Hydrogeological Study

506, 510 and 516 Hespeler Road and 1000 Langs Drive
Cambridge, Ontario
Project no. OGTW2201

Prepared for:

Starbank Developments 516 (& 506) Corporation
62 Progress Court, Brampton, Ontario, L6S 5X2

18-May-22

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18 May 2022
OGTW2201

Bill Tishler
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Brampton, Ontario, L6S 5X2

Subject: **Hydrogeological Study**
506, 510 and 516 Hespeler Road and 1000 Langs Drive
Cambridge, Ontario

Dear Mr. Tishler:

Enclosed please find a report on the hydrogeological study completed in support of the proposed development of properties at 506, 510 and 516 Hespeler Road and 1000 Langs Drive in Cambridge, Ontario.

Yours truly,
Wood Environment & Infrastructure Solutions,
a Division of Wood Canada Limited

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List of Abbreviations and Units

AMSL	above mean sea level
BGS	below ground surface
cm	centimetre
d	day
EASR	environmental activity and sector registry
ERIS	Environmental Risk Information Services
ESC	erosion and sediment control
GRCA	Grand River Conservation Authority
IAZ	intake protection zone
K	hydraulic conductivity
l or ℓ	litre
m	metre
m^3	cubic metre
mg	milligram
µg	microgram
mm	millimetre
DL	detection limit
MECP	Ontario Ministry of Environment, Conservation and Parks
OGS	Ontario Geological Survey
OPSS	Ontario Provincial Standards and Specifications
O. Reg.	Ontario regulation
PAH	polycyclic aromatic hydrocarbon
PHC	petroleum hydrocarbon compound
PTTW	permit to take water
PWQO	Ontario provincial water quality objective
s	second
SCS	site condition standard
SGRA	significant groundwater recharge area
SVOC	semi-volatile organic compound
SWRT	single well response test
TDS	total dissolved solids
TSS	total suspended solids
VOC	volatile organic compound
WHPA	wellhead protection area

1.0 INTRODUCTION

Wood Environment & Infrastructure Solutions (Wood) was retained by Starbank Developments 516 (& 506) Corporation (Starbank) to conduct a geotechnical and hydrogeological investigation for the proposed commercial and residential development of properties at 506, 510 and 516 Hespeler Road and 1000 Langs Drive in Cambridge, Ontario (Site). The Site location map and Site plan are shown on Figures 1 and 2, respectively.

Previously, Wood (formerly Amec Foster Wheeler) had performed geotechnical investigations (Amec Foster Wheeler, 24 May 2017 and Wood, 4 May 2022), a Phase I environmental site assessment (ESA), a Phase II ESA (Amec Foster Wheeler, 26 March 2018) and a supplemental environmental Site investigation (Amec Foster Wheeler, 27 March 2018). Information from these reports was used during this hydrogeological study. Four boreholes BH22-1, BH22-2, BH22-3 and BH22-4 were drilled as part of this geotechnical and hydrogeological investigation and monitoring wells were installed in each of the boreholes.

The Site is in a commercially zoned area surrounded by industrially zoned areas. It is a brownfield Site with existing retail development and an open-air paved parking lot. Most of the Site is covered by grass. The latest concept from 10 March 2022 considered five high-rise / podium buildings (buildings A to E), with up to two underground parking levels and retail areas. The podiums are proposed to be two to six storeys high with the high-rises 20 storeys high. The buildings, access roads and parking lots are proposed to be built along the eastern part of the Site and a park is proposed for the western part of the Site adjacent to Groff Mill Creek (Figure 2).

The underground parking garage is proposed to be approximately 70 m wide in the north, 130 m wide in the south, 150 m long along the east and 230 m long along the west, which is approximately 30,000 m^2. The bottom of the two-level parking garage is proposed to be 6.5 m below ground surface (BGS). The excavation for the entire parking garage is assumed to extend another metre deeper, i.e. to 7.5 m BGS, the concrete slab level. Excavation details are unknown at this time; however, for preliminary recommendations it is assumed that shoring structures and a groundwater control curtain (i.e. sheet piles) will be driven into the ground along the entire perimeter of the underground parking garage prior to excavation. Shoring structures are typically driven sufficiently below the maximum depth of excavation, possibly locked into less permeable deposits or bedrock, to reduce the potential for basal instability and basal influx of groundwater. Once the perimeter is shored, the inside of the watertight shoring structure will be excavated to the concrete slab level at approximately 7.5 m BGS. Dewatering will be needed inside the shoring structure to capture groundwater that may seep through the sheet pile interlocks or may migrate below the shoring structure and up to the bottom of the excavation.

After the entire shoring structure is excavated and dewatered to the slab level (at 7.5 m BGS), it is assumed that further trenches will need to be excavated below the slab level to install utility services (assumed approximately another metre deeper below slab level to 8.5 m BGS) and elevator shafts (assumed approximately another 1.5 m below slab level to 9 m BGS). For the purposes of dewatering, these trenches are assumed to be 1 m deep, 1 m wide and 15 m long and the elevator shafts are assumed to be 1.5 m deep, 2 m wide and 6 m long.

1.1 Purpose

The purpose of this hydrogeological study was to assess the groundwater conditions beneath the Site, how the proposed construction work may affect the adjacent Groff Mill Creek and the amount of dewatering that is anticipated to be necessary during construction. The study will support the application for a water taking permit which is anticipated to be required.

The hydrogeological study included a review of topographical and geological maps from the Grand River Conservation Authority (GRCA) and Ontario Geological Survey (OGS), drilling of boreholes and installation of monitoring wells at the Site, groundwater level monitoring and sampling from those wells, single well response tests completed on all four of the wells, determination of hydraulic conductivity and dewatering rate estimation.

2.0 SITE SETTING

2.1 Surrounding Land Uses

The Site is located near the southwestern corner of the intersection of Langs Drive and Hespeler Road in a commercial zone of Cambridge in Ontario, Canada (Figures 1 and 2). An industrial zone is west of the Site. Water well records were not reviewed because it was assumed that all the surrounding properties are supplied with potable water from the municipal water supply and distribution system. Municipal well information was reviewed and is described further in Section 3.5.2.

2.2 Physiography and Drainage

The Site is in the Guelph Drumlin Field physiographical region consisting of spillways (Chapman and Putnam 1984 and OGS 2022). The topography is flat at an elevation of approximately 292 m above mean sea level (AMSL). Groff Mill Creek flows south along the western edge of the Site in a depression approximately 4 m deep (i.e. base at 288 m AMSL). Most of the Site is within the regulated floodplain of Groff Mill Creek. The creek flows into the Grand River approximately 2.4 km south of the Site. The proposed parking garage and buildings will be approximately 60 m from the creek.

2.3 Geology

The surficial geology in the area, including the Site, is composed of gravelly deposits of glaciofluvial origin from Late Wisconsinan Age (GRCA and OGS 2022).

From four boreholes drilled at the Site during this investigation to a maximum depth of 15.5 m BGS, up to 0.5 m of topsoil was encountered in the grassed area, up to 1.4 m of sand and gravel fill was encountered beneath the existing paved area, and these were observed to be underlain by sand and/or gravel deposits up to approximately 7.0 to 7.5 m BGS. Below the sand and gravel, silt and sand with trace to some gravel, possibly till, was observed to extend to the top of dolostone bedrock encountered at 13 m BGS in borehole BH22-4. The overburden stratigraphy observed in the four boreholes was consistent with the stratigraphy observed in historically drilled boreholes at the Site (Amec Foster Wheeler, 24 May 2017 and 26 March 2018; Wood, 4 May 2022).

The bedrock underlying the Site is dolostone of the Guelph Formation from the Upper Silurian Period (OGS 2022). The dolostone was encountered in borehole BH22-4 and possibly at the bottoms of the other three boreholes which were terminated due to refusal. Borehole logs of the four boreholes drilled at the Site during this investigation are provided in Appendix A.

2.4 Hydrogeology

According to the encountered stratigraphy described above, the general hydrostratigraphy beneath the Site is interpreted as follows:

- Shallow aquifer: sand and gravel overburden from 0 – 7.2 m BGS
- Aquitard: silt and sand till overburden from 7.2 – 13 m BGS
- Deep aquifer: dolostone bedrock >13 m BGS

The hydrostratigraphic unit in the overburden beneath the Site, comprising the sand and gravel deposits, was the shallow aquifer that was investigated during this hydrogeological study, i.e. the shallow groundwater flow system. The four monitoring wells BH22-1, BH22-2, BH22-3 and BH22-4 were installed near the bottom of the shallow aquifer, ranging from 6.1 to 7.6 m BGS.

Groundwater levels were measured three times in the monitoring wells: on 15 March 2022 before well development, on 4 April 2022 before groundwater sampling and on 5 April 2022 before single well response testing. Groundwater levels from these three days ranged from 2.34 m BGS at BH22-1 to 3.47 m BGS at BH22-2 (Table 1). Based on groundwater elevations from 4 April 2022, groundwater was estimated to flow west-southwest beneath the Site under a horizontal hydraulic gradient of 0.0017 m/m towards Groff Mill Creek (Figure 2). This was similar to the groundwater flow direction to the southwest under a gradient of 0.0033 m/m reported by Wood in 2017 (Amec Foster Wheeler, 26 March 2018).

The vertical hydraulic gradient could not be determined as nested or clustered wells were not present at the Site. The GRCA reported vertical hydraulic gradients to be downward at the Site and surrounding area (GRCA 2022). The Site is in an area with an average annual groundwater recharge rate of 164 mm/year and is not considered to be a significant groundwater recharge area (SGRA) (GRCA 2022). The shallow groundwater is expected to be connected to the adjacent Groff Mill Creek, potentially providing base flow for the stream.

The geological information and the water level data suggest the presence of a shallow hydrostatic system (i.e. a shallow aquifer), above the sandy silt / till unit (i.e. an aquitard). It is our opinion that groundwater movement will occur within the geological layers above the till unit. Hydraulic conductivity of the sand and gravel layers within the shallow aquifer was tested to assist in estimating groundwater flows within the shallow aquifer to assess the water taking aspect of this project. Hydraulic conductivity of the till aquitard and the deep bedrock aquifer was not investigated. The deep aquifer is considered to represent a deep groundwater flow system.

3.0 WATER TAKING

The proposed underground parking garage, service utilities and elevator shafts will be constructed several metres below the groundwater table and will thus require some degree of dewatering during excavating, even though a shoring structure / groundwater curtain is anticipated to be installed around the parking garage prior to excavation.

3.1 Hydraulic Conductivity

Single well response tests (SWRTs) were carried out in all four monitoring wells BH22-1, BH22-2, BH22-3 and BH22-4 to estimate the hydraulic conductivity of the subsurface stratigraphic layers. Falling head and rising head tests were conducted by inserting or removing a stainless-steel slug (i.e. rod 1 m long with diameter of 3.7 cm) into the well and measuring the water level response in the well until the water level returned to the static condition. A non-vented pressure transducer programmed to record pressure readings at regular intervals was placed in each monitoring well to record water levels throughout the test. Water levels were also measured manually to verify the transducer readings.

Table 2: Hydraulic Conductivity

Well Name	Screened Interval (m BGS)	Screened Formation	Type of Test	Hydraulic Conductivity (K) (m/s)	Arithmetic Mean K (m/s)
BH22-1	4.6 – 7.6	sand & gravel	FH 1	1.7×10^{-3}	1.7×10^{-3}
			FH 2	1.7×10^{-3}	
			RH 1	1.6×10^{-3}	
			RH 2	1.9×10^{-3}	
BH22-2	3.1 – 6.1	sand	FH 1	1.3×10^{-4}	1.2×10^{-4}
			FH 2	8.0×10^{-5}	
			RH 1	1.3×10^{-4}	
			RH 2	1.6×10^{-4}	
BH22-3	3.1 – 6.1	sand & gravel	RH 1	2.0×10^{-4}	1.9×10^{-4}
			RH 2	1.8×10^{-4}	
BH22-4	4.6 – 7.6	sand & gravel	FH 1	4.1×10^{-3}	4.5×10^{-3}
			FH 2	3.4×10^{-3}	
			RH 1	7.1×10^{-3}	
			RH 2	3.6×10^{-3}	

Notes: FH – falling head; RH – rising head; m BGS – metres below ground surface; m/s – metres per second

The recovery data were analyzed using the Bouwer-Rice solution in AQTESOLV version 4.5. The software incorporates the transducer water level data collected during the SWRTs and monitoring well construction details to estimate the hydraulic conductivity of the soil formation at the well

screen level. A summary of the hydraulic conductivity values estimated from the SWRTs is provided in Table 2 above.

Hydraulic conductivities determined from each of the SWRTs ranged from 8.0×10^{-5} to 7.1×10^{-3} m/s. The lowest average hydraulic conductivity of 1.2×10^{-4} m/s was calculated from the four SWRTs conducted in well BH22-2 and the highest average hydraulic conductivity of 4.5×10^{-3} m/s was calculated from the four SWRTs conducted in well BH22-4.

Details of the AQTESOLV analyses are provided in Appendix B. Given that the soil of the subsurface within the depth of investigation is variable across the Site, the hydraulic properties can vary over short distances. Different hydraulic conductivities, other than those calculated from the monitoring wells, could thus be encountered in other parts of the Site during construction.

3.2 Water Taking Rate

Water taking rates were estimated using the Dupuit solution, corrected from Powers et al. (2007), for open-cut excavations. The following equation for an unconfined, open trench was used:

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

where
Q = groundwater inflow rate (m^3/d)
K = hydraulic conductivity (m/s)
H_0 = ambient groundwater level head above the top of the aquitard (m)
h_e = dewatered groundwater level head above the top of the aquitard at the excavation (m)
w = trench width (m)
l = trench length (m)
R_i = radius of influence (m), estimated using the Sichardt equation:

$$R_i = 3000(H_0 - h_e)\sqrt{K}$$

Limited construction details for the project were provided to Wood; therefore, dewatering rates were estimated for three excavation scenarios and two conditions (no shoring and with shoring) based on possible excavation methodology. In the first condition, no shoring was assumed and the radius of influence was thus calculated using the Sichardt equation. In the second condition, the Sichardt equation was not used but rather a radius of influence of 75 m was imposed on the calculations to simulate the dewatering inside the shored area of approximately 30,000 m^2. It was assumed that aside from minor seepage through the shoring structure (i.e. sheet piling) no groundwater influx into the shored area is occurring from the sides or from the aquitard below

the shallow aquifer. To determine whether such a flux could occur would require installation of clustered monitoring wells into the shallow aquifer, aquitard and deep aquifer to determine vertical hydraulic gradients (i.e. is groundwater moving upward?) and to determine hydraulic conductivity of the aquitard and deep aquifer.

Scenario 1 – Parking Garage

Following the installation of shoring structures around the perimeter of the proposed underground parking garage, the area is assumed to be excavated progressively using small trenches from ground surface to the slab level depth of about 7.5 m BGS. The following assumptions and input parameters were used in the calculation of the dewatering rate for the installation of the underground parking base structure:

- one trench 15 m long, 3 m wide and 7.5 m BGS deep
- average groundwater depth = 2.5 m BGS (highest seasonal level)
- average hydraulic conductivity = 1.6×10^{-3} m/s
- average unconfined shallow aquifer thickness = 7.2 m.

Scenario 2 – Utility Services

Following the excavation and dewatering of the entire underground parking garage, trenches are assumed to be required below the slab level to install service utilities. Based on the stratigraphy, the slab level is to be at approximately the same level as the bottom of the shallow aquifer. The service trenches may thus potentially be opened into the underlying aquitard for which no hydraulic conductivity data were obtained. Therefore, it was assumed that the shallow aquifer extends up to one metre below the depth of the service trench excavations. The following assumptions and input parameters were used in the calculation of the dewatering rate for the installation of utility services below the base of the underground parking garage:

- one trench 15 m long, 1 m wide and 1 m BGS deep
- average groundwater depth = 0 m BGS
- average hydraulic conductivity = 1.6×10^{-3} m/s
- average unconfined shallow aquifer thickness = 2 m.

Scenario 3 – Elevator Shafts

Following the excavation and dewatering of the entire underground parking garage, trenches are assumed to be required below the slab level to install bases of elevator shafts. Based on the stratigraphy, the slab level is to be at approximately the same level as the bottom of the shallow aquifer. The elevator shaft trenches may thus potentially be opened into the underlying aquitard for which no hydraulic conductivity data were obtained. Therefore, it was assumed that the shallow aquifer extends up to one metre below the depth of the service trench excavations. The

following assumptions and input parameters were used in the calculation of the dewatering rate for the installation of utility services below the base of the underground parking garage:

- one trench 6 m long, 2 m wide and 1.5 m BGS deep
- average groundwater depth = 0 m BGS
- average hydraulic conductivity = 1.6×10^{-3} m/s
- average unconfined shallow aquifer thickness = 2.5 m.

The following additional assumptions were used in the calculations of the dewatering rates:

- one excavation is open and dewatered at one time
- no groundwater influx occurs into shored area from the sides or from below
- radius of influence inside shored area is approximately 75 m
- radial, steady-state flow is assumed for inflow to trench ends
- linear, steady-state flow is assumed for inflow to trench sides
- the shallow aquifer is assumed to be unconfined and hydrogeologically homogeneous
- a seasonal variation of 0.5 m in the groundwater level is assumed
- an uncertainty factor of 3 has been incorporated into the dewatering rate estimations to account for:
    - uncertainty in the estimate of hydraulic conductivity
    - initial depletion of shallow aquifer storage, a temporary response to dewatering; i.e. the initial dewatering rate should decrease to the expected rate once equilibrium conditions are reached
    - infiltration or runoff from precipitation events.

Details of the dewatering rate calculations are provided in Appendix C and the dewatering estimates are summarized in Table 3.

It should be noted that the worst-case scenario is Scenario 1 without the presence of a shoring structure / groundwater control curtain and therefore, calculations were done to highlight that case to assist in developing the need for such a groundwater control structure, if necessary.

The calculations shown in Table 3 below do not include vertical upward flow from the bedrock (i.e. deep aquifer) as it is assumed that the sandy silt / till aquitard will prevent upward migration of groundwater. Confirmation that those conditions exist will be required if the method of construction will be via a shoring structure with open ended bottom, as described herein. Additional monitoring wells drilled into the aquitard and deep bedrock aquifer will be required and combined with existing wells to create nested or clustered monitoring systems. Hydraulic testing of the new wells will also be required to confirm whether upward movement of

groundwater will be an issue or not. This information will also be beneficial in determining the depth of penetration required for a shoring structure.

Table 3: Dewatering Rates

Installation Trench Dimensions Condition	Excavation Method	Radius of Influence (m)	Dewatering Rate (max.) (m^3/d)	EASR Limit (m^3/d)	PTTW Limit (m^3/d)	Type of Permit Required
Parking Garage 15 m long, 3 m wide, 7.5 m deep **no shoring**	open cut	970	5,000	50	400	PTTW
Parking Garage 15 m long, 3 m wide, 7.5 m deep **with shoring**	open cut	75	9,000	50	400	PTTW
Utility Services 15 m long, 1 m wide, 1 m deep **no shoring**	open cut	200	900	50	400	PTTW
Utility Services 15 m long, 1 m wide, 1 m deep **with shoring**	open cut	75	1,000	50	400	PTTW
Elevator Shafts 6 m long, 2 m wide, 1.5 m deep **no shoring**	open cut	300	1,400	50	400	PTTW
Elevator Shafts 6 m long, 2 m wide, 1.5 m deep **with shoring**	open cut	75	1,800	50	400	PTTW

Notes: Radii of influence and dewatering rates are estimates and include uncertainty factor of 3.
PTTW – permit to take water
EASR – Environmental Activity and Sector Registry
m^3/d – cubic metres per day

For the un-shored condition, dewatering rates were estimated to range from 900 to 5,000 m^3/d with an uncertainty factor of 3 applied to the hydraulic conductivity, with associated radii of influence ranging from 200 to 970 m. These dewatering rates would be continuous during the construction and during the operation of the parking structure. For the shored condition, temporary dewatering would occur until steady-state dewatered levels would be established. The radius of influence was set at 75 m and resulted in dewatering rate estimates to range from 1,000 to 9,000 m^3/d with an uncertainty factor of 3 applied to the hydraulic conductivity.

It should be noted that the dewatering rates shown above are the highest anticipated rates during initial drainage of the surrounding formation as groundwater is drained from storage. Under the shored condition, assuming the shored area is isolated from groundwater influx from the surrounding shallow aquifer, aquitard and deep aquifer, the approximate total volume of groundwater inside the shored area is estimated to be finite with an approximate volume of 45,000 m^3, assuming an area of 30,000 m^2, a porosity of 0.3 for sand and gravel, and a 5-m depth of groundwater in the shallow aquifer. Therefore, the estimated dewatering rates of 1,000 to 9,000 m^3/d would decrease over time as the soil inside the shored area is excavated and groundwater abstracted. It is estimated that a period of 5 to 45 days of pumping would be required to attain a steady-state groundwater level that would provide safe conditions for construction. The actual time period required to establish safe groundwater levels would depend on the design and layout of the dewatering system.

Maintenance dewatering should be expected within the excavation to collect rainwater, seepage water through the shoring system and minor seepage through the bottom of the excavation.

3.3 Water Taking Permit

Under all scenarios and conditions, the estimated dewatering rates are above the threshold of 400 m^3/d for registration in the Environmental Activity and Sector Registry (EASR), hence a permit to take water (PTTW) is required for the construction dewatering. The PTTW will cover any dewatering requirements for the entire project. A Category 3 PTTW is required because the dewatering is expected to last longer than 30 consecutive days and to exceed 400 m^3/d.

3.4 Water Taking Method

An appropriate water taking method will need to be used by the dewatering contractor, considering the presence of saturated sand and gravel. A detailed dewatering plan should be developed by the dewatering contractor.

3.5 Water Taking Impact Assessment

Dewatering will be required, and the adjacent Groff Mill Creek may be affected unless appropriate shoring is used to isolate the dewatering area from the surrounding shallow aquifer.

3.5.1 Zone of Influence

If un-shored, the zone of influence from the water taking is predicted to range between 200 and 970 m from each dewatered trench as calculated using the Sichardt equation for the steady-state dewatering rates discussed in Section 3.2 (Table 3). If shored, as is understood to be planned, the zone of influence is assumed to be confined to within the shoring structure (i.e. sheet piles).

3.5.2 Local Well Users

Water well records were not reviewed because it was assumed that all the surrounding properties are supplied with potable water from the municipal water supply and distribution system. The nearest municipal water supply wells are G5 (24 m deep) and G5A (134 m deep) approximately 1.1 km northeast of the Site along Pinebush Road. This is outside the un-shored radii of influence calculated for the three scenarios (Table 3). Additional municipal wells are farther east. The Site is outside the nearest wellhead protection area (WHPA). The nearest 25-year time-of-travel WHPA zone D with low (2) vulnerability is 450 m northeast of the Site. There are also no intake protection zones (IAZs) from surface water features to the municipal water supply system near the Site (GRCA 2022). The Site is not in a significant groundwater recharge area.

The nearest municipal wells G5 and G5A were determined not likely to be affected by dewatering activities at the Site because they are deeper than the anticipated maximum excavation depths and outside the estimated zones of influence for the dewatering.

3.5.3 Surface Water

The source of Groff Mill Creek is approximately 500 m north of the Site (GRCA 2022) where the channel of this stream is shown to begin. The stream may serve to drain surface water runoff from the surrounding areas. There are no areas of natural of scientific interest (ANSIs) on or in the vicinity of the Site. However, the Site is in a natural heritage area per the Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF) database in which the Midland painted turtle is listed as a species of concern and the Jefferson salamander is listed as an endangered species. Groff Mill Creek could thus be a potential habitat for these two animal species.

Shallow groundwater may provide base flow for Groff Mill Creek; therefore, lowering the groundwater level below the current level at the stream may reduce water flow in the stream, thus impacting potential habitat for any plant and animal species. If the entire area to be dewatered is inside the shoring structure sufficiently keyed into underlying low permeability silt and sand till (the aquitard), and dewatering impacts do not occur outside the shoring structure, no impact to Groff Mill Creek would be anticipated.

3.5.4 Settlement and Subsidence

Dewatering can cause settlements due to an increase in effective stress of the soil that is being subject to dewatering. Settlement will occur more likely in fine-grained soils such as clay and silt that are compressible than in coarse-grained soil such as sand and gravel. The surficial sediments beneath the Site are sand and gravel in the upper 7 to 7.5 m, underlain by approximately 5 to 6 m of silt and sand with trace to some gravel, occasionally also clay, followed by dolostone bedrock.

The majority of the underlying material is thus coarse-grained material. Preliminary estimates of settlement were determined by Wood to be expected to be limited to 25 mm and 15 mm for global and differential settlement, respectively (Wood, 4 May 2022).

3.6 Water Taking Monitoring

The amount of water taking during each day of the construction work will need to be recorded daily to ensure that the dewatering remains within the maximum dewatering rate approved by the PTTW. Stream flow in Groff Mill Creek should also be monitored to ensure it is not being affected by dewatering at the construction site, whether shored or not. The developer should also consider having a contingency action plan in place prior to commencing construction to implement quickly to mitigate impacts to Groff Mill Creek.

4.0 WATER DISCHARGE

The dewatering will include primarily groundwater but may include storm water that enters the excavations. Soil should be excavated in smaller trenches to decrease the amount of groundwater or storm water to be handled and discharged at a time. A detailed discharge plan should be developed by the dewatering contractor.

4.1 Water Discharge Quality and Monitoring

4.1.1 Applicable Regulatory Framework

The applicable groundwater quality criteria are defined by Ontario Regulation 153/04, as amended (O. Reg. 153/04) under Part XV.1 of the Environmental Protection Act (MOE, 15 April 2011). The Site is in a commercial zone with commercial land use. The municipal government considers the entire Waterloo Region to be in a potable groundwater condition because most of the drinking water for the Region is sourced from groundwater. The Site is within 30 m of Groff Mill Creek. Therefore, the applicable groundwater standards at the Site are the Table 8 generic site condition standards (Table 8 SCS) for use within 30 m of a water body in a potable groundwater condition for all types of property uses and the Table 2 full depth generic site condition standards (Table 2 SCS) for use in a potable groundwater condition for all types of property uses (Amec Foster Wheeler, 26 March 2018).

The quality of the water discharged into a sanitary sewer should meet the sanitary sewer criteria of Waterloo Region By-law no. 21-036. This by-law came into effect on 1 January 2022 and while there are no specific discharge limits for storm sewers (unlike in the previous repealed by-law), Section 8(5) requires that the discharge to a storm sewer "*does not impair the quality of the water in any well, lake, river, pond, spring, stream, reservoir or other water or watercourse*". Therefore, the Ontario Provincial Water Quality Objectives (PWQOs) are considered to be applicable for the discharge to a storm sewer which ultimately discharges to a natural surface water body. The quality of the water discharged into a storm sewer or natural surface water body such as Groff Mill Creek should thus meet the PWQOs.

4.1.2 Groundwater Quality

On 4 April 2022, groundwater samples were collected from monitoring wells BH22-1 and BH22-3. The samples were submitted to the ALS laboratory in Waterloo, Ontario for the analysis of general chemistry, metals, petroleum hydrocarbons (PHCs), volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs). The sample from BH22-1 was also analyzed for fecal coliforms, oil and grease, polychlorinated biphenyls (PCBs) and other parameters regulated by By-law 21-036 for discharge to the sanitary sewer. The groundwater analytical results are provided in Tables 4 to 9 and in the laboratory certificates of analysis in Appendix D.

A quality assurance and quality control assessment was completed on the analytical results and it was determined that the results in the two laboratory certificates of analysis provided in Appendix D are considered to be reliable and the groundwater analytical data are considered to be representative of field conditions. There are no issues that could potentially affect the assessment of the presented data.

No PHCs (Table 6) or VOCs (Table 7), including no tetrachloroethene (PCE), were detected in either of the two groundwater samples and all were below the respective O. Reg. 153/04 Table 8 SCS and Table 2 SCS, as well as below the respective PWQOs and sanitary sewer criteria. PCE had been detected in 2017 in historical monitoring well MW2 upgradient of BH22-1 at a concentration of 2.1 µg/l exceeding the Table 2 and 8 SCS of 1.6 µg/l (Amec Foster Wheeler, 26 March 2018).

No fecal coliforms, oil and grease or PCBs were detected in the BH22-1 sample, the concentrations of which were below the respective PWQOs and sanitary sewer criteria (Table 9). However, it should be noted that the laboratory detection limit of 0.04 µg/l for PCBs was above the PWQO of 0.001 µg/l; therefore, it is not possible to determine if the concentration of PCBs exceeds the PWQO.

Concentrations of all other parameters were below the respective O. Reg. 153/04 Table 8 and Table 2 SCS, except for chloride (Table 4) and sodium (Table 5) in the BH22-3 sample. This was consistent with elevated sodium and chloride concentrations detected in 2017 in historical monitoring well MW1 upgradient of BH22-3 (Amec Foster Wheeler, 26 March 2018) and is likely related to the use of salt for de-icing purposes in winter at the existing restaurant property and/or along the adjacent Hespeler Road.

Concentrations of dissolved molybdenum (Table 5), fluoranthene, phenanthrene (Table 8), total phosphorus and thirteen total metals (Table 9) exceeded the respective PWQOs in one or both of the groundwater samples. Considering that dissolved metal concentrations (Table 5) were almost all undetectable and all below the respective PWQOs, except for the dissolved molybdenum concentration of 0.0401 mg/l, just above the PWQO of 0.04 mg/l, if suspended sediment in the abstracted water is removed (to which metals and other parameters may be adsorbed), the resulting concentrations of metals and possibly also phosphorus and PAHs fluoranthene and phenanthrene might be reduced to below the respective PWQOs. However, this would need to be confirmed by regular sampling during dewatering as described in Section 4.1.3. Based on the current results, the groundwater from beneath the Site cannot be discharged to Groff Mill Creek or a storm sewer.

Concentrations of total suspended solids (TSS), total aluminum, total iron, total lead and total manganese (Table 9) also exceeded the respective sanitary sewer criteria. Therefore, the groundwater from beneath the Site cannot be discharged to a sanitary sewer. However, as

discussed above, the dissolved concentrations of metals were much lower (and mostly undetectable) than the total concentrations, indicating that metals were adsorbed to entrained sediment in the samples. Therefore, removing the suspended solids from the abstracted water prior to discharge should also decrease the amount of metals in the resulting sediment-free water to acceptable limits for discharge to the sanitary sewer. This would need to be confirmed by regular sampling during dewatering as described in Section 4.1.3.

4.1.3 Water Quality Monitoring

Water samples should be collected from the discharge water during construction and submitted for analysis to monitor the need for and effectiveness of treatment and to ensure the water quality meets the PWQOs for discharge to a storm sewer or surface water body and the sanitary sewer criteria for discharge to a sanitary sewer. Dewatering could mobilize any contaminants in the subsurface towards the abstraction points.

To determine if the abstracted water is suitable for discharge to the storm sewer, the samples of discharge water should be analyzed at least for (as listed in Tables 6, 8 and 9):

- pH
- total metals
- PHCs
- hardness
- oil & grease
- VOCs
- total phosphorus
- total phenols
- PAHs

To determine if the abstracted water is suitable for discharge to the sanitary sewer, the samples of discharge water should be analyzed at least for (as listed in Tables 6 and 9):

- pH
- fluoride
- sulphate
- total metals
- total phenols
- total PCBs
- TSS
- total Kjeldahl nitrogen
- sulphide
- BOD
- VOCs
- PHCs
- chloride
- total phosphorus
- cyanide
- oil & grease
- SVOCs

4.2 Water Discharge Method and Location

The abstracted groundwater and storm water could be discharged into the storm or sanitary sewer depending on whether the quality meets the PWQOs or sanitary sewer criteria as discussed above and if permitted by the water taking permit (if applicable), GRCA and Waterloo Region. Appropriate erosion, sediment and quality control measures would need to be used for discharges to storm sewer, sanitary sewer or surface water. Standard erosion and sediment control (ESC) measures should be applied and meet or exceed Ontario Provincial Standards and Specifications

(OPSS). The control measures should be implemented prior to work and be maintained during construction until disturbed areas have been effectively stabilized and restored. As a minimum and as required, the following standards should be followed:

a. Installation of silt fencing consisting of geotextile and wooden stakes; fencing is installed such that a minimum of 600 mm of geotextile is above ground and a minimum of 300 mm is buried.

b. All operations are to be controlled to prevent entry of deleterious materials into the watercourse that could be toxic to fish or fish habitat.

c. Equipment maintenance and refuelling shall be controlled so as to prevent any discharge of petroleum products and should be conducted a minimum of 30 m from the bank of any watercourse.

d. The escape of any visible emission, settlement of dust or debris, including abrasive media which may enter a watercourse while conducting structural repairs over or in the vicinity of a watercourse, should be prevented to the extent possible.

e. Construction material and excess materials should be stored / stockpiled more than 30 m away from any watercourse, drainage feature and top of steep slope.

f. A spill control and response plan should be in place with a spill kit on-Site.

Suspended solids from the abstracted water should be removed prior to discharge into the natural environment, storm sewer or sanitary sewer. This can be achieved by filter bags or for higher amounts by collecting the abstracted water in a weir tank to allow sediment to settle out of the water first. If additional treatment of the abstracted water is necessary, a mobile treatment system can be set up with appropriate treatment media. These are available through specialized subcontractors who have mobile ECAs for operation of such mobile treatment systems. Alternatively, if the abstracted water requires treatment before discharge, it could be discharged into the municipal sanitary sewer system as discussed above.

4.3 Water Discharge Rate

Abstracted groundwater should be discharged at a rate that will be sustainable for the storm sewer, sanitary sewer or natural environment of a surface water body. The discharge location to which the abstracted groundwater will be discharged should be monitored for adverse effects with respect to the amount of water being discharged. If any adverse effects are observed, such as local flooding or erosion, they need to be mitigated.

5.0 SUMMARY AND CONCLUSIONS

Based on the results of the hydrogeological study, Wood provides the following summary and conclusions:

1. The construction of an underground parking garage with buildings two to twelve storeys high is proposed in a commercially zoned area of Cambridge, Ontario, with underground utility services and elevator shafts. The concrete slab level of the underground parking garage is proposed to be approximately 7.5 m BGS, with the groundwater table at approximately 3 m BGS.

2. It is understood that a shoring system (groundwater control structure) will be constructed prior to the start of the excavation of the soils for the foundations and underground parking structure. Although the details of this shoring structure are not known at this time, it is assumed that the structure will be watertight and allow only minimal groundwater flow into the completed excavation.

3. Groff Mill Creek flows south adjacent to the western edge of the Site and may be hydraulically connected with the shallow groundwater flow system observed at the Site.

4. The stratigraphy beneath the Site is a sand and gravel aquifer (shallow aquifer groundwater flow system) up to approximately 7.2 m BGS, underlain by a silt and sand aquitard which extends to the top of dolostone bedrock (deep aquifer groundwater flow system) at approximately 13 m BGS.

5. Four monitoring wells were installed into the bottom portion of the shallow aquifer during this current investigation. Groundwater was determined to range from 2.34 m to 3.47 m BGS and to flow west-southwest towards Groff Mill Creek at a horizontal hydraulic gradient of 0.0017 m/m.

