ALTONA GROUP

HYDROGEOLOGICAL REVIEW

RESIDENTIAL DEVELOPMENT AT
1294 KINGSTON ROAD, 1848 AND 1852 LIVERPOOL ROAD
PICKERING, ONTARIO

23 May 2019

CT2817.00

Distribution
Altona Group, 1 copy
Terrapex Environmental Ltd., 1 copy

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EXECUTIVE SUMMARY

Terrapex Environmental Ltd. (Terrapex) was retained by Altona Group (the Client) to conduct a hydrogeological review in support of the re-development of the site known municipally as 1294 Kingston Road, 1848 Liverpool Road, and 1852 Liverpool Road ("subject site") in the City of Pickering, Ontario. Altona Group, the owner of the site is proposing the redevelopment and intensification of the subject site with a mixed-use development that incorporates a 25-storey tower, a 12-storey midrise building, and a row of 3-storey townhouses. The proposed development will also have driving lanes and landscaped areas. An underground parking garage structure will be constructed to three levels.

A network of groundwater monitoring wells was installed at nine locations. Groundwater levels were measured for three events at the monitoring wells. Single well hydraulic tests were performed. One groundwater sample was analysed for suitability for discharge to the Region of Durham's sewers.

The shallowest water table encountered was at 1.5 metres below ground, indicating the construction excavation and the underground parking structure will extend into saturated soils.

The construction excavation for the underground parking structure will likely experience seepage. The anticipated maximum rate of seepage to be managed will be 621,000 litres/day, which will require a Permit To Take Water (PTTW). In addition, approximately 181,400 litres of storm water might need to be periodically extracted, based on a relatively large precipitation event. The combined amount is 802,400 litres/day, which should be specified on the PTTW application. Foundation drains may collect up to 593,600 litres/day in post-construction.

The groundwater quality reported by the laboratory complies with the Region of Durham's bylaw criteria for sanitary/combined sewers. The quality complies with the storm sewer criteria with treatment for total suspended solids (TSS). TSS can be reduced in concentration by filtering and settlement methods prior to discharge to sewers. TSS generation should be prevented to avoid mining out of adjacent soils.

Pre-construction land use predominantly consists of several low-rise buildings with asphalt-paved open-air parking areas. The post-construction land use will consist of the proposed new buildings, retained heritage building, underground parking garage, driving lanes, surface parking, paved pedestrian areas and landscaped areas. Both pre- and post-construction land uses are essentially impervious, so there will be negligible change in recharge to the shallow groundwater regime. Low impact development (LID) measures to improve infiltration are not feasible due to the underlying parking garage occupying most of the site and that the remaining area has insufficient vertical room above the water table and below the asphalt paving subgrade for a buried type system. Permeable pavers or planters would be feasible in the southern area, but clayey soils will naturally limit infiltration amounts.

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1.0 BACKGROUND

Terrapex Environmental Ltd. (Terrapex) was retained by Altona Group to conduct field studies and to prepare this hydrogeological review for the development described in Section 2.3 at 1294 Kingston Road and at 1848 and 1852 Liverpool Road (site), in Pickering, Ontario. This review herein is intended to satisfy requirements under the municipal development application process.

A companion geotechnical study for the site was concurrently undertaken by Alston Associates (now the geotechnical division of Terrapex). The final report for that study was submitted under separate cover (Alston, 2019). Companion Phase One and Two Environmental Site Assessment (ESA) studies for the site were concurrently undertaken by Terrapex. The draft Phase One ESA was submitted under separate cover (Terrapex, 2019). At the time of writing, the Phase Two ESA was under preparation (Terrapex, 2019).

2.0 LOCATION AND SETTING

2.1 LOCATION AND PROPERTY DIMENSIONS

The site is located on the northwest corner of the major intersection of Liverpool Road and Kingston Road in the southern portion of Pickering, which is within the Region of Durham. The general location is mapped on Figure 1.

The site covers an elongated area of approximately 9,100 m^2, with approximate dimensions of 55 m by 166 m, as averages. The maximum width of 66 m is planned for the north-central portion.

2.2 PRESENT LAND USE

The land use currently has three components. The southern most portion is a historic low-rise building used as a restaurant (Old Liverpool House), with adjacent asphalt-paved parking. The central portion hosts an elongated low-rise building with diverse commercial and retail tenants, with adjacent asphalt-paved parking. Fringes of lawn are present on the east, west and south sides. The northern portion is a child daycare within a single storey formerly residential dwelling, paved parking and playground backyard.

The land in the vicinity of the site (500 m radius) is shown on Figure 2. The current local land uses essentially consist of the following diverse features.

- ***Southwest to southeast:*** A gas station (PetroCanada), the Pickering Town Centre mall, other shopping plazas consisting of multiple buildings with diverse commercial tenants and open-air asphalt-paved parking. Also present are, two mid-rise office towers east of Liverpool Road and a low-rise office tower and restaurant buildings west of Liverpool Road.
- ***West and Northwest:*** Immediately to the west is a small plaza with restaurant and retail tenants. Further west is a residential neighbourhood of single-family dwellings. Green space flanks a corridor along Pine Creek.

- ***East and Northeast:*** A commercial strip plaza (Liverpool Plaza) with several buildings and asphalt-paved parking, residential neighbourhoods of single-family dwellings and townhouse blocks, and high-rise residential buildings.

2.3 PROPOSED DEVELOPMENT

Altona Group, owner of the site known municipally as 1294 Kingston Road, 1848 Liverpool Road, and 1852 Liverpool Road ("subject site"), is proposing the redevelopment and intensification of the subject site with a mixed-use development that incorporates a 25-storey tower, a 12-storey midrise building, and a row of 3-storey townhouses. The proposal also commits to the restoration and adaptive reuse of the Old Liverpool House as well as new publicly accessible open space and improvements to the public realm.

The proposed development adds 391 units to the 0.91 hectare site with a total residential gross floor area of 32,350 square metres. Active at-grade retail and commercial uses make up 850 square metres along the Liverpool and Kingston Road frontages of the new buildings and the retained Old Liverpool House. A total gross floor area of 33,200 square metres is proposed at a density of 3.6 FSI over the subject site. A total of 512 parking spaces will be provided, mostly within 3 levels of underground parking with 10 spaces provided at-grade to support the retail.

The common parking garage spans most of the property, over the footprint shown on Figure 2. The garage will extend to three subsurface levels.

The existing Old Liverpool House building will be preserved and shifted southward within the site.

2.4 SITE TOPOGRAPHY

Relief in the site vicinity is a plain with a general slope grading downward toward the southwest. The on-site grade is flat with a slight grade downward toward the southwest. Most of the site grade is between 88.0 and 89.4 metres above sea level (masl). The maximum elevation is 89.5 masl in the northeast corner and the lowest elevation is 87.7 masl in the southwest corner.

2.5 DRAINAGE

Pine Creek flows approximately 230 m to the west of the site, eventually discharging to Frenchman's Bay in Lake Ontario. No other watercourses, ponds, or other surface water features are located on the site itself or within 500 m of the site.

Local roads and adjacent properties manage stormwater through catch basins and the piped municipal storm sewer system.

2.6 REGIONAL GEOLOGY

A surficial geological map (Ontario Geological Survey, 2010) shows the site is situated in an area of a former glacial lake, leaving deposits comprised of silt and clay with minor and gravel.

A bedrock geological map (Ontario Geological Survey, 2007) shows the site is underlain by the Blue Mountain Formation, which is dominantly comprised of shale with minor limestone interbeds.

Based on water well database maintained by the Ministry of the Environment, Conservation and Parks (MECP), one well (No. 910330801) encountered bedrock of shale at a depth of 19.2 metres below ground (mbg). The database listings for the area within approximately 500 m of the site are provided in Appendix III.

2.7 SENSITIVE ECOLOGICAL RECEIVERS

Designated sensitive ecological areas such as Areas of Natural and Scientific Interest (ANSI), Environmentally Significant Areas (ESA's), and/or designated wetlands are absent within 500 m of the site (MNRF, 2019). Undesignated woodlands are mapped at approximately 60 m to 600 m to the north on the west side of Liverpool Road, and east near Glengrove Road, which consists of back yards of houses, suggesting these woodlands were mapped prior to development. Another green space extends as a corridor along Pine Creek that is 250 m to west.

2.8 GROUNDWATER SUPPLY WELLS

The surrounding vicinity is urbanized, so occupied properties are provided with piped municipal supplies sourced from Lake Ontario. The MECP database listings reported five local wells with a domestic supply purpose and three with a commercial purpose, but these wells were constructed during the early 1960's when the area was rural in character. These private supply wells are likely abandoned or demolished and so are not in use.

The site is shown as not being within a defined type of groundwater or surface water vulnerable area (MECP, 2019a).

3.0 FIELD PROGRAM

The following describes the methodology and locations of investigation in the field program. Observations are provided in Section 4 and interpretations are provided in Section 5.

3.1 DRILLING

Drilling programs were conducted at ten locations during 2 to 13 January and 2 to 8 February 2019 to serve the purposes of this hydrogeological review, the Phase Two environmental site assessment and the geotechnical assessment. The boreholes, with or without monitoring wells, were advanced to depth ranging from 4.0 to 16.8 mbg. Soils were logged in the field by a qualified geotechnical technician and then descriptions were confirmed by a Professional Engineer at Terrapex's Toronto facilities.

3.2 MONITORING WELLS

Monitoring wells were installed in nine of the ten borehole locations, with BH5 being a borehole without a well. Two locations, MW2 and MW4, were clustered pairs of wells with deep and shallow (A) screened intervals in adjacent separate boreholes. All of the other locations were single wells.

The well components and their relationships to adjacent stratigraphy are shown in the borehole records of Appendix III and their dimensions are reported in Table 1. The well locations and elevations were measured using a Topcon-500 GNSS device with centimetre-scale accuracy.

The monitoring wells were constructed using environmental grade, 50 mm diameter, Schedule 40, PVC piping with machine-slotted (10 slot) screens at the bottom. Each well was covered by a flush-mount casing.

Monitoring wells, when no longer useful, must eventually be abandoned by a licensed water well contractor. Abandonment must proceed in accordance with Regulation 903 and amendments issued under the Ontario Water Resources Act. The monitoring wells should remain until the time of construction to be available for observing future seasonal conditions and groundwater conditions closer to the time of construction for dewatering planning.

3.3 GROUNDWATER LEVELS MEASUREMENTS

Suites of groundwater levels were measured in the monitoring well network on 15 and 22 February and on 1 and 15 March 2019. Water levels were measured using an electric sounder device with a graduated tape. MW9 was measured less frequently due to its inaccessible location in an active restaurant's basement.

3.4 GROUNDWATER SAMPLING

The selected monitoring well for groundwater sampling was MW8. Fourteen well volumes were purged on February 15, 2019. The well was sampled using "low-flow" methodology with a peristaltic pump on March 15, 2019. Sample water was discharged directly without filtering to pre-cleaned bottles supplied by the laboratory with preservatives as appropriate for parameters. These bottles were iced and held in a cooler prior to delivery.

The sample was submitted to ALS Canada of Mississauga (ALS), which is an independent laboratory and is certified by the Standards Council of Canada (SCC). ALS completed analysis for the suite of parameters specified under the municipal bylaw.

3.5 HYDRAULIC CONDUCTIVITY TESTS

Single well response tests to assess the hydraulic conductivity of adjacent formations were performed on the monitoring wells MW1, MW6, and MW8. The test method applied was a bail test, which is a rapid removal of a volume of water using an elongated bailer. The ensuing rising recovery to static level is observed over time. Data were analysed using the Aqtesolv software package by the Bouwer and Rice method.

4.0 OBSERVATIONS

4.1 SUBSURFACE MATERIALS AND HYDROSTRATIGRAPHY

Eight boreholes were advanced within or near to the area of the planned garage at broad distribution across the site. Two boreholes were drilled south of the planned garage. The subsurface conditions encountered at each borehole are detailed on the borehole records provided in Appendix III.

With respect to the planned construction, the vertical zone of most interest for hydrogeological conditions is the portion shallower than approximately 10.7 mbg. The following characterizes the hydrostratigraphy.

- Fill. A fill layer with variable texture extends from surface to a depth ranging from 0.7 to 1.5 mbg. The fill texture ranges from granular sand and gravel to silty clay, with brick inclusions at some locations.

- Fine grained soils. Below the fill, to depths shallower than approximately 6.0 mbg in the north and west and 5.0 m in the south and east, the subsurface is dominantly comprised of layers of silty clay, clay and silt and clay till. Such soil layers will exhibit relatively lower hydraulic conductivity. Also, this layer is at a shallower depth so is partially saturated and has relatively less piezometric pressure, so will seep lesser water quantity to the construction excavation and the foundation drain.

- Moderate grained soils. Below the fine-grained layer, the subsurface is dominantly sand till with silt, clay and gravel that is anticipated to exhibit moderate values of hydraulic conductivity. This layer is within the saturated zone below the water table, so will yield moderate quantities of seepage to the construction excavation and to the foundation drain.

- Granular soils. A lens of silty sand in MW3 and a lens of sand and gravel in BH5 were encountered. Such layers will exhibit relatively higher hydraulic conductivity. Where encountered and below the water table, such lenses will yield relatively higher rates of seepage to the construction excavation and to the foundation drain. Rates of discharge will be initially rapid, then lessen as the lens is drained and the surrounding lower hydraulic conductivity soil limits replenishment of the lens. It is anticipated that these lenses are not hydraulically connected to each other.

- Shale. The top of bedrock was encountered in MW3 at an elevation of 73.2 masl, and a corresponding depth of 15.3 mbg. The bedrock is weathered shale, which may have low to moderate hydraulic conductivity. Generally, bedrock is too deep to affect hydrogeological conditions related to the planned development at the site.

The above stratigraphic description is a generalization. Variations could occur in thickness, depth, presence and texture of units. Constructors and dewatering contractors should review the nearest borehole records for specific locations and if necessary, drill to confirm conditions if critical to their activities. Internal sand lenses and clayey lenses not so far encountered are also possible.

Grain size analyses (Alston Associates, 2019) were conducted on selected samples from MW3, MW5 and MW6 had combined silt and clay contents of 40%, 30% and 98%, respectively.

4.2 GROUNDWATER LEVELS

Groundwater level observations are presented as depth and as elevations on Table 2. The water table is indicated in wells MW2(A), MW4(A), MW7, MW8, and MW10. Piezometric pressures are indicated by MW1, MW2, MW3, MW4, and MW6.

The average depth to the water table was 2.3 mbg. The shallowest depth was in MW7 at 1.5 mbg and the greatest depth was in MW1 at 3.8 mbg. The average elevation of the water table was at 87.4 masl. The highest elevation was in MW4A at 87.8 masl. The lowest elevation was in MW2A at 86.9 masl.

The deeper piezometers at the MW2 and the MW4 clusters had groundwater elevations that were approximately 0.4 m and 0.8 m lower than in the adjacent shallower piezometers, respectively.

Groundwater levels naturally fluctuate in response to seasons, to annual variations and possibly to major storm events. The measurements reported herein occurred during later winter (February and March) which is usually near to the highest elevation (shallowest depth) period in a typical annual cycle. It is probable that the water table elevation could still rise further (become shallower depth) during early spring or in a wetter-than-average season.

5.0 ANALYSIS

5.1 HYDRAULIC CONDUCTIVITY

Hydraulic conductivity is a parameter for quantifying the ability of a soil unit to transmit water. This parameter is necessary for predicting the rate of seepage into excavations to be intercepted or collected by dewatering efforts during construction.

The bail tests were interpreted and analysis curves are presented in Appendix V. The resulting interpreted hydraulic conductivity values for MW1, MW6, and MW8 were $1x10^{-6}$ m/s, $3x10^{-6}$ m/s, and $3x10^{-6}$ m/s, respectively.

Grain size analysis can sometimes be used to interpret a hydraulic conductivity using the Hazen formula that is a function of the d_{10} value, which is the size fraction below 10% by weight. This formula is applicable for silt and coarser sediments. However, the samples from MW3 and MW5 had d_{10} values of approximately 0.0015 mm, which is below the applicable range for the Hazen formula. The sample from MW6 was from above the water table, so was not applicable. Grain-size distribution curves are provided in Appendix III.

5.2 HYDRAULIC GRADIENT

The water table surface is commonly a subdued reflection of the overlying ground surface with shallow groundwater movement parallel to the overlying general grade and toward watercourses.

Based on this interpretation and local topography, shallow groundwater in the vicinity of the site would be anticipated to move southwestward.

The groundwater elevations for the shallow monitoring wells (MW4A, MW7, MW8, MW9, and MW10) were interpreted to indicate a horizontal hydraulic gradient of approximately 0.003 m/m and a direction of movement toward the southwest. It is noted that the groundwater elevations were very similar, within 0.25 m, which are minor differences for this scale of site and possibly might not reflect the groundwater flow direction. The groundwater elevation for MW2(A) was disregarded as an outlier. The groundwater elevations for the deeper piezometers (MW1, MW2, MW3, MW4, and MW6) were interpreted to indicate a horizontal hydraulic gradient of approximately 0.03 and a direction of movement toward the west. The contours are shown on Figure 5.

The vertical hydraulic gradients were measured at the MW2 and MW4 clusters. The consistent directions are downward, with one exception. The average magnitudes of the vertical gradients at MW2 and MW4 were approximately 0.05 and 0.13 m/m, respectively. The exception was at MW2 on 22 February 2019 when an upward gradient was indicated, but may be an erroneous reading that will be verified by longer-term monitoring.

Local variations in topography, soil type and buried utilities trenches can influence the direction of the horizontal gradient.

5.3 GROUNDWATER QUALITY

Concentrations of tested parameters as reported by ALS for the sample obtained from MW8 are provided in Table 3. The Certificate of Analysis as issued by the laboratory is provided in Appendix IV. Water quality was compared to criteria in the Regional Municipality of Durham's By-Law No. 55-2013 that regulates discharges to sanitary/combined sewer and storm sewer.

Groundwater quality was acceptable with respect to the criteria for the sanitary/combined sewers.

Groundwater quality was acceptable with respect to criteria for the storm sewers, with the exception of total suspended solids (TSS). The concentration was 15.4 mg/L, as compared to the storm sewer criterion of 15 mg/L.

A datalogger was installed on 15 March 2019 in MW6, MW1 and MW8 that recorded groundwater temperatures of 12.6, 11.6 and 11.8°C, respectively.

5.4 BUILDING GEOMETRY AND HYDROGEOLOGY

The parking garage will extend to three levels. The design plan will set the foundation slab be at a depth of 9.2 mbg. Assuming that a representative elevation for the site is at 89.2 masl, then the P3 level slab will be at approximately 80.0 masl.

Building footings are typically constructed to 1.5 m below the slab level. Similarly, an elevator core is typically set approximately 1.5 m below the foundation slab. These features suggest a probable excavation elevation of approximately 78.5 masl.

The shallowest water table was at an elevation of approximately 87.8 masl. Thus, the construction excavation and finished garage will be significantly set below the water table into the saturated zone, so will require dewatering during construction and to the foundation drains over the long-term.

