

HYDROGEOLOGICAL ASSESSMENT AND TERRAIN ANALYSIS

GRIZZLY HOMES SUBDIVISION, BECKWITH, ON



Project No.: CCO-22-0256

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EXECUTIVE SUMMARY

McIntosh Perry (MP) was retained by Grizzly Homes ('the Client') to conduct a Hydrogeological Assessment and Terrain Analysis at the Grizzly Homes Subdivision in the Township of Beckwith, Franktown, Ontario (the Site) (Figure 1). The site is bounded by Fourth Line Road to the north, Perth Road to the south, and is located approximately 275m west of Highway 15, near the hamlet of Franktown within the Township of Beckwith. An outline of the Site, showing the neighbouring properties is presented on Figure 2. At the present time, the Site consists primarily of undeveloped shrub/forested land, with the exception of the presence of a single residential dwelling in the northern portion of the site

The Site is relatively flat. The elevation ranges between 136 and 148.5 metres above sea level (m asl), with the majority of the site at an elevation between 140 and 148 metres above sea level (m asl).

McIntosh Perry supervised the installation of four on-site water wells, as well as the excavation of fifteen on-site test pits. Wells were used for groundwater quality and quantity testing, and all test well locations were selected for eventual domestic use when the Site is developed. Test pit data were collected for purposes of soil classification and overburden thickness. A summary of the test wells and test pit locations is illustrated on Figure 2.

All test wells were pumped for at least six hours and were sampled twice during this time, per Ministry of Environment, Conservation and Parks (MECP) Procedure D-5-5. Analytical data and pumping test results from all test wells suggests that on-site water supply aquifer is of high yield and good quality.

Test pit excavations revealed on-site shallow overburden to consist of either shallow bedrock, sand, gravelly sand or clay overlain by topsoil. Bedrock was found at a maximum depth of approximately 1.7 metres below ground surface (m bgs) and generally consists of dolostone and sandstone of the Beekmantown Group based on Ontario Geological Survey (OGS) and MECP Water Well Information System (WWIS) records (2020).

The site appears to be suitable for the proposed development, from a hydrogeological perspective.

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1.0 INTRODUCTION

McIntosh Perry (MP) was retained by Grizzly Homes ('the Client') to conduct a Hydrogeological Assessment and Terrain Analysis at a property located west of Highway 15, between Fourth Line Road and Perth Road in the Township of Beckwith, Franktown, Ontario (the Site) (Figure 1). The approximate civic address of the property is 2084 Fourth Line Road, Smiths Falls. This hydrogeological assessment and terrain analysis has been prepared in support of an application for the approval of a proposed 30-lot subdivision at the Site, which currently consists primarily of undeveloped forested land with the exception of a single residential dwelling located on the northern portion of the Site.

This work was conducted in general accordance with Ministry of Environment, Conservation and Parks (MECP) guidance as follows:

- Procedure D-5-5: Technical Guideline for Private Wells: Water Supply Assessment (August 1996); and
- Procedure D-5-4: Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment (August 1996).

This work was initiated by McIntosh Perry in 2021 with a Site reconnaissance to observe surface conditions and select drilling locations. The work presented herein involved the following:

- Topographic survey of on-site drilled wells (completed by McIntosh Perry Surveying Inc.);
- Hydrogeological assessment (for evaluating water supply); and
- Terrain Analysis (for evaluating existing conditions for private sewage treatment).

The property is owned by Grizzly Homes Inc. and is legally described as follows:

PT SW1/2 LT 10 CON 3 BECKWITH AS IN RS45238, EXCEPT 27R2160, 27R5512, 27R6268, 27R4263, 27R4808, 27R3949; S/T RS34528; BECKWITH

A full Preliminary Concept Plan is included as Appendix A.

This report considers the development potential of the entire land holding, which includes a total of 30 lots over a total area of approximately 27 hectares. The Hydrogeological Assessment and Terrain Analysis address the following:

- General Site setting information;
- Geological and hydrogeological background;
- Site-specific conditions;
- Soils evaluation; and
- Contaminant attenuation.

2.0 INVESTIGATION

2.1 Site Setting

The Site is located in the western portion of the hamlet of Franktown within the Township of Beckwith in central Eastern Ontario, south of the Town of Carleton Place (Figure 1).

The Site currently exists predominantly as undeveloped forested/shrub land with the exception of a single residential dwelling located on the northern portion of the Site. There are residentially developed lands immediately north and south of the Site along Fourth Line Road and Perth Road, as well as to the east along Highway 15; otherwise, the surrounding land use is predominately forested land.

This region is characterized by thin overburden overlying Paleozoic bedrock (OGS, 2022; MECP, 2020).

The Site currently consists of forested land and several wetlands and has likely never been contemporarily developed with the exception of the existing residential present on the northern portion of the Site. On-site elevation ranges between 141 and 149 metres above sea level (m asl). The topography of the Site is generally flat.

2.2 Neighbouring Properties and Land Uses

For purposes of this report, Highway 15 is assumed to be oriented in a North-South direction. The property is bounded to the north by Fourth Line Road, Highway 15 and rural residential properties to the east, Perth Road and rural residential properties to the south, and undeveloped forested land to the west.

Based on a review of MECP Well Record Information System (WWIS) records, it appears that all residences in the area are privately serviced with wells and septic systems.

The subject site and the surrounding properties to the east and south are located within a community development area designated as residential, while the properties to the north and west are designated as rural lands within rural areas in the Township of Beckwith's Official Plan. The Township's Official Plan – Schedule A is included as Appendix B.

2.3 Hydrology

The Site is relatively flat. Wetland areas appear to be present around the center of the Site. A small local waterbody is also present on Site, as seen in Figure 2. The Franktown Swamp, which forms part of the Upper Jock River (part of the Mississippi River system), is the closest permanent waterbody to the Site and is located approximately 550 m east of the Site at its closest point. On a local scale, shallow groundwater flow cannot be determined fully due to limited data, however there is likely a northwestern flow component and potentially more localized flow patterns toward on-site water features (pond, wetland).

2.4 Background Geology and Hydrology

2.4.1 Surficial and Bedrock Geology

According to Ontario Geological Survey (OGS) regional mapping, surficial overburden at the Site is thin, and is characterized by Paleozoic bedrock (OGS, 2022). This classification is consistent with on-site observations made by McIntosh Perry. Based on OGS 2022 data, the underlying bedrock is classified as dolostone and sandstone of the Beekmantown Group, which is consistent with MECP WWIS Records (MECP 2020).

Well records for on-site drilled test wells indicate an average overburden thickness of approximately 1.0 m, with only one record indicating an overburden depth greater than 1.8 m. It should be noted that overburden thickness was recorded at less than 0.5 m in some areas of the Site. A review of the MECP Water Well Information System (WWIS) well records within 500 m of the Site showed that the depth to bedrock ranges from 0 – 4.3 m bgs, with an average depth of approximately 0.83 m bgs. Where noted in the well records, bedrock is typically referred to as either “sandstone” or “limestone” by the driller (Appendix C).

An offsite well used strictly for testing purposes located at 2030 Fourth Line Road indicates that overburden thickness is approximately 1.2 m.

2.4.2 Recharge and Discharge Areas

A review of topographic data, geological maps, and field notes show that the property is generally flat with some local sloping down towards the northwest. Shallow groundwater and surface water likely drain in this direction. Shallow groundwater in the northern portion of the site may move toward what appears to be a large on-site wetland complex and waterbody, located in the middle of the Site. In most areas of the Site, the terrain appears to be well-drained.

2.4.3 Hydrogeologically Sensitive Areas

The underlying bedrock appears to be relatively shallow across the property, ranging from 0.3 – 1.8 m bgs based on test well records. Areas exhibiting exposed bedrock were observed during fieldwork, closest to the south property boundary along Perth Road. Based on the thin overburden, the Site is considered to be hydrogeologically sensitive.

2.4.4 Potential Sources of Contamination

A windshield survey of the area was conducted in combination with a review of maps and zoning information. The Site is located in a predominantly forested area, with forested/undeveloped and/or residential-rural properties in the immediate vicinity. None of these uses are expected to pose a significant source of potential contamination to the proposed development.

As there is no wastewater service available in the area surrounding the Site, there are likely individual on-site sewage systems at all nearby residences. There are currently no known services located on the Site, aside from private services assumed to be connected to the single detached dwelling present at the northern end of the site accessed from Fourth Line Road..

A review of the MECP WWIS database indicated 62 water wells located within 500 m of the Site. 60 of these wells are listed for domestic purposes, while the remaining 2 wells are listed as either observation well or abandoned. The MECP WWIS records are shown on Figure 2, and data are summarized in Appendix D.

3.0 HYDROGEOLOGICAL ASSESSMENT

3.1 Preamble

McIntosh Perry conducted a detailed hydrogeological investigation at the Site to assess the feasibility of individual private wells for servicing the proposed residential lots. As noted in Section 1, the work generally followed the Guidance of MECP Procedure D-5-5: Technical Guideline for Private Wells – Water Supply Assessment.

3.2 Methodology

Air Rock Drilling Ltd. (Air Rock; Well Contractor’s Licence No.1119) was retained by Cavanagh Construction to drill four water wells at the Site for testing purposes and eventual domestic use when the property is developed. The drilling was conducted by licensed employees of Air Rock, and McIntosh Perry personnel observed the grouting of each well per O. Reg. 903 (Wells), as amended. The driller also provided and installed a pump for the pumping test activities at the drilled test wells (TW2, TW3, TW4, TW5). A summary of the test well construction based on driller-provided well records is presented in Table 1. The location of all on-site wells is noted on Figure 2.

It is important to note that TW1 is an existing offsite well, located at 2030 Fourth Line Road, Beckwith, ON.

Table 1: On-Site Test Well Details

Well ID	Depth (m bgs)	Completion Material¹	Driller’s Estimated Yield² (L/min)
TW 1 (offsite)	24.7	Sandstone	90
TW 2	30.5	Sandstone	90

TW 3	36.6	Sandstone	90
TW4	37.2	Sandstone	90
TW 5	42.7	Sandstone	90

¹ Bedrock formations as noted on Well Record

² Recommended pumping rates as noted on Well Record

The initial estimation of the yield and quality of water from each test well was made by the drillers during development, which occurred approximately one day after drilling was completed. The yield determined by this one-hour test is noted in Table 1. MECP water well records are provided in Appendix D.

A minimum six-hour pumping test was conducted at each of the four on-site test wells (TW2, TW3, TW4, and TW5) and the offsite private well (TW1), by McIntosh Perry staff (July 2021 – January 2022). During each test, the test wells were pumped at a rate not less than the driller-recommended pumping rate, with the exception of TW1, offsite which utilized existing plumbing fixtures. Water levels were measured in the pumped well and at other on-site test wells in the vicinity, where possible. Water quality was also monitored and recorded in the field during the tests at all five locations. Two water samples were collected from each pumped well during their respective tests (one each during the first and last hours of the test) for analysis of the “subdivision supply” suite of parameters, in addition to a select suite of metals.

All samples were collected unfiltered and unchlorinated directly into clean bottles supplied by the analytical laboratory (Paracel Laboratories of Ottawa, ON). Prior to each sample collection, a field test for chlorine (disposable testing strips) was completed to ensure no residual chlorine persisted from the initial well shocking. Visual and olfactory observations of the pumped water were made during each pumping test to monitor for effervescence, odours, or other physical indicators of water quality. Samples were kept on ice and shipped directly to Paracel under strict chain of custody procedures. All samples were received by the laboratory within 24 hours of collection. Paracel is fully accredited by the Standards Council of Canada/Canadian Association for Laboratory Accreditation (SCC/CALA) and has accreditation for Ontario Safe Drinking Water Act (OSDWA) testing.

During all five pumping tests, water level monitoring consisted of manual readings with a water level tape. Drawdown was measured in the pumped wells and recovery measurements were made until at least 95% recovery was achieved in the pumping well, or 24 hours had passed (whichever came first).

Water level drawdown and recovery data from the pumping tests were plotted and analyzed using the Cooper-Jacob solution and were used to calculate transmissivity (T) and hydraulic conductivity (K) for the aquifer. Storativity (S) of the aquifer was estimated wherever suitable observation well measurements could be made.

3.3 Results

Drawdown curves and tabular data from the pumping tests are available in Appendix E and Table 3, respectively. A summary of groundwater quality data and the official Laboratory Certificates of Analysis are available in Appendix F.

3.3.1 *Static Conditions provided by drillers*

Prior to the initiation of pumping, water levels were measured in the seven test wells (Table 2, below). The static groundwater elevation ranged between 136.141 – 137.569 m asl at the time of the pumping tests (Figure 4). Static groundwater elevations suggest that on-site bedrock groundwater flow has a southwestern component, toward Mississippi Lake. On-site wells were completed in a similar geologic unit (listed by the driller as “sandstone”). Well depths are noted in Table 2, below.

Table 2: Test Well Information

Well ID	Well Depth (m bgs)	Top of Well Casing Elevation (m asl) ¹	Stick Up (m)	Static Groundwater Level (m btoc)	Static Water Elevation (m asl)
TW1	24.7	N/A	N/A	3.78	N/A
TW 2	30.5	142.904	0.626	4.762	138.142
TW 3	36.6	147.776	0.637	9.481	138.295
TW 4	37.2	148.299	0.648	11.51	136.789
TW 5	42.7	148.916	0.548	11.446	137.47

¹ As measured by McIntosh Perry Surveyors Inc. (May 2022)

3.3.2 *Test Well Installations*

Pumping tests were conducted at each of the five wells by McIntosh Perry. The pump, hose, and power supply were provided by Air Rock, who installed and removed the pump from each well, with the exception of TW1. TW1 was completed at a private residence where the plumbing was already installed. The discharged water was directed away from each pumping well and allowed to flow overland away and downgradient from the test well. At the time of the on-site pumping tests, the weather was approximately between 22-25 °C, with sun and clouds. The weather was approximately -15°C with sun and clouds at the time of the pumping test at TW1.

All the water level measurement data are presented in Table 3.

TW1

TW1 (an existing private well) was drilled to a depth of 24.7 m. The overburden was approximately 1.22 m thick at this location. A 12.8 m long steel casing (including approximately 0.61 m of above-ground stickup) was installed in the hole and sealed with cement. The hole was grouted from ground surface to approximately 12.2 m bgs. The remainder of the well is an open hole in the rock. The rock was described as “limestone” with “sandstone with limestone” from 1.22 m – 24.7 m by the driller. Water was encountered at 21.64 m and 22.9 m.

The driller initially estimated a yield of 90 L/min (20 gal/min), which was also the final recommended pumping rate for this well.

McIntosh Perry undertook a pumping test at this location on January 18, 2022. The well was pumped at a rate of 21.1 L/min for over six hours. The water levels stabilized at approximately 4.15 m btoc. Over 95% recovery in water level was achieved within 51 minutes of terminating the test.

