Hydrogeological Assessment
Proposed Development
401-417 Martha Street
Burlington, Ontario

Submitted to:

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Table of Contents

1.0 INTRODUCTION 1
1.1 Project Description 2
1.2 Previous Subsurface Investigations 2
1.3 Site Description & Regional Geology 3

2.0 FIELD INVESTIGATION 3
2.1 Borehole Drilling and Monitoring Well Installations 4
2.2 Subsurface Conditions 5
2.3 Groundwater Level Monitoring 6
2.4 Well Development 5
2.5 Hydraulic Conductivity Testing 7
2.6 Sampling and Analytical Testing 8

3.0 PROPOSED WATER TAKING 9
3.1 Proposed Development 9
3.2 Excavation and Dewatering Assumptions 9
3.3 Dewatering Rate Estimation 11
3.4 Zone of Influence 12
3.5 Dewatering Recommendation 12
3.6 Dewatering Discharge Disposal 13

4.0 IMPACT ASSESSMENT 14
4.1 Private Water Supply 14
4.2 Source Water Protection 14
4.3 Subsidence and Settlement 15
4.4 Surface Water & Natural Environment 15
4.5 Mitigation Measures 15

5.0 CLOSURE 16

List of Figures

Figure 1 Site Location
Figure 2 Proposed Development & Borehole Location Plan
Figure 3 Groundwater Levels
Figure 4 Excavation & Zone of Influence

List of Appendices

Appendix A Architectural Site Plan Drawings
Appendix B Borehole / Monitoring Well Logs
Appendix C Hydraulic Conductivity Results
Appendix D Laboratory Results
Appendix E Dewatering Estimates
Appendix F Limitations

1.0 Introduction

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited (Wood) was retained by Landform Development Group Inc. (Landform), to conduct a scoped hydrogeological assessment for a proposed redevelopment at 401-417 Martha Street in Burlington, Ontario. The site location is shown on Figure 1.

This hydrogeological assessment was originally conducted in 2018 and submitted to Landform on November 13, 2018. Following minor changes to the site plan drawings in early 2020, this hydrogeological assessment was revised to reflect the changes to the site plan drawings (Hydrogeological Assessment Rev. 1, dated April 16, 2020). Following additional minor changes later in 2002 to the site plan drawings and comments from the City of Burlington, this hydrogeological assessment was further revised to reflect the changes to the site plan drawings and to address comments from the City of Burlington (Hydrogeological Assessment Rev. 2, dated November 18, 2020).

The purpose of the scoped hydrogeological assessment was to confirm the groundwater conditions (level, need for construction dewatering, permanent depressurizing), and if the project could have a negative impact and propose mitigation measures. As the current design process for the site is preliminary and this assessment identifies that additional investigation is recommended, this report should also be considered preliminary and addition assessment may be required to support water taking permitting for construction dewatering, such as an Environmental Activity and Sector Registry (EASR) from the Ministry of the Environment, Conservation and Parks (MECP).

The information was obtained by means of a limited number of boreholes, in-situ tests and laboratory testing.

This report contains the findings of Wood's hydrogeological assessment, these finding are based on factual information. The number of boreholes may not be sufficient to determine all the factors that may affect construction methods and costs. Subsurface and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of site investigation. The anticipated construction conditions are also discussed, but only to the extent for the review process. Construction methods discussed, however, express Wood's opinion only and are not intended to direct the Contractors on how to carry out the construction. Contractors should also be aware that the data and their interpretation presented in this report may not be sufficient to assess all the factors that may have an effect

upon the construction.

The report is prepared with the condition that the design will be in accordance with all applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practice. Further, the findings in this report are applicable only to the proposed project as described above.

On-going liaison with Wood during the final design and construction phase of the project is recommended to confirm that the findings in this report are applicable and/or correctly interpreted and implemented. Also, any queries concerning the hydrogeological aspects of the proposed project should be directed to Wood for further elaboration and/or clarification.

1.1 Project Description

The project involved the proposed redevelopment of 401 – 417 Martha Street in Burlington, Ontario, the 'site'. The redevelopment involves the construction of an 11 storey, 130 unit apartment building with four storeys of underground parking. The approximate boundary of the proposed development is shown on Figure 2. Site plan drawings, dated Dec. 18, 2020 have been provided by the client and are included as Appendix A.

1.2 Previous Subsurface Investigations

Prior to this hydrogeological assessment, a geotechnical investigation and a supplemental geotechnical investigation were carried out by Soil-Mat Engineers & Consultants LTD. (Soil-Mat) in September 2016 and March 2017 respectively.

During the 2016 geotechnical investigation, two boreholes (BH/MW 1 and BH 2) were advance on August 4, 2016 near the front of 409 and 417 Marth Street to 15.5 m and 7.8 m respectively, with BH/MW 1 being equipped with a groundwater monitoring well. The subsurface soil conditions encountered were generally gravel (driveway) underlain by clayey silt and shale. The shale was encountered at 1.3 m depth and 2.1 m depth. The shale was severely weathered in the upper portion and became more sound with depth. The groundwater depth in BH/MW 1 was reported to be 5.04 m on September 9, 2016.

During the 2017 supplemental geotechnical investigation, primarily conducted to provide additional slope stability information, two additional boreholes (BH101 and BH102) were advanced on February 9, 2017 in the rear yards of 405 and 413 Martha Street to 3.5 m and 1.7 m

respectively. The subsurface soils conditions encountered were generally topsoil, underlain by silty sand fill and shale.

The approximate locations of these boreholes are shown on figure 2 and the borehole logs can be found in Appendix B.

1.3 Site Description & Regional Geology

The site is a series of individual lots, 401 – 417 on Martha Street in Burlington Ontario. It is proposed to redevelop the properties and construct an apartment building. The site lies in an urban setting in an area of residential land use. The site is bounded by Martha Street to the southwest, an existing apartment building to the southeast, the lower section of Rambo Creek to the east / northeast, and Waterfront Trail to the northwest.

Rambo Creek has been significantly altered over the years through urbanization and by the diversion of upstream flows through the Hager-Rambo diversion channel.

An elevation survey of the site completed by Mackey Mackay & Peters Limited dated April 13, 2017 shows the elevation at the site is approximately 82-83 m near Martha Street and falls to approximately 79-80 m in the rear yards where it drops sharply into Rambo Creek which has an approximate elevation of 77-78 m (CGVD-1928: 1978 Adjustment).

According to the 2010 Surficial Geology of Southern Ontario Miscellaneous Release – Data 128 REV, published by the Ontario Geological Survey (OGS), the surficial geology in the vicinity of the site is interpreted to be course-textured glaciolacustrine deposits (9) which consist of sand and gravel, minor silt and clay. Based on the review of the soils encountered during the Soil-Mat geotechnical investigation, the sand and gravel does not appear to be a major component of the overburden soils at the site.

According to the 2007 Paleozoic Geology of Southern Ontario Miscellaneous Release – Data 219, published by Armstrong, D.K. and Dodge, J.E.P. of the OGS, the bedrock in the vicinity of the site consists of shale of the Queenston formation.

2.0 Field Investigation

A Field investigation was completed by Wood from July to October 2018. The work consisted of an assessment of an existing monitoring well at the site, borehole drilling and monitoring well

installation, water level monitoring, well development, hydraulic conductivity testing and water quality sampling.

Wood assessed the existing monitoring well (BH/MW 1) from the Soil-Mat geotechnical investigation on July 25, 2018 and found that it appeared to be in suitable condition to be used for the hydrogeological assessment. This monitoring well will be used to provide deep (6 - 15 m) hydrogeological conditions of the shale bedrock for the assessment. For the purposes of this investigation it has been renamed BH/MW 1 D.

2.1 Borehole Drilling and Monitoring Well Installation

To provide shallow hydrogeological conditions, particularly for the weathered shale, a shallow borehole (BH/MW 1 S) was advanced in the vicinity of BH/MW1 D to 4.6 m and equipped with a groundwater monitoring well. Borehole drilling was completed on August 15, 2018 under supervision of Wood by Davis Drilling Ltd., a licensed drilling subcontractor. The approximate location of this borehole is shown on Figure 2 and the borehole log can be found in Appendix B.

BH/MW 1 S was advanced using 200 mm hollow stem augers. Soil samples were generally obtained at 1.5 m intervals via the Standard Penetration Test method, ASTM D1586. The soil stratigraphy within the borehole was visually examined and classified at the time of drilling in accordance with the modified Unified Soil Classification System (USCS) and the Canadian Foundation Manual (2006). Soil samples were collected from each borehole at selected depths and retained in sealed plastic bags for further detailed examination and laboratory testing. The monitoring well was constructed by placing a 0.05 m (2-inch) inside diameter PVC riser pipe with a 10-slot screen and a length of 3 m within the center of the hollow stem auger to the base of the borehole.

BH/MW 1 S monitoring well screen was set approximately to 4.6 m. Silica sand was poured into the center of the hollow stem auger to fill the borehole annulus from the bottom of the screen to approximately 0.3 m above the screen. While pouring the sand, the hollow stem augers were slowly removed. Bentonite was poured into the hollow stem augers, or directly into the borehole if augers had been fully removed to approximately 0.3 m below ground surface, the bentonite was hydrated to provide a seal from the ground surface. The monitoring well was completed with lockable J-plug caps and flushmount protective casings embedded in concrete at the ground surface. The monitoring well was tagged and labelled in accordance with Ontario Regulation 903 (O. Reg. 903) of the Ontario Water Resources Act by the well drillers and the water well records were submitted to the MOECC by the drilling subcontractor.

Wood recommends the decommissioning of the groundwater monitoring wells identified in this report when they are no longer required for study or if they are an obstacle for construction. In conformance with O. Reg. 903, the installation and eventual decommissioning of groundwater wells must be carried out by a licensed well contractor.

2.2 Well Development

BH/MW 1 D was developed on August 23, 2018 using a Waterra® inertial lift pump (i.e. foot valve) fitted with dedicated polyethylene tubing. Well development was carried out by purging the monitoring well dry. Well development is carried out to remove some fine particles from the sand filter pack and the native soils immediately surrounding the well screen in preparation for hydraulic conductivity testing and groundwater sampling. It is noted that full development of the monitoring well was not attainable due to the low permeability of the screened materials and the scope / budget of this investigation.

2.3 Subsurface Conditions

The detailed subsurface conditions encountered in the borehole of this hydrogeological assessment, as well as the preceding geotechnical investigations are presented on the Record of Boreholes / Monitoring Wells, which can be found in Appendix B.

The boreholes at the site generally encountered a thin layer surficial soils (fill soils over clayey silt) over weathered shale which became more competent with depth.

A ground surface elevation point shown on the elevation survey of the site completed by Mackey Mackay & Peters Limited indicates that the ground surface elevation in the vicinity of BH/MW 1 S and BH/MW 1 D is approximately 83.4 m. Using this elevation as the ground surface elevation for both BH/MW 1 S and BH/MW 1 D, the weathered shale was encountered at 81.4 m (BH/MW 1 S) and 82.1 m (BH/MW 1 D). The difference in these depth at which weathered shale bedrock begins is an interpretation as the clayey silt soils and the weathered bedrock appear very similar due to the degree of weathering. Based on a review of the blow counts during split spoon sampling, the highly weathered shale appears to be about 2-3 m in thickness before more competent bedrock was encountered between 79-80 m.

Based on the weathered bedrock elevations above, observations during the field program, and the surveyed elevations, Rambo Creek flows within an eroded channel on shale bedrock with an elevation of approximately 77-78 m.

2.4 Groundwater Level Monitoring

Groundwater levels were measured in BH/MW 1 D on July 25, August 23, September 10 & 27, October 13, 16 & 17, 2018. BH/MW1 S was found to be dry on the same dates following monitoring well installation. Pressure transducers were installed in BH/MW 1 S and BH/MW 1 D on September 10, 2018 to provide a continuous record of groundwater level. A separate pressure transducer (barologger) was placed in one of the monitoring wells above the water level such that the pressure transducers data from each monitoring well will be compensated for atmosphere barometric changes. Groundwater levels were measured on May 30 and October 15, 2019 for the long-term monitoring.

The groundwater level in BH/MW1 D was found to range between 4.4 m and 5.9 m below ground surface (mbgs) which corresponds to groundwater elevations ranging between 77.5 and 79.0 m above sea level (masl) as seen in Figure 3. Notable variations (spikes) of the water level between September and October 2018 are due to testing completed for the field investigation with the exception of on September 25, 2018, which is believed to have been caused by an unsecured J plug cap and water entering the monitoring well following precipitation events. Based on the long term monitoring it appears the groundwater level between August and October 2018 was likely affected by the testing where it was artificially lowered and did not recharge back to typically levels until the return of significant recharge in the fall which was measured during the long-term monitoring (October 2018 – October 2019). However, it is possible that drier conditions were present in the summer of 2018 as compared to those measured during the summer of 2019.

The groundwater level in BH/MW1 S was found to range between 4.0 m below ground surface and where the monitoring well was dry, suggesting that the groundwater level was below the depth of the shallow monitoring well. This corresponds with a maximum groundwater elevation of 79.4 masl. Where the BH/MW1 S manual water level is not shown during corresponding monitoring events in the deep well on Figure 3, it is where the monitoring well is or is assumed to be dry. Transducer data for the fall of 2019 was not available due to a transducer failure.

The groundwater elevations were generally above the water surface elevations of Rambo Creek according to the Mackey Mackay & Peters elevation survey which show the edge of water to have an elevation of approximately 77.5-78 m. This combined with apparent downward gradients from the shallow to deep well, suggest groundwater flow is towards the creek, but the flow is sufficiently restricted by the low permeability of the geologic units to prevent draining of the groundwater levels to the creek levels.

2.5 Hydraulic Conductivity Testing

Hydraulic conductivity testing was conducted in BH/MW 1 D on September 10 and October 18, 2018.

The hydraulic conductivity testing on September 10, 2018 consisted of conducting a single well response test in the form of a rising head test. A non-vented pressure transducer programmed to record pressure readings at two-minute intervals was placed in the monitoring well prior to the start of the test and recorded throughout the test. Manual water levels were measured in the monitoring well prior to and during the initial portion of the test to match the transducer's pressure data to the measured manual water levels, which provides a continuous record of the water level in the monitoring well during the test.

The rising head test was completed by purging a volume of water out of the monitoring well to create a downward displacement of the water level in the monitoring well and allow it to recover back to equilibrium.

Upon reviewing the data, the September 10, 2018 test may have been slightly affected by a build up of air pressure within the monitoring well due to the use of a J-plug to seal the top of the monitoring well, combined with the low permeability bedrock and groundwater inflow may have caused the pressure to build up. At some point either during the test or following the test, the J-plug was popped off the top of the monitoring well by the pressure as upon our next visit the J-plug was found to be unsecured.

To confirm the original hydraulic conductivity test result, a second test in the form of a falling head test was conducted in BH/MW 1 D on October 16, 2018 with the J-plug removed. The falling head test was completed by adding a volume of water to the monitoring well to create an upward displacement of the water level in the monitoring well and allow it to recover back to equilibrium.