The planned development will include buried municipal infrastructure, such as piped sanitary sewer, storm sewer and potable water. Construction will require excavation trenches, for which the depths are presently not determined. Seepage management should be anticipated for safe installation of this infrastructure in dry conditions, unless markedly shallower than the average water table at 2.1 mbg.

The saturated soils within the planned depth of excavation consists of layers of varying hydraulic conductivity through which seepage inflows will vary. Calculations of groundwater inflows are provided in Section 6.

6.0 DEWATERING

6.1 RATE PREDICTION

The MECP requires a Permit to Take Water (PTTW) or an Environmental Activity and Sector Registry (EASR) for groundwater takings exceeding 50,000 litres per day (L/day). For the purpose of construction, a PTTW is required for dewatering extraction rates that exceed 400,000 L/day. An EASR is required for a rate between 50,000 and 400,000 L/day.

Estimation of the rate of dewatering to counteract groundwater inflows is based on mathematical analogy to a simplified, elongated rectangular trench excavation (Powers et al., 2007) with an approximate area of 7,260 m^2 for the three subsurface levels. The calculations anticipate that the groundwater regime will behave similarly to an unconfined aquifer. The formula, anticipated geometric conditions and values used are specified on Table 4. A hydraulic conductivity value of 3×10^{-6} m/s was used. The calculations predict a possible seepage at a maximum rate of 621,000 litres per day. This rate indicates that a PTTW will be required for construction.

The methods of dewatering of adjacent soils, such as by wellpoints or by collection from sumps should be decided by the construction and dewatering contractors.

The open excavation will capture incident precipitation. The excavation area of 7,260 m^2 and a relatively large precipitation event of 25 mm will capture approximately 181,450 litres. Such rain events are anticipated to recur four to five times per year. Obviously, larger precipitation events would produce larger amounts to manage, although occurring less frequently. The precipitation amount must be added to the groundwater seepage amount in the PTTW, which should be approximately 802,400 litres per day.

The volume of seepage that could need to be managed by the finished building foundation drains was calculated similarly as for the construction excavation. The depth of foundation drain was set at 0.3 m below the P3 foundation slab. The foundation drains may collect up to 593,600 litres per

day in post-construction. The calculations assume there are no contributions by stormwater or from a low impact development infiltration measure.

The calculations are based on conservative assumptions that predict relatively high rates that are less likely, but remain possible. The hydraulic conductivity that is the highest observed was input, whereas lower hydraulic conductivity conditions are more likely to prevail. The highest water table observed was applied, but lower elevations will be more common at other times of the year, at depth, and across site. The estimated rate incorporates a factor of safety of 2.0 to allow for unknown conditions, such as a permeable soil horizon between boreholes or just beyond the excavation walls.

The cumulative amount pumped from excavations should be monitored daily to confirm that the requested pumping rate limit stated in the PTTW is not exceeded. Approval must be obtained from the Durham Region to allow dewatering discharge to the storm sewer or to the sanitary sewer, if this type of outlet is proposed as a receiver.

6.2 RADIUS OF INFLUENCE AND SENSITIVE RECEIVERS

The radius of influence is the distance range beyond which the drawdown on groundwater caused by dewatering is not expected to be detectable. The radius of influence is commonly estimated using the formula of Sichart and Kryieleis (Powers et al, 2007), which is noted in Table 4. The radius of influence predicted here is approximately 56 m beyond the excavation boundary.

No off-site ecologically sensitive receivers or private water supply wells exist within the radius of influence that could be negatively affected by dewatering. Residences and commercial buildings to the west, north and east are in proximity and should be monitored prior to and during construction in case of claims of adverse effects.

6.3 WATER QUALITY OF DISCHARGE

As noted in Section 5.3, the reported groundwater quality can be discharged to a sanitary/combined sewer. The reported groundwater quality can be discharged to a storm sewer with treatment for total suspended solids (TSS).

The elevated concentration of TSS is likely due to sampling from a monitoring well screen completed in silty and clayey soil. Most of the shallow subsurface has fine-grained texture, so may be anticipated to produce waters with elevated suspended solids. Construction should anticipate the requirement to filter and/or settle water to meet the discharge criterion. Dewatering extraction systems should be thoroughly developed prior to connection to sewers to reduce the production of particulates and the mining out / erosion of adjacent soils. Similarly, the foundation base should be designed using structures, materials and/or coating that prevent the mining out / erosion of adjacent soils over the long term.

The water quality of discharge should be monitored regularly during construction. Land uses that are sometimes associated with groundwater contamination include dry cleaners and gas stations. A dry cleaner is approximately upgradient of the site at 1794 Liverpool Road. Other dry cleaners

are located at 1298 Kingston Road and 1792 Liverpool Road. Gas stations are located at 1299 Kingston Road within 100 m of the site and at 1799 Liverpool Road. Some Potentially Contaminating Activities (PCAs) were identified in the Phase One ESA (Terrapex, 2019). These cautions being said, there was no indication of fuel or other industrial contamination in the groundwater sample obtained on site or by the Phase Two Environmental Site Assessment (Terrapex, 2019).

7.0 WATER BALANCE ASPECTS

Precipitation incident to a pervious soil surface infiltrates to move through the unsaturated zone and then recharges the shallow groundwater. In turn, shallow groundwater moves toward a watercourse to contribute to baseflow or to replenish aquifers. Impervious surfaces, such as buildings or paving, prevent infiltration and precipitation becomes runoff directed to storm sewers.

The pre-construction existing site consists of buildings with paved asphalt open-air parking areas. The post-construction site will be occupied by proposed new buildings, the retained heritage building, the underground parking garage, driving lands, surface parking, paved pedestrian areas and landscaped areas. Both pre-construction and post-construction land uses are dominantly impervious, so there will be negligible change to the annual recharge to the shallow groundwater regime at the site.

Low impact development (LID) measures to promote infiltration are not feasible at the northern and central parts of the site. The northern and central parts of the site will consist of the impervious parking garage up to the property line and infiltration should not be located above or within 4 m from the footprint of the parking garage. This leaves a southern portion that is within approximately 25 m of the southern property line (southern portion) that is not underlain by the parking garage or within 4 m of the garage. Pavers and planters to be located above the parking garage would not contribute to groundwater recharge.

The portion of the site that is south of the parking garage will be unsuitable for a buried chamber style LID measure, if such were being considered. Practice guidelines (Government of Ontario, 2003) require a minimum 1.0 m vertical gap between the base of a buried chamber / gallery infiltration system and the annual high water table. The shallowest water table in the southern part of the site, as indicated at MW7, was at 1.5 m bg. The combined thickness of asphalt and sub-base for a parking area typically require a vertical span of at least 0.5 m. Thus, the vertical gap between the sub-base and the water table is approximately 0.5 m, which is insufficient vertical span for a buried infiltration system.

Permeable pavers or planters would be feasible in the area beyond 4 m south of the parking garage but clayey soils here will naturally limit the amount that can be infiltrated.

8.0 CLOSURE

This hydrogeological review was prepared in accordance with the terms of reference for this project as agreed upon by Altona Group and generally accepted engineering or environmental consulting practices in this area. The reported information is believed to provide a reasonable representation of the general environmental conditions at the site, however, the data were collected at specific locations and conditions may vary at other locations.

This report has been prepared for the sole use of the Altona Group. Terrapex Environmental Ltd. accepts no liability for claims arising from the use of this report, or from actions taken or decisions made as a result of this report, by parties other than the Altona Group.

Respectfully submitted,

TERRAPEX ENVIRONMENTAL LTD.

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9.0 REFERENCES

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APPENDICES

Appendix I
Figures

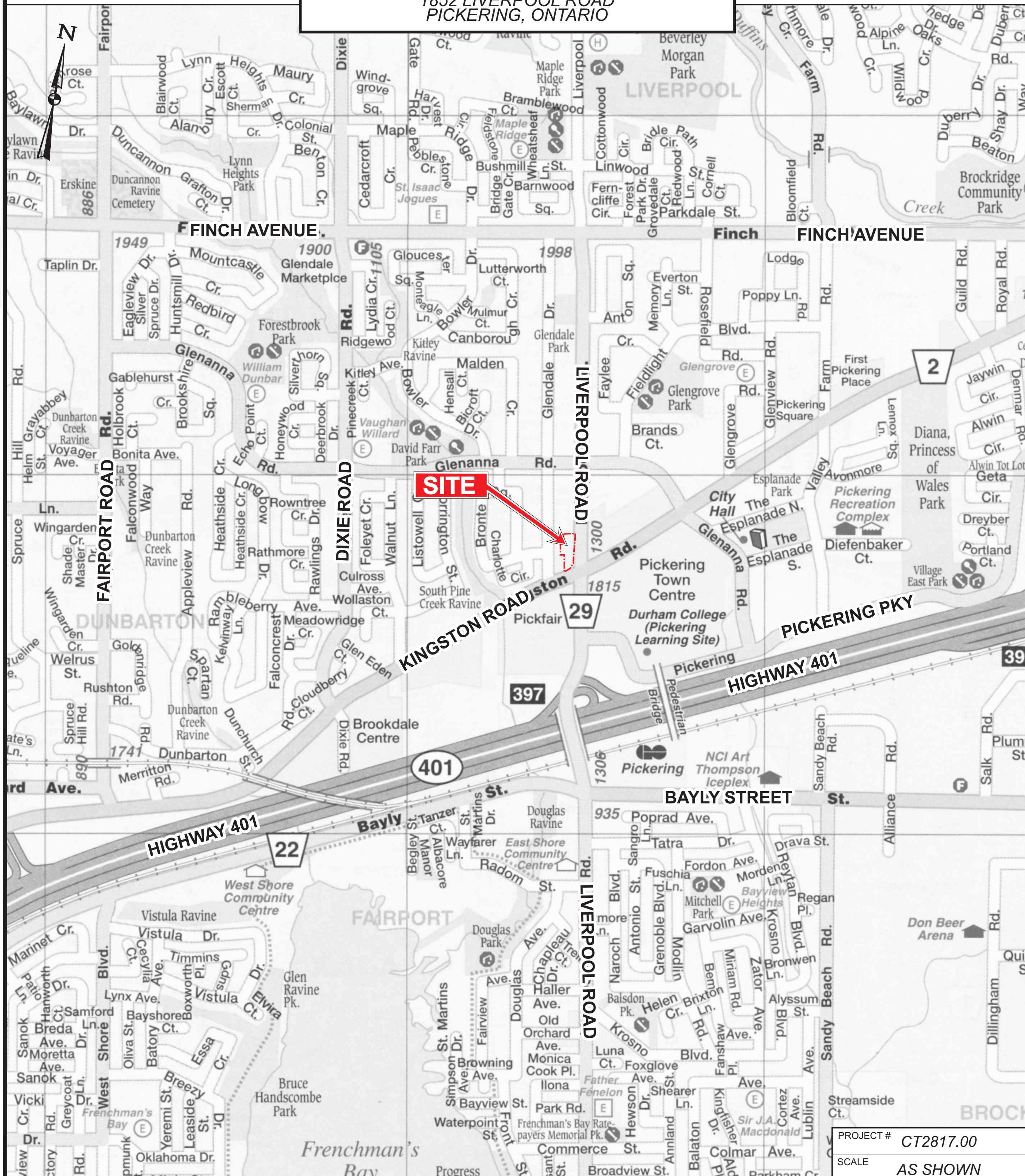
TERRAPEX

SITE LOCATION PLAN

1294 KINGSTON ROAD, 1848 AND
1852 LIVERPOOL ROAD
PICKERING, ONTARIO

CLIENT

ALTONA GROUP



0 500m 1km
(APPROXIMATE)

SOURCE: CCCMAPS, THE GOLDEN HORSESHOE, 2015 EDITION, PAGES 99 AND 111.

PROJECT #	CT2817.00
SCALE	AS SHOWN
DATE	APRIL 2019
DRAWN	SF
CHECKED	
DRAWING #	FIGURE 1

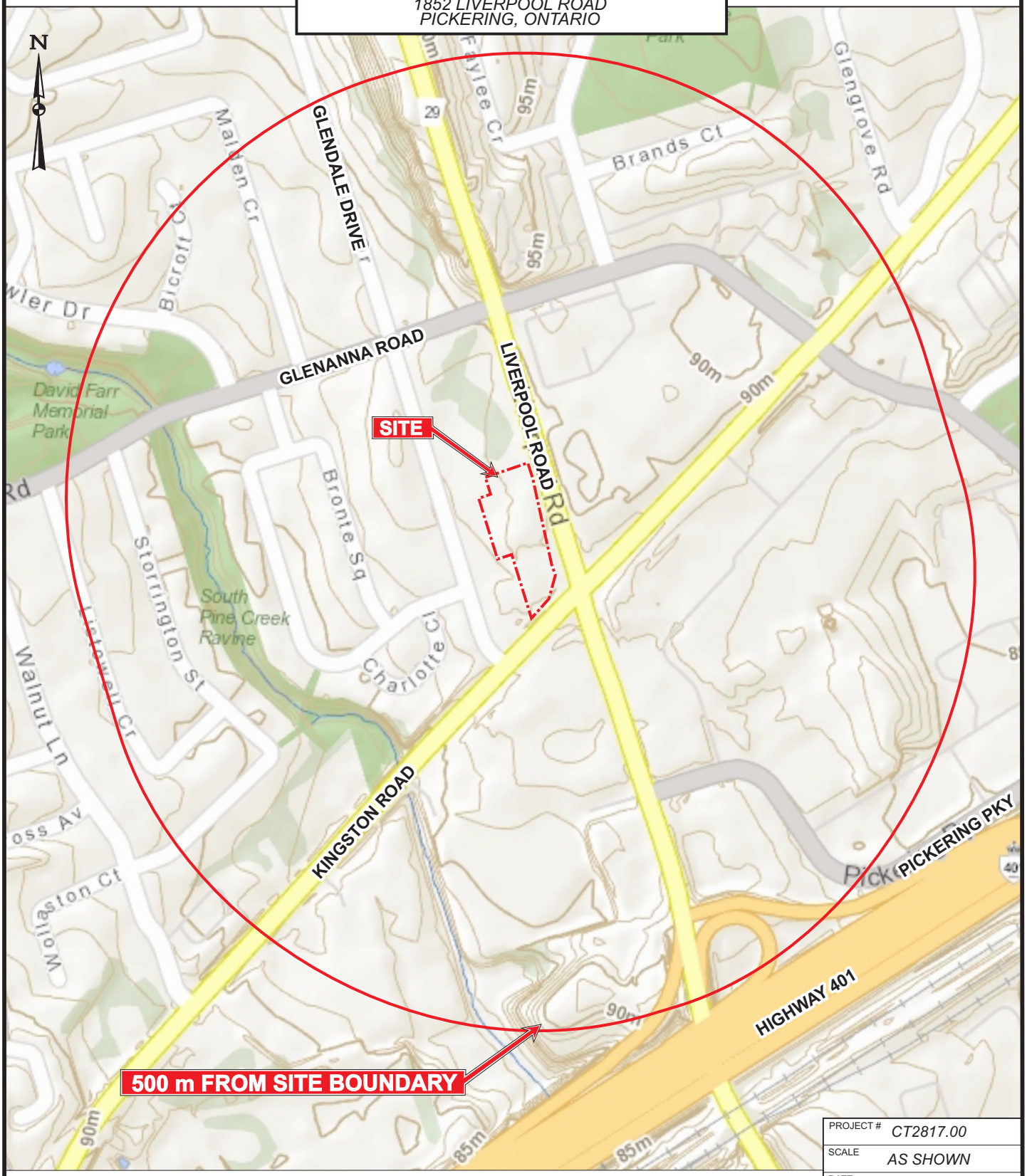
TERRAPEX

SITE VICINITY PLAN

1294 KINGSTON ROAD, 1848 AND
1852 LIVERPOOL ROAD
PICKERING, ONTARIO

CLIENT

ALTONA GROUP



0 200m 400m
(APPROXIMATE)

SOURCE: DURHAM REGION, yourDURHAM.

PROJECT #	CT2817.00
SCALE	AS SHOWN
DATE	APRIL 2019
DRAWN	SF
CHECKED	
DRAWING #	FIGURE 2

TERRAPEX

DEVELOPMENT CONCEPT PLAN

1294 KINGSTON ROAD, 1848 AND
1852 LIVERPOOL ROAD
PICKERING, ONTARIO

CLIENT

ALTONA GROUP

0 25m 50m
(APPROXIMATE)

SOURCE: LANDSCAPE PLAN BY THE MBTW GROUP, JANUARY 2019, REVISED MAY 22, 2019.

PROJECT #	CT2817.00
SCALE	AS SHOWN
DATE	MAY 2019
DRAWN	SF
CHECKED	
DRAWING #	FIGURE 3

TERRAPEX

LOCATIONS OF INVESTIGATIONS

1294 KINGSTON ROAD, 1848 AND 1852 LIVERPOOL ROAD
PICKERING, ONTARIO

CLIENT

ALTONA GROUP

LEGEND

- MONITORING WELL
- BOREHOLE
- APPROXIMATE LIMITS OF UNDERGROUND PARKING

0 25m 50m
(APPROXIMATE)

SOURCE: VUMAP, FIRST BASE SOLUTIONS, 2018 IMAGERY.