TW 2

TW 2 was drilled to a depth of 30.48 m. The overburden was approximately 0.30 m thick at this location. A 13.4 m long steel casing (including approximately 0.61 m of above-ground stickup) was installed in the hole and sealed with a cement/bentonite grout. The hole was grouted from ground surface to approximately 9.76 m bgs. The remainder of the well is an open hole in the rock. The rock was described as “limestone” from 0.30 m – 9.14 m and “sandstone” from 9.14 – 30.48 m by the driller. Water was encountered at 28.65 m.

The driller initially estimated a yield of 90 L/min (20 gal/min), which was also the final recommended pumping rate for this well.

McIntosh Perry undertook a pumping test at this location on July 13, 2021. The well was pumped at a rate of 87.3 L/min for over six hours. The water levels stabilized at approximately 9.5 m btoc (~133.404 m asl). Over 95% recovery in water level was achieved within 35 minutes of terminating the test.

TW 3

TW 3 was drilled to a depth of 36.6 m. The overburden was approximately 1.52 m thick at this location. A 13.4 m long steel casing (including approximately 0.61 m of above-ground stickup) was installed in the hole and sealed with a cement/bentonite grout. The hole was grouted from approximately 9.75 m to the ground surface. The remainder of the well is an open hole in the rock. The driller described the rock as “limestone” from 0.31 – 9.14 m, and “sandstone” from 9.14 – 36.6 m. Water was encountered at 9.57 m.

The driller initially estimated a yield of 90 L/min (20 gal/min), which was also the final recommended pumping rate for this well.

McIntosh Perry undertook a pumping test at this location on January 13, 2021. The well was pumped at a rate of 90 L/min for over six hours. The water levels stabilized at approximately 9.9 m btoc (~137.876 m asl). Approximately 69% recovery in water level was achieved within 24 hours of terminating the test; it is assumed that atmospheric pressure changes and further well development over the pumping and recovery period may have contributed to the failure to fully recover past 95%.

TW 4

TW 4 was drilled to a depth of 37.2 m. The overburden was approximately 1.83 m thick at this location. A 13.4 m long steel casing (including approximately 0.61 m of above-ground stickup) was installed in the hole and sealed with a cement/bentonite grout. The hole was grouted from approximately 9.8 m to the ground surface. The remainder of the well is an open hole in the rock. The rock was described as “limestone” from 1.83 – 7.62 m by the driller. Water was encountered at 29.9 and 35.4 m bgs.

The driller initially estimated a yield of 90 L/min (20 gal/min), which was also the final recommended pumping rate for this well.

McIntosh Perry undertook a pumping test at this location on September 9, 2021. The well was pumped at a rate of 90 L/min for over six hours. The water levels stabilized at approximately 11.85 m btoc (~136.449 m asl). Over 95% recovery in water level was achieved within 161 minutes of terminating the test.

TW 5

TW 5 was drilled to a depth of 42.7 m. The overburden was approximately 1.52 m thick at this location. A 13.4 m long steel casing (including approximately 0.61 m of above-ground stickup) was installed in the hole and sealed with a cement/bentonite grout. The hole was grouted from approximately 9.75 m to the ground surface. The remainder of the well is an open hole in the rock. The rock was described as “limestone” from 1.52 – 8.23 m bgs, and “sandstone” from 8.23 – 42.7 m bgs by the driller. Water was encountered at 26.5 m bgs and again at 35.2 m bgs.

The driller initially estimated a yield of 90 L/min (20 gal/min), which was also the final recommended pumping rate for this well.

McIntosh Perry undertook a pumping test at this location on January 6, 2021. The well was pumped at a rate of 90 L/min for over six hours. The drawdown stabilized at approximately 11.64 m btoc (~137.276 m asl). Over 95% recovery in water level was achieved within 24 hours of terminating the test.

Table 3: Summary of Pump Tests

Test Well ID	Final Pumping Rate (L/min)	Maximum Drawdown in Pumping Well (m)	Observation Well ID	Max Drawdown in Observation Well (m)	Approximate Distance between Pumping Well and Observation Well (m)
TW 1	21	0.431	Observation well not available at the time of the test	N/A	N/A
TW 2	87.27	4.791	Observation well not available at the time of the test	N/A	N/A
TW 3	90	0.632	Observation well not used due to proximity and accessibility	N/A	N/A
TW 4	90	0.377	TW2	Minimal drawdown observed	527
			TW3	Minimal drawdown observed	300
			TW5	Minimal drawdown observed	225
TW 5	90	0.236	Observation well not used due to proximity and accessibility	N/A	N/A

3.3.3 Well Yield

The testing and development undertaken by the driller immediately after well installation provided a reasonable indication of the yield of each well. All test wells were demonstrated to have yields suitable for supplying single family homes. During McIntosh Perry’s pumping tests at the five well locations, at least 7,560 L of water was pumped from each well. This volume exceeds the daily demand for water for a typical 4-bedroom home (2,000 L) and the minimum volume for a 6-hour pumping test (6,750 L), as specified in the Guideline Procedure D-5-5 Private Wells: Water Supply Assessment. At each location, at least 95% recovery

was achieved between 0 and 1,440 minutes (24 hours) after the cessation of pumping, with the exception of TW3.

The five well locations were spaced 250 m apart at minimum. Due to the distance between wells and accessibility throughout the property, observation well measurements were not recorded, with the exception of TW4. Two observation wells (TW2 and TW3) were monitored during the 6-hour pumping test at TW4. Minimal drawdown (0.028 – 0.15 m btoc) was observed in the observations wells.

3.3.4 *Transmissivity and Storativity*

A summary of the transmissivity values calculated using the Cooper-Jacob method are presented in Table 4.

Table 4: Transmissivity Values

Well ID	Transmissivity (m ² /day) (Pumping Test Calculation) (Recovery Calculation)
TW 1	43.3
	55.4
TW 2	13.9
	16.7
TW 3	175.8
	192.9
TW 4	26.7
	26.4
TW 5	474.6
	365.1

The calculations for transmissivity and storativity are presented in Appendix G.

Transmissivity is calculated using the Cooper-Jacob straight line method:

$$T = 2.3 Q / 4\pi \Delta s$$

Where possible, storativity is calculated using data from an observation well with the following equation:

$$S = 2.25 T t_0 / r^2$$

Where:

- T is the transmissivity (m²/day)
- Q is the pumping rate (m³/day)
- Δs is the change in hydraulic head over one log cycle (drawdown vs. log time)
- S is the storativity
- t₀ is the x-intercept of the observation well drawdown vs. log time line of best fit
- r is the distance between the pumped well and the observation well

Transmissivity values ranged from 13.9 – 474.6 m²/day, as calculated based on water level drawdown and recovery data from pumped test wells.

Storativity cannot be assessed properly without the use of observation wells, which were not available for a majority of the pumping tests. Observations wells were used during the pumping test at TW4, but minimal drawdown was observed.

3.3.5 *Hydraulic conductivity*

The hydraulic conductivity of each test well was calculated based on the average transmissivity.

Hydraulic conductivity is calculated using the following equation:

$$K=T/b$$

Where:

- K is the hydraulic conductivity (m/s)
- T is the transmissivity (m²/day, the more conservative value is used)
- b is the thickness of X m, which corresponds to the interval between the bottom of the casing and the bottom of the well, used as aquifer thickness (m)

Table 5: Summary of Hydraulic Conductivity Calculations

Well ID	TW1	TW2	TW3	TW4	TW5
Hydraulic Conductivity (m/s)	4.01x10 ⁻⁵	9.1 x10 ⁻⁶	8.56 x10 ⁻⁵	1.25 x10 ⁻⁵	1.41 x10 ⁻⁴

The hydraulic conductivity values summarized in Table 5 are generally consistent with higher values for limestone published by Freeze and Cherry, 1979 (10⁻⁹ to 10⁻⁵).

The calculations for hydraulic conductivity are presented in Appendix G.

3.3.6 *Long Term Yield*

Long term safe yield describes the amount of water that can safely be withdrawn from an aquifer without negative impact. The long-term safe yield of each well was estimated based on the following factors:

- Observations during six-hour pumping test;
- Driller’s recommendation; and
- Calculated properties.

Farvolden Method

Utilizing transmissivity values calculated from individual pumping tests (Table 4), the theoretical long-term safe yield for each of the pumping wells was calculated following the Farvolden Method and presented in Table 6.

The following Farvolden equation calculates the long term 20-year safe pumping rate (Q_{20}).

$$Q_{20} = 0.68 T H_a S_f$$

Where:

- Q_{20} is the twenty-year safe yield (m^3/day)
- T , is the transmissivity (m^2/day)
- H_a is the available water column height (m)
- S_f is a safety factor

Moell Method

The Moell Method was also used to calculate the theoretical long-term 20-year safe pumping rate for each of the pumping wells. The long-term safe pumping rate (Q_{20}) was calculated using the following equation:

$$(Q_{20}) = (Q H_a S_f) / (s_{100} + 5 \Delta s)$$

Where:

- Q_{20} is the twenty-year safe yield (m^3/day)
- H_a is the available water column height (m)
- S_f is a safety factor
- s_{100} is the drawdown at 100 minutes (semi-log long-term graph)
- Δs is the change in hydraulic head over one log cycle (drawdown vs. log time, see Appendix E)

Based on the above Farvolden and Moell calculations, the estimated pumping rate of each test well that could be sustained for a twenty-year period of continuous pumping is shown in Table 6, below. Long term yield calculations are presented in Appendix G.

Q20 Verification – Cooper-Jacob Graphical Method

It should be noted that long-term projections of drawdown using the Cooper-Jacob method indicate that all test wells can sustain a constant pumping at rates exceeding 18.75 L/min (considered the base rate for a house in this proposed development) if pumped constantly for 20 years (see Appendix E). The calculated maximum

drawdown for all wells when theoretically pumped at a rate of 18.75 L/min was below 0.95 m, with the exception of TW2 which would be expected to have a drawdown of approximately 2.2m.

Table 6: Summary of Long-Term Yield Calculations

Well ID	TW1	TW2	TW3	TW4	TW5
Farvolden Method Long Term Yield (Q₂₀) (L/min)	207.7	90.2	1,220.3	165.5	3,032.4
Moell Method Long Term Yield (Q₂₀) (L/min)	206.1	84.7	1,155.5	249.0	3,518.2
Tested Pumping Rate (L/min)	21.0	81.8	90	90	90
Driller-Recommended Pumping Rate (L/min)	75.7	75.7	75.7	75.7	75.7

The calculation and consideration of long-term yield estimations is inherently conservative; wells are typically not pumped continuously for long periods of time, and a safety factor is incorporated into the calculations. In all cases, both the tested pumping rates and the driller-recommended pumping rates are considerably lower than the estimated long-term Q₂₀ values. Data collected from the Site indicate a highly productive aquifer.

Additionally, the lowest and most conservative transmissivity value from each test well was used to calculate long-term yields using both the Farvolden and Moell method.

Accordingly, McIntosh Perry is of the opinion that the aquifer is capable of supplying water at a flow rate which is greater than the minimum flow rate of 13.7 L/min as outlined in Procedure D-5-5, as well as the base rate of 18.75 L/min, which is considered a more reasonable peak flow rate for a house in this proposed development.

3.3.7 *Water Quality*

Laboratory Certificates of Analysis for all groundwater testing are presented in Appendix F. A summary of results from the sampling of the test wells (TW1, TW2, TW3, TW4, and TW5) is presented in Table 8, appended to this report. Samples were taken twice during the six-hour test at all test well locations; initial samples are denoted by a '-1' (e.g. TW1-1), while post-test samples are denoted by a '-2' (e.g. TW1-2).

Based on the overall test results, the water quality will be acceptable in terms of health-related and most aesthetic parameters.

Laboratory-noted exceedances of non-health related standards were as follows:

- Aesthetic Objectives (AO) for **colour** were exceeded in samples TW1-1 and TW1-2.
- Operational Guidelines (OG) for **hardness** were exceeded in samples TW1-1, TW1-2, TW2-1, TW2-2, TW3-1, TW3-2, TW4-1, and TW4-2;
- Aesthetic Objects (AO) for laboratory-reported **turbidity** were exceeded in TW1-1, TW1-2, TW2-1, TW3-1, TW3-2, and TW4-1. Laboratory results for turbidity are typically considered exaggerated due to the precipitation of iron and other low-solubility solids with changes in temperature and pH. As such, field measurements of turbidity were treated as a more accurate indicator of water quality and were compared to the AO of 1.0 NTU as set out in Procedure D-5-5. It is important to note that all field turbidity measurements were recorded below 1.0 NTU prior to the cessation of pumping (TW1: 0.87 NTU, TW2: 0.73 NTU, TW3: 0.89 NTU and TW4: 0.9 NTU);
- Aesthetic Objects (AO) for **iron** were exceeded in samples TW1-1, TW1-2, and TW3-1; these exceedances appear to be loosely associated with elevated turbidity and/or colour in TW1, TW2, and TW3.
- Aesthetic Objects (AO) for **manganese** were exceeded in samples TW1-1, TW1-2, TW2-1, TW2-2, and TW3-1.
- The health-related warning limit for **sodium** (20 mg/L) was exceeded in samples TW5-1 and TW5-2.

Nitrate was reported as ‘non-detectable’ in TW1, and concentrations were below 3 mg/L in all other test wells. The highest nitrate concentrations were found in TW3-1 (2.5 mg/L) and TW3-2 (2.4 mg/L)).

3.4 Water Well Record Review

The MECP’s WWIS database indicated 62 water wells that are located within 500 m of the Site boundary. All wells are listed for domestic purposes, with the exception of one observation well, and one abandoned. The MECP WWIS records are shown on Figure 2, and data are summarized in Appendix D.

Most wells were completed in either limestone or sandstone, with isolated records listing driller-reported “shale” or “dolomite”. After removing obviously erroneous records, the total depths of the wells ranged from 14.9 – 39.6 m, with an average depth of 25.6 m. Static water levels ranged from 0.3 – 13.7 m bgs and averaged at approximately 7.16 m bgs (MECP 2020).

A review of the MECP Water Well Information System (WWIS) well records within 500 m of the Site showed that the depth to bedrock ranges from 0 – 4.3 m bgs, with an average depth of approximately 0.83 m bgs.

4.0 TERRAIN ANALYSIS

4.1 Preamble

A series of 15 test pits were advanced under supervision of McIntosh Perry staff on December 14th, 2021, at various locations throughout the Site (see Figure 7 for test pit locations). The test pit locations were advanced by use of a mini-excavator (operated by an Owner’s representative) to determine the exact depth of overburden, depth to shallow groundwater and to permit the collection of overburden soil samples for characterization. Various soil samples were taken throughout the test pits by use of hand shovel and by use of mini-excavator, where required.

4.2 General Soils Evaluations

Overburden across the Site was found to be relatively shallow (< 1.7 m below ground surface (bgs)), having an average thickness of 0.95 m bgs. It should be noted that shallow overburden (<= 0.17 m bgs) was encountered in TP10.

Soil types, total depth, and depth to shallow groundwater for each of the 15 test pits are summarized in Table 7, below.

