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Hydrogeological Investigation Report

Proposed Residential Development
150 Mohawk Road East
Hamilton, Ontario
L9A 2H1

Prepared for:

Urban Solutions
3 Studebaker Place, Unit 1
Hamilton, Ontario
L8L 0C8

Landtek File: 22106
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EXECUTIVE SUMMARY

SCOPE OF SERVICES

Proposed Development	Based on the preliminary site drawings provided to Landtek, the proposed development is to comprise of an eleven-storey, 161-unit apartment building and a four-storey stacked townhouse development consisting of 22 units. One level of basement parking is proposed across the majority of the site. The development is to include at-grade light- and heavy-duty pavements for site access routes and parking areas surrounding the structure, and deck pavements for the basement parking area.
Report Deliverables	The Hydrogeological Investigation is required to assess the current site groundwater conditions, determine potential development/post development effects of the proposed development; and provide monitoring and mitigation plans for the development.

SITE DETAILS AND SETTING

Coordinates	591503, 4786532	**Geodetic Elevation**	207 m to 211 m

Site Description	The site is situated in a primarily residential and light commercial area, is semi-rectangular in shape and covers an area of approximately 15,580 m2 (1.56 hectare). The topography at the site relatively flat lying and is currently the site of an apartment complex with associated parking lot areas, one of which being a 2-tiered parking lot (above- and below-ground). The site is bound to the north and east by Mohawk Road East and Upper Wellington Street, respectively, and to the west and south by existing residential properties.
Geology	Organic soils and existing pavement materials were encountered at ground level. Underlying the organic soils and existing pavement structures are fill materials comprising of clayey silt to silty clay with variable fractions of sand. Native silt to sandy silt deposits were encountered in boreholes BH1 and BH2 underlying the organic materials. Clayey silt to silty clay deposits were encountered in all boreholes underlying the fill and silt/sandy silt deposits and extend to approximately 4.5 m to 6.3 m below ground level. Till deposits consisting of silty clay, clayey silt and sandy silt were encountered in all boreholes and extend to 6.7 m to 9.1 m, and 7.5 to 9.8 m below the ground surface, respectively. Bedrock was encountered at depths of approximately 6.8 m and 9.8 m across the site and was found to be limestone/dolostone of the Lockport Formation.
Groundwater	Depths to groundwater in all monitoring wells at the Site were obtained manually by Landtek staff on July 26, August 2, September 8, and November 11, 2022; and January 12, February 15, March 9, April 23, and May12, 2023. Based on the groundwater levels, the highest water level was determined to be 0.47 mbgs (207.74 masl). Groundwater samples were collected from two monitoring wells and analyzed for the City of Hamilton Sanitary/Storm Sewers Discharge Limits. All analyzed parameters were within guideline Limits for Sanitary/Storm sewer discharge analysis. However, Total Suspended Solids (TSS) exceeded the Storm Sewer Discharge guideline.

DEWATERING CONSIDERATIONS

Short Term	The short-term dewatering rate outside periods of active precipitation was estimated to be approximately 29,790 L/day (0.34 L/s).
Long Term	Long-term dewatering will not be required at the Site as the underground parking level will be waterproofed below the seasonal highest groundwater level based on the City of Hamilton stipulation. It is recommended that the proposed parking level be waterproofed below the established "*seasonally high groundwater level*" plus the required buffer zone (nominally 1.0 m to 1.5 m above).
Monitoring and Mitigation Plans	Monitoring, mitigation, and contingency plans are provided. The monitoring plans include dewatering abstraction, construction, and settlement monitoring. Mitigation includes methods to limit adverse dewatering settlement.

PERMIT CONSIDERATIONS

EASR or PTTW	The maximum dewatering rate of groundwater for the proposed excavation is estimated to be approximately 709,474 L/day or ~709 m^3/day (radial inflow and direct precipitation). The short-term dewatering rate outside periods of active precipitation was estimated to be approximately 29,790 L/day (0.34 L/s). However, Environmental Activity and Sector Registry EASR or permit to take water (PTTW) will not be required at the Site if construction is scheduled outside the spring and rainy season.

IMPACTS CONSIDERATION

Construction	The radius of influence from the proposed dewatering was determined to be approximately 7.0 m. Potential geotechnical impacts are anticipated within 7.0 m of Site during dewatering at the Site. As a result, surrounding buildings and roads should be monitored by geotechnical instrumentation to determine impact, if any.

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1.0 INTRODUCTION

1.1 Background

Landtek Limited (Landtek) has been retained by Urban Solutions to complete a Hydrogeological Investigation for the proposed residential development at 150 Mohawk Road East in Hamilton, Ontario (the Site or development).

The site is currently a developed asphalt paved parking lot. It is located at the southwest corner area of the intersection of Mohawk Road East and Upper Wellington Street in Hamilton. The Site is irregular in shape and covers an area of approximately 14,900 m2 (3.7 acres). The topography at the site is relatively flat, ranging from 208 masl at the south portion to 210 masl at the north portion of the Site. The site is bound to west and south by residential developments, to the north by Mohawk Road East, and to the east by a 12-storey apartment building followed by Upper Wellington Street. The Site location is shown on Figure 1, in Appendix A.

It is understood that the proposed development will involve the removal of the existing 0.5-storey parking structure in the west of the site and the construction of an 11-storey, 138-unit apartment building. Additionally, the proposal includes a four-storey stacked townhouse development, consisting of 22 units, fronting on to Mohawk Road East. One level of underground parking is proposed below the new apartment building and stacked townhouses. The Site and Underground Level Plan are shown on Figures 2 and 3, respectively in Appendix A.

The purpose of the Hydrogeological Investigation is to evaluate the groundwater conditions at the site, delineate possible development/post-development effects, and suggest mitigation measures to minimize the effects to the shallow groundwater system during and post-development. Specifically, the report provides the following:

- A description of the hydrogeologic setting of the Site and a summary of the existing soil and groundwater conditions at the site.
- Identification of hydrogeologic features such as zones of significant groundwater recharge and discharge.
- Assessment of the requirement for groundwater control during construction, if any.

1.2 Work Scope and Report Organization

The scope of work for this investigation includes the following:

- Review of available background information. A review of published works of available geologic and hydrogeologic information for the site including topographical and geological maps and water well records. A review of Meteorological data to assess the local climate.
- Site Assessment. A detailed visual inspection of the site and surrounding area to identify and document local topography, surface water drainage features, and the potential presence of significant hydrogeological features such as closed depressions (areas of ground water recharge), seeps, springs, or the presence of phreatophytic vegetation.

- A subsurface investigation. Drilling of boreholes and monitoring wells at the Site to characterize the subsurface soil and/or bedrock as well as assess the site-specific groundwater conditions.

- Hydraulic Conductivity Tests. In-situ rising head tests were completed in selected installed monitoring wells to assess the subsurface soil and/or bedrock hydraulic conductivity.

- Groundwater Monitoring. Groundwater level monitoring was conducted in all monitoring wells in order to assess the depth of groundwater level across the site.

The report is organized as follows:

Section 1 contains a brief introduction to the project and the scope of work undertaken by Landtek.

Section 2 outlines the methodologies followed during completion of the desktop study and the field investigation.

Section 3 summarizes the findings of the investigation. It includes:
- a description of the physical setting
- the results of the field investigation

Section 4 provides Water Taking Evaluation and Impact Assessment

Section 5 provides a Monitoring Plan.

Section 6 provides Mitigation Plan.

Section 7 provides Summary and Conclusions.

Section 8 provides recommendations.

Section 9 provides Closure.

Section 10 provides References.

Section 11 provides Limitations.

2.0 METHODOLOGY

2.1 Desktop Study

A review of published works was done of available geological and hydrogeological information for the site including topographic and geologic maps.

The Ministry of Environment, Conservation and Park (MECP) water well database for the local area was also accessed and the individual well record obtained for wells located within 500 m radius of the Site.

2.2 Site Inspection to Assess Hydrogeologic Features

A detailed site inspection was conducted on July 20, 2022, to assess the presence of features which may be significant from a hydrogeologic viewpoint. In particular, the site was inspected to assess the following:

- The presence of closed drainage features, depressions, or sandy areas which may allow for ponding and significant or enhanced infiltration of water.
- Assessment of the presence of phreatophytic vegetation which may indicate seasonally high groundwater levels and/or groundwater discharge and seepage.
- Identification of any zones of visible seepage or groundwater discharge.

2.3 Field Investigation

2.3.1 Drilling and Well Installation

The subsurface drilling at the site was conducted on June 1 and July 27, 2022, with the monitoring wells drilled on June 1, 2022. It included five (5) boreholes (BH1, BH2, BH3, BH4, and BH5) at 5 locations, with BH3, BH4, and BH5 completed as monitoring wells MW3, MW4, and MW5, respectively to depths ranging from approximately 7.0 mbgs to 9.8 mbgs.

The boreholes were advanced using a continuous flight power auger track-mounted drill rig equipped with conventional soil sampling and testing tools. The drilling was conducted by Element Geo of Hamilton Ontario under the supervision of a member of Landtek staff who logged the borings and examined the samples as they were obtained. The results of the drilling are recorded in detail on the accompanying borehole logs, provided in Appendix B.

The monitoring wells were constructed with 50 mm inner diameter, Schedule 40 machine slotted PVC screens equipped with a bottom cap, and machine threaded riser pipe. The screen length and slot size are 3.0 m, and 0.10-inch, respectively.

The annular space between the PVC riser pipes and each borehole wall was backfilled to at least 0.3 m above the top of the screen with selected silica sand. A bentonite seal was placed immediately above the sand pack to a height just below grade. Each monitoring well was finished with a flushmount protective steel casing, which was cemented in-place.

A summary of the monitoring well installation details is presented on the following page in Table 1. The locations of the monitoring wells are shown on Figure 4, in Appendix A.

Table 1. Construction Details

Monitoring Well ID	Easting* (NAD83)	Northing* (NAD83)	Ground Surface Elevation (masl)**	Well Depth (mbgs)	Surface Completion	Screened Interval (m)	Screened Material
MW3	591461	4786542	209.00	9.8	Flush Mount	6.8-9.8	Silt Till
MW4	591437	4786524	208.21	7.0	Flush Mount	4.0-7.0	Silty Clay Till
MW5	591483	4786502	208.55	7.5	Flush Mount	4.5-7.5	Silty Clay Till

Notes:
masl = meters above sea level
mbgs = meters below ground level
m = meters
* Values are approximate by GPS +/- 4 m
**The approximate geodetic elevations, Site Plan, March 17, 2022.

2.3.2 Monitoring Well Development

Well Development: Each of the installed monitoring wells MW3, MW4, and MW5 was developed to remove any sediment that may have been introduced during installation and to improve the hydraulic properties of the formation against which the wells were screened. The monitoring wells were developed by Landtek staff on staff on July 26, 2022. Development employed electric well pump/waterra tubing with foot valves and each well was developed until a visible decrease in turbidity and steady flow were observed.

2.3.3 Groundwater Monitoring

Depths to groundwater in monitoring wells MW3, MW4, and MW5 were obtained manually by Landtek staff on July 26, August 2, September 8, and November 11, 2022; and January 12, February 15, March 9, April 23, and May12, 2023.

2.3.4 Groundwater Sampling

On August 18, 2022, groundwater samples were collected from monitoring wells MW3 and MW4 after purging. All collected samples were stored in a cooler with freezer packs after collection and during transport to the AGAT Environmental Analytical Laboratory in Mississauga, Ontario. The samples were analyzed for the City of Hamilton Sanitary/Storm Sewers Discharge Limits. AGAT is accredited by the *Canadian Associations for Laboratory Accreditation Inc*. (CALA).

2.3.5 Hydraulic Conductivity Testing

Hydraulic conductivity tests were completed in monitoring wells MW3 and MW4 to provide estimates of the hydraulic conductivity for the zones against which the screens for the wells were set. MW5 was under a car in the parking lot. As a result, it could not be tested. Rising head tests were conducted by Landtek on August 2, 2022. The tests involved the extraction of a volume of groundwater to displace the water level. A datalogger programed at 2 second interval was used to record the water level response during the tests.

Data Analysis: The rising head test data were analyzed using AqteSolve Professional Version 4.5 software package developed by Glenn M. Duffield of HydroSOLVE Inc. applying the Hvorslev analysis solutions, depending on hydrogeology.

3.0 FINDINGS

3.1 Topography, Drainage and Hydrology

The topography at the site is relatively flat, ranging from 208 masl at the south portion to 210 masl at the north portion of the Site, with a slight slope to the north. The Site is located in the Hamilton Region Source Protection Area in a Highly Vulnerable Aquifer Area with a score of 6. It is not located in a regulated watercourse or wetland designated area by the Hamilton Conservation Authority (HCA, November 25, 2021).

According to the Karst Map of Southern Ontario, the Site is located in a potential Karst area – areas of carbonate rock units identified as most susceptible to karst processes (Ontario Geological Survey).

3.2 Regional Physiography

The site is located within the physiographic region known as the Iroquois Plain, which lies between the foot of the Niagara Escarpment and Lake Ontario (Chapman and Putnam, 1984; Chapman and Putnam, 2007). This Region resulted from inundation of the area in the late Pleistocene by glacial Lake Iroquois. The Iroquois Plain consists of lacustrine deposits and lake-bottom sediments that have been smoothed by wave action and extends around the western end of Lake Ontario. The width of the Plain in the Winona area is approximately 2.5 km. The plain is cut by a number of creeks between Lake Ontario and the Niagara Escarpment (City of Hamilton, 2010).

3.3 Climate

The site is located in the Mixedwood Plains ecozone of Ontario (Natural Resources Canada, 2012). The general climate data presented below in Table 2 was obtained from Environment Canada publications and from the Environment Canada online database. Average climate data was taken from the Hamilton A station (Hamilton Airport) for the period of 1981 to 2010.

Table 2. 1981 to 2010 Climate Normals for Hamilton A Station (as averages)

	Daily Average Temperature (°C)	Average Rainfall (mm)	Average Snowfall (cm)	Average Precipitation (mm)
January	-5.5	29.7	40.8	64.0
February	-4.6	28.2	35.1	57.8
March	-0.1	42.6	26.5	68.4
April	6.7	71.3	8.4	79.1
May	12.8	78.7	0.5	79.4
June	18.3	84.9	0.0	84.9
July	20.9	100.7	0.0	100.7
August	20.0	79.2	0.0	79.2
September	15.8	81.9	0.0	81.9
October	9.3	76.5	0.7	77.4
November	3.7	74.4	11.0	84.3
December	-2.3	43.8	33.5	73.0
Year	7.9	791.7	156.5	929.8

3.4 Regional Geology

The City of Hamilton is underlain by clastic and carbonate sedimentary rocks of Late Ordovician to Middle Silurian age, which make up parts of three major depositional sequences (Johnson et al., 1992). The oldest bedrock unit outcropping in the area, the Queenston Formation, is predominantly dark red, fissile, hematitic, calcareous shale (Liberty et al., 1976).

The Queenston Formation is found north of the Niagara Escarpment and consists in many places of up to 4 feet (1.2 m) of very weathered bedrock (red clay) which grades downward into typical brick-red shale. The Queenston shale is overlain by Halton Till in the area of the site.

