WESTLANE DEVELOPMENT GROUP LTD.

HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY

226 BROCK STREET EAST, UXBRIDGE, ONTARIO

MARCH 17, 2021

HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY

226 BROCK STREET EAST, UXBRIDGE, ONTARIO

WESTLANE DEVELOPMENT GROUP LTD.

PROJECT NO.: 181-06778-00 100
DATE: MARCH 17, 2021

WSP
UNIT 2
126 DON HILLOCK DRIVE
AURORA, ON, CANADA L4G 0G9

T: +1 905 750-3080
F: +1 905 727-0463
WSP.COM

March 17, 2021

WESTLANE DEVELOPMENT GROUP LTD.
2 Farr Avenue
Sharon, Ontario
L0G 1V0

Attention: David Sud

Dear David,

Subject: Updated Hydrogeological Assessment and Water Balance Study
226 Brock Street East, Uxbridge, Ontario

WSP Canada Inc. (WSP) is pleased to submit the attached report to document the updated Hydrogeological Assessment and Water Balance Study prepared for a proposed subdivision development at 226 Brock Street East, Uxbridge, Ontario.

The report provides an assessment of the existing hydrogeological conditions beneath the Site as well as water budgets for existing and future conditions to illustrate the likely changes in water balance that would be expected due to the proposed development. Estimates of potential volumes of groundwater that may be generated from construction dewatering or from foundation have also been incorporated into this update. This report has been prepared to reflect planned low impact development measures as described in concurrent work and reporting prepared by IBI Group (formerly Cole Engineering Group Limited).

Thank you for the opportunity to carry out this study on your behalf. We trust that this information is sufficient for your current needs. If you have any questions or require further information, please contact us.

Yours truly,

Lloyd Lemon, M.Sc., P.Geo.
Senior Project Geoscientist

VB/LAL

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UNIT 2
126 DON HILLOCK DRIVE
AURORA, ON, CANADA L4G 0G9

T: +1 905 750-3080
F: +1 905 727-0463
wsp.com

EXECUTIVE SUMMARY

WSP Canada Inc. (WSP) was retained by Westlane Development Group Ltd. to prepare a Hydrogeological Assessment and Water Balance Study for the proposed residential development located at 226 Brock Street East, Uxbridge, Ontario (Site).

The proposed development area lies within the Peterborough Drumlin Field physiographic region as defined by Chapman and Putnam (1984). The Peterborough Drumlin Field is typically characterized by rolling till plain. The area in and around the Site consist of clay plains.

The Site currently contains a headwater drainage feature that drains northerly across the site and discharges to a culvert beneath Brock Street. The development proposal includes a plan to incorporate the form and function of this headwater drainage feature in a naturalized drainage feature to be constructed along the east side of the property, pending approval of the LSRCA.

Based on the stratigraphy observed during the borehole drilling at the Site and well records from Ministry of the Environment, Conservation and Parks (MECP) Water Well Information System, the Site is predominantly underlain by alternating layers of sand and clay with isolated layers of silt, silty sand/sandy silt and silty clay observed in individual boreholes.

Groundwater elevations measured between May 2018 and May 2019 indicate that seasonally high groundwater levels are observed between February and May and also in the late fall, while groundwater levels are observed to be the lowest between July and October.

The apparent groundwater flow direction is to the north or northwest. The spacing of monitoring wells and the presence of the headwater drainage feature in the center of the site are factors to be considered in interpreting the groundwater flow direction from groundwater elevation data.

Representative groundwater samples were collected from the three (3) monitoring wells on June 21, 2018 and submitted for water quality analysis. The results of the tests indicated that parameter concentrations are less than MECP Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition for All Types of Property Use (Coarse Textured Soil).

The Climate-Based Water Budget indicates that average annual precipitation over the past 30 years is 886.2 mm/year. The available moisture surplus at the Site ranges between 327.1 mm/yr to 341.1 mm/year depending on the type of soil and vegetation cover. The moisture surplus will reflect the infiltration and runoff based on the soil properties, slopes, and vegetation within individual catchments.

Under existing conditions, the Site is considered to be one drainage catchment that drains to the ditch along the northern boundary of the site via overland flow.

The Pre-Development Water Budget reflects infiltration for the Site of approximately 6,994 m^3/yr and runoff from the Site of approximately 1,889 m^3/yr.

The Post-Development Water Budget reflects changes in land use to include increased areas of impervious surfaces (i.e. roads, buildings etc.) and re-grading. A naturalized drainage feature, with swales and soakaway pits is proposed to be constructed to replace the form and function of the headwater drainage feature. The proposed development conditions have been subdivided into six (6) on-site catchments. Runoff within the developed portion of the site is primarily captured by stormwater drainage systems.

The Stormwater Management Plan prepared by *IBI* incorporates Low Impact Development features in the form of an infiltration trench in the centre of the development to infiltrate runoff generated from rooftops and rear lots in the centre block of the development. The effect of these features is considered in the Post-Development Water Budget.

The Post-Development Water Budget predicts a net on-site infiltration of 5,610 m^3/yr. Approximately 2,557 m^3/yr of this infiltration is generated through the proposed LID measures. This reflects a net reduction of 1,385 m^3/yr or 20% relative to Pre-Development. Additional opportunities to further mitigate the infiltration deficit have not been identified.

The Post-Development Water Budget predicts a net runoff of 9,382 m^3/yr over the Site area. This is an increase of 7,493 m^3/yr (397%) relative to Pre-Development.

The Site lies within WHPA-Q1 and WHPA-Q2 for the Uxbridge Water Supply system with assigned stress levels of moderate. Source Protection Plan (SPP) policies for WHPA-Q1 apply to areas where activities that take water without returning it to the same source may be a threat. SPP policies for WHPA-Q2 apply to areas where activities that reduce recharge might be a threat. Based on the estimated volumes of water that may require removal during construction and long-term drainage of the residential condominium, the Site will need to comply further with policies for WHPA-Q1. Policy number DEMD-1 of the Approved Source Protection Plan for the South Georgian Bay Lake Simcoe Protection Region will apply to the water taking activities during the dewatering for construction and long-term drainage. Policies associated with WHPA – Q2 may apply to offset identified infiltration deficit relative to pre-development conditions.

The Site lies within Intake Protection Zone 3 (IPZ-3) for water supplies that draw from Lake Simcoe. The proposed residential activities at the Site are not considered to present an increased risk to water quality for these water supplies.

The Site is mapped as a Highly Vulnerable Aquifer in the Approved Assessment Report for the Lakes Simcoe and Couchiching Source Protection Area. The proposed land use as residential is expected to have minimal potential to affect underlying groundwater resources.

The majority of the Site is mapped as an SGRA in the Approved Assessment Report for the Lakes Simcoe and Couchiching Source Protection Area. The water balance assessment demonstrates that the proposed mitigation enhance recharge from pre-development levels.

The estimated pumping rate that may be experienced to maintain dry conditions during construction of building foundations is up to 78,173 L/day. WSP recommends that the dewatering activity be registered on the EASR prior to construction. Additional groundwater quality testing is recommended to confirm suitability for discharge to nearby Region of Durham storm sewers.

The proposed footing elevations in the south-west portion of the Site are below the seasonally high water table. Estimates of the dewatering rates to maintain dry foundations are up to 55,381 L/day, including a 1.5 factor of safety. Water proofing of the foundations is recommended to reduce the potential that water is being removed and to thereby comply with Policy DEMD-1.

SIGNATURES

PREPARED BY

Valyn Bernard, P.Eng.
Project Engineer

March 17, 2021
Date

REVIEWED BY

PROFESSIONAL GEOSCIENTIST
LLOYD A. LEMON
PRACTISING MEMBER
0395
March 17 2021
ONTARIO

Lloyd Lemon, P.Geo., M.Sc.
Senior Project Geoscientist

March 17, 2021
Date

WSP Canada Inc ("WSP") prepared this report solely for the use of the intended recipient, WESTLANE DEVELOPMENT GROUP LTD., in accordance with the professional services agreement between the parties. In the event a contract has not been executed, the parties agree that the WSP General Terms for Consultant shall govern their business relationship which was provided to you prior to the preparation of this report.

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

The conclusions presented in this report are based on work performed by trained, professional and technical staff, in accordance with their reasonable interpretation of current and accepted engineering and scientific practices at the time the work was performed.

The content and opinions contained in the present report are based on the observations and/or information available to WSP at the time of preparation, using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by WSP and other engineering/scientific practitioners working under similar conditions, and subject to the same time, financial and physical constraints applicable to this project.

WSP disclaims any obligation to update this report if, after the date of this report, any conditions appear to differ significantly from those presented in this report; however, WSP reserves the right to amend or supplement this report based on additional information, documentation or evidence.

WSP makes no other representations whatsoever concerning the legal significance of its findings.

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WSP has provided services to the intended recipient in accordance with the professional services agreement between the parties and in a manner consistent with that degree of care, skill and diligence normally provided by members of the same profession performing the same or comparable services in respect of projects of a similar nature in similar circumstances. It is understood and agreed by WSP and the recipient of this report that WSP provides no warranty, express or implied, of any kind. Without limiting the generality of the foregoing, it is agreed and understood by WSP and the recipient of this report that WSP makes no representation or warranty whatsoever as to the sufficiency of its scope of work for the purpose sought by the recipient of this report.

In preparing this report, WSP has relied in good faith on information provided by others, as noted in the report. WSP has reasonably assumed that the information provided is correct and WSP is not responsible for the accuracy or completeness of such information.

Benchmark and elevations used in this report are primarily to establish relative elevation differences between the specific testing and/or sampling locations and should not be used for other purposes, such as grading, excavating, construction, planning, development, etc.

WSP disclaims any responsibility for consequential financial effects on transactions or property values, or requirements for follow-up actions /or costs.

Design recommendations given in this report are applicable only to the project and areas as described in the text and then only if constructed in accordance with the details stated in this report. The comments made in this report on potential construction issues and possible methods are intended only for the guidance of the designer. The number of testing and/or sampling locations may not be sufficient to determine all the factors that may affect construction methods and costs. 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.

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

The original of this digital file will be kept by WSP for a period of not less than 10 years. As the digital file transmitted to the intended recipient is no longer under the control of WSP, its integrity cannot be assured. As such, WSP does not guarantee any modifications made to this digital file subsequent to its transmission to the intended recipient.

This limitations statement is considered an integral part of this report.

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1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by Westlane Development Group Ltd. to prepare a Hydrogeological Assessment and Water Balance Study for the proposed subdivision development located at 226 Brock Street East, Uxbridge, Ontario, herein referred to as the Site. The location of the Site is shown on **Figure 1**.

The Site is located approximately south of Brock Street E and approximately 100 meters east of Nelkydd Lane in Uxbridge, Ontario. The Site is approximately 2.61 hectares in size, rectangular in shape, and is currently occupied by agricultural fields, uncultivated areas, two (2) residential dwellings (now vacant), gravel roads and lawns. The existing conditions at the Site are shown in **Figure 2** and the development plans provided to WSP are presented in **Figure 3**. Under post-development conditions, the Site is proposed to include 60 townhomes, roadways and associated servicing.

This report documents the work performed to provide an understanding of the hydrogeological conditions at the Site, to prepare a water balance analysis, and to provide preliminary recommendations for Site design and construction.

1.1 OBJECTIVES AND SCOPE

The need for a Hydrogeological Assessment and Water Balance Study was identified to help support the development application process and to quantify changes in Site runoff, infiltration and evapotranspiration between the pre- and post-development conditions for the development plan.

The Hydrogeological Assessment and Water Balance Study has been designed to:

- Review historical information and integrate findings.
- Identify the inventory of groundwater users within 500 m of the property.
- Confirm groundwater flow directions and patterns.
- Confirm and identify potential watershed divides, if any, which control groundwater flow.
- Characterize the water quality of the shallow groundwater.
- Characterize the relationships between on-site groundwater flow systems and adjacent surface water bodies.
- Create an annual water budget for the existing conditions at the property for use as a baseline.
- Determine a future annual water budget for the proposed development scenario.
- Identify significant changes to the water balance or to the form and function of the groundwater or surface water systems that might result from future plans and provide recommendations for mitigative measures to address these changes.
- Estimate the volumes of water that may need to be removed to construct proposed structures and utilities and also to that may be drained based on proposed footing elevations.
- Prepare a project report.

1.2 ANALYSIS AND DOCUMENTATION

The following published information and mapping was reviewed and considered in our analysis of the Site:

- Hydrogeological Assessments - Conservation Authority Guidelines to Support Development Applications, April 2013.
- Assessment Report, South Georgian Bay Lake Simcoe Source Protection Region, Part 1 (Lake Simcoe, May 2015 update). Approved Lakes Simcoe and Couchiching Source Protection Plan.
- Ministry of Environment, Conservation and Parks Water Well Information System (MECP WWIS);
- Other sources of information as listed in **Section 9.0.**

2 REGIONAL SETTING

2.1 PHYSIOGRAPHY

The regional physiography for the Site area is shown in **Figure 4**. The proposed development area lies within the Peterborough Drumlin Field physiographic region as defined by Chapman and Putnam (1984). The Peterborough Drumlin Field consists of a rolling till plain. The landforms in the area within and surrounding the Site consist of clay plains.

2.2 DRAINAGE

Regional topography is illustrated on **Figure 5**. The topography of the Site generally slopes gently toward the centre of the property at an approximate elevation of 280 metres above sea level (m asl).

The Site is located approximately 3.5 km northwest of the divide between the Lake Simcoe Watershed (draining to North) and the Kawartha-Haliburton Watershed (draining locally to northeast) and approximately 9 km north of the Duffins Creek Watershed (draining to South).

The Site currently contains a headwater drainage feature that drains northerly across the site and discharges to a culvert beneath Brock Street. The headwater drainage feature is within the area regulated by the LSRCA under O.Reg. 179/06. The development proposal includes a plan to incorporate the form and function of this headwater drainage feature in a bioswale to be constructed along the east side of the property, pending approval of the LSRCA.

2.3 REGIONAL GEOLOGY

The near surface soils are the top unit in a layered sequence of glacial and interglacial sediments that comprise the stratigraphic profile overlying bedrock beneath the Lake Simcoe region. The distribution of surficial soil types in and around the Site are shown on **Figure 6**. The surficial soils at the Site are predominantly characterized by sand deposits with some silt deposits in the north of the property. The deposits and stratigraphy for the regional area are described in a series of papers and posters prepared by the Geological Survey of Canada under the direction of Dr. David Sharpe.

The stratigraphic profile beneath Oak Ridges Moraine area typically includes the following layers, from youngest to oldest:

1) Recent deposits.
2) Oak Ridges Moraine (ORM) Sediments
3) Newmarket Till.
4) Thorncliffe Formation.
5) Sunnybrook Drift.
6) Scarborough Formation.
7) Don Formation.
8) York Till.
9) Bedrock.

The Site area is not located within the ORM and some of these deposits may not all be observed at this location. The Site is close to the ORM (approximately 1 km), and is expected to present a similar stratigraphic profile.

The ORM sediments are a complex package of granular sediments deposited in the meltwater at the later stages of the last glacial period, which serve as the topographic and groundwater divide between Lake Simcoe and Lake Ontario. These deposits generally become finer, and typically become thinner and eventually pinch out away from the original outlets of meltwater. Certain areas with the ORM sediments may be overlain by a thin layer of Halton Till.

The Newmarket Till represents a regionally extensive stratum that is associated with the most recent period of glaciation. This till is typically dense to very hard and sandy to silty in texture with relatively low gravel content.

The stratigraphic layers between the Newmarket Till and the underlying bedrock are commonly grouped as the Lower Sediments. The Lower Sediments are considered to have been formed by similar cycles of earlier glacial advances and retreats and associated meltwater events that resulted in the deposition of the Newmarket Till and Oak Ridges Moraine sediments. Five (5) stratigraphic layers that constitute the Lower Sediments are described below, although not all are interpreted to occur below the study area.

— The Thorncliffe Formation is a complex of stratified glaciofluvial and glaciolacustrine deposits. The texture of the Thorncliffe Formation is highly variable and is best described as fine-grained, with interbedded coarse-grained material capable of yielding notable amounts of water.
— The Sunnybrook Drift is a fine-grained material deposited in glacial and proglacial lacustrine depositional environments (diamicton). The advance of the ice sheet blocked the main drainage from the regional basin, which caused water levels to rise and form a deep lacustrine environment with deposits including varved clays.
— The Scarborough Formation is a coarsening upward sequence of sediment that ranges from clay/silt rythmites (fine-grained) to channelized cross-bedded sands (coarse-grained). The coarser fractions of this delta are a potential source of groundwater.
— The Don Formation is only rarely preserved within southern Ontario and consists of alternating beds of fossiliferous sand and mud.
— The York Till was deposited immediately overlying the bedrock by the preceding Illinoian glaciation. This till occurs only sporadically within the study area and is believed to be preserved in lows upon the bedrock surface. The till is dark grey with a sandy silt matrix and includes clusters of the underlying shale.

The bedrock in the study area is mapped as shale/limestone/dolostone/siltstone of the Blue Mountain Formation (Ontario Geological Survey, 2011) as illustrated on **Figure 7**. The depth to bedrock is estimated to be between 80 to 90 metres below ground surface, based on bedrock topography mapping and topographic mapping of the ground surface (Gao, et. al., 2006). A map of overburden thickness is provided in **Figure 8**. The thickness of overburden is typically greatest along the crest of the Oak Ridges Moraine or in areas where there are topographic lows in the underlying bedrock surface.

2.4 REGIONAL HYDROGEOLOGY

The movement of groundwater through the subsurface is controlled by the hydraulic gradients and the relative distribution of coarse and fine-grained sediments. In general, water will move laterally through coarse-grained sediments (sands and gravels) and vertically through fine-grained sediments (silts and clays). As such, the geologic units are typically grouped into hydrostratigraphic units that reflect the capacity of the geologic units to transmit water. Hydrostratigraphic units are considered to be either aquifers (with good capacity to transmit water) or aquitards (which typically impede transmission of water). Ultimately the distribution and interconnection of aquifers and aquitards are responsible for observed groundwater movement.

Earthfx Inc. (2006) grouped the regional stratigraphic profile into a seven-layer hydrostratigraphic profile as follows:

1) Recent Deposits
2) Oak Ridges Aquifer Complex (ORAC).

3) Newmarket Aquitard.
4) Thorncliffe Aquifer Complex.
5) Sunnybrook Aquitard.
6) Scarborough Aquifer Complex.
7) Bedrock.

The Oak Ridges Aquifer Complex is a regional aquifer system in Ontario that corresponds to the area where the Oak Ridges Sediments are deposited. The aquifer is a significant source of groundwater for domestic, commercial, industrial, institutional, agricultural, and municipal water supplies. The ORAC provides baseflow to the headwaters of creeks and rivers where the Halton Aquitard is absent. The shallow water table will typically be observed within this layer. The ORAC may be present at the Site.

The Newmarket Aquitard consists of the Newmarket Till and low permeability deposits that are known to infill the erosional channels. The Newmarket Aquitard is considered to be a leaky confining layer that provides protection from contamination to aquifers within the underlying hydrostratigraphic units. The Newmarket Aquitard may be present at ground surface beneath the southern part of the Site.

The Thorncliffe Aquifer Complex consists of fine to coarse-grained sediments of the Thorncliffe Formation. Local sand and gravel deposits within the Thorncliffe Aquifer Complex provide high yield wells. Groundwater in this layer is typically under pressure and in areas to the south of Aurora, the groundwater is under artesian pressure which can result in flowing wells.

The Sunnybrook Aquitard separates the Thorncliffe and Scarborough Aquifer Complexes. This aquitard demonstrates low permeability, provides some resistance to vertical groundwater movement, and protects the underlying aquifer from potential contaminant movement.

The Scarborough Aquifer Complex consists of fine to coarse-grained sediments associated with the Scarborough Formation. In general, these sediments tend to be coarse-grained and thicker where they fill topographic lows and valleys in the underlying bedrock surface. Groundwater within the Scarborough Aquifer Complex is typically under pressure, but only local artesian conditions occur. Locally, the Scarborough Aquifer Complex produces high well yields suitable for municipal or commercial wells. Due to its depth and presence of shallower aquifers, the Scarborough Aquifer Complex is not exploited extensively for private water supplies.

2.4.1 REGIONAL GROUNDWATER MOVEMENT

In general terms, precipitation infiltrates vertically into the surficial sand/gravel soil units. Groundwater will primarily move downward to the water table within the upper aquifer or aquitard unit. Groundwater will then tend to flow up or down through the aquitard units and laterally within the aquifers. Groundwater flow patterns can be influenced by established watercourses where there is potential for groundwater discharge to supply baseflow into the watercourses. The rate of groundwater discharge is controlled by the relative permeability of the recent deposits at the base of the streams. Discharge as baseflow is typically low through fine-grained base soils and higher where the streams have eroded down into coarser aquifers.

The horizontal groundwater movement through the subsurface aquifers tends to reflect the ground surface topography and the presence of stream channels.

3 WORK PERFORMED

The work program for the Hydrogeological Assessment and Water Balance Study included the following activities:

1) Description of the natural Site conditions: surface features, surface topography, soil types and stratigraphy.
2) Identification of current users of groundwater within 500 m of the subject property through the review of the Ministry of Environment, Conservation and Parks (MECP) Water Well Information System.
3) Installation of three (3) groundwater monitoring wells at various locations throughout the Site.
4) Measurement of groundwater elevations in the monitoring well network.
5) Development of the wells to a silt free condition.
6) Collection of representative samples from the monitoring well network for groundwater quality analysis.
7) Preparation of an annual climatic water budget and Site-specific water balance for Pre- and Post-Development conditions.
8) Calculation of estimated groundwater volumes that would be generated during construction dewatering or from drainage of foundations below the water table.

3.1 BACKGROUND REVIEW OF GEOLOGICAL CONDITIONS

The geologic conditions beneath the proposed development were reviewed using published map sources, records from work on adjacent properties, and the WWIS database as maintained by the MECP.

Water well records within a 500-metre radius of the Site were reviewed to obtain information on existing wells and to provide information on the geology of the area. A summary of the well record search is provided in Table A-1, **Appendix A** and water well record locations are plotted on **Figure 9**.

3.2 BOREHOLE DRILLING

Ontario One Call was consulted to identify where existing public utilities entered the Site boundaries prior to initiating on-site activities. In addition, given that the Site is a private property, WSP retained the services of a private utility locator to clear the specific borehole and test pit locations from potential interference with private utilities.

The borehole drilling and monitoring well installation was carried out between May 16 and May 17, 2018. Drilling and excavation services were provided by Orbit Garant Drilling Inc. of Sharon, Ontario. A CME 750 Rubber Tire ATV-mounted auger drill was used for borehole drilling and monitoring well installation. A WSP technician was on-site to supervise the drilling, monitor installation.

The borehole and test pit locations are shown on **Figure 2**. The drilling program consisted of installing three (3) monitoring wells, designated as MW18-1 to MW18-3, to depths ranging from 3.0 m and 4.6 m below ground surface (bgs). Records of the observed stratigraphy in the boreholes and test pits are provided in **Appendix B**.

3.3 MONITORING WELL INSTALLATION

The positions of the monitoring well screens in MW18-1 to MW18-3 were determined based on the observed soil profile and were targeted to correspond with identified sandy or wet and more permeable layers of the soil within the upper 7 m of ground surface. This depth was determined based on observations from past investigations in the area.

The monitoring wells were constructed upon reaching the target depth in the direct push boreholes. The wells were constructed in individual boreholes using 52 mm (2 inch) inside nominal diameter (ID), schedule 40, environmental grade PVC riser pipes and well screens. The well screens are factory slotted with No. 10 slot size, and are 3.05 m

(10 feet) long. The wells were constructed to leave the PVC riser pipe between 0.84 and 0.88 m above ground surface.

The borehole annulus around the well screens were filled with No. 2 silica sand to approximately 0.6 m above the top of the well screen to provide a filter pack. A low-permeability seal was placed above the filter pack using bentonite pellets. A 1.5 m long, lockable, steel, protective casing was placed over the PVC riser pipe.

The monitoring well installations were completed to O. Reg. 903 standards and a well tag was submitted to the MOE by the licensed driller for each individual well. The monitoring well construction details are summarized in on borehole records provided in **Appendix B**.

3.4 GROUNDWATER LEVEL MEASUREMENTS

Observations during the drilling MW18-1 to MW18-3 confirmed that the water table is relatively shallow beneath the Site. The well screen intervals were placed at depth in stratigraphic positions that were considered to have potential to yield water.

A groundwater monitoring program was implemented after the construction of the monitoring wells, and consisted of measuring the groundwater levels at the three (3) monitoring wells on a monthly basis for a period of one (1) year. Static groundwater elevations were estimated by subtracting the measured water depth from the determined reference elevation at each monitoring well. The monitoring program was carried out from May 2018 to May 2019, with an additional groundwater level measurement recorded on August 19, 2020.

A summary of groundwater elevations is provided in **Table 1**. A site plan showing the measured groundwater elevations is presented as **Figure 10**.

3.5 WELL DEVELOPMENT

The monitoring wells were developed after installation to remove silt and sediment. The purpose of development is to ensure that representative formation water is obtained for water quality analysis.

The volume of water in the well casing was estimated based on the static groundwater level measurement. A dedicated Waterra™ Inertial pump was installed in the monitoring well and used to remove water from the well. Standing water was observed in all three (3) monitoring wells.

3.6 WATER QUALITY SAMPLING

Representative samples of groundwater were collected from the three (3) monitoring wells on June 21, 2018. A duplicate sample was taken for QA/QC purposes. Samples were collected via the dedicated Waterra™ inertial pump placed in the monitoring well. Field measurements of temperature, electrical conductivity, and pH were recorded at the time of sample collection. The water samples were collected in sample bottles prepared by and provided by ALS Environmental Laboratories (ALS) located in Waterloo, Ontario.

The water quality samples were submitted to determine concentrations of:

— General water quality parameters (major cations, major anions, pH)

— Dissolved Metals

— Dissolved Organic Carbon

— Nutrients.

The Certificates of Analysis provided by ALS are provided in **Appendix C**.

The water quality results were reviewed with respect to Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition for All Types of Property Use (Coarse Textured Soil), hereinto referred to as the "MECP Table 2 SCS", as outlined in the Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act (April 15, 2011). This table was selected as it provides a conservative assessment of potential water quality concerns in groundwater as the area surrounding the Site is serviced by municipal water supplies.

3.7 WATER BUDGET ANALYSIS

A Water Budget provides an accounting of the water inputs and water outputs within a defined area. In this case, the area of the proposed development is used to estimate the water budgets in the existing condition (Pre-Development) and in the future condition (Post-Development).

The basic assumption of a water budget analysis is that there is a balance between water inputs and outputs, unless there is a clear understanding that water is being removed from storage within the system. The water budget is typically represented in a simple form as:

Water In = Water Out

P + EI = ET + IR + RO + EO

Where:

P	=	Precipitation
EI	=	External Inputs (including run-on, irrigation, and vertical/lateral transfers)
ET	=	Evapotranspiration
IR	=	Infiltration Recharge
RO	=	Runoff
EO	=	External Outputs (including water taking, and vertical/lateral transfers)

In more complex scenarios, lateral inputs through groundwater and surface water, movement between subsurface aquifer layers, and removal from storage can also be considered.

The objectives of the Water Budget Analysis are to:

a) quantify the water budget equation for the existing conditions;
b) quantify the water budget equation for proposed future conditions; and
c) illustrate that there is either no significant change (i.e. a water balance) between the existing or future conditions, or that mitigation methods can be employed to minimize the estimated change.

The Water Budget Analysis was completed in three main steps:

Step 1) Analysis of Climatic Data;

Step 2) Pre-Development Water Budget; and

Step 3) Post-Development Water Budget (including planned mitigation).

A previous iteration of the Water Balance Study identified potential infiltration deficits that were subsequently addressed by the current stormwater management plan. In this case, Steps 3 and 4 were combined. The water budget analysis has been completed using methods outlined in "Hydrogeological Technical Information Requirements for Land Development Applications" (MECP, 1995).

3.7.1 ANALYSIS OF CLIMATE DATA

Climate data available from on-line resources maintained by the Meteorological Service of Canada (Environmental Canada) were obtained and analyzed to determine the appropriate values for annual average precipitation and evapotranspiration. The surplus left over after subtraction of the evapotranspiration from the average precipitation is considered to represent the quantity of water available for infiltration and runoff under existing conditions.

Climate data was obtained for the Udora Climate Station for the period from 1981 until 2010. These data are provided in Table G-1, **Appendix D**. Mean monthly temperatures were calculated by averaging mean monthly minimum and maximum temperatures. Temperature data were derived from the 30-year (1981-2010) climate data summaries.

The Thornthwaite-Mather method was used to estimate potential and actual evapotranspiration on a monthly basis. The Thornthwaite-Mather method is based on an empirical relationship between potential evapotranspiration and mean air temperature. The method also takes into account the water holding capacity for the soil to compute the actual evapotranspiration and the resulting moisture surplus that is available for infiltration and runoff.

The water holding capacity of the soil depends on two different factors – the soil type and structure, and the type of vegetation growing on the surface. Different types of soil hold different amounts of moisture storage capacity, while different species of vegetation will send roots into the soil to different depths and therefore retain varying amounts of moisture. The water holding capacity for each soil type/vegetation type combination found on the Site was determined from the Environmental Design Criteria of the Storm Water Management Planning and Design Manual published by the MECP in 2003.

The monthly estimates were used to calculate an annual average for precipitation, potential evapotranspiration, actual evapotranspiration, and available moisture surplus for each combination of soil and vegetation type found on-site. The moisture surplus represents the quantity of water available for infiltration and runoff on an annual average basis. Tables that document the details of the Thornthwaite-Mather analysis for the combinations of soil type and land use are provided in **Appendix D.**

3.7.2 PRE-DEVELOPMENT WATER BUDGET

The Pre-Development Water Budget was estimated using the approach recommended in Table 2 of the "Hydrogeological Technical Information Requirements for Land Development Applications" (MECP, 1995). The steps taken to estimate the Pre-Development Water Budget included:

1) Identify sensitive features and to observe existing topography, soil types, and other controls on infiltration and runoff.
2) Delineating drainage catchments and sub-catchments based on observed drainage outlets and physical characteristics as described below.
3) Estimating the quantities of infiltration and runoff for each of the sub-catchment areas and preparing summary estimates for catchments related to identified drainage outlets and for the proposed development area.

The drainage catchments and sub-catchments were defined by considering the following factors:

- Existing elevations;
- Existing property boundaries;
- Post-development features and property boundaries;
- Natural topographical features;
- Slope ratio; and
- Land cover, and
- Land use.

The sub-catchments defined for the Pre-Development Water Budget also considered the proposed development areas and future drainage considerations for the proposed development. This was incorporated into the analysis to be able to demonstrate changes in drainage to the identified outlets and infiltration beneath the development area. The defined sub-catchments for the Pre-Development Water Budget are shown on **Figure 11** and in Table E-1, **Appendix E**.

The Infiltration Factor for each Pre-Development sub-catchment was estimated by adding the sub-factors for topography, soil type, and land cover as recommended in the MECP methodology. A geographic information system (GIS) was used to evaluate the topography, soil type and land use for each of the Pre-Development, Current Condition, and Post-Development scenarios and to generate a set of sub-catchments that can be used in analysis of each scenario. Section 6 provides a characterization of the Site in terms of the topography, soil type, and land use as input into the water budget analysis. The calculated infiltration factor for each catchment was reviewed and updated manually, as a confirmation that they reflect actual conditions. Assumptions applied to the Pre-Development water budget scenario are described in Section 6.2.

The volume of Pre-Development Infiltration was estimated as the product of [sub-catchment area] x [moisture surplus] x [Infiltration factor]. The Pre-Development Runoff was estimated by subtracting the volume of infiltration from the total volume of moisture surplus for each sub-catchment. A detailed table to document the calculations of the Pre-development Water Budget is provided in **Appendix E**.

3.7.3 POST-DEVELOPMENT WATER BUDGET

The Post-Development Water Budget was estimated using a similar approach as outlined for the Pre-Development case. The proposed development plan and future drainage plan were used to establish new drainage sub-catchments that relate to the outlets identified in the Pre-Development case. Within each drainage sub-catchment, the area of pervious soils and impervious development (roads, driveways, amenities, and roofs) were estimated based on Site plans and grading plans as provided by *IBI*. A draft of the post-development water budget was provided to *IBI* for use in finalizing stormwater management plans and in preparing designs for systems to infiltrate runoff to balance recharge. The Post-Development Water Budget calculations were revisited to be consistent with the documentation prepared by *IBI*.

For the pervious areas, the quantity of infiltration was calculated using the [pervious area] x [precipitation surplus] x [Infiltration Factor]. The Infiltration Factors were reviewed to correspond to the Post-Development conditions. The runoff for the pervious areas was estimated by subtracting the volume of infiltration from the total volume of precipitation surplus for the pervious area in each sub-catchment.

The volume of runoff from the impervious surfaces was estimated using the area of impervious surfaces and the volume of precipitation. A factor of 10% was considered to represent some evaporation in the course of runoff. This value is consistent with assumptions made on adjacent lands.

The Site will be municipally serviced for water and sewage. The Post-Development Water Budget reflects this.

The Post-Development Water Budget was compared to the Pre-Development Water Budget to evaluate the effects of the proposed development. The Post-Development Water Budget takes into consideration mitigation measures to address a potential infiltration deficit that was identified in the initial draft the water balance. The findings of the initial draft water balance analysis were used by *Cole* in the design of Low Impact Development measures to maintain pre-development recharge.

Details of the Post-Development Water Budget calculations are provided in **Appendix F**.

4 OBSERVATIONS

The information obtained during previous site studies was reviewed and analyzed to characterize the soil profile and the groundwater system at the Site.

4.1 SOIL PROFILE

Based on the stratigraphy observed during the borehole drilling and test pit excavations, the Site is predominantly underlain by alternating layers of sand and clay with isolated layers of silt, silty sand/sandy silt and silty clay observed in certain boreholes.

A layer of topsoil ranging from 100 – 800 mm in depth was observed in BH18-1 to BH18-3. The topsoil was underlain by different soil types depending on location and these included: sand, sandy silt, and silty sand. The first layer of stratigraphy typically extended to a depth of 0.8 – 1.5 m bgs. Below this level, the stratigraphy predominantly consisted of alternating layers of sand and clay or combinations of both down to a maximum depth of 4.6 m bgs.

The stratigraphy observed during the borehole investigation is generally consistent with the stratigraphy information reported in the water well records obtained through the MECP borehole logs. Table A-1 in **Appendix A** provides a list of water well records. Borehole logs are provided in **Appendix B**.

4.2 GROUNDWATER ELEVATIONS

Upon development of the wells, the water level within each monitoring well was observed and recorded. The water levels ranged from 1.1 m bgs to 2.8 m bgs on June 21, 2018. A groundwater elevation monitoring program was implemented at the Site where water levels were recorded on a monthly basis between May 2018 and May 2019, and on August 19, 2020. The groundater elevation measurements are summarized in **Table 1.**

The measured groundwater depths and elevations at the on-site monitoring wells indicate that groundwater levels were observed to vary between vary between 0.74 and 2.27 m bgs at monitoring well MW18-1, between 0.09 and 1.78 m bgs at monitoring well MW18-2 and between 0.09 and 0.30 m bgs at monitoring well MW18-3. The observed groundwater level ranges correspond to groundwater elevation ranges of 269.41 to 270.94 m above sea level (masl) for monitoring well MW18-1, 270.21 to 271.90 masl for monitoring well MW18-2 and 269.67 to 269.88 masl for monitoring well MW18-3.

The highest water levels within MW18-3 were observed between January and March 2019 when the water was frozen. The measurements indicate the water level was 0.09 m bgs, however, the readings may reflect the expansion of ice within the well casing. The highest reading where the water was not frozen was recorded in April 2019. The lowest level at MW18-3 was recorded in August 2020.

Seasonal high groundwater levels were observed in May 2019 in MW18-1 (270.94 masl), and in April 2019 in MW18-2 (271.90 masl) and MW18-3 (269.87 masl). The lowest groundwater levels were observed in July 2018 at MW18-1 (269.41 masl), and in August 2020 in MW18-2 (270.21 masl) and MW18-3 (269.67 masl). Typically, groundwater levels are observed to be the highest between February and May and also in the late fall, while groundwater levels tend to be lowest between July and October. The observed groundwater levels generally follow the typical groundwater level trends.

Figure 10 presents a map illustrating seasonally high groundwater elevations observed at the Site and the interpreted groundwater flow direction. The apparent groundwater flow direction is inferred to be in a northerly direction based on observations of active flow in the central headwater drainage feature on June 21, 2018. This inferred groundwater flow direction generally consistent with the topography observed at the Site. The monitoring well locations were chosen near the corners of the property and this may not reflect the influence of topography and surface water drainage in the center of the Site.

The Site's location to the north of the regional groundwater divide indicates that the local groundwater flow feeds the regional groundwater system to the north.

4.3 WATER USE

The two (2) residential dwellings located on the Site obtain water from on-site wells and have private individual sewage systems. The proposed development will be municipally serviced for water and sewage.

WSP recommends that the private individual sewage systems be decommissioned prior to the start of construction activities, according to best practices and that the onsite private water supply wells be decommissioned according to O.Reg. 903.

4.3.1 MECP WATER WELL SEARCH

A list of MECP water well records within 500 m of the Site is provided in **Appendix A**. **Figure 9** illustrates the locations of wells located within 500 m of the Site property as per the MECP WWIS. The well record database includes seventy-three (73) water well records within a 500-metre radius of the Site. Of the well records, 11 are water supply wells for domestic, irrigation, livestock, industrial and municipal purposes, 36 are test holes or monitoring wells, 19 are abandoned, one (1) is for dewatering purposes, and six (6) are for other purposes.

Of the 11 water supply wells, five (5) draw water from sand and gravel lenses at a depth less than 20 m, seven (7) draw water from sand and gravel lenses at depths ranging between 20 and 40 m, and three (3) draw water from silt, stone and sand lenses greater than 40 m. The water supply wells were constructed between 1965 and 1977.

Domestic water supply well ID 1905167 is screened in a sand lens at a depth of approximately 5 m bgs and is located approximately 100 m west of the Site. The property on which this well is constructed on is currently vacant. WSP interprets this well as no longer in use.

Domestic water supply well IDs 1909134, 1910043, 1913524, 4603034, 4605817, 4605818 are 4605920 are all located greater than 150 m from the site. Due to the distance of the water supply wells and the estimated drawdown required for the construction activities at the Site, minimal impacts to the supply wells are anticipated

Municipal supply well ID7209840 is screened sand at a depth of approximately 17 m bgs is located approximately 300 m southwest of the Site. Due to the distance of the water supply well and the estimated drawdown required for construction activities at the Site, minimal impacts to this supply well are anticipated.

WSP understands that much of the search area is now municipally serviced for water supply. This is reflected by the relatively high proportion of reported abandoned wells. It is likely that some of the identified of the domestic water supply wells have also been removed from active use, but are not documented in the MECP WWIS.

It is possible that the MECP WWIS database includes other wells that are incorrectly located and there may be some wells for which well records are not on file at the MECP.

4.4 WATER QUALITY

The results of water quality testing at the three (3) on-site monitoring wells are summarized in **Table 2**. The water quality analysis reports as provided by ALS are presented in **Appendix C**.

The concentrations of the parameters tested are less than the relevant MECP Table 2 Site Condition Standard (SCS) values.

5 WATER BUDGET ANALYSIS

The Water Budget Analysis is presented in the following sections. Section 5.1 describes the analysis of historical climate data to estimate annual average precipitation and potential evapotranspiration. Section 5.2 describes the Pre-Development Water Budget. Section 5.3 Describes the Post-Development Water Budget. Section 5.4 revisits the Post-Development Water Budget to consider the potential benefits of identified mitigation opportunities.

5.1 CLIMATE-BASED WATER BUDGET

The climate-based water budget calculations are included in Tables **D-1** to **D-4** (**Appendix D**) and are summarized in **Table 3**. The average annual precipitation for the thirty year normal data between 1981 and 2010 is about 886.2 mm/m^2/year (mm/year). The annual potential evapotranspiration is calculated in Table D-1 at 579.3 mm/year. This equates to a potential water surplus of 393.1 mm/year and a soil moisture deficit of 86.2 mm/year. Thus the net annual water surplus based on potential evapotranspiration is 306.9 mm/year.

The calculations were expanded to include the water holding capacity of the soil as presented in Tables D-2 to D-4. This will produce a total moisture surplus based on the calculated actual evapotranspiration. Three (3) combinations of soil type and vegetation type were identified on the Site for the Pre-Development and Post-Development scenarios. The majority of the surficial soil at the site is considered to be fine sandy loam. The land use classifications and the corresponding water holding capacities are:

— Fine Sandy Loam, Urban Lawn (75 mm/year);
— Fine Sandy Loam, Cultivated (150 mm/year);
— Fine Sandy Loam, Uncultivated (150 mm/year); and

Consideration of these factors produces a range of net annual moisture surplus between 283.8 and 341.1 mm/year as summarized in **Table 3**. The soils with higher water holding capacity effectively increase the water removed as evapotranspiration.

The calculated moisture surplus occurs during the winter, spring and fall months, and a water deficit occurs during the summer months. Much of the water surplus in the winter accumulates as snow. Snowmelt during the spring results in the runoff or infiltration of precipitation that is effectively equivalent to the winter and spring water surplus.

5.2 PRE-DEVELOPMENT WATER BUDGET

The Pre-Development Water Budget was developed based on topographic information provided by Ontario Base Mapping and the preliminary Site Grading Plan provided by *IBI*.

5.2.1 PRE-DEVELOPMENT CATCHMENTS

Figure 11 illustrates the delineation of drainage catchments and sub-catchments for the Site. The Site is represented by one (1) (on site) catchment area that is not considered to receive run-on from adjacent properties. The Pre-Development Drainage Plan prepared by *IBI* includes an external catchment to the south of the Site. *IBI* confirmed that the external catchment was included in their analysis to estimate the quantity of runoff from off-site to be conveyed through the headwater drainage feature. The water generated in the off-site catchment is considered to be conveyed through the site and does not contribute to on-Site infiltration. WSP did not include this off-site catchment in the pre-development water balance calculations.

The on-Site catchment areas have been further subdivided. The drainage sub-catchments are based on similar slopes, soils, and vegetation/land use. The drainage sub-catchments also include consideration of post-development drainage boundaries so that changes to drainage areas can be evaluated for the post-development conditions. The outlets for drainage of the identified Pre-Development catchments are as follows:

On-Site Catchments:

— **Pre-Development On-Site Catchment A:** Drains off-site through the north-eastern property boundary via overland flow (to the ditch along Brock Street East).

Table E-1 (**Appendix E**) provides a summary of the data attributes used to estimate the infiltration factor for each pre-development catchment and sub-catchment. The infiltration factor determined the proportion of the annual water surplus that would infiltrate or runoff within each sub-catchment.

Additional infiltration was attributed to Catchment A due to observed saturated conditions during the site visits. The water in the central area of the site appeared primarily to be standing water with minimum flow observed and is considered to provide an opportunity for enhanced infiltration in this area. An additional 25% of the runoff was allocated for infiltration in the pre-development scenario. This step is reflected in the water budget summary on **Table 4**, but not within the detailed water budget calculations (**Appendix E**).

5.2.2 PRE-DEVELOPMENT ANALYSIS

Properties associated with area, slope, soil type, and land cover were analyzed and assigned to each Pre-Development sub-catchment. The values assigned to each Pre-Development sub-catchment are provided in Table E-1. These values were used to estimate an Infiltration Factor. The Infiltration Factors were reviewed to confirm that they are appropriate and adjusted if necessary. Existing paved areas were assumed to be impervious and to generate runoff equivalent to the precipitation volume minus a 10% evaporative loss. Gravel areas were assumed to have a surplus equivalent to that of urban lawn areas.

Table E-1 includes the overall analysis of the total Study Area's infiltration and runoff. Table H-1 also documents the calculation of volumes associated with input and output parameters for the Pre-Development conditions. These volumes are also expressed in terms of the number of mm of water within each sub-catchment area.

A summary of the Pre-Development water budget calculations is provided in **Table 4**. These values will be used to assess the changes that proposed development will create relative to the pre-development conditions.

5.2.3 PRE-DEVELOPMENT INFILTRATION

The estimated total infiltration for the Site is 6,994 m^3/yr or an equivalent of 267.8 mm/year (mm/m^2/yr). The calculated infiltration represents approximately 30% of the annual precipitation (886.2 mm/yr) and 79% of the estimated annual water surplus (340.1 mm/yr).

5.2.4 PRE-DEVELOPMENT RUNOFF

The total runoff for the Site is 1,889 m^3/yr or an equivalent of 72.3 mm/year. The calculated runoff represents approximately 8% of the annual precipitation (886.2 mm/yr) and 21% of the estimated annual water surplus (340.1 mm/yr).

5.3 WATER BUDGET– POST-DEVELOPMENT CONDITIONS

The Post-Development Water Budget was based on the proposed concept plan presented in **Figure 3**. The Post-Development scenario introduces 60 townhomes, and new driveway and roadway areas. WSP understands that a naturalized drainage feature is to be constructed along the south and east side of this development area to convey water currently drained by the headwater drainage feature.

The Post-Development scenario presented by *IBI* in the Functional Servicing and Stormwater Management Report (IBI, 2021) includes the off-site catchment to the south as was included in Pre-Development. *IBI* has confirmed that the volume of water previously conveyed through the Site via the headwater drainage feature would now be directed to the proposed natural drainage feature along the south and east side of the property. The natural drainage features include a series of swales/soak away pits that have been designed to promote infiltration. *IBI* confirmed that the perimeter drainage feature is capable of promoting infiltration. WSP has accounted for this by increasing the soil infiltration factor within the drainage feature in detailed water budget calculations (**Appendix F**).

IBI also allowed for an infiltration trench to capture and infiltrate runoff from rooftops within the central area of the development. WSP also accounted for this infiltration in the detailed water budget calculations (**Appendix F**).

5.3.1 POST-DEVELOPMENT CATCHMENTS

Figure 12 illustrates the delineation of drainage catchments and sub-catchments for the Site under post-development conditions. The Site has been subdivided into six (6) on-site catchments. Sub-catchment delineations in Pre-Development conditions were maintained for the Post-Development analysis. The post-development catchments were prepared based on a preliminary grading plan and drainage area plan provided by *IBI*.

Under Post-Development conditions, a new naturalized drainage feature that drains off-site to the northwest is introduced in Catchment PF. Runoff from within the developed areas of the Site drains northwest via the on-site storm sewer system and rear lot catch basins, or directly to the offsite northwest via overland flow. WSP has assumed that the runoff from the upgradient properties (to the south and west) will be conveyed through the natural drainage feature. The outlets for each Catchment are summarized below:

<u>On-Site Catchments</u>:

— **Post-Development On-Site Catchment PA1:** Drains off-site to the northwest via overland flow.

— **Post-Development On-Site Catchment PA2:** Drains off-site to the northwest via overland flow.

— **Post-Development On-Site Catchment PB:** Drains off-site to the northwest via the on-site storm sewer system.

— **Post-Development On-Site Catchment PC:** Drains to the rear lot infiltration trench, which connects to the on-site storm system and subsequently flows off-site to the north.

— **Post-Development On-Site Catchment PD:** Drains to the rear lot catch basins which connect to the on-site storm sewer system and subsequently flows off-site to the north.

— **Post-Development On-Site Catchment PE:** Drains to the rear lot catch basins which connect to the on-site storm sewer system and subsequently flows off-site to the north.

— **Post-Development On-Site Catchment PF:** Drains to the proposed drainage swale which subsequently flows off-site to the north west via overland flow

Table F-1 (**Appendix F**) provides a summary of the data attributes used to estimate the infiltration factor for each post-development catchment and sub-catchment. The infiltration factor determined the proportion of the annual water surplus that would infiltrate or runoff within each sub-catchment. Runoff from the developed areas in on-site catchment areas will be affected by the creation of buildings and driveway areas.

WSP prepared the post-development catchments with input from *IBI* on split drainage from rooftops to rear lot catch basins. This results in some differences in catchment delineations between the *IBI* Post Development Drainage Area Plan (*IBI, 2021)* and the post-development site catchment areas in **Figure 12**. Catchment A1 in Post Development Drainage Area Plan (PDDAP) includes Catchment PF in **Figure 12.** Catchment A2 in the PDDAP includes Catchment PA1 and PA2 in **Figure 12.** Catchment A3 in the PDDAP includes Catchment PB, PC, PD and PE in **Figure 12.** The difference in catchment delineations is primarily due to the manner in which runoff is accounted for in stormwater management as opposed to the water balances.

5.3.2 POST-DEVELOPMENT ANALYSIS

Properties associated with area, slope, soil type, and land cover were analyzed and assigned to each Post-Development sub-catchment. The values assigned to each Post-Development sub-catchment are provided in

Table F-1 (**Appendix F**). These values were used to estimate an Infiltration Factor. The Infiltration Factors were reviewed to confirm that they are appropriate and adjusted if necessary.

Table F-1 includes the overall analysis of the total Study Area's infiltration and runoff. Table F-1 also documents the calculation of volumes associated with input and output parameters for the Post-Development condition. These volumes are also expressed in terms of the number of mm of water within each sub-catchment area. The volumes are summed by catchment and for the total property area.

Assumptions incorporated into the water budget for the Post-Development scenario included:

1) Impervious surfaces (roads, driveways and buildings) are assumed to have a 10% evaporative loss.
2) Runoff is assumed to be conveyed directly to the outlets and not infiltrated.
3) Runoff from external sub-catchments is conveyed through the Site and not infiltrated.
4) Infiltration through the naturalized drainage feature is included in the Water Budget Summary in **Table 4**.
5) Rooftop runoff from the entire roof area in Catchment PC will be redirected to the rear lawns, and 50% of the volumes are assumed to infiltrate.
6) Rooftop runoff from rear roof areas in Catchment PA1, PD and PE will be redirected to the rear lawns and 50% of the volumes are assumed to infiltrate.
7) The remaining rooftop runoff in Catchment PC and the runoff the from rear lawn areas will be captured by the infiltration trench in Catchment PC, with 80% of the volume received by the infiltration trench assumed to infiltrate.

A summary of the Post-Development water budget calculations is provided in **Table 4**.

5.3.3 POST-DEVELOPMENT INFILTRATION

In the post-development condition, the Site will contain approximately 13,574 m^2 of impervious surfaces. This would result in a net infiltration of 3,053 m^3/year or 117 mm/yr through natural pervious areas, including infiltration in the naturalized drainage area. A further 1,685 m^3/yr will infiltrate through the rear lawns by rooftop disconnect and 872 m^3/yr will infiltrate through the rear yard infiltration trench. This results in a net infiltration of 5,610 m^3/yr. The net infiltration would reflect approximately 24% of the precipitation (886.2 mm/yr).

5.3.4 POST-DEVELOPMENT RUNOFF

The introduction of impervious surfaces will increase the total runoff from the developed area. The total runoff generated by the proposed development area is11,939 m^3/yr or 457 mm/year. As mentioned above, 1,685 m^3/yr of this runoff will infiltrate through the rear lawns by rooftop disconnect and 872 m^3/yr will infiltrate through the central rear-lot infiltration trench. The net runoff generated in the post-development scenario if 9,382 m^3/yr. The total calculated net Post-Development runoff represents approximately 40.5% of the annual precipitation (886.2 mm/yr).

5.3.5 COMPARISON WITH PRE-DEVELOPMENT

Table 4 provides a comparison of the water budget estimates for the Pre-Development and Post-Development cases. The Post-Development scenario includes measures designed to enhance infiltration at the site. The total on-site infiltration is reduced by approximately 20% or 1,385 m^3/yr when compared to the Pre-Development Scenario. The introduction of additional impervious surfaces increases the total runoff by 7,493 m^3/yr. This increased runoff is managed by the stormwater management system.

Measures are proposed to re-direct front and rear roof-top runoff from the townhouse to the back lawns assumes that 50% of the redirected roof-top runoff will infiltrate into the lawns. The infiltration trench proposed in the rear lots of Catchment PC will have the ability to infiltrate runoff from the lawns. It is assumed that 80% of the volumes received are able to infiltrate back in the groundwater beneath the development site. The net infiltration is enhanced by 2,557 m^3/year through these actions. The primary goal of the water balance mitigation analysis is to determine whether the annual infiltration to groundwater beneath the development area can be maintained.

If other options for mitigation are preferred due to site area availability, it would also be possible to enhance infiltration by redirecting some of the runoff from driveways and other impervious surfaces. This can be accomplished by changing the infiltration characteristics of the pervious surfaces to allow for more infiltration.

5.4 WATER QUALITY

The water budget analysis must also consider potential changes to water quality that could be experienced in relation to the proposed development. The following sections describe the typical contaminants associated with the current and future land uses.

5.4.1 EXISTING CONDITIONS

The Site is currently vacant. As such, there are no activities present that could potentially impact groundwater quality at this time.

5.4.2 FUTURE CONDITIONS

The proposed Post-Development condition includes new driveway and roadway areas. These areas may be a future source of contamination to groundwater infiltration or surface water runoff by winter road de-icing agents. The most effective method of reducing potential impacts from salt or other winter road de-icing agents is to minimize the mass/volume of material applied through the use of Best Management Practices (BMPs). Any pervious areas used for winter snow storage may also become potential sources of contamination from winter road de-icing agents. BMPs recommend storing snow on impervious surfaces.

The driveway and roadway areas may also be a potential sources of petroleum hydrocarbons. These are typically contained in vehicles. The release of these substances will typically be the result of accidents. These potential releases could result in impairment of water quality by infiltrating into the groundwater. The risk of an accident occurring at the Site is low considering the only traffic will be the residents who occupy the building.

In pervious areas, soil-enrichment agents (i.e. fertilizers) and/or herbicides may also be a source of contamination. Application of these products should be minimized in order to reduce potential contamination.

6 POLICY AREAS

6.1 WELLHEAD PROTECTION AREAS

The Durham Region Official Plan (DROP) delineates Wellhead Protection Areas (WHPA) for protection of the groundwater supplies that are used to provide the primary source of potable drinking water. The wellhead protection policies of the DROP conform to the requirements of the Oak Ridges Moraine Conservation Plan and are included in the Official Plan for the Township of Uxbridge. Section 1.9.6 of the Official Plan for the Township of Uxbridge states:

Wellhead Protection Areas are designated on Schedule "L" to this Plan. They include lands that contribute water to municipal wells (capture zone). Land use restrictions shall be applied within Wellhead Protection Areas based on "time-of-travel" for groundwater to reach the municipal well and the relative threat posed by certain land use/activities in proximity to such wellheads. Land uses which pose a risk to the quality and quantity of groundwater in the wellhead protection areas are prohibited or restricted in accordance with Schedule 'E' – Tables 'E5' and 'E6' in the Durham Regional Official Plan and the policies of Section 2.3.25 to 2.3.28 inclusive of the Durham Regional Official Plan.

In addition to the DROP, a Provincial initiative on Drinking Water Source Protection under *The Clean Water Act,* 2006 has been underway since 2006 to develop Drinking Water Source Protection Plans. *The Clean Water Act provides* regulations that define requirements for a "Risk Management Plan" that is not necessarily consistent with the DROP policies. A Risk Management Plan will only be required in areas where the Provincial Regulations under *The Clean Water Act*, 2006 apply. The WHPA and vulnerability scores from the Assessment Report for the Lakes Simcoe and Couchiching Source Protection Area are provided as **Figure 13**.

The Site does not lie within WHPA-A to D for the Town of Uxbridge wells as mapped under *The Clean Water Act*.

The Site does lie within the WHPA-Q1 and WHPA-Q2 areas that are mapped to identify the overall recharge areas for municipal wells and have assigned stress levels of moderate. Source Protection Plan (SPP) policies for WHPA-Q1 apply to areas where activities that take water without returning it to the same source may be a threat. SPP policies for WHPA-Q2 apply to areas where activities that reduce recharge might be a threat. Policy number DEMD-1 of the Approved Source Protection Plan for the South Georgian Bay Lake Simcoe Protection Region will apply to the water taking activities during dewatering for construction and long-term drainage.

Based on the estimated volumes of water that may require removal during construction and long-term drainage of the townhouse buildings (see **Section 7**), these activities will need to comply with policies for WHPA-Q1.

The proposed land use is residential and is not anticipated to present a threat to groundwater resources as per DROP Section 2.3.26.

6.2 INTAKE PROTECTION ZONE

Intake Protection Zones (IPZ) refer to areas on the water and land surrounding a municipal surface water intake. **Figure 14** illustrates that the Site lies within an IPZ-3 as delineated for municipal water supplies that draw water from Lake Simcoe. IPZ-3 includes areas that can be delineated if modelling demonstrates that spills from a specific activity, that is located outside IPZ-1 and IPZ-2, may be transported to a water supply intake and result in a deterioration of the water quality at an intake. In this case, there is potential for contaminants at the Site to be transported northward to Lake Simcoe. The vulnerability score associated with IPZ-3 is relatively low and reflects that activities on this Site would have a relatively low likelihood of affecting the water quality in a surface water intake in Lake Simcoe. The mitigation measures proposed in the Functional Servicing and Stormwater Management Report (*IBI*, 2021) enhance the pre-development rate of infiltration/recharge.

6.3 HIGHLY VULNERABLE AQUIFERS

The Source Protection Plan for the Lakes Simcoe and Couchiching Source Protection Area contains policies that apply to Highly Vulnerable Aquifers. **Figure 15** presents the mapping of Highly Vulnerable Aquifers (HVA) from the Assessment Report for the Lakes Simcoe and Couchiching Source Protection Area. HVA are considered susceptible to contamination of groundwater from activities on the surface or shallow subsurface. The Site is mapped as a Highly Vulnerable Aquifer. The proposed land use as residential is expected to have minimal potential to affect underlying groundwater resources.

6.4 SIGNIFICANT GROUNDWATER RECHARGE AREAS

Policies 6.36 DP through 6.40 DP of the Lake Simcoe Protection Plan address Significant Groundwater Recharge Areas (SGRA).

The Assessment Report for the Lakes Simcoe and Couchiching Source Protection Area contains mapping of Significant Groundwater Recharge Areas (SGRA). SGRA are regional areas that receive more than the average estimated recharge for a watershed area.

Most of the Site is within a mapped SGRA as shown on **Figure 16**. More than half of the Site including the central portion and the portions in the southeast corner are shown to have high sensitivity.

The mitigation measures proposed in the Functional Servicing and Stormwater Management Report (*Cole*, 2018) enhance the pre-development rate of infiltration/recharge.

7 DEWATERING ASSESSMENT

The potential requirements for dewatering in association with construction of the proposed residences, for long-term drainage from foundation drains and associated buried utilities (storm and sanitary sewers) is assessed below. The potential requirements for permitting associated with dewatering activities are as follows:

— Takings of less than 50,000 L/day at any one time do not require a permit;

— Takings of greater than 50,000 L/day but less than 400,000 L/day at any one time requires registration with the Environmental Activity and Sector Registry (EASR); or

— Takings of greater than 400,000 L/day at any one time for the project will require a Category 3 Permit to Take Water (PTTW).

WSP has prepared a preliminary assessment of the dewatering requirements and the associated impacts associated with construction and long-term drainage.

7.1 DEWATERING EQUATIONS AND ASSUMPTIONS

Given the subsurface conditions encountered in the study area, equations are used to account for excavations under unconfined groundwater conditions. For the purposes of these calculations, long narrow trench equations are assumed to be more appropriate to estimate flows for the foundation excavation, since the length to width ratio of the excavation is greater than 1.5.

LONG NARROW TRENCH EQUATION – UNCONFINED CONDITIONS

Dewatering volumes were estimated using the following equation from Powers (1992) for drainage trench of finite length with a length to width ratio of greater than 1.5 for an unconfined system:

$$Q = \frac{xK(H^2 - h^2)}{In\frac{R_o}{r_s}} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right]$$

where Q is discharge (m^3/s), x is the trench sidewall length (m), K is hydraulic conductivity (m/s), H is initial water level (m), h is the required drawdown (m), R_0 is the equivalent radius of influence (m), and r_s is the equivalent well radius (m). For more details, please refer to Powers (1992). Using the equation for a long, narrow system provides a more conservative estimate for dewatering rates when compared with using the equation for a drainage trench from a line source.

DARCY'S LAW

Dewatering volumes for the calculation of seepage across the base of the excavation was estimated using the empirical Darcy's Law equation as described in Powers (1992):

$$Q = K_V Ai$$

where Q is discharge (m^3/s), K_V is vertical hydraulic conductivity (m/s), A is cross-sectional area (m^2), and i is the hydraulic gradient.

