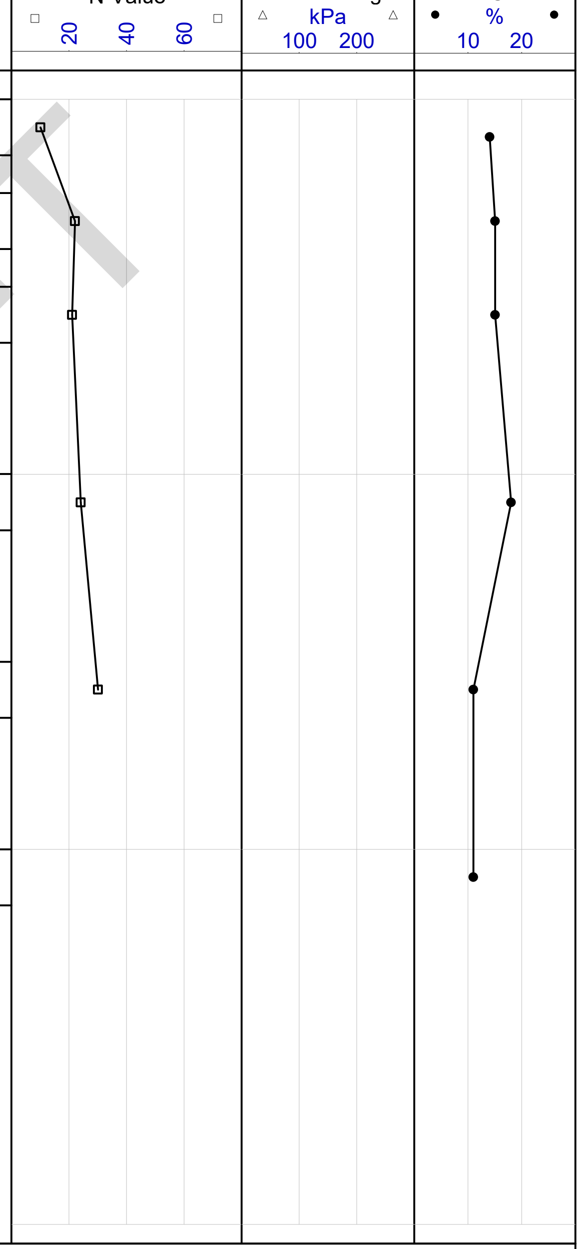
SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value
SS	1	100	10
SS	2	100	22
SS	3	100	21
SS	4	100	24
SS	5	100	30
SS	6	100	>50

Standard Penetration N-Value

Shear Strength kPa

Water Content %



Contractor: TEC **Grade Elevation:** 236.84 masl

Drilling Method: Solid Stem Augers **Top of Casing Elevation:** NA

Well Casing Size: NA **Sheet:** 1 of 1

Log of Borehole: BH3

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

Client: Prologis

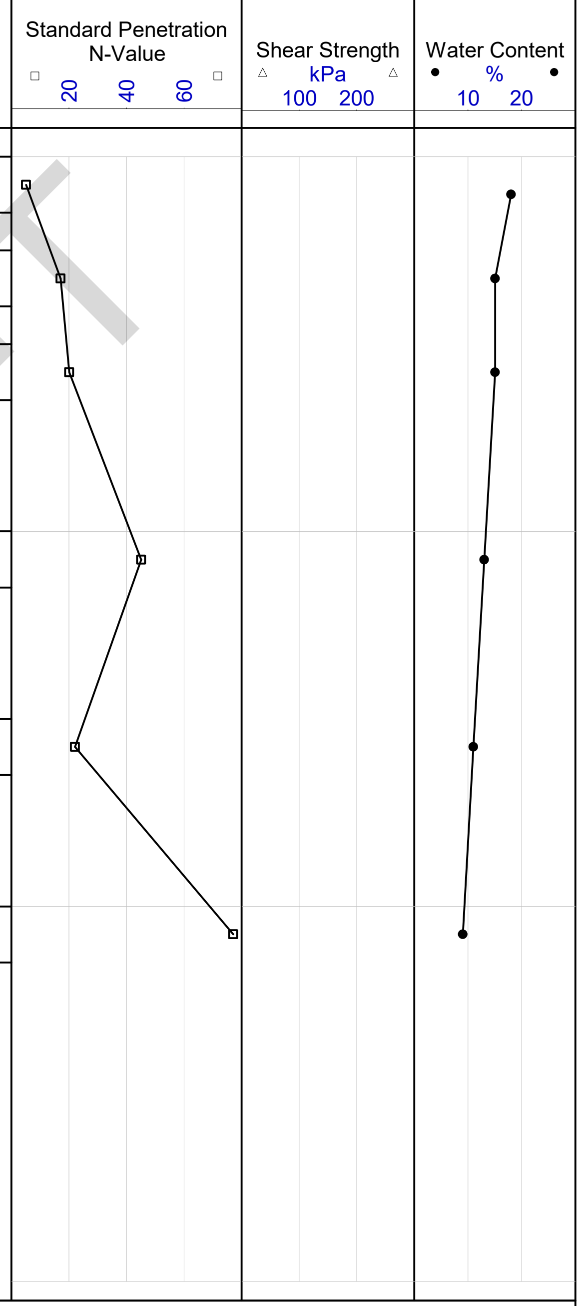
Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value
0	Ground Surface	234.22	No Monitoring Well Installed				
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 150 mm	233.46		SS	1	100	5
0.76	**Silt** Reddish brown silt, some clay, trace sand,loose, wet			SS	2	100	17
	Silt, some clay, trace sand and gravel, compact, moist			SS	3	100	20
3.05	Brown, dense	231.17		SS	4	100	45
4.57	Greyish brown, compact	229.65		SS	5	100	22
6.10	Greyish brown silt, some sand trace clay and gravel, very dense	228.12		SS	6	100	77
6.55	End of Borehole	227.67					

Borehole terminated at 6.6 mbgs.



DRAFT

Contractor: TEC

Drilling Method: Solid Stem Augers

Well Casing Size: NA

Grade Elevation: 234.22 masl

Top of Casing Elevation: NA

Sheet: 1 of 1

Log of Borehole: BH4

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

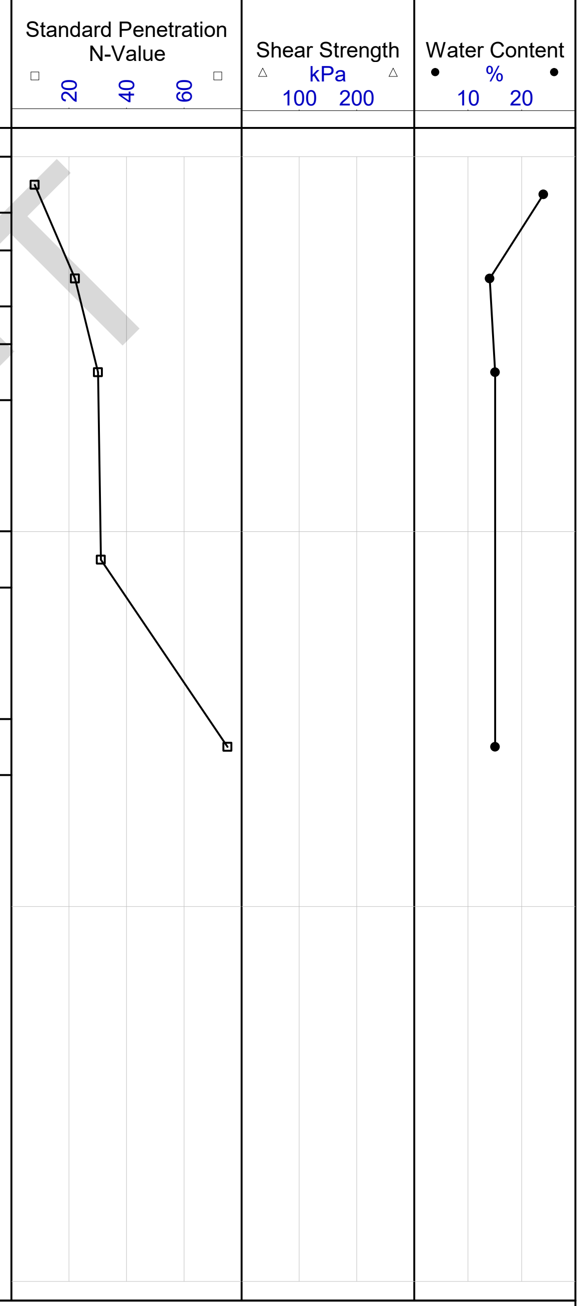
Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value
0	Ground Surface	238.53	No Monitoring Well Installed				
	Topsoil Dark brown silt, trace sand, with organics - 150 mm	237.77		SS	1	100	8
1	**Silt** Reddish brown clayey silt, trace sand, firm APL	237.01		SS	2	100	22
	Brown silt, some clay, trace sand and gravel, compact, moist			SS	3	100	30
2	Dense	235.48					
3	Silt and clay, some sand, trace gravel, very hard, DTPL	233.96		SS	4	100	31
4	Greyish brown, very dense	233.50		SS	5	100	75
5	End of Borehole						
	Borehole terminated at 5.0 mbgs.						



Contractor: TEC

Drilling Method: Solid Stem Augers

Well Casing Size: NA

Grade Elevation: 238.53 masl

Top of Casing Elevation: NA

Sheet: 1 of 1

Log of Borehole: BH5

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

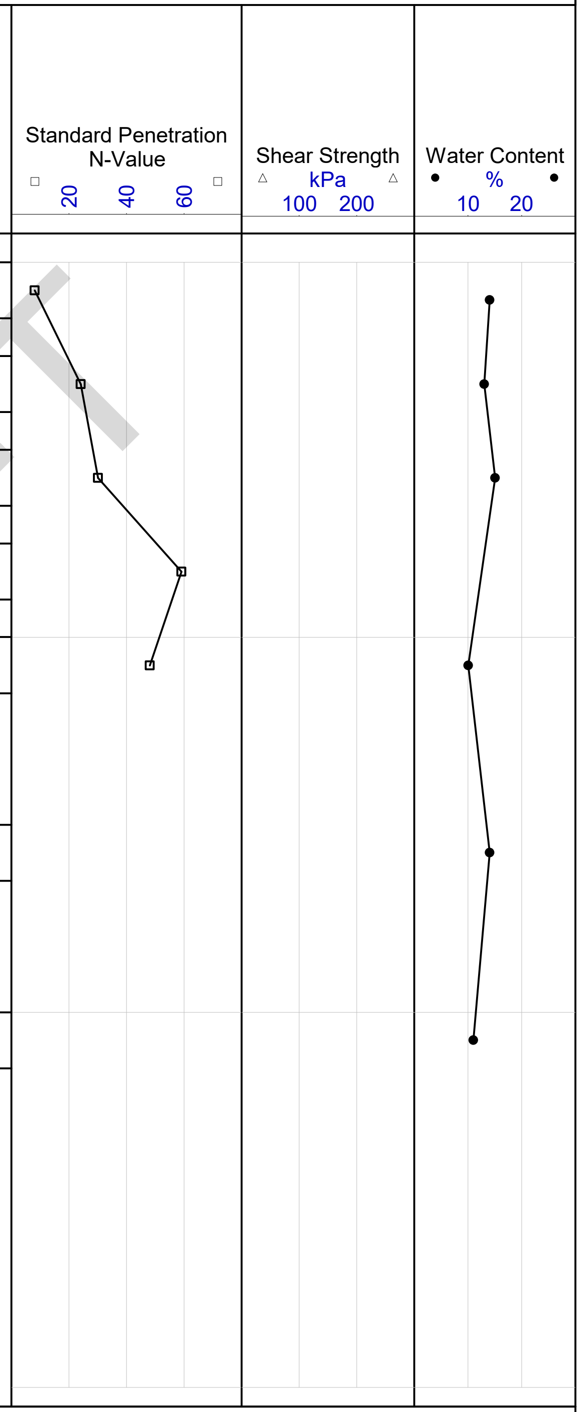
SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
	Ground Surface	237.53
0	**Topsoil** Dark brown silt, trace sand, with organics - 150 mm	
	Silt Brown with grey mottling silt, some clay, with some oxidation, loose, moist	236.77
	Compact	236.01
2	Dense	
	Very dense	235.24
3	Dense	234.48
	Very dense	232.96
6.6	End of Borehole	230.98
	Borehole terminated at 6.6 mbgs.	

Monitoring Well Details: No Monitoring Well Installed

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value
SS	1	70	8
SS	2	100	24
SS	3	100	30
SS	4	100	59
SS	5	100	48
SS	6	20	>50
SS	7	100	>50



DRAFT

Contractor: TEC **Grade Elevation:** 237.53 masl

Drilling Method: Solid Stem Augers **Top of Casing Elevation:** NA

Well Casing Size: NA **Sheet:** 1 of 1

Log of Borehole: BH6

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

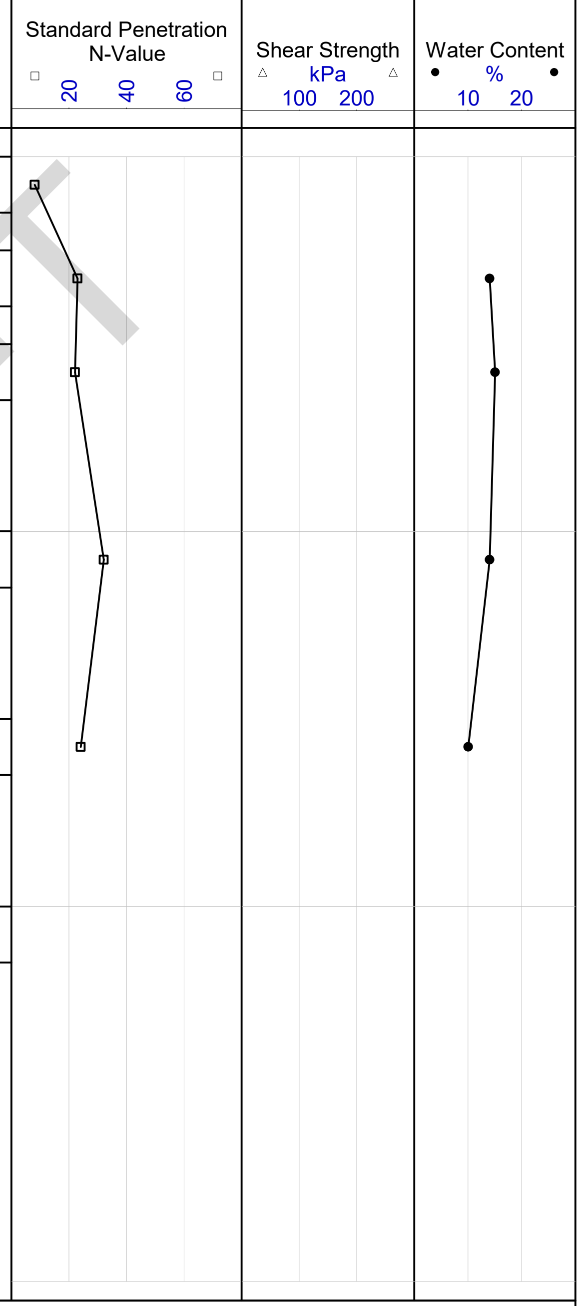
Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE				SAMPLE			
Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value
0	Ground Surface	234.12	No Monitoring Well Installed				
0–0.8	**Topsoil** Dark brown silt, trace sand, with organics - 150 mm	233.36		SS	1	100	8
0.8–3.0	**Silt** Reddish brown clayey silt, some sand, trace gravel, stiff, APL			SS	2	100	23
	Silt, some clay, trace sand and gravel, compact, moist	231.07		SS	3	100	22
3.0–4.6	Greyish brown, dense	229.55		SS	4	100	32
4.6–6.1	Compact	228.02		SS	5	100	24
6.1–6.6	Grey, silt, trace sand, very dense	227.57		SS	6	100	>50
6.6	End of Borehole						

Borehole terminated at 6.6 mbgs.



Contractor: TEC **Grade Elevation:** 234.12 masl

Drilling Method: Solid Stem Augers **Top of Casing Elevation:** NA

Well Casing Size: NA **Sheet:** 1 of 1

Log of Borehole: BH7

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

Client: Prologis

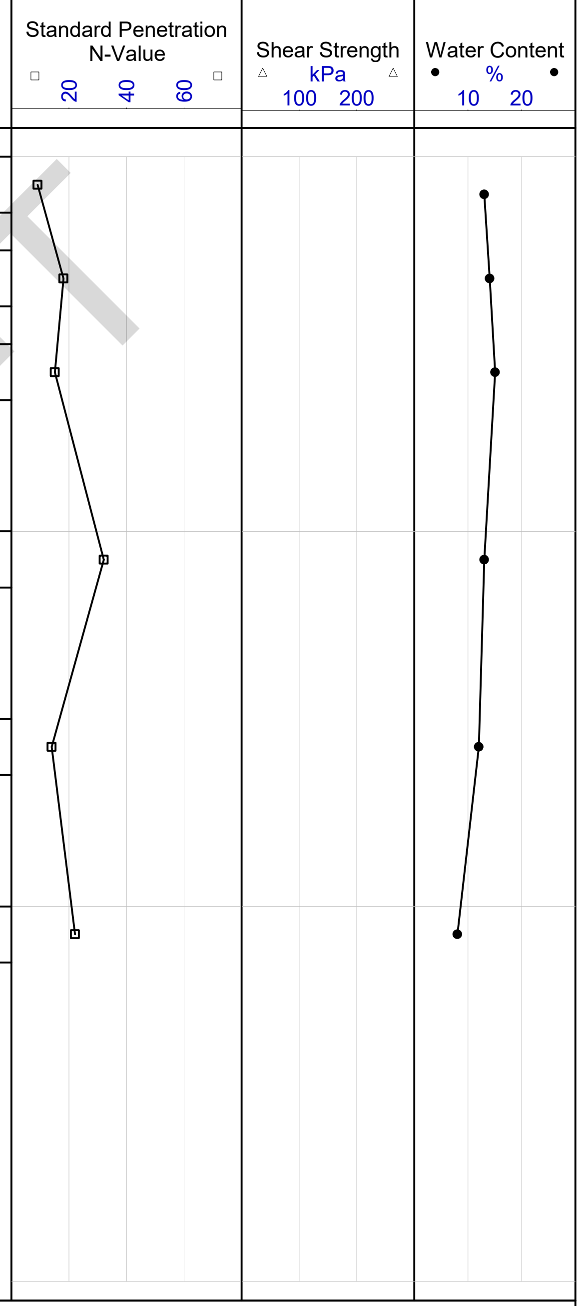
Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 17, 2022 **Project Manager:** SA

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value
0	Ground Surface	233.76	No Monitoring Well Installed				
0–0.8	**Topsoil** Dark brown silt, trace sand, with organics - 150 mm	233.00		SS	1	80	9
0.8–3.2	**Silt** Reddish brown silt, some clay, trace sand and gravel, loose, moist; Compact			SS	2	75	18
				SS	3	60	15
3.2	Dense	230.71		SS	4	60	32
4.6	Grey, compact	229.19		SS	5	40	14
6.1	Grey silt, trace sand,and gravel	227.66		SS	6	40	22
6.6	End of Borehole	227.21					

Borehole terminated at 6.6 mbgs.



Contractor: TEC

Drilling Method: Solid Stem Augers

Well Casing Size: NA

Grade Elevation: 233.76 masl

Top of Casing Elevation: NA

Sheet: 1 of 1

Log of Borehole: BH8

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

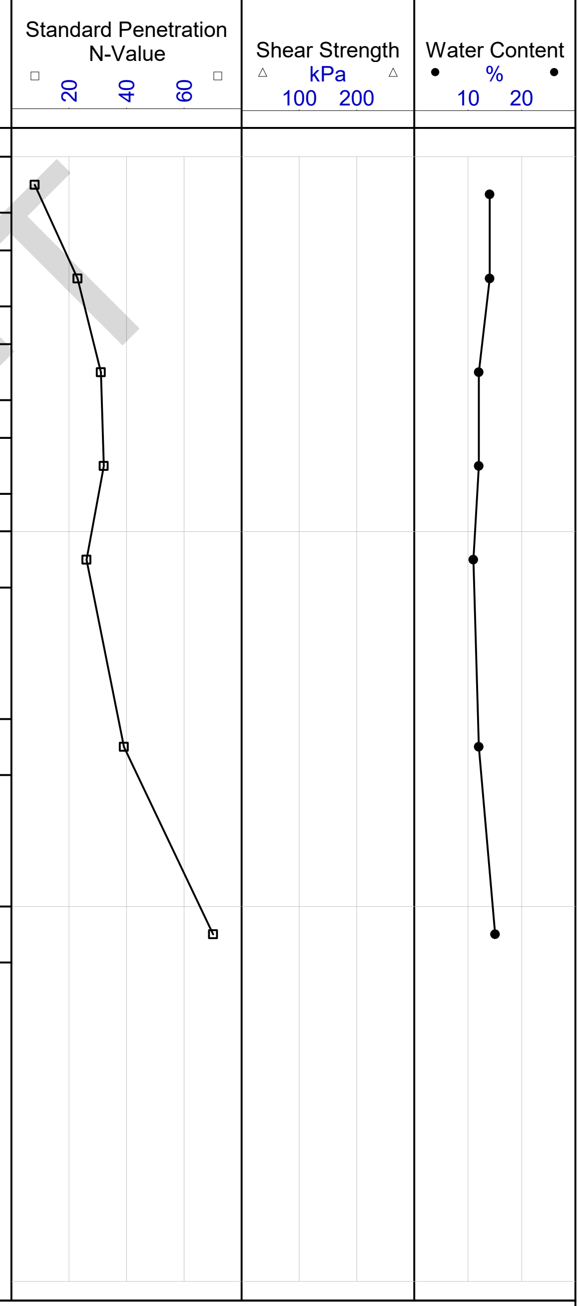
Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value
0	Ground Surface	237.78	No Monitoring Well Installed				
	Topsoil Dark brown silt, trace sand, with organics - 150 mm	237.02		SS	1	100	8
1	**Silt** Brown with some grey mottling silt, some clay and sand, trace gravel, loose, moist	236.26		SS	2	100	23
	Silt trace clay and sand, compact			SS	3	100	31
2	Dense	234.73		SS	4	100	32
3	Grey, trace oxidation, compact	233.21		SS	5	100	26
4–5	Dense	231.68		SS	6	100	39
6	Very dense	231.23		SS	7	100	70
	End of Borehole						
	Borehole terminated at 6.6 mbgs.						



