Hydrogeological Assessment
REVISED
16533 Highway 12& 823 King St., Town of Midland, Ontario

Pratt-Galloway/Orsi Subdivision

Prepared for:
Pratt Development Inc.

Prepared by:
Azimuth Environmental
Consulting, Inc.

November 2022

AEC 18-143

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

November 28, 2022 AEC 18-143

Pratt Development Inc.
27 Clapperton Street
Barrie, Ontario
L4M 3E6

Attention: Don Pratt, President

Re: **REVISED Hydrogeological Assessment**
16533 Highway 12 & 823 King St., Town of Midland, Simcoe County

Dear Mr. Pratt:

Azimuth Environmental Consulting, Inc. (Azimuth) is pleased to provide our Revised Hydrogeological Assessment for the property located at 16533 Highway 12 & 823 King Street within the Town of Midland, Simcoe County, Ontario (the "Site"). This evaluation was focused on the existing soil and ground water regime underlying the Site and the potential for the proposed development to impact existing conditions. This report reflects a revised version of the report which incorporates revisions to the development plan as well as addresses review comments provided by the Town of Midland and Severn Sound Environmental Association (SSEA).

Should you have any questions or wish to discuss the report in greater detail, please do not hesitate to contact the undersigned.

Yours truly,

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Colin Ross, B.Sc., P.Geo.
Senior Hydrogeologist

Table of Contents

List of In-Text Tables

List of Figures

List of Appendices

1.0 INTRODUCTION

Azimuth Environmental Consulting, Inc. ("Azimuth") has been retained by Pratt Development Inc. to conduct a Hydrogeological Assessment for the proposed Pratt-Galloway/Orsi Subdivision located at 16533 Highway 12 and 823 King Street within the Town of Midland, Simcoe County, Ontario (the "Site")(Figure 1). This report reflects a revised version of the report which incorporates revisions to the development plan as well as addresses review comments provided by the Town of Midland and Severn Sound Environmental Association (SSEA).

The Site is approximately 31 hectares (ha) in size and is located on the north side of Highway 12, to the west of William Street and to the east of King Street (Figure 2). The Site includes a 13.5 ha parcel of land referred to as the Pratt-Galloway property in addition to a 17.5 ha parcel of land referred to as the Orsi land. The Site was reportedly historically used for agricultural production, and is currently composed of undeveloped forest, shrub, meadow, wetland, and a gravel access path.

The current assessment provides a summary of the existing environmental conditions as it relates to the soil and ground water regime at the Site.

2.0 BACKGROUND

The following documents were reviewed as part of the current assessment:

- Jones Consulting Group. 2022. Preliminary Servicing & Stormwater Management Report. Pratt-Galloway Subdivision.;
- Terraprobe, Inc. 2019. Assessment of Groundwater Levels May 2018 to June 2019 Monitoring Proposed Galloway Subdivision Residential Development Midland, Ontario. 3-18-0034-02;

3.0 BACKGROUND ENVIRONMENTAL SETTING

3.1 Soil

The soil map of Simcoe County (Soil Survey Report No. 29, Scale 1:63,360) shows the uppermost soil at the Site to be composed of Vasey sandy loam. Vasey sandy loam is a light grey, calcareous loam and sandy loam till with good drainage. This soil classified within hydrologic soil group AB. Group A soils represent material with low runoff potential and high infiltration rates even when thoroughly wetted. Group B soils represent material with moderate infiltration rates when thoroughly wetted.

3.2 Physiography

The Ontario Geologic Survey (Chapman and Putnam, 1984) describes the area as being located within the Simcoe Uplands Physiographic region. The Simcoe Uplands comprise a series of broad, rolling till plains separated by steep-sided flat-floored valleys. The rolling till plains are encircled by numerous shorelines, indicating that they were previously islands in glacial Lake Algonquin. The till in these upland areas consists of a gritty loam, becoming more sandy toward the north.

3.3 Topography and Drainage

According to local topographic mapping, the Site is found at an elevation of 206 – 220 masl (Figure 2). The surrounding area slopes toward the Site from the north and west. A drainage feature/tributary of the Wye River traverses the east half of the Site, discharging in the south east corner of the Site to a roadside ditch that conveys flow to two culverts beneath William Street (Figure 2). The channel continues toward the Wye River and empties into Georgian Bay approximately 800 m north east of the Site.

3.4 Bedrock Geology

The Ontario Geologic Survey (OGS) Earth Database shows that the uppermost bedrock unit at the subject property consists of limestone with minor shale or dolostone of the Simcoe Group of the Gull River and Bobcaygeon Formations (OGS, 2017). The Simcoe Group is Middle Ordovican in age. Bedrock is sufficiently deep (70m+) and does not influence the shallow hydrogeology of the Site.

3.5 Quaternary Geology

The surficial material at the Site is composed of ice-contact stratified deposits consisting of sand and gravel with minor silt, clay, and till (OGS, 2017). Site specific material descriptions are included in Section 4.1 below.

3.6 Hydrogeology

The Ontario Ministry of Environment, Conservation, and Parks (MECP)'s Water Well Records (Appendix B) were referenced for any recorded well information within the vicinity (~ 500 m) of the Site (GIN, 2019, Table 1). The development will be serviced with public utilities; however historic well records can be used to gain subsurface information which can provide insight into the geological formations within the area. All wells within 500 m of the Site are provided on Figure 3.

Table 1: MECP Water Well Database Summary

Well No.	Distance from the Site (m)	Direction from the Site	Elevation (m)	Date Drilled	Well Type	Well Depth (m)	Water Level (m)	Primary Use
4905240	5	E	212	1977-11-13	Overburden	6.1	3.1	Livestock
5715451	5	SW	210	1978-07-20	Overburden	42.1	28.4	Domestic
5703911	130	SW	210	1964-05-06	Overburden	64.9	-	Test Hole
5703908	175	SW	209	1963-04-18	Overburden	34.1	26.5	Livestock
5738829	300	E	193	2004-05-12	Overburden	7.0	-	Observation
5703912	310	NW	216	1948-01-16	Overburden	33.2	24.4	Domestic
5703910	365	SW	212	1959-07-29	Overburden	34.8	24.4	Domestic
5703909	390	SW	212	1951-10-15	Overburden	39.9	25.9	Commercial
5707895	425	SW	213	1971-02-10	Bedrock	75.0	-	Abandoned

The well records included within Table 1 were advanced primarily for domestic, livestock, commercial, observation, or test hole use, with one record listed as abandoned due to limited supply. The wells were drilled between 6.1 and 75.0 mbgs. All but one of the recorded water levels were between 24.4 and 28.4 mbgs with the remaining water level recorded at 3.1 mbgs. The overburden material listed in the well records was variable, ranging between surficial clay, sand or gravel. One record encountered shale bedrock at a depth of 74.4 mbgs. One record (No. 4905240) is located in close proximity to the Site based on the well record coordinates; however upon inspection of the original well record it is located within the Township of Caledon on Mona Road. This record is therefore not located within the vicinity of the Site.

A review of the Source Water Protection Areas as identified on the MECP Source Protection Information Atlas website indicates that the Site is located in a Significant Ground Water Recharge Area (SGRA); however it is not considered a Highly Vulnerable Aquifer (HVA). A portion of the north west corner of the Site is located within the Wellhead Protection Area (WHPA) Q1 zone, while the entire Site is located within a Wellhead Protection Area (WHPA) Q2. However, the Site is not located in a WHPA-A, B, C, D, or E area. Given the location within the Q2 area, ground water recharge at the Site will need to be maintained and is addressed in Section 6.0. As a portion of the Site is located within a Q1 area, this would limit activities in this area where water is removed without returning it to the same source. As this section of the property is residential, there is no concerns with respect to the proposed landuse. It is further noted that the entire development will be municipally serviced such that no permanent ground water taking will occur.

According to information obtained from the Oak Ridges Moraine Groundwater Program (ORMGP), the ground water table at the Site is located at 182 to 189 masl which corresponds to 18 to 30 m below ground surface (mbgs). The ground water flow direction is from west to east toward the Wye River. These data are an estimate based on

static water levels from nearby wells less than 20 m deep. The accuracy is dependent on the density of wells in the vicinity of the Site. These data should therefore be used as an approximation only and the Site specific data discussed below are a better representation.

4.0 MONITORING

4.1 Drilling Program

A geotechnical program was completed for the Site in May of 2018 by Terraprobe Inc. As part of this program, twelve (12) boreholes were advanced across the Site to depths between 6.2 and 6.6 mbgs. The location of each borehole is provided in Appendix C. The boreholes were advanced using a track-mounted, continuous-flight power-auger machine equipped for soil sampling. Split-spoon samples were recovered for soil classification and laboratory testing. Upon completion, each location was equipped with a 32 mm diameter piezometer with 1.5 m length screens.

The Terraprobe borehole logs are provided in Appendix C. In general, the subsurface material was composed of a layer of topsoil (75 to 380 mm) overlying sandy silt / sand and silt / silt layer overlying a clayey silt / clay and silt/ silty clay layer overlying a sandy silt till /silty sand till layer. One borehole (102) encountered up to 0.9m of fill mixed with topsoil overlying the native material and two boreholes (103 & 205) encountered a surficial layer of sand or sand and gravel.

4.2 Ground Water Elevation

As noted above, twelve monitoring wells were installed by Terraprobe in May of 2018. The water level at each well was measured by Terraprobe monthly between June of 2018 and June of 2019. Azimuth then completed monthly measurements of 103, 104b, 105, 106, and 206 between July of 2019 and November of 2019. The complete record of measurements is included in Appendix C. The original well 104 was destroyed sometime after September of 2018. This well was replaced in June of 2019 and the new well is identified as “104b”.

It should be noted that typically upon installation, the end cap of a piezometer / well screen is punctured to allow for drainage of any collected water. The well cap is usually 10 cm deep, and therefore if it is not punctured then water may accumulate in the well cap and create a false positive when a water level is collected. A false positive is determined when the reading is consistently recorded within 10 cm of the bottom of the well and does not follow the typical pattern of seasonal variation.

The readings collected for 101, 102, and 105 show the pattern consistent with false positive recordings and are therefore considered dry for the period of record (*i.e.* actual water table depth below bottom of well). In addition, the measurements collected by

Terraprobe in May of 2018 were upon borehole completion, and are therefore not considered stabilized readings.

Based on the range of ground water measurements collected across the Site, the measurements collected on April 18th, 2019 are considered the high ground water table for preliminary design. The data collected at this time is shown on Figure 4. It should be noted that additional monitoring did occur in April and May of 2020 to confirm the high ground water conditions, particularly within the storm water management pond area of the Orsi development (MW104b). As the overall ground water elevations in 2020 were not as high as they were in 2019, the 2019 were maintained as the representative highs and are provided in Table 2. Given MW104b was not installed during the April 2019 monitoring event, the April 2020 value has been included the table as well as Figure 4 to provide an estimate of high water table in that area.

Table 2: High Ground Water Conditions

Well ID	Screen Depth	Ground Elevation	April 2019 Measurement[1,2]	
	mbgs	masl	mbgs	masl
101	4.9 – 6.4	211.3	6.4 (dry)	204.9 (dry)
102	5.1 – 6.6	209.8	6.3 (dry)	203.5 (dry)
103	5.1 – 6.6	211.0	3.0	208.0
104	5.1 – 6.6	208.8	-	-
104b	5.1 – 6.6	208.4	**2.1***	**206.3***
105	5.1 – 6.6	208.5	6.4 (dry)	202.1 (dry)
106	5.1 – 6.6	206.9	3.8	203.2
201	5.1 – 6.6	211.6	2.3	209.3
202	5.1 – 6.6	211.2	0.3	210.9
203	4.7 – 6.2	210.3	0.3	210.0
204	5.1 – 6.6	210.1	5.0	205.1
205	5.1 – 6.6	212.6	2.9	209.7
206	4.7 – 6.2	212.1	1.7	210.4

[1] From Terraprobe (2019)

*** - measurements from April 2020**

The measured ground water level at the Site in April of 2019 ranged from less than 202.1 masl to 210.9 masl. This represents a variability of at least 8.8 m across the Site area.

The ground water flow direction was not consistent across the Site area. This is likely due to incomplete data (some wells were dry or destroyed prior to spring conditions), perched conditions above the silty clay, or the presence of the buried sanitary sewer line. The high ground water conditions are provided on Figure 4. The contours show that on the east side of the site, the flow radiates out ward to the west and south from the north east corner. On the west side of the Site, ground water flow is from west to east. Dry wells or deeper ground water conditions at BH101, BH102 and BH204 along the middle

of the Site are apparent, and contours show ground water flow toward this centre area from both the east and the west.

Due to the presence of forest cover, ground water monitors were not installed in the south west portion of the Site. Most of this vegetation has since been removed from the Site.

4.3 Hydraulic Conductivity Testing

In order to understand the hydraulic characteristics of the underlying overburden, transient slug tests were performed within four (4) monitoring wells constructed at the Site.

A slug test involves the instantaneous injection or withdrawal of a volume or slug of water or solid cylinder of known volume. This is accomplished by adding or displacing a known volume to/from a well and measuring water level response time to return to equilibrium. Water level measurements were recorded manually. Data was analyzed using the Hvorslev Method (1951), which assumes a homogeneous, isotropic medium in which soil and water are incompressible. Hydraulic testing results are summarized in Table 3.

Table 3: Hydraulic Testing Results

Monitoring Well	Log Hydraulic Conductivity (m/s)	Soil Description
104	2.1×10^{-7}	Sandy Silt Till
106	9.9×10^{-9}	Clayey Silty Sand Till
202	1.2×10^{-6}	Sandy Silt Till
205	3.5×10^{-9}	Sandy Silt Till

Notes: Values rounded off for presentation purposes

The four locations (104, 106, 202, and 205) were chosen based on the subsurface material encountered in the borehole logs, presence of ground water in the wells, and to ensure adequate coverage across the Site. Slug test data indicates that the hydraulic conductivity of the deposits range between 1.2×10^{-6} to 3.5×10^{-9} m/s. Both MW106 and MW205 had slow recovery after water was purged from the well, while the tests completed at MW104 and MW202 were consistent with published hydraulic conductivity values for a sandy silt till material. This differential is likely the result of variability within till unit across the Site due to possible desiccation or composition.

The results of each of the slug tests are included in Appendix D.

4.4 Water Quality Sampling

A water quality sample was collected from Well 104 and 202 on January 20th 2020. These samples were collected following purging of 3x borehole volumes or until the well went dry and then sampled following sufficient recovery as per standard practice. The results are included in Appendix E. The results show that all of the parameters meet the Ontario Provincial Water Quality Objectives (PWQO) with the exception of total phosphorus. It should be noted that the samples both contained a high turbidity value (11,000 and 72,000 NTU). Phosphorus is commonly bound to soil particles suspended in the water column. Erosion and sediment control measures will be put in place to ensure discharge water does not contain elevated sediment prior to discharge. These measures will likely significantly reduce the concentration of phosphorus in the discharge water. These results are expected to be representative of the Site due to the undeveloped nature of the parcel.

5.0 DEWATERING AND IMPACT ASSESSMENT

The proposed development will include the construction of residential homes, underground servicing, and a storm water management pond. Based on the proposed servicing elevations and measured ground water elevations discussed below, dewatering will be required to facilitate a dry working area during construction of the underground services and pond.

5.1 Drawdown Conditions

Drawing No. PND-1, PND-2, and PP1 to PP-10 of the Jones (2022) report were reviewed to determine the minimum structure elevation. For the SWM pond, a 1.0 m contingency was added to pond base to account for a pond liner, if required.

The base of the the SWM pond will be approximately 206.3 masl which means dewatering to 205.3 masl. The high ground water table in the vicinity of the pond block is estimated to be between 203.5 and ~209 masl. These elevations result in the intersection of the water table by up to 3.7 m. The target ground water depth during dewatering is 1.0 m below the maximum excavation to maintain dry conditions, so a total drawdown of 4.7 m is required.

Profile PP-2 contained the largest drawdown depth of 2.6 m. This is based on a minimum structure elevation of 206.6 masl, which corresponds to a target dewatering depth of 205.6 masl. The high ground water table in the vicinity of PP-2 is estimated to be 210.9 masl. These elevations result in a total drawdown of 5.3 m.

Based on this information, the maximum required drawdown for the pond is estimated to be 4.70 m, and 5.3 m for the servicing. The actual drawdown will depend on

construction timing and length of servicing trenches constructed / dewatered at a time. It is therefore recommended that pond and service corridor excavation is completed in the dry summer months.

5.2 Approximate Dewatering Volumes

Based on the hydraulic (slug) testing completed at the three Site monitoring wells (Section 4.3), a range of hydraulic conductivities was established (1.2×10^{-6} to 3.5×10^{-9} m/s), which given the range indicates variability in the grain size of the till material beneath the Site. The highest hydraulic conductivity value representing the sandy silt till unit of 1.2×10^{-6} was utilized in the calculations which represent a more elevated value for conservative purposes.

Calculations for dewatering rates / volumes were completed using the following steady state flow equation derived from Drisoll, 1986 used for trench excavations:

$$Q = \{[(\pi * K) * (H^2 - h^2)] / [\ln(R_o / r_e)]$$

(Ref: Powers *et al*. (2007)

Table 4: Summary of Structure Dewatering Conditions

Variable	Entire Pond*	Max Profile**
Estimate of Equivalent Radius **[r_e]** (m)	150	1.5
Hydraulic Conductivity **[K]** (m/s)	1.2×10^{-6}	1.2×10^{-6}
Maximum Required Drawdown **[H-h]** (m)	4.7	5.3
Saturated Thickness Before Pumping **[H]** (m)	4.7	5.3
Depth of Water During Pumping **[h]** (m)	0	
length of excavation **[a]** (m)	425	150
width of excavation **[b]** (m)	45	3
Radius of Influence **[R]** (m) [1]	165	17
Discharge **[Q]** (L/day)	73,000	54,000
Discharge [Q] (L/day) 3 X Safety Factor Applied	**219,000**	**162,000**

1 - $R_o = 3000 * (H-h) * \sqrt{k}$ - *Sichardts Formula, (Powers et al. 2007)*
2 - $r_e = (a+b) / \pi$ *(Powers et al. 2007).*
* - It was assumed that 1 m liner could be present at base of pond
** - It was assumed that each trench will be 3 m wide and up to 150 m will be open at one time

Based on the information provided in Table 4, the dewatering volume for entire pond cell is anticipated to be 73,000 L/day, while applying a 3X safety factor would create an

estimated daily volume of 219,000 L. The dewatering volume for the max profile is anticipated to be 54,000 L/day, while applying a 3X safety factor would create an estimated daily volume of 162,000 L/day. These values are based on worst case spring season ground water values, and assume up to 150 m of trench will be constructed at any one time. The dewatering volume is anticipated to be lower during dry summer months or in other areas of the Site where the servicing does not penetrate the water table as deep.

Any construction dewatering between 50,000 L/day and 400,000 L/day requires registration under the Environmental Activity and Sector Registry (EASR). Any active construction dewatering above 400,000 L/day requires a Permit To Take Water (PTTW). As noted above, the magnitude of dewatering required will vary on the timing of construction and less dewatering could be needed in the summer drought conditions. Peak ground water elevation occurred in April. Based on the above estimate, registration under EASR may be advisable as rates will likely exceed 50,000 L/day but be within 400,000 L.

5.3 Area of Influence Impact

The calculated zone of influence for the Stormwater pond is estimated to be 165 m, 17 m.

In reviewing impacts to surrounding ground water users and natural features, it is noted that municipal water is available for adjacent parcels in the vicinity of the Site. This is evident through the presence of water service lines within the Underground Services maps provided in Jones (2021).

In Section 3.6, all private wells within 500 m of the Site were reviewed. Table 1 shows the presence of nine (9) wells installed for livestock, domestic, observation, test hole, or commercial use. Other than the well drilled for observation use, all of the wells were drilled between the years 1948 and 1978. These wells were likely advanced prior to the availability of municipal services, when the area was used primarily for agricultural or rural residential. It is our expectation that these wells are no longer in use due to the conversion of land through single lot home development, or by connecting to the municipal system.

In the event wells included in Table 1 are still in use, the potential for impact through on-site dewatering is low. Seven records are 130m+ from the Site boundary, which is beyond the dewatering area of influence. In addition, six of these records are at least 33 m deep and are therefore less susceptible for impact. The remaining well is only 7 m deep; however it is listed for observation use and therefore is not relied upon for water supply.

The remaining two records are located within the area of influence and are positioned approximately 5m east or south west of the Site. As noted in Section 3.6, the coordinates recorded for well No. 4905240 are not correct and the well is not within the vicinity of the Site. The final well record (No. 5715451) is located approximately 5m to the south west in the vicinity of Brandon Street. This well was drilled for domestic purposes in the 1970s. Although there is the potential for this well to be active, the area is now primarily used for commercial purposes. In addition, the well is approximately 42m deep and is therefore less susceptible for impact.

Similarly, the closest natural heritage feature is the drainage feature/tributary of the Wye River that traverses the east half of the Site, discharging in the south east corner of the Site to a roadside ditch that conveys flow to two culverts beneath William Street. Based on the proposed development plans included in Jones (2021), this feature will not be retained post-development. The primary concern is therefore the down gradient portion of this feature. However, any potential interference associated with this feature could likely be mitigated through dewatering discharge being directed to the culverts beneath William Street (after appropriate erosion and sediment controls) to maintain existing flows.

Based on the above assessment, the potential for temporary dewatering to impact adjacent private well or natural heritage features is low. However, the dewatering contractor should still return discharge water back into the environment in the vicinity of the Site after appropriate erosion and sediment controls when practical.

5.4 Construction Dewatering Plan & Monitoring

Although the dewatering plan will ultimately be up to the discretion of the dewatering contractor, discharge water will likely be directed toward south east corner of the Site toward the road side ditch along William Street after appropriate sediment and erosion controls.

The dewatering contractor will be required to provide appropriate control measures to ensure sediment load in the discharge water is limited with total suspended solids (TSS) concentrations being maintained below 15 mg/L. Although specific plans and associated structures are best designed by the dewatering contractor retained during the construction phase, at a minimum the plan should include a temporary sedimentation pond and / or setting tanks to ensure any mobilized solids collected from the inductor well or sump pumps are allowed to fall from suspension prior to discharge into the natural environment or storm water infrastructure.

Throughout construction, regular inspection and repairs of control measures should be completed by the dewatering or construction contractors. A representative should be available onsite to complete periodic inspection during the construction period, while the following specific items should also be completed:

- All silt / sediment controls are to be inspected daily, and deficiencies corrected immediately;
- All silt / sediment controls are to be monitored during and following rain events;
- Photographs are to be collected of the work area prior to, and during construction;
- Prior to discharge of water into the tributary, a water sample should be collected and submitted for laboratory analysis of TSS. Once it is confirmed that TSS concentrations are below 15 mg/L, discharge can commence,
- Daily visual inspections should be completed of the discharge water to ensure sedimentation within any natural features does not occur,
- Weekly TSS sampling or field turbidity readings, if a correlation between turbidity and TSS concentrations could be developed.
- If TSS concentrations are found to exceed 15 mg/L, then dewatering should cease or additional mitigation measures employed to bring the discharge water quality back into compliance, which could include additional mitigation items such as settling tanks, envirobags, or other similar techniques which suit the actual dewatering setup employed such that sediment loading can be reduced.

Additional monitoring activities for water levels in the adjacent monitoring wells and stream are not viewed as critical as shallow private wells are not anticipated within the dewatering zone of influence. Dewatering discharge is proposed to be directed to the William Street culvert after appropriate sediment and erosion controls.