It is noted that both slug tests did not fully recover to the pretest assumed static water level however this is not expected to alter the analysis of the tests.

The recovery data from the September 10, 2018 and the October 16, 2018 tests were analyzed using the Bouwer-Rice method (Bouwer & Rice, 1976) in AQTESOLV version 4.5. The software incorporates transducer water level data collected during the hydraulic conductivity testing as well as monitoring well construction details in the estimation of the hydraulic conductivity of the screened soils.

The hydraulic conductivity estimates for BH/MW 1 D were 5.2 $\times 10^{-8}$ m/s (rising head – September 10, 2018) and 6.3 $\times 10^{-8}$ m/s (falling head – October 16, 2018). These hydraulic conductivity values represent a relatively low permeability unweathered bedrock material that is consistent with expected hydraulic conductivity values for shale bedrock.

As the shallow monitoring well completed in the weathered shale was dry, an estimate of the weathered shale bedrock was not obtained during this investigation.

The full results of the analysis are found in Appendix C.

2.6 Sampling and Analytical Testing

Groundwater sampling was undertaken on September 27, 2018 in BH/MW 1 D. A low flow peristaltic pump was installed to sample the monitoring well's groundwater. The monitoring well was pumped until field parameters (temperature, electrical conductivity, and pH) stabilized. Unfiltered groundwater samples were collected from the monitoring well and submitted for analysis for all the parameters listed in the Halton Region Sewer Bylaw (By-Law No. 2-03).

A surface water sample of the stream (Rambo Creek) was collected on September 27, 2018 and submitted for the same analysis as the groundwater sample for comparison of the groundwater and surface water.

The results were compared to the limits for sanitary sewers and combined sewers discharge. Where applicable, the results were also compared to the limits for storm sewer discharge (City of Burlington Storm Sewer Discharge Bylaw By-Law 86-2002) and the Provincial Water Quality Objectives (PWQOs) for the parameters analyzed. It is noted that separate analysis was conducted for the metals to comply with the lab analysis technique for the PWQOs. It is further noted that the analysis did not include analysis for Escherichia (E.) coli colonies which is a limit of the storm sewer bylaw.

All laboratory chemical analyses were conducted by AGAT Laboratories (AGAT), accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) in accordance with ISO/IEC 17025:1999 – General Requirements for the Competence of Testing and Calibration Laboratories for the tested parameters set out in the Soil, Ground Water and Sediment Standards document (MOE, 15 April 2011).

The results of the groundwater sample analysis are shown in the Certificates of Analysis (COA) which are found in Appendix D.

The groundwater sampling results indicate an exceedance of both the sewer bylaws for total suspended solids (TSS). When compared to the PWQOs, the results indicated exceedances for total phosphorus, cobalt, copper, iron and zinc. It is noted that the stream sample also exceed the PWQOs for total phosphorus.

It is Wood's experience that high TSS can result in elevated metals concentrations when metals adsorbed to suspended particles are liberated during sample preparation at the laboratory. As the high TSS in the groundwater sample is directly related to the method of sample collection (agitation of settled soils while pumping the partially developed monitoring well), it is reasonable to expect that with a reduction of TSS (with adequate sediment controls), this would result in reduced metal concentrations.

3.0 Proposed Water Taking

3.1 Proposed Development

The proposed apartment building is a 11 storey apartment building with four storeys of underground parking. The proposed dimensions of the underground portion (underground parking areas) is approximately 69 m by 23 m (NW end) / 38 m (SE end). The bottom level (P4 parking level) is proposed to be 12 m below ground surface, allowing for 2 m of excavation below this depth, the elevation of the bottom of the excavation is expected to be approximately 69 masl. The limit of the underground area will be very close to the surveyed existing top of slope which has an elevation of approximately 79-80 masl, and within a few metres of the surveyed water edge of Rambo Creek (~77.5-78 masl). It is shown on the site plan drawings that the estimated flood range (100 year flood line) is approximately the top of slope.

3.2 Excavation and Dewatering Assumptions

To provide a preliminary dewatering rate estimate, the following assumptions, which are based on information provided and site conditions encountered during the investigation have been made:

- standard equipment is required for excavations within the overburden soils. Excavations into the bedrock will require the use of heavy equipment outfitted with rock teeth and hoe-ramming equipment.
- The walls of the excavation cut into sound and stable bedrock will not need to be sloped but will need to be supported and protected from further weathering or erosion. This

assessment must be made by an experienced geologist or engineer at the time of the excavation.

- Groundwater seepage entering the excavations can be controlled by the use of sump pumps.

For the excavation and construction of the proposed apartment building, it is expected that a large open cut excavation will be required that is approximately 71m by 25 m (NW end) / 40 m (SE end), which is a 1 m buffer around the underground parking limits. It is expected that the excavation will have a depth of 14 m. The footprint of this excavation is shown on Figure 4. For the purposes of estimating a dewatering rate, the width of the building has been averaged to be 34 m in the dewatering rate calculation.

It is noted that the excavation based on these dimensions is proposed to be on average within 5 m of Rambo Creek. The calculated radius of influence from dewatering is larger than the distance between the excavation and Rambo Creek, as such the radius has been defined and set to 5 m in the dewatering rate calculation.

The highest groundwater level recorded during the assessment was approximately 4 mbgs, this groundwater level is expected to include the normal seasonal fluctuation of the groundwater level.

The estimated dewatering rates have been determined under the assumption that unconfined homogenous hydrogeological conditions occur, this is a simplification and conservative assumption of the hydrogeological conditions encountered as the they are not likely homogenous, and some confined hydrogeological conditions may exist.

Additional higher inflow rates can be expected because of any or all of the following circumstances:

- Initial depletion of storage in the aquifer – this is a temporary response to dewatering and dewatering rates should fall to expected volumes once equilibrium conditions are approached.
- Infiltration or runoff from precipitation events. It is expected that surface runoff will be directed away from any open excavations.
- Excavation into the bedrock disturbs the bedrock between the excavation and Rambo Creek or encounters fractures otherwise absent at the monitoring well such that the hydraulic conductivity of the unweathered shale bedrock is underestimated and additional inflow from Rambo creek is observed.

3.3 Dewatering Rate Estimation

To estimate the dewatering rate that would be required to support construction, an analytical equation with the assumptions listed above has been used to determine a dewatering rate estimation. (corrected from Powers et al., 2007):

Where:

$$Q = \pi K \frac{(H_0^2 - h_e^2)}{\ln\left(\frac{2R_i + w}{w}\right)} + 2lK \frac{(H_0^2 - h_e^2)}{2R_i}$$

Q = groundwater flow rate (m/s).
K = hydraulic conductivity (m/s)
H_0 = static water table level (m above reference elevation) - [measured in the monitoring wells during the field investigation].
h_e = dewatered groundwater level at excavation (m above reference elevation) – [the reference elevation has been taken as 1.0 m below the proposed excavation depth. This assumes that there is no significant groundwater upflow from greater than 1.0 m below the excavation.
w = dewatering area width (m).
ℓ = dewatering area length (m).
R_i = radius of influence (m) – [estimated using Sichardt's Equation: $L=3000(H-h)K^{1/2}$].

A preliminary dewatering rate estimation based on the equation above, with the assumptions listed in section 3.2 is provided in the far-right column of the Dewatering Rate Estimation found in Appendix E. The estimated dewatering rate indicates that sustained groundwater discharge rates of 17,200[1] L/day (17.2 m^3/day) may be required. To account for higher, short term inflows, a safety factor of three (3) is applied, resulting in an estimated dewatering rate of up to approximately 51,700[1] L/day (51.7 m^3/day).

This preliminary estimate has been prepared based on available information from the current investigation which assumes that excavation below the local groundwater level is completed entirely within the unweathered shale bedrock. It is not known for the excavation sidewall closest to Rambo Creek if the groundwater level would be within the weathered shale bedrock. It is reasonable to expect that the weathered bedrock horizon would decrease in elevation closer to the creek, where erosion of sediments exposes the bedrock to more weathering. Should this be the case, the hydraulic conductivity value used in the calculations would be underestimated, and additional inflow would be expected.

[1] Rounded to nearest 1,000 L/day

Further investigation particularly with respect to Rambo Creek and if a weathered zone is present below the groundwater level is recommended to refine the dewatering requirements for the proposed development.

3.4 Zone of Influence

An estimation of the Zone of Influence (ZOI) from the dewatering of a single point can be made using Sichardt's Equation (Powers et al., 2007):

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

Where:

L = Radius of Influence (m)
H = Hydraulic Head of the original water table (m) – measured from the base of the aquifer unit
h = Hydraulic Head at the Maximum Dewatering (m) – measured from the base of the aquifer unit
K = Hydraulic Conductivity (m/s)

The estimated ZOI based on the equation above, with the assumptions listed in section 3.2 are also provided in the Dewatering Rate Estimation found in Appendix E. The estimated ZOI including a safety factor of three (3) on the hydraulic conductivity in the equation is 13 m, indicating a relatively small ZOI from the proposed dewatering.

The ZOI calculated above is for a single point, to show the ZOI for the excavation, the ZOI has been applied to the outside of the expected excavation as shown on Figure 4. Where the ZOI reaches the creek, it is assumed that the ZOI will be limited to the water's edge.

3.5 Dewatering Recommendation

Based on the water table depth, dewatering is expected to be required during construction. It is expected that groundwater would seep into the excavation from the excavation walls and flow down the walls to the excavation base. A sump or a series of sumps within the excavation could be used to pump the groundwater out of the excavation to maintain a dry excavation. Standard sediment control measures should be applied to reduce the sediment pumped from these sumps.

As the subsurface conditions indicate that the shale bedrock is to extend to the full depth of the excavation, a deeper, distinct confined aquifer is not present and thus depressurization of such a unit is not expected to be necessary.

The dewatering rate which includes a safety factor suggest that the dewatering rate may exceed the Ministry of the Environment, Conservation and Parks (MECP) threshold of 50,000 L/day which requires registration of the water takings on the Environmental Activity and Sector Registry (EASR).

At the time of preparing this assessment, a detailed design of the foundation has not been completed. It is expected that either a watertight structure, or a foundation drainage collection system, or a combination of the two will be designed. If a watertight structure is feasible, no permanent dewatering is expected to be required. If a foundation drainage collection system is used, permanent dewatering will be required. It is expected that the dewatering rate will be similar to what was expected for construction due to the similar size of the excavation relative to the buildings underground footprint.

3.6 Dewatering Discharge Disposal

Discharge to either the sanitary or the storm sewer, or to the local environment (to land) are the expected options for dewatering discharge disposal.

As described in Section 2.6, the results of the groundwater and surface water sample analysis carried out as part of this investigation by AGAT are shown on the Certificates of Analysis (COA) in Appendix D. To assess groundwater disposal options, the results were compared to the limits for sanitary sewers and combined sewers discharge, storm sewer discharge and to the corresponding Provincial Water Quality Objectives (PWQOs) for those parameters. Groundwater results indicated an exceedance of the sewer bylaws for total suspended solids (TSS). When compared to the PWQOs, the results indicated exceedances for total phosphorus, cobalt, copper, iron and zinc. It is noted that the stream sample also exceeded the PWQO limit for total phosphorus.

It is Wood's experience that high TSS can result in elevated metals concentrations when metals adsorbed to suspended particles are liberated during sample preparation at the laboratory. As the high TSS in the groundwater sample is directly related to the method of sample collection (agitation of settled soils while pumping the partially developed monitoring well), it is reasonable to expect that a reduction of TSS with adequate sediment control would result in reduced metal concentrations.

Based on the above, it is expected that the groundwater would be suitable for discharge to the sanitary and combined sewer provided reduction of TSS and an agreement is in place with the City of Burlington.

It is possible that by reducing the TSS, that the water quality would be suitable for discharge to the storm sewer, or if space surrounding the construction / excavation permits to land, however further water quality testing would be required to assess the expected discharge water quality. Furthermore, due to the proximity of any potential discharge area(s) to Rambo Creek, or the direct flow to Rambo Creek that would result from discharging to the storm sewer, this potentially would require an assessment of the assimilation capacity of Rambo Creek to assess the impacts of discharging elevated concentrations above PWQOs (as applicable).

In the event that discharge to the storm sewer or to land is permitted, standard erosion and sediment control (ESC) measures should be applied that meet or exceed Ontario Provincial Standards and Specifications (OPSS) to ensure relatively sediment free water either infiltrates or reaches drainage features which typically carry surface water such that sediment laden water does not enter Rambo Creek. The control measures shall be implemented prior to work, be maintained during construction, and until disturbed areas have been effectively stabilized with permanent vegetation cover.

4.0 Impact Assessment

4.1 Private Water Supply

A water well record search was conducted within a 0.5 km radius of the site. The records were obtained from the Ministry of the Environment, Conservation and Parks (MECP) online interactive Water Well Record database.

The search returned a total of 40 well records located within the search area. None of the well records were listed water supply wells, all of the well records were listed as monitoring, test hole, observation well, abandoned, or other status.

Considering that this area is an urban residential neighborhood serviced by municipal water, and there are no domestic water supply wells, impacts on private water supply are not expected.

4.2 Source Water Protection

A review of Source Water Protection documents prepared on behalf of the Halton-Hamilton Source Protection Committee (2015) indicated that municipal water supply for the City of Burlington is sourced from Lake Ontario.

All discharged water would be expected to eventually enter Lake Ontario, however the discharge water will either be treated as sanitary sewer water, or should the water quality be sufficient to

discharge to the storm sewer or land, it is expected that the water would be discharged in such a manner that the discharge water quality water eventually entering Lake Ontario would not impact the municipal water supply at the intake.

There are no municipal wells within the urban boundary of the City of Burlington and thus the Site is not within any WHPAs of any municipal wells.

4.3 Subsidence and Settlement

Dewatering can cause settlements due to a decrease in pore water pressure accompanied by an increase of effective stress of the soil that is being subject to dewatering. A review of the boreholes advanced by Soil-Mat (2016 & 2017) and by Wood for this hydrogeological assessment shows that the excavation, particularly that below the groundwater level will be within the shale bedrock. Based on this, it is not expected that there will be any subsidence or settlement impacts related to dewatering.

4.4 Surface Water & Natural Environment

Surface water and the natural environment can be affected by dewatering operation where surface water is intercepted by dewatering. At depths where the bedrock between Rambo Creek and the excavation are unweathered and remain relatively undistributed, due to the relatively low permeability of the shale, this will act as an barrier between the excavation and Rambo Creek and will restrict the ability for water to flow from the creek through the shale to the excavation. However, should weathered or fractured shale bedrock extend below the groundwater level, or the bedrock is disturbed during construction, the estimated hydraulic conductivity would likely be underestimated and additional inflow from Rambo creek would be expected.

4.5 Potential Mitigation Measures

Based on the hydrogeological assessment, reduced flow in Rambo Creek downstream of the site may be expected.