PROJECT #	CT2817.00
SCALE	AS SHOWN
DATE	MAY 2019
DRAWN	SF
CHECKED	
DRAWING #	FIGURE 4

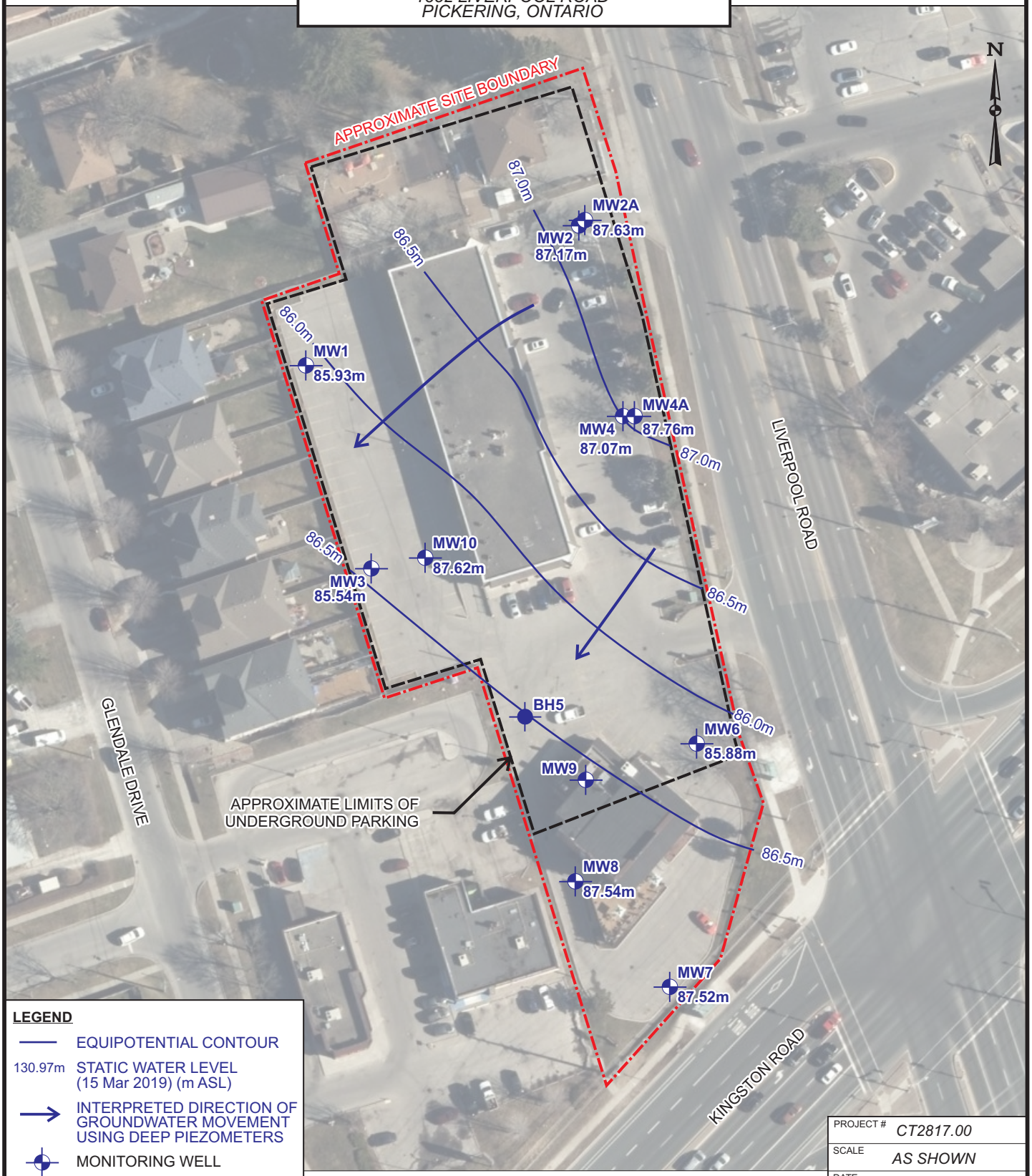
TERRAPEX

GROUNDWATER REGIME MAP

1294 KINGSTON ROAD, 1848 AND 1852 LIVERPOOL ROAD
PICKERING, ONTARIO

CLIENT

ALTONA GROUP



LEGEND

- EQUIPOTENTIAL CONTOUR
- 130.97m STATIC WATER LEVEL (15 Mar 2019) (m ASL)
- INTERPRETED DIRECTION OF GROUNDWATER MOVEMENT USING DEEP PIEZOMETERS
- MONITORING WELL
- BOREHOLE
- APPROXIMATE LIMITS OF UNDERGROUND PARKING

0 25m 50m
(APPROXIMATE)

SOURCE: VUMAP, FIRST BASE SOLUTIONS, 2018 IMAGERY.

PROJECT #	CT2817.00
SCALE	AS SHOWN
DATE	MAY 2019
DRAWN	SF
CHECKED	
DRAWING #	FIGURE 5

Appendix II
Tables

TABLE 1
Monitoring Well Construction Details
1294 Kingston Road, 1848 and 1852 Liverpool Road, Pickering

Position and Depth

Well Desig.	UTM Easting	UTM Northing	Date of Construct	Stick Down	Depth of Borehole	Depth to Well Bottom	Screen Length	Depth to Screen Bottom	Depth to Screen Top	Depth to Top Sand
(m)	(m)	(m)		(m)	(m bg)	(m bg)	(m)	(m bg)	(m bg)	(m bg)
MW1	653399	4855495	13-Jan-19	0.09	15.30	12.29	1.50	12.19	10.69	10.4
MW2	653450	4855523	07-Feb-19	0.13	14.20	12.87	1.50	12.77	11.27	11.0
MW2(A)	653450	4855523	08-Feb-19	0.09	5.20	5.20	3.00	5.10	2.10	1.8
MW3	653412	4855458	07-Jan-19	0.08	16.80	10.80	3.00	10.70	7.70	7.4
MW4	653460	4855487	02-Jan-19	0.21	16.80	11.00	1.50	10.90	9.40	9.1
MW4(A)	653460	4855487	02-Jan-19	0.16	4.50	4.50	1.50	4.40	2.90	2.6
MW6	653473	4855427	02-Feb-19	0.12	14.30	12.32	1.50	12.22	10.72	10.4
MW7	653469	4855382	07-Feb-19	0.15	15.30	4.97	3.00	4.87	1.87	1.6
MW8	653451	4855401	07-Feb-19	0.11	6.10	6.10	3.00	6.00	3.00	2.7
MW9	653452	4855416	31-Mar-19	0.10	3.94	3.94	3.00	3.84	0.84	0.5
MW10	653422	4855460	07-Feb-19	0.11	6.00	5.16	3.00	5.06	2.06	1.8

Key Elevations

Well Desig.	Ground Elev.	End of Borehole Elev.	Top of Pipe Elev.	Screen Bottom Elev.	Screen Top Elev.
	(m asl)	(m asl)	(m asl)	(m asl)	(m asl)
MW1	89.69	74.39	89.60	77.50	79.00
MW2	90.63	76.43	90.50	77.86	79.36
MW2(A)	90.62	85.42	90.53	85.52	88.52
MW3	89.45	72.65	89.37	78.75	81.75
MW4	90.20	73.40	89.98	79.30	80.80
MW4(A)	90.23	85.73	90.07	85.83	87.33
MW6	89.68	75.38	89.56	77.46	78.96
MW7	89.02	73.72	88.87	84.15	87.15
MW8	89.22	83.12	89.11	83.22	86.22
MW9	87.70	83.76	87.60	83.86	86.86
MW10	89.48	83.48	89.37	84.42	87.42

Notes:
1. m asl = metres above sea level
2. m bg = metres below ground (or grade)
3. UTM locations measured by GNSS device
4. Elevations interpolated from survey points

TABLE 2
Observed Groundwater Levels
1294 Kingston Road, 1848 and 1852 Liverpool Road, Pickering

Well Desig.	Date	Ground Elev. (m asl)	Top Pipe Elev. (m asl)	Well Depth (m bg)	Groundwater Depth (m bmp)	Groundwater Depth (m bg)	Groundwater Elev. (m asl)
MW1	15-Feb-19	89.69	89.60	12.29	3.20	3.29	86.41
	22-Feb-19				3.36	3.45	86.24
	01-Mar-19				3.77	3.86	85.83
	15-Mar-19				3.67	3.76	85.93
MW2	15-Feb-19	90.63	90.50	12.87	3.49	3.62	87.01
	22-Feb-19				3.37	3.50	87.14
	01-Mar-19				3.55	3.68	86.95
	15-Mar-19				3.33	3.46	87.17
MW2(A)	15-Feb-19	90.62	90.53	5.20	3.21	3.30	87.32
	22-Feb-19				3.67	3.76	86.87
	01-Mar-19				3.22	3.31	87.32
	15-Mar-19				2.90	2.99	87.63
MW3	15-Feb-19	89.45	89.37	10.80	3.68	3.76	85.69
	22-Feb-19				4.11	4.19	85.26
	01-Mar-19				3.98	4.06	85.40
	15-Mar-19				3.83	3.91	85.54
MW4	15-Feb-19	90.20	89.98	11.00	3.26	3.48	86.73
	22-Feb-19				3.23	3.45	86.75
	01-Mar-19				3.12	3.34	86.87
	15-Mar-19				2.91	3.13	87.07
MW4(A)	15-Feb-19	90.23	90.07	4.50	2.28	2.44	87.80
	22-Feb-19				2.47	2.63	87.60
	01-Mar-19				2.39	2.55	87.69
	15-Mar-19				2.31	2.47	87.76
MW6	15-Feb-19	89.68	89.56	12.32	3.58	3.70	85.98
	22-Feb-19				3.88	4.00	85.69
	01-Mar-19				3.77	3.89	85.79
	15-Mar-19				3.68	3.80	85.88
MW7	15-Feb-19	89.02	88.87	4.97	1.70	1.85	87.17
	22-Feb-19				1.73	1.88	87.14
	01-Mar-19				1.61	1.76	87.26
	15-Mar-19				1.35	1.50	87.52

TABLE 2
Observed Groundwater Levels
1294 Kingston Road, 1848 and 1852 Liverpool Road, Pickering

Well Desig.	Date	Ground Elev. (m asl)	Top Pipe Elev. (m asl)	Well Depth (m bg)	Groundwater Depth (m bmp)	Groundwater Depth (m bg)	Groundwater Elev. (m asl)
MW8	15-Feb-19	89.22	89.11	6.10	2.01	2.12	87.10
	22-Feb-19				2.10	2.21	87.02
	01-Mar-19				1.93	2.04	87.18
	15-Mar-19				1.57	1.68	87.54
MW9	22-Feb-19	87.70	87.60	6.10	0.50	0.60	87.10
	01-Mar-19				0.41	0.51	87.19
MW10	15-Feb-19	89.48	89.37	5.16	2.04	2.15	87.33
	22-Feb-19				2.09	2.20	87.28
	01-Mar-19				2.01	2.12	87.36
	15-Mar-19				1.75	1.86	87.62

Notes

1. Ground elevation based on site survey by Topcon GNSS device
2. Tops of pipe elevation based on stick down elevation in relation to ground elevation
3. m asl = metres above sea level
4. m bmp = metres below measurement point
5. m bg = metres below ground

TABLE 3
Summary of Groundwater Quality
1294 Kingston Road, 1848 and 1852 Liverpool Road, Pickering

	Units	Sewers Bylaw		MW8
		Table 1	Table 2	15-Mar-19
MISCELLANEOUS INORGANIC PARAMETERS				
Fluoride	mg/L	10	-	<0.10
pH	pH units	6.0 - 10.5	6.0 - 9.0	7.11
Total Suspended Solids	mg/L	350	***15***	***15.4***
Total Phosphorus	mg/L	10	0.4	0.0052
Cyanide - Total (CN)	mg/L	2	0.02	<0.0020
METALS (Total)				
Aluminium (Al)	mg/L	50	-	<0.050
Antimony (Sb)	mg/L	5	-	<0.0010
Arsenic (As)	mg/L	1	0.02	<0.0010
Cadmium (Cd)	mg/L	0.7	0.008	<0.000050
Chromium (Cr)	mg/L	2	0.08	<0.0050
Cobalt (Co)	mg/L	5	-	<0.0010
Copper (Cu)	mg/L	3	0.05	<0.010
Lead (Pb)	mg/L	1	0.12	<0.00050
Manganese (Mn)	mg/L	5	0.15	0.088
Mercury (Hg)	mg/L	0.01	0.0004	<0.000010
Molybdenum (Mo)	mg/L	5	-	<0.00050
Nickel (N)	mg/L	2	0.08	<0.0050
Selenium (Se)	mg/L	1	0.02	<0.00050
Silver (Ag)	mg/L	5	0.12	<0.00050
Tin (Sn)	mg/L	5	-	<0.0010
Titanium (Ti)	mg/L	5	-	<0.0030
Zinc (Zn)	mg/L	2	0.04	<0.030
MICROBIOLOGICAL AND NUTRIENTS				
Escherichia coli	CFU/100 mL	-	200	0
Oil & Grease: Animal and Vegetable	mg/L	150	-	<2.0
Mineral Oil and Grease	mg/L	15	-	<1.0
Biological Oxygen Demand (BOD)	mg/L	300	15	<3.0
Phenols (4AAP)	mg/L	1	0.008	<0.0010
Sulfate (SO4)	mg/L	1500	-	63
Total Kjeldahl Nitrogen (TKN)	mg/L	100	1	0.24

Notes

1. Table 1 is the specified criteria for sanitary and combined sewers
2. Table 2 is the specified criteria for storm sewer
3. Values based on Durham sanitary sewer bylaw (55-2013)
4. Bold and italic values at least exceed either Table 1 or Table 2, as highlighted
5. mg/L = milligrams per litre
6. CFU/100mL = colony forming units per 100 millilitres
8. "-" indicates no established criteria for the parameter

TABLE 3
Summary of Groundwater Quality
1294 Kingston Road, 1848 and 1852 Liverpool Road, Pickering

	Units	Sewers Bylaw		MW8
		Table 1	Table 2	15-Mar-19
VOLATILE ORGANIC COMPOUNDS				
Benzene	ug/L	10	2	<0.50
Chloroform	ug/L	40	2	<1.0
Dichlorobenzene, 1,2-	ug/L	50	5.6	<0.50
Dichlorobenzene,1,4-	ug/L	80	6.8	<0.50
Dichloroethylene, cis-1,2-	ug/L	4000	5.6	<0.50
Dichloropropene, trans-1,3-	ug/L	140	5.6	<0.50
Ethylbenzene	ug/L	160	2	<0.50
Methyl Ethyl Ketone	ug/L	8000	-	<20
Styrene	ug/L	200	-	<0.50
Tetrachloroethane, 1,1,2,2-	ug/L	1400	17	<0.50
Tetrachloroethylene	ug/L	1000	4.4	<0.50
Toluene	ug/L	270	2	<0.50
Trichloroethylene	ug/L	400	8	<0.50
Xylenes (Total)	ug/L	1400	4.4	<1.1
SEMIVOLATILE ORGANIC COMPOUNDS				
Bis (2-ethylexyl) phthalate	ug/L	12	8.8	<2.0
Di-N-Butyl phthalate	ug/L	80	15	<1.0
MISCELLANEOUS ORGANIC PARAMETERS				
Nonylphenols (Total)	ug/L	20	-	<1.0
Nonylphenol Ethoxylate (Total)	ug/L	200	-	<2.0
PCBs	ug/L	1	0.4	<0.040

Notes

1. Table 1 is the specified criteria for sanitary and combined sewers
2. Table 2 is the specified criteria for storm sewer
3. Values based on Durham sanitary sewer bylaw (55-2013)
4. Bold and italic values at least exceed either Table 1 or Table 2, as highlighted
5. mg/L = milligrams per litre
6. CFU/100mL = colony forming units per 100 millilitres
7. ND = below laboratory reported detection limits. See laboratory report for detailed values.
8. "-" indicates no established criteria for the parameter

TABLE 4
Predicted Construction Dewatering Rate for Parking Garage
1294 Kingston Road, 1848 and 1852 Liverpool Road, Pickering

Parameter	Value	Units	Symbol	Origin of Value
Aquifer Hydraulic Conditions				
Hydraulic conductivity	3E-06	m/s	K	Highest observed in field tests
Hydraulically connected to water table				Unconfined is anticipated
Analogous Dewatering Array Dimensions				
Analogous shape	Trench			
Long axis along excavation	131.0	m	X	Based on design plans, average length
Short axis along exavation	55.4	m	J	= A / X (ie average length)
Garage footprint area to be dewatered	7,258	m^2	A	Based on design plans
Radius of equivalent wells at short sides	27.7	m	R_W	= J / 2
Subsurface Vertical Dimensions				
Surface grade (general average)	89.2	masl	E_G	Site Survey
Number of basement levels	3		N	Based on design plans
Height of single subsurface level	3.1	m	C	Average based on slab depth, =D_F / N
Foundation slab (upper surface), depth	9.2	mbg	D_F	Based on design plans
Foundation slab (upper surface), elevation	80.0	masl	E_F	= E_G - N * C
Elevation difference between excavation base and foundation slab surface	1.5	m		Typical for this type of structure
Excavation base (bases of footings), elevation	78.5	masl	E_{EX}	Assumed 1.5 m lower than foundation slab surface
Excavation base (bases of footings), depth	10.7	mbg	D_{EX}	Assumed 1.5 m deeper than foundation slab surface
Assumed elevation difference between excavation base and reference datum	3.0	m		
Reference datum (for calculation)	75.5	masl	E_{RD}	Set at 3 m below base of excavation
Dewatering Levels and Dimensions				
Water table observed, elevation	87.8	masl	EW_{HIGH}	Highest of field measurements.
Average water table observed, depth	2.1	m	DW_{SHALL}	= E_G - EW_{HIGH}
Buffer for seasonal fluctuation	0.5	m	B	Based on water levels mostly observed in late winter
Water table elevation (pre-pumping level)	88.3	masl	$EW_{HIGHEST}$	= EW_{HIGH} + B. Allows for seasonal fluctuation
Height of water table above reference datum	12.8	m	H	= $EW_{HIGHEST}$ - E_{RD}
Target dewatering level, elevation	77.5	m asl	EW_{TARG}	Target is 1 m lower than excavation base. = E_{EX} - 1.0
Target dewatering level, depth	11.7	mbg	DW_{TARG}	Target is 1 m deeper than excavation base. = D_{EX} + 1
Height of target water level above datum	2.0	m	h_T	Target is 1 m below excavation base
Radius of Influence				
Applied equation	$R_O = 3000 * (H - h_T) * (K)^{0.5}$			Sichart and Kryieleis (1930)
Radius of Influence	56	m	R_O	As measured from excavation edge
Equivalent line source	28	m	L	Half of radius of influence
Incident Stormwater				
Excavation open area	7,258	m^2	A	Excavation design
Typical large storm	25	mm/day	P_T	Assumed. Typically 4-5 events/year. Larger is possible.
Stormwater (i.e. from precipitation)	181	m^3/day	Q_{STORM}	= A * P_T
Change of units (rounded)	181,450	litres/day	Q_{STORM}	
Estimated Flows to be Managed				
Applied equation for trench long sides	$Q_{GW} = 2 * X * K * (H^2 - h_T^2) / (3.34 \times 10^{-5} * L)$			Powers et. al, 2007
Applied equation for trench short sides	$Q_{GW} = K * (H^2 - h_T^2) / (5.31 \times 10^{-6} * \ln((R_O+R_W/R_W))$			Powers et. al, 2007
Groundwater seepage from long sides	134.1	litres/min	Q_{GW-LS}	Calculated from values in this sheet.
Groundwater seepage from short sides	81.6	litres/min	Q_{GW-ShS}	Calculated from values in this sheet.
Groundwater seepage from all sides	215.6	litres/min	$_{GW-ShS}$ + Q_{GW-LS}	
Change of units	310,493	litres/day		
Safety factor	2.0			Allow for unknown conditions between boreholes or beyond the excavation walls
Groundwater seepage, with safety factor	620,986	litres/day		= Safety Factor x Q_{GW}
Groundwater seepage plus storm water	802,436	litres/day		= Safety Factor x Q_{GW} + Q_{STORM}
Applicable Regulatory Instrument	**PTTW Required**			MECP, O.Reg 245/11, O.Reg 387/04; OWRA S.41
Value to specify in regulatory instrument	***802,400***	litres/day		Value includes stormwater.