6.0 WATER BALANCE

In order to determine the potential changes to the natural ground water recharge conditions, a pre- and post-development water balance assessment has been completed using the Thornthwaite and Mather method (1957). This method evaluates evapotranspiration based on precipitation and temperature. Residual soil saturation is a function of topography and soil type. Monthly data are tabulated from daily average temperature and precipitation, and the water budget is a continuous calculation over the period of record. To clarify, the method and the approach used by many individuals in examining infiltration resets annual conditions (moisture deficit, snow storage, etc) over the winter months because of the general lack of infiltration during the frost period. However, we maintain those records and carry them forward from month to month during the entire period of record.

Values were determined on a monthly basis, compiled from daily Environment Canada meteorological data station located in Barrie, Ontario between 1970 and 2021 (Station ID 6110557/611770). The calculations are based on the average conditions during this period; the average precipitation was 907 mm, rainfall was 654 mm, evapotranspiration was 479 mm and the surplus was 428 mm.

The Site slopes toward the south east corner in the pre- and post-development scenario. Based on this slope, the Site can be considered one catchment in terms of the water balance assessment. Pre- and post-development catchments are provided in the Jones (2021) report. The water balance will therefore be completed on a Site scale, and can be used as a feature based assessment for any down gradient features.

6.1 Land Use

6.1.1 Pre-Development

The pre-development Site area was classified according to land use/vegetation type. Land within the pre-development area is considered impervious (structure or gravel), meadow or forest. A summary of the pre-development land use is provided in Table 5, which was estimated based on review of aerial photographs of the Site.

Table 5: Pre Development Area Classification

Land Use	Land Area (m^2)
Impervious (structure or gravel)	10,825
Meadow	181,160
Forest	121,400
TOTAL	**313,385**

Land within the pre-development scenario is considered 3% impervious.

6.1.2 Post-Development

The land classification in the post-development scenario was based on catchment information provided in the Jones (2022) report and the below assumptions:

Orsi Property

- The storm water block is 40,559 m^2 in size including with 12,220 m^2 of this is considered impervious land comprising of the lined permanent pool and 2,342 m^2 of other impervious (i.e. service road);
- The road right of way network is 14,040 m^2 in size and is considered 53% impervious land;
- The remaining area is composed of industrial lots that are 60% impervious. The impervious land is composed of 20% structures and 80% asphalt;

- The remaining land is considered landscaped grass;

Pratt Galloway Property:

- The road right of way network is estimated to be 33,617 m^2 in size and is considered 46% impervious land;
- The remaining area is composed of residential lots that are 60% impervious. The Impervious land is composed of 67% structure and 37% asphalt;
- The remaining land is considered landscaped grass;

Land within the post-development Site is summarized in the below Table 6:

Table 6: Post Development Area Classification

Land Use	Classification	Land Area (m^2)
Stormwater Management Pond (Lined Perm. Pool)	Impervious	12,220
Landscaped Grass	Pervious	133,344
Structures	Impervious	105,035
Other Impervious (roads, driveways, sidewalks)	Impervious	62,785
	TOTAL	**313,385**

Land within the post-development scenario is considered 50% impervious.

6.2 Infiltration

Infiltration is generated one of two ways: (1) directly from rainfall impact on pervious surfaces; and (2) indirectly when runoff from impervious surfaces is diverted into adjacent naturalized areas.

Infiltration factors for the Site were estimated based on the underlying soil, local topography, and ground cover as per Table 2 of the Ministry of Environment and Energy (MOEE) Hydrogeological Technical Information Requirements for Land Development Applications (1995).

The soil variable factor was determined by taking into account information obtained from the regional geologic mapping (Section 3.0) and the geotechnical program completed for the Site (Section 4.1). This information suggests that the surficial material at the Site is primarily composed of sandy silt / silty sand overlying a clayey silt / clay and silt/ silty clay layer overlying a sandy silt till /silty sand till layer. The infiltration factors utilized in the water balance assessment are summarized in Table 6 below.

Table 7: Summary of Pervious Land Infiltration Factor

Scenario	Land Use	Infiltration Factor	Assumption
Pre-Development	Forest	0.55	Rolling land (0.15), sandy silt or clayey silt soil (0.2), woodland (0.2)
	Shrub / Meadow	0.50	Rolling land (0.15), sandy silt or clayey silt soil (0.2), shrub/meadow (0.15)
Post-Development	Landscaped	0.50	Rolling land (0.2*), sandy silt or clayey silt soil (0.2), landscaped grass (0.1)

* - consideration given to flatter grade across site in post-development

6.2.1 Pre-Development Infiltration

Pre-development infiltration was determined by multiplying the annual average surplus amount, the area of each land use, and the infiltration factor for each land use. The pre-development annual infiltration is therefore 67,346 m^3/year (Table A - Appendix F).

6.2.2 Post-Development Infiltration

Post-development infiltration (without mitigation) was determined by multiplying the annual average surplus amount, the area of each land use, and the infiltration factor for each land use. The post-development annual direct infiltration is therefore 28,536 m^3/year. There is therefore a decrease in infiltration of 38,810 m^3/year from pre- to post-development without any mitigation measures employed (Table B - Appendix F) .

Additional infiltration will also be gained through low impact development (LID). Infiltration will be gained when residential rooftop downspouts are directed onto adjacent grassy areas. It is assumed that 75% of the rooftop runoff is directed to grass, while the remaining 25% is directed to impervious asphalt. The volume of infiltration gained from rooftop runoff is therefore determined by multiplying the rooftop area by 75%, by the total rainfall volume, by 80% (to account for evaporation) and by the infiltration factor of the receiving land use (grass). Infiltration gained from rooftop runoff is therefore 8,268 m^3/year, bringing the post-development infiltration to 36,804 m^3/year. It is noted that larger rooftop areas and more limited grassed area adjacent to rooftops are typical in industrial developments such that rooftop rainfall recovery is not as easily designed or achieved. As such, no rainfall recovery has been accounted for in these calculations and all runoff is directed to adjacent impervious areas into the LID / SWMP.

It is our understanding that additional LIDs such as an infiltration gallery will be incorporated into the SWM block to facilitate infiltration. In order to correlate event based rainfall data, for which the LID's are designed (i.e. 5 mm rainfall event), to annual averages, as is what is utilized in water balances, an event based assessment has been

completed for the Barrie Climate station. Rainfall events over a recent 5 year period (2013 – 2017) were broken down by event size, such that total volumes for each of these events could be calculated. These totals were then related to the total volume over the same period to obtain a percentage. This percentage is then multiplied by the annual average rainfall value (654 mm) utilized in the overall water balance to obtain an annual average amount / depth for the various intervals.

There is approximately 125,680 m^2 of impervious area which includes roads and paved areas associated with both the residential and industrial blocks as well as the rooftop area for the industrial lots that can contribute runoff to the LID. After incorporating the residential rooftop infiltration, the deficit that must be captured through the LID is 30,542 m^3. This equates to 243 mm of rainfall per 1 m^2 of impervious area per year. Based on the above frequency analysis using data from the Barrie Climate Station, 243 mm represents 37% of the annual rainfall which represents capturing the 3.5 mm event across the entire 125,680 m^2 area. This represents an LID with a storage volume of approximately 440 m^3. As the design for the LID storage is 460 m^3 (Jones, 2022), this allows for capture of the required rainfall event size.

The total infiltration gained through indirect measures is 38,844 m^3, which includes 8,268 m^3 from residential rooftop diversion and 28,536 m^3 from the proposed infiltration trench LID (Table C - Appendix F).

It is noted that added conservancy is reflected in these numbers through discounting of snow melt. Although difficult to quantify due to seasonal storage and movement (i.e. snow banks), snow melt can provide a potential meaningful contribution as it represents ~28% of total precipitation. In addition, since the SWM pond collects runoff from off Site sources, additional water will be available for infiltration within the on Site LID.

The complete water balance tables are included in Appendix F.

6.3 Water Balance Summary

Using the climate model data and calculations mentioned above, the water balance was completed for pre-development, post-development, and post-development with mitigation (Table D - Appendix F).

The pre-development infiltration volume is 67,346 m^3/year. This assumes the Site is composed of forest, shrub/meadow, and impervious land. The post-development without mitigation infiltration volume is 28,536 m^3/year, which is a deficit of 38,810 m^3/year. This assumes the Site is composed of roads, structures, a SWM block, and landscaped grass. An additional 8,268 m^3 can be obtained from rooftop diversion and an additional

28,536 m^3 from the proposed infiltration LID within the pond. The post-development infiltration volume with mitigation is therefore 67,380 m^3/year which represents 100% of the pre-development volume.

7.0 SUMMARY AND CONCLUSIONS

Azimuth was retained by Pratt Development Inc. to conduct a Hydrogeological Assessment for the proposed Pratt-Galloway/Orsi Subdivision located at 16533 Highway 12 within the Town of Midland, Simcoe County, Ontario. The Site is approximately 31 hectares (ha) in size and is located on the north side of Highway 12, to the west of William Street and to the east of King Street. The Site includes a 13.5 ha parcel of land referred to as the Pratt-Galloway property in addition to a 17.5 ha parcel of land referred to as the Orsi land. The Site was reportedly historically used for agricultural production, and is currently composed of undeveloped forest, shrub, meadow, wetland, and a gravel access path. The current assessment provides a summary of the existing environmental conditions as it relates to the soil and ground water regime at the Site.

The Site is found at an elevation of 206 – 220 masl. The surrounding area slopes toward the Site from the north and west. An intermittent, naturalized stream channel is present in the east half of the Site, discharging via two culverts beneath William Street in the south east corner of the Site. A drilling program was conducted at the Site in May of 2018 to advance 12 boreholes with monitoring well completion. The program encountered of topsoil overlying sandy silt / sand and silt / silt layer overlying a clayey silt / clay and silt/ silty clay layer overlying a sandy silt till /silty sand till layer

Manual ground water measurements were collected from the monitoring wells installed at the Site. The high ground water level was collected in April of 2019. The high ground water level ranged from less than 202.1 masl to 210.9 masl. This represents a gradient of at least 8.8m across the Site area.

Slug tests were completed on four wells located on Site. The four locations (104, 106, 202, and 205) were chosen based on the subsurface material encountered in the borehole logs, presence of ground water in the wells, and to ensure adequate coverage across the Site. Slug test data indicates that the hydraulic conductivity of the deposits range between 1.2 $x10^{-6}$ to 3.5 $x10^{-9}$ m/s.

A water quality sample was collected from Well 104 and 202 on January 20th 2020. The results show that all of the parameters meet the PWQO with the exception of total phosphorus. This parameter is likely elevated due to the presence of suspended sediment within the water column of the monitoring well. Erosion and sediment control measures implemented during construction should lower this value prior to discharge.

A dewatering analysis was completed for the proposed SWM pond and proposed service lines. Based on the dewatering analysis, the dewatering volume for entire pond cell is anticipated to be 73,000 L/day, while applying a 3X safety factor would create an estimated daily volume of 219,000 L. The dewatering volume for the max profile is anticipated to be 54,000 L/day, while applying a 3X safety factor would create an estimated daily volume of 162,000 L/day. These values are based on worst case spring season ground water values, and assume up to 150 m of trench will be constructed at any one time. The dewatering volume is anticipated to be lower during dry summer months. Based on the above estimate, registration under EASR may be advisable as rates will likely exceed 50,000 L/day but be within 400,000 L.

Azimuth looked at the potential dewatering area of influence for construction dewatering. Based on the assessment, the potential for temporary dewatering to impact adjacent private well or natural heritage features is low. However, the dewatering contractor should still return discharge water back into the environment in the vicinity of the Site after appropriate erosion and sediment controls when practical.

A water balance was completed for the Site. The pre-development infiltration volume is 67,346 m^3/year. This assumes the Site is composed of forest, shrub/meadow, and impervious land. The post-development without mitigation infiltration volume is 28,536 m^3/year, which is a deficit of 38,810 m^3/year. This assumes the Site is composed of roads, structures, a SWM block, and landscaped grass. An additional 8,268 m^3 can be obtained from rooftop diversion and additional 28,536 m^3 from the proposed infiltration trench LID. The post-development infiltration volume with mitigation is therefore 67,380 m^3/year, which represents 100% of the pre-development volume and indicates that maintenance of ground water infiltration at the Site is achieved in the post development condition.

8.0 REFERENCES

Barnett, P.J., Cowan, W.R. and Henry, A.P. 1991. Quaternary Geology of Ontario, Ontario Geological Survey, Map 2556, Scale 1:1,000,000.

Chapman L.J., and D.F. Putnam, 1984. The Physiography of Southern Ontario. 3rd Edition, OGS Special Volume 2, Ministry of Natural Resources.

Hoffman, D.W. & N.R. Richards, 1962. Soil Survey of Simcoe County. Report No. 29 of the Ontario Soil Survey.

Jones Consulting Group, 2022. Preliminary Servicing and Stormwater Management Report – Pratt – Galloway Industrial Subdivision

Ontario Geological Survey (OGS).2017. OGS Earth Mapping. Obtained from: https://www.mndm.gov.on.ca/en/mines-and-minerals/applications/ogsearth

Ontario Ministry of the Environment and Climate Change (MOECC), 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications.

Thornthwaite, C.W., and Mather, J.R., 1957. Instructions and tables for computing potential evapotranspiration and the water balance. Climatology, vol. 10.

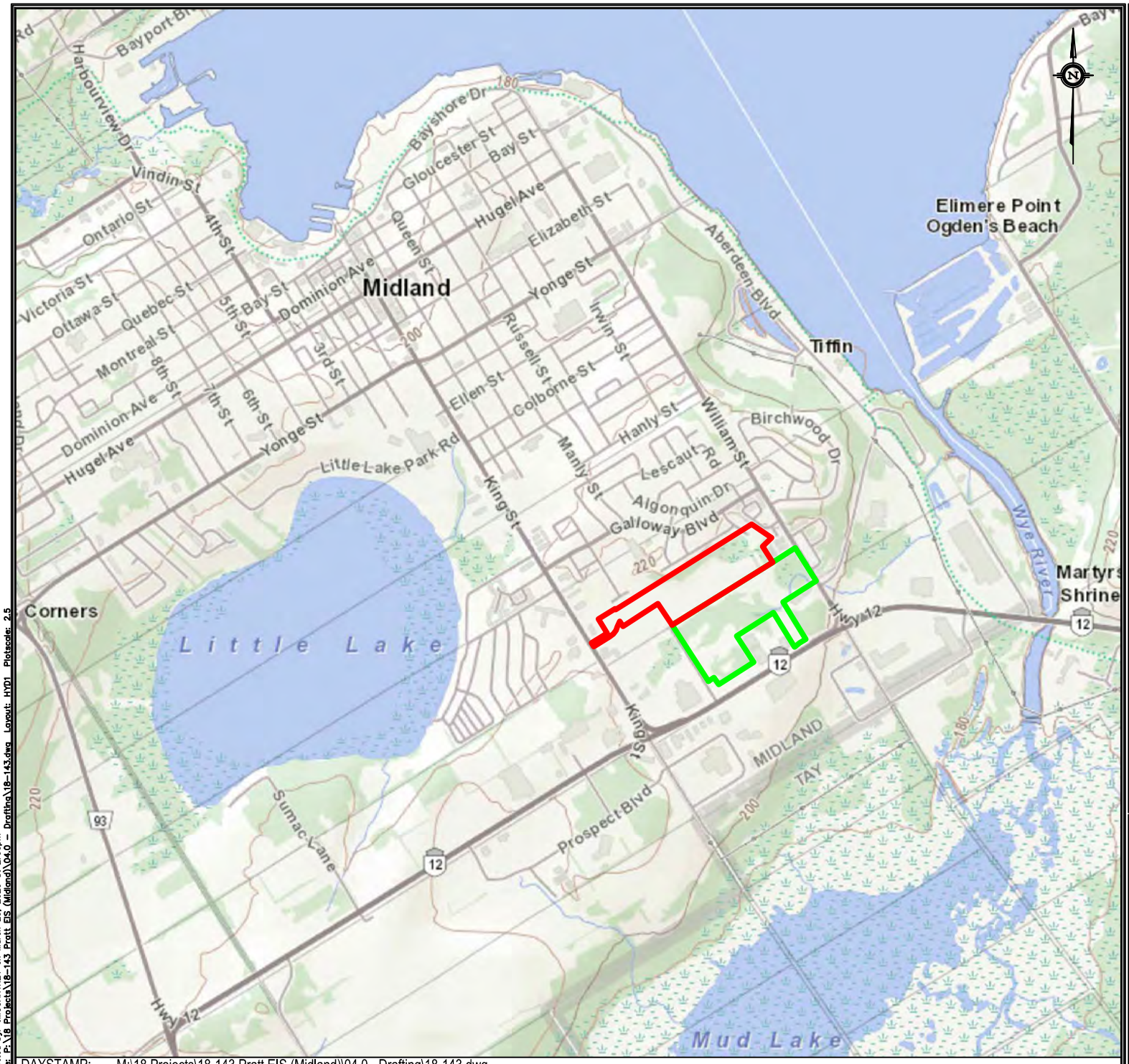
Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC). 2010. Low Impact Development Stormwater Management Planning And Design Guide. Version 1.

APPENDICES

Appendix A: **Figures**
Appendix B: **MECP Well Records**
Appendix C: **Terraprobe Report**
Appendix D: **Hydraulic Conductivity Tests**
Appendix E: **Water Quality Results**
Appendix F: **Water Balance Information**
Appendix G: **Ground Water Elevation Data**
Appendix H: **Development Plan**

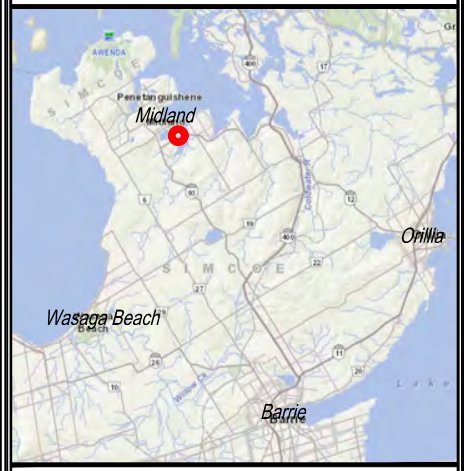
APPENDIX A

Figures



LEGEND:

- *Pratt-Galloway Subdivision*
- *ORSI Lands*



REG MAP

250m 0 750m

HORIZONTAL SCALE 1:25,000

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

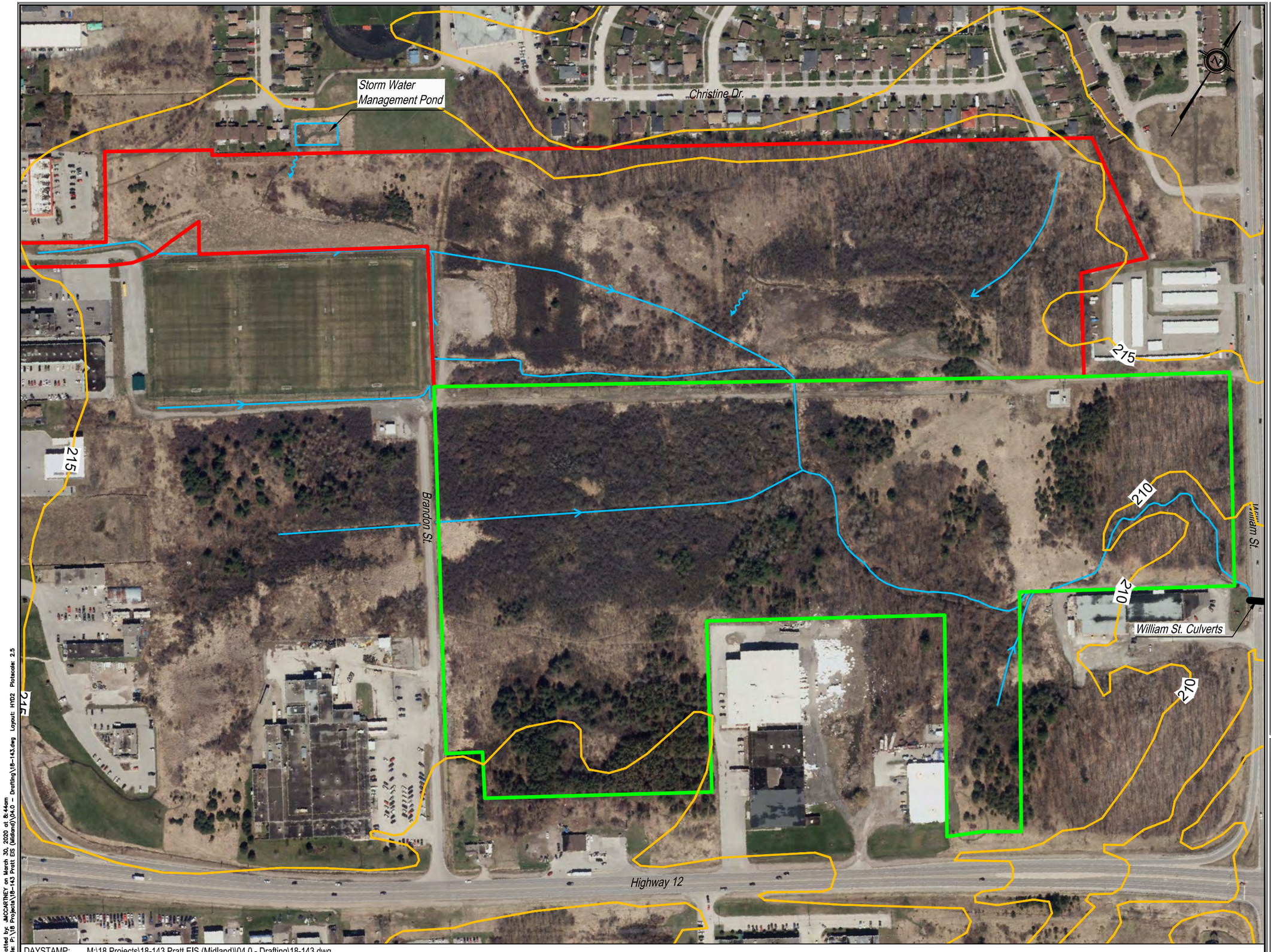
Study Area Location

Pratt Lands,
Midland, ON

DATE ISSUED: *January 2020*	Figure No.
CREATED BY: *JLM*	
PROJECT NO.: *18-143*	1
REFERENCE: *MNRF*	

DAYSTAMP: M:\18 Projects\18-143 Pratt EIS (Midland)\04.0 - Drafting\18-143.dwg

Plotted by: JMCCARTNEY on March 25, 2020 at 2:55pm
File: P:\18 Projects\18-143 Pratt EIS (Midland)\04.0 – Drafting\18-143.dwg Layout: HY01 Plotscale: 2.5



LEGEND:

- Pratt-Galloway Subdivision
- ORSI Lands
- Drainage Feature
- 5m OBM Contours

50m 0 100m

HORIZONTAL SCALE 1: 3,000

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

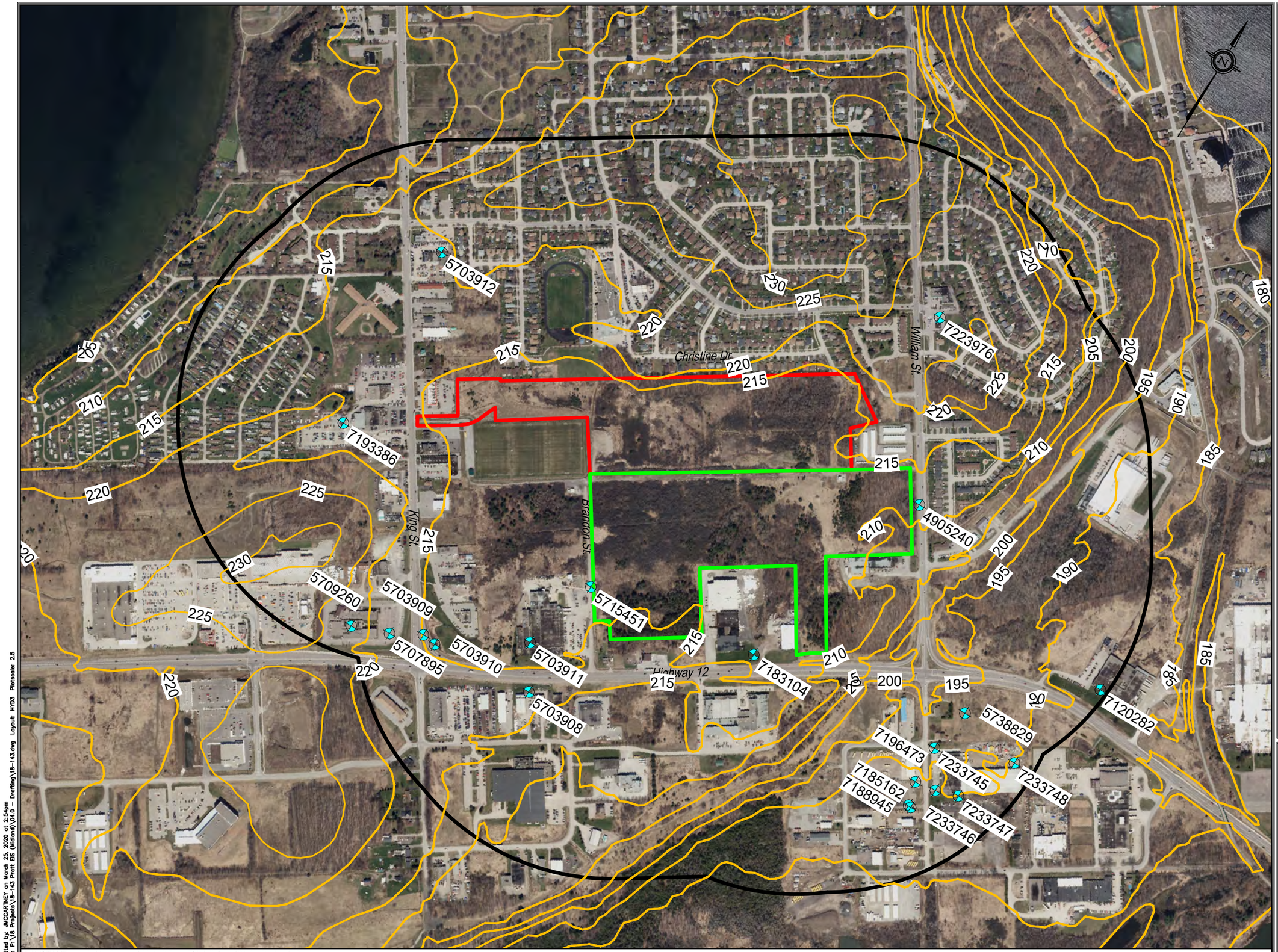
Existing Conditions

Pratt Lands, Midland, ON

DATE ISSUED:	April 2018	Figure No. 2
CREATED BY:	JLM	
PROJECT NO.:	18-143	
REFERENCE:	Simcoe County Maps	

DAYSTAMP: M:\18 Projects\18-143 Pratt EIS (Midland)\04.0 - Drafting\18-143.dwg

Plotted by: JMCCARTNEY on March 30, 2020 at 8:44am
File: P:\18 Projects\18-143 Pratt EIS (Midland)\04.0 - Drafting\18-143.dwg Layout: HY02 Plotscale: 2.5



LEGEND:

- *Pratt-Galloway Subdivision*
- *ORSI Lands*
- *50mm Study Area*
- *5m OBM Contours*
- *Water Well Locations*

Note:
Well locations are based on MECP well records and/ or GIN (2019) mapping.

100m 0 200m

HORIZONTAL SCALE 1:7,500

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

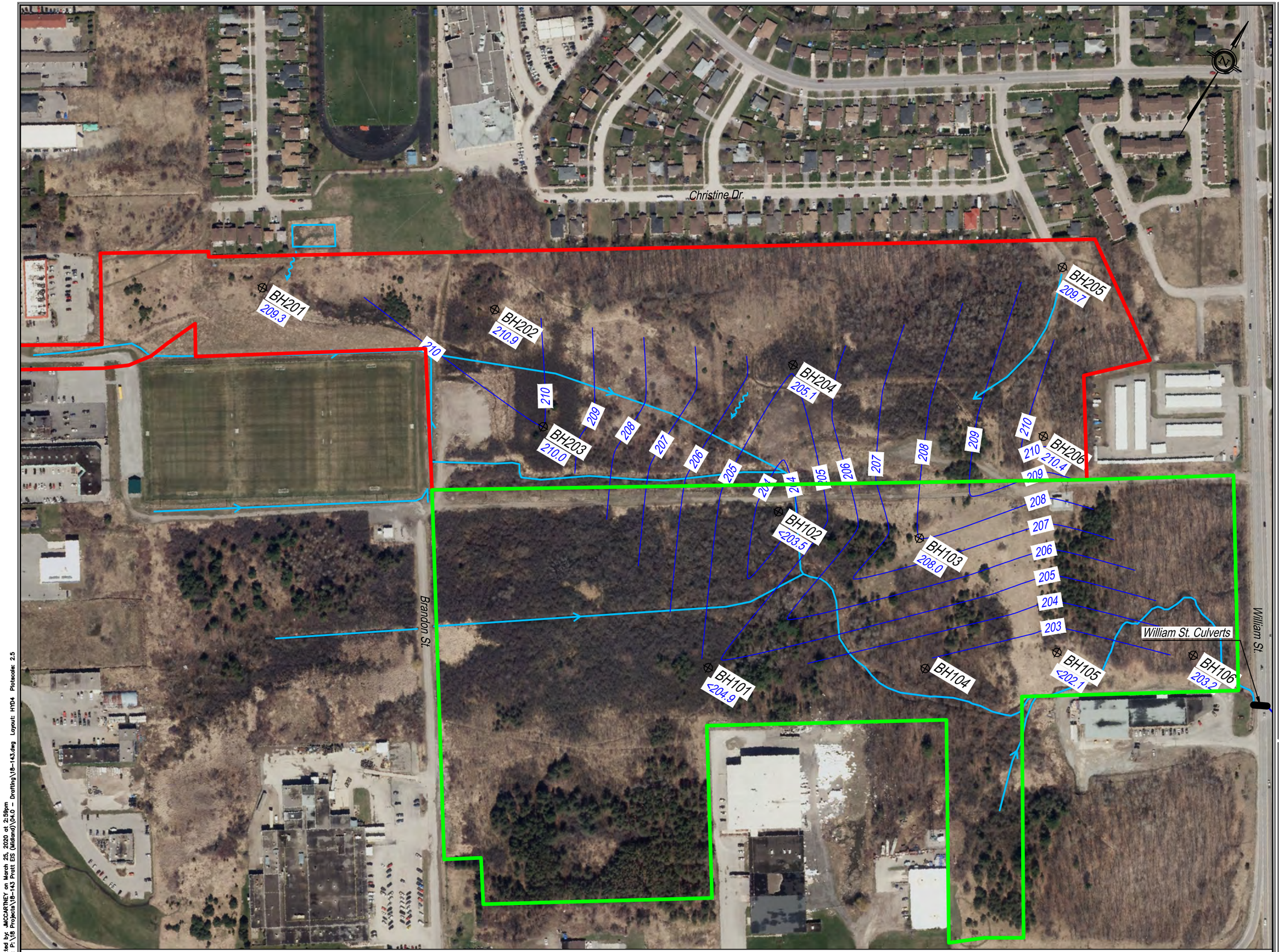
MECP Well Records

Pratt Lands,
Midland, ON

DATE ISSUED:	*April 2018*	Figure No. 3
CREATED BY:	*JLM*	
PROJECT NO.:	*18-143*	
REFERENCE:	*Simcoe County Maps*	

DAYSTAMP: M:\18 Projects\18-143 Pratt EIS (Midland)\04.0 - Drafting\18-143.dwg

Plotted by: JMCCARTNEY on March 25, 2020 at 2:54pm
File: P:\18 Projects\18-143 Pratt EIS (Midland)\04.0 – Drafting\18-143.dwg Layout: HYD3 Plotscale: 2.5



LEGEND:

- Pratt-Galloway Subdivision
- ORSI Lands
- Drainage Feature
- Borehole Locations
- 208.1 High Ground Water Elevation (April, 2019)
- 1m Ground Water Contours

50m 0 100m

HORIZONTAL SCALE 1: 3,000

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

High Ground Water Conditions

Pratt Lands,
Midland, ON

DATE ISSUED:	April 2018	Figure No. 4
CREATED BY:	JLM	
PROJECT NO.:	18-143	
REFERENCE:	Simcoe County Maps	

DAYSTAMP: M:\18 Projects\18-143 Pratt EIS (Midland)\04.0 - Drafting\18-143.dwg

Plotted by: JMCCARTNEY on March 25, 2020 at 2:59pm
File: P:\18 Projects\18-143 Pratt EIS (Midland)\04.0 - Drafting\18-143.dwg Layout: HY04 Plotscale: 2.5

APPENDIX B

MECP Well Records

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.4905240
External identity : ca.on.waterWell.4905240
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 6.10m
Elevation : 274.32m
Water level : 3.05m
Water yield : 4.55lpm
Water use : Livestock
Well status : Water Supply
Well type : Unknown

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	0.30	**Soil**	TOPSOIL HARD		
		Unknown material			
0.30	3.66	**Clay**	CLAY HARD	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
3.66	6.10	**Sand**	SAND LOOSE	[26,53]%	[2E-7,6E-3]m.s-1
		Unknown material			
6.10	6.10	**Gravel**	GRAVEL LOOSE	[24,44]%	[3E-4,3E-2]m.s-1
		Unknown material			

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5715451
External identity : ca.on.waterWell.5715451
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 42.06m
Elevation : 210.31m
Water level : 28.35m
Water yield : 22.73lpm
Water use : Domestic
Well status : Water Supply
Well type : Unknown
Sealing components : From 40.23 to 42.06m.
Screen components : From 38.4048 to 39.32m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	1.52	**Gravel**	STONES GRAVEL	[24,44]%	[3E-4,3E-2]m.s-1
		Gravel		[24,44]%	[3E-4,3E-2]m.s-1
1.52	3.35	**Clay**	CLAY	[34,57]%	[1E-11,4.7E-9]m.s-1
3.35	21.34	**Gravel**	GRAVEL	[24,44]%	[3E-4,3E-2]m.s-1
21.34	23.16	**Sand**	COARSE SAND	[26,53]%	[2E-7,6E-3]m.s-1
23.16	26.82	**Gravel**	GRAVEL CLAY MEDIUM SAND	[24,44]%	[3E-4,3E-2]m.s-1
		Clay		[34,57]%	[1E-11,4.7E-9]m.s-1
		Sand		[26,53]%	[2E-7,6E-3]m.s-1
26.82	40.54	**Sand**	COARSE SAND	[26,53]%	[2E-7,6E-3]m.s-1
40.54	42.06	**Sand**	FINE SAND	[26,53]%	[2E-7,6E-3]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5703911
External identity : ca.on.waterWell.5703911
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 64.92m
Elevation : 210.31m
Water use : Not Used
Well status : Test Hole
Well type : Unknown

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	0.61	**Soil**	TOPSOIL		
0.61	21.34	**Clay** **Gravel** **Gravel**	CLAY STONES BOULDERS	[34,57]% [24,44]% [24,44]%	[1E-11,4.7E-9]m.s-1 [3E-4,3E-2]m.s-1 [3E-4,3E-2]m.s-1
21.34	30.18	**Gravel** **Gravel** **Sand**	STONES GRAVEL MEDIUM SAND	[24,44]% [24,44]% [26,53]%	[3E-4,3E-2]m.s-1 [3E-4,3E-2]m.s-1 [2E-7,6E-3]m.s-1
30.18	30.78	**Gravel** **Sand** **Silt**	GRAVEL MEDIUM SAND SILT	[24,44]% [26,53]% [34,61]%	[3E-4,3E-2]m.s-1 [2E-7,6E-3]m.s-1 [1E-9,2E-5]m.s-1
30.78	34.14	**Gravel** **Sand**	GRAVEL MEDIUM SAND	[24,44]% [26,53]%	[3E-4,3E-2]m.s-1 [2E-7,6E-3]m.s-1
34.14	35.05	**Gravel** **Gravel**	GRAVEL BOULDERS	[24,44]% [24,44]%	[3E-4,3E-2]m.s-1 [3E-4,3E-2]m.s-1
35.05	44.20	**Clay** **Gravel** **Sand**	CLAY GRAVEL MEDIUM SAND	[34,57]% [24,44]% [26,53]%	[1E-11,4.7E-9]m.s-1 [3E-4,3E-2]m.s-1 [2E-7,6E-3]m.s-1
44.20	45.11	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
45.11	48.16	**Clay**	CLAY	[34,57]%	[1E-11,4.7E-9]m.s-1
48.16	64.92	**Clay** **Sand** **Gravel**	CLAY MEDIUM SAND STONES	[34,57]% [26,53]% [24,44]%	[1E-11,4.7E-9]m.s-1 [2E-7,6E-3]m.s-1 [3E-4,3E-2]m.s-1

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5703908
External identity : ca.on.waterWell.5703908
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 34.14m
Elevation : 208.79m
Water level : 26.52m
Water yield : 68.19lpm
Water use : Livestock
Well status : Water Supply
Well type : Unknown
Screen components : From 33.2232 to 34.14m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	27.43	**Unknown material**	PREVIOUSLY DUG		
27.43	34.14	**Sand**	COARSE SAND	[26,53]%	[2E-7,6E-3]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5738829
External identity : ca.on.waterWell.5738829
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 7.00m
Elevation : NaNm
Water use : Not Used
Well status : Observation Wells
Well type : Unknown
Well casings : From 0.00 to 1.70m.
Sealing components : From 0.00 to 0.00m; From 1.70 to 1.70m.
Screen components : From 1.7 to 5.00m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	1.50	**Sand** **Gravel**	SAND GRAVEL	[26,53]% [24,44]%	[2E-7,6E-3]m.s-1 [3E-4,3E-2]m.s-1
1.50	2.00	**Sand** **Silt**	SAND SILT	[26,53]% [34,61]%	[2E-7,6E-3]m.s-1 [1E-9,2E-5]m.s-1
2.00	3.00	**Sand** **Gravel** **Unknown material**	SAND GRAVEL WATER-BEARING	[26,53]% [24,44]%	[2E-7,6E-3]m.s-1 [3E-4,3E-2]m.s-1
3.00	7.00	**Sand** **Gravel** **Silt**	SAND GRAVEL SILT	[26,53]% [24,44]% [34,61]%	[2E-7,6E-3]m.s-1 [3E-4,3E-2]m.s-1 [1E-9,2E-5]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5703912
External identity : ca.on.waterWell.5703912
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 33.22m
Elevation : 216.41m
Water level : 24.38m
Water use : Domestic
Well status : Water Supply
Well type : Unknown

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	27.43	**Clay** **Gravel**	CLAY BOULDERS	[34,57]% [24,44]%	[1E-11,4.7E-9]m.s-1 [3E-4,3E-2]m.s-1
27.43	32.00	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
32.00	33.22	**Gravel**	GRAVEL	[24,44]%	[3E-4,3E-2]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5703910
External identity : ca.on.waterWell.5703910
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 34.75m
Elevation : 211.84m
Water level : 24.38m
Water yield : 27.28lpm
Water use : Domestic
Well status : Water Supply
Well type : Unknown
Screen components : From 33.2232 to 34.75m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	6.10	**Unknown material**	PREVIOUSLY DUG		
6.10	27.43	**Gravel**	STONES CLAY	[24,44]%	[3E-4,3E-2]m.s-1
		Clay		[34,57]%	[1E-11,4.7E-9]m.s-1
27.43	34.75	**Sand**	COARSE SAND	[26,53]%	[2E-7,6E-3]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5703909
External identity : ca.on.waterWell.5703909
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 39.93m
Elevation : 211.84m
Water level : 25.91m
Water use : Commercial
Well status : Water Supply
Well type : Unknown
Screen components : From 38.1 to 39.01m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	13.41	**Gravel** **Diamicton**	BOULDERS HARDPAN	[24,44]%	[3E-4,3E-2]m.s-1
13.41	37.80	**Diamicton** **Gravel**	HARDPAN STONES	[24,44]%	[3E-4,3E-2]m.s-1
37.80	39.32	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
39.32	39.93	**Clay**	CLAY	[34,57]%	[1E-11,4.7E-9]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5707895
External identity : ca.on.waterWell.5707895
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 74.98m
Elevation : 213.36m
Well status : Abandoned-Supply
Well type : Unknown

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	0.30	**Soil**	TOPSOIL		
0.30	3.05	**Clay**	CLAY	[34,57]%	[1E-11,4.7E-9]m.s-1
3.05	3.96	**Clay** **Sand** **Gravel**	CLAY SAND GRAVEL	[34,57]% [26,53]% [24,44]%	[1E-11,4.7E-9]m.s-1 [2E-7,6E-3]m.s-1 [3E-4,3E-2]m.s-1
3.96	16.46	**Sand** **Gravel** **Clay**	SAND GRAVEL CLAY	[26,53]% [24,44]% [34,57]%	[2E-7,6E-3]m.s-1 [3E-4,3E-2]m.s-1 [1E-11,4.7E-9]m.s-1
16.46	21.34	**Clay** **Gravel**	CLAY GRAVEL	[34,57]% [24,44]%	[1E-11,4.7E-9]m.s-1 [3E-4,3E-2]m.s-1
21.34	39.62	**Sand** **Clay**	SAND CLAY	[26,53]% [34,57]%	[2E-7,6E-3]m.s-1 [1E-11,4.7E-9]m.s-1
39.62	42.06	**Sand** **Clay**	SAND CLAY	[26,53]% [34,57]%	[2E-7,6E-3]m.s-1 [1E-11,4.7E-9]m.s-1
42.06	62.79	**Clay** **Gravel**	CLAY GRAVEL	[34,57]% [24,44]%	[1E-11,4.7E-9]m.s-1 [3E-4,3E-2]m.s-1
62.79	73.46	**Clay** **Gravel**	CLAY GRAVEL	[34,57]% [24,44]%	[1E-11,4.7E-9]m.s-1 [3E-4,3E-2]m.s-1
73.46	74.37	**Clay** **Gravel** **Gravel**	CLAY STONES GRAVEL	[34,57]% [24,44]% [24,44]%	[1E-11,4.7E-9]m.s-1 [3E-4,3E-2]m.s-1 [3E-4,3E-2]m.s-1
74.37	74.98	**Shale**	SHALE	[1,10]%	[1E-13,2E-9]m.s-1

APPENDIX C

Terraprobe Report

Terraprobe
Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

June 24, 2019 Our File No. 3-18-0034-02

Pratt Development Inc.
27 Clapperton Street
Barrie, Ontario
L4M 3E6

Attention: Mr. Ken Cave Email: kcave_cpm@rogers.com

**RE: ASSESSMENT OF GROUNDWATER LEVELS
MAY 2018 TO JUNE 2019 MONITORING
PROPOSED GALLOWAY SUBDIVISION
RESIDENTIAL DEVELOPMENT
MIDLAND, ONTARIO**

Dear Sir;

Further to our geotechnical investigation report being prepared for the above property, Terraprobe was authorized by Mr. Ken Cave to visit the above site periodically beginning in June 2018 in order to assess anticipated fluctuations in the groundwater level.

The attached graphs and tabulated data summarize our measured water levels in the previously installed piezometers through these periods to the present date. A borehole location plan is also attached indicating borehole/piezometer locations.

The most recent visit to the site (June 11, 2019) generally indicated groundwater levels falling following a period of rising levels through the spring. Groundwater levels were generally measured to be at their lowest stable elevation in August to November 2018 as shown on the attached graphs. Peak levels recorded to date were measured in June 2018 and March to May 2019.

The peak groundwater levels recorded to date may not represent the highest levels to be expected. However, based on the monitoring data, these levels represent suitable seasonal peak levels to consider for design purposes.

Water levels during the spring events were encountered within 0 to 4m of the existing ground surface for the majority of the boreholes. The groundwater surface elevation generally falls with surface topography from a high point in the north down to the south.

Further to your earlier direction, unless otherwise instructed, Terraprobe will discontinue with groundwater level monitoring as of this date. Below-grade basement/lower floor levels of the structures should be kept at least 0.5m above the seasonally high groundwater level.

We trust that the above information and attachments are sufficient for your present requirements. If you should have any questions, or if we can be of further assistance, please do not hesitate to contact the undersigned.

Sincerely,
Terraprobe Inc.