6. Vertical hydraulic gradients were not obtained; however, they are considered to be minimal under natural gradients. Considerations for vertical gradients during construction and operation of the underground parking garage should be given if an open-bottom shoring option is selected for the project.

7. The hydraulic conductivity of the shallow aquifer was determined by single well response tests to range from 1.2×10^{-4} to 4.5×10^{-3} m/s.

8. For the un-shored condition, dewatering rates were estimated to range from 900 to 5,000 m^3/d with an uncertainty factor of 3 applied to the hydraulic conductivity, with

associated radii of influence ranging from 200 to 970 m. These dewatering rates would be continuous during the construction and during the operation of the parking structure.

9. For the shored condition, the radius of influence was set at 75 m and resulted in dewatering rate estimates to range from 1,000 to 9,000 m^3/d with an uncertainty factor of 3 applied to the hydraulic conductivity. Assuming watertight conditions inside the shoring structure, these rates are expected to decrease over time as the soil inside the shored area is excavated and finite amount of groundwater abstracted.

10. Under the scenarios and conditions considered, the estimated dewatering rates are above the threshold of 400 m^3/d for registration in the Environmental Activity and Sector Registry (EASR), hence a permit to take water (PTTW) is required for the construction dewatering.

11. The Site is outside the nearest wellhead protection area. The nearest 25-year time-of-travel WHPA zone D with low (2) vulnerability is 450 m northeast of the Site. There are also no intake protection zones from surface water features to the municipal water supply system near the Site. The Site is not in a significant groundwater recharge area. The nearest municipal wells G5 and G5A were determined not likely to be affected by dewatering activities at the Site because they are deeper than the anticipated maximum excavation depths and outside the estimated zones of influence for the dewatering.

12. If the entire area to be dewatered is inside the shoring structure sufficiently keyed into underlying low permeability silt and sand till (the aquitard), and dewatering impacts do not occur outside the shoring structure, no impact to Groff Mill Creek would be anticipated. Groff Mill Creek could be a potential habitat to species of concern Midland painted turtle and/or the endangered Jefferson salamander.

13. The applicable groundwater quality criteria at the Site are the O. Reg. 153/04 Table 8 SCS for use within 30 m of a water body and O. Reg. 153/04 Table 2 SCS in a potable groundwater condition for all property uses. The applicable criteria for discharges to surface water and the storm sewer are the PWQOs. The applicable criteria for discharges to the sanitary sewer are the sanitary sewer criteria of Waterloo Region By-law no. 21-036.

14. Groundwater quality of two samples collected from monitoring wells BH22-1 and BH22-3 indicated that concentrations of general chemistry, dissolved metals, PHCs, VOCs and PAHs were below the O. Reg. 153/04 Table 8 SCS and Table 2 SCS, except for chloride and sodium in the BH22-3 sample, attributed to the use of salt for winter de-icing purposes in the area.

15. Concentrations of dissolved molybdenum, fluoranthene, phenanthrene, total phosphorus and thirteen total metals exceeded the respective PWQOs in one or both of the

groundwater samples. Therefore, the groundwater from beneath the Site cannot be discharged to Groff Mill Creek or a storm sewer prior to treatment. Removing sediment may remove some or all of the elevated concentrations.

16. Concentrations of TSS, total aluminum, total iron, total lead and total manganese also exceeded the respective sanitary sewer criteria in the BH22-3 groundwater sample. Therefore, the groundwater from beneath the Site cannot be discharged to a sanitary sewer prior to treatment. Removing sediment may remove some or all of the elevated concentrations.

6.0 RECOMMENDATIONS

Based on the conclusions of the hydrogeological study, Wood provides the following recommendations:

1. Complete the shoring system design and allow Wood to review the design and assess the compatibility with the recommendations provided herein.

2. To refine the dewatering rate estimates, install nested or clustered monitoring well screens into the shallow aquifer, aquitard and deep aquifer to determine vertical hydraulic gradients (i.e. is groundwater moving upward under natural conditions or during construction?) and to determine hydraulic conductivity of the aquitard and upper bedrock (i.e. deep aquifer).

3. Apply for a permit to take water.

4. A detailed dewatering plan and a detailed discharge plan should be developed by a dewatering contractor.

5. Record the amount of water taking during each day of dewatering to ensure the maximum water taking does not exceed the amount specified by the water taking permit. The water taking amounts will need to be provided to the MECP.

6. Monitor stream flow in Groff Mill Creek to ensure it is not being affected by dewatering at the construction site, whether shored or not. The developer should also consider having a contingency action plan in place prior to commencing construction to implement quickly to mitigate impacts to Groff Mill Creek.

7. Use standard erosion and sediment control (ESC) measures that meet or exceed Ontario Provincial Standards and Specifications to discharge the abstracted water into Sheffield Wetland or other natural surface water body. The ESC measures should be implemented prior to work and be maintained during construction until disturbed areas have been effectively stabilized and restored. Removing sediment from the abstracted water could be achieved by filter bags or for higher amounts by collecting the abstracted water in a weir tank to allow sediment to settle out of the water first.

8. Collect water samples from the discharge water during construction and submit them for analysis to monitor the need for and effectiveness of treatment and to ensure the water quality meets the PWQOs for discharge to a storm sewer or surface water body and the sanitary sewer criteria for discharge to a sanitary sewer. Dewatering could mobilize any contaminants in the subsurface towards the abstraction points.

9. To determine if the abstracted water is suitable for discharge to the storm sewer, the samples of discharge water should be analyzed at least for (as listed in Tables 6, 8 and 9):

- pH
- total metals
- PHCs
- hardness
- oil & grease
- VOCs
- total phosphorus
- total phenols
- PAHs

10. To determine if the abstracted water is suitable for discharge to the sanitary sewer, the samples of discharge water should be analyzed at least for (as listed in Tables 6 and 9):

- pH
- fluoride
- sulphate
- total metals
- total phenols
- total PCBs
- TSS
- total Kjeldahl nitrogen
- sulphide
- BOD
- VOCs
- PHCs
- chloride
- total phosphorus
- cyanide
- oil & grease
- SVOCs

11. Abstracted groundwater should be discharged at a rate that will be sustainable for the storm sewer, sanitary sewer or natural environment of a surface water body. The discharge location to which the abstracted groundwater will be discharged should be monitored for adverse effects with respect to the amount of water being discharged. If any adverse effects are observed, such as local flooding or erosion, they need to be mitigated.

7.0 CLOSURE

This report is subject to the limitations contained in Appendix E. We trust the information presented in this report meets your current requirements. Should you have any questions or concerns, please contact the undersigned.

Yours truly,
Wood Environment & Infrastructure Solutions,
a Division of Wood Canada Limited

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8.0 REFERENCES

Amec Foster Wheeler Environment & Infrastructure, *Additional Supplemental Environmental Site Investigation, 516 Hespeler Road, Cambridge, Ontario*, SWC176321, 27 March 2018.

Amec Foster Wheeler Environment & Infrastructure, *Phase II Environmental Site Assessment, 516 Hespeler Road, Cambridge, Ontario*, SWC176253, 26 March 2018.

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Wood Environment & Infrastructure Solutions (Wood), *Supplemental Geotechnical Investigation Report, Development of 506, 510 and 516 Hespeler Road and 1000 Langs Drive, Cambridge, Ontario*, OGTW2201, 4 May 2022.

Figures

NOTES:
ALL LOCATIONS ARE APPROXIMATE.

REFERENCES:
CANMAP STREETFILES V2008.4.

CLIENT:	TITLE:	PROJECT:
STARBANK DEVELOPMENTS 516 (& 506)	SITE LOCATION MAP	HYDROGEOLOGICAL STUDY 506, 510 AND 516 HESPELER ROAD AND 1000 LANGS DRIVE CAMBRIDGE, ONTARIO

Wood Environment & Infrastructure Solutions
900 MAPLE GROVE ROAD, UNIT 10
CAMBRIDGE, ONTARIO
N3H 4R7
519-650-7100

wood.

DATUM:	PROJECTION:	DATE:
NAD83	UTM Zone 17	MAY 6, 2022
DWN BY: LMK	REV. No: 0	PROJECT No: OGTW2201
CHK'D BY: MN	SCALE: 1:30,000	FIGURE No: 1

DATE PLOTTED: 5/6/2022 5:10:46 PM
FILE LOCATION: Q:\CCGEM\2022\Projects\Geotechnical\OGTW2201 - Starbank Developments 516 (& 506) - Hespeler Rd\14 CAD\GEO\OGTW2201-R01001.dwg

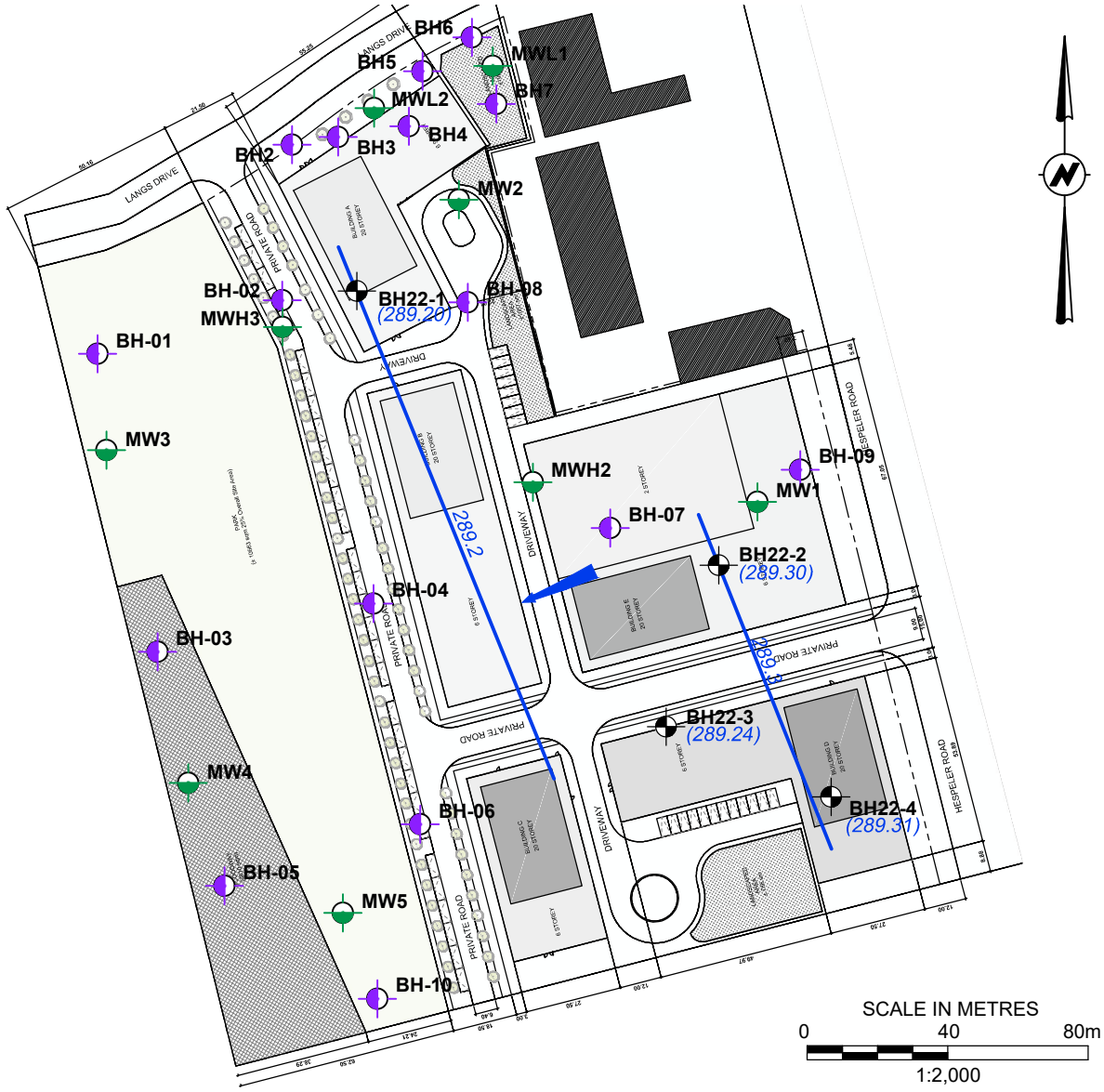
BH ID	NORTHING	EASTING
BH22-1	4805532	554457
BH22-2	4805454	554560
BH22-3	4805408	554545
BH22-4	4805388	554592

LEGEND:

- MONITORING WELL
- HISTORICAL BOREHOLE (AMEC FOSTER WHEELER 2017)
- HISTORICAL MONITORING WELL (AMEC FOSTER WHEELER 2017)
- *289.3* GROUNDWATER ELEVATION (m AMSL)
- GROUNDWATER ELEVATION CONTOUR
- INFERRED GROUNDWATER FLOW DIRECTION

NOTES:
ALL LOCATIONS ARE APPROXIMATE.

REFERENCES:
PLAN PROVIDED BY CLIENT.



CLIENT: STARBANK DEVELOPMENTS 516 (& 506)	DWN BY: LMK	PROJECT: HYDROGEOLOGICAL STUDY 506, 510 AND 516 HESPELER ROAD AND 1000 LANGS DRIVE CAMBRIDGE, ONTARIO	DATE: MAY 6, 2022
	CHK'D BY: MN		PROJECT No: OGTW2201
	DATUM: NAD83	TITLE: SITE PLAN AND GROUNDWATER FLOW DIRECTION	REV. No: 0
	PROJECTION: UTM Zone 17		FIGURE No: 2
	SCALE: 1:2,000		

Wood
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900 MAPLE GROVE ROAD, UNIT 10
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Tables

Table 1: Well Details and Groundwater Elevations

Well name	BH22-1		BH22-2		BH22-3		BH22-4	
ID (cm)	5.1		5.1		5.1		5.1	
Well depth (m BGS) per borehole log	7.6		6.1		6.1		7.6	
Well depth (m BGS) per measurement	7.4		5.8		5.8		7.1	
Ground surface elevation (m AMSL)	291.55		292.69		292.50		292.46	
Stick-up (m AGS)	1.01		0.99		-0.20		-0.18	
Top of pipe elevation (m AMSL)	292.56		293.68		292.30		292.28	
Date	Groundwater Levels and Elevations							
	(m BGS)	(m AMSL)	(m BGS)	(m AMSL)	(m BGS)	(m AMSL)	(m BGS)	(m AMSL)
15-Mar-22	2.41	289.14	3.47	289.22	3.34	289.16	3.27	289.23
4-Apr-22	2.35	289.20	3.39	289.30	3.26	289.24	3.19	289.31
5-Apr-22	2.34	289.21	3.38	289.31	3.26	289.24	3.18	289.32

NOTES:
-- not available / not measured
ID - inside diameter of well
Well depths are from borehole logs.
Ground surface elevations are from well survey conducted by Wood.
Top of pipe elevations are based on measured stickups from surveyed ground surface elevations.
m AGS - metres above ground surface (negative value indicates below ground surface)
m BGS - metres below ground surface
m AMSL - metres above mean sea level
15 March 2022 measurements were before wells were developed.

Table 4: Groundwater Quality - General Chemistry

Sample / Monitor Name		O. Reg. 153/04		Ontario	Waterloo	BH22-1	BH22-3
Laboratory Sample ID		Table 8	Table 2		Sanitary	L2696563-1	L2696563-2
Date Collected	Units	SCS [1]	SCS [2]	PWQO [3]	Criteria [4]	4-Apr-22	4-Apr-22
General chemistry							
pH	--	--	--	6.5 - 8.5	6 - 10.5	7.55	8.11
Electrical conductivity	mS/cm	--	--	--	--	2.78	3.7
Colour, apparent	CU	--	--	--	--	53	30.1
Total Dissolved Solids	mg/l	--	--	--	--	1500	1970
Turbidity	NTU	--	--	(a)	--	>4000	>4000
Anions and nutrients							
Alkalinity, Bicarbonate (as CaCO3)	mg/l	--	--	--	--	433	287
Alkalinity, Carbonate (as CaCO3)	mg/l	--	--	--	--	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/l	--	--	--	--	<1.0	<1.0
Alkalinity, Total (as CaCO3)	mg/l	--	--	(b)	--	433	287
Ammonia, Total (as N)	mg/l	--	--	--	--	0.08	0.051
Bromide (Br)	mg/l	--	--	--	--	<0.50	1.56
Chloride (Cl)	mg/l	790	790	--	1500	691	**1150**
Fluoride (F)	mg/l	--	--	--	10	<0.10	0.35
Hardness (as CaCO3)	mg/l	--	--	--	--	391	646
Nitrate and Nitrite as N	mg/l	--	--	--	--	0.66	<0.11
Nitrate (as N)	mg/l	--	--	--	--	0.66	<0.10
Nitrite (as N)	mg/l	--	--	--	--	<0.050	<0.050
Orthophosphate-Dissolved (as P)	mg/l	--	--	--	--	0.003	<0.0030
Sulphate (SO4)	mg/l	--	--	--	1500	74.5	69.1
Anion Sum	me/l	--	--	--	--	28.2	38.5
Cation Sum	me/l	--	--	--	--	25.4	35.7
Cation - Anion Balance	%	--	--	--	--	-5	-4
Cyanides							
Cyanide, free	mg/l	0.052	0.066	0.005	2	<0.002	<0.002
Organic / inorganic carbon							
Dissolved Organic Carbon	mg/l	--	--	--	--	3.22	5.62
Inorganic parameters							
Silica	mg/l	--	--	--	--	7.7	8.6

NOTES:

--	no criterion / not analyzed / not available / not applicable
mS/cm	milliSiemens per centimetre
CU	colour unit
mg/l	milligrams per litre
NTU	nephelometric turbidity unit
<	less than the laboratory detection limit (DL)
OG	operational guideline (non-health related)
AO	aesthetic objective (non-health related)
MAC	maximum acceptable concentration (health related)
100	exceeds O. Reg. 153/04 Table 8 and/or Table 2 SCS
100	exceeds PWQO
100	exceeds sanitary sewer criterion
(1)	Table 8 Generic Site Condition Standards (SCS) within 30 m of a water body in a potable groundwater condition for all types of property uses of O. Reg. 153/04, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, Ontario Ministry of Environment (MOE), 15 April 2011.
(2)	Table 2 Full Depth Generic Site Condition Standards (SCS) in a potable groundwater condition for all types of property uses of O. Reg. 153/04, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, Ontario Ministry of Environment (MOE), 15 April 2011.
(3)	Ontario Ministry of Environment Provincial Water Quality Objectives (PWQOs) (MOE 1999).
(4)	Waterloo Region Sanitary Sewer Criteria, Bylaw no. 21-036 (1 January 2022).
(a)	Suspended matter should not be added to surface water in concentrations that will change the natural Secchi disc reading by more than 10 %.
(b)	Alkalinity should not be decreased by more than 25 % of the natural concentration.

Table 5: Groundwater Quality - Dissolved Metals

Sample / Monitor Name		O. Reg. 153/04		Ontario	Waterloo	BH22-1	BH22-3
Laboratory Sample ID		Table 8	Table 2		Sanitary	L2696563-1	L2696563-2
Date Collected	Units	SCS [1]	SCS [2]	PWQO [3]	Criteria [4]	4-Apr-22	4-Apr-22
Antimony	mg/l	0.006	0.006	0.02	5	<0.001	<0.001
Arsenic	mg/l	0.025	0.025	0.1 / 0.005	1	<0.001	<0.001
Barium	mg/l	1	1	--	--	0.271	0.222
Beryllium	mg/l	0.004	0.004	1.1 (a)	--	<0.001	<0.001
Boron	mg/l	5	5	0.2	--	<0.1	0.16
Cadmium	mg/l	0.0021	0.0027	0.0005 (b)	0.5	<0.00005	<0.00005
Chromium (total)	mg/l	0.05	0.05	0.0089	2.8	<0.005	<0.005
Chromium (Cr^{6+})	mg/l	0.025	0.025	0.001	--	<0.0005	<0.0005
Cobalt	mg/l	0.0038	0.0038	0.0009	5	**<0.001**	**<0.001**
Copper	mg/l	0.069	0.087	0.005 (c)	2	<0.002	<0.002
Lead	mg/l	0.01	0.01	0.005 (d)	1	<0.0005	<0.0005
Mercury	mg/l	0.00029	0.00029	0.0002	0.05	<0.000005	<0.000005
Molybdenum	mg/l	0.07	0.07	0.04	5	0.00076	**0.0401**
Nickel	mg/l	0.1	0.1	0.025	2	<0.005	<0.005
Selenium	mg/l	0.01	0.01	0.1	1	<0.0005	<0.0005
Silver	mg/l	0.0012	0.0015	0.0001	5	**<0.0005**	**<0.0005**
Sodium	mg/l	490	490	--	--	403	**517**
Thallium	mg/l	0.002	0.002	0.0003	--	<0.0001	<0.0001
Uranium	mg/l	0.02	0.02	0.005	--	0.00199	0.00133
Vanadium	mg/l	0.0062	0.0062	0.006	5	<0.005	<0.005
Zinc	mg/l	0.89	1.1	0.03 / 0.02	3	<0.01	<0.01

NOTES:

--	no criterion / not analyzed / not available / not applicable
mg/l	milligrams per litre
<	less than the laboratory detection limit (DL)
0.1 / 0.005	standard / interim PWQO
<0.001	DL exceeds PWQO
100	exceeds O. Reg. 153/04 Table 8 and/or Table 2 SCS
100	exceeds PWQO
100	exceeds sanitary sewer criterion
(1)	Table 8 Generic Site Condition Standards (SCS) within 30 m of a water body in a potable groundwater condition for all types of property uses of O. Reg. 153/04, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, Ontario Ministry of Environment (MOE), 15 April 2011.
(2)	Table 2 Full Depth Generic Site Condition Standards (SCS) in a potable groundwater condition for all types of property uses of O. Reg. 153/04, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, Ontario Ministry of Environment (MOE), 15 April 2011.
(3)	Ontario Ministry of Environment Provincial Water Quality Objectives (PWQOs) (MOE 1999).
(4)	Waterloo Region Sanitary Sewer Criteria, Bylaw no. 21-036 (1 January 2022).
(a)	Beryllium PWQO = 11 ug/l at hardness < 75 mg/l; 1100 ug/l at hardness > 75 mg/l (as CaCO3).
(b)	Cadmium interim PWQO = 0.1 ug/l at hardness < 100 mg/l; 0.5 ug/l at hardness > 100 mg/l (as CaCO3). Cadmium PWQO = 0.2 ug/l.
(c)	Copper interim PWQO = 1 ug/l at hardness < 20 mg/l; 5 ug/l at hardness > 20 mg/l (as CaCO3).
(d)	Lead interim PWQO = 1 ug/l at hardness < 30 mg/l; 3 ug/l at hardness 30 - 80 mg/l; 5 ug/l at hardness > 80 mg/l.

Table 6: Groundwater Quality - Petroleum Hydrocarbons

Sample / Monitor Name		O. Reg. 153/04		Ontario	Waterloo	BH22-1	BH22-3
Laboratory Sample ID		Table 8	Table 2		Sanitary	L2696563-1	L2696563-2
Date Collected	Units	SCS [1]	SCS [2]	PWQO [3]	Criteria [4]	4-Apr-22	4-Apr-22
F1 (C6-C10)	µg/l	420	750	--	0	<25	<25
F1-BTEX	µg/l	420	750	--	0	<25	<25
F2 (C10-C16)	µg/l	150	150	--	0	<100	<100
F2-Naphth	µg/l	--	--	--	0	<100	<100
F3 (C16-C34)	µg/l	500	500	--	0	<250	<250
F3-PAH	µg/l	--	--	--	0	<250	<250
F4 (C34-C50)	µg/l	500	500	--	0	<250	<250

NOTES:

--	no criterion / not analyzed / not available / not applicable
µg/l	micrograms per litre
<	less than the laboratory detection limit (DL)
100	exceeds O. Reg. 153/04 Table 8 and/or Table 2 SCS
100	exceeds PWQO
100	exceeds sanitary sewer criterion
(1)	Table 8 Generic Site Condition Standards (SCS) within 30 m of a water body in a potable groundwater condition for all types of property uses of O. Reg. 153/04, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, Ontario Ministry of Environment (MOE), 15 April 2011.
(2)	Table 2 Full Depth Generic Site Condition Standards (SCS) in a potable groundwater condition for all types of property uses of O. Reg. 153/04, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, Ontario Ministry of Environment (MOE), 15 April 2011.
(3)	Ontario Ministry of Environment Provincial Water Quality Objectives (PWQOs) (MOE 1999).
(4)	Waterloo Region Sanitary Sewer Criteria, Bylaw no. 21-036 (1 January 2022).

Table 7: Groundwater Quality - Volatile Organic Compounds

Sample / Monitor Name		O. Reg. 153/04		Ontario	Waterloo	BH22-1	BH22-3
Laboratory Sample ID		Table 8	Table 2		Sanitary	L2696563-1	L2696563-2
Date Collected	Units	SCS [1]	SCS [2]	PWQO [3]	Criteria [4]	4-Apr-22	4-Apr-22
Acetone	µg/l	2700	2700	--	--	<30	<30
Benzene	µg/l	5	5	100	10	<0.50	<0.50
Bromodichloromethane	µg/l	16	16	200	--	<2.0	<2.0
Bromoform	µg/l	25	25	60	--	<5.0	<5.0
Bromomethane	µg/l	0.89	0.89	0.9	--	<0.50	<0.50
Carbon tetrachloride	µg/l	0.79	0.79	--	--	<0.20	<0.20
Chlorobenzene	µg/l	30	30	15	--	<0.50	<0.50
Chloroform	µg/l	2.4	2.4	--	40	<1.0	<1.0
Dibromochloromethane	µg/l	25	25	40	--	<2.0	<2.0
1,2-Dibromoethane	µg/l	0.2	0.2	5	--	<0.20	<0.20
1,2-Dichlorobenzene	µg/l	3	3	2.5	50	<0.50	<0.50
1,3-Dichlorobenzene	µg/l	59	59	2.5	--	<0.50	<0.50
1,4-Dichlorobenzene	µg/l	1	1	4	80	<0.50	<0.50
Dichlorodifluoromethane	µg/l	590	590	--	--	<2.0	<2.0
1,1-Dichloroethane	µg/l	5	5	200	--	<0.50	<0.50
1,2-Dichloroethane	µg/l	1.6	1.6	100	--	<0.50	<0.50
1,1-Dichloroethene	µg/l	1.6	1.6	40	--	<0.50	<0.50
cis-1,2-Dichloroethene	µg/l	1.6	1.6	200	4000	<0.50	<0.50
trans-1,2-Dichloroethene	µg/l	1.6	1.6	200	--	<0.50	<0.50
Methylene Chloride	µg/l	50	50	100	2000	<5.0	<5.0
1,2-Dichloropropane	µg/l	5	5	0.7	--	<0.50	<0.50
cis-1,3-Dichloropropene	µg/l	0.5	0.5	--	--	<0.30	<0.30
trans-1,3-Dichloropropene	µg/l	0.5	0.5	7	140	<0.30	<0.30
1,3-Dichloropropene (cis & trans)	µg/l	0.5	0.5	--	--	<0.50	<0.50
Ethylbenzene	µg/l	2.4	2.4	8	160	<0.50	<0.50
n-Hexane	µg/l	51	51	--	--	<0.50	<0.50
Methyl Ethyl Ketone	µg/l	1800	1800	400	--	<20	<20
Methyl Isobutyl Ketone	µg/l	640	640	--	--	<20	<20
MTBE	µg/l	15	15	200	--	<2.0	<2.0
Styrene	µg/l	5.4	5.4	4	--	<0.50	<0.50
1,1,1,2-Tetrachloroethane	µg/l	1.1	1.1	20	--	<0.50	<0.50
1,1,2,2-Tetrachloroethane	µg/l	1	1	70	1400	<0.50	<0.50
Tetrachloroethene	µg/l	1.6	1.6	50	1000	<0.50	<0.50
Toluene	µg/l	22	24	0.8	270	<0.50	<0.50
1,1,1-Trichloroethane	µg/l	200	200	10	--	<0.50	<0.50
1,1,2-Trichloroethane	µg/l	4.7	4.7	800	--	<0.50	<0.50
Trichloroethene	µg/l	1.6	1.6	20	400	<0.50	<0.50
Trichlorofluoromethane	µg/l	150	150	--	--	<5.0	<5.0
Vinyl chloride	µg/l	0.5	0.5	600	--	<0.50	<0.50
o-Xylene	µg/l	--	--	40	--	<0.30	<0.30
m+p-Xylenes	µg/l	--	--	2(m), 30(p)	--	<0.40	<0.40
Xylenes (Total)	µg/l	300	300	--	1400	<0.50	<0.50

NOTES:

--	no criterion / not analyzed / not available / not applicable
µg/l	micrograms per litre
<	less than the laboratory detection limit (DL)
100	exceeds O. Reg. 153/04 Table 8 and/or Table 2 SCS
100	exceeds PWQO
100	exceeds sanitary sewer criterion
(1)	Table 8 Generic Site Condition Standards (SCS) within 30 m of a water body in a potable groundwater condition for all types of property uses of O. Reg. 153/04, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, Ontario Ministry of Environment (MOE), 15 April 2011.
(2)	Table 2 Full Depth Generic Site Condition Standards (SCS) in a potable groundwater condition for all types of property uses of O. Reg. 153/04, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, Ontario Ministry of Environment (MOE), 15 April 2011.
(3)	Ontario Ministry of Environment Provincial Water Quality Objectives (PWQOs) (MOE 1999).
(4)	Waterloo Region Sanitary Sewer Criteria, Bylaw no. 21-036 (1 January 2022).

Table 8: Groundwater Quality - Polycyclic Aromatic Hydrocarbons

Sample / Monitor Name		O. Reg. 153/04		Ontario	Waterloo	BH22-1	BH22-3
Laboratory Sample ID		Table 8	Table 2		Sanitary	L2696563-1	L2696563-2
Date Collected	Units	SCS [1]	SCS [2]	PWQO [3]	Criteria [4]	4-Apr-22	4-Apr-22
Acenaphthene	µg/l	4.1	4.1	--	--	<0.020	<0.020
Acenaphthylene	µg/l	1	1	--	--	<0.020	0.02
Anthracene	µg/l	1	2.4	0.0008	--	**<0.020**	**<0.020**
Benzo(a)anthracene	µg/l	1	1	0.0004	--	**<0.020**	**<0.020**
Benzo(a)pyrene	µg/l	0.01	0.01	--	--	<0.010	<0.010
Benzo(b&j)fluoranthene	µg/l	0.1	0.1	--	--	<0.020	<0.020
Benzo(g,h,i)perylene	µg/l	0.2	0.2	0.00002	--	**<0.020**	**<0.020**
Benzo(k)fluoranthene	µg/l	0.1	0.1	0.0002	--	**<0.020**	**<0.020**
Chrysene	µg/l	0.1	0.1	0.0001	--	**<0.020**	**<0.020**
Dibenz(a,h)anthracene	µg/l	0.2	0.2	0.002	--	**<0.020**	**<0.020**
Fluoranthene	µg/l	0.41	0.41	0.0008	--	**0.03**	**0.032**
Fluorene	µg/l	120	120	0.2	--	**<0.020**	**<0.020**
Indeno(1,2,3-cd)pyrene	µg/l	0.2	0.2	--	--	<0.020	<0.020
1+2-Methylnaphthalenes	µg/l	3.2	3.2	--	--	0.057	0.129
1-Methylnaphthalene	µg/l	3.2	3.2	2	--	0.024	0.062
2-Methylnaphthalene	µg/l	3.2	3.2	2	--	0.033	0.068
Naphthalene	µg/l	11	11	7	--	<0.050	0.054
Phenanthrene	µg/l	1	1	0.03	--	**0.031**	**0.049**
Pyrene	µg/l	4.1	4.1	--	--	0.033	0.047

NOTES:

--	no criterion / not analyzed / not available / not applicable
µg/l	micrograms per litre
<	less than the laboratory detection limit (DL)
<0.02	DL exceeds PWQO
100	exceeds O. Reg. 153/04 Table 8 and/or Table 2 SCS
100	exceeds PWQO
100	exceeds sanitary sewer criterion
(1)	Table 8 Generic Site Condition Standards (SCS) within 30 m of a water body in a potable groundwater condition for all types of property uses of O. Reg. 153/04, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, Ontario Ministry of Environment (MOE), 15 April 2011.
(2)	Table 2 Full Depth Generic Site Condition Standards (SCS) in a potable groundwater condition for all types of property uses of O. Reg. 153/04, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, Ontario Ministry of Environment (MOE), 15 April 2011.
(3)	Ontario Ministry of Environment Provincial Water Quality Objectives (PWQOs) (MOE 1999).
(4)	Waterloo Region Sanitary Sewer Criteria, Bylaw no. 21-036 (1 January 2022).