The Late Wisconsinan Halton Till is a clay to clayey silt till and is exposed in the form of a till plain from Lake Ontario southward to the Niagara Escarpment. It is the youngest glacial unit in the region and has been found to be relatively thick (up to 30 m) in the buried bedrock valley between Grimsby and Grimsby Beach. The basal part of the till is red, relatively coarser textured, and consists almost entirely of Queenston shale. Proglacial Lake Iroquois clay, silt and sand is mapped as overlying the Queenston shale in the southern portion of the site. The lake terrace is mainly underlain by Queenston shale and Halton Till although a sheet of predominantly fine sand was deposited along the shoreline and is relatively thicker (up to 4.5 m) in the vicinity of Grimsby (Feenstra, 1974).

3.5 Local and Regional Hydrogeology

Local hydrogeology conditions were assessed on the basis of local water well records and available ground investigation reports for the area.

The hydrostratigraphy (i.e., the vertical sequence and horizontal extent of aquifers and aquitards) in the overburden and bedrock generally follows the geologic layering. Till formations in the overburden act as aquitards while the sandier units generally behave as aquifers. Shale generally acts as an aquitard with an upper weathered bedrock aquifer layer (City of Hamilton, 2010).

The Halton till has low infiltration potential due to the composition of the clay and density of the till. The groundwater recharge potential is classified as moderate to low in the area.

3.6 MECP Water Well Records and Groundwater Resources

The Ministry of Environment, Conservation and Park (MECP) Water Well Information System is a publicly available database which contains information such as groundwater well location, well construction details, static water level, geologic units encountered with depth, general water quality observations, water use, date of construction, and screened interval.

The MECP records for wells located within approximately 500 meters of the site were reviewed to assess the general nature and use of the groundwater resource in the area and to characterize local hydrogeologic conditions.

Desk Top Study

A search of the MECP water well records within approximately 500 m of the site, conducted on July 12, 2022, returned a total of 17 wells comprising of ten (10) water wells, 6 test holes, and 1 abandoned well. The records were reviewed to assess the general nature of the groundwater resource in the area and to characterize local hydrogeologic conditions. The locations of the

wells are shown on Figure 5 in Appendix A. The well records summary is provided in Appendix C.

A summary of the data obtained from the well survey is presented below.

Well Construction

- Wells terminated in bedrock 11
- Wells terminated in overburden 6
- **Total 17**

Well Uses

- Water Wells 10
- Test Holes 6
- Abandoned Well 1
- **Total 17**

Well Depth

- Less than 15 m 15
- Between 15 m and 30 m 1
- Greater than 30 m 1
- **Total 17**

Based on the well records review, it was determined that there are ten (10) water wells within 500 m radius of the Site.

3.7 Results of Site Inspection

A detailed site inspection was conducted on July 20, 2022, to assess the presence of features which may be significant from a hydrogeologic viewpoint.

Presence of significant hydrogeologic features such as closed depressions (areas of ground water recharge), seeps, springs, or the presence of phreatophytic vegetation were not observed during the inspection.

3.8 Results of Subsurface Investigation

The borehole information is generally consistent with the geological data of the area, and the predominant soils is comprised of silt till, overlying clay till which overlies bedrock.

Detailed monitoring wells logs are presented in Appendix B, and the lithologies encountered during drilling are discussed further in the following sections.

Topsoil

An approximately 50 mm to 300 mm thick layer of topsoil was encountered at ground surface at boreholes BH1 and BH2.

Fill

Approximately 0.5 to 1.5 m thick layer of fill was encountered in all boreholes, below the topsoil. The fill generally consists of silt, trace sand, trace gravel, cobbles, and moist.

Silt Till

A silt till layer was encountered in all boreholes except for MW4, underlying the fill layer in the other boreholes, and extending to depths ranging from approximately from 0.6 mbgs to 4.6 mbgs. Silt till was also encountered in MW3 below the clay till layer from a depth of 6.1 mbgs to 9.1 mbgs, and overlying clay till. The silt till is brown and generally consists of silt, trace gravel, trace sand, and some clay.

Clay Till

A clay till layer was encountered in all boreholes, underlying the fill layer in borehole BH3, and the silt till layer in the other boreholes. It generally extends from depths ranging from approximately from 0.8 mbgs to 7.6 mbgs. It also underlies Silt till layer in MW3 at a depth of 9.1 mbgs to end of borehole at 9.8 mbgs. The clay till is brown, with silt and sand.

Bedrock

Bedrock was encountered at depths ranging from 6.7 mbgs to 9.8 mbgs. The bedrock is grey, highly weathered and fractured.

3.9 Groundwater Monitoring

Depths to groundwater in monitoring wells MW3, MW4 and MW5 were obtained manually by Landtek staff on July 26, August 2, and September 8, 2022. The readings are presented below in Table 3.

Table 3. Groundwater Monitoring Data

MW ID	Date	Total Depth (mbgs)	Water Strike (mbgs)*	Completion	Water Level (mbgs)	Water Level (masl)	Ground Elevation (masl)**
MW3	26-Jul-22	9.8	1.8	Flush Mount	3.30	206.70	209.00
	2-Aug-22				2.54	207.47	
	8-Sep-22				2.67	206.33	
	11-Nov-22				2.76	206.24	
	12-Jan-23				2.17	206.83	
	15-Feb-23				1.31	207.69	
	9-Mar-23				2.33	206.67	
	14-Apr-23				2.28	206.72	
	12-May-23				2.33	206.67	
MW4	26-Jul-22	7.0	1.2	Flush Mount	1.10	207.11	208.21
	2-Aug-22				1.18	207.03	
	8-Sep-22				1.29	206.92	
	11-Nov-22				0.77	207.44	
	12-Jan-23				0.51	207.70	
	15-Feb-23				0.75	207.46	
	9-Mar-23				0.49	207.72	
	14-Apr-23				0.47	207.74	
	12-May-23				0.62	207.59	
MW5	26-Jul-22	7.5	None	Flush Mount	1.95	206.60	208.55
	2-Aug-22				NA**	NA	
	8-Sep-22				1.78	206.77	
	11-Nov-22				1.80	206.75	
	12-Jan-23				1.49	207.06	
	15-Feb-23				0.91	207.64	
	9-Mar-23				NA**	NA	
	14-Apr-23				1.54	207.01	

	12-May-23				1.56		

Notes:
NA: Under a Car at the existing parking lot
[*] Water strike/groundwater seepage
[**] Could not be found. Under a snow pile or a Car

mbgs = meters below ground surface
masl = meters above sea-level
**The approximate geodetic elevations, Site Plan, March 17, 2022.

3.10 Hydraulic Gradients and Flow

Vertical Hydraulic Gradient

Groundwater generally flows from the shallow to deeper aquifers as leakage across the aquitards. However, this may vary locally, and the direction of vertical flow depends on the relative heads in the different layers. Leakage rates vary locally depending on the magnitude of the vertical gradients and on the thickness and hydraulic conductivity of the confining units (City of Hamilton, 2010).

Horizontal Hydraulic Gradient

The Groundwater contour diagram was generated by triangulation using groundwater level readings from the monitored wells MW3, MW4 and MW5. The groundwater flow gradient on September 8, 2022, was determined to be 0.035 m/m in a northeast direction. The groundwater contour diagram is shown on Figure 6 in Appendix A.

3.11 Estimated Hydraulic Conductivity

3.11.1 Hydraulic Conductivity Tests Analysis

The analyses were completed using the Hvorslev method (Fetter, 1994). The graphical results of the hydraulic conductivity analysis are presented in Appendix D, and the results are summarized below in Table 4.

Table 4. Hydraulic Conductivity Results

Monitoring Well	Hydraulic Conductivity (m/s)	Screened Material
MW3	1.275×10^{-7}	Silt Till
MW4	3.397×10^{-8}	Silty Clay Till
MW5	NA*	Silty Clay Till

NA* - Under a car at the parking lot.

The results indicate that the hydraulic conductivity of the screened till material at the site range from 3.397×10^{-8} m/s to 1.275×10^{-7} m/s, with an average of 8.073×10^{-8} m/s.

3.12 Groundwater Quality

Copies of the laboratory Certificates of Analysis are provided in Appendix E. The results of the analyzed groundwater samples collected from monitoring wells MW3 and MW4 were compared to the City of Hamilton Sanitary/Storm Sewers Discharge Limits Discharge Limit.

All analyzed parameters were within guideline Limits for Sanitary/Storm Sewer Combined Discharge.

4.0 WATER TAKING EVALUATION & IMPACT ASSESSMENT

Based on the Concept Site Plan by **KNYMH ARCHITECTURE SOLUTIONS**, it is understood that the proposed development will comprise one-level of underground parking. The underground parking level plan is shown on Figure 3 in Appendix A.

Underground Parking Level

Based on Figure 3, the dimensions of the equivalent rectangle of the underground level were determined to be approximately 92.6 m x 73.4 m.

There will be one (1) level of underground parking. As a result, the maximum depth of the underground levels is estimated to be 4.1 mbgs. A dewatering depth of approximately 0.5 m below the excavation bottom (4.6 mbgs) is assumed in order to keep the bottom of the excavation dry during construction.

Static Water Levels

Depths to groundwater in all monitoring wells were obtained manually by Landtek staff on July 26, August 2, September 8, and November 11, 2022; and January 12, February 15, March 9, April 23, and May 12, 2023. The readings are presented in Table 3 of this report. Based on the groundwater levels, the highest water level was determined to be 0.47 mbgs (207.74 masl).

4.1 Groundwater Dewatering Requirements

Groundwater seepage will occur where excavations are made below the groundwater level. If groundwater levels are intercepted within the excavation, adequate pumping should be provided to prevent significant groundwater volumes from accumulating.

In order to evaluate the potential groundwater control requirements during construction of the proposed underground parking levels, depth to groundwater of 0.47 mbgs, (the highest groundwater level recorded at MW4 on April 14, 2023, was assumed for the entire Site.

The method suitable for dewatering an area depends on the locations, type, size and depth of the dewatering needs; and the hydrogeological conditions such as stratification, thickness, and hydraulic conductivity of the foundation soils below the water table into which the excavation extends or is underlain. It is assumed that any groundwater dewatering for the Site excavations would likely be completed with standard construction sump pump/well points or equivalent, depending on conditions encountered such as water table elevation and subsurface materials. The pumps must appropriately be used to prevent the pumping of fines and loss of ground during dewatering activities and the flow of water should be appropriately managed so that sediment is not pumped into the proposed discharge point.

For the purposes of this assessment, an open excavation was assumed. The use of conventional shoring could further reduce the amount of groundwater infiltration and should be determined in consultation with the selected subcontractor.

4.1.1 Dewatering Calculations

The potential groundwater flow rate to the underground parking excavation was estimated using the dewatering equation for a fully penetrated well of unconfined aquifer fed by circular source (Powers, et. al., 2007):

$$Q = \pi K (H^2 - h_w^2)/(\ln R_o/r_e)$$

Where: Q = pumping rate [m^3/s]
K = hydraulic conductivity [m/s]
H = saturated thickness of the aquifer before dewatering [m]
h_w = saturated thickness of the aquifer after dewatering [m]
R_o. = radius of cone of depression [m]
r_e = equivalent radius [m]

The radius of cone of depression R can be estimated using:

$$R_o = Ch*Sqrt(K)$$

Where: C = is a factor equal to 3000 for radial flow to a pumping well

h = H- h_w =required drawdown [m]
K = hydraulic conductivity [m/s]

Dewatering of a rectangular area can be accomplished by using an equivalent radius (r_e) to assess drawdown where r_e is given by the following equation:

$r_e = (a + b)/\pi)$ (applies when $a/b<1.5$ and $R_o >> r_e$)
$r_e = Sqrt (length*width/\pi)$ (applies when $a/b>1.5$ and $R_o << r_e$)

Underground Parking Excavation Dewatering

The volume of groundwater required to be pumped for dewatering the excavation associated with the underground level construction, assuming there is no rainfall and applying a factor of safety of 2.0, was determined be approximately 29,790 L/day (0.34 L/s) and the radius of influence determined to be approximately 7.0 m with a factor of safety of 2.0. These calculations and associated assumptions are provided on Table 1, Appendix F.

Direct precipitation was not assessed. However, it is recommended that dewatering should not be completed during period of active precipitation.

4.2 Dewatering Considerations

4.2.1 Estimating Total Dewatering Volume

The dewatering rate for the proposed excavation must also consider management of direct precipitation input. As a result, dewatering volume is estimated from the following two contributions:

- Radial flow into an excavation under a water table condition (Section 4.1).
- Direct precipitation

Direct Precipitation

Note: Radial flow into an excavation under a water table condition estimate does not take into account storm water management from rainfall events. Additional volume generated from a 100 year-storm event for the City of Burlington of 100 mm (from Extreme Rainfall Intensity-Duration-Frequency [IDF] Curve for the City of Burlington) rainfall event is estimated as follows:

Direct Precipitation into the proposed excavation = A (m^2) *rainfall (m) = (92.6 m x 73.4 m)*0.100 m = 679.7 m^3/day = 679,684 L/day

It is advised that dewatering should not be completed during period of active precipitation.

4.2.2 Short Term Dewatering Volume

- Dewatering rate outside periods of active precipitation: ~ 29,790 L/day or 29.79 m^3/day
- Dewatering during Spring/active precipitation period: ~29,790 L/day (radial flow into excavation) + 679,684 L/day (direct precipitation) = 709,474 L/day or ~709 m^3/day.

Normal condition is considered to be weather conditions that should be expected during the operation of the construction dewatering. Normal operation does not include extreme weather events. Dewatering requirements less precipitation is estimated to be approximately 29,790 L/day = 29.79 m^3/day.

4.2.3 Long Term Groundwater Control (Post Construction)

The developer proposes that the proposed below grade structure be waterproofed to prevent inflow of groundwater into the subsurface parking structures and foundation, post construction, according to the City of Hamilton stipulation. The proposed below-grade structure should be waterproofed to a minimum height of 1.5 m above the seasonal high groundwater table. As a result, long term dewatering will not be required at the Site.

4.2.4 Permit to Take Water

The maximum dewatering rate of groundwater for the proposed excavation is estimated to be approximately 709,474 L/day or ~709 m^3/day (radial inflow and direct precipitation).

However, Environmental Activity and Sector Registry EASR or permit to take water (PTTW) will not be required at the Site if construction is scheduled outside the spring and rainy season, temporary dewatering estimate is 29,790 L/day which is less that 50,000 L/day.

4.2.5 Dewatering Procedure

Based on the results of the hydraulic conductivity tests, seepage through the overburden and bedrock beneath the Site should be feasible to be handled by a sump and/or well point dewatering system. The type of dewatering system to be used should be discussed with a dewatering contractor and be evaluated based on anticipated low and high volumes estimates.

The following general construction practices should be implemented to minimize the volume of water to be extracted:

- Schedule construction outside the spring period when the water table is typically elevated and avoid constructing during period of active precipitation.

- Excavation should be staged or constructed in such a manner to be able to manage dewatering volume conveniently.
- Reduce the length of time during which the excavation cut remains open.

4.2.6 Water Management and Discharge Plan

Water extracted during construction dewatering is required to be discharged into an approved storm, sanitary or combined sewers near the Site.

As per the Sewers ByLaw, in order to issue a discharge approval, information relating to the quality and quantity of the discharge must be provided to City of Hamilton. It is strongly recommended that the applicant provide this information eight to twelve weeks prior to the proposed start of discharge.