Contractor: TEC **Grade Elevation:** 237.78 masl

Drilling Method: Solid Stem Augers **Top of Casing Elevation:** NA

Well Casing Size: NA **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

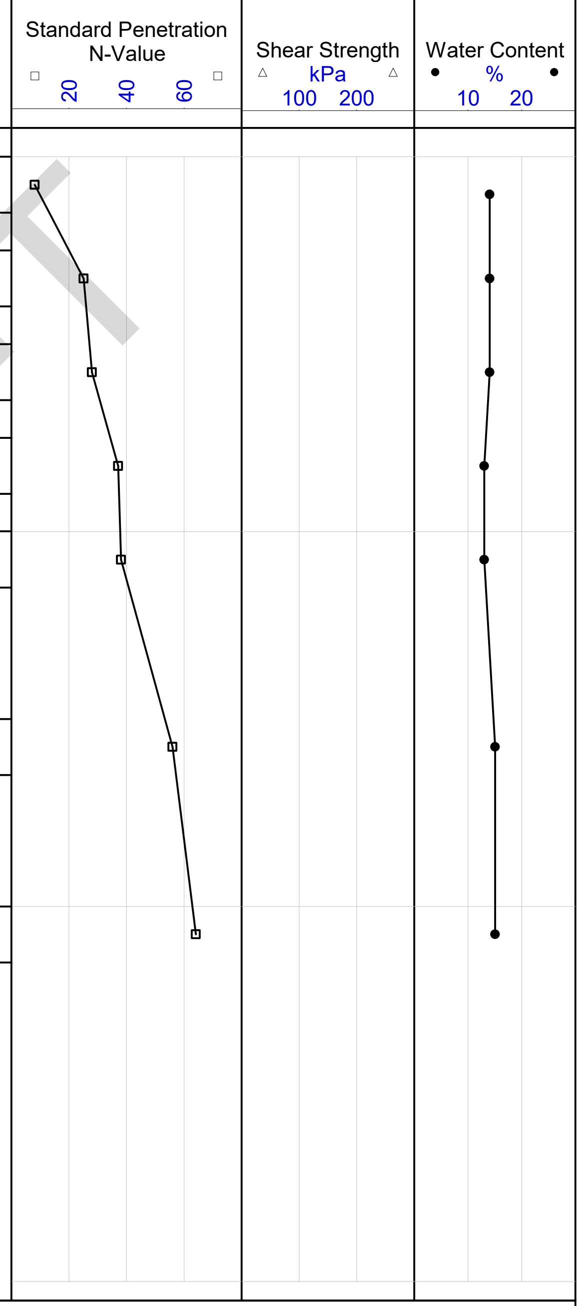
Depth (m)	Description	Elevation (m)
0	Ground Surface	235.57
0 – 0.76	**Topsoil** Dark brown silt, trace sand, with organics - 150 mm	234.81
0.76 – 1.52	**Silt** Brown with some grey mottling silt, some clay, trace sand with some oxidation, loose, moist	234.05
1.52 – 2.29	Compact Silt, some clay, trace sand and gravel	233.28
2.29 – 3.05	Dense	232.52
3.05 – 4.57	Brownish grey silt, trace sand, gravel and clay	231.00
4.57 – 6.55	Grey, very dense	229.02
6.55	End of Borehole Borehole terminated at 6.6 mbgs.	

Monitoring Well Details: Bentonite, Riser, 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



Contractor: TEC

Drilling Method: Solid Stem Augers

Well Casing Size: 51 mm

Grade Elevation: 235.57 masl

Top of Casing Elevation: 236.69 masl

Sheet: 1 of 1

Log of Borehole: BH10

Project #: 308567.001 ***Logged By:*** KS

Project: Geotechnical Investigation

Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

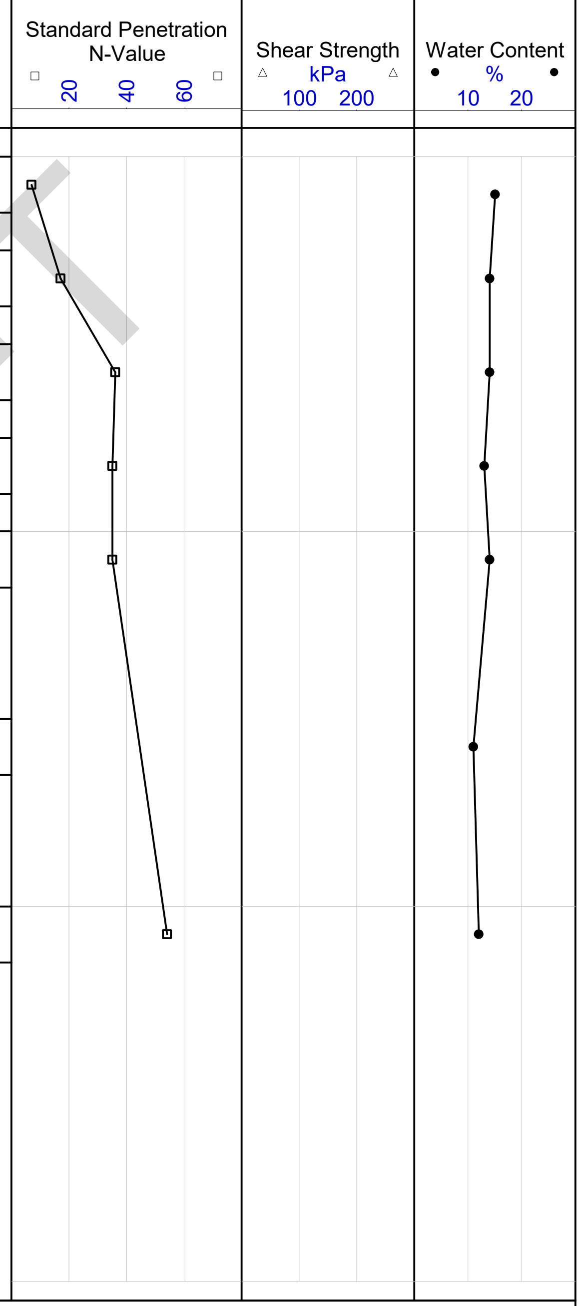
Drill Date: April 16, 2022 ***Project Manager:*** SA

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)	Monitoring Well Details
0	Ground Surface	233.40	No Monitoring Well Installed
0 – 0.76	**Topsoil** Dark brown silt, trace sand, with organics - 150 mm	232.64	
0.76 – 1.52	**Silt** Brown with some grey mottling, clayey silt, trace sand, firm, APL	231.88	
	Silt some clay, trace sand, compact, moist		
	Silt some to trace clay, trace sand and fine gravel, dense	230.35	
3.05	Grey	228.83	
4.57	Very dense	226.85	
6.55	End of Borehole		
	Borehole terminated at 6.6 mbgs.		

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value
SS	1	100	7
SS	2	100	17
SS	3	100	36
SS	4	100	35
SS	5	100	35
SS	6	100	>50
SS	7	100	54



Contractor: TEC ***Grade Elevation:*** 233.40 masl

Drilling Method: Solid Stem Augers ***Top of Casing Elevation:*** NA

Well Casing Size: NA ***Sheet:*** 1 of 1

Log of Borehole: BH11

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

Client: Prologis

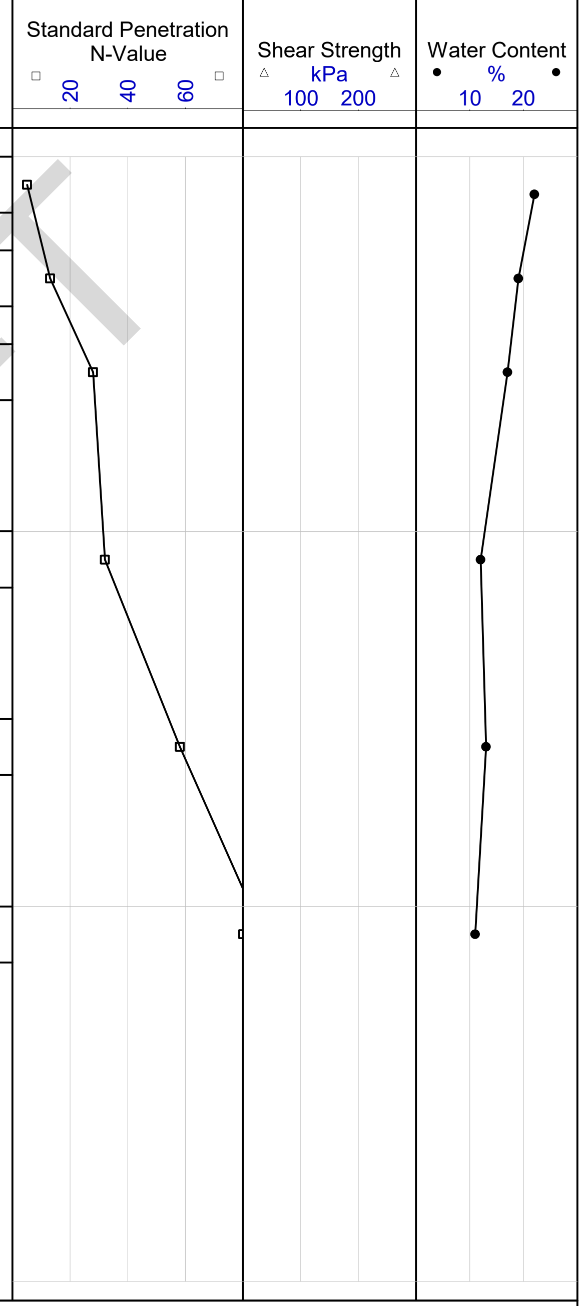
Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value
0	Ground Surface	233.45	No Monitoring Well Installed				
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 150 mm	232.69		SS	1	80	5
0.76–3.05	**Silt** Mottled grey/brown clayey silt, trace sand, stiff, WTPL; Silt some clay, trace sand and gravel, compact, wet	230.40		SS	2	80	13
				SS	3	70	28
3.05–4.57	Grey, dense, moist	228.88		SS	4	80	32
4.57–6.55	Silt, trace sand and fine gravel, very dense	226.90		SS	5	80	58
				SS	6	75	87
	End of Borehole						

Borehole terminated at 6.6 mbgs.



Contractor: TEC **Grade Elevation:** 233.45 masl

Drilling Method: Solid Stem Augers **Top of Casing Elevation:** NA

Well Casing Size: NA **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

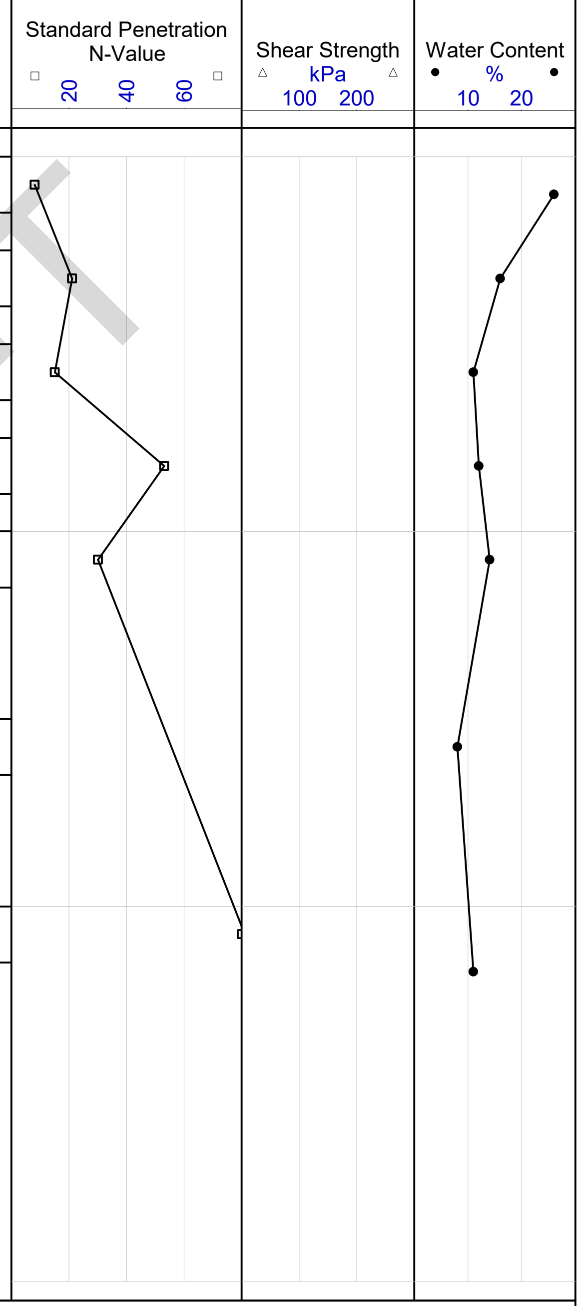
Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value
0	Ground Surface	237.15					
	Topsoil Dark brown silt, trace sand, with organics - 150 mm	236.39	Bentonite	SS	1	100	8
1	**Silt** Brown with some grey mottling silt, some clay, trace sand and gravel with some oxidation, loose, wet	235.63	Riser	SS	2	100	21
2	Reddish brown clayey silt, trace sand, very stiff, APL-WTPL	234.86		SS	3	100	15
	Brown, silt some sand trace clay, compact, moist			SS	4	100	53
3	Greyish brown sandy silt, trace gravel, very dense	234.10					
	Silt some clay and sand, trace gravel, dense, moist	232.58	Silica sand	SS	5	100	30
5	Wet, very dense	231.05	Screen	SS	6	100	>50
6	Grey sandy silt some clay, trace gravel	230.60		SS	7	100	81
	End of Borehole						

Borehole terminated at 6.6 mbgs.

Water level = 1.15 mbgs, As measured on April 25, 2022



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

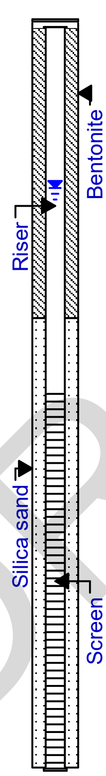
Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	237.42
0 – 0.76	**Topsoil** Dark brown silt, trace sand, with organics - 150 mm	236.66
0.76 – 1.52	**Silt** Reddish brown with some grey mottling silt, some clay, trace sand, loose, wet	235.90
1.52 – 3.05	Compact Silt, some clay, trace sand and gravel	234.37
3.05 – 4.57	Silt, trace sand, gravel and clay, dense, moist	232.85
4.57 – 6.1	Grey silt, trace sand and gravel	231.32
6.1	End of Borehole	

Borehole terminated at 6.1 mbgs.

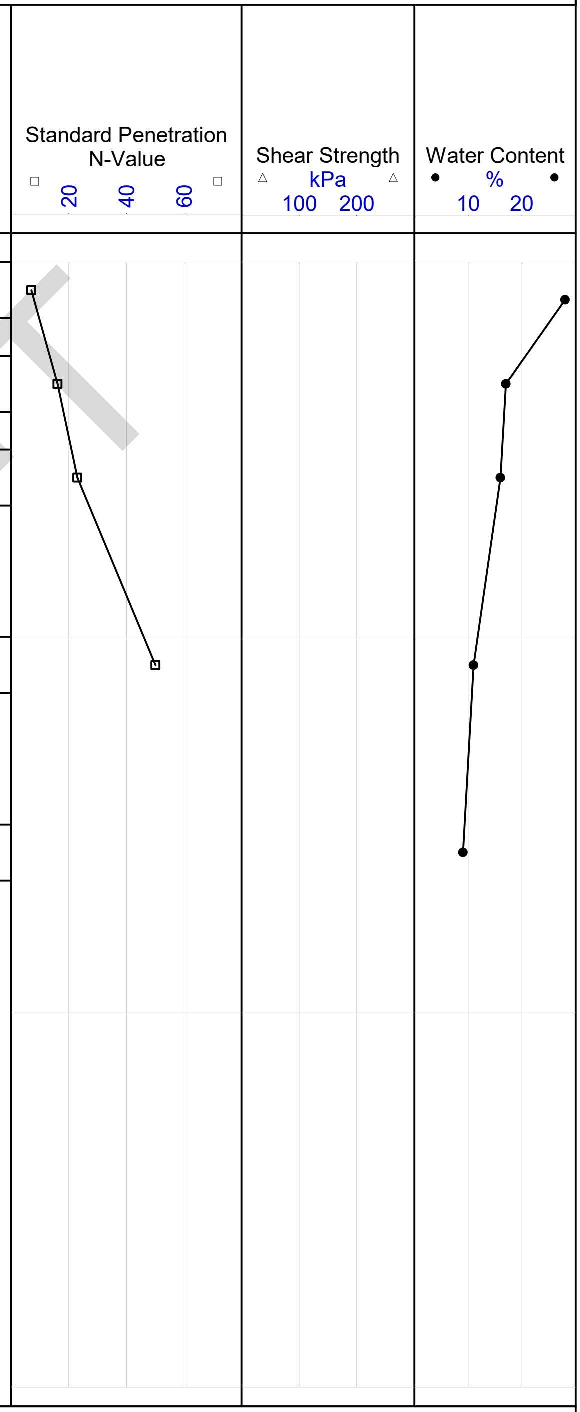
Monitoring Well Details



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



Contractor: TEC

Drilling Method: Solid Stem Augers

Well Casing Size: 51 mm

Grade Elevation: 237.42 masl

Top of Casing Elevation: 238.49 masl

Sheet: 1 of 1

Log of Borehole: BH14

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 17, 2022 **Project Manager:** SA

SUBSURFACE PROFILE				SAMPLE					
Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value	Water Content %
0	Ground Surface	235.25	No Monitoring Well Installed	SS	1	100	7		
	Topsoil Dark brown silt, trace sand, with organics - 150 mm	234.49							
1	**Silt** Reddish brown/grey clayey silt, trace sand, firm, APL	233.73		SS	2	90	25		
	Silt, trace to some sand and clay, trace gravel, compact, wet			SS	3	90	58		
2	with green staining, very dense, moist	232.20							
3	Grey silt, some clay, trace sand and gravel			SS	4	20	>50		
5		230.22		SS	5	10	>50		
	End of Borehole								
	Borehole terminated at 5.0 mbgs.								