EQUIVALENT RADIUS OF INFLUENCE (R_O)

The equivalent radius of influence R_0 is assumed to be equivalent to the zone of influence (ZOI). R_0 was estimated using the empirical Sichart equation as described in Powers (1992):

$$R_0 = 3000(H - h)\sqrt{K}$$

where R_0 is the equivalent radius of influence or ZOI (meters), H is the initial water level (meters), h is the required drawdown (meters), and K is hydraulic conductivity (meters/second).

7.2 ASSUMPTIONS

A number of assumptions were incorporated based on the site-specific data collected in site investigations and information about the proposed development. The assumptions related to construction dewatering are as follows:

- No measures are to be put in place to restrict flows into the excavations (e.g., sheet piling, caissons) to provide more conservative (overestimate) dewatering rates;
- The aquifer is uniform, continuous and of infinite extent;
- The proposed elevations of the building footings and storm and sanitary sewer inverts were provided by *IBI* in the Site Servicing Plan dated March 2019.
- The dimensions for each building used to estimate potential dewatering requirements are outlined below:
  - Building 1 – 29.4 x 13.3 m
  - Building 2 – 36.5 x 13.3 m
  - Building 3 – 35.4 x 14.2 m
  - Buildings 4 through 9 – 42.5 x 14.2 m
  - Buildings 10 and 11 – 54.4 x 16.2 m
- The Site Servicing plan showing the depths of building footings and depths of structures, pipe lengths and slopes are presented in **Appendix G.**
- Assumed hydraulic conductivity is based on the field saturated hydraulic conductivity estimated from the infiltration testing conducted at the Site by WSP (WSP, 2018). The field saturated hydraulic conductivity was observed to be 4.2 x 10^{-5} m/sec. This value is considered to be conservative for the observed soils.
- For the purposes of estimating flux across the base of the excavation, vertical hydraulic conductivity was used in the calculation using the Darcy equation. The vertical hydraulic conductivity is assumed to be an order of magnitude lower than the horizontal hydraulic conductivity (4.2 10^{-6} m/sec for the conservative dewatering rate)
- The vertical hydraulic gradient was assumed to be 0.1 m/m;
- Dewatering during construction is assumed to lower the water table by 0.5 m below the base of the building footing and 1.0 m below the base of the sewer inverts.
- Assumed seasonal high groundwater elevations for the Site is based on elevations measured in mid April and May of 2019 (**Table 1**).
- Groundwater elevation contours were used to prepare **Figure 17** to illustrate relative elevations of building foundations to the seasonally high groundwater elevations for use in the dewatering estimates.
- Groundwater elevation contours were used to prepare **Figure 18** to illustrate relative elevations of proposed utilities to the seasonally high groundwater elevations for use in the dewatering estimates. .
- Excavations for storm and sanitary sewers are assumed to not be any greater than 50 m trench segments.
- Precipitation entering the open excavations were estimated assuming a 10 mm rain storm event.
- A safety factor of 50% is applied to the dewatering estimates to account for fluctuations in groundwater elevations and variations in soil conditions.

The primary factors that will control the rate of seepage into the excavation or foundations are the hydraulic conductivity and the depth that the water table will be lowered.

This assessment does not represent an engineering design of a dewatering operation, but a preliminary hydrogeological analysis for assessment of dewatering volumes. The actual design of the dewatering operation will be the responsibility of the contractor.

7.3 DEWATERING CALCULATIONS

7.3.1 CONSTRUCTION DEWATERING FOR RESIDENTIAL FOUNDATIONS

The calculations of the estimated volumes of water that could enter the excavations during construction of each building lot are shown in **Table 5**. These calculations show the conservative dewatering rate that may be observed. Dewatering calculations are provided in **Appendix H1**.

Residential building foundations in the north-east portion of the Site (buildings 3, 4, 5, 8, 9 and 10) appear to above the seasonally high groundwater elevations assumed at the Site. Residential building foundations in the south-west potion of the Site (buildings 1, 2, 6, 7 and 11) have potential to be below the seasonally high groundwater elevations assumed at the Site.

The total volume that would potentially need to be dewatered to maintain all foundations open at the same time would be up to 313,000 L/day. Typical approaches for construction of these types of projects result in only a few individual building foundations being constructed at any one time. It was estimated that precipitation may contribute between 3,910 and 8,813 L/day for a single excavation, in addition to the estimated volumes listed above. The zone of hydraulic influence from building excavations would be less than 24 m. There is potential that hydraulic influence would extend off-site if multiple lots near the Site boundaries were constructed at the same time. Review of the conservatism in the estimates, the likelihood that construction will be carried out in stages, and the effects of seasonality on potential impacts, it is prudent to register the proposed dewatering activity for the subdivision on the EASR and to manage activities such that daily dewatering volumes are maintained below 400,000 L/day.

The following is a summary of the dewatering estimates for each building foundation with footings depths below the water table:

— **Building 1 with proposed footing depths plus 0.5m construction drawdown between 1.0 and 1.5 m below the water table:** The dewatering volumes entering across the walls and the floor of a single excavation is estimated to be up to 58,494 L/day, with an estimated zone of influence (ZOI) of up to 24m. It was estimated that precipitation may contribute up to 3,910 L/day for a single excavation, in addition to the estimated volumes listed above. Dewatering for the construction of the building foundation would likely require registering on the EASR. Registration is recommended based on the potential that the total rate of dewatering at the Site could be between 50,000 L and 400,000 L/day.

— **Building 2 with proposed footing depths plus 0.5m construction drawdown between 0.5 and 1.0 m below the water table:** The dewatering volumes entering across the walls and the floor of a single excavation is estimated to be up to 47,092 L/day, with an estimated zone of influence (ZOI) of up to 15m. It was estimated that precipitation may contribute up to 4,855 L/day for a single excavation, in addition to the estimated volumes listed above. These building foundations could potentially be constructed without registration on the EASR, but registration is prudent to minimize potential for delays.

— **Building 3 with proposed footing depths plus 0.5m construction drawdown between 1.0 and 1.5 m above the water table:** A comparison of the average groundwater elevation and proposed building foundation footing elevations indicates that the footings will be above the water table. These building foundations could potentially be constructed without registration on the EASR, but registration is prudent to minimize potential for delays.

— **Building 4 with proposed footing depths plus 0.5m construction drawdown between 1.0 and 1.5 m above the water table:** A comparison of the average groundwater elevation and the proposed building foundation footing elevations indicates that the footings will be above the water table. These building foundations could potentially be constructed without registration on the EASR, but registration is prudent to minimize potential for delays.

— **Building 5 with proposed footing depths plus 0.5m construction drawdown between 0.5 and 1.0 m above the water table:** A comparison of the average groundwater elevation and the proposed building foundation footing elevations indicates that the footings will be above the water table. These building foundations could potentially be constructed without registration on the EASR, but registration is prudent to minimize potential for delays..

- **Building 6 with proposed footing depths plus 0.5m construction drawdown between 1.0 and 1.5 m below the water table:** The dewatering volumes entering across the walls and the floor of a single excavation is estimated to be up to 78,173 L/day, with an estimated zone of influence (ZOI) of up to 24m. It was estimated that precipitation may contribute up to 6,035 L/day for a single excavation, in addition to the estimated volumes listed above. Dewatering for the construction of the building foundation would likely require registering on the EASR. Registration is recommended based on the potential that the total rate of dewatering at the Site could be between 50,000 L and 400,000 L/day.
- **Building 7 with proposed footing depths plus 0.5m construction drawdown between 1.0 and 1.5 m below the water table:** The dewatering volumes entering across the walls and the floor of a single excavation is estimated to be up to 55,381 L/day, with an estimated zone of influence (ZOI) of up to 15m. It was estimated that precipitation may contribute up to 6,035 L/day for a single excavation, in addition to the estimated volumes listed above. Dewatering for the construction of the building foundation would likely require registering on the EASR. Registration is recommended based on the potential that the total rate of dewatering at the Site could be between 50,000 L and 400,000 L/day.
- **Building 8 with proposed footing depths plus 0.5m construction drawdown between 0.5 and 1.0 m above the water table:** A comparison of the average groundwater elevation and the proposed building foundation footing elevations indicates that the footings will be above the water table. These building foundations could potentially be constructed without registration on the EASR, but registration is prudent to minimize potential for delays.
- **Building 9 with proposed footing depths plus 0.5m construction drawdown between 0.5 and 1.0 m above the water table:** A comparison of the average groundwater elevation and the proposed building foundation footing elevations indicates that the footings will be above the water table. These building foundations could potentially be constructed without registration on the EASR, but registration is prudent to minimize potential for delays..
- **Building 10 with proposed footing depths plus 0.5m construction drawdown between 0 and 0.5 m above the water table:** A comparison of the average groundwater elevation and the proposed building foundation footing elevations indicates that the footings will be above the water table. These building foundations could potentially be constructed without registration on the EASR, but registration is prudent to minimize potential for delays..
- **Building 11 with proposed footing depths plus 0.5m construction drawdown between 0.5 and 1.0 m below the water table:** The dewatering volumes entering across the walls and the floor of a single excavation is estimated to be up to 73,962 L/day, with an estimated zone of influence (ZOI) of up to 15m. It was estimated that precipitation may contribute up to 8,813 L/day for a single excavation, in addition to the estimated volumes listed above. Dewatering for the construction of the building foundation would likely require registering on the EASR. Registration is recommended based on the potential that the total rate of dewatering at the Site could be between 50,000 L and 400,000 L/day.

The dewatering estimates provided herein address dewatering associated with construction of the building foundations and is intended to be conservative to reflect the maximum volume that could be experienced. These calculations only reflect dewatering requirements for construction of the building foundations. Additional dewatering may also be required to construct underground utilities. Ideally, work can be coordinated on the Site so that the combined daily flows from all dewatering can be managed to be less than 400,000 L/day such that a Permit To Take Water is not required.

This assessment does not represent an engineering design of a dewatering operation, but provides a preliminary hydrogeological analysis for assessment of dewatering volumes. The actual design of the dewatering operation will be the responsibility of the contractors.

7.3.2 LONG-TERM DRAINAGE

Based on the observed water table elevations in April and May 2019, some of the proposed building footings will require drainage to maintain dry foundations in seasonally high conditions. WSP understands that the footings are intended to drain by gravity to the storm sewers.

The conservative calculations of the estimated volumes of water that could enter the foundation drains for each building lot are shown in **Table 6**. These calculations show a conservative seepage rate that may be experienced during peak drainage conditions. Foundation seepage calculations are provided in **Appendix H2**.

For long term drainage, the potential requirements for permitting are assessed based on the daily volume that will be removed from a single building block.

The following is a summary of the dewatering estimates for each building block:

- **Building 1 with proposed footing depths between 0.5 and 1.0m below the water table:** The potential rate of seepage into the foundation for this building may be up to 39,785 L/day, with precipitation potentially contributing up to 3,910 L/day during a rain event. This estimated volume is below the threshold requirement for a Category 3 PTTW of 50,000 L/day.
- **Building 2 with proposed footing depths between 0 and 0.5m below the water table:** The potential rate of seepage into the foundation for this building may be up to 31,099 L/day, with precipitation potentially contributing up to 4,855 L/day during a rain event. This estimated volume is below the threshold requirement for a Category 3 PTTW of 50,000 L/day.
- **Building 3 with proposed footing depths between 1.0 and 1.5 m above the water table:** Seepage into the foundation for this building is not anticipated.
- **Building 4 with proposed footing depths between 1.0 and 1.5 m above the water table:** Seepage into the foundation for this building is not anticipated.
- **Building 5 with proposed footing depths between 0.5 and 1.0 m above the water table:** Seepage into the foundation for this building is not anticipated.
- **Building 6 with proposed footing depths between 0.5 and 1.0m below the water table:** The potential rate of seepage into the foundation for this building may be up to 55,381 L/day, with precipitation potentially contributing up to 6,035 L/day during a rain event. This estimated volume is above the threshold requirement for a Category 3 PTTW of 50,000 L/day. Registration is recommended based on the potential that the total rate of long term drainage for this building could be between 50,000 L and 400,000 L/day.
- **Building 7 with proposed footing depths between 0 and 0.5m below the water table:** The potential rate of seepage into the foundation for this building may be up to 37,950 L/day, with precipitation potentially contributing up to 6,035 L/day during a rain event. This estimated volume is below the threshold requirement for a Category 3 PTTW of 50,000 L/day.
- **Building 8 with proposed footing depths between 0.5 and 1.0 m above the water table:** Seepage into the foundation for this building is not anticipated.
- **Building 9 with proposed footing depths between 0.5 and 1.0 m above the water table:** Seepage into the foundation for this building is not anticipated.
- **Building 10 with proposed footing depths between 0 and 0.5 m above the water table:** Seepage into the foundation for this building is not anticipated.
- **Building 11 with proposed footing depths between 0 and 0.5 below the water table:** The potential rate of seepage into the foundation for this building may be up to 53,877 L/day, with precipitation potentially contributing up to 8,813 L/day during a rain event. This estimated volume is above the threshold requirement for a Category 3 PTTW of 50,000 L/day.

7.3.3 CONSTRUCTION DEWATERING FOR INSTALLATION OF UTILITIES

The calculations of the estimated volumes of water that could enter the excavations during the installation of storm and sanitary sewers, watermain and lined filtration trenches are shown in **Table 7**. These calculations show the conservative estimate of the dewatering rate that may be observed per trench segment, ranging in lengths between 3 and 50 m. Dewatering calculations are provided in **Appendix H3**.

The following is a summary of the dewatering estimates for utility installations with similar maximum excavation depths below the water table:

— **Storm sewer (450 mm dia.) trench with proposed pipe invert depths plus 1.0m construction drawdown between 1.0 and 1.5 m below the water table:** The dewatering volumes entering across the walls a single 7 m trench excavation is estimated to be up to 13,206 L/day, with an estimated zone of influence (ZOI) of up to 29m. It was estimated that precipitation may contribute up to 112 L/day, in addition to the estimated volumes listed above. There is one trench segment in this category. Individual trench segments within this category of sewers could be excavated and dewatered without registering on the EASR.

— **Storm sewer (1800mm x 900mm) trench with proposed pipe invert depths plus 1.0m construction drawdown between 2.0 and 2.5 m below the water table:** The dewatering volumes entering across the walls a single trench excavation is estimated to range between 66,203 and 70,876 L/day, with an estimated zone of influence (ZOI) of up to 49m. It was estimated that precipitation may contribute up to 1,282 L/day, in addition to the estimated volumes listed above. There are two trench segments in this category, ranging in lengths between 41 and 46m. This estimated volume is above the threshold requirement for a Category 3 PTTW of 50,000 L/day. Registration is recommended based on the potential that the construction dewatering rate for these installations could be between 50,000 L and 400,000 L/day.

— **Storm sewer (250mm dia.) trench with proposed pipe invert depths plus 1.0m construction drawdown between 2.5 and 3.0m below the water table:** The dewatering volumes entering across the walls a single trench excavation is estimated to be up to 54,065 L/day, with an estimated zone of influence (ZOI) of up to 58m. It was estimated that precipitation may contribute up to 244 L/day, in addition to the estimated volumes listed above. There is one trench segment in this category, with a trench length of 20m. This estimated volume is above the threshold requirement for a Category 3 PTTW of 50,000 L/day. Registration is recommended based on the potential that the construction dewatering rate for these installations could be between 50,000 L and 400,000 L/day.

— **Storm sewer (1800mm x 900mm.) trench with proposed pipe invert depths plus 1.0m construction drawdown between 2.5 and 3.0m below the water table:** The dewatering volumes entering across the walls a single trench excavation is estimated to be up to 90,883 L/day, with an estimated zone of influence (ZOI) of up to 58m. It was estimated that precipitation may contribute up to 1,291 L/day, in addition to the estimated volumes listed above. There is one trench segment in this category, with a trench length of 46m. This estimated volume is above the threshold requirement for a Category 3 PTTW of 50,000 L/day. Registration is recommended based on the potential that the construction dewatering rate for these installations could be between 50,000 L and 400,000 L/day.

— **Storm sewer (200mm dia.) trench with proposed pipe invert depths plus 1.0m construction drawdown between 1.0 and 1.5m below the water table:** The dewatering volumes entering across the walls a single trench excavation is estimated to range between 12,875 and 22,683 L/day, with an estimated zone of influence (ZOI) of up to 29m. It was estimated that precipitation may contribute up to 281L/day, in addition to the estimated volumes listed above. There are two trench segments in this category, ranging in lengths between 8 and 23m. Individual trench segments within this category of sewers could be excavated and dewatered without registering on the EASR.

— **Sanitary sewer (200mm dia.) trench with proposed pipe invert depths plus 1.0m construction drawdown between 2.0 and 2.5 below the water table:** The dewatering volumes entering across the walls a single trench excavation is estimated to range between 57,651and 66,614 L/day, with an estimated zone of influence (ZOI) of up to 49m. It was estimated that precipitation may contribute up to 539 L/day, in addition to the estimated volumes listed above. There are three trench segments in this category, ranging in lengths between 36 and 45m. This estimated volume is above the threshold requirement for a Category 3 PTTW of 50,000 L/day. Registration is recommended based on the potential that the construction dewatering rate for these installations could be between 50,000 L and 400,000 L/day.

— **Sanitary sewer (200mm dia.) trench with proposed pipe invert depths plus 1.0m construction drawdown between 2.5 and 3.0m below the water table:** The dewatering volumes entering across the walls a single trench excavation is estimated to be up to 90,612 L/day, with an estimated zone of influence (ZOI) of up to 58m. It was estimated that precipitation may contribute up to 600 L/day, in addition to the estimated volumes listed above. There is two trench segments in this category, with trench lengths ranging from 20 to 50m. This estimated volume is above the threshold requirement for a Category 3 PTTW of 50,000 L/day. Registration is recommended based on the potential that the construction dewatering rate for these installations could be between 50,000 L and 400,000 L/day.

— **Sanitary sewer (200mm dia.) trench with proposed pipe invert depths plus 1.0m construction drawdown between 3.5 and 4.0 below the water table:** The dewatering volumes entering across the walls a single trench excavation is estimated to range between 108,527 and 118,337 L/day, with an estimated zone of influence (ZOI) of up to 78m. It was estimated that precipitation may contribute up to 491 L/day, in addition to the estimated volumes listed above. There are two trench segments in this category, ranging in lengths between 35 and 41 m. This estimated volume is above the threshold requirement for a Category 3 PTTW of 50,000 L/day. Registration is recommended based on the potential that the construction dewatering rate for these installations could be between 50,000 L and 400,000 L/day.

— **Sanitary sewer (200mm dia.) trench with proposed pipe invert depths plus 1.0m construction drawdown between 4.5 and 5.0 m below the water table:** The dewatering volumes entering across the walls a single trench excavation is estimated to range between 136,834 and 179,899 L/day, with an estimated zone of influence (ZOI) of up to 97m. It was estimated that precipitation may contribute up to 600 L/day, in addition to the estimated volumes listed above. There are four trench segments in this category, ranging in lengths between 16 and 50 m. This estimated volume is above the threshold requirement for a Category 3 PTTW of 50,000 L/day. Registration is recommended based on the potential that the construction dewatering rate for these installations could be between 50,000 L and 400,000 L/day.

— **Sanitary sewer (200mm dia.) trench with proposed pipe invert depths plus 1.0m construction drawdown between 5.0 and 5.5 m below the water table:** The dewatering volumes entering across the walls a single trench excavation is estimated to range between 131,903 and 157,233 L/day, with an estimated zone of influence (ZOI) of up to 107m. It was estimated that precipitation may contribute up to 213 L/day, in addition to the estimated volumes listed above. There are four trench segments in this category, ranging in lengths between 20 and 30 m. This estimated volume is above the threshold requirement for a Category 3 PTTW of 50,000 L/day. Registration is recommended based on the potential that the construction dewatering rate for these installations could be between 50,000 L and 400,000 L/day.

The dewatering estimates provided herein address dewatering associated with construction of the proposed utilities, and is intended to be conservative to reflect the maximum volume that could be experienced. These calculations only reflect dewatering requirements for construction of storm and sanitary sewers in up to 50m trench segments. Ideally, work can be coordinated on the Site so that the combined daily flows from all dewatering can be managed to be less than 400,000 L/day under a registered EASR, such that a Permit To Take Water is not required.

The utilities are to be constructed with low-permeability seals within the backfill below the seasonally high water table to minimize the potential for drainage of water or potential movement of contaminants within the excavated trenches.

This assessment does not represent an engineering design of a dewatering operation, but provides a preliminary hydrogeological analysis for assessment of dewatering volumes. The actual design of the dewatering operation will be the responsibility of the contractors.

7.4 DEWATERING SUMMARY

The conservative calculations of potential volumes of water that may require removal during construction or during long term use of the proposed residences are summarized in **Table 5, Table 6 and Table 7**.

There is potential that the volumes of water to be removed during construction dewatering may be greater than 50,000 L/day but will likely be less than 400,000 L/day. The proposed construction at the site is recommended to be registered as an activity on the EASR. Management may be required to coordinate construction activities such that daily dewatering volumes removed are maintained at less than 400,000 L/day. Records to demonstrate that daily volumes are less than 400,000 L/day for the Site will be a requirement of registration.

WSP notes that the water table is observed to vary by approximately 1.5 m in monitoring wells MW18-1 and MW18-2 during the course of the year, with higher values in the winter and spring and lower values in the summer and fall. Review of the water level data suggests that the foundation in buildings 1, 2, 6, 7 and 11 will be below the seasonally high water table. Water proofing of the foundations is recommended to reduce the potential that water is being removed and thereby complying with Policy DEMD-1 (see Section 6.1).

The potential capacity of the Region of Durham storm sewers to receive these flows has not been evaluated as part of this preliminary evaluation. The estimated rate of pumping to maintain dry foundations will likely exceed 50,000 L/day, and therefore the pumping activity will need to be registered on the EASR. An agreement with the Region of Durham will be required for discharge to be directed to the storm or sanitary sewers.

Review of the water level data suggests that the foundations for the proposed structures will be above the seasonally low water table and that foundation drainage would not occur year round, and may increase in response to precipitation events. Review of proposed foundation levels is recommended to confirm that they are above the seasonally low level.

8 CONCLUSIONS

1 WSP Canada Inc. (WSP) was retained by Westlane Development Group Ltd. to prepare a Hydrogeological Assessment and Water Balance Study for the proposed residential development located at 226 Brock Street East, Uxbridge, Ontario (Site).

2 The proposed development area lies within the Peterborough Drumlin Field physiographic region as defined by Chapman and Putnam (1984). The Peterborough Drumlin Field is typically characterized by rolling till plain. The area in and around the Site consist of clay plains.

3 The Site currently contains a headwater drainage feature that drains northerly across the site and discharges to a culvert beneath Brock Street. The development proposal includes a plan to incorporate the form and function of this headwater drainage feature in a naturalized drainage feature to be constructed along the east side of the property, pending approval of the LSRCA.

4 Based on the stratigraphy observed during the borehole drilling at the Site and well records from MECP Water Well Information System, the Site is predominantly underlain by alternating layers of sand and clay with isolated layers of silt, silty sand/sandy silt and silty clay observed in individual boreholes.

5 Groundwater elevations measured between May 2018 and May 2019 indicate that seasonally high groundwater levels are observed between February and May and also in the late fall, while groundwater levels are observed to be the lowest between July and October.

6 The apparent groundwater flow direction is to the north or northwest. The spacing of monitoring wells and the presence of the headwater drainage feature in the center of the site are factors to be considered in interpreting the groundwater flow direction from groundwater elevation data.

7 Representative groundwater samples were collected from the three (3) monitoring wells on June 21, 2018 and submitted for water quality analysis. The results of the test indicated that parameter concentrations are less than MECP Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition for All Types of Property Use (Coarse Textured Soil).

8 The Climate-Based Water Budget indicates that average annual precipitation over the past 30 years is 886.2 mm/year. The available moisture surplus at the Site ranges between 327.1 mm/year to 341.1 mm/year year depending on the type of soil and vegetation cover. The moisture surplus will reflect the infiltration and runoff based on the soil properties, slopes, and vegetation within individual catchments.

9 Under existing conditions, the Site is considered to be one drainage catchment that drains to the ditch along the northern boundary of the site via overland flow.

10 The Pre-Development Water Budget reflects infiltration for the Site of approximately 6,994 m^3/yr and runoff from the Site of approximately 1,889 m^3/yr.

11 The Post-Development Water Budget reflects changes in land use to include increased areas of impervious surfaces (i.e. roads, buildings etc.) and re-grading. A naturalized drainage feature, with swales and soakaway pits is proposed to be constructed to replace the form and function of the headwater drainage feature. The proposed development conditions have been subdivided into six (6) on-site catchments. Runoff within the developed portion of the site is primarily captured by stormwater drainage systems.

12 The Stormwater Management Plan prepared by *IBI* incorporates Low Impact Development features in the form of an infiltration trench in the centre of the development to infiltrate runoff that is generated from rooftops and rear lots in the centre block of the development. The effect of these features is considered in the Post-Development Water Budget.

13 The Post-Development Water Budget predicts a net on-site infiltration of 5,610 m^3/yr. Approximately 2,557 m^3/yr of this infiltration is generated through the proposed LID measures. This reflects a net reduction of 1,385 m^3/yr or 20% relative to Pre-Development. Additional opportunities to further mitigate the infiltration deficit have not been identified.

14 The Post-Development Water Budget predicts a net runoff of 9,382 m^3/yr over the Site area. This is an increase of 7,493 m^3/yr (397%) relative to Pre-Development.

15 The Site lies within WHPA-Q1 and WHPA-Q2 for the Uxbridge Water Supply system with assigned stress levels of moderate. Source Protection Plan (SPP) policies for WHPA-Q1 apply to areas where activities that take water without returning it to the same source may be a threat. SPP policies for WHPA-Q2 apply to areas where activities that reduce recharge might be a threat. Based on the estimated volumes of water that may require removal during construction and long-term drainage of the residential condominium, the Site will need

to comply further with policies for WHPA-Q1. Policy number DEMD-1 of the Approved Source Protection Plan for the South Georgian Bay Lake Simcoe Protection Region will apply to the water taking activities during the dewatering for construction and long-term drainage. Policies associated with WHPA – Q2 may apply to offset identified infiltration deficit relative to pre-development conditions.

16 The Site lies within Intake Protection Zone 3 (IPZ-3) for water supplies that draw from Lake Simcoe. The proposed residential activities at the Site are not considered to present an increased risk to water quality for these water supplies.

17 The Site is mapped as a Highly Vulnerable Aquifer in the Approved Assessment Report for the Lakes Simcoe and Couchiching Source Protection Area. The proposed land use as residential is expected to have minimal potential to affect underlying groundwater resources.

18 The majority of the Site is mapped as an SGRA in the Approved Assessment Report for the Lakes Simcoe and Couchiching Source Protection Area. The water balance assessment demonstrates that the proposed mitigation enhance recharge from pre-development levels.

19 The estimated pumping rate that may be experienced to maintain dry conditions during construction of building foundations is up to 78,173 L/day. WSP recommends that the dewatering activity be registered on the EASR prior to construction. Additional groundwater quality testing is recommended to confirm suitability for discharge to nearby Region of Durham storm sewers.

20 The proposed footing elevations in the south-west portion of the Site are below the seasonally high water table. Estimates of the dewatering rates to maintain dry foundations are up to 55,381 L/day, including a 1.5 factor of safety. Water proofing of the foundations is recommended to reduce the potential that water is being removed and to thereby comply with Policy DEMD-1.

This concludes the Hydrogeological Assessment and Water Balance Study. We trust that this report satisfies your requirements. If you have any questions or concerns regarding this report, do not hesitate to contact our office.

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TABLES

TABLE 1
GROUNDWATER ELEVATIONS
HYDROGEOLOGICAL STUDY AND WATER BALANCE ASSESSMENT
226 BROCK STREET
UXBRIDGE, ON

Monitor Designation	Elevation of T.O.P mASL	Elevation of Ground Surface mASL	PVC Casing Stick-up m	Measurement Date	Depth to Water m bmp	Depth to Water m bgl	Groundwater Elevation (local benchmark) m ASL	Approximate Ground Elevation m ASL	Approximate Groundwater Elevation m ASL
MW18-1	100.21	99.28	0.93	28-May-18	2.45	1.52	97.76	271.68	270.16
				21-Jun-18	2.78	1.85	97.43		269.83
				18-Jul-18	3.20	2.27	97.01		269.41
				9-Aug-18	2.49	1.56	97.72		270.12
				12-Sep-18	2.92	1.99	97.29		269.69
				19-Oct-18	2.97	2.04	97.23		269.64
				21-Nov-18	2.51	1.58	97.70		270.10
				18-Dec-19	2.28	1.35	97.93		270.33
				29-Jan-19	2.71	1.78	97.50		269.90
				15-Feb-19	2.79	1.86	97.42		269.82
				19-Mar-19	2.93	2.00	97.28		269.68
				22-Apr-19	1.84	0.91	98.37		270.77
				15-May-19	1.67	0.74	98.54		270.94
				19-Aug-20	3.13	2.20	97.08		269.48
MW18-2	100.09	99.08	1.02	28-May-18	1.97	0.95	98.13	271.99	271.04
				21-Jun-18	2.24	1.22	97.86		270.77
				18-Jul-18	2.46	1.44	97.63		270.55
				9-Aug-18	1.79	0.77	98.30		271.22
				12-Sep-18	2.07	1.06	98.02		270.93
				19-Oct-18	1.93	0.91	98.17		271.08
				21-Nov-18	1.64	0.62	98.46		271.37
				18-Dec-19	1.57	0.55	98.53		271.44
				29-Jan-19	1.80	0.78	98.29		271.21
				15-Feb-19	1.81	0.79	98.28		271.20
				19-Mar-19	1.70	0.68	98.39		271.31
				22-Apr-19	1.11	0.09	98.98		271.90
				15-May-19	1.20	0.18	98.89		271.81
				19-Aug-20	2.80	1.78	97.29		270.21
MW18-3	97.60	96.72	0.88	28-May-18	1.06	0.18	96.54	269.97	269.79
				21-Jun-18	1.09	0.20	96.52		269.77
				18-Jul-18	1.07	0.19	96.53		269.78
				9-Aug-18	1.00	0.12	96.60		269.85
				12-Sep-18	1.07	0.19	96.53		269.78
				19-Oct-18	1.14	0.25	96.47		269.72
				21-Nov-18	1.04	0.15	96.57		269.82
				18-Dec-19	-	-	-		-
				29-Jan-19	frozen @ 0.97	0.09	96.63		269.88
				15-Feb-19	frozen @ 0.97	0.09	96.63		269.88
				19-Mar-19	frozen @ 0.97	0.09	96.63		269.88
				22-Apr-19	0.99	0.10	96.62		269.87
				5-May-19	1.00	0.12	96.60		269.85
				19-Aug-20	1.18	0.30	96.42		269.67

Notes:

1) "m" indicates metres.
2) "m bmp" indicates metres below measurement point, which is the top of pipe (referred to as T.O.P.)
3) "m bgl" indicates metres below ground level.
4) "m ASL" indicates metres above sea level.
5) Approximate ground and groundwater elevations were determined based on the topographic survey completed by H.F. Grander Co. Ltd.
6) Approximate groundwater elevations highlight represent seasonally high levels observed at the monitoring well location

Table 2
WATER QUALITY RESULTS
HYDROGEOLOGICAL STUDY AND WATER BALANCE ASSESSMENT
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

Parameters	UNIT	Table 2 SCS (1)	MW18-1	MW18-2	MW18-3	DUP (MW18-3)
Sample Date			21-Jun-18	21-Jun-18	21-Jun-18	21-Jun-18
Calculated Parameters						
Anion Sum	me/L	-	3.56	8.3	12.0	11.8
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	202	293	377	372
Calculated TDS	mg/L	-	224	506	712	706
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<10	<10	<10	<10
Cation Sum	me/L	-	4.70	10.00	13.60	13.50
Hardness (CaCO3)	mg/L	-	215	324	480	478
Ion Balance (% Difference)	%	-	132.00	121.00	113.00	114.00
Langelier Index (@ 4C)	N/A	-	0.500	1.000	0.600	0.700
Saturation pH (@ 4C)	N/A	-	7.21	6.95	6.73	6.74
Inorganics						
Total Ammonia-N	mg/L	-	0.13	0.113	0.296	0.354
Conductivity	umho/cm	-	383	878	1240	1230
Dissolved Organic Carbon	mg/L	-	2.0	3.4	3.8	4.7
Orthophosphate (P)	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030
pH	pH	-	7.74	7.94	7.31	7.39
Dissolved Sulphate (SO4)	mg/L	-	8.4	11.7	33.3	34
Alkalinity (Total as CaCO3)	mg/L	-	202	293	377	372
Dissolved Chloride (Cl)	mg/L	790	1	112	181	178
Nitrite (N)	mg/L	-	<0.010	<0.010	<0.010	<0.010
Nitrate (N)	mg/L	-	0.147	0.06	<0.020	<0.020
Nitrate + Nitrite (N)	mg/L	-	0.147	0.06	<0.022	<0.022
Metals						
Dissolved Aluminum (Al)	mg/L	-	0.0323	0.0098	<0.0050	<0.0050
Dissolved Antimony (Sb)	mg/L	0.006	0.00027	0.00013	<0.00010	0.00014
Dissolved Arsenic (As)	mg/L	0.025	0.00052	0.0008	0.00178	0.00375
Dissolved Barium (Ba)	mg/L	1	0.03	0.127	0.195	0.237
Dissolved Beryllium (Be)	mg/L	0.004	<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Boron (B)	mg/L	5	0.024	0.022	0.031	0.033
Dissolved Cadmium (Cd)	mg/L	0.0027	<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Calcium (Ca)	mg/L	-	79	113	161	160
Dissolved Chromium (Cr)	mg/L	0.05	0.00079	<0.00050	<0.00050	<0.00050
Dissolved Cobalt (Co)	mg/L	0.0038	<0.00010	0.00013	0.00072	0.00074
Dissolved Copper (Cu)	mg/L	0.087	0.00067	0.00537	0.00027	<0.00020
Dissolved Iron (Fe)	mg/L	-	0.035	0.023	1.88	0.47
Dissolved Lead (Pb)	mg/L	0.01	0.000053	0.000162	0.000055	<0.000050
Dissolved Magnesium (Mg)	mg/L	-	4	10	19	19
Dissolved Manganese (Mn)	mg/L	-	0.01	0.0332	3.3700	2.9100
Dissolved Molybdenum (Mo)	mg/L	0.07	0.0034	0.00122	0.000547	0.000814
Dissolved Nickel (Ni)	mg/L	0.1	<0.00050	0.00074	0.002	0.00226
Dissolved Phosphorus (P)	mg/L	-	<0.050	<0.050	<0.050	<0.050
Dissolved Potassium (K)	mg/L	-	0.6	2.3	1.2	1.4
Dissolved Selenium (Se)	mg/L	0.01	0.000501	0.000132	<0.000050	<0.000050
Dissolved Silicon (Si)	mg/L	-	4.9	5.2	8.6	8.4
Dissolved Silver (Ag)	mg/L	0.0015	<0.000050	<0.000050	<0.000050	<0.000050
Dissolved Sodium (Na)	mg/L	-	9	80	90	91
Dissolved Strontium (Sr)	mg/L	-	0.15	0.28	0.38	0.38
Dissolved Thallium (Tl)	mg/L	0.002	<0.000010	0.000013	<0.000010	<0.000010
Dissolved Titanium (Ti)	mg/L	-	0.00142	<0.00030	<0.00030	<0.00030
Dissolved Uranium (U)	mg/L	0.02	0.0007	0.00119	0.00033	0.00049
Dissolved Vanadium (V)	mg/L	0.0062	0.0007	0.00098	<0.00050	0.00134
Dissolved Zinc (Zn)	mg/L	1.1	0.0015	0.0115	0.0019	<0.0010

NOTES

1) Table 2 SCS = Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act (April 2011).

2) Yellow shading indicates parameter reportable detection

TABLE 3
CLIMATIC WATER BUDGET SUMMARY TABLE
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

Year of Climate Data Used	Total Adjusted Potential Evapotranspiration	Total Water Surplus	Total Precipitation	Soil Type	Land Use	Water Holding Capacity	Total Actual Evapotranspiration	Total Moisture Surplus used for Water Balance
	mm/yr	mm/yr	mm/yr			mm/yr	mm/yr	mm/yr
CLIMATE NORMAL 1981-2010	579.3	306.9	886.2	Fine Sandy Loam	Residential Lawn	75	545.1	341.1
					Cultivated	150	559.1	327.1
					Uncultivated	200	559.1	327.1

NOTES:
1) Water Holding Capacity obtained from Environmental Design Criteria of the SWM Planning and Design Manual published by the MOE in 2003.

TABLE 4 WATER BALANCE SUMMARY
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

A. OVERALL WATER BALANCE

Characteristics		Pre-development		Post-development (No Recharge mitigation)		Change	
		Volume (m^3/yr)	mm/yr	Volume (m^3/yr)	mm/yr	Volume (m^3/yr)	%
Input	Precipitation	23,146	886	23,146	886	0	0%
	Runon	0	0	0	0	0	0.0%
	Total In	**23,146**	**886**	**23,146**	**886**	**0**	**0.00%**
Output	Infiltration via Pervious Areas	6,365	244	3,053	117	-3,312	-52%
	Add: Additional Headwater Infiltration	630	24	0	0	-630	-100%
	Add: Infiltration via Rooftop Disconnect	0	0	1,685	65	1,685	>100%
	Add: Infiltration via Infiltration Trench	0	0	872	33	872	>100%
	Total Infiltration	6,994	268	5,610	215	-1,385	**-20%**
	Total Run-off	2,519	96	11,939	457	9,420	374.0%
	Less: Runoff Infiltrated by Headwater	-630	-24	0	0	630	-100.0%
	Less: Infiltration via Rooftop Disconnect	0	0	-1,685	-65	-1,685	-100.0%
	Less: Infiltration via Infiltration Trench	0	0	-872	-33	-872	-100.0%
	Net Runoff	1,889	72	9,382	359	7,493	396.6%
	Evapotranspiration	14,262	546	8,154	312	-6,108	-42.8%
	Total Out	**23,146**	**886**	**23,146**	**886**	**0**	**0.00%**

TABLE 5 CONSTRUCTION DEWATERING ESTIMATES SUMMARY - BUILDINGS

UPDATED HYDROGEOLOGICAL STUDY AND WATER BALANCE ASSESSMENT
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

Building Number	Building Type	Length	Width	Area	Footing Depth Below Water Table	Footing Depth + 0.5m Below Water Table	Footing Depth Above Water Table	Construction Conservative Rate			Total Estimated Value	Precipitation Contribution Per Building
								Estimated Value	With Safety Factor	Maximum ZOI		
		(m)	(m)	(m^2)	(m)	(m)	(m)	(L/day)	(L/day)	(m)	(L/day)	(L/day)
1	A	29.4	13.3	391.0	0.5-1.0	1.0-1.5	NA	38,996	58,494	24	58,494	3,910
2	B	36.5	13.3	485.5	0-0.5	0.5-1.0	NA	31,395	47,092	15	47,092	4,855
3	C	35.4	14.2	502.7	NA	NA	1.0-1.5	NA	NA	NA	NA	5,027
4	D	42.5	14.2	603.5	NA	NA	1.0-1.5	NA	NA	NA	NA	6,035
5	D	42.5	14.2	603.5	NA	NA	0.5-1.0	NA	NA	NA	NA	6,035
6	D	42.5	14.2	603.5	0.5-1.0	1.0-1.5	NA	52,115	78,173	24	78,173	6,035
7	D	42.5	14.2	603.5	0-0.5	0.5-1.0	NA	36,921	55,381	15	55,381	6,035
8	D	42.5	14.2	603.5	NA	NA	0.5-1.0	NA	NA	NA	NA	6,035
9	D	42.5	14.2	603.5	NA	NA	0.5-1.0	NA	NA	NA	NA	6,035
10	E	54.4	16.2	881.3	NA	NA	0-0.5	NA	NA	NA	NA	8,813
11	E	54.4	16.2	881.3	0-0.5	0.5-1.0	NA	49,308	73,962	15	73,962	8,813
Total								**209,000**	**313,000**	**-**	**313,000**	**68,000**

Note: NA - Not Applicable

TABLE 6 DRAINAGE DEWATERING ESTIMATES SUMMARY - BUILDINGS

UPDATED HYDROGEOLOGICAL STUDY AND WATER BALANCE ASSESSMENT

226 BROCK STREET EAST

UXBRIDGE, ONTARIO

Building Number	Building Type	Length	Width	Area	Footing Depth Below Water Table	Footing Depth Above Water Table	Construction Conservative Rate			Total Estimated Value	Precipitation Contribution Per Building
							Estimated Value	With Safety Factor	Maximum ZOI		
		(m)	(m)	(m^2)	(m)	(m)	(L/day)	(L/day)	(m)	(L/day)	(L/day)
1	A	29.4	13.3	391.0	0.5-1.0	NA	26,524	39,785	15	39,785	3,910
2	B	36.5	13.3	485.5	0-0.5	NA	20,732	31,099	5	31,099	4,855
3	C	35.4	14.2	502.7	NA	1.0-1.5	NA	NA	NA	NA	5,027
4	D	42.5	14.2	603.5	NA	1.0-1.5	NA	NA	NA	NA	6,035
5	D	42.5	14.2	603.5	NA	0.5-1.0	NA	NA	NA	NA	6,035
6	D	42.5	14.2	603.5	0.5-1.0	NA	36,921	55,381	15	55,381	6,035
7	D	42.5	14.2	603.5	0-0.5	NA	25,300	37,950	5	37,950	6,035
8	D	42.5	14.2	603.5	NA	0.5-1.0	NA	NA	NA	NA	6,035
9	D	42.5	14.2	603.5	NA	0.5-1.0	NA	NA	NA	NA	6,035
10	E	54.4	16.2	881.3	NA	0-0.5	NA	NA	NA	NA	8,813
11	E	54.4	16.2	881.3	0-0.5	NA	35,918	53,877	5	53,877	8,813
Total							**145,000**	**218,000**	**-**	**218,000**	**68,000**

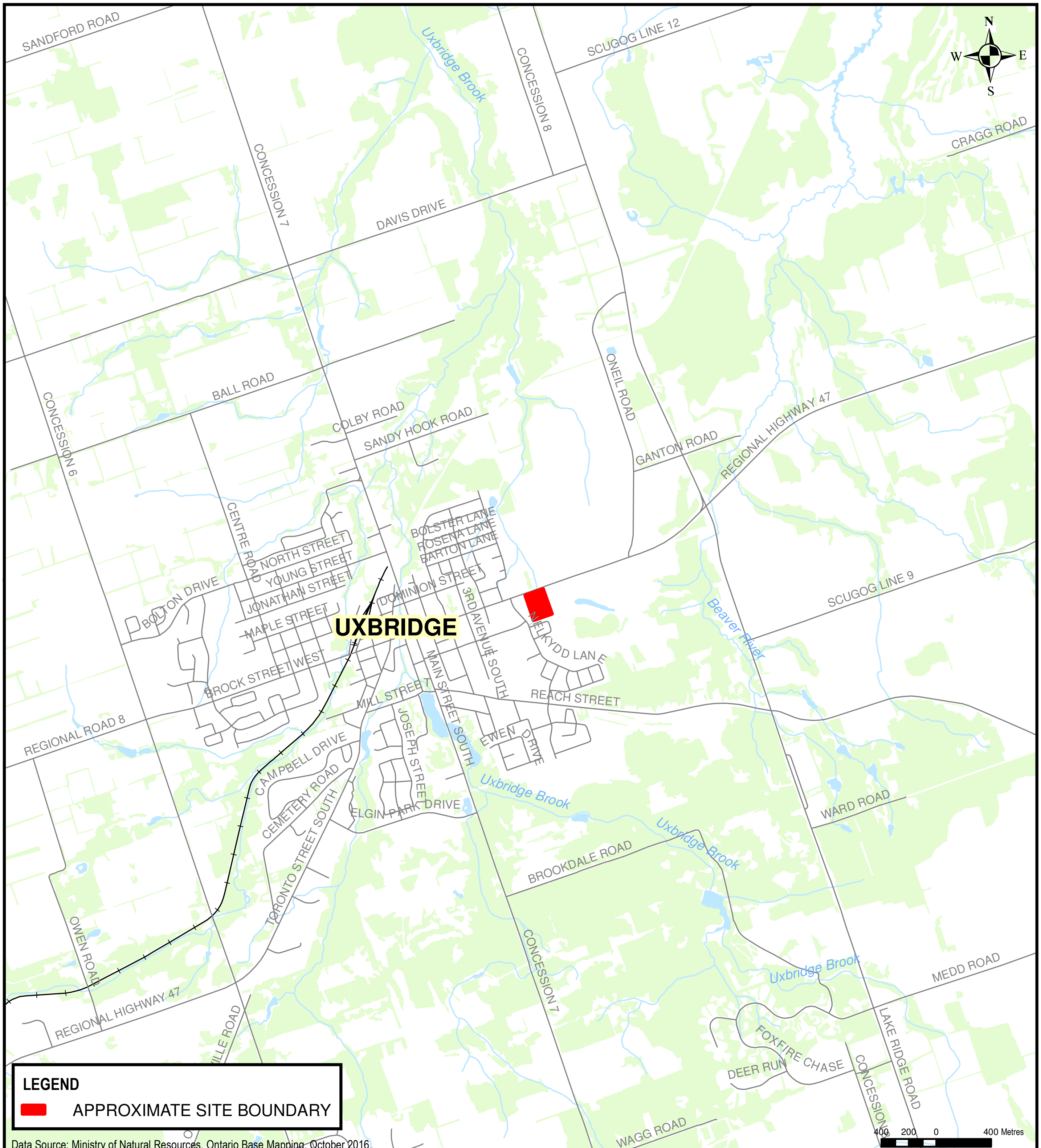
Note: NA - Not Applicable

TABLE 7 CONSTRUCTION DEWATERING ESTIMATES SUMMARY - UTILITIES
UPDATED HYDROGEOLOGICAL STUDY AND WATER BALANCE ASSESSMENT
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

Servicing Segment	Type of Servicing	Total Trench Length	Open Trench Length During Construction	No. of Trench Segments	Width	Sewer Depth Below Water Table	Sewer Depth + 1.0 m Below Water Table	Initial Elevation of Water Table	Sewer Depth Above Water Table	Construction Conservative Rate			Number of Trench Segments	Total Estimated Value	Precipitation Contribution Per Trench
										Estimated Value Per Trench	With Safety Factor	Maximum ZOI			
		(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(L/day)	(L/day)	(m)		(L/day)	(L/day)
Between STM MH11 and MH12	Storm (450mm dia.)	16.7	16.7	1.0	1.5	NA	NA	NA	0.5-1.0	0	0	0	1.0	0	242
Between STM MH11 and MH12	Storm (450mm dia.)	16.8	16.8	1.0	1.5	NA	NA	NA	>1.0	0	0	0	1.0	0	244
Between STM MH10 nad MH11	Storm (450mm dia.)	5.2	5.2	1.0	1.5	NA	NA	NA	0.5-1.0	0	0	0	1.0	0	75
Between STM MH11 and Jellyfish	Storm (450mm dia.)	3.4	3.4	1.0	1.5	NA	NA	NA	0-0.5	0	0	0	1.0	0	49
Between STM MH10 and Jellyfish	Storm (450mm dia.)	3.3	3.3	1.0	1.5	NA	NA	NA	0-0.5	0	0	0	1.0	0	48
Between STM MH9 and MH10	Storm (450mm dia.)	7.7	7.7	1.0	1.5	0-0.5	1.0-1.5	1.5	NA	13,206	13,206	29	1.0	13,206	112
Between STM MH8 and MH9	Storm (450mm dia.)	15.9	15.9	1.0	1.5	NA	NA	NA	0-0.5	0	0	0	1.0	0	231
Between STM MH8 and MH9	Storm (450mm dia.)	15.7	15.7	1.0	1.5	NA	NA	NA	0.5-1.0	0	0	0	1.0	0	228
Between STM MH2 and MH8	Storm (1800mm x 900mm)	40.8	40.8	1.0	2.8	1.0-1.5	2.0-2.5	2.5	NA	66,203	66,203	49	1.0	66,203	1,142
Between STM MH2 and MH8	Storm (1800mm x 900mm)	40.8	40.8	1.0	2.8	NA	NA	NA	0-0.5	0	0	0	1.0	0	1,142
Between STM MH1 and MH2	Storm (250mm dia.)	19.5	19.5	1.0	1.3	1.5-2.0	2.5-3.0	3	NA	54,065	54,065	58	1.0	54,065	244
Between STM MH2 and MH3	Storm (1800mm x 900mm)	46.1	46.1	1.0	2.8	1.5-2.0	2.5-3.0	3	NA	90,883	90,883	58	1.0	90,883	1,291
Between STM MH2 and MH3	Storm (1800mm x 900mm)	45.8	45.8	1.0	2.8	1.0-1.5	2.0-2.5	2.5	NA	70,876	70,876	49	1.0	70,876	1,282
Between STM MH7 and MH8	Storm (1800mm x 900mm)	53.9	50.0	1.1	2.8	NA	NA	NA	0.5-1.0	0	0	0	1.1	0	1,400
East of CBMH1	Storm (250mm dia.)	4.8	4.8	1.0	1.3	NA	NA	NA	0.5-1.0	0	0	0	1.0	0	60
East of CBMH1	Storm (250mm dia.)	33.2	33.2	1.0	1.3	NA	NA	NA	>1.0	0	0	0	1.0	0	415
Between STM MH6 and MH7	Storm (1800mm x 900mm)	54.1	50.0	1.1	2.8	NA	NA	NA	0.5-1.0	0	0	0	1.1	0	1,400
Between STM MH5 and MH6	Storm (1800mm x 900mm)	29.2	29.2	1.0	2.8	NA	NA	NA	0-0.5	0	0	0	1.0	0	818
Between STM MH5 and MH13	Storm (200mm dia.)	7.6	7.6	1.0	1.2	NA	NA	NA	0-0.5	0	0	0	1.0	0	91
Between STM MH5 and MH13	Storm (200mm dia.)	7.6	7.6	1.0	1.2	0-0.5	1.0-1.5	1.5	NA	12,875	12,875	29	1.0	12,875	91
Between STM MH13 to RLCB8	Storm (200mm dia.)	23.4	23.4	1.0	1.2	0-0.5	1.0-1.5	1.5	NA	22,683	22,683	29	1.0	22,683	281
Between STM MH4 and MH6	Storm (1800mm x 900mm)	70.0	50.0	1.4	2.8	NA	NA	NA	0-0.5	0	0	0	1.4	0	1,400
Between STM MH4 and MH14	Storm (200mm dia.)	5.7	5.7	1.0	1.2	NA	NA	NA	0-0.5	0	0	0	1.0	0	68
Between STM MH14 and RLCB7	Storm (200mm dia.)	24.8	24.8	1.0	1.2	NA	NA	NA	0-0.5	0	0	0	1.0	0	298
North of STM CBMH4	Storm (300mm dia.)	30.7	30.7	1.0	1.3	NA	NA	NA	0-0.5	0	0	0	1.0	0	399
Between STM CBMH4 and RLCB6	Storm (200mm dia.)	47.9	47.9	1.0	1.2	NA	NA	NA	0-0.5	0	0	0	1.0	0	575
									Sub Total for Storm Sewers	**331,000**	**331,000**			**331,000**	**14,000**
Between SAN MH1A and MH2A	Sanitary (200mm dia.)	40.3	40.3	1.0	1.2	1.0-1.5	2.0-2.5	2.5	NA	62,264	62,264	49	1.0	62,264	484
Between SAN MH2A and MH4A	Sanitary (200mm dia.)	44.9	44.9	1.0	1.2	1.0-1.5	2.0-2.5	2.5	NA	66,614	66,614	49	1.0	66,614	539
etween SAN MH2A and MH4A, MH3A and MH4	Sanitary (200mm dia.)	69.4	50	1.4	1.2	1.5-2.0	2.5-3.0	3	NA	90,612	90,612	58	1.4	125,770	600
Between SAN MH4A and LIFT	Sanitary (200mm dia.)	40.9	40.9	1.0	1.2	2.5-3.0	3.5-4.0	4	NA	118,337	118,337	78	1.0	118,337	491
Between SAN MH4A and LIFT	Sanitary (200mm dia.)	40.3	40.3	1.0	1.2	3.5-4.0	4.5-5.0	5	NA	160,008	160,008	97	1.0	160,008	484
Between SAN LIFT and MH8A	Sanitary (75mm dia.)	19.8	19.8	1.0	1.1	4.0-4.5	5.0-5.5	5.5	NA	131,903	131,903	107	1.0	131,903	213
Between SAN LIFT and MH8A	Sanitary (75mm dia.)	19.8	19.8	1.0	1.1	NA	NA	NA	0-0.5	0	0	0	1.0	0	213
Between SAN LIFT and MH7A	Sanitary (200mm dia.)	29.4	29.4	1.0	1.2	4.0-4.5	5.0-5.5	5.5	NA	157,233	157,233	107	1.0	157,233	353
Between SAN LIFT and MH7A	Sanitary (200mm dia.)	29.4	29.4	1.0	1.2	3.5-4.0	4.5-5.0	5	NA	136,834	136,834	97	1.0	136,834	353
Between SAN MH6A and MH7A	Sanitary (200mm dia.)	56.0	50	1.1	1.2	3.5-4.0	4.5-5.0	5	NA	179,899	179,899	97	1.1	201,487	600
Between SAN MH5A and MH6A	Sanitary (200mm dia.)	34.9	34.9	1.0	1.2	2.5-3.0	3.5-4.0	4	NA	108,527	108,527	78	1.0	108,527	419
Between SAN MH5A and MH6A	Sanitary (200mm dia.)	35.5	35.5	1.0	1.2	1-1.5	2.0-2.5	2.5	NA	57,651	57,651	49	1.0	57,651	426
									Sub Total for Sanitary Sewers	**1,270,000**	**1,270,000**			**1,327,000**	**5,000**
									Total	**1,601,000**	**1,601,000**			**1,657,000**	**19,000**

Note: NA - Not Applicable

FIGURES



Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

wsp

126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

PROJECT: HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY 226 BROCK STREET EAST, UXBRIDGE, ONTARIO	SCALE: 1:40,000		
	DRAWN BY: TP	CHECKED BY: LL	
TITLE: SITE LOCATION MAP	PROJECT NO: 181-06778-01		
	DATE: MARCH 2021		
CLIENT: WESTLANE DEVELOPMENT GROUP LTD.	FIGURE NO: 1	REV.: -	

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 1 Location Map.mxd

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

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126 DON HILLOCK DRIVE, UNIT 2
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TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

PROJECT: HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY 226 BROCK STREET EAST, UXBRIDGE, ONTARIO

TITLE: EXISTING CONDITIONS

CLIENT: WESTLANE DEVELOPMENT GROUP LTD.

SCALE: 1:2,500

DRAWN BY: TP

CHECKED BY: LL

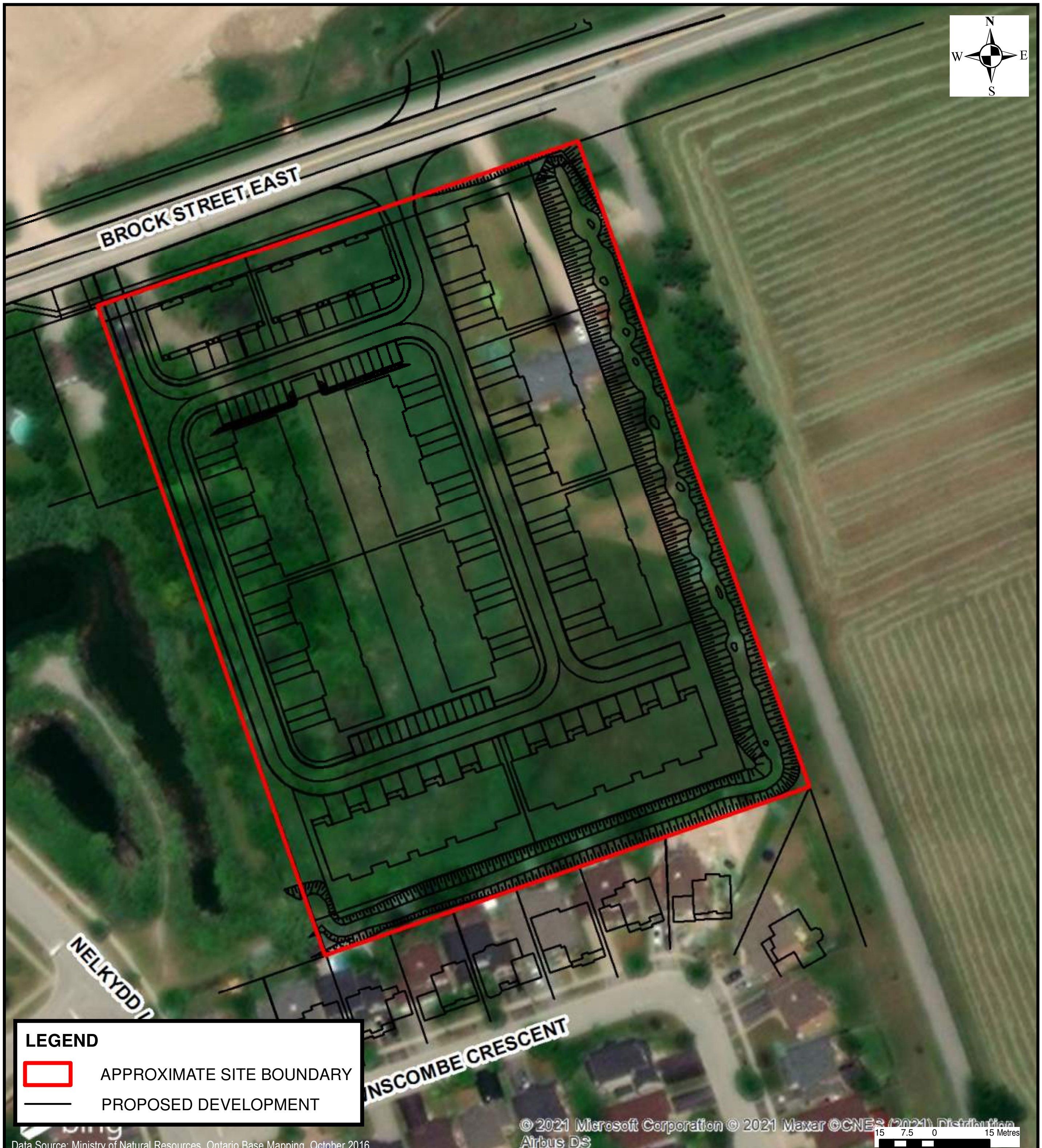
PROJECT NO: 181-06778-01

DATE: MARCH 2021

FIGURE NO: 2

REV.: -

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 2 Existing Conditions.mxd



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AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

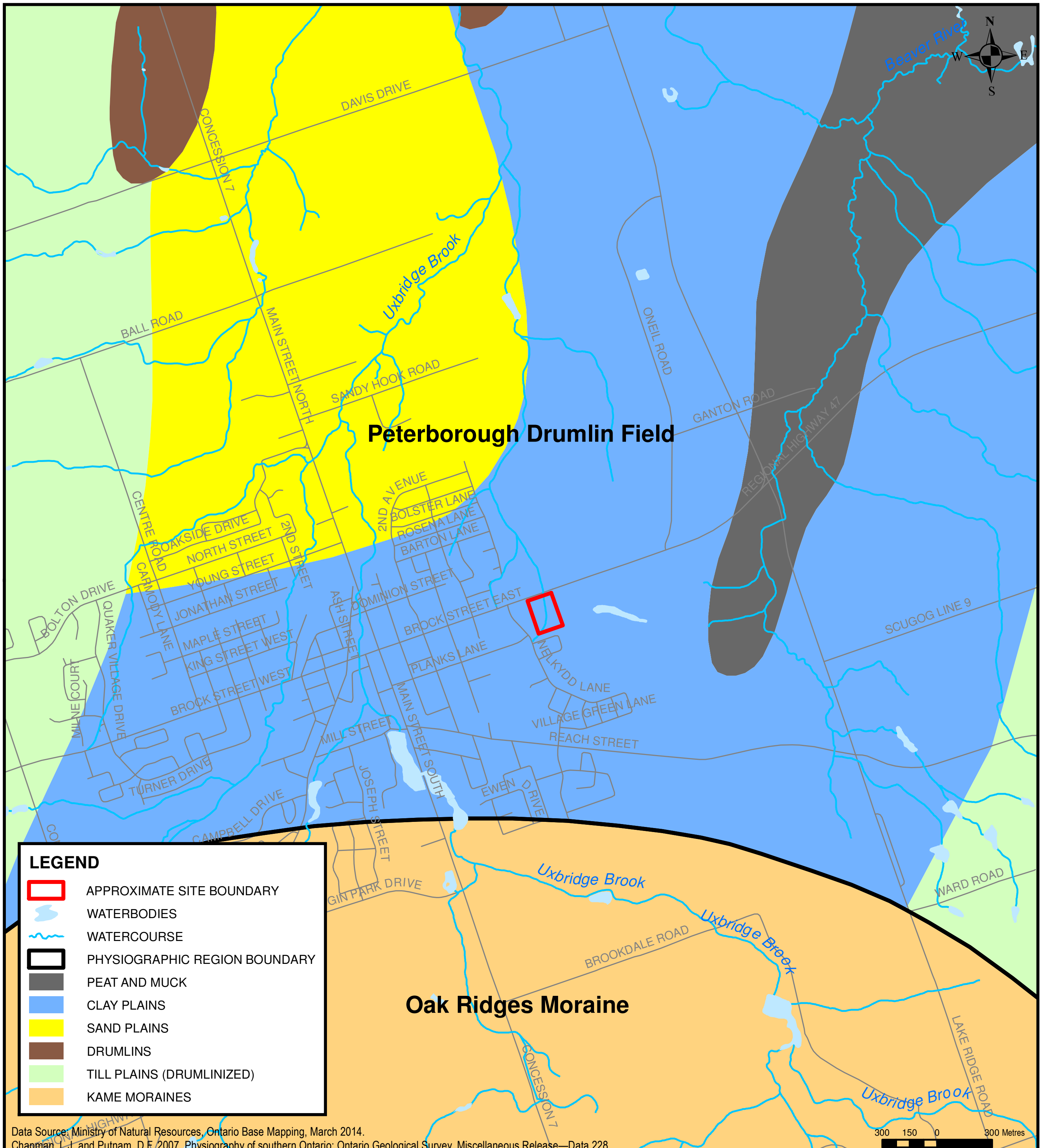
PROJECT:
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST, UXBRIDGE, ONTARIO

TITLE:
PROPOSED DEVELOPMENT

CLIENT:
WESTLANE DEVELOPMENT GROUP LTD.