The rate and total volume of the discharge during dewatering should be recorded. This would require that the discharge line be equipped with a flow meter capable of monitoring the discharge rate and a volume totalizer to record the total volume of water discharge. The discharge rate and total daily flow should be recorded with the records maintained on site.

If needed, a weir tank and filter bag should be utilized during dewatering to reduce total suspended solids (TSS) and turbidity prior to discharging of the water into either a sewer system or surface water.
A T-Coupling and valves should be installed downstream of the flow meter, which, if necessary, can be operated to divert flow for mitigation purposes.

4.3 Assessment of Potential Impacts and Water Management

4.3.1 Impact to Existing Groundwater Users

A search of the Ontario MECP within an area extending about 500 m outward from the edge of the excavation was completed.

A summary of the MECP Well Records is presented in Appendix C; and the approximate locations of the wells are shown on Figure 5 in Appendix A. Based on review, ten (10) water wells were identified within 500 m radius of the Site.

The estimated radius of influence from the proposed underground level excavation dewatering was determined to be approximately 7.0 m. As a result, potential impacts on water wells located within 500 m radius of the Site are not anticipated, as none is within the radius of influence.

4.3.2 Impact to Surface Water and Natural Functions of the Ecosystem

There are no surface water or natural functions of the Ecosystem located with 500 m radius of the Site. As a result, it is not anticipated that there will be any impact to any surface water or natural functions of the Ecosystem.

4.3.3 Contaminants Impacts

This occurs when pre-existing soil or groundwater contamination is mobilised and transported where transmission pathways are created.

There is no information on the environmental status of the Site. As a result, this report could not determine potential contaminants impacts during the planned groundwater dewatering activities.

4.3.4 Geotechnical Impacts

Geotechnical impacts occur where the geotechnical properties or state of the ground are changed by groundwater dewatering activities. The most common type of impact in this category is ground settlement, with the corresponding risk of distortion and damage to structures, services and other sensitive infrastructure.

The Site is located at the southwest corner of the intersection of Mohawk Road East and Upper Wellington Street in Hamilton. The site is bound to west and south by residential developments, to the north by Mohawk Road East, and to the east by Upper Wellington Street.

Based on the above, potential geotechnical impacts are anticipated during dewatering at the Site within a radius of influence of approximately 7.0 m. Surrounding buildings and roads should be monitored by geotechnical instrumentation to determine impact, if any.

Dewatering could be by pumping from a sump and well point dewatering system. These systems used for lowering the water table within the excavation should be properly screened and installed to ensure that pumping will not remove sediment from low permeability overburden aquifers. Removal of significant fines may result in the formation of voids and the loss of ground. It is anticipated that there will not be impact beyond the radius of influence Ro of 7.0 m.

The proposed monitoring and mitigation plans are presented in Sections 5 and 6, respectively.

5.0 MONITORING PLAN

5.1 Construction Monitoring

Once construction dewatering is initiated it will be difficult to stop pumping or significantly reduce the rate of pumping without disrupting construction activities. It will however be possible to monitor the drawdown response at the construction site and to adjust the pumping rate to optimize drawdown and the associated pumping rate.

5.2 Management of Dewatering Abstraction

5.2.1 Monitoring, Trigger Levels and Management Responses

Abstraction management is critical to ensure target water levels within the construction zone are met, but that over-pumping does not occur.

Target groundwater levels in- and outside excavations should be set individually for each dewatering monitoring well based on location, aquifer and construction requirements, in-line with stated dewatering aims above.

Trigger levels for wells should typically be set 0.5 m above the dewatering target and 1.0 m below the dewatering target to give a 1.5 m target operational zone. These targets may be reviewed and adjusted to decrease size of the operational target zone and increase the factor of safety.

If monitoring indicates that dewatering zone groundwater levels exceed the upper trigger levels (i.e., required drawdown is not being achieved or maintained) the following management actions should be carried out (in order of preference):

- Adjust automatic pump start and stop water levels.
- Increase pumping rates within the constraints of the system; and/or
- Install additional abstraction capacity (well points, spears or sump pumps).

If monitoring indicates that excavation zone groundwater levels are below the lower trigger levels (i.e., excessive drawdown) the following management actions should be carried out (in order of preference):

- Adjust automatic pump start and stop water levels; and/or
- Decrease pumping rates; and/or
- Reduce the number of pumps operating.

5.2.2 Contingency Responses

If management responses prove to be insufficient to achieve and maintain the target levels, excavations should be slowed or suspended to enable contingencies to be implemented. Available contingency measures include the following (in order of preference):

- Construction of additional dewatering wells, spears or sumps.
- Construction of additional drains or groundwater control structures.

Excavation should resume when the required drawdown is able to be reliably obtained.

5.3 Settlement Monitoring

Ground settlement can be caused by two principal mechanisms:

- Increases in effective stress as a result of lowering of groundwater levels, resulting in compression and consolidation of the ground. Such settlements are the unavoidable consequence of lowering of groundwater level.
- Removal of fine particles from the ground (loss of fines) which can occur when poorly controlled sump pumping draws out soil particles with the pumped water. With good design and implementation, loss of fines (and the associated settlement risk) can be avoided.

Implementation of a settlement monitoring plan should be completed within an approximate radius of influence of 7.0 m of the Site, the estimated radius of influence from dewatering. Prior to commencing dewatering, condition surveys of adjacent properties that could potentially be affected by dewatering, considering anticipated effects and specific dewatering design, should be completed.

Temporary access permit should be obtained from properties and utilities owners with the estimated radius of influence of the Site on a case-by-case basis prior to construction.

The following monitoring measures are recommended to be carried out before and during the temporary dewatering:

- Complete a pre-excavation condition survey and install settlement monitoring monuments and or markers at the existing buildings and roadways within the estimated zone of influence. This should be done to document existing ground elevations and building/structure conditions.

- The settlement monitoring monuments (markers) should be surveyed prior to the dewatering to establish a baseline and surveyed on a daily basis during the dewatering.

- A typical settlement monitoring system should comprise a series of settlement markers sited at various distances beyond and at the site, within the zone of influence of groundwater drawdown. Monitoring points should be surveyed to an accuracy of +/-2 mm. Note that the reference benchmark must be located beyond the extent of the anticipated influence of groundwater drawdown. For very high-risk projects, incorporation of piezometer standpipes will allow confirmation of the field groundwater drawdown and will enable calibration of field settlement observation with theoretical assessments.

- Alert and Action settlement thresholds should be set, selected through theoretical assessment of anticipated settlements and review of sensitivity of adjacent structures and infrastructures. It is prudent to implement staged groundwater drawdown, providing holding points to allow adequate time to enable observation of the delayed settlement response of the ground.

- The monitoring program will include review and alert levels. If instrument readings exceed “review” levels, the Proponent and its Contractor will jointly assess the necessity of altering the method, rate, or sequence of construction.

- The survey results should be provided to the project geotechnical engineer for evaluation. The estimated potential and actual settlements should also be reviewed by a structural engineer to assess the potential damage to the existing structures.

6.0 MITIGATION PLAN

The groundwater dewatering activities will result in localized depression of the groundwater table, and it is not anticipated that there will impact beyond the radius of influence of 7.0 m.

Mitigation would involve the reduction or elimination of the impacts induced by construction dewatering. As noted above, the potential exists for dewatering to cause ground settlement, with the corresponding risk of distortion and damage to structures, services and other sensitive infrastructure.

Methods to limit adverse dewatering settlement should include the following:

- Settlement associated with loss of fines should be mitigated through appropriate design of the dewatering system to control flow velocity and provide screens and/or filters matched to the grading of the in-situ soils. Entrainment of fines must be monitored during construction; actions could include analysis of TSS in discharge water and/or monitoring of accumulation of sediment in sedimentation tanks.

- Drawdown-induced ground settlement should be mitigated though pre-construction estimation of groundwater drawdown and settlement coefficients to identify risk prior to drawing the groundwater down, and water level monitoring in monitoring wells to check that larger drawdown than anticipated at distance from the excavation are not occurring.

- Differential settlement is most problematic. This should be reduced by managing the rate of drawdown and understanding where clear changes in soil type occur. Should potentially damaging settlement be indicated, these can be mitigated by installing groundwater cut-offs to stem or restrict groundwater flow and limit drawdown beyond the site.

- Sufficient temporary support should be provided for excavations to maintain stability, where seeps might otherwise induce progressive collapse of the sides of the excavation.

- During dewatering, staged drawdowns (where appropriate) should be implemented and field settlement and water level changes beyond the immediate site monitored, comparing against theoretical settlements and water levels to allow warning of potential dewatering settlement issues.

At “alert” levels, the dewatering should be reduced to a lower rate or ceased temporarily, and alternative measures considered for the excavation, which should be approved by the project geotechnical engineer and project team.

If the settlement monitoring indicates an undesirable deformation, the project manager should order construction operations to cease until the necessary mitigation measures are undertaken.

In the event that a property or infrastructure owner submits a claim for damages, the Developer should conduct further investigations and, if appropriate, negotiate a settlement.

7.0 SUMMARY AND CONCLUSIONS

The following summarizes the results of the investigation:

- The borehole information is generally consistent with the geological data of the area, and the predominant soils is comprised of till silt and clay till overlying bedrock.

- Significant hydrogeologic features were not identified at the site and there were no areas of significant seepage or groundwater recharge areas on the site.

- The topography at the site is relatively flat, ranging from 208 masl at the south portion to 210 masl at the north portion of the Site.

- The topography at the vicinity of the Site slopes in a northeast direction. The Groundwater contour diagram was generated by triangulation using groundwater level readings from the monitored wells MW3, MW4 and MW5. The groundwater flow gradient on August 8, 2022, was determined to be 0.017 m/m in a northeast direction.

- Depths to groundwater in all monitoring wells were obtained manually by Landtek staff on July 26, August 2, September 8, and November 11, 2022; and January 12, February 15, March 9, April 23, and May12, 2023, with the highest groundwater level determined to be 0.47 mbgs (207.74 masl).

- Groundwater samples were collected from two monitoring wells and analyzed for the City of Hamilton Sanitary/Storm Sewers Discharge Limits. All analyzed parameters were within guideline Limits for Sanitary/Storm sewer discharge analysis. However, Total Suspended Solids (TSS) exceeded the Storm Sewer Discharge guideline.

- The short-term dewatering rate outside periods of active precipitation was determined to be approximately 29,790 L/day (0.34 L/s).

- Long-term dewatering will not be required at the Site as the underground parking level will be waterproofed below the seasonal highest groundwater level in accordance with the City of Hamilton stipulation. It is recommended that the proposed parking level be waterproofed below the established "*seasonally high groundwater level*" plus the required buffer zone (nominally 1.0 m to 1.5 m above).

- The estimated dewatering rate of groundwater for the proposed excavation outside periods of active precipitation is estimated to be 29,790 L/day (0.34 L/s). Based on this volume, an Environmental Activity and Sector Registry (EASR) registration or Permit-To-Take Water (PTTW) will not be required at the Site.

8.0 RECOMMENDATIONS

The following general construction practices are recommended to minimize the volume of water to be extracted:

- Schedule construction outside the spring period when the water table is typically elevated and avoid construction during period of active precipitation.
- Reduce, where practicable, the length of time during which the open cut remains open.
- Install valves on the individual well point to allow for the flow adjustment.

As per the Sewers ByLaw, in order to issue a discharge approval, information relating to the quality and quantity of the discharge must be provided to City of Hamilton. It is strongly recommended that the applicant provide this information eight to twelve weeks prior to the proposed start of discharge.

9.0 CLOSURE

We trust this report is satisfactory for your purposes. If you have any questions regarding our submission, please do not hesitate to contact Landtek.

Yours truly,

Landtek Limited

Henry Erebor, M.Sc., P.Geo.,

10.0 REFERENCES

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Ontario Geological Survey, OGS Earth. Bedrock Geology of Ontario.

11.0 LIMITATIONS

The conclusions and recommendations given in this report are based on information determined at the borehole locations. Subsurface and ground water conditions between and beyond the boreholes may be different from those encountered at the borehole locations, and conditions may become apparent during construction that could not be detected or anticipated at the time of the geotechnical investigation. It is recommended practice that Landtek be retained during construction to confirm that the subsurface conditions throughout the site are consistent with the conditions encountered in the boreholes.

The comments made in this report on potential construction problems and possible remedial methods are intended only for the guidance of the designer. The number of boreholes may not be sufficient to determine all the factors that may influence construction methods and costs. For example, the thickness and quality of surficial topsoil or fill layers may vary markedly and unpredictably. Contractors bidding on the project or undertaking construction on the site should make their own interpretation of the factual borehole information and establish their own conclusions as to how the subsurface conditions may affect their work.

The survey elevations in the report were obtained by Landtek or others and are strictly for use by Landtek in the preparation of the geotechnical report. The elevations should not be used by any other parties for any other purpose.

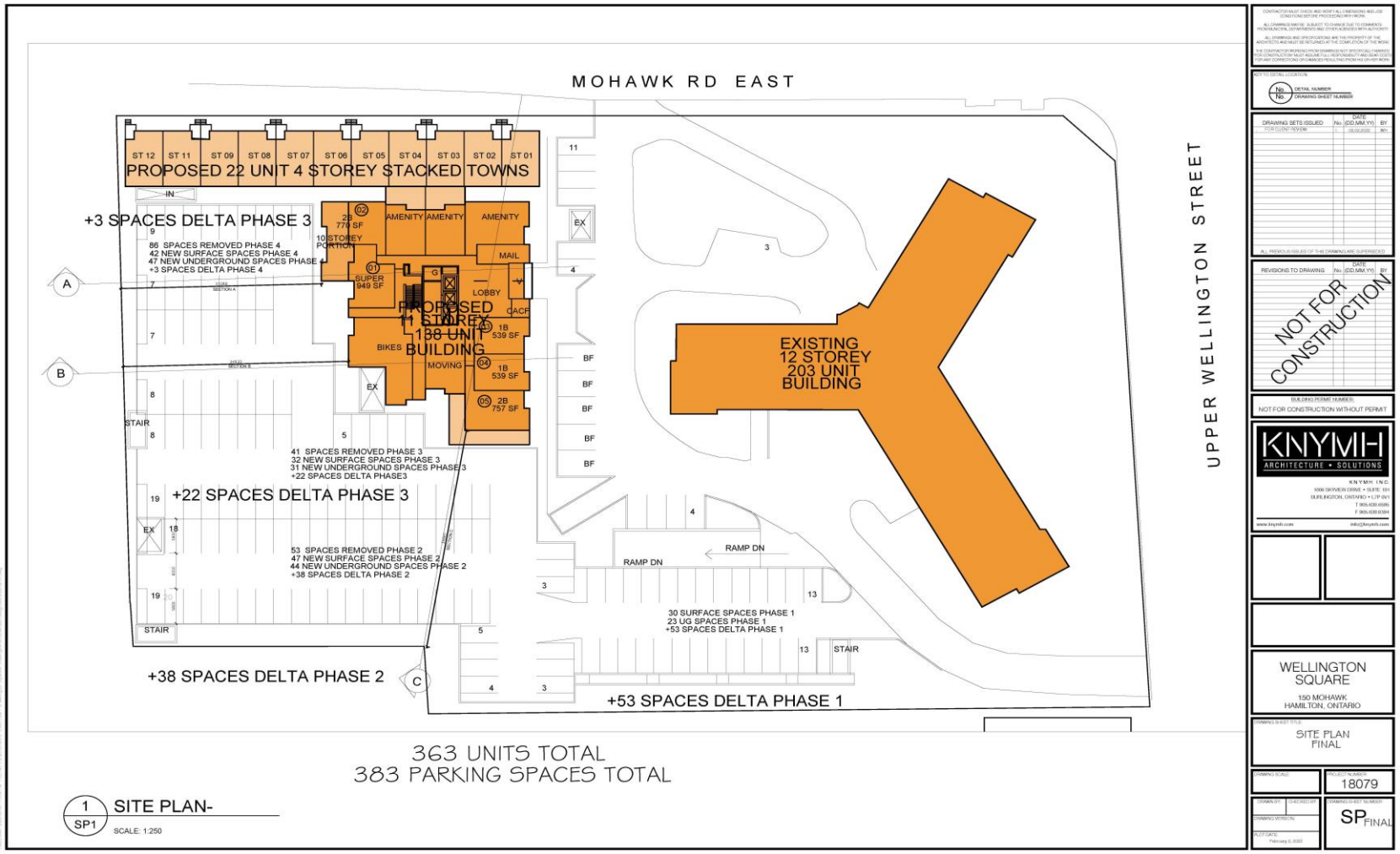
Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Landtek accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

This report does not reflect environmental issues or concerns related to the property unless otherwise stated in the report. The design recommendations given in the report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, it is recommended that Landtek be retained during the final design stage to verify that the design is consistent with the report recommendations, and that the assumptions made in the report are still valid.