Standard Penetration N-Value: 20, 40, 60
Shear Strength kPa: 100, 200
Water Content %: 10, 20

DRAFT

Contractor: TEC **Grade Elevation:** 235.25 masl

Drilling Method: Solid Stem Augers **Top of Casing Elevation:** NA

Well Casing Size: NA **Sheet:** 1 of 1

Log of Borehole: BH15

Project #: 308567.001 **Logged By:** KS

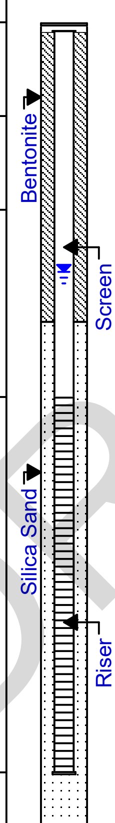
Project: Geotechnical Investigation

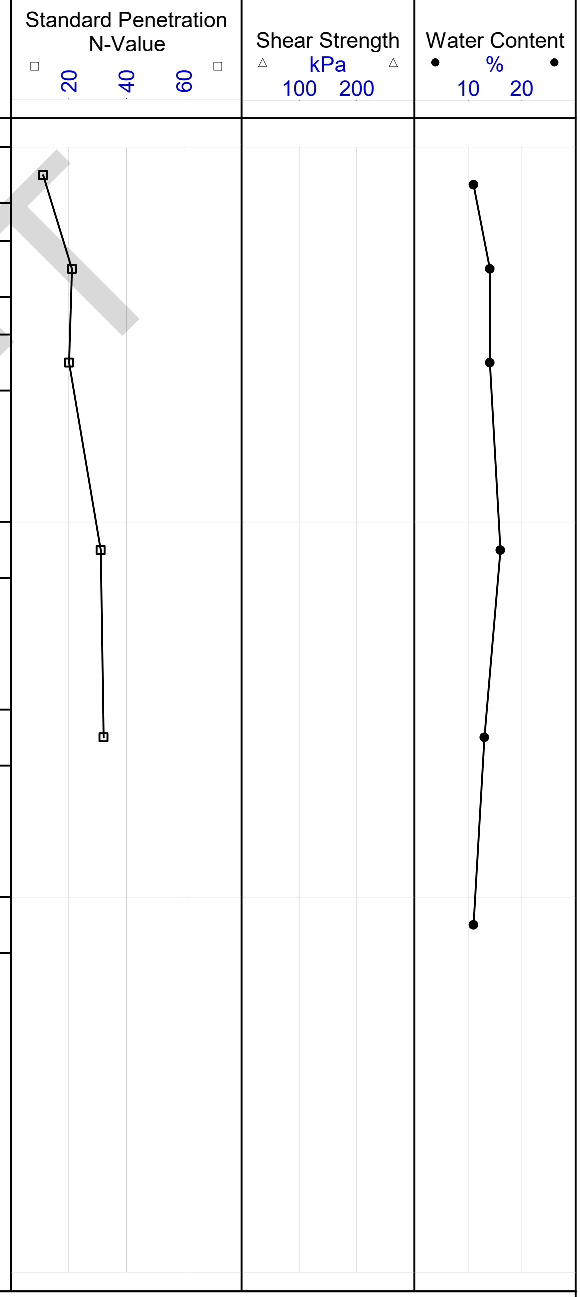
Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE				SAMPLE			
Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value
0	Ground Surface	234.02					
	Topsoil Dark brown silt, trace sand, with organics - 150 mm			SS	1	100	11
	Silt Reddish brown clayey silt, trace sand and gravel, very stiff, APL	233.26		SS	2	100	21
	brown silt, some clay, trace sand and gravel, compact, moist	232.50		SS	3	100	20
	Reddish brown						
	Greyish brown, dense	230.97		SS	4	100	31
				SS	5	100	32
	Grey silt, trace sand, very dense, moist	227.92		SS	6	100	>50
	End of Borehole	227.47					
	Borehole terminated at 6.6 mbgs.		Water level = 2.0 mbgs, as measured on April 25, 2022				





Contractor: TEC **Grade Elevation:** 234.02 masl

Drilling Method: Solid Stem Augers **Top of Casing Elevation:** 235.12 masl

Well Casing Size: 51 mm **Sheet:** 1 of 1

Log of Borehole: BH16

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

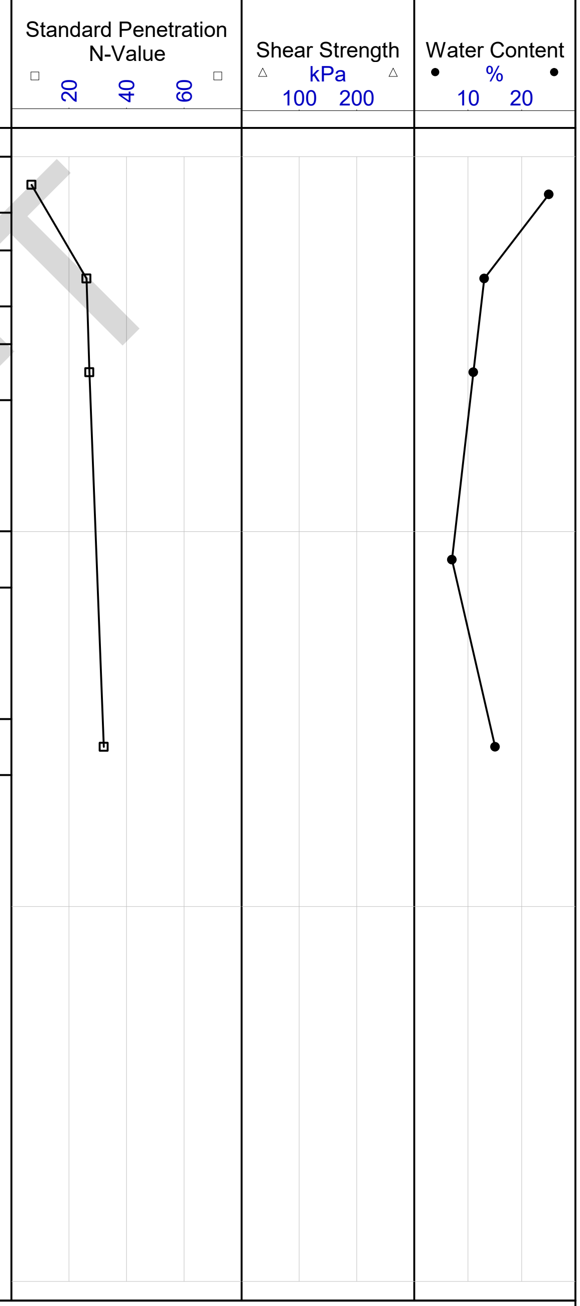
SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	234.39
0–0.15	**Topsoil** Dark brown silt, trace sand, with organics - 150 mm	
0.76	**Silt** Reddish brown silt some clay, trace and and gravel, loose, wet	233.63
	Mottled grey/brown, compact, moist	
3.05	Reddish brown silt, some sand, trace clay, very dense, moist	231.34
4.57	Grey, desne, wet	229.82
5.03	End of Borehole	229.36
	Borehole terminated at 5.5 mbgs.	

Monitoring Well Details: No Monitoring Well Installed

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value
SS	1	80	7
SS	2	60	26
SS	3	50	27
SS	4	30	>50
SS	5	50	32



Contractor: TEC

Drilling Method: Solid Stem Augers

Well Casing Size: NA

Grade Elevation: 234.39 masl

Top of Casing Elevation: NA

Sheet: 1 of 1

Log of Borehole: BH17

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

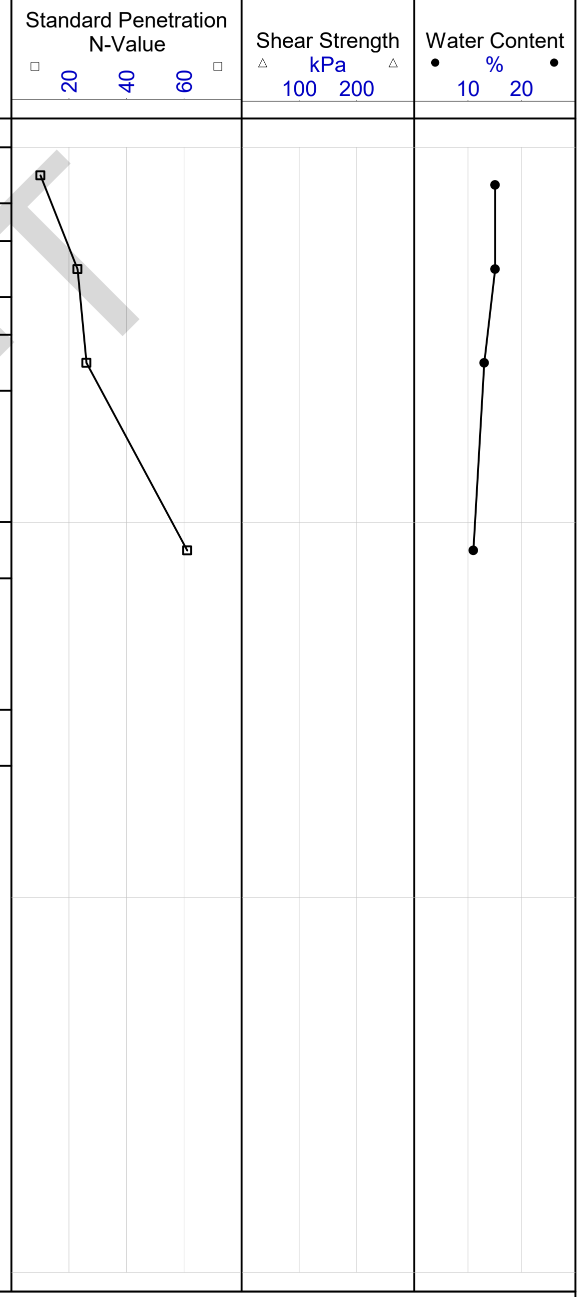
Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 16, 2022 **Project Manager:** SA

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value
0	Ground Surface	233.68	No Monitoring Well Installed				
	Topsoil Dark brown silt, trace sand, with organics - 150 mm			SS	1	100	10
	Silt Reddish brown silt some clay, trace sand, compact, moist	232.92		SS	2	80	23
	Silt, some clay, trace sand and gravel			SS	3	80	26
3	Grey/brown, very dense	230.63		SS	4	50	61
				SS	5	0	>50
5	End of Borehole	228.65					
	Borehole terminated at 5.5 mbgs.						



Contractor: TEC **Grade Elevation:** 233.68 masl

Drilling Method: Solid Stem Augers **Top of Casing Elevation:** NA

Well Casing Size: NA **Sheet:** 1 of 1

Log of Borehole: BH18

Project #: 308567.001 **Logged By:** KS

Project: Geotechnical Investigation

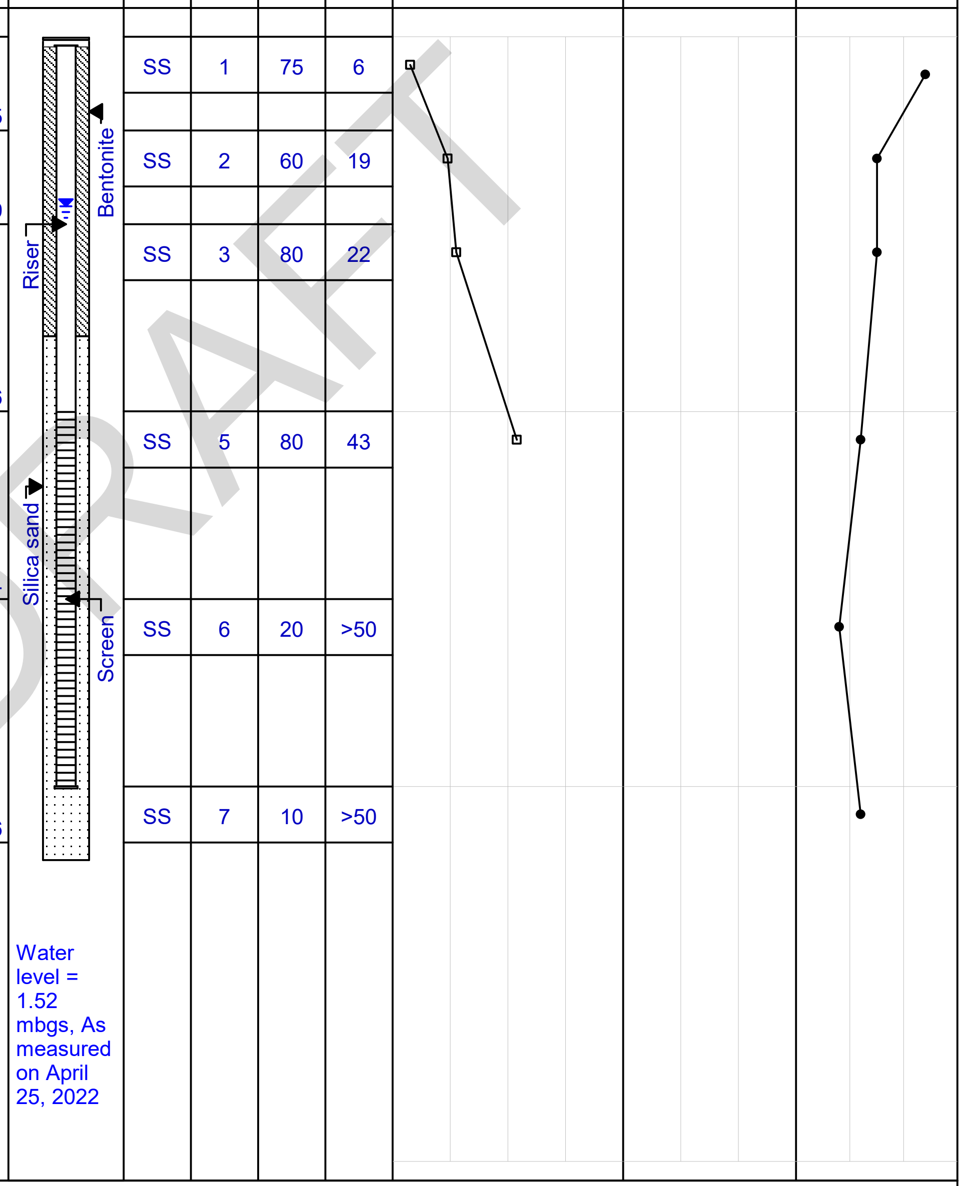
Client: Prologis

Location: 12519 & 12713 Humber Station Drive, Caledon, Ontario

Drill Date: April 16, 2022 **Project Manager:** SA

Depth (m)	Description	Elevation (m)	Sample Type	Sampler #	Recovery (%)	SPT N-Value
0	Ground Surface	232.61				
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 150 mm	231.85	SS	1	75	6
0.76–1.52	**Silt** Reddish brown with some grey mottling clayey silt, firm, WTPL	231.09	SS	2	60	19
1.52–2.1	Mottled grey/brownsilt some clay, trace sand and gravel, compact, moist		SS	3	80	22
2.1–3.05	Silt, some clay, trace sand and gravel	229.56				
3.05–4.57	Dense	228.04	SS	5	80	43
4.57–6.55	Grey sandy silt, some clay, trace gravel	226.06	SS	6	20	>50
			SS	7	10	>50
	End of Borehole					

Borehole terminated at 6.6 mbgs.



Water level = 1.52 mbgs, As measured on April 25, 2022

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: BH101

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 30, 2023 **Project Manager:** JD

SUBSURFACE PROFILE

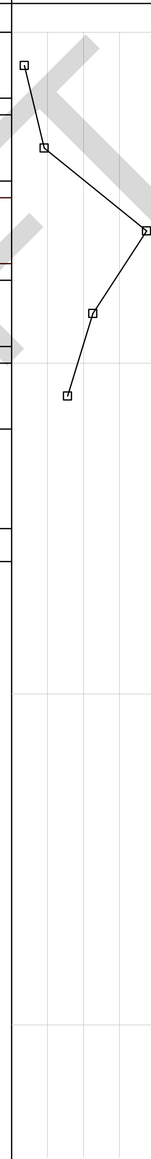
Depth (m)	Description	Elevation (m)	Monitoring Well Details
0	Ground Surface		
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 150mm	0.00	No Monitoring Well Installed
0.76	**Silty Clay** brown with some grey, trace gravel, firm, DTPL	0.76	
1.52	with black staining, trace orange oxidation, very stiff	1.52	
	trace sand, trace rock, hard		
3.05	Grey, trace gravel, trace orange oxidation	3.05	
4.57	**Silty Sand** Grey sandy silt/ silty sand, trace rock, very dense, moist	4.57	
	End of Borehole		

Borehole terminated at approximately 4.9 mbgs. At drilling completion, the borehole was open and water was measured at 4.9 mbgs.

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	35	7	18.8			
SS	2	100	18	11.9			
SS	3	75	75	14.0			
SS	4	100	45	12.4			
SS	5	65	31	9.1			
SS	6	75	>50	7.0			

Standard Penetration N-Value



Shear Strength kPa
100 200

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH102

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

SUBSURFACE PROFILE				SAMPLE									
Depth (m)	Description	Elevation (m)	Monitoring Well Details	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
0	Ground Surface												
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 200mm	0.00	No Monitoring Well Installed	SS	1	45	5			21.3			
0.76	**Silty Clay** Brown silty clay, trace gravel, firm, DTPL	0.76		SS	2	80	21			15.2			
	with some grey mottling, very stiff			SS	3	65	19			13.3			
2.29		2.29		SS	4	100	22			17.0			
3.05	with black staining, trace orange oxidation	3.05		SS	5	100	21			13.7			
3.66	End of Borehole Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.	3.66											

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **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

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 150mm	0.00
	Silty Clay Brown with some grey mottling silty clay, trace gravel, firm, DTPL	
1.52	with black staining, trace oxidation, hard	1.52
2.29	trace gravel and rock, hard, APL	2.29
3.05	trace orange oxidation, very stiff, DTPL	3.05
4.57	Grey	4.57
6.10	**Silty Sand** Grey silty sand, trace gravel, very dense, moist	6.10
	End of Borehole	
	Borehole terminated at approximately 6.4 mbgs.	

Monitoring Well Details: Riser, Bentonite, Screen, Silica Sand

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	65	6	20.9			
SS	2	95	19	14.8			
SS	3	85	34	15.9			
SS	4	80	31	13.4			
SS	5	100	27	13.1			
SS	6	100	28	12.8			
SS	7	100	>50	6.9			

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: 51 mm **Sheet:** 1 of 1

Log of Borehole: BH104

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

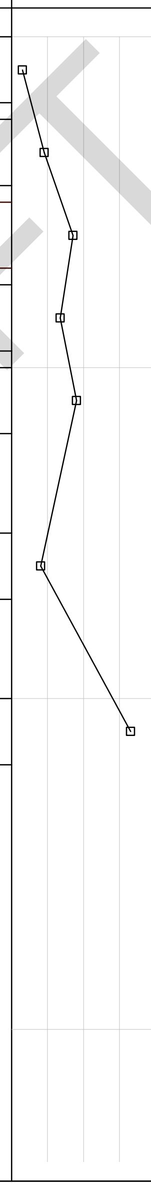
Drill Date: January 30, 2023 **Project Manager:** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 200mm	0.00	No Monitoring Well Installed	SS	1	50	6	12.9			
0.2	**Silty Clay** Brown with some grey mottling silty clay, trace gravel, firm to very stiff, DTPL			SS	2	45	18	14.2			
1.52		1.52		SS	3	100	34	16.6			
	trace orange oxidation and rock, hard										
2.29	black staining, very stiff	2.29		SS	4	100	27	15.2			
3.05	hard	3.05		SS	5	100	36	11.6			
4.57	Grey, stiff, APL	4.57		SS	6	75	16	12.5			
6.10	trace rock, hard	6.10		SS	7	100	66	7.0			
6.71	End of Borehole	6.71									

Borehole terminated at approximately 6.7 mbgs. At drilling completion, a dry cave was measured at 5.6 mbgs.

Standard Penetration N-Value (20, 40, 60); Shear Strength kPa (100, 200)



Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH105

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)	Monitoring Well Details	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
0	Ground Surface	0.00	No Monitoring Well Installed										
0.00 – 0.76	**Topsoil** Dark brown silt, trace sand, with organics - 175mm	0.00		SS	1	45	5			14.4			
0.76 – 1.52	**Silty Clay** Brown with some grey mottling silty clay, firm to very stiff, DTPL	0.76		SS	2	70	28			14.6			
1.52 – 2.29	trace gravel	1.52		SS	3	85	25			14.7			
2.29 – 3.05	trace orange oxidation; with black staining, hard	2.29		SS	4	100	36			16.0			
3.05 – 4.57	No recovery	3.05		SS	5	0	39			N/A			
4.57 – 5.18	Grey, trace gravel, hard, DTPL	4.57		SS	6	60	36			8.8			
5.18	End of Borehole	5.18											

Borehole terminated at approximately 5.2 mbgs. At drilling completion, a dry cave was measured at 4.3 mbgs.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH106

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

Elevation (m)	Description
	Ground Surface
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 200mm
0.76	**Silty Clay** Brown with some grey mottling silty clay, firm, DTPL
	trace gravel, very stiff
1.52	with black staining
2.29	Brown, trace orange oxidation, hard
3.05	trace rock
4.57	Grey, very stiff
6.10	trace sand, trace gravel and rock, hard, DTPL
	End of Borehole

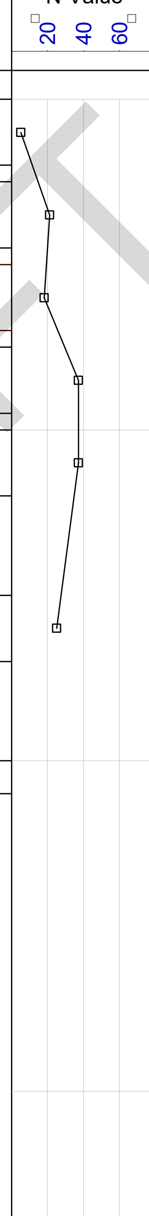
Borehole terminated at approximately 6.4 mbgs. At drilling completion, a dry cave was measured at 5.5 mbgs.