Notes.
1 Patrick Powers, Arthur Corwin, Paul Schmall, Walter Kaeck. 2007. Construction Dewatering and Groundwater Control. Third Edition.
2. mbg = metres below ground level
3. masl = metres above sea level

TABLE 5
Predicted Foundation Drainage Rate for Parking Garage
1294 Kingston Road, 1848 and 1852 Liverpool Road, Pickering

Parameter	Value	Units	Symbol	Origin of Value
Aquifer Hydraulic Conditions				
Hydraulic conductivity	3E-06	m/s	K	Highest observed in field tests
Hydraulically connected to water table (unconfined)				Unconfined
Analogous Dewatering Array Dimensions				
Analogous shape	Trench			
Long axis along excavation	131.0	m	X	Based on design plans, average length
Short axis along exavation	55.4	m	J	= A / X (ie average length)
Garage footprint area to be dewatered	7,258	m^2	A	Based on design plans
Radius of an equivalent well at ends	27.7	m	R_W	= J / 2
Subsurface Vertical Dimensions				
Surface grade (approximate average)	89.2	masl	E_G	Site Survey
Number of basement levels	3		N	Based on design plans
Height of single subsurface level	3.1	m	C	Average based on slab depth, =D_F / N
Foundation slab (upper surface), depth	9.2	mbg	D_F	Based on design plans
Foundation slab (upper surface), elevation	80.0	masl	E_F	= E_G - N * C
Elevation difference between foundation slab and foundation drains	0.3	m		Assumed, common design
Foundation drains, elevation	79.7	masl	E_{EX}	Assumed 0.3 m lower than foundation slab surface
Foundation drains, depth	9.5	mbg	D_{EX}	Assumed 0.3 m deeper than foundation slab surface
Elevation difference between foundation drain and reference datum	3.0	m		Assumed
Reference datum (for calculation)	76.7	masl	E_{RD}	Set at 3 m below foundation drains
Dewatering Levels and Dimensions				
Average water table observed, elevation	87.8	masl	EW_{HIGH}	Highest of field measurements.
Average water table observed, depth	2.1	m	DW_{SHALL}	= E_G - EW_{HIGH}
Buffer for seasonal fluctuation	0.5	m	B	Based on water levels mostly observed in late winter
Water table elevation (pre-pumping level)	88.3	masl	$EW_{HIGHEST}$	= EW_{HIGH} + B. Allows for seasonal fluctuation
Height of water table above reference datum	11.6	m	H	= $EW_{HIGHEST}$ - E_{RD}
Target dewatering level, elevation	79.7	m asl	EW_{TARG}	Target is foundation drain elevation
Target dewatering level, depth	9.5	mbg	DW_{TARG}	Target is 1 m below excavation base. = D_{EX} + 1
Height of target water level above datum	3.0	m	h_T	Target is 1 m below excavation base
Radius of Influence				
Applied equation	$R_O = 3000 * (H - h_T) * (K)^{0.5}$			Sichart and Kryieleis (1930)
Radius of Influence	45	m	R_O	As measured from excavation edge
Equivalent line source	22	m	L	Half of radius of influence
Estimated Flows to be Managed				
Applied equation for trench long sides	$Q_{GW} = 2 * X * K * (H^2 - h_T^2) / (3.34 \times 10^{-5} * L)$			Powers et. al, 2007
Applied equation for trench short sides	$Q_{GW} = K * (H^2 - h_T^2) / (5.31 \times 10^{-6} * \ln((R_O+R_W/R_W))$			Powers et. al, 2007
Groundwater seepage from long sides	132.2	litres/min	Q_{GW-LS}	Calculated from values in this sheet.
Groundwater seepage from short sides	73.9	litres/min	Q_{GW-ShS}	Calculated from values in this sheet.
Groundwater seepage from all sides	206.1	litres/min	Q_{GW-ShS} + Q_{GW-LS}	
Change of units	296,779	litres/day		
Safety factor	2.0			Allow for unknown conditions between boreholes or beyond the excavation walls
Groundwater seepage, with safety factor	593,557	litres/day		= Safety Factor x Q_{GW}

Notes.

1 Patrick Powers, Arthur Corwin, Paul Schmall, Walter Kaeck. 2007. Construction Dewatering and Groundwater Control. Third Edition.

2. mbg = metres below ground level

3. masl = metres above sea level

Appendix III
Borehole Records

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon		**BH No.: MW1**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 88.65	
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING:	PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
	150 mm Asphaltic Concrete	0	88.5	50/125		1		50/125		Groundwater measured at 3.27 m below ground surface on February 15, 2019
	(FILL) brown to dark brown coarse to fine sand some gravel, trace brick fragments	0.5	88							
	(FILL) dark brown silty clay	1	87.5	9		2		9		Bentonite
		1.5	87	14		3		14		Hollow Stem augers used to start drilling at MW1
	yellow -brown grey	2	86.5							
	varved SILTY CLAY slightly moist	2.5	86							
	------	3	85.5	6		4		6		Mud rotary drilling started at 3.5 m depth
▼	yellow -brown oxidized lenses	3.5	85							
	grey CLAY some gravel wet	4	84.5							
		4.5	84	4		5		4		
		5	83.5							
		5.5	83							
	grey SANDY SILTY CLAY some gravel	6	82.5	0		6		0		Weight of hammer/450 mm
		6.5	82							
		7	81.5							
	grey SILTY SAND some gravel some clay (TILL)	7.5	81	54		7		54		
		8	80.5							
		8.5	80							
		9	79.5	91/225		8		91/225		
		9.5	79							

alston associates
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LOGGED BY: JA	DRILLING DATE: 13 January, 2019
REVIEWED BY: VN	Page 1 of 2

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon		**BH No.: MW1**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 88.65	
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING:	PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		grey SILTY SAND some gravel some clay (TILL)	10	78.5							Bentnonite
			10.5	78	50/100		9		50/100		Sand
			11	77.5							Sand and Screen
			11.5	77							
			12	76.5	50/100		10		50/100		
			12.5	76							
			13	75.5							
			13.5	75							
			14	74.5	50/125		11		50/125		
			14.5	74							
			15	73.5							
					50/100		12		50/100		
		END OF BOREHOLE									

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LOGGED BY: JA | DRILLING DATE: 13 January, 2019

REVIEWED BY: VN |

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon	**BH No.: MW2**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 89.66
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING: PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SAMPLE NO.	SAMPLE TYPE	SPT(N)	REMARKS
	100 mm Asphaltic Concrete	0	89.5				Groundwater measured at 3.56 m below ground surface on February 15, 2019.
	(Fill) silty and gravelly sad, moist	0.5	89	1A		28	
		1		1B			
		1.5	88.5	2		6	Bentonite
	brown varved SILTY CLAY moist	2	88				Hollow stem augering used st start drilling at MW2
		2.5	87.5	3		3	
		3	87	4		7	
	brown -grey, moist to wet	3.5	86.5	5		19	
	SAND and SILT trace gravel trace clay	4	86				
	grey, wet	4.5	85.5	6		7	
		5	85	7		10	
		5.5	84.5				
	grey SILTY CLAY some gravel	6	84	8		5	
		6.5	83.5				
		7	83				
		7.5	82.5				
		8	82	9		16	Mud rotary drilling started at 8.0 m depth.
		8.5	81.5				
	grey SILTY SAND some gravel some clay (TILL)	9	81				
		9.5	80.5	10		29	
			80				

Shear Strength (kPa) ● 40 80 120 160
N-Value (Blows/300mm) ▲ 20 40 60 80
Water Content (%) PL W.C. LL 20 40 60 80

28 6 3 7 19 7 10 5 16 29

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LOGGED BY: ALPK | DRILLING DATE: 7 February, 2019
REVIEWED BY: VN |

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon	**BH No.: MW2**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 89.66
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING: PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		grey SILTY SAND some clay some gravel (TILL)	10	79.5							Bentonite
			10.5	79	38		11		38		Sand
			11	78.5							Sand and Screen
			11.5	78							
			12	77.5	44		12		44		
			12.5	77							
			13	76.5							
			13.5	76	38		13		38		
			14	75.5							
		END OF BOREHOLE									

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LOGGED BY: ALPK | DRILLING DATE: 7 February, 2019
REVIEWED BY: VN |

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon		**BH No.: MW2A**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 89.66	
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING:	PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
▼		For soil stratigraphy refer to MW2	0 – 5	89.5 – 84.5						Sand / Sand and Screen	Groundwater measured at 3.28 m below ground surface on February 15, 2019. Bentonite
		END OF BOREHOLE									

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LOGGED BY: DM | DRILLING DATE: 8 February, 2019
REVIEWED BY: VN | Page 1 of 1

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon		**BH No.: MW3**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 88.52	
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING:	PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		150 mm Asphaltic Concrete	0	88.5							Groundwater measured at 3.75 m below ground surface on February 15, 2019.
		450 mm Granular Base	0.5	88			1A		76		
		(FILL) dark brown to brown sandy silty clay					1B				
			1	87.5			2		5		Bentonite
		varved, brown -grey, moist	1.5	87			3		7		
			2	86.5							
			2.5	86			4		5		
		------ brown -grey, wet ------	3	85.5			5		6		
			3.5	85							
		SILTY CLAY trace sand trace gravel	4	84.5			6		3		
			4.5	84							
		grey, wet	5	83.5			7		1		
			5.5	83							
			6	82.5							
			6.5	82			8		2		
			7	81.5							
		grey SILTY SAND some gravel some clay (TILL)	7.5	81			9		69		Sand
			8	80.5							
			8.5	80							Sand and Screen
			9	79.5			10		57		
			9.5	79							

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LOGGED BY: DM | DRILLING DATE: 7 January, 2019

REVIEWED BY: VN | Page 1 of 2

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon	**BH No.: MW3**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 88.52
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING: PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		grey SILTY SAND some gravel some clay (TILL)	10 – 11.5	78.5 – 77	50/150	8	11		50/150		Sand and Screen
		grey to dark grey SANDY SILT wet to moist	12 – 12.5	76.5 – 76	50/125	8, 13	12		50/125		
		grey SILTY SAND some gravel some clay (TILL)	13 – 16	75.5 – 72	50/150; 50/150; 50/75	7; 7; 10	13; 14; 15		50/150; 50/150; 50/75		
		grey weathered SHALE	16.5	72							
		END OF BOREHOLE									

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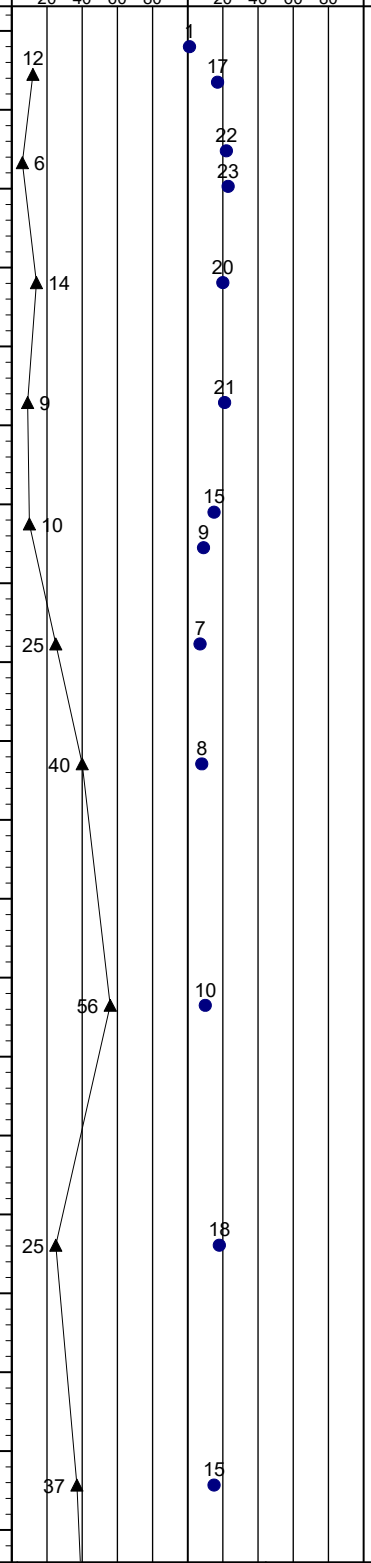
REVIEWED BY: VN | Page 2 of 2

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon	**BH No.: MW4**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 89.15
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING: PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		200 mm Asphaltic Concrete	0	89							
		(FILL) brown gravelly sand base brown clayey silt	0.5	88.5							
		varved, brown, moist	1	88							
		------	1.5	87.5							
		SILTY CLAY varved, brown, wet	2	87							
		------	2.5	86.5							
▼		grey, wet	3	86							
			3.5	85.5							
		moist	4	85							
			4.5	84.5							
		------	5	84							
		wet	5.5	83.5							
		grey SILTY SAND some gravel some clay (TILL)	6	83							
			6.5	82.5							
			7	82							
			7.5	81.5							
			8	81							
			8.5	80.5							
			9	80							
			9.5	79.5							



SAMPLE NO.	SAMPLE TYPE	SPT(N)
1A		
1B		12
2A		6
2B		
3		14
4		9
5A		10
5B		
6		25
7		40
8		56
9		25
10		37

REMARKS: Groundwater at 3.32 m below ground surface on February 15, 2019.

Well Construction: Bentonite

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LOGGED BY: DM	DRILLING DATE: 2 January, 2019
REVIEWED BY: VN	Page 1 of 2

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon		**BH No.: MW4**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 89.15	
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING:	PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		grey SILTY SAND some gravel some clay (TILL) wet	10 – 11.5	79 – 77.5	43	14	11		43		Sand; Sand and Screen
		grey CLAYEY SILT trace sand trace gravel moist (TILL)	12 – 14	77 – 75	48; 50/125	14; 7	12; 13		48; 50/125		Bentonite
		dark brown SANDY SILTY CLAY some gravel	14.5 – 16	74.5 – 73	62	9	14		62		
		grey weathered SHALE	16.5	72.5	50/25	15	15		50/25		
		END OF BOREHOLE									

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon		**BH No.: MW4A**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 89.15	
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING:	PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
▼		For stratigraphy please refer to MW4	0 0.5 1 1.5 2 2.5 3 3.5 4 4.5	89 88.5 88 87.5 87 86.5 86 85.5 85							Concrete Groundwater at 2.34 m below ground surface on February 15, 2019. Bentonite Sand Sand and Screen
		END OF BOREHOLE									

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LOGGED BY: DM	DRILLING DATE: 2/3 January, 2019
REVIEWED BY: VN	Page 1 of 1

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon		**BH No.: 5**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 88.42	
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING:	PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		150 mm Asphaltic Concrete	0	88	15		1A				
		450 mm Granular Base	0.5				1B		15		
		(FILL) dark brown silty clay some organics	1	87.5	7		2		7		
		varved, brown	1.5	87							
			2	86.5	6		3		6		
		moist to wet	2.5	86	10		4A		10		
		SILTY CLAY trace to some sand trace gravel	3	85.5			4B				
		------	3.5	85	4		5		4		
		grey	4	84.5	79+		6A		4		
			4.5	84	4		6B				
			5	83.5	1		7		1		
			5.5	83	35 (6)						
		dark grey SANDY SILTY CLAY trace gravel (TILL)	6	82.5							
			6.5	82	36		8		36		
		dark grey GRAVELLY SAND some silt some clay (TILL) moist to wet	7	81.5							
			7.5	81							
			8	80.5	56		9		56		
			8.5	80							
		dark grey SILTY SAND trace to some clay trace to some gravel (TILL), moist	9	79.5							
			9.5	79	50/100		10		50/100		

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LOGGED BY: DM | DRILLING DATE: 3/4 January, 2019

REVIEWED BY: VN |

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon	**BH No.: 5**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 88.42
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING: PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		grey medium to coarse SAND and gravel trace silt wet	10 – 11	78.5 – 77.5	50/75		11		50/75		
		grey SILTY SAND some gravel some clay (TILL)	11 – 13	77 – 74.5	50/100, 50/150		12, 13		50/100, 50/150		
		grey weathered SHALE	13 – 15.5	74 – 72.5	50/25, 50/25		14A 14B, 15		50/25, 50/25		
		END OF BOREHOLE	16								

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LOGGED BY: DM | DRILLING DATE: 3/4 January, 2019
REVIEWED BY: VN |

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon		**BH No.: MW6**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 88.66	
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING:	PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		100 mm Asphaltic Concrete	0	88.5							Groundwater at 3.65 m below ground surface on February 15, 2019.
		(FILL) brown sandy silt some gravel, damp	0.5	88	53		1		53		
			1	87.5	3		2		3		Bentonite
		varved, yellow -brown	1.5	87	5	10	3		5		
			2	86.5							
			2.5	86	6		4		6		
		SILT and CLAY trace to some sand moist	3	85.5	6		5		6		
▼			3.5	85							
		brown -grey	4	84.5							
			4.5	84	2		6		2		
			5	83.5							
			5.5	83							
		grey SILTY SAND some clay some gravel (TILL) slightly moist	6	82.5	31		7		31		
			6.5	82							
			7	81.5							
			7.5	81	32		8		32		
			8	80.5							
			8.5	80							
			9	79.5	98/250		9		98/250		
			9.5	79							

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LOGGED BY: JA	DRILLING DATE: 2 February 2019
REVIEWED BY: VN	Page 1 of 2

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon	**BH No.: MW6**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 88.66
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING: PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		------	10	78.5							Bentonite
		occasional sand seams, wet	10.5	78	84/275		10		84/275		Sand
		------	11	77.5							Sand and Screen
		grey SILTY SAND some clay some gravel (TILL)	11.5	77							
		wet	12	76.5	88		11		88		
		------	12.5	76							
		shale fragments	13	75.5							
			13.5	75	50/140		12		50/140		
			14	74.5							
		END OF BOREHOLE									

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon		**BH No.: MW7**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 88.02	
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING:	PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		100 mm Asphaltic Concrete	0	88							Groundwater at 1.77 m below ground surface on completion.
		(FILL) dark brown to brown clayey silt some sand, trace gravel trace brick fragments	0.5	87.5	30		1		30		
			1	87	9		2		9		Bentonite
▼		yellow -brown, oxidized lenses, moist	1.5	86.5							Sand
		varved SILTY CLAY	2	86	5		3		5		
			2.5	85.5	3		4		3		Sand and Screen
		------	3	85							
		wet	3.5	84.5	4		5		4		
		brown-grey CLAYEY SILT wet	4	84	4		6		4		
			4.5	83.5							Weight of hammer/450
		grey SILTY CLAY some gravel wet	5	83	0		7		0		
			5.5	82.5	0		8		0		Weight of hammer/450
			6	82							
			6.5	81.5	5		9		5		
		grey SILTY SAND some clay some gravel (TILL) wet	7	81							
			7.5	80.5							
			8	80	42		10		42		
			8.5	79.5							
			9	79							
			9.5	78.5	58		11		58		

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LOGGED BY: JA | DRILLING DATE: 7 February 2019

REVIEWED BY: VN

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon	**BH No.: MW7**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 88.02
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING: PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		grey SILTY SAND some clay some gravel (TILL) wet	10 – 12.5	78 – 75.5	74, 58		12, 13		74, 58		
		grey GRAVELLY coarse to fine SAND some silt (TILL)	12.5 – 15	75.5 – 73	54, 50/75		14, 15		54, 50/75		
		END OF BOREHOLE									

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LOGGED BY: JA | DRILLING DATE: 7 February 2019
REVIEWED BY: VN |