Blair E. Goss, P. Eng.
Associate

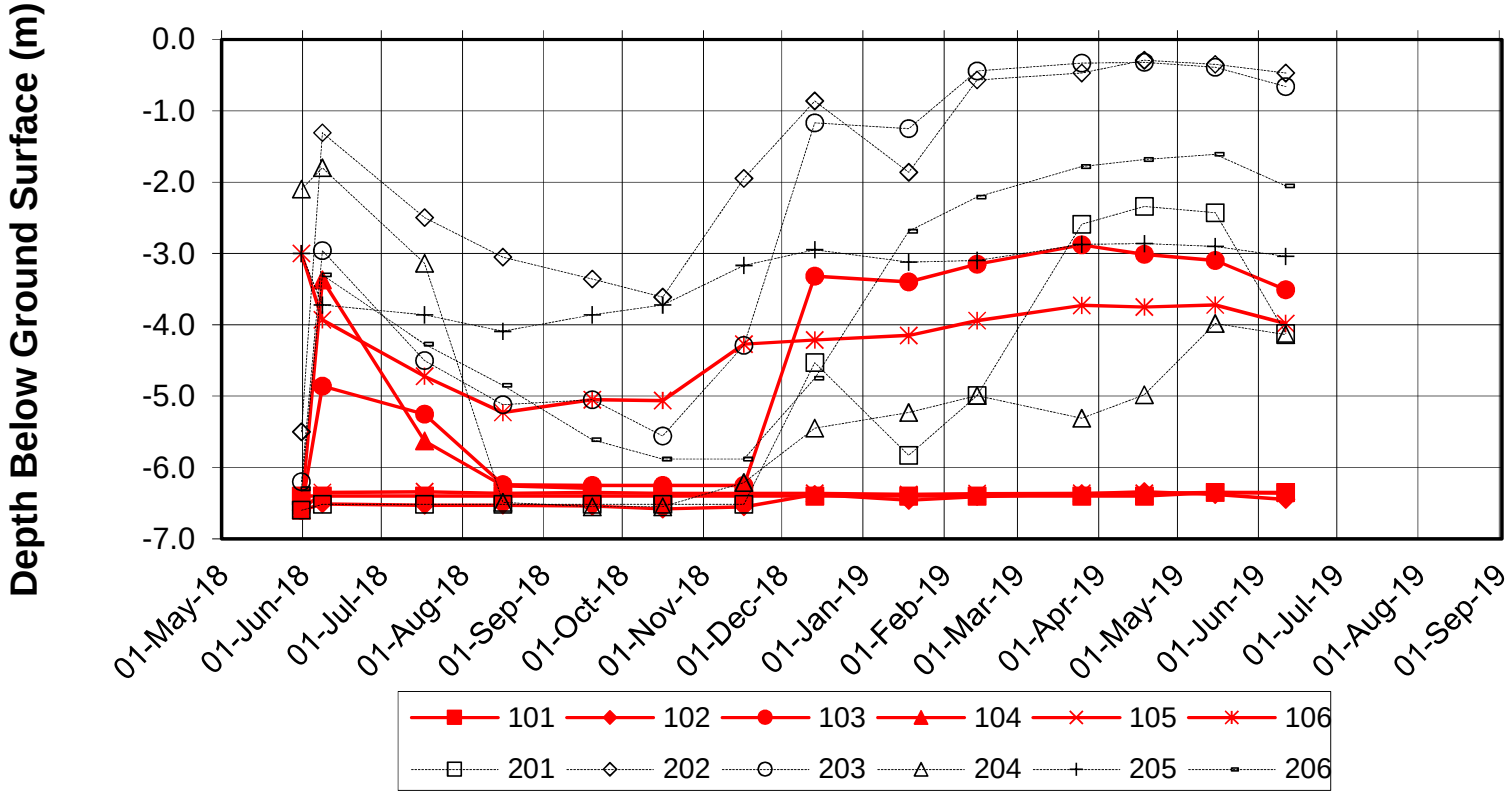
Attached: Static Water Level Monitoring Graphs and Data Table
Borehole Logs 101 to 106 and 201 to 206
Figures 1 to 3

Terraprobe -- 3-18-0034
Galloway Subdivision, William Street, Midland

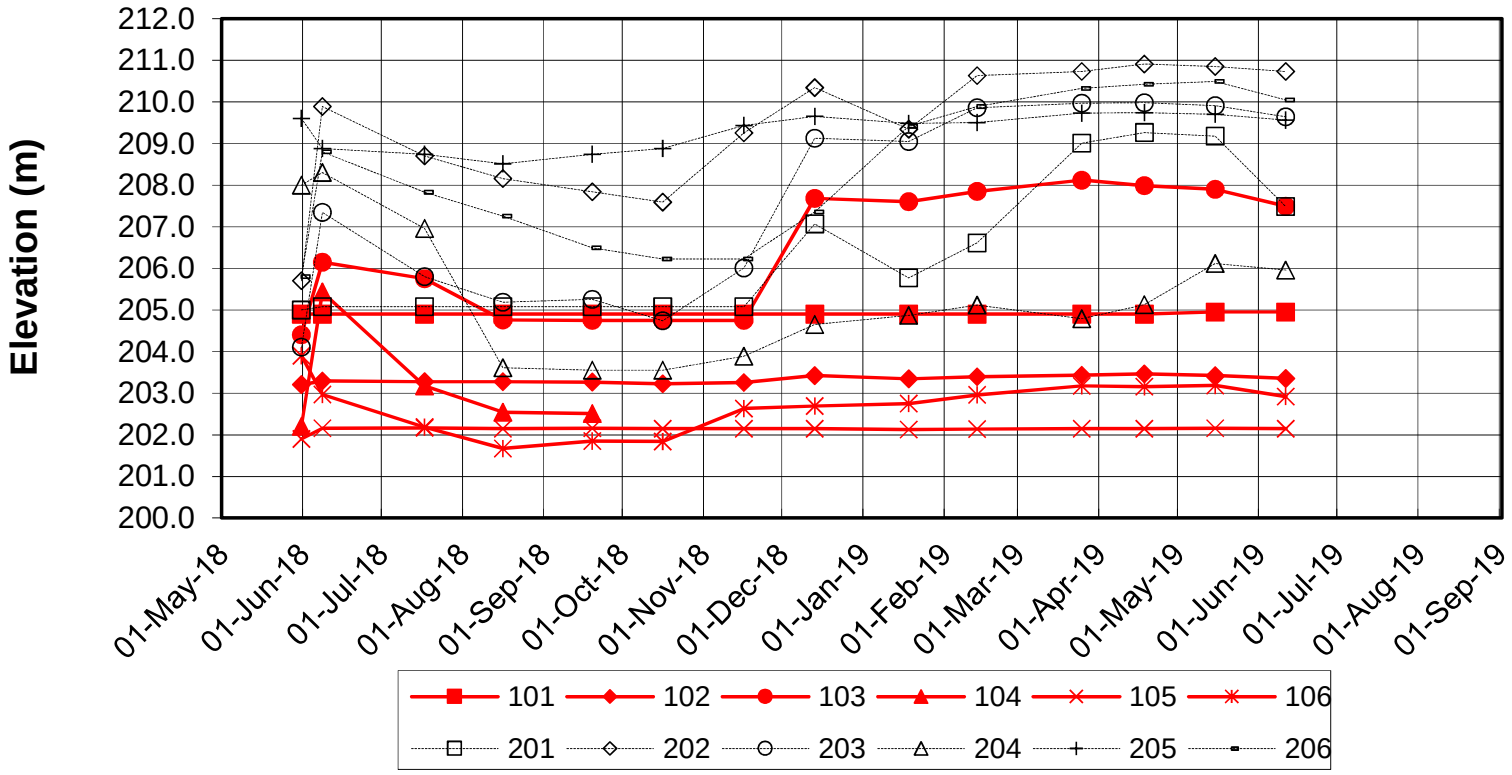
Monitoring/ Borehole Location	Ground Surface Elevation (m)	Static Water Level Depth Below Existing Ground Surface (m)														
		31-May-18	8-Jun-18	17-Jul-18	16-Aug-18	19-Sep-18	16-Oct-18	16-Nov-18	13-Dec-18	18-Jan-19	13-Feb-19	25-Mar-19	18-Apr-19	15-May-19	11-Jun-19		
101	211.3	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4		
102	209.8	-6.6	-6.5	-6.5	-6.5	-6.5	-6.6	-6.6	-6.4	-6.5	-6.4	-6.4	-6.3	-6.4	-6.5		
103	211.0	-6.6	-4.9	-5.3	-6.2	-6.3	-6.3	-6.3	-3.3	-3.4	-3.2	-2.9	-3.0	-3.1	-3.5		
104	208.8	-6.6	-3.4	-5.6	-6.3	-6.3											
105	208.5	-6.6	-6.4	-6.3	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4	-6.4		
106	206.9	-3.0	-3.9	-4.7	-5.2	-5.1	-5.1	-4.3	-4.2	-4.2	-3.9	-3.7	-3.8	-3.7	-4.0		
201	211.6	-6.6	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	-4.5	-5.8	-5.0	-2.6	-2.3	-2.4	-4.1		
202	211.2	-5.5	-1.3	-2.5	-3.1	-3.4	-3.6	-2.0	-0.9	-1.9	-0.6	-0.5	-0.3	-0.4	-0.5		
203	210.3	-6.2	-3.0	-4.5	-5.1	-5.1	-5.6	-4.3	-1.2	-1.3	-0.4	-0.3	-0.3	-0.4	-0.7		
204	210.1	-2.1	-1.8	-3.1	-6.5	-6.6	-6.6	-6.2	-5.5	-5.2	-5.0	-5.3	-5.0	-4.0	-4.1		
205	212.6	-3.0	-3.7	-3.9	-4.1	-3.9	-3.7	-3.2	-3.0	-3.1	-3.1	-2.9	-2.9	-2.9	-3.0		
206	212.1	-6.3	-3.3	-4.3	-4.9	-5.6	-5.9	-5.9	-4.8	-2.7	-2.2	-1.8	-1.7	-1.6	-2.1		
		noted		101,201 dry	101,103,20	101,103,20	101,102,10	101,103,201	101 dry			101 dry	101 dry				
							104 destroyed										

Monitoring/ Borehole Location	Ground Surface Elevation (m)	Static Water Level Elevation (m)														
		31-May-18	8-Jun-18	17-Jul-18	16-Aug-18	19-Sep-18	16-Oct-18	16-Nov-18	13-Dec-18	18-Jan-19	13-Feb-19	25-Mar-19	18-Apr-19	15-May-19	11-Jun-19		
101	211.3	204.9	204.9	204.9	204.9	204.9	204.9	204.9	204.9	204.9	204.9	204.9	204.9	205.0	205.0		
102	209.8	203.2	203.3	203.3	203.3	203.3	203.2	203.3	203.4	203.3	203.4	203.4	203.5	203.4	203.4		
103	211.0	204.4	206.1	205.8	204.8	204.8	204.8	204.8	207.7	207.6	207.9	208.1	208.0	207.9	207.5		
104	208.8	202.2	205.4	203.2	202.5	202.5											
105	208.5	201.9	202.2	202.2	202.1	202.2	202.1	202.1	202.1	202.1	202.1	202.1	202.1	202.2	202.1		
106	206.9	203.9	203.0	202.2	201.7	201.9	201.8	202.6	202.7	202.8	203.0	203.2	203.2	203.2	202.9		
201	211.6	205.0	205.1	205.1	205.1	205.1	205.1	205.1	207.1	205.8	206.6	209.0	209.3	209.2	207.5		
202	211.2	205.7	209.9	208.7	208.2	207.8	207.6	209.3	210.3	209.3	210.6	210.7	210.9	210.9	210.7		
203	210.3	204.1	207.3	205.8	205.2	205.3	204.7	206.0	209.1	209.1	209.9	210.0	210.0	209.9	209.6		
204	210.1	208.0	208.3	207.0	203.6	203.6	203.6	203.9	204.7	204.9	205.1	204.8	205.1	206.1	206.0		
205	212.6	209.6	208.9	208.7	208.5	208.7	208.9	209.4	209.7	209.5	209.5	209.7	209.7	209.7	209.6		
206	212.1	205.8	208.8	207.8	207.3	206.5	206.2	206.2	207.4	209.4	209.9	210.3	210.4	210.5	210.1		
		noted					104 destroyed										

Static Water Level Monitoring
Galloway Subdivision -- Midland
Terraprobe -- 3-18-0034



Static Water Level Monitoring
Galloway Subdivision -- Midland
Terraprobe -- 3-18-0034



LOG OF BOREHOLE 101

Terraprobe

Project No. : 3-18-0034	Client : Pratt Development Inc.	Originated by : BH
Date started : May 31, 2018	Project : William St	Compiled by : BH
Sheet No. : 1 of 1	Location : Midland, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic
Rig type : D50, track-mounted
Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	211.3	**GROUND SURFACE**				
		100mm **TOPSOIL**		1	SS	7
		SILT, some clay, trace sand, loose to compact, brown, moist		2	SS	8
1				3	SS	16
2	209.0					
	2.3	**SILTY SAND**, trace gravel, cobble and boulder inclusions, trace clay, compact to very dense, brown, moist (GLACIAL TILL)		4	SS	28
3				5	SS	50 / 150mm
4				6	SS	50 / 125mm
5						
6	204.9			7	SS	50 / 150mm
	6.4	**END OF BOREHOLE**				

Elevation Scale (m): 211, 210, 209, 208, 207, 206, 205

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
90 kPa

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL
10 56 30 4

Borehole was dry and open upon completion of drilling.

32 mm dia. piezometer installed.
1.5m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 8, 2018	dry	n/a

file: 3180034, bh logs.gpj

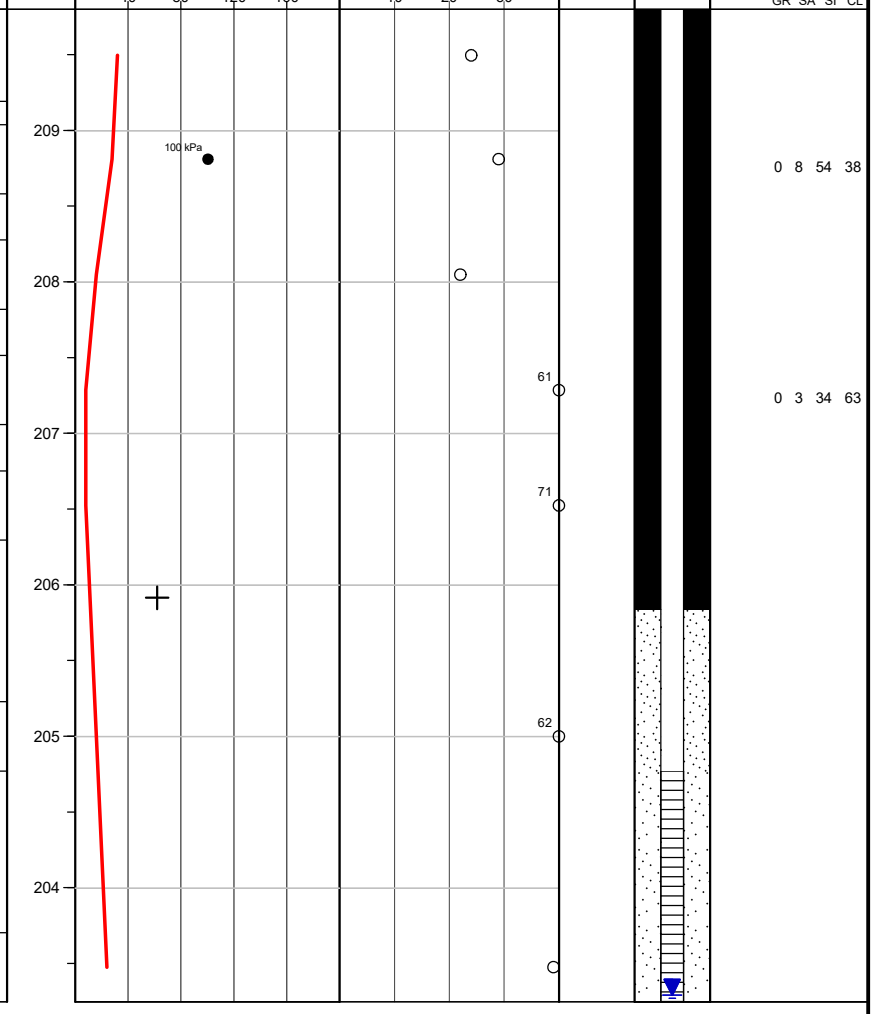
LOG OF BOREHOLE 102

Terraprobe

Project No. : 3-18-0034	Client : Pratt Development Inc.	Originated by : BH
Date started : May 30, 2018	Project : William St	Compiled by : BH
Sheet No. : 1 of 1	Location : Midland, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic
Rig type : D50, track-mounted
Drilling Method : Hollow stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	209.8	**GROUND SURFACE**				
	209.5 / 0.3	**FILL**, sand and gravel, trace silt, loose, brown, moist		1	SS	8
	209.2 / 0.6	**FILL**, topsoil, some silt, trace to some sand, loose, dark brown, moist				
1		**CLAY AND SILT**, trace sand, soft to firm, brown to grey, moist to wet		2	SS	7
				3	SS	4
2	207.5 / 2.3					
		SILTY CLAY, trace sand, very soft to firm, grey, wet		4	SS	2
3				5	SS	2
					FV	
4				6	SS	4
5						
6				7	SS	6
	203.2 / 6.6					



END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

32 mm dia. piezometer installed.
1.5m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 8, 2018	6.5	203.3

file: 3180034, bh logs.gpj

LOG OF BOREHOLE 103

Terraprobe

Project No. : 3-18-0034	Client : Pratt Development Inc.	Originated by : BH
Date started : May 30, 2018	Project : William St	Compiled by : BH
Sheet No. : 1 of 1	Location : Midland, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic
Rig type : D50, track-mounted
Drilling Method : Hollow stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	211.0	**GROUND SURFACE**				
		150mm **TOPSOIL**				
		SAND, trace silt, trace organics, compact, brown, moist		1	SS	18
	210.4 / 0.6					
1		**SILT**, some sand, trace clay, loose, brown, wet		2	SS	4
	209.5 / 1.5					
2		**SANDY SILT**, some gravel, cobble and boulder inclusions, trace to some clay, compact to very dense, brown to grey, moist (GLACIAL TILL)		3	SS	32
				4	SS	61
3				5	SS	28
4				6	SS	21
5				7	SS	45
6	204.4 / 6.6					

Elevation Scale (m): 211, 210, 209, 208, 207, 206, 205

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10 20 30 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL MC LL
10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

32 mm dia. piezometer installed.
1.5m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 8, 2018	4.9	206.1

file: 3180034, bh logs.gpj

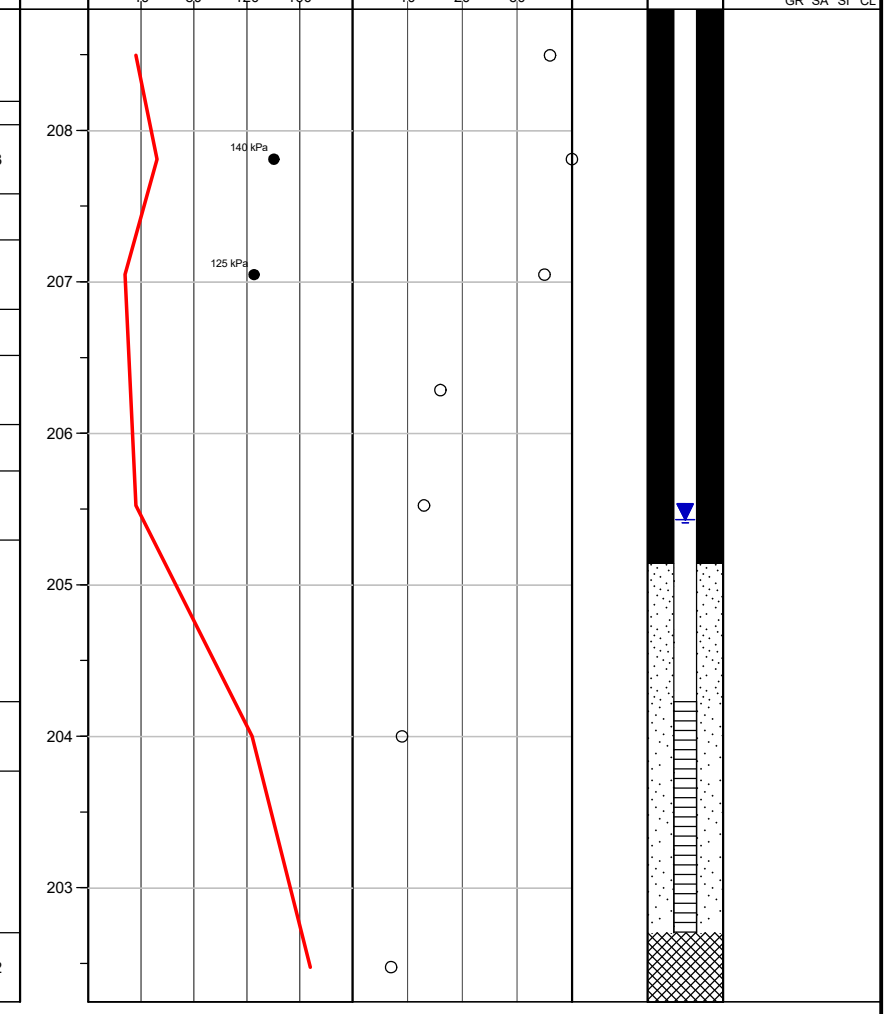
LOG OF BOREHOLE 104

Terraprobe

Project No. : 3-18-0034	Client : Pratt Development Inc.	Originated by : BH
Date started : May 30, 2018	Project : William St	Compiled by : BH
Sheet No. : 1 of 1	Location : Midland, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic
Rig type : D50, track-mounted
Drilling Method : Hollow stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	208.8	**GROUND SURFACE**				
		150mm **TOPSOIL**				
		SILT, some clay, trace sand, trace organics, loose, brown, moist		1	SS	9
	208.2 / 0.6					
1		**CLAY AND SILT**, trace sand, stiff to firm, brown, moist		2	SS	13
				3	SS	7
2	206.5 / 2.3					
		SANDY SILT, some gravel, cobble and boulder inclusions, trace to some clay, loose to dense, brown, moist (GLACIAL TILL)		4	SS	8
				5	SS	9
3						
4				6	SS	31
5						
6				7	SS	42
	202.2 / 6.6					



END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

32 mm dia. piezometer installed.
1.5m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 8, 2018	3.4	205.4

file: 3180034, bh logs.gpj

LOG OF BOREHOLE 105

Terraprobe

Project No. : 3-18-0034	Client : Pratt Development Inc.	Originated by : BH
Date started : May 30, 2018	Project : William St	Compiled by : BH
Sheet No. : 1 of 1	Location : Midland, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic
Rig type : D50, track-mounted
Drilling Method : Solid stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	208.5	**GROUND SURFACE**				
		100mm **TOPSOIL**				
		CLAY AND SILT, trace sand, stiff to firm, brown, moist		1	SS	10
				2	SS	9
				3	SS	7
	206.5 / 2.0	**SANDY SILT**, trace clay, compact, brown, wet		4	SS	25
	205.5 / 3.0	**SANDY SILT**, some gravel, cobble and boulder inclusions, trace to some clay, very dense to dense, brown to grey, moist (GLACIAL TILL)		5	SS	50 / 100mm
				6	SS	50 / 150mm
				7	SS	39
	201.9 / 6.6	**END OF BOREHOLE**				

Elevation Scale (m): 208, 207, 206, 205, 204, 203, 202

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane
40, 80, 120, 160
75 kPa

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL, MC, LL
10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

32 mm dia. piezometer installed.
1.5m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 8, 2018	6.4	202.1

file: 3180034, bh logs.gpj

LOG OF BOREHOLE 106

Terraprobe

Project No. : 3-18-0034	Client : Pratt Development Inc.	Originated by : BH
Date started : May 31, 2018	Project : William St	Compiled by : BH
Sheet No. : 1 of 1	Location : Midland, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic
Rig type : D50, track-mounted
Drilling Method : Hollow stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	206.9	**GROUND SURFACE**				
		75mm **TOPSOIL**				
		CLAYEY SILT, trace gravel, trace sand, very stiff, brown, moist		1	SS	18
1				2	SS	11
	205.4					
	1.5	**CLAYEY SILTY SAND**, some gravel, cobble and boulder inclusions, loose to very dense, brown to grey, moist to wet (GLACIAL TILL)		3	SS	4
2				4	SS	7
3				5	SS	6
4						
				6	SS	36
5						
6				7	SS	61
	200.3					
	6.6	**END OF BOREHOLE**				

Elevation Scale (m): 206, 205, 204, 203, 202, 201

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL
11 34 29 26

Unstabilized water level measured at 3.0 m below ground surface; borehole was open upon completion of drilling.

32 mm dia. piezometer installed.
1.5m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 8, 2018	3.9	203.0

file: 3180034, bh logs.gpj

LOG OF BOREHOLE 201

Terraprobe

Project No. : 3-18-0034	Client : Pratt Development Inc.	Originated by : BH
Date started : May 30, 2018	Project : William St	Compiled by : BH
Sheet No. : 1 of 1	Location : Midland, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic
Rig type : D50, track-mounted
Drilling Method : Hollow stem augers

Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
211.6	**GROUND SURFACE**				
211.2 (0.4)	380mm **TOPSOIL**		1	AS	
211.0 (0.6)	**SANDY SILT**, trace organics, brown, moist				
	SILTY CLAY, trace sand, stiff to soft, brown, moist to wet		2	SS	10
			3	SS	8
			4	SS	2
208.6 (3.0)	**SANDY SILT**, some gravel, cobble and boulder inclusions, trace to some clay, compact, brown, wet to moist (GLACIAL TILL)		5	SS	10
			6	SS	19
			7	SS	23
205.0 (6.6)	**END OF BOREHOLE**				

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40
Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160
125 kPa
90 kPa
Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL MC LL — 10 20 30
42
48
Headspace Vapour (ppm)
Instrument Details
Unstabilized Water Level
Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL
0 2 34 64

Borehole was dry and open upon completion of drilling.