Monitoring Well Details: No Monitoring Well Installed

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	50	5	16.5			
SS	2	75	21	15.1			
SS	3	90	18	15.8			
SS	4	85	37	15.6			
SS	5	100	37	14.0			
SS	6	60	25	9.8			
SS	7	100	>50	9.3			

Standard Penetration N-Value



Shear Strength kPa 100 200

Depth (m): 0 1 2 3 4 5 6 7 8 9 10

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH107

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

Depth (m)	Description (SUBSURFACE PROFILE)	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
	Ground Surface										
0	**Topsoil** Dark brown silt, trace sand, with organics - 150mm	0.00	No Monitoring Well Installed	SS	1	40	7	16.5			
0.76	**Silty Clay** Brown with some grey mottling silty clay with sand, trace gravel, firm, DTPL	0.76		SS	2	100	18	15.6			
				SS	3	100	21	14.6			
2.29	black staining, very stiff; trace rock, hard	2.29		SS	4	100	33	16.3			
3.05	Grey, trace orange oxidation, trace gravel and rock, very stiff, DTPL	3.05		SS	5	100	28	13.2			
				SS	6	100	30	10.6			
5.18	End of Borehole	5.18									

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Borehole terminated at approximately 5.2 mbgs. At drilling completion, a dry cave was measured at 4.4 mbgs.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **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)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm) / Laboratory Analysis
0	Ground Surface									
0	**Topsoil** Dark brown silt, trace sand, with organics - 150mm	0.00	Riser	SS	1	55	12	16.4		
1	**Silty Clay** Brown with some grey mottling silty clay, trace gravel, very stiff, DTPL	1.22		SS	2	55	16	16.3		
2	trace layer of sand			SS	3	75	19	15.4		
	with black staining, trace orange oxidation		Bentonite	SS	4	80	16	15.4		
3	trace grey mottling	3.05		SS	5	100	27	17.1		
4			Silica Sand / Screen	SS	6	100	26	15.1		
5	trace rock	5.03								
6	Grey, hard, APL	6.10		SS	7	100	>50	11.1		
	End of Borehole									

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Borehole terminated at approximately 6.4 mbgs.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: 51 mm **Sheet:** 1 of 1

Log of Borehole: BH109

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 1, 2023 **Project Manager:** JD

SUBSURFACE PROFILE				SAMPLE									
Depth (m)	Description	Elevation (m)	Monitoring Well Details	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
0	Ground Surface												
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 150mm	0.00	No Monitoring Well Installed	SS	1	50	9			15.2			
	Silty Clay Brown with some grey mottling silty clay, trace gravel, trace orange oxidation, firm to very stiff, DTPL			SS	2	70	19			14.9			
1.52		1.52		SS	3	75	22			15.2			
2.29	with black staining	2.29		SS	4	33	30			15.0			
	Brown to grey			SS	5	100	22			17.4			
4.57	Grey silty clay with sand, trace gravel and rock, very stiff, APL	4.57		SS	6	100	16			12.4			
5.18	End of Borehole	5.18											

Borehole terminated at approximately 5.2 mbgs. At drilling completion, a wet cave was measured at 4.4 mbgs, and water was measured at 4.4 mbgs.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH110

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 1, 2023 **Project Manager:** JD

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface	0.00	No Monitoring Well Installed								
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 200mm			SS	1	45	5	30.2			
0.76	**Silty Clay** Brown silty clay, trace orange oxidation, firm, DTPL	0.76		SS	2	50	8	29.7			
1.52	with some grey mottling, trace gravel	1.52		SS	3	85	21	16.5			
2.29	with black staining, very stiff trace rock, hard	2.29		SS	4	50	32	16.2			
3.05	Grey, very stiff, APL	3.05		SS	5	100	18	16.2			
4.57	No recovery	4.57		SS	6	0	15	N/A			
6.10	Grey silty clay with sand, trace gravel and rock, very stiff, APL	6.10		SS	7	65	15	9.0			
6.71	End of Borehole	6.71									

Borehole terminated at approximately 6.7 mbgs. At drilling completion, a wet cave was measured at 5.5 mbgs, and water was measured at 5.4 mbgs.

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH111

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

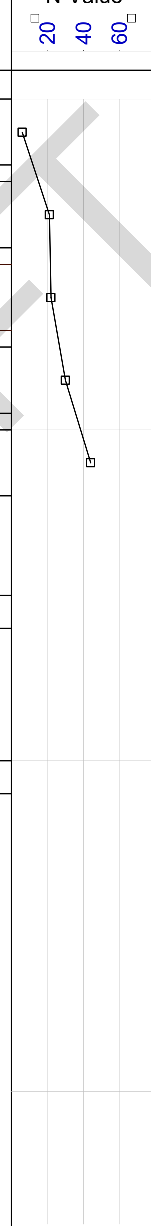
Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 27, 2023 **Project Manager:** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface	0.00	No Monitoring Well Installed								
0–0.23	**Topsoil** Dark brown silt, trace sand, with organics - 230mm			SS	1	55	6	14.1			
	Silty Clay Brown with some grey mottling silty clay with sand, trace gravel, firm to very stiff, DTPL			SS	2	60	21	15.1			
1.52	Brown with black staining, trace layer of sand, very stiff	1.52		SS	3	100	22	14.4			
2.29	trace orange oxidation, trace rock	2.29		SS	4	85	30	12.0			
3.05	No recovery	3.05		SS	5	0	44	N/A			
				SS	6	0	>50	N/A			
6.10	Grey silty clay, some sand, trace gravel, hard, APL	6.10		SS	7	100	>50	6.2			



Shear Strength kPa 100 200

End of Borehole

Borehole terminated at approximately 6.4 mbgs. At drilling completion, the borehole was open and dry.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH112

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)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 150mm	0.00	No Monitoring Well Installed	SS	1	40	7	18.4			
0.76	**Silty Clay** Brown with some grey mottling silty clay, firm, DTPL	0.76		SS	2	85	20	14.0			
1.52	trace gravel, very stiff	1.52		SS	3	100	28	14.2			
	with black staining										
2.29	trace orange oxidation, trace rock	2.29		SS	4	100	28	13.4			
				SS	5	100	28	13.6			
4.57	Grey silty clay with sand, trace gravel, very stiff, APL	4.57		SS	6	100	24	9.1			
5.18	End of Borehole	5.18									

Borehole terminated at approximately 5.2 mbgs. At drilling completion, a dry cave was measured at 4.0 mbgs.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH113

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

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 255mm	0.00	No Monitoring Well Installed	SS	1	50	7	17.8			
0.76	**Silty Clay** Brown with some grey mottling silty clay, some sand, trace orange oxidation, firm, DTPL	0.76		SS	2	70	18	14.4			
				SS	3	75	23	13.7			
	with black staining, trace gravel, very stiff										
2.29	No recovery	2.29		SS	4	0	55	N/A			
3.05	Brown, trace rock, hard	3.05		SS	5	100	38	11.6			
4.57	Grey, trace gravel and rock, hard, DTPL	4.57		SS	6	100	42	8.6			
				SS	7	85	52	10.4			
6.71	End of Borehole	6.71									

Borehole terminated at approximately 6.7 mbgs. At drilling completion, a dry cave was measured at 5.5 mbgs.

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH114

Project #: 308567.002 **Logged By:** SL

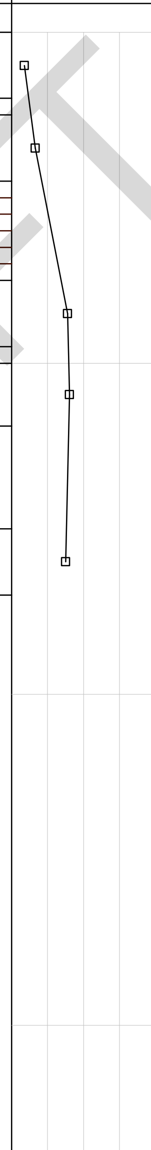
Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 30, 2023 **Project Manager:** JD

SUBSURFACE PROFILE				SAMPLE										
Depth (m)	Description	Elevation (m)	Monitoring Well Details	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
0	Ground Surface	0.00	No Monitoring Well Installed										
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 200mm	0.00		SS	1	65	7			19.6			
0.76	**Silty Clay** Brown silty clay, trace gravel, firm, DTPL	0.76		SS	2	85	13			16.8			
1.52	with some grey mottling, very stiff	1.52		SS	3	85	NA			15.4			
2.29	with black staining, trace orange oxidation; Brown, hard	2.29		SS	4	100	31			13.8			
3.05	Grey with black staining trace gravel, DTPL	3.05		SS	5	100	32			10.5			
4.57	**Sandy Silt** Grey sandy silt, trace gravel, compact, moist	4.57		SS	6	65	30			10.3			
5.18	End of Borehole	5.18											



Borehole terminated at approximately 5.2 mbgs. At drilling completion, a wet cave was measured at 4.4 mbgs, and water was measured at 4.1 mbgs.

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH115

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 1, 2023 **Project Manager:** JD

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
	Ground Surface										
0	**Topsoil** Dark brown silt, trace sand, with organics - 200mm	0.00	No Monitoring Well Installed	SS	1	60	6	14.3			
0.76	**Silty Clay** Brown silty clay with some grey mottling and black staining, firm, DTPL	0.76		SS	2	60	18	14.6			
1.52	trace orange oxidation, very stiff	1.52		SS	3	100	24	13.5			
	Brown, trace rock, hard			SS	4	80	36	10.8			
3.05	No recovery	3.05		SS	5	0	32	N/A			
4.57	Grey silty clay with sand, trace gravel, hard, DTPL	4.57		SS	6	100	82	9.0			
6.10	APL	6.10		SS	7	80	>50	14.0			
	End of Borehole										

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Borehole terminated at approximately 6.4 mbgs. At drilling completion, the borehole was open and dry.

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH116

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

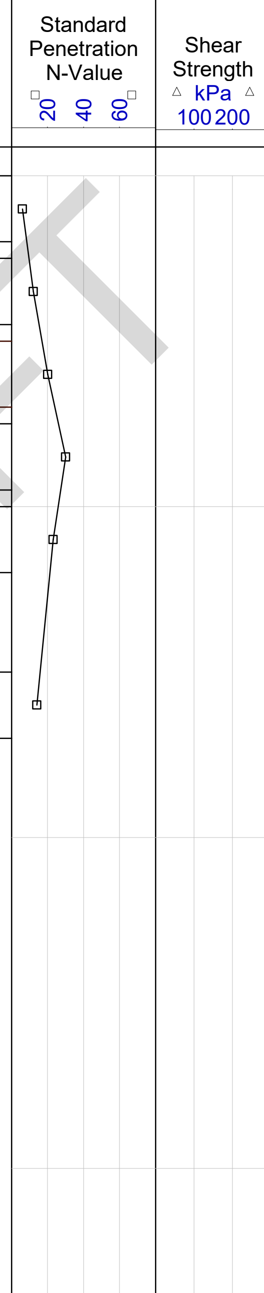
Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: February 1, 2023 **Project Manager:** JD

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
0	**Topsoil** Dark brown silt, trace sand, with organics - 150mm	0.00	No Monitoring Well Installed	SS	1	30	6	26.5			
0.76	**Silty Clay** Brown silty clay, firm, DTPL	0.76		SS	2	60	12	13.1			
	with some grey mottling, trace gravel, very stiff			SS	3	65	20	16.4			
2.29	with black staining, trace orange staining	2.29		SS	4	100	30	16.1			
3.05	very stiff, APL	3.05		SS	5	85	23	18.5			
4.57	Grey	4.57		SS	6	100	14	14.7			
5.18	End of Borehole	5.18									

Borehole terminated at approximately 5.2 mbgs. At drilling completion, a dry cave was measured at 4.4 mbgs.



DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH117

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 1, 2023 **Project Manager:** JD

SUBSURFACE PROFILE			
Depth (m)	Description	Elevation (m)	Monitoring Well Details
0	Ground Surface	0.00	No Monitoring Well Installed
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 200mm	0.00	
0.76–1.52	**Silty Clay** Brown silty clay with sand, firm, DTPL	0.76	
1.52–2.29	with some grey mottling, trace gravel, trace orange oxidation, very stiff	1.52	
2.29–3.05	trace layer of sand; hard	2.29	
3.05–5.18	Grey, very stiff to hard	3.05	
5.18	End of Borehole	5.18	

Borehole terminated at approximately 5.2 mbgs. At drilling completion, the borehole was open and dry.

SAMPLE									
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	5			26.0			
SS	2	65	17			23.6			
SS	3	70	24			16.0			
SS	4	100	33			16.2			
SS	5	100	28			14.7			
SS	6	100	31			12.5			

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH118

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

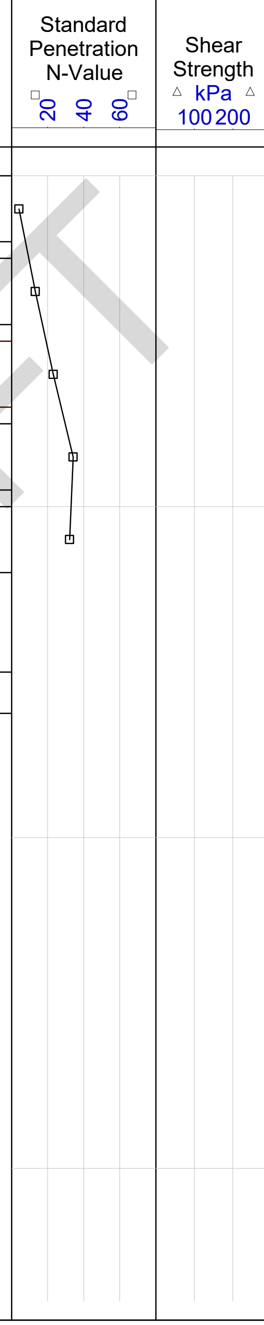
Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 30, 2023 **Project Manager:** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
	Topsoil Dark brown silt, trace sand, with organics - 150mm	0.00	No Monitoring Well Installed	SS	1	50	4	26.3			
	Silty Clay Brown silty clay, soft	0.76		SS	2	65	13	26.1			
	Brown with some grey mottling, trace gravel, very stiff, DTPL	1.52		SS	3	70	23	15.9			
	with black staining, trace orange oxidation	2.29		SS	4	100	34	12.0			
	Brown, trace rock, hard			SS	5	100	32	11.0			
	Sandy Silt Grey sandy silt, trace rock, very dense, moist	4.57		SS	6	100	>50	8.3			
	End of Borehole	4.95									

Borehole terminated at approximately 5.0 mbgs. At drilling completion, a dry cave was measured at 4.4 mbgs.



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Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH119

Project #: 308567.002 **Logged By:** SL

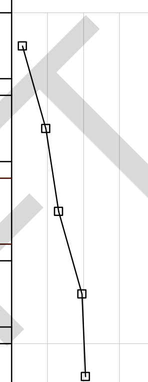
Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 30, 2023 **Project Manager:** JD

SUBSURFACE PROFILE					SAMPLE									
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	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
0		Ground Surface	0.00	No Monitoring Well Installed										
		Topsoil Dark brown silt, trace sand, with organics - 175mm			SS	1	50	6			14.1			
1		**Silty Clay** Brown with some grey mottling silty clay, firm, DTPL	0.76		SS	2	50	19			16.8			
2		with black staining, trace gravel, very stiff	1.52		SS	3	100	26			17.2			
		trace orange oxidation												
3		Brown, trace rock, hard	2.29		SS	4	100	39			15.6			
		No recovery	3.05		SS	5	0	41			N/A			
4														
5		Grey, DTPL	4.57		SS	6	100	>50			6.7			
		End of Borehole												
6		Borehole terminated at approximately 4.9 mbgs. At drilling completion, the borehole was open and dry.												
7														
8														
9														
10														



DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH120

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 6, 2023 **Project Manager:** JD

SUBSURFACE PROFILE

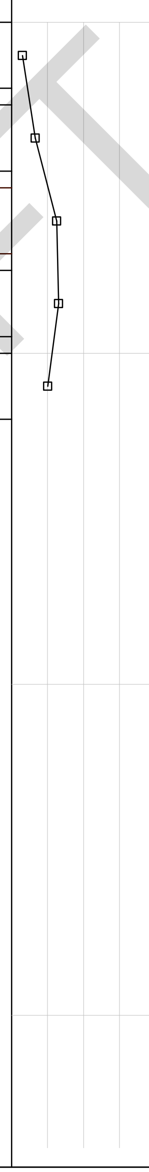
Depth (m)	Description	Elevation (m)	Monitoring Well Details
0	Ground Surface	0.00	No Monitoring Well Installed
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 240mm	0.00	
0.76–1.52	**Silty Clay** Brown silty clay, trace orange oxidation, firm, DTPL	0.76	
1.52–2.29	with some grey mottling and black staining, trace gravel, very stiff	1.52	
2.29	No recovery	2.29	
2.29–3.66	trace orange oxidation, very stiff, APL		
3.66	End of Borehole	3.66	

Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	60	6	21.2			
SS	2	50	13	15.6			
SS	3	0	25	N/A			
SS	4	15	26	17.2			
SS	5	100	20	17.9			

Standard Penetration N-Value



Shear Strength kPa
100 200

Contractor: Geo-Environmental Drilling Inc.	**Grade Elevation:** 0
Drilling Method: Split Spoon / Hollow Stem Auger	**Top of Casing Elevation:** 0
Well Casing Size: N/A	**Sheet:** 1 of 1

Log of Borehole: BH121

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 6, 2023 **Project Manager:** JD

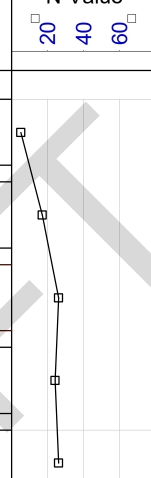
SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	0.00
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 150mm	0.76
0.76–3.66	**Silty Clay** Brown with some grey mottling silty clay, trace gravel, firm, DTPL	1.52
	trace layer of sand, very stiff	
	with black staining, trace rock	2.29
	trace orange oxidation, trace black fragment	
3.66	End of Borehole	3.66
	Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.	

Monitoring Well Details: No Monitoring Well Installed

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	65	5	15.2			
SS	2	100	17	14.9			
SS	3	65	26	15.0			
SS	4	100	24	14.7			
SS	5	100	26	16.9			



Shear Strength kPa 100 200

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH122

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

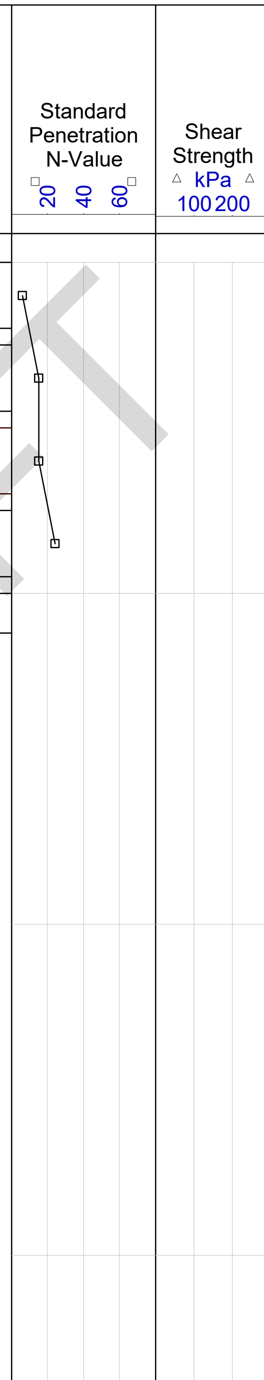
Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: February 6, 2023 **Project Manager:** JD

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface	0.00	No Monitoring Well Installed								
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 175mm			SS	1	50	6	19.8			
0.76	**Silt** Brown silty clay, trace gravel, firm, DTPL	0.76		SS	2	80	15	21.2			
1.52		1.52		SS	3	70	15	15.4			
	with some grey mottling, trace orange oxidation, very stiff			SS	4	100	24	16.3			
	with black staining, very stiff to hard			SS	5	85	>50	15.3			
3.41	End of Borehole	3.41									

Borehole terminated at approximately 3.4 mbgs. At drilling completion, the borehole was open and dry.



Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

PINCHIN

Log of Borehole: BH123

Project #: 308567.002 **Logged By:** SL

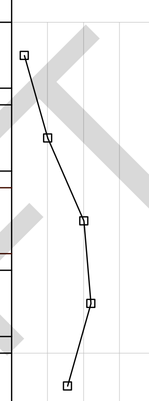
Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 20, 2023 **Project Manager:** JD

SUBSURFACE PROFILE					SAMPLE										
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	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
0		Ground Surface													
		Topsoil Dark brown silt, trace sand, with organics - 150mm	0.00	No Monitoring Well Installed	SS	1	50	7			19.2			
1		**Silty Clay** Brown silty clay with sand, trace gravel, firm, DTPL	0.76		SS	2	80	20			19.5			
2		with some grey mottling and black staining, trace orange oxidation, very stiff	1.52		SS	3	90	40			13.4			
		hard	2.29		SS	4	75	44			12.4			
3		trace black crystal												
		Grey	3.05		SS	5	75	31			12.9			
4		End of Borehole	3.66											
5		Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.												
6														
7														
8														
9														
10														



Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

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

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	0.00
0 – 0.76	**Topsoil** Dark brown silt, trace sand, with organics - 150mm	0.00
0.76 – 4.57	**Silty Clay** Brown silty clay with sand, trace gravel, firm, DTPL; with some grey mottling, trace rock, trace orange oxidation, very stiff; with black staining; hard	0.76 / 1.52 / 2.29
4.57 – 6.10	**Sand** Grey sand, trace silt, dense, moist	4.57
6.10 – 6.4	**Sandy Silt** Grey sandy silt, very dense, moist	6.10
	End of Borehole	

Borehole terminated at approximately 6.4 mbgs.

Monitoring Well Details: Riser; Screen; Bentonite; Silica Sand

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	50	7	23.5			
SS	2	75	24	16.6			
SS	3	100	28	16.0			
SS	4	100	37	13.1			
SS	5	100	57	15.1			
SS	6	15	40	12.7			
SS	7	100	>50	6.3			

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: 51 mm **Sheet:** 1 of 1

Log of Borehole: BH125

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

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)	Monitoring Well Details
0	Ground Surface	0.00	No Monitoring Well Installed
0 – 0.76	**Topsoil** Dark brown silt, trace sand, with organics - 200mm		
0.76 – 1.52	**Silty Clay** Brown silty clay with sand, stiff, DTPL	0.76	
1.52 – 2.29	with some grey mottling, trace gravel, trace orange oxidation, very stiff	1.52	
2.29 – 2.6	with black staining	2.29	
2.6 – 3.66	trace rock, hard		
3.66	End of Borehole Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.	3.66	

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	85	11	22.6			
SS	2	65	27	14.7			
SS	3	100	25	15.2			
SS	4	100	39	12.9			
SS	5	100	36	12.2			

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH126

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

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
	Ground Surface	
0	**Topsoil** Dark brown silt, trace sand, with organics - 175mm	0.00
0.76	**Silty Clay** Brown silty clay, some sand, trace gravel, firm, APL	0.76
	with some grey mottling, very stiff	
2.29	with black staining, trace orange oxidation	2.29
4.57	Grey	4.57
6.10	**Sandy Silt** Grey sandy silt, trace gravel, very dense, moist	6.10
	Sand Grey sand, trace silt, trace gravel, moist	
	End of Borehole	

Borehole terminated at approximately 6.7 mbgs. At drilling completion, a wet cave was measured at 5.3 mbgs, and water was measured at 6.1. mbgs.