To mitigate a reduction in flow in Rambo Creek during construction, should the discharge water be found to be of suitable water quality, by discharging dewatering discharge water in a suitable manner to the storm sewer, this would reintroduce water back into Rambo Creek downstream of the storm sewer outlet.

To mitigate a reduction in flow in Rambo Creek for the permanent building, a watertight structure design, if feasible would remove the need for dewatering and thus would eliminate any dewatering effects on Rambo Creek. A second option, also if feasible may be to line the excavation walls closest to Rambo Creek with a low permeability material to restore a less permeable barrier between the creek and the building's drainage system.

5.0 Closure

The Limitations of this Report, as stated in Appendix F, form an integral part of this Report.

We trust that the information presented in this report meets your current requirements. Should you have any questions, or concerns, please do not hesitate to contact the undersigned.

Respectfully Submitted,

Wood Environment & Infrastructure Solutions,
a Division of Wood Canada Limited.

Prepared by:





Nick Schmidt, B.Sc., P.Geo
Senior Hydrogeologist

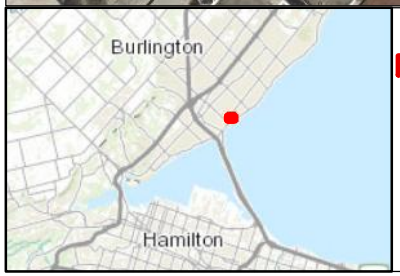
Reviewed by:



Simon Gautrey, M.Sc, MBA, P.Geo.
Senior Associate Hydrogeologist

Figures





LEGEND

Site Location

NOTES:

LOCATION OF FEATURES ARE APPROXIMATE

This drawing should be read in conjunction with the Wood Environment & Infrastructure Solutions Report No. TPB163165

Conditions encountered in the field may be different from the interpreted information presented on this figure.

SOURCE: Google Earth, 2015, ORN, 2012.. OHN, 2012

CLIENT: Landform Development Group

Drawn By: LJM	Checked By: NS
Revision: A	Projection: UTM Zone 17N
SCALE: 1:1,500	

N W E S

HYDROGEOLOGICAL ASSESSMENT

401-417 Martha Street Burlington, Ontario

Site Location

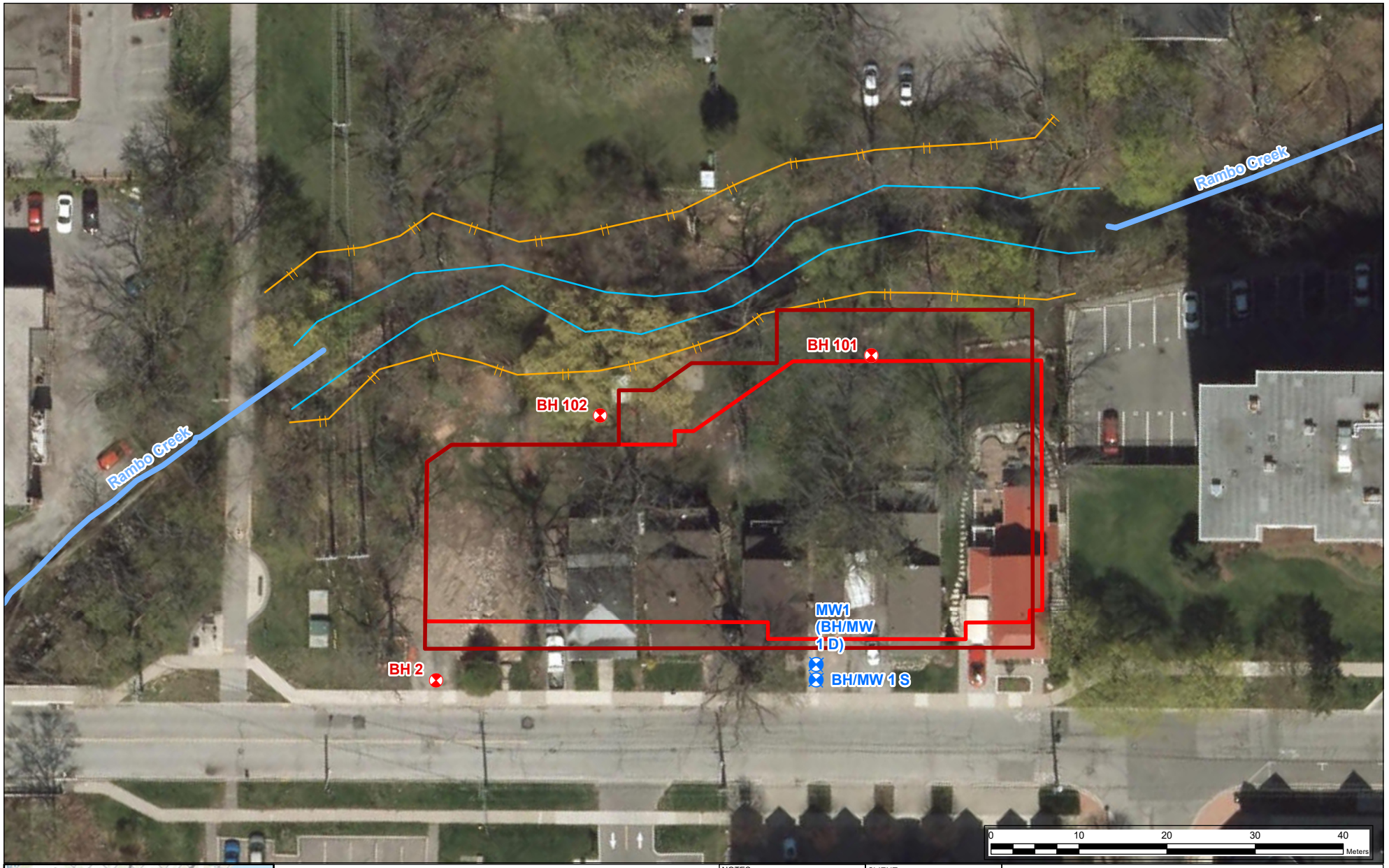
PROJECT N°: TPB163165.1801

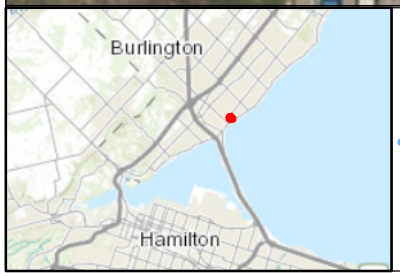
FIGURE: 1

DATE: October, 2018

Wood Environment & Infrastructure Solutions
3450 Harvester Rd, Suite 100., Burlington, Ontario, L7N 3W5
tel: 905-335-2353 www.woodplc.com

wood.





LEGEND

- BH Location
- Monitoring Well Location
- Permanent Watercourse
- SurveyedTop of Slope
- Surveyed Limits of Creek
- Limits of Building at Ground Surface
- Limits of Underground Parking

NOTES:

LOCATION OF FEATURES ARE APPROXIMATE

This drawing should be read in conjunction with the Wood Environment & Infrastructure Solutions Report No. TPB163165

Conditions encountered in the field may be different from the interpreted information presented on this figure.

SOURCE: Google Earth, 2015, ORN, 2012.. OHN, 2012

CLIENT:
Landform Development Group

Drawn By: TY	Checked By: NS
Revision: A	Projection: UTM Zone 17N
SCALE: 1:600	

HYDROGEOLOGICAL ASSESSMENT

401-417 Martha Street Burlington, Ontario

Proposed Development & Borehole Location Plan

PROJECT N°: TPB163165.1801

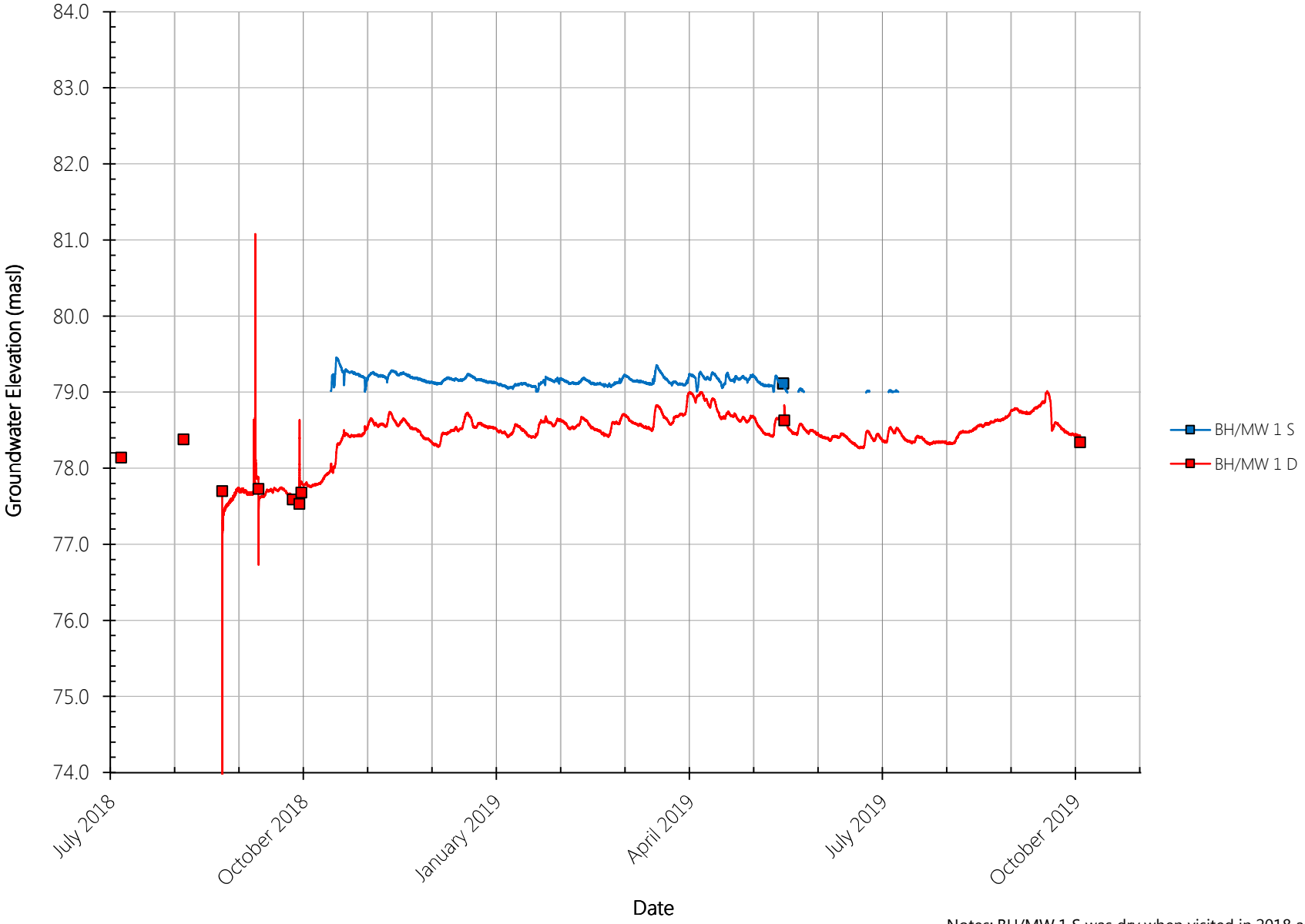
FIGURE: 2

DATE: November, 2020

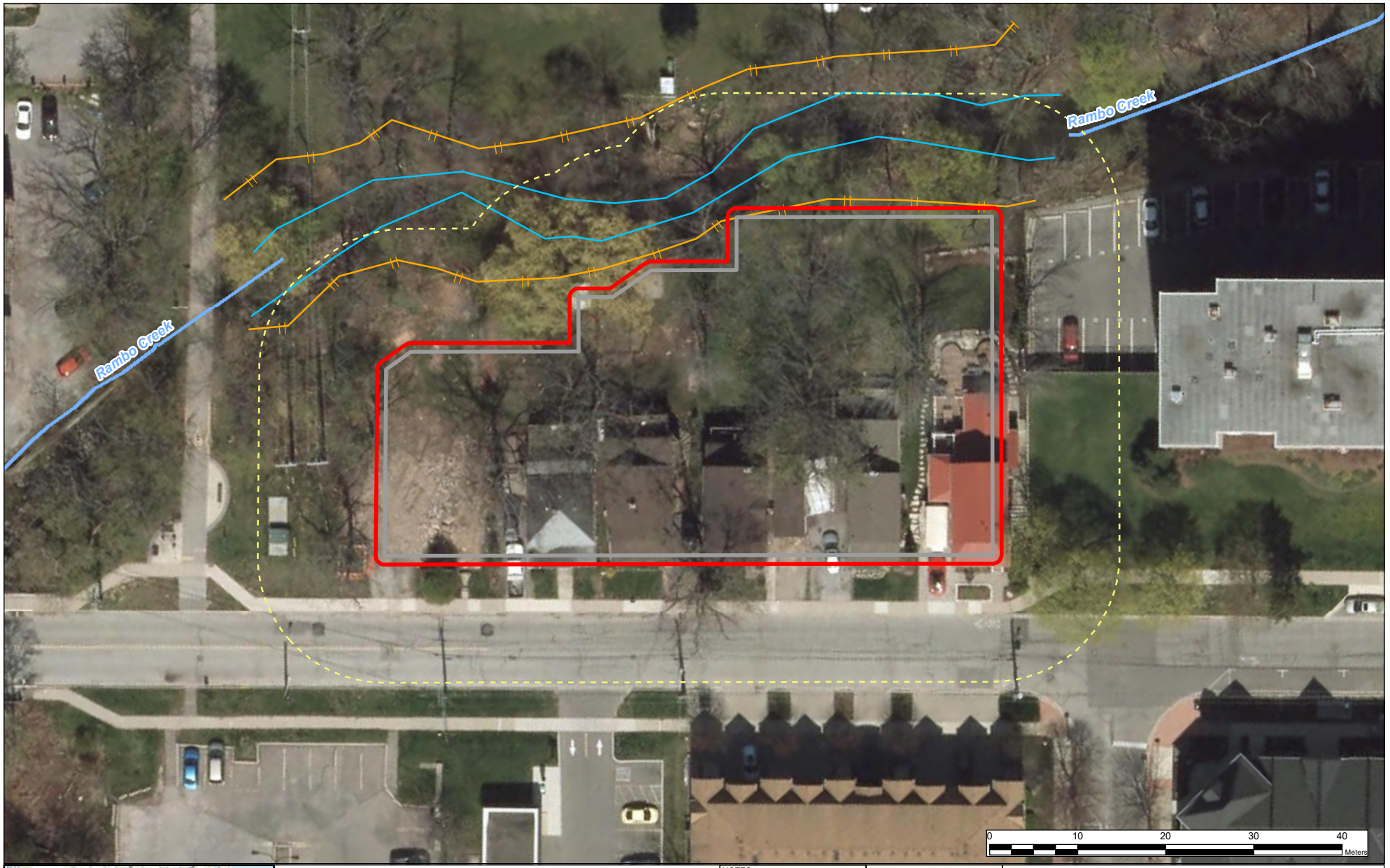
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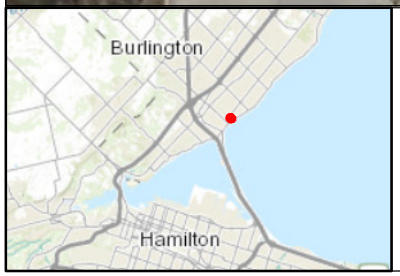
wood.