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon	**BH No.: MW8**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 88.15
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING: PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
	50 mm Asphaltic Concrete	0	88	8		1		8		Groundwater at 2.08 m below ground surface on February 15, 2019.
	(FILL) 100 mm brown sand and gravel base									
	(FILL) brown clayey silt, moist	0.5	87.5							
	(FILL) brown silty sand trace clay, moist	1	87	8		2		8		Bentonite
	varved, brown, oxidized lenses	1.5	86.5	7		3		7		
	------	2	86							
		2.5	85.5	5		4		5		Sand
	grey -brown, moist	3	85	4		5		4		Sand and Screen
	SILTY CLAY	3.5	84.5							
	------									
	grey -brown, wet	4	84	3		6		3		
	------	4.5	83.5	2		7		2		
	grey, wet	5	83							
		5.5	82.5	2		8		2		
		6								
	END OF BOREHOLE									

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LOGGED BY: ALPK	DRILLING DATE: 7 February 2019
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CLIENT: Altona Group	METHOD: Manual Split Spoon Sampling	**BH No.: MW9**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN / ELEV. (m) 86.7	
LOCATION: 1294 Kingston Road, Pickering	NORTHING: / EASTING:	PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		150 mm Concrete	0	86.5	40 80 120 160 / 20 40 60 80	20 40 60 80					Interior borehole advanced in basement of Liverpool John's Pub. Samples were collected using direct push technology. No SPT's were performed. Groundwater measured at 0.55 m below basement floor slab on February 22, 2019.
▼		varved, brown, oxidized lenses	0.5	86			1		-		Sand
			1								
		brown	1.5	85.5			2		-		
		SILTY CLAY	2	85			3		-		Sand and Screen
		------	2.5	84.5							
		grey	3	84			4		-		
			3.5	83.5			5		-		
		END OF BOREHOLE		83							

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LOGGED BY: ALPK	DRILLING DATE: 31 January 2019
REVIEWED BY: VN	Page 1 of 1

CLIENT: Altona Group	METHOD: Hollow Stem Auger and Split Spoon		**BH No.: MW10**
PROJECT: Liverpool House Condos	PROJECT ENGINEER: VN	ELEV. (m) 88.50	
LOCATION: 1294 Kingston Road, Pickering	NORTHING:	EASTING:	PROJECT NO.: 18-204

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		50 mm Asphaltic CONCRETE	0	88.5							Groundwater at 2.11 m below ground surface on February 15, 2019.
		(FILL) brown sand and gravel trace silt, trace brick fragments	0.5	88	55		1		55		
		(FILL) brown clayey silt trace organics, moist	1	87.5	7		2		7		Bentonite
			1.5	87							Sand
▼		varved, brown, moist	2	86.5	3		3		3		
		------									Sand and Screen
			2.5	86	4		4		4		
		grey -brown, wet	3	85.5							
		SILTY CLAY			4		5		4		
			3.5	85							

			4	84.5	1		6		1		
		grey, wet	4.5	84							
					1		7		1		
			5	83.5							
			5.5	83	1		8		1		
		END OF BOREHOLE									

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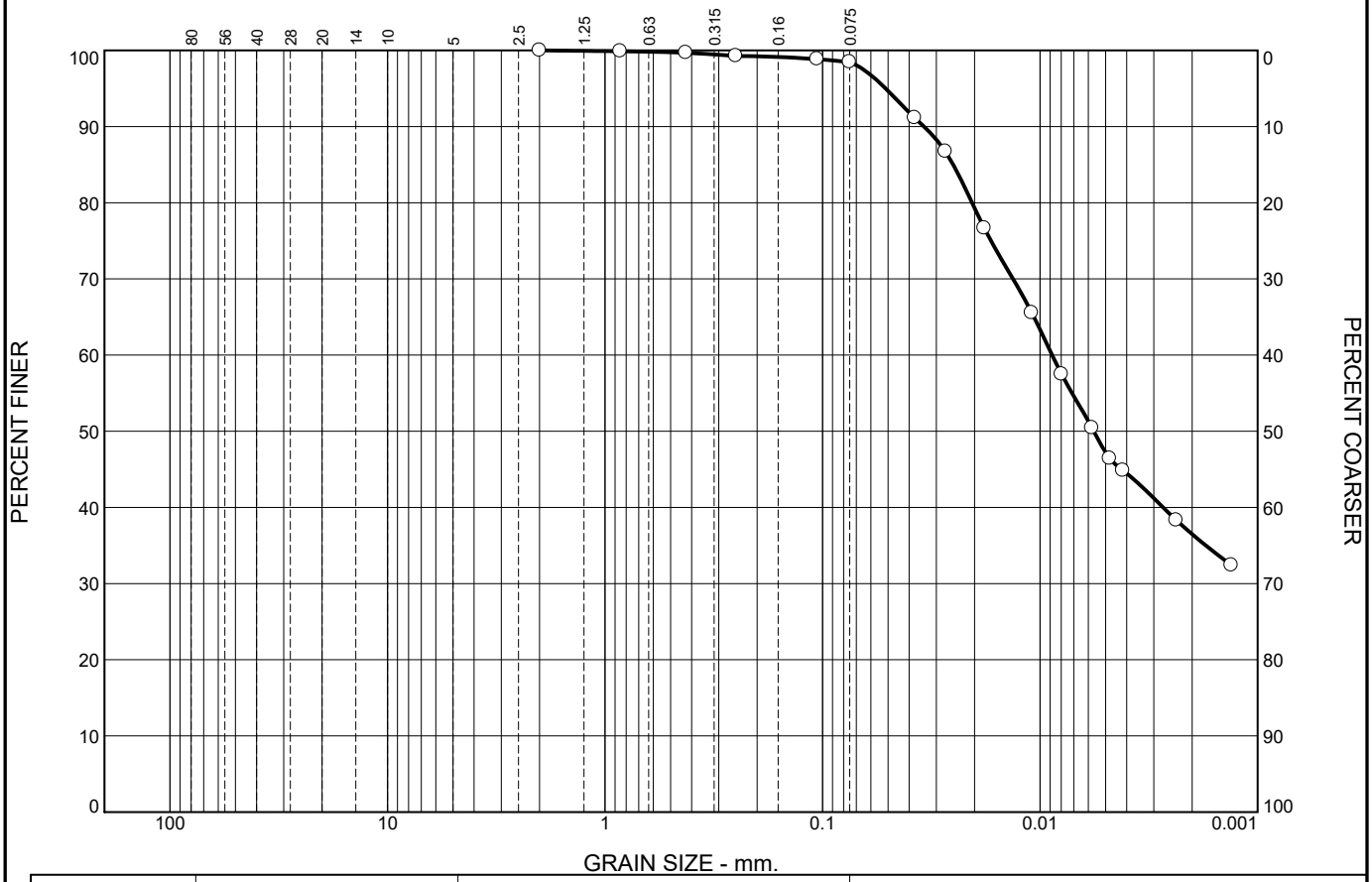
LOGGED BY: ALPK | DRILLING DATE: 7 February 2019
REVIEWED BY: VN | Page 1 of 1

Grain Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	0	2	62	36

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.0251	0.0088	0.0057					

Material Description	USCS	AASHTO
○ SILT and CLAY trace sand		

Project No. 18-204 **Client:** Altima Group

Project: 1294 Kingston Road Pickering

○ **Location:** Borehole 6 **Sample Number:** Sample 3

Date: ○ 6 February 2019

Remarks:

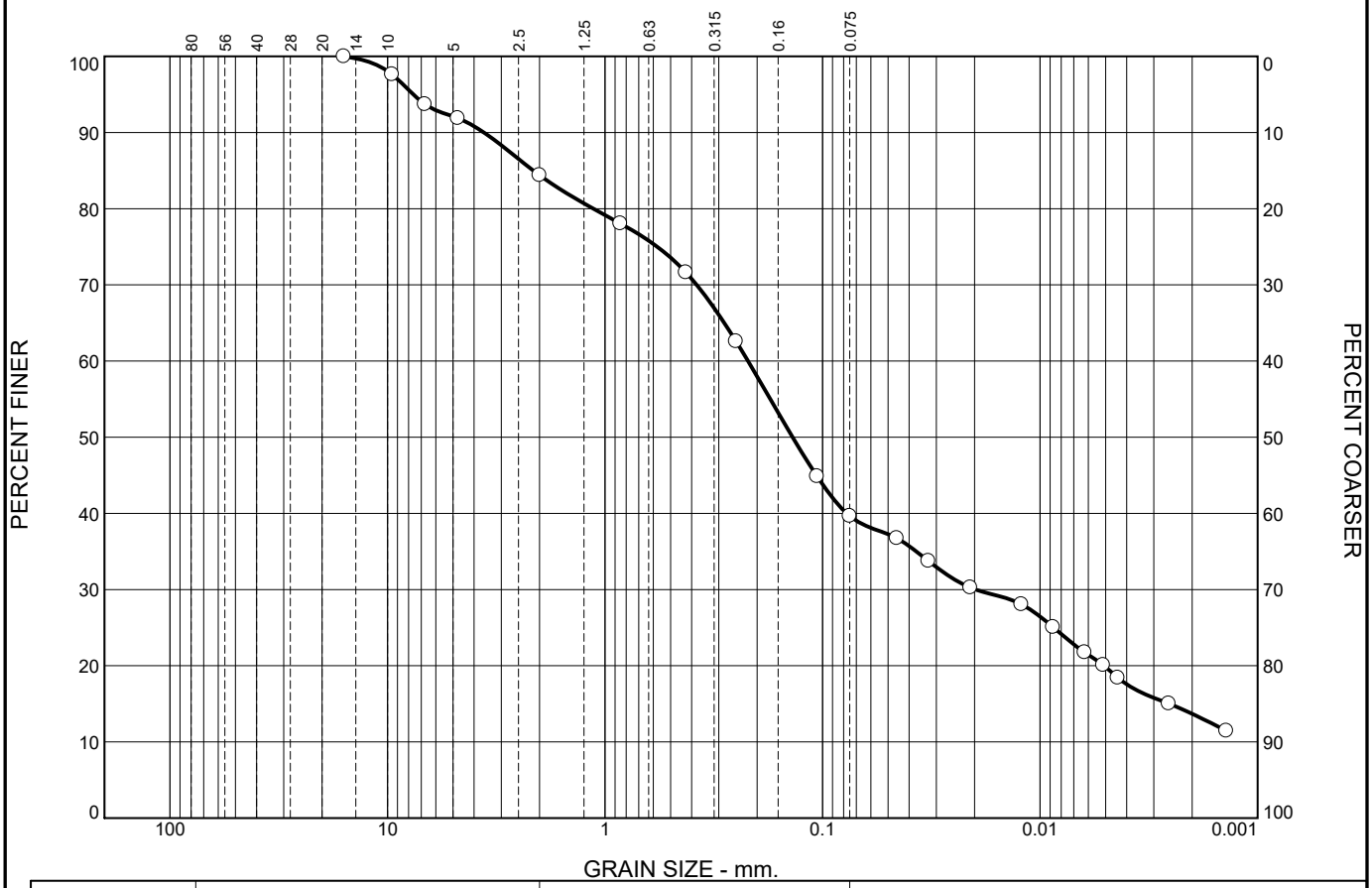
Alston Associates

Geotechnical Division of Terrapex

Figure 1

Tested By: VP **Checked By:** DM

Grain Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0	16	12	32	26	14

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				2.1356	0.2202	0.1374	0.0198	0.0025			

Material Description	USCS	AASHTO
○ SILTY SAND, some gravel, some clay		

Project No. 18-204 **Client:** Altona Group

Project: 1294 Kingston Road, Pickering

○ **Location:** Borehole 3 **Sample Number:** Sample 9

Date: ○ Feb 6, 2019

Remarks:

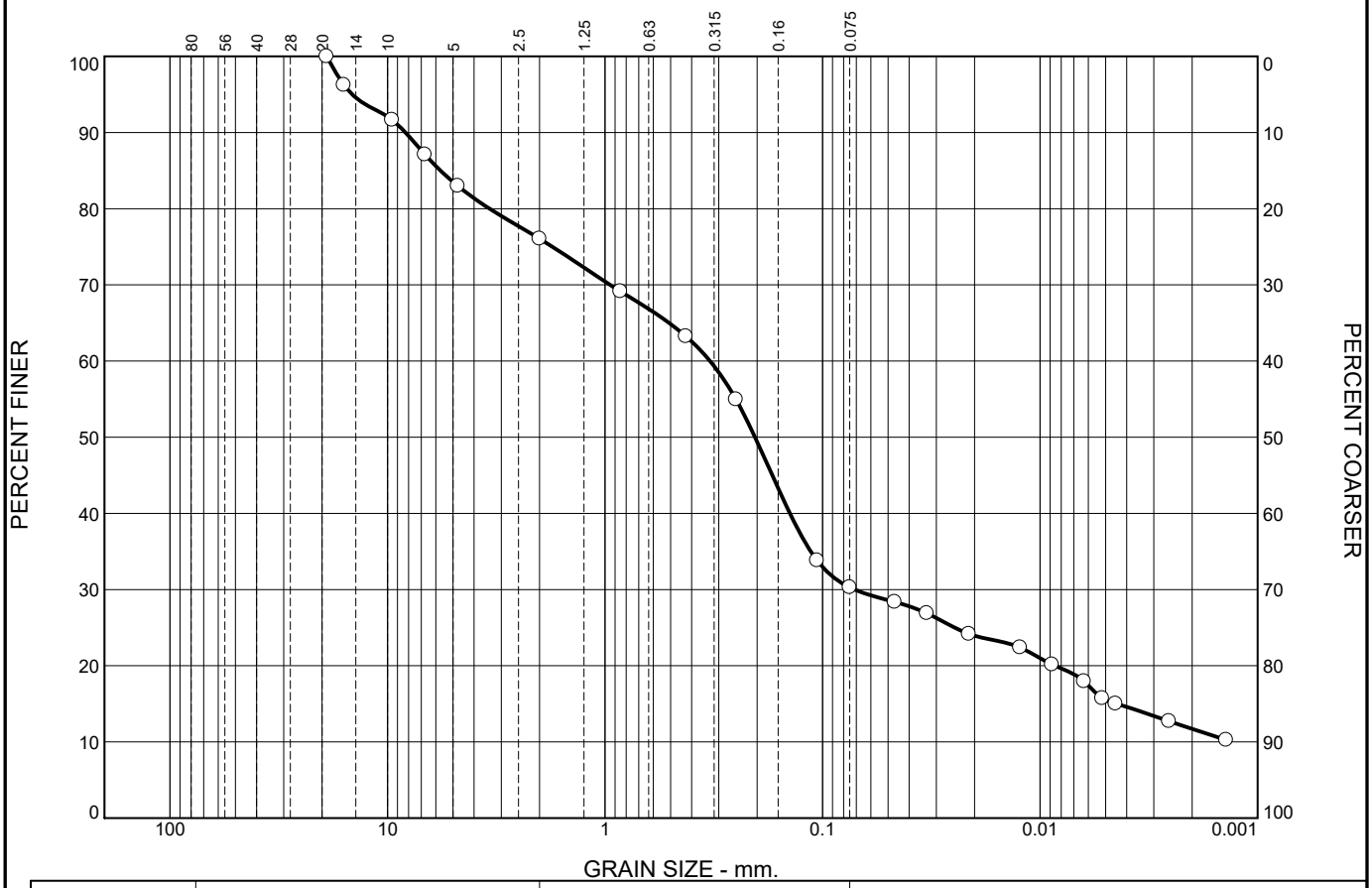
Alston Associates

Geotechnical Division of Terrapex

Figure 3

Tested By: ND/VP

Grain Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0	24	13	33	18	12

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				5.7075	0.3292	0.2045	0.0712	0.0045			

Material Description	USCS	AASHTO
○ GRAVELLY SAND, some silt, some clay		

Project No. 18-204 **Client:** Altona Group

Project: 1294 Kingston Road, Pickering

○ **Location:** Borehole 5 **Sample Number:** Sample 9

Date: ○ Feb 6, 2019

Remarks:

Alston Associates

Geotechnical Division of Terrapex

Figure 2

Tested By: ND/VP

Water Well Records

April 1, 2019

8:57:36 AM

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
PICKERING TOWN	17 653617 4855025 W	2012-10 7215						7194742 (C19399) A139600 P	
PICKERING TOWN	17 653802 4855654 W	2009-06 7303	1.97			MO		7125844 (Z89154) A	
PICKERING TOWN	17 653787 4855401 W	2009-06 6607				MO		7127684 (M05177) A	
PICKERING TOWN	17 653812 4855670 W	2009-08 6607	2.00	UK 0010		MO		7130872 (M05611) A088152	SILT SNDY 0010 CLAY SLTY 0015
PICKERING TOWN	17 653817 4855662 W	2011-03 6607						7161801 (M08456) A110392 P	
PICKERING TOWN	17 653812 4855670 W	7303						7162148 (Z107834) A088152 A	
PICKERING TOWN	17 653654 4855219 W	2011-03 6032	2			MO	0005 5	7162506 (Z121232) A106859	BRWN SAND GRVL SOFT 0004 GREY CLAY SILT SOFT 0015
PICKERING TOWN	17 653817 4855667 W	2011-04 6607						7164076 (M00645) A110392 P	
PICKERING TOWN	17 653572 4855214 W	2011-11 6032	1.79			MO	0005 10	7172558 (Z121371) A106836	BRWN FILL PCKD 0005 BRWN SILT DNSE 0010 GREY SILT SAND DNSE 0015
PICKERING TOWN	17 653608 4855187 W	2011-07 6032	1.79			MO	0005 10	7172587 (Z121285) A106836	BRWN FILL PCKD 0004 BRWN CLAY SILT HARD 0015
PICKERING TOWN	17 653590 4855182 W	2011-09 6032	1.79			MO	0005 10	7172593 (Z121333) A106836 A	BRWN FILL PCKD 0004 BRWN CLAY SILT HARD 0015
PICKERING TOWN	17 653648 4855250 W	2006-10 7190	5.09				0002 4	1918487 (Z41843) A044714	BRWN SILT SNDY 0007 GREY SILT SAND 0017 GREY SAND SILT 0020
PICKERING TOWN	17 653604 4855180 W	2012-03 6032	2			MO	0005 7	7185175 (Z131715) A106836	BRWN LOAM SAND SOFT 0002 GREY CLAY SILT DNSE 0008 GREY CLAY SILT SOFT 0012
PICKERING TOWN	17 653659 4854975 W	2013-02 7215						7200758 (C21155) P	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
PICKERING TOWN	17 653598 4854994 W	2013-02 7215						7200759 (C21094) P	
PICKERING TOWN	17 653597 4855231 W	2014-06 6607						7261650 (C23948) P	
PICKERING TOWN	17 653671 4855197 W	2016-05 7241	2				0010 10	7265182 (Z233298) A179287	BLCK ---- 0004 BRWN SILT SAND 0008 GREY CLAY SILT WBRG 0020
PICKERING TOWN	17 653370 4855745 W	2011-10 6853						7184714 (Z115803) A100215 A	
PICKERING TOWN	17 653618 4855210 W	2016-05 7241	1.5				0010 10	7265180 (Z233288) A172945	BLCK ---- 0004 BRWN SILT SAND 0005 GREY CLAY SILT WBRG 0020
PICKERING TOWN	17 653203 4854969 W	2013-11 7383	2	0010		MO	0010 5	7215927 (Z166177) A151147	0004 FILL 0015
PICKERING TOWN	17 653760 4855322 W	2016-02 7247	2	UT 0022		MT	0035 10	7261550 (Z214122) A199725	BRWN FILL GRVL 0002 BRWN SILT GRVL 0007 BRWN SILT SAND SOFT 0035 GREY SILT SHLE HARD 0043 GREY SHLE DNSE 0045
PICKERING TOWN	17 653912 4855309 W	2016-02 7241	1.5			MT	0008 10	7260305 (Z226170) A195368	BRWN SAND SILT LOOS 0005 GREY CLAY SILT SOFT 0018
PICKERING TOWN	17 653900 4855302 W	2016-02 7241	1.5			MT	0005 10	7260304 (Z226168) A195367	BRWN SAND SILT LOOS 0004 GREY CLAY SILT SOFT 0015
PICKERING TOWN	17 653909 4855287 W	2016-02 7241	1.5			MT	0007 10	7260303 (Z226171) A195366	BRWN SAND SILT LOOS 0004 GREY CLAY SILT SOFT 0017
PICKERING TOWN	17 653607 4855235 W	2014-09 7215						7229250 (C26789) A157284 P	
PICKERING TOWN	17 653485 4855332 W	2014-08 7383	2	0016			0012 10	7228643 (Z190436) A166557	BLCK ---- 0002 LOAM 0002 GREY CLAY SLTY 0022
PICKERING TOWN	17 653627 4855177 W	2016-05 7241	2				0010 10	7265181 (Z233297) A184850	BLCK ---- 0004 BRWN SILT SAND 0008 GREY CLAY SILT WBRG 0020
PICKERING TOWN	17 653607 4855235 W	2014-06 6607						7229612 (C23949) A157284 P	
PICKERING TOWN CON 01 021	17 653972 4855471 W	2016-10 6607	2.00	UT 0010		MO	0005 10	7275633 (Z240203) A209794	BRWN SAND GRVL PCKD 0002 BRWN SILT CLAY SOFT 0010 GREY SILT CLAY SOFT 0015