32 mm dia. piezometer installed.
1.5m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 8, 2018	dry	n/a

file: 3180034, bh logs.gpj

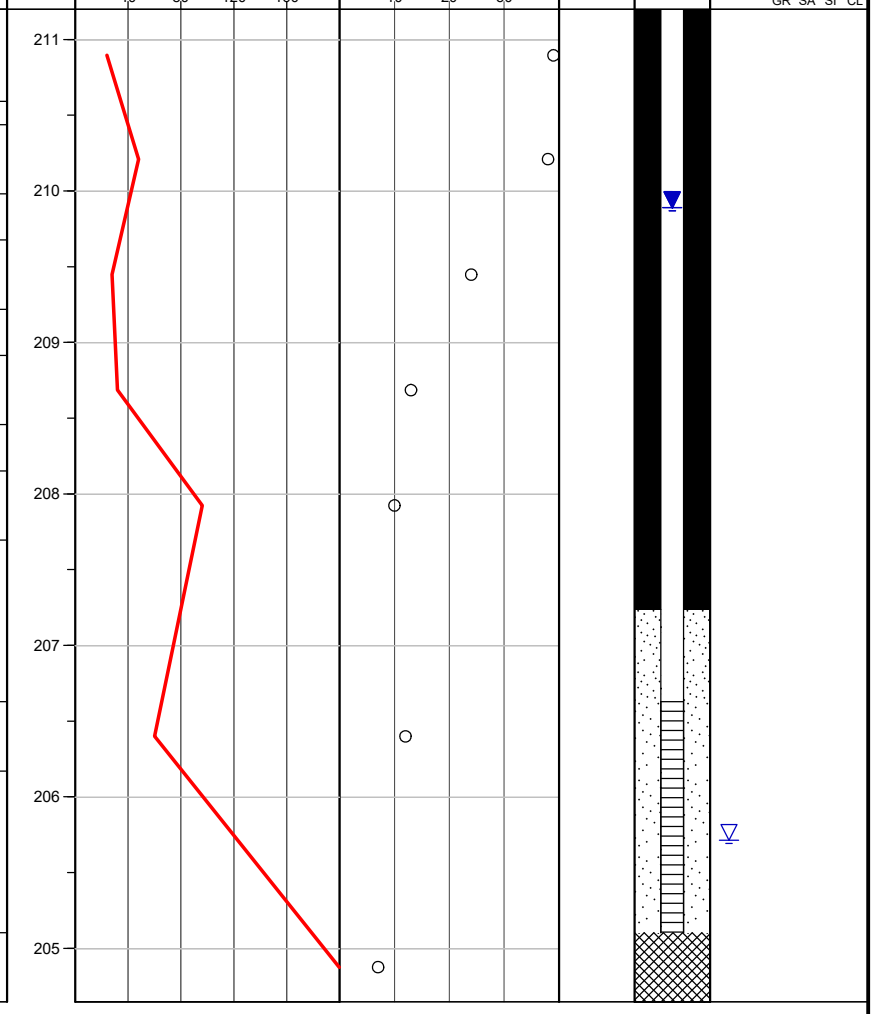
LOG OF BOREHOLE 202

Terraprobe

Project No. : 3-18-0034	Client : Pratt Development Inc.	Originated by : BH
Date started : May 30, 2018	Project : William St	Compiled by : BH
Sheet No. : 1 of 1	Location : Midland, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic
Rig type : D50, track-mounted
Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	211.2	**GROUND SURFACE**				
0		130mm **TOPSOIL**		1	SS	6
		CLAYEY SILT, trace sand, trace organics, loose to compact, brown to grey, moist		2	SS	12
1	209.7					
	1.5	**SILTY SAND**, trace gravel, trace clay, loose, brown, wet		3	SS	7
2	208.9					
	2.3	**SANDY SILT**, some gravel, cobble and boulder inclusions, trace to some clay', loose to very dense, brown, wet to moist (GLACIAL TILL)		4	SS	8
3				5	SS	24
4						
				6	SS	15
5						
6				7	SS	57
	204.6					
	6.6	**END OF BOREHOLE**				



Unstabilized water level measured at 5.5 m below ground surface; borehole was open upon completion of drilling.

32 mm dia. piezometer installed.
1.5m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 8, 2018	1.3	209.9

file: 3180034, bh logs.gpj

LOG OF BOREHOLE 203

Terraprobe

Project No. : 3-18-0034	Client : Pratt Development Inc.	Originated by : BH
Date started : May 30, 2018	Project : William St	Compiled by : BH
Sheet No. : 1 of 1	Location : Midland, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic
Rig type : D50, track-mounted
Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	210.3	**GROUND SURFACE**				
		130mm **TOPSOIL**				
		SANDY SILT, trace clay, trace organics, loose, brown, moist		1	SS	4
	209.7 / 0.6	**CLAY AND SILT**, trace sand, stiff to firm, brown to grey, moist to wet		2	SS	9
1				3	SS	4
2				4	SS	4
					FV	
	207.3 / 3.0	**SANDY SILT**, some gravel, cobble and boulder inclusions, trace to some clay, compact to very dense, brown, moist to wet (GLACIAL TILL)		5	SS	18
3				6	SS	12
4						
5						
6	204.1 / 6.2			7	SS	50 / 150mm

Elevation Scale (m): 210, 209, 208, 207, 206, 205

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40
Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160
50 kPa

Moisture / Plasticity: Plastic Limit (PL) — Natural Water Content (MC) — Liquid Limit (LL); 10 20 30

Headspace Vapour (ppm): 64, 45

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

32 mm dia. piezometer installed.
1.5m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 8, 2018	3.0	207.3

file: 3180034, bh logs.gpj

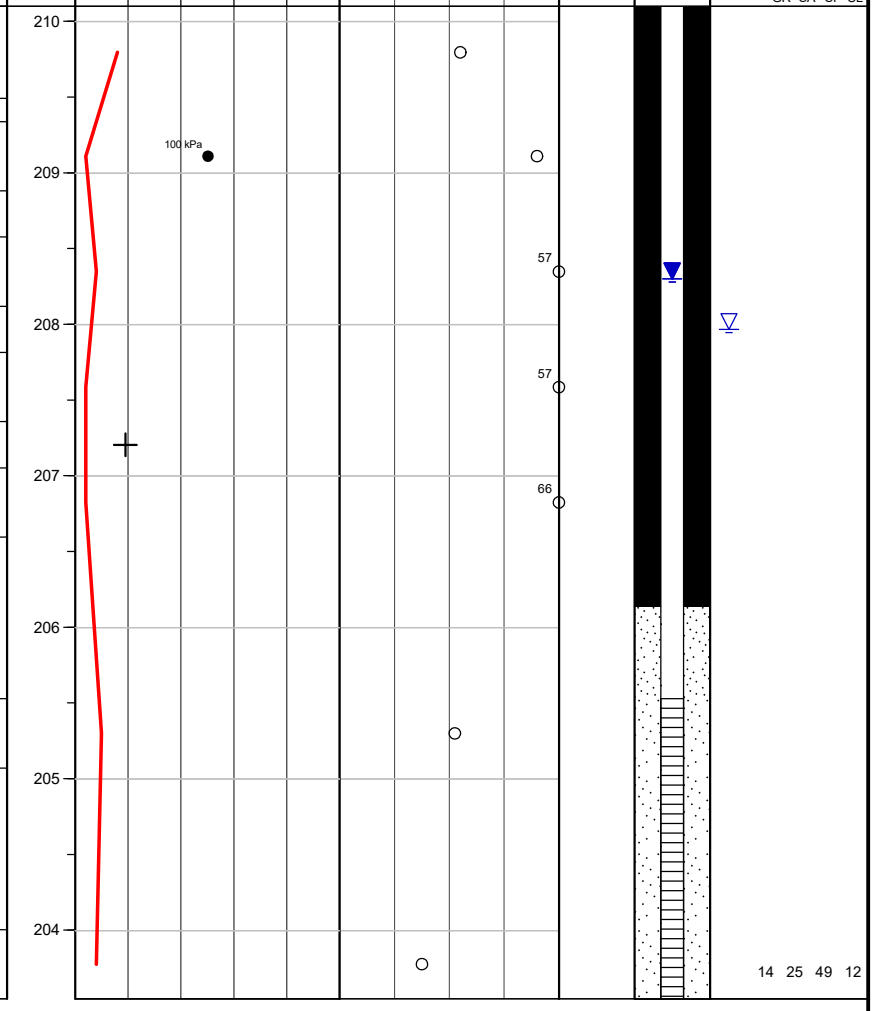
LOG OF BOREHOLE 204

Terraprobe

Project No. : 3-18-0034	Client : Pratt Development Inc.	Originated by : BH
Date started : May 31, 2018	Project : William St	Compiled by : BH
Sheet No. : 1 of 1	Location : Midland, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic
Rig type : D50, track-mounted
Drilling Method : Solid stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	210.1	**GROUND SURFACE**				
	209.9 / 0.2	180mm **TOPSOIL**				
		SILTY SAND, some clay, trace organics, loose, brown, moist		1	SS	8
	209.3 / 0.8	**CLAY AND SILT**, trace sand, very soft to firm, brown to grey, moist to wet		2	SS	2
1				3	SS	4
2				4	SS	2
					FV	
3				5	SS	2
4	205.5 / 4.6	**SANDY SILT**, some clay, some gravel, loose, grey, wet (GLACIAL TILL)		6	SS	5
5						
6	203.5 / 6.6	**END OF BOREHOLE**		7	SS	4



WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 8, 2018	1.8	208.3

Unstabilized water level measured at 2.1 m below ground surface; borehole was open upon completion of drilling.

32 mm dia. piezometer installed.
1.5m screen installed.

file: 3180034, bh logs.gpj

LOG OF BOREHOLE 205

Terraprobe

Project No. : 3-18-0034	Client : Pratt Development Inc.	Originated by : BH
Date started : May 31, 2018	Project : William St	Compiled by : BH
Sheet No. : 1 of 1	Location : Midland, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic
Rig type : D50, track-mounted
Drilling Method : Solid stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity (PL, MC, LL)	Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments (GR SA SI CL)
0	212.6	**GROUND SURFACE**										
	212.4 / 0.2	250mm **TOPSOIL**										
	212.0 / 0.6	**SAND AND GRAVEL**, trace silt, compact, brown, moist		1	SS	10						
1		**CLAY AND SILT**, trace sand, soft to stiff, brown, moist		2	SS	4	212	125 kPa	42			
				3	SS	11	211	125 kPa	45			
2	210.3 / 2.3	**SANDY SILT**, some gravel, cobble and boulder inclusions, some clay, compact, brown to grey, moist to wet (GLACIAL TILL)		4	SS	10	210					11 31 46 12
3				5	SS	17	209					
4				6	SS	11	208					
5							207					
6	206.0 / 6.6			7	SS	19						

END OF BOREHOLE

Unstabilized water level measured at 3.0 m below ground surface; borehole was open upon completion of drilling.

32 mm dia. piezometer installed.
1.5m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 8, 2018	3.7	208.9

file: 3180034, bh logs.gpj

LOG OF BOREHOLE 206

Terraprobe

Project No. : 3-18-0034	Client : Pratt Development Inc.	Originated by : BH
Date started : May 31, 2018	Project : William St	Compiled by : BH
Sheet No. : 1 of 1	Location : Midland, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic
Rig type : D50, track-mounted
Drilling Method : Solid stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	212.1	**GROUND SURFACE**				
0	211.9 / 0.2	230mm **TOPSOIL**		1	AS	
	211.5 / 0.6	**SAND AND SILT**, some organics, trace silt, brown, moist		2	SS	8
1	210.6 / 1.5	**CLAY AND SILT**, trace sand, firm, brown, moist		3	SS	10
2		**SANDY SILT**, some gravel, cobble and boulder inclusions, trace to some clay, compact to very dense, brown to grey, moist (GLACIAL TILL)		4	SS	16
3				5	SS	50 / 150mm
4				6	SS	62
5				7	SS	50 / 150mm
6	205.9 / 6.2	**END OF BOREHOLE**				

Elevation Scale (m): 212, 211, 210, 209, 208, 207, 206

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10, 20, 30, 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane
40, 80, 120, 160

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL, MC, LL
10, 20, 30

43

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

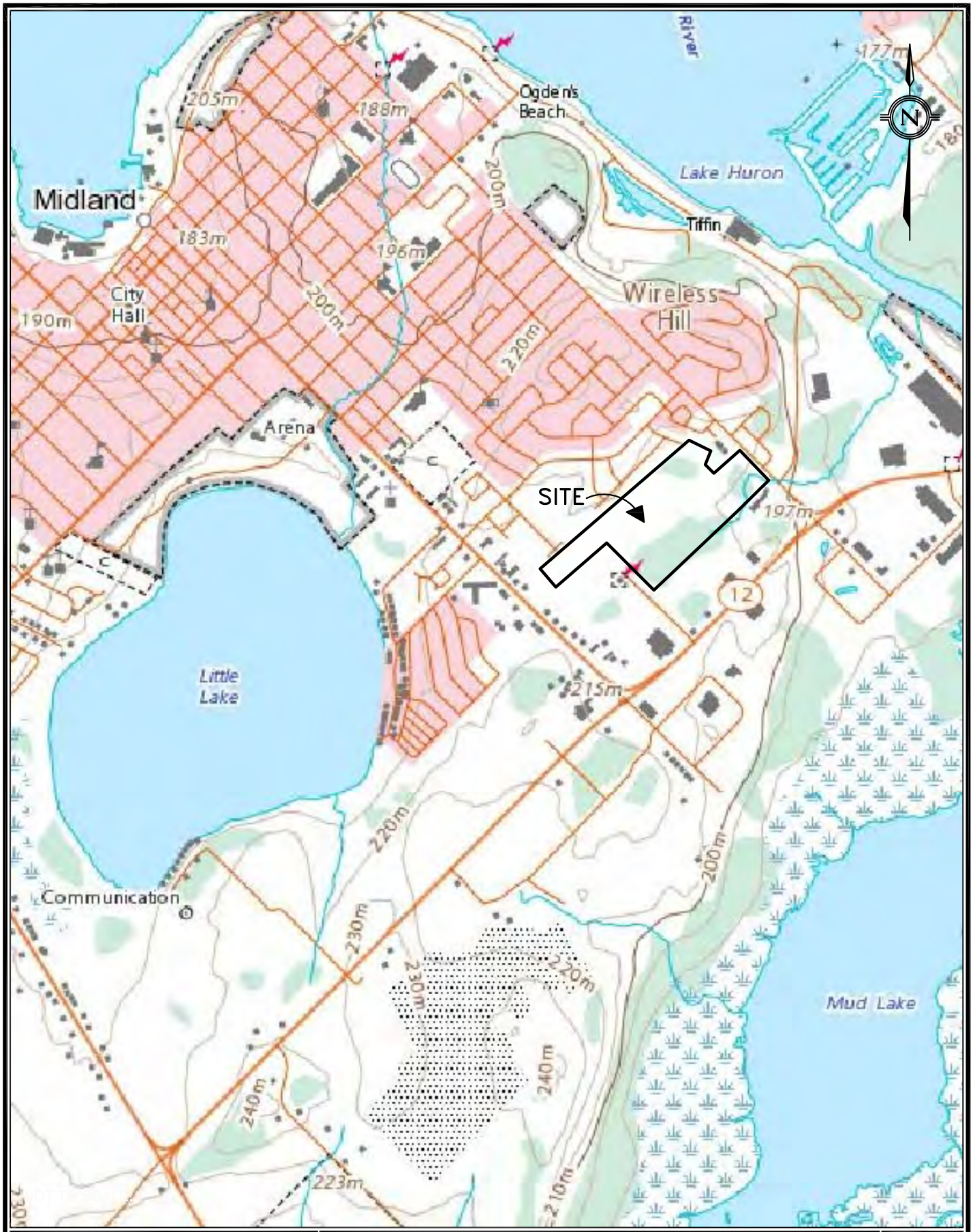
Borehole was dry and open upon completion of drilling.

32 mm dia. piezometer installed.
1.5m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 8, 2018	3.3	208.8

file: 3180034, bh logs.gpj



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
220 Bayview Drive, Unit 25 - Barrie, Ontario L4N 4Y8 (705) 739-8355

Title: SITE LOCATION PLAN

File No. 3-18-0034-01

FIGURE : 1

LEGEND

Approximate Borehole Location

Terraprobe Inc.

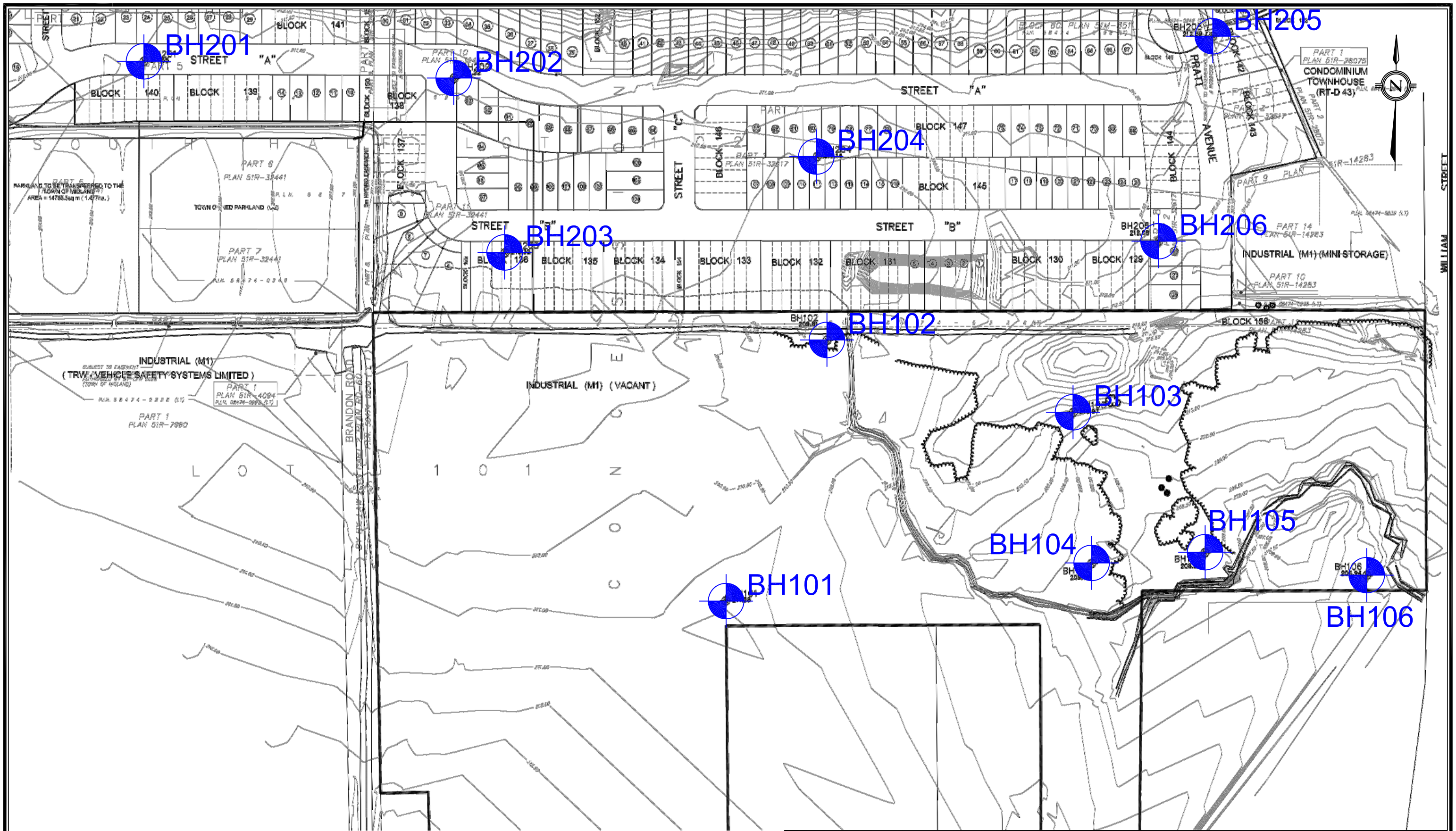
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing

220 Bayview Drive, Unit 25 - Barrie, Ontario L4N 4Y8 (705) 739-8355

Title: BOREHOLE LOCATION PLAN

File No. 3-18-0034-01

FIGURE : 2



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
220 Bayview Drive, Unit 25 - Barrie, Ontario L4N 4Y8 (705) 739-8355

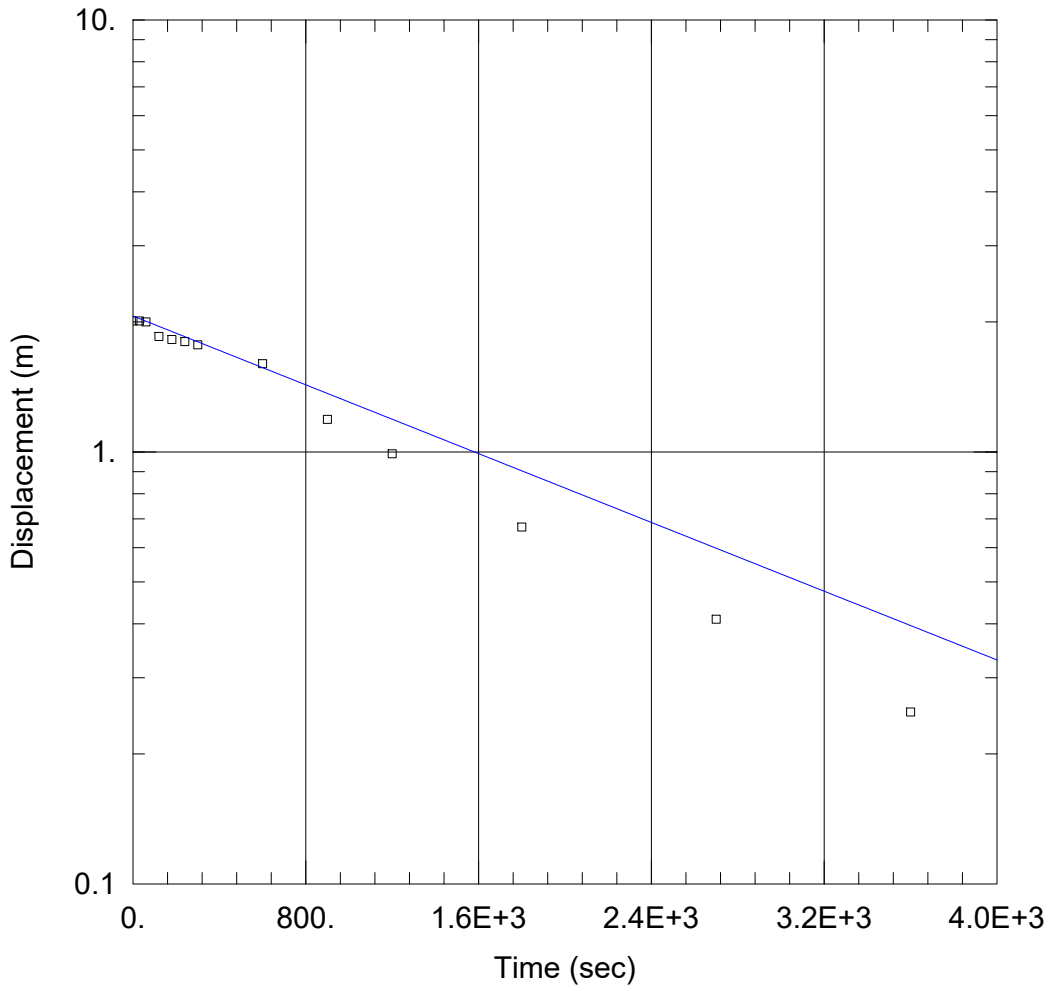
Title: BOREHOLE LOCATION PLAN

File No. 3-18-0034-01

FIGURE : 3

APPENDIX D

Hydraulic Conductivity Tests



WELL TEST ANALYSIS

Data Set: L:\...\MW104.aqt
Date: 03/17/20 Time: 17:37:41

PROJECT INFORMATION

Company: Azimuth Environmental
Client: Pratt Midland
Project: 18-143
Location: Midland
Test Well: MW-104
Test Date: January 2020