Figure 3: Hydrograph of Groundwater Elevations



Notes: BH/MW 1 S was dry when visited in 2018 and October 2019.
Transducer failure in BH/MW 1 S in August 2019.





LEGEND

- Surveyed Top of Slope
- Surveyed Limits of Creek
- Limits of Underground Parking
- Excavation Area
- Zone of Influence

NOTES:

LOCATION OF FEATURES ARE APPROXIMATE

This drawing should be read in conjunction with the Wood Environment & Infrastructure Solutions Report No. TPB163165

Conditions encountered in the field may be different from the interpreted information presented on this figure.

SOURCE: Google Earth, 2015, ORN, 2012.. OHN, 2012

CLIENT: Landform Development Group

Drawn By: TY	Checked By: NS
Revision: A	Projection: UTM Zone 17N
SCALE: 1:600	

HYDROGEOLOGICAL ASSESSMENT

401-417 Martha Street Burlington, Ontario

Zone of Influence

PROJECT N°: TPB163165.1801

FIGURE: 4

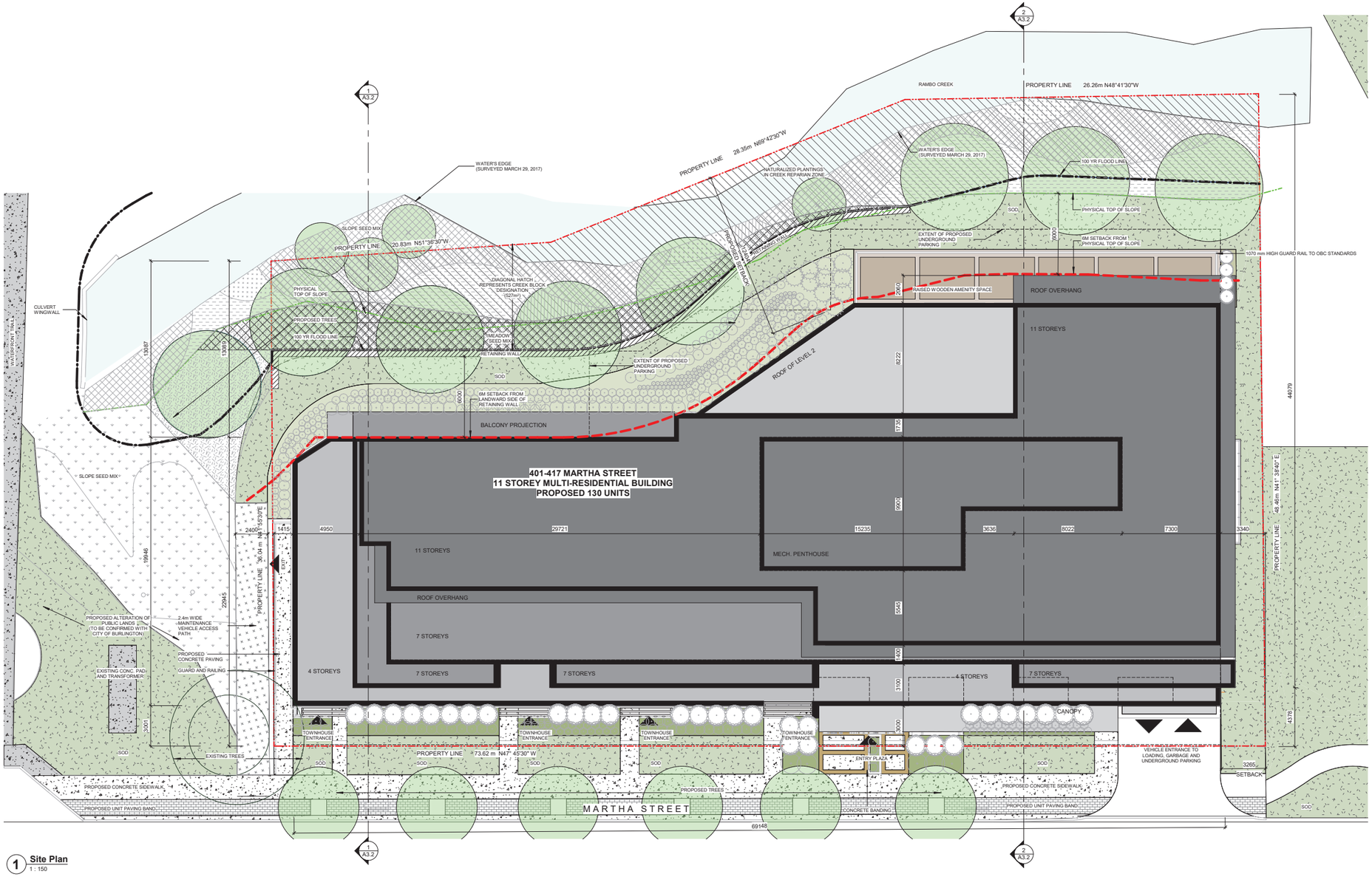
DATE: November, 2020

Wood Environment & Infrastructure Solutions
3450 Harvester Rd, Suite 100., Burlington, Ontario, L7N 3W5
tel: 905-335-2353 www.woodplc.com

Appendix A

Architectural Site Plan Drawings

Do not scale drawings. Contractors must check and verify all dimensions and report any discrepancies to the Architect before proceeding with the work. All documents remain the property of the Architect. Unauthorized use, modification, and/or reproduction of these documents is prohibited without written permission. The Contract Documents were prepared by the Consultant for the purpose of the Project and the Consultant assumes no responsibility for any use of the Contract Documents for purposes other than those intended by the Consultant. Any such use, or any reliance thereon, by any third party is at such party's sole risk. The Consultant accepts no responsibility for any alterations made to the Contract Documents by others. Any such alterations must be clearly identified as such, and the Consultant must be indemnified by the party responsible for the alterations against all claims, costs, losses and damages arising out of the alterations.



1 Site Plan
1 : 150

FLOOR PLAN EFFICIENCY

DATA	FLOOR AREA	CIRC./SERV.	AMENITY	RESIDENTIAL	EFF.
LEVEL 1	17,528 ft²	9,726 ft²	1,756 ft²	6,046 ft²	34.5%
LEVEL 1 - MEZZ	6,046 ft²			6,046 ft²	
LEVEL 2-4	15,523 ft² (x3)	1,940 ft² (x3)	-	13,583 ft² (x3)	87.5%
LEVEL 5-7	13,085 ft² (x3)	2,167 ft² (x3)	-	10,918 ft² (x3)	83.4%
LEVEL 8-11	10,733 ft² (x4)	2,571 ft² (x4)	-	8,162 ft² (x4)	76.0%
LEVEL P1	20,588 ft²		-		
LEVEL P2- P4	23,349 ft² (x3)		-		
TOTALS	242,965 ft²		1,756 ft²	118,243 ft²	

UNIT DATA

UNIT TYPE	QTY.	AREA RANGE
1 BEDROOM	44 (33.8%)	602 - 770 ft²
1 BEDROOM + DEN	10 (7.7%)	907 - 915 ft²
2 BEDROOM	42 (32.3%)	715 - 1080 ft²
3 BEDROOM	20 (20.8%)	1,033 - 1,149 ft²
2 BEDROOM TOWN HOUSE	1 (0.77%)	1162 ft²
3 BEDROOM TOWN HOUSE	6 (4.62%)	1540 - 2076 ft²
TOTALS	130 (100 %)	492-1153 ft²

PARKING DATA	QTY.
LEVEL P1	29
LEVEL P2- P4	46x3
TOTALS	**167**

BUILDING DATA

DATA	REQUIRED	PROVIDED
TOTAL DENSITY (# of units)	185 UNITS / HECTARE AT 0.32 ha = 59 units max	130 UNITS 0.32 ha = 407 units / ha
BUILDING AREA (m²)		**17,528 S.F (1,628 S.M.)**
BUILDING COVERAGE	1,628 S.M. of 3,162 sm = 51.5% coverage	
GROSS FLOOR AREA (m²)		**152,330 S.F. (14,152 S.M.)**
CONSTRUCTION FLOOR AREA (m²)		**242,965 S.F. (22,572 S.M.)**
NUMBER OF STOREYS	---	11
BUILDING HEIGHT (m)	22m MAX.	+/- 39.7m from Martha St.
COMMERCIAL/RETAIL AREA (m²)		N/A
AMENITY AREA (M²)	5 m² per unit = 5 m² x 130 = 650 m²	163 m² indoor + Terrace and Balconies

VEHICLE PARKING DATA

DATA	REQUIRED	PROVIDED
RESIDENTIAL PARKING	1.00 / UNIT = 130 stalls	134 stalls
BARRIER FREE PARKING (included)	3% OF REQ'D = 4	4 stalls (included in above)
VISITOR PARKING (additional)	0.25 / UNIT = 32.5	33 stalls
TOTAL PARKING	**163**	**167**
LOADING SPACES		1 SPACE
NUMBER OF VEHICLE ENTRANCES		1 ENTRANCE

SITE DATA

401-417 Marta Street, Burlington, Ontario
Part of Lot 92, Registered Plan 99

DATA		REQUIRED	PROVIDED
ZONING		ZONING - H-DRH	Site Specific
LOT AREA (m²)			3,162 m²
CREEK DEDICATION (m²)			527 m²
REVISED LOT AREA (m²)			2,635 m²
SETBACKS	FRONT YARD (meters)	6m (7.5m if street width= 26m)	3.0m
	INTERIOR SIDE YARD (m)	6m	1.4m NORTH
	INTERIOR SIDE YARD (m)	6m	3m SOUTH
	REAR YARD (m)	7.5m	11.96m
U/G SETBACKS	FRONT YARD (meters)	6m (7.5m if street width= 26m)	0m
	INTERIOR SIDE YARD (m)	6m	1.4m NORTH
	INTERIOR SIDE YARD (m)	6m	3m SOUTH
	REAR YARD (m)	7.5m	12.0m

PARKING STRUCTURE DOES NOT CONFORM TO SETBACKS STATED IN THE OLD ZONING APPLICATION - 1990



KEY PLAN
1 : 5000

SITE PLAN LEGEND

(EXISTING) CONCRETE SIDEWALK
(PROPOSED) PROPOSED CONCRETE PATH
(PROPOSED) MAINTENANCE VEHICLE PATH
(PROPOSED) ASPHALT PATH
(PROPOSED) UNIT PAVING BAND
PROPOSED UNDERGROUND PARKING LINE
PROPERTY LINE/ SETBACK FROM HAZARD LINE (CLOSER OF EITHER: 100 YEAR FLOOD PLANE OR PHYSICAL TOP OF SLOPE
RETAINING WALL
CREEK BLOCK DESIGNATION
MEADOW SEED MIX
LANDSCAPED
SOD
WOODEN AMENITY
EXISTING TREES
PROPOSED TREES
CONCRETE BANDING
EXISTING CREEK

Project North **True North**

No.	Date	Revision
2	2020-12-18	RE-ISSUED FOR SITE PLAN APPROVAL
1	2020-11-06	ISSUED FOR SITE PLAN APPROVAL

srm ARCHITECTS INC.

Project No 17032
Issue Date
Drawn by PG
Checked by WC
Plot Date / Time 2020-12-15 11:38:44 AM

MARTHA STREET, BURLINGTON

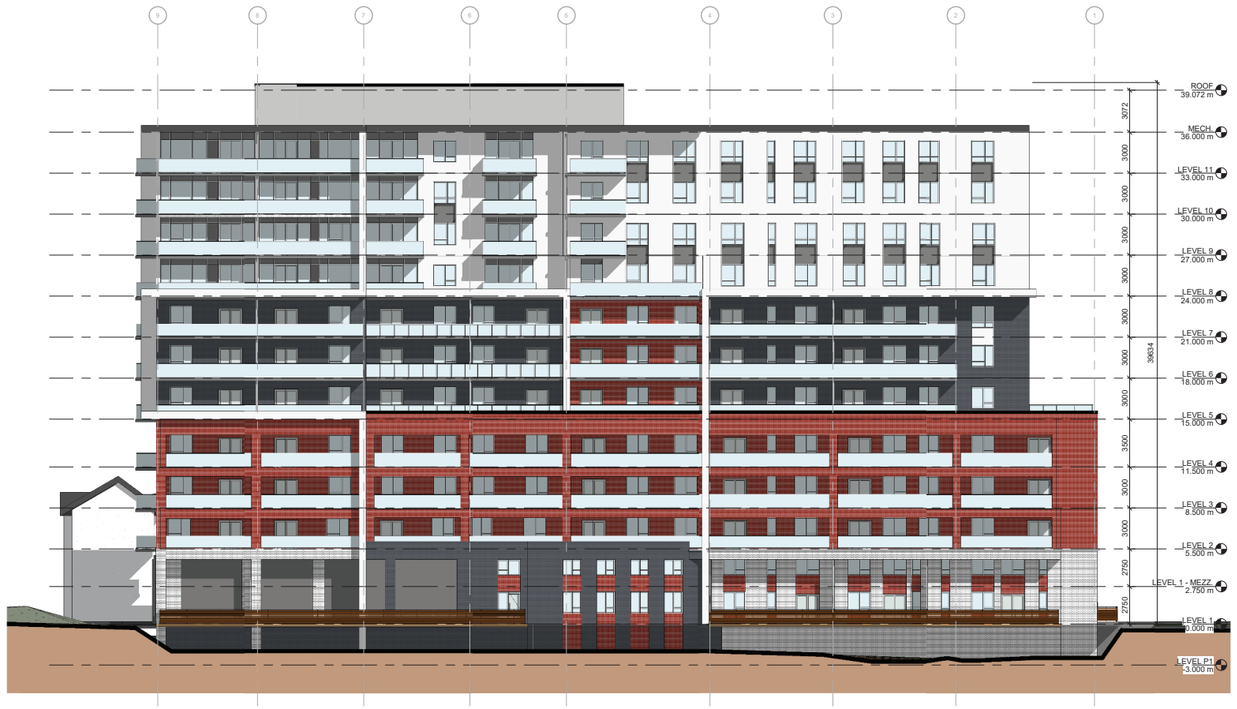
SITE PLAN

ONTARIO ASSOCIATION OF ARCHITECTS
EDWARD THOMAS LICENCE 5572

Drawing Scale As indicated
Status
Drawing No. A1.1 - r2
Revision No.