Table 7: Summary of Test Pits

Test Pit ID	Total Depth (m)	Depth to Water (m)	Main Soil Characterization	Notes
TP-1	0.40	0.30	Shallow bedrock	-Wet
TP-2	1.70	1.10	Sandy gravel/ gravelly sand	-Wet -Cobbles up to 15 cm diameter
TP-3	1.45	0.80	Sandy gravel/ gravelly sand	-Wet -Cobbles up to 25 cm diameter
TP-4	0.70	-	Sandy gravel/ gravelly sand	-
TP-5	0.38	-	Sand	-Red/brown
TP-6	0.45	-	Sand	-Brown
TP-7	0.70	0.60	Sand	-Wet -Red
TP-8	0.25	-	Shallow bedrock	-

Test Pit ID	Total Depth (m)	Depth to Water (m)	Main Soil Characterization	Notes
TP-9	0.30	-	Shallow bedrock	-
TP-10	0.17	-	Shallow bedrock	-
TP-11	0.30	-	Shallow bedrock	-
TP-12	0.60	-	Clay trace sand trace gravel	-
TP-13	0.85	0.75	Sand trace gravel	-Brown
TP-14	1.20	-	Clay and gravel	-Very dry
TP-15	0.65	0.5	Sandy gravel/ gravelly sand	-Wet -Cobbles

4.2.1 **Overburden Characterization**

Soil and shallow groundwater conditions for each of the 15 test pits are summarized in Appendix H. Test pit locations are outlined in Figure 7. Soil characterization is summarized in Figure 8.

Boundaries between zones on the logs are often not discrete but transitional and have been interpreted. Subsurface conditions described have various degrees of precision based on the frequency of test pits, uniformity of subsurface conditions and number of samples collected. Where conditions at locations other than the test pit locations are reported, these are inferred and may vary from the conditions at the test pits.

The soil descriptions in this report are based on commonly accepted classification and identification employed in engineering practice. McIntosh Perry employed judgement in the classification and description of soil and may not be exact, but are accurate to the what is common in current engineering practice.

No grain size distribution testing was undertaken for the soils encountered.

4.2.1.1 **Topsoil**

A layer of topsoil was encountered within all 15 test pits. The topsoil generally consists of dark brown sand and silt mix with organic material and had a varying thickness between 0.05m and 0.60m.

In test pit TP10, a thin layer of topsoil (0.17 m) was located directly on top of bedrock. In all other test pits, soil was encountered at varying thicknesses were located under the topsoil layer.

4.2.1.2 **Shallow Bedrock**

Soil was characterized as 'shallow bedrock' where less than 25 cm of native soil material was present under the topsoil. This occurred within test pits TP1, TP8, TP9, TP10 and TP11.

Test pits TP1, TP8, TP9, TP10 and TP11 are located within the East and North-East portions of the site (Figure 8).

4.2.1.3 Gravelly Sand

Native deposits of gravelly sand were encountered within test pits TP2, TP3, TP4, and TP15, under the topsoil layer.

Test pits TP2, TP3, and TP4 are located within the East portion of the Site. Test pit TP15 is located within the South-West portion of the Site (Figure 8).

Gravelly sand was also encountered within test pit TP1 from 0.20 m bgs to 0.40 m bgs.

4.2.1.4 Sand

Native deposits of sand were encountered within test pits TP5, TP6, TP7, and TP13.

The sand layer in both TP5 and TP7 was described as red/ brown sand. In TP6, a shelf of weathered bedrock was breaking off in larger chunks (up to 0.6 m) directly under the topsoil layer. Beside the bedrock shelf was a layer of brown sand of from 0.15 m to 0.45 m bgs. The sand layer in TP13 is described as brown sand and gravel.

Test pits TP5, TP6, TP7, and TP13 are located within the West and South-West portions of the site (Figure 8).

4.2.1.5 Clay

Native deposits of clay were encountered within test pits TP12 and TP14.

Both test pits TP12 and TP14 are located within the North, North-West portion of the Site.

The clay layer located within TP12 is described as grey clay with trace sand and trace gravel. The clay layer within TP14 is underlain by a relatively thick layer of topsoil (0.6 m). The clay layer is described as having a dry and crumbly texture.

4.2.2 *Soil Classification for Private Sanitary Servicing*

Comparison of the soil classification for the Unified Soil Classification as provided in the Ministry of Municipal Affairs and Housing (MMAH) Supplementary Standard SB-6: Time and Soil Descriptions, reveals that the main native soils assessed on-site for **Test Pits TP2 through TP7, TP13, and TP15** falls within either of the following:

- SW: Well graded sands, gravelly sands, little or no fines

- According to Table 2 of SB-6, the GW group of soils has a coefficient of permeability (K) of 10^{-1} to 10^{-4} cm/sec with a percolation time (T) of 2 to 12 min/cm.
 - Due to the medium permeability of this soil type, it is deemed acceptable as the native receiving soil for a proposed Class 4 sewage systems.
- SP: Poorly graded sand, gravelly sand, little or no fines
 - According to Table 2 of SB-6, the SM group of soils has a coefficient of permeability (K) of 10^{-1} to 10^{-3} cm/sec with a percolation time (T) of 2 to 8 min/cm.
 - Due to the medium permeability of this soil type, it is deemed acceptable as the native receiving soil for a proposed Class 4 sewage systems.

Comparison of the soil classification for the Unified Soil Classification as provided in the Ministry of Municipal Affairs and Housing (MMAH) Supplementary Standard SB-6: Time and Soil Descriptions, reveals that the main native soils assessed on-site of the **Test Pits TP12 and TP14** falls within either of the following:

- SC: Clayey sands, sand-clay mixtures
 - According to Table 2 of SB-6, the SM group of soils has a coefficient of permeability (K) of 10^{-4} to 10^{-6} cm/sec with a percolation time (T) of 12 to 50 min/cm.
 - Due to the medium to low permeability of this soil, it may be deemed acceptable as the native receiving soil for proposed Class 4 sewage systems, dependant on the amount of clay.
- CL, CH, or OH: Inorganic or Organic Clays
 - According to Table 2 of SB-6, the CL, CH, and OH group of soils has a coefficient of permeability (K) of less than 10^{-6} with a percolation time (T) of over 50 min/cm.
 - Due to the low permeability of clay-based soils, these are deemed unacceptable as the native receiving soil for proposed Class 4 sewage systems. Sewage systems installed in areas where these soils are present would be required to be constructed using imported leaching bed fill.

Please note that for the purposes of this report, a minimum thickness of 0.25 m of soil located under the topsoil and above the bedrock was used when establishing the main soil type for each test pit. Refer to Figure 8 for a distribution of soil types throughout the Site.

4.3 Contaminant Attenuation

As part of the subdivision application process as sewage system (septic) impact assessment was completed as per MECP requirements. The MECP Procedure D-5-4 (Technical Guideline for Individual On-site Sewage Systems: Water Quality Impact Risk Assessment) outlines the following steps to be completed as part of the impact assessment:

- Step 1 – Lot Size Consideration

- Step 2 – System Isolation Consideration
- Step 3 – Contaminant Attenuation Considerations

The following outlines the results of the sewage system impact assessment undertaken by McIntosh Perry.

Step 1 - Lot Size Consideration

The proposed new subdivision consists of lots that are on average approximately 0.66 hectares each in size. Accordingly, McIntosh Perry considers that there does not exist enough spatial area to naturally attenuate nitrate-nitrogen to acceptable concentration based on MECP Procedure D-5-4, as the average size of the lots created would not be greater than 1 hectare. Due to this, a review of Step 2 – System Isolation Consideration was undertaken.

Step 2 - System Isolation Consideration

As previously outlined, the lots to be created are on average 0.66 hectares in size, therefore McIntosh Perry assessed whether System Isolation Considerations were applicable to the proposed residential subdivision. If it can be demonstrated that the sewage system effluent is hydrogeologically isolated from the existing or potential drinking water supply aquifer, then the risk to groundwater is considered to be low. The system isolation review needs to account for lands that extend up to 500 metres from the Site.

Based on a review of available geological information and mapping, in conjunction with site observations made during the Terrain Analysis, the Site cannot be determined to be hydrogeologically isolated and, as such, the consideration for system isolation of sewage system effluent from the groundwater supply aquifer is not applicable to this site.

Step 3 – Contaminant Attenuation Considerations

Since neither lot size nor system isolation considerations apply to the proposed severances, a predictive nitrate-nitrogen attenuation assessment was undertaken to determine if sufficient attenuation of nitrate-nitrogen could be achieved on the subject site.

The Thornthwaite Water Balance method, in conjunction with local climatic data available from Environment Canada for Ottawa's MacDonald-Cartier Internal Airport station (Site Climate ID: 6106000), was used to estimate the net potential infiltration for the proposed residential subdivision.

The nitrate concentration at the site boundaries was calculated assuming a standard domestic strength sewage nitrate-nitrogen concentration (C_e) of 40 mg/L at the point of subsurface discharge as per procedure D-5-4.

Please see below for information regarding other inputs/parameters used in the analysis (refer to Appendix G for more information):

- A water surplus (W_s) value of **333.87 mm/yr** was calculated based on 1981-2010 Climate Normal data for Ottawa's MacDonald -Cartier Int'l A (YOW) station (Site Climate ID: 6106000);
- An infiltration factor (I_f) of **0.610** was calculated as per Table 2 of MECP's document titled "MOEE Hydrogeological Technical Requirements for Land Development Applications", dated April 1995. The factors used to calculate the Infiltration Factor (I_f) and the associated rationale for selection are presented below:
 - A topographic factor of 0.1875 was used for rolling land (0.7% slope).
 - A soil factor of 0.260 was used. This factor represents a weighted average of the soil conditions on-site, with approximately 47% of the site consisting of topsoil over shallow bedrock or clay (infiltration factor of 0.10), with the remaining 53% of the site consisting of sandy soil with gravel or trace clay (infiltration factor 0.40) having a minimum depth of 0.25 m.
 - A cover factor of 0.15 was used as the site is expected to consist of a mix of woodland and cultivated land after development.
- Available infiltration (I) was calculated by multiplying the water surplus (W_s) by the infiltration factor (I_f). This yielded an infiltration value of **0.199491 m/yr**.
- The infiltration area (A) was determined to be 24.14 ha (241,443 m²). This consists of the total site area (26.85 ha) minus the proposed road right-of-way (2.119 ha) and 200 m² for each of the proposed houses.
- The dilution water (D_w) available was calculated as 48,165 m³/yr (131,960 L/day) by multiplying the infiltration area (A) with the available infiltration (I).
- Background nitrate concentration (C_b) of 2.5 mg/L was used, which represents the maximum concentration found within all test well samples collected (refer to Appendix F).

Based on the above-noted information, in order to maintain the nitrate concentration at the downgradient property boundary (C_w) below the Ontario Drinking Water Objective (ODWO) of 10 mg/L for nitrate-nitrogen, the maximum number of lots in the proposed residential subdivision would be as follows:

- Assuming standard domestic strength sewage nitrate-nitrogen concentration (C_e) of 40 mg/L at the point of subsurface discharge: **$N = 30.452$ severed lots.**

As can be seen above, the property can accommodate a subdivision of up to 30 lots to proceed while ensuring the Ontario Drinking Water Objective (ODWO) of 10 mg/L for nitrate-nitrogen is not exceeded. The proposed 30 lot residential subdivision yields a calculated nitrate-nitrogen concentration of **9.909 mg/L** at the property boundary.

It should be noted that the above-noted analysis does not account for the possible use of Low Impact Development (LID) into the developed Site's stormwater management strategy. The use of LID, such as infiltration trenches, are typically used to reduce stormwater runoff by increasing groundwater recharge, which in turn would be expected to be associated with a reduction of the predicted nitrate-nitrogen concentration compared to results presented from the calculations above.

5.0 SUMMARY OF CONDITIONS

5.1 Preamble

The Site is located in the western portion of the hamlet of Franktown within the Township of Beckwith in central Eastern Ontario, south of the Town of Carleton Place (Figure 1). The site is bounded by Fourth Line Road to the north, Perth Road to the south, and is located approximately 275 m west of Highway 15.

The Site currently exists predominantly as undeveloped forested/shrub land with the exception of a single residential dwelling located on the northern portion of the Site. There are residentially developed lands immediately north and south of the Site along Fourth Line Road and Perth Road, as well as to the east along Highway 15; otherwise, the surrounding land use is predominately forested land.

According to Ontario Geological Survey (OGS) regional mapping, surficial overburden at the Site is thin, and is characterized by Paleozoic bedrock (OGS, 2022). This classification is consistent with on-site observations made by McIntosh Perry. Based on OGS 2022 data, the underlying bedrock is classified as dolostone and sandstone of the Beekmantown Group, which is consistent with MECP WWIS Records (MECP 2020).

The 1981-2010 mean annual precipitation is approximately 943.4 mm with 223.5 cm as snow, and the mean daily temperature is 6.4 °C (Environment Canada Climate Normals for Ottawa MacDonald-Cartier International Airport).

The Site currently consists of forested land and several wetlands and has likely never been contemporarily developed. On-site elevation ranges between 141 and 149 metres above sea level (m asl). The topography of the Site is generally flat.

5.2 Regional Hydrogeology

The Site is relatively flat. Wetland areas appear to be present around the center of the Site. A small local waterbody is also present on Site, as seen in Figure 2. The Franktown Swamp, which forms part of the Upper Jock River (part of the Mississippi River system), is the closest permanent waterbody to the Site and is located approximately 550 m east of the Site at its closest point. On a local scale, shallow groundwater flow cannot be determined fully due to limited data, however there is likely a northwestern flow component and potentially more localized flow patterns toward on-site water features (pond, wetland).

5.3 Site Hydrogeology

A review of topographic data, geological maps, and field notes show that the property is generally flat with some local sloping down towards the northwest. Shallow groundwater and surface water likely drain in this direction. On a local scale, shallow groundwater flow cannot be determined fully due to limited data, however there is likely a northwestern flow component and potentially more localized flow patterns toward on-site water features (pond, wetland). In most areas of the Site, the terrain appears to be well-drained.

Based on OGS 2020 data, the underlying bedrock is classified as dolostone and sandstone of the Beekmantown Group, which is consistent with MECP WWIS Records (MECP 2020).

A review of the MECP Water Well Information System (WWIS) well records within 500 m of the Site showed that the depth to bedrock ranges from 0 – 4.3 m bgs, with an average depth of approximately 0.83 m bgs. Where noted in the well records, bedrock is typically referred to as either “sandstone” or “limestone” by the driller (Appendix C).

The bedrock aquifer was found to have high yield and exhibited good recovery during pumping tests. There was very little groundwater level movement observed in observation wells during the pumping tests, showing minimal well interference across the Site.

5.4 Water Supply

Groundwater testing at the site showed that the water yield and water quality is good. Based on calculations following the Farvolden and Moell methods, on-site test wells could theoretically supply a twenty-year safe yield ranging from 84.7 – 3,518.2 L/min, as shown in Table 6.