Monitoring Well Details: No Monitoring Well Installed

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	60	5	27.9			
SS	2	60	22	16.3			
SS	3	85	28	15.1			
SS	4	85	44	13.2			
SS	5	85	28	12.7			
SS	6	75	20	13.8			
SS	7	100	55	10.4			

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH127

Project #: 308567.002 **Logged By:** SL

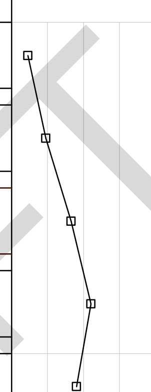
Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 20, 2023 **Project Manager:** JD

SUBSURFACE PROFILE				SAMPLE										
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	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
0		Ground Surface	0.00	No Monitoring Well Installed										
		Topsoil Dark brown silt, trace sand, with organics - 175mm			SS	1	70	9			19.0			
		Silty Clay Brown silty clay, some sand, trace gravel, firm, DTPL	0.76		SS	2	50	19			15.1			
2		some grey mottling, very stiff			SS	3	90	33			15.8			
		No recovery	2.29		SS	4	0	44			N/A			
3		hard, DTPL	3.05		SS	5	10	36			14.4			
		Sandy Silt Grey sandy silt, trace gravel, trace rock, very dense, moist	4.57		SS	6	100	>50			5.8			
		End of Borehole												



Borehole terminated at approximately 4.9 mbgs. At drilling completion, a dry cave was measured at 3.7 mbgs.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH128

PINCHIN

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 23, 2023 **Project Manager:** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface	0.00	No Monitoring Well Installed								
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 150mm			SS	1	45	9	30.4			
0.76	**Silty Clay** Brown with some grey mottling silty clay with sand, firm, APL	0.76		SS	2	60	16	15.5			
1.52	with black staining, trace gravel, very stiff	1.52		SS	3	90	24	16.9			
2.29	trace orange oxidation, DTPL	2.29		SS	4	100	39	13.3			
	trace rock, hard			SS	5	35	92	8.1			
4.57	No recovery	4.57		SS	6	0	>50	N/A			
	End of Borehole										

Standard Penetration N-Value: 20, 40, 60

Shear Strength kPa: 100, 200

Borehole terminated at approximately 5.0 mbgs. At drilling completion, a dry cave was measured at 4.0 mbgs.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH129

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 19, 2023 **Project Manager:** JD

SUBSURFACE PROFILE				SAMPLE										
Depth (m)	Description	Elevation (m)	Monitoring Well Details	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
0	Ground Surface												
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 150mm	0.00	No Monitoring Well Installed	SS	1	65	5			26.4			
0.76	**Silty Clay** Brown silty clay, some sand, trace gravel, firm, APL	0.76		SS	2	65	20			15.7			
				SS	3	95	20			13.7			
	with some grey mottling and black staining, trace orange oxidation, trace crystal, very stiff, DTPL	2.29		SS	4	100	40			14.0			
	Brown, hard			SS	5	100	45			10.8			
3.66	End of Borehole	3.66											

End of Borehole

Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH130

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 26, 2023 **Project Manager:** JD

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 150mm	0.00
0.76	**Silty Clay** Brown with some grey mottling sandy silty clay, trace gravel, firm, DTPL	0.76
2.29	trace orange oxidation, very stiff Brown with black staining	2.29
3.05	trace rock, hard	3.05
4.57	Grey, very stiff	4.57
6.10	**Silty Sand** Grey silty sand, trace gravel, very dense, moist	6.10
6.52	End of Borehole	6.52

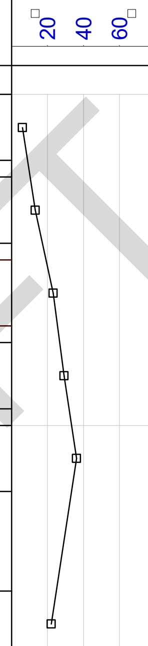
Monitoring Well Details: No Monitoring Well Installed

Borehole terminated at approximately 6.5 mbgs. At drilling completion, a dry cave was measured at 5.2 mbgs.

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	60	6	18.9			
SS	2	90	13	12.9			
SS	3	15	23	14.4			
SS	4	50	29	13.7			
SS	5	100	36	13.3			
SS	6	90	22	9.5			
SS	7	100	>50	10.2			

Standard Penetration N-Value



Shear Strength kPa 100 200

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH131

Project #: 308567.002 ***Logged By:*** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

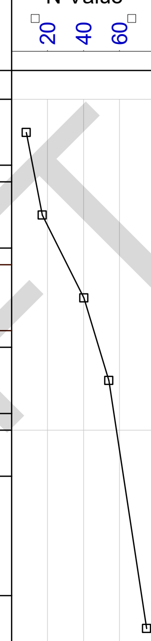
Drill Date: January 26, 2023 ***Project Manager:*** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 230mm	0.00	No Monitoring Well Installed	SS	1	65	8	14.1			
0.76	**Silty Clay** Brown silty clay with sand, trace gravel, trace orange oxidation, firm, DTPL	0.76		SS	2	50	17	15.6			
1.52	with some grey mottling, very stiff	1.52		SS	3	100	40	11.9			
2.29	with black staining, hard; trace rock	2.29		SS	4	85	54	10.2			
				SS	5	100	>50	10.8			
4.57	Grey, APL	4.57		SS	6	75	75	13.7			
5.18	End of Borehole	5.18									

Borehole terminated at approximately 5.2 mbgs. At drilling completion, a wet cave was measured at 4.3 mbgs, and water was measured at 2.2 mbgs.

Standard Penetration N-Value



Shear Strength kPa 100 200

DRAFT

Contractor: Geo-Environmental Drilling Inc. ***Grade Elevation:*** 0

Drilling Method: Split Spoon / Hollow Stem Auger ***Top of Casing Elevation:*** 0

Well Casing Size: N/A ***Sheet:*** 1 of 1

Log of Borehole: BH132

Project #: 308567.002 **Logged By:** SL

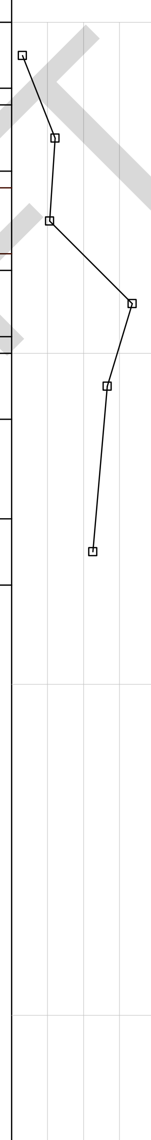
Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 23, 2023 **Project Manager:** JD

SUBSURFACE PROFILE				SAMPLE										
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	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
		Ground Surface												
0		**Topsoil** Dark brown silt, trace sand, with organics - 200mm	0.00	No Monitoring Well Installed	SS	1	60	6			18.5			
1		**Silty Clay** Brown with some grey mottling silty clay, some sand, firm, DTPL	0.76		SS	2	80	24			14.9			
2		with black staining, trace gravel, trace orange oxidation, very stiff			SS	3	100	21			16.5			
		No recovery	2.29		SS	4	0	67			N/A			
3		hard	3.05		SS	5	100	53			11.0			
4														
5		**Silty Sand** Grey silty sand, trace gravel, dense. wet	4.57		SS	6	80	45			15.1			
		Sand Grey sand, trace silt, some gravel, dense, wet												
6		End of Borehole												



Borehole terminated at approximately 5.2 mbgs. At drilling completion, a wet cave was measured at 4.3 mbgs, and water was measured at 4.4 mbgs.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH133

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 23, 2023 **Project Manager:** JD

SUBSURFACE PROFILE / **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
	Topsoil Dark brown silt, trace sand, with organics - 200mm	0.00	No Monitoring Well Installed	SS	1	60	5	17.0			
1	**Silty Clay** Brown with some grey mottling silty clay, firm, DTPL	0.76		SS	2	65	20	15.7			
2	trace gravel, trace orange oxidation, very stiff			SS	3	75	24	15.3			
	with black staining	2.29		SS	4	90	27	15.5			
3	trace rock, hard	3.05		SS	5	80	50	11.4			
5	**Sandy Silt** Grey sandy silt, trace clay, trace rock, very dense, moist	4.57		SS	6	90	76	9.1			
	End of Borehole	5.18									

Borehole terminated at approximately 5.2 mbgs. At drilling completion, the borehole was open and dry.

Standard Penetration N-Value (20, 40, 60); Shear Strength kPa (100, 200)

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH134

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 19, 2023 **Project Manager:** JD

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)	Monitoring Well Details
	Ground Surface		
0	**Topsoil** Dark brown silt, trace sand, with organics - 150mm	0.00	No Monitoring Well Installed
		0.76	
1	**Silty Clay** Dark brown silty clay with sand, trace gravel, firm, WTPL		
		1.52	
2	with some grey mottling and black staining, trace orange oxidation, hard		
		2.29	
	trace rock, very stiff, APL		
3	Brown, trace black and pink crystal, hard	3.05	
	Grey, very stiff, DTPL	3.51	
	End of Borehole		
4			
5	Borehole terminated at approximately 3.5 mbgs. At drilling completion, the borehole was open and dry.		
6			
7			
8			
9			
10			

SAMPLE

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	8			38.7			
SS	2	60	>50			21.9			
SS	3	100	26			11.2			
SS	4	40	50			12.4			
SS	5	100	29			8.0			

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH135

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

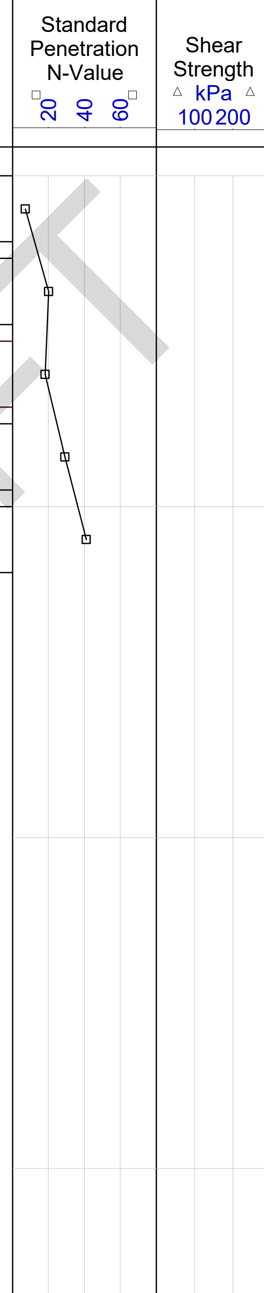
Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 19, 2023 **Project Manager:** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
	Topsoil Dark brown silt, trace sand, with organics - 150mm	0.00	No Monitoring Well Installed	SS	1	85	7	32.8			
1	**Silty Clay** Dark brown silty clay with sand, trace orange oxidation, firm, APL	0.76		SS	2	100	20	13.2			
2	with some grey mottling and black staining, trace gravel, very stiff	1.52		SS	3	100	18	13.7			
	with black staining, DTPL			SS	4	100	29	13.6			
3	Grey, hard	3.05		SS	5	100	41	12.4			
4	End of Borehole	3.66									
5	Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.										



Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH136

Project #: 308567.002 ***Logged By:*** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

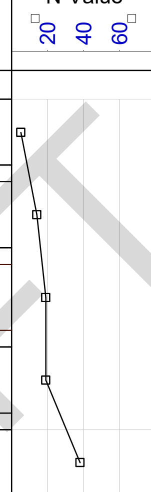
Drill Date: January 19, 2023 ***Project Manager:*** JD

SUBSURFACE PROFILE / **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface	0.00	No Monitoring Well Installed								
	Topsoil Dark brown silt, trace sand, with organics - 150mm			SS	1	65	5	22.3			
	Silty Clay Brown silty clay with sand, firm, DTPL	0.76		SS	2	100	14	12.6			
	with some grey mottling, trace gravel, trace black crystal, stiff	1.52		SS	3	85	19	22.9			
	layer of sand, very stiff, APL	2.29		SS	4	100	19	17.5			
	trace orange oxidation										
	Grey, trace rock, hard, DTPL	3.05		SS	5	85	38	12.7			
	End of Borehole	3.66									

Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.

Standard Penetration N-Value



Shear Strength kPa 100 200

DRAFT

Contractor: Geo-Environmental Drilling Inc. ***Grade Elevation:*** 0

Drilling Method: Split Spoon / Hollow Stem Auger ***Top of Casing Elevation:*** 0

Well Casing Size: N/A ***Sheet:*** 1 of 1

Log of Borehole: BH137

Project #: 308567.002 **Logged By:** SL

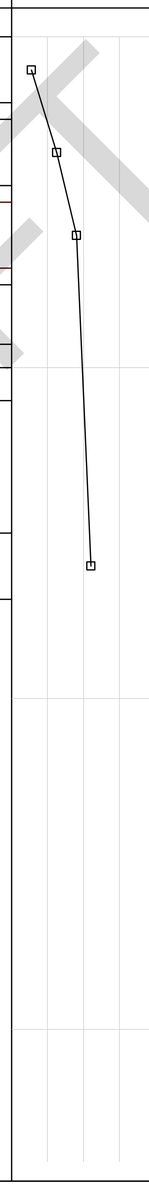
Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 23, 2023 **Project Manager:** JD

SUBSURFACE PROFILE				SAMPLE									
Depth (m)	Description	Elevation (m)	Monitoring Well Details	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
0	Ground Surface												
0.00–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 200mm	0.00	No Monitoring Well Installed	SS	1	60	11			16.6			
0.76–2.29	**Silty Clay** Brown silty clay with sand, stiff, APL	0.76		SS	2	65	25			12.7			
	with some grey mottling and black staining, trace gravel, trace orange oxidation, very stiff to hard, DTPL			SS	3	80	36			11.8			
2.29–3.05	No recovery	2.29		SS	4	0	>50			N/A			
3.05–4.57	**Sand** Grey sand, trace silt, very dense, moist	3.05		SS	5	100	>50			6.0			
4.57–5.18	**Sandy Silt** Grey sandy silt, layer of sand, dense, wet	4.57		SS	6	65	44			10.0			
5.18	End of Borehole	5.18											



Borehole terminated at approximately 5.2 mbgs. At drilling completion, a wet cave was measured at 4.1 mbgs, and water was measured at 3.6 mbgs.

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH138

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 25, 2023 **Project Manager:** JD

SUBSURFACE PROFILE					SAMPLE									
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	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
		Ground Surface												
0		**Topsoil** Dark brown silt, trace sand, with organics - 230mm	0.00	No Monitoring Well Installed	SS	1	50	5			19.9			
1		**Silty Clay** Brown silty clay with sand, trace gravel, trace orange oxidation, firm, APL	0.76		SS	2	75	22			15.3			
2		with some grey mottling and black staining, very stiff	1.52		SS	3	85	27			12.5			
		DTPL	2.29		SS	4	65	42			10.6			
3		trace rock, hard			SS	5	8	58			13.5			
4		End of Borehole	3.66											

Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH139

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 25, 2023 **Project Manager:** JD

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 230mm	0.00	No Monitoring Well Installed	SS	1	85	5	17.5			
0.76	**Silty Clay** Brown silty clay with sand, with black staining, trace orange oxidation, firm, APL	0.76		SS	2	70	33	15.1			
1.52	with some grey mottling, trace gravel, hard, DTPL; trace rock, very stiff	1.52		SS	3	30	27	16.6			
				SS	4	80	41	10.2			
3.05	No recovery	3.05		SS	5	0	66	N/A			
3.57	End of Borehole	3.57									

Borehole terminated at approximately 3.6 mbgs. At drilling completion, the borehole was open and dry.

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH140

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

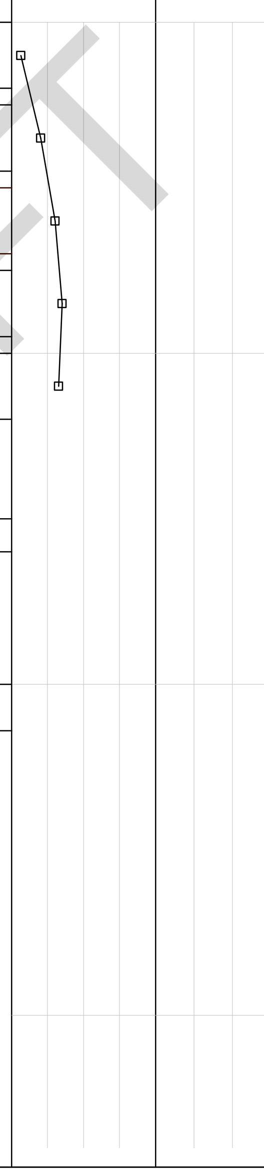
Drill Date: January 26, 2023 **Project Manager:** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
	Ground Surface										
0	**Topsoil** Dark brown silt, trace sand, with organics - 200mm	0.00	No Monitoring Well Installed	SS	1	50	5	21.3			
	Silty Clay Brown silty clay with sand, firm, DTPL	0.76		SS	2	50	16	15.3			
	with some grey mottling, trace gravel, very stiff	1.52		SS	3	80	24	15.3			
	with black staining, trace rock; trace orange oxidation	2.29		SS	4	100	28	19.7			
				SS	5	40	26	14.4			
	Grey, trace gravel, hard	4.57		SS	6	100	>50	8.6			
				SS	7	100	>50	12.2			
	End of Borehole	6.52									

Borehole terminated at approximately 6.5 mbgs. At drilling completion, a dry cave was measured at 5.2 mbgs.

Standard Penetration N-Value (20, 40, 60); Shear Strength kPa (100, 200)



Depth scale (m): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH141

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 26, 2023
Project Manager: JD

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
	Ground Surface										
0	**Topsoil** Dark brown silt, trace sand, with organics - 255mm	0.00	No Monitoring Well Installed	SS	1	55	8	16.0			
1	**Silty Clay** Brown with some grey mottling silty clay with sand, trace gravel, firm, DTPL	0.76		SS	2	75	19	13.5			
2	with black staining, very stiff	1.52		SS	3	75	35	7.9			
	trace rock, layer of black sand, hard	2.29		SS	4	100	42	10.7			
3	trace orange oxidation										
	Grey, trace gravel	3.05		SS	5	75	>50	8.1			
4											
				SS	6	100	>50	14.4			
5	End of Borehole	4.88									
6	Borehole terminated at approximately 4.9 mbgs. At drilling completion, a dry cave was measured at 4.0 mbgs.										
7											
8											
9											
10											

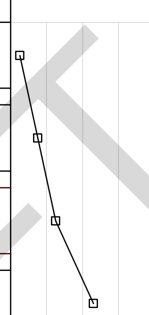
Standard Penetration N-Value: 20 40 60
Shear Strength kPa: 100 200

Contractor: Geo-Environmental Drilling Inc.
Grade Elevation: 0
Drilling Method: Split Spoon / Hollow Stem Auger
Top of Casing Elevation: 0
Well Casing Size: N/A
Sheet: 1 of 1

Log of Borehole: BH142

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 23, 2023 **Project Manager:** JD

SUBSURFACE PROFILE					SAMPLE										
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	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
0		Ground Surface												
0		**Topsoil** Dark brown silt, trace sand, with organics - 200mm	0.00	No Monitoring Well Installed	SS	1	50	5			21.7			
0.76		**Silty Clay** Brown silty clay, some sand, trace gravel, firm, APL	0.76		SS	2	100	15			23.5			
		with some grey mottling, very stiff			SS	3	100	25			17.0			
2.29		Brown with black staining, trace orange oxidation, trace black crystal, hard, DTPL	2.29		SS	4	100	46			12.8			
					SS	5	100	>50			11.4			
4.57		**Sand** Grey sand, trace silt, trace rock, very dense, moist	4.57		SS	6	100	>50			9.1			
		End of Borehole												



Borehole terminated at approximately 4.9 mbgs. At drilling completion, a dry cave was measured at 4.3 mbgs.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0
Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0
Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH143

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 25, 2023 **Project Manager:** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface	0.00	No Monitoring Well Installed								
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 200mm			SS	1	50	7	13.9			
0.76	**Silty Clay** Brown silty clay, trace gravel, firm, APL	0.76		SS	2	100	24	15.1			
1.52	with some grey mottling, trace rock, trace orange oxidation, very stiff	1.52		SS	3	75	19	14.0			
	with black staining, DTPL			SS	4	100	28	12.1			
3.05	hard	3.05		SS	5	70	>50	11.4			
4.57	Grey	4.57		SS	6	100	>50	9.5			
5.00	End of Borehole	5.00									

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Borehole terminated at approximately 5.0 mbgs. At drilling completion, a wet cave was measured at 4.0 mbgs, and water was measured at 4.0 mbgs.

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH144

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 25, 2023 ***Project Manager:*** JD

SUBSURFACE PROFILE / **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 230mm	0.00	No Monitoring Well Installed	SS	1	50	7	16.3			
0.76	**Silty Clay** Brown sandy silty clay, trace orange oxidation, firm, APL	0.76		SS	2	100	18	14.9			
1.52	with some grey mottling, trace gravel, very firm	1.52		SS	3	75	19	15.4			
2.29	trace rock, DTPL; with black staining	2.29		SS	4	100	28	13.3			
3.05	hard	3.05		SS	5	70	47	11.9			
4.57	**Sandy Silt** Grey sandy silt, layer of sand, very dense, moist	4.57		SS	6	100	>50	7.6			
	End of Borehole										

Standard Penetration N-Value (20, 40, 60); Shear Strength kPa (100, 200)

Borehole terminated at approximately 5.0 mbgs. At drilling completion, a dry cave was measured at 4.0 mbgs.