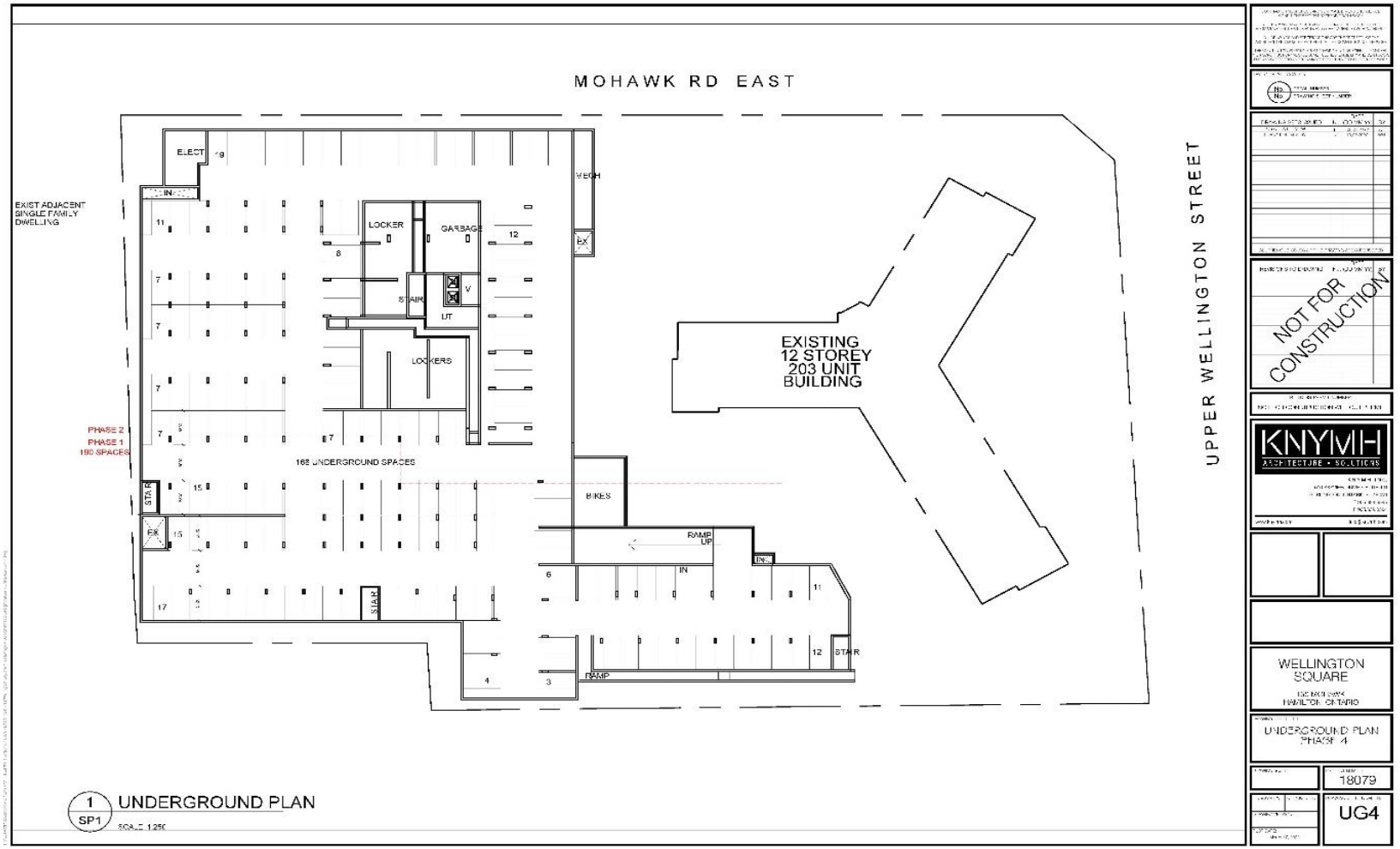
APPENDIX A

FIGURES

	LANDTEK LIMITED ***CONSULTING ENGINEERS*** **205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1**
	Scale: On Map — Date: August 2022
Project:	Hydrogeological Investigation 150 Mohawk Road East Hamilton, Ontario
Title:	Figure 1: Site Location
Project No.	22106



	LANDTEK LIMITED ***CONSULTING ENGINEERS*** **205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1**	
	Scale: As Noted	Date: August 2022
Project:	Hydrogeological Investigation 150 Mohawk Road East Hamilton, Ontario	
Title:	Figure 2: Site Plan	
Project No.	22106	



	LANDTEK LIMITED ***CONSULTING ENGINEERS*** **205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1**	
	Scale: As Noted	Date: August 2022
Project:	Hydrogeological Investigation 150 Mohawk Road East Hamilton, Ontario	
Title:	Figure 3: Underground Level Plan	
Project No.	22106	

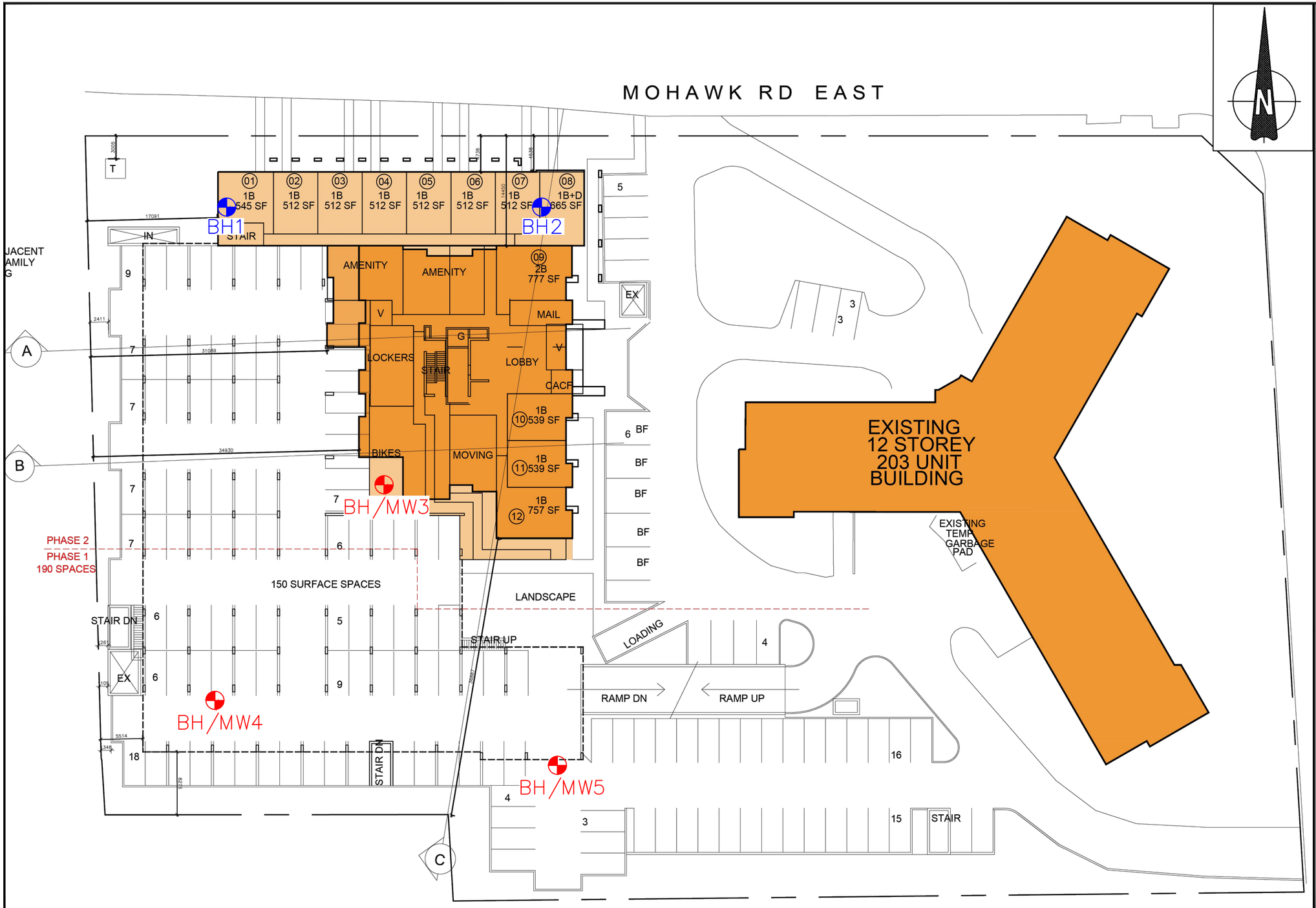


Figure 4

LANDTEK LIMITED
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engineering@landtek.ca
www.landtek.ca

project location

Location plan an extract from Maps.Hamilton.ca*

Legend:

- Approximate location of borehole drilled by Landtek Limited on June 7th and July 27th, 2022.
- Approximate location of monitoring wells drilled by Landtek Limited on June 7th, 2022.

Notes:

Base drawing provided by KNYMH Architecture Solutions

revisions

#	date	revision/comment

client
Urban Solutions

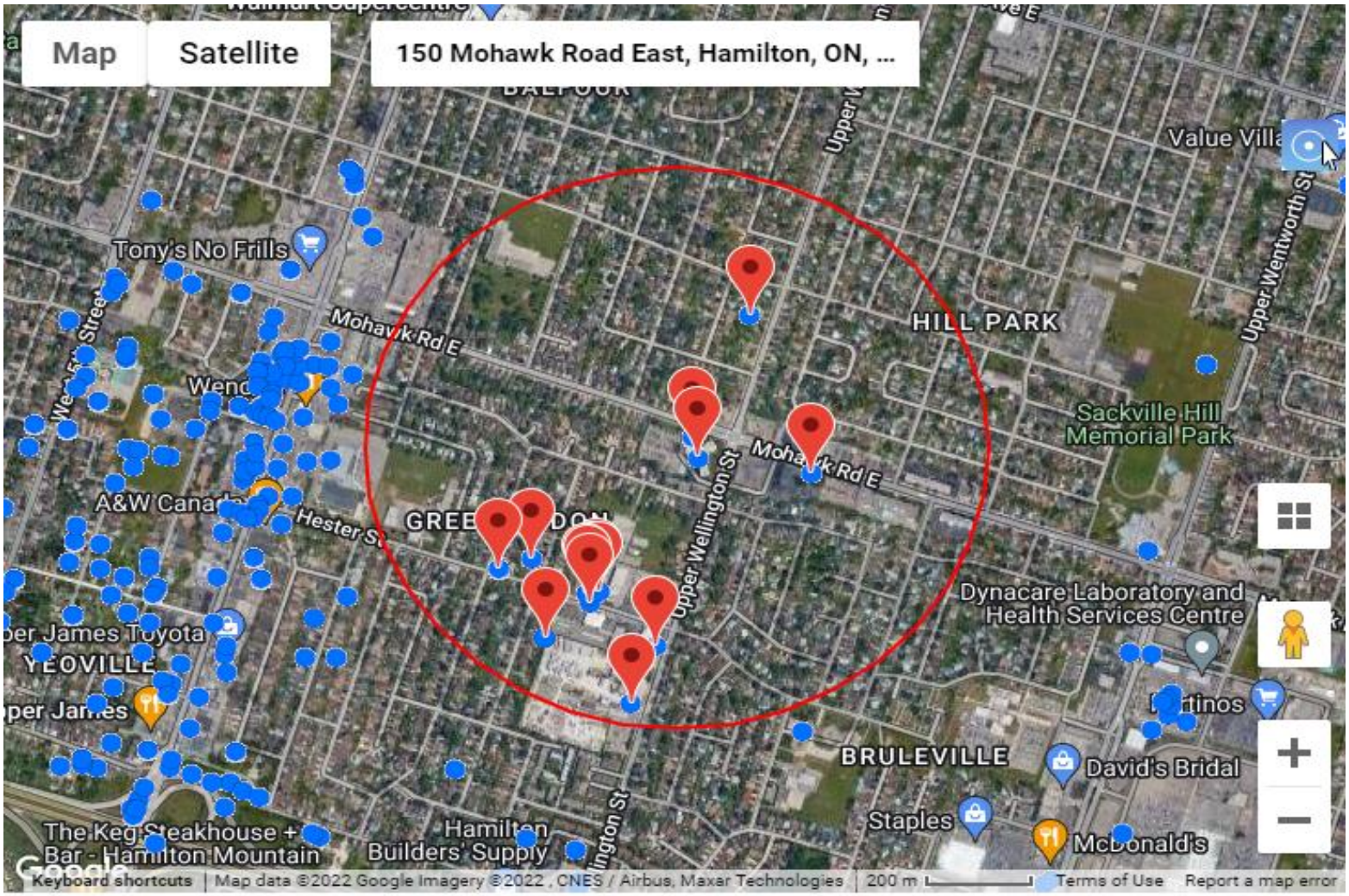
municipality
City of Hamilton

project
Geotechnical Investigation
150 Mohawk Road East, Hamilton, Ontario

sheet
Borehole Location Plan

date: July 30th, 2022
drawn: MDC
checked: JDC
project #: 22105
scale: 1:2

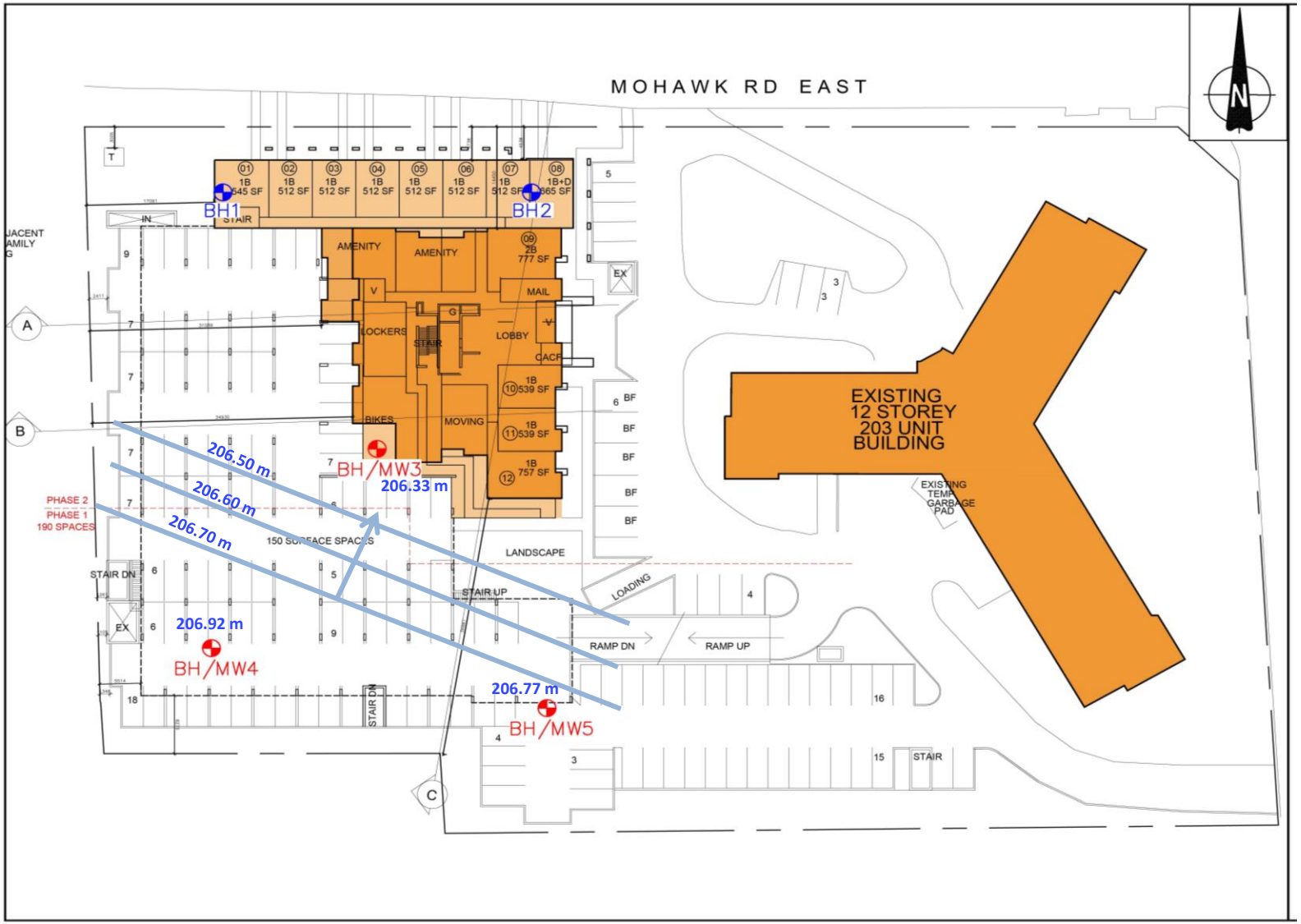
22105-01



Latitude:43.21833, Longitude:-79.86590 (UTM Zone:17, Easting:592111, Northing:4785684)

● MECP Wells

	LANDTEK LIMITED *CONSULTING ENGINEERS* **205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1**	
	Scale: On Map	Date: August 2022
Project:	Hydrogeological Investigation 150 Mohawk Road East Hamilton, Ontario	
Title:	Figure 5: MECP Wells Locations	
Project No.	22106	



LEGEND

- Borehole/Monitoring Well
- Groundwater Contour
- Groundwater Flow Direction
- 206.00 m Groundwater Level Elevation

	LANDTEK LIMITED *CONSULTING ENGINEERS* **205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1**
	Scale: On Map — Date: September 2022
Project:	Hydrogeological Investigation 150 Mohawk Road East Hamilton, Ontario
Title:	Figure 6: Groundwater Table Contours
Project No.	22106

APPENDIX B

MONITORING WELL LOGS

LOG OF BOREHOLE BH1

Project No.: 22105
Project Name: 22105 - Geotech_ HydroG Assessment
Location: 150 Mohawk Road East, Hamilton

Drill Date: 2022-07-27
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.226569
Easting: -79.873899
Ground Surface Elevation: 208.4

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity PL MC LL / Moisture / Plasticity 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor (ppm) [LEL(%)]	Comments
0		208.0	**Organic Material** Sandy Silt (~ 300 mm). Brown.	1	SS	3 4 6 6	10		14.2				
			Silt trace sand, trace gravel. Brown, loose to compact, moist.										
1			...compact.	2	SS	3 5 8	13		16.4				
		207.0	...no gravel.	3	SS	5 6 10	16		20.7				
2													
		206.0	**Clayey Silt** Brown, stiff, moist.	4	SS	4 5 8	13		26.4				
3													
			Silty Clay trace sand inclusions. Grey and brown, firm, moist.	5	SS	3 3 3	6		22.2				
4		205.0											
		204.0	...soft to firm.	6	SS	2 2 2	4		32.0				
5													
		203.0											
6			**Silty Clay Till** trace gravel, trace sand inclusions. Grey and brown, stiff, moist.	7	SS	4 5 8	13		18.2				
		202.0											
			Limestone Grey, highly weathered to weathered, dry.	8	SS	5 50-4	50		10.4				
7			End of Log										
		201.0											
8													
		200.0											
9													
		199.0											
10													

Additional Notes:
1. Borehole open to approximately 6.8 m depth on completion.
2. Groundwater or water seepage not encountered.
3. Auger and split spoon refusal at approximately 6.8 m below the ground surface.
4.

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Ph: (905) 383-3733

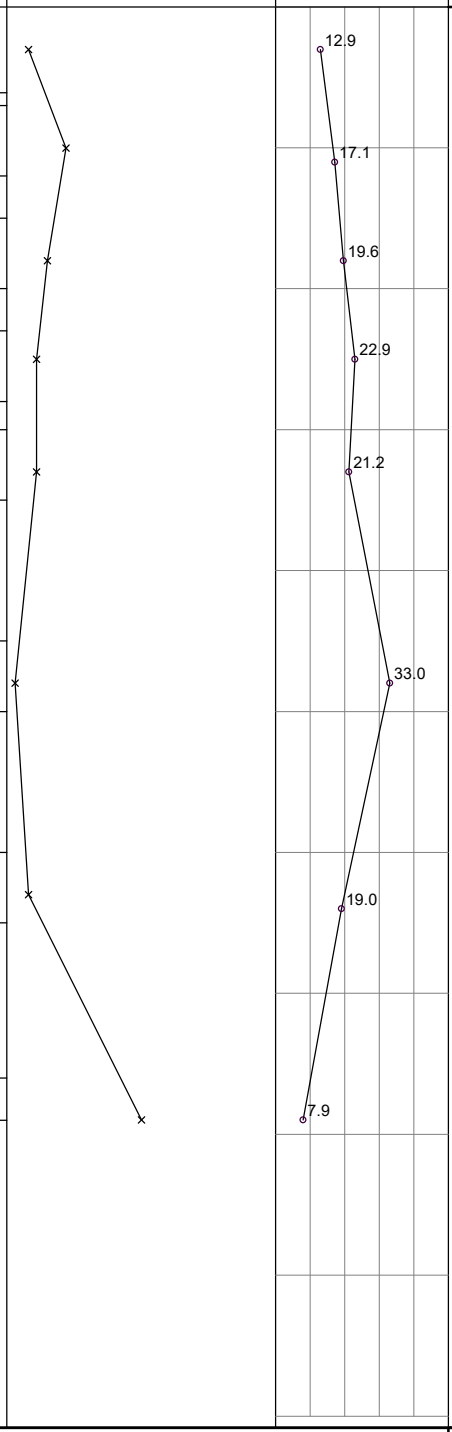
LOG OF BOREHOLE BH2

Project No.: 22105
Project Name: 22105 - Geotech_ HydroG Assessment
Location: 150 Mohawk Road East, Hamilton

Drill Date: 2022-07-27
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.226403
Easting: -79.873264
Ground Surface Elevation: 208.6

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Penetration / Strength Results	Moisture / Plasticity	Well Details	Groundwater Conditions	Headspace Vapor (ppm) [LEL(%)]	Comments
			Organic Material Sandy silt (~300 mm). Brown.	1	SS	3 3 5 6	8	Undrained Shear Strength Values (kPa) ▲ 40 80 120 160 ▲ Penetration Test Values (Blows / 0.3m) × 20 40 60 80 ×	PL MC LL Moisture / Plasticity ○ 10 20 30 40 ○				
			Sandy Silt trace gravel. Brown, firm to stiff, moist.										
		208.0											
1			**Silt** trace sand, trace gravel. Brown, compact, moist.	2	SS	7 9 13	22						
		207.0	**Clayey Silt** trace gravel, trace sand inclusions. Brown, stiff to very stiff, moist.	3	SS	5 6 9	15						
2													
			...stiff.	4	SS	3 5 6	11						
		206.0											
3				5	SS	3 4 7	11						
		205.0											
4													
		204.0	**Silty Clay** Grey and brown, soft, very moist to wet.	6	SS	1 1 2	3						
5													
		203.0											
6			**Silty Clay Till** trace gravel. Grey and brown, firm to stiff, moist.	7	SS	3 3 5	8						
		202.0											
7													
		201.0	...trace limestone fragments. Hard.	8	SS	50-2	50						
8			**Limestone** Grey, highly weathered to weathered, dry.										
			End of Log										
		200.0											
9													
		199.0											
10													



Additional Notes:
1. Borehole open to approximately 7.7 m depth on completion.
2. Groundwater or water seepage not encountered.
3. Auger and split spoon refusal at approximately 7.7 m below the ground surface.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE MW3

Project No.: 22105
Project Name: 22105 - Geotech_ HydroG Assessment
Location: 150 Mohawk Road East, Hamilton

Drill Date: 2022-06-01
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.226104
Easting: -79.873755
Ground Surface Elevation: 208.1

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength (kPa) / Penetration Test Values (Blows / 0.3m)	Moisture / Plasticity (PL MC LL)	Well Details	Groundwater Conditions	Headspace Vapor (ppm) [LEL(%)]	Comments
0		208.0	**Asphalt** (~50mm)										
			Granular Sand and gravel, trace cobbles. Brown, compact, dry.	1	SS	9 2 3 5	5		22.2				
1		207.0	**Fill** Clayey silt. Brown, firm, very moist to wet.	2	SS	3 5 5	10		22.2				
			Silty Clay trace sand inclusions. Brown, stiff, moist.	3	SS	4 5 7	12		22.7	1/2" Bentonite Pellets	WL on date of drilling		
2		206.0		4	SS	3 5 5	10		22.7				
3		205.0	...firm.	5	SS	3 2 4	6		25.0				
4		204.0											
				6	SS	3 2 4	6		16.6				
5		203.0											
6		202.0	**Clayey Silt Till** trace gravel, trace cobbles. Brown, hard, moist.	7	SS	7 6 50-4	56		11.6				
7		201.0											
			...trace sand inclusions.	8	SS	18 24 24	48		12.0	#40 Well Slot Sand	2" Schedule 40 PVC Screen		
8		200.0											
9		199.0	**Sandy Silt Till** trace gravel, trace limestone fragments. Brown, dense, moist.	9	SS	10 20 34	54		14.4				
10		198.0	**Limestone** Grey, highly weathered to weathered, dry.								2" Schedule 40 PVC Riser		
			End of Log										

Additional Notes:
1. Borehole open to approximately 9.8 m depth on completion.
2. Groundwater or water seepage encountered during drilling at approximately 1.8 m below the ground surface.
3. Auger and split spoon refusal at approximately 9.8 m below the ground surface.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE MW4

Project No.: 22105
Project Name: 22105 - Geotech_ HydroG Assessment
Location: 150 Mohawk Road East, Hamilton

Drill Date: 2022-06-01
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.225969
Easting: -79.874034
Ground Surface Elevation: 208.2

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength (kPa) / Penetration Test Values (Blows / 0.3m)	Moisture / Plasticity (PL MC LL)	Well Details	Groundwater Conditions	Headspace Vapor (ppm) [LEL(%)]	Comments
0	208.0	**Asphalt** (~100mm)										
		Granular Sand and gravel, trace cobbles. Brown, compact, dry.	1	SS	18 10 8 3	18		6.3				
1	207.0	**Fill** Silty clay, trace sand. Brown, stiff, moist to very moist.	2	SS	3 4 5	9		23.2				
		...firm.	3	SS	2 3 4	7		31.8				
2	206.0	**Clayey Silt** trace sand inclusions. Brown, stiff, moist.	4	SS	4 6 5	11		28.0				
3	205.0		5	SS	4 6 8	14		25.2	3/8" Bentonite Pellets			
4	204.0								#40 Well Slot Sand	2" Schedule 40 PVC Riser		
5	203.0	**Silty Clay Till** trace gravel, trace sand inclusions. Brown, stiff, moist.	6	SS	4 6 7	13		25.3				
6	202.0	...trace cobbles, trace limestone fragments. Hard.	7	SS	6 8 38 50-5	46		12.5		2" Schedule 40 PVC Screen		
7	201.0	**Limestone** Grey, highly weathered to weathered, dry.	8	SS	50 - 1	50		9.5				
		End of Log										
8	200.0											
9	199.0											
10												

Additional Notes:
1. Borehole open to approximately 7.0 m depth on completion.
2. Grounwater or water seepage encountered during drilling at approximately 1.2 m below the ground surface.
3. Auger and split spoon refusal at approximately 7.0 below the ground surface.
4.