SCALE:	1:1,500
DRAWN BY:	TP
CHECKED BY:	LL
PROJECT NO:	181-06778-01
DATE:	MARCH 2021
FIGURE NO:	3
REV.:	-

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 3 Proposed Development.mxd

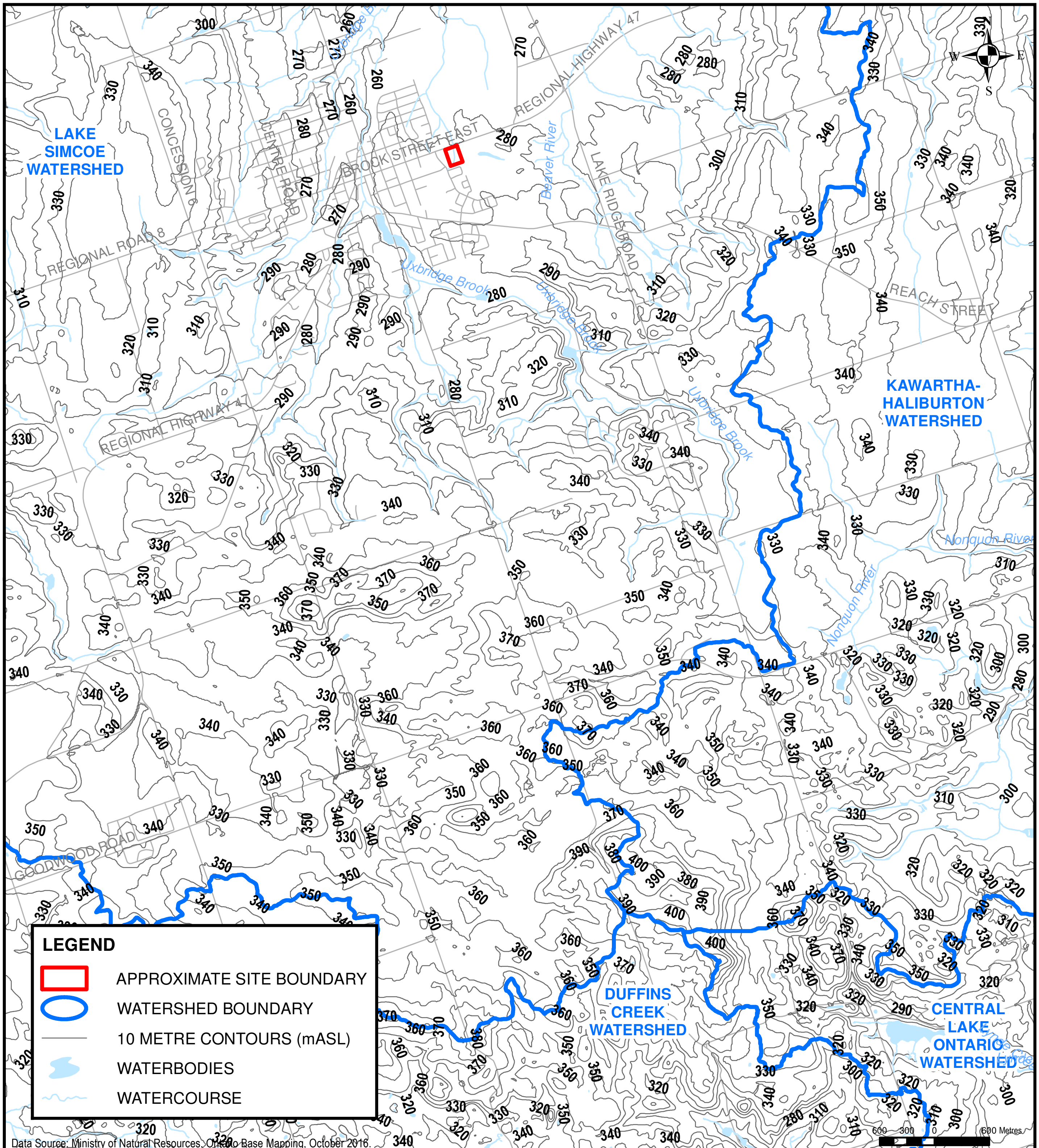


Data Source: Ministry of Natural Resources, Ontario Base Mapping, March 2014.
Chapman, L.J. and Putnam, D.F. 2007. Physiography of southern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 228.

wsp
126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

PROJECT: HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY 226 BROCK STREET EAST, UXBRIDGE, ONTARIO	SCALE: 1:30,000
	DRAWN BY: TP
	CHECKED BY: LL
TITLE: REGIONAL PHYSIOGRAPHY	PROJECT NO: 181-06778-01
	DATE: MARCH 2021
CLIENT: WESTLANE DEVELOPMENT GROUP LTD.	FIGURE NO: 4
	REV.: -

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 4 Physiography.mxd



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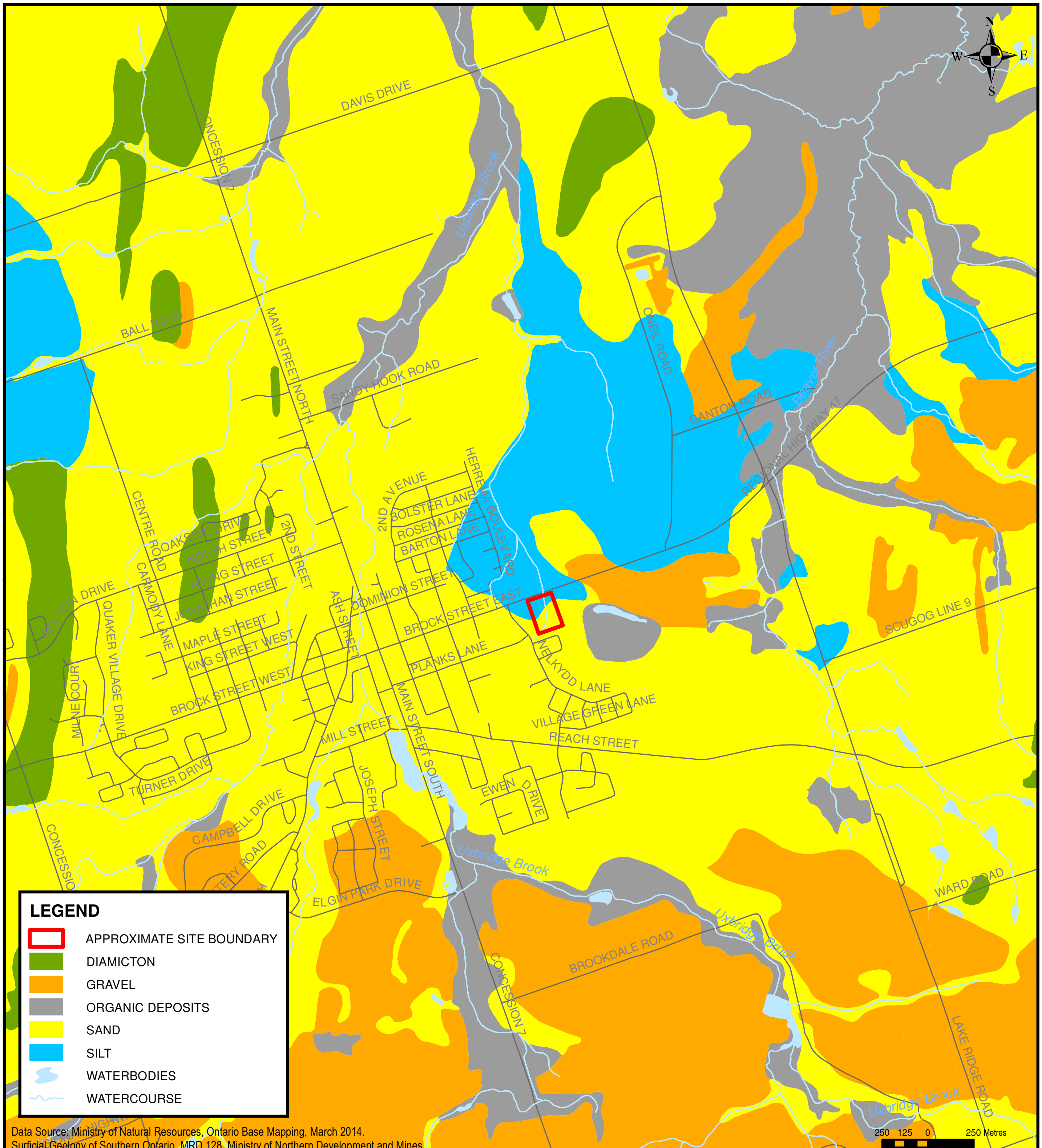
PROJECT: HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY 226 BROCK STREET EAST, UXBRIDGE, ONTARIO	SCALE: 1:60,000
	DRAWN BY: TP — CHECKED BY: LL
TITLE: REGIONAL TOPOGRAPHY AND DRAINAGE	PROJECT NO: 181-06778-01
	DATE: MARCH 2021
CLIENT: WESTLANE DEVELOPMENT GROUP LTD.	FIGURE NO: 5 — REV.: -

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 5 Drainage.mxd



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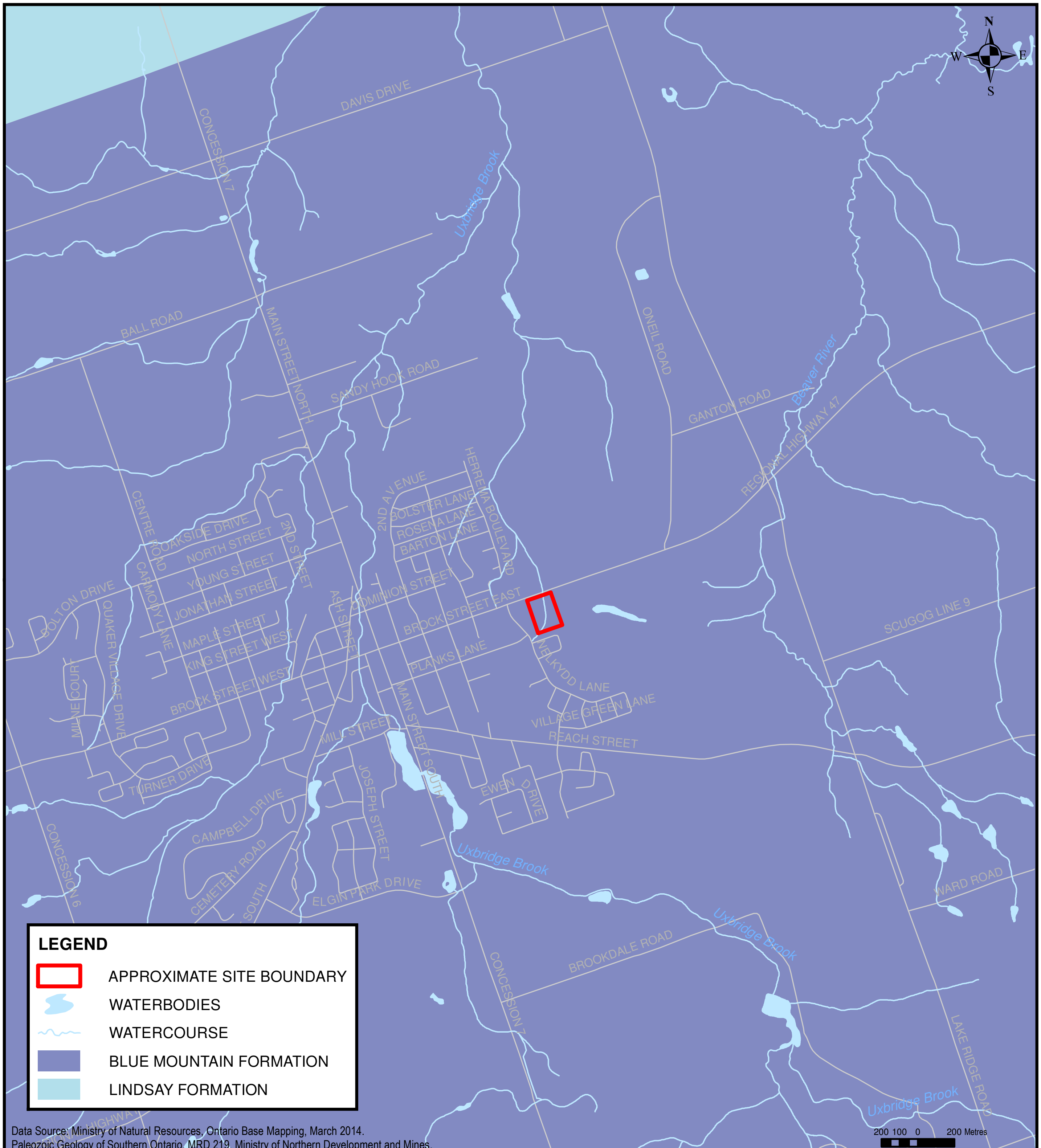
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

PROJECT: HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY 226 BROCK STREET EAST, UXBRIDGE, ONTARIO	SCALE: 1:30,000
	DRAWN BY: TP / CHECKED BY: LL
TITLE: SURFICIAL GEOLOGY	PROJECT NO: 181-06778-01
	DATE: MARCH 2021
CLIENT: WESTLANE DEVELOPMENT GROUP LTD.	FIGURE NO: 6 / REV.: -

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 6 Surficial Geology.mxd



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126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

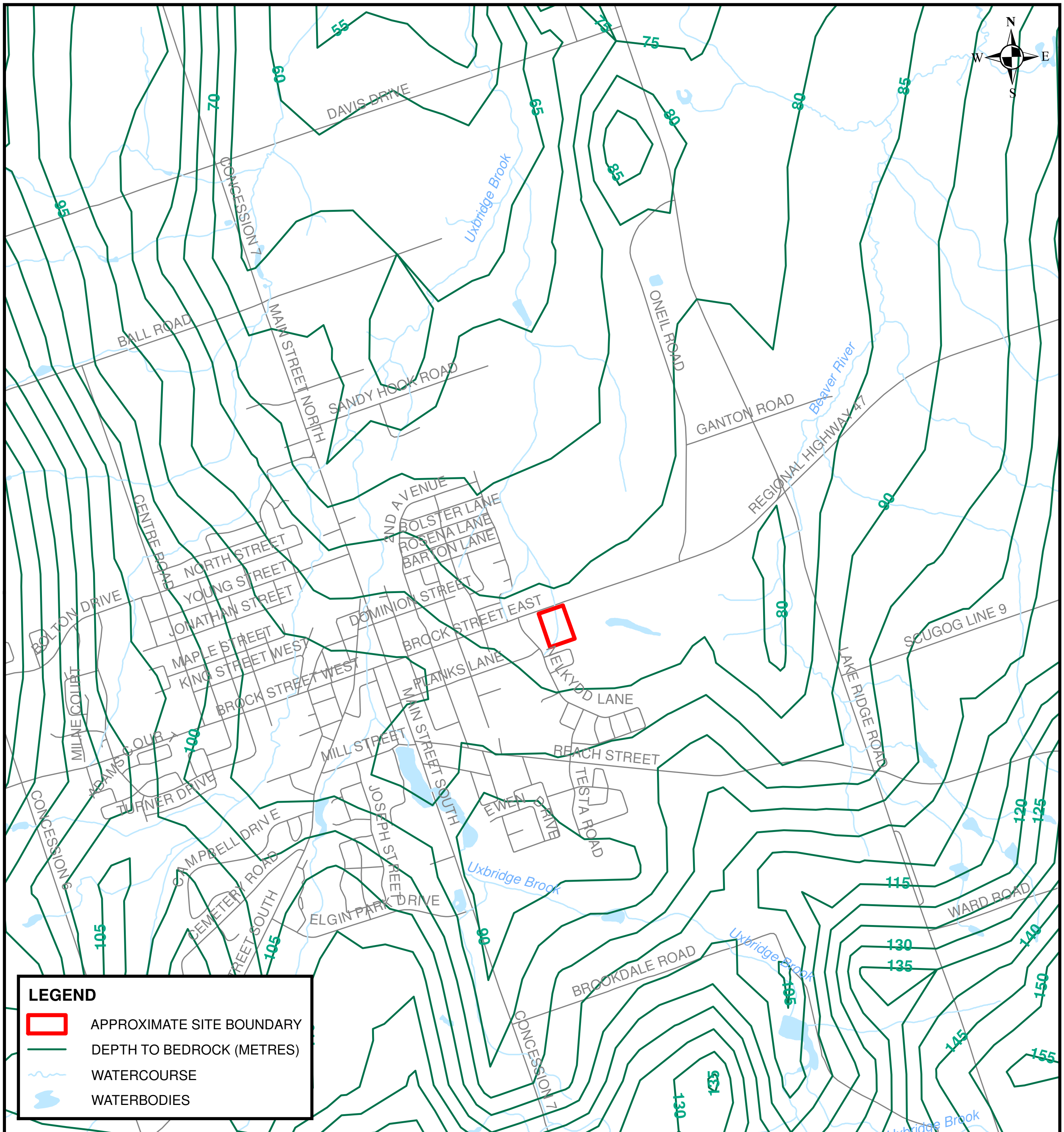
PROJECT:
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST, UXBRIDGE, ONTARIO

TITLE:
BEDROCK GEOLOGY

CLIENT:
WESTLANE DEVELOPMENT GROUP LTD.

SCALE: 1:30,000	
DRAWN BY: TP	CHECKED BY: LL
PROJECT NO: 181-06778-01	
DATE: MARCH 2021	
FIGURE NO: 7	REV.: -

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 7 Bedrock Geology.mxd



Data Source: Ministry of Natural Resources, Ontario Base Mapping, March 2014.
Bedrock Topography and Overburden Thickness Mapping, Southern Ontario, MRD 207, Ministry of Northern Development and Mines.

126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

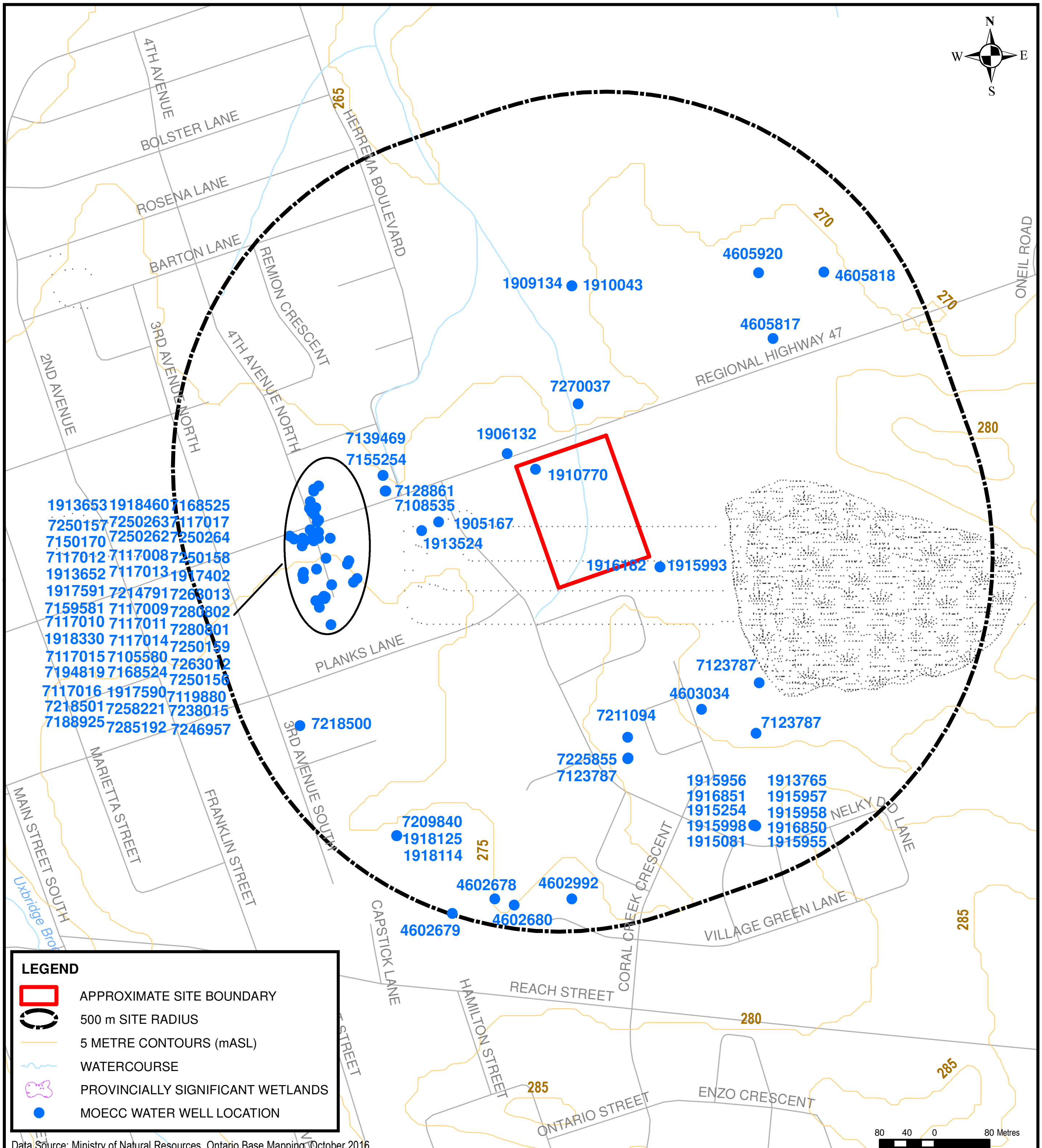
PROJECT:
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST, UXBRIDGE, ONTARIO

TITLE:
OVERBURDEN THICKNESS

CLIENT:
WESTLANE DEVELOPMENT GROUP LTD.

SCALE: 1:30,000	
DRAWN BY: TP	CHECKED BY: LL
PROJECT NO: 181-06778-01	
DATE: MARCH 2021	
FIGURE NO: 8	REV.: -

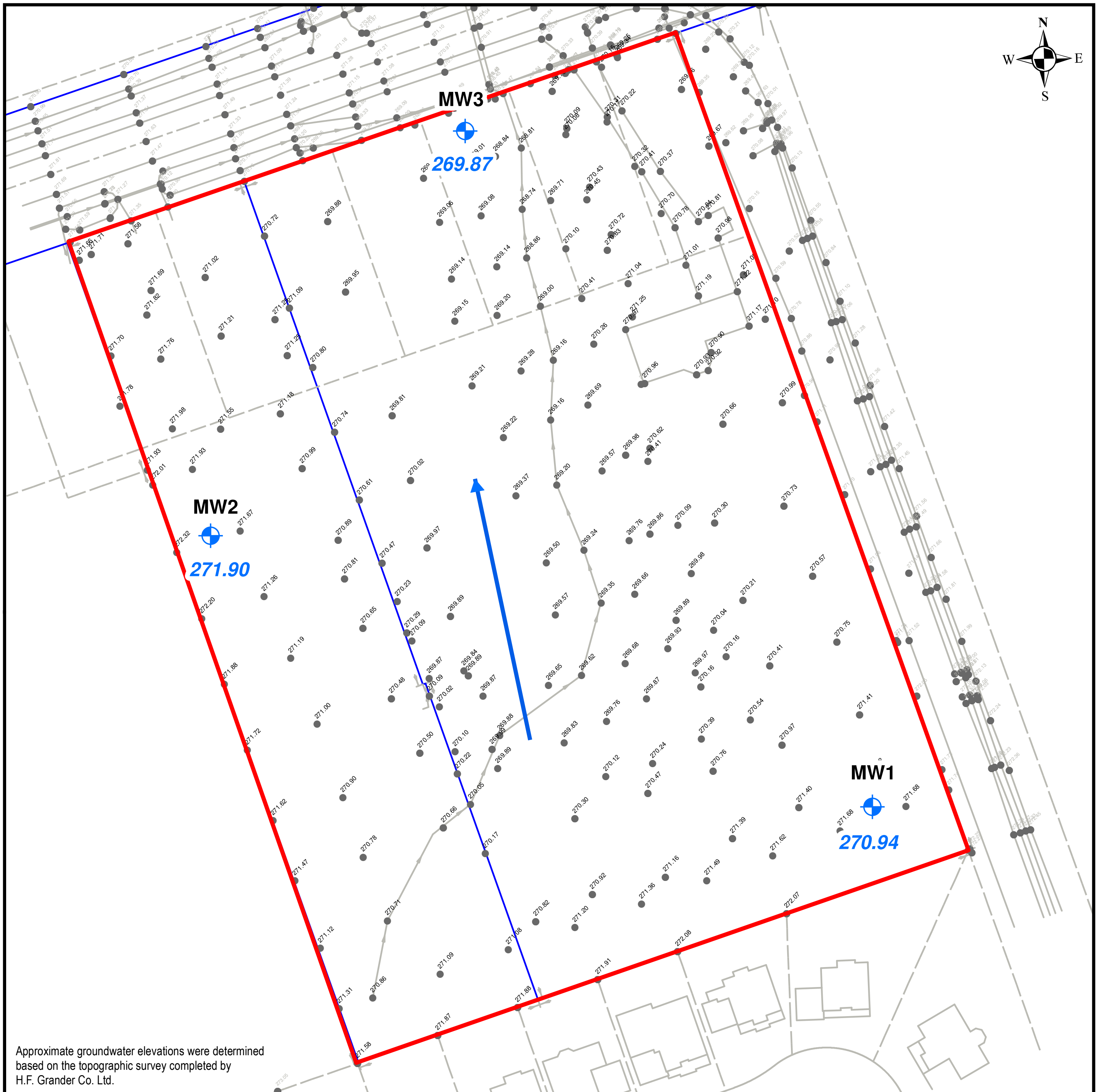
Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 8 Overburden Thickness.mxd



Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

126 DON HILLOCK DRIVE, UNIT 2 AURORA, ONTARIO CANADA L4G 0G9 TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM	PROJECT: HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY 226 BROCK STREET EAST, UXBRIDGE, ONTARIO	SCALE: 1:8,000 DRAWN BY: TP CHECKED BY: LL
	TITLE: MECP WATER WELLS	PROJECT NO: 181-06778-01 DATE: MARCH 2021
	CLIENT: WESTLANE DEVELOPMENT GROUP LTD.	FIGURE NO: 9 REV.: -

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 9 MECP Wells.mxd



Approximate groundwater elevations were determined based on the topographic survey completed by H.F. Grander Co. Ltd.

LEGEND

- APPROXIMATE SITE BOUNDARY
- MONITORING WELL LOCATION
- 271.90 GROUNDWATER ELEVATION
- APPARENT GROUNDWATER FLOW DIRECTION

15 7.5 0 15 Metres

wsp

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AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

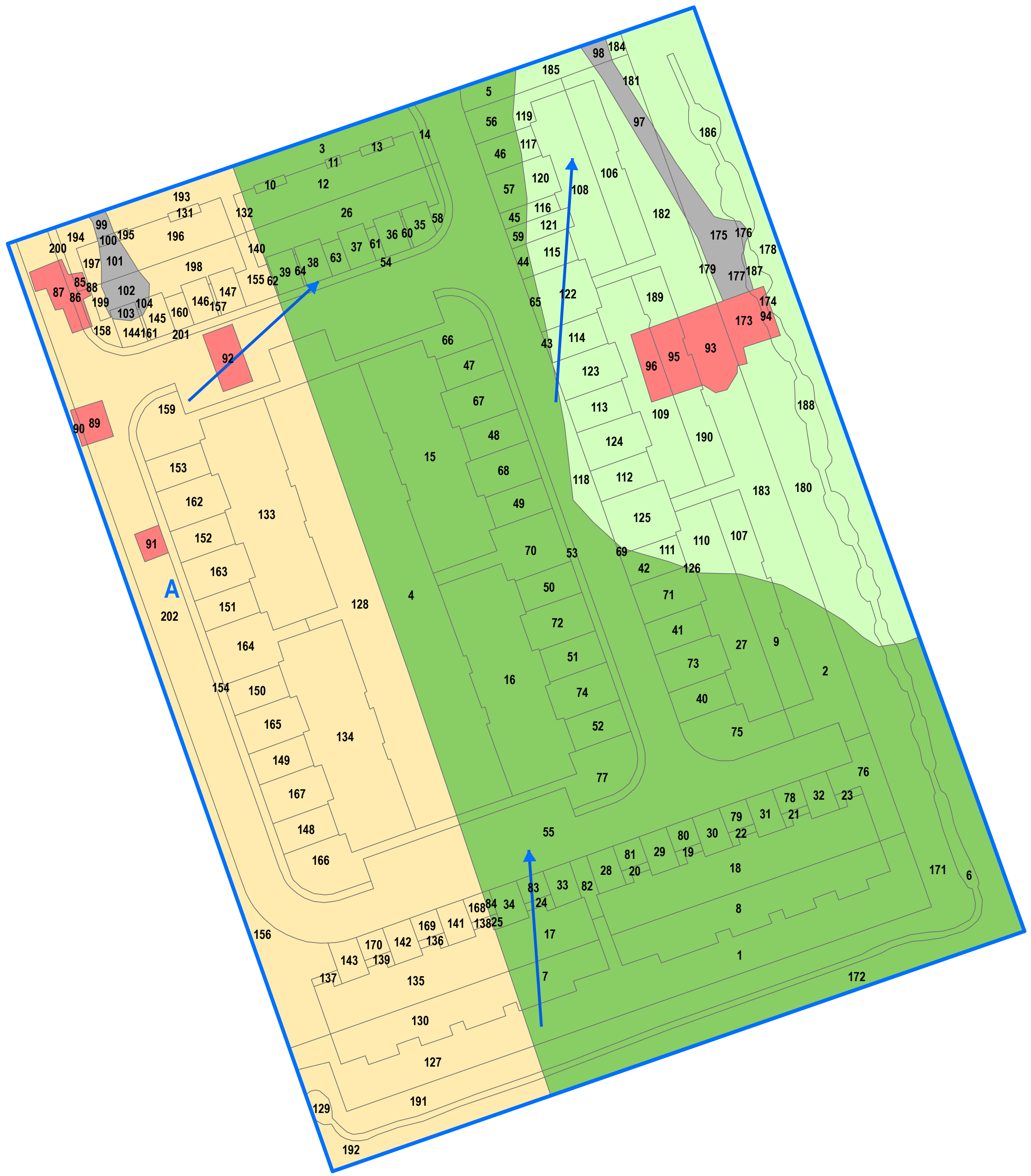
PROJECT:
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST, UXBRIDGE, ONTARIO

TITLE:
SEASONAL HIGH WATER LEVELS

CLIENT:
WESTLANE DEVELOPMENT GROUP LTD.

SCALE: 1:1,250	
DRAWN BY: TP	CHECKED BY: LL
PROJECT NO: 181-06778-01	
DATE: MARCH 2021	
FIGURE NO: 10	REV.: -

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 10 GW Flow V2.mxd



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LEGEND

- PRE DEVELOPMENT CATCHMENT AREAS
- BUILDING
- CULTIVATED
- GRAVEL
- LAWNS
- UNCULTIVATED
- PRE DEVELOPMENT FLOW DIRECTION

N
W E
S

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

CLIENT: WESTLANE DEVELOPMENT GROUP LTD.	
PROJECT: HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY 226 BROCK STREET EAST, UXBRIDGE, ONTARIO	
PROJECT NO: 181-06778-01	DATE: MARCH 2021
DESIGNED BY: -	
DRAWN BY: T.P.	
CHECKED BY: LL	
FIGURE NO: 11	SCALE: 1:1,000
TITLE: PRE DEVELOPMENT SITE CATCHMENT AREAS	
DISCIPLINE: ENVIRONMENT	
ISSUE: -	REV.: -

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 11 Pre Development.mxd

wsp

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AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

LEGEND

- POST DEVELOPMENT CATCHMENT AREAS
- BUILDING
- DRIVEWAY
- LAWN
- PORCH
- ROAD
- SIDEWALK
- UNCULTIVATED
- WETLAND
- POST DEVELOPMENT FLOW DIRECTION
- PROPOSED SWALE
- PROPOSED CATCHBASIN
- PROPOSED INFILTRATION TRENCH

N
W E
S

10 5 0 10 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

CLIENT:

WESTLANE DEVELOPMENT GROUP LTD.

PROJECT:

HYDROGEOLOGICAL ASSESSMENT AND
WATER BALANCE STUDY
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

PROJECT NO:	DATE:
181-06778-01	MARCH 2021

DESIGNED BY:
-

DRAWN BY:
T.P.

CHECKED BY:
LL

FIGURE NO:	SCALE:
12	1:1,000

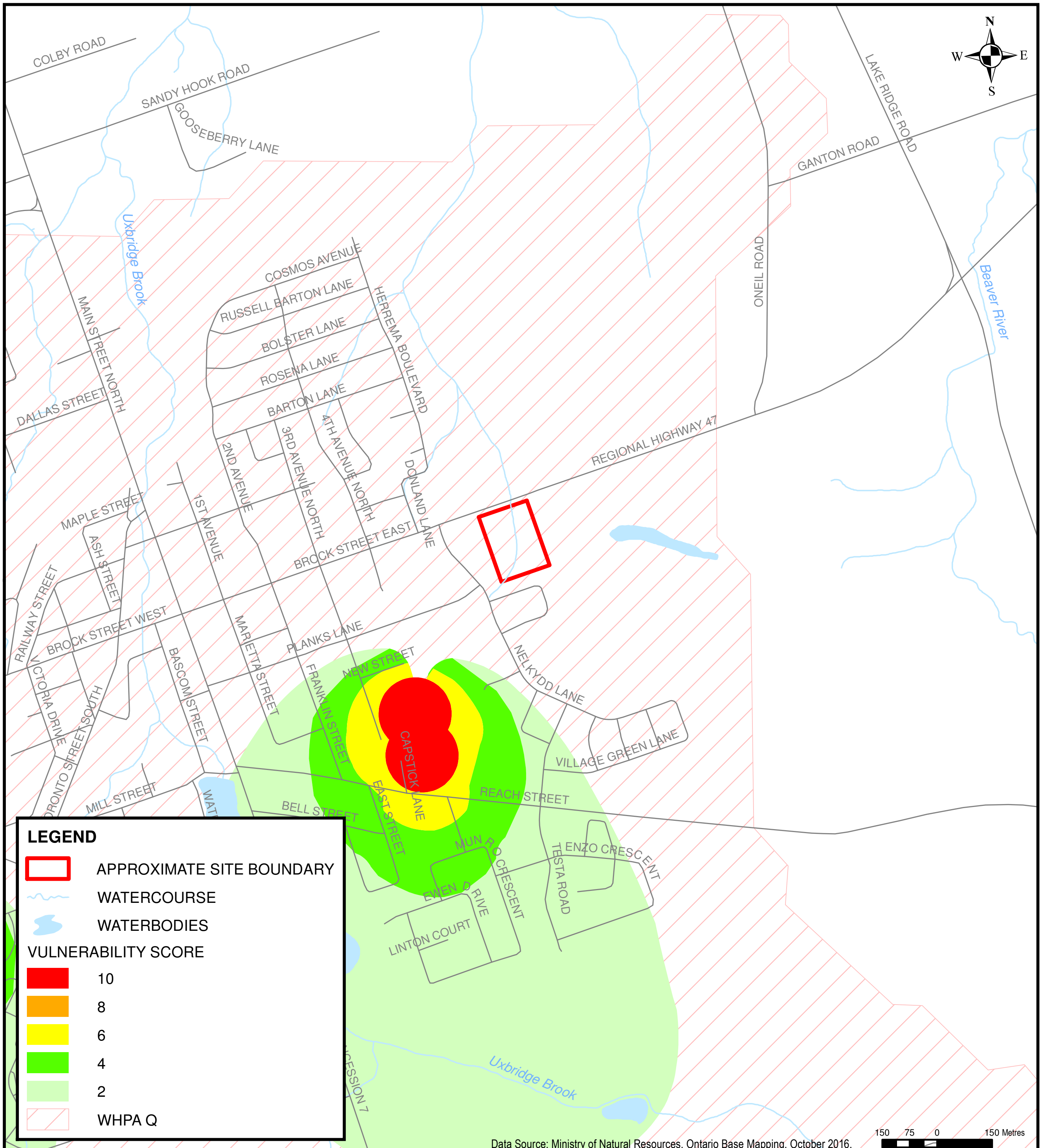
TITLE:

POST DEVELOPMENT SITE CATCHMENT AREAS

DISCIPLINE:

ENVIRONMENT

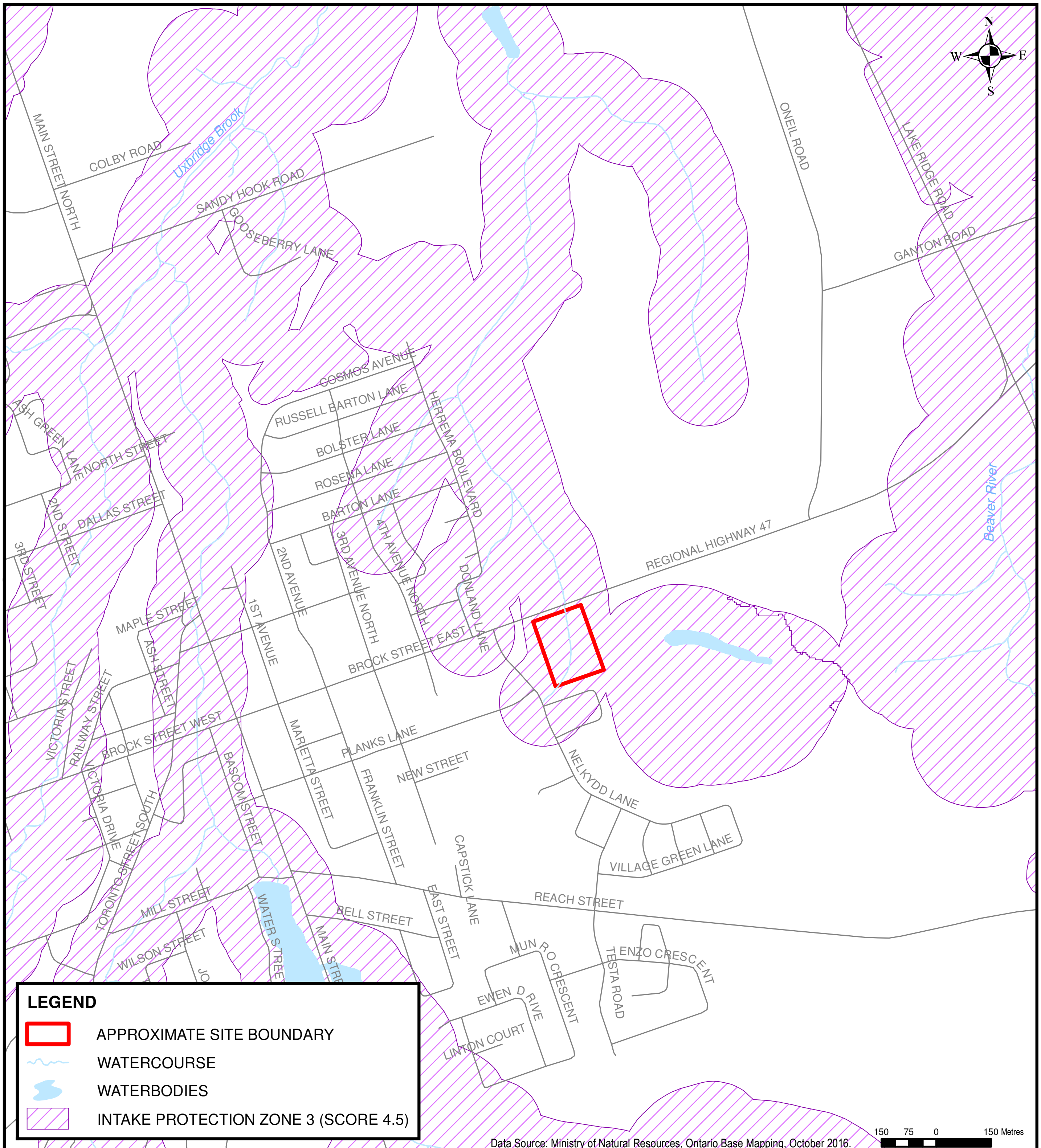
ISSUE:	REV.:
-	-



126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

PROJECT: HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY 226 BROCK STREET EAST, UXBRIDGE, ONTARIO	SCALE: 1:15,000
	DRAWN BY: TP / CHECKED BY: LL
TITLE: WELLHEAD PROTECTION AREAS	PROJECT NO: 181-06778-01
	DATE: MARCH 2021
CLIENT: WESTLANE DEVELOPMENT GROUP LTD.	FIGURE NO: 13 / REV.: -

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 13 WHPA.mxd



wsp

126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

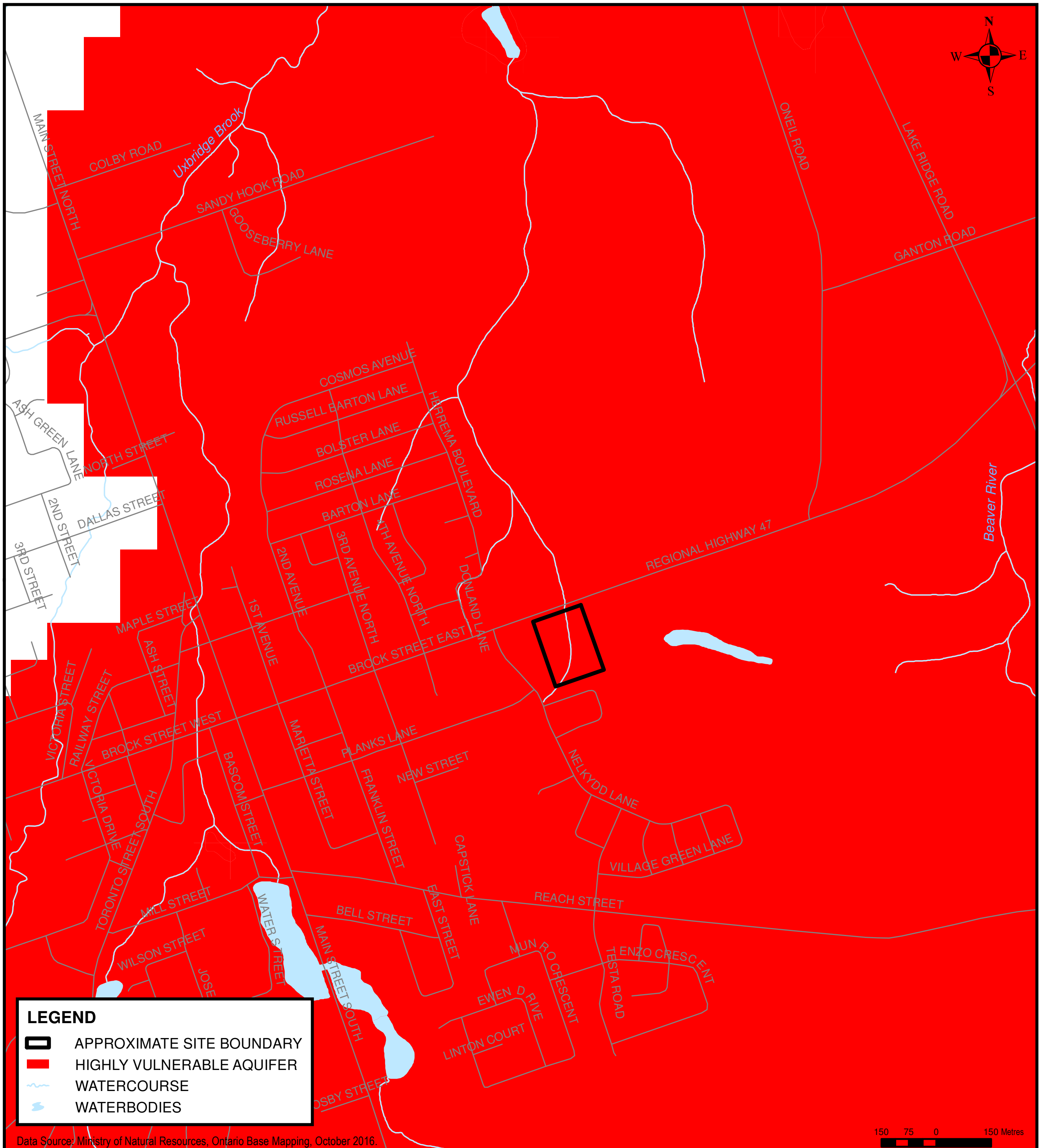
PROJECT:
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST, UXBRIDGE, ONTARIO

TITLE:
INTAKE PROTECTION ZONES

CLIENT:
WESTLANE DEVELOPMENT GROUP LTD.

SCALE: 1:15,000	
DRAWN BY: TP	CHECKED BY: LL
PROJECT NO: 181-06778-01	
DATE: MARCH 2021	
FIGURE NO: 14	REV.: -

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 14 IPZ.mxd



wsp

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TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

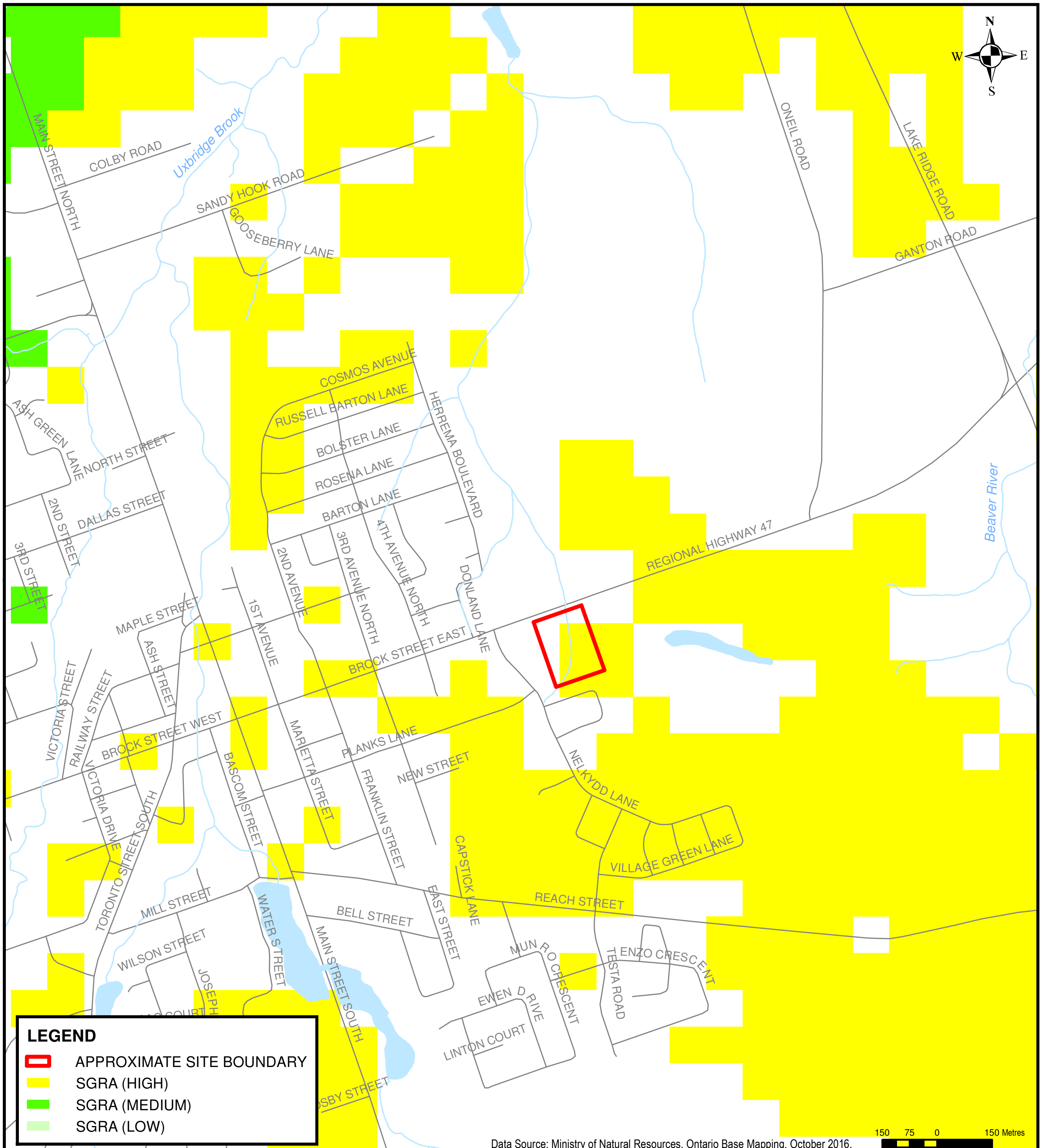
PROJECT:
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST, UXBRIDGE, ONTARIO

TITLE:
HIGHLY VULNERABLE AQUIFERS

CLIENT:
WESTLANE DEVELOPMENT GROUP LTD.

SCALE:	1:15,000
DRAWN BY:	TP
CHECKED BY:	LL
PROJECT NO:	181-06778-01
DATE:	MARCH 2021
FIGURE NO:	15
REV.:	-

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 15 HVA.mxd



126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

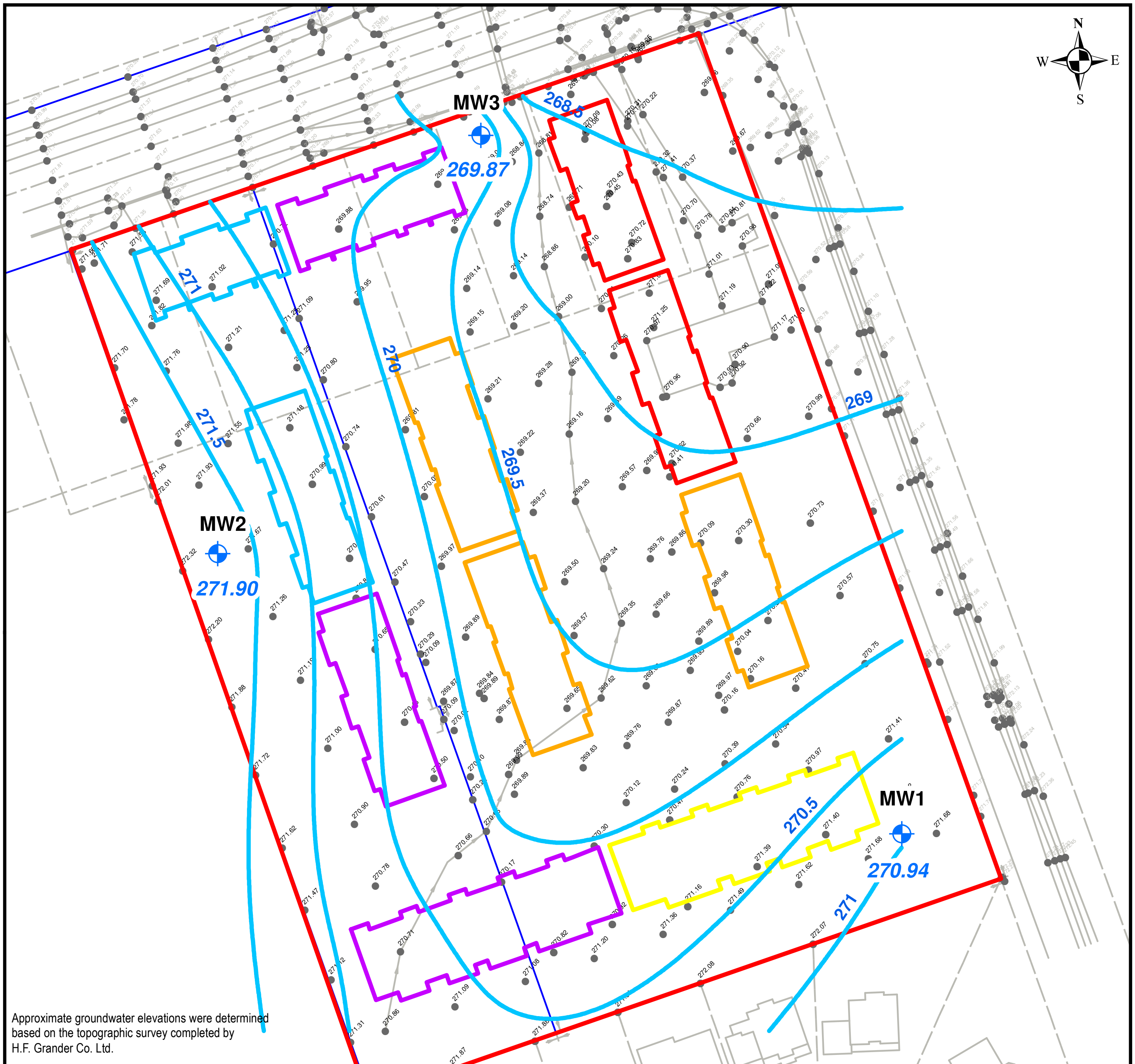
PROJECT:
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST, UXBRIDGE, ONTARIO

TITLE:
SIGNIFICANT GROUNDWATER RECHARGE AREAS

CLIENT:
WESTLANE DEVELOPMENT GROUP LTD.

SCALE: 1:15,000
DRAWN BY: TP
CHECKED BY: LL
PROJECT NO: 181-06778-01
DATE: MARCH 2021
FIGURE NO: 16
REV.: -

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 16 SGRA.mxd



Approximate groundwater elevations were determined based on the topographic survey completed by H.F. Grander Co. Ltd.

LEGEND

- APPROXIMATE SITE BOUNDARY
- GROUNDWATER CONTOURS
- MONITORING WELL LOCATION
- 0.5 - 1 m BELOW GROUNDWATER
- 0 - 0.5 m BELOW GROUNDWATER
- 0 - 0.5 m ABOVE GROUNDWATER LEVEL
- 0.5 - 1 m ABOVE GROUNDWATER LEVEL
- 1 - 1.5 m ABOVE GROUNDWATER LEVEL

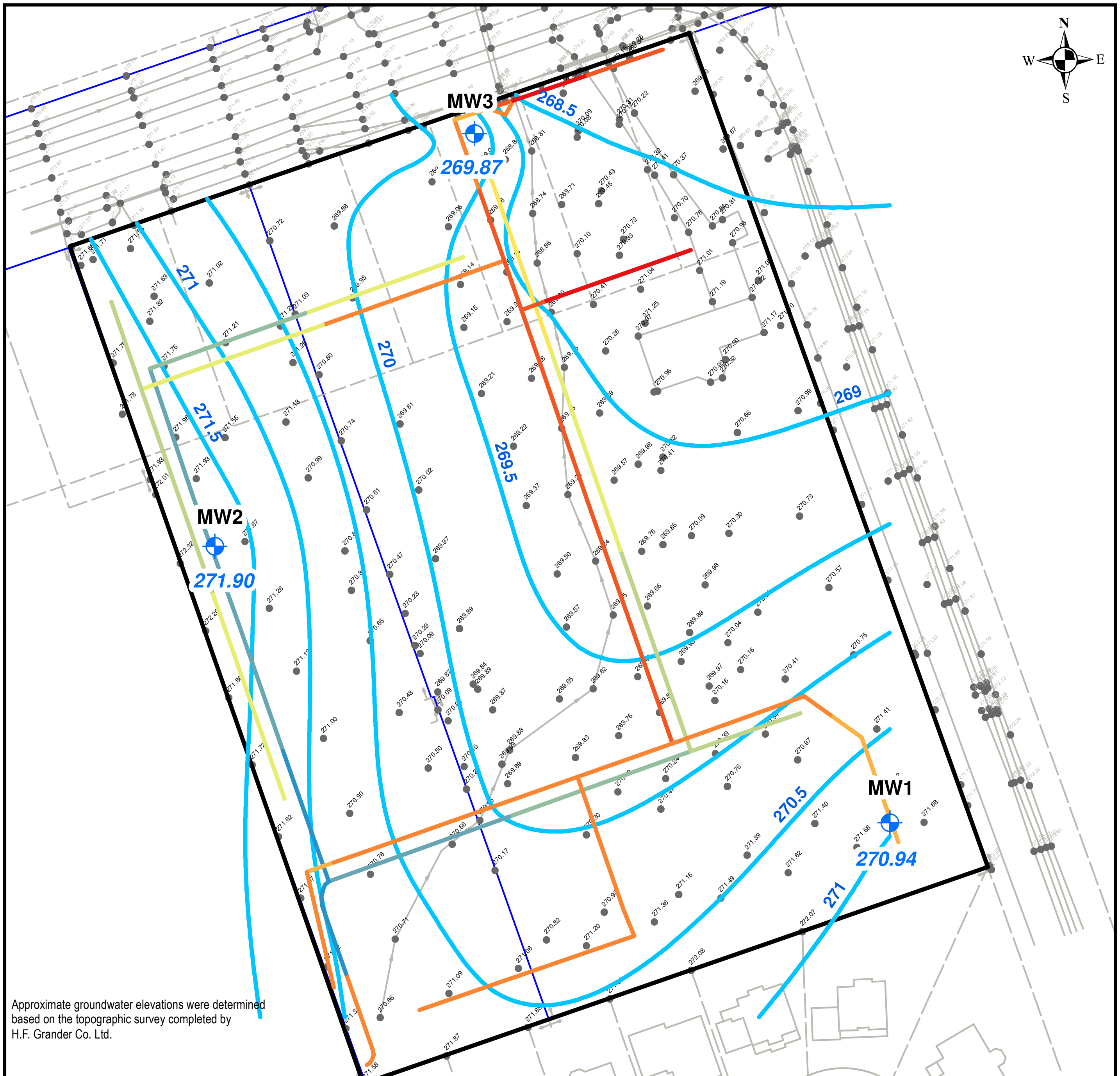
15 7.5 0 15 Metres

wsp

126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

PROJECT: HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY 226 BROCK STREET EAST, UXBRIDGE, ONTARIO	SCALE: 1:1,250
	DRAWN BY: TP / CHECKED BY: LL
TITLE: FOOTINGS ABOVE AND BELOW WATER LEVELS	PROJECT NO: 181-06778-01
	DATE: MARCH 2021
CLIENT: WESTLANE DEVELOPMENT GROUP LTD.	FIGURE NO: 17 / REV.: -

Document Path: D:\aProjects\181-06778-01\2020\MXD\181-06778-01 Figure 17 GW Contours.mxd



LEGEND

- APPROXIMATE SITE BOUNDARY
- GROUNDWATER CONTOURS
- MONITORING WELL LOCATION
- 4 - 4.5 m BELOW GROUNDWATER LEVEL
- 3.5 - 4 m BELOW GROUNDWATER LEVEL
- 2.5 - 3 m BELOW GROUNDWATER LEVEL
- 1.5 - 2 m BELOW GROUNDWATER LEVEL
- 1 - 1.5 m BELOW GROUNDWATER LEVEL
- 0.5 - 1 m BELOW GROUNDWATER LEVEL
- 0 - 0.5 m BELOW GROUNDWATER LEVEL
- 0 - 0.5 m ABOVE GROUNDWATER LEVEL
- 0.5 - 1 m ABOVE GROUNDWATER LEVEL
- > 1 m ABOVE GROUNDWATER LEVEL

15 7.5 0 15 Metres

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PROJECT:
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST, UXBRIDGE, ONTARIO

TITLE:
UTILITIES ABOVE AND BELOW WATER LEVELS

CLIENT:
WESTLANE DEVELOPMENT GROUP LTD.