No Maximum Allowable Concentrations, as outlined by the Ontario Drinking Water Standards (MACs), were exceeded in final samples taken from the five test wells. Field-measured turbidity was noted to be below 1.0 NTU at all wells during the pumping tests, with the exception of marginal and isolated exceedances in the laboratory-reported data.

Several additional ODWS Aesthetic Objectives (AO) were exceeded. These exceedances were noted for colour, lab-reported turbidity, iron, manganese, and the health-warning limit for sodium. Additionally, Operational Guideline (OG) exceedances were noted at TW1-TW4. Exceedances of these Aesthetic Objectives and Operational Guideline is considered normal for the region and are considered treatable.

Escherichia Coli, Faecal Coliform, and Total Coliform counts were reported as 0 ct/100 mL in the final samples collected from all test wells.

It has been shown that the bedrock aquifer is suitable for supplying the needs of 30 lots in the proposed development in terms of both quantity and quality when incorporating standard on-site sewage systems to service the individual lots.

Based on typical residential demand, it is not expected that the subdivision will cause any water supply issues for the surrounding private wells that exist in the vicinity.

6.0 RECOMMENDATIONS

6.1 Water Supply

Well Construction

- The four newly installed test wells (TW2, TW3, TW4, and TW5) are suitable for supplying groundwater for domestic use at the Site. All future wells should adhere to the requirements of O. Reg. 903 (Wells), as amended, with regards to casing length, positive drainage, stickup height, etc.
- The test wells should be maintained prior to domestic use.

Water Quality and Treatment

- Water generally meets all applicable health-related standards at the present time.
- Aesthetic parameters such as color, iron, and manganese can be readily treated.
 - Colour can be treated using an activated carbon filter.
 - Iron can be treated through water softeners or manganese greensand filters, oxidation with filtration through proprietary filter media, or chlorination followed by sand or multimedia filtration, depending on the iron concentrations.
- If water softening is desired, the use of potassium salts (i.e. KCl) is recommended. With the use of conventional water softeners, it is important to note that sodium concentrations will be elevated.
 - It is important to note that water with a hardness above 300 mg/L is considered very hard. The ODWS states that groundwater with hardness that exceeds 500 mg/L is unacceptable for domestic purposes.
- Due to the low field turbidity observed in the fully developed test wells, a UV system may be used as a precaution against bacteriological impacts.
- Prior to occupation, it is recommended that the Client notify the local Medical Officer of Health of the sodium exceeding the health-related warning limit at TW5.

6.2 Wastewater Treatment

Private Sewage Systems

- Approval for individual on-site sewage systems will be governed by the OBC as it is understood that the Daily Design Flow proposed system will be less than 10,000 litres per day/lot.
- Based on the general characterization of overburden in the vicinity of the proposed sewage systems, it is expected that imported leaching bed fill will be necessary on the a large portion of the lots to provide the required vertical separation from shallow groundwater or bedrock/impervious layer.

- The proposed lot sizes are sufficient to meet the requirements of Procedure D-5-4, assuming that each lot is serviced by an OBC-approved Class 4 sewage system.
- Any septic systems must be constructed with all appropriate setbacks, treatment units and stipulations as per applicable Ontario Regulations.

7.0 LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by McIntosh Perry Consulting Engineers Ltd. for Grizzly Homes. It is intended for the sole, and exclusive use of Grizzly Homes, their affiliated companies and partners and their respective insurers, agents, employees, advisors, and reviewers. The report may not be relied upon by any other person or entity without the express written consent (Reliance Letter) of McIntosh Perry Consulting Engineers Ltd.

Any use which a third party makes of this report, or any reliance on decisions made based on it, without a reliance letter are the responsibility of such third parties. McIntosh Perry Consulting Engineers Ltd. accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The investigation undertaken by McIntosh Perry Consulting Engineers Ltd. with respect to this report and any conclusions or recommendations made in this report reflect McIntosh Perry Consulting Engineers Ltd. judgment based on the site conditions observed at the time of the site inspection on the date(s) set out in this report and on information available at the time of the preparation of this report.

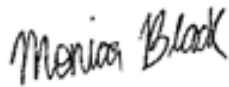
This report has been prepared for specific application to this site and it is based, in part, upon visual observation of the site, subsurface investigation at discrete locations and depths, and specific analysis of specific chemical parameters and materials during a specific time interval, all as described in this report. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site which were unavailable for direct investigation, subsurface locations which were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the site, substances addressed by the investigation may exist in areas of the site not investigated and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken.

If site conditions or applicable standards change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

We trust that this information is satisfactory for your present requirements. Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

Respectfully submitted,

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HYDROGEOLOGICAL ASSESSMENT AND TERRAIN ANALYSIS GRIZZLY HOMES SUBDIVISION, BECKWITH, ONTARIO



TABLES

Table 8
Summary of Laboratory Results
Grizzly Homes, Beckwith, Ontario

Sample ID	Units	MDL	ODWSOG	Limit Type	TW1-1	TW1-2	TW2-1	TW2-2	TW3-1	TW3-2	TW4-1	TW4-2	TW5-1	TW5-2
Sample Date					18-Jan-22		13-Jul-21		14-Jul-21		09-Sep-21		15-Jul-21	
<i>Microbiological Parameters</i>														
<i>E. Coli</i>	MPN/100 mL	1	0	MAC	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Fecal Coliforms	CFU/100 mL	1	0	-	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Total Coliforms	MPN/100 mL	1	0	MAC	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Heterotrophic Plate Count	CFU/mL	10	-	-	170	70	ND (10)	ND (10)	ND (10)	ND (10)	-	-	-	-
<i>General Inorganics</i>														
Alkalinity, total	mg/L	5	500	OG	254	252	272	269	279	280	269	272	264	264
Ammonia as N	mg/L	0.01	-	AO	0.04	0.05	0.05	0.06	0.05	0.05	0.01	0.01	0.04	0.04
Dissolved Organic Carbon	mg/L	0.5	5	AO	2.3	2.3	2	1.8	0.9	1	1.3	0.9	2.5	1.7
Colour	TCU	2	5	AO	17	16	2	3	ND (2)	ND (2)	ND (2)	ND (2)	3	3
Conductivity	uS/cm	5	-	-	546	528	620	614	668	678	621	643	662	667
Hardness	mg/L		80-100	OG	255	256	293	293	282	283	286	292	-	-
pH	pH Units	0.1	6.5-8.5	-	7.5	7.5	7.7	7.7	7.7	7.7	7.7	7.7	7.6	7.7
Phenolics	mg/L	0.001	-	-	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)
Total Dissolved Solids	mg/L	10	500	AO	288	300	332	314	334	356	298	340	346	338
Sulphide	mg/L	0.02	0.05	AO	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)
Tannin & Lignin	mg/L	0.1	-	-	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
Total Kjeldahl Nitrogen	mg/L	0.1	-	-	0.1	ND (0.1)	ND (0.1)	ND (0.1)	0.1	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
Turbidity	NTU	0.1	5	AO	7.4	5.7	12.5	1.2	30.2	6.3	17	0.8	1.6	0.3
<i>Anions</i>														
Chloride	mg/L	1	250	-	13	12	21	20	27	28	30	26	39	39
Fluoride	mg/L	0.1	1.5	MAC	0.3	0.3	0.2	0.2	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
Nitrate as N	mg/L	0.1	10	MAC	ND (0.1)	ND (0.1)	0.6	0.5	2.5	2.4	1.3	1.6	0.9	0.8
Nitrite as N	mg/L	0.05	1	MAC	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)
Sulphate	mg/L	1	500	-	15	14	16	17	15	15	16	15	16	16
<i>Metals</i>														
Calcium	mg/L	0.1	-	-	71	70.8	80	80.3	75.7	75.5	79.5	81.3	64.5	63.9
Iron	mg/L	0.1	0.3	AO	0.9	0.9	0.3	ND (0.1)	0.4	0.1	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
Magnesium	mg/L	0.2	-	-	18.9	19.3	22.6	22.4	22.7	22.9	21.2	21.7	19.7	19.9
Manganese	mg/L	0.005	0.02	AO	0.078	0.078	0.053	0.059	0.026	0.01	0.008	ND (0.005)	ND (0.005)	ND (0.005)
Potassium	mg/L	0.1	-	-	2.5	2.5	3	2.7	4.2	3.6	3.5	3.4	1.37	1.4
Sodium	mg/L	0.2	20	MAC	5.6	5.5	9.3	8.5	13.4	13.3	22.2	19.4	23.6	24

- Notes:
- MDL Method Detection Limit
 - ODWSOG Ontario Drinking Water Standards, Objectives, and Guidelines (MECP, 2003 rev. 2006)
 - AO Aesthetic Objective
 - MAC Maximum Allowable Concentration (Health-Related Parameter)
 - OG Operational Guideline
 - ND Non detectable (below MDL)
 - mg/L Milligrams per litre
 - TCU True Colour Units
 - uS/cm Microseimens per centimeter
 - NTU Nephelometric Turbidity Units
 - CFU/100 mL Number of bacteria-forming colonies per 100 mL
 - Exceedance of ODWS Parameters

**Table 9
Summary of Field Parameters
Grizzly Homes, Beckwith, Ontario**

Test Well 1

Pumping Test at:		TW1	Date:		18-Jan-22	
Time Elapsed (min)	Turbidity (NTU)	pH	Conductivity (ms/cm)	Temperature (°C)	TDS (g/L)	
15	9.6	6.51	N/A	9.97	0.345	
26	2.4	6.67	0.543	8.17	0.347	
36	2.2	6.65	0.545	7.9	0.348	
50	1.7	6.68	0.548	7.14	0.352	
60	1.8	7.14	0.549	7.08	0.351	
120	1.7	7.35	0.546	8.03	0.351	
180	1.1	7.45	0.535	8.78	0.342	
240	1.2	7.26	0.535	8.78	0.343	
300	1.4	7.18	0.538	8.6	0.344	
360	0.82	7.27	0.54	8.37	0.346	
Notes:		Flow rate measured with bucket and stopwatch				

Test Well 2

Pumping Test at:		TW2	Date:		Jan 13 2021	
Time Elapsed (min)	Turbidity (NTU)	pH	Conductivity (us/cm)	Temperature (°C)	TDS (ppm)	
23	12.3	6.14	487	10.1	245	
60	11.6	6.53	493	9.8	247	
120	4.48	6.14	503	10	252	
180	2.87	6.13	503	10.2	250	
240	2.21	6.52	497	10.3	249	
300	1.5	6.42	494	10.3	248	
360	0.73	6.71	502	9.9	251	
Notes:		Flow rate measured with bucket and stopwatch				

Test Well 3

Pumping Test at:		TW3	Date:		14-Jul-21	
Time Elapsed (min)	Turbidity (NTU)	pH	Conductivity (us/cm)	Temperature (°C)	TDS (ppm)	
20	28.7	6.26	552	9.4	274	
60	21	6.58	553	9.2	276	
120	11.4	6.35	547	9.7	275	
180	11.8	6.81	547	10.0	274	
240	9.66	6.28	546	10.2	272	
300	8.22	6.67	549	9.6	275	
360	0.89	6.68	546	9.8	270	
Notes:		Flow rate measured with bucket and stopwatch				

Test Well 4

Pumping Test at:		TW2	Date:		09-Sep-21	
Time Elapsed (min)	Turbidity (NTU)	pH	Conductivity (us/cm)	Temperature (°C)	TDS (ppm)	
5	73.5	6.72	552	8.9	276	
34	35	6.7	549	8.7	276	
60	22.1	6.74	558	8.9	278	
120	5.86	6.63	547	9	273	
180	2.62	-	548	9	274	
240	1.38	6.43	545	9.1	273	
300	1.5	6.6	539	9.2	270	
360	0.9	6.6	543	9	272	
Notes:		Flow rate measured with bucket and stopwatch				

Test Well 5

Pumping Test at:		TW5	Date:		15-Jul-21	
Time Elapsed (min)	Turbidity (NTU)	pH	Conductivity (us/cm)	Temperature (°C)	TDS (ppm)	
15	1.74	6.65	544	9.7	273	
106	1.02	6.77	545	9.9	273	
120	0.3	6.84	556	9.1	278	
180	0.28	6.86	548	9.6	271	
240	0.2	6.8	550	9.6	275	
300	0.08	6.31	533	10	267	
360	0.09	6.31	533	9.8	267	
Notes:		Flow rate measured with bucket and stopwatch				

NOTES:
min Minutes
NTU Nephelometric Turbidity Units
(us/cm) Microsiemens per centimeter
(°C) Degrees celsius
g/L Grams per litre
ppm Parts per million
N/A Not Analyzed

HYDROGEOLOGICAL ASSESSMENT AND TERRAIN ANALYSIS GRIZZLY HOMES SUBDIVISION, BECKWITH, ONTARIO



FIGURES

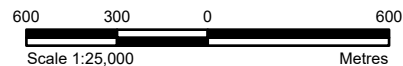


LEGEND

-  Site Location
-  Watercourse
-  Local Road
-  Waterbody
-  Major Road
-  Wooded Area

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2021.



CLIENT:		GRIZZLY HOLDINGS INC.	
PROJECT:		HYDROGEOLOGICAL ASSESSMENT GRIZZLY HOMES SUBDIVISION	
TITLE:		SITE LOCATION	
McINTOSH PERRY	PROJECT NO: CCO-22-0256	FIGURE:	
	Date	Aug., 03, 2021	
	GIS	EU	
Checked By	MB		1

115 Walgreen Road, RR3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com



LEGEND

- Approximate Site Boundary
- Test Well Location
- Lot & Concession
- Waterbody
- Watercourse
- Unevaluated Wetland

C:\Users\M.Grunstra\Documents\Projects\2022\COO\CCO-22-0256 Grizzly Homes - 4th Line Rd - Franktown\aprx\Environmental\HydroGIS\COO-22-0256_HydroG.aprx

REFERENCE
 GIS data provided by the Ontario Ministry of Natural Resources, 2022.



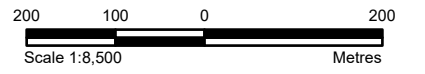
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PROJECT:		HYDROGEOLOGICAL ASSESSMENT GRIZZLY HOMES SUBDIVISION	
TITLE:		SITE LAYOUT	
McINTOSH PERRY <small>115 Walgreen Road, RR3, Carp, ON K0A1L0 Tel: 613-836-2184 Fax: 613-836-3742 www.mcintoshperry.com</small>	PROJECT NO: CCO-22-0256	FIGURE:	2
	Date	Aug., 11, 2022	
	GIS	MG	
	Checked By	MB	

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- LEGEND**
- Approximate Site Boundary
 - MECP Well Location
 - 500m Buffer
 - Local Road
 - Major Road
 - ~ Watercourse
 - Waterbody
 - Unevaluated Wetland
 - Provincially Significant Wetland

REFERENCE
 GIS data provided by the Ontario Ministry of Natural Resources and Ontario Ministry of the Environment, Conservation and Parks 2021.