Contractor: Geo-Environmental Drilling Inc. ***Grade Elevation:*** 0

Drilling Method: Split Spoon / Hollow Stem Auger ***Top of Casing Elevation:*** 0

Well Casing Size: N/A ***Sheet:*** 1 of 1

Log of Borehole: BH145

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 25, 2023 **Project Manager:** JD

SUBSURFACE PROFILE				SAMPLE									
Depth (m)	Description	Elevation (m)	Monitoring Well Details	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
0	Ground Surface		No Monitoring Well Installed										
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 255mm	0.00		SS	1	50	5			13.0			
0.76–3.05	**Silty Clay** Brown silty clay with sand, trace gravel, trace orange oxidation, firm, APL	0.76		SS	2	85	20			13.6			
	with some grey mottling and black staining, very stiff	1.52		SS	3	80	29			9.8			
	trace rock, DTPL	2.29		SS	4	100	21			12.7			
	Brown to grey												
3.05–4.57	**Silty Sand** Grey silty sand, trace gravel, trace rock, layer of sand, compact, moist	3.05		SS	5	55	17			10.9			
4.57–5.18	**Silt** Grey silt, trace clay, dense, moist	4.57		SS	6	85	37			15.0			
5.18	End of Borehole	5.18											

Borehole terminated at approximately 5.2 mbgs. At drilling completion, a dry cave was measured at 4.0 mbgs.

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH146

Project #: 308567.002 **Logged By:** SL

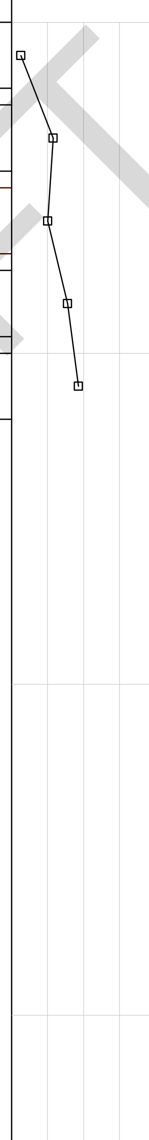
Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 26, 2023 **Project Manager:** JD

SUBSURFACE PROFILE					SAMPLE									
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	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
0		Ground Surface	0.00	No Monitoring Well Installed										
		Topsoil Dark brown silt, trace sand, with organics - 200mm			SS	1	65	5			16.9			
1		**Silty Clay** Brown with some grey mottling silty clay, trace gravel, firm, APL	0.76		SS	2	90	23			15.6			
2		with black staining, trace gravel, very stiff	1.52		SS	3	75	20			13.7			
		trace rock, DTPL	2.29		SS	4	90	31			11.3			
3		Brown, trace orange oxidation, hard			SS	5	100	37			9.7			
4		End of Borehole	3.66											
		Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.												



Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH147

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 23, 2023 **Project Manager:** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
0.00–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 150mm	0.00	No Monitoring Well Installed	SS	1	65	4	23.1			
0.76–2.29	**Silty Clay** Brown with some grey mottling silty clay with sand, trace orange oxidation, firm, APL; with black staining, trace gravel; trace rock, hard, DTPL	0.76		SS	2	90	8	23.1			
		1.52		SS	3	75	58	11.3			
2.29–3.05	**Sandy Silt** Grey sandy silt, trace rock, very dense, moist	2.29		SS	4	90	85	8.3			
3.05–3.66	**Sand and Gravel** Grey sand and gravel, dense, wet	3.05		SS	5	100	50	9.8			
3.66	End of Borehole	3.66									

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and water was measured at 1.3 mbgs.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH148

Project #: 308567.002 **Logged By:** SL

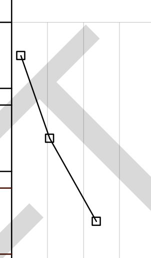
Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: January 25, 2023 **Project Manager:** JD

SUBSURFACE PROFILE				SAMPLE									
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	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
0		Ground Surface	0.00	No Monitoring Well Installed										
		Topsoil Dark brown silt, trace sand, with organics - 200mm			SS	1	60	5			16.9			
1		**Silty Clay** Brown silty clay with sand, trace gravel, firm, APL	0.76		SS	2	90	21			14.5			
2		with some grey mottling, very stiff	1.52		SS	3	100	47			10.7			
		Brown with black staining, trace orange oxidation, hard, DTPL	2.29		SS	4	30	>50			8.1			
3		trace rock												
		Sandy Silt Brown sandy silt, trace gravel, trace rock, layer of black sand, very dense, moist	3.05		SS	5	100	>50			13.8			
4		End of Borehole												



Borehole terminated at approximately 3.4 mbgs. At drilling completion, the borehole was open and dry.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH149

Project #: 308567.002 **Logged By:** SL

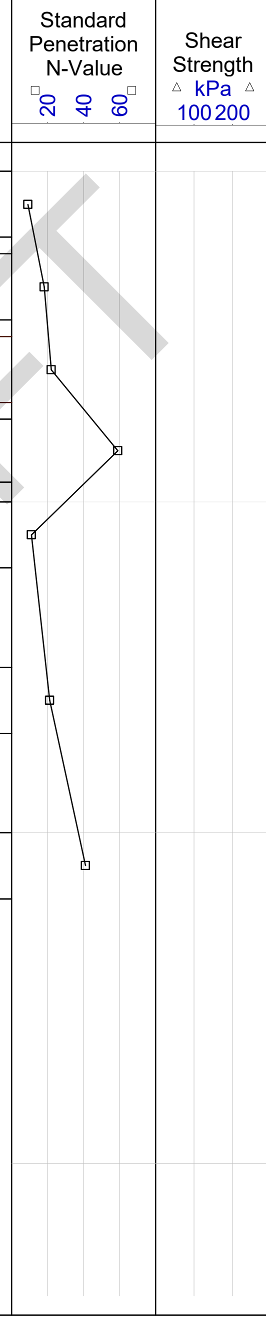
Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: February 9, 2023 **Project Manager:** JD

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 230mm	0.00	No Monitoring Well Installed	SS	1	100	9	15.4			
0.76	**Silty Clay** Brown silty clay with sand, trace gravel, firm, APL	0.76		SS	2	85	18	15.3			
1.52	with some grey mottling, trace orange oxidation, very stiff	1.52		SS	3	85	22	13.7			
2.29	DTPL; trace orange oxidation, hard	2.29		SS	4	70	59	15.0			
3.05	grey, stiff, APL	3.05		SS	5	65	11	15.0			
4.57	very stiff to hard	4.57		SS	6	70	21	15.0			
				SS	7	75	41	13.6			
6.71	End of Borehole. Borehole terminated at approximately 6.7 mbgs.	6.71									



Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH150

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 9, 2023 **Project Manager:** JD

SUBSURFACE PROFILE					SAMPLE									
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	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
0		Ground Surface	0.00	No Monitoring Well Installed										
		Topsoil Dark brown silt, trace sand, with organics - 175mm			SS	1	60	4			19.5			
0.76		**Silty Clay** Brown silty clay, trace orange oxidation, soft, WTPL	0.76		SS	2	40	19			15.5			
1.52		some grey mottling, trace gravel, very stiff, APL	1.52		SS	3	85	18			15.6			
2.29		trace orange oxidation hard, DTPL	2.29		SS	4	100	21			15.2			
					SS	5	100	36			11.3			
4.57		Grey	4.57		SS	6	85	90			12.3			
5.15		End of Borehole	5.15											
		Borehole terminated at approximately 5.2 mbgs.												

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH151

Project #: 308567.002 **Logged By:** SL

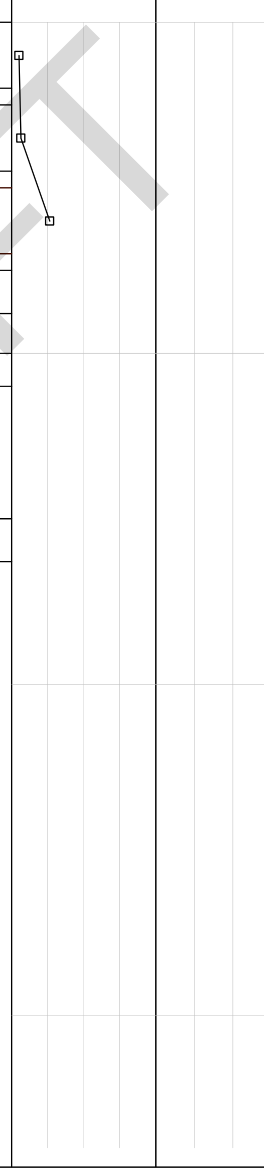
Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: February 9, 2023 **Project Manager:** JD

SUBSURFACE PROFILE				SAMPLE									
Depth (m)	Description	Elevation (m)	Monitoring Well Details	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
0	Ground Surface												
0	**Topsoil** Dark brown silt, trace sand, with organics - 200mm	0.00	No Monitoring Well Installed	SS	1	40	4			29.7			
0.76	**Silty Clay** Brown silty clay with sand, trace orange oxidation, soft, WTPL	0.76		SS	2	60	5			28.2			
1.52	with black staining, trace gravel, firm	1.52		SS	3	70	21			17.5			
	layer of sand, very stiff to hard, APL			SS	4	80	>50			16.2			
3.05	No recovery	3.05		SS	5	0	>50			N/A			
4.57	Grey, DTPL	4.57		SS	6	100	>50			12.4			
4.97	End of Borehole Borehole terminated at approximately 5.0 mbgs.	4.97											



DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH152

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 9, 2023 **Project Manager:** JD

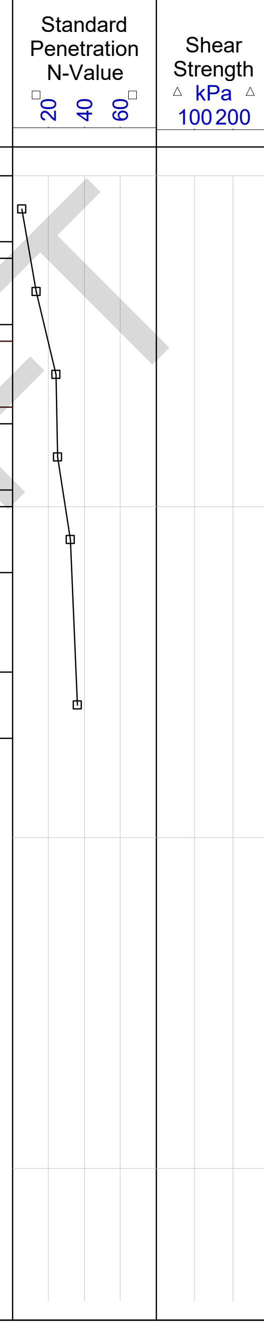
SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	0.00
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 200mm	
0.76	**Silty Clay** Brown silty clay, some sand, trace gravel, firm, WTPL	0.76
	with some grey mottling and black staining, stiff, APL	
3.05	trace orange oxidation, very stiff	3.05
4.57	Grey, hard, DTPL	4.57
5.18	End of Borehole	5.18
	Borehole terminated at approximately 5.2 mbgs.	

Monitoring Well Details: No Monitoring Well Installed

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	85	5	29.6			
SS	2	100	13	18.9			
SS	3	100	24	16.0			
SS	4	100	25	15.9			
SS	5	100	32	14.9			
SS	6	95	36	11.0			



DRAFT

Contractor: Geo-Environmental Drilling Inc.

Grade Elevation: 0

Drilling Method: Split Spoon / Hollow Stem Auger

Top of Casing Elevation: 0

Well Casing Size: N/A

Sheet: 1 of 1

Log of Borehole: BH153

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

Ground Surface

Depth (m)	Description	Elevation (m)
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 240mm	0.00
0.76	**Silty Clay** Brown with some grey mottling silty clay, firm, APL; with black staining, trace gravel and rock, trace orange oxidation, hard	0.76
4.57	**Sandy Silt** Grey sandy silt, trace gravel, trace clay, very dense, moist	4.57

End of Borehole

Monitoring Well Details: No Monitoring Well Installed

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	60	5	21.1			
SS	2	50	35	15.0			
SS	3	85	24	15.0			
SS	4	100	46	15.9			
SS	5	100	>50	10.3			
SS	6	100	>50	12.9			

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Borehole terminated at approximately 4.9 mbgs. At drilling completion, a wet cave was measured at 4.3 mbgs, and water was measured at 2.9 mbgs.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH154

Project #: 308567.002 ***Logged By:*** SL

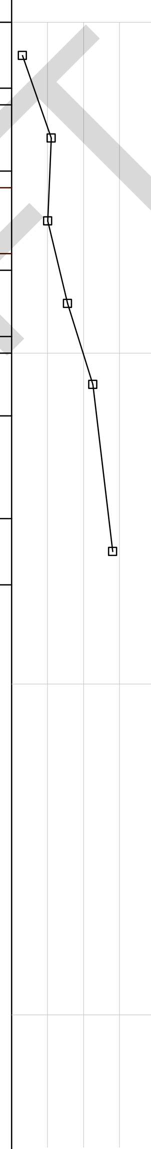
Project: Geotechnical Investigation for Proposed Industrial Development

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)	Monitoring Well Details	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	
	Ground Surface													
0	**Topsoil** Dark brown silt, trace sand, with organics - 230mm	0.00	No Monitoring Well Installed	SS	1	50	6			20.9				
0.76	**Silty Clay** Brown sandy silty clay, firm, APL	0.76		SS	2	100	22			13.8				
1.52	with some grey mottling, trace gravel, trace orange oxidation, very stiff	1.52		SS	3	100	20			16.6				
2.29	with black staining, DTPL; trace rock, hard	2.29		SS	4	100	31			11.9				
				SS	5	100	45			11.4				
4.57	**Sand and Gravel** Brown sand and gravel, very dense, wet	4.57		SS	6	85	56			7.3				
5.18	End of Borehole	5.18												



Borehole terminated at approximately 5.2 mbgs. At drilling completion, a wet cave was measured at 4.3 mbgs, and water was measured at 2.8 mbgs.

Contractor: Geo-Environmental Drilling Inc. ***Grade Elevation:*** 0

Drilling Method: Split Spoon / Hollow Stem Auger ***Top of Casing Elevation:*** 0

Well Casing Size: N/A ***Sheet:*** 1 of 1

Log of Borehole: BH155

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

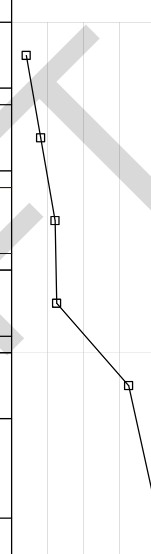
Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: February 8, 2023 **Project Manager:** JD

SUBSURFACE PROFILE / **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 280mm	0.00	No Monitoring Well Installed	SS	1	50	8	18.3			
0.76	**Silty Clay** Brown silty clay, firm, APL	0.76		SS	2	100	16	14.8			
1.52	with some grey mottling, trace gravel, trace orange oxidation, very stiff	1.52		SS	3	100	24	13.3			
2.29	with black staining; very stiff to hard	2.29		SS	4	100	25	11.7			
				SS	5	100	65	8.0			
4.57	Grey, DTPL	4.57		SS	6	65	85	8.3			
5.15	End of Borehole	5.15									

Standard Penetration N-Value (20, 40, 60) / Shear Strength kPa (100, 200)



End of Borehole

Borehole terminated at approximately 5.2 mbgs. At drilling completion, a wet cave was measured at 4.0 mbgs, and water was measured at 3.7 mbgs.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH156

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 10, 2023 **Project Manager:** JD

SUBSURFACE PROFILE				SAMPLE									
Depth (m)	Description	Elevation (m)	Monitoring Well Details	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
0	Ground Surface	0.00	No Monitoring Well Installed										
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 240mm			SS	1	55	3			21.1			
0.76–1.52	**Silty Clay** Brown with some grey mottling silty clay with sand, soft, WTPL	0.76		SS	2	50	29			12.7			
1.52–2.29	with black staining, trace gravel, trace orange oxidation, very stiff, APL	1.52		SS	3	85	20			16.7			
2.29–3.05	DTPL	2.29		SS	4	100	30			14.0			
3.05–3.66	trace rock, hard / Mottled grey/brown	3.05		SS	5	100	36			14.2			
3.66	End of Borehole	3.66											

Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH157

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 10, 2023 **Project Manager:** JD

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface	0.00	No Monitoring Well Installed								
	Topsoil Dark brown silt, trace sand, with organics - 240mm			SS	1	70	9	15.2			
0.76	**Silty Clay** Brown silty clay, trace gravel, stiff, APL	0.76		SS	2	85	18	15.3			
	with some grey mottling and black staining, trace orange oxidation, very stiff to hard, DTPL			SS	3	100	20	14.7			
				SS	4	100	31	13.9			
				SS	5	100	63	14.7			
3.60	End of Borehole	3.60									

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

End of Borehole

Borehole terminated at approximately 3.6 mbgs. At drilling completion, the borehole was open and dry.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH158

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

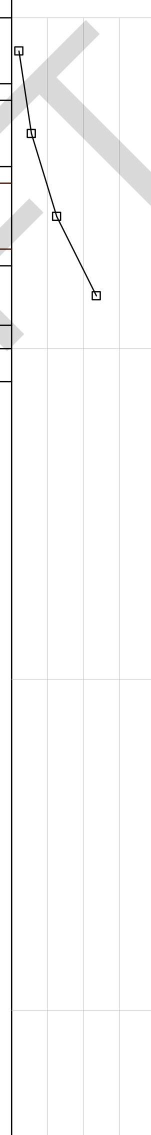
Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: February 10, 2023 **Project Manager:** JD

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface	0.00	No Monitoring Well Installed								
	Topsoil Dark brown silt, trace sand, with organics - 240mm			SS	1	60	4	18.9			
0.76	**Silty Clay** Brown silty clay, some sand trace gravel, soft, APL	0.76		SS	2	85	11	14.7			
1.52	with some grey mottling and black staining, trace orange oxidation, stiff	1.52		SS	3	100	25	12.9			
	very stiff to hard, DTPL			SS	4	100	47	9.8			
3.05	No recovery	3.05		SS	5	0	>50	N/A			
	End of Borehole										

Standard Penetration N-Value (20, 40, 60)

Shear Strength kPa (100, 200)



Borehole terminated at approximately 3.4 mbgs. At drilling completion, the borehole was open and dry.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH159

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 10, 2023 **Project Manager:** JD

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
	Ground Surface										
0	**Topsoil** Dark brown silt, trace sand, with organics - 200mm	0.00	No Monitoring Well Installed	SS	1	85	5	19.1			
	Silty Clay Brown with some grey mottling silty clay with sand, firm, APL	0.76		SS	2	100	17	17.2			
	with black staining, trace orange oxidation, trace gravel, very stiff			SS	3	100	28	13.0			
	trace rock, hard, DTPL	2.29		SS	4	100	57	9.3			
				SS	5	100	>50	10.0			
	End of Borehole	3.35									
	Borehole terminated at approximately 3.4 mbgs. At drilling completion, the borehole was open and dry.										

Standard Penetration N-Value: 20, 40, 60

Shear Strength kPa: 100, 200

Depth scale (m): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **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		
Depth (m)	Description	Elevation (m)
0	Ground Surface	0.00
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 255mm	0.00
0.76	**Silty Clay** Brown silty clay, some sand, soft, APL	0.76
1.52	trace gravel, very stiff	1.52
2.29	with some grey mottling and black staining, trace orange oxidation; layer of sand	2.29
3.05	hard	3.05
4.57	**Sandy Silt** Grey sandy silt, trace gravel, very dense, moist	4.57
6.10	**Silt** Grey silt, trace sand, very dense, moist	6.10
	End of Borehole	
	Borehole terminated at approximately 6.4 mbgs.	

Monitoring Well Details: Riser; Bentonite; Silica Sand; Screen

SAMPLE										
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	4			20.2			
SS	2	65	19			12.4			
SS	3	80	28			13.3			
SS	4	100	28			12.0			
SS	5	100	40			9.8			
SS	6	75	>50			6.7			
SS	7	100	>50			12.2			

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

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

Depth (m)	Description	Elevation (m)	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)
0	Ground Surface	0.00					
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 255mm		SS	1	60	6	15.4
0.76	**Silty Clay** Brown silty clay, firm, APL	0.76	SS	2	80	17	15.1
1.52	with some grey mottling, trace gravel, very stiff	1.52	SS	3	75	28	12.3
2.29	with black staining, trace orange oxidation; Brown, hard, DTPL	2.29	SS	4	40	31	11.4
			SS	5	65	49	9.3
3.51	trace rock	3.51					
4.57	Grey, very stiff	4.57	SS	6	70	20	8.4
6.10	hard	6.10	SS	7	100	31	17.8
6.71	End of Borehole	6.71					

Borehole terminated at approximately 6.7 mbgs.