SCALE: 1:1,250	
DRAWN BY: TP	CHECKED BY: LL
PROJECT NO: 181-06778-01	
DATE: MARCH 2021	
FIGURE NO: 18	REV.: -

Document Path: D:\aProjects\181-06778-00\2020\MXD\181-06778-01 Figure 18 GW Contours.mxd

APPENDIX

A MECP WATER WELL RECORDS

Appendix A - Summary of MOECC Water Well Records within 500 m
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

Well ID	X	Y	Elevation (m)	Well Depth (m)	Construction Method	Water Level (m)	Water Yield	Units of Measurement	Water Use	Water Status	Formation Depth (m)	Material Colour	Material 1	Material 2	Material 3
1905167	651114.9	4885923	272.593658	4.87680006	Boring	3.048000097		GPM	Domestic	Water Supply	0.6		TOPSOIL		
											3.0	BROWN	CLAY	STONEY	
											4.9		COARSE SAND		
1906132	651214.9	4886023	271.525054	31.69919968	Cable Tool	25.90800095	20	GPM	Domestic	Water Supply	0.6	BLACK	TOPSOIL		
											5.2	BROWN	CLAY	SOFT	
											25.9	BLUE	CLAY	SOFT	
											29.0	BROWN	SAND	SILT	DIRTY
											31.7	BROWN	COARSE SAND		
1909134	651308.9	4886267	269.258789	22.86000061	Rotary (Convent.)	22.86000061	8	GPM	Domestic	Water Supply	16.5	BROWN	GRAVEL	CLAY	BOULDERS
											20.4	GREY	CLAY	BOULDERS	HARD
											22.9	GREY	SAND	CLEAN	
1910043	651308.9	4886267	269.258789	11.27760029	Rotary (Air)	11.27760029	6	GPM	Domestic	Water Supply	3.0	BROWN	CLAY	DENSE	
											4.6	BROWN	SAND	FINE SAND	
											11.3	GREY	SAND	FINE SAND	
1910770	651255.9	4886000	271.236328	24.38400078	Rotary (Air)	24.38400078	12	GPM	Domestic	Water Supply	3.7	BROWN	CLAY	SOFT	
											5.2	GREY	CLAY	SOFT	
											17.4	BLUE	SILT	SOFT	
											21.3	BROWN	SAND	MEDIUM SAND	
											24.4	BROWN	SAND	MEDIUM SAND	CLEAN
1913524	651090	4885911	272.539215	23.46960068	Rotary (Air)	23.46960068	40	GPM	Domestic	Water Supply	4.6	BROWN	SAND	PACKED	
											12.2	GREY	CLAY	SOFT	
											17.1	GREY	SILT	SOFT	
											23.5	BROWN	SAND	GRAVEL	COARSE-GRAINED
4603034	651497.9	4885651	274.356475	28.34640121	Cable Tool	28.34640121	9	GPM	Irrigation	Water Supply	9.1		PREVIOUSLY DUG		
											15.8		CLAY	MEDIUM SAND	
											18.6	RED	FINE SAND		
											25.0	BLUE	MEDIUM SAND		
											28.3	BLACK	MEDIUM SAND		
4605817	651601.9	4886190	272.364318	10.66800022	Boring	6.705600262	0	GPM	Livestock	Water Supply	1.2		CLAY		
											5.5		SAND		
											6.4		SANDSTONE		
											9.4		QUICKSAND		
											10.7		COARSE SAND		
4605818	651675.9	4886287	270.361145	10.66800022	Boring	7.924799919		GPM	Livestock	Water Supply	3.7		CLAY		
											6.7		SAND		
											9.1		SANDSTONE		
											10.7		SAND	GRAVEL	
4605920	651580.9	4886286	270.920379	27.43200111	Rotary (Convent.)	27.43200111	9	GPM	Livestock	Water Supply	7.6	BROWN	SAND	CLAY	
											27.4	BROWN	SAND		
7105580	650938	4885870	275.0	4.2	Auger	2.4			Not Used	Other Status	4.2	BROWN	MEDIUM SAND		
1913652	650932	4885903	274.26773							Test Hole	4.572000027	BROWN	SAND	SILT	LOOSE
1913653	650928	4885912	274.034484							Test Hole	5.486400127	BROWN	SAND	SILT	LOOSE
1915993	651437.2	4885858	273.423126							Abandoned-Other					
1916182	651437.2	4885858	273.423126							Abandoned-Other					
1917402	650928	4885912	274.034484							Observation Wells	1.22	BROWN	SAND		
											4.28	BROWN	SAND	WATER-BEARING	
1917590	650959	4885832	275.415618							Observation Wells	0.15	BROWN	GRAVEL		
											4.5	BROWN	SAND		
1917591	650957	4885900	274.293457							Observation Wells	3	BROWN	SAND	DRY	
											4.5	BROWN	SAND		
1918330	650940	4885900	274.353515							Observation Wells	2.4	BROWN	MEDIUM SAND	GRAVEL	
											3.6	BROWN	MEDIUM SAND	GRAVEL	
1918460	651037	4885968	270.425231						Not Used	Test Hole	0.1				
											0.3		GRAVEL	SANDY	FILL
											2	BROWN	SAND	SILT	
											2.3	BROWN	SILT	SAND	
											6	BROWN	SAND	SILT	
7108535	651038	4885968	270.408782							Abandoned-Other					
7117008	650934	4885934	273.390747						Test Hole	Test Hole	1.2	BROWN	SAND		MEDIUM-GRAINED
											3	BROWN	SAND	SILT	
											5.1	BROWN	SAND	SILT	COARSE-GRAINED
7117009	650898	4885903	274.189971							7258221	1.2	BROWN	SAND		MEDIUM-GRAINED
											1.8	BROWN	SAND	SILT	MEDIUM-GRAINED
											4.5	BROWN	SAND	SILT	WATER-BEARING
7117010	650940	4885909	274.099853						Test Hole	Test Hole	0.6	BROWN	SAND		COARSE-GRAINED
											1.8	BROWN	SAND	SILT	MEDIUM-GRAINED
											4.5	BROWN	SAND	SILT	WATER-BEARING
7117011	650933	4885896	274.444671						Test Hole	Test Hole	0.6	BROWN	SAND	GRAVEL	COARSE-GRAINED
											1.8	BROWN	SAND	SILT	FINE-GRAINED
											4.2	BROWN	SAND	SILT	WATER-BEARING
											4.6	GREY	SILT	SAND	WATER-BEARING
7117012	650904	4885899	274.299011						Test Hole	Test Hole	1.8	BROWN	SAND		FINE-GRAINED
											3	BROWN	SAND	SILT	
											4.5	BROWN	SAND	SILT	MEDIUM-GRAINED
7117013	650951	4885871	275.050262						Test Hole	Test Hole	1.5	BROWN	SAND	MEDIUM GRAVEL	
											2.8	BROWN	SAND	SILT	
											3.6	BROWN	SAND	CLAY	SILT
											4.8	BROWN	SAND	SILT	CLAY
											5.1	BROWN	SILT	CLAY	WATER-BEARING
											5.9	BROWN	CLAY	SILT	WATER-BEARING
7117014	650917	4885846	275.190399						Test Hole	Test Hole	1.8	BROWN	SAND		FINE-GRAINED
											3	BROWN	SAND	SILTY	WATER-BEARING
											4.5	BROWN	SAND		WATER-BEARING
7117015	650984	4885867	274.794677						Test Hole	Test Hole	0.3	BROWN	TOPSOIL		
											3.8	BROWN	SAND		WATER-BEARING
7117016	650991	4885836	275.18045						Test Hole	Test Hole	1.5	BROWN	SAND		MEDIUM-GRAINED
											5.3	BROWN	SAND	SILT	CLAY
											5.9	GREY	CLAY		WATER-BEARING
7117017	650958	4885774	275.578857						Test Hole	Test Hole	1.2	BROWN	SAND	MEDIUM-GRAINED	
											3.6	BROWN	SAND	SILT	MEDIUM-GRAINED
											5.4	BROWN	SAND	SILT	WATER-BEARING
7119880	650950	4885814	275.5						Test Hole	Test Hole	3.8	BROWN	SAND		SOFT
											4.4	BROWN	CLAY		SOFT
											5.2	BROWN	SAND		SOFT
7123787	651582	4885689	273.245361						Monitoring and Test	Test Hole	10	BROWN	SAND	SILT	WATER-BEARING
											15	GREY	SAND	SILT	WATER-BEARING
7128861	651038	4885968	270.408782							Abandoned-Other					

7139469	651034	4885991	270.067626						Not Used	Test Hole	0.9	GREY	STONES	GRAVEL	
											3.05	BROWN	SAND	SILT	SILTY
7150170	650938	4885903	274.272674							Abandoned-Other					
7155254	651034	4885991													
7159581	650920	4885896							Test Hole	Test Hole	3	BROWN	FILL	SAND	LOOSE
											7	BROWN	FILL	SAND	GRAVEL
											15	BROWN	FILL	SAND	WATER-BEARING
7168524	650916	4885889								Abandoned-Other					
7168525	650982	4885862								Abandoned-Other					
7188925	650996	4885841													
7194819	650937	4885855							Test Hole	Test Hole	3.657599926	BROWN	FILL		LOOSE
											4.572000027	BROWN	MEDIUM SAND		WATER-BEARING
7211094	651390	4885610								Abandoned-Other					
7214791	650918	4885850								Abandoned Monitoring and Test Hole					
7218500	650913	4885627							Test Hole	Test Hole	0.304800004	BROWN	TOPSOIL	HARD	DENSE
											3.96239996	YELLOW	SAND	SILT	
											4.572000027	YELLOW	SAND	CLAY	WATER-BEARING
7218501	650918	4885841							Test Hole	Test Hole	0.304800004	BROWN	TOPSOIL	HARD	DENSE
											3.96239996	YELLOW	SAND	SILT	
											4.572000027	YELLOW	SAND	CLAY	WATER-BEARING
7225855	651390	4885579							Not Used	Abandoned-Other					
7238015	650948	4885815													
7246957	650949	4885812							Test Hole	Test Hole	2.43840003	BROWN	SAND		
											4.572000027	BROWN	SAND		WATER-BEARING
7250156	650927	4885943							Test Hole	Observation Wells	1	BROWN	TOPSOIL	LOOSE	
											5	BROWN	FILL	LOOSE	
											17.5	GREY	SILT	CLAY	SOFT
7250157	650930	4885938							Test Hole	Observation Wells	1	BROWN	TOPSOIL	LOOSE	
											5	BROWN	FILL	LOOSE	
											17.5	GREY	SILT	CLAY	SOFT
7250158	650928	4885953							Test Hole	Observation Wells	1	BROWN	TOPSOIL	SOFT	
											5	BROWN	SAND	SILT	SOFT
											15	GREY	SILT	CLAY	SOFT
7250159	650936	4885944							Test Hole	Observation Wells	1	BROWN	TOPSOIL	SOFT	
											5	BROWN	SAND	SILT	SOFT
											15	GREY	SILT	CLAY	SOFT
7250262	650933	4885968							Test Hole	Observation Wells	0.152400002	BROWN	TOPSOIL	LOOSE	
											0.304800004	BROWN	SAND	SILT	LOOSE
											2.743200064	BROWN	SILT	CLAY	LOOSE
											4.572000027	GREY	SILT	CLAY	LOOSE
7250263	650933	4885971							Test Hole	Observation Wells	0.152400002	BROWN	TOPSOIL	LOOSE	
											0.304800004	BROWN	SAND	SILT	LOOSE
											2.743200064	BROWN	SILT	CLAY	LOOSE
											4.572000027	GREY	SILT	CLAY	LOOSE
7250264	650940	4885976							Test Hole	Observation Wells	0.152400002	BROWN	TOPSOIL	LOOSE	
											0.304800004	BROWN	SAND	SILT	LOOSE
											2.743200064	BROWN	SILT	CLAY	LOOSE
											4.572000027	GREY	SILT	CLAY	LOOSE
7258221	650941	4885799							Monitoring	Observation Wells	0.300000012	BROWN	TOPSOIL		TOPSOIL
											2.440000057	BROWN	SAND		SOFT
											4.570000172	BROWN	SAND		WATER-BEARING
7263012	650940	4885926													
7263013	650938	4885923													
1915081	651574.7	4885482	278.811401	21.33600044	Rotary (Air)	21.33600044	10	GPM	Domestic	Water Supply	3.657599926	BROWN	SAND	PACKED	
											17.37360001	GREY	CLAY	SOFT	
											21.33600044	BROWN	FINE SAND		
1915998	651574.2	4885482	278.797729	49.37760162	Rotary (Convent.)	49.37760162		GPM	Irrigation	Water Supply	3.657599926	BLACK	SAND		
											7.924799919	BROWN	CLAY	STONES	
											19.81200027	GREY	CLAY	STONES	
											24.99360085		COARSE SAND	STONES	
											40.23360062	GREY	CLAY	STONES	
											49.37760162		COARSE SAND	STONES	
1916850	651575.2	4885482	278.82492	72.23760223	Rotary (Convent.)	61.26480103	200	GPM	Not Used		0.304800004	BLACK	TOPSOIL		
											1.828799963	BROWN	SAND	GRAVEL	
											4.572000027	BROWN	CLAY	SANDY	GRAVEL
											7.924799919	GREY	CLAY	SANDY	GRAVEL
											13.10640049	BROWN	SAND	SILTY	CLAY
											16.45919991	BROWN	SILT	SAND	WATER-BEARING
											19.50720024	GREY	SILT	SAND	CLAY
											24.99360085	GREY	SAND	SILTY	WATER-BEARING
											30.78479958	GREY	CLAY	SILTY	GRAVEL
											33.52799988	GREY	CLAY	SILTY	GRAVEL
											36.88080215	GREY	CLAY	SILTY	SAND
											41.45280075	GREY	CLAY	SANDY	SILT
											51.81600189	GREY	SAND	SILT	WATER-BEARING
											58.21680069	GREY	FINE SAND	SILT	WATER-BEARING
											59.43600082	GREY	SAND	GRAVEL	WATER-BEARING
											62.48400116	GREY	SAND	GRAVEL	WATER-BEARING
											64.00800323	GREY	SAND	GRAVEL	WATER-BEARING
											68.58000183	GREY	SAND	GRAVEL	WATER-BEARING
											70.40879822	GREY	SAND	GRAVEL	WATER-BEARING
											72.23760223	GREY	CLAY	SANDY	GRAVEL
1916851	651575.2	4885482	278.82492	84.42960358	Rotary (Air)	78.02880096	49	GPM	Not Used		0.304800004	BLACK	TOPSOIL		
											2.133599997	BROWN	SAND	SILTY	
											6.400800228	BROWN	CLAY	SILT	
											7.619999886	BROWN	CLAY	SILT	SAND
											12.19200039	BROWN	CLAY	SANDY	SILT
											18.28800011	BROWN	FINE SAND	SILT	
											19.20240021	BROWN	CLAY	SILTY	
											19.81200027	GREY	CLAY	SILTY	
											24.99360085	BROWN	FINE SAND	SILT	WATER-BEARING
											26.21280098	BROWN	SAND	GRAVEL	WATER-BEARING
											28.65120125	GREY	CLAY	SANDY	GRAVEL
											31.08959961	GREY	SAND	GRAVEL	WATER-BEARING
											33.52799988	GREY	CLAY	SILTY	SAND
											39.62400055	GREY	SILT	CLAY	WATER-BEARING
											41.45280075	GREY	CLAY	SANDY	SILT
											43.58639908	GREY	CLAY	SILT	WATER-BEARING
											45.72000122	GREY	CLAY	SANDY	SILT
											51.81600189	GREY	SILT	SANDY	WATER-BEARING
											54.25440216	GREY	SAND	GRAVEL	WATER-BEARING
											61.26480103	GREY	FINE SAND	WATER-BEARING	
											62.78879929	GREY	SAND	GRAVEL	WATER-BEARING
											64.00800323	GREY	SAND	GRAVEL	WATER-BEARING
											65.83679962	GREY	SAND	WATER-BEARING	
											84.42960358	BLACK	SHALE		

1918125	651054	4885467	275.167114	71.59999847	Rotary (Air)	38		GPM	Municipal	Water Supply	0.899999976	BROWN	TOPSOIL		
											2.099999905		SAND	SILT	
											6.099999905	GREY	CLAY	SILT	
											25	GREY	SAND	SILT	
											27.39999962	GREY	CLAY		
											30.5	GREY	SILT		
											38	GREY	CLAY	SILT	
											42.70000076	GREY	SILT	SAND	
											59.40000153	GREY	SAND	SILT	
											61	GREY	GRAVEL	SAND	
											64	GREY	SAND	SILT	
											65.5	GREY	GRAVEL	SAND	
											71.59999847	GREY	SAND	SILT	
4602678	651196.9	4885375	274.979156	85.34400177	Rotary (Convent.)	57.91200256	33	GPM	Not Used	Test Hole	0.304800004		TOPSOIL		
											1.219200015		MEDIUM SAND	CLAY	
											2.743200064		MEDIUM SAND	GRAVEL	
											27.43200111		CLAY		
											37.79520035		CLAY	GRAVEL	
											41.14799881		CLAY	MEDIUM SAND	
											45.72000122		FINE SAND	SILT	
											52.42560196		FINE SAND	GRAVEL	
											55.16880035		MEDIUM SAND	GRAVEL	CLAY
											56.99760056		FINE SAND	GRAVEL	
											57.3024025	BROWN	CLAY	GRAVEL	
											57.91200256		FINE SAND	GRAVEL	
											62.48400116		MEDIUM SAND	GRAVEL	
											77.11440277		MEDIUM SAND	GRAVEL	CLAY
											85.34400177		CLAY	MEDIUM SAND	GRAVEL
4602679	651134.9	4885354	276.160461	77.11440277	Cable Tool	45.72000122	220	GPM	Industrial	Water Supply	0.304800004		TOPSOIL		
											0.914399981		CLAY	MEDIUM SAND	
											7.010400295	BROWN	CLAY	STONES	
											15.5447998		MEDIUM SAND	SILT	CLAY
											16.76399994		MEDIUM SAND	SILT	
											20.42160034		MEDIUM SAND	SILT	CLAY
											21.94560051		COARSE SAND		
											25.29840088		FINE SAND		
											31.69919968		CLAY	GRAVEL	
											45.72000122		FINE SAND	SILT	GRAVEL
											54.25440216		FINE SAND	GRAVEL	CLAY
											59.74079895		FINE SAND	GRAVEL	SILT
											68.88480377		MEDIUM SAND	GRAVEL	BOULDERS
											70.71360016		MEDIUM SAND	GRAVEL	SILT
											76.80960083		MEDIUM SAND	GRAVEL	
											77.11440277		MEDIUM SAND	GRAVEL	BOULDERS
4602680	651224.9	4885366	274.987609	78.02880096	Rotary (Convent.)	61.26480103	32	GPM	Not Used	Test Hole	0.304800004		TOPSOIL		
											0.914399981		MEDIUM SAND	CLAY	
											5.791200161		CLAY		
											19.50720024		CLAY	MEDIUM SAND	
											21.64080048		MEDIUM SAND	GRAVEL	CLAY
											23.77440071		FINE SAND	CLAY	
											32.00400162	GREY	CLAY		
											36.88080215		SILT	MEDIUM SAND	
											51.81600189		FINE SAND	GRAVEL	SILT
											56.38800049		CLAY	MEDIUM SAND	GRAVEL
											61.26480103		MEDIUM SAND	GRAVEL	CLAY
											67.05599976		GRAVEL	MEDIUM SAND	CLAY
											68.27519989		MEDIUM SAND	GRAVEL	BOULDERS
											70.10400391		BOULDERS	MEDIUM SAND	GRAVEL
											71.32320404		MEDIUM SAND	GRAVEL	CLAY
											76.20000458		MEDIUM SAND	GRAVEL	CLAY
											77.41920471		BOULDERS	MEDIUM SAND	GRAVEL
											78.02880096		FINE SAND	CLAY	GRAVEL
4602992	651308.9	4885375	275.827636	77.72399902	Rotary (Convent.)	53.64480209		GPM	Not Used	Test Hole	0.304800004		TOPSOIL		
											0.914399981		MEDIUM SAND	CLAY	
											4.572000027	GREY	CLAY		
											23.77440071		FINE SAND	CLAY	GRAVEL
											25.60320091		MEDIUM SAND	GRAVEL	CLAY
											38.10000229	GREY	CLAY	GRAVEL	
											48.46319962		FINE SAND	CLAY	GRAVEL
											53.64480209		CLAY	MEDIUM SAND	GRAVEL
											56.69280243		FINE SAND	GRAVEL	
											61.87440109		FINE SAND	GRAVEL	CLAY
											65.83679962		CLAY	MEDIUM SAND	
											69.18959808	GREY	CLAY	GRAVEL	
											72.54240417		GRAVEL	MEDIUM SAND	CLAY
											74.98080444		GRAVEL	MEDIUM SAND	CLAY
											77.72399902	GREY	CLAY	GRAVEL	
1913765	651576.9	4885481	278.858917		Not Known					Abandoned-Other					
1915254	651575.2	4885482	278.82492	78.33360291	Rotary (Convent.)					Observation Wells	0.609600008	BLACK	TOPSOIL		
1915254	651575.2	4885482	278.82492	78.33360291	Rotary (Convent.)					Observation Wells	2.43840003	BROWN	SAND	SILTY	
1915254	651575.2	4885482	278.82492	78.33360291	Rotary (Convent.)					Observation Wells	3.657599926	BROWN	CLAY		
1915254	651575.2	4885482	278.82492	78.33360291	Rotary (Convent.)					Observation Wells	7.924799919	GREY	CLAY		
1915254	651575.2	4885482	278.82492	78.33360291	Rotary (Convent.)					Observation Wells	12.19200039	BROWN	CLAY	SANDY	
1915254	651575.2	4885482	278.82492	78.33360291	Rotary (Convent.)					Observation Wells	39.62400055	GREY	CLAY	GRAVEL	
1915254	651575.2	4885482	278.82492	78.33360291	Rotary (Convent.)					Observation Wells	47.85359955	GREY	SAND	GRAVEL	
1915254	651575.2	4885482	278.82492	78.33360291	Rotary (Convent.)					Observation Wells	60.95999908	GREY	SAND	GRAVEL	CLAY
1915254	651575.2	4885482	278.82492	78.33360291	Rotary (Convent.)					Observation Wells	75.89520264	GREY	COARSE SAND	COARSE GRAVEL	WATER-BEARING
1915254	651575.2	4885482	278.82492	78.33360291	Rotary (Convent.)					Observation Wells	78.33360291	GREY	GRAVEL	SANDY	CLAY
1915955	651574.2	4885482	278.797729	92.04959869	Rotary (Convent.)					Abandoned-Supply	3.048000097	BLACK	SAND		
1915955	651574.2	4885482	278.797729	92.04959869	Rotary (Convent.)					Abandoned-Supply	11.27760029	BROWN	CLAY	STONES	
1915955	651574.2	4885482	278.797729	92.04959869	Rotary (Convent.)					Abandoned-Supply	15.84959984	GREY	CLAY	STONES	
1915955	651574.2	4885482	278.797729	92.04959869	Rotary (Convent.)					Abandoned-Supply	19.20240021	BROWN	FINE SAND		
1915955	651574.2	4885482	278.797729	92.04959869	Rotary (Convent.)					Abandoned-Supply	28.34640121	GREY	CLAY	STONES	
1915955	651574.2	4885482	278.797729	92.04959869	Rotary (Convent.)					Abandoned-Supply	30.17519951		GRAVEL	CEMENTED	
1915955	651574.2	4885482	278.797729	92.04959869	Rotary (Convent.)					Abandoned-Supply	31.08959961	GREY	CLAY	STONES	

1915955	651574.2	4885482	278.797729	92.04959869	Rotary (Convent.)					Abandoned-Supply	34.13759995		GRAVEL	CEMENTED	
1915955	651574.2	4885482	278.797729	92.04959869	Rotary (Convent.)					Abandoned-Supply	89.91600037	GREY	CLAY	STONES	
1915955	651574.2	4885482	278.797729	92.04959869	Rotary (Convent.)					Abandoned-Supply	92.04959869	BLACK	SHALE		
1915956	651574.2	4885482	278.797729	46.32960129	Rotary (Convent.)					Abandoned-Supply	3.657599926	BLACK	SAND		
1915956	651574.2	4885482	278.797729	46.32960129	Rotary (Convent.)					Abandoned-Supply	7.924799919	BROWN	CLAY	STONES	
1915956	651574.2	4885482	278.797729	46.32960129	Rotary (Convent.)					Abandoned-Supply	19.81200027	GREY	CLAY	STONES	
1915956	651574.2	4885482	278.797729	46.32960129	Rotary (Convent.)					Abandoned-Supply	24.99360085		COARSE SAND	STONES	
1915956	651574.2	4885482	278.797729	46.32960129	Rotary (Convent.)					Abandoned-Supply	46.32960129	GREY	CLAY	STONES	
1915957	651574.2	4885482	278.797729	49.37760162	Rotary (Convent.)	40.23360062				Observation Wells	3.657599926	BLACK	SAND		
1915957	651574.2	4885482	278.797729	49.37760162	Rotary (Convent.)	40.23360062				Observation Wells	7.924799919	BROWN	CLAY	STONES	
1915957	651574.2	4885482	278.797729	49.37760162	Rotary (Convent.)	40.23360062				Observation Wells	19.81200027	GREY	CLAY	STONES	
1915957	651574.2	4885482	278.797729	49.37760162	Rotary (Convent.)	40.23360062				Observation Wells	24.99360085		COARSE SAND	STONES	
1915957	651574.2	4885482	278.797729	49.37760162	Rotary (Convent.)	40.23360062				Observation Wells	40.23360062	GREY	CLAY	STONES	
1915957	651574.2	4885482	278.797729	49.37760162	Rotary (Convent.)	40.23360062				Observation Wells	49.37760162		COARSE SAND	STONES	
1915958	651574.2	4885482	278.797729	95.09760284	Rotary (Convent.)					Abandoned-Supply	3.657599926	BLACK	SAND		
1915958	651574.2	4885482	278.797729	95.09760284	Rotary (Convent.)					Abandoned-Supply	9.753600121	BROWN	CLAY		
1915958	651574.2	4885482	278.797729	95.09760284	Rotary (Convent.)					Abandoned-Supply	19.50720024		CLAY	STONES	
1915958	651574.2	4885482	278.797729	95.09760284	Rotary (Convent.)					Abandoned-Supply	24.99360085		COARSE SAND	STONES	
1915958	651574.2	4885482	278.797729	95.09760284	Rotary (Convent.)					Abandoned-Supply	40.23360062	GREY	CLAY	STONES	
1915958	651574.2	4885482	278.797729	95.09760284	Rotary (Convent.)					Abandoned-Supply	49.37760162		COARSE SAND	STONES	
1915958	651574.2	4885482	278.797729	95.09760284	Rotary (Convent.)					Abandoned-Supply	79.2480011	GREY	CLAY	STONES	
1915958	651574.2	4885482	278.797729	95.09760284	Rotary (Convent.)					Abandoned-Supply	90.52560425	GREY	CLAY		
1915958	651574.2	4885482	278.797729	95.09760284	Rotary (Convent.)					Abandoned-Supply	95.09760284	BLACK	SHALE		
1918114	651054	4885467	275.167114		Rotary (Air)					Abandoned-Other					
7209840	651054	4885467	275.166687						Municipal	Water Supply					

APPENDIX

B BOREHOLE LOGS

BOREHOLE NO. MW18-1

PROJECT NAME: 226 BROCK STREET
PROJECT NO.: 181-06778-00
CLIENT: OXFORD HOMES
DATE COMPLETED: May 16, 2018
BOREHOLE TYPE: 210 mm HOLLOW STEM AUGER
SUPERVISOR: JSW
GROUND ELEVATION: NOT DETERMINED
REVIEWER: LAL

DEPTH (m)	ELEV (mASL)	STRATIGRAPHIC DESCRIPTION	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	REMARKS
0.0		**TOPSOIL:** Dark brown, trace sand, some rootlets, moist.						
0.2		**SAND:** Orangey brown, moist.	SS1	4		50		
0.8		**SILTY SAND:** Brown, silty sand, very wet to saturated, loose.	SS2	6		58		
		- Brown to orangy brown	SS3	12		46		
2.3		**SILT:** Brown to orangy brown, some sand, saturated.	SS4	13		63		
3.0		**SANDY SILT:** Brown, trace clay, saturated.						
3.3		**SILTY CLAY:** Silty clay, trace sand, wet to very wet.	SS5	13		75		
			SS6	8				
4.6		Borehole terminated at 4.6 m in **SILTY CLAY**						

CONE PENETRATION: "N" VALUE 10 20 30; SHEAR STRENGTH
WATER CONTENT %: 10 20 30; W_P W_L

UTM CO-ORDINATES
UTM Zone: NAD:
Easting:
Northing:

WSP GEOLOGIC (METRIC) WITH MASL 181-06778-00 LOGS.GPJ WSP_ENV_V1.GDT 6/20/18

BOREHOLE NO. MW18-2

PROJECT NAME: 226 BROCK STREET
PROJECT NO.: 181-06778-00
CLIENT: OXFORD HOMES
DATE COMPLETED: May 17, 2018
BOREHOLE TYPE: 210 mm HOLLOW STEM AUGER
SUPERVISOR: JSW
GROUND ELEVATION: NOT DETERMINED
REVIEWER: LAL

DEPTH (m)	ELEV (mASL)	STRATIGRAPHIC DESCRIPTION	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	REMARKS
0.0		**TOPSOIL:** Dark brown, some silt, some rootlets, very moist.						UTM CO-ORDINATES: UTM Zone: NAD: Easting: Northing:
0.1		**SILTY SAND:** Light brown, orange mottling, very moist.	SS1	13		88		
0.8		**SAND:** Light brown to orange mottling, wet, very wet in last 5.1 cm.	SS2	15		60		
		- Very wet to saturated	SS3	19		88		
2.3		**CLAY:** Light grey, trace cobble, moist to wet.	SS4	13		69		
3.0		Borehole terminated at 3.0 m in **CLAY**.						

Columns also shown: STRATIGRAPHY; MONITOR DETAILS; CONE PENETRATION "N" VALUE (10 20 30), SHEAR STRENGTH; WATER CONTENT % (10 20 30), W_P W_L.

BOREHOLE NO. MW18-3

PROJECT NAME: 226 BROCK STREET
PROJECT NO.: 181-06778-00
CLIENT: OXFORD HOMES
DATE COMPLETED: May 16, 2018
BOREHOLE TYPE: 210 mm HOLLOW STEM AUGER
SUPERVISOR: JSW
GROUND ELEVATION: NOT DETERMINED
REVIEWER: LAL

UTM CO-ORDINATES
UTM Zone: NAD:
Easting:
Northing:

DEPTH (m)	ELEV (mASL)	STRATIGRAPHIC DESCRIPTION	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	REMARKS
0.0		**SILTY TOPSOIL:** Dark brown, some rootlets, trace orange mottling, wet.	SS1	2		79		
0.8		**SANDY SILT TO SILTY SAND:** light brown, fine. - Light brown to grey, trace clay, orange stains throughout, very wet.	SS2	7		79		
1.5		**SILTY CLAY:** Grey, trace sand, orange staining, wet to saturated.	SS3	4		79		
2.2		**SILTY SAND TO SAND:** GREY TO greyish brown, trace clay, saturated.						
2.5		**CLAY:** Grey, some silt, trace sand, saturated.	SS4	14		83		
		- Interbedded with seams of sand, saturated.	SS5	8				
3.8		Borehole terminated at 3.8 m in **CLAY**						

Column headings also printed: STRATIGRAPHY; MONITOR DETAILS; CONE PENETRATION "N" VALUE 10 20 30, SHEAR STRENGTH; WATER CONTENT % 10 20 30, W_P W_L.

APPENDIX

C WATER QUALITY

WSP Canada Inc. (Aurora)
ATTN: Jake Whittamore
126 Don Hilock Drive
Unit 2
Aurora ON L4G 0G9

Date Received: 22-JUN-18
Report Date: 29-JUN-18 10:05 (MT)
Version: FINAL

Client Phone: 289-984-0418

Certificate of Analysis

Lab Work Order #: L2117286

Project P.O. #: NOT SUBMITTED
Job Reference: 181-06778-00/100/1003
C of C Numbers: 17-624360
Legal Site Desc:

Mary-Lynn Pike
Client Services Supervisor

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2117286-1 MW 18-1 Sampled By: CLIENT on 21-JUN-18 @ 11:20 Matrix: WATER							
Physical Tests							
Colour, Apparent	87.8		2.0	CU		25-JUN-18	R4096736
Conductivity	383		3.0	umhos/cm		23-JUN-18	R4096667
pH	7.74		0.10	pH units		23-JUN-18	R4096667
Total Dissolved Solids	272	DLDS	20	mg/L		27-JUN-18	R4099427
Turbidity	>4000		0.10	NTU		22-JUN-18	R4095398
Anions and Nutrients							
Alkalinity, Bicarbonate (as CaCO3)	202		10	mg/L		27-JUN-18	R4098480
Alkalinity, Carbonate (as CaCO3)	<10		10	mg/L		27-JUN-18	R4098480
Alkalinity, Hydroxide (as CaCO3)	<10		10	mg/L		27-JUN-18	R4098480
Alkalinity, Total (as CaCO3)	202		10	mg/L		27-JUN-18	R4098480
Ammonia, Total (as N)	0.127		0.020	mg/L		25-JUN-18	R4096446
Bromide (Br)	<0.10		0.10	mg/L		26-JUN-18	R4098230
Chloride (Cl)	1.25		0.50	mg/L		26-JUN-18	R4098230
Computed Conductivity	373			uS/cm		28-JUN-18	
Conductivity % Difference	-2.6			%		28-JUN-18	
Fluoride (F)	0.048		0.020	mg/L		26-JUN-18	R4098230
Hardness (as CaCO3)	215			mg/L		28-JUN-18	
Ion Balance	132			%		28-JUN-18	
Langelier Index	0.5					28-JUN-18	
Nitrate and Nitrite as N	0.147		0.022	mg/L		27-JUN-18	
Nitrate (as N)	0.147		0.020	mg/L		26-JUN-18	R4098230
Nitrite (as N)	<0.010		0.010	mg/L		26-JUN-18	R4098230
Saturation pH	7.21			pH		28-JUN-18	
Orthophosphate-Dissolved (as P)	<0.0030		0.0030	mg/L		25-JUN-18	R4096504
TDS (Calculated)	224			mg/L		28-JUN-18	
Sulfate (SO4)	8.39		0.30	mg/L		26-JUN-18	R4098230
Anion Sum	3.56			me/L		28-JUN-18	
Cation Sum	4.70			me/L		28-JUN-18	
Cation - Anion Balance	13.9			%		28-JUN-18	
Organic / Inorganic Carbon							
Dissolved Organic Carbon	2.0		1.0	mg/L		28-JUN-18	R4102418
Inorganic Parameters							
Silica	10.5		0.11	mg/L		26-JUN-18	
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					25-JUN-18	R4096104
Aluminum (Al)-Dissolved	0.0323		0.0050	mg/L	25-JUN-18	25-JUN-18	R4097078
Antimony (Sb)-Dissolved	0.00027		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Arsenic (As)-Dissolved	0.00052		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Barium (Ba)-Dissolved	0.0343		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Beryllium (Be)-Dissolved	<0.00010		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Boron (B)-Dissolved	0.024		0.010	mg/L	25-JUN-18	25-JUN-18	R4097078

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2117286-1 MW 18-1 Sampled By: CLIENT on 21-JUN-18 @ 11:20 Matrix: WATER							
Dissolved Metals							
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L	25-JUN-18	25-JUN-18	R4097078
Calcium (Ca)-Dissolved	78.8		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Chromium (Cr)-Dissolved	0.00079		0.00050	mg/L	25-JUN-18	25-JUN-18	R4097078
Cobalt (Co)-Dissolved	<0.00010		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Copper (Cu)-Dissolved	0.00067		0.00020	mg/L	25-JUN-18	25-JUN-18	R4097078
Iron (Fe)-Dissolved	0.035		0.010	mg/L	25-JUN-18	25-JUN-18	R4097078
Lead (Pb)-Dissolved	0.000053		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Magnesium (Mg)-Dissolved	4.42		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Manganese (Mn)-Dissolved	0.00505		0.00050	mg/L	25-JUN-18	25-JUN-18	R4097078
Molybdenum (Mo)-Dissolved	0.00335		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Nickel (Ni)-Dissolved	<0.00050		0.00050	mg/L	25-JUN-18	25-JUN-18	R4097078
Phosphorus (P)-Dissolved	<0.050		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Potassium (K)-Dissolved	0.637		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Selenium (Se)-Dissolved	0.000501		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Silicon (Si)-Dissolved	4.92		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Silver (Ag)-Dissolved	<0.000050		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Sodium (Na)-Dissolved	8.72		0.50	mg/L	25-JUN-18	25-JUN-18	R4097078
Strontium (Sr)-Dissolved	0.152		0.0010	mg/L	25-JUN-18	25-JUN-18	R4097078
Sulfur (S)-Dissolved	<5.0		5.0	mg/L	25-JUN-18	25-JUN-18	R4097078
Thallium (Tl)-Dissolved	<0.000010		0.000010	mg/L	25-JUN-18	25-JUN-18	R4097078
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Titanium (Ti)-Dissolved	0.00142		0.00030	mg/L	25-JUN-18	25-JUN-18	R4097078
Tungsten (W)-Dissolved	<0.00010		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Uranium (U)-Dissolved	0.000727		0.000010	mg/L	25-JUN-18	25-JUN-18	R4097078
Vanadium (V)-Dissolved	0.00074		0.00050	mg/L	25-JUN-18	25-JUN-18	R4097078
Zinc (Zn)-Dissolved	0.0015		0.0010	mg/L	25-JUN-18	25-JUN-18	R4097078
Zirconium (Zr)-Dissolved	<0.00030		0.00030	mg/L	25-JUN-18	26-JUN-18	R4097078
L2117286-2 MW 18-2 Sampled By: CLIENT on 21-JUN-18 @ 11:35 Matrix: WATER							
Physical Tests							
Colour, Apparent	96.6		2.0	CU		25-JUN-18	R4096736
Conductivity	878		3.0	umhos/cm		23-JUN-18	R4096667
pH	7.94		0.10	pH units		23-JUN-18	R4096667
Total Dissolved Solids	528	DLDS	20	mg/L		27-JUN-18	R4099427
Turbidity	339		0.10	NTU		22-JUN-18	R4095398
Anions and Nutrients							
Alkalinity, Bicarbonate (as CaCO3)	293		10	mg/L		27-JUN-18	R4098480
Alkalinity, Carbonate (as CaCO3)	<10		10	mg/L		27-JUN-18	R4098480
Alkalinity, Hydroxide (as CaCO3)	<10		10	mg/L		27-JUN-18	R4098480
Alkalinity, Total (as CaCO3)	293		10	mg/L		27-JUN-18	R4098480
Ammonia, Total (as N)	0.113		0.020	mg/L		25-JUN-18	R4096446

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2117286-2 MW 18-2							
Sampled By: CLIENT on 21-JUN-18 @ 11:35							
Matrix: WATER							
Anions and Nutrients							
Bromide (Br)	<0.10		0.10	mg/L		26-JUN-18	R4098230
Chloride (Cl)	112		0.50	mg/L		26-JUN-18	R4098230
Computed Conductivity	829			uS/cm		28-JUN-18	
Conductivity % Difference	-5.7			%		28-JUN-18	
Fluoride (F)	0.043		0.020	mg/L		26-JUN-18	R4098230
Hardness (as CaCO3)	324			mg/L		28-JUN-18	
Ion Balance	121			%		28-JUN-18	
Langelier Index	1.0					28-JUN-18	
Nitrate and Nitrite as N	0.061		0.022	mg/L		27-JUN-18	
Nitrate (as N)	0.061		0.020	mg/L		26-JUN-18	R4098230
Nitrite (as N)	<0.010		0.010	mg/L		26-JUN-18	R4098230
Saturation pH	6.95			pH		28-JUN-18	
Orthophosphate-Dissolved (as P)	<0.0030		0.0030	mg/L		25-JUN-18	R4096504
TDS (Calculated)	506			mg/L		28-JUN-18	
Sulfate (SO4)	11.7		0.30	mg/L		26-JUN-18	R4098230
Anion Sum	8.26			me/L		28-JUN-18	
Cation Sum	10.0			me/L		28-JUN-18	
Cation - Anion Balance	9.7			%		28-JUN-18	
Organic / Inorganic Carbon							
Dissolved Organic Carbon	3.4		1.0	mg/L		28-JUN-18	R4102418
Inorganic Parameters							
Silica	11.1		0.11	mg/L		26-JUN-18	
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					25-JUN-18	R4096104
Aluminum (Al)-Dissolved	0.0098		0.0050	mg/L	25-JUN-18	25-JUN-18	R4097078
Antimony (Sb)-Dissolved	0.00013		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Arsenic (As)-Dissolved	0.00080		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Barium (Ba)-Dissolved	0.127		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Beryllium (Be)-Dissolved	<0.00010		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Boron (B)-Dissolved	0.022		0.010	mg/L	25-JUN-18	25-JUN-18	R4097078
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L	25-JUN-18	25-JUN-18	R4097078
Calcium (Ca)-Dissolved	113		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Chromium (Cr)-Dissolved	<0.00050		0.00050	mg/L	25-JUN-18	25-JUN-18	R4097078
Cobalt (Co)-Dissolved	0.00013		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Copper (Cu)-Dissolved	0.00537		0.00020	mg/L	25-JUN-18	25-JUN-18	R4097078
Iron (Fe)-Dissolved	0.023		0.010	mg/L	25-JUN-18	25-JUN-18	R4097078
Lead (Pb)-Dissolved	0.000162		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Magnesium (Mg)-Dissolved	9.83		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Manganese (Mn)-Dissolved	0.0332		0.00050	mg/L	25-JUN-18	25-JUN-18	R4097078
Molybdenum (Mo)-Dissolved	0.00122		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Nickel (Ni)-Dissolved	0.00074		0.00050	mg/L	25-JUN-18	25-JUN-18	R4097078

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2117286-2 MW 18-2 Sampled By: CLIENT on 21-JUN-18 @ 11:35 Matrix: WATER							
Dissolved Metals							
Phosphorus (P)-Dissolved	<0.050		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Potassium (K)-Dissolved	2.28		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Selenium (Se)-Dissolved	0.000132		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Silicon (Si)-Dissolved	5.21		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Silver (Ag)-Dissolved	<0.000050		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Sodium (Na)-Dissolved	80.4		0.50	mg/L	25-JUN-18	25-JUN-18	R4097078
Strontium (Sr)-Dissolved	0.282		0.0010	mg/L	25-JUN-18	25-JUN-18	R4097078
Sulfur (S)-Dissolved	<5.0		5.0	mg/L	25-JUN-18	25-JUN-18	R4097078
Thallium (Tl)-Dissolved	0.000013		0.000010	mg/L	25-JUN-18	25-JUN-18	R4097078
Tin (Sn)-Dissolved	0.00067		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L	25-JUN-18	25-JUN-18	R4097078
Tungsten (W)-Dissolved	<0.00010		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Uranium (U)-Dissolved	0.00119		0.000010	mg/L	25-JUN-18	25-JUN-18	R4097078
Vanadium (V)-Dissolved	0.00098		0.00050	mg/L	25-JUN-18	25-JUN-18	R4097078
Zinc (Zn)-Dissolved	0.0115		0.0010	mg/L	25-JUN-18	25-JUN-18	R4097078
Zirconium (Zr)-Dissolved	<0.00030		0.00030	mg/L	25-JUN-18	26-JUN-18	R4097078
L2117286-3 MW 18-3 Sampled By: CLIENT on 21-JUN-18 @ 10:40 Matrix: WATER							
Physical Tests							
Colour, Apparent	95.0		2.0	CU		25-JUN-18	R4096736
Conductivity	1240		3.0	umhos/cm		23-JUN-18	R4096667
pH	7.31		0.10	pH units		23-JUN-18	R4096667
Total Dissolved Solids	853	DLDS	20	mg/L		27-JUN-18	R4099427
Turbidity	>4000		0.10	NTU		22-JUN-18	R4095398
Anions and Nutrients							
Alkalinity, Bicarbonate (as CaCO3)	377		10	mg/L		27-JUN-18	R4098480
Alkalinity, Carbonate (as CaCO3)	<10		10	mg/L		27-JUN-18	R4098480
Alkalinity, Hydroxide (as CaCO3)	<10		10	mg/L		27-JUN-18	R4098480
Alkalinity, Total (as CaCO3)	377		10	mg/L		27-JUN-18	R4098480
Ammonia, Total (as N)	0.296		0.020	mg/L		25-JUN-18	R4096446
Bromide (Br)	<0.10		0.10	mg/L		26-JUN-18	R4098230
Chloride (Cl)	181		0.50	mg/L		26-JUN-18	R4098230
Computed Conductivity	1140			uS/cm		28-JUN-18	
Conductivity % Difference	-8.3			%		28-JUN-18	
Fluoride (F)	0.037		0.020	mg/L		26-JUN-18	R4098230
Hardness (as CaCO3)	480			mg/L		28-JUN-18	
Ion Balance	113			%		28-JUN-18	
Langelier Index	0.6					28-JUN-18	
Nitrate and Nitrite as N	<0.022		0.022	mg/L		27-JUN-18	
Nitrate (as N)	<0.020		0.020	mg/L		26-JUN-18	R4098230
Nitrite (as N)	<0.010		0.010	mg/L		26-JUN-18	R4098230

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2117286-3 MW 18-3							
Sampled By: CLIENT on 21-JUN-18 @ 10:40							
Matrix: WATER							
Anions and Nutrients							
Saturation pH	6.73			pH		28-JUN-18	
Orthophosphate-Dissolved (as P)	<0.0030		0.0030	mg/L		25-JUN-18	R4096504
TDS (Calculated)	712			mg/L		28-JUN-18	
Sulfate (SO4)	33.3		0.30	mg/L		26-JUN-18	R4098230
Anion Sum	12.0			me/L		28-JUN-18	
Cation Sum	13.6			me/L		28-JUN-18	
Cation - Anion Balance	6.2			%		28-JUN-18	
Organic / Inorganic Carbon							
Dissolved Organic Carbon	3.8		1.0	mg/L		28-JUN-18	R4102418
Inorganic Parameters							
Silica	18.4		0.11	mg/L		26-JUN-18	
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					25-JUN-18	R4096104
Aluminum (Al)-Dissolved	<0.0050		0.0050	mg/L	25-JUN-18	25-JUN-18	R4097078
Antimony (Sb)-Dissolved	<0.00010		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Arsenic (As)-Dissolved	0.00178		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Barium (Ba)-Dissolved	0.195		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Beryllium (Be)-Dissolved	<0.00010		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Boron (B)-Dissolved	0.031		0.010	mg/L	25-JUN-18	25-JUN-18	R4097078
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L	25-JUN-18	25-JUN-18	R4097078
Calcium (Ca)-Dissolved	161		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Chromium (Cr)-Dissolved	<0.00050		0.00050	mg/L	25-JUN-18	25-JUN-18	R4097078
Cobalt (Co)-Dissolved	0.00072		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Copper (Cu)-Dissolved	0.00027		0.00020	mg/L	25-JUN-18	25-JUN-18	R4097078
Iron (Fe)-Dissolved	1.88		0.010	mg/L	25-JUN-18	25-JUN-18	R4097078
Lead (Pb)-Dissolved	0.000055		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Magnesium (Mg)-Dissolved	18.7		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Manganese (Mn)-Dissolved	3.37	DLHC	0.0050	mg/L	25-JUN-18	26-JUN-18	R4097078
Molybdenum (Mo)-Dissolved	0.000547		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Nickel (Ni)-Dissolved	0.00200		0.00050	mg/L	25-JUN-18	25-JUN-18	R4097078
Phosphorus (P)-Dissolved	<0.050		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Potassium (K)-Dissolved	1.17		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Selenium (Se)-Dissolved	<0.000050		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Silicon (Si)-Dissolved	8.58		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Silver (Ag)-Dissolved	<0.000050		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Sodium (Na)-Dissolved	90.4		0.50	mg/L	25-JUN-18	25-JUN-18	R4097078
Strontium (Sr)-Dissolved	0.383		0.0010	mg/L	25-JUN-18	25-JUN-18	R4097078
Sulfur (S)-Dissolved	13.1		5.0	mg/L	25-JUN-18	25-JUN-18	R4097078
Thallium (Tl)-Dissolved	<0.000010		0.000010	mg/L	25-JUN-18	25-JUN-18	R4097078
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L	25-JUN-18	25-JUN-18	R4097078

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2117286-3 MW 18-3 Sampled By: CLIENT on 21-JUN-18 @ 10:40 Matrix: WATER							
Dissolved Metals							
Tungsten (W)-Dissolved	<0.00010		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Uranium (U)-Dissolved	0.000327		0.000010	mg/L	25-JUN-18	25-JUN-18	R4097078
Vanadium (V)-Dissolved	<0.00050		0.00050	mg/L	25-JUN-18	25-JUN-18	R4097078
Zinc (Zn)-Dissolved	0.0019		0.0010	mg/L	25-JUN-18	25-JUN-18	R4097078
Zirconium (Zr)-Dissolved	<0.00030		0.00030	mg/L	25-JUN-18	26-JUN-18	R4097078
L2117286-4 DUP Sampled By: CLIENT on 21-JUN-18 @ 10:50 Matrix: WATER							
Physical Tests							
Colour, Apparent	61.7		2.0	CU		25-JUN-18	R4096736
Conductivity	1230		3.0	umhos/cm		23-JUN-18	R4096667
pH	7.39		0.10	pH units		23-JUN-18	R4096667
Total Dissolved Solids	796	DLDS	20	mg/L		27-JUN-18	R4099427
Turbidity	>4000		0.10	NTU		22-JUN-18	R4095398
Anions and Nutrients							
Alkalinity, Bicarbonate (as CaCO3)	372		10	mg/L		27-JUN-18	R4098480
Alkalinity, Carbonate (as CaCO3)	<10		10	mg/L		27-JUN-18	R4098480
Alkalinity, Hydroxide (as CaCO3)	<10		10	mg/L		27-JUN-18	R4098480
Alkalinity, Total (as CaCO3)	372		10	mg/L		27-JUN-18	R4098480
Ammonia, Total (as N)	0.354		0.020	mg/L		25-JUN-18	R4096446
Bromide (Br)	<0.10		0.10	mg/L		26-JUN-18	R4098230
Chloride (Cl)	178		0.50	mg/L		26-JUN-18	R4098230
Computed Conductivity	1130			uS/cm		28-JUN-18	
Conductivity % Difference	-8.3			%		28-JUN-18	
Fluoride (F)	0.045		0.020	mg/L		26-JUN-18	R4098230
Hardness (as CaCO3)	478			mg/L		28-JUN-18	
Ion Balance	114			%		28-JUN-18	
Langelier Index	0.7					28-JUN-18	
Nitrate and Nitrite as N	<0.022		0.022	mg/L		27-JUN-18	
Nitrate (as N)	<0.020		0.020	mg/L		26-JUN-18	R4098230
Nitrite (as N)	<0.010		0.010	mg/L		26-JUN-18	R4098230
Saturation pH	6.74			pH		28-JUN-18	
Orthophosphate-Dissolved (as P)	<0.0030		0.0030	mg/L		25-JUN-18	R4096504
TDS (Calculated)	706			mg/L		28-JUN-18	
Sulfate (SO4)	34.3		0.30	mg/L		26-JUN-18	R4098230
Anion Sum	11.8			me/L		28-JUN-18	
Cation Sum	13.5			me/L		28-JUN-18	
Cation - Anion Balance	6.7			%		28-JUN-18	
Organic / Inorganic Carbon							
Dissolved Organic Carbon	4.7		1.0	mg/L		28-JUN-18	R4102418
Inorganic Parameters							
Silica	18.0		0.11	mg/L		26-JUN-18	

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2117286-4 DUP Sampled By: CLIENT on 21-JUN-18 @ 10:50 Matrix: WATER							
Inorganic Parameters							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					25-JUN-18	R4096104
Aluminum (Al)-Dissolved	<0.0050		0.0050	mg/L	25-JUN-18	25-JUN-18	R4097078
Antimony (Sb)-Dissolved	0.00014		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Arsenic (As)-Dissolved	0.00375		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Barium (Ba)-Dissolved	0.237		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Beryllium (Be)-Dissolved	<0.00010		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Boron (B)-Dissolved	0.033		0.010	mg/L	25-JUN-18	25-JUN-18	R4097078
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L	25-JUN-18	25-JUN-18	R4097078
Calcium (Ca)-Dissolved	160		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Chromium (Cr)-Dissolved	<0.00050		0.00050	mg/L	25-JUN-18	25-JUN-18	R4097078
Cobalt (Co)-Dissolved	0.00074		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Copper (Cu)-Dissolved	<0.00020		0.00020	mg/L	25-JUN-18	25-JUN-18	R4097078
Iron (Fe)-Dissolved	0.470		0.010	mg/L	25-JUN-18	25-JUN-18	R4097078
Lead (Pb)-Dissolved	<0.000050		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Magnesium (Mg)-Dissolved	19.1		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Manganese (Mn)-Dissolved	2.91	DLHC	0.0050	mg/L	25-JUN-18	26-JUN-18	R4097078
Molybdenum (Mo)-Dissolved	0.000814		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Nickel (Ni)-Dissolved	0.00226		0.00050	mg/L	25-JUN-18	25-JUN-18	R4097078
Phosphorus (P)-Dissolved	<0.050		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Potassium (K)-Dissolved	1.40		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Selenium (Se)-Dissolved	<0.000050		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Silicon (Si)-Dissolved	8.42		0.050	mg/L	25-JUN-18	25-JUN-18	R4097078
Silver (Ag)-Dissolved	<0.000050		0.000050	mg/L	25-JUN-18	25-JUN-18	R4097078
Sodium (Na)-Dissolved	90.7		0.50	mg/L	25-JUN-18	25-JUN-18	R4097078
Strontium (Sr)-Dissolved	0.383		0.0010	mg/L	25-JUN-18	25-JUN-18	R4097078
Sulfur (S)-Dissolved	12.7		5.0	mg/L	25-JUN-18	25-JUN-18	R4097078
Thallium (Tl)-Dissolved	<0.000010		0.000010	mg/L	25-JUN-18	25-JUN-18	R4097078
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L	25-JUN-18	25-JUN-18	R4097078
Tungsten (W)-Dissolved	<0.00010		0.00010	mg/L	25-JUN-18	25-JUN-18	R4097078
Uranium (U)-Dissolved	0.000492		0.000010	mg/L	25-JUN-18	25-JUN-18	R4097078
Vanadium (V)-Dissolved	0.00134		0.00050	mg/L	25-JUN-18	25-JUN-18	R4097078
Zinc (Zn)-Dissolved	<0.0010		0.0010	mg/L	25-JUN-18	25-JUN-18	R4097078
Zirconium (Zr)-Dissolved	<0.00030		0.00030	mg/L	25-JUN-18	26-JUN-18	R4097078

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Chloride (Cl)	MS-B	L2117286-1, -2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2117286-1, -2, -3, -4
Matrix Spike	Boron (B)-Dissolved	MS-B	L2117286-1, -2, -3, -4
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2117286-1, -2, -3, -4
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2117286-1, -2, -3, -4
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2117286-1, -2, -3, -4
Matrix Spike	Potassium (K)-Dissolved	MS-B	L2117286-1, -2, -3, -4
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L2117286-1, -2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2117286-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2117286-1, -2, -3, -4
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L2117286-1, -2, -3, -4
Matrix Spike	Uranium (U)-Dissolved	MS-B	L2117286-1, -2, -3, -4

Sample Parameter Qualifier key listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-AUTO-WT	Water	Automated Speciated Alkalinity	EPA 310.2

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

ALK-SPECIATED-WT	Water	pH Measurement for Spec. Alk	APHA 4500 H-Electrode

Water samples are analyzed directly by a calibrated pH meter.

BR-IC-N-WT	Water	Bromide in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

C-DIS-ORG-WT	Water	Dissolved Organic Carbon	APHA 5310B

Sample is filtered through a 0.45um filter, then injected into a heated reaction chamber which is packed with an oxidative catalyst. The water is vaporized and the organic carbon is oxidized to carbon dioxide. The carbon dioxide is transported in a carrier gas and is measured by a non-dispersive infrared detector.

CL-IC-N-WT	Water	Chloride by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

COLOUR-APPARENT-WT	Water	Colour	APHA 2120

Apparent Colour is measured spectrophotometrically by comparison to platinum-cobalt standards using the single wavelength method after sample decanting. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.

EC-WT	Water	Conductivity	APHA 2510 B

Water samples can be measured directly by immersing the conductivity cell into the sample.

ETL-N2N3-WT	Water	Calculate from NO2 + NO3	APHA 4110 B
ETL-SILICA-CALC-WT	Water	Calculate from SI-TOT-WT	EPA 200.8
F-IC-N-WT	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

IONBALANCE-OP03-WT	Water	Detailed Ion Balance Calculation	APHA 1030E, 2330B, 2510A
MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Reference Information

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

NH3-WT	Water	Ammonia, Total as N	EPA 350.1

Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.