CLIENT:	GRIZZLY HOLDINGS INC.	
PROJECT:	HYDROGEOLOGICAL ASSESSMENT GRIZZLY HOMES SUBDIVISION	
TITLE:	MECP WWIS SUMMARY	
McINTOSH PERRY <small>115 Walgreen Road, RR3, Carp, ON K0A1L0 Tel: 613-836-2184 Fax: 613-836-3742 www.mcintoshperry.com</small>	PROJECT NO: CCO-22-0256	FIGURE:
	Date	Aug., 03, 2021
	Checked By	MB
	GIS	3

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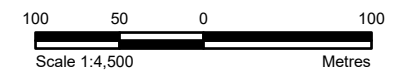


LEGEND

- Approximate Site Boundary
- Waterbody
- Unevaluated Wetland
- Test Well Location
- ← Groundwater direction
- 136.1 Static water elevation

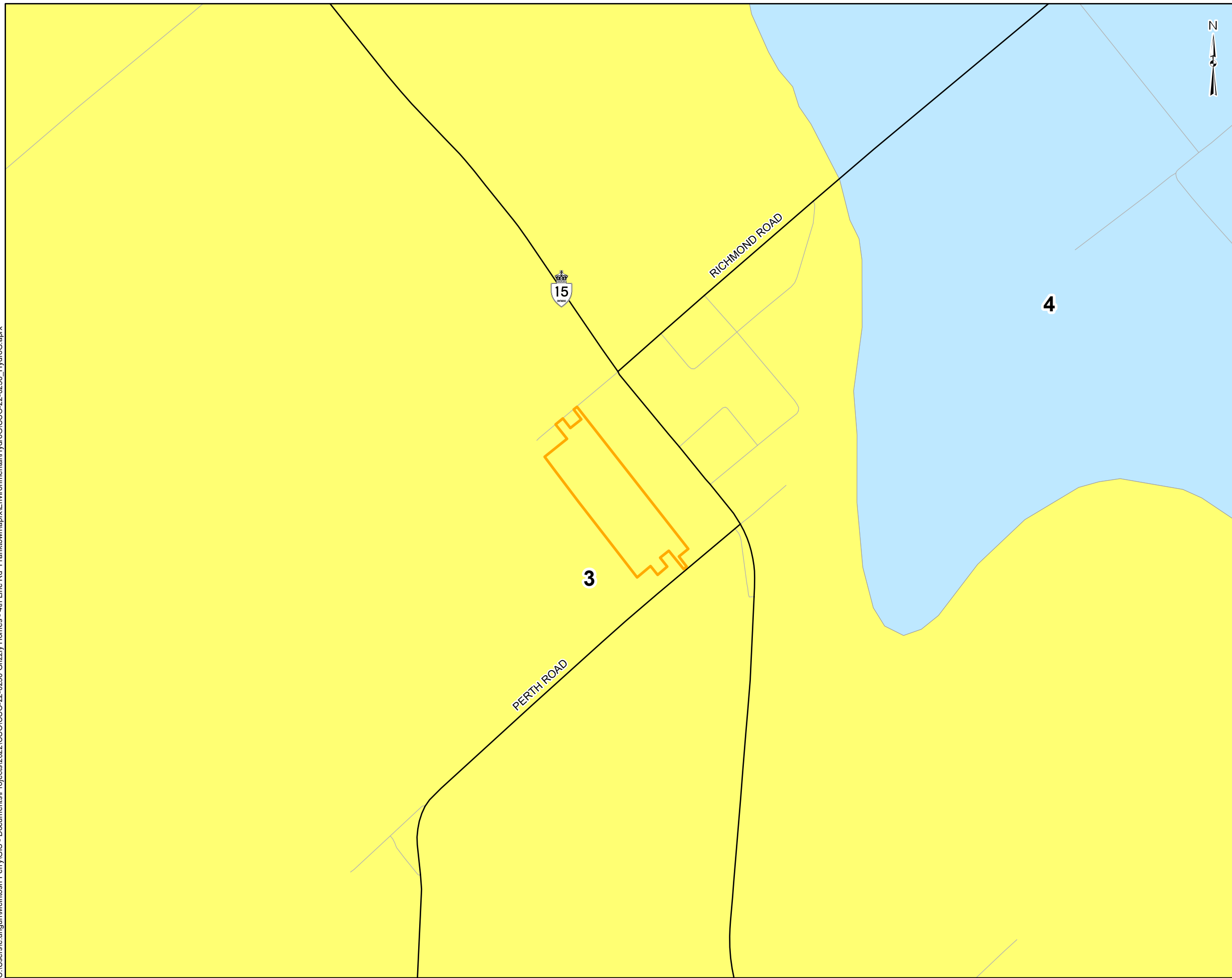
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GIS data provided by the Ontario Ministry of Natural Resources, 2022.



CLIENT:	GRIZZLY HOLDINGS INC.	
PROJECT:	HYDROGEOLOGICAL ASSESSMENT GRIZZLY HOMES SUBDIVISION	
TITLE:	GROUNDWATER CONTOUR AND FLOW DIRECTION	
McINTOSH PERRY <small>115 Walgreen Road, RR3, Carp, ON K0A1L0 Tel: 613-836-2184 Fax: 613-836-3742 www.mcintoshperry.com</small>	PROJECT NO: CCO-22-0256	FIGURE:
	Date	Jun., 20, 2022
	GIS	MG
	Checked By	MB
		4

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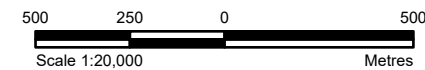


LEGEND

- Approximate Site Boundary
- Local Road
- Major Road
- Bedrock Geology**
- Lower Ordovician**
- 4** Oxford Formation: Sublithographic to fine crystalline dolostone
- 3** March Formation: Interbedded quartz sandstone, sandy dolostone, and dolostone

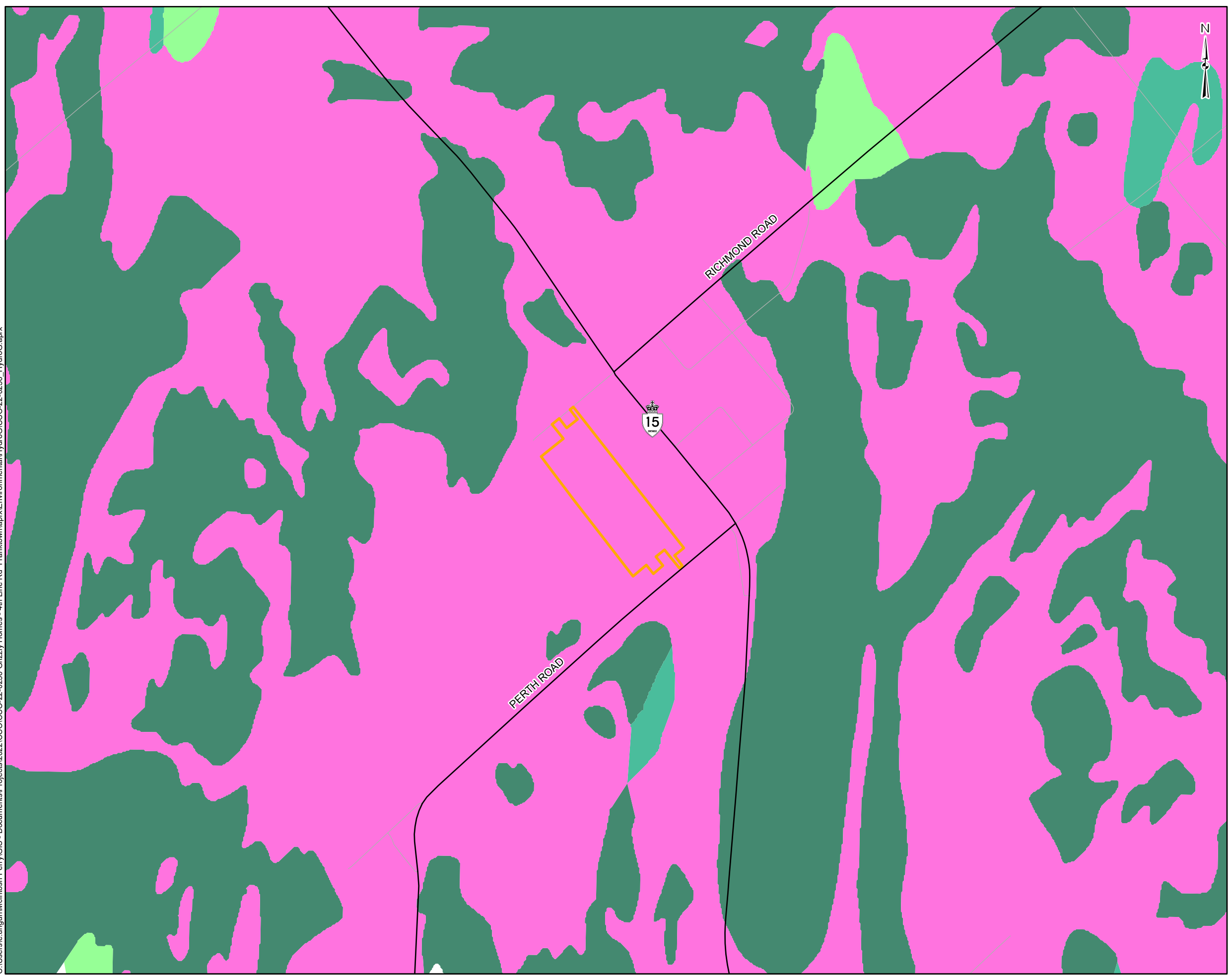
REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2021.
 Urban Geology of the National Capital Area, Bélanger, R;
 Geological Survey of Canada, Open File 5311, 2008



CLIENT:	GRIZZLY HOLDINGS INC.		
PROJECT:	HYDROGEOLOGICAL ASSESSMENT GRIZZLY HOMES SUBDIVISION		
TITLE:	BEDROCK FORMATION		
McINTOSH PERRY <small>115 Walgreen Road, RR3, Carp, ON K0A1L0 Tel: 613-836-2184 Fax: 613-836-3742 www.mcintoshperry.com</small>	PROJECT NO: CCO-22-0256	FIGURE:	
	Date	Aug., 03, 2021	
	GIS	EU	
	Checked By	MB	
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LEGEND

- Approximate Site Boundary
- Local Road
- Major Road

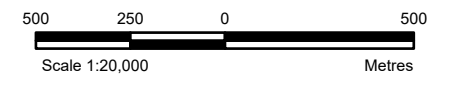
Surficial geology

Description

- Organic Deposits
- Beach Formations
- Till, plain
- Paleozoic Bedrock

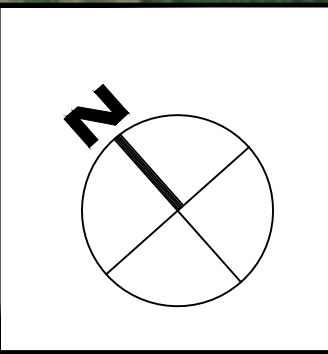
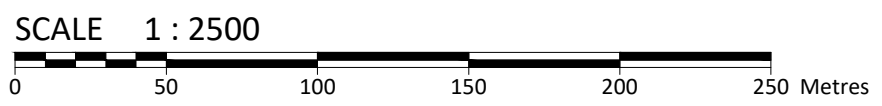
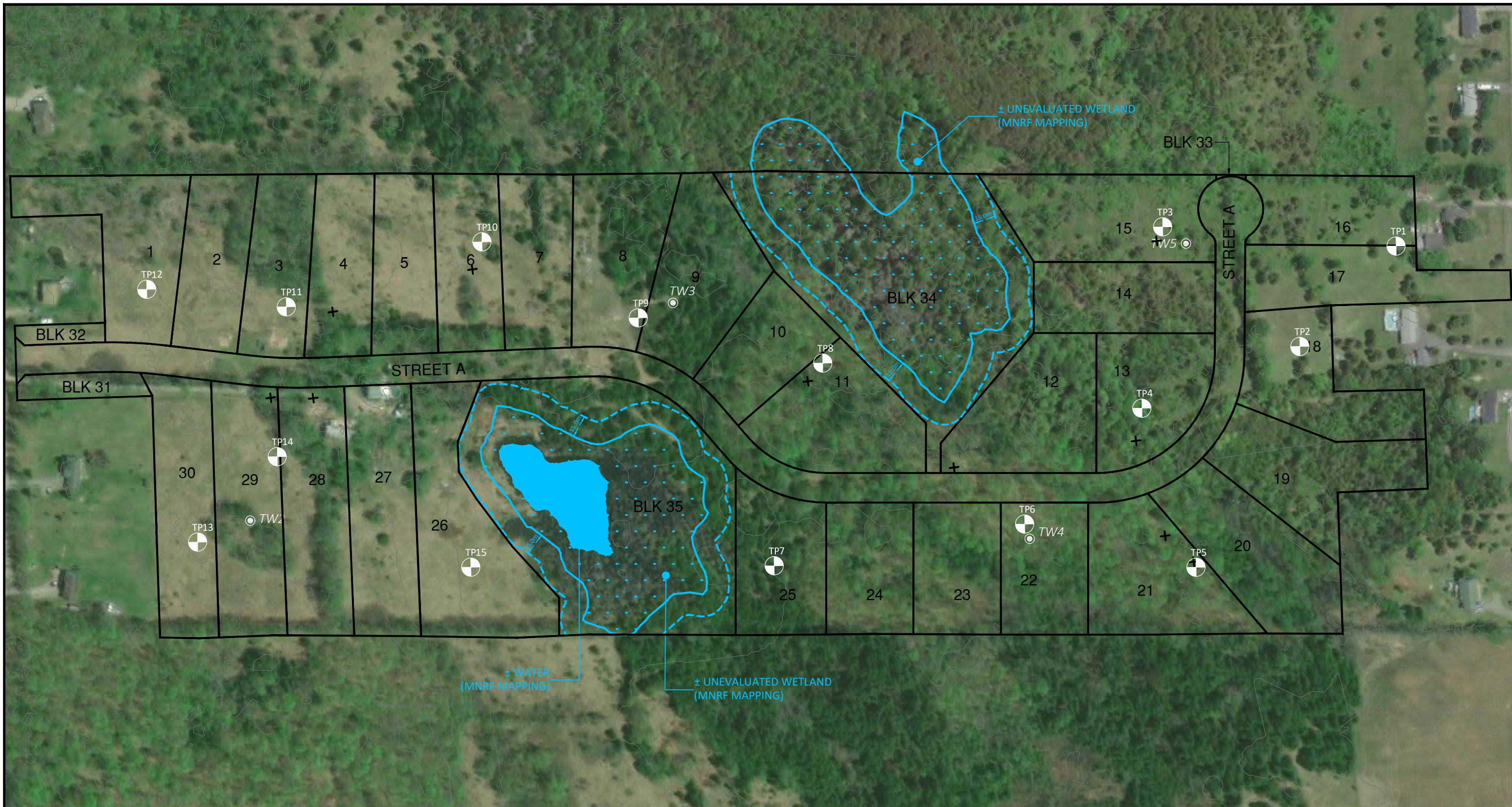
REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2021.
 Surficial Geology of Southern Ontario provided by the Ontario Geological Survey, Miscellaneous Release - Data 128 - Revised