AQUIFER DATA

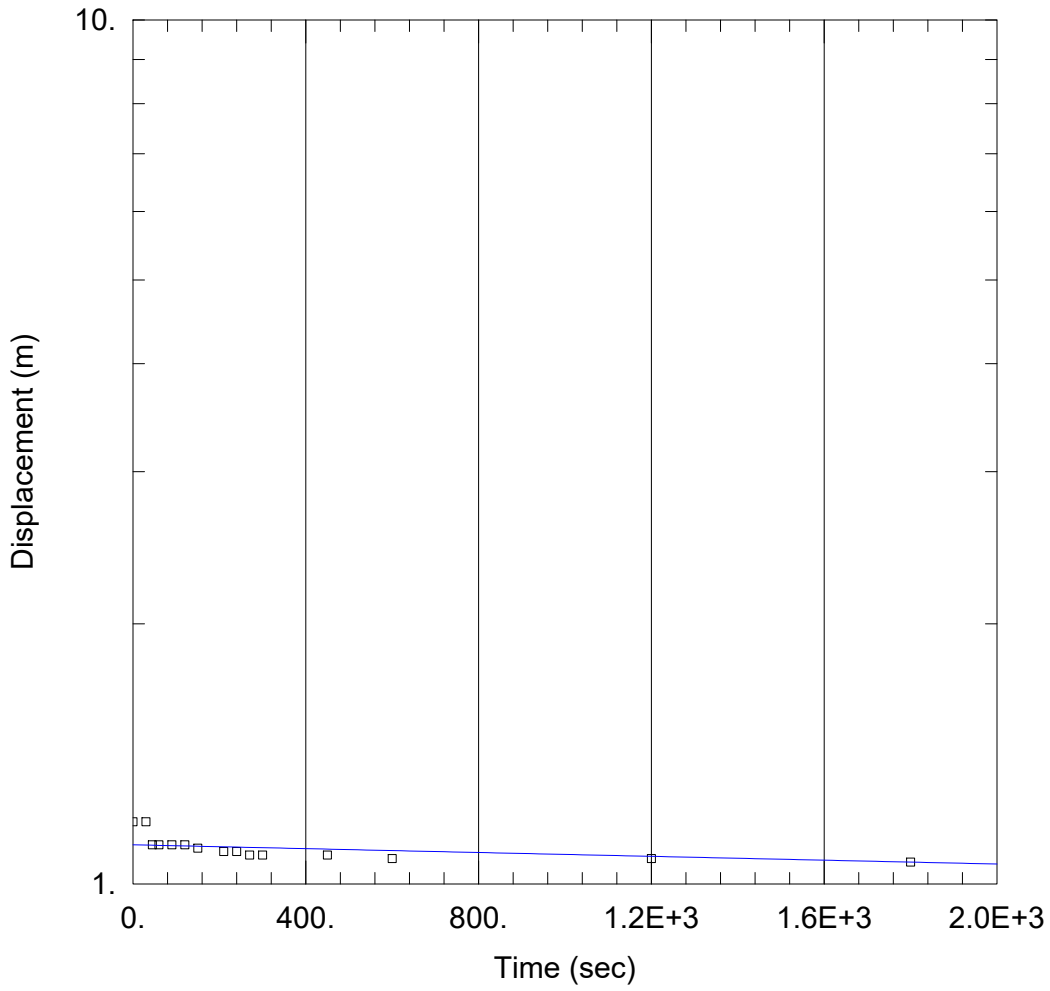
Saturated Thickness: 3.54 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW104)

Initial Displacement: 2.01 m
Total Well Penetration Depth: 3.54 m
Casing Radius: 0.016 m
Static Water Column Height: 3.54 m
Screen Length: 1.5 m
Well Radius: 0.016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 2.047E-7 m/sec
y0 = 2.063 m



WELL TEST ANALYSIS

Data Set: L:\...\MW106.aqt
Date: 03/17/20 Time: 18:27:35

PROJECT INFORMATION

Company: Azimuth Environmental
Client: Pratt Midland
Project: 18-143
Location: Midland
Test Well: MW-106
Test Date: January 2020

AQUIFER DATA

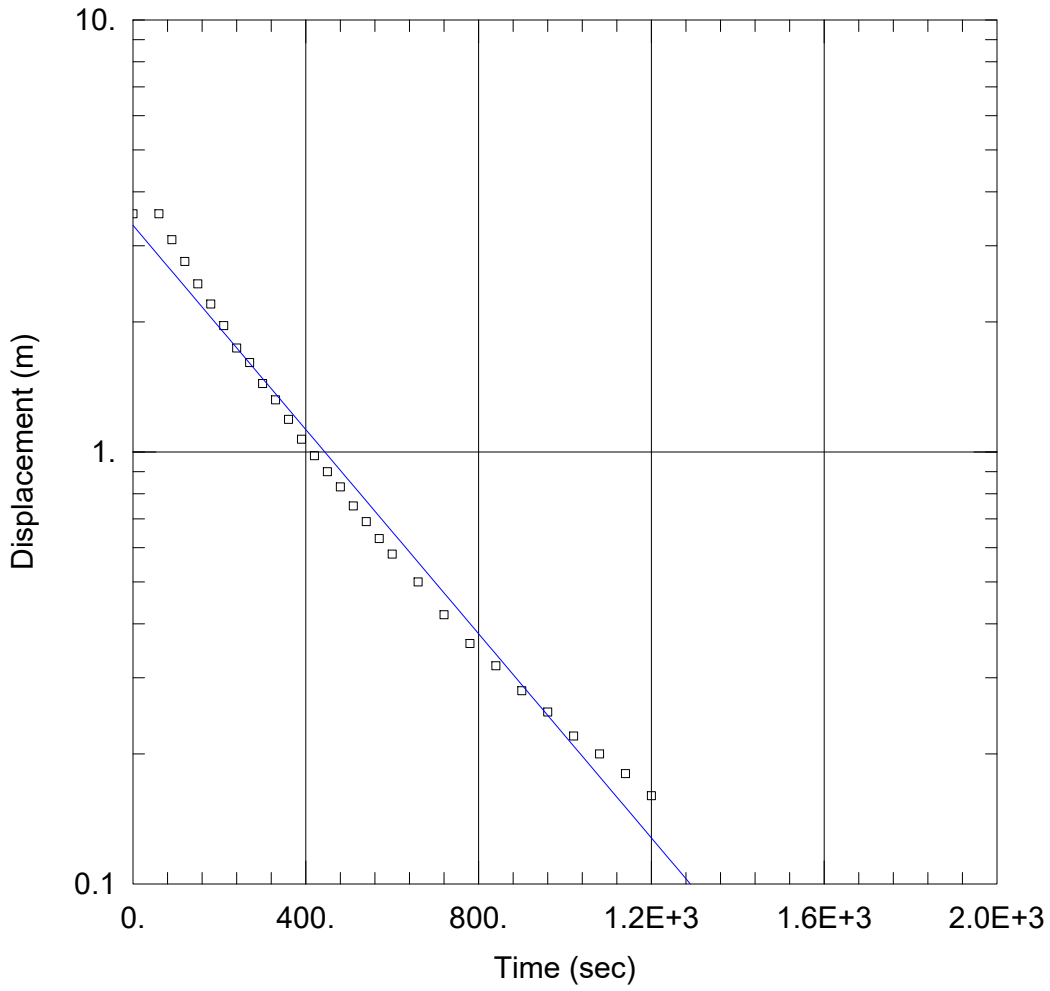
Saturated Thickness: 1.51 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW106)

Initial Displacement: 1.18 m Static Water Column Height: 1.51 m
Total Well Penetration Depth: 1.5 m Screen Length: 1.5 m
Casing Radius: 0.016 m Well Radius: 0.016 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev
K = 9.93E-9 m/sec y0 = 1.11 m



WELL TEST ANALYSIS

Data Set: L:\...\MW202.aqt
Date: 03/17/20 Time: 18:01:16

PROJECT INFORMATION

Company: Azimuth Environmental
Client: Pratt Midland
Project: 18-143
Location: Midland
Test Well: MW-202
Test Date: January 2020

AQUIFER DATA

Saturated Thickness: 5.62 m Anisotropy Ratio (Kz/Kr): 1.

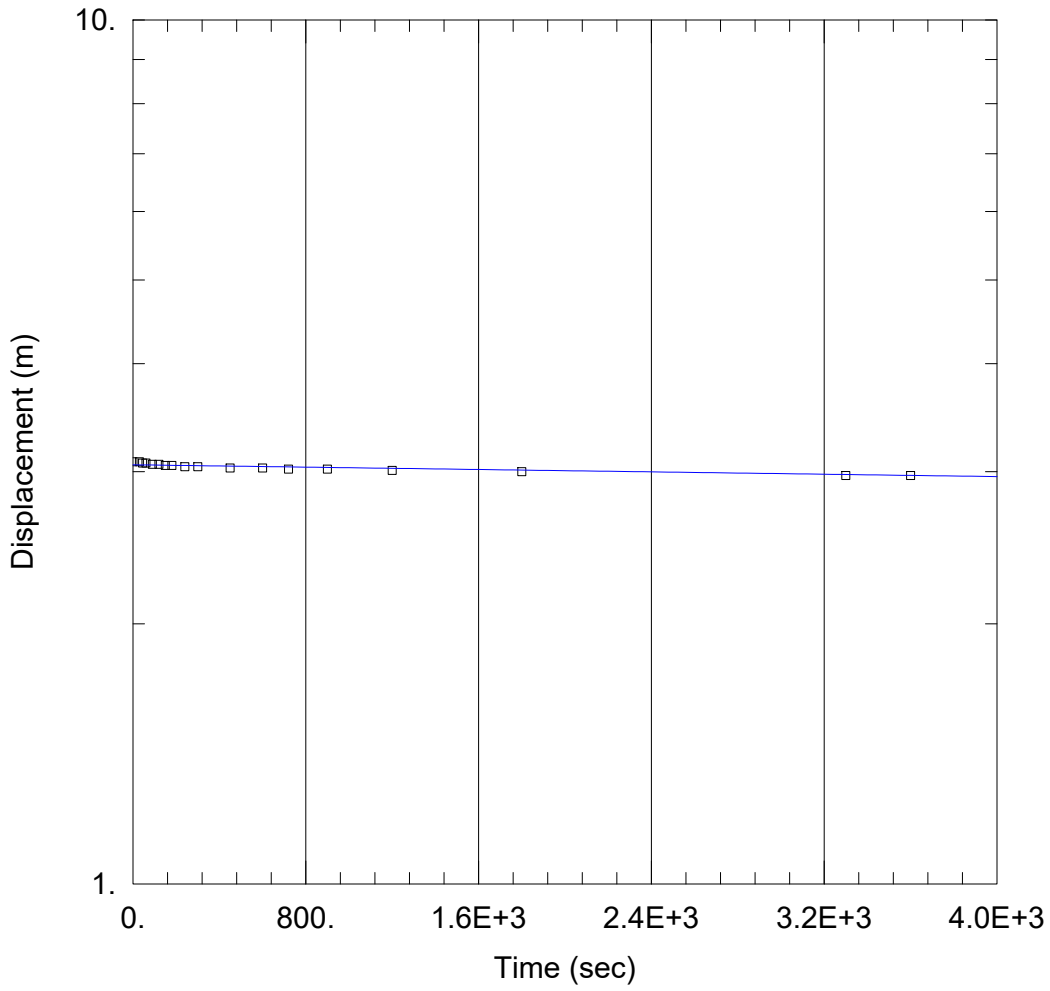
WELL DATA (MW-202)

Initial Displacement: 3.56 m
Total Well Penetration Depth: 5.62 m
Casing Radius: 0.016 m
Static Water Column Height: 5.62 m
Screen Length: 1.5 m
Well Radius: 0.016 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 1.215E-6 m/sec y0 = 3.346 m



WELL TEST ANALYSIS

Data Set: L:\...\MW205.aqt
Date: 03/17/20 Time: 18:27:07

PROJECT INFORMATION

Company: Azimuth Environmental
Client: Pratt Midland
Project: 18-143
Location: Midland
Test Well: MW-205
Test Date: January 2020

AQUIFER DATA

Saturated Thickness: 3.36 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW205)

Initial Displacement: 3.08 m
Total Well Penetration Depth: 3.36 m
Casing Radius: 0.016 m
Static Water Column Height: 3.36 m
Screen Length: 1.5 m
Well Radius: 0.016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 3.514E-9 m/sec
y0 = 3.056 m

APPENDIX E

Water Quality Results

Results of Water Chemical Analyses

			Provincial Water Quality Objectives (1994)	BH 104	BH 202
				Sampled on: 2020-01-20	**Sampled on:** 2020-01-20
				Sampled by: Azimuth	**Sampled by:** Azimuth
				Analyzed by: Caduceon Labs	**Analyzed by:** Caduceon Labs
Parameter	**Symbol**	**Units**	**Objective**		
Saturation pH		N/A	**-**	6.99	7.21
pH		N/A	6.5-8.5	7.94	7.99
Langlier Index		N/A	-	0.95	0.781
Alkalinity (as CaCO3)		mg/L	-	314	237
Bicarbonate (as CaCO3)	HCO_3^-	mg/L	-	314	237
Carbonate (as CaCO3)	CO_3^{-2}	mg/L	-	<5	<5
Hydroxide		mg/L	-	<5	<5
Electrical Conductivity		uS/cm	-	565	526
Fluoride	F^-	mg/L	-	0.6	0.4
Chloride	Cl^-	mg/L	-	3.9	19.9
Nitrate as N	NO_3-N	mg/L	-	0.2	0.3
Nitrite as N	NO_2-N	mg/L	-	<0.1	<0.1
Bromide	Br^-	mg/L	-	<0.4	<0.4
Sulphate	SO_4^{-2}	mg/L	-	8	17
Calcium	Ca	mg/L	-	90.3	72.3
Magnesium	Mg	mg/L	-	20.4	21.2
Sodium	Na	mg/L	-	7.9	12.9
Potassium	K	mg/L	-	4.1	2.5
Ammonia as N	NH_3-N	mg/L	-	0.1	0.28
Phosphate as P	PO_4^{-3}	mg/L	-	0.28	0.101
Total Phosphorus	P	mg/L	0.03	**7.85**	**33.1**
Reactive Silica	Si	mg/L	-	14.7	17.7
Total Organic Carbon	TOC	mg/L	-	6.5	7.2
Colour		Colour Units	-	<2	<2
Turbidity		NTU	-	11000	72000
Aluminum	Al	mg/L	0.075	0.05	0.04
Arsenic	As	mg/L	0.1	0.0005	0.0003
Barium	Ba	mg/L	-	0.095	0.081
Boron	B	mg/L	0.2	0.019	0.006
Cadmium	Cd	mg/L	0.0005	<0.000015	<0.000015
Chromium	Cr	mg/L	0.0089	0.002	0.002
Copper	Cu	mg/L	0.005	<0.002	<0.002
Iron	Fe	mg/L	0.3	<0.005	<0.005
Lead	Pb	mg/L	0.005	0.00003	0.00003
Manganese	Mn	mg/L	-	0.036	0.001
Molybdenum	Mo	mg/L	0.04	<0.01	<0.01
Nickel	Ni	mg/L	0.025	<0.01	<0.01
Selenium	Se	mg/L	0.1	<0.001	<0.001
Silver	Ag	mg/L	0.0001	<0.0001	<0.0001
Strontium	Sr	mg/L	-	0.171	0.119
Thallium	Tl	mg/L	0.0003	<0.00005	<0.00005
Tin	Sn	mg/L	-	<0.05	<0.05
Titanium	Ti	mg/L	-	<0.005	<0.005
Uranium	U	mg/L	0.005	0.00069	0.00057
Vanadium	V	mg/L	0.006	0.0009	0.0012
Zinc	Zn	mg/L	0.02	<0.005	<0.005
Total Dissolved Solids	TDS	mg/L	-	324	290
Total Hardness (as CaCO3)		mg/L	-	310	267
Bold and highlighted indicates PWQO exceedance					

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G85556 **REPORT No. B20-00902**

Report To:

Azimuth Environmental
642 Welham Rd,
Barrie ON L4N9A1 Canada
Attention: Ian Acheson

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 10-Jan-20
DATE REPORTED: 17-Jan-20
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: Piatt Midland
P.O. NUMBER: 18-143
WATERWORKS NO.

			Client I.D.		BH 104	BH 202		
			Sample I.D.		B20-00902-1	B20-00902-2		
			Date Collected		10-Jan-20	10-Jan-20		
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
Saturation pH (25°C)	-		Calc.	14-Jan-20/O	6.99	7.21		
pH @25°C	pH Units		SM 4500H	13-Jan-20/O	7.94	7.99		
Langelier Index(25°C)	S.I.		Calc.	14-Jan-20/O	0.950	0.781		
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	13-Jan-20/O	314	237		
Bicarbonate(as CaCO3)	mg/L	5	SM 2320B	13-Jan-20/O	314	237		
Carbonate (as CaCO3)	mg/L	5	SM 2320B	13-Jan-20/O	< 5	< 5		
Hydroxide (as CaCO3)	mg/L	5	SM 2320B	13-Jan-20/O	< 5	< 5		
Conductivity @25°C	µS/cm	1	SM 2510B	13-Jan-20/O	565	526		
Fluoride	mg/L	0.1	SM4110C	13-Jan-20/O	0.6	0.4		
Chloride	mg/L	0.5	SM4110C	13-Jan-20/O	3.9	19.9		
Nitrate (N)	mg/L	0.1	SM4110C	13-Jan-20/O	0.2	0.3		
Nitrite (N)	mg/L	0.1	SM4110C	13-Jan-20/O	< 0.1	< 0.1		
Bromide	mg/L	0.4	SM4110C	13-Jan-20/O	< 0.4	< 0.4		
Sulphate	mg/L	1	SM4110C	13-Jan-20/O	8	17		
Calcium	mg/L	0.02	SM 3120	13-Jan-20/O	90.3	72.3		
Magnesium	mg/L	0.02	SM 3120	13-Jan-20/O	20.4	21.1		
Sodium	mg/L	0.2	SM 3120	13-Jan-20/O	7.9	12.9		
Potassium	mg/L	0.1	SM 3120	13-Jan-20/O	4.1	2.5		
Ammonia (N)-Total	mg/L	0.01	SM4500-NH3-H	13-Jan-20/K	0.10	0.28		
o-Phosphate (P)	mg/L	0.002	PE4500-S	13-Jan-20/K	0.280	0.101		
Phosphorus-Total	mg/L	0.01	E3199A.1	13-Jan-20/K	7.85	33.1		
Silica	mg/L	0.02	SM 3120	13-Jan-20/O	14.7	17.7		
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	14-Jan-20/O	6.5	7.2		
Colour	TCU	2	SM 2120C	14-Jan-20/O	< 2	< 2		

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G85556 **REPORT No. B20-00902**

Report To:

Azimuth Environmental
642 Welham Rd,
Barrie ON L4N9A1 Canada
Attention: Ian Acheson

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 10-Jan-20
DATE REPORTED: 17-Jan-20
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: Piatt Midland
P.O. NUMBER: 18-143
WATERWORKS NO.

			Client I.D.		BH 104	BH 202		
			Sample I.D.		B20-00902-1	B20-00902-2		
			Date Collected		10-Jan-20	10-Jan-20		
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
Turbidity	NTU	0.1	SM 2130	14-Jan-20/O	11000	72000		
Aluminum	mg/L	0.01	SM 3120	13-Jan-20/O	0.05	0.04		
Arsenic	mg/L	0.0001	EPA 200.8	13-Jan-20/O	0.0005	0.0003		
Barium	mg/L	0.001	SM 3120	13-Jan-20/O	0.095	0.081		
Boron	mg/L	0.005	SM 3120	13-Jan-20/O	0.019	0.006		
Cadmium	mg/L	0.000015	EPA 200.8	13-Jan-20/O	< 0.000015	< 0.000015		
Chromium	mg/L	0.001	EPA 200.8	13-Jan-20/O	0.002	0.002		
Copper	mg/L	0.002	SM 3120	13-Jan-20/O	< 0.002	< 0.002		
Iron	mg/L	0.005	SM 3120	13-Jan-20/O	< 0.005	< 0.005		
Lead	mg/L	0.00002	EPA 200.8	13-Jan-20/O	0.00003	0.00003		
Manganese	mg/L	0.001	SM 3120	13-Jan-20/O	0.036	0.001		
Molybdenum	mg/L	0.01	SM 3120	13-Jan-20/O	< 0.01	< 0.01		
Nickel	mg/L	0.01	SM 3120	13-Jan-20/O	< 0.01	< 0.01		
Selenium	mg/L	0.001	EPA 200.8	13-Jan-20/O	< 0.001	< 0.001		
Silver	mg/L	0.0001	EPA 200.8	13-Jan-20/O	< 0.0001	< 0.0001		
Strontium	mg/L	0.001	SM 3120	13-Jan-20/O	0.171	0.119		
Thallium	mg/L	0.00005	EPA 200.8	13-Jan-20/O	< 0.00005	< 0.00005		
Tin	mg/L	0.05	SM 3120	13-Jan-20/O	< 0.05	< 0.05		
Titanium	mg/L	0.005	SM 3120	13-Jan-20/O	< 0.005	< 0.005		
Uranium	mg/L	0.00005	EPA 200.8	13-Jan-20/O	0.00069	0.00057		
Vanadium	mg/L	0.0001	EPA 200.8	13-Jan-20/O	0.0009	0.0012		
Zinc	mg/L	0.005	SM 3120	13-Jan-20/O	< 0.005	< 0.005		
TDS(ion sum calc.)	mg/L	1	Calc.	14-Jan-20/O	324	290		
Hardness (as CaCO3)	mg/L	1	SM 3120	13-Jan-20/O	310	267		
Anion Sum	meq/L		Calc.	14-Jan-20/O	6.59	5.69		

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G85556 **REPORT No. B20-00902**

Report To:

Azimuth Environmental
642 Welham Rd,
Barrie ON L4N9A1 Canada
Attention: Ian Acheson

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 10-Jan-20
DATE REPORTED: 17-Jan-20
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: Piatt Midland
P.O. NUMBER: 18-143
WATERWORKS NO.