4 **North Elevation**
1 : 200



3 **East Elevation**
1 : 200



2 **South Elevation**
1 : 200



1 **West Elevation**
1 : 200

GENERAL NOTES

1. **DO NOT SCALE DRAWINGS**. WRITTEN DIMENSIONS SHALL HAVE PRECEDENCE OVER SCALED DIMENSIONS.
2. ALL WORK SHALL COMPLY WITH THE 2012 ONTARIO BUILDING CODE AND AMENDMENTS.
3. CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND SPECIFICATIONS AND REPORT ANY DISCREPANCIES TO THE ARCHITECT BEFORE PROCEEDING WITH THE WORK.
4. ALL CONTRACTORS AND SUB-CONTRACTORS SHALL HAVE A SET OF APPROVED CONSTRUCTION DOCUMENTS ON SITE AT ALL TIMES.
5. ALL DOCUMENTS REMAIN THE PROPERTY OF THE ARCHITECT. UNAUTHORIZED USE, MODIFICATION, AND/OR REPRODUCTION OF THESE DOCUMENTS IS PROHIBITED WITHOUT WRITTEN PERMISSION. THE CONTRACT DOCUMENTS WERE PREPARED BY THE CONSULTANT FOR THE ACCOUNT OF THE OWNER.
6. THE MATERIAL CONTAINED HEREIN REFLECTS THE CONSULTANTS BEST JUDGEMENT IN LIGHT OF THE INFORMATION AVAILABLE TO HIM AT THE TIME OF PREPARATION. ANY USE WHICH A THIRD PARTY MAKES OF THE CONTRACT DOCUMENTS, OR ANY RELIANCE ON/OR DECISIONS TO BE MADE BASED ON THEM ARE THE RESPONSIBILITY OF SUCH THIRD PARTIES.
7. THE CONSULTANT ACCEPTS NO RESPONSIBILITY FOR DAMAGES, IF ANY, SUFFERED BY ANY THIRD PARTY AS A RESULT OF DECISIONS MADE OR ACTIONS BASED ON THE CONTRACT DOCUMENTS.

No.	Date	Revision
2	2020-12-18	RE-ISSUED FOR SITE PLAN APPROVAL
1	2020-11-06	ISSUED FOR SITE PLAN APPROVAL

srm ARCHITECTS INC.

Project No	17032
Issue Date	
Drawn by	KJ
Checked by	WC
Plot Date / Time	2020-12-15 11:39:10 AM

MARTHA STREET, BURLINGTON

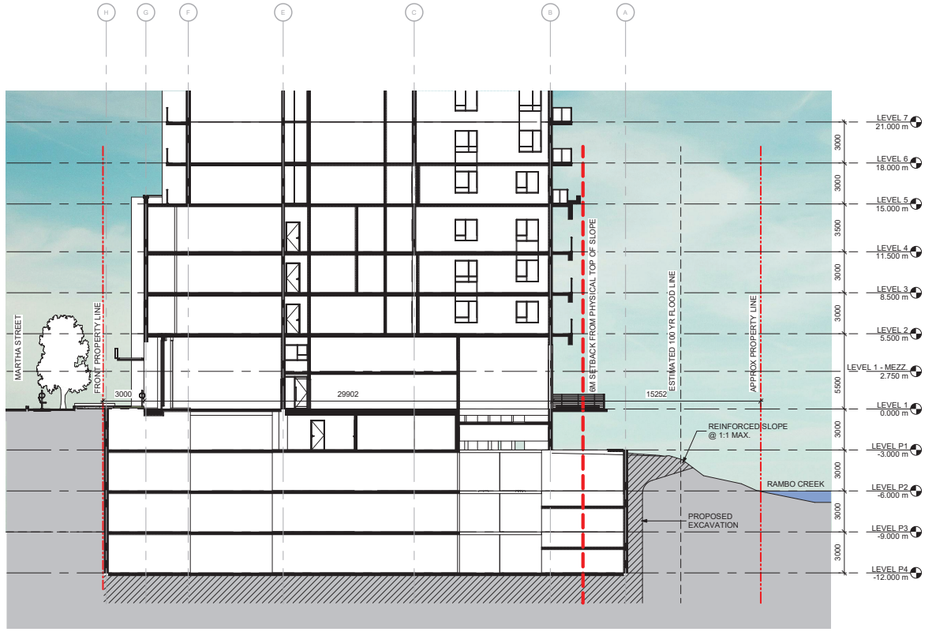
ELEVATIONS

ONTARIO ASSOCIATION OF ARCHITECTS
EDWARD THOMAS
LICENCE
5572

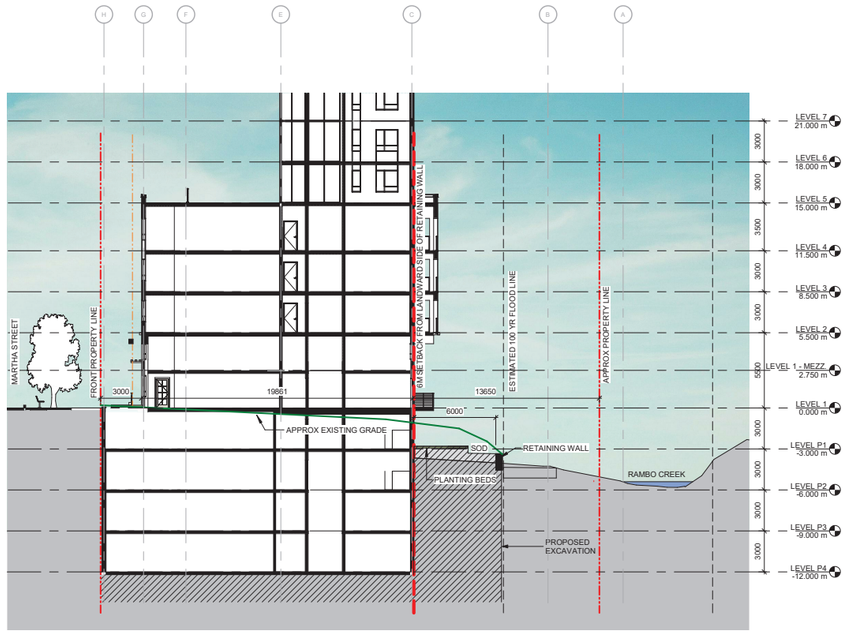
Drawing Scale	As indicated
Status	
Drawing No.	A3.1
Revision No.	- r2

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2 **SITE SECTION 2**
1 : 200



1 **SITE SECTION 1**
1 : 200

GENERAL NOTES

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No.	Date	Revision
2	2020-12-18	RE-ISSUED FOR SITE PLAN APPROVAL
1	2020-11-06	ISSUED FOR SITE PLAN APPROVAL

srm ARCHITECTS INC.

Project No 17032
Issue Date
Drawn by KJ
Checked by WC
Plot Date / Time 2020-12-15 11:39:12 AM

MARTHA STREET, BURLINGTON

BUILDING SECTIONS

ONTARIO ASSOCIATION OF ARCHITECTS
EDWARD THOMAS LICENCE 5572

Drawing Scale As indicated
Status
Drawing No. A3.2 Revision No. - r2

Appendix B

Borehole Logs

RECORD OF BOREHOLE No. BH/MW 1 S

Project Number: **TPB163165.1801**
Drilling Location: **597791; 4797904**
Project Client: **Landform Development Group**
Drilling Method: **150 mm Solid Stem Augers**
Project Name: **401-417 Martha Street**
Drilling Machine: **Truck Mounted Drill**
Project Location: **409 Martha Street**
Date Started: **Aug 15, 18** Date Completed: **Aug 15, 18**

Logged by: **TH** Compiled by: **TH** Reviewed by: **TR** Revision No.: **0, 10/11/18**

wood.

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Local Ground Surface Elevation:	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	Soil Vapour Reading: □ COV (LEL) ■ TOV (LEL) 2 4 6 8; △ COV (ppm) ▲ TOV (ppm) 100 200 300 400; W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	Grey Sand & Gravel **FILL** trace silt moist 0.2	SS	1	17	1			○			
	Brown Sandy SILT **FILL** trace gravel										
	Brown **Clayey SILT** trace sand moist 0.6										
		SS	2	79	9	1		○			
	Reddish Brown										
		SS	3	100	66			○			
	Red **Weathered Shale** 2.0					2					
		SS	4	100	94/ 225mm						
						3					
		SS	5	91	50/ 125mm						
		SS	6	50	50/ 50mm	4					
		SS	7	0	50/ 25mm						
	Borehole Terminated 4.6										

▽ No freestanding groundwater observed in open borehole upon completion of drilling.

Wood
Environment & Infrastructure Solutions
3450 Harvester Road
Burlington, Ontario, L7N 3W5
Canada
Tel. No.: 1 (905) 335-2353
wood.com

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 34

Project No: SM 166905-G

Log of Borehole No. 1

Project: Proposed Residential Development

Project Manager: Ian Shaw, P.Eng.

Location: 401-417 Martha St., Burlington, ON

Borehole Location: See Drawing No. 1

Client: Landform Development Group Inc.

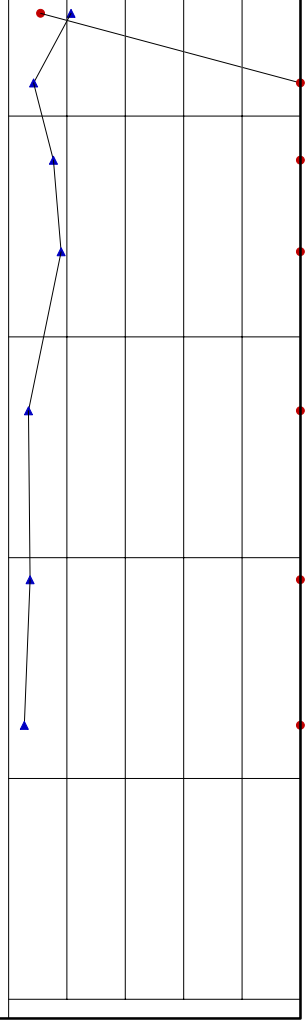
SUBSURFACE PROFILE

SAMPLE

Depth (ft)	Depth (m)	Elevation [m]	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		0.00	Ground Surface							
0	0		***Gravel*** Approximately 150 millimetres in thickness							
2			***Clayey Silt*** Brown, trace gravel, stiff							
4		-1.30		SS	1	5,4,7,13	11			
6	2		***Queenston Shale*** Red, severely weathered in the upper level, becoming more sound with depth, occasional more resistant grey layers, hard in terms of soil	SS	2	15,45,50/1"	100			
8				SS	3	22,50/3"	100			
10				SS	4	23,45,50/1"	100			
12	4									
14										
16				SS	5	50/2"	100			
18										
20	6			SS	6	50/2"	100			
22										
24		-7.62		SS	7	50/1"	100			
26	8		Run #1: Cored from 7.62 to 8.54 metres	NQ						
28		-8.54	Recovery= 50% RQD= 91% Run#2 Cored from 8.54 to 10.06 metres							
30			Recovery= 100% RQD= 60%	NQ						
32		-10.04	Qu @ 9.9m= 51.6 MPa							

Moisture Content w% (10, 20, 30, 40)

Standard Penetration Test blows/300mm (20, 40, 60, 80)



Drill Method: Hollow-Stem Auger

Drill Date: August 4, 2016

Hole Size: 150mm

Drill Contractor: Davis Drilling

SOIL-MAT ENGINEERS & CONSULTANTS LTD.
130 Lancing Drive, Hamilton, ON L8W 3A1
Phone: (905) 318-7440 Fax: (905) 318-7455
e-mail: info@soil-mat.on.ca

Datum: Temporary Benchmark

Field Logged by: M. Brown

Checked by: I. Shaw

Project No: SM 166905-G

Log of Borehole No. 1

Project: Proposed Residential Development

Project Manager: Ian Shaw, P.Eng.

Location: 401-417 Martha St., Burlington, ON

Borehole Location: See Drawing No. 1

Client: Landform Development Group Inc.

SUBSURFACE PROFILE

Depth	Elevation [m]	Description
34		Run#3 Cored from 10.06 to 11.58 metres Recover= 98% RQD= 100% Qu @ 10.2m= 26.3 metres
36	-11.58	
38		Run #4 Cored from 11.58 to 13.10 metres Recovery= 100% RQD= 82% Qu @ 12.8m= 45.1 MPa
40	12	
42	-13.10	
44		Run #5 Cored from 13.10 to 14.62 metres Recovery= 98% RQD= 60%
46	14	
48	-14.62	
50		Run #6 Cored from 14.62 to 15.54 metres Recovery= 93% RQD= 80% Qu @ 14.8= 40.8 MPa
52	-15.54	End of Borehole
54	16	
56		
58	18	
60		
62		
64		

SAMPLE

Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
NQ						
NQ						
NQ						
NQ						

Moisture Content w% (10, 20, 30, 40)

Standard Penetration Test blows/300mm (20, 40, 60, 80)

NOTES:

1. Borehole was advanced using solid stem auger equipment on August 4, 2016 to termination at a depth of 7.6 metres. Bedrock was cored froma depth of 7.6 metres to a depth of 15.5 metres.

2. Borehole was recorded as 'wet' at a depth of 2.0 metres upon completion of drilling and backfilled as per Ontario Regulation 903. It is noted that the majority of waterencountered following drilling was the result of the introduction of water for coring purposes.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

4. A monitoring well was installed upon the completion of drilling and the following free groundwater levels have been measured:

September 9, 2016- 5.04m
September 3, 2016- 5.12m

Drill Method: Hollow-Stem Auger
Drill Date: August 4, 2016
Hole Size: 150mm
Drill Contractor: Davis Drilling

SOIL-MAT ENGINEERS & CONSULTANTS LTD.
130 Lancing Drive, Hamilton, ON L8W 3A1
Phone: (905) 318-7440 Fax: (905) 318-7455
e-mail: info@soil-mat.on.ca

Datum: Temporary Benchmark
Field Logged by: M. Brown
Checked by: I. Shaw
Sheet: 2 of 2

Project No: SM 166905-G

Log of Borehole No. 2

Project: Proposed Residential Development

Project Manager: Ian Shaw, P.Eng.

Location: 401-417 Martha St., Burlington, ON

Borehole Location: See Drawing No. 1

Client: Landform Development Group Inc.