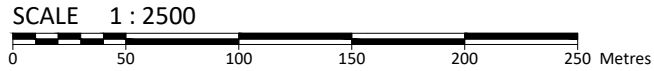
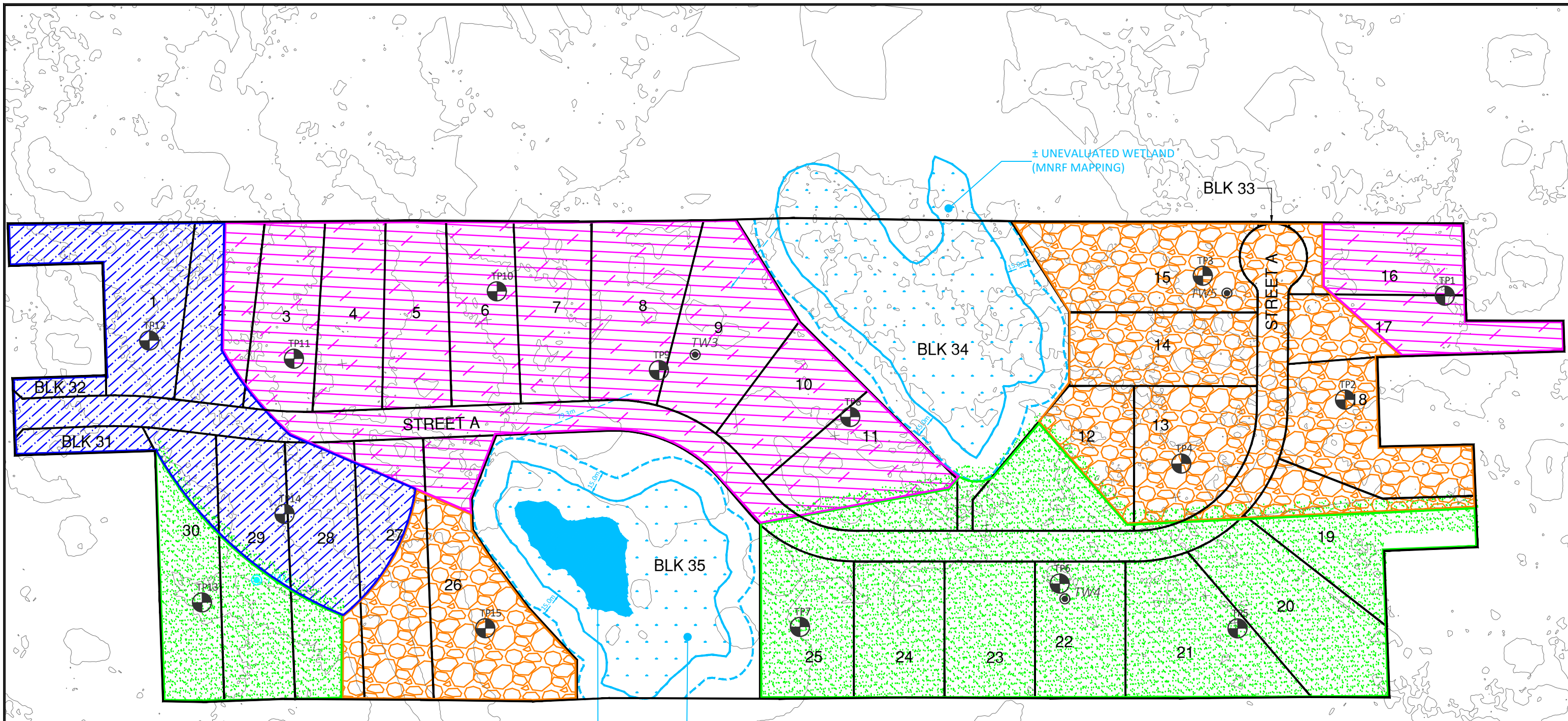
CLIENT:		GRIZZLY HOLDINGS INC.	
PROJECT:		HYDROGEOLOGICAL ASSESSMENT GRIZZLY HOMES SUBDIVISION	
TITLE:		SURFICIAL GEOLOGY	
PROJECT NO: CCO-22-0256 115 Walgreen Road, RR3, Carp, ON K0A1L0 Tel: 613-836-2184 Fax: 613-836-3742 www.mcintoshperry.com	Date	Aug., 03, 2021	
	Checked By	MB	
	FIGURE:	6	

FILENAME: U:\Perth\MPE\Projects\2022\CCO\CCO-22-0256 - Grizzly Homes - Franktown Subdivision Review\Hydro GI\Terrain Analysis\CCO-22-0256 Grizzly Franktown- Test Pit Layout.dwg
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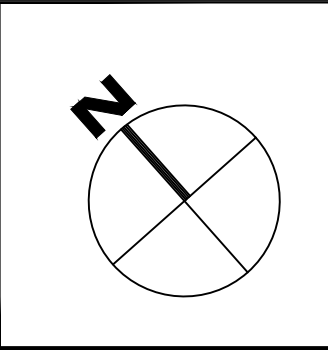


McINTOSH PERRY 115 Walgreen Road, RR3, Carp, ON K0A 1L0 Tel: 613-836-2184 Fax: 613-836-3742 www.mcintoshperry.com		Client: GRIZZLY HOMES P.O. BOX 422, RR#7 ASHTON, ONTARIO, K0A 1B0	
		Project: FRANKTOWN SUBDIVISION	
Drawing Title: TEST PIT LAYOUT		Drawing Number: 7	
Drawn by: E.W.S.	Checked By: P.L.		
Scale: 1:2500	Project Number: CCO-22-0256	0 FOR SUBMISSION	AUG/22/2022
No.	Revisions	Date	

FILENAME: U:\Perth\MPEE\Projects\2022\CCO\CCO-22-0256 - Grizzly Homes - Franktown Subdivision Review\Hydro GI\Terrain Analysis\CCO-22-0256 Grizzly Franktown Soil Characterization_Aug.22.2022.dwg
 LAST PLOTTED: Tuesday, August 23, 2022 10:51:58 AM
 LAST USER: jmcintosh



LEGEND	
	Clay
	Sand
	Gravelly sand
	Shallow bedrock



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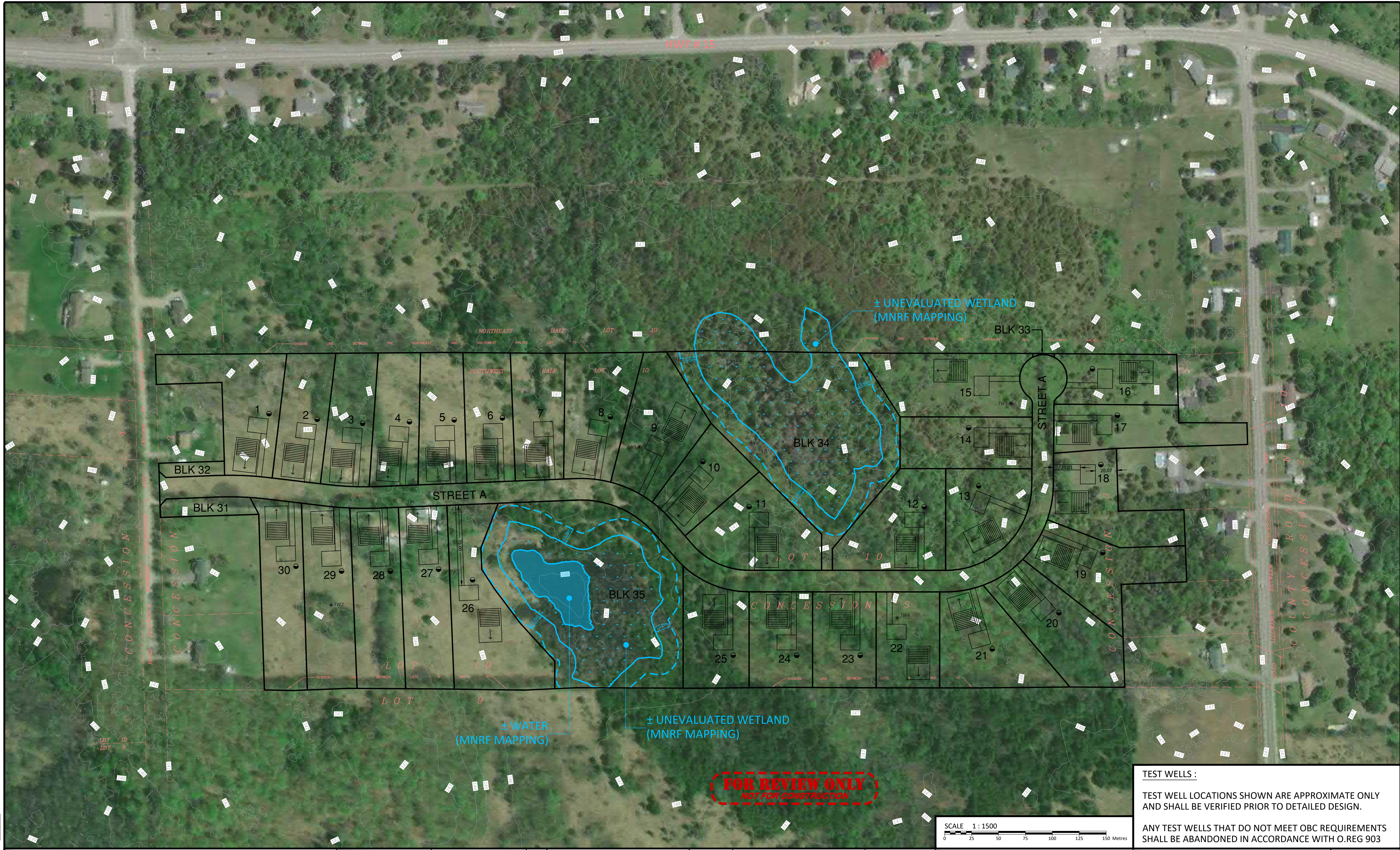
Drawn by: E.Ws.	Checked By: P.L.
Scale: 1:2500	Project Number: CCO-22-0256

Client: GRIZZLY HOMES P.O. BOX 422, RR#7 ASHTON, ONTARIO, K0A 1B0	
Project: FRANKTOWN SUBDIVISION	
Drawing Title: SOIL CHARACTERIZATION	
0 FOR SUBMISSION	AUG/22/2022
No. Revisions	Date
Drawing Number: 8	

HYDROGEOLOGICAL ASSESSMENT AND TERRAIN ANALYSIS GRIZZLY HOMES SUBDIVISION, BECKWITH, ONTARIO



APPENDIX A: PRELIMINARY CONCEPT PLAN



DESIGN: Franktown Subdivision Review #12 - Draw/CCO-22-0256 Grizzly Franktown-Cons. Dev. Inc. 1/25/21
 DATE SAVED: Monday, December 13, 2021 1:42:54 PM
 LAST PLOTTED: Monday, December 13, 2021 1:48:55 PM

LEGEND 	No. Revision/Issue Date	McINTOSH PERRY 3240 Drummond Cons 5A, R.R. #7, Perth, ON K7H 3C9 Tel: 613-267-6524 Fax: 613-267-7992 www.mcintoshperry.com	Designed by: SH Drawn by: SH Checked by: AO Scale: 1:1500	Client: GRIZZLY HOMES P.O. BOX 422, RR#7 ASHTON, ONTARIO, K0A 1B0 Project: FRANKTOWN SUBDIVISION BECKWITH TOWNSHIP	Drawing Title: <h2 style="text-align: center;">CONCEPTUAL LOT DEVELOPMENT PLAN</h2>	Date: DEC.10.2021 Project Number: CCO-22-0256 Drawing Number: DEV
	TEST WELLS : TEST WELL LOCATIONS SHOWN ARE APPROXIMATE ONLY AND SHALL BE VERIFIED PRIOR TO DETAILED DESIGN. ANY TEST WELLS THAT DO NOT MEET OBC REQUIREMENTS SHALL BE ABANDONED IN ACCORDANCE WITH O.REG 903		SCALE 1 : 1500 		Check and verify all dimensions before proceeding with the work Do not scale drawings	

**HYDROGEOLOGICAL ASSESSMENT AND TERRAIN
ANALYSIS
GRIZZLY HOMES SUBDIVISION, BECKWITH, ONTARIO**



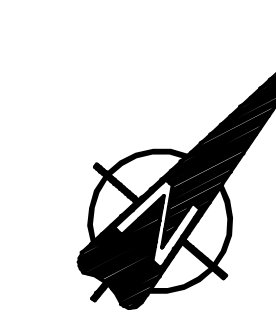
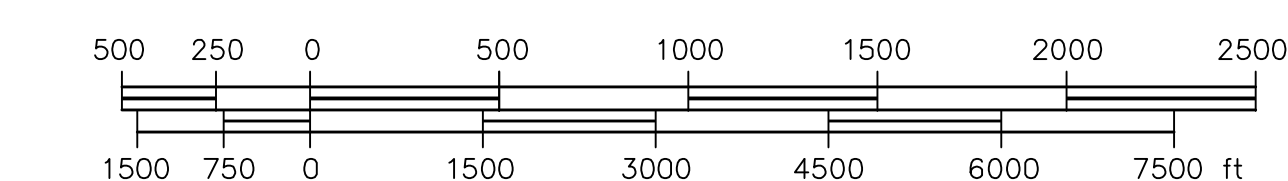
APPENDIX B: BECKWITH TOWNSHIP OFFICIAL PLAN