Monitoring Well Details: Riser, Bentonite, Silica Sand, Screen

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: 51 mm **Sheet:** 1 of 1

Log of Borehole: BH162

Project #: 308567.002 ***Logged By:*** SL

Project: Geotechnical Investigation for Proposed Industrial Development

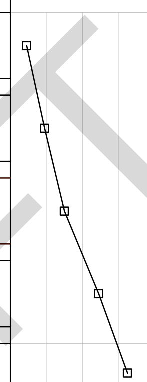
Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: February 8, 2023 ***Project Manager:*** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	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
0		Ground Surface												
		Topsoil Dark brown silt, trace sand, with organics - 230mm	0.00	No Monitoring Well Installed	SS	1	75	9			20.6			
1		**Silty Clay** Brown with some grey mottling silty clay, trace gravel, firm, APL	0.76		SS	2	100	19			14.2			
2		with black staining, trace orange oxidation, very stiff	1.52		SS	3	100	30			11.0			
		trace rock	2.29		SS	4	100	49			10.3			
3		hard, DTPL												
		trace rock	3.05		SS	5	75	65			7.8			
4		End of Borehole Borehole terminated at approximately 3.6 mbgs. At drilling completion, the borehole was open and dry.	3.60											
5														
6														
7														
8														
9														
10														



Contractor: Geo-Environmental Drilling Inc. ***Grade Elevation:*** 0

Drilling Method: Split Spoon / Hollow Stem Auger ***Top of Casing Elevation:*** 0

Well Casing Size: N/A ***Sheet:*** 1 of 1

Log of Borehole: BH163

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

Depth (m)	Description	Elevation (m)
	Ground Surface	
0	**Topsoil** Dark brown silt, trace sand, with organics - 200mm	0.00
0.76	**Silty Clay** Brown silty clay with sand, firm, APL	0.76
1.52	with some grey mottling and black staining, trace gravel, very stiff	1.52
2.29	layer of sand; trace orange oxidation, trace rock, hard, DTPL	2.29
3.05	No recovery	3.05
	End of Borehole	

Monitoring Well Details: No Monitoring Well Installed

Borehole terminated at approximately 3.4 mbgs. At drilling completion, the borehole was open and dry.

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	65	5	17.3			
SS	2	75	12	19.3			
SS	3	100	16	17.3			
SS	4	100	>50	11.6			
SS	5	0	>50	N/A			

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH164

Project #: 308567.002 **Logged By:** SL

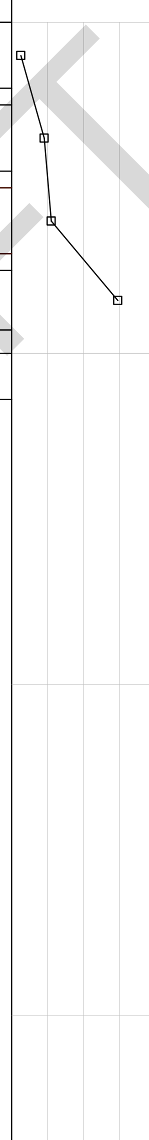
Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: February 7, 2023 **Project Manager:** JD

SUBSURFACE PROFILE					SAMPLE										
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	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
0		Ground Surface	0.00	No Monitoring Well Installed										
		Topsoil Dark brown silt, trace sand, with organics - 200mm			SS	1	65	5			14.0			
1		**Silty Clay** Brown silty clay with sand, trace gravel, firm, APL	0.76		SS	2	100	18			10.4			
2		with some grey mottling, trace sand, trace orange oxidation, very stiff	1.52		SS	3	100	22			15.9			
		trace black fragment	2.29		SS	4	80	59			8.7			
3		trace rock, hard, DTPL												
		Sand Brown sand, very dense, moist	3.25		SS	5	100	>50			8.9			
4		End of Borehole												



Borehole terminated at approximately 3.5 mbgs. At drilling completion, the borehole was open and dry.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH165

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 7, 2023 **Project Manager:** JD

SUBSURFACE PROFILE				SAMPLE										
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	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
0		Ground Surface	0.00	No Monitoring Well Installed										
		Topsoil Dark brown silt, trace sand, with organics - 230mm			SS	1	65	5			18.0			
1		**Silty Clay** Brown silty clay with sand, trace gravel, trace orange oxidation, firm, APL	0.76		SS	2	50	16			14.8			
2		very stiff	1.52		SS	3	85	17			16.2			
		with some grey mottling and black staining	2.29		SS	4	100	34			13.1			
3		hard, DTPL												
		sandy, very stiff	3.05		SS	5	90	28			10.7			
		Grey	3.54											
4		End of Borehole												

Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH166

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 6, 2023 **Project Manager:** JD

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 240mm	0.00	No Monitoring Well Installed	SS	1	60	8	21.5			
0.76	**Silty Clay** Brown with some grey mottling silty clay with sand, trace gravel, firm, APL	0.76		SS	2	75	17	15.7			
1.52		1.52		SS	3	65	25	14.0			
	layer of sand, very stiff										
2.29	trace orange oxidation; trace rock, hard	2.29		SS	4	90	33	15.1			
3.05	very stiff	3.05		SS	5	100	25	16.7			
3.66	End of Borehole	3.66									

Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH167

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)	Monitoring Well Details	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
0	Ground Surface												
	Topsoil Dark brown silt, trace sand, with organics - 305mm	0.00	No Monitoring Well Installed	SS	1	55	6			21.6			
1	**Silty Clay** Brown with some grey mottling silty clay, trace gravel, firm, APL	0.76		SS	2	0	16			N/A			
2	No recovery; with black staining, trace orange oxidation, very stiff to hard	1.52		SS	3	75	25			15.7			
				SS	4	100	38			14.7			
3	Grey, trace gravel, DTPL	3.05		SS	5	100	35			13.7			
4	End of Borehole	3.66											

Borehole terminated at approximately 3.7 mbgs. At drilling completion, a dry cave was measured at 3.0 mbgs.

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: 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 (%)	Sample ID	Soil Vapour Concentration (ppm) / Laboratory Analysis
0	Ground Surface								
0–1.52	**Topsoil** Dark brown silt, trace sand, with organics - 150mm	0.00	SS	1	50	5	17.2		
	Silty Clay Brown with some grey mottling silty clay with sand, trace gravel, firm, APL		SS	2	50	19	14.8		
1.52–2.29		1.52	SS	3	65	24	12.3		
2.29–3.05	with black staining, trace orange oxidation, very stiff; Brown	2.29	SS	4	100	26	14.0		
3.05–6.10	Grey	3.05	SS	5	65	27	13.4		
			SS	6	65	24	15.4		
6.10–6.71	No recovery	6.10	SS	7	0	47	N/A		
6.71	End of Borehole. Borehole terminated at approximately 6.7 mbgs.	6.71							

Monitoring Well Details: Riser, Bentonite, Screen, Silica Sand

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: 51 mm **Sheet:** 1 of 1

Log of Borehole: BH169

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)	Monitoring Well Details	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
	Ground Surface												
0	**Topsoil** Dark brown silt, trace sand, with organics - 175mm	0.00	No Monitoring Well Installed	SS	1	65	4			19.6			
0.76	**Silty Clay** Brown silty clay with sand, trace gravel, soft, APL	0.76		SS	2	70	19			15.8			
1.52	with some grey mottling and black staining, stiff	1.52		SS	3	85	23			14.8			
2.29	trace orange oxidation; trace rock, very stiff to hard	2.29		SS	4	90	30			14.5			
				SS	5	100	23			14.5			
4.57	Grey, trace gravel, very stiff, DTPL	4.57		SS	6	90	17			11.9			
5.18	End of Borehole	5.18											

Borehole terminated at approximately 5.2 mbgs. At drilling completion, a dry cave was measured at 4.4 mbgs.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH170

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)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface	0.00	No Monitoring Well Installed								
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 230mm			SS	1	60	7	18.2			
0.76	**Silty Clay** Brown with some grey mottling silty clay, trace gravel, firm, APL	0.76		SS	2	70	18	14.2			
	with black staining, trace black sand, trace orange oxidation, very stiff			SS	3	85	25	15.2			
2.29	hard	2.29		SS	4	90	33	15.5			
3.05	Mottled brown/grey, trace orange oxidation	3.05		SS	5	100	36	16.2			
4.57	Grey, trace rock, very stiff, DTPL	4.57		SS	6	90	24	10.4			
5.18	End of Borehole	5.18									

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Borehole terminated at approximately 5.2 mbgs. At drilling completion, a dry cave was measured at 4.4 mbgs.

DRAFT

Contractor: Geo-Environmental Drilling Inc. ***Grade Elevation:*** 0

Drilling Method: Split Spoon / Hollow Stem Auger ***Top of Casing Elevation:*** 0

Well Casing Size: N/A ***Sheet:*** 1 of 1

Log of Borehole: BH171

Project #: 308567.002 **Logged By:** SL

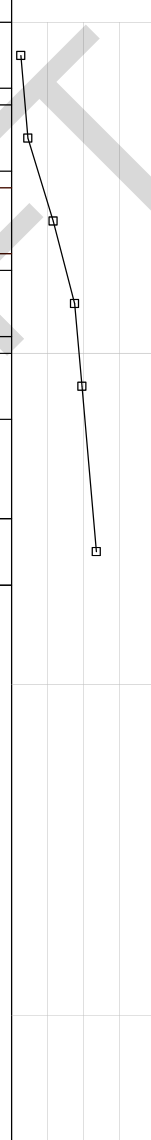
Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: February 6, 2023 **Project Manager:** JD

SUBSURFACE PROFILE					SAMPLE									
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	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
0		Ground Surface												
0		**Topsoil** Dark brown silt, trace sand, with organics - 230mm	0.00	No Monitoring Well Installed	SS	1	60	5			22.9			
1		**Silty Clay** Brown silty clay with sand, trace orange oxidation, firm, APL	0.76		SS	2	60	9			19.5			
2		with some grey mottling black staining, firm to hard			SS	3	75	23			15.7			
					SS	4	100	35			13.7			
3					SS	5	65	39			10.1			
4		trace rock	3.51											
5		Grey, trace gravel, DTPL	4.57		SS	6	40	47			9.7			
		End of Borehole	5.18											
6–10		Borehole terminated at approximately 5.2 mbgs. At drilling completion, the borehole was open and dry.												



Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH172

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 7, 2023 **Project Manager:** JD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface		No Monitoring Well Installed								
0	**Topsoil** Dark brown silt, trace sand, with organics - 230mm	0.00		SS	1	60	5	19.8			
0.76	**Silty Clay** Brown silty clay with sand, trace black staining, trace orange oxidation, firm, APL	0.76		SS	2	85	12	13.5			
	with some grey mottling, trace gravel, trace rock, very stiff to hard			SS	3	100	27	12.2			
				SS	4	100	45	11.9			
3.05	No recovery	3.05		SS	5	0	>50	N/A			
4.57	**Silty Sand** Grey silty sand, trace gravel, trace rock, very dense, moist	4.57		SS	6	100	>50	10.2			
4.97	End of Borehole	4.97									

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Borehole terminated at approximately 5.0 mbgs. At drilling completion, a wet cave was measured at 4.0 mbgs, and water was measured at 3.6 mbgs.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH173

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)	Monitoring Well Details	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
0	Ground Surface		No Monitoring Well Installed										
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 175mm	0.00		SS	1	55	5			17.0			
0.76–3.05	**Silty Clay** Brown with some grey mottling sandy silty clay, trace gravel, firm, APL	0.76		SS	2	65	18			16.6			
	with black staining, trace orange oxidation, very stiff to hard			SS	3	65	25			15.8			
				SS	4	85	33			16.4			
3.05–4.57	Brown, trace rock, hard, DTPL	3.05		SS	5	100	81			15.9			
4.57–5.18	Grey, trace gravel and rock, very stiff	4.57		SS	6	100	17			9.3			
5.18	End of Borehole Borehole terminated at approximately 5.2 mbgs. At drilling completion, a dry cave was measured at 4.4 mbgs.	5.18											

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A

Log of Borehole: BH174

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 6, 2023 **Project Manager:** JD

Depth (m)	Description (SUBSURFACE PROFILE)	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface		No Monitoring Well Installed								
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 255mm	0.00		SS	1	85	5	20.4			
0.76	**Silty Clay** Brown silty clay, trace gravel, trace orange oxidation, firm, APL	0.76		SS	2	75	16	19.3			
	with some grey mottling and black staining, very stiff			SS	3	100	22	15.4			
2.29	Brown, hard	2.29		SS	4	100	31	12.8			
3.05	trace rock	3.05		SS	5	100	31	14.4			
4.57	No recovery	4.57		SS	6	0	27	N/A			
5.18	End of Borehole Borehole terminated at approximately 5.2 mbgs. At drilling completion, a dry cave was measured at 4.4 mbgs.	5.18									

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Depth (m): 0 1 2 3 4 5 6 7 8 9 10

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH175

Project #: 308567.002 **Logged By:** SL

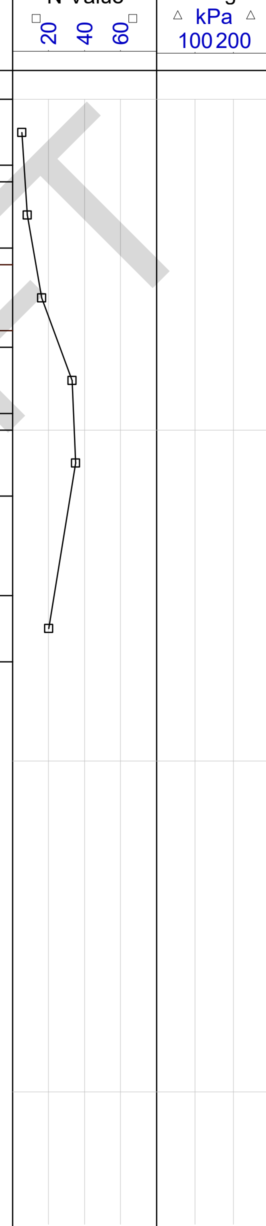
Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: February 7, 2023 **Project Manager:** JD

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface	0.00	No Monitoring Well Installed								
0–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 175m	0.00		SS	1	50	5	22.6			
0.76	**Silty Clay** Brown silty clay with sand, trace gravel, trace orange oxidation, firm, APL	0.76		SS	2	75	8	27.0			
1.52	trace black fragment	1.52		SS	3	90	16	14.5			
2.29	with some grey mottling and black staining, very stiff	2.29		SS	4	100	33	15.8			
3.05	hard; trace rock	3.05		SS	5	100	35	13.6			
4.57	Grey, trace gravel and rock, very stiff, DTPL	4.57		SS	6	35	20	10.8			
5.18	End of Borehole	5.18									



Borehole terminated at approximately 5.2 mbgs. At drilling completion, the borehole was open and dry.

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A

Log of Borehole: BH176

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

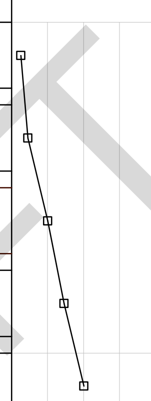
Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

Drill Date: Fevruary 7, 2023 **Project Manager:** JD

SUBSURFACE PROFILE | SAMPLE

Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	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
0		Ground Surface	0.00	No Monitoring Well Installed										
		Topsoil Dark brown silt, trace sand, with organics - 215mm			SS	1	75	5			19.6			
1		**Silt** Brown silty clay with sand, trace gravel, firm, APL	0.76		SS	2	100	9			13.4			
2		with black staining, layer of sand	1.52		SS	3	100	20			15.1			
		very stiff												
		trace orange oxidation, very stiff to hard	2.29		SS	4	100	29			13.1			
3					SS	5	100	40			13.6			
4		End of Borehole	3.66											
		Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.												

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10



Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH177

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 7, 2023 **Project Manager:** JD

SUBSURFACE PROFILE / **SAMPLE**

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface										
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 255mm	0.00	No Monitoring Well Installed	SS	1	75	7	15.0			
0.76	**Silty Clay** Brown silty clay with sand, trace gravel, trace orange oxidation, firm, APL	0.76		SS	2	85	20	13.9			
1.52	with some grey mottling and black staining, very stiff	1.52		SS	3	80	18	14.7			
2.29	Brown trace rock, hard	2.29		SS	4	85	41	12.1			
				SS	5	100	53	11.9			
4.57	Grey, DTPL	4.57		SS	6	75	>50	13.8			
	End of Borehole										

Borehole terminated at approximately 4.9 mbgs. At drilling completion, the borehole was open and dry.

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH178

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

Description	Elevation (m)
Ground Surface	0.00
Topsoil Dark brown silt, trace sand, with organics - 150mm	
Silty Clay Brown with some grey mottling silty clay with sand, trace gravel, firm to stiff, APL	1.52
with black staining, trace orange oxidation, layer of sand, very stiff	2.29
hard	
trace rock	3.05
End of Borehole	3.66

Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.

Monitoring Well Details: No Monitoring Well Installed

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	65	5	15.2			
SS	2	60	22	14.0			
SS	3	85	19	14.2			
SS	4	95	32	15.5			
SS	5	100	37	14.1			

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

Depth (m): 0 1 2 3 4 5 6 7 8 9 10

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH179

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 7, 2023 **Project Manager:** JD

SUBSURFACE PROFILE

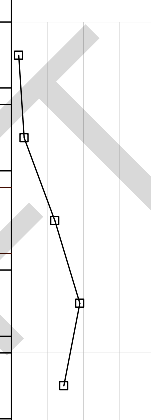
Depth (m)	Description	Elevation (m)	Monitoring Well Details
0	Ground Surface	0.00	No Monitoring Well Installed
0.00–0.76	**Topsoil** Dark brown silt, trace sand, with organics - 240mm	0.00	
0.76	**Silty Clay** Brown silty clay with sand, trace gravel, trace orange oxidation, firm, APL	0.76	
	some sand		
1.52	with black staining, trace rock, very stiff to hard	1.52	
3.05	layer of sand, very stiff	3.05	
3.66	End of Borehole Borehole terminated at approximately 3.7 mbgs.	3.66	

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	75	4	21.5			
SS	2	65	7	21.4			
SS	3	100	24	17.4			
SS	4	100	38	14.2			
SS	5	100	29	14.7			

Standard Penetration N-Value: 20, 40, 60

Shear Strength kPa: 100, 200



Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH180

Project #: 308567.002 **Logged By:** SL

Project: Geotechnical Investigation for Proposed Industrial Development

Client: Prologis

Location: 12519 & 12713 Humber Station Road, Caledon, Ontario

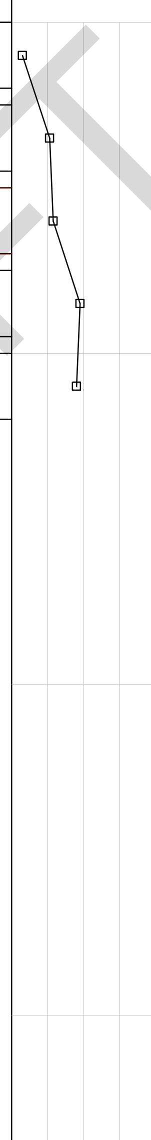
Drill Date: Fevruary 7, 2023 **Project Manager:** JD

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0	Ground Surface	0.00	No Monitoring Well Installed								
	Topsoil Dark brown silt, trace sand, with organics - 240mm			SS	1	65	6	21.3			
1	**Silty Clay** Brown silty clay with sand, trace gravel, firm, APL	0.76		SS	2	100	21	15.4			
2	with some grey mottling, very stiff	1.52		SS	3	85	23	14.7			
	layer of sand										
	trace rock, hard	2.29		SS	4	20	38	12.1			
3				SS	5	100	36	13.5			
4	End of Borehole	3.66									

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200



Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH181

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

Depth (m)	Description	Elevation (m)	Monitoring Well Details
0	Ground Surface		
0.00	**Topsoil** Dark brown silt, trace sand, with organics - 255mm	0.00	No Monitoring Well Installed
0.76	**Silt** Brown silty clay with sand, trace gravel, firm, APL	0.76	
1.52	with some grey mottling, very stiff	1.52	
	trace rock		
2.29	with black staining, trace orange oxidation	2.29	
3.05	hard	3.05	
3.44	End of Borehole	3.44	
	Borehole terminated at approximately 3.4 mbgs. At drilling completion, the borehole was open and dry.		