SUBSURFACE PROFILE

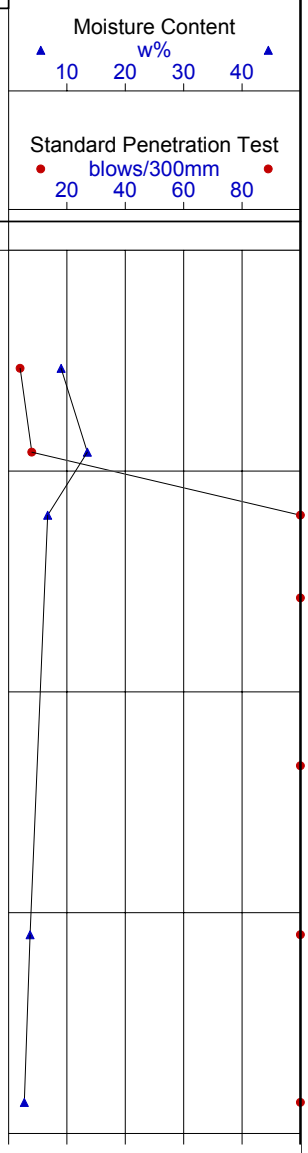
Depth (ft)	Depth (m)	Elevation [m]	Description
0	0	0.00	Ground Surface
		-0.20	**Gravel**
			Approximately 200 millimetres in thickness
			Clayey Silt Fill
			Brown, trace coal fragments and slag, firm
		-1.50	
			Clayey Silt
	2	-2.10	Brown, trace gravel, stiff
			Queenston Shale
			Red, severely weathered in the upper level, becoming more sound with depth, occasional more resistant grey layers, hard in terms of soil
	4		
	6		
	8	-7.82	End of Borehole

SAMPLE

Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
SS	1	4,2,2,6	4			
SS	2	6,4,4,6	8			
SS	3	32,50/3"	100			
SS	4	50/3"	100			
SS	5	50/2"	100			
SS	6	50/2"	100			
SS	7	50/1"	100			

Moisture Content w% (10, 20, 30, 40)

Standard Penetration Test blows/300mm (20, 40, 60, 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on August 4, 2016 to termination at a depth of 7.8 metres.
2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.
3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Hollow-Stem Auger
Drill Date: August 4, 2016
Hole Size: 150mm
Drill Contractor: Davis Drilling

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Phone: (905) 318-7440 Fax: (905) 318-7455
e-mail: info@soil-mat.on.ca

Datum: Temporary Benchmark
Field Logged by: M. Brown
Checked by: I. Shaw
Sheet: 1 of 1

Project No: SM 166905-G

Project: Slope Stability Assessment

Location: 401-417 Martha St., Burlington, ON

Client: Landform Development Group Inc.

Log of Borehole No. 101

Project Manager: Ian Shaw, P.Eng.

Borehole Location: See Drawing No. 1

Soil-Mat

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Elevation [m]	Description
0	0	97.65	Ground Surface
			Topsoil Approximately 100 millimetres of overlying topsoil.
			Silty Sand Fill Brown, with trace gravel, brick, and debris, very loose to loose.
		95.10	
			Queenston Shale Red, severely weathered in the upper level, becoming more sound with depth, with occasional more resistant grey layers, hard in terms of soil.
		94.20	
			End of Borehole

NOTES:

1. Borehole was advanced using solid stem auger equipment on February 9, 2017 to termination at a depth of 3.5 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

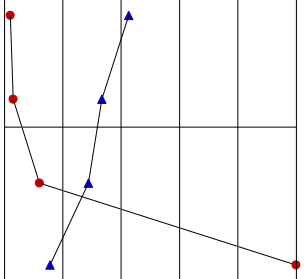
SAMPLE

Type	Number	Blow Counts	Blows/300mm	Recovery
SS	1	1,1,1	2	
SS	2	2,1,2	3	
SS	3	3,5,7	12	
SS	4	40,24, 50/3"	100	

PP (kgf/cm2) | U.Wt.(kN/m3)

Moisture Content w% 10 20 30 40

Standard Penetration Test blows/300mm 20 40 60 80



Drill Method: Solid Stem Augers
Drill Date: February 9, 2017
Hole Size: 150mm
Drill Contractor: Determination

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130 Lancing Drive, Hamilton, ON L8W 3A1
Phone: (905) 318-7440 Fax: (905) 318-7455
e-mail: info@soil-mat.on.ca

Datum: Temporary Benchmark
Field Logged by: RM
Checked by: IS
Sheet: 1 of 1

Project No: SM 166905-G

Project: Slope Stability Assessment

Location: 401-417 Martha St., Burlington, ON

Client: Landform Development Group Inc.

Log of Borehole No. 102

Project Manager: Ian Shaw, P.Eng.

Borehole Location: See Drawing No. 1

Soil-Mat

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Elevation [m]	Description	Well Data
0	0	96.70	Ground Surface	
			Topsoil Approximately 150 millimetres of overlying topsoil.	
		95.70	**Silty Sand Fill** Brown, with trace clay, gravel, and debris, loose.	
		95.00	**Queenston Shale** Red, severely weathered in the upper level, becoming more sound with depth, with occasional more resistant grey layers, hard in terms of soil.	
			End of Borehole	

NOTES:

1. Borehole was advanced using solid stem auger equipment on February 9, 2017 to termination at a depth of 1.7 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

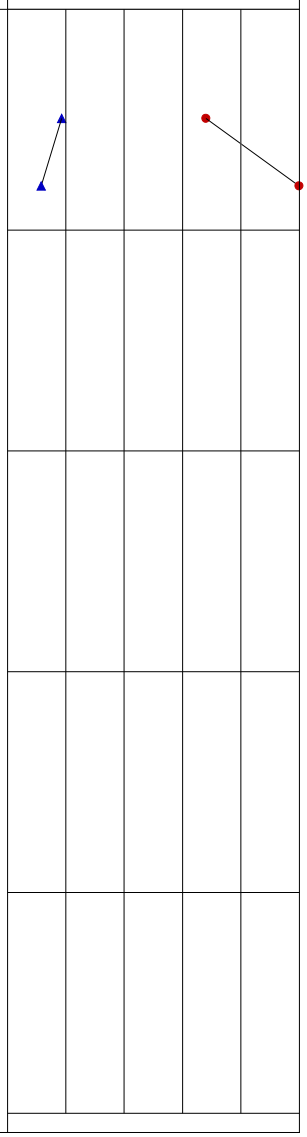
3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

SAMPLE

Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
SS	1	17,24,44	68			
SS	2	25,50/2"	100			

Moisture Content w% 10 20 30 40

Standard Penetration Test blows/300mm 20 40 60 80



Drill Method: Solid Stem Augers

Drill Date: February 9, 2017

Hole Size: 150mm

Drill Contractor: Determination

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e-mail: info@soil-mat.on.ca

Datum: Temporary Benchmark

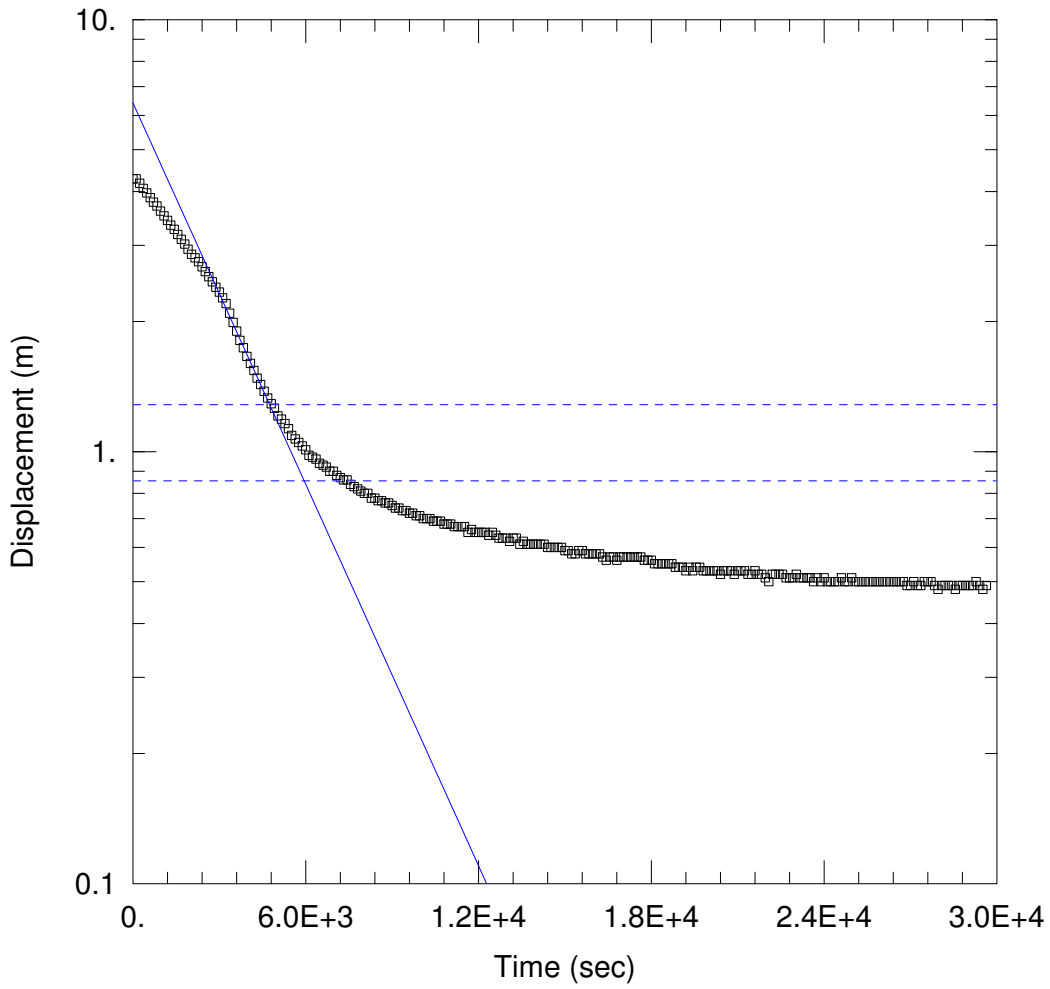
Field Logged by: RM

Checked by: IS

Sheet: 1 of 1

Appendix C

Hydraulic Conductivity Results



WELL TEST ANALYSIS

Data Set: P:\...\BHMW 1 D #1.aqt
Date: 10/24/18 Time: 14:54:30

PROJECT INFORMATION

Company: Wood
Client: Landform Development Group Inc
Project: TPB163165.1801
Location: 409 Martha St, Burlington ON
Test Well: BH/MW1
Test Date: September 10, 2018

AQUIFER DATA

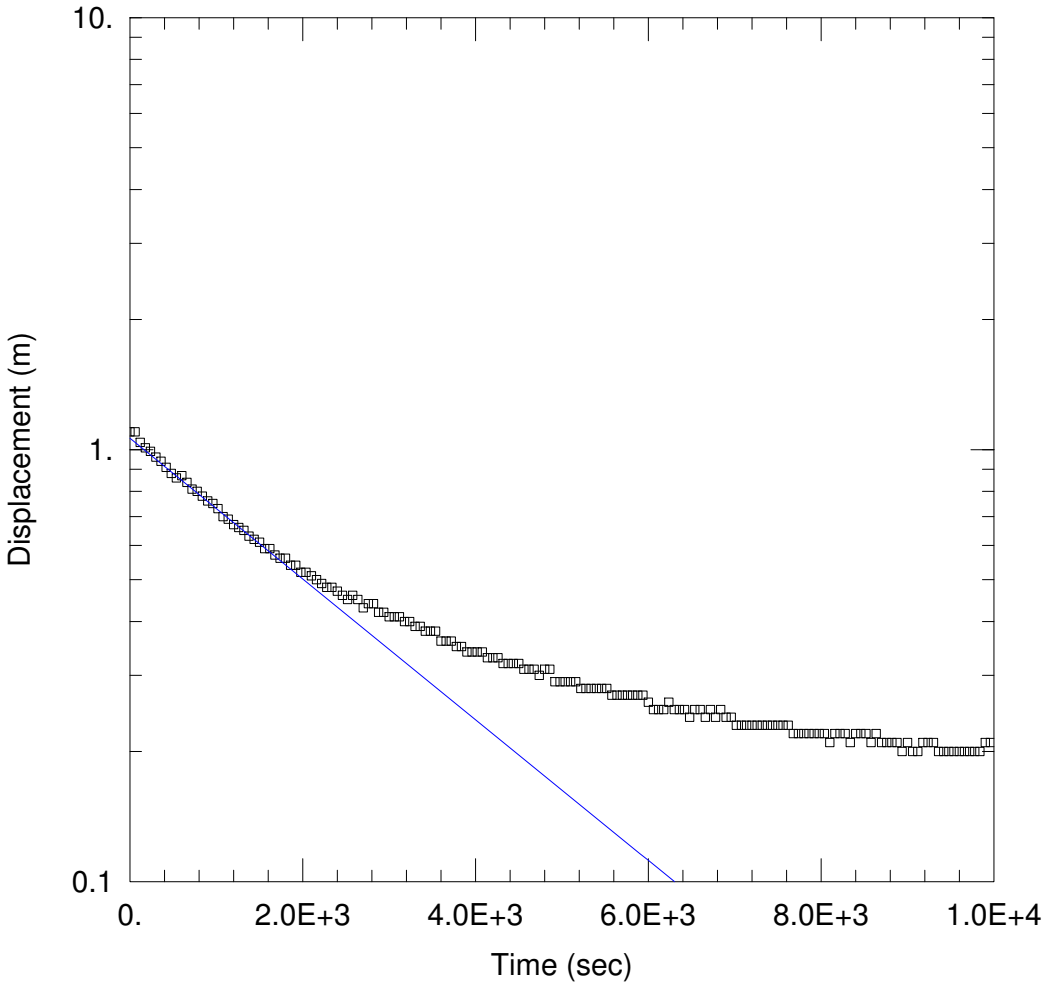
Saturated Thickness: 9.54 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BH/MW 1 D)

Initial Displacement: 4.28 m
Total Well Penetration Depth: 9.54 m
Casing Radius: 0.0254 m
Static Water Column Height: 9.54 m
Screen Length: 9.14 m
Well Radius: 0.075 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 5.168E-8 m/sec
y0 = 6.41 m



WELL TEST ANALYSIS

Data Set: P:\...\BHMW 1 D #2.aqt
Date: 10/24/18 Time: 14:54:42

PROJECT INFORMATION

Company: Wood
Client: Landform Development Group Inc
Project: TPB163165.1801
Location: 409 Martha St, Burlington ON
Test Well: BH/MW 1 D
Test Date: October 16, 2018

AQUIFER DATA

Saturated Thickness: 9.37 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BH/MW 1 D)

Initial Displacement: 1.1 m
Total Well Penetration Depth: 9.37 m
Casing Radius: 0.0254 m
Static Water Column Height: 9.37 m
Screen Length: 9.14 m
Well Radius: 0.075 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 6.334E-8 m/sec y0 = 1.062 m

Appendix D

Laboratory Results

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: WOOD ENVIRONMENTAL & INFRASTRUCTURE SOLUTIONS
3300 Merrittville Hwy, Unit 5
Thorold, ON L2V4Y6
(905) 687-6616

ATTENTION TO: Nick Schmidt

PROJECT: TPB163165.1801

AGAT WORK ORDER: 18T391313

TRACE ORGANICS REVIEWED BY: Pinkal Patel, Report Reviewer

WATER ANALYSIS REVIEWED BY: Yris Verastegui, Report Reviewer

DATE REPORTED: Oct 09, 2018

PAGES (INCLUDING COVER): 13

VERSION*: 2

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES
VERSION 2: Revised report with PWQO guideline, issued on Oct 12, 2018.