2010 Official Plan of the Township of Beckwith

Schedule A Land Use

Scale 1:20000



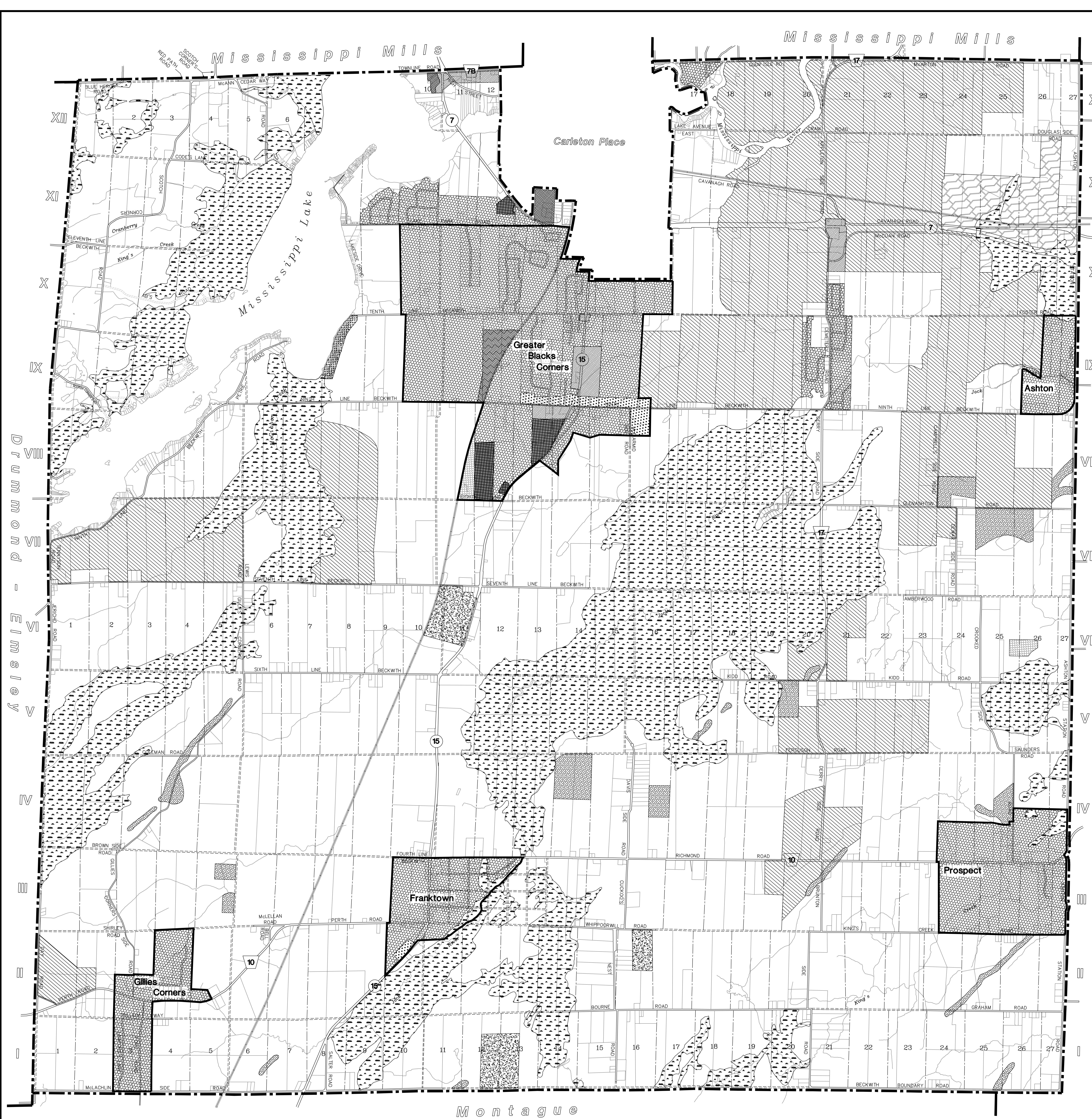
township boundary		county road	
provincial highway		secondary local road	
primary local road		private road	
unopened row			

Legend:

Community Development Areas

Residential	
Commercial	
Industrial	
Institutional	
Rural Areas	
Agriculture	
Mineral Aggregate Pit	
Mineral Aggregate Quarry	
Wetlands	
Rural Lands	
Mobile Home Park	
Wrecking Yard	
Airport	
Waste Disposal Site	
Hauled Septage Disposal Site	
Rural Residential - Special policy Area	
Highway 7 Corridor Area	

DRUMMOND - EIMSLEY



HYDROGEOLOGICAL ASSESSMENT AND TERRAIN ANALYSIS GRIZZLY HOMES SUBDIVISION, BECKWITH, ONTARIO



APPENDIX C: ON-SITE WATER WELL RECORDS (AIR ROCK DRILLING)

CERTIFICATE OF WELL COMPLIANCE

(REQUIRED FOR OCCUPANCY INSPECTION ONLY)

I, Jeremy Hanna (License T3632) of AIR ROCK DRILLING CO. LTD. - do hereby certify that I am

Licensed to drill wells in the Province of Ontario and that I have supervised the drilling of a well on the

PROPERTY OF GRIZZLY HOMES
(Name of Landowner)

LOCATED AT # 2085 4TH Line Beckwith, Franktown
(Civic Address)


LOT # 10 CON # 3 ~~PLAN #~~ Test Well # 2 S/L # 29


IN the **TOWNSHIP OF BECKWITH** - IN the **COUNTY OF LANARK**

AND FURTHER THAT I am aware of the well drilling requirements of the Township of Beckwith and the guidelines, recommendations and regulations of the Ministry of the Environment as they govern well installation in the Province of Ontario.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased and cement grouted to the standards required.

Signed this 9TH day of JULY 2021


Air Rock Drilling Co. Ltd. (C-7681) Jeremy Hanna


Witness Debbie Davis

HYDROLOGIST (Signature / Stamp)

2021
A320952

Measurements recorded in: Metric Imperial

A320952

Page ___ of ___

Well Owner's Information

First Name: GRIZZLY HOMES
 Last Name/Organization: GRIZZLY HOMES
 E-mail Address: _____
 Well Constructed by Well Owner
 Mailing Address (Street Number/Name): Box 422 RR 4
 Municipality: Ashton Ont
 Province: ONT
 Postal Code: K9A 1B0
 Telephone No. (inc. area code): _____

Well Location

Address of Well Location (Street Number/Name): #2085 4th Line Beckwith
 Township: Beckwith
 Lot: 10
 Concession: 3
 County/District/Municipality: LANARK
 City/Town/Village: Franktown
 Province: Ontario
 Postal Code: _____
 UTM Coordinates: Zone: NAD 83 | Easting: 18415703 | Northing: 4908086
 Municipal Plan and Sublot Number: TW# 2
 Other: S/L29

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m)
From	To			From To
	Sand			0' 1'
	Gray limestone			1' 30'
	Gray Sandstone			30' 100'
* TW# 2 S/L29 *				

Annular Space

Depth Set at (m)	Type of Sealant Used (Material and Type)	Volume Placed (m ³)
From To		
42' 32'	Neat Cement Slurry	10.92
32' 0'	Portland Slurry	4.20

Method of Construction

Cable Tool Diamond Public Commercial Not used
 Rotary (Conventional) Jetting Domestic Municipal Dewatering
 Rotary (Reverse) Driving Livestock Test Hole Monitoring
 Boring Digging Irrigation Cooling & Air Conditioning
 Air percussion Industrial Other, specify _____
 Other, specify _____

Construction Record - Casing

Inside Diameter (cm)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm)	Depth (m)	Status of Well
			From To	
6 1/4"	Steel	.188"	+2' 42'	<input checked="" type="checkbox"/> Water Supply
6"	Open Hole		42' 100'	<input type="checkbox"/> Replacement Well

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)
			From To

Water Details

Water found at Depth (m/ft)	Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	Hole Diameter
		Depth (m/ft) From To Diameter (cm/in)
94'		0' 42' 9 3/4"
		42' 100' 6"

Well Contractor and Well Technician Information

Business Name of Well Contractor: AIRROCK DRILLING CO LTD
 Well Contractor's Licence No.: C76811
 Business Address (Street Number/Name): 6659 Franktown Road Richmond
 Municipality: Richmond
 Province: ONT Postal Code: K9A 2Z0 Business E-mail Address: _____

Bus. Telephone No. (inc. area code): 6138382170
 Name of Well Technician (Last Name, First Name): HANNA, Henry
 Well Technician's Licence No.: T3632
 Signature of Technician and/or Contractor: _____
 Date Submitted: 20210710

Results of Well Yield Testing

After test of well yield, water was: <input type="checkbox"/> Clear and sand free <input type="checkbox"/> Other, specify _____	Draw Down		Recovery	
	Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
If pumping discontinued, give reason: <input checked="" type="checkbox"/> Pump intake set at (m/ft) 80 Pumping rate (l/min/GPM) 20 Duration of pumping 1 hrs + 0 min Final water level end of pumping (m) 33' 8" If flowing give rate (l/min/GPM) _____	Static Level	15' 6"		33' 8"
	1	22.5	1	27.6
	2	23.3	2	23.2
	3	27.	3	20.5
	4	28.3	4	17.9
	5	29.2	5	15.6
10	31.5	10	15' 6"	
15	32.5	15		
20	33.1	20		
25	33.2	25		
30	33.4	30		
40	33.6	40		
50	33.7	50		
60	33' 8"	60		

Map of Well Location

Please provide a map below following instructions on the back of this form.

4th Line Beckwith
 0.24km
 250 FT
 #2085 4th Line Beckwith TW# 2
 10 Parth Road 10

Comments: 1/2 HP-10 GPM S&E @ 8 FT

Well owner's information package delivered: Yes No
 Date Package Delivered: 20210712
 Date Work Completed: 20210709

Ministry Use Only
 Audit No.: Z355100
 Received: _____

CERTIFICATE OF WELL COMPLIANCE

(REQUIRED FOR OCCUPANCY INSPECTION ONLY)

I, Jeremy Hanna (License T3632) of AIR ROCK DRILLING CO. LTD. - do hereby certify that I am

Licensed to drill wells in the Province of Ontario and that I have supervised the drilling of a well on the

PROPERTY OF GRIZZLY HOMES
(Name of Landowner)

LOCATED AT # 2085 4TH Line Beckwith, Franktown
(Civic Address)


LOT # 10 CON # 3 ~~PLAN #~~ Test Well # 3 S/L # 9

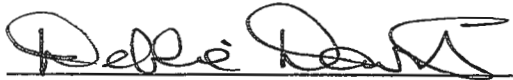
IN the TOWNSHIP OF BECKWITH - IN the COUNTY OF LANARK

AND FURTHER THAT I am aware of the well drilling requirements of the Township of Beckwith and the guidelines, recommendations and regulations of the Ministry of the Environment as they govern well installation in the Province of Ontario.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased and cement grouted to the standards required.

Signed this 13TH day of JULY 2021


Air Rock Drilling Co. Ltd. (C-7681) Jeremy Hanna


Witness **Debbie Davis**

HYDROLOGIST (Signature / Stamp)

2021
A320954

Measurements recorded in: Metric Imperial

A320954

Page ___ of ___

Well Owner's Information

Last Name/ Organization: **GLIZZLY HOMES** E-mail Address: _____
 Mailing Address (Street Number/Name): **Box 422 RR4** Municipality: **Ashton Ont** Postal Code: **K0A1B0** Telephone No. (inc. area code): _____

Well Location

Address of Well Location (Street Number/Name): **#2085 4th line Beckwith** Township: **Beckwith** Lot: **10** Concession: **3**
 County/District/Municipality: **LANARK** City/Town/Village: **Franktown** Province: **Ontario** Postal Code: _____
 UTM Coordinates: Zone: **18** Easting: **415984** Northing: **4907947** Municipal Plan and Sublot Number: **TW# 3** Other: **S1L9**

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From To
	Sand			0' 65'
	Grey limestone			65' 30'
	Grey sandstone			30' 120'
TW# 3 - S1L9				

Annular Space

Depth Set at (m/ft) From To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
42' 32'	Neat Cement Slurry	10.92
32' 0'	Portland Slurry	4.20

Results of Well Yield Testing

Time (min)	Draw Down		Recovery	
	Water Level (m/ft)	Time (min)	Water Level (m/ft)	Time (min)
Static Level	31' 5"		33' 4"	
1	32.3	1	31' 5"	
2	32.5	2	31' 5"	
3	32.6	3		
4	32.7	4		
5	32.8	5		
10	32.9	10		
15	33	15		
20	33.1	20		
25	33.2	25		
30	33.2	30		
40	33.3	40		
50	33.3	50		
60	33.4	60		

Method of Construction: Air percussion
 Well Use: Domestic, Livestock, Industrial

Construction Record - Casing

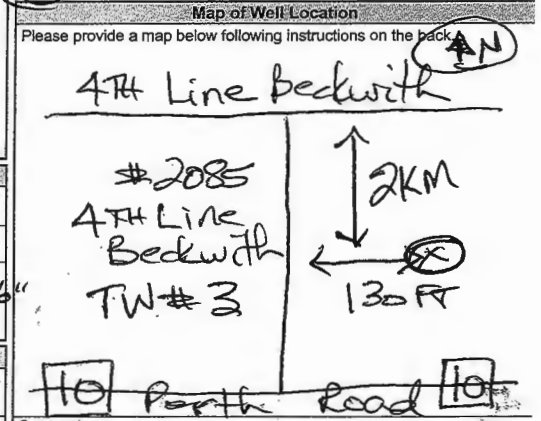
Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm)	Depth (m/ft) From To	Status of Well
6 1/4"	Steel	.188"	12' 42'	<input checked="" type="checkbox"/> Water Supply
5 15/16"	Open hole		42' 120'	<input checked="" type="checkbox"/> Replacement Well

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From To

Water Details

Water found at Depth (m/ft)	Kind of Water: <input checked="" type="checkbox"/> Fresh <input checked="" type="checkbox"/> Intested	Hole Diameter Depth (m/ft) From To	Diameter (cm)
90	<input checked="" type="checkbox"/> Gas <input checked="" type="checkbox"/> Other, specify	0' 42'	9 3/4"
114	<input checked="" type="checkbox"/> Gas <input checked="" type="checkbox"/> Other, specify	42' 120'	5 15/16"



Well Contractor and Well Technician Information

Business Name of Well Contractor: **AP ROCK DRILLING CO LTD** Well Contractor's Licence No.: **C7681**
 Business Address (Street Number/Name): **6659 Franktown Road Richmond** Municipality: _____
 Province: **Ont** Postal Code: **K0A1B0** Business E-mail Address: _____

Comments: **1/2HP-10GPM Set @ 100 FT**

Bus. Telephone No. (inc. area code): **6138382170** Name of Well Technician (Last Name, First Name): **HANNA Jeremy**
 Well Technician's Licence No.: **T3632** Signature of Technician and/or Contractor: _____ Date Submitted: **20210731**

Well owner's information package delivered: Yes No
 Date Package Delivered: **20210714**
 Date Work Completed: **20210730**
 Ministry Use Only: Audit No.: **Z364644**
 Received: _____

CERTIFICATE OF WELL COMPLIANCE

(REQUIRED FOR OCCUPANCY INSPECTION ONLY)

I, Jeremy Hanna (License T3632) of AIR ROCK DRILLING CO. LTD. - do hereby certify that I am

Licensed to drill wells in the Province of Ontario and that I have supervised the drilling of a well on the

PROPERTY OF GRIZZLY HOMES
(Name of Landowner)

LOCATED AT # 2085 4TH LINE BECKWITH, Franktown
(Civic Address)


LOT # 10 CON # 3 PLAN # TW# 4 S/L # 22

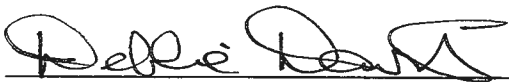
IN the TOWNSHIP OF BECKWITH - IN the COUNTY OF LANARK

AND FURTHER THAT I am aware of the well drilling requirements of the Township of Beckwith and the guidelines, recommendations and regulations of the Ministry of the Environment as they govern well installation in the Province of Ontario.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased and cement grouted to the standards required.