Table 9: Groundwater Quality - Sanitary Sewer Parameters

Sample / Monitor Name		Ontario	Waterloo	BH22-1
Laboratory Sample ID			Sanitary	L2696571-1
Date Collected	Units	PWQO [1]	Criteria [2]	4-Apr-22
General chemistry				
pH	--	6.5 - 8.5	6 - 10.5	7.73
Hardness (as CaCO3)	mg/l	--	--	415
Total Suspended Solids	mg/l	--	350	**11,700**
Anions and nutrients				
Chloride (Cl)	mg/l	--	1500	718
Fluoride (F)	mg/l	--	10	<0.1
Total Kjeldahl Nitrogen	mg/l	--	100	0.79
Phosphorus, Total	mg/l	0.03 (a)	10	**1.11**
Sulphate (SO4)	mg/l	--	1500	75.7
Sulphide (S)	mg/l	--	1000	0.045
Cyanides				
Cyanide, total	mg/l	0.005	2	<0.002
Bacteriological tests				
Fecal coliforms	CFU/100 ml	--	--	<2
Total metals				
Aluminum (Al)-Dissolved	mg/l	0.075 (b)	--	<0.05
Aluminum (Al)-Total	mg/l	--	50	**92.6**
Antimony (Sb)-Total	mg/l	0.02	5	<0.001
Arsenic (As)-Total	mg/l	0.1 / 0.005	1	0.0424
Beryllium (Be)-Total	mg/l	1.1 (c)	--	0.0052
Bismuth (Bi)-Total	mg/l	--	5	0.00267
Boron (B)-Total	mg/l	0.2	--	0.12
Cadmium (Cd)-Total	mg/l	0.0005 (d)	0.5	**0.00425**
Calcium (Ca)-Dissolved	mg/l	--	--	124
Chromium (Cr)-Total	mg/l	0.0089	2.8	**0.195**
Chromium (Cr^{6+})	mg/l	0.001	--	<0.0005
Cobalt (Co)-Total	mg/l	0.0009	5	**0.105**
Copper (Cu)-Total	mg/l	0.005 (e)	2	**0.543**
Iron (Fe)-Total	mg/l	0.3	50	**198**
Lead (Pb)-Total	mg/l	0.005 (f)	1	**1.03**
Magnesium (Mg)-Dissolved	mg/l	--	--	25.6
Manganese (Mn)-Total	mg/l	--	5	**7.18**
Mercury (Hg)-Dissolved	mg/l	0.0002	--	<0.000005
Mercury (Hg)-Total	mg/l	--	0.05	0.0000143
Molybdenum (Mo)-Total	mg/l	0.04	5	0.00104
Nickel (Ni)-Total	mg/l	0.025	2	**0.195**
Selenium (Se)-Total	mg/l	0.1	1	0.00203
Silver (Ag)-Total	mg/l	0.0001	5	**0.00182**
Thallium (Tl)-Total	mg/l	0.0003	--	**0.00148**
Tin (Sn)-Total	mg/l	--	5	0.0011
Titanium (Ti)-Total	mg/l	--	5	1.43
Tungsten (W)-Total	mg/l	0.03	--	<0.001
Uranium (U)-Total	mg/l	0.005	--	**0.00922**
Vanadium (V)-Total	mg/l	0.006	5	**0.185**
Zinc (Zn)-Total	mg/l	0.03 / 0.02	3	**2.9**
Zirconium (Zr)-Total	mg/l	0.004	--	**0.0043**
Aggregate organics				
BOD Carbonaceous	mg/l	--	300	<3.0
Oil and Grease, Total	mg/l	(g)	--	<5.0
Animal/Veg Oil & Grease	mg/l	(g)	100	<5.0
Mineral Oil and Grease	mg/l	(g)	15	<2.5
Phenols (4AAP)	mg/l	0.001	1	<0.001
Volatile organic compounds				
Benzene	µg/l	100	10	<0.50
Chloroform	µg/l	--	40	<1.0
1,2-Dichlorobenzene	µg/l	2.5	50	<0.50

Table 9: Groundwater Quality - Sanitary Sewer Parameters

Sample / Monitor Name		Ontario	Waterloo	BH22-1
Laboratory Sample ID			Sanitary	L2696571-1
Date Collected	Units	PWQO [1]	Criteria [2]	4-Apr-22
1,4-Dichlorobenzene	µg/l	4	80	<0.50
cis-1,2-Dichloroethene	µg/l	200	4000	<0.50
Dichloromethane	µg/l	100	2000	<2.0
trans-1,3-Dichloropropene	µg/l	7	140	<0.30
Ethylbenzene	µg/l	8	160	<0.50
Styrene	µg/l	4	--	<0.50
1,1,2,2-Tetrachloroethane	µg/l	70	1400	<0.50
Tetrachloroethene	µg/l	50	1000	<0.50
Toluene	µg/l	0.8	270	<0.40
Trichloroethene	µg/l	20	400	<0.50
o-Xylene	µg/l	40	--	<0.30
m+p-Xylenes	µg/l	2(m), 30(p)	--	<0.40
Xylenes (Total)	µg/l	--	1400	<0.50
Semi-volatile organics				
N-Nitrosodimethylamine	µg/l	15	0.4	<0.03
N-Nitrosomethylethylamine	µg/l	--	0.2	<0.10
Polychlorinated biphenyls				
Aroclor 1242	µg/l	--	--	<0.020
Aroclor 1248	µg/l	--	--	<0.020
Aroclor 1254	µg/l	--	--	<0.020
Aroclor 1260	µg/l	--	--	<0.020
Total PCBs	µg/l	0.001	4	**<0.040**

NOTES:

--	no criterion / not analyzed / not available / not applicable
µg/l	micrograms per litre
mg/l	milligrams per litre
CFU	colony forming unit
<	less than the laboratory detection limit (DL)
0.1 / 0.005	standard / interim PWQO
<0.02	DL exceeds PWQO
100	exceeds PWQO
100	exceeds sanitary sewer criterion
(1)	Ontario Ministry of Environment Provincial Water Quality Objectives (PWQOs) (MOE 1999).
(2)	Waterloo Region Sanitary Sewer Criteria, Bylaw no. 21-036 (1 January 2022).
(a)	Total phosphorus interim PWQO = 10 ug/l for high level of aesthetic protection in lakes; 20 ug/l to avoid algae nuisance; 30 ug/l to avoid excessive plant growth in streams and rivers.
(b)	Aluminum interim PWQO = 15 ug/l at 4.5 < pH < 5.5; <10 % increase from background concentration at 5.5 < pH < 6.5; 75 ug/l at 6.5 < pH < 9.
(c)	Beryllium PWQO = 11 ug/l at hardness < 75 mg/l; 1100 ug/l at hardness > 75 mg/l (as CaCO3).
(d)	Cadmium interim PWQO = 0.1 ug/l at hardness < 100 mg/l; 0.5 ug/l at hardness > 100 mg/l (as CaCO3). Cadmium PWQO = 0.2 ug/l.
(e)	Copper interim PWQO = 1 ug/l at hardness < 20 mg/l; 5 ug/l at hardness > 20 mg/l (as CaCO3).
(f)	Lead interim PWQO = 1 ug/l at hardness < 30 mg/l; 3 ug/l at hardness 30 - 80 mg/l; 5 ug/l at hardness > 80 mg/l.
(g)	Oil or petrochemicals should not be present in concentrations that can be detected as a visible film, sheen or discolouration on the surface; can be detected by odour; can cause tainting or can form deposits.

Appendix A

Borehole Logs

RECORD OF BOREHOLE No. BH22-1

Project Number: **OGTW2201**
Drilling Location: **N:4805532, E:554457**
Project Client: **Starbank Developments**
Drilling Method: **200 mm Hollow Stem Augering**
Project Name: **506, 510 and 516 Hespeler road and Langs Drive**
Drilling Machine: **Track Mounted Drill**
Project Location: **Cambridge Ontario**
Date Started: **Mar 1, 22** Date Completed: **Mar 2, 22**

Logged by: **HP** Compiled by: **TF** Reviewed by: **MN** Revision No.: **0, 5/8/22**

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 291.5 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	PenetrationTesting: 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
	460mm **Topsoil**	291.1	SS	1	75	9	0	291	28		50mm Stick-up Monitoring Well Top of Pipe Elevation: 292.61				
	Brown **Sand** Trace silt, trace gravel Compact Moist	0.5	SS	2	56	17	1	290	11						
		289.4	SS	3	56	19	2	289	5						
	Brown **Sand & Gravel** Trace cobbles Compact to dense Saturated	2.1	SS	4	56	28	3	288	10						
		286.9	SS	5	56	36	4	287	13						
	Grey **Sand** Some silt, trace gravel Dense Saturated	4.7	SS	6	100	39	5	286	16						
		285.5					6	285							
	Grey **Sand & Gravel** Trace silt Dense Saturated	6.1	SS	7	100	40	7	284	14						
		284.4					8	283							
	Grey **Sandy Silt** Some gravel till, occasional clay pocket Dense Wet	7.2	SS	8	56	42	9	282	10						
		282.9					10	281							
	Grey **Sand and Silt Till** Some clay and gravel Very dense Moist	8.7	SS	9	93	79/23	11	280	79 23	9		13	39	36	12
			SS	10	100	50/8	12	279	50 8	11					
	occasional wet sand seam		SS	11	91	50/28	13	278	50 28	17					
		277.6	SS	12	100	50/5			50 5	11					
	Borehole termination on Inferred Berock	13.9													

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

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

▼ Groundwater depth observed on 2022-03-15 at a depth of: 2.4 m.

Scale: 1 : 84

RECORD OF BOREHOLE No. BH22-2

Project Number: **OGTW2201** Drilling Location: **N:4805454, E:554560**

Project Client: **Starbank Developments** Drilling Method: **200 mm Hollow Stem Augering**

Project Name: **506, 510 and 516 Hespeler road and Langs Drive** Drilling Machine: **Track Mounted Drill**

Project Location: **Cambridge Ontario** Date Started: **Feb 25, 22** Date Completed: **Feb 25, 22**

Logged by: **HP** Compiled by: **TF** Reviewed by: **MN** Revision No.: **0, 5/8/22**

Geodetic Ground Surface Elevation: 292.7 m

Depth (m)	Description	Elevation (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)
0.0	125 mm **Topsoil**	292.6				
	Brown Sand & gravel **FILL** Trace silt & clay, trace wood debris Loose to compact Moist		SS	1	50	23
1.2		291.5	SS	2	6	12
	Brown **Sand** Trace silt, trace gravel Compact Moist		SS	3	56	16
			SS	4	56	12
			SS	5	67	17
3.8	Saturated	288.9				
			SS	6	100	16
6.5	Grey **Cobbles** Some silt, trace sand Dense Saturated	286.2	SS	7	89	49
7.0	Grey **Sand and Silt Till** Occasional sand seams Very dense Moist	285.7	SS	8	80	50/13
			SS	9	71	88/28
			SS	10	80	50/13
12.3	**Borehole terminated on Inferred Boulder or Bedrock**	280.3	NR	11	0	50/3

FIELD TESTING

Penetration Testing: ○ SPT □ PPT ● DCPT

MTO Vane*: △ Intact ▲ Remould

Nilcon Vane*: ◇ Intact ◆ Remould

* Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING

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

50mm Stick-up Monitoring Well

Top of Pipe Elevation: 293.64

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
2	88	(7)	

Wood
Environment & Infrastructure Solutions

3450 Harvester Road
Burlington, Ontario, L7N 3W5
Canada
Tel. No.: 1 (905) 335-2353
woodplc.com

▽ No freestanding groundwater observed in open borehole upon completion of drilling. ■ Cave in depth after removal of augers: 3.0 m.

▼ Groundwater depth observed on 2022-03-15 at a depth of: 3.5 m.

RECORD OF BOREHOLE No. BH22-3

Project Number: **OGTW2201** Drilling Location: **N:4805408, E:554545**

Project Client: **Starbank Developments** Drilling Method: **200 mm Hollow Stem Augering**

Project Name: **506, 510 and 516 Hespeler road and Langs Drive** Drilling Machine: **Track Mounted Drill**

Project Location: **Cambridge Ontario** Date Started: **Feb 24, 22** Date Completed: **Feb 25, 22**

Logged by: **HP** Compiled by: **TF** Reviewed by: **MN** Revision No.: **0, 5/8/22**

Geodetic Ground Surface Elevation: 292.5 m

Description	Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	Elevation (m)
Pavement Structure	292.4					
115 mm **Asphalt**	292.2 / 0.1					
200 mm **Granualar Base**	0.3	SS	1	89	50/318	
Brown Sand **FILL** Some gravel Compact Moist	291.1 / 1.4	SS	2	67	24	292
Light brown to brown **Sand** Some silt, trace gravel Compact Moist		SS	3	56	29	291
		SS	4	56	12	290
	289.6					
Brown **Sand & Gravel** Trace silt Compact to very dense Wet to saturated	2.9	SS	5	67	45	289
	288.6					
Grey	3.9	SS	6	78	32	288
		SS	7	44	23	287
		SS	8	100	32	286
Trace cobbles		SS	9	73	50/13	285
	285.5					
Grey **Sandy Silt** Some gravel Very Dense Moist	7.0 / 284.7 / 7.8	SS	10	111	71	284
Grey **Sand and Silt Till** Trace clay, trace cobbles Very dense Moist		SS	11	67	50/8	283
	281.8					282
Grey **Silty Sand/Silty Gravel** Gravelly, trace cobbles and bedrock fragments Very dense Moist	10.7	SS	12	67	85/23	281
		SS	13	25	50/10	280
	279.5					
Borehole terminated due to Auger refusal	13.0					

FIELD TESTING

Penetration Testing: ○ SPT □ PPT ● DCPT

MTO Vane*: △ Intact ▲ Remould

Nilcon Vane*: ◇ Intact ◆ Remould

* Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING

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

50mm Flushmount Monitoring Well
Top of Pipe Elevation: 292.45

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
2	78	16	4
33	37	25	5

Wood
Environment & Infrastructure Solutions

3450 Harvester Road
Burlington, Ontario, L7N 3W5
Canada
Tel. No.: 1 (905) 335-2353
woodplc.com

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

▼ Groundwater depth observed on 2022-03-15 at a depth of: 3.3 m.

RECORD OF BOREHOLE No. BH22-4

Project Number: **OGTW2201** Drilling Location: **N:4805388, E:554592**

Project Client: **Starbank Developments** Drilling Method: **200 mm Hollow Stem Augering**

Project Name: **506, 510 and 516 Hespeler road and Langs Drive** Drilling Machine: **Track Mounted Drill**

Project Location: **Cambridge Ontario** Date Started: **Feb 28, 22** Date Completed: **Feb 28, 22**

Logged by: **HP** Compiled by: **TF** Reviewed by: **MN** Revision No.: **0, 5/8/22**

Geodetic Ground Surface Elevation: 292.5 m

Description	Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	Elevation (m)
Pavement Structure	292.4	SS	1	100	50	
100 mm **Asphalt**	292.3 0.1					
60 mm **Granualar Base**	292.2 0.2					
Brown Sand **FILL** Some silt, some gravel Dense Moist	291.2 1.2	SS	2	67	40	292
Brown **Sand** Trace sand, trace gravel Compact Moist		SS	3	56	15	291
		SS	4	56	16	290
	289.6					289
Brown **Sand & Gravel** Occasional cobbles Dense Wet	2.9 288.8 3.7	SS	5	56	38	
Brown to Grey **Sand** Trace silt & gravel, trace cobbles Loose Saturated		SS	6	56	8	288
		SS	7	67	20	287
		SS	8	100	18	286
	286.1	SS	9	100	63	
Grey **Sand & Gravel** Occasional cobbles Very dense Saturated	6.3 285.0					285
Grey **Sandy Silt** Some gravel till Very dense Moist	7.5	SS	10	73	50/13	284
		SS	11	55	50/13	283
	281.9					282
Grey **Silty Sand/Silty Gravel** Trace clay Dense Wet	10.5 280.4	SS	12		43	281
Grey **Sandy Silt** Some gravel till Very dense Wet	12.0 279.4	SS	13	67	50/8	280
Light grey **LIMESTONE** Very poor quality	13.0 278.2	RC	1	50	17	279
Light grey **LIMESTONE** Excellent quality	14.2 276.9	RC	2	92	92	278
Borehole terminated	15.5					277

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: 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

Lab Testing	Depth (m)
4	0
9	1
6	2
6	2
8	3
26	4
23	5
23	6
11	6
9	8
9	9
7	11
10	12

INSTRUMENTATION INSTALLATION: 50mm Flushmount Monitoring Well; Top of Pipe Elevation: 292.43

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
35	38	22	5

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

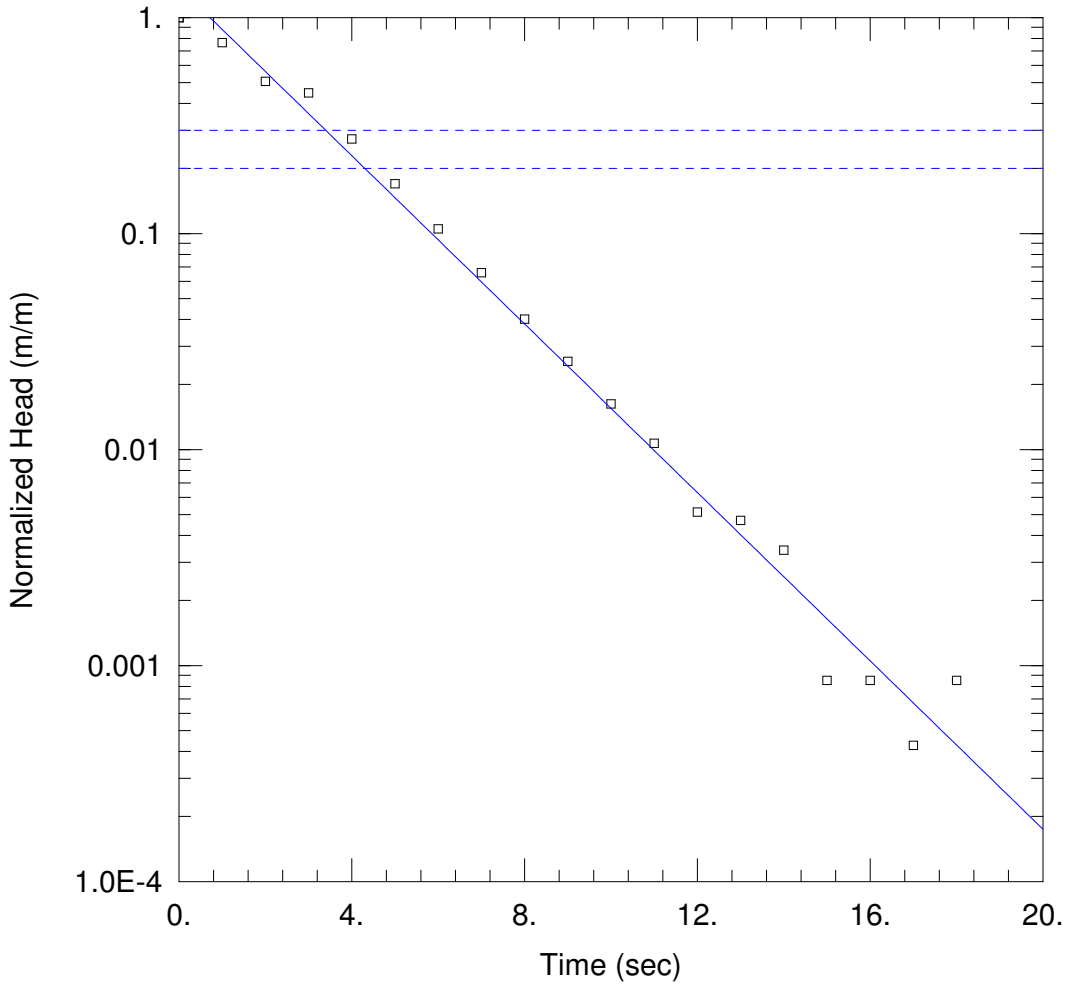
▽ No freestanding groundwater observed in open borehole upon completion of drilling.

▼ Groundwater depth observed on 2022-03-15 at a depth of: 3.3 m.

Scale: 1 : 84

Appendix B

Hydraulic Conductivity



BH22-1 FALLING HEAD TEST 1

Data Set: C:\2_Projects\OGTW2201_Starbanks\5_Ks\BH22-1\BH22-1_FHT 1.aqt
Date: 05/07/22 Time: 10:22:12

PROJECT INFORMATION

Company: Wood
Client: Starbank
Project: OGTW2201
Location: Hespeler / Langs, Cambridge ON
Test Well: BH22-1
Test Date: 5 April 2022

AQUIFER DATA

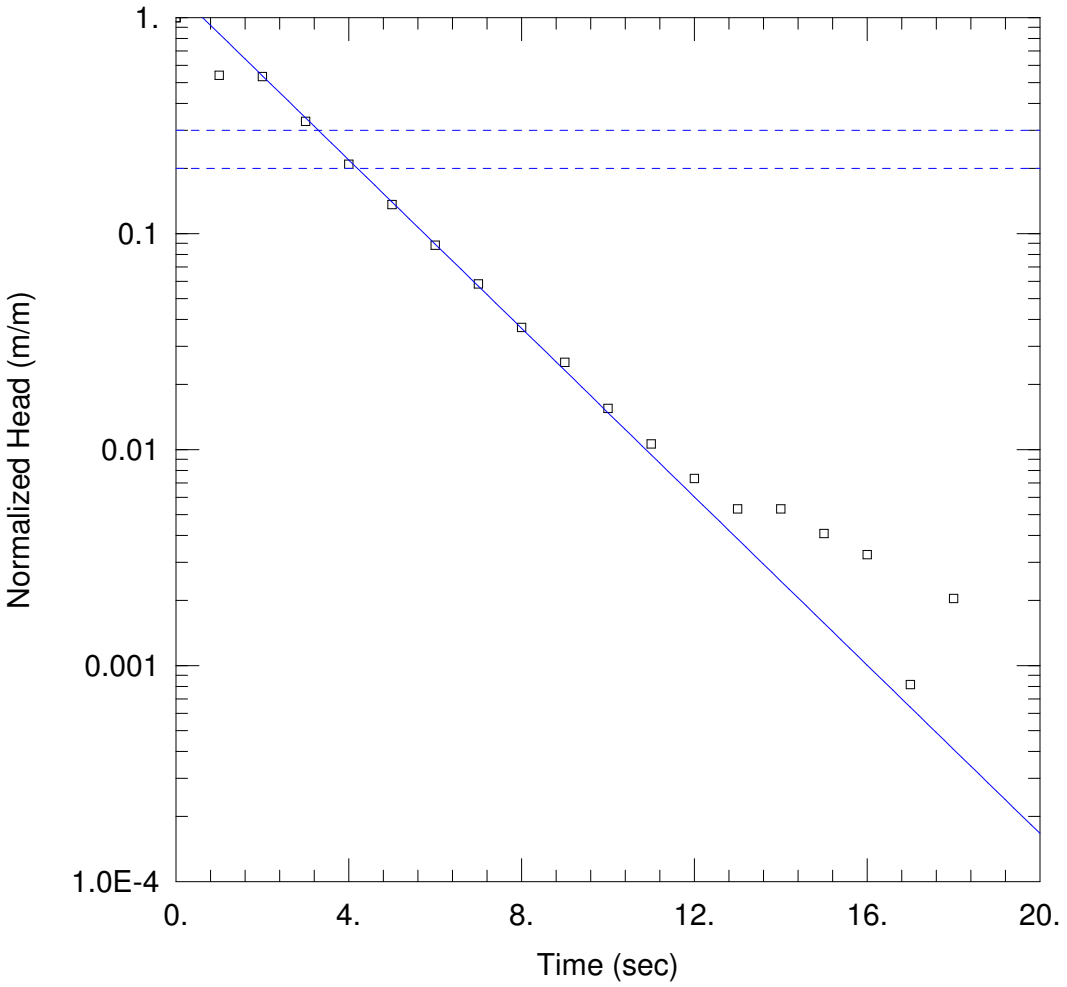
Saturated Thickness: 4.86 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH22-1)

Initial Displacement: 0.2341 m
Total Well Penetration Depth: 4.86 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.09 m
Screen Length: 2.6 m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.001718 m/sec
y0 = 0.3229 m



BH22-1 FALLING HEAD TEST 2

Data Set: C:\2_Projects\OGTW2201_Starbanks\5_Ks\BH22-1\BH22-1_FHT 2.aqt
Date: 05/07/22 Time: 10:28:36

PROJECT INFORMATION

Company: Wood
Client: Starbank
Project: OGTW2201
Location: Hespeler / Langs, Cambridge ON
Test Well: BH22-1
Test Date: 5 April 2022

AQUIFER DATA

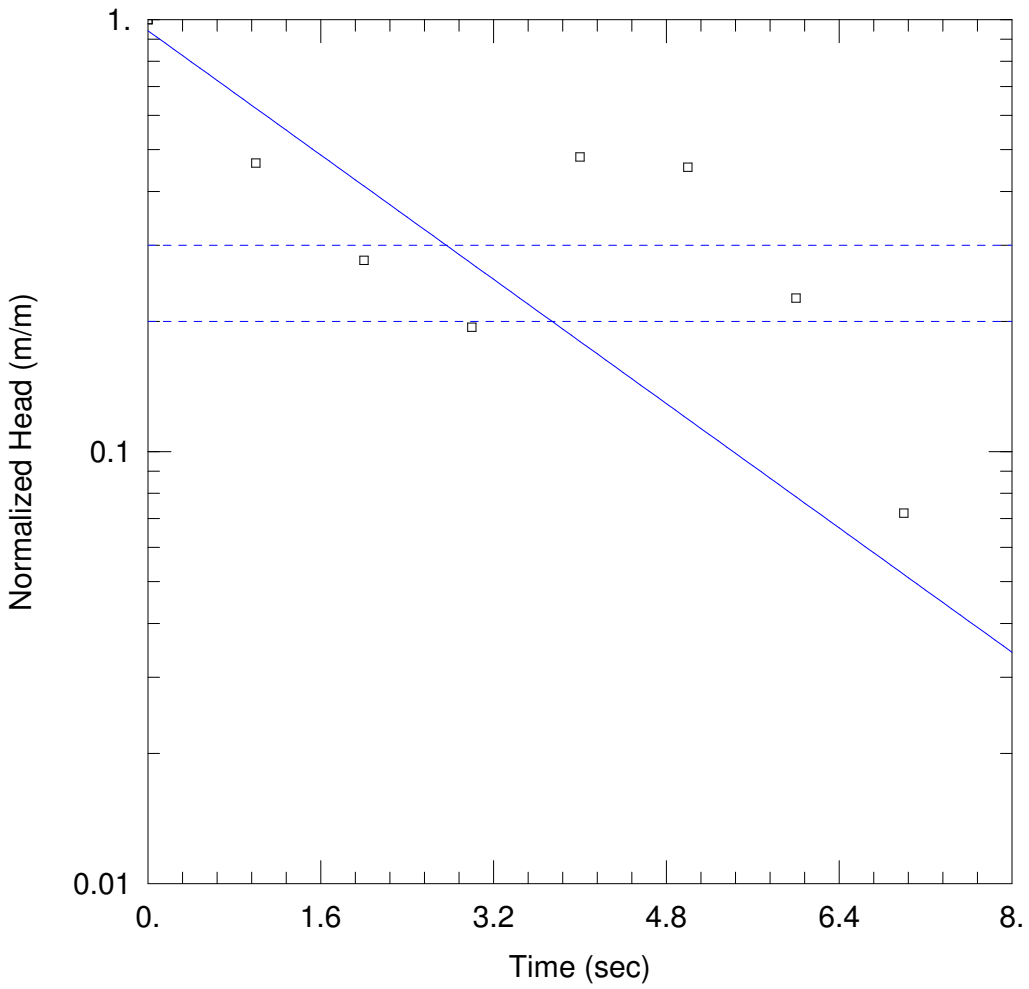
Saturated Thickness: 4.86 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH22-1)

Initial Displacement: 0.245 m
Total Well Penetration Depth: 4.86 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.09 m
Screen Length: 2.6 m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.001718 m/sec
y0 = 0.3229 m



BH22-1 RISING HEAD TEST 1

Data Set: C:\2_Projects\OGTW2201_Starbanks\5_Ks\BH22-1\BH22-1_RHT 1.aqt
Date: 05/07/22 Time: 10:32:23

PROJECT INFORMATION

Company: Wood
Client: Starbank
Project: OGTW2201
Location: Hespeler / Langs, Cambridge ON
Test Well: BH22-1
Test Date: 5 April 2022

AQUIFER DATA

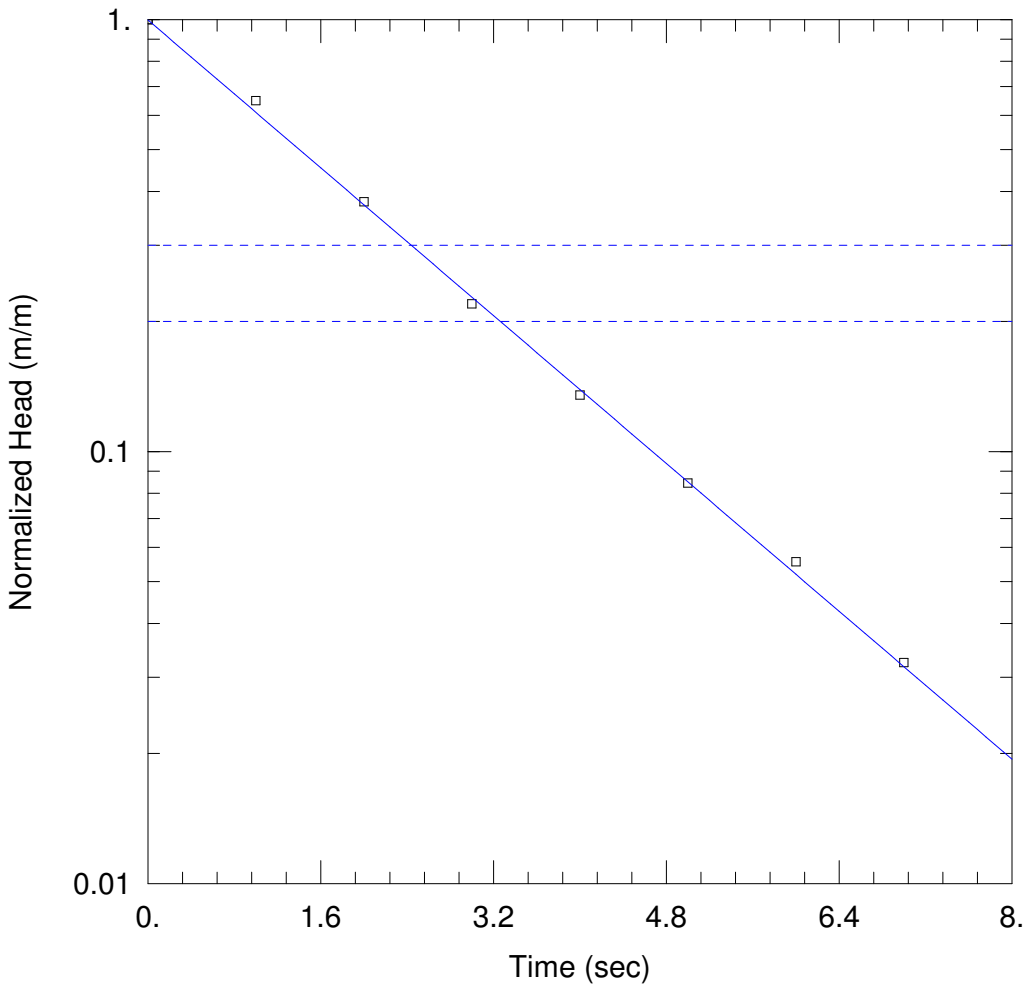
Saturated Thickness: 4.86 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH22-1)

Initial Displacement: 0.3581 m
Total Well Penetration Depth: 4.86 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.09 m
Screen Length: 2.6 m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.001586 m/sec
y0 = 0.3373 m



BH22-1 RISING HEAD TEST 2

Data Set: C:\2_Projects\OGTW2201_Starbanks\5_Ks\BH22-1\BH22-1_RHT 2.aqt
Date: 05/07/22 Time: 10:35:11

PROJECT INFORMATION

Company: Wood
Client: Starbank
Project: OGTW2201
Location: Hespeler / Langs, Cambridge ON
Test Well: BH22-1
Test Date: 5 April 2022

AQUIFER DATA

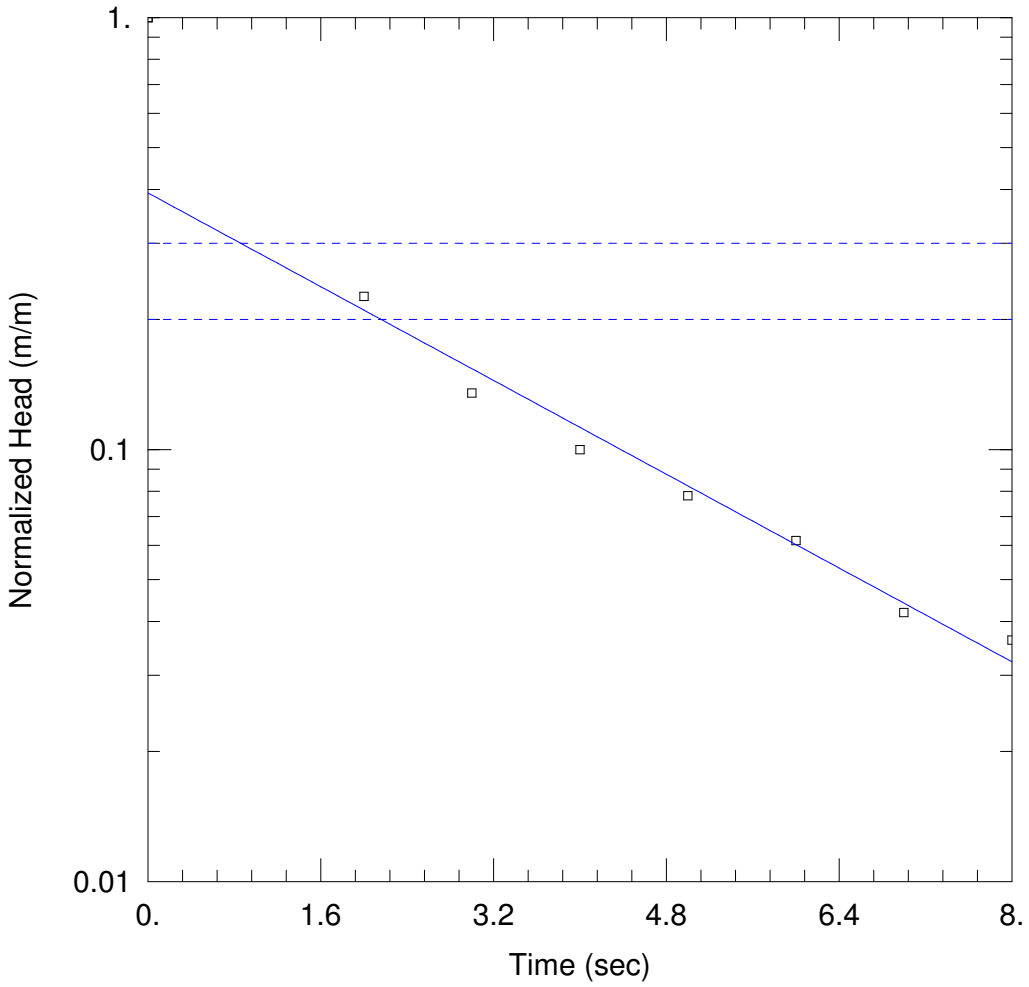
Saturated Thickness: 4.86 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH22-1)

Initial Displacement: 0.4066 m
Total Well Penetration Depth: 4.86 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.09 m
Screen Length: 2.6 m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.001886 m/sec
y0 = 0.4053 m



BH22-2 FALLING HEAD TEST 1

Data Set: C:\2_Projects\OGTW2201_Starbanks\5_Ks\BH22-2\BH22-2_FHT 1.aqt
Date: 05/07/22 Time: 10:57:01

PROJECT INFORMATION

Company: Wood
Client: Starbank
Project: OGTW2201
Location: Hespeler / Langs, Cambridge ON
Test Well: BH22-2
Test Date: 5 April 2022