NO2-IC-WT	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

PO4-DO-COL-WT	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TDS-WT	Water	Total Dissolved Solids	APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TURBIDITY-WT	Water	Turbidity	APHA 2130 B

Sample result is based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. Sample readings are obtained from a Nephelometer.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

17-624360

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: WSP Canada Inc. (Aurora)
126 Don Hilock Drive Unit 2
Aurora ON L4G 0G9
Contact: Jake Whittamore

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-AUTO-WT	**Water**							
Batch R4098480								
WG2808519-3 CRM		**WT-ALK-CRM**						
Alkalinity, Total (as CaCO3)			95.4		%		80-120	27-JUN-18
WG2808519-4 DUP		**L2118034-1**						
Alkalinity, Total (as CaCO3)		107	108		mg/L	0.8	20	27-JUN-18
WG2808519-2 LCS								
Alkalinity, Total (as CaCO3)			94.4		%		85-115	27-JUN-18
WG2808519-1 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	27-JUN-18
ALK-SPECIATED-WT	**Water**							
Batch R4096667								
WG2805161-4 DUP		**WG2805161-3**						
pH		7.78	7.80	J	pH units	0.03	0.2	23-JUN-18
WG2805161-2 LCS								
pH			6.98		pH units		6.9-7.1	23-JUN-18
BR-IC-N-WT	**Water**							
Batch R4098230								
WG2807031-10 DUP		**L2117286-4**						
Bromide (Br)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	26-JUN-18
WG2807031-7 LCS								
Bromide (Br)			99.7		%		85-115	26-JUN-18
WG2807031-6 MB								
Bromide (Br)			<0.10		mg/L		0.1	26-JUN-18
WG2807031-9 MS		**L2117286-4**						
Bromide (Br)			91.6		%		75-125	26-JUN-18
C-DIS-ORG-WT	**Water**							
Batch R4102418								
WG2810133-3 DUP		**L2117612-2**						
Dissolved Organic Carbon		4.9	3.3	J	mg/L	1.6	2	28-JUN-18
WG2810133-2 LCS								
Dissolved Organic Carbon			98.0		%		80-120	28-JUN-18
WG2810133-1 MB								
Dissolved Organic Carbon			<1.0		mg/L		1	28-JUN-18
WG2810133-4 MS		**L2117612-2**						
Dissolved Organic Carbon			82.2		%		70-130	28-JUN-18
CL-IC-N-WT	**Water**							

Quality Control Report

Client: WSP Canada Inc. (Aurora)
126 Don Hilock Drive Unit 2
Aurora ON L4G 0G9
Contact: Jake Whittamore

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-N-WT	**Water**							
Batch R4098230								
WG2807031-10 DUP		**L2117286-4**						
Chloride (Cl)		178	177		mg/L	0.5	20	26-JUN-18
WG2807031-7 LCS								
Chloride (Cl)			102.3		%		90-110	26-JUN-18
WG2807031-6 MB								
Chloride (Cl)			<0.50		mg/L		0.5	26-JUN-18
WG2807031-9 MS		**L2117286-4**						
Chloride (Cl)			N/A	MS-B	%		-	26-JUN-18
COLOUR-APPARENT-WT	**Water**							
Batch R4096736								
WG2804951-3 DUP		**L2117286-1**						
Colour, Apparent		87.8	85.1		CU	3.1	20	25-JUN-18
WG2804951-2 LCS								
Colour, Apparent			107.5		%		85-115	25-JUN-18
WG2804951-1 MB								
Colour, Apparent			<2.0		CU		2	25-JUN-18
EC-WT	**Water**							
Batch R4096667								
WG2805161-4 DUP		**WG2805161-3**						
Conductivity		82.3	80.0		umhos/cm	2.8	10	23-JUN-18
WG2805161-2 LCS								
Conductivity			96.6		%		90-110	23-JUN-18
WG2805161-1 MB								
Conductivity			<3.0		umhos/cm		3	23-JUN-18
F-IC-N-WT	**Water**							
Batch R4098230								
WG2807031-10 DUP		**L2117286-4**						
Fluoride (F)		0.045	0.046		mg/L	3.6	20	26-JUN-18
WG2807031-7 LCS								
Fluoride (F)			102.2		%		90-110	26-JUN-18
WG2807031-6 MB								
Fluoride (F)			<0.020		mg/L		0.02	26-JUN-18
WG2807031-9 MS		**L2117286-4**						
Fluoride (F)			99.9		%		75-125	26-JUN-18
MET-D-CCMS-WT	**Water**							

Quality Control Report

Client: WSP Canada Inc. (Aurora)
126 Don Hilock Drive Unit 2
Aurora ON L4G 0G9
Contact: Jake Whittamore

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R4097078								
WG2805781-4 DUP		**WG2805781-3**						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	26-JUN-18
Antimony (Sb)-Dissolved		0.00112	0.00113		mg/L	0.3	20	26-JUN-18
Arsenic (As)-Dissolved		0.00437	0.00427		mg/L	2.3	20	26-JUN-18
Barium (Ba)-Dissolved		0.135	0.139		mg/L	2.4	20	26-JUN-18
Beryllium (Be)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-JUN-18
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	26-JUN-18
Boron (B)-Dissolved		0.199	0.211		mg/L	6.1	20	26-JUN-18
Cadmium (Cd)-Dissolved		<0.0000050	<0.000005C	RPD-NA	mg/L	N/A	20	26-JUN-18
Calcium (Ca)-Dissolved		30.7	30.6		mg/L	0.1	20	26-JUN-18
Chromium (Cr)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	26-JUN-18
Cobalt (Co)-Dissolved		0.00016	0.00016		mg/L	4.2	20	26-JUN-18
Copper (Cu)-Dissolved		0.00059	0.00059		mg/L	0.2	20	26-JUN-18
Iron (Fe)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	26-JUN-18
Lead (Pb)-Dissolved		0.000193	0.000191		mg/L	0.9	20	26-JUN-18
Magnesium (Mg)-Dissolved		79.2	81.0		mg/L	2.2	20	26-JUN-18
Manganese (Mn)-Dissolved		0.0594	0.0602		mg/L	1.3	20	26-JUN-18
Molybdenum (Mo)-Dissolved		0.00905	0.00913		mg/L	0.9	20	26-JUN-18
Nickel (Ni)-Dissolved		0.00080	0.00081		mg/L	1.6	20	26-JUN-18
Phosphorus (P)-Dissolved		0.150	0.132		mg/L	13	20	26-JUN-18
Potassium (K)-Dissolved		11.8	12.0		mg/L	1.7	20	26-JUN-18
Selenium (Se)-Dissolved		0.000481	0.000478		mg/L	0.5	20	26-JUN-18
Silicon (Si)-Dissolved		5.66	5.57		mg/L	1.7	20	26-JUN-18
Silver (Ag)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	26-JUN-18
Sodium (Na)-Dissolved		259	258		mg/L	0.2	20	25-JUN-18
Strontium (Sr)-Dissolved		0.368	0.375		mg/L	1.9	20	26-JUN-18
Sulfur (S)-Dissolved		31.7	31.6		mg/L	0.3	20	26-JUN-18
Thallium (Tl)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	26-JUN-18
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-JUN-18
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	26-JUN-18
Tungsten (W)-Dissolved		0.00197	0.00194		mg/L	1.5	20	26-JUN-18
Uranium (U)-Dissolved		0.000509	0.000486		mg/L	4.7	20	26-JUN-18
Vanadium (V)-Dissolved		0.00171	0.00171		mg/L	0.0	20	26-JUN-18
Zinc (Zn)-Dissolved		0.0021	0.0017		mg/L			26-JUN-18

Quality Control Report

Client: WSP Canada Inc. (Aurora)
126 Don Hilock Drive Unit 2
Aurora ON L4G 0G9
Contact: Jake Whittamore

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R4097078								
WG2805781-4 DUP		**WG2805781-3**						
Zinc (Zn)-Dissolved		0.0021	0.0017	J	mg/L	0.0004	0.002	26-JUN-18
Zirconium (Zr)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	26-JUN-18
WG2805781-2 LCS								
Aluminum (Al)-Dissolved			103.8		%		80-120	25-JUN-18
Antimony (Sb)-Dissolved			102.2		%		80-120	25-JUN-18
Arsenic (As)-Dissolved			103.2		%		80-120	25-JUN-18
Barium (Ba)-Dissolved			99.5		%		80-120	25-JUN-18
Beryllium (Be)-Dissolved			103.0		%		80-120	25-JUN-18
Bismuth (Bi)-Dissolved			103.8		%		80-120	25-JUN-18
Boron (B)-Dissolved			101.3		%		80-120	25-JUN-18
Cadmium (Cd)-Dissolved			96.9		%		80-120	25-JUN-18
Calcium (Ca)-Dissolved			100.5		%		80-120	25-JUN-18
Chromium (Cr)-Dissolved			100.5		%		80-120	25-JUN-18
Cobalt (Co)-Dissolved			101.1		%		80-120	25-JUN-18
Copper (Cu)-Dissolved			100.9		%		80-120	25-JUN-18
Iron (Fe)-Dissolved			104.4		%		80-120	25-JUN-18
Lead (Pb)-Dissolved			98.7		%		80-120	25-JUN-18
Magnesium (Mg)-Dissolved			109.1		%		80-120	25-JUN-18
Manganese (Mn)-Dissolved			107.9		%		80-120	25-JUN-18
Molybdenum (Mo)-Dissolved			99.5		%		80-120	25-JUN-18
Nickel (Ni)-Dissolved			100.7		%		80-120	25-JUN-18
Phosphorus (P)-Dissolved			106.8		%		80-120	25-JUN-18
Potassium (K)-Dissolved			107.9		%		80-120	25-JUN-18
Selenium (Se)-Dissolved			104.2		%		80-120	25-JUN-18
Silicon (Si)-Dissolved			106.4		%		60-140	25-JUN-18
Silver (Ag)-Dissolved			96.6		%		80-120	25-JUN-18
Sodium (Na)-Dissolved			110.2		%		80-120	25-JUN-18
Strontium (Sr)-Dissolved			98.1		%		80-120	25-JUN-18
Sulfur (S)-Dissolved			108.4		%		80-120	25-JUN-18
Thallium (Tl)-Dissolved			106.2		%		80-120	25-JUN-18
Tin (Sn)-Dissolved			96.7		%		80-120	25-JUN-18
Titanium (Ti)-Dissolved			99.7		%		80-120	25-JUN-18
Tungsten (W)-Dissolved			99.9		%		80-120	25-JUN-18
Uranium (U)-Dissolved			99.7		%		80-120	25-JUN-18

Quality Control Report

Client: WSP Canada Inc. (Aurora)
126 Don Hilock Drive Unit 2
Aurora ON L4G 0G9

Contact: Jake Whittamore

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R4097078								
WG2805781-2 LCS								
Vanadium (V)-Dissolved			104.3		%		80-120	25-JUN-18
Zinc (Zn)-Dissolved			96.3		%		80-120	25-JUN-18
Zirconium (Zr)-Dissolved			96.0		%		80-120	25-JUN-18
WG2805781-1 MB								
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	25-JUN-18
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	25-JUN-18
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	25-JUN-18
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	25-JUN-18
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	25-JUN-18
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	25-JUN-18
Boron (B)-Dissolved			<0.010		mg/L		0.01	25-JUN-18
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	25-JUN-18
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	25-JUN-18
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	25-JUN-18
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	25-JUN-18
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	25-JUN-18
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	25-JUN-18
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	25-JUN-18
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	25-JUN-18
Manganese (Mn)-Dissolved			<0.00050		mg/L		0.0005	25-JUN-18
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	25-JUN-18
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	25-JUN-18
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	25-JUN-18
Potassium (K)-Dissolved			<0.050		mg/L		0.05	25-JUN-18
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	25-JUN-18
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	25-JUN-18
Silver (Ag)-Dissolved			<0.000050		mg/L		0.00005	25-JUN-18
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	25-JUN-18
Strontium (Sr)-Dissolved			<0.0010		mg/L		0.001	25-JUN-18
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	25-JUN-18
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	25-JUN-18
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	25-JUN-18
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	25-JUN-18
Tungsten (W)-Dissolved			<0.00010		mg/L		0.0001	25-JUN-18

Client: WSP Canada Inc. (Aurora)
126 Don Hilock Drive Unit 2
Aurora ON L4G 0G9
Contact: Jake Whittamore

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R4097078								
WG2805781-1 MB								
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	25-JUN-18
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	25-JUN-18
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	25-JUN-18
Zirconium (Zr)-Dissolved			<0.00030		mg/L		0.0003	25-JUN-18
WG2805781-5 MS		**WG2805781-3**						
Aluminum (Al)-Dissolved			105.5		%		70-130	26-JUN-18
Antimony (Sb)-Dissolved			92.0		%		70-130	26-JUN-18
Arsenic (As)-Dissolved			100.9		%		70-130	26-JUN-18
Barium (Ba)-Dissolved			N/A	MS-B	%		-	26-JUN-18
Beryllium (Be)-Dissolved			100.8		%		70-130	26-JUN-18
Bismuth (Bi)-Dissolved			89.2		%		70-130	26-JUN-18
Boron (B)-Dissolved			N/A	MS-B	%		-	26-JUN-18
Cadmium (Cd)-Dissolved			95.8		%		70-130	26-JUN-18
Calcium (Ca)-Dissolved			N/A	MS-B	%		-	26-JUN-18
Chromium (Cr)-Dissolved			95.6		%		70-130	26-JUN-18
Cobalt (Co)-Dissolved			92.9		%		70-130	26-JUN-18
Copper (Cu)-Dissolved			90.7		%		70-130	26-JUN-18
Iron (Fe)-Dissolved			91.5		%		70-130	26-JUN-18
Lead (Pb)-Dissolved			99.0		%		70-130	26-JUN-18
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	26-JUN-18
Manganese (Mn)-Dissolved			N/A	MS-B	%		-	26-JUN-18
Molybdenum (Mo)-Dissolved			96.2		%		70-130	26-JUN-18
Nickel (Ni)-Dissolved			89.3		%		70-130	26-JUN-18
Phosphorus (P)-Dissolved			104.2		%		70-130	26-JUN-18
Potassium (K)-Dissolved			N/A	MS-B	%		-	26-JUN-18
Selenium (Se)-Dissolved			100.3		%		70-130	26-JUN-18
Silicon (Si)-Dissolved			N/A	MS-B	%		-	26-JUN-18
Silver (Ag)-Dissolved			93.4		%		70-130	26-JUN-18
Sodium (Na)-Dissolved			N/A	MS-B	%		-	25-JUN-18
Strontium (Sr)-Dissolved			N/A	MS-B	%		-	26-JUN-18
Sulfur (S)-Dissolved			N/A	MS-B	%		-	26-JUN-18
Thallium (Tl)-Dissolved			92.3		%		70-130	26-JUN-18
Tin (Sn)-Dissolved			97.0		%		70-130	26-JUN-18
Titanium (Ti)-Dissolved			98.8		%		70-130	26-JUN-18

ALS Environmental

Quality Control Report

Client: WSP Canada Inc. (Aurora)
126 Don Hilock Drive Unit 2
Aurora ON L4G 0G9
Contact: Jake Whittamore

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R4097078								
WG2805781-5 MS		**WG2805781-3**						
Tungsten (W)-Dissolved			103.5		%		70-130	26-JUN-18
Uranium (U)-Dissolved			N/A	MS-B	%		-	26-JUN-18
Vanadium (V)-Dissolved			100.6		%		70-130	26-JUN-18
Zinc (Zn)-Dissolved			96.8		%		70-130	26-JUN-18
Zirconium (Zr)-Dissolved			98.0		%		70-130	26-JUN-18
NH3-WT	**Water**							
Batch R4096446								
WG2805816-3 DUP		**L2117300-1**						
Ammonia, Total (as N)		<0.020	<0.020	RPD-NA	mg/L	N/A	20	25-JUN-18
WG2805816-2 LCS								
Ammonia, Total (as N)			99.96		%		85-115	25-JUN-18
WG2805816-1 MB								
Ammonia, Total (as N)			<0.020		mg/L		0.02	25-JUN-18
WG2805816-4 MS		**L2117300-1**						
Ammonia, Total (as N)			94.1		%		75-125	25-JUN-18
NO2-IC-WT	**Water**							
Batch R4098230								
WG2807031-10 DUP		**L2117286-4**						
Nitrite (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	25	26-JUN-18
WG2807031-7 LCS								
Nitrite (as N)			101.9		%		70-130	26-JUN-18
WG2807031-6 MB								
Nitrite (as N)			<0.010		mg/L		0.01	26-JUN-18
WG2807031-9 MS		**L2117286-4**						
Nitrite (as N)			92.6		%		70-130	26-JUN-18
NO3-IC-WT	**Water**							
Batch R4098230								
WG2807031-10 DUP		**L2117286-4**						
Nitrate (as N)		<0.020	<0.020	RPD-NA	mg/L	N/A	25	26-JUN-18
WG2807031-7 LCS								
Nitrate (as N)			101.6		%		70-130	26-JUN-18
WG2807031-6 MB								
Nitrate (as N)			<0.020		mg/L		0.02	26-JUN-18
WG2807031-9 MS		**L2117286-4**						
Nitrate (as N)			100.2		%		70-130	26-JUN-18
PO4-DO-COL-WT	**Water**							

Quality Control Report

Client: WSP Canada Inc. (Aurora)
126 Don Hilock Drive Unit 2
Aurora ON L4G 0G9
Contact: Jake Whittamore

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PO4-DO-COL-WT	**Water**							
Batch R4096504								
WG2805871-3 DUP		**L2116343-1**						
Orthophosphate-Dissolved (as P)		<0.0030	<0.0030	RPD-NA	mg/L	N/A	30	25-JUN-18
WG2805871-7 DUP		**L2117286-1**						
Orthophosphate-Dissolved (as P)		<0.0030	<0.0030	RPD-NA	mg/L	N/A	30	25-JUN-18
WG2805871-2 LCS								
Orthophosphate-Dissolved (as P)			102.9		%		70-130	25-JUN-18
WG2805871-6 LCS								
Orthophosphate-Dissolved (as P)			108.6		%		70-130	25-JUN-18
WG2805871-1 MB								
Orthophosphate-Dissolved (as P)			<0.0030		mg/L		0.003	25-JUN-18
WG2805871-5 MB								
Orthophosphate-Dissolved (as P)			<0.0030		mg/L		0.003	25-JUN-18
WG2805871-4 MS		**L2116343-1**						
Orthophosphate-Dissolved (as P)			100.7		%		70-130	25-JUN-18
WG2805871-8 MS		**L2117286-1**						
Orthophosphate-Dissolved (as P)			109.8		%		70-130	25-JUN-18
SO4-IC-N-WT	**Water**							
Batch R4098230								
WG2807031-10 DUP		**L2117286-4**						
Sulfate (SO4)		34.3	34.2		mg/L	0.1	20	26-JUN-18
WG2807031-7 LCS								
Sulfate (SO4)			103.0		%		90-110	26-JUN-18
WG2807031-6 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	26-JUN-18
WG2807031-9 MS		**L2117286-4**						
Sulfate (SO4)			105.1		%		75-125	26-JUN-18
SOLIDS-TDS-WT	**Water**							
Batch R4099427								
WG2807086-3 DUP		**L2117148-1**						
Total Dissolved Solids		119	123		mg/L	2.9	20	27-JUN-18
WG2807086-2 LCS								
Total Dissolved Solids			94.1		%		85-115	27-JUN-18
WG2807086-1 MB								
Total Dissolved Solids			<10		mg/L		10	27-JUN-18
TURBIDITY-WT	**Water**							

Quality Control Report

Client: WSP Canada Inc. (Aurora)
126 Don Hilock Drive Unit 2
Aurora ON L4G 0G9

Contact: Jake Whittamore

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TURBIDITY-WT	**Water**							
Batch R4095398								
WG2804812-3 DUP		**L2117286-2**						
Turbidity		339	344		NTU	1.5	15	22-JUN-18
WG2804812-2 LCS								
Turbidity			105.0		%		85-115	22-JUN-18
WG2804812-1 MB								
Turbidity			<0.10		NTU		0.1	22-JUN-18

Client: WSP Canada Inc. (Aurora)
126 Don Hilock Drive Unit 2
Aurora ON L4G 0G9

Contact: Jake Whittamore

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Client: WSP Canada Inc. (Aurora)
126 Don Hilock Drive Unit 2
Aurora ON L4G 0G9

Contact: Jake Whittamore

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Colour							
	1	21-JUN-18 11:20	25-JUN-18 00:00	48	85	hours	EHTL
	2	21-JUN-18 11:35	25-JUN-18 00:00	48	84	hours	EHTL
	3	21-JUN-18 10:40	25-JUN-18 00:00	48	85	hours	EHTL
	4	21-JUN-18 10:50	25-JUN-18 00:00	48	85	hours	EHTL

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2117286 were received on 22-JUN-18 12:05.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L2117286-COFC

COC Number: 17 - 624360

Page of

Report To	Contact and company name below will appear on the final report
Company:	WSP Canada Inc.
Contact:	Jake Whittamore
Phone:	289-552-1022
	Company address below will appear on the final report
Street:	126 Don Hillock Dr
City/Province:	Aurora, ON
Postal Code:	L4G 0G9
Invoice To	Same as Report To [X] YES [ ] NO
	Copy of Invoice with Report [X] YES [ ] NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: [X] PDF [X] EXCEL [ ] EDD (DIGITAL)

Quality Control (QC) Report with Report [X] YES [ ] NO

[ ] Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: [X] EMAIL [ ] MAIL [ ] FAX

Email 1 or Fax: jake.whittamore@gmail.com

Email 2:

Email 3:

Invoice Distribution

Select Invoice Distribution: [X] EMAIL [ ] MAIL [ ] FAX

Email 1 or Fax: jake.whittamore@gmail.com

Email 2: payables.ontario@wsp.com

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] [X] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] [ ] / 3 day [P3-25%] [ ] / 2 day [P2-50%] [ ]

EMERGENCY: 1 Business day [E-100%] [ ] / Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] [ ]

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: As per company pricing agreement

Job #: 161-06776-00/100/1003

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#:

Major/Minor Code: | Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only): L2117286 RK 22 JB

ALS Contact: MW

Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	GENCHEM 3	DOC	Metals (F/P)	NH3 (P)	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
1	MW18-1	21-Jun-18	11:20	GW	X	X	X	X			4
2	MW18-2	↓	11:35	GW	X	X	X	X			4
3	MW18-3	↓	10:40	GW	X	X	X	X			4
4	DUP	↓	10:50	GW	X	X	X	X			4

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] YES [X] NO

Are samples for human consumption/ use? [ ] YES [X] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No

Ice Packs [ ] Ice Cubes [ ] Custody seal intact Yes [ ] No

Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C | FINAL COOLER TEMPERATURES °C: 4.8

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Jake Whittamore	Date: 06/21/18	Time: 14:30	Received by: [redacted]	Date:	Time:	Received by: [signature]	Date: JUNE 22/18	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION — WHITE - LABORATORY COPY — YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

APPENDIX

D

CLIMATE BASED WATER BUDGET

TABLE D-1
CLIMATIC WATER BUDGET: CLIMATE NORMAL 1981-2010 (UDORA CLIMATE STATION)
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

	Thornthwaite (1948)							
Month	**Mean Temperature (°C)**	**Heat Index**	**Potential Evapo-transpiration (mm)**	**Daylight Correction Value**	**Adjusted Potential Evapo-transpiration (mm)**	**Total Precipitation (mm)**	**Surplus (mm)**	**Deficit (mm)**
January	-7	0.0	0.0	0.7839	0.00	64.9	64.9	0.0
February	-6.6	0.0	0.0	0.8679	0.00	45.9	45.9	0.0
March	-1.3	0.0	0.0	0.9871	0.00	53.1	53.1	0.0
April	5.7	1.2	26.5	1.1200	29.70	67.9	38.2	0.0
May	12.2	3.9	59.4	1.2290	72.97	82.1	9.1	0.0
June	18	7.0	89.6	1.2900	115.62	106.6	0.0	9.0
July	19.9	8.1	99.7	1.2581	125.40	86.4	0.0	39.0
August	19.3	7.7	96.5	1.1613	112.06	73.9	0.0	38.2
September	15.1	5.3	74.4	1.0400	77.39	87.3	9.9	0.0
October	8.6	2.3	41.0	0.9194	37.69	74.9	37.2	0.0
November	2.4	0.3	10.6	0.8000	8.49	83.2	74.7	0.0
December	-4	0.0	0.0	0.7355	0.00	60	60.0	0.0
TOTALS		**35.8**			**579.3**	**886.2**	**393.1**	**86.2**

TOTAL WATER SURPLUS 306.9 mm

NOTES:

1) Water budget adjusted for latitude and daylight.
2) (°C) - Represents calculated mean of daily temperatures for the month.
3) Precipitation and Temperature data from the Udora Climate Station located at latitude 44°15'45.000" N, longitude 79°09'41.004" W, elevation 262.0 m.
4) Total Water Surplus (Thornthwaite, 1948) is calculated as total precipitation minus adjusted potential evapotranspiration.
5) Total Moisture Surplus (Thornthwaite and Mather, 1957) is calculated as total precipitation minus actual evapotranspiration.

TABLE D-2
CLIMATIC WATER BUDGET: CLIMATE NORMAL 1981-2010 (UDORA CLIMATE STATION)
FINE SANDY LOAM, URBAN LAWN (75 mm HOLDING CAPACITY)
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

	Thornthwaite (1948)									Thornthwaite and Mather (1957)					
Month	Mean Temperature (°C)	Heat Index	Potential Evapo-transpiration (mm)	Daylight Correction Value	Adjusted Potential Evapo-transpiration (mm)	Total Precipitation (mm)	Surplus (mm)	Deficit (mm)	TP - PET (mm)	Accumulated Potential Water Loss (mm)	Soil Moisture (mm)	Change in Soil Moisture (mm) (delta S)	Actual Evapo-transpiration (mm)	Moisture Deficit (mm)	Unadjusted Moisture Surplus (mm)
January	-7.0	0.0	0.0	0.7839	0.00	64.9	64.9	0.0	64.9	0.0	75.0	0.0	0.0	0.0	64.9
February	-6.6	0.0	0.0	0.8679	0.00	45.9	45.9	0.0	45.9	0.0	75.0	0.0	0.0	0.0	45.9
March	-1.3	0.0	0.0	0.9871	0.00	53.1	53.1	0.0	53.1	0.0	75.0	0.0	0.0	0.0	53.1
April	5.7	1.2	26.5	1.1200	29.70	67.9	38.2	0.0	38.2	0.0	75.0	0.0	29.7	0.0	38.2
May	12.2	3.9	59.4	1.2290	72.97	82.1	9.1	0.0	9.1	0.0	75.0	0.0	73.0	0.0	9.1
June	18.0	7.0	89.6	1.2900	115.62	106.6	0.0	9.0	-9.0	-9.0	66.0	-9.0	115.6	0.0	0.0
July	19.9	8.1	99.7	1.2581	125.40	86.4	0.0	39.0	-39.0	-48.0	38.0	-28.0	114.4	11.0	0.0
August	19.3	7.7	96.5	1.1613	112.06	73.9	0.0	38.2	-38.2	-86.2	23.0	-15.0	88.9	23.2	0.0
September	15.1	5.3	74.4	1.0400	77.39	87.3	9.9	0.0	9.9	0.0	32.9	9.9	77.4	0.0	0.0
October	8.6	2.3	41.0	0.9194	37.69	74.9	37.2	0.0	37.2	0.0	70.1	37.2	37.7	0.0	0.0
November	2.4	0.3	10.6	0.8000	8.49	83.2	74.7	0.0	74.7	0.0	75.0	4.9	8.5	0.0	69.8
December	-4.0	0.0	0.0	0.7355	0.00	60.0	60.0	0.0	60.0	0.0	75.0	0.0	0.0	0.0	60.0
TOTALS		**35.8**			**579.3**	**886.2**	**393.1**	**86.2**	**306.9**	**-86.2**	**755.0**	**0.0**	**545.1**	**34.2**	**341.1**

TOTAL WATER SURPLUS **306.9** **mm**

TOTAL MOISTURE SURPLUS **341.1** **mm**

NOTES:

1) Water budget adjusted for latitude and daylight.

2) (°C) - Represents calculated mean of daily temperatures for the month.

3) Precipitation and Temperature data from the Udora Climate Station located at latitude 44°15'45.000" N, longitude 79°09'41.004" W, elevation 262.0 m.

4) Total Water Surplus (Thornthwaite, 1948) is calculated as total precipitation minus adjusted potential evapotranspiration.

5) Total Moisture Surplus (Thornthwaite and Mather, 1957) is calculated as total precipitation minus actual evapotranspiration.

TABLE D-3
CLIMATIC WATER BUDGET: CLIMATE NORMAL 1981-2010 (UDORA CLIMATE STATION)
FINE SANDY LOAM, CULTIVATED (150 mm HOLDING CAPACITY)
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

	Thornthwaite (1948)									Thornthwaite and Mather (1957)					
Month	Mean Temperature (°C)	Heat Index	Potential Evapo-transpiration (mm)	Daylight Correction Value	Adjusted Potential Evapo-transpiration (mm)	Total Precipitation (mm)	Surplus (mm)	Deficit (mm)	TP - PET (mm)	Accumulated Potential Water Loss (mm)	Soil Moisture (mm)	Change in Soil Moisture (mm) (delta S)	Actual Evapo-transpiration (mm)	Moisture Deficit (mm)	Unadjusted Moisture Surplus (mm)
January	-7.0	0.0	0.0	0.7839	0.00	64.9	64.9	0.0	64.9	0.0	150.0	0.0	0.0	0.0	64.9
February	-6.6	0.0	0.0	0.8679	0.00	45.9	45.9	0.0	45.9	0.0	150.0	0.0	0.0	0.0	45.9
March	-1.3	0.0	0.0	0.9871	0.00	53.1	53.1	0.0	53.1	0.0	150.0	0.0	0.0	0.0	53.1
April	5.7	1.2	26.5	1.1200	29.70	67.9	38.2	0.0	38.2	0.0	150.0	0.0	29.7	0.0	38.2
May	12.2	3.9	59.4	1.2290	72.97	82.1	9.1	0.0	9.1	0.0	150.0	0.0	73.0	0.0	9.1
June	18.0	7.0	89.6	1.2900	115.62	106.6	0.0	9.0	-9.0	-9.0	141.0	-9.0	115.6	0.0	0.0
July	19.9	8.1	99.7	1.2581	125.40	86.4	0.0	39.0	-39.0	-48.0	108.0	-33.0	119.4	6.0	0.0
August	19.3	7.7	96.5	1.1613	112.06	73.9	0.0	38.2	-38.2	-86.2	84.0	-24.0	97.9	14.2	0.0
September	15.1	5.3	74.4	1.0400	77.39	87.3	9.9	0.0	9.9	0.0	93.9	9.9	77.4	0.0	0.0
October	8.6	2.3	41.0	0.9194	37.69	74.9	37.2	0.0	37.2	0.0	131.1	37.2	37.7	0.0	0.0
November	2.4	0.3	10.6	0.8000	8.49	83.2	74.7	0.0	74.7	0.0	150.0	18.9	8.5	0.0	55.8
December	-4.0	0.0	0.0	0.7355	0.00	60.0	60.0	0.0	60.0	0.0	150.0	0.0	0.0	0.0	60.0
TOTALS		**35.8**			**579.3**	**886.2**	**393.1**	**86.2**	**306.9**	**-86.2**	**1608.0**	**0.0**	**559.1**	**20.2**	**327.1**

TOTAL WATER SURPLUS **306.9** **mm**

TOTAL MOISTURE SURPLUS **327.1** **mm**

NOTES:

1) Water budget adjusted for latitude and daylight.

2) (°C) - Represents calculated mean of daily temperatures for the month.

3) Precipitation and Temperature data from the Udora Climate Station located at latitude 44°15'45.000" N, longitude 79°09'41.004" W, elevation 262.0 m.

4) Total Water Surplus (Thornthwaite, 1948) is calculated as total precipitation minus adjusted potential evapotranspiration.

5) Total Moisture Surplus (Thornthwaite and Mather, 1957) is calculated as total precipitation minus actual evapotranspiration.

TABLE D-4
CLIMATIC WATER BUDGET: CLIMATE NORMAL 1981-2010 (UDORA CLIMATE STATION)
FINE SANDY LOAM, UNCULTIVATED (150 mm HOLDING CAPACITY)
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

	Thornthwaite (1948)									Thornthwaite and Mather (1957)					
Month	Mean Temperature (°C)	Heat Index	Potential Evapo-transpiration (mm)	Daylight Correction Value	Adjusted Potential Evapo-transpiration (mm)	Total Precipitation (mm)	Surplus (mm)	Deficit (mm)	TP - PET (mm)	Accumulated Potential Water Loss (mm)	Soil Moisture (mm)	Change in Soil Moisture (mm) (delta S)	Actual Evapo-transpiration (mm)	Moisture Deficit (mm)	Unadjusted Moisture Surplus (mm)
January	-7.0	0.0	0.0	0.7839	0.00	64.9	64.9	0.0	64.9	0.0	150.0	0.0	0.0	0.0	64.9
February	-6.6	0.0	0.0	0.8679	0.00	45.9	45.9	0.0	45.9	0.0	150.0	0.0	0.0	0.0	45.9
March	-1.3	0.0	0.0	0.9871	0.00	53.1	53.1	0.0	53.1	0.0	150.0	0.0	0.0	0.0	53.1
April	5.7	1.2	26.5	1.1200	29.70	67.9	38.2	0.0	38.2	0.0	150.0	0.0	29.7	0.0	38.2
May	12.2	3.9	59.4	1.2290	72.97	82.1	9.1	0.0	9.1	0.0	150.0	0.0	73.0	0.0	9.1
June	18.0	7.0	89.6	1.2900	115.62	106.6	0.0	9.0	-9.0	-9.0	141.0	-9.0	115.6	0.0	0.0
July	19.9	8.1	99.7	1.2581	125.40	86.4	0.0	39.0	-39.0	-48.0	108.0	-33.0	119.4	6.0	0.0
August	19.3	7.7	96.5	1.1613	112.06	73.9	0.0	38.2	-38.2	-86.2	84.0	-24.0	97.9	14.2	0.0
September	15.1	5.3	74.4	1.0400	77.39	87.3	9.9	0.0	9.9	0.0	93.9	9.9	77.4	0.0	0.0
October	8.6	2.3	41.0	0.9194	37.69	74.9	37.2	0.0	37.2	0.0	131.1	37.2	37.7	0.0	0.0
November	2.4	0.3	10.6	0.8000	8.49	83.2	74.7	0.0	74.7	0.0	150.0	18.9	8.5	0.0	55.8
December	-4.0	0.0	0.0	0.7355	0.00	60.0	60.0	0.0	60.0	0.0	150.0	0.0	0.0	0.0	60.0
TOTALS		**35.8**			**579.3**	**886.2**	**393.1**	**86.2**	**306.9**	**-86.2**	**1608.0**	**0.0**	**559.1**	**20.2**	**327.1**

TOTAL WATER SURPLUS **306.9** **mm**

TOTAL MOISTURE SURPLUS **327.1** **mm**

NOTES:

1) Water budget adjusted for latitude and daylight.

3) Precipitation and Temperature data from the Welland Climate Station located at latitude 42°59'33.096" N, longitude 79°15'40.098" W, elevation 175.30 m.

3) Precipitation and Temperature data from the Udora Climate Station located at latitude 44°15'45.000" N, longitude 79°09'41.004" W, elevation 262.0 m.

4) Total Water Surplus (Thornthwaite, 1948) is calculated as total precipitation minus adjusted potential evapotranspiration.

5) Total Moisture Surplus (Thornthwaite and Mather, 1957) is calculated as total precipitation minus actual evapotranspiration.

APPENDIX

E WATER BUDGET CALCULATIONS – PRE-DEVELOPMENT

TABLE E-1 PRE-DEVELOPMENT WATER BUDGET (BY CATCHMENT)
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

Subcatchment Designation	Post Dev Cat Delineation	Outlet	Area	MOE TABLE 2 Components					MOE Infiltration Factor	Adjusted MOE Infiltration Factor	Precipitation	Precipitation Total	Precipitation Surplus	Evapotranspiration	Runon		Net Surplus		Infiltration		Runoff*		Total Infiltration + Runoff
			(m^2)	Cover		Soil		Topography			(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(m^3/a)
Cat A-1	Cat PE-1	Offsite to the Northeast via overland flow	697.1	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	617.7	327.1	389.8	0	0	327.1	228.0	245.3	171.0	81.8	57.0	228.0
Cat A-2	Cat PD-2	Offsite to the Northeast via overland flow	261.1	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	231.4	327.1	146.0	0	0	327.1	85.4	245.3	64.0	81.8	21.3	85.4
Cat A-3	Cat PA1-3	Offsite to the Northeast via overland flow	184.4	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	163.4	327.1	103.1	0	0	327.1	60.3	245.3	45.2	81.8	15.1	60.3
Cat A-4	Cat PC-4	Offsite to the Northeast via overland flow	953.1	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	844.6	327.1	532.9	0	0	327.1	311.7	245.3	233.8	81.8	77.9	311.7
Cat A-5	Cat PA2-5	Offsite to the Northeast via overland flow	51.0	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	45.2	327.1	28.5	0	0	327.1	16.7	245.3	12.5	81.8	4.2	16.7
Cat A-6	Cat PF-6	Offsite to the Northeast via overland flow	227.6	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	201.7	327.1	127.3	0	0	327.1	74.5	245.3	55.8	81.8	18.6	74.5
Cat A-7	Cat PE-7	Offsite to the Northeast via overland flow	129.5	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	114.7	327.1	72.4	0	0	327.1	42.3	245.3	31.8	81.8	10.6	42.3
Cat A-8	Cat PE-8	Offsite to the Northeast via overland flow	395.0	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	350.1	327.1	220.9	0	0	327.1	129.2	245.3	96.9	81.8	32.3	129.2
Cat A-9	Cat PD-9	Offsite to the Northeast via overland flow	148.1	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	131.3	327.1	82.8	0	0	327.1	48.5	245.3	36.3	81.8	12.1	48.5
Cat A-10	Cat PA1-10	Offsite to the Northeast via overland flow	10.3	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	9.1	327.1	5.8	0	0	327.1	3.4	245.3	2.5	81.8	0.8	3.4
Cat A-11	Cat PA1-11	Offsite to the Northeast via overland flow	4.9	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	4.4	327.1	2.8	0	0	327.1	1.6	245.3	1.2	81.8	0.4	1.6
Cat A-12	Cat PA1-12	Offsite to the Northeast via overland flow	234.6	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	207.9	327.1	131.2	0	0	327.1	76.7	245.3	57.5	81.8	19.2	76.7
Cat A-13	Cat PA1-13	Offsite to the Northeast via overland flow	11.2	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	9.9	327.1	6.3	0	0	327.1	3.7	245.3	2.8	81.8	0.9	3.7
Cat A-14	Cat PA1-14	Offsite to the Northeast via overland flow	17.4	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	15.4	327.1	9.7	0	0	327.1	5.7	245.3	4.3	81.8	1.4	5.7
Cat A-15	Cat PC-15	Offsite to the Northeast via overland flow	571.6	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	506.5	327.1	319.6	0	0	327.1	186.9	245.3	140.2	81.8	46.7	186.9
Cat A-16	Cat PC-16	Offsite to the Northeast via overland flow	571.6	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	506.5	327.1	319.6	0	0	327.1	186.9	245.3	140.2	81.8	46.7	186.9
Cat A-17	Cat PB-17	Offsite to the Northeast via overland flow	157.9	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	139.9	327.1	88.3	0	0	327.1	51.6	245.3	38.7	81.8	12.9	51.6
Cat A-18	Cat PB-18	Offsite to the Northeast via overland flow	470.6	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	417.0	327.1	263.1	0	0	327.1	153.9	245.3	115.4	81.8	38.5	153.9
Cat A-19	Cat PB-19	Offsite to the Northeast via overland flow	10.3	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	9.1	327.1	5.8	0	0	327.1	3.4	245.3	2.5	81.8	0.8	3.4
Cat A-20	Cat PB-20	Offsite to the Northeast via overland flow	10.1	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	9.0	327.1	5.7	0	0	327.1	3.3	245.3	2.5	81.8	0.8	3.3
Cat A-21	Cat PB-21	Offsite to the Northeast via overland flow	9.8	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	8.7	327.1	5.5	0	0	327.1	3.2	245.3	2.4	81.8	0.8	3.2
Cat A-22	Cat PB-22	Offsite to the Northeast via overland flow	9.8	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	8.7	327.1	5.5	0	0	327.1	3.2	245.3	2.4	81.8	0.8	3.2
Cat A-23	Cat PB-23	Offsite to the Northeast via overland flow	10.1	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	8.9	327.1	5.6	0	0	327.1	3.3	245.3	2.5	81.8	0.8	3.3
Cat A-24	Cat PB-24	Offsite to the Northeast via overland flow	10.3	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	9.2	327.1	5.8	0	0	327.1	3.4	245.3	2.5	81.8	0.8	3.4
Cat A-25	Cat PB-25	Offsite to the Northeast via overland flow	3.8	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	3.4	327.1	2.2	0	0	327.1	1.3	245.3	0.9	81.8	0.3	1.3
Cat A-26	Cat PB-26	Offsite to the Northeast via overland flow	220.5	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	195.4	327.1	123.3	0	0	327.1	72.1	245.3	54.1	81.8	18.0	72.1
Cat A-27	Cat PB-27	Offsite to the Northeast via overland flow	221.3	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	196.1	327.1	123.7	0	0	327.1	72.4	245.3	54.3	81.8	18.1	72.4
Cat A-28	Cat PB-28	Offsite to the Northeast via overland flow	42.0	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	37.2	327.1	23.5	0	0	327.1	13.7	245.3	10.3	81.8	3.4	13.7
Cat A-29	Cat PB-29	Offsite to the Northeast via overland flow	43.1	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	38.2	327.1	24.1	0	0	327.1	14.1	245.3	10.6	81.8	3.5	14.1
Cat A-30	Cat PB-30	Offsite to the Northeast via overland flow	43.2	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	38.3	327.1	24.2	0	0	327.1	14.1	245.3	10.6	81.8	3.5	14.1
Cat A-31	Cat PB-31	Offsite to the Northeast via overland flow	42.5	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	37.7	327.1	23.8	0	0	327.1	13.9	245.3	10.4	81.8	3.5	13.9
Cat A-32	Cat PB-32	Offsite to the Northeast via overland flow	42.3	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	37.5	327.1	23.7	0	0	327.1	13.8	245.3	10.4	81.8	3.5	13.8
Cat A-33	Cat PB-33	Offsite to the Northeast via overland flow	39.8	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	35.2	327.1	22.2	0	0	327.1	13.0	245.3	9.8	81.8	3.3	13.0
Cat A-34	Cat PB-34	Offsite to the Northeast via overland flow	41.5	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	36.8	327.1	23.2	0	0	327.1	13.6	245.3	10.2	81.8	3.4	13.6
Cat A-35	Cat PB-35	Offsite to the Northeast via overland flow	37.2	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	32.9	327.1	20.8	0	0	327.1	12.2	245.3	9.1	81.8	3.0	12.2
Cat A-36	Cat PB-36	Offsite to the Northeast via overland flow	39.0	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	34.6	327.1	21.8	0	0	327.1	12.8	245.3	9.6	81.8	3.2	12.8
Cat A-37	Cat PB-37	Offsite to the Northeast via overland flow	39.6	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	35.1	327.1	22.1	0	0	327.1	12.9	245.3	9.7	81.8	3.2	12.9
Cat A-38	Cat PB-38	Offsite to the Northeast via overland flow	39.3	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	34.8	327.1	22.0	0	0	327.1	12.9	245.3	9.6	81.8	3.2	12.9
Cat A-39	Cat PB-39	Offsite to the Northeast via overland flow	39.7	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	35.2	327.1	22.2	0	0	327.1	13.0	245.3	9.7	81.8	3.2	13.0
Cat A-40	Cat PB-40	Offsite to the Northeast via overland flow	71.5	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	63.3	327.1	40.0	0	0	327.1	23.4	245.3	17.5	81.8	5.8	23.4
Cat A-41	Cat PB-41	Offsite to the Northeast via overland flow	71.5	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	63.4	327.1	40.0	0	0	327.1	23.4	245.3	17.5	81.8	5.8	23.4
Cat A-42	Cat PB-42	Offsite to the Northeast via overland flow	42.0	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	37.3	327.1	23.5	0	0	327.1	13.8	245.3	10.3	81.8	3.4	13.8
Cat A-43	Cat PB-43	Offsite to the Northeast via overland flow	3.6	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	3.2	327.1	2.0	0	0	327.1	1.2	245.3	0.9	81.8	0.3	1.2
Cat A-44	Cat PB-44	Offsite to the Northeast via overland flow	15.9	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	14.1	327.1	8.9	0	0	327.1	5.2	245.3	3.9	81.8	1.3	5.2
Cat A-45	Cat PB-45	Offsite to the Northeast via overland flow	16.0	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	14.2	327.1	9.0	0	0	327.1	5.2	245.3	3.9	81.8	1.3	5.2
Cat A-46	Cat PB-46	Offsite to the Northeast via overland flow	48.2	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	42.7	327.1	27.0	0	0	327.1	15.8	245.3	11.8	81.8	3.9	15.8
Cat A-47	Cat PB-47	Offsite to the Northeast via overland flow	73.0	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	64.7	327.1	40.8	0	0	327.1	23.9	245.3	17.9	81.8	6.0	23.9
Cat A-48	Cat PB-48	Offsite to the Northeast via overland flow	74.6	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	66.1	327.1	41.7	0	0	327.1	24.4	245.3	18.3	81.8	6.1	24.4
Cat A-49	Cat PB-49	Offsite to the Northeast via overland flow	71.1	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	63.1	327.1	39.8	0	0	327.1	23.3	245.3	17.5	81.8	5.8	23.3
Cat A-50	Cat PB-50	Offsite to the Northeast via overland flow	71.5	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	63.4	327.1	40.0	0	0	327.1	23.4	245.3	17.5	81.8	5.8	23.4
Cat A-51	Cat PB-51	Offsite to the Northeast via overland flow	72.6	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	64.4	327.1	40.6	0	0	327.1	23.8	245.3	17.8	81.8	5.9	23.8
Cat A-52	Cat PB-52	Offsite to the Northeast via overland flow	71.5	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	63.4	327.1	40.0	0	0	327.1	23.4	245.3	17.5	81.8	5.8	23.4
Cat A-53	Cat PB-53	Offsite to the Northeast via overland flow	176.3	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	156.2	327.1	98.5	0	0	327.1	57.6	245.3	43.2	81.8	14.4	57.6
Cat A-54	Cat PB-54	Offsite to the Northeast via overland flow	72.1	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	63.9	327.1	40.3	0	0	327.1	23.6	245.3	17.7	81.8	5.9	23.6
Cat A-55	Cat PB-55	Offsite to the Northeast via overland flow	2184.0	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	1935.4	327.1	1221.1	0	0	327.1	714.3	245.3	535.7	81.8	178.6	714.3
Cat A-56	Cat PB-56	Offsite to the Northeast via overland flow	58.3	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	51.6	327.1	32.6	0	0	327.1	19.1	245.3	14.3	81.8	4.8	19.1
Cat A-57	Cat PB-57	Offsite to the Northeast via overland flow	50.6	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	44.8	327.1	28.3	0	0	327.1	16.6	245.3	12.4	81.8	4.1	16.6
Cat A-58	Cat PB-58	Offsite to the Northeast via overland flow	19.6	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	17.4	327.1	11.0	0	0	327.1	6.4	245.3	4.8	81.8	1.6	6.4
Cat A-59	Cat PB-59	Offsite to the Northeast via overland flow	14.2	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	12.6	327.1	8.0	0	0	327.1	4.7	245.3	3.5	81.8	1.2	4.7
Cat A-60	Cat PB-60	Offsite to the Northeast via overland flow	3.1	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	2.7	327.1	1.7	0	0	327.1	1.0	245.3	0.8	81.8	0.3	1.0
Cat A-61	Cat PB-61	Offsite to the Northeast via overland flow	12.7	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	11.3	327.1	7.1	0	0	327.1	4.2	245.3	3.1	81.8	1.0	4.2
Cat A-62	Cat PB-62	Offsite to the Northeast via overland flow	1.8	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	1.6	327.1	1.0	0	0	327.1	0.6	245.3	0.4	81.8	0.1	0.6
Cat A-63	Cat PB-63	Offsite to the Northeast via overland flow	23.2	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	20.6	327.1	13.0	0	0	327.1	7.6	245.3	5.7	81.8	1.9	7.6
Cat A-64	Cat PB-64	Offsite to the Northeast via overland flow	2.8	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	2.5	327.1	1.6	0	0	327.1	0.9	245.3	0.7	81.8	0.2	0.9
Cat A-65	Cat PB-65	Offsite to the Northeast via overland flow	18.0	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	16.0	327.1	10.1	0	0	327.1	5.9	245.3	4.4	81.8	1.5	5.9
Cat A-66	Cat PB-66	Offsite to the Northeast via overland flow	185.8	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	164.7	327.1	103.9	0	0	327.1	60.8	245.3	45.6	81.8	15.2	60.8
Cat A-67	Cat PB-67	Offsite to the Northeast via overland flow	99.6	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	88.2	327.1	55.7	0	0	327.1	32.6	245.3	24.4	81.8	8.1	32.6
Cat A-68	Cat PB-68	Offsite to the Northeast via overland flow	96.2	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	85.3	327.1	53.8	0	0	327.1	31.5	245.3	23.6	81.8	7.9	31.5
Cat A-69	Cat PB-69	Offsite to the Northeast via overland flow	2.4	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	2.1	327.1	1.3	0	0	327.1	0.8	245.3	0.6	81.8	0.2	0.8
Cat A-70	Cat PB-70	Offsite to the Northeast via overland flow	168.0	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	148.9	327.1	93.9	0	0	327.1	55.0	245.3	41.2	81.8	13.7	55.0
Cat A-71	Cat PB-71	Offsite to the Northeast via overland flow	97.1	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	86.0	327.1	54.3	0	0	327.1	31.7	245.3	23.8	81.8	7.9	31.7
Cat A-72	Cat PB-72	Offsite to the Northeast via overland flow	97.8	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	86.7	327.1	54.7	0	0	327.1	32.0	245.3	24.0	81.8	8.0	32.0
Cat A-73	Cat PB-73	Offsite to the Northeast via overland flow	96.9	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	85.9	327.1	54.2	0	0	327.1	31.7	245.3	23.8	81.8	7.9	31.7
Cat A-74	Cat PB-74	Offsite to the Northeast via overland flow	95.7	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	84.8	327.1	53.5	0	0	327.1	31.3	245.3	23.5	81.8	7.8	31.3
Cat A-75	Cat PB-75	Offsite to the Northeast via overland flow	153.4	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	135.9	327.1	85.8	0	0	327.1	50.2	245.3	37.6	81.8	12.5	50.2
Cat A-76	Cat PB-76	Offsite to the Northeast via overland flow	128.0	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	113.4	327.1	71.6	0	0	327.1	41.9	245.3	31.4	81.8	10.5	41.9
Cat A-77	Cat PB-77	Offsite to the Northeast via overland flow	171.4	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	151.9	327.1	95.8	0	0	327.1	56.0	245.3	42.0	81.8	14.0	56.0
Cat A-78	Cat PB-78	Offsite to the Northeast via overland flow	27.2	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	24.1	327.1	15.2	0	0	327.1	8.9	245.3	6.7	81.8	2.2	8.9
Cat A-79	Cat PB-79	Offsite to the Northeast via overland flow	26.9	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	23.9	327.1	15.1	0	0	327.1	8.8	245.3	6.6	81.8	2.2	8.8
Cat A-80	Cat PB-80	Offsite to the Northeast via overland flow	26.4	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	23.4	327.1	14.8	0	0	327.1	8.6	245.3	6.5	81.8	2.2	8.6
Cat A-81	Cat PB-81	Offsite to the Northeast via overland flow	26.9	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	23.8	327.1	15.0	0	0	327.1	8.8	245.3	6.6	81.8	2.2	8.8
Cat A-82	Cat PB-82	Offsite to the Northeast via overland flow	36.2	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	32.1	327.1	20.2	0	0	327.1	11.8	245.3	8.9	81.8	3.0	11.8
Cat A-83	Cat PB-83	Offsite to the Northeast via overland flow	25.4	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	22.5	327.1	14.2	0	0	327.1	8.3	245.3	6.2	81.8	2.1	8.3
Cat A-84	Cat PB-84	Offsite to the Northeast via overland flow	6.4	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	5.7	327.1	3.6	0	0	327.1	2.1	245.3	1.6	81.8	0.5	2.1
Cat A-85	Cat PA1-85	Offsite to the Northeast via overland flow	7.2	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	886.2	6.4	797.6	0.6	0	0	797.6	5.7	0.0	0.0	797.6	5.7	5.7

TABLE E-1 PRE-DEVELOPMENT WATER BUDGET (BY CATCHMENT)
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

Subcatchment Designation	Post Dev Cat Delineation	Outlet	Area	MOE TABLE 2 Components					MOE Infiltration Factor	Adjusted MOE Infiltration Factor	Precipitation	Precipitation Total	Precipitation Surplus	Evapotranspiration	Runon		Net Surplus		Infiltration		Runoff*		Total Infiltration + Runoff
			(m^2)	Cover		Soil		Topography			(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(m^3/a)
Cat A-86	Cat PB-86	Offsite to the Northeast via overland flow	18.6	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	886.2	16.5	797.6	1.7	0	0	797.6	14.9	0.0	0.0	797.6	14.9	14.9
Cat A-87	Cat PB-87	Offsite to the Northeast via overland flow	53.8	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	886.2	47.7	797.6	4.8	0	0	797.6	42.9	0.0	0.0	797.6	42.9	42.9
Cat A-88	Cat PB-88	Offsite to the Northeast via overland flow	6.0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	886.2	5.3	797.6	0.5	0	0	797.6	4.8	0.0	0.0	797.6	4.8	4.8
Cat A-89	Cat PB-89	Offsite to the Northeast via overland flow	38.6	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	886.2	34.2	797.6	3.4	0	0	797.6	30.8	0.0	0.0	797.6	30.8	30.8
Cat A-90	Cat PB-90	Offsite to the Northeast via overland flow	7.1	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	886.2	6.3	797.6	0.6	0	0	797.6	5.7	0.0	0.0	797.6	5.7	5.7
Cat A-91	Cat PB-91	Offsite to the Northeast via overland flow	27.7	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	886.2	24.5	797.6	2.5	0	0	797.6	22.1	0.0	0.0	797.6	22.1	22.1
Cat A-92	Cat PB-92	Offsite to the Northeast via overland flow	69.5	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	886.2	61.6	797.6	6.2	0	0	797.6	55.4	0.0	0.0	797.6	55.4	55.4
Cat A-93	Cat PD-93	Offsite to the Northeast via overland flow	120.0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	886.2	106.4	797.6	10.6	0	0	797.6	95.7	0.0	0.0	797.6	95.7	95.7
Cat A-94	Cat PF-94	Offsite to the Northeast via overland flow	18.1	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	886.2	16.0	797.6	1.6	0	0	797.6	14.4	0.0	0.0	797.6	14.4	14.4
Cat A-95	Cat PD-95	Offsite to the Northeast via overland flow	78.2	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	886.2	69.3	797.6	6.9	0	0	797.6	62.3	0.0	0.0	797.6	62.3	62.3
Cat A-96	Cat PB-96	Offsite to the Northeast via overland flow	54.6	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	886.2	48.4	797.6	4.8	0	0	797.6	43.6	0.0	0.0	797.6	43.6	43.6
Cat A-97	Cat PD-97	Offsite to the Northeast via overland flow	86.5	Gravel	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	76.7	341.1	47.2	0	0	341.1	29.5	238.7	20.7	102.3	8.9	29.5
Cat A-98	Cat PA2-98	Offsite to the Northeast via overland flow	19.2	Gravel	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	17.1	341.1	10.5	0	0	341.1	6.6	238.7	4.6	102.3	2.0	6.6
Cat A-99	Cat PA1-99	Offsite to the Northeast via overland flow	15.2	Gravel	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	13.4	341.1	8.3	0	0	341.1	5.2	238.7	3.6	102.3	1.6	5.2
Cat A-100	Cat PA1-100	Offsite to the Northeast via overland flow	6.4	Gravel	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	5.6	341.1	3.5	0	0	341.1	2.2	238.7	1.5	102.3	0.7	2.2
Cat A-101	Cat PA1-101	Offsite to the Northeast via overland flow	37.7	Gravel	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	33.4	341.1	20.6	0	0	341.1	12.9	238.7	9.0	102.3	3.9	12.9
Cat A-102	Cat PB-102	Offsite to the Northeast via overland flow	46.8	Gravel	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	41.5	341.1	25.5	0	0	341.1	16.0	238.7	11.2	102.3	4.8	16.0
Cat A-103	Cat PB-103	Offsite to the Northeast via overland flow	13.5	Gravel	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	11.9	341.1	7.3	0	0	341.1	4.6	238.7	3.2	102.3	1.4	4.6
Cat A-104	Cat PB-104	Offsite to the Northeast via overland flow	4.5	Gravel	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	3.9	341.1	2.4	0	0	341.1	1.5	238.7	1.1	102.3	0.5	1.5
Cat A-105	Cat PB-105	Offsite to the Northeast via overland flow	0.7	Gravel	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	0.6	341.1	0.4	0	0	341.1	0.2	238.7	0.2	102.3	0.1	0.2
Cat A-106	Cat PD-106	Offsite to the Northeast via overland flow	202.6	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	179.6	341.1	110.5	0	0	341.1	69.1	238.7	48.4	102.3	20.7	69.1
Cat A-107	Cat PD-107	Offsite to the Northeast via overland flow	96.5	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	85.5	341.1	52.6	0	0	341.1	32.9	238.7	23.0	102.3	9.9	32.9
Cat A-108	Cat PB-108	Offsite to the Northeast via overland flow	272.7	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	241.6	341.1	148.6	0	0	341.1	93.0	238.7	65.1	102.3	27.9	93.0
Cat A-109	Cat PB-109	Offsite to the Northeast via overland flow	274.0	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	242.8	341.1	149.4	0	0	341.1	93.5	238.7	65.4	102.3	28.0	93.5
Cat A-110	Cat PB-110	Offsite to the Northeast via overland flow	106.4	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	94.3	341.1	58.0	0	0	341.1	36.3	238.7	25.4	102.3	10.9	36.3
Cat A-111	Cat PB-111	Offsite to the Northeast via overland flow	29.9	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	26.5	341.1	16.3	0	0	341.1	10.2	238.7	7.1	102.3	3.1	10.2
Cat A-112	Cat PB-112	Offsite to the Northeast via overland flow	71.6	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	63.4	341.1	39.0	0	0	341.1	24.4	238.7	17.1	102.3	7.3	24.4
Cat A-113	Cat PB-113	Offsite to the Northeast via overland flow	74.6	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	66.1	341.1	40.7	0	0	341.1	25.4	238.7	17.8	102.3	7.6	25.4
Cat A-114	Cat PB-114	Offsite to the Northeast via overland flow	67.4	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	59.8	341.1	36.8	0	0	341.1	23.0	238.7	16.1	102.3	6.9	23.0
Cat A-115	Cat PB-115	Offsite to the Northeast via overland flow	55.1	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	48.8	341.1	30.0	0	0	341.1	18.8	238.7	13.2	102.3	5.6	18.8
Cat A-116	Cat PB-116	Offsite to the Northeast via overland flow	20.0	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	17.7	341.1	10.9	0	0	341.1	6.8	238.7	4.8	102.3	2.0	6.8
Cat A-117	Cat PB-117	Offsite to the Northeast via overland flow	20.7	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	18.3	341.1	11.3	0	0	341.1	7.1	238.7	4.9	102.3	2.1	7.1
Cat A-118	Cat PB-118	Offsite to the Northeast via overland flow	82.4	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	73.0	341.1	44.9	0	0	341.1	28.1	238.7	19.7	102.3	8.4	28.1
Cat A-119	Cat PB-119	Offsite to the Northeast via overland flow	40.0	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	35.4	341.1	21.8	0	0	341.1	13.6	238.7	9.5	102.3	4.1	13.6
Cat A-120	Cat PB-120	Offsite to the Northeast via overland flow	46.8	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	41.4	341.1	25.5	0	0	341.1	15.9	238.7	11.2	102.3	4.8	15.9
Cat A-121	Cat PB-121	Offsite to the Northeast via overland flow	34.8	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	30.9	341.1	19.0	0	0	341.1	11.9	238.7	8.3	102.3	3.6	11.9
Cat A-122	Cat PB-122	Offsite to the Northeast via overland flow	115.3	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	102.2	341.1	62.8	0	0	341.1	39.3	238.7	27.5	102.3	11.8	39.3
Cat A-123	Cat PB-123	Offsite to the Northeast via overland flow	96.0	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	85.1	341.1	52.3	0	0	341.1	32.7	238.7	22.9	102.3	9.8	32.7
Cat A-124	Cat PB-124	Offsite to the Northeast via overland flow	97.5	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	86.4	341.1	53.2	0	0	341.1	33.3	238.7	23.3	102.3	10.0	33.3
Cat A-125	Cat PB-125	Offsite to the Northeast via overland flow	132.3	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	117.2	341.1	72.1	0	0	341.1	45.1	238.7	31.6	102.3	13.5	45.1
Cat A-126	Cat PB-126	Offsite to the Northeast via overland flow	1.0	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	0.9	341.1	0.5	0	0	341.1	0.3	238.7	0.2	102.3	0.1	0.3
Cat A-127	Cat PE-127	Offsite to the Northeast via overland flow	343.4	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	304.3	327.1	192.0	0	0	327.1	112.3	261.6	89.8	65.4	22.5	112.3
Cat A-128	Cat PC-128	Offsite to the Northeast via overland flow	785.5	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	696.1	327.1	439.2	0	0	327.1	256.9	261.6	205.5	65.4	51.4	256.9
Cat A-129	Cat PF-129	Offsite to the Northeast via overland flow	76.6	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	67.9	327.1	42.8	0	0	327.1	25.1	261.6	20.0	65.4	5.0	25.1
Cat A-130	Cat PE-130	Offsite to the Northeast via overland flow	257.8	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	228.5	327.1	144.2	0	0	327.1	84.3	261.6	67.5	65.4	16.9	84.3
Cat A-131	Cat PA1-131	Offsite to the Northeast via overland flow	10.8	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	9.6	327.1	6.0	0	0	327.1	3.5	261.6	2.8	65.4	0.7	3.5
Cat A-132	Cat PA1-132	Offsite to the Northeast via overland flow	12.7	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	11.2	327.1	7.1	0	0	327.1	4.2	261.6	3.3	65.4	0.8	4.2
Cat A-133	Cat PC-133	Offsite to the Northeast via overland flow	572.4	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	507.2	327.1	320.0	0	0	327.1	187.2	261.6	149.8	65.4	37.4	187.2
Cat A-134	Cat PC-134	Offsite to the Northeast via overland flow	572.4	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	507.2	327.1	320.0	0	0	327.1	187.2	261.6	149.8	65.4	37.4	187.2
Cat A-135	Cat PB-135	Offsite to the Northeast via overland flow	320.4	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	283.9	327.1	179.1	0	0	327.1	104.8	261.6	83.8	65.4	21.0	104.8
Cat A-136	Cat PB-136	Offsite to the Northeast via overland flow	9.8	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	8.7	327.1	5.5	0	0	327.1	3.2	261.6	2.6	65.4	0.6	3.2
Cat A-137	Cat PB-137	Offsite to the Northeast via overland flow	9.8	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	8.7	327.1	5.5	0	0	327.1	3.2	261.6	2.6	65.4	0.6	3.2
Cat A-138	Cat PB-138	Offsite to the Northeast via overland flow	5.8	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	5.2	327.1	3.3	0	0	327.1	1.9	261.6	1.5	65.4	0.4	1.9
Cat A-139	Cat PB-139	Offsite to the Northeast via overland flow	9.6	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	8.5	327.1	5.4	0	0	327.1	3.1	261.6	2.5	65.4	0.6	3.1
Cat A-140	Cat PB-140	Offsite to the Northeast via overland flow	12.0	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	10.6	327.1	6.7	0	0	327.1	3.9	261.6	3.1	65.4	0.8	3.9
Cat A-141	Cat PB-141	Offsite to the Northeast via overland flow	41.2	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	36.5	327.1	23.0	0	0	327.1	13.5	261.6	10.8	65.4	2.7	13.5
Cat A-142	Cat PB-142	Offsite to the Northeast via overland flow	41.5	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	36.8	327.1	23.2	0	0	327.1	13.6	261.6	10.9	65.4	2.7	13.6
Cat A-143	Cat PB-143	Offsite to the Northeast via overland flow	42.2	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	37.4	327.1	23.6	0	0	327.1	13.8	261.6	11.0	65.4	2.8	13.8
Cat A-144	Cat PB-144	Offsite to the Northeast via overland flow	25.8	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	22.9	327.1	14.4	0	0	327.1	8.4	261.6	6.7	65.4	1.7	8.4
Cat A-145	Cat PB-145	Offsite to the Northeast via overland flow	35.5	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	31.4	327.1	19.8	0	0	327.1	11.6	261.6	9.3	65.4	2.3	11.6
Cat A-146	Cat PB-146	Offsite to the Northeast via overland flow	40.1	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	35.6	327.1	22.4	0	0	327.1	13.1	261.6	10.5	65.4	2.6	13.1
Cat A-147	Cat PB-147	Offsite to the Northeast via overland flow	39.5	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	35.0	327.1	22.1	0	0	327.1	12.9	261.6	10.3	65.4	2.6	12.9
Cat A-148	Cat PB-148	Offsite to the Northeast via overland flow	69.6	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	61.6	327.1	38.9	0	0	327.1	22.7	261.6	18.2	65.4	4.5	22.7
Cat A-149	Cat PB-149	Offsite to the Northeast via overland flow	69.7	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	61.7	327.1	39.0	0	0	327.1	22.8	261.6	18.2	65.4	4.6	22.8
Cat A-150	Cat PB-150	Offsite to the Northeast via overland flow	69.3	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	61.4	327.1	38.7	0	0	327.1	22.7	261.6	18.1	65.4	4.5	22.7
Cat A-151	Cat PB-151	Offsite to the Northeast via overland flow	69.2	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	61.3	327.1	38.7	0	0	327.1	22.6	261.6	18.1	65.4	4.5	22.6
Cat A-152	Cat PB-152	Offsite to the Northeast via overland flow	69.9	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	62.0	327.1	39.1	0	0	327.1	22.9	261.6	18.3	65.4	4.6	22.9
Cat A-153	Cat PB-153	Offsite to the Northeast via overland flow	68.9	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	61.0	327.1	38.5	0	0	327.1	22.5	261.6	18.0	65.4	4.5	22.5
Cat A-154	Cat PB-154	Offsite to the Northeast via overland flow	192.3	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	170.4	327.1	107.5	0	0	327.1	62.9	261.6	50.3	65.4	12.6	62.9
Cat A-155	Cat PB-155	Offsite to the Northeast via overland flow	56.8	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	50.3	327.1	31.7	0	0	327.1	18.6	261.6	14.9	65.4	3.7	18.6
Cat A-156	Cat PB-156	Offsite to the Northeast via overland flow	470.1	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	416.6	327.1	262.9	0	0	327.1	153.8	261.6	123.0	65.4	30.8	153.8
Cat A-157	Cat PB-157	Offsite to the Northeast via overland flow	3.6	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	3.2	327.1	2.0	0	0	327.1	1.2	261.6	0.9	65.4	0.2	1.2
Cat A-158	Cat PB-158	Offsite to the Northeast via overland flow	29.0	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	25.7	327.1	16.2	0	0	327.1	9.5	261.6	7.6	65.4	1.9	9.5
Cat A-159	Cat PB-159	Offsite to the Northeast via overland flow	184.2	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	163.2	327.1	103.0	0	0	327.1	60.2	261.6	48.2	65.4	12.0	60.2
Cat A-160	Cat PB-160	Offsite to the Northeast via overland flow	25.2	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	22.3	327.1	14.1	0	0	327.1	8.2	261.6	6.6	65.4	1.6	8.2
Cat A-161	Cat PB-161	Offsite to the Northeast via overland flow	2.8	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	2.4	327.1	1.5	0	0	327.1	0.9	261.6	0.7	65.4	0.2	0.9
Cat A-162	Cat PB-162	Offsite to the Northeast via overland flow	97.4	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	86.3	327.1	54.5	0	0	327.1	31.9	261.6	25.5	65.4	6.4	31.9
Cat A-163	Cat PB-163	Offsite to the Northeast via overland flow	95.6	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	84.7	327.1	53.4	0	0	327.1	31.3	261.6	25.0	65.4	6.3	31.3
Cat A-164	Cat PB-164	Offsite to the Northeast via overland flow	147.6	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	130.8	327.1	82.5	0	0	327.1	48.3	261.6	38.6	65.4	9.7	48.3
Cat A-165	Cat PB-165	Offsite to the Northeast via overland flow	96.0	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	85.1	327.1	53.7	0	0	327.1	31.4	261.6	25.1	65.4	6.3	31.4
Cat A-166	Cat PB-166	Offsite to the Northeast via overland flow	164.4	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	145.7	327.1	91.9	0	0	327.1	53.8	261.6	43.0	65.4	10.8	53.8
Cat A-167	Cat PB-167	Offsite to the Northeast via overland flow	96.9	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	85.9	327.1	54.2	0	0	327.1	31.7	261.6	25.4	65.4	6.3	31.7
Cat A-168	Cat PB-168	Offsite to the Northeast via overland flow	18.6	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	16.5	327.1	10.4	0	0	327.1	6.1	261.6	4.9	65.4	1.2	6.1
Cat A-169	Cat PB-169	Offsite to the Northeast via overland flow	25.5	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	22.6	327.1	14.2	0	0	327.1	8.3	261.6	6.7	65.4	1.7	8.3
Cat A-170	Cat PB-170	Offsite to the Northeast via overland flow	24.9	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	22.1	327.1	13.9	0	0	327.1	8.1	261.6	6.5	65.4	1.6	8.1