SAMPLE

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			30.8			
SS	2	50	23			18.8			
SS	3	75	26			12.6			
SS	4	90	21			13.5			
SS	5	100	>50			11.0			

DRAFT

Contractor: Geo-Environmental Drilling Inc. ***Grade Elevation:*** 0

Drilling Method: Split Spoon / Hollow Stem Auger ***Top of Casing Elevation:*** 0

Well Casing Size: N/A ***Sheet:*** 1 of 1

Log of Borehole: BH182

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 6, 2023 **Project Manager:** JD

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	0.00
0 – 0.76	**Topsoil** Dark brown silt, trace sand, with organics - 230mm	0.00
0.76 – 3.66	**Silty Clay** Brown with some grey mottling silty clay with sand, trace gravel, firm, APL; with black staining, trace orange oxidation, very stiff (from 2.29); Brown, very stiff to hard	0.76 / 2.29
3.66	End of Borehole. Borehole terminated at approximately 3.7 mbgs. At drilling completion, the borehole was open and dry.	3.66

Monitoring Well Details: No Monitoring Well Installed

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	65	5	20.2			
SS	2	65	26	15.3			
SS	3	100	15	15.6			
SS	4	100	25	13.8			
SS	5	50	48	16.1			

Standard Penetration N-Value: 20 40 60

Shear Strength kPa: 100 200

DRAFT

Contractor: Geo-Environmental Drilling Inc. **Grade Elevation:** 0

Drilling Method: Split Spoon / Hollow Stem Auger **Top of Casing Elevation:** 0

Well Casing Size: N/A **Sheet:** 1 of 1

APPENDIX III

Laboratory Testing Reports for Soil Samples

Unified Soil Classification System

Sample ID	Depth (ft)	% Gravel	% Sand	% Silt	% Clay
BH4 SS4	3.0-3.5	2.0	16.3	45.7	36.0
BH6 SS1	0.0-0.6	3.0	19.7	49.3	28.0
BH14 SS5	4.5-4.7	1.0	7.2	77.8	14.0
BH18 SS4	3.0-3.5	4.0	27.9	46.1	22.0

PINCHIN

Pinchin Waterloo - 225 Labrador Drive, Unit 1, Waterloo, Ontario N2K 4M8

PARTICLE SIZE DISTRIBUTION ANALYSIS

Proposed Industrial Development - 12519 & 12713 Humber Station Dr, Caledon, ON
Prologis

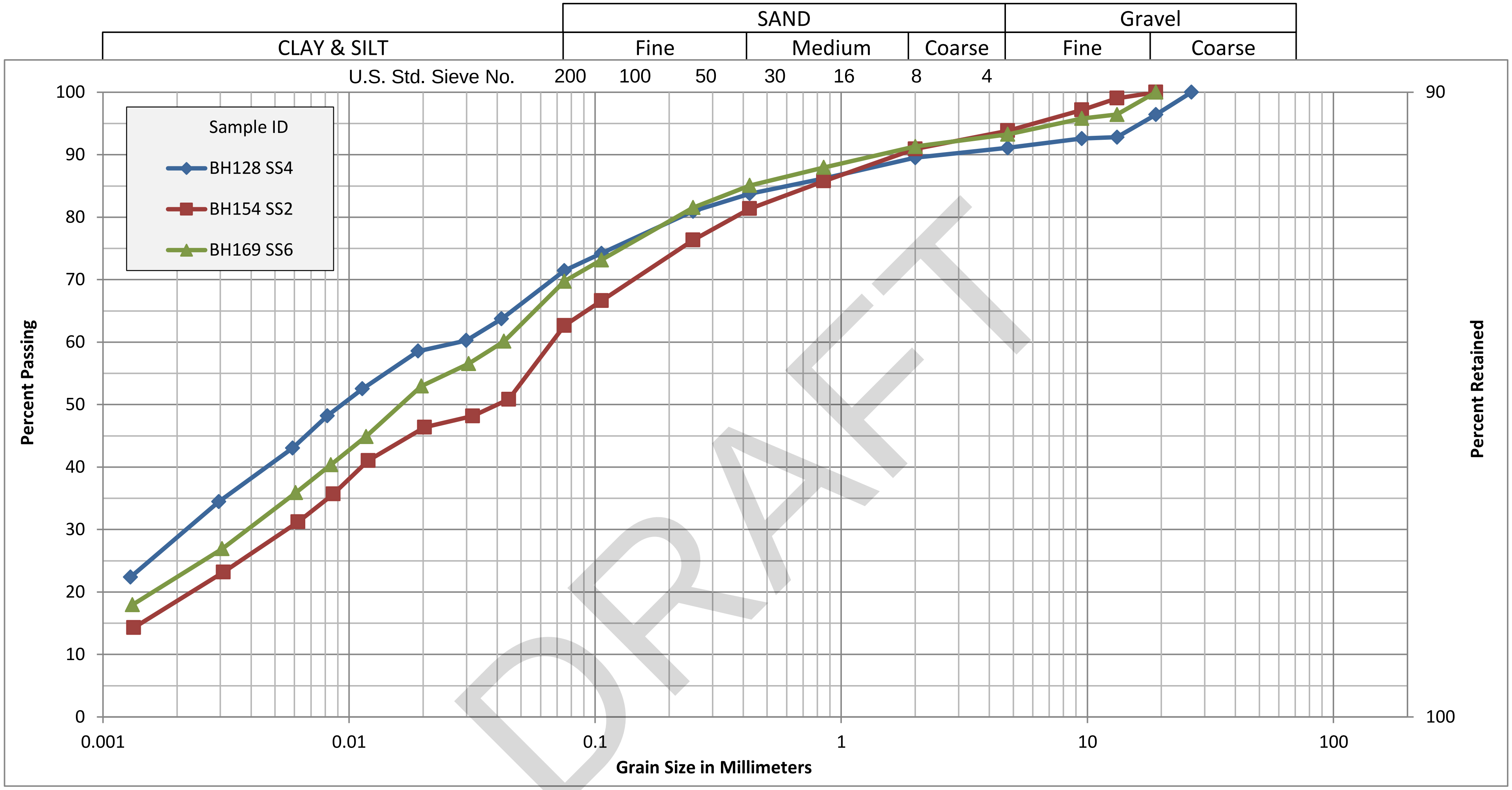
Figure No. 1

308567.001

Reviewed By:

More information available upon request

Unified Soil Classification System



Sample ID	Depth (ft)	% Gravel	% Sand	% Silt	% Clay
BH128 SS4	7'6"-9'3"	9.0	19.6	43.4	28.0
BH154 SS2	2'6"-4'6"	6.0	31.4	44.6	18.0
BH169 SS6	15.0-17.0	7.0	23.3	48.7	21.0

PINCHIN

Pinchin Waterloo - 225 Labrador Drive,
Unit 1, Waterloo, Ontario N2K 4M8

PARTICLE SIZE DISTRIBUTION ANALYSIS

Supplementary Geotechnical Investigation-12519 & 12713 Humber Station Dr, Caledon, ON
Prologis

Figure No. 1

308567.002

Reviewed By:

More information available upon request

Atterberg Limits

LS 703&704 / ASTM D4318

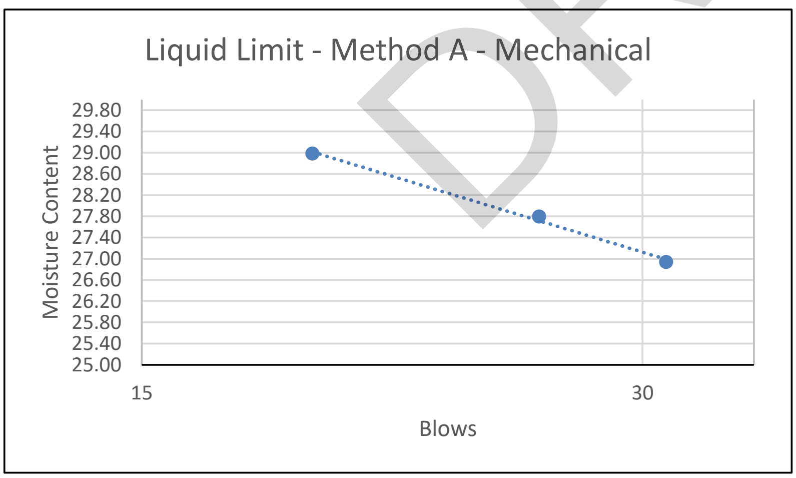
Project Name: Supplementary Geotechnical Investigation
Project No. 308567.002
Client: Prologis
Location: 12519 & 12713 Humber Station Dr, Caledon, (
Material: Soil
Sample: BH 128 SS 4 7'6"-9'3"

Test Date: March 1, 2023
Tested By: B Frank
Sample Date: January 23, 2023
Sampled By: S Liu
Reviewed By: V Marshall

Liquid Limit - Method A - Mechanical						
Pot Number	1	2	4			
Number of blows	31	26	19			
Wet mass + pot	36.18	32.13	35.23			
Dry mass + pot	31.80	28.55	30.81			
Tare	15.54	15.67	15.56			
Water content %	26.94	27.80	28.98			

Plastic Limit - Hand Rolled			
Pot Number	1	2	
Wet mass + pot	26.19	23.69	
Dry mass + pot	24.84	22.62	
Tare	15.75	15.39	
Water content %	14.9	14.8	

PI = LL - PL	
Liquid Limit %	**28**
Plastic Limit %	**15**
Plastic Index	**13**
Non Plastic	



** More information available upon request*

Atterberg Limits

LS 703&704 / AASHTO T89

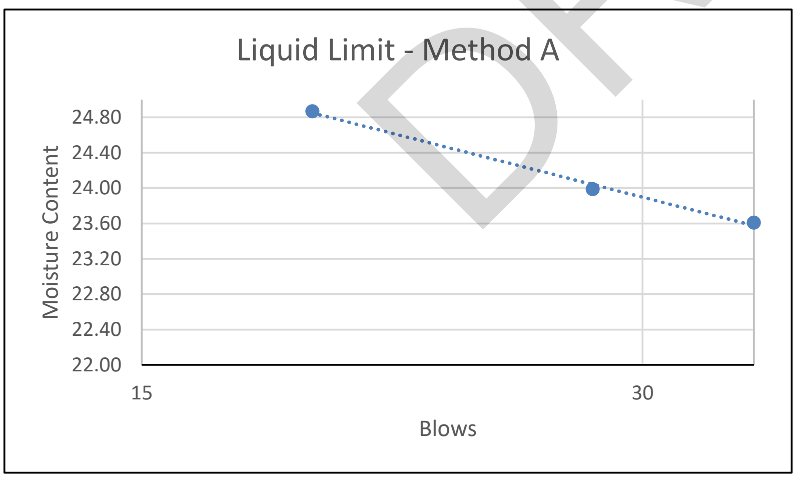
Project Name: Supplementary Geotechnical Investigation
Project No. 308567.002
Client: Prologis
Location: 12519 & 12713 Humber Station Dr, Caledon, (
Material: Soil
Sample: BH154 SS2 2'6"-4'6"

Test Date: March 1, 2023
Tested By: B Frank
Sample Date: February 8, 2023
Sampled By: S Liu
Reviewed By: V Marshall

Liquid Limit - Method A						
Pot Number	1	2	4			
Number of blows	35	28	19			
Wet mass + pot	36.79	36.82	34.67			
Dry mass + pot	32.72	32.73	30.90			
Tare	15.48	15.68	15.74			
Water content %	23.61	23.99	24.87			

Plastic Limit			
Pot Number	1	2	
Wet mass + pot	27.12	24.17	
Dry mass + pot	25.62	23.07	
Tare	15.72	15.78	
Water content %	15.2	15.1	

PI = LL - PL	
Liquid Limit %	**24.3**
Plastic Limit %	**15**
Plastic Index	**9**
Non Plastic	



Atterberg Limits

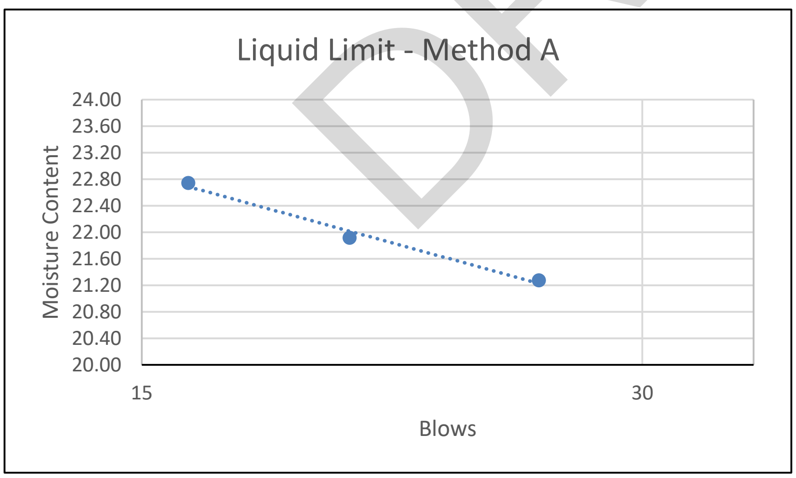
LS 703&704 / AASHTO T89

Project Name:	Supplementary Geotechnical Investigation	**Test Date:**	March 1, 2023
Project No.	308567.002	**Tested By:**	B Frank
Client:	Prologis	**Sample Date:**	February 2, 2023
Location:	12519 & 12713 Humber Station Dr, Caledon,	**Sampled By:**	S Liu
Material:	Soil	**Reviewed By:**	V Marshall
Sample:	BH169 SS6 15.0-17.0		

Liquid Limit - Method A						
Pot Number	1	2	3			
Number of blows	26	20	16			
Wet mass + pot	32.66	30.72	38.73			
Dry mass + pot	29.69	28.02	34.50			
Tare	15.73	15.70	15.90			
Water content %	21.28	21.92	22.74			

Plastic Limit			
Pot Number	1	2	
Wet mass + pot	25.92	23.76	
Dry mass + pot	24.69	22.82	
Tare	15.28	15.55	
Water content %	13.1	12.9	

PI = LL - PL	
Liquid Limit %	**21.3**
Plastic Limit %	**13**
Plastic Index	**8**
Non Plastic	



APPENDIX IV

Report Limitations and Guidelines for Use

REPORT LIMITATIONS & GUIDELINES FOR USE

This information has been provided to help manage risks with respect to the use of this report.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report was prepared for the exclusive use of the Client and their authorized agents, subject to the conditions and limitations contained within the duly authorized work plan. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third parties. If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice.

SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical report is based on the existing conditions at the time the study was performed, and Pinchin's opinion of soil conditions are strictly based on soil samples collected at specific test hole locations. The findings and conclusions of Pinchin's reports may be affected by the passage of time, by manmade events such as construction on or adjacent to the Site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations.

LIMITATIONS TO PROFESSIONAL OPINIONS

Interpretations of subsurface conditions are based on field observations from test holes that were spaced to capture a 'representative' snap shot of subsurface conditions. Site exploration identifies subsurface conditions only at points of sampling. Pinchin reviews field and laboratory data and then applies professional judgment to formulate an opinion of subsurface conditions throughout the Site. Actual subsurface conditions may differ, between sampling locations, from those indicated in this report.

LIMITATIONS OF RECOMMENDATIONS

Subsurface soil conditions should be verified by a qualified geotechnical engineer during construction. Pinchin should be notified if any discrepancies to this report or unusual conditions are found during construction.

Sufficient monitoring, testing and consultation should be provided by Pinchin during construction and/or excavation activities, to confirm that the conditions encountered are consistent with those indicated by the test hole investigation, and to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated. In addition, monitoring, testing and consultation by Pinchin should be completed to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining Pinchin for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions. However, please be advised that any construction/excavation observations by Pinchin is over and above the mandate of this geotechnical evaluation and therefore, additional fees would apply.

MISINTERPRETATION OF GEOTECHNICAL ENGINEERING REPORT

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having Pinchin confer with appropriate members of the design team after submitting the report. Also retain Pinchin to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having Pinchin participate in pre-bid and preconstruction conferences, and by providing construction observation. Please be advised that retaining Pinchin to participation in any 'other' activities associated with this project is over and above the mandate of this geotechnical investigation and therefore, additional fees would apply.

CONTRACTORS RESPONSIBILITY FOR SITE SAFETY

This geotechnical report is not intended to direct the contractor's procedures, methods, schedule or management of the work Site. The contractor is solely responsible for job Site safety and for managing construction operations to minimize risks to on-Site personnel and to adjacent properties. It is ultimately the contractor's responsibility that the Ontario Occupational Health and Safety Act is adhered to, and Site conditions satisfy all 'other' acts, regulations and/or legislation that may be mandated by federal, provincial and/or municipal authorities.

SUBSURFACE SOIL AND/OR GROUNDWATER CONTAMINATION

This report is geotechnical in nature and was not performed in accordance with any environmental guidelines. As such, any environmental comments are very preliminary in nature and based solely on field observations. Accordingly, the scope of services do not include any interpretations, recommendations, findings, or conclusions regarding the, assessment, prevention or abatement of contaminants, and no conclusions or inferences should be drawn regarding contamination, as they may relate to this project. The term "contamination" includes, but is not limited to, molds, fungi, spores, bacteria, viruses, PCBs, petroleum hydrocarbons, inorganics, pesticides/insecticides, volatile organic compounds, polycyclic aromatic hydrocarbons and/or any of their by-products.

Pinchin will not be responsible for any consequential or indirect damages. Pinchin will only be held liable for damages resulting from the negligence of Pinchin. Pinchin will not be liable for any losses or damage if the Client has failed, within a period of two years following the date upon which the claim is discovered within the meaning of the Limitations Act, 2002 (Ontario), to commence legal proceedings against Pinchin to recover such losses or damage.

ARCADIS PROFESSIONAL SERVICES (CANADA) INC.

Memo

SUBJECT
Infiltration Testing – Humber Station Village – Option 6 Lands

TO
Humber Station Village Landowner Group Inc.

DATE
June 13, 2024

OUR REF
141438

DEPARTMENT
Resilience

PROJECT NUMBER
141438

COPIES TO
Schaeffers, GEI

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**

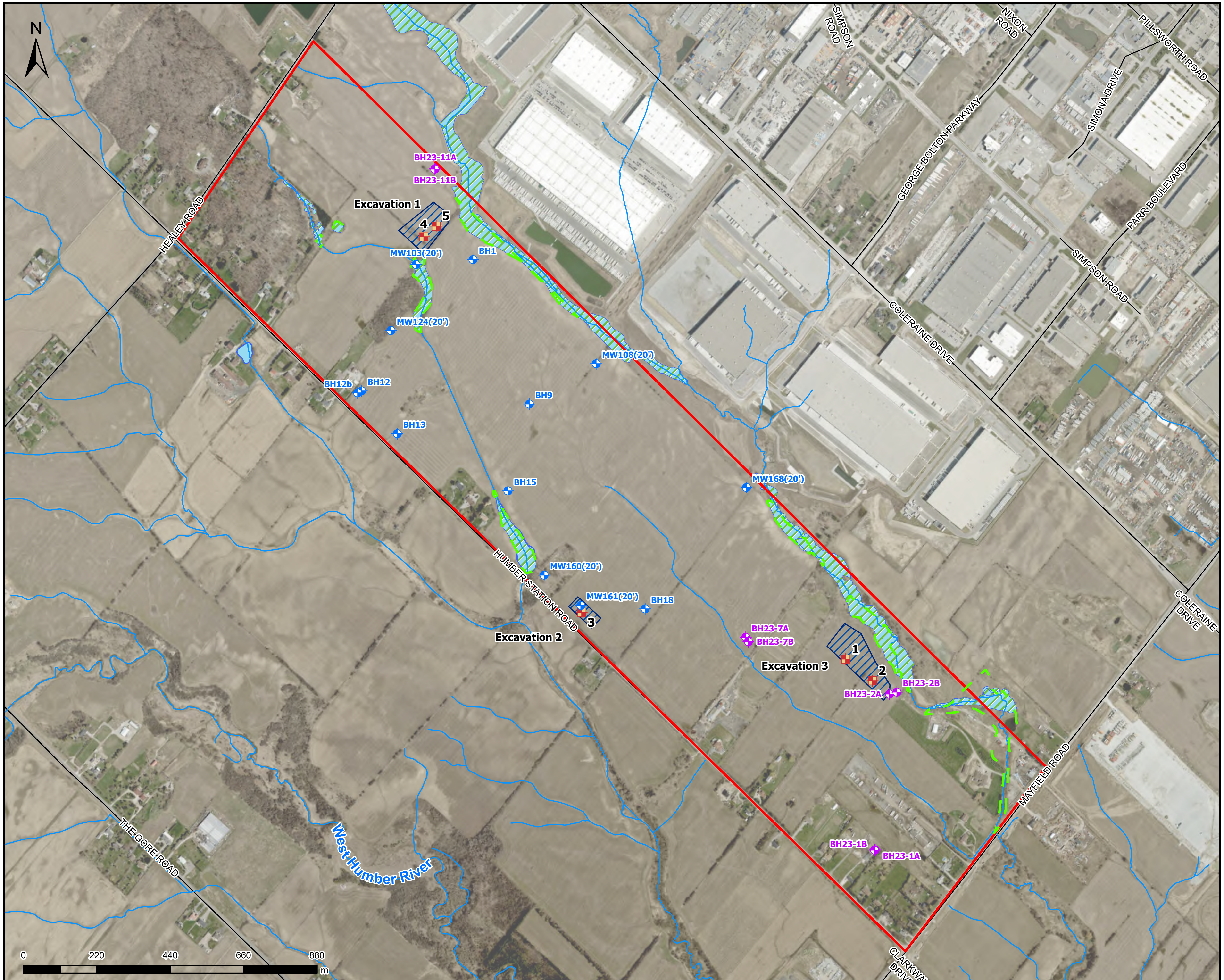
Appropriate safety factor specified in the *Low Impact Development Stormwater Management Planning and Design Guide* should also be applied to the estimated infiltration rate when designing infiltration BMPs to account for the natural variation in infiltration rate. After applying the recommended safety factors, the corresponding infiltration rate for the clayey silt to silty clay till materials ranged between 1.4mm/hour and 7.8mm/hour.

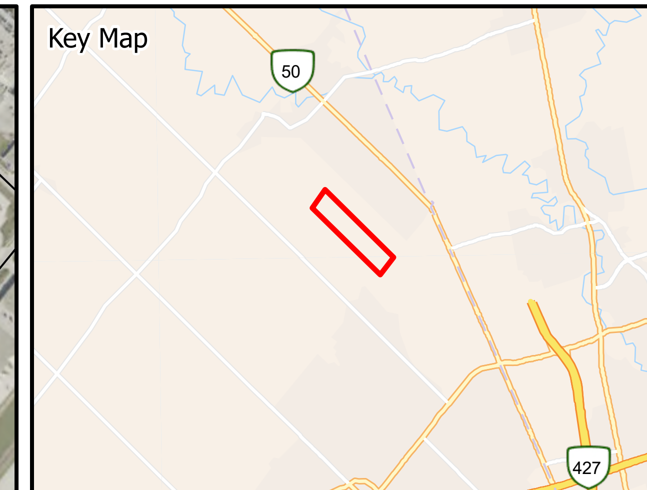
Based on the infiltration tests, the estimated infiltration rates for the clayey silt to silty clay till materials encountered at the locations of Test Pit 1 to Test Pit 5 were lower than the 15mm/hour threshold specified in the *Stormwater Management Planning and Design Manual*, which indicate the Site 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 Facility
- 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

Path: J:\141438_HumberVil\7.0_Production\7.07_Spatial_Design\Humber Station Village Option 6\Humber Station Village Option 6.aprx (Infiltration Testing - Fig 1)

Last updated on 2024-06-11 by BRADLEY.TRINH