AQUIFER DATA

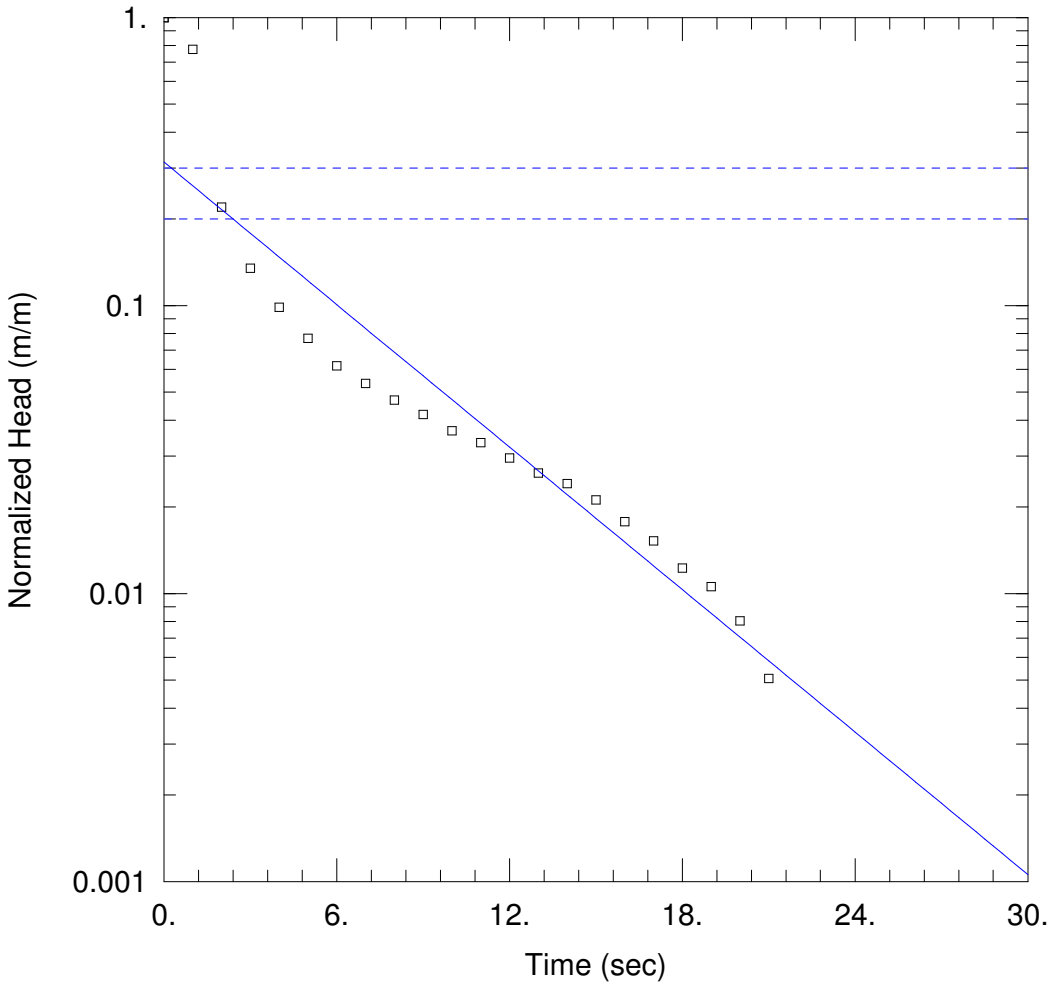
Saturated Thickness: 3.62 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH22-2)

Initial Displacement: 0.1932 m
Total Well Penetration Depth: 2.46 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.46 m
Screen Length: 2.46 m
Well Radius: 0.0254 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0001308 m/sec
y0 = 0.07584 m



BH22-2 FALLING HEAD TEST 2

Data Set: C:\2_Projects\OGTW2201_Starbanks\5_Ks\BH22-2\BH22-2_FHT 2.aqt
Date: 05/07/22 Time: 11:04:13

PROJECT INFORMATION

Company: Wood
Client: Starbank
Project: OGTW2201
Location: Hespeler / Langs, Cambridge ON
Test Well: BH22-2
Test Date: 5 April 2022

AQUIFER DATA

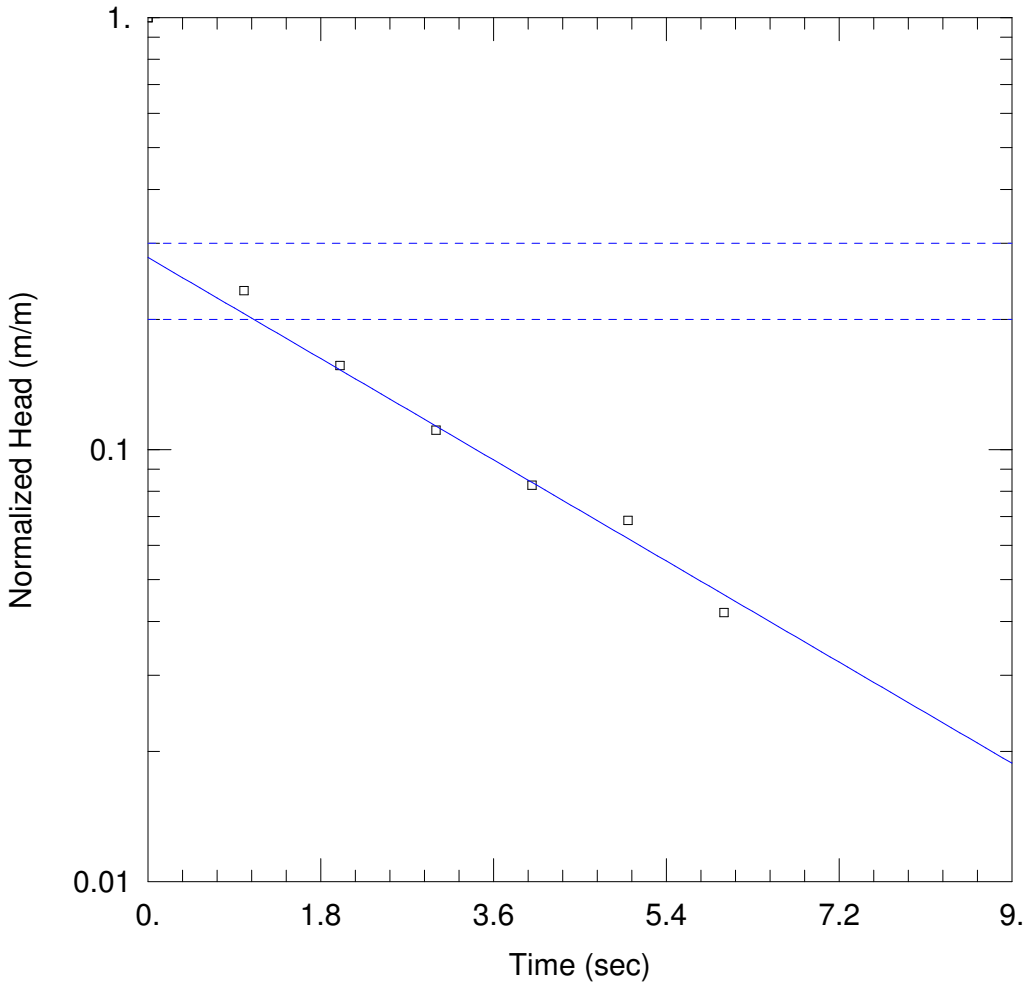
Saturated Thickness: 3.62 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH22-2)

Initial Displacement: 0.2366 m
Total Well Penetration Depth: 2.46 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.46 m
Screen Length: 2.46 m
Well Radius: 0.0254 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 7.95E-5 m/sec
y0 = 0.0745 m



BH22-2 RISING HEAD TEST 1

Data Set: C:\2_Projects\OGTW2201_Starbanks\5_Ks\BH22-2\BH22-2_RHT 1.aqt
Date: 05/07/22 Time: 11:07:52

PROJECT INFORMATION

Company: Wood
Client: Starbank
Project: OGTW2201
Location: Hespeler / Langs, Cambridge ON
Test Well: BH22-2
Test Date: 5 April 2022

AQUIFER DATA

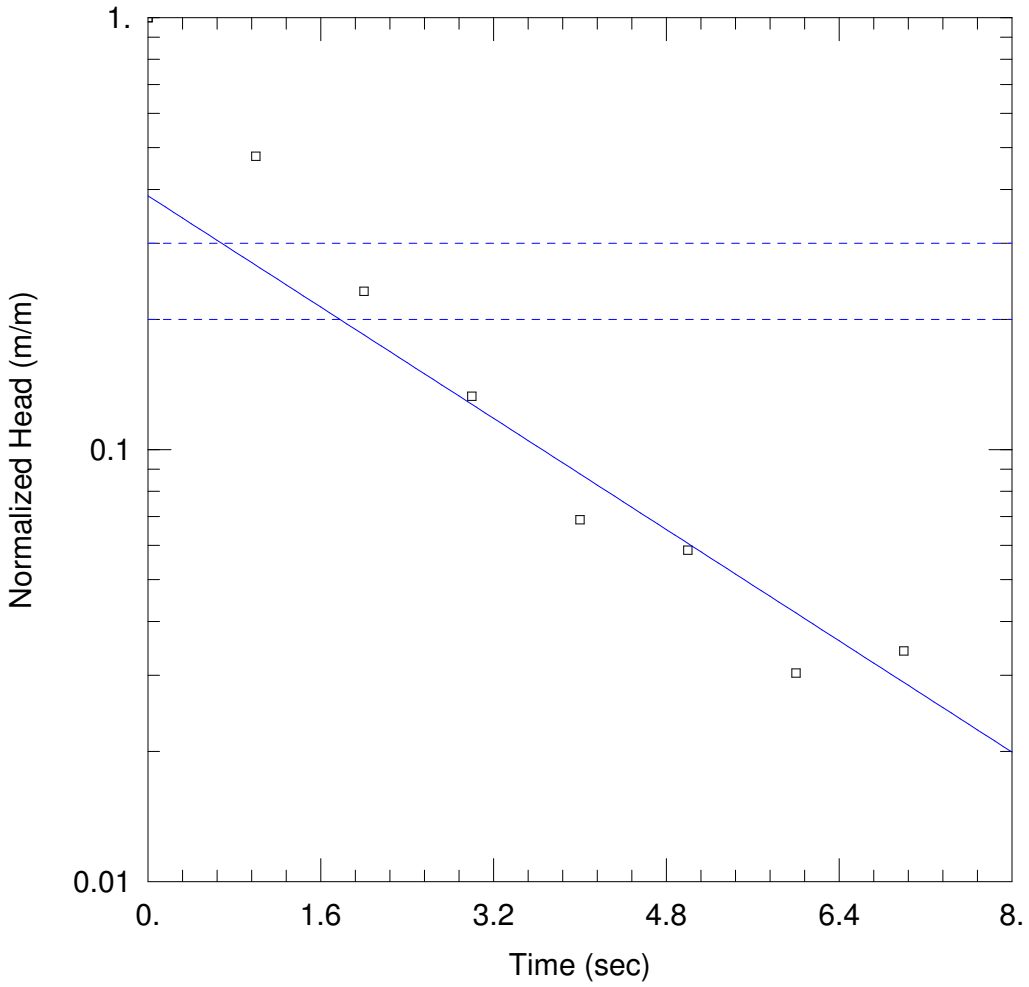
Saturated Thickness: 3.62 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH22-2)

Initial Displacement: 0.2481 m
Total Well Penetration Depth: 2.46 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.46 m
Screen Length: 2.46 m
Well Radius: 0.0254 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0001253 m/sec
y0 = 0.06905 m



BH22-2 RISING HEAD TEST 2

Data Set: C:\2_Projects\OGTW2201_Starbanks\5_Ks\BH22-2\BH22-2_RHT 2.aqt
Date: 05/07/22 Time: 11:11:09

PROJECT INFORMATION

Company: Wood
Client: Starbank
Project: OGTW2201
Location: Hespeler / Langs, Cambridge ON
Test Well: BH22-2
Test Date: 5 April 2022

AQUIFER DATA

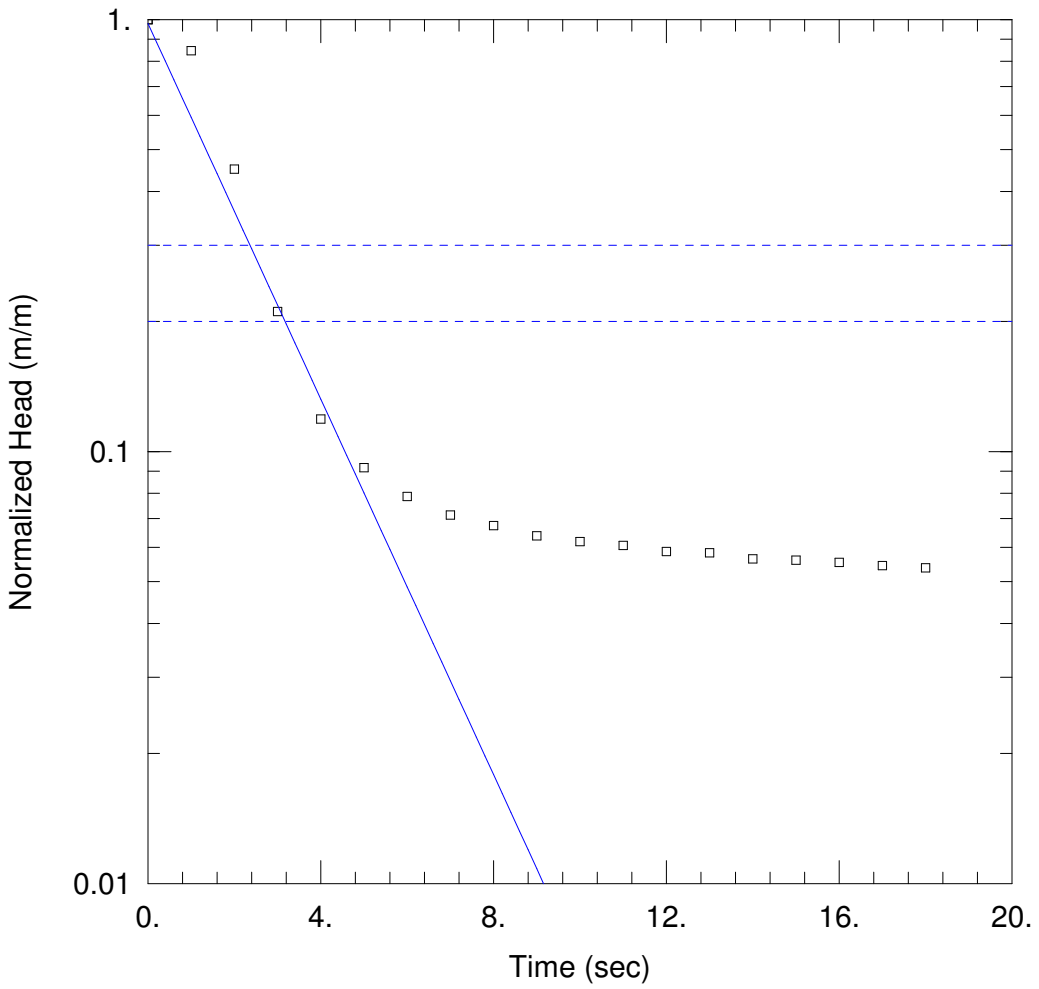
Saturated Thickness: 3.62 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH22-2)

Initial Displacement: 0.2633 m
Total Well Penetration Depth: 2.46 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.46 m
Screen Length: 2.46 m
Well Radius: 0.0254 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0001552 m/sec
y0 = 0.1018 m



BH22-3 RISING HEAD TEST 1

Data Set: C:\2_Projects\OGTW2201_Starbanks\5_Ks\BH22-3\BH22-3_RHT 1.aqt
Date: 05/07/22 Time: 11:32:59

PROJECT INFORMATION

Company: Wood
Client: Starbank
Project: OGTW2201
Location: Hespeler / Langs, Cambridge ON
Test Well: BH22-3
Test Date: 5 April 2022

AQUIFER DATA

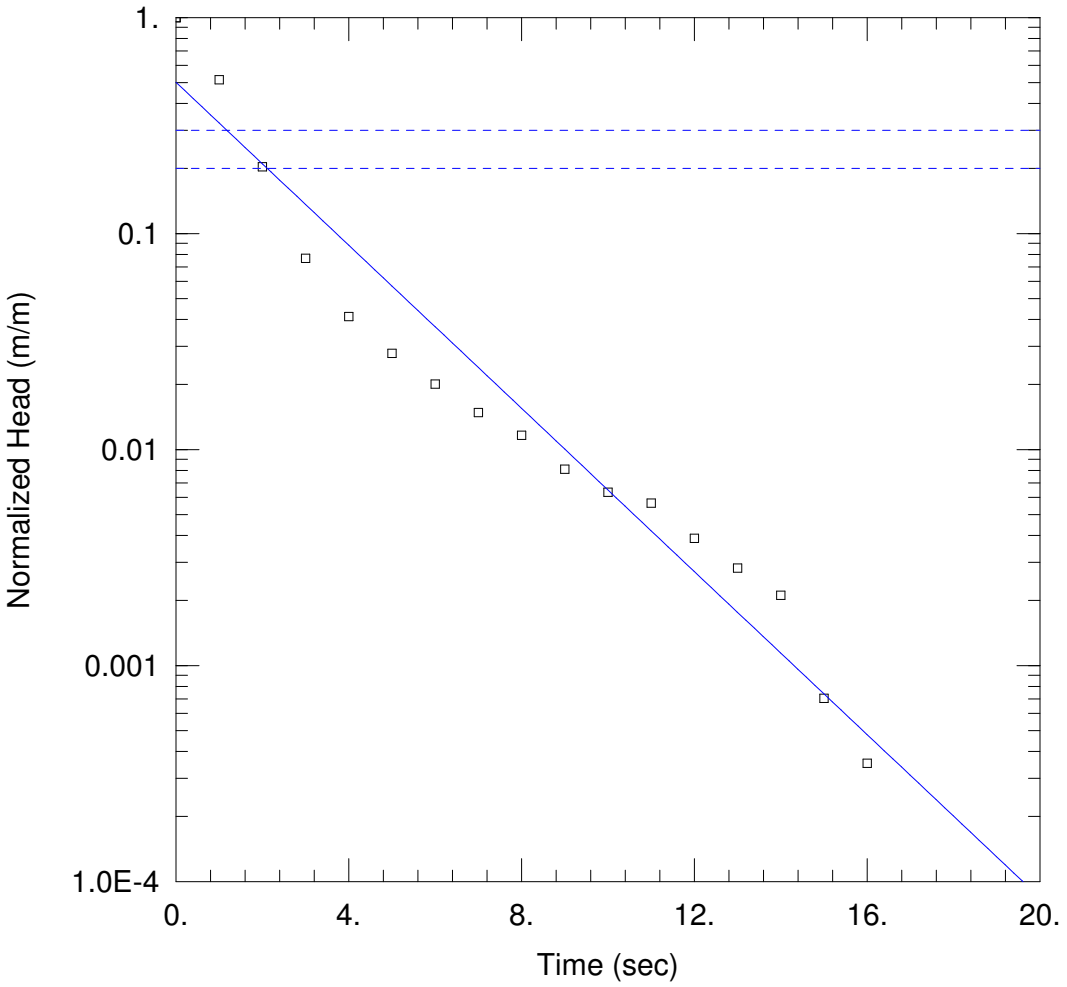
Saturated Thickness: 3.74 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH22-3)

Initial Displacement: 0.3086 m
Total Well Penetration Depth: 2.54 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.54 m
Screen Length: 2.54 m
Well Radius: 0.0254 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0002045 m/sec
y0 = 0.3021 m



BH22-3 RISING HEAD TEST 2

Data Set: C:\2_Projects\OGTW2201_Starbanks\5_Ks\BH22-3\BH22-3_RHT 2.aqt
Date: 05/07/22 Time: 11:36:20

PROJECT INFORMATION

Company: Wood
Client: Starbank
Project: OGTW2201
Location: Hespeler / Langs, Cambridge ON
Test Well: BH22-3
Test Date: 5 April 2022

AQUIFER DATA

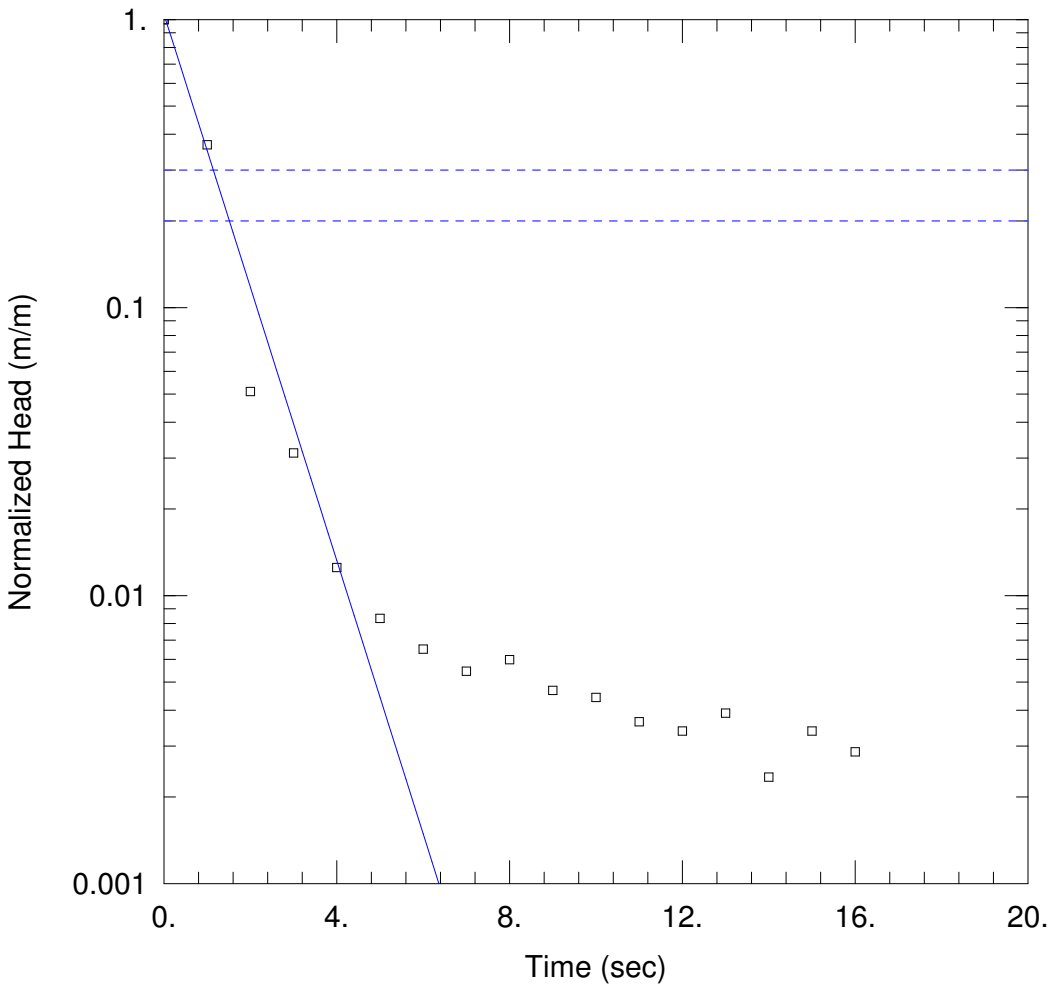
Saturated Thickness: 3.74 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH22-3)

Initial Displacement: 0.2836 m
Total Well Penetration Depth: 2.54 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.54 m
Screen Length: 2.54 m
Well Radius: 0.0254 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0001775 m/sec
y0 = 0.1422 m



BH22-4 FALLING HEAD TEST 1

Data Set: C:\2_Projects\OGTW2201_Starbanks\5_Ks\BH22-4\BH22-4_FHT 1.aqt
Date: 05/07/22 Time: 11:55:29

PROJECT INFORMATION

Company: Wood
Client: Starbank
Project: OGTW2201
Location: Hespeler / Langs, Cambridge ON
Test Well: BH22-4
Test Date: 5 April 2022

AQUIFER DATA

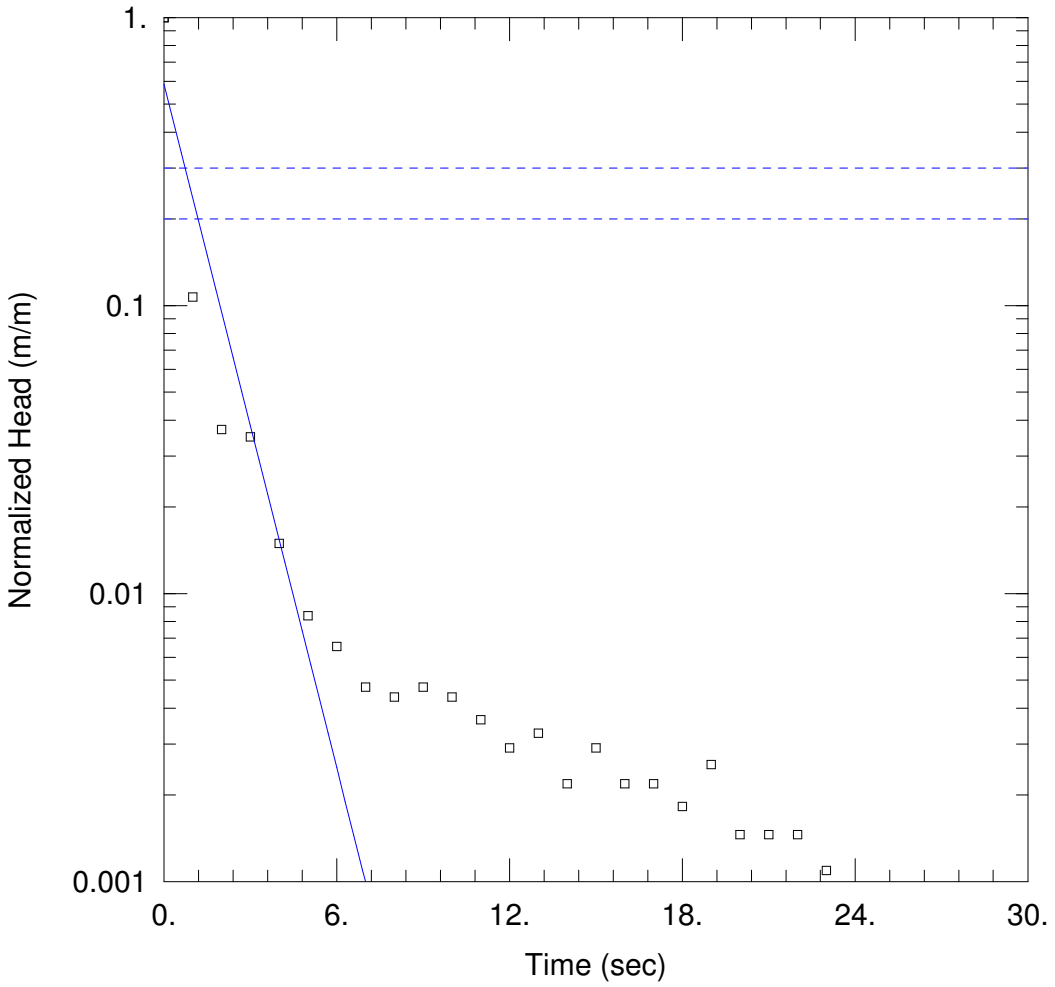
Saturated Thickness: 3.95 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH22-4)

Initial Displacement: 0.3841 m
Total Well Penetration Depth: 3.95 m
Casing Radius: 0.0254 m
Static Water Column Height: 3.95 m
Screen Length: 2.53 m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.004055 m/sec
y0 = 0.4013 m



BH22-4 FALLING HEAD TEST 2

Data Set: C:\2_Projects\OGTW2201_Starbanks\5_Ks\BH22-4\BH22-4_FHT 2.aqt
Date: 05/07/22 Time: 11:59:15

PROJECT INFORMATION

Company: Wood
Client: Starbank
Project: OGTW2201
Location: Hespeler / Langs, Cambridge ON
Test Well: BH22-4
Test Date: 5 April 2022

AQUIFER DATA

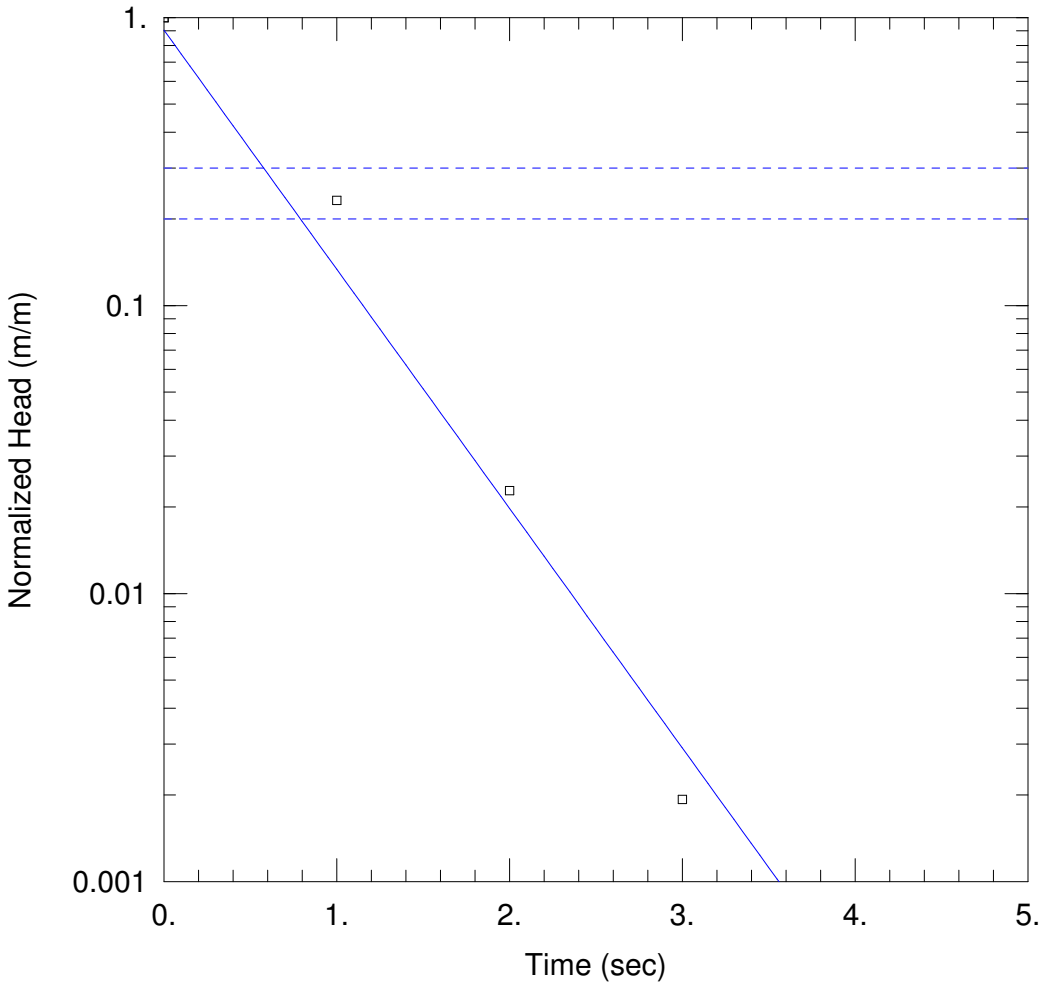
Saturated Thickness: 3.95 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH22-4)

Initial Displacement: 0.2747 m
Total Well Penetration Depth: 3.95 m
Casing Radius: 0.0254 m
Static Water Column Height: 3.95 m
Screen Length: 2.53 m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.003379 m/sec
y0 = 0.161 m



BH22-4 RISING HEAD TEST 1

Data Set: C:\2_Projects\OGTW2201_Starbanks\5_Ks\BH22-4\BH22-4_RHT 1.aqt
Date: 05/07/22 Time: 12:02:10

PROJECT INFORMATION

Company: Wood
Client: Starbank
Project: OGTW2201
Location: Hespeler / Langs, Cambridge ON
Test Well: BH22-4
Test Date: 5 April 2022

AQUIFER DATA

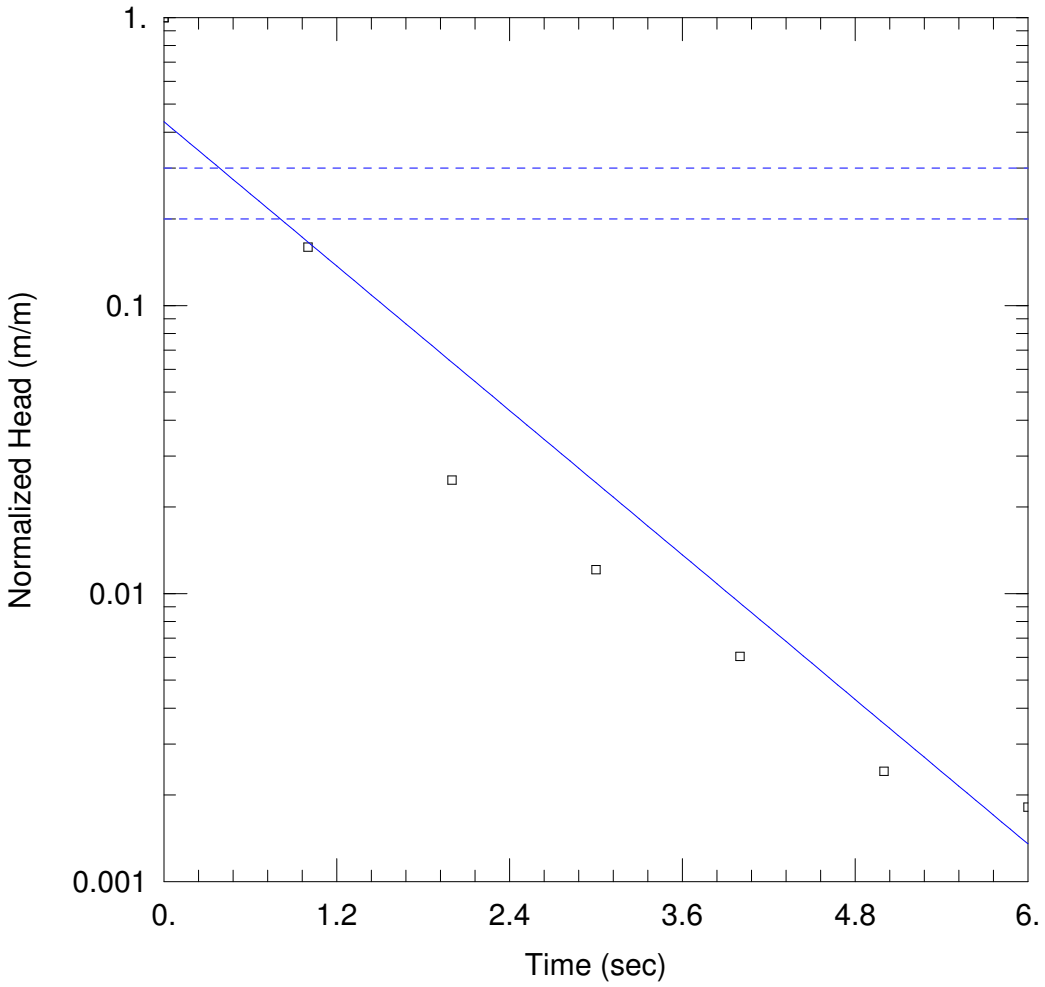
Saturated Thickness: 3.95 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH22-4)

Initial Displacement: 0.2593 m
Total Well Penetration Depth: 3.95 m
Casing Radius: 0.0254 m
Static Water Column Height: 3.95 m
Screen Length: 2.53 m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.007098 m/sec
y0 = 0.2344 m



BH22-4 RISING HEAD TEST 2

Data Set: C:\2_Projects\OGTW2201_Starbanks\5_Ks\BH22-4\BH22-4_RHT 2.aqt
Date: 05/07/22 Time: 12:04:39

PROJECT INFORMATION

Company: Wood
Client: Starbank
Project: OGTW2201
Location: Hespeler / Langs, Cambridge ON
Test Well: BH22-4
Test Date: 5 April 2022

AQUIFER DATA

Saturated Thickness: 3.95 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH22-4)

Initial Displacement: 0.1655 m
Total Well Penetration Depth: 3.95 m
Casing Radius: 0.0254 m
Static Water Column Height: 3.95 m
Screen Length: 2.53 m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.003571 m/sec
y0 = 0.07196 m

Appendix C

Dewatering Rates

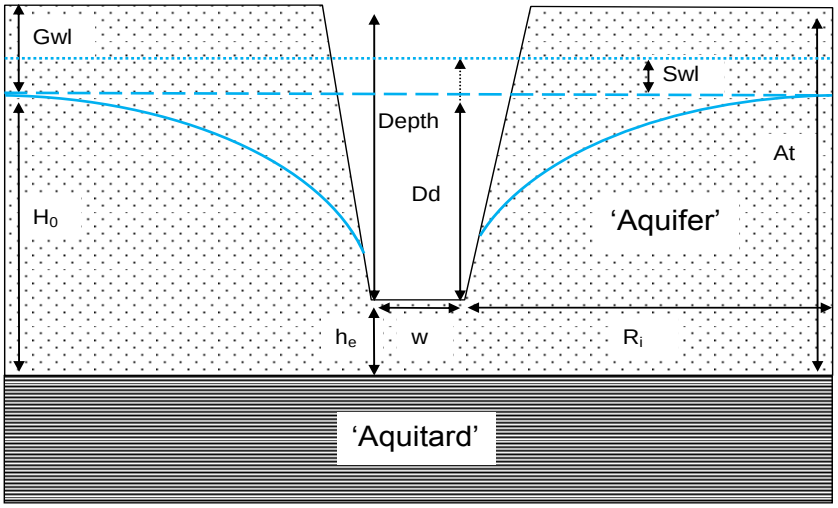
Dewatering Rate Estimation - Unconfined Trench

Project No.:	**OGTW2201**
Project Name:	**506, 510 and 516 Hespeler Road and 1000 Langs Drive**
Client:	**Starbank Developments 516 (& 506) Corporation**
Location:	**506, 510 and 516 Hespeler Road and 1000 Langs Drive**
Description:	**Open-cut excavation for underground parking garage - no shoring**
Date:	**12 May 2022**

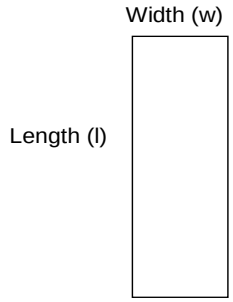
Performed by:	Tomas Cihula
Checked by:	Gil Violette

EXCAVATION INFO	
Length, l (m)	**15.0**
Width, w (m)	**3.0**
Depth (m BGS)	**7.5**

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
2) linear steady-state for inflow to trench sides.