TABLE E-1 PRE-DEVELOPMENT WATER BUDGET (BY CATCHMENT)
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

Subcatchment Designation	Post Dev Cat Delineation	Outlet	Area	MOE TABLE 2 Components					MOE Infiltration Factor	Adjusted MOE Infiltration Factor	Precipitation	Precipitation Total	Precipitation Surplus	Evapotranspiration	Runon		Net Surplus		Infiltration		Runoff*		Total Infiltration + Runoff
			(m^2)	Cover		Soil		Topography			(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(mm/a)	(m^3/a)	(m^3/a)
Cat A-171	Cat PF-171	Offsite to the Northeast via overland flow	817.4	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	724.4	327.1	457.1	0	0	327.1	267.4	245.3	200.5	81.8	66.8	267.4
Cat A-172	Cat PF-172	Offsite to the Northeast via overland flow	712.6	Cultivated	0.1	Open Sandy Loam	0.4	0.25	0.75	0.75	886.2	631.5	327.1	398.4	0	0	327.1	233.1	245.3	174.8	81.8	58.3	233.1
Cat A-173	Cat PF-173	Offsite to the Northeast via overland flow	77.5	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	886.2	68.7	797.6	6.9	0	0	797.6	61.8	0.0	0.0	797.6	61.8	61.8
Cat A-174	Cat PF-174	Offsite to the Northeast via overland flow	2.3	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	886.2	2.1	797.6	0.2	0	0	797.6	1.8	0.0	0.0	797.6	1.8	1.8
Cat A-175	Cat PF-175	Offsite to the Northeast via overland flow	152.5	Gravel	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	135.2	341.1	83.2	0	0	341.1	52.0	238.7	36.4	102.3	15.6	52.0
Cat A-176	Cat PF-176	Offsite to the Northeast via overland flow	6.0	Gravel	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	5.3	341.1	3.3	0	0	341.1	2.0	238.7	1.4	102.3	0.6	2.0
Cat A-177	Cat PF-177	Offsite to the Northeast via overland flow	5.2	Gravel	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	4.6	341.1	2.8	0	0	341.1	1.8	238.7	1.2	102.3	0.5	1.8
Cat A-178	Cat PF-178	Offsite to the Northeast via overland flow	840.4	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	744.7	341.1	458.1	0	0	341.1	286.6	238.7	200.6	102.3	86.0	286.6
Cat A-179	Cat PF-179	Offsite to the Northeast via overland flow	14.3	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	12.7	341.1	7.8	0	0	341.1	4.9	238.7	3.4	102.3	1.5	4.9
Cat A-180	Cat PF-180	Offsite to the Northeast via overland flow	449.3	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	398.2	341.1	245.0	0	0	341.1	153.3	238.7	107.3	102.3	46.0	153.3
Cat A-181	Cat PD-181	Offsite to the Northeast via overland flow	24.4	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	21.7	341.1	13.3	0	0	341.1	8.3	238.7	5.8	102.3	2.5	8.3
Cat A-182	Cat PD-182	Offsite to the Northeast via overland flow	331.4	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	293.7	341.1	180.7	0	0	341.1	113.0	238.7	79.1	102.3	33.9	113.0
Cat A-183	Cat PD-183	Offsite to the Northeast via overland flow	375.3	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	332.6	341.1	204.6	0	0	341.1	128.0	238.7	89.6	102.3	38.4	128.0
Cat A-184	Cat PA2-184	Offsite to the Northeast via overland flow	13.7	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	12.1	341.1	7.5	0	0	341.1	4.7	238.7	3.3	102.3	1.4	4.7
Cat A-185	Cat PA2-185	Offsite to the Northeast via overland flow	65.7	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	58.2	341.1	35.8	0	0	341.1	22.4	238.7	15.7	102.3	6.7	22.4
Cat A-186	Cat PF-186	Offsite to the Northeast via overland flow	106.6	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	94.5	341.1	58.1	0	0	341.1	36.4	238.7	25.5	102.3	10.9	36.4
Cat A-187	Cat PF-187	Offsite to the Northeast via overland flow	24.1	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	21.3	341.1	13.1	0	0	341.1	8.2	238.7	5.8	102.3	2.5	8.2
Cat A-188	Cat PF-188	Offsite to the Northeast via overland flow	171.7	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	152.1	341.1	93.6	0	0	341.1	58.6	238.7	41.0	102.3	17.6	58.6
Cat A-189	Cat PD-189	Offsite to the Northeast via overland flow	59.8	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	53.0	341.1	32.6	0	0	341.1	20.4	238.7	14.3	102.3	6.1	20.4
Cat A-190	Cat PD-190	Offsite to the Northeast via overland flow	105.7	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	886.2	93.7	341.1	57.6	0	0	341.1	36.0	238.7	25.2	102.3	10.8	36.0
Cat A-191	Cat PF-191	Offsite to the Northeast via overland flow	246.0	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	218.0	327.1	137.5	0	0	327.1	80.5	261.6	64.4	65.4	16.1	80.5
Cat A-192	Cat PF-192	Offsite to the Northeast via overland flow	181.8	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	161.1	327.1	101.6	0	0	327.1	59.4	261.6	47.6	65.4	11.9	59.4
Cat A-193	Cat PA1-193	Offsite to the Northeast via overland flow	143.6	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	127.2	327.1	80.3	0	0	327.1	47.0	261.6	37.6	65.4	9.4	47.0
Cat A-194	Cat PA1-194	Offsite to the Northeast via overland flow	47.9	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	42.5	327.1	26.8	0	0	327.1	15.7	261.6	12.5	65.4	3.1	15.7
Cat A-195	Cat PA1-195	Offsite to the Northeast via overland flow	4.3	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	3.8	327.1	2.4	0	0	327.1	1.4	261.6	1.1	65.4	0.3	1.4
Cat A-196	Cat PA1-196	Offsite to the Northeast via overland flow	150.5	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	133.4	327.1	84.2	0	0	327.1	49.2	261.6	39.4	65.4	9.8	49.2
Cat A-197	Cat PA1-197	Offsite to the Northeast via overland flow	27.9	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	24.7	327.1	15.6	0	0	327.1	9.1	261.6	7.3	65.4	1.8	9.1
Cat A-198	Cat PB-198	Offsite to the Northeast via overland flow	110.5	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	98.0	327.1	61.8	0	0	327.1	36.2	261.6	28.9	65.4	7.2	36.2
Cat A-199	Cat PB-199	Offsite to the Northeast via overland flow	13.7	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	12.1	327.1	7.7	0	0	327.1	4.5	261.6	3.6	65.4	0.9	4.5
Cat A-200	Cat PB-200	Offsite to the Northeast via overland flow	12.1	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	10.8	327.1	6.8	0	0	327.1	4.0	261.6	3.2	65.4	0.8	4.0
Cat A-201	Cat PB-201	Offsite to the Northeast via overland flow	61.3	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	54.3	327.1	34.3	0	0	327.1	20.0	261.6	16.0	65.4	4.0	20.0
Cat A-202	Cat PB-202	Offsite to the Northeast via overland flow	1682.9	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8	886.2	1491.4	327.1	941.0	0	0	327.1	550.4	261.6	440.3	65.4	110.1	550.4
Pre-Development Catchment A Total		**Offsite to the Northeast via overland flow**	**26,118**								**886.2**	**23,146**	**340.1**	**14,262**	**0**	**0**	**340.1**	**8,884**	**244**	**6,365**	**96**	**2,519**	**8,884**
SITE TOTAL			**26,118**								**886.2**	**23,146**	**340.1**	**14,262**	**0**	**0**	**340.1**	**8,884**	**244**	**6,365**	**96**	**2,519**	**8,884**

APPENDIX

F

WATER BUDGET CALCULATIONS – POST DEVELOPMENT

TABLE F-1 POST-DEVELOPMENT WATER BUDGET (BY CATCHMENT)
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

ANNUAL PRECIPITATION	EVAPORATION AND EVAPOTRANSPIRATION FACTORS: Impervious Areas		Waterbody	
mm	%	mm	%	mm
886	10%	89	73%	646

On-Site Subcatchment Designation	Outlet	Total Area (m^2)	Impervious: Total Impervious % of Total Area	Total Impervious (m^2)	Assumed Buildings % of Impervious Area	Assumed Buildings (m^2)	Assumed Road/ Parking/ Amenities % of Impervious Area	Assumed Road/ Parking/ Amenities (m^2)	Other Impervious (m^2)	Pervious: Total Pervious % of Total Area	Total Pervious (m^2)	MOE TABLE 2 Components: Cover		Soil		Topography	MOE Infiltration Factor	Adjusted MOE Infiltration Factor	Inputs: Precipitation Annual Average (m^3/yr)	Surplus (Pervious) (m^3/yr)	Surplus (Impervious) (m^3/yr)	Total Inputs (m^3/yr)	Outputs: Evapotranspiration Pervious (m^3/yr)	Evapotranspiration Impervious (m^3/yr)	Total Evapotranspiration (m^3/yr)	Infiltration Pervious Areas (m^3/yr)	Rooftop Discon (m^3/yr)	Infiltration Trenches (m^3/yr)	Total Infiltration (m^3/yr)	Runoff Pervious (m^3/yr)	Landscaped Area Redirected (m3/yr)	Building (m^3/yr)	Road/ Driveway/ Amenities (m^3/yr)	Other Impervious (m^3/yr)	Total Impervious (m^3/yr)	Total Runoff (m^3/yr)	Rooftop Runoff Infiltrated (m^3/yr)	Infiltration Trenches (mm/yr)	Infiltration Trenches (m^3/yr)	Net Runoff (mm/yr)	Net Runoff (m^3/yr)	Total Outputs (mm/yr)	Total Outputs (m^3/yr)
Cat PA1-3	Offsite to the north via overland flow	184.4	0%	0.0	0%	0.0	0%	0.0	0.0	100%	184	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	163	63	0	163	101	0	101	44	0	0	44	19	0	0	0	0	0	19	0	0	0	102	19	886	163
Cat PA1-10	Offsite to the north via overland flow	10.3	100%	10.3	0%	0.0	100%	10.3	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	9	0	8	9	0	1	1	0	0	0	0	0	0	0	8	0	8	8	0	0	0	798	8	886	9
Cat PA1-11	Offsite to the north via overland flow	4.9	100%	4.9	0%	0.0	100%	4.9	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	4	0	4	4	0	0	0	0	0	0	0	0	0	0	4	0	4	4	0	0	0	798	4	886	4
Cat PA1-12	Offsite to the north via overland flow	234.6	100%	234.6	100%	234.6	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	208	0	187	208	0	21	21	0	94	0	94	0	0	187	0	0	187	187	-94	0	0	399	94	886	208
Cat PA1-13	Offsite to the north via overland flow	11.2	100%	11.2	0%	0.0	100%	11.2	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	10	0	9	10	0	1	1	0	0	0	0	0	0	0	9	0	9	9	0	0	0	798	9	886	10
Cat PA1-14	Offsite to the north via overland flow	17.4	100%	17.4	0%	0.0	100%	17.4	0.0	0%	0	Sidewalk	0	Open Sandy Loam	0.4	0.25	0.65	0	15	0	14	15	0	2	2	0	0	0	0	0	0	0	14	0	14	14	0	0	0	798	14	886	15
Cat PA1-85	Offsite to the north via overland flow	7.2	0%	0.0	0%	0.0	0%	0.0	0.0	100%	7	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	6	2	0	6	4	0	4	2	0	0	2	1	0	0	0	0	0	1	0	0	0	102	1	886	6
Cat PA1-99	Offsite to the north via overland flow	15.2	0%	0.0	0%	0.0	0%	0.0	0.0	100%	15	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	13	5	0	13	8	0	8	4	0	0	4	2	0	0	0	0	0	2	0	0	0	102	2	886	13
Cat PA1-100	Offsite to the north via overland flow	6.4	100%	6.4	0%	0.0	100%	6.4	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	6	0	5	6	0	1	1	0	0	0	0	0	0	0	5	0	5	5	0	0	0	798	5	886	6
Cat PA1-101	Offsite to the north via overland flow	37.7	100%	37.7	100%	37.7	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	33	0	30	33	0	3	3	0	15	0	15	0	0	30	0	0	30	30	-15	0	0	399	15	886	33
Cat PA1-131	Offsite to the north via overland flow	10.8	100%	10.8	0%	0.0	100%	10.8	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	10	0	9	10	0	1	1	0	0	0	0	0	0	0	9	0	9	9	0	0	0	798	9	886	10
Cat PA1-132	Offsite to the north via overland flow	12.7	100%	12.7	100%	12.7	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	11	0	10	11	0	1	1	0	5	0	5	0	0	10	0	0	10	10	-5	0	0	399	5	886	11
Cat PA1-193	Offsite to the north via overland flow	143.6	0%	0.0	0%	0.0	0%	0.0	0.0	100%	144	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	127	49	0	127	78	0	78	34	0	0	34	15	0	0	0	0	0	15	0	0	0	102	15	886	127
Cat PA1-194	Offsite to the north via overland flow	47.9	0%	0.0	0%	0.0	0%	0.0	0.0	100%	48	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	42	16	0	42	26	0	26	11	0	0	11	5	0	0	0	0	0	5	0	0	0	102	5	886	42
Cat PA1-195	Offsite to the north via overland flow	4.3	100%	4.3	0%	0.0	100%	4.3	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	4	0	3	4	0	0	0	0	0	0	0	0	0	0	3	0	3	3	0	0	0	798	3	886	4
Cat PA1-196	Offsite to the north via overland flow	150.5	100%	150.5	100%	150.5	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	133	0	120	133	0	13	13	0	60	0	60	0	0	120	0	0	120	120	-60	0	0	399	60	886	133
Cat PA1-197	Offsite to the north via overland flow	27.9	100%	27.9	100%	27.9	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	25	0	22	25	0	2	2	0	11	0	11	0	0	22	0	0	22	22	-11	0	0	399	11	886	25
Post-Development Catchment PA1 Total	**Offsite to the north via overland flow**	**927**	**57%**	**529**	**50%**	**463**	**7%**	**65**	**0**	**43%**	**398**								**821**		**422**	**821**	**217**	**47**	**264**	**95**	**185**	**0**	**280**	**41**	**0**	**370**	**52**	**0**	**422**	**462**	**-185**	**0**	**0**	**300**	**278**	**886**	**821**
Cat PA2-5	Offsite to the north via overland flow	51.0	0%	0.0	0%	0.0	0%	0.0	0.0	100%	51	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	45	17	0	45	28	0	28	12	0	0	12	5	0	0	0	0	0	5	0	0	0	102	5	886	45
Cat PA2-98	Offsite to the north via overland flow	19.2	0%	0.0	0%	0.0	0%	0.0	0.0	100%	19	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	17	7	0	17	10	0	10	5	0	0	5	2	0	0	0	0	0	2	0	0	0	102	2	886	17
Cat PA2-184	Offsite to the north via overland flow	13.7	0%	0.0	0%	0.0	0%	0.0	0.0	100%	14	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	12	5	0	12	7	0	7	3	0	0	3	1	0	0	0	0	0	1	0	0	0	102	1	886	12
Cat PA2-185	Offsite to the north via overland flow	65.7	0%	0.0	0%	0.0	0%	0.0	0.0	100%	66	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	58	22	0	58	36	0	36	16	0	0	16	7	0	0	0	0	0	7	0	0	0	102	7	886	58
Post-Development Catchment PA2 Total	**Offsite to the north via overland flow**	**150**	**0%**	**0**	**0%**	**0**	**0%**	**0**	**0**	**100%**	**150**								**133**		**0**	**133**	**82**	**0**	**82**	**36**	**0**	**0**	**36**	**15**	**0**	**0**	**0**	**0**	**0**	**15**	**0**	**0**	**0**	**102**	**15**	**886**	**133**
Cat PB-17	Offsite to the north via onsite catchbasins and stormsewers	157.9	100%	157.9	100%	157.9	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	140	0	126	140	0	14	14	0	0	0	0	0	0	126	0	0	126	126	0	0	0	798	126	886	140
Cat PB-18	Offsite to the north via onsite catchbasins and stormsewers	470.6	100%	470.6	100%	470.6	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	417	0	375	417	0	42	42	0	0	0	0	0	0	375	0	0	375	375	0	0	0	798	375	886	417
Cat PB-19	Offsite to the north via onsite catchbasins and stormsewers	10.3	100%	10.3	0%	0.0	100%	10.3	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	9	0	8	9	0	1	1	0	0	0	0	0	0	0	8	0	8	8	0	0	0	798	8	886	9
Cat PB-20	Offsite to the north via onsite catchbasins and stormsewers	10.1	100%	10.1	0%	0.0	100%	10.1	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	9	0	8	9	0	1	1	0	0	0	0	0	0	0	8	0	8	8	0	0	0	798	8	886	9
Cat PB-21	Offsite to the north via onsite catchbasins and stormsewers	9.8	100%	9.8	0%	0.0	100%	9.8	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	9	0	8	9	0	1	1	0	0	0	0	0	0	0	8	0	8	8	0	0	0	798	8	886	9
Cat PB-22	Offsite to the north via onsite catchbasins and stormsewers	9.8	100%	9.8	0%	0.0	100%	9.8	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	9	0	8	9	0	1	1	0	0	0	0	0	0	0	8	0	8	8	0	0	0	798	8	886	9
Cat PB-23	Offsite to the north via onsite catchbasins and stormsewers	10.1	100%	10.1	0%	0.0	100%	10.1	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	9	0	8	9	0	1	1	0	0	0	0	0	0	0	8	0	8	8	0	0	0	798	8	886	9
Cat PB-24	Offsite to the north via onsite catchbasins and stormsewers	10.3	100%	10.3	0%	0.0	100%	10.3	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	9	0	8	9	0	1	1	0	0	0	0	0	0	0	8	0	8	8	0	0	0	798	8	886	9
Cat PB-25	Offsite to the north via onsite catchbasins and stormsewers	3.8	100%	3.8	0%	0.0	100%	3.8	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	3	0	3	3	0	0	0	0	0	0	0	0	0	0	3	0	3	3	0	0	0	798	3	886	3
Cat PB-26	Offsite to the north via onsite catchbasins and stormsewers	220.5	100%	220.5	100%	220.5	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	195	0	176	195	0	20	20	0	0	0	0	0	0	176	0	0	176	176	0	0	0	798	176	886	195
Cat PB-27	Offsite to the north via onsite catchbasins and stormsewers	221.3	100%	221.3	100%	221.3	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	196	0	177	196	0	20	20	0	0	0	0	0	0	177	0	0	177	177	0	0	0	798	177	886	196
Cat PB-28	Offsite to the north via onsite catchbasins and stormsewers	42.0	100%	42.0	0%	0.0	100%	42.0	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	37	0	33	37	0	4	4	0	0	0	0	0	0	0	33	0	33	33	0	0	0	798	33	886	37
Cat PB-29	Offsite to the north via onsite catchbasins and stormsewers	43.1	100%	43.1	0%	0.0	100%	43.1	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	38	0	34	38	0	4	4	0	0	0	0	0	0	0	34	0	34	34	0	0	0	798	34	886	38
Cat PB-30	Offsite to the north via onsite catchbasins and stormsewers	43.2	100%	43.2	0%	0.0	100%	43.2	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	38	0	34	38	0	4	4	0	0	0	0	0	0	0	34	0	34	34	0	0	0	798	34	886	38
Cat PB-31	Offsite to the north via onsite catchbasins and stormsewers	42.5	100%	42.5	0%	0.0	100%	42.5	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	38	0	34	38	0	4	4	0	0	0	0	0	0	0	34	0	34	34	0	0	0	798	34	886	38
Cat PB-32	Offsite to the north via onsite catchbasins and stormsewers	42.3	100%	42.3	0%	0.0	100%	42.3	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	38	0	34	38	0	4	4	0	0	0	0	0	0	0	34	0	34	34	0	0	0	798	34	886	38
Cat PB-33	Offsite to the north via onsite catchbasins and stormsewers	39.8	100%	39.8	0%	0.0	100%	39.8	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	35	0	32	35	0	4	4	0	0	0	0	0	0	0	32	0	32	32	0	0	0	798	32	886	35
Cat PB-34	Offsite to the north via onsite catchbasins and stormsewers	41.5	100%	41.5	0%	0.0	100%	41.5	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	37	0	33	37	0	4	4	0	0	0	0	0	0	0	33	0	33	33	0	0	0	798	33	886	37
Cat PB-35	Offsite to the north via onsite catchbasins and stormsewers	37.2	100%	37.2	0%	0.0	100%	37.2	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	33	0	30	33	0	3	3	0	0	0	0	0	0	0	30	0	30	30	0	0	0	798	30	886	33
Cat PB-36	Offsite to the north via onsite catchbasins and stormsewers	39.0	100%	39.0	0%	0.0	100%	39.0	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	35	0	31	35	0	3	3	0	0	0	0	0	0	0	31	0	31	31	0	0	0	798	31	886	35
Cat PB-37	Offsite to the north via onsite catchbasins and stormsewers	39.6	100%	39.6	0%	0.0	100%	39.6	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	35	0	32	35	0	4	4	0	0	0	0	0	0	0	32	0	32	32	0	0	0	798	32	886	35
Cat PB-38	Offsite to the north via onsite catchbasins and stormsewers	39.3	100%	39.3	0%	0.0	100%	39.3	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	35	0	31	35	0	3	3	0	0	0	0	0	0	0	31	0	31	31	0	0	0	798	31	886	35
Cat PB-39	Offsite to the north via onsite catchbasins and stormsewers	39.7	100%	39.7	0%	0.0	100%	39.7	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	35	0	32	35	0	4	4	0	0	0	0	0	0	0	32	0	32	32	0	0	0	798	32	886	35
Cat PB-40	Offsite to the north via onsite catchbasins and stormsewers	71.5	100%	71.5	0%	0.0	100%	71.5	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	63	0	57	63	0	6	6	0	0	0	0	0	0	0	57	0	57	57	0	0	0	798	57	886	63
Cat PB-41	Offsite to the north via onsite catchbasins and stormsewers	71.5	100%	71.5	0%	0.0	100%	71.5	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	63	0	57	63	0	6	6	0	0	0	0	0	0	0	57	0	57	57	0	0	0	798	57	886	63
Cat PB-42	Offsite to the north via onsite catchbasins and stormsewers	42.0	100%	42.0	0%	0.0	100%	42.0	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	37	0	34	37	0	4	4	0	0	0	0	0	0	0	34	0	34	34	0	0	0	798	34	886	37
Cat PB-43	Offsite to the north via onsite catchbasins and stormsewers	3.6	100%	3.6	0%	0.0	100%	3.6	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	3	0	3	3	0	0	0	0	0	0	0	0	0	0	3	0	3	3	0	0	0	798	3	886	3
Cat PB-44	Offsite to the north via onsite catchbasins and stormsewers	15.9	100%	15.9	0%	0.0	100%	15.9	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	14	0	13	14	0	1	1	0	0	0	0	0	0	0	13	0	13	13	0	0	0	798	13	886	14
Cat PB-45	Offsite to the north via onsite catchbasins and stormsewers	16.0	100%	16.0	0%	0.0	100%	16.0	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	14	0	13	14	0	1	1	0	0	0	0	0	0	0	13	0	13	13	0	0	0	798	13	886	14
Cat PB-46	Offsite to the north via onsite catchbasins and stormsewers	48.2	100%	48.2	0%	0.0	100%	48.2	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	43	0	38	43	0	4	4	0	0	0	0	0	0	0	38	0	38	38	0	0	0	798	38	886	43
Cat PB-47	Offsite to the north via onsite catchbasins and stormsewers	73.0	100%	73.0	0%	0.0	100%	73.0	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	65	0	58	65	0	6	6	0	0	0	0	0	0	0	58	0	58	58	0	0	0	798	58	886	65
Cat PB-48	Offsite to the north via onsite catchbasins and stormsewers	74.6	100%	74.6	0%	0.0	100%	74.6	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	66	0	59	66	0	7	7	0	0	0	0	0	0	0	59	0	59	59	0	0	0	798	59	886	66
Cat PB-49	Offsite to the north via onsite catchbasins and stormsewers	71.1	100%	71.1	0%	0.0	100%	71.1	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	63	0	57	63	0	6	6	0	0	0	0	0	0	0	57	0	57	57	0	0	0	798	57	886	63
Cat PB-50	Offsite to the north via onsite catchbasins and stormsewers	71.5	100%	71.5	0%	0.0	100%	71.5	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	63	0	57	63	0	6	6	0	0	0	0	0	0	0	57	0	57	57	0	0	0	798	57	886	63
Cat PB-51	Offsite to the north via onsite catchbasins and stormsewers	72.6	100%	72.6	0%	0.0	100%	72.6	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	64	0	58	64	0	6	6	0	0	0	0	0	0	0	58	0	58	58	0	0	0	798	58	886	64
Cat PB-52	Offsite to the north via onsite catchbasins and stormsewers	71.5	100%	71.5	0%	0.0	100%	71.5	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	63	0	57	63	0	6	6	0	0	0	0	0	0	0	57	0	57	57	0	0	0	798	57	886	63
Cat PB-53	Offsite to the north via onsite catchbasins and stormsewers	176.3	100%	176.3	0%	0.0	100%	176.3	0.0	0%	0	Sidewalk	0	Open Sandy Loam	0.4	0.25	0.65	0	156	0	141	156	0	16	16	0	0	0	0	0	0	0	141	0	141	141	0	0	0	798	141	886	156
Cat PB-54	Offsite to the north via onsite catchbasins and stormsewers	72.1	100%	72.1	0%	0.0	100%	72.1	0.0	0%	0	Sidewalk	0	Open Sandy Loam	0.4	0.25	0.65	0	64	0	58	64	0	6	6	0	0	0	0	0	0	0	58	0	58	58	0	0	0	798	58	886	64
Cat PB-55	Offsite to the north via onsite catchbasins and stormsewers	2184.0	100%	2184.0	0%	0.0	100%	2184.0	0.0	0%	0	Road	0	Open Sandy Loam	0.4	0.25	0.65	0	1,935	0	1,742	1,935	0	194	194	0	0	0	0	0	0	0	1,742	0	1,742	1,742	0	0	0	798	1,742	886	1,935
Cat PB-56	Offsite to the north via onsite catchbasins and stormsewers	58.3	0%	0.0	0%	0.0	0%	0.0	0.0	100%	58	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	52	20	0	52	32	0	32	14	0	0	14	6	0	0	0	0	0	6	0	0	0	102	6	886	52
Cat PB-57	Offsite to the north via onsite catchbasins and stormsewers	50.6	0%	0.0	0%	0.0	0%	0.0	0.0	100%	51	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	45	17	0	45	28	0	28	12	0	0	12	5	0	0	0	0	0	5	0	0	0	102	5	886	45
Cat PB-58	Offsite to the north via onsite catchbasins and stormsewers	19.6	0%	0.0	0%	0.0	0%	0.0	0.0	100%	20	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	17	7	0	17	11	0	11	5	0	0	5	2	0	0	0	0	0	2	0	0	0	102	2	886	17
Cat PB-59	Offsite to the north via onsite catchbasins and stormsewers	14.2	0%	0.0	0%	0.0	0%	0.0	0.0	100%	14	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	13	5	0	13	8	0	8	3	0	0	3	1	0	0	0	0	0	1	0	0	0	102	1	886	13
Cat PB-60	Offsite to the north via onsite catchbasins and stormsewers	3.1	0%	0.0	0%	0.0	0%	0.0	0.0	100%	3	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	3	1	0	3	2	0	2	1	0	0	1	0	0	0	0	0	0	0	0	0	0	102	0	886	3
Cat PB-61	Offsite to the north via onsite catchbasins and stormsewers	12.7	0%	0.0	0%	0.0	0%	0.0	0.0	100%	13	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	11	4	0	11	7	0	7	3	0	0	3	1	0	0	0	0	0	1	0	0	0	102	1	886	11
Cat PB-62	Offsite to the north via onsite catchbasins and stormsewers	1.8	0%	0.0	0%	0.0	0%	0.0	0.0	100%	2	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	2	1	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	102	0	886	2
Cat PB-63	Offsite to the north via onsite catchbasins and stormsewers	23.2	0%	0.0	0%	0.0	0%	0.0	0.0	100%	23	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	21	8	0	21	13	0	13	6	0	0	6	2	0	0	0	0	0	2	0	0	0	102	2	886	21
Cat PB-64	Offsite to the north via onsite catchbasins and stormsewers	2.8	0%	0.0	0%	0.0	0%	0.0	0.0	100%	3	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	2	1	0	2	2	0	2	1	0	0	1	0	0	0	0	0	0	0	0	0	0	102	0	886	2
Cat PB-65	Offsite to the north via onsite catchbasins and stormsewers	18.0	0%	0.0	0%	0.0	0%	0.0	0.0	100%	18	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	16	6	0	16	10	0	10	4	0	0	4	2	0	0	0	0	0	2	0	0	0	102	2	886	16
Cat PB-66	Offsite to the north via onsite catchbasins and stormsewers	185.8	0%	0.0	0%	0.0	0%	0.0	0.0	100%	186	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	165	63	0	165	101	0	101	44	0	0	44	19	0	0	0	0	0	19	0	0	0	102	19	886	165
Cat PB-67	Offsite to the north via onsite catchbasins and stormsewers	99.6	0%	0.0	0%	0.0	0%	0.0	0.0	100%	100	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	88	34	0	88	54	0	54	24	0	0	24	10	0	0	0	0	0	10	0	0	0	102	10	886	88
Cat PB-68	Offsite to the north via onsite catchbasins and stormsewers	96.2	0%	0.0	0%	0.0	0%	0.0	0.0	100%	96	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	85	33	0	85	52	0	52	23	0	0	23	10	0	0	0	0	0	10	0	0	0	102	10	886	85
Cat PB-69	Offsite to the north via onsite catchbasins and stormsewers	2.4	0%	0.0	0%	0.0	0%	0.0	0.0	100%	2	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	2	1	0	2	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	102	0	886	2
Cat PB-70	Offsite to the north via onsite catchbasins and stormsewers	168.0	0%	0.0	0%	0.0	0%	0.0	0.0	100%	168	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	149	57	0	149	92	0	92	40	0	0	40	17	0	0	0	0	0	17	0	0	0	102	17	886	149
Cat PB-71	Offsite to the north via onsite catchbasins and stormsewers	97.1	0%	0.0	0%	0.0	0%	0.0	0.0	100%	97	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	86	33	0	86	53	0	53	23	0	0	23	10	0	0	0	0	0	10	0	0	0	102	10	886	86
Cat PB-72	Offsite to the north via onsite catchbasins and stormsewers	97.8	0%	0.0	0%	0.0	0%	0.0	0.0	100%	98	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	87	33	0	87	53	0	53	23	0	0	23	10	0	0	0	0	0	10	0	0	0	102	10	886	87
Cat PB-73	Offsite to the north via onsite catchbasins and stormsewers	96.9	0%	0.0	0%	0.0	0%	0.0	0.0	100%	97	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	86	33	0	86	53	0	53	23	0	0	23	10	0	0	0	0	0	10	0	0	0	102	10	886	86
Cat PB-74	Offsite to the north via onsite catchbasins and stormsewers	95.7	0%	0.0	0%	0.0	0%	0.0	0.0	100%	96	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	85	33	0	85	52	0	52	23	0	0	23	10	0	0	0	0	0	10	0	0	0	102	10	886	85
Cat PB-75	Offsite to the north via onsite catchbasins and stormsewers	153.4	0%	0.0	0%	0.0	0%	0.0	0.0	100%	153	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	136	52	0	136	84	0	84	37	0	0	37	16	0	0	0	0	0	16	0	0	0	102	16	886	136
Cat PB-76	Offsite to the north via onsite catchbasins and stormsewers	128.0	0%	0.0	0%	0.0	0%	0.0	0.0	100%	128	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	113	44	0	113	70	0	70	31	0	0	31	13	0	0	0	0	0	13	0	0	0	102	13	886	113
Cat PB-77	Offsite to the north via onsite catchbasins and stormsewers	171.4	0%	0.0	0%	0.0	0%	0.0	0.0	100%	171	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	152	58	0	152	93	0	93	41	0	0	41	18	0	0	0	0	0	18	0	0	0	102	18	886	152
Cat PB-78	Offsite to the north via onsite catchbasins and stormsewers	27.2	0%	0.0	0%	0.0	0%	0.0	0.0	100%	27	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	24	9	0	24	15	0	15	6	0	0	6	3	0	0	0	0	0	3	0	0	0	102	3	886	24
Cat PB-79	Offsite to the north via onsite catchbasins and stormsewers	26.9	0%	0.0	0%	0.0	0%	0.0	0.0	100%	27	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	24	9	0	24	15	0	15	6	0	0	6	3	0	0	0	0	0	3	0	0	0	102	3	886	24
Cat PB-80	Offsite to the north via onsite catchbasins and stormsewers	26.4	0%	0.0	0%	0.0	0%	0.0	0.0	100%	26	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	23	9	0	23	14	0	14	6	0	0	6	3	0	0	0	0	0	3	0	0	0	102	3	886	23
Cat PB-81	Offsite to the north via onsite catchbasins and stormsewers	26.9	0%	0.0	0%	0.0	0%	0.0	0.0	100%	27	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	24	9	0	24	15	0	15	6	0	0	6	3	0	0	0	0	0	3	0	0	0	102	3	886	24
Cat PB-82	Offsite to the north via onsite catchbasins and stormsewers	36.2	0%	0.0	0%	0.0	0%	0.0	0.0	100%	36	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	32	12	0	32	20	0	20	9	0	0	9	4	0	0	0	0	0	4	0	0	0	102	4	886	32
Cat PB-83	Offsite to the north via onsite catchbasins and stormsewers	25.4	0%	0.0	0%	0.0	0%	0.0	0.0	100%	25	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	22	9	0	22	14	0	14	6	0	0	6	3	0	0	0	0	0	3	0	0	0	102	3	886	22
Cat PB-84	Offsite to the north via onsite catchbasins and stormsewers	6.4	0%	0.0	0%	0.0	0%	0.0	0.0	100%	6	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	6	2	0	6	3	0	3	2	0	0	2	1	0	0	0	0	0	1	0	0	0	102	1	886	6
Cat PB-86	Offsite to the north via onsite catchbasins and stormsewers	18.6	100%	18.6	0%	0.0	100%	18.6	0.0	0%	0	Sidewalk	0	Open Sandy Loam	0.4	0.25	0.65	0	17	0	15	17	0	2	2	0	0	0	0	0	0	0	15	0	15	15	0	0	0	798	15	886	17
Cat PB-87	Offsite to the north via onsite catchbasins and stormsewers	53.8	100%	53.8	0%	0.0	100%	53.8	0.0	0%	0	Road	0	Open Sandy Loam	0.4	0.25	0.65	0	48	0	43	48	0	5	5	0	0	0	0	0	0	0	43	0	43	43	0	0	0	798	43	886	48
Cat PB-88	Offsite to the north via onsite catchbasins and stormsewers	6.0	0%	0.0	0%	0.0	0%	0.0	0.0	100%	6	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	5	2	0	5	3	0	3	1	0	0	1	1	0	0	0	0	0	1	0	0	0	102	1	886	5
Cat PB-89	Offsite to the north via onsite catchbasins and stormsewers	38.6	100%	38.6	0%	0.0	100%	38.6	0.0	0%	0	Road	0	Open Sandy Loam	0.4	0.25	0.65	0	34	0	31	34	0	3	3	0	0	0	0	0	0	0	31	0	31	31	0	0	0	798	31	886	34
Cat PB-90	Offsite to the north via onsite catchbasins and stormsewers	7.1	0%	0.0	0%	0.0	0%	0.0	0.0	100%	7	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	6	2	0	6	4	0	4	2	0	0	2	1	0	0	0	0	0	1	0	0	0	102	1	886	6
Cat PB-91	Offsite to the north via onsite catchbasins and stormsewers	27.7	100%	27.7	0%	0.0	100%	27.7	0.0	0%	0	Road	0	Open Sandy Loam	0.4	0.25	0.65	0	25	0	22	25	0	2	2	0	0	0	0	0	0	0	22	0	22	22	0	0	0	798	22	886	25
Cat PB-92	Offsite to the north via onsite catchbasins and stormsewers	69.5	100%	69.5	0%	0.0	100%	69.5	0.0	0%	0	Road	0	Open Sandy Loam	0.4	0.25	0.65	0	62	0	55	62	0	6	6	0	0	0	0	0	0	0	55	0	55	55	0	0	0	798	55	886	62
Cat PB-96	Offsite to the north via onsite catchbasins and stormsewers	54.6	100%	54.6	100%	54.6	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	48	0	44	48	0	5	5	0	0	0	0	0	0	44	0	0	44	44	0	0	0	798	44	886	48
Cat PB-102	Offsite to the north via onsite catchbasins and stormsewers	46.8	100%	46.8	100%	46.8	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	42	0	37	42	0	4	4	0	0	0	0	0	0	37	0	0	37	37	0	0	0	798	37	886	42
Cat PB-103	Offsite to the north via onsite catchbasins and stormsewers	13.5	100%	13.5	0%	0.0	100%	13.5	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	12	0	11	12	0	1	1	0	0	0	0	0	0	0	11	0	11	11	0	0	0	798	11	886	12
Cat PB-104	Offsite to the north via onsite catchbasins and stormsewers	4.5	100%	4.5	0%	0.0	100%	4.5	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	4	0	4	4	0	0	0	0	0	0	0	0	0	0	4	0	4	4	0	0	0	798	4	886	4
Cat PB-105	Offsite to the north via onsite catchbasins and stormsewers	0.7	0%	0.0	0%	0.0	0%	0.0	0.0	100%	1	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	102	0	886	1
Cat PB-108	Offsite to the north via onsite catchbasins and stormsewers	272.7	100%	272.7	100%	272.7	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	242	0	217	242	0	24	24	0	0	0	0	0	0	217	0	0	217	217	0	0	0	798	217	886	242
Cat PB-109	Offsite to the north via onsite catchbasins and stormsewers	274.0	100%	274.0	100%	274.0	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	243	0	219	243	0	24	24	0	0	0	0	0	0	219	0	0	219	219	0	0	0	798	219	886	243
Cat PB-110	Offsite to the north via onsite catchbasins and stormsewers	106.4	100%	106.4	100%	106.4	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	94	0	85	94	0	9	9	0	0	0	0	0	0	85	0	0	85	85	0	0	0	798	85	886	94
Cat PB-111	Offsite to the north via onsite catchbasins and stormsewers	29.9	100%	29.9	0%	0.0	100%	29.9	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	27	0	24	27	0	3	3	0	0	0	0	0	0	0	24	0	24	24	0	0	0	798	24	886	27

TABLE F-1 POST-DEVELOPMENT WATER BUDGET (BY CATCHMENT)
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

ANNUAL PRECIPITATION	EVAPORATION AND EVAPOTRANSPIRATION FACTORS			
	Impervious Areas		Waterbody	
mm	%	mm	%	mm
886	10%	89	73%	646

On-Site Subcatchment Designation	Outlet	Total Area	Impervious							Pervious		MOE TABLE 2 Components					MOE Infiltration Factor	Adjusted MOE Infiltration Factor	Inputs				Outputs																					
			Total Impervious		Assumed Buildings		Assumed Road/ Parking/ Amenities		Other Impervious	Total Pervious									Precipitation			Total Inputs	Evapotranspiration			Infiltration				Runoff												Total Outputs	
																			Annual Average	Surplus (Pervious)	Surplus (Impervious)		Pervious	Impervious	Total Evapotranspiration	Pervious Areas	Rooftop Discon	Infiltration Trenches	Total Infiltration	Pervious	Landscaped Area Redirected	Building	Road/ Driveway/ Amenities	Other Impervious	Total Impervious	Total Runoff	Rooftop Runoff Infiltrated	Infiltration Trenches		Net Runoff			
		(m^2)	% of Total Area	(m^2)	% of Impervious Area	(m^2)	% of Impervious Area	(m^2)	(m^2)	% of Total Area	(m^2)	Cover		Soil		Topography			(m^3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(m3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)	(mm/yr)	(m^3/yr)
Cat PB-112	Offsite to the north via onsite catchbasins and stormsewers	71.6	100%	71.6	0%	0.0	100%	71.6	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	63	0	57	63	0	6	6	0	0	0	0	0	0	0	57	0	57	57	0	0	0	798	57	886	63
Cat PB-113	Offsite to the north via onsite catchbasins and stormsewers	74.6	100%	74.6	0%	0.0	100%	74.6	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	66	0	60	66	0	7	7	0	0	0	0	0	0	0	60	0	60	60	0	0	0	798	60	886	66
Cat PB-114	Offsite to the north via onsite catchbasins and stormsewers	67.4	100%	67.4	0%	0.0	100%	67.4	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	60	0	54	60	0	6	6	0	0	0	0	0	0	0	54	0	54	54	0	0	0	798	54	886	60
Cat PB-115	Offsite to the north via onsite catchbasins and stormsewers	55.1	100%	55.1	0%	0.0	100%	55.1	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	49	0	44	49	0	5	5	0	0	0	0	0	0	0	44	0	44	44	0	0	0	798	44	886	49
Cat PB-116	Offsite to the north via onsite catchbasins and stormsewers	20.0	100%	20.0	0%	0.0	100%	20.0	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	18	0	16	18	0	2	2	0	0	0	0	0	0	0	16	0	16	16	0	0	0	798	16	886	18
Cat PB-117	Offsite to the north via onsite catchbasins and stormsewers	20.7	100%	20.7	0%	0.0	100%	20.7	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	18	0	17	18	0	2	2	0	0	0	0	0	0	0	17	0	17	17	0	0	0	798	17	886	18
Cat PB-118	Offsite to the north via onsite catchbasins and stormsewers	82.4	100%	82.4	0%	0.0	100%	82.4	0.0	0%	0	Road	0	Open Sandy Loam	0.4	0.25	0.65	0	73	0	66	73	0	7	7	0	0	0	0	0	0	0	66	0	66	66	0	0	0	798	66	886	73
Cat PB-119	Offsite to the north via onsite catchbasins and stormsewers	40.0	0%	0.0	0%	0.0	0%	0.0	0.0	100%	40	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	35	14	0	35	22	0	22	10	0	0	10	4	0	0	0	0	0	4	0	0	0	102	4	886	35
Cat PB-120	Offsite to the north via onsite catchbasins and stormsewers	46.8	0%	0.0	0%	0.0	0%	0.0	0.0	100%	47	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	41	16	0	41	25	0	25	11	0	0	11	5	0	0	0	0	0	5	0	0	0	102	5	886	41
Cat PB-121	Offsite to the north via onsite catchbasins and stormsewers	34.8	0%	0.0	0%	0.0	0%	0.0	0.0	100%	35	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	31	12	0	31	19	0	19	8	0	0	8	4	0	0	0	0	0	4	0	0	0	102	4	886	31
Cat PB-122	Offsite to the north via onsite catchbasins and stormsewers	115.3	0%	0.0	0%	0.0	0%	0.0	0.0	100%	115	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	102	39	0	102	63	0	63	28	0	0	28	12	0	0	0	0	0	12	0	0	0	102	12	886	102
Cat PB-123	Offsite to the north via onsite catchbasins and stormsewers	96.0	0%	0.0	0%	0.0	0%	0.0	0.0	100%	96	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	85	33	0	85	52	0	52	23	0	0	23	10	0	0	0	0	0	10	0	0	0	102	10	886	85
Cat PB-124	Offsite to the north via onsite catchbasins and stormsewers	97.5	0%	0.0	0%	0.0	0%	0.0	0.0	100%	98	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	86	33	0	86	53	0	53	23	0	0	23	10	0	0	0	0	0	10	0	0	0	102	10	886	86
Cat PB-125	Offsite to the north via onsite catchbasins and stormsewers	132.3	0%	0.0	0%	0.0	0%	0.0	0.0	100%	132	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	117	45	0	117	72	0	72	32	0	0	32	14	0	0	0	0	0	14	0	0	0	102	14	886	117
Cat PB-126	Offsite to the north via onsite catchbasins and stormsewers	1.0	0%	0.0	0%	0.0	0%	0.0	0.0	100%	1	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	102	0	886	1
Cat PB-135	Offsite to the north via onsite catchbasins and stormsewers	320.4	100%	320.4	100%	320.4	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	284	0	256	284	0	28	28	0	0	0	0	0	0	256	0	0	256	256	0	0	0	798	256	886	284
Cat PB-136	Offsite to the north via onsite catchbasins and stormsewers	9.8	100%	9.8	0%	0.0	100%	9.8	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	9	0	8	9	0	1	1	0	0	0	0	0	0	0	8	0	8	8	0	0	0	798	8	886	9
Cat PB-137	Offsite to the north via onsite catchbasins and stormsewers	9.8	100%	9.8	0%	0.0	100%	9.8	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	9	0	8	9	0	1	1	0	0	0	0	0	0	0	8	0	8	8	0	0	0	798	8	886	9
Cat PB-138	Offsite to the north via onsite catchbasins and stormsewers	5.8	100%	5.8	0%	0.0	100%	5.8	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	5	0	5	5	0	1	1	0	0	0	0	0	0	0	5	0	5	5	0	0	0	798	5	886	5
Cat PB-139	Offsite to the north via onsite catchbasins and stormsewers	9.6	100%	9.6	0%	0.0	100%	9.6	0.0	0%	0	Porch	0	Open Sandy Loam	0.4	0.25	0.65	0	9	0	8	9	0	1	1	0	0	0	0	0	0	0	8	0	8	8	0	0	0	798	8	886	9
Cat PB-140	Offsite to the north via onsite catchbasins and stormsewers	12.0	100%	12.0	100%	12.0	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	11	0	10	11	0	1	1	0	0	0	0	0	0	10	0	0	10	10	0	0	0	798	10	886	11
Cat PB-141	Offsite to the north via onsite catchbasins and stormsewers	41.2	100%	41.2	0%	0.0	100%	41.2	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	37	0	33	37	0	4	4	0	0	0	0	0	0	0	33	0	33	33	0	0	0	798	33	886	37
Cat PB-142	Offsite to the north via onsite catchbasins and stormsewers	41.5	100%	41.5	0%	0.0	100%	41.5	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	37	0	33	37	0	4	4	0	0	0	0	0	0	0	33	0	33	33	0	0	0	798	33	886	37
Cat PB-143	Offsite to the north via onsite catchbasins and stormsewers	42.2	100%	42.2	0%	0.0	100%	42.2	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	37	0	34	37	0	4	4	0	0	0	0	0	0	0	34	0	34	34	0	0	0	798	34	886	37
Cat PB-144	Offsite to the north via onsite catchbasins and stormsewers	25.8	100%	25.8	0%	0.0	100%	25.8	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	23	0	21	23	0	2	2	0	0	0	0	0	0	0	21	0	21	21	0	0	0	798	21	886	23
Cat PB-145	Offsite to the north via onsite catchbasins and stormsewers	35.5	100%	35.5	0%	0.0	100%	35.5	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	31	0	28	31	0	3	3	0	0	0	0	0	0	0	28	0	28	28	0	0	0	798	28	886	31
Cat PB-146	Offsite to the north via onsite catchbasins and stormsewers	40.1	100%	40.1	0%	0.0	100%	40.1	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	36	0	32	36	0	4	4	0	0	0	0	0	0	0	32	0	32	32	0	0	0	798	32	886	36
Cat PB-147	Offsite to the north via onsite catchbasins and stormsewers	39.5	100%	39.5	0%	0.0	100%	39.5	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	35	0	31	35	0	3	3	0	0	0	0	0	0	0	31	0	31	31	0	0	0	798	31	886	35
Cat PB-148	Offsite to the north via onsite catchbasins and stormsewers	69.6	100%	69.6	0%	0.0	100%	69.6	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	62	0	55	62	0	6	6	0	0	0	0	0	0	0	55	0	55	55	0	0	0	798	55	886	62
Cat PB-149	Offsite to the north via onsite catchbasins and stormsewers	69.7	100%	69.7	0%	0.0	100%	69.7	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	62	0	56	62	0	6	6	0	0	0	0	0	0	0	56	0	56	56	0	0	0	798	56	886	62
Cat PB-150	Offsite to the north via onsite catchbasins and stormsewers	69.3	100%	69.3	0%	0.0	100%	69.3	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	61	0	55	61	0	6	6	0	0	0	0	0	0	0	55	0	55	55	0	0	0	798	55	886	61
Cat PB-151	Offsite to the north via onsite catchbasins and stormsewers	69.2	100%	69.2	0%	0.0	100%	69.2	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	61	0	55	61	0	6	6	0	0	0	0	0	0	0	55	0	55	55	0	0	0	798	55	886	61
Cat PB-152	Offsite to the north via onsite catchbasins and stormsewers	69.9	100%	69.9	0%	0.0	100%	69.9	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	62	0	56	62	0	6	6	0	0	0	0	0	0	0	56	0	56	56	0	0	0	798	56	886	62
Cat PB-153	Offsite to the north via onsite catchbasins and stormsewers	68.9	100%	68.9	0%	0.0	100%	68.9	0.0	0%	0	Driveway	0	Open Sandy Loam	0.4	0.25	0.65	0	61	0	55	61	0	6	6	0	0	0	0	0	0	0	55	0	55	55	0	0	0	798	55	886	61
Cat PB-154	Offsite to the north via onsite catchbasins and stormsewers	192.3	100%	192.3	0%	0.0	100%	192.3	0.0	0%	0	Sidewalk	0	Open Sandy Loam	0.4	0.25	0.65	0	170	0	153	170	0	17	17	0	0	0	0	0	0	0	153	0	153	153	0	0	0	798	153	886	170
Cat PB-155	Offsite to the north via onsite catchbasins and stormsewers	56.8	0%	0.0	0%	0.0	0%	0.0	0.0	100%	57	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	50	19	0	50	31	0	31	14	0	0	14	6	0	0	0	0	0	6	0	0	0	102	6	886	50
Cat PB-156	Offsite to the north via onsite catchbasins and stormsewers	470.1	0%	0.0	0%	0.0	0%	0.0	0.0	100%	470	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	417	160	0	417	256	0	256	112	0	0	112	48	0	0	0	0	0	48	0	0	0	102	48	886	417
Cat PB-157	Offsite to the north via onsite catchbasins and stormsewers	3.6	0%	0.0	0%	0.0	0%	0.0	0.0	100%	4	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	3	1	0	3	2	0	2	1	0	0	1	0	0	0	0	0	0	0	0	0	0	102	0	886	3
Cat PB-158	Offsite to the north via onsite catchbasins and stormsewers	29.0	0%	0.0	0%	0.0	0%	0.0	0.0	100%	29	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	26	10	0	26	16	0	16	7	0	0	7	3	0	0	0	0	0	3	0	0	0	102	3	886	26
Cat PB-159	Offsite to the north via onsite catchbasins and stormsewers	184.2	0%	0.0	0%	0.0	0%	0.0	0.0	100%	184	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	163	63	0	163	100	0	100	44	0	0	44	19	0	0	0	0	0	19	0	0	0	102	19	886	163
Cat PB-160	Offsite to the north via onsite catchbasins and stormsewers	25.2	0%	0.0	0%	0.0	0%	0.0	0.0	100%	25	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	22	9	0	22	14	0	14	6	0	0	6	3	0	0	0	0	0	3	0	0	0	102	3	886	22
Cat PB-161	Offsite to the north via onsite catchbasins and stormsewers	2.8	0%	0.0	0%	0.0	0%	0.0	0.0	100%	3	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	2	1	0	2	2	0	2	1	0	0	1	0	0	0	0	0	0	0	0	0	0	102	0	886	2
Cat PB-162	Offsite to the north via onsite catchbasins and stormsewers	97.4	0%	0.0	0%	0.0	0%	0.0	0.0	100%	97	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	86	33	0	86	53	0	53	23	0	0	23	10	0	0	0	0	0	10	0	0	0	102	10	886	86
Cat PB-163	Offsite to the north via onsite catchbasins and stormsewers	95.6	0%	0.0	0%	0.0	0%	0.0	0.0	100%	96	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	85	33	0	85	52	0	52	23	0	0	23	10	0	0	0	0	0	10	0	0	0	102	10	886	85
Cat PB-164	Offsite to the north via onsite catchbasins and stormsewers	147.6	0%	0.0	0%	0.0	0%	0.0	0.0	100%	148	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	131	50	0	131	80	0	80	35	0	0	35	15	0	0	0	0	0	15	0	0	0	102	15	886	131
Cat PB-165	Offsite to the north via onsite catchbasins and stormsewers	96.0	0%	0.0	0%	0.0	0%	0.0	0.0	100%	96	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	85	33	0	85	52	0	52	23	0	0	23	10	0	0	0	0	0	10	0	0	0	102	10	886	85
Cat PB-166	Offsite to the north via onsite catchbasins and stormsewers	164.4	0%	0.0	0%	0.0	0%	0.0	0.0	100%	164	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	146	56	0	146	90	0	90	39	0	0	39	17	0	0	0	0	0	17	0	0	0	102	17	886	146
Cat PB-167	Offsite to the north via onsite catchbasins and stormsewers	96.9	0%	0.0	0%	0.0	0%	0.0	0.0	100%	97	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	86	33	0	86	53	0	53	23	0	0	23	10	0	0	0	0	0	10	0	0	0	102	10	886	86
Cat PB-168	Offsite to the north via onsite catchbasins and stormsewers	18.6	0%	0.0	0%	0.0	0%	0.0	0.0	100%	19	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	17	6	0	17	10	0	10	4	0	0	4	2	0	0	0	0	0	2	0	0	0	102	2	886	17
Cat PB-169	Offsite to the north via onsite catchbasins and stormsewers	25.5	0%	0.0	0%	0.0	0%	0.0	0.0	100%	25	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	23	9	0	23	14	0	14	6	0	0	6	3	0	0	0	0	0	3	0	0	0	102	3	886	23
Cat PB-170	Offsite to the north via onsite catchbasins and stormsewers	24.9	0%	0.0	0%	0.0	0%	0.0	0.0	100%	25	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	22	8	0	22	14	0	14	6	0	0	6	3	0	0	0	0	0	3	0	0	0	102	3	886	22
Cat PB-198	Offsite to the north via onsite catchbasins and stormsewers	110.5	100%	110.5	100%	110.5	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	98	0	88	98	0	10	10	0	0	0	0	0	0	88	0	0	88	88	0	0	0	798	88	886	98
Cat PB-199	Offsite to the north via onsite catchbasins and stormsewers	13.7	100%	13.7	100%	13.7	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	12	0	11	12	0	1	1	0	0	0	0	0	0	11	0	0	11	11	0	0	0	798	11	886	12
Cat PB-200	Offsite to the north via onsite catchbasins and stormsewers	12.1	100%	12.1	0%	0.0	100%	12.1	0.0	0%	0	Sidewalk	0	Open Sandy Loam	0.4	0.25	0.65	0	11	0	10	11	0	1	1	0	0	0	0	0	0	0	10	0	10	10	0	0	0	798	10	886	11
Cat PB-201	Offsite to the north via onsite catchbasins and stormsewers	61.3	100%	61.3	0%	0.0	100%	61.3	0.0	0%	0	Sidewalk	0	Open Sandy Loam	0.4	0.25	0.65	0	54	0	49	54	0	5	5	0	0	0	0	0	0	0	49	0	49	49	0	0	0	798	49	886	54
Cat PB-202	Offsite to the north via onsite catchbasins and stormsewers	1682.9	100%	1682.9	0%	0.0	100%	1682.9	0.0	0%	0	Road	0	Open Sandy Loam	0.4	0.25	0.65	0	1,491	0	1,342	1,491	0	149	149	0	0	0	0	0	0	0	1,342	0	1,342	1,342	0	0	0	798	1,342	886	1,491
Post-Development Catchment PBTotal	**Offsite to the north via onsite catchbasins and stormsewers**	**13,172**	**70%**	**9,284**	**17%**	**2,282**	**53%**	**7,003**	**0**	**30%**	**3,888**								**11,673**		**7,405**	**11,673**	**2,120**	**823**	**2,942**	**928**	**0**	**0**	**928**	**398**	**0**	**1,820**	**5,585**	**0**	**7,405**	**7,803**	**0**	**0**	**0**	**592**	**7,803**	**886**	**11,673**
Cat PC-4	Infiltration Trench	953.1	0%	0.0	0%	0.0	0%	0.0	0.0	100%	953	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	845	325	0	845	520	0	520	228	0	78	306	98	0	0	0	0	0	98	0	-82	-78	20	20	886	845
Cat PC-15	Infiltration Trench	571.6	100%	571.6	100%	571.6	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	507	0	456	507	0	51	51	0	228	182	410	0	0	456	0	0	456	456	-228	-191	-182	80	46	886	507
Cat PC-16	Infiltration Trench	571.6	100%	571.6	100%	571.6	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	507	0	456	507	0	51	51	0	228	182	410	0	0	456	0	0	456	456	-228	-191	-182	80	46	886	507
Cat PC-128	Infiltration Trench	785.5	0%	0.0	0%	0.0	0%	0.0	0.0	100%	785	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	696	268	0	696	428	0	428	188	0	64	252	80	0	0	0	0	0	80	0	-82	-64	20	16	886	696
Cat PC-133	Infiltration Trench	572.4	100%	572.4	100%	572.4	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	507	0	456	507	0	51	51	0	228	183	411	0	0	456	0	0	456	456	-228	-232	-183	80	46	886	507
Cat PC-134	Infiltration Trench	572.4	100%	572.4	100%	572.4	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	507	0	456	507	0	51	51	0	228	183	411	0	0	456	0	0	456	456	-228	-232	-183	80	46	886	507
Post-Development Catchment PCTotal	**Infiltration Trench**	**4,026**	**57%**	**2,288**	**57%**	**2,288**	**0%**	**0**	**0**	**43%**	**1,739**								**3,568**	**593**	**1,825**	**3,568**	**948**	**203**	**1,150**	**415**	**912**	**872**	**2,200**	**178**	**0**	**1,825**	**0**	**0**	**1,825**	**2,003**	**-912**	**-217**	**-872**	**54**	**218**	**886**	**3,568**
Cat PD-2	Off-site via swales and rearlot catchbasins	261.1	0%	0.0	0%	0.0	0%	0.0	0.0	100%	261	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	231	89	0	231	142	0	142	62	0	0	62	27	0	0	0	0	0	27	0	0	0	102	27	886	231
Cat PD-9	Off-site via swales and rearlot catchbasins	148.1	100%	148.1	100%	148.1	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	131	0	118	131	0	13	13	0	59	0	59	0	0	118	0	0	118	118	-59	0	0	399	59	886	131
Cat PD-93	Off-site via swales and rearlot catchbasins	120.0	0%	0.0	0%	0.0	0%	0.0	0.0	100%	120	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	106	41	0	106	65	0	65	29	0	0	29	12	0	0	0	0	0	12	0	0	0	102	12	886	106
Cat PD-95	Off-site via swales and rearlot catchbasins	78.2	100%	78.2	100%	78.2	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	69	0	62	69	0	7	7	0	31	0	31	0	0	62	0	0	62	62	-31	0	0	399	31	886	69
Cat PD-97	Off-site via swales and rearlot catchbasins	86.5	0%	0.0	0%	0.0	0%	0.0	0.0	100%	87	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	77	30	0	77	47	0	47	21	0	0	21	9	0	0	0	0	0	9	0	0	0	102	9	886	77
Cat PD-106	Off-site via swales and rearlot catchbasins	202.6	100%	202.6	100%	202.6	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	180	0	162	180	0	18	18	0	81	0	81	0	0	162	0	0	162	162	-81	0	0	399	81	886	180
Cat PD-107	Off-site via swales and rearlot catchbasins	96.5	100%	96.5	100%	96.5	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	85	0	77	85	0	9	9	0	38	0	38	0	0	77	0	0	77	77	-38	0	0	399	38	886	85
Cat PD-181	Off-site via swales and rearlot catchbasins	24.4	0%	0.0	0%	0.0	0%	0.0	0.0	100%	24	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	22	8	0	22	13	0	13	6	0	0	6	2	0	0	0	0	0	2	0	0	0	102	2	886	22
Cat PD-182	Off-site via swales and rearlot catchbasins	331.4	0%	0.0	0%	0.0	0%	0.0	0.0	100%	331	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	294	113	0	294	181	0	181	79	0	0	79	34	0	0	0	0	0	34	0	0	0	102	34	886	294
Cat PD-183	Off-site via swales and rearlot catchbasins	375.3	0%	0.0	0%	0.0	0%	0.0	0.0	100%	375	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	333	128	0	333	205	0	205	90	0	0	90	38	0	0	0	0	0	38	0	0	0	102	38	886	333
Cat PD-189	Off-site via swales and rearlot catchbasins	59.8	100%	59.8	100%	59.8	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	53	0	48	53	0	5	5	0	24	0	24	0	0	48	0	0	48	48	-24	0	0	399	24	886	53
Cat PD-190	Off-site via swales and rearlot catchbasins	105.7	100%	105.7	100%	105.7	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	94	0	84	94	0	9	9	0	42	0	42	0	0	84	0	0	84	84	-42	0	0	399	42	886	94
Post-Development Catchment PD Total	**Off-site via swales and rearlot catchbasins**	**1,890**	**37%**	**691**	**37%**	**691**	**0%**	**0**	**0**	**63%**	**1,199**								**1,675**	**409**	**551**	**1,675**	**653**	**61**	**715**	**286**	**276**	**0**	**562**	**123**	**0**	**551**	**0**	**0**	**551**	**674**	**-276**	**0**	**0**	**211**	**398**	**886**	**1,675**
Cat PE-1	Off-site via rearlot catchbasins and PF drainage feature	697.1	0%	0.0	0%	0.0	0%	0.0	0.0	100%	697	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	618	238	0	618	380	0	380	166	0	0	166	71	0	0	0	0	0	71	0	0	0	102	71	886	618
Cat PE-7	Off-site via rearlot catchbasins and PF drainage feature	129.5	100%	129.5	100%	129.5	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	115	0	103	115	0	11	11	0	52	0	52	0	0	103	0	0	103	103	-52	0	0	399	52	886	115
Cat PE-8	Off-site via rearlot catchbasins and PF drainage feature	395.0	100%	395.0	100%	395.0	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	350	0	315	350	0	35	35	0	158	0	158	0	0	315	0	0	315	315	-158	0	0	399	158	886	350
Cat PE-127	Off-site via rearlot catchbasins and PF drainage feature	343.4	0%	0.0	0%	0.0	0%	0.0	0.0	100%	343	Lawns	0.05	Open Sandy Loam	0.4	0.25	0.7	0.7	304	117	0	304	187	0	187	82	0	0	82	35	0	0	0	0	0	35	0	0	0	102	35	886	304
Cat PE-130	Off-site via rearlot catchbasins and PF drainage feature	257.8	100%	257.8	100%	257.8	0%	0.0	0.0	0%	0	Building	0	Open Sandy Loam	0.4	0.25	0.65	0	228	0	206	228	0	23	23	0	103	0	103	0	0	206	0	0	206	206	-103	0	0	399	103	886	228
Post-Development Catchment PE Total	**Off-site via rearlot catchbasins and PF drainage feature**	**1,823**	**43%**	**782**	**43%**	**782**	**0%**	**0**	**0**	**57%**	**1,040**								**1,615**	**355**	**624**	**1,615**	**567**	**69**	**637**	**248**	**312**	**0**	**560**	**106**	**0**	**624**	**0**	**0**	**624**	**730**	**-312**	**0**	**0**	**230**	**418**	**886**	**1,615**