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
PICKERING TOWN CON 01 021	17 653992 4855377 W	1961-08 4610	7 7	FR 0046	7/75/3/8:0	CO		4601177 ()	BRWN CLAY 0009 BLUE CLAY 0038 HPAN 0045 GREY SHLE 0075
PICKERING TOWN CON 01 022	17 653560 4855325 W	1960-08 5412	30	SU 0025	11//1/:	DO		4601178 ()	LOAM 0001 BRWN CLAY 0009 BLUE CLAY 0020 BLUE CLAY MSND 0028
PICKERING TOWN CON 01 022	17 653509 4855539 W	1959-05 2615	36	FR 0013 FR 0018	13///:	DO		4601179 ()	LOAM CLAY 0004 CLAY 0009 BLUE CLAY 0013 MSND 0016 CLAY 0018 GRVL CLAY 0022
PICKERING TOWN CON 01 022	17 653589 4855351 W	1964-08 3414	4	FR 0063	18/80/3/6:0	CO		4601181 ()	LOAM 0001 SILT CLAY 0022 GRVL CLAY 0063 BLCK SHLE 0116
PICKERING TOWN CON 01 022	17 653564 4855345 W	1964-08 3414	4 4	FR 0063	18/75/4/5:0	CO		4601182 ()	LOAM 0001 CLAY BLDR SILT 0022 CLAY GRVL 0063 BLCK SHLE 0116
PICKERING TOWN CON 01 022	17 653655 4855143 W	1970-09 5459	6	FR 0029 SU 0090		NU		4604667 () A	YLLW CLAY 0018 BRWN CLAY MSND 0029 BRWN MSND CLAY SILT 0045 BRWN SHLE 0090 GREY SHLE 0123 GREY GRNT 0145 LMSN 0250
PICKERING TOWN CON 01 022	17 653633 4855240 W	2014-08 7147						7226679 (C26889) A157284 P	
PICKERING TOWN CON 01 022	17 653768 4855329 W	2016-01 7147						7279497 (C35701) P	
PICKERING TOWN CON 01 023	17 653350 4855850 W	1967-07 3102	30	FR 0022	20///:	DO		4601191 ()	LOAM 0001 BRWN CLAY 0017 BLUE CLAY 0022 CSND 0026 BLUE CLAY STNS 0027
PICKERING TOWN CON 01 023	17 653238 4855707 W	1958-10 2501	6					4601190 () A	BLUE CLAY 0068
PICKERING TOWN CON 01 023	17 653351 4855537 W	1963-07 5412	30	FR 0019	10//1/:	DO		4601188 ()	LOAM 0001 BRWN CLAY 0010 BLUE CLAY 0018 CSND 0019 BLUE CLAY STNS 0024
PICKERING TOWN CON 01 023	17 653297 4855683 W	2013-01 1663	36	UT	8///:	NU		7200619 (Z161082) A	BRWN FILL 0004 GREY 0016
PICKERING TOWN CON 01 023	17 653388 4855709 W	2013-01 1663	36	UT	8///:	NU		7200618 (Z161081) A	BRWN FILL 0004 GREY 0020
PICKERING TOWN CON 01 023	17 653394 4855683 W	2013-01 1663	30		3///:	NU		7200617 (Z161080) A	BRWN FILL 0004 GREY 0016
PICKERING TOWN CON 01 023	17 653392 4855629 W	2013-01 1663	36	UT		NU		7200616 (Z161079) A	BRWN FILL 0004 GREY 0016
PICKERING TOWN CON 01 024	17 653113 4854921 W	1964-12 5420	34	FR 0023	10///:	DO		4601195 ()	LOAM 0001 BRWN CLAY 0008 CLAY 0022 GRVL MSND 0024

Notes:
UTM: UTM in Zone, Easting, Northing and Datum is NAD83; L: UTM estimated from Centroid of Lot; W: UTM not from Lot Centroid
DATE CNTR: Date Work Completedand Well Contractor Licence Number
CASING DIA: .Casing diameter in inches
WATER: Unit of Depth in Fee. See Table 4 for Meaning of Code

PUMP TEST: Static Water Level in Feet / Water Level After Pumping in Feet / Pump Test Rate in GPM / Pump Test Duration in Hour : Minutes
WELL USE: See Table 3 for Meaning of Code
SCREEN: Screen Depth and Length in feet
WELL: WEL (AUDIT #) Well Tag . A: Abandonment; P: Partial Data Entry Only
FORMATION: See Table 1 and 2 for Meaning of Code

1. Core Material and Descriptive terms

Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
BLDR	BOULDERS	FCRD	FRACTURED	IRFM	IRON FORMATION	PORS	POROUS	SOFT	SOFT
BSLT	BASALT	FGRD	FINE-GRAINED	LIMY	LIMY	PRDG	PREVIOUSLY DUG	SPST	SOAPSTONE
CGRD	COARSE-GRAINED	FGVL	FINE GRAVEL	LMSN	LIMESTONE	PRDR	PREV. DRILLED	STKY	STICKY
CGVL	COARSE GRAVEL	FILL	FILL	LOAM	TOPSOIL	QRTZ	QUARTZITE	STNS	STONES
CHRT	CHERT	FLDS	FELDSPAR	LOOS	LOOSE	QSND	QUICKSAND	STNY	STONEY
CLAY	CLAY	FLNT	FLINT	LTCL	LIGHT-COLOURED	QTZ	QUARTZ	THIK	THICK
CLN	CLEAN	FOSS	FOSILIFEROUS	LYRD	LAYERED	ROCK	ROCK	THIN	THIN
CLYY	CLAYEY	FSND	FINE SAND	MARL	MARL	SAND	SAND	TILL	TILL
CMTD	CEMENTED	GNIS	GNEISS	MGRD	MEDIUM-GRAINED	SHLE	SHALE	UNKN	UNKNOWN TYPE
CONG	CONGLOMERATE	GRNT	GRANITE	MGVL	MEDIUM GRAVEL	SHLY	SHALY	VERY	VERY
CRYS	CRYSTALLINE	GRSN	GREENSTONE	MRBL	MARBLE	SHRP	SHARP	WBRG	WATER-BEARING
CSND	COARSE SAND	GRVL	GRAVEL	MSND	MEDIUM SAND	SHST	SCHIST	WDFR	WOOD FRAGMENTS
DKCL	DARK-COLOURED	GRWK	GREYWACKE	MUCK	MUCK	SILT	SILT	WTHD	WEATHERED
DLMT	DOLOMITE	GVLY	GRAVELLY	OBDN	OVERBURDEN	SLTE	SLATE		
DNSE	DENSE	GYPS	GYPSUM	PCKD	PACKED	SLTY	SILTY		
DRTY	DIRTY	HARD	HARD	PEAT	PEAT	SNDS	SANDSTONE		
DRY	DRY	HPAN	HARDPAN	PGVL	PEA GRAVEL	SNDY	SANDYOAPSTONE		

2. Core Color

Code	Description
WHIT	WHITE
GREY	GREY
BLUE	BLUE
GREN	GREEN
YLLW	YELLOW
BRWN	BROWN
RED	RED
BLCK	BLACK
BLGY	BLUE-GREY

3. Well Use

Code	Description	Code	Description
DO	Domestic	OT	Other
ST	Livestock	TH	Test Hole
IR	Irrigation	DE	Dewatering
IN	Industrial	MO	Monitoring
CO	Commercial	MT	Monitoring TestHole
MN	Municipal		
PS	Public		
AC	Cooling And A/C		
NU	Not Used		

4. Water Detail

Code	Description	Code	Description
FR	Fresh	GS	Gas
SA	Salty	IR	Iron
SU	Sulphur		
MN	Mineral		
UK	Unknown		

Appendix IV
Laboratory Record of Groundwater Quality

TERRAPEX ENVIRONMENTAL LTD. (Toronto)
ATTN: Brian Theimer
90 Scarsdale Road
Toronto ON M3B 2R7

Date Received: 15-MAR-19
Report Date: 22-MAR-19 14:15 (MT)
Version: FINAL

Client Phone: 416-245-0011

Certificate of Analysis

Lab Work Order #: L2245008

Project P.O. #: NOT SUBMITTED
Job Reference: CT2817.00
C of C Numbers: 17-724722
Legal Site Desc:

Mathy Mahadeva
Account Manager

Summary of Guideline Exceedances

ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
Guideline						
Ontario Sewer Use Bylaws - Durham Sanitary Sewer (55-2013)						
(No parameter exceedances)						
Ontario Sewer Use Bylaws - Durham Storm Sewer - (55-2013)						
L2245008-1	MW8	Physical Tests	Total Suspended Solids	15.4	15	mg/L

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Physical Tests - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2245008-1 Sample Date: 15-MAR-19 Sample ID: MW8
pH	pH units	6.00-10.5	6.0-9.0	7.11
Total Suspended Solids	mg/L	350	15	15.4

Guide Limit #1: Durham Sanitary Sewer (55-2013)
Guide Limit #2: Durham Storm Sewer - (55-2013)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Anions and Nutrients - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2245008-1 Sample Date: 15-MAR-19 Sample ID: MW8
Fluoride (F)	mg/L	10	-	<0.10 DLDS
Total Kjeldahl Nitrogen	mg/L	100	1	0.24
Phosphorus, Total	mg/L	10	0.4	0.0052
Sulfate (SO4)	mg/L	1500	-	63.0 DLDS

Guide Limit #1: Durham Sanitary Sewer (55-2013)
Guide Limit #2: Durham Storm Sewer - (55-2013)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Cyanides - WATER

			Lab ID	L2245008-1
			Sample Date	15-MAR-19
			Sample ID	MW8
		Guide Limits		
Analyte	Unit	#1	#2	
Cyanide, Total	mg/L	2	0.02	<0.0020

Guide Limit #1: Durham Sanitary Sewer (55-2013)
Guide Limit #2: Durham Storm Sewer - (55-2013)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Bacteriological Tests - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2245008-1 Sample Date: 15-MAR-19 Sample ID: MW8
E. Coli	CFU/100mL	-	200	0

Guide Limit #1: Durham Sanitary Sewer (55-2013)
Guide Limit #2: Durham Storm Sewer - (55-2013)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Total Metals - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2245008-1 Sample Date: 15-MAR-19 Sample ID: MW8
Aluminum (Al)-Total	mg/L	50	-	<0.050 DLHC
Antimony (Sb)-Total	mg/L	5	-	<0.0010 DLHC
Arsenic (As)-Total	mg/L	1	0.02	<0.0010 DLHC
Cadmium (Cd)-Total	mg/L	0.7	0.008	<0.000050 DLHC
Chromium (Cr)-Total	mg/L	2	0.08	<0.0050 DLHC
Cobalt (Co)-Total	mg/L	5	-	<0.0010 DLHC
Copper (Cu)-Total	mg/L	3	0.05	<0.010 DLHC
Lead (Pb)-Total	mg/L	1	0.12	<0.00050 DLHC
Manganese (Mn)-Total	mg/L	5	0.15	0.0877 DLHC
Mercury (Hg)-Total	mg/L	0.01	0.0004	<0.000010
Molybdenum (Mo)-Total	mg/L	5	-	<0.00050 DLHC
Nickel (Ni)-Total	mg/L	2	0.08	<0.0050 DLHC
Selenium (Se)-Total	mg/L	1	0.02	<0.00050 DLHC
Silver (Ag)-Total	mg/L	5	0.12	<0.00050 DLHC
Tin (Sn)-Total	mg/L	5	-	<0.0010 DLHC
Titanium (Ti)-Total	mg/L	5	-	<0.0030 DLHC
Zinc (Zn)-Total	mg/L	2	0.04	<0.030 DLHC

Guide Limit #1: Durham Sanitary Sewer (55-2013)
Guide Limit #2: Durham Storm Sewer - (55-2013)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Aggregate Organics - WATER

			Lab ID	L2245008-1
			Sample Date	15-MAR-19
			Sample ID	MW8
		Guide Limits		
Analyte	**Unit**	**#1**	**#2**	
BOD	mg/L	300	15	<3.0 BODL
Oil and Grease, Total	mg/L	-	-	<2.0
Animal/Veg Oil & Grease	mg/L	150	-	<2.0
Mineral Oil and Grease	mg/L	15	-	<1.0
Phenols (4AAP)	mg/L	1	0.008	<0.0010

Guide Limit #1: Durham Sanitary Sewer (55-2013)
Guide Limit #2: Durham Storm Sewer - (55-2013)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

Volatile Organic Compounds - WATER

			Lab ID	L2245008-1
			Sample Date	15-MAR-19
			Sample ID	MW8
		Guide Limits		
Analyte	**Unit**	**#1**	**#2**	
Benzene	ug/L	10	2	<0.50
Chloroform	ug/L	40	2	<1.0
1,2-Dichlorobenzene	ug/L	50	5.6	<0.50
1,4-Dichlorobenzene	ug/L	80	6.8	<0.50
cis-1,2-Dichloroethylene	ug/L	4000	5.6	<0.50
Dichloromethane	ug/L	2000	5.2	<2.0
trans-1,3-Dichloropropene	ug/L	140	5.6	<0.50
Ethylbenzene	ug/L	160	2	<0.50
Methyl Ethyl Ketone	ug/L	8000	-	<20
Styrene	ug/L	200	-	<0.50
1,1,2,2-Tetrachloroethane	ug/L	1400	17	<0.50
Tetrachloroethylene	ug/L	1000	4.4	<0.50
Toluene	ug/L	270	2	<0.50
Trichloroethylene	ug/L	400	8	<0.50
o-Xylene	ug/L	-	-	<0.50
m+p-Xylenes	ug/L	-	-	<1.0
Xylenes (Total)	ug/L	1400	4.4	<1.1
Surrogate: 4-Bromofluorobenzene	%	-	-	95.7
Surrogate: 1,4-Difluorobenzene	%	-	-	100.5

Guide Limit #1: Durham Sanitary Sewer (55-2013)
Guide Limit #2: Durham Storm Sewer - (55-2013)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Phthalate Esters - WATER

			Lab ID	L2245008-1
			Sample Date	15-MAR-19
			Sample ID	MW8
		Guide Limits		
Analyte	Unit	#1	#2	
Bis(2-ethylhexyl)phthalate	ug/L	12	8.8	<2.0
Surrogate: 2-fluorobiphenyl	%	-	-	93.7
Surrogate: p-Terphenyl d14	%	-	-	112.9

Guide Limit #1: Durham Sanitary Sewer (55-2013)
Guide Limit #2: Durham Storm Sewer - (55-2013)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Semi-Volatile Organics - WATER

			Lab ID	L2245008-1
			Sample Date	15-MAR-19
			Sample ID	MW8
		Guide Limits		
Analyte	Unit	#1	#2	
Di-n-butylphthalate	ug/L	80	15	<1.0
Surrogate: 2-Fluorobiphenyl	%	-	-	93.7
Surrogate: p-Terphenyl d14	%	-	-	112.9

Guide Limit #1: Durham Sanitary Sewer (55-2013)
Guide Limit #2: Durham Storm Sewer - (55-2013)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Polychlorinated Biphenyls - WATER

			Lab ID	L2245008-1
			Sample Date	15-MAR-19
			Sample ID	MW8
		Guide Limits		
Analyte	**Unit**	**#1**	**#2**	
Aroclor 1242	ug/L	-	-	<0.020
Aroclor 1248	ug/L	-	-	<0.020
Aroclor 1254	ug/L	-	-	<0.020
Aroclor 1260	ug/L	-	-	<0.020
Total PCBs	ug/L	1	0.4	<0.040
Surrogate: 2-Fluorobiphenyl	%	-	-	99.0

Guide Limit #1: Durham Sanitary Sewer (55-2013)
Guide Limit #2: Durham Storm Sewer - (55-2013)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Organic Parameters - WATER

			Lab ID	L2245008-1
			Sample Date	15-MAR-19
			Sample ID	MW8
		Guide Limits		
Analyte	**Unit**	**#1**	**#2**	
Nonylphenol	ug/L	20	-	<1.0
Nonylphenol Diethoxylates	ug/L	-	-	0.16
Total Nonylphenol Ethoxylates	ug/L	200	-	<2.0
Nonylphenol Monoethoxylates	ug/L	-	-	<2.0

Guide Limit #1: Durham Sanitary Sewer (55-2013)
Guide Limit #2: Durham Storm Sewer - (55-2013)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
BODL	Limit of Reporting for BOD was increased to account for the largest volume of sample tested.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
625-BIS-2-PHTH-WT	Water	Bis(2-ethylhexyl)phthalate	SW846 8270
Aqueous samples are extracted and extracts are analyzed on GC/MSD.			
625-DNB-PHTH-WT	Water	Di-n-Butyl Phthalate	SW846 8270
Aqueous samples are extracted and extracts are analyzed on GC/MSD.			
BOD-WT	Water	BOD	APHA 5210 B
This analysis is carried out using procedures adapted from APHA Method 5210B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.			
CN-TOT-WT	Water	Cyanide, Total	ISO 14403-2
Total cyanide is determined by the combination of UV digestion and distillation. Cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.			
When using this method, high levels of thiocyanate in samples can cause false positives at ~1-2% of the thiocyanate concentration. For samples with detectable cyanide analyzed by this method, ALS recommends analysis for thiocyanate to check for this potential interference			
EC-WW-MF-WT	Water	E. Coli	SM 9222D
A 100 mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at 44.5 –0 .2 °C for 24 – 2 h. Method ID: WT-TM-1200			
F-IC-N-WT	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
HG-T-CVAA-WT	Water	Total Mercury in Water by CVAAS	EPA 1631E (mod)
Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.			
MET-T-CCMS-WT	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
NP,NPE-LCMS-WT	Water	Nonylphenols and Ethoxylates by LC/MS-MS	J. Chrom A849 (1999) p.467-482
Water samples are filtered and analyzed on LCMS/MS by direct injection.			
OGG-SPEC-CALC-WT	Water	Speciated Oil and Grease A/V Calc	CALCULATION

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
		Sample is extracted with hexane, sample speciation into mineral and animal/vegetable fractions is achieved via silica gel separation and is then determined gravimetrically.	
OGG-SPEC-WT	Water	Speciated Oil and Grease-Gravimetric	APHA 5520 B
		The procedure involves an extraction of the entire water sample with hexane. Sample speciation into mineral and animal/vegetable fractions is achieved via silica gel separation and is then determined gravimetrically.	
P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
		This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is deteremined colourimetrically after persulphate digestion of the sample.	
PCB-WT	Water	Polychlorinated Biphenyls	EPA 8082
		PCBs are extracted from an aqueous sample at neutral pH with aliquots of dichloromethane using a modified separatory funnel technique. The extracts are analyzed by GC/MSD.	
PH-WT	Water	pH	APHA 4500 H-Electrode
		Water samples are analyzed directly by a calibrated pH meter.	
		Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days	
PHENOLS-4AAP-WT	Water	Phenol (4AAP)	EPA 9066
		An automated method is used to distill the sample. The distillate is then buffered to pH 9.4 which reacts with 4AAP and potassium ferricyanide to form a red complex which is measured colorimetrically.	
SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)
		Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
SOLIDS-TSS-WT	Water	Suspended solids	APHA 2540 D-Gravimetric
		A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 104–1°C for a minimum of four hours or until a constant weight is achieved.	
TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-Norg D
		This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 Celsius with analysis using an automated colorimetric method.	
VOC-ROU-HS-WT	Water	Volatile Organic Compounds	SW846 8260
		Aqueous samples are analyzed by headspace-GC/MS.	
XYLENES-SUM-CALC-WT	Water	Sum of Xylene Isomer Concentrations	CALCULATION
		Total xylenes represents the sum of o-xylene and m&p-xylene.	