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

Well	Gwl Measured Groundwater Level (m BGS)	Swl Estimated Seasonal Fluctuation above Gwl (m)	K Hydraulic Conductivity (m/s)	At 'Aquifer' Thickness (m BGS)	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)
BH22-1	**2.35**	**0.50**	**1.7E-03**	**7.2**	5.4	0.0	5.4	661.8		2263.4
BH22-2	**3.39**	**0.50**	**1.2E-04**	**7.0**	4.1	0.0	4.1	135.1		141.4
BH22-3	**3.26**	**0.50**	**1.9E-04**	**7.0**	4.2	0.0	4.2	175.3		219.6
BH22-4	**3.19**	**0.50**	**4.5E-03**	**7.5**	4.8	0.0	4.8	968.0		4506.3
Maximum										4506.3
K Geometric Mean			6.5E-04	7.18	4.63	0.00	4.63	352.9		738.1
K Arithmetic Mean			1.6E-03	7.18	4.63	0.00	4.63	560.1		1677.2

Uncertainty Factor (UF)	***3***	**Maximum × UF**	**(K Geometric Mean) × UF**	**(K Arithmetic Mean) × UF**
Q Groundwater Inflow (m^3/d)		**13518.9**	**2214.4**	**5031.5**
Uncertainty Factor (UF)	***3***	**S(Maximum K × UF)**	**S(K Geometric Mean × UF)**	**S(K Arithmetic Mean × UF)**
R_i Radius of Influence, Sichardt (m)		**1613.0**	**611.3**	**970.0**

Notes
m BGS - metres below ground surface
The user-defined R_i is used for the calculation of groundwater inflow (Q), if specified.
Geometric mean calculation is applied only to the hydraulic conductivity (K) - other input parameters for the Dupuit and Sichardt equation use the arithmetic average.
The calculated groundwater inflows for the arithmetic and geometric mean both use the Sichardt R_i calculated from the respective mean K.
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
Gwl is the water level measured in the 4 representative wells on 4 April 2022.
Swl is assumed at 0.5 m as it is likely the water levels in April 2022 are near the highest of the year.
The four wells were screened near the excavation depth interval and near the bottom of the shallow aquifer.
Average high groundwater level is 2.55 m BGS or approximately 5 m above bottom of aquifer at approximiately 7.5 m BGS.
Volume of groundwater within shored area of approximately 30,000 m^2, assuming porosity of 0.3, is approximately 45,000 m^3.

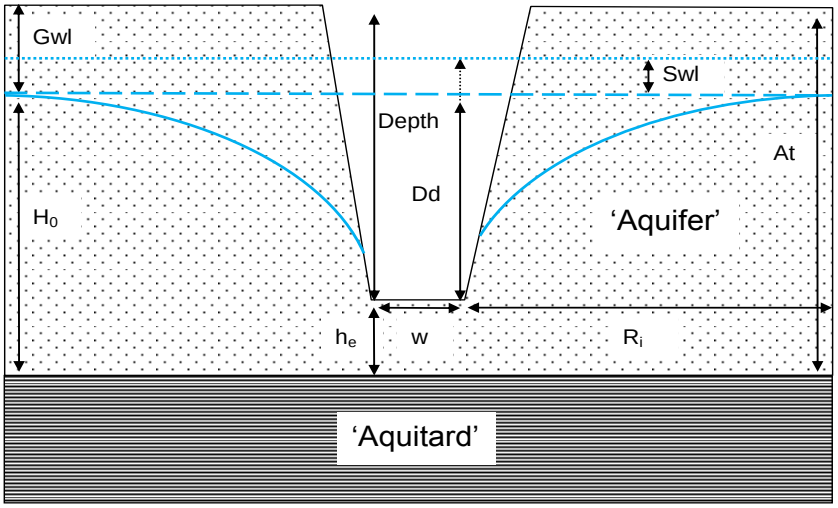
Dewatering Rate Estimation - Unconfined Trench

Project No.:	**OGTW2201**
Project Name:	**506, 510 and 516 Hespeler Road and 1000 Langs Drive**
Client:	**Starbank Developments 516 (& 506) Corporation**
Location:	**506, 510 and 516 Hespeler Road and 1000 Langs Drive**
Description:	**Open-cut excavation for underground parking garage - with shoring**
Date:	**12 May 2022**

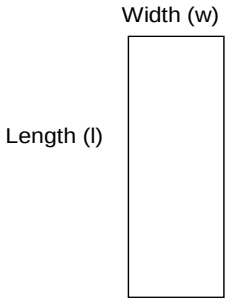
Performed by:	Tomas Cihula
Checked by:	Gil Violette

EXCAVATION INFO	
Length, l (m)	**15.0**
Width, w (m)	**3.0**
Depth (m BGS)	**7.5**

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
2) linear steady-state for inflow to trench sides.

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

Well	Gwl Measured Groundwater Level (m BGS)	Swl Estimated Seasonal Fluctuation above Gwl (m)	K Hydraulic Conductivity (m/s)	At 'Aquifer' Thickness (m BGS)	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)
BH22-1	**2.35**	**0.50**	**1.7E-03**	**7.2**	5.4	0.0	5.4	661.8	**75.0**	4199.9
BH22-2	**3.39**	**0.50**	**1.2E-04**	**7.0**	4.1	0.0	4.1	135.1	**75.0**	175.0
BH22-3	**3.26**	**0.50**	**1.9E-04**	**7.0**	4.2	0.0	4.2	175.3	**75.0**	294.8
BH22-4	**3.19**	**0.50**	**4.5E-03**	**7.5**	4.8	0.0	4.8	968.0	**75.0**	8986.5
Maximum										8986.5
K Geometric Mean			6.5E-04	7.18	4.63	0.00	4.63	352.9	**75.0**	1194.5
K Arithmetic Mean			1.6E-03	7.18	4.63	0.00	4.63	560.1	**75.0**	3008.2

Uncertainty Factor (UF)	***3***	**Maximum × UF**	**(K Geometric Mean) × UF**	**(K Arithmetic Mean) × UF**
Q Groundwater Inflow (m^3/d)		**26959.4**	**3583.4**	**9024.5**
Uncertainty Factor (UF)	***3***	**S(Maximum K × UF)**	**S(K Geometric Mean × UF)**	**S(K Arithmetic Mean × UF)**
R_i Radius of Influence, Sichardt (m)		**1613.0**	**611.3**	**970.0**

Notes
m BGS - metres below ground surface
The user-defined R_i is used for the calculation of groundwater inflow (Q), if specified.
Geometric mean calculation is applied only to the hydraulic conductivity (K) - other input parameters for the Dupuit and Sichardt equation use the arithmetic average.
The calculated groundwater inflows for the arithmetic and geometric mean both use the Sichardt R_i calculated from the respective mean K.
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
Gwl is the water level measured in the 4 representative wells on 4 April 2022.
Swl is assumed at 0.5 m as it is likely the water levels in April 2022 are near the highest of the year.
The four wells were screened near the excavation depth interval and near the bottom of the shallow aquifer.
Average high groundwater level is 2.55 m BGS or approximately 5 m above bottom of aquifer at approximately 7.5 m BGS.
Volume of groundwater within shored area of approximately 30,000 m^2, assuming porosity of 0.3, is approximately 45,000 m^3.

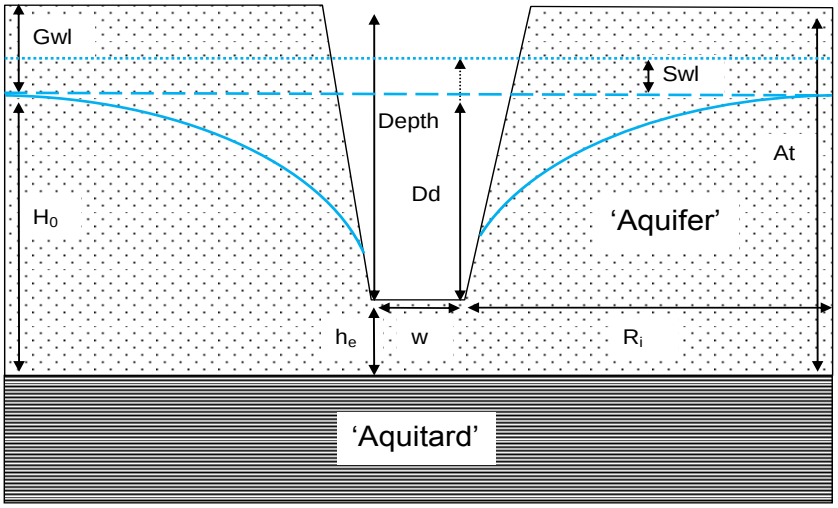
Dewatering Rate Estimation - Unconfined Trench

Project No.:	**OGTW2201**
Project Name:	**506, 510 and 516 Hespeler Road and 1000 Langs Drive**
Client:	**Starbank Developments 516 (& 506) Corporation**
Location:	**506, 510 and 516 Hespeler Road and 1000 Langs Drive**
Description:	**Open-cut excavation at bottom of parking garage excavation for underground service utilities - no shoring**
Date:	**12 May 2022**

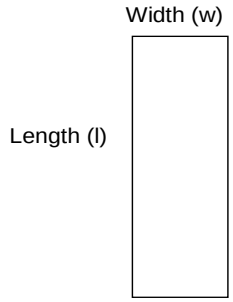
Performed by:	Tomas Cihula
Checked by:	Gil Violette

EXCAVATION INFO	
Length, l (m)	**15.0**
Width, w (m)	**1.0**
Depth (m BGS)	**1.0**

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
2) linear steady-state for inflow to trench sides.

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

Well	Gwl Measured Groundwater Level (m BGS)	Swl Estimated Seasonal Fluctuation above Gwl (m)	K Hydraulic Conductivity (m/s)	At 'Aquifer' Thickness (m BGS)	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)
BH22-1	**0.00**	**0.00**	**1.7E-03**	**2.0**	2.0	1.0	1.0	123.7		304.4
BH22-2	**0.00**	**0.00**	**1.2E-04**	**2.0**	2.0	1.0	1.0	32.9		37.5
BH22-3	**0.00**	**0.00**	**1.9E-04**	**2.0**	2.0	1.0	1.0	41.4		52.8
BH22-4	**0.00**	**0.00**	**4.5E-03**	**2.0**	2.0	1.0	1.0	201.2		697.6
Maximum										697.6
K Geometric Mean			6.5E-04	2.00	2.00	1.00	1.00	76.3		137.5
K Arithmetic Mean			1.6E-03	2.00	2.00	1.00	1.00	121.0		293.5

Uncertainty Factor (UF)	***3***	**Maximum × UF**	**(K Geometric Mean) × UF**	**(K Arithmetic Mean) × UF**
Q Groundwater Inflow (m^3/d)		**2092.9**	**412.5**	**880.6**
Uncertainty Factor (UF)	***3***	**S(Maximum K × UF)**	**S(K Geometric Mean × UF)**	**S(K Arithmetic Mean × UF)**
R_i Radius of Influence, Sichardt (m)		**348.6**	**132.1**	**209.6**

Notes

m BGS - metres below ground surface

The user-defined R_i is used for the calculation of groundwater inflow (Q), if specified.

Geometric mean calculation is applied only to the hydraulic conductivity (K) - other input parameters for the Dupuit and Sichardt equation use the arithmetic average.

The calculated groundwater inflows for the arithmetic and geometric mean both use the Sichardt R_i calculated from the respective mean K.

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

Gwl is the water level at the base of the 7.5-m deep excavation, the bottom of the lower parking level.

It is assumed that the aquifer extends 2 m below the bottom of the lower parking level and laterally to edges of shored area. In reality, these service trenches may be in the aquitard below for which no hydraulic conductivity data were obtained, hence the groundwater inflow estimates may be overestimated.

It is assumed that no groundwater input, aside from some minor seepage through sheet piling, is occurring into the shored area.

It is assumed that there is not an upward hydraulic gradient of groundwater from the aquitard up into the excavated area.

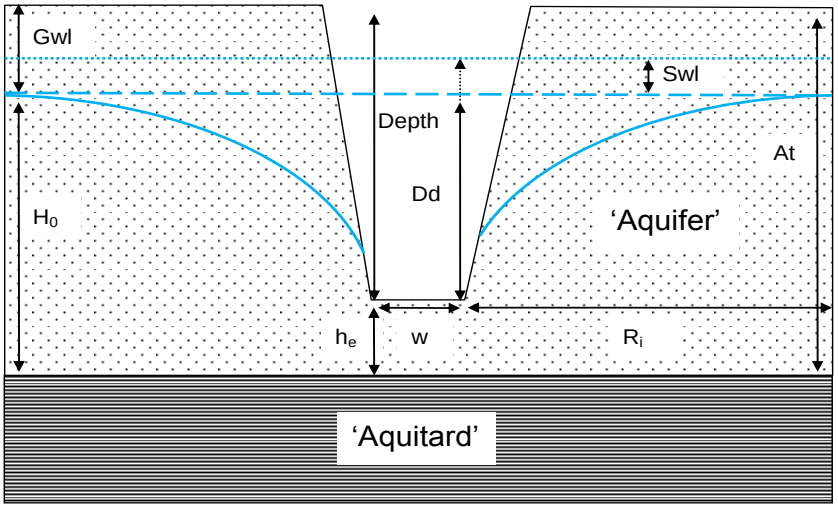
Dewatering Rate Estimation - Unconfined Trench

Project No.:	**OGTW2201**
Project Name:	**506, 510 and 516 Hespeler Road and 1000 Langs Drive**
Client:	**Starbank Developments 516 (& 506) Corporation**
Location:	**506, 510 and 516 Hespeler Road and 1000 Langs Drive**
Description:	**Open-cut excavation at bottom of parking garage for underground service utilities - with shoring**
Date:	**12 May 2022**

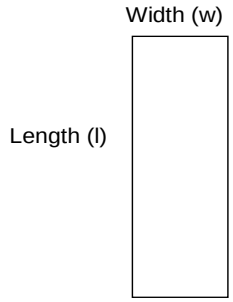
Performed by:	Tomas Cihula
Checked by:	Gil Violette

EXCAVATION INFO	
Length, l (m)	**15.0**
Width, w (m)	**1.0**
Depth (m BGS)	**1.0**

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
2) linear steady-state for inflow to trench sides.

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

Well	Gwl Measured Groundwater Level (m BGS)	Swl Estimated Seasonal Fluctuation above Gwl (m)	K Hydraulic Conductivity (m/s)	At 'Aquifer' Thickness (m BGS)	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)
BH22-1	**0.00**	**0.00**	**1.7E-03**	**2.0**	2.0	1.0	1.0	123.7	**75.0**	364.0
BH22-2	**0.00**	**0.00**	**1.2E-04**	**2.0**	2.0	1.0	1.0	32.9	**75.0**	25.7
BH22-3	**0.00**	**0.00**	**1.9E-04**	**2.0**	2.0	1.0	1.0	41.4	**75.0**	40.7
BH22-4	**0.00**	**0.00**	**4.5E-03**	**2.0**	2.0	1.0	1.0	201.2	**75.0**	963.6
Maximum										963.6
K Geometric Mean			6.5E-04	2.00	2.00	1.00	1.00	76.3	**75.0**	138.4
K Arithmetic Mean			1.6E-03	2.00	2.00	1.00	1.00	121.0	**75.0**	348.5

Uncertainty Factor (UF)	***3***	**Maximum × UF**	**(K Geometric Mean) × UF**	**(K Arithmetic Mean) × UF**
Q Groundwater Inflow (m^3/d)		**2890.9**	**415.2**	**1045.5**
Uncertainty Factor (UF)	***3***	**S(Maximum K × UF)**	**S(K Geometric Mean × UF)**	**S(K Arithmetic Mean × UF)**
R_i Radius of Influence, Sichardt (m)		**348.6**	**132.1**	**209.6**

Notes
m BGS - metres below ground surface
The user-defined R_i is used for the calculation of groundwater inflow (Q), if specified.
Geometric mean calculation is applied only to the hydraulic conductivity (K) - other input parameters for the Dupuit and Sichardt equation use the arithmetic average.
The calculated groundwater inflows for the arithmetic and geometric mean both use the Sichardt R_i calculated from the respective mean K.
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
Gwl is the water level at the base of the 7.5-m deep excavation, the bottom of the lower parking level.
It is assumed that the aquifer extends 2 m below the bottom of the lower parking level and laterally to edges of shored area. In reality, these service trenches may be in the aquitard below for which no hydraulic conductivity data were obtained, hence the groundwater inflow estimates may be overestimated.
It is assumed that no groundwater input, aside from some minor seepage through sheet piling, is occurring into the shored area.
It is assumed that there is not an upward hydraulic gradient of groundwater from the aquitard up into the excavated area.

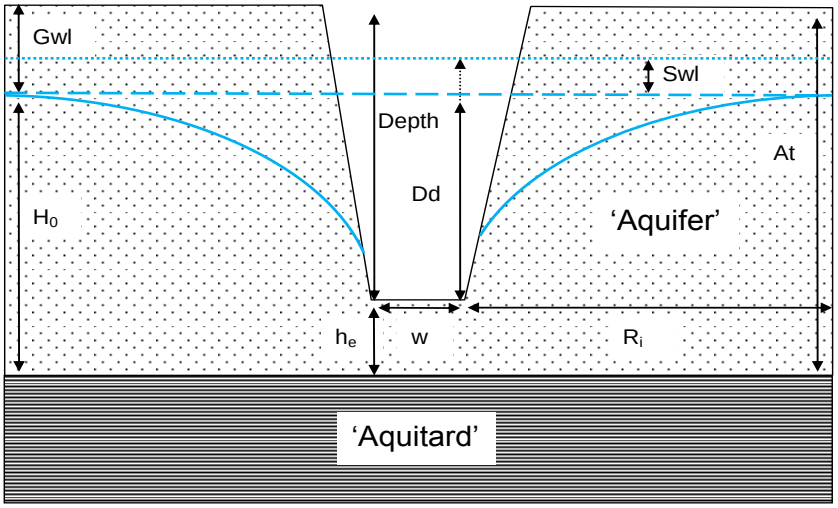
Dewatering Rate Estimation - Unconfined Trench

Project No.:	**OGTW2201**
Project Name:	**506, 510 and 516 Hespeler Road and 1000 Langs Drive**
Client:	**Starbank Developments 516 (& 506) Corporation**
Location:	**506, 510 and 516 Hespeler Road and 1000 Langs Drive**
Description:	**Open-cut excavation at bottom of parking garage excavation for elevator shaft - no shoring**
Date:	**12 May 2022**

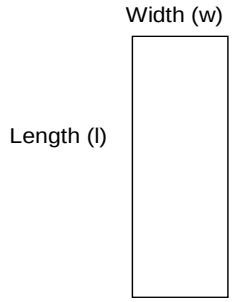
Performed by:	Tomas Cihula
Checked by:	Gil Violette

EXCAVATION INFO	
Length, l (m)	**6.0**
Width, w (m)	**2.0**
Depth (m BGS)	**1.5**

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
2) linear steady-state for inflow to trench sides.

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

Well	Gwl Measured Groundwater Level (m BGS)	Swl Estimated Seasonal Fluctuation above Gwl (m)	K Hydraulic Conductivity (m/s)	At 'Aquifer' Thickness (m BGS)	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)
BH22-1	**0.00**	**0.00**	**1.7E-03**	**2.5**	2.5	1.0	1.5	185.5		488.3
BH22-2	**0.00**	**0.00**	**1.2E-04**	**2.5**	2.5	1.0	1.5	49.3		50.3
BH22-3	**0.00**	**0.00**	**1.9E-04**	**2.5**	2.5	1.0	1.5	62.0		73.7
BH22-4	**0.00**	**0.00**	**4.5E-03**	**2.5**	2.5	1.0	1.5	301.9		1163.0
Maximum										1163.0
K Geometric Mean			6.5E-04	2.50	2.50	1.00	1.50	114.4		209.3
K Arithmetic Mean			1.6E-03	2.50	2.50	1.00	1.50	181.5		469.8

Uncertainty Factor (UF)	***3***	**Maximum × UF**	**(K Geometric Mean) × UF**	**(K Arithmetic Mean) × UF**
Q Groundwater Inflow (m^3/d)		**3488.9**	**628.0**	**1409.4**
Uncertainty Factor (UF)	***3***	**S(Maximum K × UF)**	**S(K Geometric Mean × UF)**	**S(K Arithmetic Mean × UF)**
R_i Radius of Influence, Sichardt (m)		**522.9**	**198.1**	**314.4**

Notes

m BGS - metres below ground surface

The user-defined R_i is used for the calculation of groundwater inflow (Q), if specified.

Geometric mean calculation is applied only to the hydraulic conductivity (K) - other input parameters for the Dupuit and Sichardt equation use the arithmetic average.

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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

Gwl is the water level at the base of the 7.5-m deep excavation, the bottom of the lower parking level.

It is assumed that the aquifer extends 2.5 m below the bottom of the lower parking level and laterally to edges of shored area. In reality, these service trenches may be in the aquitard below for which no hydraulic conductivity data were obtained, hence the groundwater inflow estimates may be overestimated.

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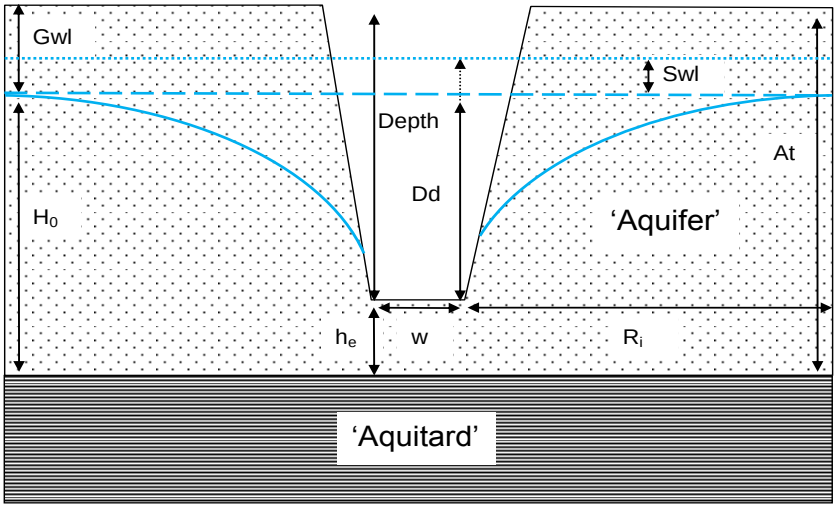
Dewatering Rate Estimation - Unconfined Trench

Project No.:	**OGTW2201**
Project Name:	**506, 510 and 516 Hespeler Road and 1000 Langs Drive**
Client:	**Starbank Developments 516 (& 506) Corporation**
Location:	**506, 510 and 516 Hespeler Road and 1000 Langs Drive**
Description:	**Open-cut excavation at bottom of parking garage excavation for elevator shaft - with shoring**
Date:	**12 May 2022**

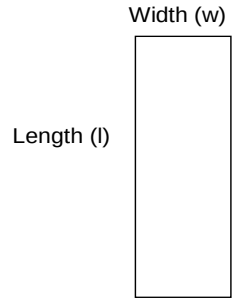
Performed by:	Tomas Cihula
Checked by:	Gil Violette

EXCAVATION INFO	
Length, l (m)	**6.0**
Width, w (m)	**2.0**
Depth (m BGS)	**1.5**

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
2) linear steady-state for inflow to trench sides.

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

Well	Gwl Measured Groundwater Level (m BGS)	Swl Estimated Seasonal Fluctuation above Gwl (m)	K Hydraulic Conductivity (m/s)	At 'Aquifer' Thickness (m BGS)	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)
BH22-1	**0.00**	**0.00**	**1.7E-03**	**2.5**	2.5	1.0	1.5	185.5	**75.0**	621.1
BH22-2	**0.00**	**0.00**	**1.2E-04**	**2.5**	2.5	1.0	1.5	49.3	**75.0**	43.8
BH22-3	**0.00**	**0.00**	**1.9E-04**	**2.5**	2.5	1.0	1.5	62.0	**75.0**	69.4
BH22-4	**0.00**	**0.00**	**4.5E-03**	**2.5**	2.5	1.0	1.5	301.9	**75.0**	1644.0
Maximum										1644.0
K Geometric Mean			6.5E-04	2.50	2.50	1.00	1.50	114.4	**75.0**	236.1
K Arithmetic Mean			1.6E-03	2.50	2.50	1.00	1.50	181.5	**75.0**	594.6

Uncertainty Factor (UF)	***3***	**Maximum × UF**	**(K Geometric Mean) × UF**	**(K Arithmetic Mean) × UF**
Q Groundwater Inflow (m^3/d)		**4932.1**	**708.3**	**1783.8**
Uncertainty Factor (UF)	***3***	**S(Maximum K × UF)**	**S(K Geometric Mean × UF)**	**S(K Arithmetic Mean × UF)**
R_i Radius of Influence, Sichardt (m)		**522.9**	**198.1**	**314.4**

Notes
m BGS - metres below ground surface
The user-defined R_i is used for the calculation of groundwater inflow (Q), if specified.
Geometric mean calculation is applied only to the hydraulic conductivity (K) - other input parameters for the Dupuit and Sichardt equation use the arithmetic average.
The calculated groundwater inflows for the arithmetic and geometric mean both use the Sichardt R_i calculated from the respective mean K.
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
Gwl is the water level at the base of the 7.5-m deep excavation, the bottom of the lower parking level.
It is assumed that the aquifer extends 2.5 m below the bottom of the lower parking level and laterally to edges of shored area. In reality, these service trenches may be in the aquitard below for which no hydraulic conductivity data were obtained, hence the groundwater inflow estimates may be overestimated.
It is assumed that no groundwater input, aside from some minor seepage through sheet piling, is occurring into the shored area.
It is assumed that there is not an upward hydraulic gradient of groundwater from the aquitard up into the excavated area.

Appendix D

Laboratory Certificates of Analysis

Wood Environment & Infrastructure Solutions (Cambridge)
ATTN: TOMAS CIHULA
900 MAPLE GROVE ROAD
UNIT 10
CAMBRIDGE ON N3H 4R7

Date Received: 04-APR-22
Report Date: 10-MAY-22 11:56 (MT)
Version: FINAL REV. 2

Client Phone: 519-650-7100

Certificate of Analysis

Lab Work Order #: L2696563

Project P.O. #: OGTW2201.3000.5800.5730-00
Job Reference: OGTW2201.3000
C of C Numbers:
Legal Site Desc:

Comments: 10-MAY-2022 Sample date corrected

Gayle Braun
Senior Account Manager

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1
L2696563-1 BH 22-1						
Sampled By: RL on 04-APR-22 @ 12:00						
Matrix: WATER						
Physical Tests						
Colour, Apparent	53.0		2.0	CU	05-APR-22	
Conductivity	2.78		0.0030	mS/cm	05-APR-22	
Hardness (as CaCO3)	391		1.3	mg/L	05-APR-22	
pH	7.55		0.10	pH units	05-APR-22	
Total Dissolved Solids	1500	DLDS	20	mg/L	08-APR-22	
Turbidity	>4000	TMV	0.10	NTU	05-APR-22	
Anions and Nutrients						
Alkalinity, Bicarbonate (as CaCO3)	433		1.0	mg/L	05-APR-22	
Alkalinity, Carbonate (as CaCO3)	<1.0		1.0	mg/L	05-APR-22	
Alkalinity, Hydroxide (as CaCO3)	<1.0		1.0	mg/L	05-APR-22	
Alkalinity, Total (as CaCO3)	433		1.0	mg/L	05-APR-22	
Ammonia, Total (as N)	0.080		0.010	mg/L	07-APR-22	
Bromide (Br)	<0.50	DLDS	0.50	mg/L	05-APR-22	
Chloride (Cl)	691	DLDS	2.5	mg/L	05-APR-22	790
Computed Conductivity	2350			uS/cm	08-APR-22	
Conductivity % Difference	-17			%	08-APR-22	
Fluoride (F)	<0.10	DLDS	0.10	mg/L	05-APR-22	
Hardness (as CaCO3)	391			mg/L	08-APR-22	
Ion Balance	90			%	08-APR-22	
Langelier Index	1			No Unit	08-APR-22	
Nitrate and Nitrite as N	0.66		0.11	mg/L	06-APR-22	
Nitrate (as N)	0.66	DLDS	0.10	mg/L	05-APR-22	
Nitrite (as N)	<0.050	DLDS	0.050	mg/L	05-APR-22	
Saturation pH	6.87			pH	08-APR-22	
Orthophosphate-Dissolved (as P)	0.0030		0.0030	mg/L	05-APR-22	
TDS (Calculated)	1580			mg/L	08-APR-22	
Sulfate (SO4)	74.5	DLDS	1.5	mg/L	05-APR-22	
Anion Sum	28.2			me/L	08-APR-22	
Cation Sum	25.4			me/L	08-APR-22	
Cation - Anion Balance	-5			%	08-APR-22	
Cyanides						
Cyanide, Weak Acid Diss	<2.0		2.0	ug/L	05-APR-22	66
Organic / Inorganic Carbon						
Dissolved Carbon Filtration Location	LAB			No Unit	05-APR-22	
Dissolved Organic Carbon	3.22		0.50	mg/L	05-APR-22	
Inorganic Parameters						
Silica	7.7		1.1	mg/L	05-APR-22	
Dissolved Metals						
Dissolved Mercury Filtration Location	FIELD			No Unit	04-APR-22	
Dissolved Metals Filtration Location	FIELD			No Unit	04-APR-22	
Antimony (Sb)-Dissolved	<1.0	DLHC	1.0	ug/L	04-APR-22	6
Arsenic (As)-Dissolved	<1.0	DLHC	1.0	ug/L	04-APR-22	25
Barium (Ba)-Dissolved	271	DLHC	1.0	ug/L	04-APR-22	1000
Beryllium (Be)-Dissolved	<1.0	DLHC	1.0	ug/L	04-APR-22	4
Boron (B)-Dissolved	<100	DLHC	100	ug/L	04-APR-22	5000
Cadmium (Cd)-Dissolved	<0.050	DLHC	0.050	ug/L	04-APR-22	2.7
Chromium (Cr)-Dissolved	<5.0	DLHC	5.0	ug/L	04-APR-22	50

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

T2-Ground Water (Coarse Soil)-All Types of Property Use

#1: T2-Ground Water (Coarse Soil)-All Types of Property Use

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1
L2696563-1 BH 22-1						
Sampled By: RL on 04-APR-22 @ 12:00						
Matrix: WATER						
Dissolved Metals						
Cobalt (Co)-Dissolved	<1.0	DLHC	1.0	ug/L	04-APR-22	3.8
Copper (Cu)-Dissolved	<2.0	DLHC	2.0	ug/L	04-APR-22	87
Lead (Pb)-Dissolved	<0.50	DLHC	0.50	ug/L	04-APR-22	10
Mercury (Hg)-Dissolved	<0.0050		0.0050	ug/L	05-APR-22	0.29
Molybdenum (Mo)-Dissolved	0.76	DLHC	0.50	ug/L	04-APR-22	70
Nickel (Ni)-Dissolved	<5.0	DLHC	5.0	ug/L	04-APR-22	100
Selenium (Se)-Dissolved	<0.50	DLHC	0.50	ug/L	04-APR-22	10
Silver (Ag)-Dissolved	<0.50	DLHC	0.50	ug/L	04-APR-22	1.5
Sodium (Na)-Dissolved	403000	DLHC	500	ug/L	04-APR-22	490000
Thallium (Tl)-Dissolved	<0.10	DLHC	0.10	ug/L	04-APR-22	2
Uranium (U)-Dissolved	1.99	DLHC	0.10	ug/L	04-APR-22	20
Vanadium (V)-Dissolved	<5.0	DLHC	5.0	ug/L	04-APR-22	6.2
Zinc (Zn)-Dissolved	<10	DLHC	10	ug/L	04-APR-22	1100
Speciated Metals						
Chromium, Hexavalent	<0.50		0.50	ug/L	05-APR-22	25
Volatile Organic Compounds						
Acetone	<30	OWP	30	ug/L	06-APR-22	2700
Benzene	<0.50	OWP	0.50	ug/L	06-APR-22	5
Bromodichloromethane	<2.0	OWP	2.0	ug/L	06-APR-22	16
Bromoform	<5.0	OWP	5.0	ug/L	06-APR-22	25
Bromomethane	<0.50	OWP	0.50	ug/L	06-APR-22	0.89
Carbon tetrachloride	<0.20	OWP	0.20	ug/L	06-APR-22	0.79
Chlorobenzene	<0.50	OWP	0.50	ug/L	06-APR-22	30
Dibromochloromethane	<2.0	OWP	2.0	ug/L	06-APR-22	25
Chloroform	<1.0	OWP	1.0	ug/L	06-APR-22	2.4
1,2-Dibromoethane	<0.20	OWP	0.20	ug/L	06-APR-22	0.2
1,2-Dichlorobenzene	<0.50	OWP	0.50	ug/L	06-APR-22	3
1,3-Dichlorobenzene	<0.50	OWP	0.50	ug/L	06-APR-22	59
1,4-Dichlorobenzene	<0.50	OWP	0.50	ug/L	06-APR-22	1
Dichlorodifluoromethane	<2.0	OWP	2.0	ug/L	06-APR-22	590
1,1-Dichloroethane	<0.50	OWP	0.50	ug/L	06-APR-22	5
1,2-Dichloroethane	<0.50	OWP	0.50	ug/L	06-APR-22	1.6
1,1-Dichloroethylene	<0.50	OWP	0.50	ug/L	06-APR-22	1.6
cis-1,2-Dichloroethylene	<0.50	OWP	0.50	ug/L	06-APR-22	1.6
trans-1,2-Dichloroethylene	<0.50	OWP	0.50	ug/L	06-APR-22	1.6
Methylene Chloride	<5.0	OWP	5.0	ug/L	06-APR-22	50
1,2-Dichloropropane	<0.50	OWP	0.50	ug/L	06-APR-22	5
cis-1,3-Dichloropropene	<0.30	OWP	0.30	ug/L	06-APR-22	
trans-1,3-Dichloropropene	<0.30	OWP	0.30	ug/L	06-APR-22	
1,3-Dichloropropene (cis & trans)	<0.50		0.50	ug/L	06-APR-22	0.5
Ethylbenzene	<0.50	OWP	0.50	ug/L	06-APR-22	2.4
n-Hexane	<0.50	OWP	0.50	ug/L	06-APR-22	51
Methyl Ethyl Ketone	<20	OWP	20	ug/L	06-APR-22	1800
Methyl Isobutyl Ketone	<20	OWP	20	ug/L	06-APR-22	640
MTBE	<2.0	OWP	2.0	ug/L	06-APR-22	15