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

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Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested and to all the items tested
All reportable information as specified by ISO 17025:2005 is available from AGAT Laboratories upon request

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Certificate of Analysis

AGAT WORK ORDER: 18T391313

PROJECT: TPB163165.1801

CLIENT NAME: WOOD ENVIRONMENTAL & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Nick Schmidt

SAMPLING SITE:409 Martha St

SAMPLED BY:ET

Halton Sanitary and Combined Sewer Use By-law - Organics

DATE RECEIVED: 2018-09-28

DATE REPORTED: 2018-10-09

Parameter	Unit	G / S: A	G / S: B	RDL	SAMPLE DESCRIPTION: MW1-D SAMPLE TYPE: Water DATE SAMPLED: 2018-09-27 9589471	SAMPLE DESCRIPTION: Stream SAMPLE TYPE: Water DATE SAMPLED: 2018-09-27 9589624
Oil and Grease (animal/vegetable) in water	mg/L	150		0.5	0.9[<A]	1.3[<A]
Oil and Grease (mineral) in water	mg/L	15		0.5	<0.5	<0.5
Methylene Chloride	mg/L	2		0.0003	<0.0003	<0.0003
Chloroform	mg/L	0.04		0.0002	<0.0002	0.0007[<A]
Benzene	mg/L		0.1	0.0002	<0.0002	<0.0002
Trichloroethene	mg/L	0.4		0.0002	<0.0002	<0.0002
Toluene	mg/L	0.016	0.0008	0.0002	<0.0002	<0.0002
Tetrachloroethene	mg/L	1	0.05	0.010	<0.010	<0.010
Ethylbenzene	mg/L	0.16	0.008	0.0001	<0.0001	<0.0001
1,4-Dichlorobenzene	mg/L	0.08	0.004	0.0002	<0.0002	<0.0002
Naphthalene	mg/L	0.14	0.007	0.0003	<0.0003	<0.0003

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to ON Halton SN&Comb 15, B Refers to PWQO (mg/L)
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Results relate only to the items tested and to all the items tested

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AGAT WORK ORDER: 18T391313

PROJECT: TPB163165.1801

CLIENT NAME: WOOD ENVIRONMENTAL & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Nick Schmidt

SAMPLING SITE:409 Martha St

SAMPLED BY:ET

Dissolved Al & Hg (Water)

DATE RECEIVED: 2018-09-28

DATE REPORTED: 2018-10-09

		SAMPLE DESCRIPTION:		MW1-D	Stream
		SAMPLE TYPE:		Water	Water
		DATE SAMPLED:		2018-09-27	2018-09-27
Parameter	Unit	G / S	RDL	9589471	9589624
Aluminum (dissolved)	mg/L	0.075	0.004	0.008	0.009
Dissolved Mercury	mg/L	0.0002	0.0001	<0.0001	<0.0001

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO (mg/L) **Dependent on alkalinity
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Iris Verastegui

Results relate only to the items tested and to all the items tested

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AGAT WORK ORDER: 18T391313
PROJECT: TPB163165.1801

CLIENT NAME: WOOD ENVIRONMENTAL & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Nick Schmidt

SAMPLING SITE:409 Martha St

SAMPLED BY:ET

Halton Sanitary and Combined Sewer Use By-law - Inorganics

DATE RECEIVED: 2018-09-28

DATE REPORTED: 2018-10-09

					SAMPLE DESCRIPTION:	MW1-D		Stream
					SAMPLE TYPE:	Water		Water
					DATE SAMPLED:	2018-09-27		2018-09-27
Parameter	Unit	G / S: A	G / S: B	RDL	9589471	RDL	9589624
pH	pH Units	6.0-10.0	6.5-8.5	NA	7.61	NA	7.95
CBOD (5)	mg/L	300		5	<5	5	<5
Total Suspended Solids	mg/L	350		10	416[>A]	10	<10
Fluoride	mg/L	10		1.0	<1.0	1.0	<1.0
Sulphate	mg/L	1500		2.0	274[<A]	2.0	203[<A]
Total Cyanide	mg/L	2		0.002	<0.002	0.002	<0.002
Phenols	mg/L	1	0.001	0.002	<0.002	0.002	<0.002
Total Kjeldahl Nitrogen	mg/L	100		0.10	0.74[<A]	0.10	0.44[<A]
Total Phosphorus	mg/L	10	0.030	0.10	0.54[B-A]	0.02	0.07[B-A]
Total Aluminum	mg/L	50		0.020	15.3[<A]	0.020	0.110[<A]
Total Antimony	mg/L	5		0.020	<0.020	0.020	<0.020
Total Arsenic	mg/L	1		0.015	<0.015	0.015	<0.015
Total Beryllium	mg/L	5		0.010	<0.010	0.010	<0.010
Total Cadmium	mg/L	1		0.010	<0.010	0.010	<0.010
Total Chromium	mg/L	3		0.020	0.024[<A]	0.020	<0.020
Total Cobalt	mg/L	5		0.020	<0.020	0.020	<0.020
Total Copper	mg/L	3		0.015	<0.015	0.015	<0.015
Total Iron	mg/L	50		0.050	15.3[<A]	0.050	0.171[<A]
Total Lead	mg/L	3		0.020	<0.020	0.020	<0.020
Total Manganese	mg/L	5		0.020	0.479[<A]	0.020	0.027[<A]
Total Mercury	mg/L	0.05		0.0002	<0.0002	0.0002	<0.0002
Total Molybdenum	mg/L	5		0.020	<0.020	0.020	<0.020
Total Nickel	mg/L	3		0.015	0.022[<A]	0.015	<0.015
Total Selenium	mg/L	5		0.020	<0.020	0.020	<0.020
Total Silver	mg/L	5		0.020	<0.020	0.020	<0.020
Total Tin	mg/L	5		0.025	<0.025	0.025	<0.025
Total Titanium	mg/L	5		0.020	0.471[<A]	0.020	<0.020
Total Zinc	mg/L	3		0.020	0.074[<A]	0.020	0.357[<A]

Certified By: Iris Verastegui

Results relate only to the items tested and to all the items tested

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Certificate of Analysis

AGAT WORK ORDER: 18T391313

PROJECT: TPB163165.1801

CLIENT NAME: WOOD ENVIRONMENTAL & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Nick Schmidt

SAMPLING SITE:409 Martha St

SAMPLED BY:ET

Halton Sanitary and Combined Sewer Use By-law - Inorganics

DATE RECEIVED: 2018-09-28

DATE REPORTED: 2018-10-09

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to ON Halton San. Comb, B Refers to PWQO (mg/L) **Dependent on alkalinity
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9589471-9589624 Elevated RDLs indicate the degree of sample dilutions prior to the analysis to keep analytes within the calibration range, reduce matrix interference and/or to avoid contaminating the instrument.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Iris Verastegui

Results relate only to the items tested and to all the items tested

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AGAT WORK ORDER: 18T391313

PROJECT: TPB163165.1801

CLIENT NAME: WOOD ENVIRONMENTAL & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Nick Schmidt

SAMPLING SITE:409 Martha St

SAMPLED BY:ET

PWQO Metals (mg/L)

DATE RECEIVED: 2018-09-28

DATE REPORTED: 2018-10-09

		SAMPLE DESCRIPTION:		MW1-D	Stream
		SAMPLE TYPE:		Water	Water
		DATE SAMPLED:		2018-09-27	2018-09-27
Parameter	Unit	G / S	RDL	9589471	9589624
Aluminum (dissolved)	mg/L	0.075	0.004	0.008	0.009
Antimony	mg/L	0.020	0.003	<0.003	<0.003
Arsenic	mg/L	0.1	0.003	0.006	<0.003
Beryllium	mg/L	0.011	0.001	<0.001	<0.001
Cadmium	mg/L	0.0002	0.0001	0.0001	<0.0001
Chromium	mg/L		0.003	0.005	<0.003
Cobalt	mg/L	0.0009	0.0005	0.0025	<0.0005
Copper	mg/L	0.005	0.001	0.006	0.003
Iron	mg/L	0.3	0.01	2.24	<0.01
Lead	mg/L	**	0.001	0.011	<0.001
Manganese	mg/L		0.002	0.323	0.024
Dissolved Mercury	mg/L	0.0002	0.0001	<0.0001	<0.0001
Molybdenum	mg/L	0.04	0.002	0.005	0.003
Nickel	mg/L	0.025	0.003	<0.003	<0.003
Selenium	mg/L	0.1	0.004	<0.004	<0.004
Silver	mg/L	0.0001	0.0001	<0.0001	<0.0001
Tin	mg/L		0.002	<0.002	<0.002
Titanium	mg/L		0.002	0.041	0.004
Zinc	mg/L	0.03	0.005	0.031	0.016

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO (mg/L) **Dependent on alkalinity
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Iris Verastegui

Results relate only to the items tested and to all the items tested

AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 18T391313

PROJECT: TPB163165.1801

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CLIENT NAME: WOOD ENVIRONMENTAL & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Nick Schmidt

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
9589471	MW1-D	ON Halton San. Comb	Halton Sanitary and Combined Sewer Use By-law - Inorganics	Total Suspended Solids	mg/L	350	416
9589471	MW1-D	ON PWQO 2015 (mg/L)	Halton Sanitary and Combined Sewer Use By-law - Inorganics	Total Phosphorus	mg/L	0.030	0.54
9589471	MW1-D	ON PWQO 2015 (mg/L)	PWQO Metals (mg/L)	Cobalt	mg/L	0.0009	0.0025
9589471	MW1-D	ON PWQO 2015 (mg/L)	PWQO Metals (mg/L)	Copper	mg/L	0.005	0.006
9589471	MW1-D	ON PWQO 2015 (mg/L)	PWQO Metals (mg/L)	Iron	mg/L	0.3	2.24
9589471	MW1-D	ON PWQO 2015 (mg/L)	PWQO Metals (mg/L)	Zinc	mg/L	0.03	0.031
9589624	Stream	ON PWQO 2015 (mg/L)	Halton Sanitary and Combined Sewer Use By-law - Inorganics	Total Phosphorus	mg/L	0.030	0.07

Results relate only to the items tested and to all the items tested

AGAT Laboratories

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Quality Assurance

CLIENT NAME: WOOD ENVIRONMENTAL & INFRASTRUCTURE SOLUTIONS

AGAT WORK ORDER: 18T391313

PROJECT: TPB163165.1801

ATTENTION TO: Nick Schmidt

SAMPLING SITE:409 Martha St

SAMPLED BY:ET

Trace Organics Analysis

RPT Date: Oct 09, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Halton Sanitary and Combined Sewer Use By-law - Organics															
Oil and Grease (animal/vegetable) in water		TW	< 0.5	< 0.5	NA	< 0.5	NA	60%	130%	100%	60%	130%	105%	60%	130%
Oil and Grease (mineral) in water		TW	< 0.5	< 0.5	NA	< 0.5	NA	60%	130%	81%	60%	130%	83%	60%	130%
Methylene Chloride	9590153		< 0.0003	< 0.0003	NA	< 0.0003	77%	60%	130%	78%	60%	130%	113%	60%	130%
Chloroform	9590153		< 0.0002	< 0.0002	NA	< 0.0002	78%	60%	130%	76%	60%	130%	86%	60%	130%
Benzene	9590153		< 0.0002	< 0.0002	NA	< 0.0002	88%	60%	130%	87%	60%	130%	83%	60%	130%
Trichloroethene	9590153		< 0.0002	< 0.0002	NA	< 0.0002	102%	60%	130%	94%	60%	130%	78%	60%	130%
Toluene	9590153		< 0.0002	< 0.0002	NA	< 0.0002	89%	60%	130%	77%	60%	130%	82%	60%	130%
Tetrachloroethene	9590153		< 0.0001	< 0.0001	NA	< 0.010	78%	60%	130%	71%	60%	130%	78%	60%	130%
Ethylbenzene	9590153		< 0.0001	< 0.0001	NA	< 0.0001	78%	60%	130%	89%	60%	130%	77%	60%	130%
1,4-Dichlorobenzene	9590153		< 0.0001	< 0.0001	NA	< 0.0002	97%	60%	130%	85%	60%	130%	93%	60%	130%
Naphthalene		TW	< 0.0003	< 0.0003	NA	< 0.0003	115%	60%	140%	99%	60%	140%	101%	60%	140%

Comments: Tap water analysis has been performed as QC sample testing for duplicate and matrix spike due to insufficient sample volume.
When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