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

Chain of Custody Numbers:

Reference Information

17-724722

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

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

GLOSSARY OF REPORT TERMS

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

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

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

Quality Control Report

Workorder: L2245008 Report Date: 22-MAR-19

Client: TERRAPEX ENVIRONMENTAL LTD. (Toronto)
90 Scarsdale Road
Toronto ON M3B 2R7
Contact: Brian Theimer

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
625-BIS-2-PHTH-WT	**Water**							
Batch R4570797								
WG3009223-2 CVS								
Bis(2-ethylhexyl)phthalate			112.3		%		70-130	20-MAR-19
WG3008485-2 LCS								
Bis(2-ethylhexyl)phthalate			117.2		%		50-140	19-MAR-19
WG3008485-1 MB								
Bis(2-ethylhexyl)phthalate			<2.0		ug/L		2	19-MAR-19
Surrogate: 2-fluorobiphenyl			85.4		%		40-130	19-MAR-19
Surrogate: p-Terphenyl d14			108.9		%		40-130	19-MAR-19
625-DNB-PHTH-WT	**Water**							
Batch R4570797								
WG3008485-2 LCS								
Di-n-butylphthalate			112.4		%		50-150	19-MAR-19
WG3008485-1 MB								
Di-n-butylphthalate			<1.0		ug/L		1	19-MAR-19
Surrogate: 2-Fluorobiphenyl			85.4		%		40-130	19-MAR-19
Surrogate: p-Terphenyl d14			108.9		%		40-130	19-MAR-19
BOD-WT	**Water**							
Batch R4575848								
WG3007949-6 DUP		**L2245008-1**						
BOD		<3.0	<3.0	RPD-NA	mg/L	N/A	20	21-MAR-19
WG3007949-7 LCS								
BOD			91.4		%		85-115	21-MAR-19
WG3007949-5 MB								
BOD			<2.0		mg/L		2	21-MAR-19
CN-TOT-WT	**Water**							
Batch R4570657								
WG3008550-7 DUP		**L2244585-4**						
Cyanide, Total		0.0020	<0.0020	RPD-NA	mg/L	N/A	20	18-MAR-19
WG3008550-6 LCS								
Cyanide, Total			85.4		%		80-120	18-MAR-19
WG3008550-5 MB								
Cyanide, Total			<0.0020		mg/L		0.002	18-MAR-19
WG3008550-8 MS		**L2244585-4**						
Cyanide, Total			82.6		%		70-130	18-MAR-19
EC-WW-MF-WT	**Water**							

Quality Control Report

Client: TERRAPEX ENVIRONMENTAL LTD. (Toronto)
90 Scarsdale Road
Toronto ON M3B 2R7
Contact: Brian Theimer

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-WW-MF-WT	**Water**							
Batch R4568202								
WG3007759-3 DUP		**L2245008-1**						
E. Coli		0	0		CFU/100mL	0.0	65	17-MAR-19
WG3007759-1 MB								
E. Coli			0		CFU/100mL		1	17-MAR-19
F-IC-N-WT	**Water**							
Batch R4570912								
WG3008460-9 DUP		**WG3008460-8**						
Fluoride (F)		0.226	0.223		mg/L	1.4	20	18-MAR-19
WG3008460-7 LCS								
Fluoride (F)			98.1		%		90-110	18-MAR-19
WG3008460-6 MB								
Fluoride (F)			<0.020		mg/L		0.02	18-MAR-19
WG3008460-10 MS		**WG3008460-8**						
Fluoride (F)			100.3		%		75-125	18-MAR-19
HG-T-CVAA-WT	**Water**							
Batch R4568585								
WG3008209-4 DUP		**WG3008209-3**						
Mercury (Hg)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	18-MAR-19
WG3008209-2 LCS								
Mercury (Hg)-Total			94.4		%		80-120	18-MAR-19
WG3008209-1 MB								
Mercury (Hg)-Total			<0.000010		mg/L		0.00001	18-MAR-19
WG3008209-6 MS		**WG3008209-5**						
Mercury (Hg)-Total			92.2		%		70-130	18-MAR-19
MET-T-CCMS-WT	**Water**							
Batch R4568437								
WG3008134-4 DUP		**WG3008134-3**						
Aluminum (Al)-Total		0.0162	0.0066	J	mg/L	0.0096	0.01	18-MAR-19
Antimony (Sb)-Total		0.00011	0.00010		mg/L	9.7	20	18-MAR-19
Arsenic (As)-Total		0.00026	0.00025		mg/L	4.0	20	18-MAR-19
Cadmium (Cd)-Total		<0.0000050	0.0000060	RPD-NA	mg/L	N/A	20	18-MAR-19
Chromium (Cr)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	18-MAR-19
Cobalt (Co)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	18-MAR-19
Copper (Cu)-Total		0.0482	0.0470		mg/L	2.6	20	18-MAR-19
Lead (Pb)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	18-MAR-19
Manganese (Mn)-Total		0.00068	0.00089	J	mg/L	0.00022	0.001	18-MAR-19

Quality Control Report

Client: TERRAPEX ENVIRONMENTAL LTD. (Toronto)
90 Scarsdale Road
Toronto ON M3B 2R7
Contact: Brian Theimer

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R4568437								
WG3008134-4 DUP		**WG3008134-3**						
Molybdenum (Mo)-Total		0.000553	0.000559		mg/L	1.2	20	18-MAR-19
Nickel (Ni)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	18-MAR-19
Selenium (Se)-Total		0.000104	0.000089		mg/L	15	20	18-MAR-19
Silver (Ag)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	18-MAR-19
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	18-MAR-19
Titanium (Ti)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	18-MAR-19
Zinc (Zn)-Total		0.0539	0.0538		mg/L	0.2	20	18-MAR-19
WG3008134-2 LCS								
Aluminum (Al)-Total			98.7		%		80-120	18-MAR-19
Antimony (Sb)-Total			108.3		%		80-120	18-MAR-19
Arsenic (As)-Total			95.6		%		80-120	18-MAR-19
Cadmium (Cd)-Total			97.1		%		80-120	18-MAR-19
Chromium (Cr)-Total			97.6		%		80-120	18-MAR-19
Cobalt (Co)-Total			95.1		%		80-120	18-MAR-19
Copper (Cu)-Total			95.0		%		80-120	18-MAR-19
Lead (Pb)-Total			102.8		%		80-120	18-MAR-19
Manganese (Mn)-Total			97.9		%		80-120	18-MAR-19
Molybdenum (Mo)-Total			102.2		%		80-120	18-MAR-19
Nickel (Ni)-Total			96.2		%		80-120	18-MAR-19
Selenium (Se)-Total			95.0		%		80-120	18-MAR-19
Silver (Ag)-Total			106.1		%		80-120	18-MAR-19
Tin (Sn)-Total			100.0		%		80-120	18-MAR-19
Titanium (Ti)-Total			95.2		%		80-120	18-MAR-19
Zinc (Zn)-Total			93.5		%		80-120	18-MAR-19
WG3008134-1 MB								
Aluminum (Al)-Total			<0.0050		mg/L		0.005	18-MAR-19
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	18-MAR-19
Arsenic (As)-Total			<0.00010		mg/L		0.0001	18-MAR-19
Cadmium (Cd)-Total			<0.000005(		mg/L		0.000005	18-MAR-19
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	18-MAR-19
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	18-MAR-19
Copper (Cu)-Total			<0.0010		mg/L		0.001	18-MAR-19
Lead (Pb)-Total			<0.000050		mg/L		0.00005	18-MAR-19
Manganese (Mn)-Total			<0.00050		mg/L		0.0005	18-MAR-19

Quality Control Report

Client: TERRAPEX ENVIRONMENTAL LTD. (Toronto)
90 Scarsdale Road
Toronto ON M3B 2R7
Contact: Brian Theimer

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R4568437								
WG3008134-1 MB								
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	18-MAR-19
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	18-MAR-19
Selenium (Se)-Total			<0.000050		mg/L		0.00005	18-MAR-19
Silver (Ag)-Total			<0.000050		mg/L		0.00005	18-MAR-19
Tin (Sn)-Total			<0.00010		mg/L		0.0001	18-MAR-19
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	18-MAR-19
Zinc (Zn)-Total			<0.0030		mg/L		0.003	18-MAR-19
WG3008134-5 MS		**WG3008134-6**						
Aluminum (Al)-Total			95.0		%		70-130	18-MAR-19
Antimony (Sb)-Total			100.5		%		70-130	18-MAR-19
Arsenic (As)-Total			92.5		%		70-130	18-MAR-19
Cadmium (Cd)-Total			95.5		%		70-130	18-MAR-19
Chromium (Cr)-Total			93.4		%		70-130	18-MAR-19
Cobalt (Co)-Total			91.2		%		70-130	18-MAR-19
Copper (Cu)-Total			N/A	MS-B	%		-	18-MAR-19
Lead (Pb)-Total			95.4		%		70-130	18-MAR-19
Manganese (Mn)-Total			92.7		%		70-130	18-MAR-19
Molybdenum (Mo)-Total			98.4		%		70-130	18-MAR-19
Nickel (Ni)-Total			91.4		%		70-130	18-MAR-19
Selenium (Se)-Total			92.9		%		70-130	18-MAR-19
Silver (Ag)-Total			98.6		%		70-130	18-MAR-19
Tin (Sn)-Total			97.8		%		70-130	18-MAR-19
Titanium (Ti)-Total			92.6		%		70-130	18-MAR-19
Zinc (Zn)-Total			N/A	MS-B	%		-	18-MAR-19
NP,NPE-LCMS-WT	**Water**							
Batch R4579356								
WG3008172-3 DUP		**L2245008-1**						
Nonylphenol		<1.0	<1.0	RPD-NA	ug/L	N/A	30	22-MAR-19
Nonylphenol Monoethoxylates		<2.0	<2.0	RPD-NA	ug/L	N/A	30	22-MAR-19
Nonylphenol Diethoxylates		0.16	0.14		ug/L	13	30	22-MAR-19
WG3008172-2 LCS								
Nonylphenol			82.8		%		75-125	22-MAR-19
Nonylphenol Monoethoxylates			92.0		%		75-125	22-MAR-19
Nonylphenol Diethoxylates			102.0		%		75-125	22-MAR-19

Quality Control Report

Client: TERRAPEX ENVIRONMENTAL LTD. (Toronto)
90 Scarsdale Road
Toronto ON M3B 2R7
Contact: Brian Theimer

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NP,NPE-LCMS-WT	**Water**							
Batch R4579356								
WG3008172-1 MB								
Nonylphenol			<1.0		ug/L		1	22-MAR-19
Nonylphenol Monoethoxylates			<2.0		ug/L		2	22-MAR-19
Nonylphenol Diethoxylates			<0.10		ug/L		0.1	22-MAR-19
WG3008172-4 MS		**L2245008-1**						
Nonylphenol			94.1		%		50-150	22-MAR-19
Nonylphenol Monoethoxylates			144.8		%		50-150	22-MAR-19
Nonylphenol Diethoxylates			89.0		%		50-150	22-MAR-19
OGG-SPEC-WT	**Water**							
Batch R4569821								
WG3008115-2 LCS								
Oil and Grease, Total			91.7		%		70-130	17-MAR-19
Mineral Oil and Grease			81.3		%		70-130	17-MAR-19
WG3008115-1 MB								
Oil and Grease, Total			<2.0		mg/L		2	17-MAR-19
Mineral Oil and Grease			<1.0		mg/L		1	17-MAR-19
P-T-COL-WT	**Water**							
Batch R4578468								
WG3010605-3 DUP		**L2245008-1**						
Phosphorus, Total		0.0052	0.0050		mg/L	3.7	20	22-MAR-19
WG3010605-2 LCS								
Phosphorus, Total			93.9		%		80-120	22-MAR-19
WG3010605-1 MB								
Phosphorus, Total			<0.0030		mg/L		0.003	22-MAR-19
WG3010605-4 MS		**L2245008-1**						
Phosphorus, Total			89.0		%		70-130	22-MAR-19
PCB-WT	**Water**							
Batch R4570035								
WG3008478-2 LCS								
Aroclor 1242			128.5		%		65-130	18-MAR-19
Aroclor 1248			126.0		%		65-130	18-MAR-19
Aroclor 1254			126.8		%		65-130	18-MAR-19
Aroclor 1260			110.0		%		65-130	18-MAR-19
WG3008478-1 MB								
Aroclor 1242			<0.020		ug/L		0.02	18-MAR-19
Aroclor 1248			<0.020		ug/L		0.02	18-MAR-19

Quality Control Report

Client: TERRAPEX ENVIRONMENTAL LTD. (Toronto)
90 Scarsdale Road
Toronto ON M3B 2R7
Contact: Brian Theimer

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PCB-WT	**Water**							
Batch R4570035								
WG3008478-1 MB								
Aroclor 1254			<0.020		ug/L		0.02	18-MAR-19
Aroclor 1260			<0.020		ug/L		0.02	18-MAR-19
Surrogate: 2-Fluorobiphenyl			99.7		%		50-150	18-MAR-19
PH-WT	**Water**							
Batch R4568568								
WG3007742-8 DUP		**WG3007742-7**						
pH		8.05	7.98	J	pH units	0.07	0.2	16-MAR-19
WG3007742-6 LCS								
pH			7.00		pH units		6.9-7.1	16-MAR-19
PHENOLS-4AAP-WT	**Water**							
Batch R4568507								
WG3008305-11 DUP		**L2244461-15**						
Phenols (4AAP)		0.0021	0.0019		mg/L	8.9	20	18-MAR-19
WG3008305-10 LCS								
Phenols (4AAP)			99.9		%		85-115	18-MAR-19
WG3008305-9 MB								
Phenols (4AAP)			<0.0010		mg/L		0.001	18-MAR-19
WG3008305-12 MS		**L2244461-15**						
Phenols (4AAP)			95.1		%		75-125	18-MAR-19
SO4-IC-N-WT	**Water**							
Batch R4570912								
WG3008460-9 DUP		**WG3008460-8**						
Sulfate (SO4)		60.2	59.4		mg/L	1.5	20	18-MAR-19
WG3008460-7 LCS								
Sulfate (SO4)			98.1		%		90-110	18-MAR-19
WG3008460-6 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	18-MAR-19
WG3008460-10 MS		**WG3008460-8**						
Sulfate (SO4)			97.7		%		75-125	18-MAR-19
SOLIDS-TSS-WT	**Water**							
Batch R4575087								
WG3009949-3 DUP		**L2244899-7**						
Total Suspended Solids		5810	5840		mg/L	0.5	20	21-MAR-19
WG3009949-2 LCS								
Total Suspended Solids			100.6		%		85-115	21-MAR-19
WG3009949-1 MB								

Quality Control Report

Client: TERRAPEX ENVIRONMENTAL LTD. (Toronto)
90 Scarsdale Road
Toronto ON M3B 2R7
Contact: Brian Theimer

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SOLIDS-TSS-WT	**Water**							
Batch R4575087								
WG3009949-1 MB								
Total Suspended Solids			<2.0		mg/L		2	21-MAR-19
TKN-WT	**Water**							
Batch R4573769								
WG3009913-3 DUP		**L2245000-1**						
Total Kjeldahl Nitrogen		2.08	1.83		mg/L	13	20	20-MAR-19
WG3009913-2 LCS								
Total Kjeldahl Nitrogen			115.3		%		75-125	20-MAR-19
WG3009913-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	20-MAR-19
WG3009913-4 MS		**L2245000-1**						
Total Kjeldahl Nitrogen			101.3		%		70-130	20-MAR-19
VOC-ROU-HS-WT	**Water**							
Batch R4568354								
WG3005238-4 DUP		**WG3005238-3**						
1,1,2,2-Tetrachloroethane		<0.50	<0.50	RPD-NA	ug/L	N/A	30	18-MAR-19
1,2-Dichlorobenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	18-MAR-19
1,4-Dichlorobenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	18-MAR-19
Benzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	18-MAR-19
Chloroform		<1.0	<1.0	RPD-NA	ug/L	N/A	30	18-MAR-19
cis-1,2-Dichloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	18-MAR-19
Dichloromethane		<2.0	<2.0	RPD-NA	ug/L	N/A	30	18-MAR-19
Ethylbenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	18-MAR-19
m+p-Xylenes		<1.0	<1.0	RPD-NA	ug/L	N/A	30	18-MAR-19
Methyl Ethyl Ketone		<20	<20	RPD-NA	ug/L	N/A	30	18-MAR-19
o-Xylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	18-MAR-19
Styrene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	18-MAR-19
Tetrachloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	18-MAR-19
Toluene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	18-MAR-19
trans-1,3-Dichloropropene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	18-MAR-19
Trichloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	18-MAR-19
WG3005238-1 LCS								
1,1,2,2-Tetrachloroethane			109.6		%		70-130	18-MAR-19
1,2-Dichlorobenzene			108.6		%		70-130	18-MAR-19