			Client I.D.		BH 104	BH 202		
			Sample I.D.		B20-00902-1	B20-00902-2		
			Date Collected		10-Jan-20	10-Jan-20		
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
Cation Sum	meq/L		Calc.	14-Jan-20/O	6.64	5.99		
% Difference	%		Calc.	14-Jan-20/O	0.371	2.57		

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

APPENDIX F

Water Balance Information

Table A: Pre-Development

Catchment Designation	Forest	Shrub / Meadow	Impervious	Total
Area (m^2)	121,400	181,160	10,825	313,385
Pervious Area (m^2)	121,400	181,160	0	302,560
Impervious Area (m^2)	0	0	10,825	10,825
Infiltration Factors				
Topography Infiltration Factor	0.15	0.15	0	
Soil Infiltration Factor	0.2	0.2	0	
Land Cover Infiltration Factor	0.2	0.15	0	
Infiltration Factor	0.55	0.5	0	
Run-Off Coefficient	0.45	0.5	1	
Run-Off From Impervious Surfaces	0.8	0.8	0.8	
Inputs (Per Unit Area)				
Precipitation (mm/yr)	907	907	907	907
Rainfall (mm/yr)	654	654	654	654
Run-On (mm/yr)	0	0	0	0
Other Inputs (mm/yr)	0	0	0	0
Total Inputs (mm/yr)	**907**	**907**	**907**	907
Outputs (Per Unit Area)				
Precipitation Surplus (mm/yr)	428	428	726	438
Net Surplus (mm/yr)	428	428	726	438
Evapotranspiration (mm/yr)	479	479	181	469
Infiltration (mm/yr)	235	214	0	215
Surplus Infiltration (mm/yr)	0	0	0	0
Total Infiltration (mm/yr)	235	214	0	215
Run-Off Pervious Areas (mm/yr)	193	214	0	198
Run-Off Impervious Areas (mm/yr)	0	0	726	25
Total Run-Off (mm/yr)	193	214	726	223
Total Outputs (mm/yr)	**907**	**907**	**907**	**907**
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**
Inputs (Volumes)				
Precipitation (m^3/yr)	110,110	164,312	9,818	284,240
Run-On (m^3/yr)	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0
Total Inputs (m^3/yr)	**110,110**	**164,312**	**9,818**	**284,240**
Outputs (Volumes)				
Precipitation Surplus (m^3/yr)	51,959	77,536	7,855	137,350
Net Surplus (m^3/yr)	51,959	77,536	7,855	137,350
Evapotranspiration (m^3/yr)	58,151	86,775	1,964	146,890
Infiltration (m^3/yr)	28,578	38,768	0	67,346
Surplus Infiltration (m^3/yr)	0	0	0	0
Total Infiltration (m^3/yr)	**28,578**	**38,768**	**0**	**67,346**
Run-Off Pervious Areas (m^3/yr)	23,382	38,768	0	62,150
Run-Off Impervious Areas (m^3/yr)	0	0	7,855	7,855
Total Run-Off (m^3/yr)	23,382	38,768	7,855	70,004
Total Outputs (m^3/yr)	110,110	164,312	9,818	284,240
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**

Table B: Post-Development (no mitigation)

Catchment Designation	Landscaped Grass	Other Impervious	Structure (industrial)	Structure (residential)	SWM	Total
Area (m^2)	133,344	62,785	62,895	42,140	12,220	313,385
Pervious Area (m^2)	133,344	0	0	0	0	133,344
Impervious Area (m^2)	0	62,785	62,895	42,140	12,220	180,041
Infiltration Factors						
Topography Infiltration Factor	0.2	0	0	0	0	
Soil Infiltration Factor	0.2	0	0	0	0	
Land Cover Infiltration Factor	0.1	0	0	0	0	
Infiltration Factor	0.5	0	0	0	0	
Run-Off Coefficient	0.5	1	1	1	1	
Run-Off From Impervious Surfaces	0.8	0.8	0.8	0.8	0.8	
Inputs (Per Unit Area)						
Precipitation (mm/yr)	907	907	907	907	907	907
Rainfall (mm/yr)	654	654	654	654	654	654
Run-On (mm/yr)	0	0	0	0	0	0
Other Inputs (mm/yr)	0	0	0	0	0	0
Total Inputs (mm/yr)	**907**	**907**	**907**	**907**	**907**	907
Outputs (Per Unit Area)						
Precipitation Surplus (mm/yr)	428	726	726	726	726	599
Net Surplus (mm/yr)	428	726	726	726	726	599
Evapotranspiration (mm/yr)	479	181	181	181	181	308
Infiltration (mm/yr)	214	0	0	0	0	91
Surplus Infiltration (mm/yr)	0	0	0	0	0	0
Total Infiltration (mm/yr)	214	0	0	0	0	91
Run-Off Pervious Areas (mm/yr)	214	0	0	0	0	91
Run-Off Impervious Areas (mm/yr)	0	726	726	726	726	417
Total Run-Off (mm/yr)	214	726	726	726	726	508
Total Outputs (mm/yr)	**907**	**907**	**907**	**907**	**907**	**907**
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	**0**
Inputs (Volumes)						
Precipitation (m^3/yr)	120,943	56,946	57,046	38,221	11,084	284,240
Run-On (m^3/yr)	0	0	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0	0	0
Total Inputs (m^3/yr)	**120,943**	**56,946**	**57,046**	**38,221**	**11,084**	**284,240**
Outputs (Volumes)						
Precipitation Surplus (m^3/yr)	57,071	45,557	45,637	30,577	8,867	187,709
Net Surplus (m^3/yr)	57,071	45,557	45,637	30,577	8,867	187,709
Evapotranspiration (m^3/yr)	63,872	11,389	11,409	7,644	2,217	96,531
Infiltration (m^3/yr)	28,536	0	0	0	0	28,536
Surplus Infiltration (m^3/yr)	0	0	0	0	0	0
Total Infiltration (m^3/yr)	**28,536**	**0**	**0**	**0**	**0**	**28,536**
Run-Off Pervious Areas (m^3/yr)	28,536	0	0	0	0	28,536
Run-Off Impervious Areas (m^3/yr)	0	45,557	45,637	30,577	8,867	130,638
Total Run-Off (m^3/yr)	28,536	45,557	45,637	30,577	8,867	159,173
Total Outputs (m^3/yr)	120,943	56,946	57,046	38,221	11,084	284,240
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	**0**

Table C: Post-Development (with mitigation)

Catchment Designation	Landscaped Grass	Structure (industrial)	Other Impervious	Structure (residential)	SWM	Total
Area (m^2)	133,344	62,895	62,785	42,140	12,220	313,385
Pervious Area (m^2)	133,344	0	0	0	0	133,344
Impervious Area (m^2)	0	62,895	62,785	42,140	12,220	180,041
Infiltration Factors						
Topography Infiltration Factor	0.2	0	0	0	0	
Soil Infiltration Factor	0.2	0	0	0	0	
Land Cover Infiltration Factor	0.1	0	0	0	0	
Infiltration Factor	0.5	0	0	0	0	
Run-Off Coefficient	0.5	1	1	1	1	
Run-Off From Impervious Surfaces	0.8	0.8	0.8	0.8	0.8	
Inputs (Per Unit Area)						
Precipitation (mm/yr)	907	907	907	907	907	907
Rainfall (mm/yr)	654	654	654	654	654	654
Run-On (mm/yr)	0	0	0	0	0	0
Other Inputs (mm/yr)	0	0	0	0	0	0
Total Inputs (mm/yr)	**907**	**907**	**907**	**907**	**907**	907
Outputs (Per Unit Area)						
Precipitation Surplus (mm/yr)	428	726	726	726	726	599
Net Surplus (mm/yr)	428	726	726	726	726	599
Evapotranspiration (mm/yr)	479	181	181	181	181	308
Infiltration (mm/yr)	214	0	0	0	0	91
Surplus Infiltration (mm/yr)	0	243	243	196	0	124
Total Infiltration (mm/yr)	214	243	243	196	0	215
Run-Off Pervious Areas (mm/yr)	214	0	0	0	0	91
Run-Off Impervious Areas (mm/yr)	0	482	482	529	726	293
Total Run-Off (mm/yr)	214	482	482	529	726	384
Total Outputs (mm/yr)	**907**	**907**	**907**	**907**	**907**	**907**
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	**0**
Inputs (Volumes)						
Precipitation (m^3/yr)	120,943	57,046	56,946	38,221	11,084	284,240
Run-On (m^3/yr)	0	0	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0	0	0
Total Inputs (m^3/yr)	**120,943**	**57,046**	**56,946**	**38,221**	**11,084**	**284,240**
Outputs (Volumes)						
Precipitation Surplus (m^3/yr)	57,071	45,637	45,557	30,577	8,867	187,709
Net Surplus (m^3/yr)	57,071	45,637	45,557	30,577	8,867	187,709
Evapotranspiration (m^3/yr)	63,872	11,409	11,389	7,644	2,217	96,531
Infiltration (m^3/yr)	28,536	0	0	0	0	28,536
Surplus Infiltration (m^3/yr)	0	15,302	15,275	8,268	0	38,844
Total Infiltration (m^3/yr)	**28,536**	**15,302**	**15,275**	**8,268**	**0**	**67,380**
Run-Off Pervious Areas (m^3/yr)	28,536	0	0	0	0	28,536
Run-Off Impervious Areas (m^3/yr)	0	30,335	30,282	22,309	8,867	91,793
Total Run-Off (m^3/yr)	28,536	30,335	30,282	22,309	8,867	120,329
Total Outputs (m^3/yr)	120,943	57,046	56,946	38,221	11,084	284,240
Difference (Inputs - Outputs)	0	0	0	0	0	0

Table D: Water Balance Summary Table

Characteristic	Site						
	Pre-Development	Post-Development	Change (Pre to Post)		Post-Development with Mitigation	Change (Pre to Post with Mitigation)	
Inputs (Volume)							
Precipitation (m^3/yr)	284,240	284,240	0	0%	284,240	0	0%
Run-On (m^3/yr)	0	0	0	NA	0	0	NA
Other Inputs (m^3/yr)	0	0	0	NA	0	0	NA
Total Inputs (m^3/yr)	284,240	284,240	0	0%	284,240	0	0%
Outputs (Volume)							
Precipitation Surplus (m^3/yr)	137,350	187,709	50,359	37%	187,709	50,359	37%
Net Surplus (m3/yr)	137,350	187,709	50,359	37%	187,709	50,359	37%
Evapotranspiration (m^3/yr)	146,890	96,531	-50,359	-34%	96,531	-50,359	-34%
Infiltration (m^3/yr)	67,346	28,536	-38,810	-58%	28,536	-38,810	-58%
Rooftop Infiltration (m^3/yr)	0	0	0	NA	8,268	8,268	NA
LID Infiltration (m^3/yr)	0	0	0	NA	30,577	30,577	NA
Total Infiltration (m^3/yr)	**67,346**	**28,536**	**-38,810**	**-58%**	**67,380**	**34**	**0%**
Run-Off Pervious Areas (m^3/yr)	62,150	28,536	-33,614	-54%	28,536	-33,614	-54%
Run-Off Impervious Areas (m^3/yr)	7,855	130,638	122,783	1563%	91,793	83,938	1069%
Total Run-Off (m^3/yr)	70,004	159,173	89,169	127%	120,329	50,324	72%
Total Outputs (m^3/yr)	**284,240**	**284,240**	**0**	**0%**	**284,240**	**0**	**0%**

Table A: Barrie Meteorological Station

Period of Record (1970-2021)

Calendar Year Evaluation (Theoretical)

Year	Total Precipitation	Rainfall	% Rainfall	(May - Aug) Precipitation	(Mar-May) Precipitation	(Oct-Dec) Precipitation ONLY	ET	Unadjusted ET	Summer* ET	Unadjusted Summer ET	Rain Surplus^	Snow Surplus	Total Surplus**
1970	955	701	73%	368	169	140	566	577	511	521	134	254	388
1971	700	406	58%	269	91	81	409	563	370	497	4	294	291
1972	856	556	65%	298	153	159	447	522	413	488	109	300	409
1973	766	632	83%	245	207	208	424	596	357	528	208	134	341
1974	833	622	75%	358	257	126	485	535	444	495	137	211	348
1975	806	475	59%	233	168	71	421	576	356	510	68	331	385
1976	900	581	65%	270	173	69	452	540	424	512	129	319	448
1977	964	692	72%	329	132	130	490	573	435	518	202	272	474
1978	1,032	538	52%	291	152	109	472	556	425	509	66	494	560
1979	975	686	70%	254	228	238	411	563	358	510	275	288	563
1980	929	623	67%	328	181	132	494	550	460	516	130	306	436
1981	883	675	76%	350	186	157	507	564	469	525	168	207	375
1982	954	699	73%	334	163	252	515	548	460	493	184	255	439
1983	775	556	72%	234	219	166	397	568	351	522	159	219	377
1984	880	543	62%	265	277	109	433	560	379	506	67	338	447
1985	1,041	671	64%	383	196	172	532	565	481	515	131	370	509
1986	1,095	878	80%	391	205	117	549	565	508	524	329	217	546
1987	916	785	86%	411	179	188	575	593	538	556	210	130	340
1988	925	653	71%	280	158	187	475	581	432	539	178	272	450
1989	845	620	73%	306	194	211	444	565	402	522	175	225	400
1990	860	686	80%	270	200	199	463	580	411	528	223	174	397
1991	770	623	81%	255	258	123	448	609	402	563	176	146	322
1992	829	615	74%	281	153	179	467	528	428	489	148	214	362
1993	919	644	70%	321	190	125	490	551	450	511	154	275	429
1994	802	558	70%	287	195	127	465	575	407	517	93	244	337
1995	1,297	972	75%	461	179	326	569	570	525	526	403	325	727
1996	1,106	821	74%	365	265	154	529	551	489	512	292	285	577
1997	855	517	60%	296	217	117	438	545	393	500	79	338	417
1998	853	717	84%	318	190	156	495	611	441	557	183	137	358
1999	875	691	79%	382	107	187	582	610	533	560	116	185	293
2000	1,047	853	82%	504	251	136	550	589	484	521	303	194	496
2001	928	719	77%	289	185	309	495	618	430	553	224	209	433
2002	883	702	80%	348	299	129	454	601	415	562	248	181	429
2003	995	697	70%	404	185	156	532	570	483	521	165	298	463
2004	988	681	69%	382	270	137	479	578	424	523	202	308	509
2005	848	603	71%	269	171	145	480	626	429	568	123	245	368
2006	888	670	75%	226	196	256	429	574	382	527	241	218	459
2007	913	532	58%	190	175	192	380	577	323	520	152	381	533
2008	957	612	64%	340	180	176	504	513	448	455	114	345	452
2009	918	659	72%	314	258	147	501	523	454	476	157	260	417
2010	954	831	87%	503	162	116	589	593	535	539	243	123	365
2011	911	620	68%	304	241	163	502	578	450	526	118	291	409
2012	639	519	81%	268	102	85	477	586	416	525	42	120	162
2013	1,214	871	72%	416	252	231	549	563	506	520	322	343	665
2014	864	647	75%	351	170	135	525	542	472	489	122	217	340
2015	718	560	78%	267	116	151	430	570	379	519	130	158	289
2016	824	592	72%	228	257	105	413	570	354	511	183	232	411
2017	1,075	717	67%	373	298	163	480	556	428	504	237	358	595
2018	916	680	74%	247	258	252	362	547	332	518	318	237	554
2019	803	528	66%	220	224	129	379	531	338	490	149	275	424
2020	889	657	74%	380	207	129	477	557	424	504	158	232	412
2021	793	648	82%	263	126	152	481	583	420	522	166	145	311
Ave	**907**	**654**	**72%**	**318**	**197**	**160**	**479**	**568**	**430**	**518**	**174**	**252**	**428**
Median	**895**	**650**	**73%**	**305**	**190**	**151**	**479**	**569**	**428**	**519**	**162**	**250**	**417**
SD	**119**	**107**	**0**	**70**	**50**	**55**	**55**	**25**	**55**	**22**	**79**	**78**	**100**
-99%	**628**	**404**	**55%**	**154**	**81**	**33**	**352**	**510**	**303**	**466**	**-10**	**72**	**194**
99%	**1,185**	**904**	**90%**	**481**	**312**	**287**	**606**	**626**	**558**	**571**	**358**	**433**	**662**

APPENDIX G

Ground Water Elevation Data

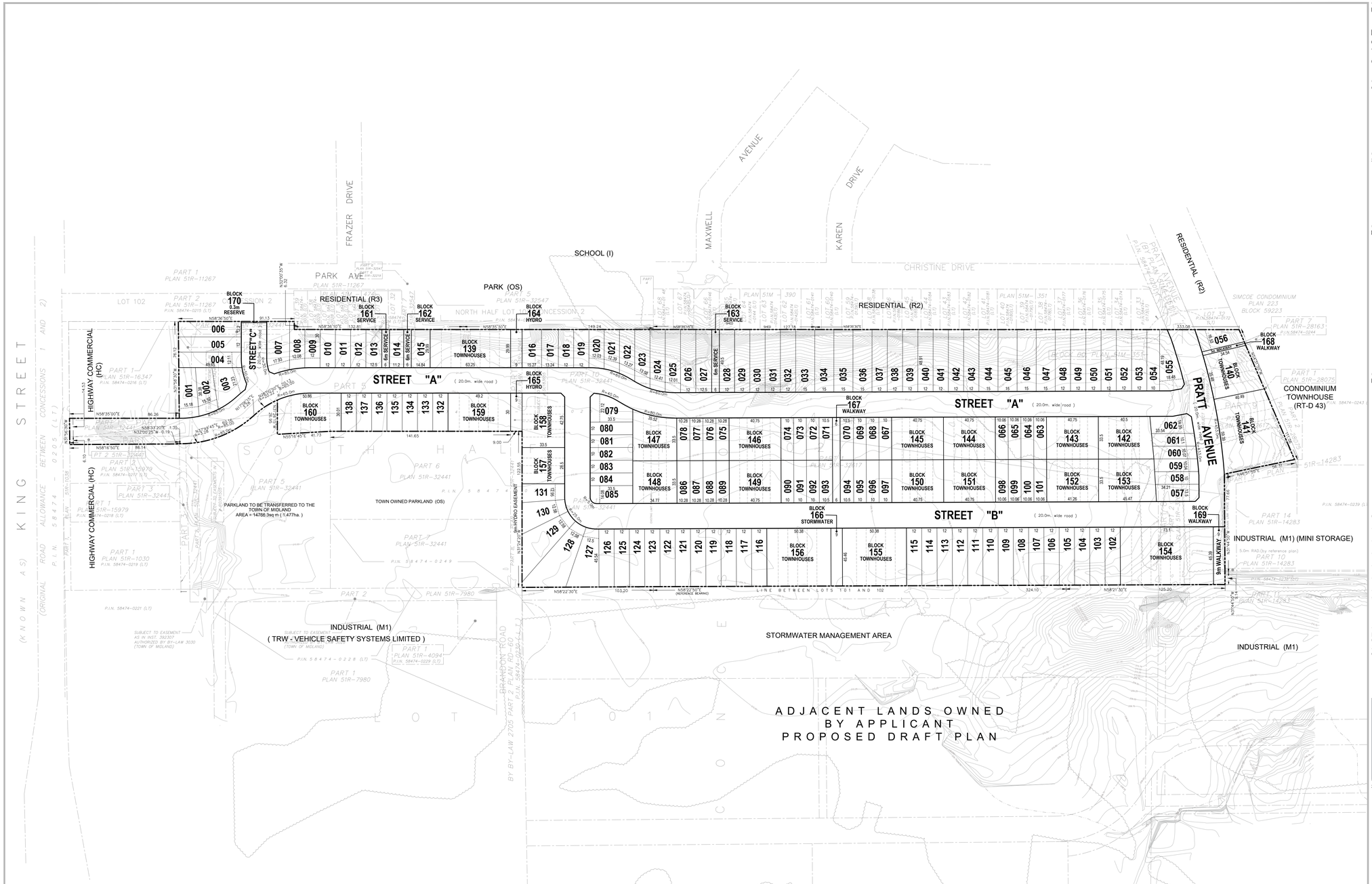
Well ID	Screen Depth	Ground Elevation	Reference Elevation	Stickup	Ground Water Level (mbtoc)														
	mbgs	masl	masl	m	31-May-18	08-Jun-18	17-Jul-18	16-Aug-18	19-Sep-18	16-Oct-18	16-Nov-18	13-Dec-18	18-Jan-19	13-Feb-19	25-Mar-19	18-Apr-19	15-May-19	11-Jun-19	27-Apr-20	13-May-20
101	4.9 – 6.4	211.3	212.79	1.49	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.6	7.6
102	5.1 – 6.6	209.8	210.58	0.78	7.4	7.3	7.3	7.3	7.3	7.4	7.4	7.2	7.3	7.2	7.2	7.1	7.2	7.3	7.3	7.3
103	5.1 – 6.6	211	211.80	0.80	7.4	5.7	6.1	7.0	7.1	7.1	7.1	4.1	4.2	4.0	3.7	3.8	3.9	4.3	4.4	4.6
104	5.1 – 6.6	208.8	209.60	0.80																
104B	5.1 – 6.6	208.4	209.70	1.30															3.4	4.2
105	5.1 – 6.6	208.5	209.78	1.28	7.9	7.7	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.6	7.6
106	5.1 – 6.6	206.9	207.71	0.81	3.8	4.7	5.5	6.0	5.9	5.9	5.1	5.0	5.0	4.7	4.5	4.6	4.5	4.8	5.0	5.2
201	5.1 – 6.6	211.6	212.74	1.14	7.7	7.6	7.6	7.6	7.6	7.6	7.6	5.6	6.9	6.1	3.7	3.4	3.5	5.2	6.2	7.6
202	5.1 – 6.6	211.2	212.66	1.46	7.0	2.8	4.0	4.6	4.9	5.1	3.5	2.4	3.4	2.1	2.0	1.8	1.9	2.0	1.9	2.0
203	4.7 – 6.2	210.3	211.70	1.40	7.6	4.4	5.9	6.5	6.5	7.0	5.7	2.6	2.7	1.8	1.7	1.7	1.8	2.1	2.1	2.4
204	5.1 – 6.6	210.1	210.99	0.89	3.0	2.7	4.0	7.4	7.5	7.5	7.1	6.4	6.1	5.9	6.2	5.9	4.9	5.0	2.3	2.3
205	5.1 – 6.6	212.6	213.33	0.73	3.7	4.4	4.6	4.8	4.6	4.4	3.9	3.7	3.8	3.8	3.6	3.6	3.6	3.7	3.9	3.9
206	4.7 – 6.2	212.1	212.98	0.88	7.2	4.2	5.2	5.8	6.5	6.8	6.8	5.7	3.6	3.1	2.7	2.6	2.5	3.0	2.8	3.0