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T2-Ground Water (Coarse Soil)-All Types of Property Use

#1: T2-Ground Water (Coarse Soil)-All Types of Property Use

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1
L2696563-1 BH 22-1						
Sampled By: RL on 04-APR-22 @ 12:00						
Matrix: WATER						
Volatile Organic Compounds						
Styrene	<0.50	OWP	0.50	ug/L	06-APR-22	5.4
1,1,1,2-Tetrachloroethane	<0.50	OWP	0.50	ug/L	06-APR-22	1.1
1,1,2,2-Tetrachloroethane	<0.50	OWP	0.50	ug/L	06-APR-22	1
Tetrachloroethylene	<0.50	OWP	0.50	ug/L	06-APR-22	1.6
Toluene	<0.50	OWP	0.50	ug/L	06-APR-22	24
1,1,1-Trichloroethane	<0.50	OWP	0.50	ug/L	06-APR-22	200
1,1,2-Trichloroethane	<0.50	OWP	0.50	ug/L	06-APR-22	4.7
Trichloroethylene	<0.50	OWP	0.50	ug/L	06-APR-22	1.6
Trichlorofluoromethane	<5.0	OWP	5.0	ug/L	06-APR-22	150
Vinyl chloride	<0.50	OWP	0.50	ug/L	06-APR-22	0.5
o-Xylene	<0.30	OWP	0.30	ug/L	06-APR-22	
m+p-Xylenes	<0.40	OWP	0.40	ug/L	06-APR-22	
Xylenes (Total)	<0.50		0.50	ug/L	06-APR-22	300
Surrogate: 4-Bromofluorobenzene	98.2		70-130	%	06-APR-22	
Surrogate: 1,4-Difluorobenzene	100.9		70-130	%	06-APR-22	
Hydrocarbons						
F1 (C6-C10)	<25	OWP	25	ug/L	06-APR-22	750
F1-BTEX	<25		25	ug/L	07-APR-22	750
F2 (C10-C16)	<100		100	ug/L	06-APR-22	150
F2-Naphth	<100		100	ug/L	07-APR-22	
F3 (C16-C34)	<250		250	ug/L	06-APR-22	500
F3-PAH	<250		250	ug/L	07-APR-22	
F4 (C34-C50)	<250		250	ug/L	06-APR-22	500
Total Hydrocarbons (C6-C50)	<370		370	ug/L	07-APR-22	
Chrom. to baseline at nC50	YES			No Unit	06-APR-22	
Surrogate: 2-Bromobenzotrifluoride	85.4		60-140	%	06-APR-22	
Surrogate: 3,4-Dichlorotoluene	60.3		60-140	%	06-APR-22	
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	<0.020		0.020	ug/L	07-APR-22	4.1
Acenaphthylene	<0.020		0.020	ug/L	07-APR-22	1
Anthracene	<0.020		0.020	ug/L	07-APR-22	2.4
Benzo(a)anthracene	<0.020		0.020	ug/L	07-APR-22	1
Benzo(a)pyrene	<0.010		0.010	ug/L	07-APR-22	0.01
Benzo(b&j)fluoranthene	<0.020		0.020	ug/L	07-APR-22	0.1
Benzo(g,h,i)perylene	<0.020		0.020	ug/L	07-APR-22	0.2
Benzo(k)fluoranthene	<0.020		0.020	ug/L	07-APR-22	0.1
Chrysene	<0.020		0.020	ug/L	07-APR-22	0.1
Dibenz(a,h)anthracene	<0.020		0.020	ug/L	07-APR-22	0.2
Fluoranthene	0.030		0.020	ug/L	07-APR-22	0.41
Fluorene	<0.020		0.020	ug/L	07-APR-22	120
Indeno(1,2,3-cd)pyrene	<0.020		0.020	ug/L	07-APR-22	0.2
1+2-Methylnaphthalenes	0.057		0.028	ug/L	07-APR-22	3.2
1-Methylnaphthalene	0.024		0.020	ug/L	07-APR-22	3.2
2-Methylnaphthalene	0.033		0.020	ug/L	07-APR-22	3.2
Naphthalene	<0.050		0.050	ug/L	07-APR-22	11
Phenanthrene	0.031		0.020	ug/L	07-APR-22	1

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

T2-Ground Water (Coarse Soil)-All Types of Property Use

#1: T2-Ground Water (Coarse Soil)-All Types of Property Use

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits
L2696563-1 BH 22-1						
Sampled By: RL on 04-APR-22 @ 12:00						
Matrix: WATER						#1
Polycyclic Aromatic Hydrocarbons						
Pyrene	0.033		0.020	ug/L	07-APR-22	4.1
Surrogate: Chrysene d12	103.6		50-150	%	07-APR-22	
Surrogate: Naphthalene d8	115.8		60-140	%	07-APR-22	
Surrogate: Phenanthrene d10	120.0		60-140	%	07-APR-22	
L2696563-2 BH 22-3						
Sampled By: RL on 04-APR-22 @ 10:00						
Matrix: WATER						#1
Physical Tests						
Colour, Apparent	30.1		2.0	CU	05-APR-22	
Conductivity	3.70		0.0030	mS/cm	05-APR-22	
Hardness (as CaCO3)	646		1.3	mg/L	05-APR-22	
pH	8.11		0.10	pH units	05-APR-22	
Total Dissolved Solids	1970	DLDS	20	mg/L	08-APR-22	
Turbidity	>4000	TMV	0.10	NTU	05-APR-22	
Anions and Nutrients						
Alkalinity, Bicarbonate (as CaCO3)	287		1.0	mg/L	05-APR-22	
Alkalinity, Carbonate (as CaCO3)	<1.0		1.0	mg/L	05-APR-22	
Alkalinity, Hydroxide (as CaCO3)	<1.0		1.0	mg/L	05-APR-22	
Alkalinity, Total (as CaCO3)	287		1.0	mg/L	05-APR-22	
Ammonia, Total (as N)	0.051		0.010	mg/L	07-APR-22	
Bromide (Br)	1.56	DLDS	0.50	mg/L	05-APR-22	
Chloride (Cl)	1150	DLDS	2.5	mg/L	05-APR-22	*790
Computed Conductivity	3210			uS/cm	08-APR-22	
Conductivity % Difference	-14			%	08-APR-22	
Fluoride (F)	0.35	DLDS	0.10	mg/L	05-APR-22	
Hardness (as CaCO3)	646			mg/L	08-APR-22	
Ion Balance	93			%	08-APR-22	
Langelier Index	1			No Unit	08-APR-22	
Nitrate and Nitrite as N	<0.11		0.11	mg/L	06-APR-22	
Nitrate (as N)	<0.10	DLDS	0.10	mg/L	05-APR-22	
Nitrite (as N)	<0.050	DLDS	0.050	mg/L	05-APR-22	
Saturation pH	7.26			pH	08-APR-22	
Orthophosphate-Dissolved (as P)	<0.0030		0.0030	mg/L	05-APR-22	
TDS (Calculated)	2110			mg/L	08-APR-22	
Sulfate (SO4)	69.1	DLDS	1.5	mg/L	05-APR-22	
Anion Sum	38.5			me/L	08-APR-22	
Cation Sum	35.7			me/L	08-APR-22	
Cation - Anion Balance	-4			%	08-APR-22	
Cyanides						
Cyanide, Weak Acid Diss	<2.0		2.0	ug/L	05-APR-22	66
Organic / Inorganic Carbon						
Dissolved Carbon Filtration Location	LAB			No Unit	05-APR-22	
Dissolved Organic Carbon	5.62		0.50	mg/L	05-APR-22	
Inorganic Parameters						
Silica	8.6		1.1	mg/L	05-APR-22	

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

T2-Ground Water (Coarse Soil)-All Types of Property Use

#1: T2-Ground Water (Coarse Soil)-All Types of Property Use

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1
L2696563-2 BH 22-3						
Sampled By: RL on 04-APR-22 @ 10:00						
Matrix: WATER						
Dissolved Metals						
Dissolved Mercury Filtration Location	FIELD			No Unit	04-APR-22	
Dissolved Metals Filtration Location	FIELD			No Unit	04-APR-22	
Antimony (Sb)-Dissolved	<1.0	DLHC	1.0	ug/L	04-APR-22	6
Arsenic (As)-Dissolved	<1.0	DLHC	1.0	ug/L	04-APR-22	25
Barium (Ba)-Dissolved	222	DLHC	1.0	ug/L	04-APR-22	1000
Beryllium (Be)-Dissolved	<1.0	DLHC	1.0	ug/L	04-APR-22	4
Boron (B)-Dissolved	160	DLHC	100	ug/L	04-APR-22	5000
Cadmium (Cd)-Dissolved	<0.050	DLHC	0.050	ug/L	04-APR-22	2.7
Chromium (Cr)-Dissolved	<5.0	DLHC	5.0	ug/L	04-APR-22	50
Cobalt (Co)-Dissolved	<1.0	DLHC	1.0	ug/L	04-APR-22	3.8
Copper (Cu)-Dissolved	<2.0	DLHC	2.0	ug/L	04-APR-22	87
Lead (Pb)-Dissolved	<0.50	DLHC	0.50	ug/L	04-APR-22	10
Mercury (Hg)-Dissolved	<0.0050		0.0050	ug/L	05-APR-22	0.29
Molybdenum (Mo)-Dissolved	40.1	DLHC	0.50	ug/L	04-APR-22	70
Nickel (Ni)-Dissolved	<5.0	DLHC	5.0	ug/L	04-APR-22	100
Selenium (Se)-Dissolved	<0.50	DLHC	0.50	ug/L	04-APR-22	10
Silver (Ag)-Dissolved	<0.50	DLHC	0.50	ug/L	04-APR-22	1.5
Sodium (Na)-Dissolved	517000	DLHC	500	ug/L	04-APR-22	*490000
Thallium (Tl)-Dissolved	<0.10	DLHC	0.10	ug/L	04-APR-22	2
Uranium (U)-Dissolved	1.33	DLHC	0.10	ug/L	04-APR-22	20
Vanadium (V)-Dissolved	<5.0	DLHC	5.0	ug/L	04-APR-22	6.2
Zinc (Zn)-Dissolved	<10	DLHC	10	ug/L	04-APR-22	1100
Speciated Metals						
Chromium, Hexavalent	<0.50		0.50	ug/L	05-APR-22	25
Volatile Organic Compounds						
Acetone	<30	OWP	30	ug/L	06-APR-22	2700
Benzene	<0.50	OWP	0.50	ug/L	06-APR-22	5
Bromodichloromethane	<2.0	OWP	2.0	ug/L	06-APR-22	16
Bromoform	<5.0	OWP	5.0	ug/L	06-APR-22	25
Bromomethane	<0.50	OWP	0.50	ug/L	06-APR-22	0.89
Carbon tetrachloride	<0.20	OWP	0.20	ug/L	06-APR-22	0.79
Chlorobenzene	<0.50	OWP	0.50	ug/L	06-APR-22	30
Dibromochloromethane	<2.0	OWP	2.0	ug/L	06-APR-22	25
Chloroform	<1.0	OWP	1.0	ug/L	06-APR-22	2.4
1,2-Dibromoethane	<0.20	OWP	0.20	ug/L	06-APR-22	0.2
1,2-Dichlorobenzene	<0.50	OWP	0.50	ug/L	06-APR-22	3
1,3-Dichlorobenzene	<0.50	OWP	0.50	ug/L	06-APR-22	59
1,4-Dichlorobenzene	<0.50	OWP	0.50	ug/L	06-APR-22	1
Dichlorodifluoromethane	<2.0	OWP	2.0	ug/L	06-APR-22	590
1,1-Dichloroethane	<0.50	OWP	0.50	ug/L	06-APR-22	5
1,2-Dichloroethane	<0.50	OWP	0.50	ug/L	06-APR-22	1.6
1,1-Dichloroethylene	<0.50	OWP	0.50	ug/L	06-APR-22	1.6
cis-1,2-Dichloroethylene	<0.50	OWP	0.50	ug/L	06-APR-22	1.6
trans-1,2-Dichloroethylene	<0.50	OWP	0.50	ug/L	06-APR-22	1.6
Methylene Chloride	<5.0	OWP	5.0	ug/L	06-APR-22	50

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

T2-Ground Water (Coarse Soil)-All Types of Property Use

#1: T2-Ground Water (Coarse Soil)-All Types of Property Use

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1
L2696563-2 BH 22-3						
Sampled By: RL on 04-APR-22 @ 10:00						
Matrix: WATER						
Volatile Organic Compounds						
1,2-Dichloropropane	<0.50	OWP	0.50	ug/L	06-APR-22	5
cis-1,3-Dichloropropene	<0.30	OWP	0.30	ug/L	06-APR-22	
trans-1,3-Dichloropropene	<0.30	OWP	0.30	ug/L	06-APR-22	
1,3-Dichloropropene (cis & trans)	<0.50		0.50	ug/L	06-APR-22	0.5
Ethylbenzene	<0.50	OWP	0.50	ug/L	06-APR-22	2.4
n-Hexane	<0.50	OWP	0.50	ug/L	06-APR-22	51
Methyl Ethyl Ketone	<20	OWP	20	ug/L	06-APR-22	1800
Methyl Isobutyl Ketone	<20	OWP	20	ug/L	06-APR-22	640
MTBE	<2.0	OWP	2.0	ug/L	06-APR-22	15
Styrene	<0.50	OWP	0.50	ug/L	06-APR-22	5.4
1,1,1,2-Tetrachloroethane	<0.50	OWP	0.50	ug/L	06-APR-22	1.1
1,1,2,2-Tetrachloroethane	<0.50	OWP	0.50	ug/L	06-APR-22	1
Tetrachloroethylene	<0.50	OWP	0.50	ug/L	06-APR-22	1.6
Toluene	<0.50	OWP	0.50	ug/L	06-APR-22	24
1,1,1-Trichloroethane	<0.50	OWP	0.50	ug/L	06-APR-22	200
1,1,2-Trichloroethane	<0.50	OWP	0.50	ug/L	06-APR-22	4.7
Trichloroethylene	<0.50	OWP	0.50	ug/L	06-APR-22	1.6
Trichlorofluoromethane	<5.0	OWP	5.0	ug/L	06-APR-22	150
Vinyl chloride	<0.50	OWP	0.50	ug/L	06-APR-22	0.5
o-Xylene	<0.30	OWP	0.30	ug/L	06-APR-22	
m+p-Xylenes	<0.40	OWP	0.40	ug/L	06-APR-22	
Xylenes (Total)	<0.50		0.50	ug/L	06-APR-22	300
Surrogate: 4-Bromofluorobenzene	101.5		70-130	%	06-APR-22	
Surrogate: 1,4-Difluorobenzene	100.4		70-130	%	06-APR-22	
Hydrocarbons						
F1 (C6-C10)	<25	OWP	25	ug/L	06-APR-22	750
F1-BTEX	<25		25	ug/L	07-APR-22	750
F2 (C10-C16)	<100		100	ug/L	06-APR-22	150
F2-Naphth	<100		100	ug/L	07-APR-22	
F3 (C16-C34)	<250		250	ug/L	06-APR-22	500
F3-PAH	<250		250	ug/L	07-APR-22	
F4 (C34-C50)	<250		250	ug/L	06-APR-22	500
Total Hydrocarbons (C6-C50)	<370		370	ug/L	07-APR-22	
Chrom. to baseline at nC50	YES			No Unit	06-APR-22	
Surrogate: 2-Bromobenzotrifluoride	91.2		60-140	%	06-APR-22	
Surrogate: 3,4-Dichlorotoluene	68.9		60-140	%	06-APR-22	
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	<0.020		0.020	ug/L	07-APR-22	4.1
Acenaphthylene	0.020	R	0.020	ug/L	07-APR-22	1
Anthracene	<0.020		0.020	ug/L	07-APR-22	2.4
Benzo(a)anthracene	<0.020		0.020	ug/L	07-APR-22	1
Benzo(a)pyrene	<0.010		0.010	ug/L	07-APR-22	0.01
Benzo(b&j)fluoranthene	<0.020		0.020	ug/L	07-APR-22	0.1
Benzo(g,h,i)perylene	<0.020		0.020	ug/L	07-APR-22	0.2
Benzo(k)fluoranthene	<0.020		0.020	ug/L	07-APR-22	0.1
Chrysene	<0.020		0.020	ug/L	07-APR-22	0.1

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

T2-Ground Water (Coarse Soil)-All Types of Property Use

#1: T2-Ground Water (Coarse Soil)-All Types of Property Use

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1
L2696563-2 BH 22-3						
Sampled By: RL on 04-APR-22 @ 10:00						
Matrix: WATER						
Polycyclic Aromatic Hydrocarbons						
Dibenz(a,h)anthracene	<0.020		0.020	ug/L	07-APR-22	0.2
Fluoranthene	0.032		0.020	ug/L	07-APR-22	0.41
Fluorene	<0.020		0.020	ug/L	07-APR-22	120
Indeno(1,2,3-cd)pyrene	<0.020		0.020	ug/L	07-APR-22	0.2
1+2-Methylnaphthalenes	0.129		0.028	ug/L	07-APR-22	3.2
1-Methylnaphthalene	0.062		0.020	ug/L	07-APR-22	3.2
2-Methylnaphthalene	0.068		0.020	ug/L	07-APR-22	3.2
Naphthalene	0.054		0.050	ug/L	07-APR-22	11
Phenanthrene	0.049		0.020	ug/L	07-APR-22	1
Pyrene	0.047		0.020	ug/L	07-APR-22	4.1
Surrogate: Chrysene d12	97.9		50-150	%	07-APR-22	
Surrogate: Naphthalene d8	109.8		60-140	%	07-APR-22	
Surrogate: Phenanthrene d10	116.1		60-140	%	07-APR-22	

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

T2-Ground Water (Coarse Soil)-All Types of Property Use

#1: T2-Ground Water (Coarse Soil)-All Types of Property Use

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
R	The ion abundance ratio(s) did not meet the acceptance criteria. Value is an estimated maximum.
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
PEHR	Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.
TMV	Turbidity exceeded upper limit of the nephelometric method. Minimum value reported.
OWP	Organic water sample contained visible sediment (must be included as part of analysis). Measured concentrations of organic substances in water can be biased high due to presence of sediment.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference***
ALK-SPEC-PCT-WT	Water	Automated Speciated Alkalinity	APHA 2320B

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ALK-WT	Water	Alkalinity, Total (as CaCO3)	APHA 2320B

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint.

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

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

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

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

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

CN-WAD-R511-WT	Water	Cyanide (WAD)-O.Reg 153/04	APHA 4500CN I-Weak acid Dist Colorimet

Weak acid dissociable cyanide (WAD) is determined by undergoing a distillation procedure. Cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011 and as of November 30, 2020), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

COLOUR-APPARENT-WT	Water	Colour	APHA 2120

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

CR-CR6-IC-R511-WT	Water	Hex Chrom-O.Reg 153/04 (July 2011)	EPA 7199

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 7199, published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution. Chromium (III) is calculated as the difference between the total chromium and the chromium (VI) results.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011 and as of November 30, 2020), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

DOC-WT	Water	Dissolved Organic Carbon	APHA 5310B

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

EC-R511-WT	Water	Conductivity-O.Reg 153/04 (July 2011)	APHA 2510 B

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

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011 and as of November 30, 2020), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

Reference Information

EC-SCREEN-WT	Water	Conductivity Screen (Internal Use Only)	APHA 2510

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

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

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

F1-F4-511-CALC-WT	Water	F1-F4 Hydrocarbon Calculated Parameters	CCME CWS-PHC, Pub #1310, Dec 2001-L

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

F1-HS-511-WT	Water	F1-O.Reg 153/04 (July 2011)	E3398/CCME TIER 1-HS

Fraction F1 is determined by analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011 and as of November 30, 2020), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

F2-F4-511-WT	Water	F2-F4-O.Reg 153/04 (July 2011)	EPA 3511/CCME Tier 1

Petroleum Hydrocarbons (F2-F4 fractions) are extracted from water using a hexane micro-extraction technique. Instrumental analysis is by GC-FID, as per the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Tier 1 Method, CCME, 2001.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011 and as of November 30, 2020), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

HARDNESS-CALC-WT	Water	Hardness	APHA 2340 B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-UG/L-CVAA-WT	Water	Diss. Mercury in Water by CVAAS (ug/L)	EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.

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

IONBALANCE-OP03-WT	Water	Detailed Ion Balance Calculation	APHA 1030E, 2330B, 2510A
MET-D-UG/L-MS-WT	Water	Diss. Metals in Water by ICPMS (ug/L)	EPA 200.8

The metal constituents of a non-acidified sample that pass through a membrane filter prior to ICP/MS analysis.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

METHYLNAPS-CALC-WT	Water	PAH-Calculated Parameters	SW846 8270

Reference Information

NH3-F-WT	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

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

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

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

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

PAH-511-WT	Water	PAH-O. Reg 153/04 (July 2011)	SW846 3510/8270

Aqueous samples, fortified with surrogates, are extracted using liquid/liquid extraction technique. The sample extracts are concentrated and then analyzed using GC/MS. Results for benzo(b) fluoranthene may include contributions from benzo(j)fluoranthene, if also present in the sample.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011 and as of November 30, 2020), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

PH-WT	Water	pH	APHA 4500 H-Electrode

Water samples are analyzed directly by a calibrated pH meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days

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

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

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

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

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

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

TURBIDITY-WT	Water	Turbidity	APHA 2130 B

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

VOC-1,3-DCP-CALC-WT	Water	Regulation 153 VOCs	SW8260B/SW8270C
VOC-511-HS-WT	Water	VOC by GCMS HS O.Reg 153/04 (July 2011)	SW846 8260

Liquid samples are analyzed by headspace GC/MSD.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011 and as of November 30, 2020), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

XYLENES-SUM-CALC-WT	Water	Sum of Xylene Isomer Concentrations	CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

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

Chain of Custody numbers:

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

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

Reference Information

GLOSSARY OF REPORT TERMS

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

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

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Quality Control Report

Workorder: L2696563 Report Date: 10-MAY-22

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7

Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-SPEC-PCT-WT	**Water**							
Batch R5756157								
WG3713640-4 DUP		**WG3713640-3**						
Alkalinity, Total (as CaCO3)		110	115		mg/L	4.6	20	05-APR-22
Alkalinity, Bicarbonate (as CaCO3)		110	115		mg/L	4.6	20	05-APR-22
Alkalinity, Carbonate (as CaCO3)		<1.0	<1.0	RPD-NA	mg/L	N/A	20	05-APR-22
Alkalinity, Hydroxide (as CaCO3)		<1.0	<1.0	RPD-NA	mg/L	N/A	20	05-APR-22
WG3713640-2 LCS								
Alkalinity, Total (as CaCO3)			97.8		%		85-115	05-APR-22
WG3713640-1 MB								
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	05-APR-22
Alkalinity, Bicarbonate (as CaCO3)			<2.0		mg/L		4	05-APR-22
Alkalinity, Carbonate (as CaCO3)			<2.0		mg/L		2	05-APR-22
Alkalinity, Hydroxide (as CaCO3)			<2.0		mg/L		2	05-APR-22
ALK-WT	**Water**							
Batch R5756157								
WG3713640-4 DUP		**WG3713640-3**						
Alkalinity, Total (as CaCO3)		110	115		mg/L	4.6	20	05-APR-22
WG3713640-2 LCS								
Alkalinity, Total (as CaCO3)			97.8		%		85-115	05-APR-22
WG3713640-1 MB								
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	05-APR-22
BR-IC-N-WT	**Water**							
Batch R5756278								
WG3713912-14 DUP		**WG3713912-15**						
Bromide (Br)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	05-APR-22
WG3713912-12 LCS								
Bromide (Br)			101.3		%		85-115	05-APR-22
WG3713912-11 MB								
Bromide (Br)			<0.10		mg/L		0.1	05-APR-22
WG3713912-13 MS		**WG3713912-15**						
Bromide (Br)			98.7		%		75-125	05-APR-22
CL-IC-N-WT	**Water**							
Batch R5756278								
WG3713912-14 DUP		**WG3713912-15**						
Chloride (Cl)		71.8	71.7		mg/L	0.2	20	05-APR-22
WG3713912-12 LCS								
Chloride (Cl)			102.0		%		90-110	05-APR-22
WG3713912-11 MB								

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-N-WT	**Water**							
Batch R5756278								
WG3713912-11 MB								
Chloride (Cl)			<0.50		mg/L		0.5	05-APR-22
WG3713912-13 MS		**WG3713912-15**						
Chloride (Cl)			98.6		%		75-125	05-APR-22
CN-WAD-R511-WT	**Water**							
Batch R5756137								
WG3714037-8 DUP		**WG3714037-10**						
Cyanide, Weak Acid Diss		<2.0	<2.0	RPD-NA	ug/L	N/A	20	05-APR-22
WG3714037-7 LCS								
Cyanide, Weak Acid Diss			103.8		%		80-120	05-APR-22
WG3714037-6 MB								
Cyanide, Weak Acid Diss			<2.0		ug/L		2	05-APR-22
WG3714037-9 MS		**WG3714037-10**						
Cyanide, Weak Acid Diss			109.9		%		75-125	05-APR-22
COLOUR-APPARENT-WT	**Water**							
Batch R5755882								
WG3714034-3 DUP		**L2696657-3**						
Colour, Apparent		<2.0	<2.0	RPD-NA	CU	N/A	20	05-APR-22
WG3714034-2 LCS								
Colour, Apparent			98.1		%		85-115	05-APR-22
WG3714034-1 MB								
Colour, Apparent			<2.0		CU		2	05-APR-22
CR-CR6-IC-R511-WT	**Water**							
Batch R5756422								
WG3713909-4 DUP		**WG3713909-3**						
Chromium, Hexavalent		<0.50	<0.50	RPD-NA	ug/L	N/A	20	05-APR-22
WG3713909-2 LCS								
Chromium, Hexavalent			99.0		%		80-120	05-APR-22
WG3713909-1 MB								
Chromium, Hexavalent			<0.50		ug/L		0.5	05-APR-22
WG3713909-5 MS		**WG3713909-3**						
Chromium, Hexavalent			98.5		%		70-130	05-APR-22
DOC-WT	**Water**							
Batch R5757824								
WG3713645-3 DUP		**L2696563-2**						
Dissolved Organic Carbon		5.62	5.14		mg/L	8.8	20	05-APR-22
WG3713645-2 LCS								

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
DOC-WT	**Water**							
Batch R5757824								
WG3713645-2 LCS								
Dissolved Organic Carbon			97.3		%		80-120	05-APR-22
WG3713645-1 MB								
Dissolved Organic Carbon			<0.50		mg/L		0.5	05-APR-22
WG3713645-4 MS		**L2696563-2**						
Dissolved Organic Carbon			94.8		%		70-130	05-APR-22
EC-R511-WT	**Water**							
Batch R5756157								
WG3713640-4 DUP		**WG3713640-3**						
Conductivity		0.528	0.526		mS/cm	0.4	10	05-APR-22
WG3713640-2 LCS								
Conductivity			100.1		%		90-110	05-APR-22
WG3713640-1 MB								
Conductivity			<0.0030		mS/cm		0.003	05-APR-22
F-IC-N-WT	**Water**							
Batch R5756278								
WG3713912-14 DUP		**WG3713912-15**						
Fluoride (F)		0.527	0.524		mg/L	0.4	20	05-APR-22
WG3713912-12 LCS								
Fluoride (F)			102.4		%		90-110	05-APR-22
WG3713912-11 MB								
Fluoride (F)			<0.020		mg/L		0.02	05-APR-22
WG3713912-13 MS		**WG3713912-15**						
Fluoride (F)			98.0		%		75-125	05-APR-22
F1-HS-511-WT	**Water**							
Batch R5755023								
WG3713604-4 DUP		**WG3713604-3**						
F1 (C6-C10)		<25	<25	RPD-NA	ug/L	N/A	30	06-APR-22
WG3713604-1 LCS								
F1 (C6-C10)			110.8		%		80-120	05-APR-22
WG3713604-2 MB								
F1 (C6-C10)			<25		ug/L		25	05-APR-22
Surrogate: 3,4-Dichlorotoluene			105.6		%		60-140	05-APR-22
WG3713604-5 MS		**WG3713604-3**						
F1 (C6-C10)			95.5		%		60-140	06-APR-22
F2-F4-511-WT	**Water**							

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-F4-511-WT	**Water**							
Batch R5756441								
WG3713565-2 LCS								
F2 (C10-C16)			105.7		%		70-130	06-APR-22
F3 (C16-C34)			107.5		%		70-130	06-APR-22
F4 (C34-C50)			104.7		%		70-130	06-APR-22
WG3713565-1 MB								
F2 (C10-C16)			<100		ug/L		100	06-APR-22
F3 (C16-C34)			<250		ug/L		250	06-APR-22
F4 (C34-C50)			<250		ug/L		250	06-APR-22
Surrogate: 2-Bromobenzotrifluoride			88.1		%		60-140	06-APR-22
HG-D-UG/L-CVAA-WT	**Water**							
Batch R5755456								
WG3713508-4 DUP		**WG3713508-3**						
Mercury (Hg)-Dissolved		<0.0050	<0.0050	RPD-NA	ug/L	N/A	20	05-APR-22
WG3713508-2 LCS								
Mercury (Hg)-Dissolved			96.5		%		80-120	05-APR-22
WG3713508-1 MB								
Mercury (Hg)-Dissolved			<0.0050		ug/L		0.005	05-APR-22
WG3713508-6 MS		**WG3713508-5**						
Mercury (Hg)-Dissolved			92.5		%		70-130	05-APR-22
MET-D-UG/L-MS-WT	**Water**							
Batch R5754720								
WG3713519-4 DUP		**WG3713519-3**						
Antimony (Sb)-Dissolved		1.4	1.4		ug/L	2.7	20	04-APR-22
Arsenic (As)-Dissolved		7.0	6.6		ug/L	6.4	20	04-APR-22
Barium (Ba)-Dissolved		55.0	55.2		ug/L	0.3	20	04-APR-22
Beryllium (Be)-Dissolved		<1.0	<1.0	RPD-NA	ug/L	N/A	20	04-APR-22
Boron (B)-Dissolved		1160	1220		ug/L	5.4	20	04-APR-22
Cadmium (Cd)-Dissolved		<0.050	<0.050	RPD-NA	ug/L	N/A	20	04-APR-22
Chromium (Cr)-Dissolved		<5.0	<5.0	RPD-NA	ug/L	N/A	20	04-APR-22
Cobalt (Co)-Dissolved		13.5	12.9		ug/L	4.2	20	04-APR-22
Copper (Cu)-Dissolved		<2.0	<2.0	RPD-NA	ug/L	N/A	20	04-APR-22
Lead (Pb)-Dissolved		<0.50	<0.50	RPD-NA	ug/L	N/A	20	04-APR-22
Molybdenum (Mo)-Dissolved		6.24	5.82		ug/L	7.1	20	04-APR-22
Nickel (Ni)-Dissolved		<5.0	<5.0	RPD-NA	ug/L	N/A	20	04-APR-22
Selenium (Se)-Dissolved		0.72	0.75		ug/L	3.4	20	04-APR-22

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Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-UG/L-MS-WT	**Water**							
Batch R5754720								
WG3713519-4 DUP		**WG3713519-3**						
Silver (Ag)-Dissolved		<0.50	<0.50	RPD-NA	ug/L	N/A	20	04-APR-22
Sodium (Na)-Dissolved		267000	266000		ug/L	0.1	20	04-APR-22
Thallium (Tl)-Dissolved		<0.10	<0.10	RPD-NA	ug/L	N/A	20	04-APR-22
Uranium (U)-Dissolved		0.86	0.92		ug/L	6.8	20	04-APR-22
Vanadium (V)-Dissolved		<5.0	<5.0	RPD-NA	ug/L	N/A	20	04-APR-22
Zinc (Zn)-Dissolved		<10	<10	RPD-NA	ug/L	N/A	20	04-APR-22
WG3713519-2 LCS								
Antimony (Sb)-Dissolved			108.4		%		80-120	04-APR-22
Arsenic (As)-Dissolved			106.3		%		80-120	04-APR-22
Barium (Ba)-Dissolved			103.3		%		80-120	04-APR-22
Beryllium (Be)-Dissolved			95.4		%		80-120	04-APR-22
Boron (B)-Dissolved			88.5		%		80-120	04-APR-22
Cadmium (Cd)-Dissolved			108.5		%		80-120	04-APR-22
Chromium (Cr)-Dissolved			100.6		%		80-120	04-APR-22
Cobalt (Co)-Dissolved			100.2		%		80-120	04-APR-22
Copper (Cu)-Dissolved			99.8		%		80-120	04-APR-22
Lead (Pb)-Dissolved			110.6		%		80-120	04-APR-22
Molybdenum (Mo)-Dissolved			104.6		%		80-120	04-APR-22
Nickel (Ni)-Dissolved			100.1		%		80-120	04-APR-22
Selenium (Se)-Dissolved			105.6		%		80-120	04-APR-22
Silver (Ag)-Dissolved			98.9		%		80-120	04-APR-22
Sodium (Na)-Dissolved			102.9		%		80-120	04-APR-22
Thallium (Tl)-Dissolved			107.2		%		80-120	04-APR-22
Uranium (U)-Dissolved			111.0		%		80-120	04-APR-22
Vanadium (V)-Dissolved			103.3		%		80-120	04-APR-22
Zinc (Zn)-Dissolved			102.3		%		80-120	04-APR-22
WG3713519-1 MB								
Antimony (Sb)-Dissolved			<0.10		ug/L		0.1	04-APR-22
Arsenic (As)-Dissolved			<0.10		ug/L		0.1	04-APR-22
Barium (Ba)-Dissolved			<0.10		ug/L		0.1	04-APR-22
Beryllium (Be)-Dissolved			<0.10		ug/L		0.1	04-APR-22
Boron (B)-Dissolved			<10		ug/L		10	04-APR-22
Cadmium (Cd)-Dissolved			<0.0050		ug/L		0.005	04-APR-22
Chromium (Cr)-Dissolved			<0.50		ug/L		0.5	04-APR-22