LANDTEK LIMITED
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Ph: (905) 383-3733

LOG OF BOREHOLE MW5

Project No.: 22105
Project Name: 22105 - Geotech_ HydroG Assessment
Location: 150 Mohawk Road East, Hamilton

Drill Date: 2022-06-01
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.225775
Easting: -79.873588
Ground Surface Elevation: 208.6

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
		Asphalt (~50mm)					
		Granular Sand and gravel, trace cobbles. Brown, loose, dry to moist.	1	SS	6 4 2 2	6	
	208.0						
1		**Fill** Clayey silt, trace sand. Brown, stiff, moist.	2	SS	3 3 7	10	
		Clayey Silt trace sand inclusions. Brown, stiff, moist.					
	207.0		3	SS	4 6 5	11	
2							
			4	SS	4 6 7	13	
	206.0						
3			5	SS	4 6 6	12	
	205.0						
4							
	204.0	**Silty Clay** trace sand inclusions. Brown, stiff, moist.	6	SS	3 5 7	12	
5							
	203.0						
6		...very stiff.	7	SS	3 6 17 50-2	23	
	202.0	**Sandy Silt Till** trace gravel, trace cobbles. Brown, compact, moist.					
7							
	201.0	**Limestone** Grey, highly weathered to weathered, dry.					
8		End of Log					
	200.0						
9							
	199.0						
10							

Penetration / Strength Results
Undrained Shear Strength Values (kPa): 40 80 120 160
Penetration Test Values (Blows / 0.3m): 20 40 60 80

Moisture / Plasticity
PL MC LL
Moisture / Plasticity: 10 20 30 40
10.3
23.0
20.0
20.9
27.4
21.2
20.4

Well Details
3/8" Bentonite Pellets
#40 Well Slot Sand
2" Schedule 40 PVC Riser
2" Schedule 40 PVC Screen

Groundwater Conditions

Headspace Vapor (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 6.8 m depth on completion.
2. Groundwater or water seepage not encountered.
3. Auger and split spoon refusal at approximately 7.5 m below the ground surface.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

APPENDIX C

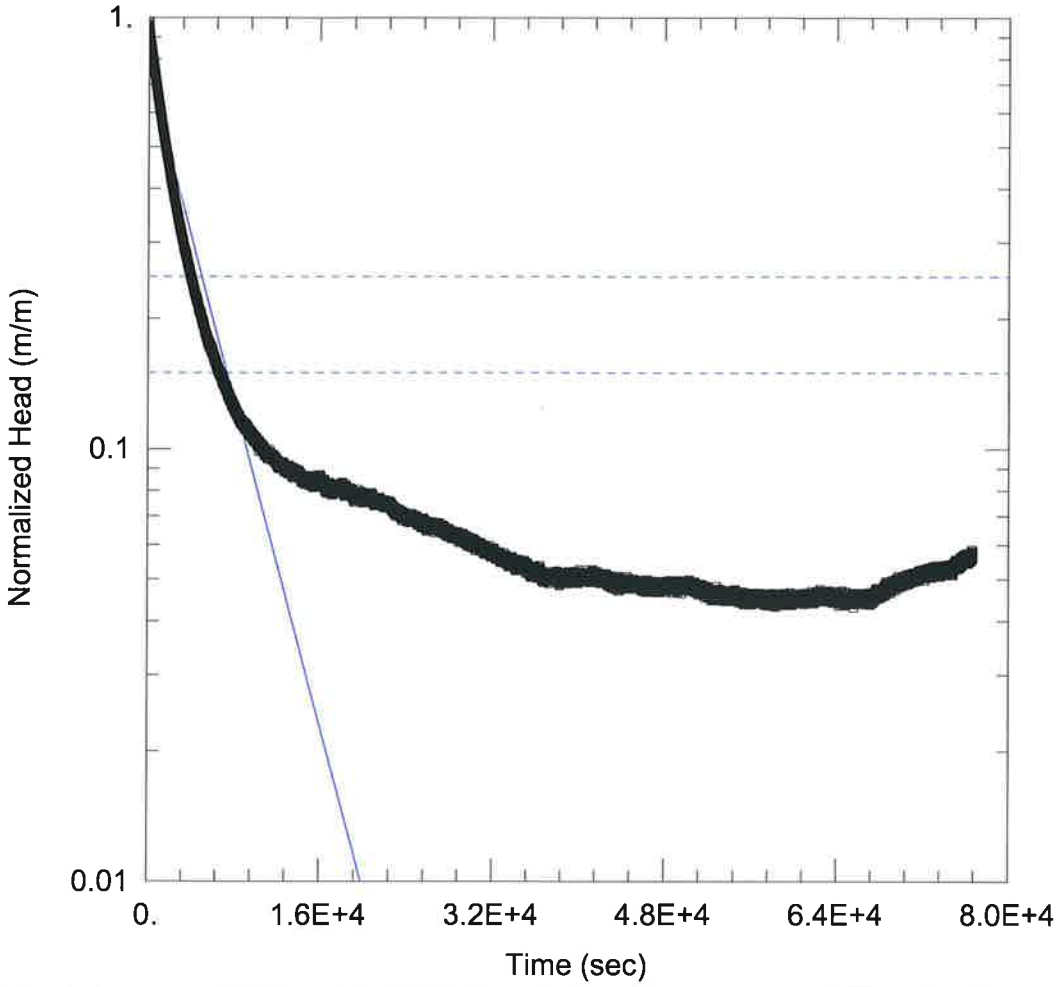
SUMMARY OF MECP WELLS RECORDS

Summary of MECP Well Records

Well #	WELL_ID	DIAMETER (inches)	DATE_COMPLETED	DATE_RECEIVED	EAST83	NORTH83	WATER_FOUND_DEPTH (FT)	Static Water Level (ft)	KIND	FINAL_STATUS	USE_1ST	USE_2ND	DEPTH_TO (ft)	DEPTH_TO (m)	Well Construction	STREET	CITY/TOWNSHIP
1	6802313	6	09-Sep-47	01-Apr-49	591635.4	4786822	NA	15	Sulphur	Water Suppy	Domestic	NA	56	17.07	Bedrock	NA	Hamilton
2	6802353	6	06-Jul-50	05-May-51	591756.4	4786491	NA	NA	Mineral	Abandoned	Not Used	NA	100	30.49	Bedrock	NA	Hamilton
3	6802354	6	04-Nov-47	01-Apr-49	591420.4	4785998	NA	Flow	Sulphur	Water Suppy	Commercial	NA	22	6.71	Bedrock	NA	Hamilton
4	6802355	6	03-Oct-49	10-Mar-50	591528.4	4786822	40	13	Fresh	Water Suppy	Domestic	NA	40	12.20	Bedrock	NA	Hamilton
5	6802356	6	15-Mar-51	10-Dec-51	591254.4	4786135	44	10	Fresh	Water Suppy	Domestic	NA	44	13.41	Bedrock	NA	Hamilton
6	6802358	6	13-Oct-51	21-Aug-52	591254.4	4786135	42	20	Fresh	Water Suppy	Domestic	NA	49	14.94	Bedrock	NA	Hamilton
7	6802359	6	04-Sep-52	18-Sep-53	591254.4	4786135	33	13	Fresh	Water Suppy	Domestic	NA	33	10.06	Bedrock	NA	Hamilton
8	6802360	6	21-Jul-53	02-Mar-54	591466.4	4786122	25	9	Sulphur	Water Suppy	Domestic	NA	25	7.62	Bedrock	NA	Hamilton
9	6802361	6	15-Dec-53	02-Mar-54	591540.4	4786520	29	12	Sulphur	Water Suppy	Commercial	NA	29	8.84	Bedrock	NA	Hamilton
10	6802363	6	02-Apr-56	15-May-56	591163.4	4786279	22	Flow	Fresh	Water Suppy	Domestic	NA	22	6.71	Bedrock	NA	Hamilton
11	6802364	6	14-Sep-56	30-Oct-56	591226.4	4786302	35	3	Sulphur	Water Suppy	Domestic	NA	36	10.98	Bedrock	NA	Hamilton
12	7201581	2	12-Apr-13	15-May-13	591344.0	4786235	NA	NA	NA	Test Hole	Monitoring & Test Hole	NA	14	4.27	Overburden	141 Hester Street	Hamilton
13	7201582	2	12-Apr-13	15-May-13	591351.0	4786241	NA	NA	NA	Test Hole	Monitoring & Test Hole	NA	14	4.27	Overburden	141 Hester Street	Hamilton
14	7201583	2	12-Apr-13	15-May-13	591333.0	4786229	NA	NA	NA	Test Hole	Monitoring & Test Hole	NA	13	3.96	Overburden	141 Hester Street	Hamilton
15	7201584	2	12-Apr-13	15-May-13	591340.0	4786211	NA	NA	NA	Test Hole	Monitoring & Test Hole	NA	14	4.27	Overburden	141 Hester Street	Hamilton
16	7201585	2	12-Apr-13	15-May-13	591336.0	4786226	NA	NA	NA	Test Hole	Monitoring & Test Hole	NA	14	4.27	Overburden	141 Hester Street	Hamilton
17	7201586	2	12-Apr-13	15-May-13	591355.0	4786235	NA	NA	NA	Test Hole	Monitoring & Test Hole	NA	13	3.96	Overburden	141 Hester Street	Hamilton

APPENDIX D

HYDRAULIC CONDUCTIVITY TESTING ANALYSIS RESULTS



HDROGEOLOGICAL INVESTIGATION

Data Set: M:\...\MW3.aqt
Date: 09/26/22 Time: 12:53:46

PROJECT INFORMATION

Company: Landtek Limited
Client: Urban Solutions
Project: 22106
Location: 150 Mohawk Road East
Test Well: MW3
Test Date: August 2, 2022

AQUIFER DATA

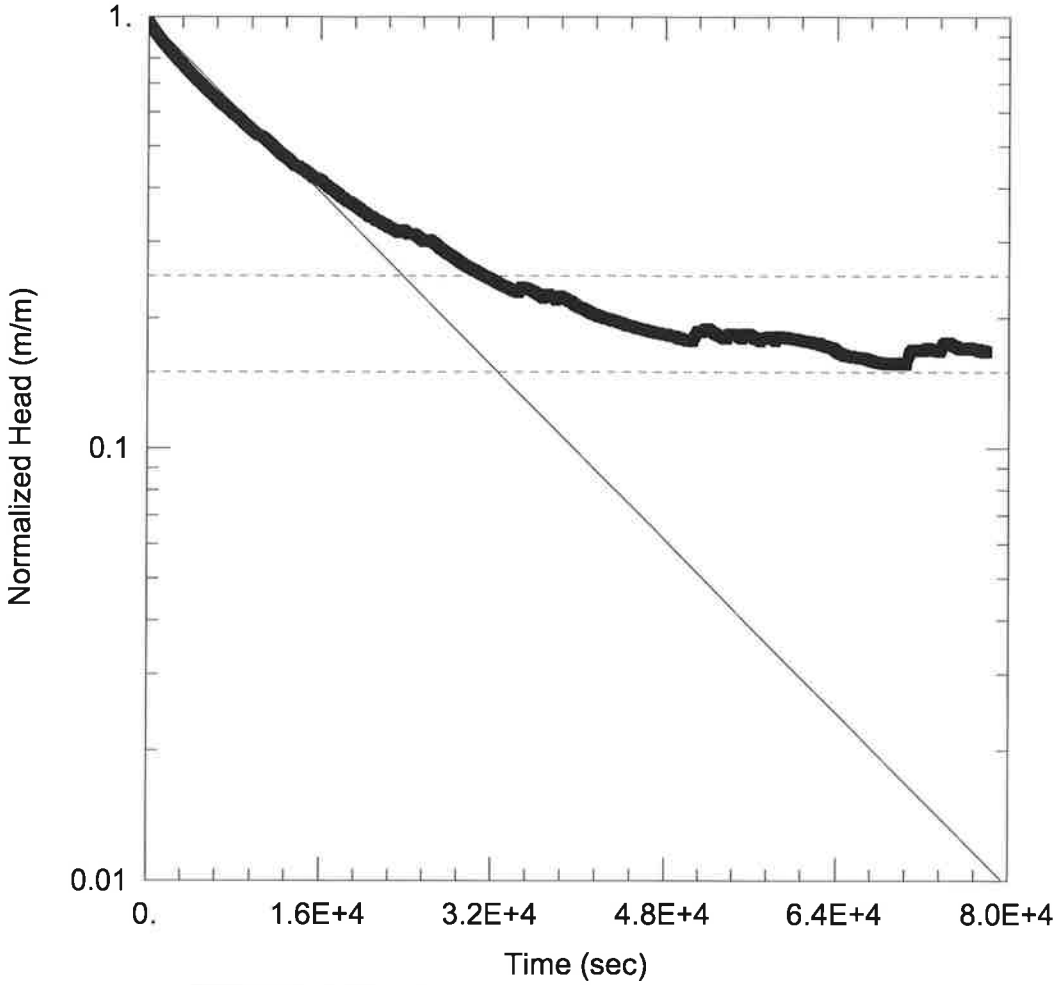
Saturated Thickness: 7.72 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW3)

Initial Displacement: 0.4628 m
Total Well Penetration Depth: 7.72 m
Casing Radius: 0.0254 m
Static Water Column Height: 7.72 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.275E-7 m/sec
y0 = 0.3432 m



HDROGEOLOGICAL INVESTIGATION

Data Set: M:\...\MW4.aqt
Date: 09/26/22 Time: 12:54:08

PROJECT INFORMATION

Company: Landtek Limited
Client: Urban Solutions
Project: 22106
Location: 150 Mohawk Road East
Test Well: MW4
Test Date: August 2, 2022

AQUIFER DATA

Saturated Thickness: 5.01 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW4)

Initial Displacement: 0.4593 m
Total Well Penetration Depth: 5.01 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.01 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
K = 3.397E-8 m/sec
Solution Method: Hvorslev
y0 = 0.4521 m

APPENDIX E

LABORATORY CERTIFICATE OF ANALYSIS

AGAT Laboratories

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

CLIENT NAME: LANDTEK LTD.
205 NEBO ROAD, UNIT 3
HAMILTON, ON L8W2E1
(905) 383-3733
ATTENTION TO: Henry Erebor
PROJECT: 22106
AGAT WORK ORDER: 22H934582
MICROBIOLOGY ANALYSIS REVIEWED BY: Nivine Basily, Inorganics Report Writer
TRACE ORGANICS REVIEWED BY: Pinkal Patel, Report Reviewer
WATER ANALYSIS REVIEWED BY: Jacky Zhu, Spectroscopy Technician
DATE REPORTED: Aug 29, 2022
PAGES (INCLUDING COVER): 19
VERSION*: 1

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

*Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
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- *The test results reported herewith relate only to the samples as received by the laboratory.*
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- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 22H934582

PROJECT: 22106

CLIENT NAME: LANDTEK LTD.

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

E. Coli (Using MI Agar)

DATE RECEIVED: 2022-08-18

DATE REPORTED: 2022-08-29

				SAMPLE DESCRIPTION:	MW3	MW4
				SAMPLE TYPE:	Water	Water
				DATE SAMPLED:	2022-08-18	2022-08-18
Parameter	Unit	G / S	RDL		4218041	4218045
Escherichia coli	CFU/100mL	2400			0	78

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to City of Hamiliton Storm Sewer Discharge
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4218041-4218045 Escherichia coli RDL = 1 CFU/100mL.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

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CANADA L4Z 1Y2
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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 22H934582

PROJECT: 22106

CLIENT NAME: LANDTEK LTD.

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

Hamilton Sanitary Sewer and Combined Sewer Use - Organics

DATE RECEIVED: 2022-08-18

DATE REPORTED: 2022-08-29

					SAMPLE DESCRIPTION:	MW3	MW4
					SAMPLE TYPE:	Water	Water
					DATE SAMPLED:	2022-08-18	2022-08-18
Parameter	Unit	G / S: A	G / S: B	RDL		4218041	4218045
Oil and Grease (animal/vegetable) in water	mg/L	150	10	0.5		1.55[<B]	1.06[<B]
Oil and Grease (mineral) in water	mg/L	15		0.5		<0.5	<0.5
Di-n-butyl phthalate	mg/L	0.08		0.0005		0.0007[<A]	<0.0005
Bis(2-Ethylhexyl)phthalate	mg/L	0.012		0.0005		<0.0005	<0.0005
3,3'-Dichlorobenzidine	mg/L	0.002		0.0005		<0.0005	<0.0005
Pentachlorophenol	mg/L	0.005		0.0005		<0.0005	<0.0005
Phenanthrene	mg/L			0.0003		<0.0003	<0.0003
Anthracene	mg/L			0.0003		<0.0003	<0.0003
Fluoranthene	mg/L			0.0003		<0.0003	<0.0003
Pyrene	mg/L			0.0002		<0.0002	<0.0002
Benzo(a)anthracene	mg/L			0.0002		<0.0002	<0.0002
Chrysene	mg/L			0.0003		<0.0003	<0.0003
Benzo(b+j)fluoranthene	mg/L			0.0002		<0.0002	<0.0002
Benzo(k)fluoranthene	mg/L			0.0002		<0.0002	<0.0002
Benzo(a)pyrene	mg/L			0.0001		<0.0001	<0.0001
Perylene	mg/L			0.0001		<0.0001	<0.0001
Indeno(1,2,3-cd)pyrene	mg/L			0.0003		<0.0003	<0.0003
Dibenzo(a,h)anthracene	mg/L			0.0002		<0.0002	<0.0002
Benzo(ghi)perylene	mg/L			0.0002		<0.0002	<0.0002
Dibenzo(a,i)pyrene*	mg/L			0.0001		<0.0001	<0.0001
Benzo(e)pyrene*	mg/L			0.0001		<0.0001	<0.0001
Dibenzo(a,j)acridine*	mg/L			0.0001		<0.0001	<0.0001
7H-dibenzo(c,g)carbazole*	mg/L			0.0001		<0.0001	<0.0001
Total PAHs	mg/L	0.005		0.0003		<0.0003	<0.0003
Aldrin	mg/L			0.00005		<0.00005	<0.00005
Dieldrin	mg/L			0.00005		<0.00005	<0.00005
Aldrin + Dieldrin	mg/L	0.0002		0.0002		<0.0002	<0.0002
alpha - chlordane	mg/L			0.0001		<0.0001	<0.0001
gamma-Chlordane	mg/L			0.0002		<0.0002	<0.0002

Certified By: Pinkal Patel

AGAT Laboratories

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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 22H934582

PROJECT: 22106

CLIENT NAME: LANDTEK LTD.