TABLE F-1 POST-DEVELOPMENT WATER BUDGET (BY CATCHMENT)
HYDROGEOLOGICAL ASSESSMENT AND WATER BALANCE STUDY
226 BROCK STREET EAST
UXBRIDGE, ONTARIO

ANNUAL PRECIPITATION	EVAPORATION AND EVAPOTRANSPIRATION FACTORS			
	Impervious Areas		Waterbody	
mm	%	mm	%	mm
886	10%	89	73%	646

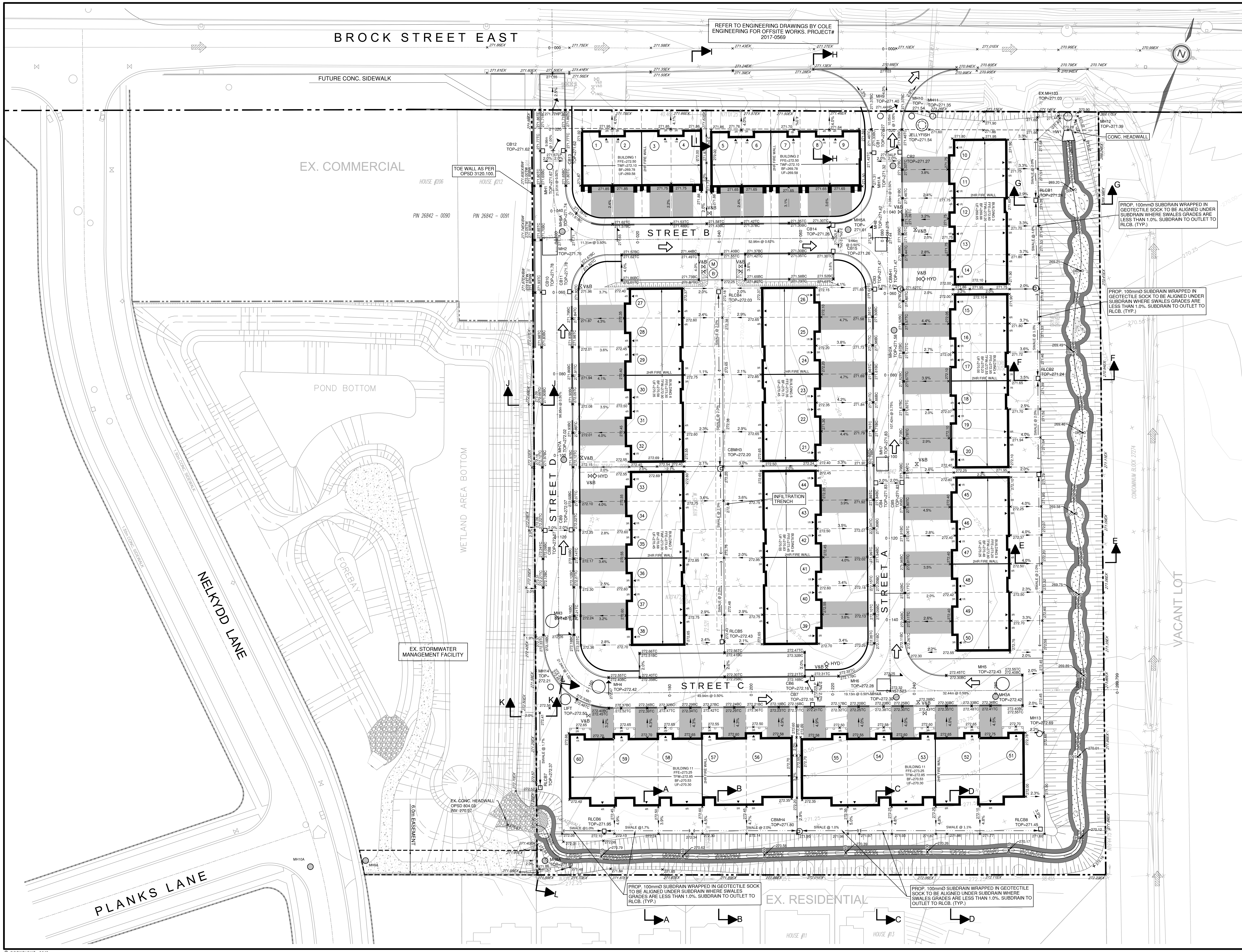
On-Site Subcatchment Designation	Outlet	Total Area (m²)	Impervious: Total Impervious % of Total Area	Total Impervious (m²)	Assumed Buildings % of Impervious Area	Assumed Buildings (m²)	Assumed Road/ Parking/ Amenities % of Impervious Area	Assumed Road/ Parking/ Amenities (m²)	Other Impervious (m²)	Pervious: Total Pervious % of Total Area	Total Pervious (m²)	MOE TABLE 2 Components: Cover		Soil		Topography	MOE Infiltration Factor	Adjusted MOE Infiltration Factor
Cat PF-6	Off-site to the north	227.6	0%	0.0	0%	0.0	0%	0.0	0.0	100%	228	Drainage Feature	0.2	Open Sandy Loam	0.4	0.25	0.85	0.85
Cat PF-94	Off-site to the north	18.1	0%	0.0	0%	0.0	0%	0.0	0.0	100%	18	Drainage Feature	0.2	Open Sandy Loam	0.4	0.25	0.85	0.85
Cat PF-129	Off-site to the north	76.6	0%	0.0	0%	0.0	0%	0.0	0.0	100%	77	Drainage Feature	0.2	Open Sandy Loam	0.4	0.25	0.85	0.85
Cat PF-171	Off-site to the north	817.4	0%	0.0	0%	0.0	0%	0.0	0.0	100%	817	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8
Cat PF-172	Off-site to the north	712.6	0%	0.0	0%	0.0	0%	0.0	0.0	100%	713	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8
Cat PF-173	Off-site to the north	77.5	0%	0.0	0%	0.0	0%	0.0	0.0	100%	78	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8
Cat PF-174	Off-site to the north	2.3	0%	0.0	0%	0.0	0%	0.0	0.0	100%	2	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8
Cat PF-175	Off-site to the north	152.5	0%	0.0	0%	0.0	0%	0.0	0.0	100%	153	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8
Cat PF-176	Off-site to the north	6.0	0%	0.0	0%	0.0	0%	0.0	0.0	100%	6	Drainage Feature	0.2	Open Sandy Loam	0.4	0.25	0.85	0.85
Cat PF-177	Off-site to the north	5.2	0%	0.0	0%	0.0	0%	0.0	0.0	100%	5	Drainage Feature	0.2	Open Sandy Loam	0.4	0.25	0.85	0.85
Cat PF-178	Off-site to the north	840.4	0%	0.0	0%	0.0	0%	0.0	0.0	100%	840	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8
Cat PF-179	Off-site to the north	14.3	0%	0.0	0%	0.0	0%	0.0	0.0	100%	14	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8
Cat PF-180	Off-site to the north	449.3	0%	0.0	0%	0.0	0%	0.0	0.0	100%	449	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8
Cat PF-186	Off-site to the north	106.6	0%	0.0	0%	0.0	0%	0.0	0.0	100%	107	Drainage Feature	0.2	Open Sandy Loam	0.4	0.25	0.85	0.85
Cat PF-187	Off-site to the north	24.1	0%	0.0	0%	0.0	0%	0.0	0.0	100%	24	Drainage Feature	0.2	Open Sandy Loam	0.4	0.25	0.85	0.85
Cat PF-188	Off-site to the north	171.7	0%	0.0	0%	0.0	0%	0.0	0.0	100%	172	Drainage Feature	0.2	Open Sandy Loam	0.4	0.25	0.85	0.85
Cat PF-191	Off-site to the north	246.0	0%	0.0	0%	0.0	0%	0.0	0.0	100%	246	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8
Cat PF-192	Off-site to the north	181.8	0%	0.0	0%	0.0	0%	0.0	0.0	100%	182	Uncultivated	0.15	Open Sandy Loam	0.4	0.25	0.8	0.8
Post-Development Catchment PF Total	**Off-site to the north**	**4,130**	**0%**	**0**	**0%**	**0**	**0%**	**0**	**0**	**100%**	**4,130**							
Total Site		**26,118**	**52%**	**13,574**	**25%**	**6,506**	**27%**	**7,068**	**0**	**48%**	**12,544**							

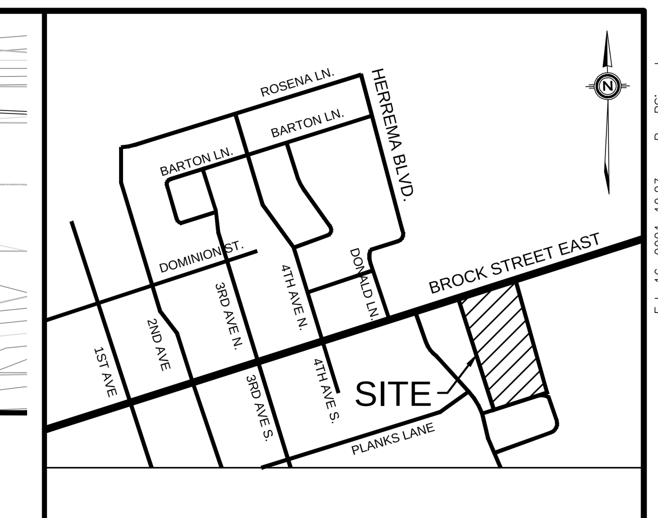
On-Site Subcatchment Designation	Inputs: Precipitation Annual Average (m³/yr)	Surplus (Pervious) (m³/yr)	Surplus (Impervious) (m³/yr)	Total Inputs (m³/yr)	Outputs: Evapotranspiration Pervious (m³/yr)	Impervious (m³/yr)	Total Evapotranspiration (m³/yr)	Infiltration Pervious Areas (m³/yr)	Rooftop Discon (m³/yr)	Infiltration Trenches (m³/yr)	Total Infiltration (m³/yr)	Runoff Pervious (m³/yr)	Landscaped Area Redirecte (m3/yr)	Building (m³/yr)	Road/ Driveway/ Amenities (m³/yr)	Other Impervious (m³/yr)	Total Impervious (m³/yr)	Total Runoff (m³/yr)	Rooftop Runoff Infiltrated (m³/yr)	Infiltration Trenches (mm/yr)	Infiltration Trenches (m³/yr)	Net Runoff (mm/yr)	Net Runoff (m³/yr)	Total Outputs (mm/yr)	Total Outputs (m³/yr)
Cat PF-6	202	55	0	202	147	0	147	46	0	0	46	8	0	0	0	0	0	8	0	0	0	36	8	886	202
Cat PF-94	16	4	0	16	12	0	12	4	0	0	4	1	0	0	0	0	0	1	0	0	0	36	1	886	16
Cat PF-129	68	18	0	68	49	0	49	16	0	0	16	3	0	0	0	0	0	3	0	0	0	36	3	886	68
Cat PF-171	724	267	0	724	457	0	457	214	0	0	214	53	0	0	0	0	0	53	0	0	0	65	53	886	724
Cat PF-172	631	233	0	631	398	0	398	186	0	0	186	47	0	0	0	0	0	47	0	0	0	65	47	886	631
Cat PF-173	69	25	0	69	43	0	43	20	0	0	20	5	0	0	0	0	0	5	0	0	0	65	5	886	69
Cat PF-174	2	1	0	2	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	65	0	886	2
Cat PF-175	135	50	0	135	85	0	85	40	0	0	40	10	0	0	0	0	0	10	0	0	0	65	10	886	135
Cat PF-176	5	1	0	5	4	0	4	1	0	0	1	0	0	0	0	0	0	0	0	0	0	36	0	886	5
Cat PF-177	5	1	0	5	3	0	3	1	0	0	1	0	0	0	0	0	0	0	0	0	0	36	0	886	5
Cat PF-178	745	275	0	745	470	0	470	220	0	0	220	55	0	0	0	0	0	55	0	0	0	65	55	886	745
Cat PF-179	13	5	0	13	8	0	8	4	0	0	4	1	0	0	0	0	0	1	0	0	0	65	1	886	13
Cat PF-180	398	147	0	398	251	0	251	118	0	0	118	29	0	0	0	0	0	29	0	0	0	65	29	886	398
Cat PF-186	95	26	0	95	69	0	69	22	0	0	22	4	0	0	0	0	0	4	0	0	0	36	4	886	95
Cat PF-187	21	6	0	21	16	0	16	5	0	0	5	1	0	0	0	0	0	1	0	0	0	36	1	886	21
Cat PF-188	152	41	0	152	111	0	111	35	0	0	35	6	0	0	0	0	0	6	0	0	0	36	6	886	152
Cat PF-191	218	80	0	218	138	0	138	64	0	0	64	16	0	0	0	0	0	16	0	0	0	65	16	886	218
Cat PF-192	161	59	0	161	102	0	102	48	0	0	48	12	0	0	0	0	0	12	0	0	0	65	12	886	161
Post-Development Catchment PF Total	**3,660**	**1,296**	**0**	**3,660**	**2,365**	**0**	**2,365**	**1,044**	**0**	**0**	**1,044**	**251**	**0**	**0**	**0**	**0**	**0**	**251**	**0**	**0**	**0**	**61**	**251**	**886**	**3,660**
Total Site	**23,146**	**2,652**	**10,826**	**23,146**	**6,951**	**1,203**	**8,154**	**3,053**	**1,685**	**872**	**5,610**	**1,112**	**0**	**5,189**	**5,637**	**0**	**10,826**	**11,939**	**-1,685**	**-33**	**-872**	**359**	**9,382**	**886**	**23,146**

APPENDIX

G

ENGINEERING DRAWINGS





LOCATION PLAN
N.T.S.

LEGEND

PROPERTY LINE	
PROPOSED GRADE	×149.50
EXISTING GRADE	×149.33EX
PROPOSED GRADE (TOP OF CURB)	×149.65TC
PROPOSED GRADE (BOTTOM OF CURB)	×149.50BC
PROPOSED GRADE (BOTTOM OF SWALE)	×147.58SW
PROPOSED GRADE (TOP OF WALL)	×147.58TW
PROPOSED SWALE	
PROPOSED SLOPE (3:1 MAX.)	
PROPOSED SANITARY MANHOLE	
PROPOSED STORM MANHOLE	
PROPOSED CATCH BASIN MANHOLE	
PROPOSED CATCH BASIN	
PROPOSED OGS	
EXISTING MANHOLE	
EXISTING CATCH BASIN	
PROPOSED VALVE AND BOX	V&B
PROPOSED FIRE HYDRANT	FH
PROPOSED SIAMESE CONNECTION	
EMERGENCY OVERLAND FLOW ROUTE	
EXISTING OVERLAND FLOW ROUTE	
LOT NUMBER	39

LIST OF DRAWINGS

SG-01 - SITE GRADING PLAN
SS-01 - SITE SERVICING PLAN
XS-01 - CROSS SECTIONS
DD-01 - DETAIL DRAWING

SITE PLAN INFORMATION

ICR ASSOCIATES INCORPORATED
12 SANDBOURNE CRESCENT
TORONTO, ONTARIO L4K 4B5
PHONE: (416) 499-9427
E-MAIL: icr.des@gmail.com

SURVEYOR INFORMATION

H.F. GRANDER Co. LTD.
1575 HIGHWAY 7A WEST, UNIT 2A
PORT PERRY, ONTARIO L9L 1A6
PHONE: (905) 985-3600
FAX: (905) 985-2347

NO.	REVISION	DATE	BY
3	RE-ISSUED FOR ZONING APPROVAL	MAR 15, 2019	LMV
2	ISSUED FOR COORDINATION	SEPT 5, 2018	TVL
1	ISSUED FOR ZONING APPROVAL	AUG 10, 2018	LMV

TOWN OF UXBRIDGE
REGION OF DURHAM

WESTLANE DEVELOPMENT GROUP LTD.
SOUTH BROCK STREET DEVELOPMENT
UXBRIDGE, ONTARIO

SITE GRADING PLAN

IBI GROUP
Unit 300 – 8133 Warden Avenue
Markham ON L6G 1B3 Canada
tel 905 763 2322 fax 905 763 9983
ibigroup.com

DESIGNED BY: LMV	DATE: JUNE 2018	CHECKED BY: JL
DRAWN BY: TVL	PROJECT No. 2018-0302	DRAWING No. SG-01
SCALE: 1:400		

5.0 0 5.0m 10.0m 15.0m 20.0m 25.0m

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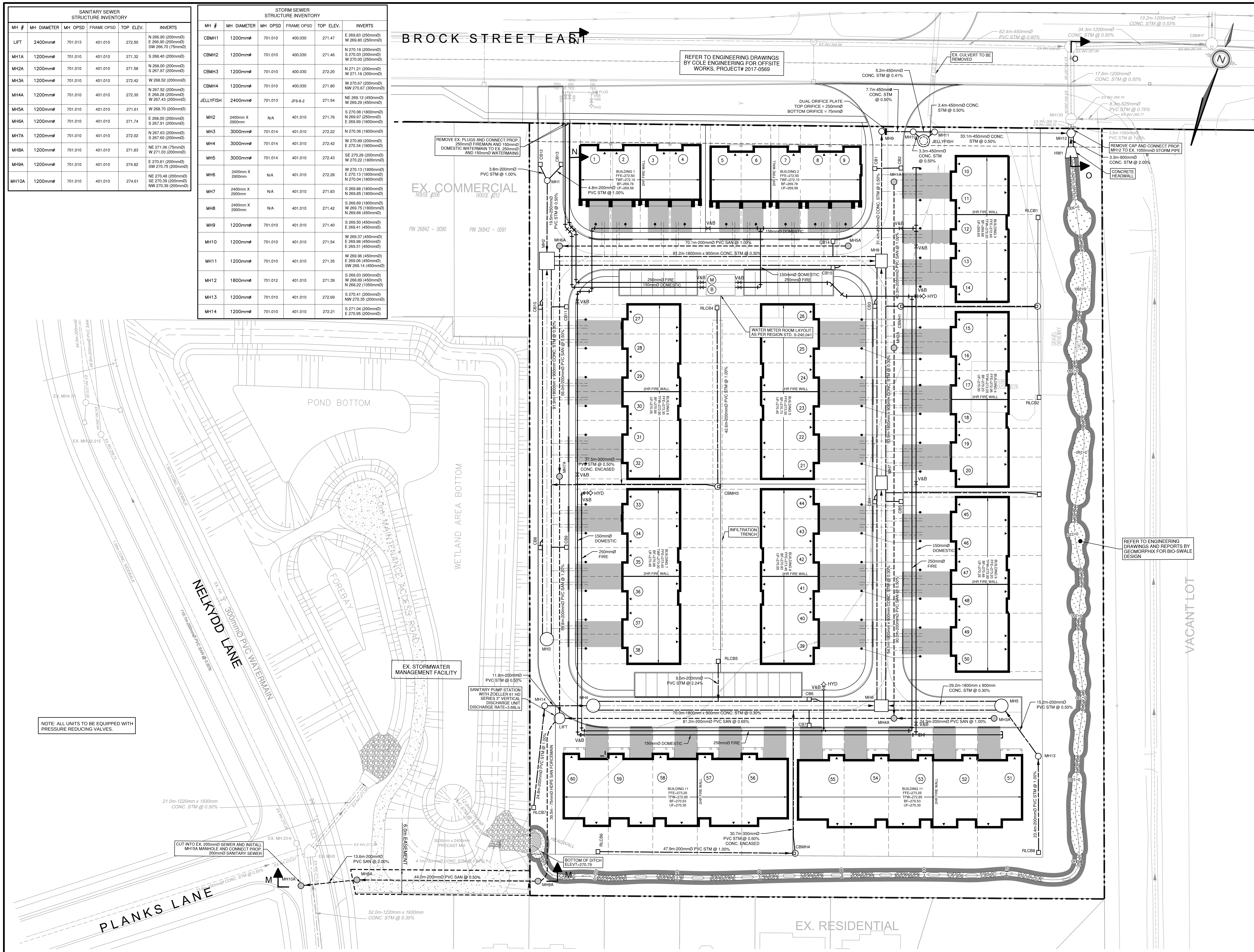
SANITARY SEWER STRUCTURE INVENTORY					
MH #	MH DIAMETER	MH OPSD	FRAME OPSD	TOP ELEV.	INVERTS
LIFT	2400mmø	701.013	401.010	272.50	N 266.90 (200mmØ) E 266.90 (200mmØ) SW 266.70 (75mmØ)
MH1A	1200mmø	701.010	401.010	271.32	S 268.40 (200mmØ)
MH2A	1200mmø	701.010	401.010	271.58	N 268.00 (200mmØ) S 267.97 (200mmØ)
MH3A	1200mmø	701.010	401.010	272.42	W 268.52 (200mmØ)
MH4A	1200mmø	701.010	401.010	272.30	N 267.52 (200mmØ) E 268.28 (200mmØ) W 267.43 (200mmØ)
MH5A	1200mmø	701.010	401.010	271.61	W 268.70 (200mmØ)
MH6A	1200mmø	701.010	401.010	271.74	E 268.00 (200mmØ) S 267.91 (200mmØ)
MH7A	1200mmø	701.010	401.010	272.02	N 267.63 (200mmØ) S 267.60 (200mmØ)
MH8A	1200mmø	701.010	401.010	271.83	NE 271.06 (75mmØ) W 271.03 (200mmØ)
MH9A	1200mmø	701.010	401.010	274.82	E 270.81 (200mmØ) SW 270.75 (200mmØ)
MH10A	1200mmø	701.010	401.010	274.61	NE 270.48 (200mmØ) SE 270.39 (200mmØ) NW 270.39 (200mmØ)

STORM SEWER STRUCTURE INVENTORY					
MH #	MH DIAMETER	MH OPSD	FRAME OPSD	TOP ELEV.	INVERTS
CBMH1	1200mmø	701.010	400.030	271.47	E 269.83 (250mmØ) W 269.80 (250mmØ)
CBMH2	1200mmø	701.010	400.030	271.46	N 270.18 (200mmØ) S 270.03 (200mmØ) W 270.00 (250mmØ)
CBMH3	1200mmø	701.010	400.030	272.20	N 271.21 (200mmØ) W 271.18 (300mmØ)
CBMH4	1200mmø	701.010	400.030	271.80	W 270.67 (200mmØ) NW 270.67 (300mmØ)
JELLYFISH	2400mmø	701.013	JF8-8-2	271.54	NE 269.12 (450mmØ) W 269.29 (450mmØ)
MH2	2400mm X 2900mm	N/A	401.010	271.76	S 270.08 (1800mmØ) N 269.97 (250mmØ) E 269.99 (1800mmØ)
MH3	3000mmø	701.014	401.010	272.22	N 270.36 (1800mmØ)
MH4	3000mmø	701.014	401.010	272.42	W 270.89 (200mmØ) E 270.34 (1800mmØ)
MH5	3000mmø	701.014	401.010	272.43	SE 270.28 (200mmØ) W 270.22 (1800mmØ)
MH6	2400mm X 2900mm	N/A	401.010	272.28	W 270.13 (1800mmØ) E 270.13 (1800mmØ) N 270.04 (1800mmØ)
MH7	2400mm X 2900mm	N/A	401.010	271.83	S 269.88 (1800mmØ) N 269.85 (1800mmØ)
MH8	2400mm X 2900mm	N/A	401.010	271.42	S 269.69 (1800mmØ) W 269.75 (1800mmØ) N 269.66 (450mmØ)
MH9	1200mmø	701.010	401.010	271.40	S 269.50 (450mmØ) E 269.41 (450mmØ)
MH10	1200mmø	701.010	401.010	271.54	W 269.37 (450mmØ) E 269.98 (450mmØ) E 269.31 (450mmØ)
MH11	1200mmø	701.010	401.010	271.35	W 269.96 (450mmØ) E 269.06 (450mmØ) SW 269.14 (450mmØ)
MH12	1800mmø	701.012	401.010	271.39	S 269.03 (900mmØ) W 268.89 (450mmØ) N 268.22 (1050mmØ)
MH13	1200mmø	701.010	401.010	272.69	S 270.41 (200mmØ) NW 270.35 (200mmØ)
MH14	1200mmø	701.010	401.010	272.21	S 271.04 (200mmØ) E 270.95 (200mmØ)



LOCATION PLAN
N.T.S.

LEGEND

- PROPERTY LINE
- PROPOSED STORM PIPE
- PROPOSED SANITARY PIPE
- PROPOSED WATER
- PROPOSED 90° VERTICAL BEND
- PROPOSED SANITARY MANHOLE
- PROPOSED STORM MANHOLE
- PROPOSED CATCH BASIN MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED OGS
- EXISTING MANHOLE
- EXISTING CATCH BASIN
- PROPOSED VALVE AND BOX — V&B
- PROPOSED FIRE HYDRANT — FH
- PROPOSED SIAMESE CONNECTION
- SUMP PUMP
- LOT NUMBER — 39
- PROPOSED BACKFLOW PREVENTOR
- PROPOSED WATER METER

LIST OF DRAWINGS

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XS-01 - CROSS SECTIONS
DD-01 - DETAIL DRAWING

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TOWN OF UXBRIDGE
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WESTLANE DEVELOPMENT GROUP LTD.
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UXBRIDGE, ONTARIO

SITE SERVICING PLAN

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Unit 300 – 8133 Warden Avenue
Markham ON L6G 1B3 Canada
tel 905 763 2322 fax 905 763 9983
ibigroup.com

DESIGNED BY: LMV	DATE: JUNE 2018	CHECKED BY: JL
DRAWN BY: TVL	PROJECT No. 2018-0302	DRAWING No. SS-01
SCALE: 1:400		

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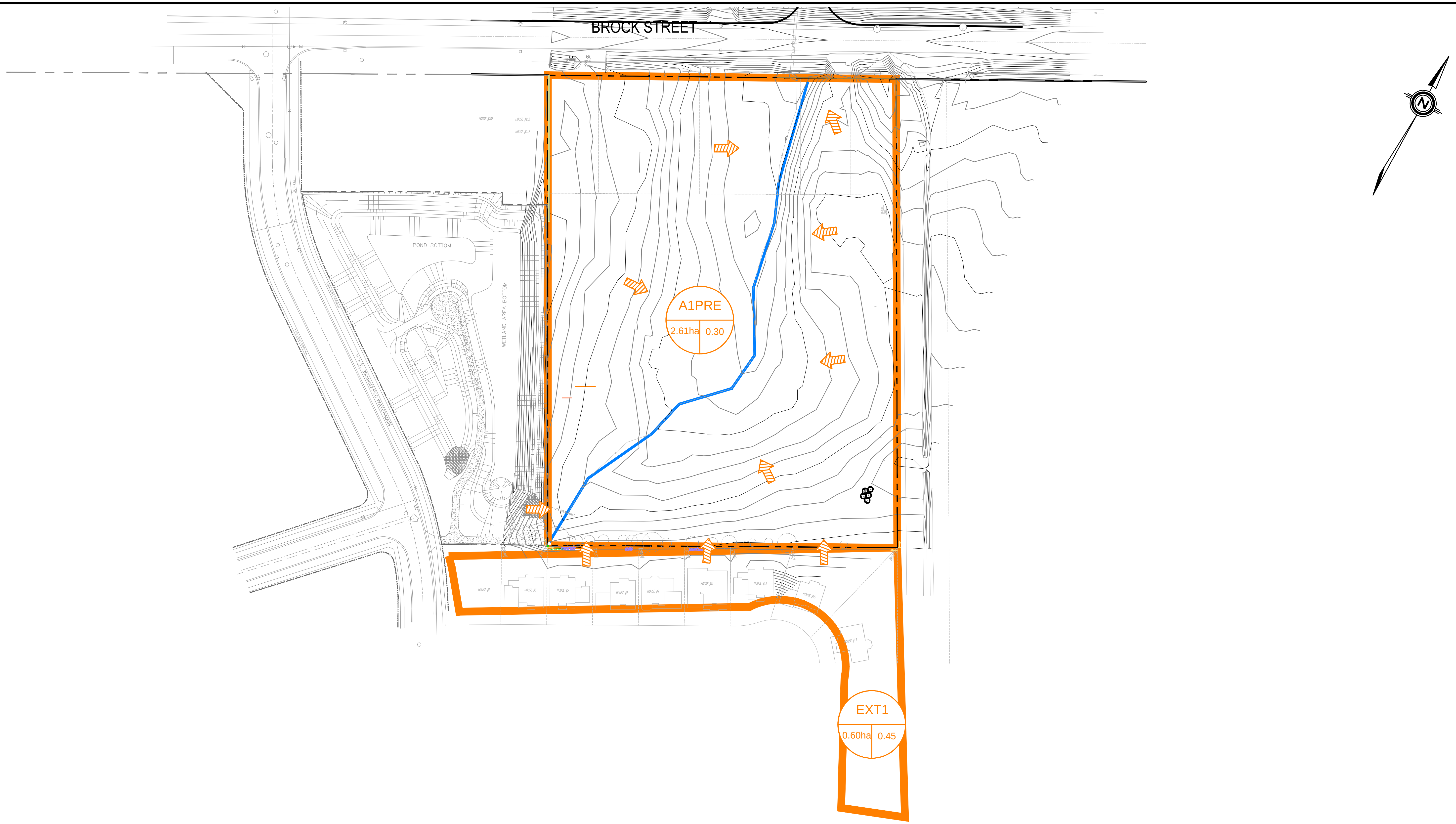

COLE
COLE ENGINEERING GROUP LTD.
70 Valleywood Drive,
Markham, ON L3R 4T5
T. 416 987 6161 | 905 940 6161
www.coleengineering.ca

LEGEND

PROPERTY LINE

EXISTING STORM DRAINAGE AREA BOUNDARY

EXISTING OVERLAND FLOW DIRECTION

A1PRE — STORM DRAINAGE AREA NUMBER

0.74ha — DRAINAGE AREA IN HECTARES

0.50 — RUNOFF COEFFICIENT

PRE DEVELOPMENT DRAINAGE AREA PLAN

WESTLANE DEVELOPMENTS LTD.
SOUTH BROCK STREET DEVELOPMENT
TOWN OF UXBRIDGE
REGIONAL MUNICIPALITY OF DURHAM

DATE:	JANUARY 2021	PROJECT No.:	2018-0302
SCALE:	1:1500	FIGURE No.:	DAP-1

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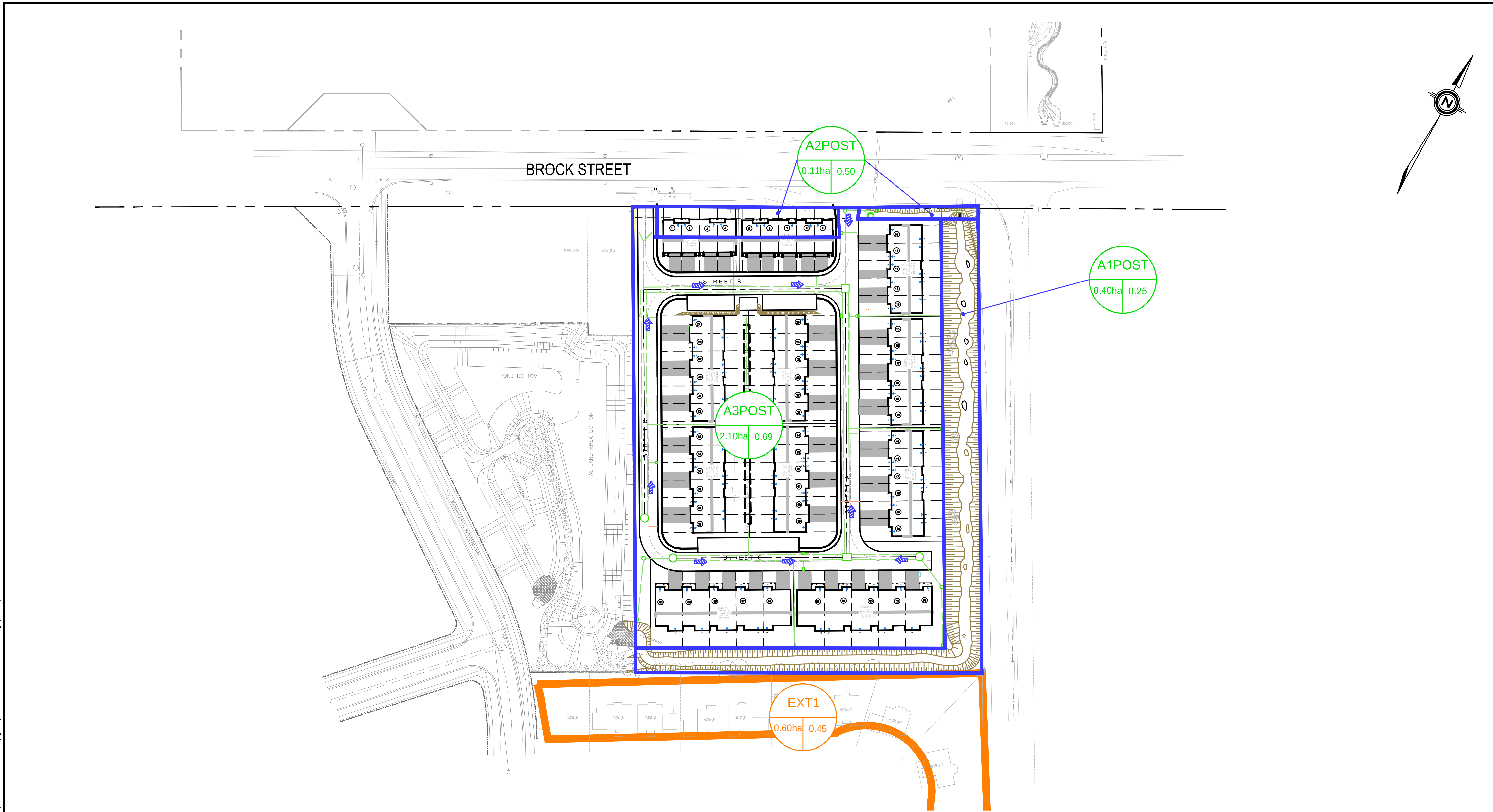

COLE

COLE ENGINEERING GROUP LTD.
70 Valleywood Drive,
Markham, ON L3R 4T5
T. 416 987 6161 | 905 940 6161
www.coleengineering.ca

LEGEND

— · — · —	PROPERTY LINE
——— (blue)	PROPOSED STORM DRAINAGE AREA BOUNDARY
⇨	PROPOSED OVERLAND FLOW DIRECTION

A1POST — STORM DRAINAGE AREA NUMBER
0.25ha — DRAINAGE AREA IN HECTARES
0.50 — RUNOFF COEFFICIENT

POST DEVELOPMENT DRAINAGE AREA PLAN

WESTLANE DEVELOPMENTS LTD.
SOUTH BROCK STREET DEVELOPMENT
TOWN OF UXBRIDGE
REGIONAL MUNICIPALITY OF DURHAM

DATE:	JANUARY 2021	PROJECT No.:	2018-0302
SCALE:	1:1500	FIGURE No.:	DAP-2

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APPENDIX

H

DEWATERING ESTIMATES

APPENDIX

H-1 CONSTRUCTION DEWATERING CALCUATIONS – BUILDING FOUNDATIONS

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type A - 226 Brock Street East, Uxbridge, Ontario

Input Parameters

Vertical Hydraulic Conductivity (m/s)	K	4.20E-06	m/s
Vertical Hydraulic Conductivity (m/d)	K	3.63E-01	m/day
Hydraulic gradient (m/m)	i	0.1	m/m
Cross Sectional Area(m^2)	A	391.02	m^2

Seepage Flow Calculations - Q

Q = K x i x A (Eq. 3.10, p. 30)

Q	14	m3/day
Q	14,189	L/day

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type B - 226 Brock Street East, Uxbridge, Ontario

Input Parameters

Vertical Hydraulic Conductivity (m/s)	K	4.20E-06	m/s
Vertical Hydraulic Conductivity (m/d)	K	3.63E-01	m/day
Hydraulic gradient (m/m)	i	0.1	m/m
Cross Sectional Area(m^2)	A	485.45	m^2

Seepage Flow Calculations - Q	Q	18	m3/day
Q = K x i x A (Eq. 3.10, p. 30)	Q	17,616	L/day

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type C - 226 Brock Street East, Uxbridge, Ontario

Input Parameters

Vertical Hydraulic Conductivity (m/s)	K	4.20E-06	m/s
Vertical Hydraulic Conductivity (m/d)	K	3.63E-01	m/day
Hydraulic gradient (m/m)	i	0.1	m/m
Cross Sectional Area(m^2)	A	502.68	m^2

Seepage Flow Calculations - Q

Q = K x i x A (Eq. 3.10, p. 30)

Q	18	m3/day
Q	18,241	L/day

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type D - 226 Brock Street East, Uxbridge, Ontario

Input Parameters

Vertical Hydraulic Conductivity (m/s)	K	4.20E-06	m/s
Vertical Hydraulic Conductivity (m/d)	K	3.63E-01	m/day
Hydraulic gradient (m/m)	i	0.1	m/m
Cross Sectional Area(m^2)	A	603.5	m^2

Seepage Flow Calculations - Q	Q	22	m3/day
Q = K x i x A (Eq. 3.10, p. 30)	Q	21,900	L/day

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type E - 226 Brock Street East, Uxbridge, Ontario

Input Parameters

Vertical Hydraulic Conductivity (m/s)	K	4.20E-06	m/s
Vertical Hydraulic Conductivity (m/d)	K	3.63E-01	m/day
Hydraulic gradient (m/m)	i	0.1	m/m
Cross Sectional Area(m^2)	A	881.28	m^2

Seepage Flow Calculations - Q

Q = K x i x A (Eq. 3.10, p. 30)

Q	32	m3/day
Q	31,980	L/day

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type A (Footing Depth + 0.5 m below water table) - 226 Brock Street E

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	1.25	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	29.4	m
Linear Trench Size (m)	b	13.3	m
Length of Dewatering - Trench Length (m)	X	29.4	m
Width of Dewatering (m)	L	18	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	35	m
Radius outside well	Ro	24	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	11	m

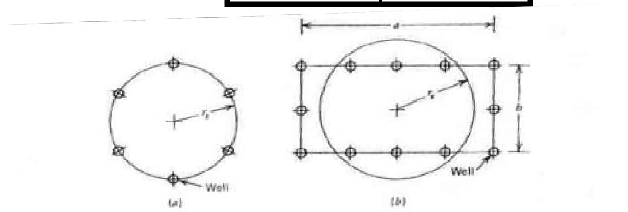


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	15	m3/day
Q	15404	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	25	m3/day
Q	24806	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	9	m3/day
Q	9402	L/day

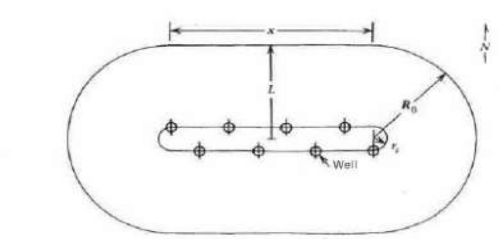
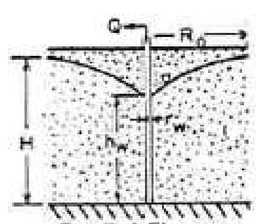
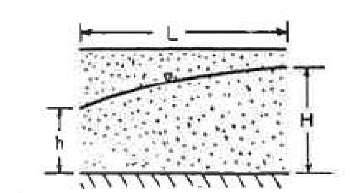


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type A (Footing Depth + 0.5 m below water table) - 226 Brock Street Ea

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	0.75	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	36.5	m
Linear Trench Size (m)	b	13.3	m
Length of Dewatering - Trench Length (m)	X	36.5	m
Width of Dewatering (m)	L	14	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	27	m
Radius outside well	Ro	15	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	12	m

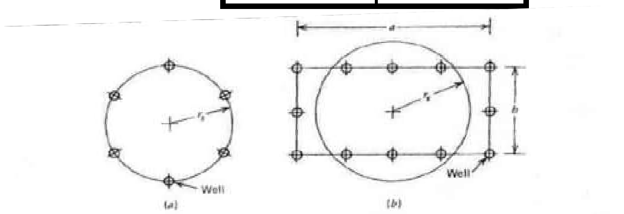


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	8	m3/day
Q	8262	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	14	m3/day
Q	13779	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	6	m3/day
Q	5516	L/day

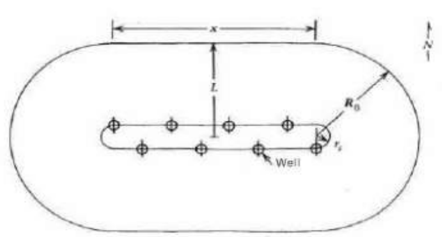
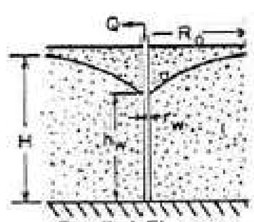
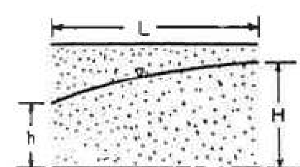


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type D (Footing Depth + 0.5 m below water table) - 226 Brock Street E

Input Parameters

Initial Elevation of Water Table (m)	H	1.25	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	42.5	m
Linear Trench Size (m)	b	14.2	m
Length of Dewatering - Trench Length (m)	X	42.5	m
Width of Dewatering (m)	L	19	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	38	m
Radius outside well	Ro	24	m

Equivalent Radius of Well (m)

Rs	14	m

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

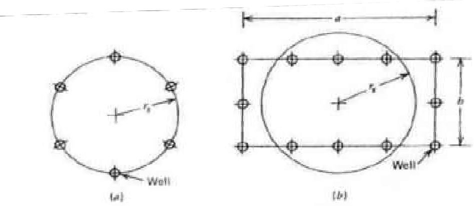


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	18	m3/day
Q	17587	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	30	m3/day
Q	30216	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	13	m3/day
Q	12629	L/day

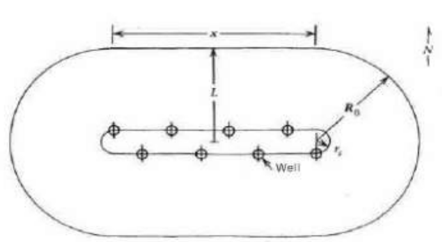
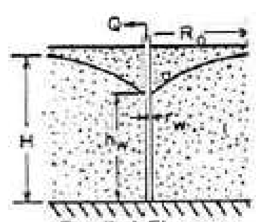
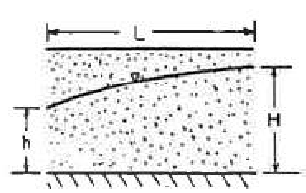


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type D (Footing Depth + 0.5 m below water table) - 226 Brock Street E

Input Parameters

Initial Elevation of Water Table (m)	H	0.75	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	42.5	m
Linear Trench Size (m)	b	14.2	m
Length of Dewatering - Trench Length (m)	X	42.5	m
Width of Dewatering (m)	L	14	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	28	m
Radius outside well	Ro	15	m

Equivalent Radius of Well (m)

Rs	14	m

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

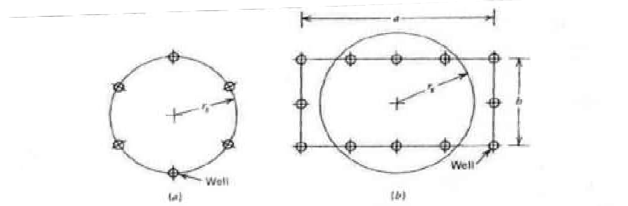


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	9	m3/day
Q	8921	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	15	m3/day
Q	15021	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	6	m3/day
Q	6100	L/day

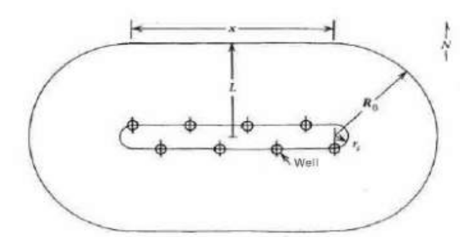
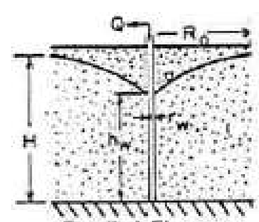
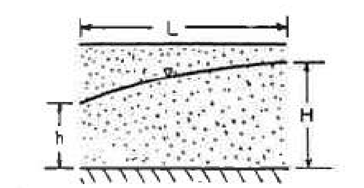


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site | Lot Type E (Footing Depth + 0.5 m below water table) - 226 Brock Street Ea

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	0.75	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	54.4	m
Linear Trench Size (m)	b	16.2	m
Length of Dewatering - Trench Length (m)	X	54.4	m
Width of Dewatering (m)	L	16	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	31	m
Radius outside well	Ro	15	m

Equivalent Radius of Well (m)

Rs	17	m

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

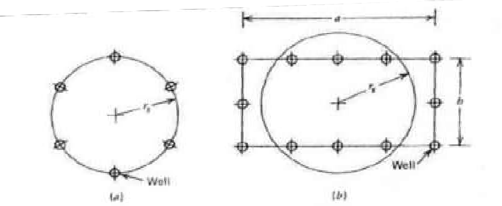


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	10	m3/day
Q	10239	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	17	m3/day
Q	17328	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	7	m3/day
Q	7088	L/day

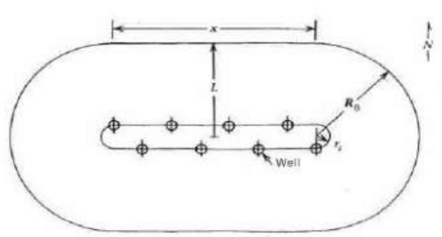
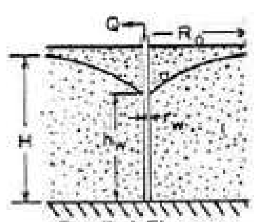
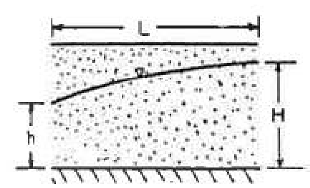


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

APPENDIX

H-2 *LONG-TERM DRAINAGE*

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type A - 226 Brock Street East, Uxbridge, Ontario

Input Parameters

Parameter	Symbol	Value	Unit
Vertical Hydraulic Conductivity (m/s)	K	4.20E-06	m/s
Vertical Hydraulic Conductivity (m/d)	K	3.63E-01	m/day
Hydraulic gradient (m/m)	i	0.1	m/m
Cross Sectional Area(m^2)	A	391.02	m^2

Seepage Flow Calculations - Q

Q = K x i x A (Eq. 3.10, p. 30)

	Symbol	Value	Unit
	Q	14	m3/day
	Q	14,189	L/day

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type B - 226 Brock Street East, Uxbridge, Ontario

Input Parameters

Vertical Hydraulic Conductivity (m/s)	K	4.20E-06	m/s
Vertical Hydraulic Conductivity (m/d)	K	3.63E-01	m/day
Hydraulic gradient (m/m)	i	0.1	m/m
Cross Sectional Area(m^2)	A	485.45	m^2

Seepage Flow Calculations - Q	Q	18	m3/day
Q = K x i x A (Eq. 3.10, p. 30)	Q	17,616	L/day

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type C - 226 Brock Street East, Uxbridge, Ontario

Input Parameters

Vertical Hydraulic Conductivity (m/s)	K	4.20E-06	m/s
Vertical Hydraulic Conductivity (m/d)	K	3.63E-01	m/day
Hydraulic gradient (m/m)	i	0.1	m/m
Cross Sectional Area(m^2)	A	502.68	m^2

Seepage Flow Calculations - Q

Q = K x i x A (Eq. 3.10, p. 30)

Q	18	m3/day
Q	18,241	L/day

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type D - 226 Brock Street East, Uxbridge, Ontario

Input Parameters

Vertical Hydraulic Conductivity (m/s)	K	4.20E-06	m/s
Vertical Hydraulic Conductivity (m/d)	K	3.63E-01	m/day
Hydraulic gradient (m/m)	i	0.1	m/m
Cross Sectional Area(m^2)	A	603.5	m^2

Seepage Flow Calculations - Q	Q	22	m3/day
Q = K x i x A (Eq. 3.10, p. 30)	Q	21,900	L/day

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type E - 226 Brock Street East, Uxbridge, Ontario

Input Parameters

Vertical Hydraulic Conductivity (m/s)	K	4.20E-06	m/s
Vertical Hydraulic Conductivity (m/d)	K	3.63E-01	m/day
Hydraulic gradient (m/m)	i	0.1	m/m
Cross Sectional Area(m^2)	A	881.28	m^2

Seepage Flow Calculations - Q

Q = K x i x A (Eq. 3.10, p. 30)

Q	32	m3/day
Q	31,980	L/day

Long Term Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type A (Footing Depth below water table) - 226 Brock Street East, Uxbri

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	0.75	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	29.4	m
Linear Trench Size (m)	b	13.3	m
Length of Dewatering - Trench Length (m)	X	29.4	m
Width of Dewatering (m)	L	13	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	26	m
Radius outside well	Ro	15	m

Equivalent Radius of Well (m)

Rs	11	m

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

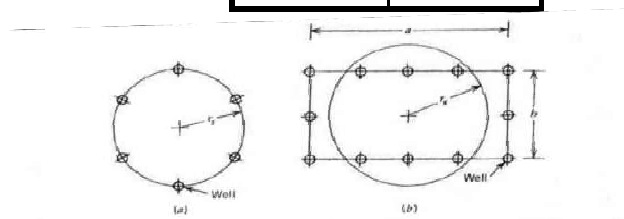


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	8	m3/day
Q	7671	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	12	m3/day
Q	12334	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	5	m3/day
Q	4663	L/day

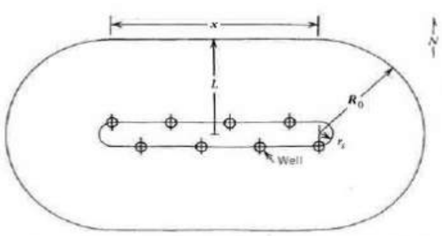
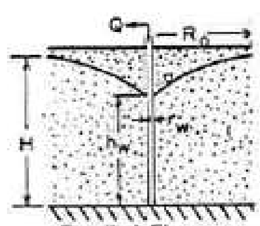
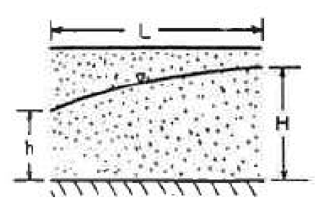


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Long Term Dewatering Worksheet - Unconfined Conditions
from Powers, 1992

Site Lot Type B (Footing Depth below water table) - 226 Brock Street East, Uxbri

Input Parameters

Initial Elevation of Water Table (m)	H	0.25	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	36.5	m
Linear Trench Size (m)	b	13.3	m
Length of Dewatering - Trench Length (m)	X	36.5	m
Width of Dewatering (m)	L	9	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	17	m
Radius outside well	Ro	5	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	12	m

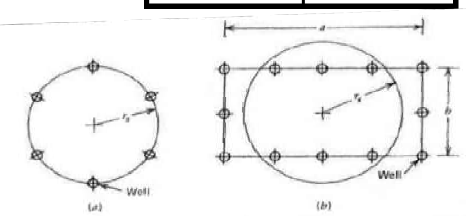


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	2	m3/day
Q	2159	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	3	m3/day
Q	3116	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	1	m3/day
Q	957	L/day