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-UG/L-MS-WT	**Water**							
Batch R5754720								
WG3713519-1 MB								
Cobalt (Co)-Dissolved			<0.10		ug/L		0.1	04-APR-22
Copper (Cu)-Dissolved			<0.20		ug/L		0.2	04-APR-22
Lead (Pb)-Dissolved			<0.050		ug/L		0.05	04-APR-22
Molybdenum (Mo)-Dissolved			<0.050		ug/L		0.05	04-APR-22
Nickel (Ni)-Dissolved			<0.50		ug/L		0.5	04-APR-22
Selenium (Se)-Dissolved			<0.050		ug/L		0.05	04-APR-22
Silver (Ag)-Dissolved			<0.050		ug/L		0.05	04-APR-22
Sodium (Na)-Dissolved			<50		ug/L		50	04-APR-22
Thallium (Tl)-Dissolved			<0.010		ug/L		0.01	04-APR-22
Uranium (U)-Dissolved			<0.010		ug/L		0.01	04-APR-22
Vanadium (V)-Dissolved			<0.50		ug/L		0.5	04-APR-22
Zinc (Zn)-Dissolved			<1.0		ug/L		1	04-APR-22
WG3713519-5 MS		**WG3713519-6**						
Antimony (Sb)-Dissolved			93.0		%		70-130	04-APR-22
Arsenic (As)-Dissolved			79.9		%		70-130	04-APR-22
Barium (Ba)-Dissolved			N/A	MS-B	%		-	04-APR-22
Beryllium (Be)-Dissolved			95.6		%		70-130	04-APR-22
Boron (B)-Dissolved			N/A	MS-B	%		-	04-APR-22
Cadmium (Cd)-Dissolved			105.3		%		70-130	04-APR-22
Chromium (Cr)-Dissolved			97.4		%		70-130	04-APR-22
Cobalt (Co)-Dissolved			78.8		%		70-130	04-APR-22
Copper (Cu)-Dissolved			90.9		%		70-130	04-APR-22
Lead (Pb)-Dissolved			100.8		%		70-130	04-APR-22
Molybdenum (Mo)-Dissolved			N/A	MS-B	%		-	04-APR-22
Nickel (Ni)-Dissolved			89.4		%		70-130	04-APR-22
Selenium (Se)-Dissolved			104.9		%		70-130	04-APR-22
Silver (Ag)-Dissolved			70.3		%		70-130	04-APR-22
Sodium (Na)-Dissolved			N/A	MS-B	%		-	04-APR-22
Thallium (Tl)-Dissolved			102.4		%		70-130	04-APR-22
Uranium (U)-Dissolved			N/A	MS-B	%		-	04-APR-22
Vanadium (V)-Dissolved			102.4		%		70-130	04-APR-22
Zinc (Zn)-Dissolved			91.7		%		70-130	04-APR-22
NH3-F-WT	**Water**							

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-F-WT	**Water**							
Batch R5757851								
WG3714511-3 DUP		**WG3714511-5**						
Ammonia, Total (as N)		0.358	0.351		mg/L	2.1	20	07-APR-22
WG3714511-2 LCS								
Ammonia, Total (as N)			103.2		%		85-115	07-APR-22
WG3714511-1 MB								
Ammonia, Total (as N)			<0.010		mg/L		0.01	07-APR-22
WG3714511-4 MS		**WG3714511-5**						
Ammonia, Total (as N)			N/A	MS-B	%		-	07-APR-22
NO2-IC-WT	**Water**							
Batch R5756278								
WG3713912-14 DUP		**WG3713912-15**						
Nitrite (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	20	05-APR-22
WG3713912-12 LCS								
Nitrite (as N)			100.5		%		90-110	05-APR-22
WG3713912-11 MB								
Nitrite (as N)			<0.010		mg/L		0.01	05-APR-22
WG3713912-13 MS		**WG3713912-15**						
Nitrite (as N)			98.5		%		75-125	05-APR-22
NO3-IC-WT	**Water**							
Batch R5756278								
WG3713912-14 DUP		**WG3713912-15**						
Nitrate (as N)		0.435	0.435		mg/L	0.0	20	05-APR-22
WG3713912-12 LCS								
Nitrate (as N)			101.0		%		90-110	05-APR-22
WG3713912-11 MB								
Nitrate (as N)			<0.020		mg/L		0.02	05-APR-22
WG3713912-13 MS		**WG3713912-15**						
Nitrate (as N)			99.4		%		75-125	05-APR-22
PAH-511-WT	**Water**							
Batch R5757878								
WG3713565-2 LCS								
1-Methylnaphthalene			117.6		%		50-140	07-APR-22
2-Methylnaphthalene			112.9		%		50-140	07-APR-22
Acenaphthene			111.3		%		60-130	07-APR-22
Acenaphthylene			105.7		%		60-130	07-APR-22
Anthracene			92.6		%		50-140	07-APR-22
Benzo(a)anthracene			100.5		%		60-140	07-APR-22

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900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-511-WT	**Water**							
Batch R5757878								
WG3713565-2 LCS								
Benzo(a)pyrene			78.2		%		50-140	07-APR-22
Benzo(b&j)fluoranthene			86.3		%		60-130	07-APR-22
Benzo(g,h,i)perylene			140.5	LCS-H	%		50-140	07-APR-22
Benzo(k)fluoranthene			87.1		%		50-140	07-APR-22
Chrysene			96.8		%		60-140	07-APR-22
Dibenz(a,h)anthracene			127.7		%		50-140	07-APR-22
Fluoranthene			103.5		%		60-140	07-APR-22
Fluorene			108.5		%		60-130	07-APR-22
Indeno(1,2,3-cd)pyrene			138.3		%		50-140	07-APR-22
Naphthalene			113.0		%		50-130	07-APR-22
Phenanthrene			107.4		%		60-140	07-APR-22
Pyrene			103.0		%		60-140	07-APR-22
WG3713565-1 MB								
1-Methylnaphthalene			<0.020		ug/L		0.02	07-APR-22
2-Methylnaphthalene			<0.020		ug/L		0.02	07-APR-22
Acenaphthene			<0.020		ug/L		0.02	07-APR-22
Acenaphthylene			<0.020		ug/L		0.02	07-APR-22
Anthracene			<0.020		ug/L		0.02	07-APR-22
Benzo(a)anthracene			<0.020		ug/L		0.02	07-APR-22
Benzo(a)pyrene			<0.010		ug/L		0.01	07-APR-22
Benzo(b&j)fluoranthene			<0.020		ug/L		0.02	07-APR-22
Benzo(g,h,i)perylene			<0.020		ug/L		0.02	07-APR-22
Benzo(k)fluoranthene			<0.020		ug/L		0.02	07-APR-22
Chrysene			<0.020		ug/L		0.02	07-APR-22
Dibenz(a,h)anthracene			<0.020		ug/L		0.02	07-APR-22
Fluoranthene			<0.020		ug/L		0.02	07-APR-22
Fluorene			<0.020		ug/L		0.02	07-APR-22
Indeno(1,2,3-cd)pyrene			<0.020		ug/L		0.02	07-APR-22
Naphthalene			<0.050		ug/L		0.05	07-APR-22
Phenanthrene			<0.020		ug/L		0.02	07-APR-22
Pyrene			<0.020		ug/L		0.02	07-APR-22
Surrogate: Naphthalene d8			114.9		%		60-140	07-APR-22
Surrogate: Phenanthrene d10			116.2		%		60-140	07-APR-22
Surrogate: Chrysene d12			106.8		%		50-150	07-APR-22

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH-WT	**Water**							
Batch R5756157								
WG3713640-4 DUP		**WG3713640-3**						
pH		8.10	8.11	J	pH units	0.01	0.2	05-APR-22
WG3713640-2 LCS								
pH			7.03		pH units		6.9-7.1	05-APR-22
PO4-DO-COL-WT	**Water**							
Batch R5755238								
WG3713770-3 DUP		**WG3713770-5**						
Orthophosphate-Dissolved (as P)		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	05-APR-22
WG3713770-2 LCS								
Orthophosphate-Dissolved (as P)			98.2		%		80-120	05-APR-22
WG3713770-1 MB								
Orthophosphate-Dissolved (as P)			<0.0030		mg/L		0.003	05-APR-22
WG3713770-4 MS		**WG3713770-5**						
Orthophosphate-Dissolved (as P)			104.0		%		70-130	05-APR-22
SO4-IC-N-WT	**Water**							
Batch R5756278								
WG3713912-14 DUP		**WG3713912-15**						
Sulfate (SO4)		31.6	31.6		mg/L	0.2	20	05-APR-22
WG3713912-12 LCS								
Sulfate (SO4)			102.6		%		90-110	05-APR-22
WG3713912-11 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	05-APR-22
WG3713912-13 MS		**WG3713912-15**						
Sulfate (SO4)			100.5		%		75-125	05-APR-22
SOLIDS-TDS-WT	**Water**							
Batch R5760680								
WG3715374-3 DUP		**L2697292-29**						
Total Dissolved Solids		111	116		mg/L	4.1	20	08-APR-22
WG3715374-2 LCS								
Total Dissolved Solids			97.6		%		85-115	08-APR-22
WG3715374-1 MB								
Total Dissolved Solids			<10		mg/L		10	08-APR-22
TURBIDITY-WT	**Water**							
Batch R5756081								
WG3713641-3 DUP		**L2696657-1**						
Turbidity		0.27	0.27		NTU	1.1	15	05-APR-22
WG3713641-2 LCS								

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TURBIDITY-WT	**Water**							
Batch R5756081								
WG3713641-2 LCS								
Turbidity			99.0		%		85-115	05-APR-22
WG3713641-1 MB								
Turbidity			<0.10		NTU		0.1	05-APR-22
VOC-511-HS-WT	**Water**							
Batch R5755023								
WG3713604-4 DUP		**WG3713604-3**						
1,1,1,2-Tetrachloroethane		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
1,1,2,2-Tetrachloroethane		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
1,1,1-Trichloroethane		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
1,1,2-Trichloroethane		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
1,1-Dichloroethane		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
1,1-Dichloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
1,2-Dibromoethane		<0.20	<0.20	RPD-NA	ug/L	N/A	30	06-APR-22
1,2-Dichlorobenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
1,2-Dichloroethane		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
1,2-Dichloropropane		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
1,3-Dichlorobenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
1,4-Dichlorobenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
Acetone		<30	<30	RPD-NA	ug/L	N/A	30	06-APR-22
Benzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
Bromodichloromethane		<2.0	<2.0	RPD-NA	ug/L	N/A	30	06-APR-22
Bromoform		<5.0	<5.0	RPD-NA	ug/L	N/A	30	06-APR-22
Bromomethane		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
Carbon tetrachloride		<0.20	<0.20	RPD-NA	ug/L	N/A	30	06-APR-22
Chlorobenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
Chloroform		<1.0	<1.0	RPD-NA	ug/L	N/A	30	06-APR-22
cis-1,2-Dichloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
cis-1,3-Dichloropropene		<0.30	<0.30	RPD-NA	ug/L	N/A	30	06-APR-22
Dibromochloromethane		<2.0	<2.0	RPD-NA	ug/L	N/A	30	06-APR-22
Dichlorodifluoromethane		<2.0	<2.0	RPD-NA	ug/L	N/A	30	06-APR-22
Ethylbenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
n-Hexane		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
m+p-Xylenes		<0.40	<0.40	RPD-NA	ug/L	N/A	30	06-APR-22

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Water**							
Batch R5755023								
WG3713604-4 DUP		**WG3713604-3**						
Methyl Ethyl Ketone		<20	<20	RPD-NA	ug/L	N/A	30	06-APR-22
Methyl Isobutyl Ketone		<20	<20	RPD-NA	ug/L	N/A	30	06-APR-22
Methylene Chloride		<5.0	<5.0	RPD-NA	ug/L	N/A	30	06-APR-22
MTBE		<2.0	<2.0	RPD-NA	ug/L	N/A	30	06-APR-22
o-Xylene		<0.30	<0.30	RPD-NA	ug/L	N/A	30	06-APR-22
Styrene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
Tetrachloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
Toluene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
trans-1,2-Dichloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
trans-1,3-Dichloropropene		<0.30	<0.30	RPD-NA	ug/L	N/A	30	06-APR-22
Trichloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
Trichlorofluoromethane		<5.0	<5.0	RPD-NA	ug/L	N/A	30	06-APR-22
Vinyl chloride		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
WG3713604-1 LCS								
1,1,1,2-Tetrachloroethane			97.3		%		70-130	05-APR-22
1,1,2,2-Tetrachloroethane			114.3		%		70-130	05-APR-22
1,1,1-Trichloroethane			102.8		%		70-130	05-APR-22
1,1,2-Trichloroethane			96.4		%		70-130	05-APR-22
1,1-Dichloroethane			99.7		%		70-130	05-APR-22
1,1-Dichloroethylene			103.3		%		70-130	05-APR-22
1,2-Dibromoethane			94.5		%		70-130	05-APR-22
1,2-Dichlorobenzene			105.4		%		70-130	05-APR-22
1,2-Dichloroethane			100.8		%		70-130	05-APR-22
1,2-Dichloropropane			101.8		%		70-130	05-APR-22
1,3-Dichlorobenzene			106.5		%		70-130	05-APR-22
1,4-Dichlorobenzene			105.5		%		70-130	05-APR-22
Acetone			97.9		%		60-140	05-APR-22
Benzene			100.7		%		70-130	05-APR-22
Bromodichloromethane			106.9		%		70-130	05-APR-22
Bromoform			97.3		%		70-130	05-APR-22
Bromomethane			100.3		%		60-140	05-APR-22
Carbon tetrachloride			106.0		%		70-130	05-APR-22
Chlorobenzene			100.2		%		70-130	05-APR-22

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Water**							
Batch R5755023								
WG3713604-1 LCS								
Chloroform			103.5		%		70-130	05-APR-22
cis-1,2-Dichloroethylene			101.1		%		70-130	05-APR-22
cis-1,3-Dichloropropene			96.2		%		70-130	05-APR-22
Dibromochloromethane			96.4		%		70-130	05-APR-22
Dichlorodifluoromethane			97.2		%		50-140	05-APR-22
Ethylbenzene			101.2		%		70-130	05-APR-22
n-Hexane			100.7		%		70-130	05-APR-22
m+p-Xylenes			102.2		%		70-130	05-APR-22
Methyl Ethyl Ketone			93.6		%		60-140	05-APR-22
Methyl Isobutyl Ketone			90.5		%		60-140	05-APR-22
Methylene Chloride			104.5		%		70-130	05-APR-22
MTBE			99.7		%		70-130	05-APR-22
o-Xylene			102.2		%		70-130	05-APR-22
Styrene			98.9		%		70-130	05-APR-22
Tetrachloroethylene			100.8		%		70-130	05-APR-22
Toluene			100.2		%		70-130	05-APR-22
trans-1,2-Dichloroethylene			105.4		%		70-130	05-APR-22
trans-1,3-Dichloropropene			93.8		%		70-130	05-APR-22
Trichloroethylene			104.8		%		70-130	05-APR-22
Trichlorofluoromethane			105.0		%		60-140	05-APR-22
Vinyl chloride			99.8		%		60-140	05-APR-22
WG3713604-2 MB								
1,1,1,2-Tetrachloroethane			<0.50		ug/L		0.5	05-APR-22
1,1,2,2-Tetrachloroethane			<0.50		ug/L		0.5	05-APR-22
1,1,1-Trichloroethane			<0.50		ug/L		0.5	05-APR-22
1,1,2-Trichloroethane			<0.50		ug/L		0.5	05-APR-22
1,1-Dichloroethane			<0.50		ug/L		0.5	05-APR-22
1,1-Dichloroethylene			<0.50		ug/L		0.5	05-APR-22
1,2-Dibromoethane			<0.20		ug/L		0.2	05-APR-22
1,2-Dichlorobenzene			<0.50		ug/L		0.5	05-APR-22
1,2-Dichloroethane			<0.50		ug/L		0.5	05-APR-22
1,2-Dichloropropane			<0.50		ug/L		0.5	05-APR-22
1,3-Dichlorobenzene			<0.50		ug/L		0.5	05-APR-22
1,4-Dichlorobenzene			<0.50		ug/L		0.5	05-APR-22

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Water**							
Batch R5755023								
WG3713604-2 MB								
Acetone			<30		ug/L		30	05-APR-22
Benzene			<0.50		ug/L		0.5	05-APR-22
Bromodichloromethane			<2.0		ug/L		2	05-APR-22
Bromoform			<5.0		ug/L		5	05-APR-22
Bromomethane			<0.50		ug/L		0.5	05-APR-22
Carbon tetrachloride			<0.20		ug/L		0.2	05-APR-22
Chlorobenzene			<0.50		ug/L		0.5	05-APR-22
Chloroform			<1.0		ug/L		1	05-APR-22
cis-1,2-Dichloroethylene			<0.50		ug/L		0.5	05-APR-22
cis-1,3-Dichloropropene			<0.30		ug/L		0.3	05-APR-22
Dibromochloromethane			<2.0		ug/L		2	05-APR-22
Dichlorodifluoromethane			<2.0		ug/L		2	05-APR-22
Ethylbenzene			<0.50		ug/L		0.5	05-APR-22
n-Hexane			<0.50		ug/L		0.5	05-APR-22
m+p-Xylenes			<0.40		ug/L		0.4	05-APR-22
Methyl Ethyl Ketone			<20		ug/L		20	05-APR-22
Methyl Isobutyl Ketone			<20		ug/L		20	05-APR-22
Methylene Chloride			<5.0		ug/L		5	05-APR-22
MTBE			<2.0		ug/L		2	05-APR-22
o-Xylene			<0.30		ug/L		0.3	05-APR-22
Styrene			<0.50		ug/L		0.5	05-APR-22
Tetrachloroethylene			<0.50		ug/L		0.5	05-APR-22
Toluene			<0.50		ug/L		0.5	05-APR-22
trans-1,2-Dichloroethylene			<0.50		ug/L		0.5	05-APR-22
trans-1,3-Dichloropropene			<0.30		ug/L		0.3	05-APR-22
Trichloroethylene			<0.50		ug/L		0.5	05-APR-22
Trichlorofluoromethane			<5.0		ug/L		5	05-APR-22
Vinyl chloride			<0.50		ug/L		0.5	05-APR-22
Surrogate: 1,4-Difluorobenzene			100.8		%		70-130	05-APR-22
Surrogate: 4-Bromofluorobenzene			103.5		%		70-130	05-APR-22
WG3713604-5 MS		**WG3713604-3**						
1,1,1,2-Tetrachloroethane			94.0		%		50-140	06-APR-22
1,1,2,2-Tetrachloroethane			85.3		%		50-140	06-APR-22
1,1,1-Trichloroethane			95.9		%		50-140	06-APR-22

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Water**							
Batch R5755023								
WG3713604-5 MS		**WG3713604-3**						
1,1,2-Trichloroethane			98.4		%		50-140	06-APR-22
1,1-Dichloroethane			96.2		%		50-140	06-APR-22
1,1-Dichloroethylene			95.1		%		50-140	06-APR-22
1,2-Dibromoethane			98.1		%		50-140	06-APR-22
1,2-Dichlorobenzene			102.1		%		50-140	06-APR-22
1,2-Dichloroethane			106.1		%		50-140	06-APR-22
1,2-Dichloropropane			101.8		%		50-140	06-APR-22
1,3-Dichlorobenzene			118.9		%		50-140	06-APR-22
1,4-Dichlorobenzene			113.8		%		50-140	06-APR-22
Acetone			106.8		%		50-140	06-APR-22
Benzene			97.3		%		50-140	06-APR-22
Bromodichloromethane			108.0		%		50-140	06-APR-22
Bromoform			88.5		%		50-140	06-APR-22
Bromomethane			94.5		%		50-140	06-APR-22
Carbon tetrachloride			98.2		%		50-140	06-APR-22
Chlorobenzene			95.9		%		50-140	06-APR-22
Chloroform			101.5		%		50-140	06-APR-22
cis-1,2-Dichloroethylene			99.9		%		50-140	06-APR-22
cis-1,3-Dichloropropene			96.8		%		50-140	06-APR-22
Dibromochloromethane			96.7		%		50-140	06-APR-22
Dichlorodifluoromethane			83.5		%		50-140	06-APR-22
Ethylbenzene			93.4		%		50-140	06-APR-22
n-Hexane			90.5		%		50-140	06-APR-22
m+p-Xylenes			94.7		%		50-140	06-APR-22
Methyl Ethyl Ketone			101.1		%		50-140	06-APR-22
Methyl Isobutyl Ketone			86.7		%		50-140	06-APR-22
Methylene Chloride			105.2		%		50-140	06-APR-22
MTBE			96.4		%		50-140	06-APR-22
o-Xylene			95.6		%		50-140	06-APR-22
Styrene			93.4		%		50-140	06-APR-22
Tetrachloroethylene			91.0		%		50-140	06-APR-22
Toluene			92.9		%		50-140	06-APR-22
trans-1,2-Dichloroethylene			99.3		%		50-140	06-APR-22

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Water**							
Batch R5755023								
WG3713604-5 MS		**WG3713604-3**						
trans-1,3-Dichloropropene			92.4		%		50-140	06-APR-22
Trichloroethylene			98.8		%		50-140	06-APR-22
Trichlorofluoromethane			95.0		%		50-140	06-APR-22
Vinyl chloride			90.2		%		50-140	06-APR-22

Quality Control Report

Workorder: L2696563 Report Date: 10-MAY-22

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Legend:

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

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
LCS-H	Lab Control Sample recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

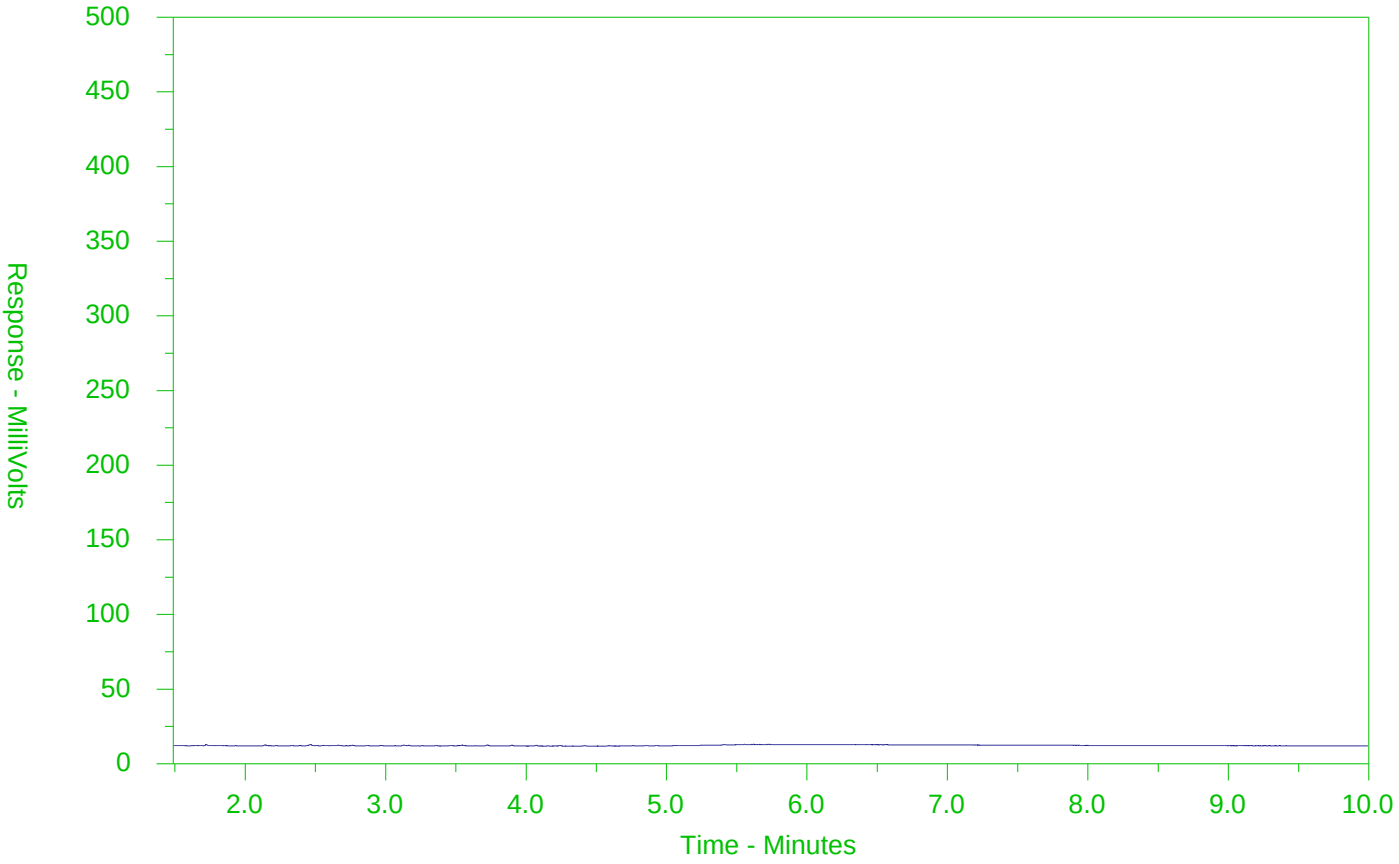
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where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

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

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

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2696563-1
Client Sample ID: BH 22-1



←F2→	←F3→	←F4→	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →	← Motor Oils/Lube Oils/Grease →		
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

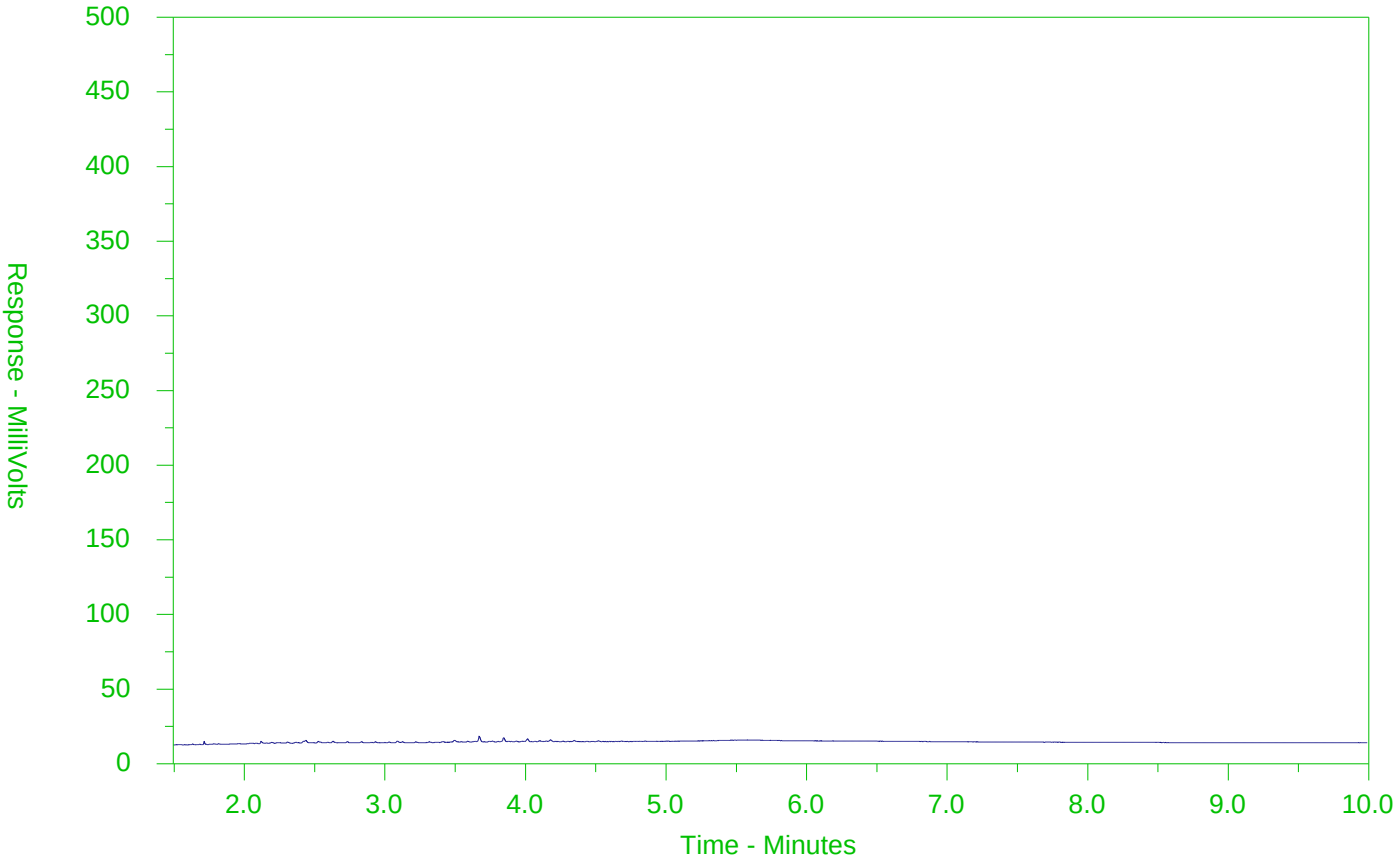
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2696563-2
Client Sample ID: BH 22-3



←F2→	←F3→	←F4→	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →	← Motor Oils/Lube Oils/Grease →		
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

Chain of Custody (COC) / Analytical Request Form

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

COC Number: 20 - 945937

Page 1 of 1

HDJ

Report To	Contact and company name below will appear on the final report
Company:	WOOD
Contact:	TOMAS CIHULA
Phone:	519 650 7100 x 7134
	Company address below will appear on the final report
Street:	900 MAPLE GROVE RD UNIT 10
City/Province:	CAMBRIDGE ON
Postal Code:	N3H 4R7
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☑ NO
Company:	
Contact:	

Reports / Recipients

Select Report Format: ☑ PDF ☐ EXCEL ☑ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☑ YES ☐ NO ☐ N/A

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

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax maura.cortes@woodplc.com

Email 2 tomas.cihula@woodplc.com

Email 3 herman.padham@woodplc.com

Invoice Recipients

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax APCambridge@woodplc.com

Email 2 maura.cortes@woodplc.com

Turnaround Time (TAT) Requested

☑ Routine [R] if received by 3pm M-F - no surcharges apply

☐ 4 day [P4] if receiv

☐ 3 day [P3] if rece

☐ 2 day [P2] if rece

☐ 1 day [E] if receiv

☐ Same day [E2] if r may apply to rush r

Date and Time

L2696563-COFC

E LABEL HERE (ALS use only)

For all tests with RUSH TATs requested, please contact your AM to confirm availability.