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

Hamilton Sanitary Sewer and Combined Sewer Use - Organics

DATE RECEIVED: 2022-08-18

DATE REPORTED: 2022-08-29

					SAMPLE DESCRIPTION:	MW3	MW4
					SAMPLE TYPE:	Water	Water
					DATE SAMPLED:	2022-08-18	2022-08-18
Parameter	Unit	G / S: A	G / S: B	RDL		4218041	4218045
Chlordane (Total)	mg/L	0.1		0.007		<0.007	<0.007
op' - DDT	mg/L			0.00005		<0.00005	<0.00005
pp'-DDT	mg/L			0.0005		<0.0005	<0.0005
DDT (o,p' + p,p')	mg/L	0.0001		0.0001		<0.0001	<0.0001
Mirex	mg/L	0.1		0.0005		<0.0005	<0.0005
Hexachlorocyclohexane	mg/L	0.1		0.0001		<0.0001	<0.0001
Hexachlorobenzene	mg/L			0.0001		<0.0001	<0.0001
PCBs	mg/L	0.001		0.0002		<0.0002	<0.0002
Benzene	mg/L			0.0002		<0.0002	<0.0002
Chloroform	mg/L	0.04		0.0002		<0.0002	<0.0002
Methylene Chloride	mg/L	2		0.0003		<0.0003	<0.0003
cis-1,2-Dichloroethylene	mg/L	4		0.0002		<0.0002	<0.0002
trans-1,3-Dichloropropylene	mg/L	0.14		0.0003		<0.0003	<0.0003
Trichloroethylene	mg/L	0.4		0.0002		<0.0002	<0.0002
1,1,2,2-Tetrachloroethane	mg/L	1.4		0.0001		<0.0001	<0.0001
Toluene	mg/L	0.016		0.0002		<0.0002	<0.0002
Ethylbenzene	mg/L	0.16		0.0001		<0.0001	<0.0001
Tetrachloroethylene	mg/L	1		0.0001		<0.0001	<0.0001
1,2-Dichlorobenzene	mg/L	0.05		0.0001		<0.0001	<0.0001
1,4-Dichlorobenzene	mg/L	0.08		0.0001		<0.0001	<0.0001
Xylenes (Total)	mg/L	1.4		0.0002		<0.0002	<0.0002
Surrogate	**Unit**	**Acceptable Limits**					
TCMX	%	50-140				101	103
Decachlorobiphenyl	%	50-140				104	115
Toluene-d8	% Recovery	50-140				106	105
4-Bromofluorobenzene	% Recovery	50-140				105	99

Certified By: Pinkal Patel

AGAT Laboratories

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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 22H934582

PROJECT: 22106

CLIENT NAME: LANDTEK LTD.

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

Hamilton Sanitary Sewer and Combined Sewer Use - Organics

DATE RECEIVED: 2022-08-18

DATE REPORTED: 2022-08-29

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to City of Hamiliton Sanitary Sewer Discharge, B Refers to City of Hamiliton Storm Sewer Discharge
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4218041-4218045 Oil and Grease animal/vegetable is a calculated parameter. The calculated value is the difference between Total O&G and Mineral O&G.
Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
Note: The result for Benzo(b+j)Flouranthene is the total of the Benzo(b)&(j)Flouranthene isomers because the isomers co-elute on the GC column.
Total PAHs is calculated as sum of Anthracene, Benzo(a)pyrene, Benzo(a)anthracene, Benzo(e)pyrene*, Benzo(b+j)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)perylene, Chrysene, Dibenz(a,h)anthracene, Dibenzo(a,i)pyrene*, Dibenzo(a,j) Acridine*, 7H-Dibenzo(c,g)carbazole*, Fluoranthene, Indeno(1,2,3-cd)pyrene, Perylene, Phenanthrene and Pyrene.
*-not accredited parameters.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Jinkal Patel

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 22H934582

PROJECT: 22106

CLIENT NAME: LANDTEK LTD.

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

CBOD5

DATE RECEIVED: 2022-08-18

DATE REPORTED: 2022-08-29

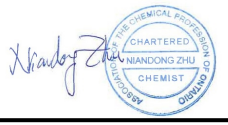
				SAMPLE DESCRIPTION:		MW4
				SAMPLE TYPE:		Water
				DATE SAMPLED:		2022-08-18
Parameter	Unit	G / S	RDL	4218041	RDL	4218045
Biochemical Oxygen Demand, Carbonaceous	mg/L	300	2.00	3	6.00	<6.00

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to City of Hamiliton Sanitary Sewer Discharge
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4218045 RDL for BOD is raised due to insufficient DO depletion at selected dilution levels.

Analysis performed at AGAT Halifax (unless marked by *)

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 22H934582

PROJECT: 22106

CLIENT NAME: LANDTEK LTD.

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

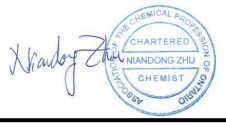
Hamilton Sanitary Sewer and Combined Sewer Use By-law - Inorganics

DATE RECEIVED: 2022-08-18

DATE REPORTED: 2022-08-29

					SAMPLE DESCRIPTION:		MW4
					SAMPLE TYPE:		Water
					DATE SAMPLED:		2022-08-18
Parameter	Unit	G / S: A	G / S: B	RDL	4218041	RDL	4218045
pH	pH Units	5.5-9.5	5.5-9.5	NA	7.63	NA	7.23
Total Suspended Solids	mg/L	350	15	10	37[B-A]	10	326[B-A]
Phenols	mg/L	1	0.02	0.002	0.003[<B]	0.008	0.018[<B]
Cyanide, SAD	mg/L	2		0.002	<0.002	0.002	<0.002
Total Kjeldahl Nitrogen	mg/L	100		0.10	0.52[<A]	0.10	1.39[<A]
Total Phosphorus	mg/L	10		0.02	0.02[<A]	0.02	<0.02
Chloride	mg/L	1500		0.12	21.0[<A]	1.2	1020[<A]
Fluoride	mg/L	10		0.05	<0.05	0.13	<0.13
Sulphate	mg/L	1500		0.19	622[<A]	0.95	152[<A]
Total Aluminum	mg/L	50		0.010	0.114[<A]	0.010	0.993[<A]
Total Antimony	mg/L	5		0.020	<0.020	0.020	<0.020
Total Arsenic	mg/L	1		0.015	<0.015	0.015	<0.015
Total Bismuth	mg/L	5		0.020	<0.020	0.020	<0.020
Total Cadmium	mg/L	0.7	1	0.020	<0.020	0.020	<0.020
Total Chromium	mg/L	5	1	0.030	<0.030	0.030	<0.030
Total Cobalt	mg/L	5		0.020	<0.020	0.020	<0.020
Total Copper	mg/L	2	1	0.030	<0.030	0.030	<0.030
Total Iron	mg/L	50		0.050	0.109[<A]	0.050	2.17[<A]
Total Lead	mg/L	2	1	0.020	<0.020	0.020	<0.020
Total Manganese	mg/L	5		0.020	0.047[<A]	0.020	3.70[<A]
Total Mercury	mg/L	0.01		0.0002	<0.0002	0.0002	<0.0002
Total Molybdenum	mg/L	1		0.020	0.028[<A]	0.020	<0.020
Total Nickel	mg/L	2	1	0.030	<0.030	0.030	<0.030
Total Selenium	mg/L	1		0.002	<0.002	0.002	<0.002
Total Silver	mg/L	5		0.020	<0.020	0.020	<0.020
Total Tin	mg/L	5		0.020	<0.020	0.020	<0.020
Total Titanium	mg/L	5		0.010	<0.010	0.010	0.044[<A]
Total Vanadium	mg/L	5		0.020	<0.020	0.020	<0.020
Total Zinc	mg/L	3	3	0.020	<0.020	0.020	<0.020

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 22H934582

PROJECT: 22106

CLIENT NAME: LANDTEK LTD.

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

Hamilton Sanitary Sewer and Combined Sewer Use By-law - Inorganics

DATE RECEIVED: 2022-08-18

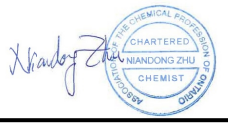
DATE REPORTED: 2022-08-29

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to City of Hamiliton Sanitary Sewer Discharge, B Refers to City of Hamiliton Storm Sewer Discharge
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4218041-4218045 Dilution required, RDL has been increased accordingly.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



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Exceedance Summary

AGAT WORK ORDER: 22H934582

PROJECT: 22106

CLIENT NAME: LANDTEK LTD.

ATTENTION TO: Henry Erebor

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
4218041	MW3	ON Hamilton SM	Hamilton Sanitary Sewer and Combined Sewer Use By-law - Inorganics	Total Suspended Solids	mg/L	15	37
4218045	MW4	ON Hamilton SM	Hamilton Sanitary Sewer and Combined Sewer Use By-law - Inorganics	Total Suspended Solids	mg/L	15	326

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Quality Assurance

CLIENT NAME: LANDTEK LTD.

AGAT WORK ORDER: 22H934582

PROJECT: 22106

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

Microbiology Analysis

RPT Date: Aug 29, 2022			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
E. Coli (Using MI Agar)															
Escherichia coli	4217947		0	0	NA										

Comments: NA - % RPD Not Applicable.

Certified By:

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Quality Assurance

CLIENT NAME: LANDTEK LTD.

AGAT WORK ORDER: 22H934582

PROJECT: 22106

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date: Aug 29, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Hamilton Sanitary Sewer and Combined Sewer Use - Organics															
Oil and Grease (animal/vegetable) in water	4161240		< 0.5	< 0.5	NA	< 0.5	95%	70%	130%	103%	70%	130%	102%	70%	130%
Oil and Grease (mineral) in water	4161240		< 0.5	< 0.5	NA	< 0.5	81%	70%	130%	90%	70%	130%	81%	70%	130%
Di-n-butyl phthalate	4222770		< 0.0005	< 0.0005	NA	< 0.0005	85%	50%	140%	78%	50%	140%	79%	50%	140%
Bis(2-Ethylhexyl)phthalate	4222770		< 0.0005	< 0.0005	NA	< 0.0005	86%	50%	140%	84%	50%	140%	87%	50%	140%
3,3'-Dichlorobenzidine	4222770		< 0.0005	< 0.0005	NA	< 0.0005	79%	30%	130%	106%	30%	130%	85%	30%	130%
Pentachlorophenol	4222770		< 0.0005	< 0.0005	NA	< 0.0005	85%	50%	140%	89%	50%	140%	108%	50%	140%
Phenanthrene	4222770		< 0.0003	< 0.0003	NA	< 0.0003	116%	50%	140%	85%	50%	140%	64%	50%	140%
Anthracene	4222770		< 0.0003	< 0.0003	NA	< 0.0003	119%	50%	140%	106%	50%	140%	86%	50%	140%
Fluoranthene	4222770		< 0.0003	< 0.0003	NA	< 0.0003	118%	50%	140%	92%	50%	140%	68%	50%	140%
Pyrene	4222770		< 0.0002	< 0.0002	NA	< 0.0002	117%	50%	140%	93%	50%	140%	67%	50%	140%
Benzo(a)anthracene	4222770		< 0.0002	< 0.0002	NA	< 0.0002	97%	50%	140%	76%	50%	140%	65%	50%	140%
Chrysene	4222770		< 0.0003	< 0.0003	NA	< 0.0003	113%	50%	140%	110%	50%	140%	68%	50%	140%
Benzo(k)fluoranthene	4222770		< 0.0002	< 0.0002	NA	< 0.0002	124%	50%	140%	101%	50%	140%	66%	50%	140%
Benzo(a)pyrene	4222770		< 0.0001	< 0.0001	NA	< 0.0001	118%	50%	140%	75%	50%	140%	69%	50%	140%
Indeno(1,2,3-cd)pyrene	4222770		< 0.0003	< 0.0003	NA	< 0.0003	66%	50%	140%	63%	50%	140%	79%	50%	140%
Dibenzo(a,h)anthracene	4222770		< 0.0002	< 0.0002	NA	< 0.0002	80%	50%	140%	62%	50%	140%	73%	50%	140%
Benzo(ghi)perylene	4222770		< 0.0002	< 0.0002	NA	< 0.0002	76%	50%	140%	63%	50%	140%	70%	50%	140%
Aldrin	4218041	4218041	< 0.00005	< 0.00005	NA	< 0.00005	100%	50%	140%	94%	50%	140%	87%	50%	140%
Dieldrin	4218041	4218041	< 0.00005	< 0.00005	NA	< 0.00005	100%	50%	140%	86%	50%	140%	82%	50%	140%
alpha - chlordane	4218041	4218041	< 0.0001	< 0.0001	NA	< 0.0001	101%	50%	140%	83%	50%	140%	83%	50%	140%
gamma-Chlordane	4218041	4218041	< 0.0002	< 0.0002	NA	< 0.0002	101%	50%	140%	80%	50%	140%	82%	50%	140%
op' - DDT	4218041	4218041	< 0.00005	< 0.00005	NA	< 0.00005	94%	50%	140%	78%	50%	140%	104%	50%	140%
pp'-DDT	4218041	4218041	< 0.0005	< 0.0005	NA	< 0.0005	87%	50%	140%	79%	50%	140%	104%	50%	140%
Mirex	4218041	4218041	< 0.0005	< 0.0005	NA	< 0.0005	99%	50%	140%	90%	50%	140%	98%	50%	140%
Hexachlorocyclohexane	4218041	4218041	< 0.0001	< 0.0001	NA	< 0.0001	104%	60%	130%	97%	60%	130%	87%	60%	130%
Hexachlorobenzene	4218041	4218041	< 0.0001	< 0.0001	NA	< 0.0001	101%	50%	140%	100%	50%	140%	100%	50%	140%
PCBs	4218041	4218041	< 0.0002	< 0.0002	NA	< 0.0002	106%	50%	140%	98%	50%	140%	95%	50%	140%
Benzene	4217435		<0.0002	<0.0002	NA	< 0.0002	119%	50%	140%	77%	60%	130%	93%	50%	140%
Chloroform	4217435		<0.0002	<0.0002	NA	< 0.0002	102%	50%	140%	82%	60%	130%	103%	50%	140%
Methylene Chloride	4217435		<0.0003	<0.0003	NA	< 0.0003	106%	50%	140%	87%	60%	130%	77%	50%	140%
cis-1,2-Dichloroethylene	4217435		<0.0002	<0.0002	NA	< 0.0002	91%	50%	140%	82%	60%	130%	104%	50%	140%
trans-1,3-Dichloropropylene	4217435		<0.0003	<0.0003	NA	< 0.0003	91%	50%	140%	89%	60%	130%	113%	50%	140%
Trichloroethylene	4217435		<0.0002	<0.0002	NA	< 0.0002	98%	50%	140%	112%	60%	130%	102%	50%	140%
1,1,2,2-Tetrachloroethane	4217435		<0.0001	<0.0001	NA	< 0.0001	90%	50%	140%	73%	60%	130%	73%	50%	140%
Toluene	4217435		<0.0002	<0.0002	NA	< 0.0002	85%	50%	140%	91%	60%	130%	115%	50%	140%
Ethylbenzene	4217435		<0.0001	<0.0001	NA	< 0.0001	88%	50%	140%	95%	60%	130%	99%	50%	140%
Tetrachloroethylene	4217435		<0.0001	<0.0001	NA	< 0.0001	101%	50%	140%	113%	60%	130%	110%	50%	140%
1,2-Dichlorobenzene	4217435		<0.0001	<0.0001	NA	< 0.0001	90%	50%	140%	90%	60%	130%	94%	50%	140%

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Quality Assurance

CLIENT NAME: LANDTEK LTD.