Well ID	Screen Depth	Ground Elevation	Reference Elevation	Stickup	Ground Water Level (mbtoc)														
	mbgs	masl	masl	m	31-May-18	08-Jun-18	17-Jul-18	16-Aug-18	19-Sep-18	16-Oct-18	16-Nov-18	13-Dec-18	18-Jan-19	13-Feb-19	25-Mar-19	18-Apr-19	15-May-19	11-Jun-19	27-Apr-20	13-May-20
101	4.9 – 6.4	211.3	212.79	1.49	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.1	6.1
102	5.1 – 6.6	209.8	210.58	0.78	6.6	6.5	6.5	6.5	6.5	6.6	6.6	6.4	6.5	6.4	6.4	6.3	6.4	6.5	6.5	6.5
103	5.1 – 6.6	211	211.80	0.80	6.6	4.9	5.3	6.2	6.3	6.3	6.3	3.3	3.4	3.2	2.9	3	3.1	3.5	3.6	3.8
104	5.1 – 6.6	208.8	209.60	0.80	6.6	3.4	5.6	6.3	6.3											
104B	5.1 – 6.6	208.4	209.70	1.30															2.1	2.9
105	5.1 – 6.6	208.5	209.78	1.28	6.6	6.4	6.3	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.3	6.3
106	5.1 – 6.6	206.9	207.71	0.81	3	3.9	4.7	5.2	5.1	5.1	4.3	4.2	4.2	3.9	3.7	3.8	3.7	4	4.2	4.4
201	5.1 – 6.6	211.6	212.74	1.14	6.6	6.5	6.5	6.5	6.5	6.5	6.5	4.5	5.8	5	2.6	2.3	2.4	4.1	5.0	6.5
202	5.1 – 6.6	211.2	212.66	1.46	5.5	1.3	2.5	3.1	3.4	3.6	2	0.9	1.9	0.6	0.5	0.3	0.4	0.5	0.4	0.5
203	4.7 – 6.2	210.3	211.70	1.40	6.2	3	4.5	5.1	5.1	5.6	4.3	1.2	1.3	0.4	0.3	0.3	0.4	0.7	0.7	1.0
204	5.1 – 6.6	210.1	210.99	0.89	2.1	1.8	3.1	6.5	6.6	6.6	6.2	5.5	5.2	5	5.3	5	4	4.1	1.4	1.4
205	5.1 – 6.6	212.6	213.33	0.73	3	3.7	3.9	4.1	3.9	3.7	3.2	3	3.1	3.1	2.9	2.9	2.9	3	3.1	3.2
206	4.7 – 6.2	212.1	212.98	0.88	6.3	3.3	4.3	4.9	5.6	5.9	5.9	4.8	2.7	2.2	1.8	1.7	1.6	2.1	1.9	2.1

Well ID	Screen Depth	Ground Elevation	Reference Elevation	Stickup	Ground Water Level (mbtoc)														
	mbgs	masl	masl	m	31-May-18	08-Jun-18	17-Jul-18	16-Aug-18	19-Sep-18	16-Oct-18	16-Nov-18	13-Dec-18	18-Jan-19	13-Feb-19	25-Mar-19	18-Apr-19	15-May-19	11-Jun-19	27-Apr-20	13-May-20
101	4.9 – 6.4	211.3	212.79	1.49	204.9	204.9	204.9	204.9	204.9	204.9	204.9	204.9	204.9	204.9	204.9	204.9	204.9	204.9	205.2	205.2
102	5.1 – 6.6	209.8	210.58	0.78	203.2	203.3	203.3	203.3	203.3	203.2	203.2	203.4	203.3	203.4	203.4	203.5	203.4	203.3	203.3	203.3
103	5.1 – 6.6	211	211.80	0.80	204.4	206.1	205.7	204.8	204.7	204.7	204.7	207.7	207.6	207.8	208.1	208.0	207.9	207.5	207.4	207.2
104	5.1 – 6.6	208.8	209.60	0.80	202.2	205.4	203.2	202.5	202.5											
104B	5.1 – 6.6	208.4	209.70	1.30															206.3	205.5
105	5.1 – 6.6	208.5	209.78	1.28	201.9	202.1	202.2	202.1	202.1	202.1	202.1	202.1	202.1	202.1	202.1	202.1	202.1	202.1	202.2	202.2
106	5.1 – 6.6	206.9	207.71	0.81	203.9	203.0	202.2	201.7	201.8	201.8	202.6	202.7	202.7	203.0	203.2	203.1	203.2	202.9	202.7	202.5
201	5.1 – 6.6	211.6	212.74	1.14	205.0	205.1	205.1	205.1	205.1	205.1	205.1	207.1	205.8	206.6	209.0	209.3	209.2	207.5	206.6	205.1
202	5.1 – 6.6	211.2	212.66	1.46	205.7	209.9	208.7	208.1	207.8	207.6	209.2	210.3	209.3	210.6	210.7	210.9	210.8	210.7	210.8	210.7
203	4.7 – 6.2	210.3	211.70	1.40	204.1	207.3	205.8	205.2	205.2	204.7	206.0	209.1	209.0	209.9	210.0	210.0	209.9	209.6	209.6	209.3
204	5.1 – 6.6	210.1	210.99	0.89	208.0	208.3	207.0	203.6	203.5	203.5	203.9	204.6	204.9	205.1	204.8	205.1	206.1	206.0	208.7	208.7
205	5.1 – 6.6	212.6	213.33	0.73	209.6	208.9	208.7	208.5	208.7	208.9	209.4	209.6	209.5	209.5	209.7	209.7	209.7	209.6	209.5	209.4
206	4.7 – 6.2	212.1	212.98	0.88	205.8	208.8	207.8	207.2	206.5	206.2	206.2	207.3	209.4	209.9	210.3	210.4	210.5	210.0	210.2	210.0

APPENDIX H

Development Plan



LAND USE SUMMARY

LAND USE	LOT / BLOCK #	UNITS	AREA
SINGLE DETACHED - 10m LOTS	014, 054, 055, 057-101	48	1.738ha
SINGLE DETACHED - 12m LOTS	001-013, 015, 017-032, 037-043, 048-053, 056, 102-138	81	4.335ha
SINGLE DETACHED - 15m LOTS	016, 033-036, 044-047	9	0.633ha
TOWNHOUSE - 6m UNITS	142-153, 157, 158	80	1.860ha
TOWNHOUSE - 7.6m UNITS	139-141,154-156, 159, 160	49	1.695ha
SERVICE	161-163		0.066ha
HYDRO	164, 165		0.054ha
STORMWATER	166		0.041ha
WALKWAY	167-169		0.091ha
ROADS	PRATT AVE, STREETS A, B, & C		3.359ha
0.3m RESERVES	170		0.002ha
TOTALS		267	13.874ha

LEGAL DESCRIPTION

PART OF LOT 102, CONCESSION 2,
GEOGRAPHIC TOWNSHIP OF TAY
TOWN OF MIDLAND
COUNTY OF SIMCOE

OWNER'S CERTIFICATE

I HEREBY AUTHORIZE MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED TO SUBMIT THIS PLAN FOR APPROVAL.

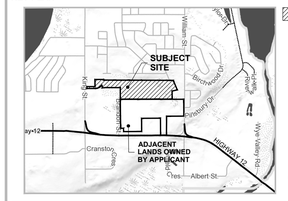
DATE: _____ _____

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

DATE: _____ _____

KEY PLAN



Subject Site

LEGEND

- SITE BOUNDARY
- RIGHT OF WAY LINE
- BLOCK LINE
- PARCEL FABRIC LINE
- WATERCOURSE
- WOODED AREA

REV. No.	DATE	ISSUED / REVISION	BY
01	NOV. 23, 2022	ADD PART 11 OF PLAN 51R-32441 TO PROPERTY, REVISE RESIDENTIAL LOT MIX, REVISE ROAD LAYOUT, ADD EXTRA SERVICING BLOCKS, ADD EXTRA WALKWAY BLOCKS, ADD STORMWATER BLOCK	M.M.

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT R.S.O. 1990 C.P.13 AS AMENDED

- **A.** AS SHOWN
- **B.** AS SHOWN
- **C.** AS SHOWN
- **D.** RESIDENTIAL
- **E.** AS SHOWN
- **F.** AS SHOWN
- **G.** AS SHOWN
- **H.** MUNICIPAL WATER SUPPLY (PIPED)
- **I.** SANDY/SANDY LOAM
- **J.** AS SHOWN
- **K.** ALL SERVICES AS REQUIRED
- **L.** AS SHOWN

113 COLLIER STREET
BARRIE, ON. L4M 1H2
P: 705 728 0045 F: 705 728 2010
WWW.MHBCPLAN.COM
PLANNING
URBAN DESIGN
& LANDSCAPE
ARCHITECTURE
MHBC PLANNING

STAMP

DATE	SEPT. 26, 2022
FILE No.	12162F
SCALE	1:1,500 (ARCH D)
DRAWN BY	M.M.
CHECKED BY	K.C.
OTHER	

PROJECT

PRATT RESIDENTIAL SUBDIVISION

PRATT DEVELOPMENTS INC.
27 CLAPPERTON ST. SUITE 300
BARRIE ON L4M 3E6
705-722-4500

FILE NAME

DRAFT PLAN OF SUBDIVISION

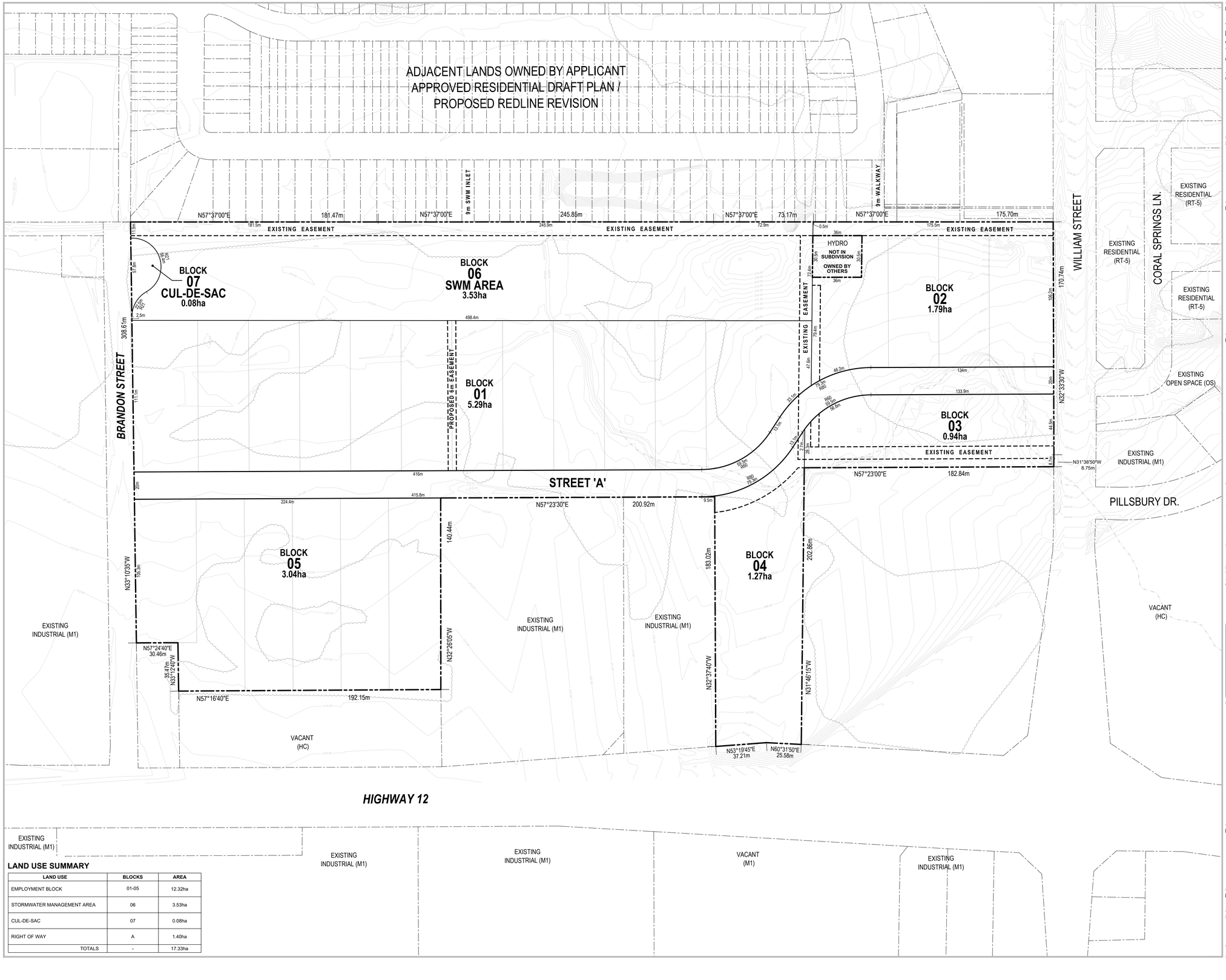
DWG No. 1 of 1

SCALE BAR

0 5 10 15 20 25 37.5 50 75 100m

MEASUREMENTS SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

N:\Brian\12162F Pratt – Residential Draft Plan of Subdivision\Drawings\Draft Plan – Redline\CAD\12162F – Residential – Draft Plan – 2022-11-23.dwg



LAND USE SUMMARY

LAND USE	BLOCKS	AREA
EMPLOYMENT BLOCK	01-05	12.32ha
STORMWATER MANAGEMENT AREA	06	3.53ha
CUL-DE-SAC	07	0.08ha
RIGHT OF WAY	A	1.40ha
TOTALS	-	17.33ha

LEGAL DESCRIPTION

16533 HIGHWAY 12
PART OF LOT 101, CONCESSION 2
GEOGRAPHIC TOWNSHIP OF TAY
TOWN OF MIDLAND
COUNTY OF SIMCOE

OWNER'S CERTIFICATE

I HEREBY AUTHORIZE MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED TO SUBMIT THIS PLAN FOR APPROVAL.

DATE: _____

PRATT DEVELOPMENT INC.
DON PRATT, PRESIDENT

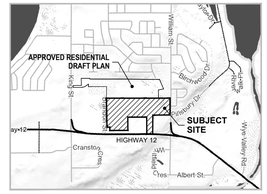
SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

DATE: _____

RUDY MAL - O.L.S.
RUDY MAK SURVEYING LTD.

KEY PLAN



LEGEND

- SITE BOUNDARY
- BLOCK & RIGHT OF WAY LINE
- EASEMENT LINE
- PARCEL FABRIC LINE
- CONCEPTUAL POTENTIAL FUTURE DEVELOPMENT BLOCK LINE
- WATERCOURSE
- WOODED AREA

REVISION No.	DATE	ISSUED / REVISION	BY
01	NOV. 23, 2022	RELOCATE STORMWATER MANAGEMENT AREA, RELOCATE CUL-DE-SAC, REVISE ROW, ADJUST BLOCKS, ADD EASEMENT	MAM

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT R.S.O. 1990 C.P.13 AS AMENDED

A. AS SHOWN
B. AS SHOWN
C. AS SHOWN
D. INDUSTRIAL/COMMERCIAL
E. AS SHOWN
F. AS SHOWN
G. AS SHOWN
H. MUNICIPAL
I. SILTY SAND/SILT AND CLAY/SILTY CLAY
J. AS SHOWN
K. MUNICIPAL
L. AS SHOWN

113 COLLIER STREET
BARRIE, ON, L4M 1H2
P: 705 728 0045 F: 705 728 2010
WWW.MHBCPLAN.COM

PLANNING
URBAN DESIGN
& LANDSCAPE
ARCHITECTURE
MHBC PLANNING

STAMP

DATE	AUG. 19, 2022
FILE No.	12162G
SCALE	1:1,250 (ARCH D)
DRAWN BY	M.M.
CHECKED BY	K.C.
OTHER	

PROJECT

PRATT EMPLOYMENT SUBDIVISION
PRATT DEVELOPMENTS INC.
27 CLAPPERTON ST. SUITE 300
BARRIE ON L4M 3E6
705-722-4500

NORTH

FILE NAME DRAFT PLAN OF SUBDIVISION

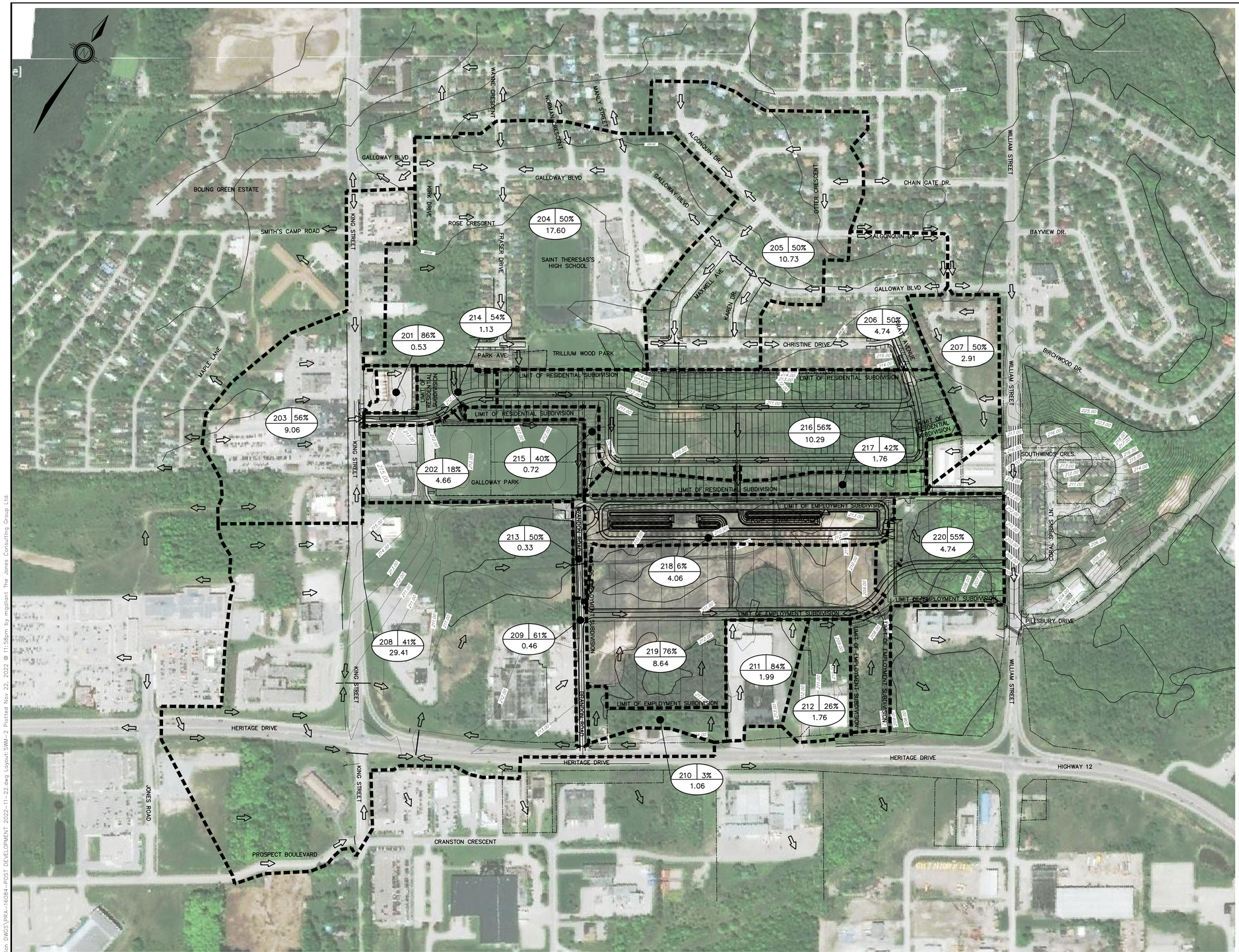
DWG No. 1 of 1

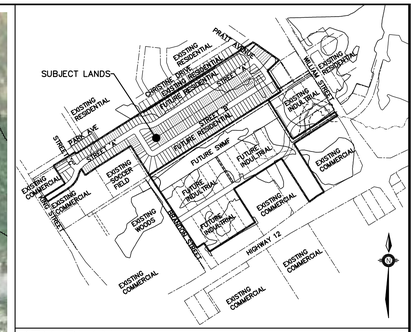
SCALE BAR

0 6 12 18 24 30 45 60 90 120m

MEASUREMENTS SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

N:\Brian\12162G\Drawings\Draft Plan\CAD\12162G – Draft Plan – 2020-10-08.dwg





KEY PLAN
NTS

LEGEND

- LIMIT OF SUBDIVISION
- EXISTING PRE-DEVELOPMENT STORM DRAINAGE
- 253.00 EX. CONTOUR AND ELEVATION
- CATCHMENT BOUNDARY
- 206 | 0.53 | 1.56 — CATCHMENT AREA ID NUMBER; PERCENT IMPERVIOUS; AREA (ha.)
- LIMIT OF DEVELOPMENT

BENCHMARK:

BENCHMARK NO. 00820038042 RIB WITH CAP, 30 CM BELOW GRADE. – LOCATED ON NORTHWEST CORNER OF HWY 12 AND WILLIAM ST IN TOWN OF MIDLAND. POINT IS LOCATED ON TRAFFIC ISLAND CLOSE TO CURB. UTM ZONE 17 E590465.059 N4954255.350 ELEV 194.842

BENCHMARK NO. 05719747317 62m NORTHEAST FROM BRANDON ST AND HWY 12 INTERSECTION UTM ZONE 17 E589914.683 N4953919.657 ELEV 213.xxx

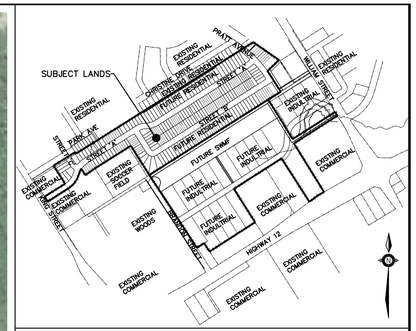
NO.	REVISIONS	DATE	INITIAL
2.	DRAFT PLAN SUBMISSION	NOV 2022	JWI
1.	FSR SUBMISSION	FEB 2020	JWI

PRATT HANSEN GROUP INC.
GALLOWAY SUBDIVISION
TOWN OF MIDLAND

POST-DEVELOPMENT
DRAINAGE AREA PLAN

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	VBS	SCALE: 1:2500	DATE NOV 2022
DRAWN	VBS	PROJECT PRA-16084	DWG. Nº SWM-2
CHECKED	JWI		



KEY PLAN
NTS

LEGEND

- LIMIT OF SUBDIVISION
- EXISTING PRE-DEVELOPMENT STORM DRAINAGE
- 253.00 EX. CONTOUR AND ELEVATION
- CATCHMENT BOUNDARY
- 206 | 15% | 1.56 — CATCHMENT AREA ID NUMBER; PERCENT IMPERVIOUS; AREA (ha.)
- LIMIT OF DEVELOPMENT

BENCHMARK:

BENCHMARK NO. 00820038042 RIB WITH CAP, 30 CM BELOW GRADE. -- LOCATED ON NORTHWEST CORNER OF HWY 12 AND WILLIAM ST IN TOWN OF MIDLAND. POINT IS LOCATED ON TRAFFIC ISLAND CLOSE TO CURB. UTM ZONE 17 E590465.059 N4954255.350 ELEV 194.842

BENCHMARK NO. 05719747317 62m NORTHEAST FROM BRANDON ST AND HWY 12 INTERSECTION UTM ZONE 17 E588914.683 N4953919.657 ELEV 213.xxx

NO.	REVISIONS	DATE	INITIAL
2.	DRAFT PLAN SUBMISSION	NOV 2022	JWI
1.	FSR SUBMISSION	FEB 2020	JWI

PRATT HANSEN GROUP INC.
GALLOWAY SUBDIVISION
TOWN OF MIDLAND

PRE-DEVELOPMENT DRAINAGE AREA PLAN

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	VBS	SCALE: 1:2500	DATE NOV 2022
DRAWN	VBS	PROJECT PRA-16084	DWG. Nº SWM-1
CHECKED	JWI		