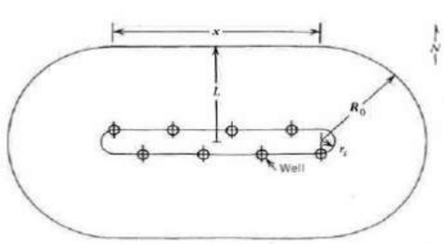
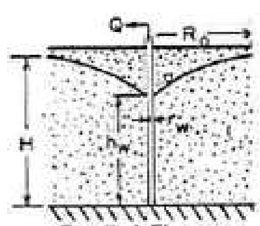
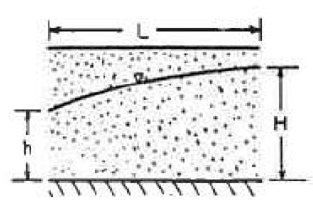


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Long Term Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type D (Footing Depth below water table) - 226 Brock Street East, Uxbri

Input Parameters

Initial Elevation of Water Table (m)	H	0.75	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	42.5	m
Linear Trench Size (m)	b	14.2	m
Length of Dewatering - Trench Length (m)	X	42.5	m
Width of Dewatering (m)	L	14	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	28	m
Radius outside well	Ro	15	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	14	m

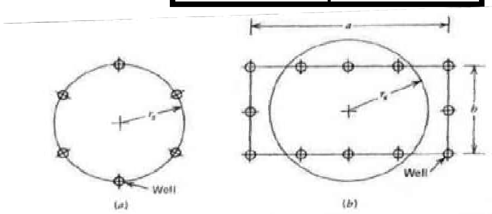


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	9	m3/day
Q	8921	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	15	m3/day
Q	15021	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	6	m3/day
Q	6100	L/day

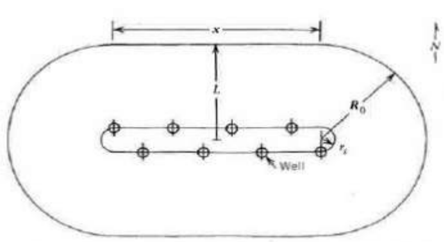
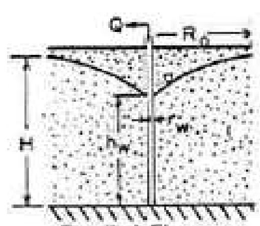
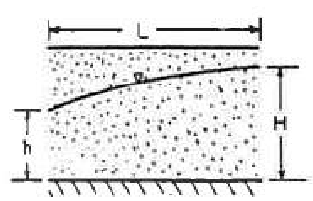


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Long Term Dewatering Worksheet - Unconfined Conditions
from Powers, 1992

Site Lot Type D (Footing Depth below water table) - 226 Brock Street East, Uxbri

Input Parameters

Initial Elevation of Water Table (m)	H	0.25	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	42.5	m
Linear Trench Size (m)	b	14.2	m
Length of Dewatering - Trench Length (m)	X	42.5	m
Width of Dewatering (m)	L	9	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	19	m
Radius outside well	Ro	5	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	14	m

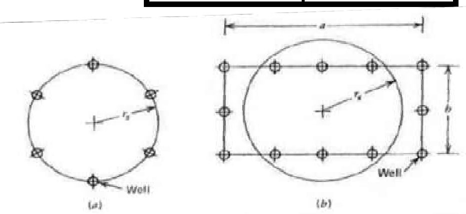


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	2	m3/day
Q	2370	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	3	m3/day
Q	3400	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	1	m3/day
Q	1030	L/day

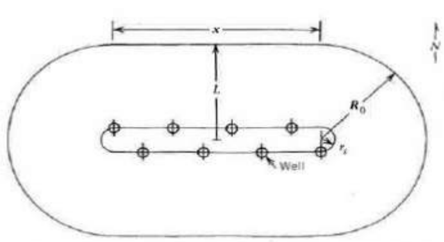
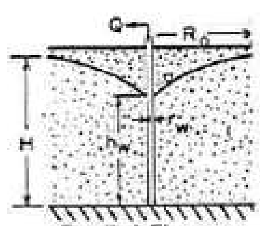
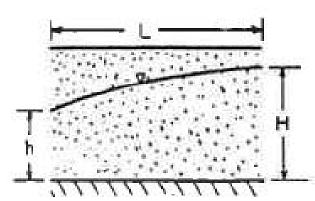


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Long Term Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site Lot Type E (Footing Depth below water table) - 226 Brock Street East, Uxbri

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	0.25	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	54.4	m
Linear Trench Size (m)	b	16.2	m
Length of Dewatering - Trench Length (m)	X	54.4	m
Width of Dewatering (m)	L	11	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	22	m
Radius outside well	Ro	5	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	17	m

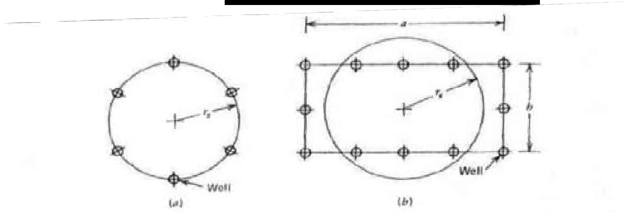


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	3	m3/day
Q	2796	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	4	m3/day
Q	3938	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	1	m3/day
Q	1142	L/day

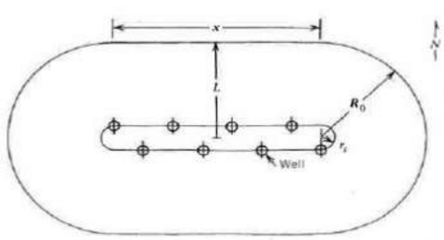
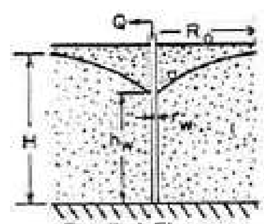
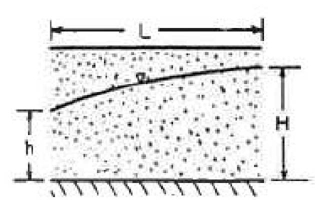


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

APPENDIX

H-3 CONSTRUCTION DEWATERING ESTIMATES - UTILITIES

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Storm Trench (Between STM MH9 and MH10)

Input Parameters

Initial Elevation of Water Table (m)	H	1.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	7.7	m
Linear Trench Size (m)	b	1.45	m
Length of Dewatering - Trench Length (m)	X	7.7	m
Width of Dewatering (m)	L	16	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	31	m
Radius outside well	Ro	29	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	2	m

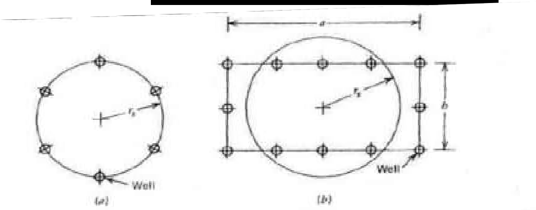


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	9	m3/day
Q	9,156	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	13	m3/day
Q	13,206	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	4	m3/day
Q	4,050	L/day

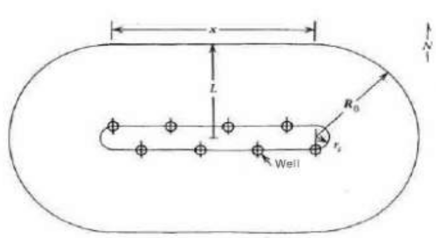
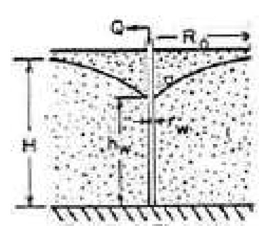
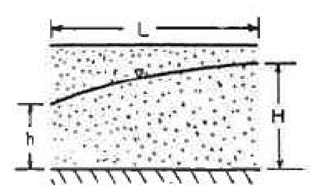


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site 226 Brock Street East, Uxbridge, Ontario - Storm Trench (Between STM MH2 and MH8)

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	2.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	40.8	m
Linear Trench Size (m)	b	2.8	m
Length of Dewatering - Trench Length (m)	X	40.8	m
Width of Dewatering (m)	L	27	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	55	m
Radius outside well	Ro	49	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	6	m

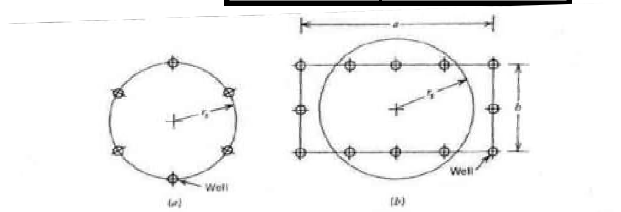


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	32	m3/day
Q	32,330	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	66	m3/day
Q	66,203	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	34	m3/day
Q	33,873	L/day

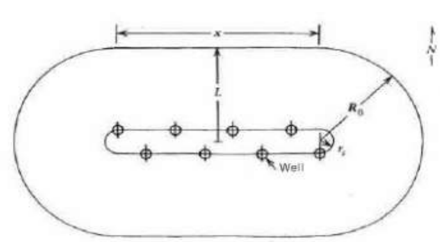
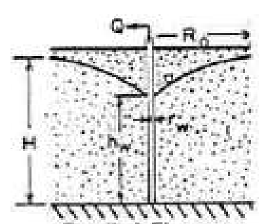
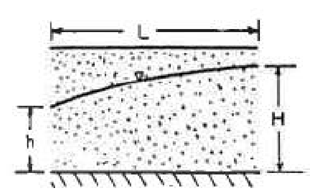


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site | 226 Brock Street East, Uxbridge, Ontario - Storm Trench (Between STM MH1 and MH2)

Input Parameters

Initial Elevation of Water Table (m)	H	3	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	19.5	m
Linear Trench Size (m)	b	1.25	m
Length of Dewatering - Trench Length (m)	X	19.5	m
Width of Dewatering (m)	L	31	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	61	m
Radius outside well	Ro	58	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	3	m

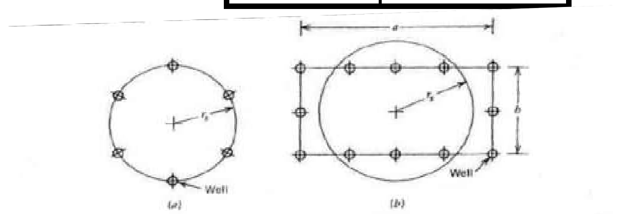


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	33	m3/day
Q	33,223	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	54	m3/day
Q	54,065	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	21	m3/day
Q	20,842	L/day

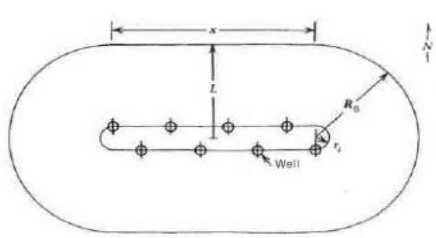
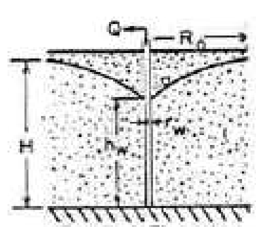
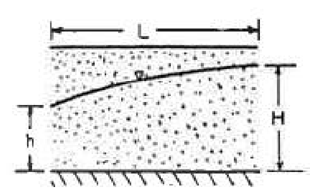


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site 226 Brock Street East, Uxbridge, Ontario - Storm Trench (Between STM MH2 and MH3)

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	3	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	46.1	m
Linear Trench Size (m)	b	2.8	m
Length of Dewatering - Trench Length (m)	X	46.1	m
Width of Dewatering (m)	L	32	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	65	m
Radius outside well	Ro	58	m

Equivalent Radius of Well (m)

Rs	6	m

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

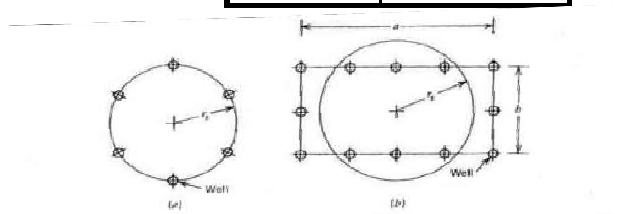


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	44	m3/day
Q	44,369	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	91	m3/day
Q	90,883	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	47	m3/day
Q	46,514	L/day

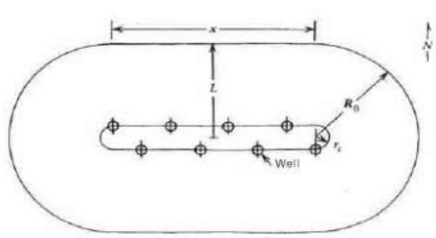
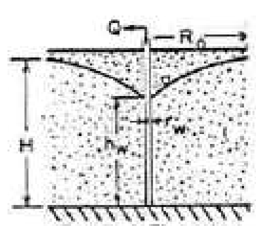
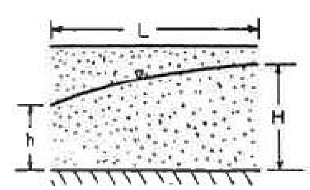


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow,
Water Table Aquifer



Water Table Flow From a Line
Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Storm Trench (Between STM MH2 and MH3)

Input Parameters

Initial Elevation of Water Table (m)	H	2.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	45.8	m
Linear Trench Size (m)	b	2.8	m
Length of Dewatering - Trench Length (m)	X	45.8	m
Width of Dewatering (m)	L	27	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	55	m
Radius outside well	Ro	49	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	6	m

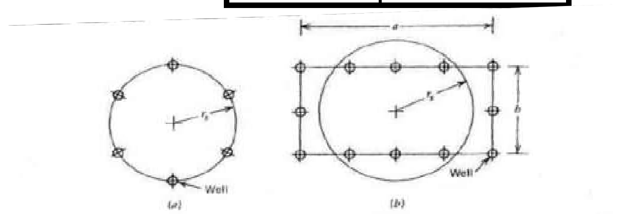


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	33	m3/day
Q	33,099	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	71	m3/day
Q	70,876	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	38	m3/day
Q	37,776	L/day

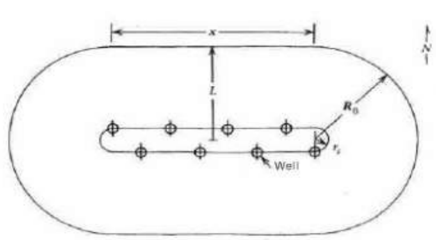
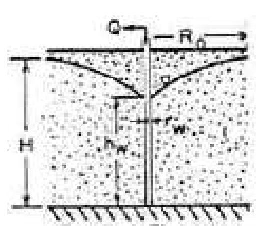
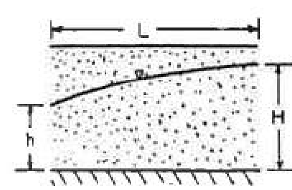


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions
from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Storm Trench (Between STM MH5 and MH13)

Input Parameters

Initial Elevation of Water Table (m)	H	1.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	7.6	m
Linear Trench Size (m)	b	1.2	m
Length of Dewatering - Trench Length (m)	X	7.6	m
Width of Dewatering (m)	L	15	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	31	m
Radius outside well	Ro	29	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	2	m

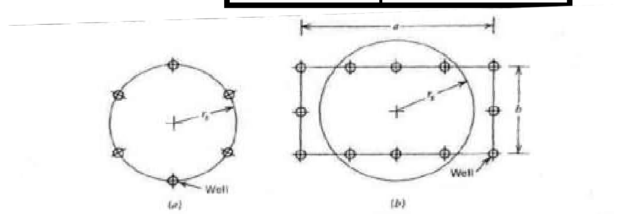


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	9	m3/day
Q	8,855	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	13	m3/day
Q	12,875	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	4	m3/day
Q	4,021	L/day

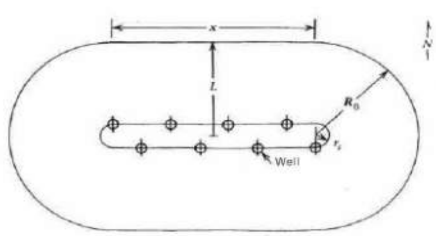
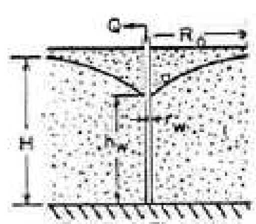
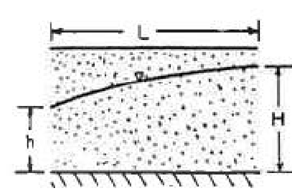


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Storm Trench (Between STM MH13 to RLCB8)

Input Parameters

Initial Elevation of Water Table (m)	H	1.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	23.4	m
Linear Trench Size (m)	b	1.2	m
Length of Dewatering - Trench Length (m)	X	23.4	m
Width of Dewatering (m)	L	16	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	32	m
Radius outside well	Ro	29	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	3	m

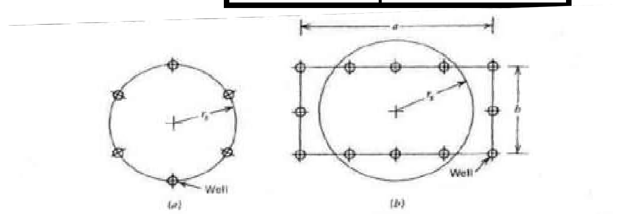


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	11	m3/day
Q	10,799	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	23	m3/day
Q	22,683	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	12	m3/day
Q	11,884	L/day

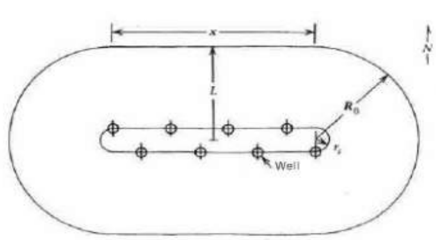
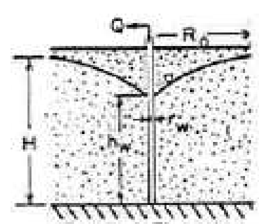
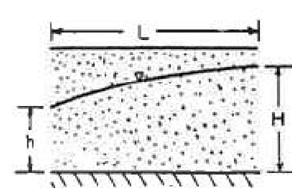


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Sanitary Trench (Between SAN MH1A and MH2A)

Input Parameters

Initial Elevation of Water Table (m)	H	2.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	40.3	m
Linear Trench Size (m)	b	1.2	m
Length of Dewatering - Trench Length (m)	X	40.3	m
Width of Dewatering (m)	L	26	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	53	m
Radius outside well	Ro	49	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	4	m

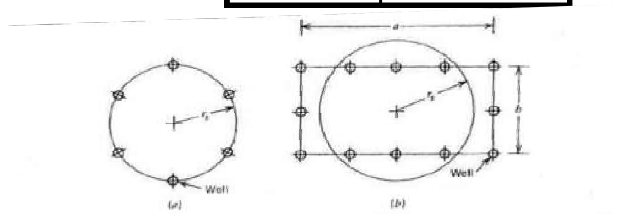


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	27	m3/day
Q	27,464	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	62	m3/day
Q	62,264	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	35	m3/day
Q	34,800	L/day

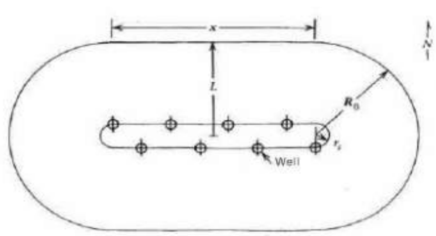
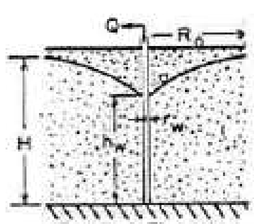
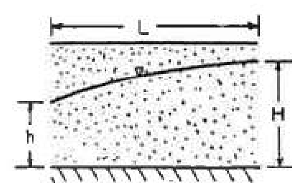


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Sanitary Trench (Between SAN MH2A and MH4A)

Input Parameters

Initial Elevation of Water Table (m)	H	2.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	44.9	m
Linear Trench Size (m)	b	1.2	m
Length of Dewatering - Trench Length (m)	X	44.9	m
Width of Dewatering (m)	L	26	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	53	m
Radius outside well	Ro	49	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	4	m

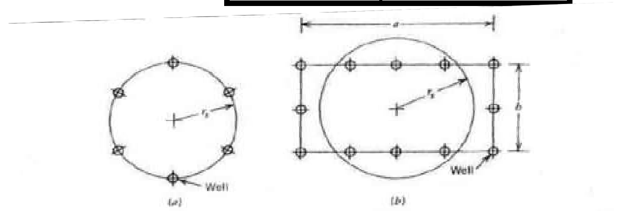


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	28	m3/day
Q	28,002	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	67	m3/day
Q	66,614	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	39	m3/day
Q	38,612	L/day

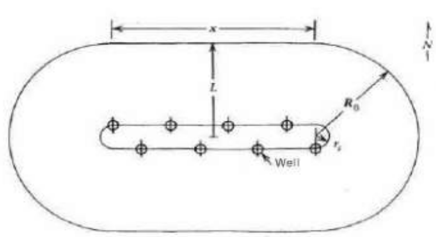
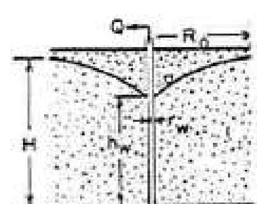
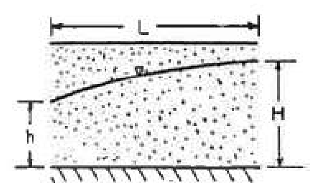


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Sanitary Trench (Between SAN MH3A and MH4A)

Input Parameters

Initial Elevation of Water Table (m)	H	3	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	50	m
Linear Trench Size (m)	b	1.2	m
Length of Dewatering - Trench Length (m)	X	50	m
Width of Dewatering (m)	L	31	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	63	m
Radius outside well	Ro	58	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	4	m

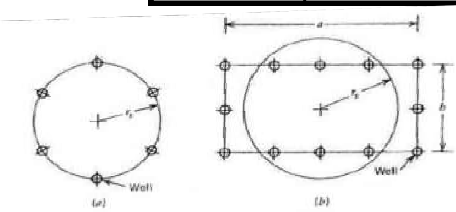


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	39	m3/day
Q	38,521	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	91	m3/day
Q	90,612	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	52	m3/day
Q	52,091	L/day

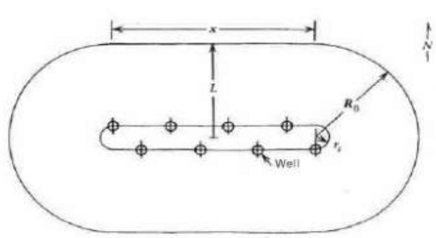
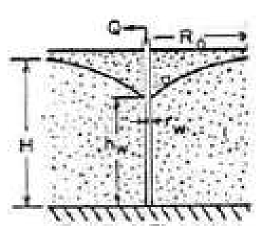
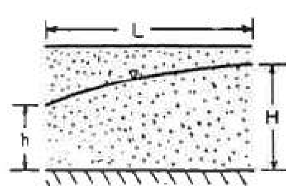


Figure 6.8 Approximate analysis of long narrow systems.


Radial Flow, Water Table Aquifer


Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site | 226 Brock Street East, Uxbridge, Ontario - Sanitary Trench (Between SAN MH4A and LIFT)

Input Parameters

Initial Elevation of Water Table (m)	H	4	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	40.9	m
Linear Trench Size (m)	b	1.2	m
Length of Dewatering - Trench Length (m)	X	40.9	m
Width of Dewatering (m)	L	41	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	82	m
Radius outside well	Ro	78	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	4	m

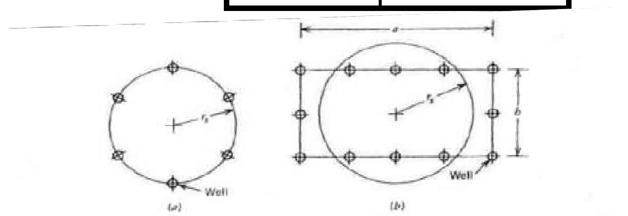


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	60	m3/day
Q	60,220	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	118	m3/day
Q	118,337	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	58	m3/day
Q	58,117	L/day

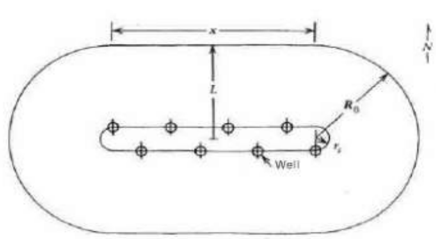
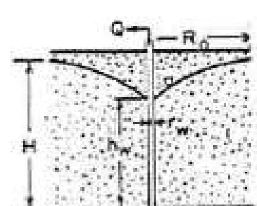
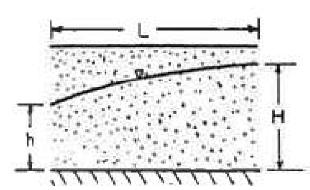


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site | 226 Brock Street East, Uxbridge, Ontario - Sanitary Trench (Between SAN MH4A and LIFT)

Input Parameters

Initial Elevation of Water Table (m)	H	5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	40.3	m
Linear Trench Size (m)	b	1.2	m
Length of Dewatering - Trench Length (m)	X	40.3	m
Width of Dewatering (m)	L	51	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	101	m
Radius outside well	Ro	97	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	4	m

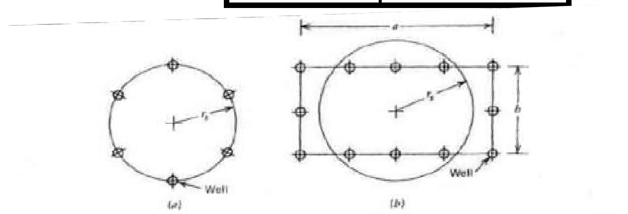


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	88	m3/day
Q	87,708	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	160	m3/day
Q	160,008	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	72	m3/day
Q	72,300	L/day

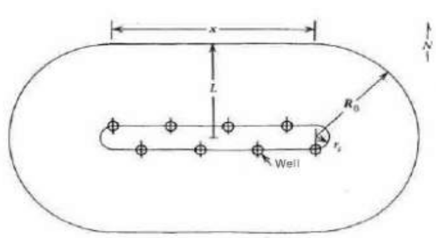
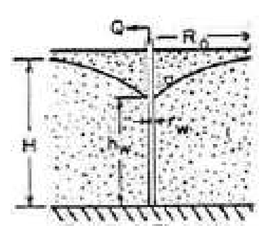
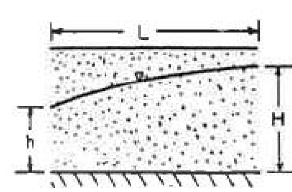


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Sanitary Trench (Between SAN LIFT and MH8A)

Input Parameters

Initial Elevation of Water Table (m)	H	5.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	19.8	m
Linear Trench Size (m)	b	1.075	m
Length of Dewatering - Trench Length (m)	X	19.8	m
Width of Dewatering (m)	L	55	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	110	m
Radius outside well	Ro	107	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	3	m

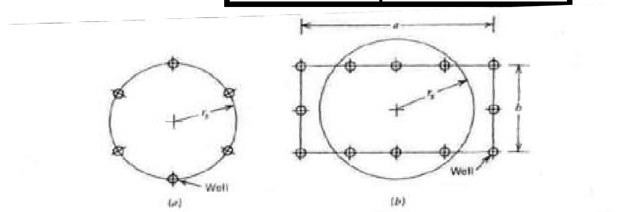


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	92	m3/day
Q	92,217	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	132	m3/day
Q	131,903	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	40	m3/day
Q	39,685	L/day

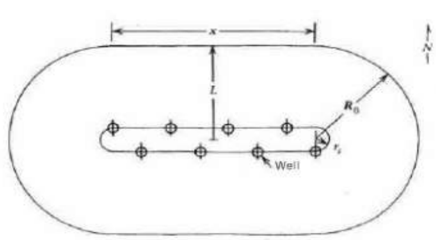
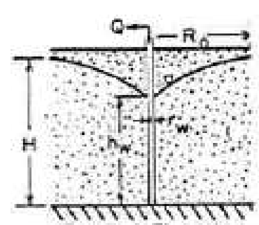
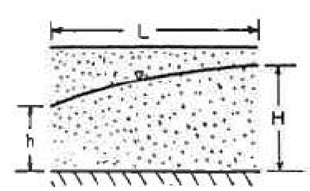


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Sanitary Trench (Between SAN LIFT and MH7A)

Input Parameters

Initial Elevation of Water Table (m)	H	5.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	29.4	m
Linear Trench Size (m)	b	1.2	m
Length of Dewatering - Trench Length (m)	X	29.4	m
Width of Dewatering (m)	L	55	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	110	m
Radius outside well	Ro	107	m

Equivalent Radius of Well (m)

Rs	3	m

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

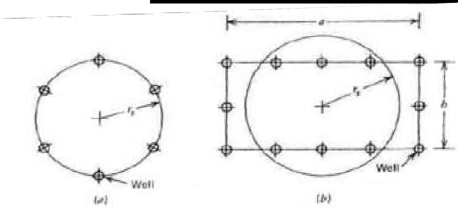


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	99	m3/day
Q	98,706	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	157	m3/day
Q	157,233	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	59	m3/day
Q	58,527	L/day

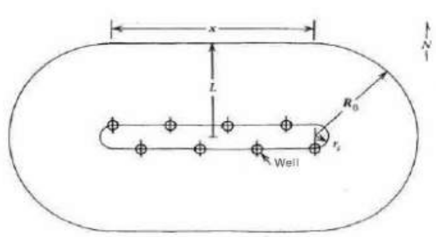
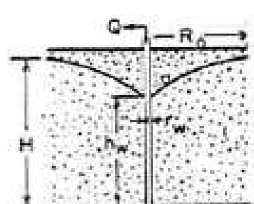
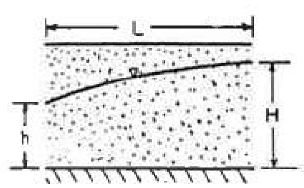


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Sanitary Trench (Between SAN LIFT and MH7A)

Input Parameters

Initial Elevation of Water Table (m)	H	5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	29.4	m
Linear Trench Size (m)	b	1.2	m
Length of Dewatering - Trench Length (m)	X	29.4	m
Width of Dewatering (m)	L	50	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	101	m
Radius outside well	Ro	97	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	3	m

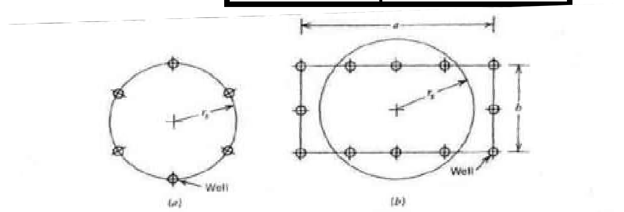


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	84	m3/day
Q	83,789	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	137	m3/day
Q	136,834	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	53	m3/day
Q	53,045	L/day

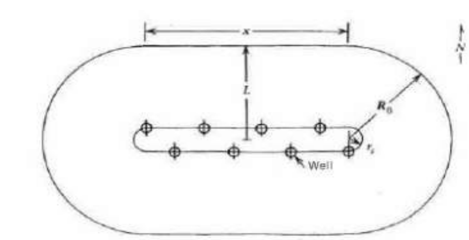
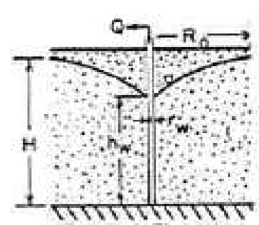
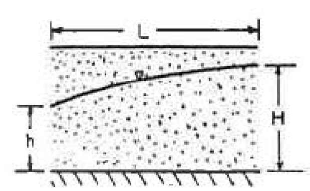


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site 226 Brock Street East, Uxbridge, Ontario - Sanitary Trench (Between SAN MH6A and MH7A)

Input Parameters

Initial Elevation of Water Table (m)	H	5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	50	m
Linear Trench Size (m)	b	1.2	m
Length of Dewatering - Trench Length (m)	X	50	m
Width of Dewatering (m)	L	51	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	102	m
Radius outside well	Ro	97	m

Equivalent Radius of Well (m)

Rs	4	m

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

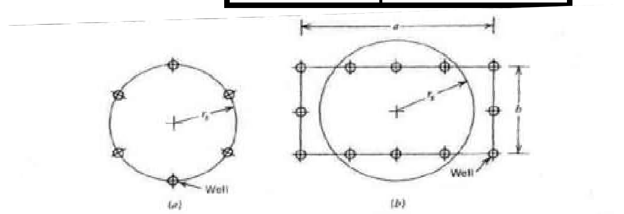


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	91	m3/day
Q	90,591	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	180	m3/day
Q	179,899	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	89	m3/day
Q	89,308	L/day

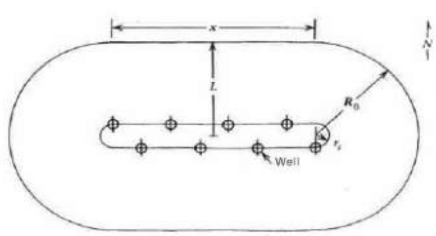
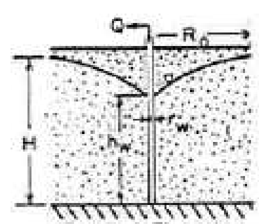
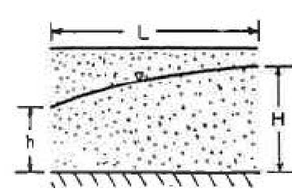


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site 226 Brock Street East, Uxbridge, Ontario - Sanitary Trench (Between SAN MH5A and MH6A)

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	4	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	34.9	m
Linear Trench Size (m)	b	1.2	m
Length of Dewatering - Trench Length (m)	X	34.9	m
Width of Dewatering (m)	L	41	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	81	m
Radius outside well	Ro	78	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	4	m

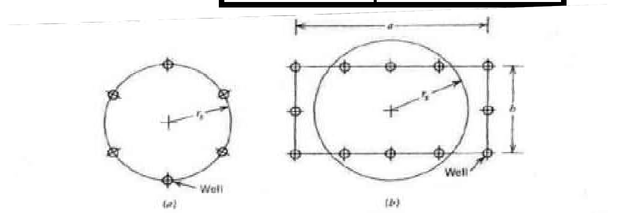


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	59	m3/day
Q	58,753	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	109	m3/day
Q	108,527	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	50	m3/day
Q	49,775	L/day

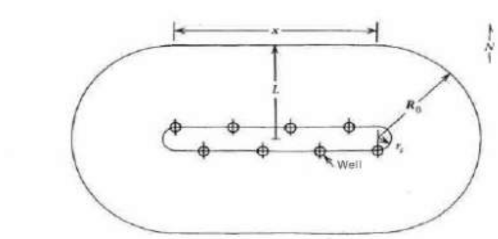
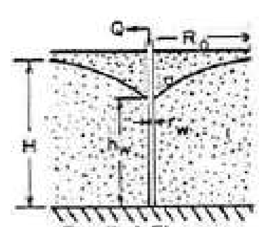
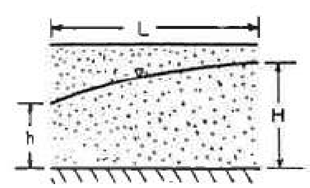


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Sanitary Trench (Between SAN MH5A and MH6A)

Input Parameters

Initial Elevation of Water Table (m)	H	2.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	35.5	m
Linear Trench Size (m)	b	1.2	m
Length of Dewatering - Trench Length (m)	X	35.5	m
Width of Dewatering (m)	L	26	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	52	m
Radius outside well	Ro	49	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	4	m

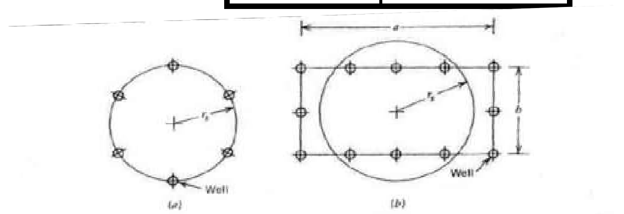


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	27	m3/day
Q	26,855	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	58	m3/day
Q	57,651	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	31	m3/day
Q	30,796	L/day

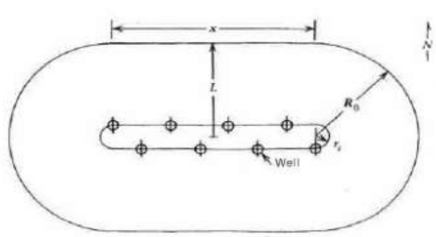
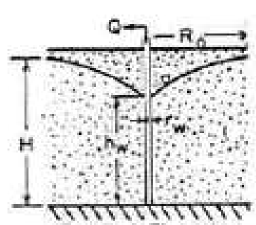
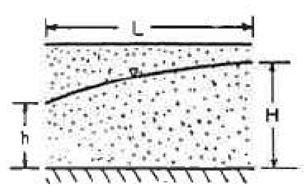


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Combined Storm and Sanitary Trench (Between SAN MH1A and STM MH 8)

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	2.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	20.6	m
Linear Trench Size (m)	b	2.15	m
Length of Dewatering - Trench Length (m)	X	20.6	m
Width of Dewatering (m)	L	26	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	52	m
Radius outside well	Ro	49	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	4	m

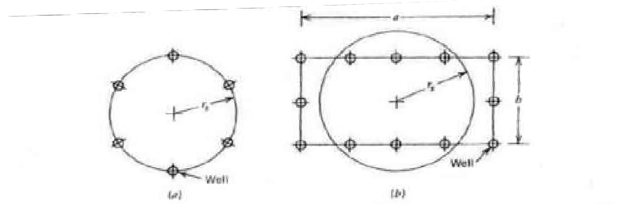


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	27	m3/day
Q	27,039	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	45	m3/day
Q	44,885	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	18	m3/day
Q	17,846	L/day

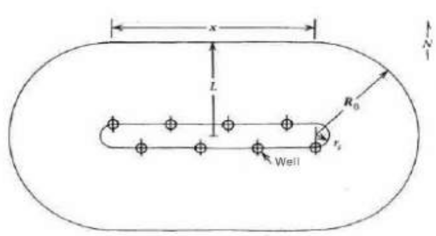
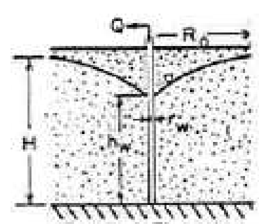
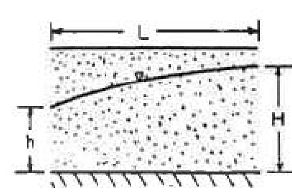


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Combined Storm and Sanitary Trench (Between SAN MH1A and MH2A, south of STM MH8)

Input Parameters

Initial Elevation of Water Table (m)	H	2.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	19.8	m
Linear Trench Size (m)	b	3.5	m
Length of Dewatering - Trench Length (m)	X	19.8	m
Width of Dewatering (m)	L	27	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	53	m
Radius outside well	Ro	49	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	5	m

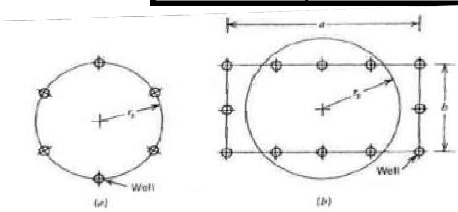


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	29	m3/day
Q	29,332	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	46	m3/day
Q	46,182	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	17	m3/day
Q	16,850	L/day

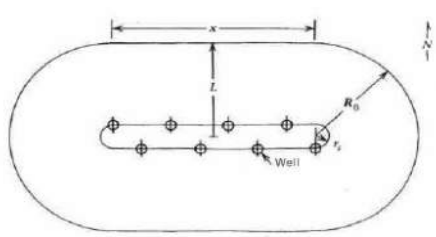
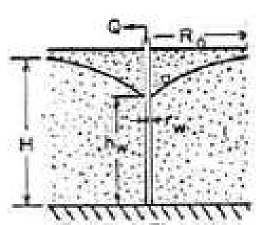
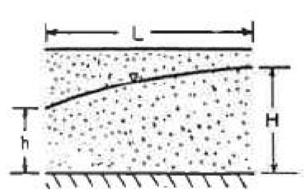


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions
from Powers, 1992

Site | 226 Brock Street East, Uxbridge, Ontario - Combiend Storm and Sanitary Trench (Between SAN MH2A and MH4A, south of STM MH8)

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	2.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	44.9	m
Linear Trench Size (m)	b	3.5	m
Length of Dewatering - Trench Length (m)	X	44.9	m
Width of Dewatering (m)	L	28	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	56	m
Radius outside well	Ro	49	m

Equivalent Radius of Well (m)

Rs	7	m

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

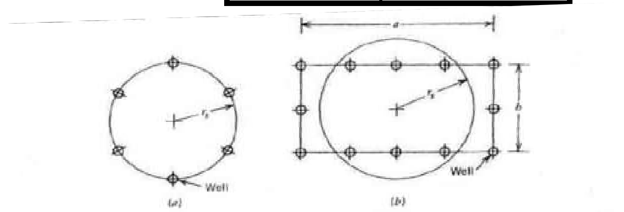


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	35	m3/day
Q	34,532	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	71	m3/day
Q	71,111	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	37	m3/day
Q	36,579	L/day

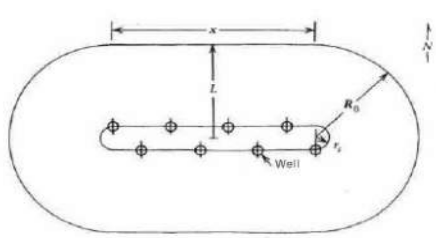
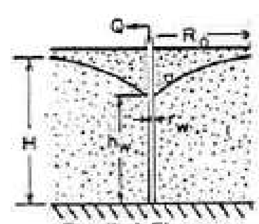
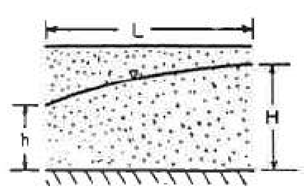


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Combined Storm and Sanitary Trench (Between SAN MH2A and MH4A, south of STM MH7)

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	3	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	45.1	m
Linear Trench Size (m)	b	3.5	m
Length of Dewatering - Trench Length (m)	X	45.1	m
Width of Dewatering (m)	L	33	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	65	m
Radius outside well	Ro	58	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	7	m

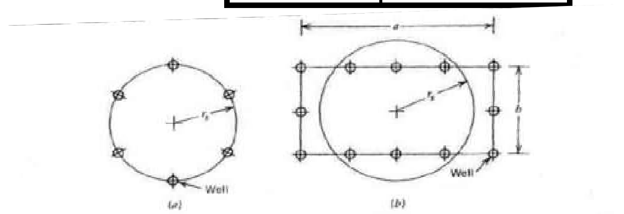


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	46	m3/day
Q	46,169	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	91	m3/day
Q	91,203	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	45	m3/day
Q	45,033	L/day

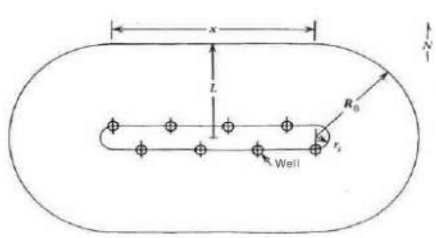
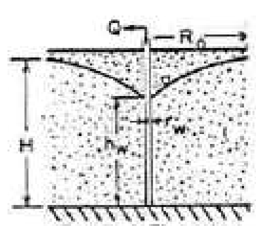
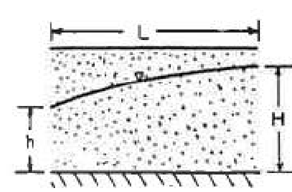


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site

226 Brock Street East, Uxbridge, Ontario - Combined Storm and Sanitary Trench (Between SAN MH3A and MH4A, between STM MH6 and MH5)

Input Parameters

Initial Elevation of Water Table (m)	H	3	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	24.3	m
Linear Trench Size (m)	b	3.5	m
Length of Dewatering - Trench Length (m)	X	24.3	m
Width of Dewatering (m)	L	32	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	64	m
Radius outside well	Ro	58	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	5	m

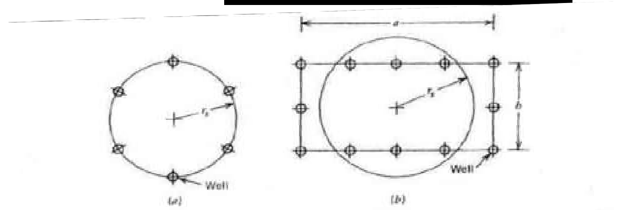


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	41	m3/day
Q	41,004	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	66	m3/day
Q	65,988	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	25	m3/day
Q	24,984	L/day

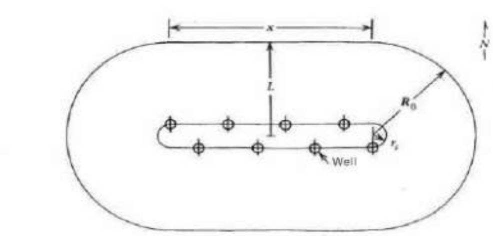
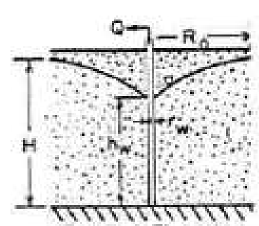
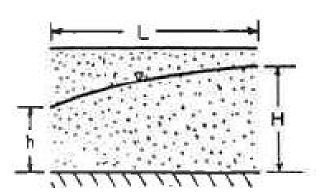


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow,
Water Table Aquifer



Water Table Flow From a Line
Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Combined Storm and Sanitary Trench (Between SAN MH4A and LIFT, west of STM MH6

Input Parameters

Initial Elevation of Water Table (m)	H	4	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	40.9	m
Linear Trench Size (m)	b	3.5	m
Length of Dewatering - Trench Length (m)	X	40.9	m
Width of Dewatering (m)	L	42	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	85	m
Radius outside well	Ro	78	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	7	m

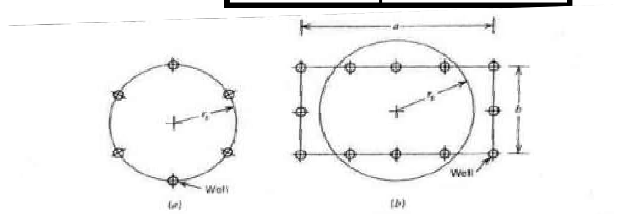


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	72	m3/day
Q	72,170	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	128	m3/day
Q	128,363	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	56	m3/day
Q	56,193	L/day

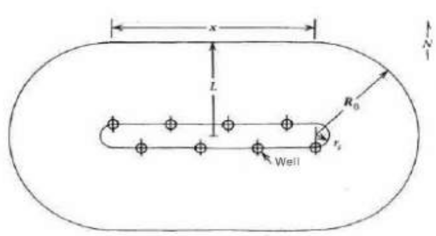
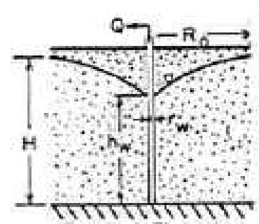
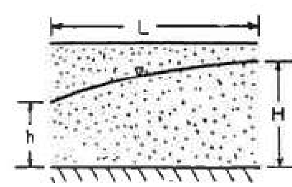


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow,
Water Table Aquifer



Water Table Flow From a Line
Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Combined Storm and Sanitary Trench (Between SAN MH4A and LIFT, west of STM MH6 to MH4, MH14)

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	40.3	m
Linear Trench Size (m)	b	3.5	m
Length of Dewatering - Trench Length (m)	X	40.3	m
Width of Dewatering (m)	L	52	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	104	m
Radius outside well	Ro	97	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	7	m

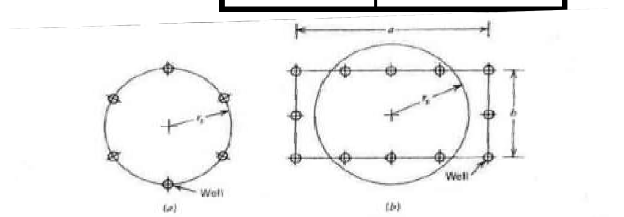


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	104	m3/day
Q	103,965	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	174	m3/day
Q	174,333	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	70	m3/day
Q	70,368	L/day

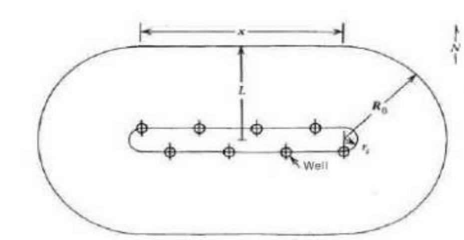
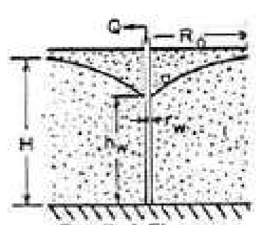
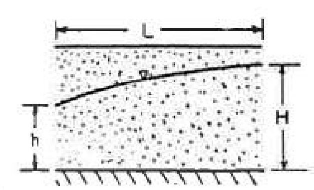


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site 226 Brock Street East, Uxbridge, Ontario - Combined Storm and Sanitary Trench (Between SAN LIFT and MH8A, south of STM MH14)

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	5.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	19.8	m
Linear Trench Size (m)	b	1.775	m
Length of Dewatering - Trench Length (m)	X	19.8	m
Width of Dewatering (m)	L	55	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	110	m
Radius outside well	Ro	107	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	3	m

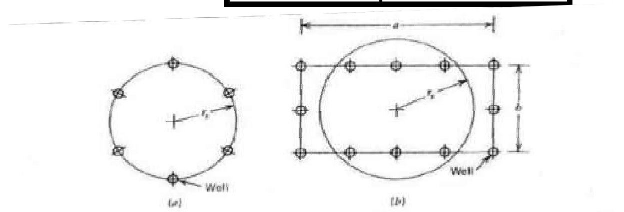


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	99	m3/day
Q	98,654	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	138	m3/day
Q	138,072	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	39	m3/day
Q	39,418	L/day

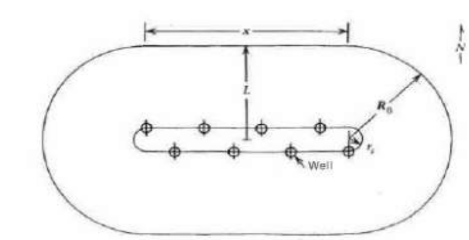
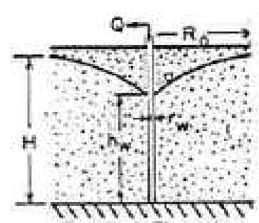
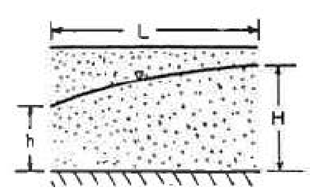


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Sanitary Trench (Between SAN LIFT and MH7A)

Input Parameters

Initial Elevation of Water Table (m)	H	5.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	10.4	m
Linear Trench Size (m)	b	3.5	m
Length of Dewatering - Trench Length (m)	X	10.4	m
Width of Dewatering (m)	L	55	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	110	m
Radius outside well	Ro	107	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	3	m

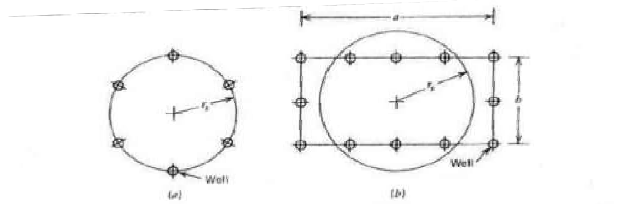


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	99	m3/day
Q	99,136	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	120	m3/day
Q	119,830	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	21	m3/day
Q	20,694	L/day

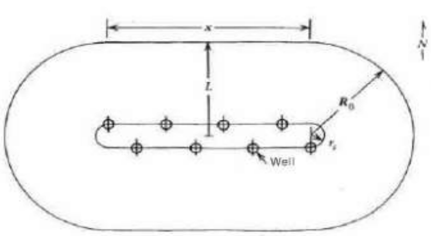
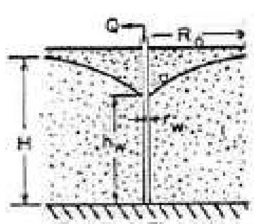
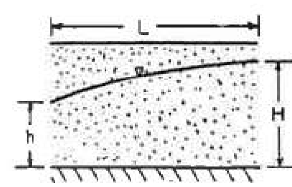


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site 226 Brock Street East, Uxbridge, Ontario - Combined Storm and Sanitary Trench (Between SAN LIFT and MH7A, north of STM MH3)

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	29.4	m
Linear Trench Size (m)	b	3.5	m
Length of Dewatering - Trench Length (m)	X	29.4	m
Width of Dewatering (m)	L	51	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	103	m
Radius outside well	Ro	97	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	6	m

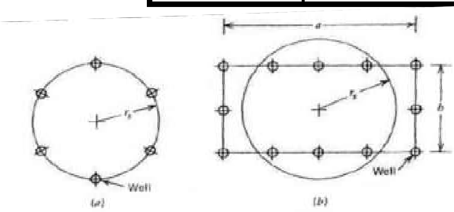


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	99	m3/day
Q	98,632	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	150	m3/day
Q	150,455	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	52	m3/day
Q	51,823	L/day

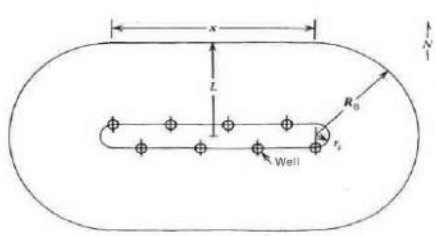
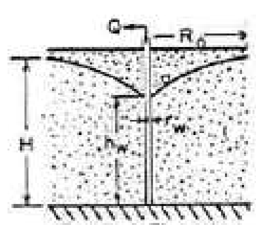
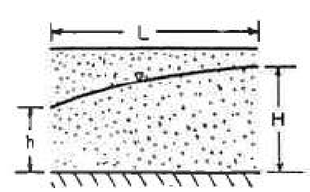


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site

226 Brock Street East, Uxbridge, Ontario - Combined Storm and Sanitary Trench (Between SAN MH6A and MH7A, north of STM MH3 to MH2)

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	50	m
Linear Trench Size (m)	b	3.5	m
Length of Dewatering - Trench Length (m)	X	50	m
Width of Dewatering (m)	L	52	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	105	m
Radius outside well	Ro	97	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	7	m

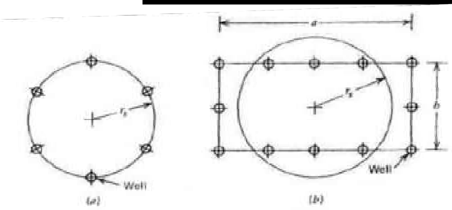


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	108	m3/day
Q	107,923	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	195	m3/day
Q	194,591	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	87	m3/day
Q	86,669	L/day

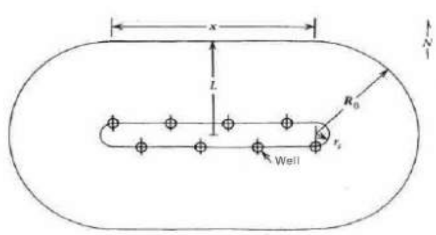
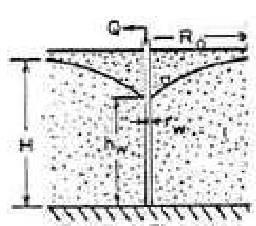
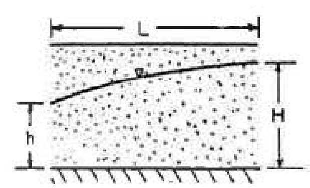


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site 226 Brock Street East, Uxbridge, Ontario - Combined Storm and Sanitary Trench (Between SAN MH5A and MH6A, between MH2 and MH8)

Input Parameters

Initial Elevation of Water Table (m)	H	4	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	34.9	m
Linear Trench Size (m)	b	3.5	m
Length of Dewatering - Trench Length (m)	X	34.9	m
Width of Dewatering (m)	L	42	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	84	m
Radius outside well	Ro	78	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	6	m

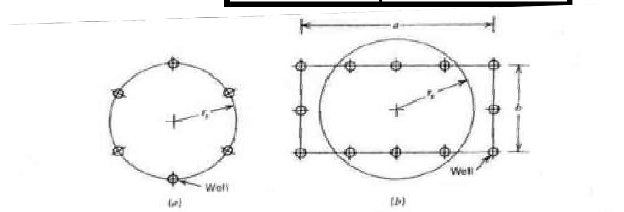


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	70	m3/day
Q	70,139	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	118	m3/day
Q	118,382	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	48	m3/day
Q	48,243	L/day

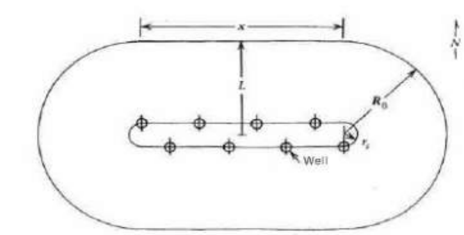
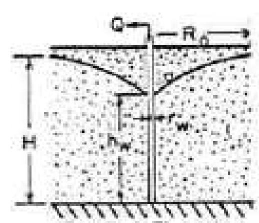
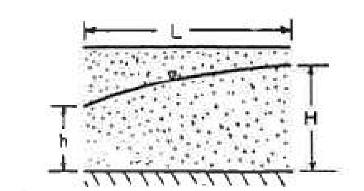


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench

Construction Dewatering Worksheet - Unconfined Conditions

from Powers, 1992

Site	226 Brock Street East, Uxbridge, Ontario - Sanitary Trench (Between SAN MH5A and MH6A, between MH2 and MH8)

Input Parameters

Parameter	Symbol	Value	Unit
Initial Elevation of Water Table (m)	H	2.5	m
Final Elevation of Water Table (m)	h	0	m
Hydraulic Conductivity (m/s)	K	4.20E-05	m/s
Hydraulic Conductivity (m/d)	K	3.63E+00	m/d
Aquifer Thickness (m)	B	4.60	
Linear Trench Size (m)	a	35.5	m
Linear Trench Size (m)	b	3.5	m
Length of Dewatering - Trench Length (m)	X	35.5	m
Width of Dewatering (m)	L	27	m

L = Ro / 2 (eq. 6.15, p. 105)

ZOI - Radius of Influence (m)

Ro = 3 (H - h) x sqrt (K) (eq. 6.14, p. 104)

Well radius + ZOI	Ro + Rs	55	m
Radius outside well	Ro	49	m

Equivalent Radius of Well (m)

Rs = sqrt ((a x b)/ pi) (eq. 6.10, p. 102)

Rs	6	m

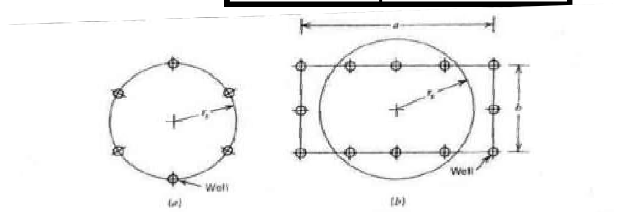


Figure 6.7 Approximation of equivalent radius r_s. (a) Circular systems. (b) Rectangular systems.

Flow Calculations - Q

Radial Flow to a Shaft (a/b < 1.5)

Shaft Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) (Eq. 6.3, p. 99)

Q	33	m3/day
Q	32,886	L/day

Long Narrow System - Trench (a/b > 1.5)

Trench Calculation (m3/day)

Q = (pi x K x (H^2 - h^2)) / ln (Ro / Rs) + 2 x (X x K x (H^2 - h^2)) / 2 x L

Q	62	m3/day
Q	62,220	L/day

Drainage Trench from a Line Source (m3/day)

Q = 2 x X x K x (H^2 - h^2) / 2 x L (eq. 6.9, p. 102)

Q	29	m3/day
Q	29,334	L/day

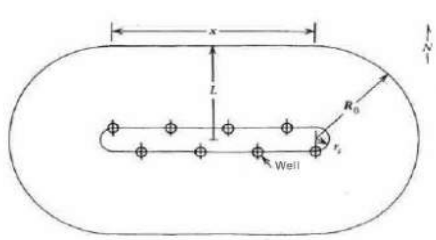
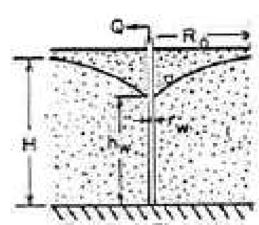
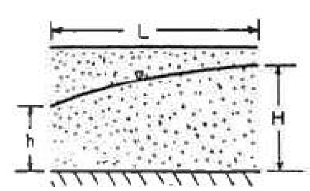


Figure 6.8 Approximate analysis of long narrow systems.



Radial Flow, Water Table Aquifer



Water Table Flow From a Line Source to a Drainage Trench