Quality Control Report

Client: TERRAPEX ENVIRONMENTAL LTD. (Toronto)
90 Scarsdale Road
Toronto ON M3B 2R7
Contact: Brian Theimer

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-ROU-HS-WT	**Water**							
Batch R4568354								
WG3005238-1 LCS								
1,4-Dichlorobenzene			107.6		%		70-130	18-MAR-19
Benzene			113.1		%		70-130	18-MAR-19
Chloroform			112.3		%		70-130	18-MAR-19
cis-1,2-Dichloroethylene			103.8		%		70-130	18-MAR-19
Dichloromethane			109.1		%		70-130	18-MAR-19
Ethylbenzene			97.5		%		70-130	18-MAR-19
m+p-Xylenes			99.8		%		70-130	18-MAR-19
Methyl Ethyl Ketone			117.8		%		60-140	18-MAR-19
o-Xylene			98.2		%		70-130	18-MAR-19
Styrene			104.4		%		70-130	18-MAR-19
Tetrachloroethylene			102.5		%		70-130	18-MAR-19
Toluene			100.2		%		70-130	18-MAR-19
trans-1,3-Dichloropropene			101.0		%		70-130	18-MAR-19
Trichloroethylene			113.0		%		70-130	18-MAR-19
WG3005238-2 MB								
1,1,2,2-Tetrachloroethane			<0.50		ug/L		0.5	18-MAR-19
1,2-Dichlorobenzene			<0.50		ug/L		0.5	18-MAR-19
1,4-Dichlorobenzene			<0.50		ug/L		0.5	18-MAR-19
Benzene			<0.50		ug/L		0.5	18-MAR-19
Chloroform			<1.0		ug/L		1	18-MAR-19
cis-1,2-Dichloroethylene			<0.50		ug/L		0.5	18-MAR-19
Dichloromethane			<2.0		ug/L		2	18-MAR-19
Ethylbenzene			<0.50		ug/L		0.5	18-MAR-19
m+p-Xylenes			<1.0		ug/L		1	18-MAR-19
Methyl Ethyl Ketone			<20		ug/L		20	18-MAR-19
o-Xylene			<0.50		ug/L		0.5	18-MAR-19
Styrene			<0.50		ug/L		0.5	18-MAR-19
Tetrachloroethylene			<0.50		ug/L		0.5	18-MAR-19
Toluene			<0.50		ug/L		0.5	18-MAR-19
trans-1,3-Dichloropropene			<0.50		ug/L		0.5	18-MAR-19
Trichloroethylene			<0.50		ug/L		0.5	18-MAR-19
Surrogate: 1,4-Difluorobenzene			99.2		%		70-130	18-MAR-19
Surrogate: 4-Bromofluorobenzene			95.9		%		70-130	18-MAR-19
WG3005238-5 MS		**WG3005238-3**						

Quality Control Report

Client: TERRAPEX ENVIRONMENTAL LTD. (Toronto)
90 Scarsdale Road
Toronto ON M3B 2R7
Contact: Brian Theimer

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-ROU-HS-WT	**Water**							
Batch R4568354								
WG3005238-5 MS		**WG3005238-3**						
1,1,2,2-Tetrachloroethane			110.8		%		50-150	18-MAR-19
1,2-Dichlorobenzene			108.7		%		50-150	18-MAR-19
1,4-Dichlorobenzene			108.6		%		50-150	18-MAR-19
Benzene			112.5		%		50-150	18-MAR-19
Chloroform			112.4		%		50-150	18-MAR-19
cis-1,2-Dichloroethylene			103.6		%		50-150	18-MAR-19
Dichloromethane			107.9		%		50-150	18-MAR-19
Ethylbenzene			97.3		%		50-150	18-MAR-19
m+p-Xylenes			100.0		%		50-150	18-MAR-19
Methyl Ethyl Ketone			101.1		%		50-150	18-MAR-19
o-Xylene			97.7		%		50-150	18-MAR-19
Styrene			103.3		%		50-150	18-MAR-19
Tetrachloroethylene			102.9		%		50-150	18-MAR-19
Toluene			99.99		%		50-150	18-MAR-19
trans-1,3-Dichloropropene			102.4		%		50-150	18-MAR-19
Trichloroethylene			112.1		%		50-150	18-MAR-19

Quality Control Report

Workorder: L2245008 Report Date: 22-MAR-19

Client: TERRAPEX ENVIRONMENTAL LTD. (Toronto)
90 Scarsdale Road
Toronto ON M3B 2R7
Contact: Brian Theimer

Legend:

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

Sample Parameter Qualifier Definitions:

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

Hold Time Exceedances:

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

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

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

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

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2245008-COFC

COC Number: 17 - 724722

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / D	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	Terrapex Environmental Ltd	Select Report Format: [X] PDF [X] EXCEL | EDD (DIGITAL)	Regular [R] [X] Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Brian Theimer	Quality Control (QC) Report with Report [ ] YES [ ] NO	PRIORITY (Business Days): 4 day [P4-20%] [ ] / 3 day [P3-25%] [ ] / 2 day [P2-50%] [ ]
Phone:	416-245-0011 x 237	[ ] Compare Results to Criteria on Report - provide details below if box checked	EMERGENCY: 1 Business day [E-100%] [ ] / Same Day, Weekend or Statutory holiday [E2-200%] (Laboratory opening fees may apply)] [ ]
	Company address below will appear on the final report	Select Distribution: [X] EMAIL | MAIL [ ] FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	90 Scarsdale Road	Email 1 or Fax: B.theimer@terrapex.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Toronto - ON	Email 2: C-li@terrapex.com	
Postal Code:	M3B 2R7	Email 3: L-ghasemi@terrapex.com	

Invoice To			Invoice Distribution	
	Same as Report To	[X] YES [ ] NO	Select Invoice Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
	Copy of Invoice with Report	[X] YES [ ] NO	Email 1 or Fax	
Company:			Email 2	
Contact:				

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#:
Job #:	CT2817-00	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):	L2245008	ALS Contact: MM	Sampler:

Analysis Request

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

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Durham Sanitary + Storm	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	~~Duplicate~~ MW 8	Mar 15/19	11:30	GW	X			16

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

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

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

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

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]

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

Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
5.4				0.3			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Lili Ghasemi	Mar 15/2019	2:00 PM	[illegible]	March 15/19	14:10	[illegible]	15-MAR-19	1730

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

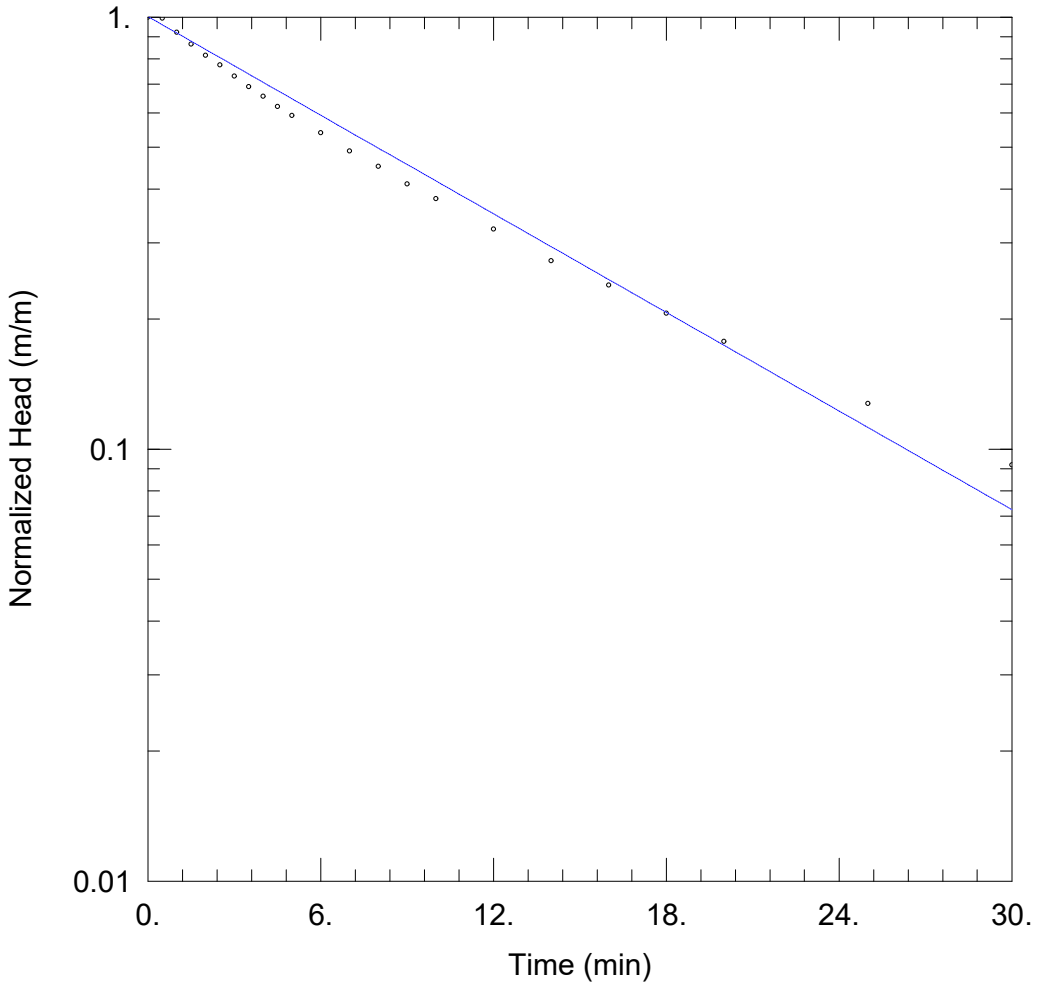
WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

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

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

Appendix V
Hydraulic Conductivity Testing



HYDROLOGICAL REVIEW

Data Set: I:\...\MW1.aqt
Date: 04/03/19 Time: 12:29:25

PROJECT INFORMATION

Company: Terrapex Environmental Ltd.
Client: Altona Group
Project: CT2817
Location: 1294 Kingston, 1848 Liverpool
Test Well: MW1
Test Date: 15 Mar 2019

AQUIFER DATA

Saturated Thickness: 9. m Anisotropy Ratio (Kz/Kr): 0.2

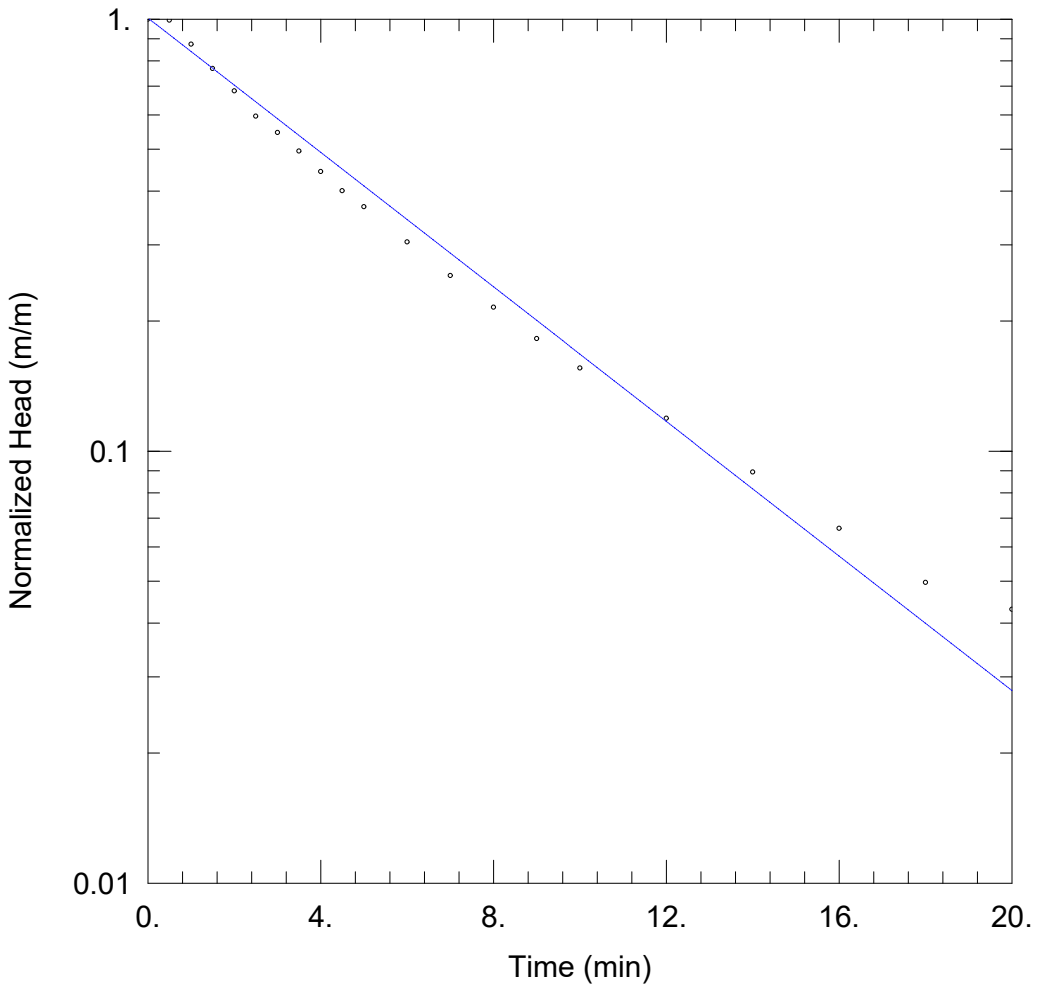
WELL DATA (MW1)

Initial Displacement: 2.1 m Static Water Column Height: 7. m
Total Well Penetration Depth: 7.04 m Screen Length: 1.5 m
Casing Radius: 0.0263 m Well Radius: 0.0302 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.335E-6 m/sec y0 = 2.106 m



HYDROLOGICAL REVIEW

Data Set: I:\...\MW8.aqt
Date: 04/03/19 Time: 12:31:22

PROJECT INFORMATION

Company: Terrapex Environmental Ltd.
Client: Altona Group
Project: CT2817
Location: 1294 Kingston, 1848 Liverpool
Test Well: MW6
Test Date: 15 Mar 2019

AQUIFER DATA

Saturated Thickness: 9. m Anisotropy Ratio (Kz/Kr): 0.2

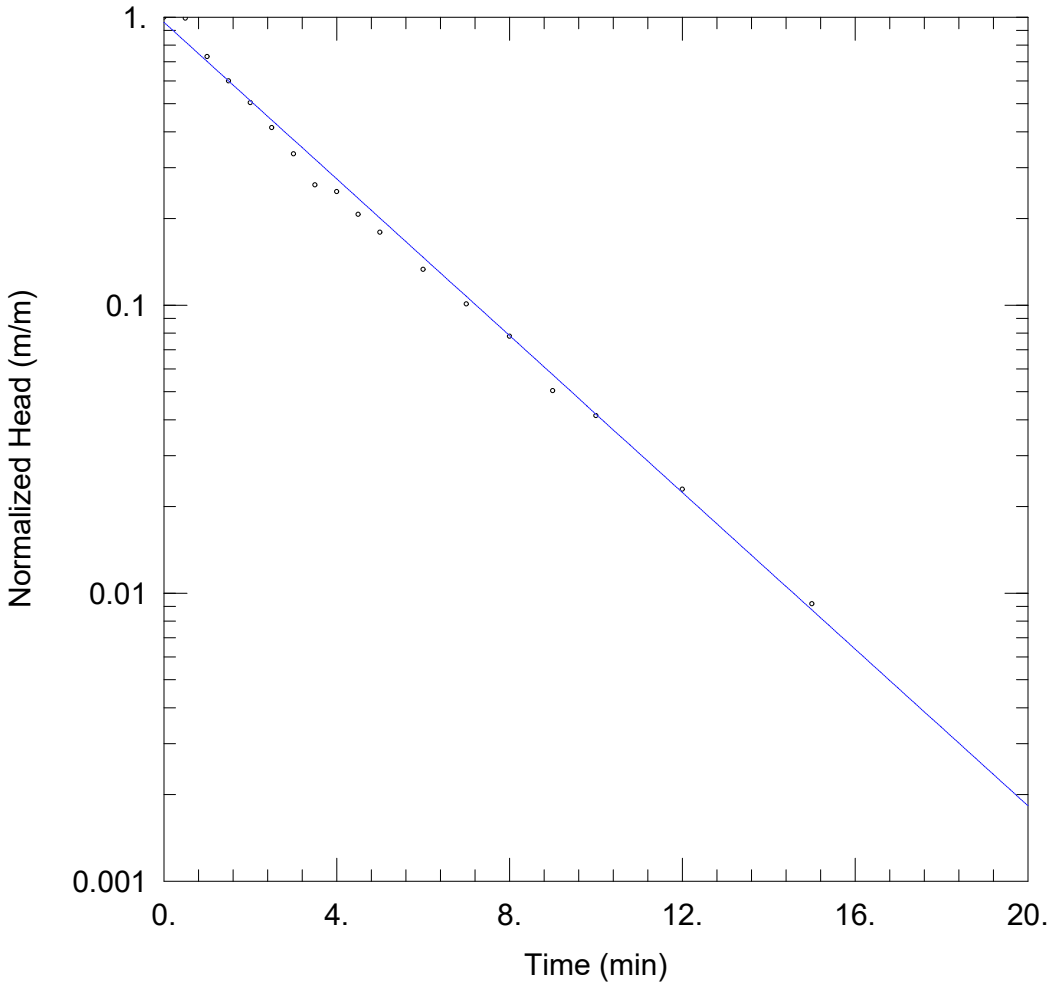
WELL DATA (MW6)

Initial Displacement: 1.51 m
Total Well Penetration Depth: 7.03 m
Casing Radius: 0.0263 m
Static Water Column Height: 7. m
Screen Length: 1.5 m
Well Radius: 0.0302 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 2.728E-6 m/sec
y0 = 1.518 m



HYDROLOGICAL REVIEW

Data Set: I:\...\MW8.aqt
Date: 04/03/19 Time: 12:34:57

PROJECT INFORMATION

Company: Terrapex Environmental Ltd.
Client: Altona Group
Project: CT2817
Location: 1294 Kingston, 1848 Liverpool
Test Well: MW8
Test Date: 15 Mar 2019

AQUIFER DATA

Saturated Thickness: 3.4 m Anisotropy Ratio (Kz/Kr): 0.2

WELL DATA (MW8)

Initial Displacement: 1.09 m
Total Well Penetration Depth: 6. m
Casing Radius: 0.0263 m
Static Water Column Height: 1.4 m
Screen Length: 3. m
Well Radius: 0.0302 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 2.818E-6 m/sec
y0 = 1.045 m