Project Information

ALS Account # / Quote #: 2022 WOOD NSA

Job #: OGTW2201.3000

PO / AFE: OGTW2201.3000.5800S730-00

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (ALS use only): L2696563 JP

ALS Contact: GB Sampler: RL

Analysis Request

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

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	O. REG 153 METALS / INORGANICS	VOC / PHC F1-F4	PAH	GEN CHEM PACKAGE 1 of 3	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	BH 22-1	04-APR-22	12:00	GW	11	X	X	X	X			
	BH 22-3	04-APR-22	10:00	GW	11	X	X	X	X			

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

Are samples taken from a Regulated DW System? ☐ YES ☑ NO

Are samples for human consumption/ use? ☐ YES ☑ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

COMPARE RESULTS TO O.REG 153/04 TABLE 2 SCS (COARSE)

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☑ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				2.9			

SHIPMENT RELEASE (client use)

Released by:	Date:	Time:
R. CALANDE	4 APRIL 2022	1300

INITIAL SHIPMENT RECEPTION (ALS use only)

Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (ALS use only)

Received by:	Date:	Time:
HDJ	04/04/22	1300

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

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

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

Wood Environment & Infrastructure Solutions (Cambridge)
ATTN: TOMAS CIHULA
900 MAPLE GROVE ROAD
UNIT 10
CAMBRIDGE ON N3H 4R7

Date Received: 04-APR-22
Report Date: 12-APR-22 08:30 (MT)
Version: FINAL

Client Phone: 519-650-7100

Certificate of Analysis

Lab Work Order #: L2696571

Project P.O. #: OGTW2201.3000.5800.5730-00
Job Reference: OGTW2201.3000
C of C Numbers:
Legal Site Desc:

Gayle Braun
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2696571-1 BH22-1 Sampled By: RL on 04-APR-22 @ 12:00 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	415		1.3	mg/L		05-APR-22	
pH	7.73		0.10	pH units		05-APR-22	R5756157
Total Suspended Solids	11700	DLHC	110	mg/L	05-APR-22	06-APR-22	R5756100
Anions and Nutrients							
Chloride (Cl)	718	DLDS	2.5	mg/L		05-APR-22	R5756278
Fluoride (F)	<0.10	DLDS	0.10	mg/L		05-APR-22	R5756278
Total Kjeldahl Nitrogen	0.79	DLM	0.50	mg/L	07-APR-22	07-APR-22	R5758202
Phosphorus, Total	1.11	DLM	0.30	mg/L	07-APR-22	08-APR-22	R5758999
Sulfate (SO4)	75.7	DLDS	1.5	mg/L		05-APR-22	R5756278
Sulphide as S	0.045		0.018	mg/L		08-APR-22	R5760025
Cyanides							
Cyanide, Total	<0.0020		0.0020	mg/L		05-APR-22	R5756137
Bacteriological Tests							
Fecal Coliforms	<2	DLM	2	CFU/100mL		05-APR-22	R5756424
Total Metals							
Aluminum (Al)-Total	92.6	DLHC	0.050	mg/L	04-APR-22	05-APR-22	R5755156
Antimony (Sb)-Total	<0.0010	DLHC	0.0010	mg/L	04-APR-22	05-APR-22	R5755156
Arsenic (As)-Total	0.0424	DLHC	0.0010	mg/L	04-APR-22	05-APR-22	R5755156
Beryllium (Be)-Total	0.0052	DLHC	0.0010	mg/L	04-APR-22	05-APR-22	R5755156
Bismuth (Bi)-Total	0.00267	DLHC	0.00050	mg/L	04-APR-22	05-APR-22	R5755156
Boron (B)-Total	0.12	DLHC	0.10	mg/L	04-APR-22	05-APR-22	R5755156
Cadmium (Cd)-Total	0.00425	DLHC	0.000050	mg/L	04-APR-22	05-APR-22	R5755156
Chromium (Cr)-Total	0.195	DLHC	0.0050	mg/L	04-APR-22	05-APR-22	R5755156
Cobalt (Co)-Total	0.105	DLHC	0.0010	mg/L	04-APR-22	05-APR-22	R5755156
Copper (Cu)-Total	0.543	DLHC	0.0050	mg/L	04-APR-22	05-APR-22	R5755156
Iron (Fe)-Total	198	DLHC	0.10	mg/L	04-APR-22	05-APR-22	R5755156
Lead (Pb)-Total	1.03	DLHC	0.00050	mg/L	04-APR-22	05-APR-22	R5755156
Manganese (Mn)-Total	7.18	DLHC	0.0050	mg/L	04-APR-22	05-APR-22	R5755156
Mercury (Hg)-Total	0.0000143		0.0000050	mg/L		05-APR-22	R5755437
Molybdenum (Mo)-Total	0.00104	DLHC	0.00050	mg/L	04-APR-22	05-APR-22	R5755156
Nickel (Ni)-Total	0.195	DLHC	0.0050	mg/L	04-APR-22	05-APR-22	R5755156
Selenium (Se)-Total	0.00203	DLHC	0.00050	mg/L	04-APR-22	05-APR-22	R5755156
Silver (Ag)-Total	0.00182	DLHC	0.00050	mg/L	04-APR-22	05-APR-22	R5755156
Thallium (Tl)-Total	0.00148	DLHC	0.00010	mg/L	04-APR-22	05-APR-22	R5755156
Tin (Sn)-Total	0.0011	DLHC	0.0010	mg/L	04-APR-22	05-APR-22	R5755156
Titanium (Ti)-Total	1.43	DLHC	0.0030	mg/L	04-APR-22	05-APR-22	R5755156
Tungsten (W)-Total	<0.0010	DLHC	0.0010	mg/L	04-APR-22	05-APR-22	R5755156
Uranium (U)-Total	0.00922	DLHC	0.00010	mg/L	04-APR-22	05-APR-22	R5755156
Vanadium (V)-Total	0.185	DLHC	0.0050	mg/L	04-APR-22	05-APR-22	R5755156
Zinc (Zn)-Total	2.90	DLHC	0.030	mg/L	04-APR-22	05-APR-22	R5755156
Zirconium (Zr)-Total	0.0043	DLHC	0.0020	mg/L	04-APR-22	05-APR-22	R5755156
Dissolved Metals							

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2696571-1 BH22-1 Sampled By: RL on 04-APR-22 @ 12:00 Matrix: WATER							
Dissolved Metals							
Dissolved Mercury Filtration Location	LAB					04-APR-22	R5754286
Dissolved Metals Filtration Location	LAB					04-APR-22	R5754376
Aluminum (Al)-Dissolved	<0.050	DLHC	0.050	mg/L	04-APR-22	05-APR-22	R5755886
Calcium (Ca)-Dissolved	124	DLHC	0.50	mg/L	04-APR-22	05-APR-22	R5755886
Magnesium (Mg)-Dissolved	25.6	DLHC	0.050	mg/L	04-APR-22	05-APR-22	R5755886
Mercury (Hg)-Dissolved	<0.0000050		0.0000050	mg/L	04-APR-22	05-APR-22	R5755456
Speciated Metals							
Chromium, Hexavalent	<0.50		0.50	ug/L		05-APR-22	R5756422
Aggregate Organics							
BOD Carbonaceous	<3.0	BODL	3.0	mg/L		04-APR-22	R5759979
Oil and Grease, Total	<5.0		5.0	mg/L	05-APR-22	05-APR-22	R5757163
Animal/Veg Oil & Grease	<5.0		5.0	mg/L		06-APR-22	
Mineral Oil and Grease	<2.5		2.5	mg/L	05-APR-22	05-APR-22	R5757163
Phenols (4AAP)	<0.0010		0.0010	mg/L		06-APR-22	R5757862
Volatile Organic Compounds							
Benzene	<0.50	OWP	0.50	ug/L		06-APR-22	R5755023
Chloroform	<1.0	OWP	1.0	ug/L		06-APR-22	R5755023
1,2-Dichlorobenzene	<0.50	OWP	0.50	ug/L		06-APR-22	R5755023
1,4-Dichlorobenzene	<0.50	OWP	0.50	ug/L		06-APR-22	R5755023
cis-1,2-Dichloroethylene	<0.50	OWP	0.50	ug/L		06-APR-22	R5755023
Dichloromethane	<2.0	OWP	2.0	ug/L		06-APR-22	R5755023
trans-1,3-Dichloropropene	<0.30	OWP	0.30	ug/L		06-APR-22	R5755023
Ethylbenzene	<0.50	OWP	0.50	ug/L		06-APR-22	R5755023
Styrene	<0.50	OWP	0.50	ug/L		06-APR-22	R5755023
1,1,2,2-Tetrachloroethane	<0.50	OWP	0.50	ug/L		06-APR-22	R5755023
Tetrachloroethylene	<0.50	OWP	0.50	ug/L		06-APR-22	R5755023
Toluene	<0.40	OWP	0.40	ug/L		06-APR-22	R5755023
Trichloroethylene	<0.50	OWP	0.50	ug/L		06-APR-22	R5755023
o-Xylene	<0.30	OWP	0.30	ug/L		06-APR-22	R5755023
m+p-Xylenes	<0.40	OWP	0.40	ug/L		06-APR-22	R5755023
Xylenes (Total)	<0.50		0.50	ug/L		06-APR-22	
Surrogate: 4-Bromofluorobenzene	99.8		70-130	%		06-APR-22	R5755023
Surrogate: 1,4-Difluorobenzene	100.9		70-130	%		06-APR-22	R5755023
Semi-Volatile Organics							
N-Nitrosodimethylamine	<0.030		0.030	ug/L	04-APR-22	04-APR-22	R5754825
N-Nitrosomethylethylamine	<0.10		0.10	ug/L	04-APR-22	04-APR-22	R5754825
Surrogate: N-Nitrosodimethylamine-d6	103.1		50-150	%	04-APR-22	04-APR-22	R5754825
Polychlorinated Biphenyls							
Aroclor 1242	<0.020		0.020	ug/L	06-APR-22	06-APR-22	R5756481
Aroclor 1248	<0.020		0.020	ug/L	06-APR-22	06-APR-22	R5756481
Aroclor 1254	<0.020		0.020	ug/L	06-APR-22	06-APR-22	R5756481
Aroclor 1260	<0.020		0.020	ug/L	06-APR-22	06-APR-22	R5756481

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2696571-1 BH22-1 Sampled By: RL on 04-APR-22 @ 12:00 Matrix: WATER							
Polychlorinated Biphenyls							
Surrogate: Decachlorobiphenyl	108.7		50-150	%	06-APR-22	06-APR-22	R5756481
Total PCBs	<0.040		0.040	ug/L	06-APR-22	06-APR-22	R5756481
Surrogate: Tetrachloro-m-xylene	100.3		50-150	%	06-APR-22	06-APR-22	R5756481

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2696571-1
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2696571-1
Matrix Spike	Aluminum (Al)-Total	MS-B	L2696571-1
Matrix Spike	Iron (Fe)-Total	MS-B	L2696571-1
Matrix Spike	Manganese (Mn)-Total	MS-B	L2696571-1
Matrix Spike	Titanium (Ti)-Total	MS-B	L2696571-1
Matrix Spike	Uranium (U)-Total	MS-B	L2696571-1
Matrix Spike	Phenols (4AAP)	MS-B	L2696571-1
Matrix Spike	Total Kjeldahl Nitrogen	MS-B	L2696571-1

Sample Parameter Qualifier key listed:

Qualifier	Description
BODL	Limit of Reporting for BOD was increased to account for the largest volume of sample tested.
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
OWP	Organic water sample contained visible sediment (must be included as part of analysis). Measured concentrations of organic substances in water can be biased high due to presence of sediment.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD-C-WT	Water	BOD Carbonaceous	APHA 5210 B (CBOD)

This analysis is carried out using procedures adapted from APHA Method 5210B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.

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

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

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

CN-TOT-WT	Water	Cyanide, Total	ISO 14403-2

Total cyanide is determined by the combination of UV digestion and distillation. Cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.

When using this method, high levels of thiocyanate in samples can cause false positives at ~1-2% of the thiocyanate concentration. For samples with detectable cyanide analyzed by this method, ALS recommends analysis for thiocyanate to check for this potential interference

CR-CR6-PWQO-IC-WT	Water	Chromium +6	EPA 7199

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 7199, published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution. Chromium (III) is calculated as the difference between the total chromium and the chromium (VI) results.

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

EC-SCREEN-WT	Water	Conductivity Screen (Internal Use Only)	APHA 2510

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

F-IC-N-WT	Water	Fluoride in Water by IC	EPA 300.1 (mod)

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

FC-WW-MF-WT	Water	Fecal Coliforms	APHA 9223B
FC-WW-MF-WT	Water	Fecal Coliforms	SM 9222D
HARDNESS-CALC-WT	Water	Hardness	APHA 2340 B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

Reference Information

HG-D-CVAA-WT	Water	Dissolved Mercury in Water by CVAAS	EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.

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

HG-T-CVAA-WT	Water	Total Mercury in Water by CVAAS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.

MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

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

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

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

MET-T-CCMS-WT	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

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

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

NITROSAMINES-LCMS-WT	Water	Nitrosamines in water	QWI-ORG/WP239

An aliquot of sample is injected directly using liquid chromatgraphy tandem mass spectrometry.

OGG-SPEC-CALC-WT	Water	Speciated Oil and Grease A/V Calc	CALCULATION

Sample is extracted with hexane, sample speciation into mineral and animal/vegetable fractions is achieved via silica gel separation and is then determined gravimetrically.

OGG-SPEC-WT	Water	Speciated Oil and Grease-Gravimetric	APHA 5520 B

The procedure involves an extraction of the entire water sample with hexane. Sample speciation into mineral and animal/vegetable fractions is achieved via silica gel separation and is then determined gravimetrically.

P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is deteremined colourimetrically after persulphate digestion of the sample.

PCB-WT	Water	Polychlorinated Biphenyls	EPA 8082

PCBs are extracted from an aqueous sample at neutral pH with aliquots of dichloromethane using a modified separatory funnel technique. The extracts are analyzed by GC/MSD.

PH-WT	Water	pH	APHA 4500 H-Electrode

Water samples are analyzed directly by a calibrated pH meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days

PHENOLS-4AAP-WT	Water	Phenol (4AAP)	EPA 9066

An automated method is used to distill the sample. The distillate is then buffered to pH 9.4 which reacts with 4AAP and potassium ferricyanide to form a red complex which is measured colorimetrically.

S2-T-COL-VA	Water	Total Sulphide by Colorimetric	APHA 4500 -S E-Auto-Colorimetry

Sulfide is determined using the gas dialysis automated methlyene blue colourimetric method. Results expressed "as H2S", if reported, represent the maximum possible H2S concentration based on the total sulfide concentration in the sample.

Reference Information

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

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

SOLIDS-TSS-WT	Water	Suspended solids	APHA 2540 D-Gravimetric

A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 104–1°C for a minimum of four hours or until a constant weight is achieved.

TKN-F-WT	Water	TKN in Water by Fluorescence	J. ENVIRON. MONIT., 2005,7,37-42,RSC

Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection

VOC-ROU-HS-WT	Water	Volatile Organic Compounds	SW846 8260

Aqueous samples are analyzed by headspace-GC/MS.

XYLENES-SUM-CALC-WT	Water	Sum of Xylene Isomer Concentrations	CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

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

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

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

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

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

Quality Control Report

Workorder: L2696571 Report Date: 12-APR-22

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7

Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BOD-C-WT	**Water**							
Batch R5759979								
WG3713448-2 DUP		**L2696571-1**						
BOD Carbonaceous		<3.0	<3.0	RPD-NA	mg/L	N/A	30	04-APR-22
WG3713448-3 LCS								
BOD Carbonaceous			101.5		%		85-115	04-APR-22
WG3713448-1 MB								
BOD Carbonaceous			<2.0		mg/L		2	04-APR-22
CL-IC-N-WT	**Water**							
Batch R5756278								
WG3713912-14 DUP		**WG3713912-15**						
Chloride (Cl)		71.8	71.7		mg/L	0.2	20	05-APR-22
WG3713912-12 LCS								
Chloride (Cl)			102.0		%		90-110	05-APR-22
WG3713912-11 MB								
Chloride (Cl)			<0.50		mg/L		0.5	05-APR-22
WG3713912-13 MS		**WG3713912-15**						
Chloride (Cl)			98.6		%		75-125	05-APR-22
CN-TOT-WT	**Water**							
Batch R5756137								
WG3714037-8 DUP		**WG3714037-10**						
Cyanide, Total		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	05-APR-22
WG3714037-7 LCS								
Cyanide, Total			100.8		%		80-120	05-APR-22
WG3714037-6 MB								
Cyanide, Total			<0.0020		mg/L		0.002	05-APR-22
WG3714037-9 MS		**WG3714037-10**						
Cyanide, Total			96.2		%		70-130	05-APR-22
CR-CR6-PWQO-IC-WT	**Water**							
Batch R5756422								
WG3713909-4 DUP		**WG3713909-3**						
Chromium, Hexavalent		<0.50	<0.50	RPD-NA	ug/L	N/A	20	05-APR-22
WG3713909-2 LCS								
Chromium, Hexavalent			99.0		%		80-120	05-APR-22
WG3713909-1 MB								
Chromium, Hexavalent			<0.50		ug/L		0.5	05-APR-22
WG3713909-5 MS		**WG3713909-3**						
Chromium, Hexavalent			98.5		%		70-130	05-APR-22
F-IC-N-WT	**Water**							

Quality Control Report

Workorder: L2696571 Report Date: 12-APR-22

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7

Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F-IC-N-WT	**Water**							
Batch R5756278								
WG3713912-14 DUP		**WG3713912-15**						
Fluoride (F)		0.527	0.524		mg/L	0.4	20	05-APR-22
WG3713912-12 LCS								
Fluoride (F)			102.4		%		90-110	05-APR-22
WG3713912-11 MB								
Fluoride (F)			<0.020		mg/L		0.02	05-APR-22
WG3713912-13 MS		**WG3713912-15**						
Fluoride (F)			98.0		%		75-125	05-APR-22
FC-WW-MF-WT	**Water**							
Batch R5756424								
WG3713689-1 MB								
Fecal Coliforms			0		CFU/100mL		1	05-APR-22
HG-D-CVAA-WT	**Water**							
Batch R5755456								
WG3713508-4 DUP		**WG3713508-3**						
Mercury (Hg)-Dissolved		<0.0000050	<0.000005(	RPD-NA	mg/L	N/A	20	05-APR-22
WG3713508-2 LCS								
Mercury (Hg)-Dissolved			96.5		%		80-120	05-APR-22
WG3713508-1 MB								
Mercury (Hg)-Dissolved			<0.000005(		mg/L		0.000005	05-APR-22
WG3713508-6 MS		**WG3713508-5**						
Mercury (Hg)-Dissolved			92.5		%		70-130	05-APR-22
HG-T-CVAA-WT	**Water**							
Batch R5755437								
WG3713507-3 DUP		**WG3713507-5**						
Mercury (Hg)-Total		<0.0000050	<0.000005(	RPD-NA	mg/L	N/A	20	05-APR-22
WG3713507-2 LCS								
Mercury (Hg)-Total			96.4		%		80-120	05-APR-22
WG3713507-1 MB								
Mercury (Hg)-Total			<0.000005(		mg/L		0.000005	05-APR-22
WG3713507-4 MS		**WG3713507-6**						
Mercury (Hg)-Total			91.3		%		70-130	05-APR-22
MET-D-CCMS-WT	**Water**							

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R5755886								
WG3713523-4 DUP		**WG3713523-3**						
Aluminum (Al)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	05-APR-22
Calcium (Ca)-Dissolved		124	126		mg/L	1.8	20	05-APR-22
Magnesium (Mg)-Dissolved		25.6	26.1		mg/L	1.8	20	05-APR-22
WG3713523-2 LCS								
Aluminum (Al)-Dissolved			99.3		%		80-120	05-APR-22
Calcium (Ca)-Dissolved			95.3		%		80-120	05-APR-22
Magnesium (Mg)-Dissolved			107.0		%		80-120	05-APR-22
WG3713523-1 MB								
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	05-APR-22
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	05-APR-22
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	05-APR-22
WG3713523-5 MS		**WG3713523-3**						
Aluminum (Al)-Dissolved			73.1		%		70-130	05-APR-22
Calcium (Ca)-Dissolved			N/A	MS-B	%		-	05-APR-22
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	05-APR-22
MET-T-CCMS-WT	**Water**							
Batch R5755156								
WG3713521-4 DUP		**WG3713521-3**						
Aluminum (Al)-Total		1.25	1.31		mg/L	4.5	20	05-APR-22
Antimony (Sb)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	05-APR-22
Arsenic (As)-Total		0.0012	0.0011		mg/L	9.2	20	05-APR-22
Beryllium (Be)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	05-APR-22
Bismuth (Bi)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	05-APR-22
Boron (B)-Total		<0.10	<0.10	RPD-NA	mg/L	N/A	20	05-APR-22
Cadmium (Cd)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	05-APR-22
Chromium (Cr)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	05-APR-22
Cobalt (Co)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	05-APR-22
Copper (Cu)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	05-APR-22
Iron (Fe)-Total		1.50	1.53		mg/L	2.3	20	05-APR-22
Lead (Pb)-Total		0.00124	0.00120		mg/L	2.6	20	05-APR-22
Manganese (Mn)-Total		0.0435	0.0442		mg/L	1.6	20	05-APR-22
Molybdenum (Mo)-Total		0.00237	0.00233		mg/L	2.0	20	05-APR-22
Nickel (Ni)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	05-APR-22
Selenium (Se)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	05-APR-22

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R5755156								
WG3713521-4 DUP		**WG3713521-3**						
Silver (Ag)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	05-APR-22
Thallium (Tl)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	05-APR-22
Tin (Sn)-Total		0.0012	0.0012		mg/L	5.6	20	05-APR-22
Titanium (Ti)-Total		0.0399	0.0388		mg/L	2.9	20	05-APR-22
Tungsten (W)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	05-APR-22
Uranium (U)-Total		0.00060	0.00059		mg/L	1.3	20	05-APR-22
Vanadium (V)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	05-APR-22
Zinc (Zn)-Total		<0.030	<0.030	RPD-NA	mg/L	N/A	20	05-APR-22
Zirconium (Zr)-Total		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	05-APR-22
WG3713521-2 LCS								
Aluminum (Al)-Total			99.2		%		80-120	05-APR-22
Antimony (Sb)-Total			101.5		%		80-120	05-APR-22
Arsenic (As)-Total			100.9		%		80-120	05-APR-22
Beryllium (Be)-Total			101.7		%		80-120	05-APR-22
Bismuth (Bi)-Total			101.2		%		80-120	05-APR-22
Boron (B)-Total			99.6		%		80-120	05-APR-22
Cadmium (Cd)-Total			103.5		%		80-120	05-APR-22
Chromium (Cr)-Total			98.7		%		80-120	05-APR-22
Cobalt (Co)-Total			98.8		%		80-120	05-APR-22
Copper (Cu)-Total			100.6		%		80-120	05-APR-22
Iron (Fe)-Total			101.1		%		80-120	05-APR-22
Lead (Pb)-Total			107.0		%		80-120	05-APR-22
Manganese (Mn)-Total			99.2		%		80-120	05-APR-22
Molybdenum (Mo)-Total			100.6		%		80-120	05-APR-22
Nickel (Ni)-Total			100.4		%		80-120	05-APR-22
Selenium (Se)-Total			103.0		%		80-120	05-APR-22
Silver (Ag)-Total			96.6		%		80-120	05-APR-22
Thallium (Tl)-Total			102.8		%		80-120	05-APR-22
Tin (Sn)-Total			102.3		%		80-120	05-APR-22
Titanium (Ti)-Total			96.1		%		80-120	05-APR-22
Tungsten (W)-Total			104.5		%		80-120	05-APR-22
Uranium (U)-Total			110.1		%		80-120	05-APR-22
Vanadium (V)-Total			101.1		%		80-120	05-APR-22

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R5755156								
WG3713521-2 LCS								
Zinc (Zn)-Total			98.8		%		80-120	05-APR-22
Zirconium (Zr)-Total			101.2		%		80-120	05-APR-22
WG3713521-1 MB								
Aluminum (Al)-Total			<0.0050		mg/L		0.005	05-APR-22
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	05-APR-22
Arsenic (As)-Total			<0.00010		mg/L		0.0001	05-APR-22
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	05-APR-22
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	05-APR-22
Boron (B)-Total			<0.010		mg/L		0.01	05-APR-22
Cadmium (Cd)-Total			<0.000005(		mg/L		0.000005	05-APR-22
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	05-APR-22
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	05-APR-22
Copper (Cu)-Total			<0.00050		mg/L		0.0005	05-APR-22
Iron (Fe)-Total			<0.010		mg/L		0.01	05-APR-22
Lead (Pb)-Total			<0.000050		mg/L		0.00005	05-APR-22
Manganese (Mn)-Total			<0.00050		mg/L		0.0005	05-APR-22
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	05-APR-22
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	05-APR-22
Selenium (Se)-Total			<0.000050		mg/L		0.00005	05-APR-22
Silver (Ag)-Total			<0.000050		mg/L		0.00005	05-APR-22
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	05-APR-22
Tin (Sn)-Total			<0.00010		mg/L		0.0001	05-APR-22
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	05-APR-22
Tungsten (W)-Total			<0.00010		mg/L		0.0001	05-APR-22
Uranium (U)-Total			<0.000010		mg/L		0.00001	05-APR-22
Vanadium (V)-Total			<0.00050		mg/L		0.0005	05-APR-22
Zinc (Zn)-Total			<0.0030		mg/L		0.003	05-APR-22
Zirconium (Zr)-Total			<0.00020		mg/L		0.0002	05-APR-22
WG3713521-5 MS		**WG3713521-6**						
Aluminum (Al)-Total			N/A	MS-B	%		-	05-APR-22
Antimony (Sb)-Total			100.2		%		70-130	05-APR-22
Arsenic (As)-Total			102.4		%		70-130	05-APR-22
Beryllium (Be)-Total			101.7		%		70-130	05-APR-22
Bismuth (Bi)-Total			107.7		%		70-130	05-APR-22

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R5755156								
WG3713521-5 MS		**WG3713521-6**						
Boron (B)-Total			93.3		%		70-130	05-APR-22
Cadmium (Cd)-Total			106.7		%		70-130	05-APR-22
Chromium (Cr)-Total			95.0		%		70-130	05-APR-22
Cobalt (Co)-Total			98.1		%		70-130	05-APR-22
Copper (Cu)-Total			97.6		%		70-130	05-APR-22
Iron (Fe)-Total			N/A	MS-B	%		-	05-APR-22
Lead (Pb)-Total			105.0		%		70-130	05-APR-22
Manganese (Mn)-Total			N/A	MS-B	%		-	05-APR-22
Molybdenum (Mo)-Total			97.9		%		70-130	05-APR-22
Nickel (Ni)-Total			98.7		%		70-130	05-APR-22
Selenium (Se)-Total			103.6		%		70-130	05-APR-22
Silver (Ag)-Total			97.1		%		70-130	05-APR-22
Thallium (Tl)-Total			105.5		%		70-130	05-APR-22
Tin (Sn)-Total			99.9		%		70-130	05-APR-22
Titanium (Ti)-Total			N/A	MS-B	%		-	05-APR-22
Tungsten (W)-Total			99.6		%		70-130	05-APR-22
Uranium (U)-Total			N/A	MS-B	%		-	05-APR-22
Vanadium (V)-Total			101.0		%		70-130	05-APR-22
Zinc (Zn)-Total			91.6		%		70-130	05-APR-22
Zirconium (Zr)-Total			88.5		%		70-130	05-APR-22
NITROSAMINES-LCMS-WT	**Water**							
Batch R5754825								
WG3713361-7 DUP		**WG3713361-9**						
N-Nitrosodimethylamine		<0.030	<0.030	RPD-NA	ug/L	N/A	50	05-APR-22
N-Nitrosomethylethylamine		<0.10	<0.10	RPD-NA	ug/L	N/A	50	05-APR-22
WG3713361-6 LCS								
N-Nitrosodimethylamine			102.0		%		50-150	04-APR-22
N-Nitrosomethylethylamine			112.8		%		50-150	04-APR-22
WG3713361-5 MB								
N-Nitrosodimethylamine			<0.030		ug/L		0.03	04-APR-22
N-Nitrosomethylethylamine			<0.10		ug/L		0.1	04-APR-22
Surrogate: N-Nitrosodimethylamine-d6			103.1		%		50-150	04-APR-22
WG3713361-8 MS		**WG3713361-9**						
N-Nitrosodimethylamine			90.3		%		50-150	05-APR-22

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NITROSAMINES-LCMS-WT	**Water**							
Batch R5754825								
WG3713361-8 MS		**WG3713361-9**						
N-Nitrosomethylethylamine			103.8		%		50-150	05-APR-22
OGG-SPEC-WT	**Water**							
Batch R5757163								
WG3713603-2 LCS								
Oil and Grease, Total			93.1		%		70-130	05-APR-22
Mineral Oil and Grease			85.5		%		70-130	05-APR-22
WG3713603-1 MB								
Oil and Grease, Total			<5.0		mg/L		5	05-APR-22
Mineral Oil and Grease			<2.5		mg/L		2.5	05-APR-22
P-T-COL-WT	**Water**							
Batch R5758999								
WG3714746-3 DUP		**L2696752-4**						
Phosphorus, Total		0.0098	0.0076	J	mg/L	0.0022	0.006	08-APR-22
WG3714746-2 LCS								
Phosphorus, Total			97.0		%		80-120	08-APR-22
WG3714746-1 MB								
Phosphorus, Total			<0.0030		mg/L		0.003	08-APR-22
WG3714746-4 MS		**L2696752-4**						
Phosphorus, Total			89.0		%		70-130	08-APR-22
PCB-WT	**Water**							
Batch R5756481								
WG3713456-2 LCS								
Aroclor 1242			96.6		%		65-130	06-APR-22
Aroclor 1248			108.4		%		65-130	06-APR-22
Aroclor 1254			98.0		%		65-130	06-APR-22
Aroclor 1260			96.8		%		65-130	06-APR-22
WG3713456-1 MB								
Aroclor 1242			<0.020		ug/L		0.02	06-APR-22
Aroclor 1248			<0.020		ug/L		0.02	06-APR-22
Aroclor 1254			<0.020		ug/L		0.02	06-APR-22
Aroclor 1260			<0.020		ug/L		0.02	06-APR-22
Surrogate: Decachlorobiphenyl			126.2		%		50-150	06-APR-22
Surrogate: Tetrachloro-m-xylene			99.1		%		50-150	06-APR-22
PH-WT	**Water**							

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH-WT	**Water**							
Batch R5756157								
WG3713640-4 DUP		**WG3713640-3**						
pH		8.10	8.11	J	pH units	0.01	0.2	05-APR-22
WG3713640-2 LCS								
pH			7.03		pH units		6.9-7.1	05-APR-22
PHENOLS-4AAP-WT	**Water**							
Batch R5757862								
WG3714005-3 DUP		**L2696467-1**						
Phenols (4AAP)		0.0440	0.0443		mg/L	0.7	20	06-APR-22
WG3714005-2 LCS								
Phenols (4AAP)			99.1		%		85-115	06-APR-22
WG3714005-1 MB								
Phenols (4AAP)			<0.0010		mg/L		0.001	06-APR-22
WG3714005-4 MS		**L2696467-1**						
Phenols (4AAP)			N/A	MS-B	%		-	06-APR-22
S2-T-COL-VA	**Water**							
Batch R5760025								
WG3715021-3 DUP		**L2697259-1**						
Sulphide as S		<0.018	<0.018	RPD-NA	mg/L	N/A	20	08-APR-22
WG3715021-2 LCS								
Sulphide as S			113.9		%		75-125	08-APR-22
WG3715021-1 MB								
Sulphide as S			<0.018		mg/L		0.018	08-APR-22
SO4-IC-N-WT	**Water**							
Batch R5756278								
WG3713912-14 DUP		**WG3713912-15**						
Sulfate (SO4)		31.6	31.6		mg/L	0.2	20	05-APR-22
WG3713912-12 LCS								
Sulfate (SO4)			102.6		%		90-110	05-APR-22
WG3713912-11 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	05-APR-22
WG3713912-13 MS		**WG3713912-15**						
Sulfate (SO4)			100.5		%		75-125	05-APR-22
SOLIDS-TSS-WT	**Water**							
Batch R5756100								
WG3713709-3 DUP		**L2696465-1**						
Total Suspended Solids		2930	2980		mg/L	1.9	20	06-APR-22
WG3713709-2 LCS								

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SOLIDS-TSS-WT	**Water**							
Batch R5756100								
WG3713709-2 LCS								
Total Suspended Solids			96.3		%		85-115	06-APR-22
WG3713709-1 MB								
Total Suspended Solids			<3.0		mg/L		3	06-APR-22
TKN-F-WT	**Water**							
Batch R5758202								
WG3714387-3 DUP		**L2696758-4**						
Total Kjeldahl Nitrogen		34.0	35.3		mg/L	3.8	20	08-APR-22
WG3714387-2 LCS								
Total Kjeldahl Nitrogen			106.7		%		75-125	07-APR-22
WG3714387-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	07-APR-22
WG3714387-4 MS		**L2696758-4**						
Total Kjeldahl Nitrogen			N/A	MS-B	%		-	08-APR-22
VOC-ROU-HS-WT	**Water**							
Batch R5755023								
WG3713604-4 DUP		**WG3713604-3**						
1,1,2,2-Tetrachloroethane		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
1,2-Dichlorobenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
1,4-Dichlorobenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
Benzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
Chloroform		<1.0	<1.0	RPD-NA	ug/L	N/A	30	06-APR-22
cis-1,2-Dichloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
Dichloromethane		<2.0	<2.0	RPD-NA	ug/L	N/A	30	06-APR-22
Ethylbenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
m+p-Xylenes		<0.40	<0.40	RPD-NA	ug/L	N/A	30	06-APR-22
o-Xylene		<0.30	<0.30	RPD-NA	ug/L	N/A	30	06-APR-22
Styrene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
Tetrachloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
Toluene		<0.40	<0.40	RPD-NA	ug/L	N/A	30	06-APR-22
trans-1,3-Dichloropropene		<0.30	<0.30	RPD-NA	ug/L	N/A	30	06-APR-22
Trichloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	06-APR-22
WG3713604-1 LCS								
1,1,2,2-Tetrachloroethane			114.3		%		70-130	05-APR-22
1,2-Dichlorobenzene			105.4		%		70-130	05-APR-22

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-ROU-HS-WT	**Water**							
Batch R5755023								
WG3713604-1 LCS								
1,4-Dichlorobenzene			105.5		%		70-130	05-APR-22
Benzene			100.7		%		70-130	05-APR-22
Chloroform			103.5		%		70-130	05-APR-22
cis-1,2-Dichloroethylene			101.1		%		70-130	05-APR-22
Dichloromethane			104.5		%		70-130	05-APR-22
Ethylbenzene			101.2		%		70-130	05-APR-22
m+p-Xylenes			102.2		%		70-130	05-APR-22
o-Xylene			102.2		%		70-130	05-APR-22
Styrene			98.9		%		70-130	05-APR-22
Tetrachloroethylene			100.8		%		70-130	05-APR-22
Toluene			100.2		%		70-130	05-APR-22
trans-1,3-Dichloropropene			93.8		%		70-130	05-APR-22
Trichloroethylene			104.8		%		70-130	05-APR-22
WG3713604-2 MB								
1,1,2,2-Tetrachloroethane			<0.50		ug/L		0.5	05-APR-22
1,2-Dichlorobenzene			<0.50		ug/L		0.5	05-APR-22
1,4-Dichlorobenzene			<0.50		ug/L		0.5	05-APR-22
Benzene			<0.50		ug/L		0.5	05-APR-22
Chloroform			<1.0		ug/L		1	05-APR-22
cis-1,2-Dichloroethylene			<0.50		ug/L		0.5	05-APR-22
Dichloromethane			<2.0		ug/L		2	05-APR-22
Ethylbenzene			<0.50		ug/L		0.5	05-APR-22
m+p-Xylenes			<0.40		ug/L		0.4	05-APR-22
o-Xylene			<0.30		ug/L		0.3	05-APR-22
Styrene			<0.50		ug/L		0.5	05-APR-22
Tetrachloroethylene			<0.50		ug/L		0.5	05-APR-22
Toluene			<0.40		ug/L		0.4	05-APR-22
trans-1,3-Dichloropropene			<0.30		ug/L		0.3	05-APR-22
Trichloroethylene			<0.50		ug/L		0.5	05-APR-22
Surrogate: 1,4-Difluorobenzene			100.8		%		70-130	05-APR-22
Surrogate: 4-Bromofluorobenzene			103.5		%		70-130	05-APR-22
WG3713604-5 MS		**WG3713604-3**						
1,1,2,2-Tetrachloroethane			85.3		%		50-150	06-APR-22
1,2-Dichlorobenzene			102.1		%		50-150	06-APR-22

Quality Control Report

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-ROU-HS-WT	**Water**							
Batch R5755023								
WG3713604-5 MS		**WG3713604-3**						
1,4-Dichlorobenzene			113.8		%		50-150	06-APR-22
Benzene			97.3		%		50-150	06-APR-22
Chloroform			101.5		%		50-150	06-APR-22
cis-1,2-Dichloroethylene			99.9		%		50-150	06-APR-22
Dichloromethane			105.2		%		50-150	06-APR-22
Ethylbenzene			93.4		%		50-150	06-APR-22
m+p-Xylenes			94.7		%		50-150	06-APR-22
o-Xylene			95.6		%		50-150	06-APR-22
Styrene			93.4		%		50-150	06-APR-22
Tetrachloroethylene			91.0		%		50-150	06-APR-22
Toluene			92.9		%		50-150	06-APR-22
trans-1,3-Dichloropropene			92.4		%		50-150	06-APR-22
Trichloroethylene			98.8		%		50-150	06-APR-22

Quality Control Report

Workorder: L2696571 Report Date: 12-APR-22

Client: Wood Environment & Infrastructure Solutions (Cambridge)
900 MAPLE GROVE ROAD UNIT 10
CAMBRIDGE ON N3H 4R7
Contact: TOMAS CIHULA

Legend:

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

Sample Parameter Qualifier Definitions:

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

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

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

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

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

Appendix F

Limitations

Limitations

1. The work performed in the preparation of this report and the conclusions presented are subject to the following:
    a. The Standard Terms and Conditions which form a part of our Professional Services Contract
    b. The Scope of Services
    c. Time and Budgetary limitations as described in our Contract
    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 and attendant structures. Our conclusions cannot and are not extended to include those portions of the Site or structures, which are 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 bylaws, 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 or 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 the part, or any reliance thereon or decisions made based on any information or 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 to any third party for any purpose whatsoever without the written permission of Wood.
11. Provided that the report is still reliable, and less than 12 months old, Wood will issue a third-party reliance letter to parties that the client identifies in writing, upon payment of the then current fee for such letters. All third parties relying on Wood's report, by such reliance agree to be bound by our proposal and Wood's standard reliance letter. Wood's standard reliance letter indicates that in no event shall Wood be liable for any damages, howsoever arising, relating to third-party reliance on Wood's report. No reliance by any party is permitted without such agreement.