AGAT WORK ORDER: 22H934582

PROJECT: 22106

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis (Continued)

RPT Date: Aug 29, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
1,4-Dichlorobenzene	4217435		<0.0001	<0.0001	NA	< 0.0001	91%	50%	140%	94%	60%	130%	96%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: Jinkal Patel

AGAT Laboratories

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Quality Assurance

CLIENT NAME: LANDTEK LTD.

AGAT WORK ORDER: 22H934582

PROJECT: 22106

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Aug 29, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Hamilton Sanitary Sewer and Combined Sewer Use By-law - Inorganics															
pH	4219368		7.59	7.85	3.4%	NA	100%	90%	110%						
Total Suspended Solids	4217824		18	18	NA	< 10	102%	80%	120%						
Phenols	4217144		0.013	0.012	8.0%	< 0.002	100%	90%	110%	100%	90%	110%	114%	80%	120%
Cyanide, SAD	4209420		<0.002	<0.002	NA	< 0.002	92%	70%	130%	91%	80%	120%	98%	70%	130%
Total Kjeldahl Nitrogen	4216208		0.93	0.94	1.1%	< 0.10	100%	70%	130%	100%	80%	120%	100%	70%	130%
Total Phosphorus	4221270		1.46	1.48	1.4%	< 0.02	99%	70%	130%	98%	80%	120%	NA	70%	130%
Chloride	4215321		2090	2040	2.4%	< 0.10	91%	70%	130%	94%	80%	120%	101%	70%	130%
Fluoride	4215321		<0.26	<0.26	NA	< 0.05	95%	70%	130%	94%	80%	120%	99%	70%	130%
Sulphate	4215321		212	208	1.9%	< 0.10	96%	70%	130%	98%	80%	120%	102%	70%	130%
Total Aluminum	4215061		2.32	2.23	4.0%	< 0.010	95%	70%	130%	97%	80%	120%	100%	70%	130%
Total Antimony	4215061		<0.020	<0.020	NA	< 0.020	98%	70%	130%	99%	80%	120%	95%	70%	130%
Total Arsenic	4215061		<0.015	<0.015	NA	< 0.015	90%	70%	130%	90%	80%	120%	91%	70%	130%
Total Bismuth	4215061		<0.020	<0.020	NA	< 0.020	91%	70%	130%	89%	80%	120%	85%	70%	130%
Total Cadmium	4215061		<0.020	<0.020	NA	< 0.020	98%	70%	130%	97%	80%	120%	90%	70%	130%
Total Chromium	4215061		<0.030	<0.030	NA	< 0.030	96%	70%	130%	94%	80%	120%	95%	70%	130%
Total Cobalt	4215061		<0.020	<0.020	NA	< 0.020	87%	70%	130%	89%	80%	120%	91%	70%	130%
Total Copper	4215061		<0.030	<0.030	NA	< 0.030	92%	70%	130%	91%	80%	120%	89%	70%	130%
Total Iron	4215061		1.07	0.943	12.6%	< 0.050	104%	70%	130%	105%	80%	120%	109%	70%	130%
Total Lead	4215061		<0.020	<0.020	NA	< 0.020	97%	70%	130%	98%	80%	120%	91%	70%	130%
Total Manganese	4215061		0.122	0.129	5.6%	< 0.020	96%	70%	130%	98%	80%	120%	92%	70%	130%
Total Mercury	4218041	4218041	<0.0002	<0.0002	NA	< 0.0002	100%	70%	130%	99%	80%	120%	98%	70%	130%
Total Molybdenum	4215061		<0.020	<0.020	NA	< 0.020	98%	70%	130%	97%	80%	120%	107%	70%	130%
Total Nickel	4215061		<0.030	<0.030	NA	< 0.030	93%	70%	130%	95%	80%	120%	94%	70%	130%
Total Selenium	4215061		0.002	0.005	NA	< 0.002	96%	70%	130%	89%	80%	120%	87%	70%	130%
Total Silver	4215061		<0.020	<0.020	NA	< 0.020	89%	70%	130%	91%	80%	120%	90%	70%	130%
Total Tin	4215061		<0.020	<0.020	NA	< 0.020	100%	70%	130%	102%	80%	120%	96%	70%	130%
Total Titanium	4215061		<0.010	<0.010	NA	< 0.010	82%	70%	130%	90%	80%	120%	88%	70%	130%
Total Vanadium	4215061		<0.020	<0.020	NA	< 0.020	93%	70%	130%	94%	80%	120%	97%	70%	130%
Total Zinc	4215061		<0.020	<0.020	NA	< 0.020	96%	70%	130%	96%	80%	120%	82%	70%	130%
CBOD5															
Biochemical Oxygen Demand, Carbonaceous	4224967		20	20	0.0%	< 2	114%	70%	130%						

Comments: NA Signifies Not Applicable.
Duplicate NA: results are less than 5X the RDL and RPD will not be calculated.
Matrix spike: Spike level < native concentration. Matrix spike acceptance limits do not apply.

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Quality Assurance

CLIENT NAME: LANDTEK LTD.

AGAT WORK ORDER: 22H934582

PROJECT: 22106

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date: Aug 29, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By:

AGAT Laboratories

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Method Summary

CLIENT NAME: LANDTEK LTD.

AGAT WORK ORDER: 22H934582

PROJECT: 22106

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Escherichia coli	MIC-93-7010	EPA 1604	Membrane Filtration

AGAT Laboratories

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Method Summary

CLIENT NAME: LANDTEK LTD.

AGAT WORK ORDER: 22H934582

PROJECT: 22106

ATTENTION TO: Henry Erebor

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SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Oil and Grease (animal/vegetable) in water	VOL-91-5011	modified from EPA SW-846 1664A & SM 5520	BALANCE
Oil and Grease (mineral) in water	VOL-91-5011	modified from EPA SW-846 1664A & SM 5520	BALANCE
Di-n-butyl phthalate	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Bis(2-Ethylhexyl)phthalate	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
3,3'-Dichlorobenzidine	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Pentachlorophenol	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Phenanthrene	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Anthracene	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Fluoranthene	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Pyrene	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(a)anthracene	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Chrysene	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(b+j)fluoranthene	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(k)fluoranthene	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(a)pyrene	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Perylene	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Indeno(1,2,3-cd)pyrene	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Dibenzo(a,h)anthracene	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(ghi)perylene	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Dibenzo(a,i)pyrene*	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(e)pyrene*	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Dibenzo(a,j)acridine*	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
7H-dibenzo(c,g)carbazole*	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Total PAHs	ORG-91-5114	modified from EPA 3510C and EPA 8270E	CALCULATION
Aldrin	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
Dieldrin	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
Aldrin + Dieldrin	ORG-91-5112	modified from EPA SW846 3510C & 8081B	CALCULATION

AGAT Laboratories

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

Method Summary

CLIENT NAME: LANDTEK LTD.

AGAT WORK ORDER: 22H934582

PROJECT: 22106

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
alpha - chlordane	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/MS
gamma-Chlordane	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
Chlordane (Total)	ORG-91-5112	modified from EPA SW846 3510C & 8081B	CALCULATION
op' - DDT	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
pp'-DDT	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
DDT (o,p' + p,p')	ORG-91-5112	modified from EPA SW846 3510C & 8081B	CALCULATION
Mirex	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
Hexachlorocyclohexane	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
Hexachlorobenzene	ORG-91-5112	modified from EPA SW846 3510C & 8081B	GC/ECD
TCMX	ORG-91-5112	modified from EPA SW-846 3510 & 8081B	GC/ECD
PCBs	ORG-91-5112	modified from EPA SW846 3510C & 8082A	GC/ECD
Decachlorobiphenyl	ORG-91-5112	modified from EPA SW846 3510C & 8082A	GC/ECD
Benzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chloroform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methylene Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
cis-1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
trans-1,3-Dichloropropylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylbenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Tetrachloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Xylenes (Total)	VOL-91-5001	modified from EPA 5030B & EPA 8260D	CALCULATION
Toluene-d8	VOL-91- 5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91- 5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS

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Method Summary

CLIENT NAME: LANDTEK LTD.

AGAT WORK ORDER: 22H934582

PROJECT: 22106

ATTENTION TO: Henry Erebor

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Biochemical Oxygen Demand, Carbonaceous	INOR-121-6023	SM 5210 B	INCUBATOR
pH	INOR-93-6000	modified from SM 4500-H+ B	PC TITRATE
Total Suspended Solids	INOR-93-6028	modified from EPA 1684,ON MOECC E3139,SM 2540C,D	BALANCE
Phenols	INOR-93-6072	modified from SM 5530 D	LACHAT FIA
Cyanide, SAD	INOR-93-6051	modified from MOECC E3015; SM 4500-CN- A, B, & C	TECHNICON AUTO ANALYZER
Total Kjeldahl Nitrogen	INOR-93-6048	modified from EPA 351.2 and SM 4500-NORG D	LACHAT FIA
Total Phosphorus	INOR-93-6022	modified from SM 4500-P B and SM 4500-P E	SPECTROPHOTOMETER
Chloride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Fluoride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Total Aluminum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Antimony	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Arsenic	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Bismuth	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cadmium	MET -93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Chromium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cobalt	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Copper	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Iron	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Lead	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Manganese	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Total Molybdenum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Nickel	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Selenium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Silver	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tin	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Titanium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Vanadium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zinc	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS

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L.T. 7.4/8.2/7.7
6.4/5.9/6.4

Chain of Custody Record

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

Laboratory Use Only

Work Order #: 22H934582

Cooler Quantity: 2 LG

Arrival Temperatures: 10.2 | 10.3 | 10.5

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes: BAGGED ICE

Report Information:

Company: LANDTEK LIMITED
Contact: HENRY EREBOR
Address: 205 Nebo Road, Unit 4B
Hamilton
Phone: 289-580-3992 Fax:
Reports to be sent to:
1. Email: henry@landtek.ca
2. Email: kathy@landtek.ca

Regulatory Requirements:

(Please check all applicable boxes)

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

☐ Excess Soils R406
Table ____ (Indicate One)

☐ Regulation 558

☐ CCME

☑ Sewer Use
☑ Sanitary ☑ Storm
____ (Region)

☐ Prov. Water Quality Objectives (PWQO)

☒ Other
City of Hamilton (Indicate One)

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

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

OR Date Required (Rush Surcharges May Apply):

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

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

Project Information:

Project: 22106
Site Location: 150 Mohawk Rd. E, Hamilton
Sampled By: JIN
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

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

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

Invoice Information:

Bill To Same: Yes ☐ No ☐

Company: LANDTEK LIMITED
Contact: Kathy Kristof
Address: 205 Nebo Rd., Unit 4B, Hamilton
Email: kathy@landtek.ca

Sample Matrix Legend

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC Y/N	O. Reg 153: Metals & Inorganics	Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	BTEX, F1-F4 PHCs	PAHs	PCBs	VOC	Aroclors	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Corrosivity: Include Moisture ☐ Sulphide ☐	City of Hamilton	Storm-Sanitary + Combined Sewer Discharge Analysis			Potentially Hazardous or High Concentration (Y/N)
MW3	18-Aug-22	AM/PM		GW														+	+	+	+	+
MW4	18-Aug-22	AM/PM		GW														+	+	+	+	+
		AM/PM																				
		AM/PM																				
		AM/PM																				
		AM/PM																				
		AM/PM																				
		AM/PM																				
		AM/PM																				
		AM/PM																				
		AM/PM																				

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
JINSUKO	2022.8.18	2:41.	DJAC	Aug 18/22	2:40pm
DJAC BSh	Aug 18/22	3pm			

Page 1 of 1

N°: T - 135348

APPENDIX F

DEWATERING ASSUMPTIONS AND CALCULATIONS – BASEMENT PARKING LEVEL

Table 1 – Underground Parking Excavation Dewatering Calculations

$$Q = \pi K (H^2 - h_w^2)/\ln (R_o/r_e)$$

Equation 1: The potential groundwater flow rate to the excavation for the proposed underground levels was estimated using the dewatering equation for a fully penetrated well of unconfined aquifer fed by circular source (Powers, et al., 2007).

Where: Q = pumping rate (m^3/s)
K = hydraulic conductivity (m/s)
H = saturated thickness of the aquifer before dewatering (m)
h_w = saturated thickness of the aquifer after dewatering (m)
R = radius of cone of depression (m)
r_e = equivalent radius (m)
C = 3000

R = C*(H – h)*√(K) Radius of Influence - Sichardt's equation

r_e = √(L * B)/π (applies when a/b>1.5 and R0 << rs)

r_e = (L + B)/π (applies when a/b<1.5 and R0 >>rs)

Approximate dimensions of the Underground Parking: 92.6 m x 73.4 m

Basement Levels	H (m)	h_w (m)	R (m)	r_e (m)	Q (m3/s)	Q (L/day)	Q (L/day) (2.0 Factor of Safety	Q (L/s) (2.0 Factor of Safety
	7.33	3.2	3.5	53.0	1.724 x 10-4	14,895	29,790	~ 0.34

Assumptions for hydrogeological setting:

1. An unconfined aquifer is presumed to exist locally, with the highest water table on April 14, 2023, determined to be 0.47 mbgs, and extending to an average depth of 7.8 mbgs (average depth of the till layer encountered in the 5 boreholes completed at the Site.
2. An ideal aquifer is assumed for the preliminary calculations of pumping rates and drawdown, as described by Powers, et al., 2007).
3. The maximum dewatering depth of construction activities is assumed to be 4.6 mbgl (0.5 m below bottom of Excavation).
4. It is assumed that as a requirement of the proposed construction activities the excavation will be pumped dry.
5. The hydraulic conductivity values for the till overburden beneath the site was determined to be 8.073 x 10^{-8} m/s