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Quality Assurance

CLIENT NAME: WOOD ENVIRONMENTAL & INFRASTRUCTURE SOLUTIONS

AGAT WORK ORDER: 18T391313

PROJECT: TPB163165.1801

ATTENTION TO: Nick Schmidt

SAMPLING SITE:409 Martha St

SAMPLED BY:ET

Water Analysis

RPT Date: Oct 09, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Halton Sanitary and Combined Sewer Use By-law - Inorganics															
pH	9585328		7.68	7.58	1.3%	NA	99%	90%	110%						
CBOD (5)	9587043		281	261	7.4%	< 5	100%	75%	125%						
Total Suspended Solids	9591731		<10	<10	NA	< 10	100%	80%	120%						
Fluoride	9585111		<0.25	<0.25	NA	< 0.05	99%	90%	110%	100%	90%	110%	103%	80%	120%
Sulphate	9585111		50.2	49.9	0.6%	< 0.10	100%	90%	110%	101%	90%	110%	101%	80%	120%
Total Cyanide	9592087		<0.002	<0.002	NA	< 0.002	107%	80%	120%	107%	90%	110%	100%	70%	130%
Phenols	9586656		<0.002	<0.002	NA	< 0.002	92%	90%	110%	102%	90%	110%	100%	80%	120%
Total Kjeldahl Nitrogen	9586697		1.20	1.05	13.3%	< 0.10	97%	80%	120%	93%	80%	120%	86%	70%	130%
Total Phosphorus	9589200		0.03	0.04	NA	< 0.02	91%	90%	110%	97%	90%	110%	108%	80%	120%
Total Aluminum	9589293		<0.020	<0.020	NA	< 0.020	106%	90%	110%	100%	80%	120%	93%	70%	130%
Total Antimony	9589293		<0.020	<0.020	NA	< 0.020	100%	90%	110%	99%	80%	120%	99%	70%	130%
Total Arsenic	9589293		<0.015	<0.015	NA	< 0.015	100%	90%	110%	102%	80%	120%	101%	70%	130%
Total Beryllium	9589293		<0.010	<0.010	NA	< 0.010	105%	90%	110%	104%	80%	120%	100%	70%	130%
Total Cadmium	9589293		<0.010	<0.010	NA	< 0.010	100%	90%	110%	102%	80%	120%	115%	70%	130%
Total Chromium	9589293		<0.020	<0.020	NA	< 0.020	102%	90%	110%	108%	80%	120%	112%	70%	130%
Total Cobalt	9589293		<0.020	<0.020	NA	< 0.020	107%	90%	110%	109%	80%	120%	108%	70%	130%
Total Copper	9589293		<0.015	<0.015	NA	< 0.015	103%	90%	110%	108%	80%	120%	104%	70%	130%
Total Iron	9589293		20.4	19.7	3.5%	< 0.050	104%	90%	110%	112%	80%	120%	105%	70%	130%
Total Lead	9589293		<0.020	<0.020	NA	< 0.020	103%	90%	110%	108%	80%	120%	106%	70%	130%
Total Manganese	9589293		5.93	6.22	4.8%	< 0.020	103%	90%	110%	107%	80%	120%	106%	70%	130%
Total Mercury	9590155		<0.0002	<0.0002	NA	< 0.0002	103%	90%	110%	99%	90%	110%	100%	70%	130%
Total Molybdenum	9589293		<0.020	<0.020	NA	< 0.020	100%	90%	110%	100%	80%	120%	100%	70%	130%
Total Nickel	9589293		0.476	0.496	4.1%	< 0.015	105%	90%	110%	110%	80%	120%	104%	70%	130%
Total Selenium	9589293		<0.020	<0.020	NA	< 0.020	104%	90%	110%	102%	80%	120%	99%	70%	130%
Total Silver	9589293		<0.020	<0.020	NA	< 0.020	97%	90%	110%	110%	80%	120%	115%	70%	130%
Total Tin	9589293		<0.025	<0.025	NA	< 0.025	103%	90%	110%	104%	80%	120%	102%	70%	130%
Total Titanium	9589293		<0.020	<0.020	NA	< 0.020	102%	90%	110%	104%	80%	120%	98%	70%	130%
Total Zinc	9589293		<0.020	<0.020	NA	< 0.020	102%	90%	110%	106%	80%	120%	112%	70%	130%
Dissolved Al & Hg (Water)															
Aluminum (dissolved)	9589471	9589471	0.008	0.008	NA	< 0.004	102%	90%	110%	100%	90%	110%	91%	70%	130%
Dissolved Mercury	9586666		<0.0001	<0.0001	NA	< 0.0001	103%	90%	110%	99%	90%	110%	102%	70%	130%
PWQO Metals (mg/L)															
Antimony	9617021		<0.003	<0.003	NA	< 0.003	100%	90%	110%	107%	90%	110%	97%	70%	130%
Arsenic	9617021		<0.003	<0.003	NA	< 0.003	104%	90%	110%	97%	90%	110%	111%	70%	130%
Beryllium	9617021		<0.001	<0.001	NA	< 0.001	100%	90%	110%	100%	90%	110%	110%	70%	130%
Cadmium	9617021		<0.0001	0.0001	NA	< 0.0001	100%	90%	110%	109%	90%	110%	100%	70%	130%
Chromium	9617021		<0.003	<0.003	NA	< 0.003	100%	90%	110%	101%	90%	110%	109%	70%	130%
Cobalt	9617021		0.0019	0.0018	NA	< 0.0005	106%	90%	110%	101%	90%	110%	107%	70%	130%

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Quality Assurance

CLIENT NAME: WOOD ENVIRONMENTAL & INFRASTRUCTURE SOLUTIONS

AGAT WORK ORDER: 18T391313

PROJECT: TPB163165.1801

ATTENTION TO: Nick Schmidt

SAMPLING SITE:409 Martha St

SAMPLED BY:ET

Water Analysis (Continued)

RPT Date: Oct 09, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Copper	9617021		0.008	0.007	13.3%	< 0.001	99%	90%	110%	102%	90%	110%	99%	70%	130%
Iron	9617021		0.45	0.46	2.2%	< 0.01	107%	90%	110%	91%	90%	110%	113%	70%	130%
Lead	9617021		0.006	0.007	15.4%	< 0.001	96%	90%	110%	101%	90%	110%	97%	70%	130%
Manganese	9617021		0.242	0.243	0.4%	< 0.002	108%	90%	110%	101%	90%	110%	110%	70%	130%
Molybdenum	9617021		0.004	0.004	NA	< 0.002	97%	90%	110%	95%	90%	110%	98%	70%	130%
Nickel	9617021		<0.003	<0.003	NA	< 0.003	103%	90%	110%	96%	90%	110%	104%	70%	130%
Selenium	9617021		<0.004	<0.004	NA	< 0.004	101%	90%	110%	97%	90%	110%	110%	70%	130%
Silver	9617021		<0.0001	<0.0001	NA	< 0.0001	105%	90%	110%	102%	90%	110%	110%	70%	130%
Tin	9617021		0.011	0.011	0.0%	< 0.002	104%	90%	110%	105%	90%	110%	94%	70%	130%
Titanium	9617021		0.018	0.020	10.5%	< 0.002	96%	90%	110%	94%	90%	110%	102%	70%	130%
Zinc	9617021		0.007	0.007	NA	< 0.005	101%	90%	110%	102%	90%	110%	109%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Iris Verastegui

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Method Summary

CLIENT NAME: WOOD ENVIRONMENTAL & INFRASTRUCTURE SOLUTIONS

AGAT WORK ORDER: 18T391313

PROJECT: TPB163165.1801

ATTENTION TO: Nick Schmidt

SAMPLING SITE:409 Martha St

SAMPLED BY:ET

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Oil and Grease (animal/vegetable) in water	VOL-91-5011	EPA SW-846 3510C & SM5520	GRAVIMETRIC
Oil and Grease (mineral) in water	VOL-91-5011	EPA SW-846 3510C & SM5520	GRAVIMETRIC
Methylene Chloride	VOL-91-5001	EPA SW-846 5230B & 8260B	(P&T)GC/MS
Chloroform	VOL-91-5001	EPA SW-846 5230B & 8260B	(P&T)GC/MS
Benzene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Trichloroethene	VOL-91-5001	EPA SW-846 5030B & 8260B	(P&T)GC/MS
Toluene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Tetrachloroethene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Ethylbenzene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	EPA SW-846 5030 & 8260	(P&T)GC/MS
Naphthalene	ORG-91-5114	EPA SW-846 3510C & 8270D	GC/MS

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Method Summary

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AGAT WORK ORDER: 18T391313

PROJECT: TPB163165.1801

ATTENTION TO: Nick Schmidt

SAMPLING SITE:409 Martha St

SAMPLED BY:ET

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Aluminum (dissolved)	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Dissolved Mercury	MET-93-6100	EPA SW 846 7470 & 245.1	CVAAS
pH	INOR-93-6000	SM 4500-H+ B	PC TITRATE
CBOD (5)	INOR-93-6006	SM 5210 B	DO METER
Total Suspended Solids	INOR-93-6028	SM 2540 D	BALANCE
Fluoride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Total Cyanide	INOR-93-6051	MOE 3015 & SM 4500 CN- A,B,C	TECHNICON AUTO ANALYZER
Phenols	INOR-93-6050	MOE ROPHEN-E3179 & SM 5530 D	TECHNICON AUTO ANALYZER
Total Kjeldahl Nitrogen	INOR-93-6048	QuiKChem 10-107-06-2-I & SM 4500-Norg D	LACHAT FIA
Total Phosphorus	INOR-93-6022	SM 4500-P B&E	SPECTROPHOTOMETER
Total Aluminum	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Antimony	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Arsenic	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Beryllium	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Cadmium	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Chromium	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Cobalt	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Copper	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Iron	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Lead	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Manganese	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Mercury	MET-93-6100	EPA SW 846-7470 & 245.1	CVAAS
Total Molybdenum	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Nickel	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Selenium	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Silver	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Tin	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Titanium	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Total Zinc	MET-93-6103	EPA SW-846 3010A & 6020A	ICP-MS
Antimony	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Chromium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Copper	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Iron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Manganese	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Nickel	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Selenium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Silver	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Tin	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Titanium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Zinc	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS

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Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: WSP
Contact: Nick Schmidt
Address: 3300 Merritville, Unit 5
Thorold, ON
Phone: 905-687-6616 Fax:
Reports to be sent to:
1. Email: Nick.Schmidt@wsp.com
2. Email:

Project Information:

Project: TPB163165.1801
Site Location: 409 Martha St
Sampled By: ET
AGAT Quote #: AS PER EMAIL PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☒ No ☐
Company:
Contact:
Address:
Email:

Regulatory Requirements:

☐ No Regulatory Requirement
(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☒ Sewer Use
☒ Sanitary ☐ Storm
Region Halton (Indicate One)
☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☒ Yes ☐ No

Laboratory Use Only

Work Order #: 18T391313
Cooler Quantity: LARGE
Arrival Temperatures: 13 | 14 | 17 | 9 | 12 | 9.0
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes:

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y / N	Field Filtered - Metals, Hg, CrVI	O. Reg 153: Metals and Inorganics	All Metals ☐ 153 Metals (excl. Hydrides)	Hydride Metals ☐ 153 Metals (Incl. Hydrides)	ORPs: ☐ B-HWS ☐ Cl ☐ CN	☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg	☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN	☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use
MW1-D	9/27/18	13:03	15	GW																					X
Stream	↓	14:05	↓	SW																					X

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
ERICA TUPA	9/28/18	4:15 pm		9/28/18	1240
	9/28				

Page 1 of 1

N°: T 078756

Document ID: DW-78-1511-015

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

Appendix E

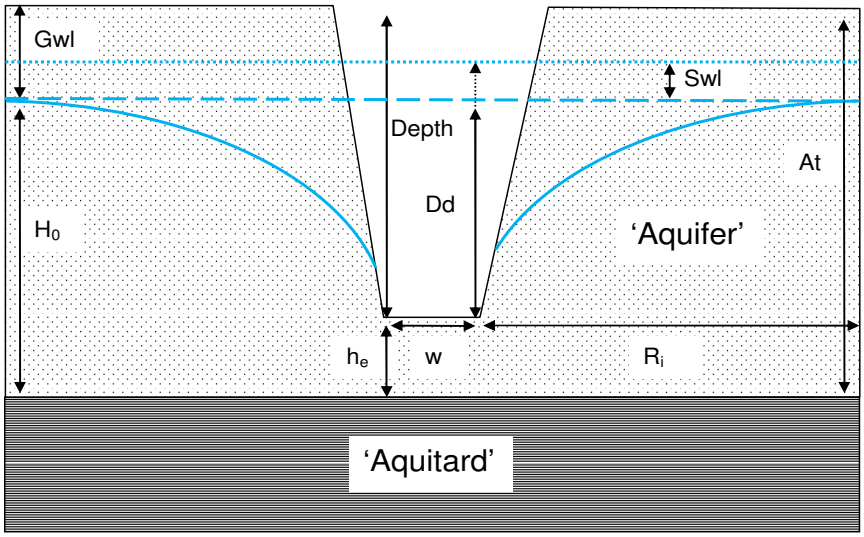
Dewatering Estimate

Dewatering Rate Estimation

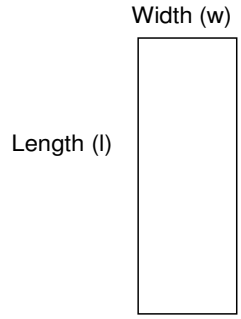
Project No.:	TPB163165.1801
Project Name:	401-417 Martha Street
Client:	Landform Development Group Inc.
Location:	401-417 Martha Street, Burlington, Ontario
Description:	Dewatering estimation for construction of proposed apartment building
Date:	April 29, 2020
Performed by:	NS
Checked by:	SG

EXCAVATION INFO		
Length, l (m)		71.0
Width, w (m)		34.0
Depth (mbgs)		14.0

Cross Section



Plan View



Radius of Influence (R_i) calculated with the Sichardt equation $R_i = 3000(H_0 - h_e)\sqrt{K}$

Groundwater Inflow (Q) to the excavation calculated with the Dupuit solution combining:
1) radial steady-state for inflow to trench ends; and
2) linear steady-state for inflow to trench sides.

$$Q = \pi K \frac{(H_0^2 - h_e^2)}{\ln\left(\frac{2R_i + w}{w}\right)} + 2lK\frac{(H_0^2 - h_e^2)}{2R_i}$$

Location	Gwl Measured Groundwater Level (mbgs)	Swl Estimated Seasonal Fluctuation above Gwl (m)	K Hydraulic Conductivity (m/s)	At 'Aquifer' Thickness (mbgs)	H_0 Ambient Head above 'Aquitard' (m)	h_e Head above 'Aquitard' at Excavation (m)	Dd Drawdown (m)	R_i Sichardt Calculation (m)	R_i User Defined (m)	Q Groundwater Inflow (m^3/d)
BH/MW 1 D	4.0	0.0	6.3E-08	15.0	11.0	1.0	10.0	7.5	5.0	17.2

Safety Factor	3	Maximum × SF
Q Groundwater Inflow (m^3/d)		51.7
Safety Factor	3	S(Maximum K × SF)
R_i Radius of Influence, Sichert (m)		13.0

Notes

1. mbgs = meters below ground surface
2. The user defined R_i is used for the calculation of groundwater inflow (Q) if specified
3. Geometric mean calculation is applied only to the hydraulic conductivity (K) - other input parameters for the Dupuit and Sichardt equation use the arithmetic average
4. The calculated groundwater inflows for the arithmetic and geometric mean both use the Sichardt R_i calculated from the respective mean K
5. If the depth of the excavation is below the base of the 'Aquifer' then the head at the excavation is set at the top of the 'Aquitard' (i.e. $h_e = 0$)

Comments

Appendix F

Limitations

Limitations

1. The work performed in the preparation of this report and the conclusions presented are subject to the following:
   (a) Wood's Standard Terms and Conditions
   (b) The Scope of Services;
   (c) Time and Budgetary limitations as described in our Contract; and,
   (d) The Limitations stated herein.
2. No other warranties or representations, either expressed or implied, are made as to the professional services provided under the terms of our Contract, or the conclusions presented.
3. The conclusions presented in this report were based, in part, on visual observations of the site. Our conclusions cannot and are not extended to include those portions of the site or structures which were not reasonably available, in Wood's opinion, for direct observation.
4. The environmental conditions at the site were assessed, within the limitations set out above, having due regard for applicable environmental regulations as of the date of the inspection. A review of compliance by past owners or occupants of the site with any applicable local, provincial or federal by-laws, orders-in-council, legislative enactments and regulations was not performed.
5. The site history research included obtaining information from third parties and employees or agents of the owner. No attempt has been made to verify the accuracy of any information provided, unless specifically noted in our report.
6. Where testing was performed, it was carried out in accordance with the terms of our contract providing for testing. Other substances, or different quantities of substances testing for, may be present on site and may be revealed by different of other testing not provided for in our contract.
7. Because of the limitations referred to above, different environmental conditions from those stated in our report may exist. Should such different conditions be encountered, Wood must be notified in order that it may determine if modifications to the conclusions in the report are necessary.
8. The utilization of Wood's services during the implementation of any remedial measures will allow Wood to observe compliance with the conclusions and recommendations contained in the report. Wood's involvement will also allow for changes to be made as necessary to suit field conditions as they are encountered.
9. This report is for the sole use of the party to whom it is addressed unless expressly stated otherwise in the report or contract. Any use which any third party makes of the report, in whole or in part, or any reliance thereon, or decisions made based on any information of conclusions in the report, is the sole responsibility of such third party. Wood accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on the report or anything set out therein.
10. This report is not to be given over to any third party for any purpose whatsoever without the written permission of Wood.