Signed this 31st day of AUGUST 2021


Air Rock Drilling Co. Ltd. (C-7681) Jeremy Hanna


Witness **Debbie Davis**

HYDROLOGIST (Signature / Stamp)

2021700
TAG A 318561
TW# 4 / S/L# 22

Measurements recorded in: Metric Imperial

Page of

A318561

Well Owner's Information

First Name: Grizzly Homes, Last Name/Organization: Grizzly Homes, Mailing Address: PO Box 422, RR#4, Municipality: Ashton, Province: On, Postal Code: K0A 1B0

Well Location

Address of Well Location: 2085 4th Line Beckwith, Township: Franktown Beckwith, Lot: 10, Concession: 3, City/Town/Village: Franktown, Province: Ontario, UTM Coordinates: 4987655, Municipal Plan and Sublot Number: TW #4, Other: SIL 22

Overburden and Bedrock Materials/Abandonment Sealing Record

Table with columns: General Colour, Most Common Material, Other Materials, General Description, Depth (m/ft). Includes handwritten notes: Sand & Stones, *TW#4 - SIL22*

Annular Space table with columns: Depth Set (m/ft), Type of Sealant Used, Volume Placed (m³/ft³). Includes entries for Neat cement and Bentonite slurry.

Method of Construction and Well Use checkboxes. Includes options like Cable Tool, Rotary, Boring, etc.

Construction Record - Casing table with columns: Inside Diameter, Open Hole OR Material, Wall Thickness, Depth. Includes handwritten entries for Steel and Open Hole.

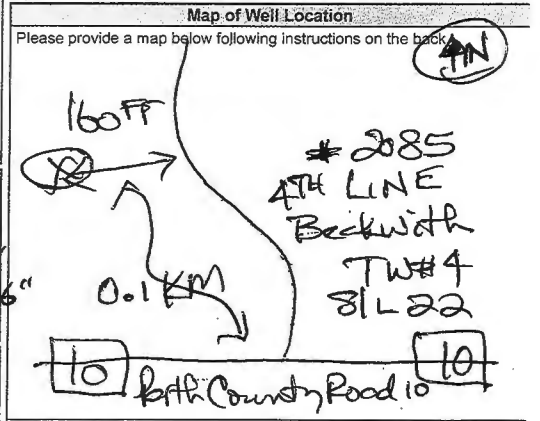
Construction Record - Screen table with columns: Outside Diameter, Material, Slot No., Depth.

Water Details and Hole Diameter tables. Includes water found at depths of 98, 116, and 122 m/ft.

Well Contractor and Well Technician Information. Business Name: Air Rock Drilling Co. Ltd., Well Contractor's Licence No.: C7681.

Business Information and Signature. Province: ON, Postal Code: K0A 2Z0, Business E-mail Address: air-rock@sympatico.ca, Name of Well Technician: Hanna, Jeremy.

Results of Well Yield Testing table. Includes Draw Down, Water Level, Recovery, and Pumping rate data.



Comments and Ministry Use Only section. Comments: 1/2 HR 10 GPM - Set @ 100 Ft. Audit No: Z368717.

CERTIFICATE OF WELL COMPLIANCE

(REQUIRED FOR OCCUPANCY INSPECTION ONLY)

I, Jeremy Hanna (License T3632) of AIR ROCK DRILLING CO. LTD. - do hereby certify that I am

Licensed to drill wells in the Province of Ontario and that I have supervised the drilling of a well on the

PROPERTY OF GRIZZLY HOMES
(Name of Landowner)

LOCATED AT # 2085 4TH Line Beckwith, Franktown
(Civic Address)

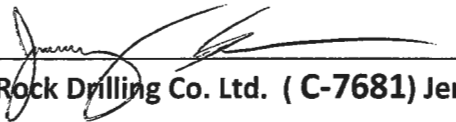
LOT # 10 CON # 3 ~~BLANK~~ Test Well # 5 S/L # 15

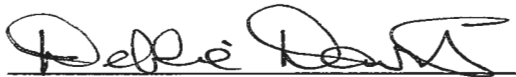
IN the TOWNSHIP OF BECKWITH - IN the COUNTY OF LANARK

AND FURTHER THAT I am aware of the well drilling requirements of the Township of Beckwith and the guidelines, recommendations and regulations of the Ministry of the Environment as they govern well installation in the Province of Ontario.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased and cement grouted to the standards required.

Signed this 14TH day of JULY 2021


Air Rock Drilling Co. Ltd. (C-7681) Jeremy Hanna


Witness Debbie Davis

HYDROLOGIST (Signature / Stamp)

2021
A320985

Measurements recorded in: Metric Imperial

A320985

Page ___ of ___

Well Owner's Information

First Name: GRIZZLY HOMES
 Last Name/Organization: GRIZZLY HOMES
 E-mail Address: _____
 Well Constructed by Well Owner
 Mailing Address (Street Number/Name): BOX 422, RR 4
 Municipality: Ashton
 Province: Ont
 Postal Code: K0A 1K0
 Telephone No. (inc. area code): _____

Well Location

Address of Well Location (Street Number/Name): #2085 4th Line Beckwith
 Township: Beckwith
 Lot: 10
 Concession: 3
 County/District/Municipality: LANARK
 City/Town/Village: Franktown
 Province: Ontario
 Postal Code: _____
 UTM Coordinates: Zone: NAD 83, Easting: 18416228, Northing: 4987683
 Municipal Plan and Sublot Number: TW# 5
 Other: S/L 15

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m) From To
	Sand			0' 5'
	Grey limestone			5' 27'
	Grey Sandstone			27' 120'
	Grey + Yellow Sandstone			120' 140'
* TW# 5 S/L 15 *				

Annular Space

Depth Set at (m) From To	Type of Sealant Used (Material and Type)	Volume Placed (m ³)
42' 32'	Neat Cement Slurry	10.92
32' 0'	Bordenite Slurry	4.22

Results of Well Yield Testing

Time (min)	Draw Down		Recovery	
	Water Level (m)	Time (min)	Water Level (m)	Time (min)
Static Level	37.8"		38.8"	
1	38.2	1	37.8"	
2	38.2	2	37.8"	
3	38.2	3		
4	38.3	4		
5	38.3	5		
10	38.4	10		
15	38.4	15		
20	38.5	20		
25	38.5	25		
30	38.6	30		
40	38.7	40		
50	38.8	50		
60	38.8"	60		

After test of well yield, water was:
 Clear and sand free
 Other, specify _____
 If pumping discontinued, give reason: _____
 Pump intake set at (m): 120'
 Pumping rate (l/min/GPM): 20
 Duration of pumping: 1 hrs + 0 min
 Final water level end of pumping (m): 38.8"
 If flowing give rate (l/min/GPM): _____
 Recommended pump depth (m): 100'
 Recommended pump rate (l/min/GPM): 20
 Well production (l/min/GPM): 20
 Disinfected? Yes No

Method of Construction: All percussion
 Cable Tool
 Rotary (Conventional)
 Rotary (Reverse)
 Airing
 Other, specify _____

Well Use: Domestic
 Commercial
 Municipal
 Test Hole
 Cooling & Air Conditioning
 Not used
 Dewatering
 Monitoring
 Industrial
 Other, specify _____

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m) From To	Status of Well
6 1/4"	Steel	1.88"	42' 42'	<input checked="" type="checkbox"/> Water Supply
6"	Open hole		42' 140'	<input type="checkbox"/> Replacement Well

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m) From To

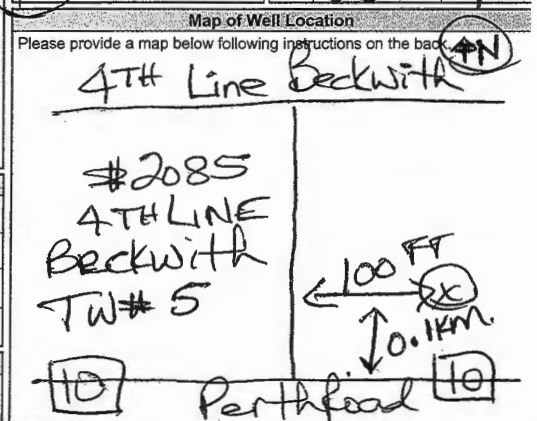
Water Details

Water found at Depth (m)	Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested	Hole Diameter Depth (m) From To Diameter (cm)
87'	<input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	0' 42' 9 3/4"
114'	<input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	42' 140' 6"

Well Contractor and Well Technician Information

Business Name of Well Contractor: AIR ROCK DRILLING CO LTD
 Well Contractor's Licence No.: C7681
 Business Address (Street Number/Name): 6659 Franktown Road
 Municipality: Richmond
 Province: Ont
 Postal Code: K0A 2Z0
 Business E-mail Address: _____

Bus. Telephone No. (inc. area code): 613 838 2170
 Name of Well Technician (Last Name, First Name): HANNA Jeremy
 Well Technician's Licence No.: T13632
 Signature of Technician and/or Contractor: _____
 Date Submitted: 2010/12/1

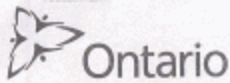


Comments: 1/2 HP 10 GPM Set @ 100 FT

Well owner's information package delivered: Yes No

Date Package Delivered: 2010/11/14
 Date Work Completed: 2010/11/14

Ministry Use Only
 Audit No.: Z355098
 Received: _____



Measurements recorded in: Metric Imperial

Well Owner's Information

First Name, Last Name / Organization, E-mail Address, Mailing Address (Street Number/Name), Municipality, Province, Postal Code, Telephone No. (inc. area code)

Well Location

Address of Well Location (Street Number/Name), Township, Lot, Concession, County/District/Municipality, City/Town/Village, Province, Postal Code, UTM Coordinates, Municipal Plan and Sublot Number, Other

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

Table with columns: General Colour, Most Common Material, Other Materials, General Description, Depth (m/ft) From, To

Annular Space: Depth Set at (m/ft), Type of Sealant Used (Material and Type), Volume Placed (m³/ft³)

Method of Construction, Well Use

Construction Record - Casing: Inside Diameter (cm/in), Open Hole OR Material, Wall Thickness (cm/in), Depth (m/ft), Status of Well

Construction Record - Screen: Outside Diameter (cm/in), Material, Slot No., Depth (m/ft)

Water Details, Hole Diameter

Well Contractor and Well Technician Information: Business Name of Well Contractor, Well Contractor's Licence No., Business Address, Municipality, Province, Postal Code, Business E-mail Address, Bus. Telephone No. (inc. area code), Name of Well Technician (Last Name, First Name), Well Technician's Licence No., Signature of Technician and/or Contractor, Date

Results of Well Yield Testing: After test of well yield, water was, Draw Down, Recovery, Static Level, Pump intake set at (m/ft), Pumping rate (l/min GPM), Duration of pumping, Final water level, end of pumping (m/ft), If flowing give rate (l/min / GPM), Recommended pump depth (m/ft), Recommended pump rate (l/min GPM), Well production (l/min GPM), Disinfected?

Map of Well Location: Please provide a map below following instructions on the back. Includes handwritten map showing well location relative to Richmond Road and a 1km distance marker.

HYDROGEOLOGICAL ASSESSMENT AND TERRAIN ANALYSIS GRIZZLY HOMES SUBDIVISION, BECKWITH, ONTARIO



APPENDIX D: MECP WELL RECORDS SUMMARY

MECP Well Data - Geology

WELL_ID	COMPLETED	WELL_DEPTH (m)	STATIC WATER LEVEL (m)	DEPTH TO BEDROCK (m)	FINAL STATUS	USE1	GEOLOGY	FORMATION_TOP_DEPTH	FORMATION_END_DEPTH	UNITS OF MEASUREMENT
2410073	07-Aug-04	34.7	2	4.3	Water Supply	Domestic	CLAY,,	0		4.2 m
2410073	07-Aug-04	34.7	2	4.3	Water Supply	Domestic	,DOLOMITE,	4.2		6 m
2410073	07-Aug-04	34.7	2	4.3	Water Supply	Domestic	,DOLOMITE,	6		34.7 m
3500134	01-Apr-63	22.9		0.9	Water Supply	Domestic	MEDIUM SAND, TOPSOIL,,	0		3 ft
3500134	01-Apr-63	22.9		0.9	Water Supply	Domestic	SANDSTONE,,	3		75 ft
3500298	25-May-61	14.9	5.5	0	Water Supply	Domestic	SHALE,,	0		10 ft
3500298	25-May-61	14.9	5.5	0	Water Supply	Domestic	SANDSTONE,,	10		49 ft
3500299	08-Mar-62	30.5	10.7	0.6	Water Supply	Domestic	TOPSOIL,,	0		2 ft
3500299	08-Mar-62	30.5	10.7	0.6	Water Supply	Domestic	LIMESTONE, MEDIUM SAND,	2		100 ft
3500300	23-Jul-65	26.2	11.3	0.6	Water Supply	Domestic	MEDIUM SAND, TOPSOIL,,	0		2 ft
3500300	23-Jul-65	26.2	11.3	0.6	Water Supply	Domestic	SANDSTONE,,	2		6 ft
3500300	23-Jul-65	26.2	11.3	0.6	Water Supply	Domestic	SANDSTONE,,	6		86 ft
3500301	24-Apr-62	16.8	3.4	0.3	Water Supply	Domestic	TOPSOIL, MEDIUM SAND,	0		1 ft
3500301	24-Apr-62	16.8	3.4	0.3	Water Supply	Domestic	SANDSTONE, MEDIUM SAND,	1		13 ft
3500301	24-Apr-62	16.8	3.4	0.3	Water Supply	Domestic	SANDSTONE,,	13		55 ft
3500307	26-Nov-59	15.2	7.9	1.2	Water Supply	Domestic	TOPSOIL, MEDIUM SAND,	0		4 ft
3500307	26-Nov-59	15.2	7.9	1.2	Water Supply	Domestic	SHALE,,	4		11 ft
3500307	26-Nov-59	15.2	7.9	1.2	Water Supply	Domestic	SANDSTONE,,	11		50 ft
3500308	29-Oct-55	25.6	7.6	0.3	Water Supply	Domestic	TOPSOIL,,	0		1 ft
3500308	29-Oct-55	25.6	7.6	0.3	Water Supply	Domestic	SANDSTONE,,	1		84 ft
3500309	24-Sep-56	21	4.6	0	Water Supply	Domestic	LIMESTONE, MEDIUM SAND,	0		69 ft
3500310	19-Mar-59	22.9	5.5	0.3	Water Supply	Domestic	TOPSOIL, MEDIUM SAND,	0		1 ft
3500310	19-Mar-59	22.9	5.5	0.3	Water Supply	Domestic	SANDSTONE,,	1		75 ft
3500311	08-May-59	21	6.1	0.3	Water Supply	Domestic	TOPSOIL, MEDIUM SAND,	0		1 ft
3500311	08-May-59	21	6.1	0.3	Water Supply	Domestic	SANDSTONE,,	1		69 ft
3500312	25-Jul-61	22.3	6.7	1.2	Water Supply	Domestic	TOPSOIL, MEDIUM SAND,	0		4 ft
3500312	25-Jul-61	22.3	6.7	1.2	Water Supply	Domestic	SANDSTONE,,	4		73 ft
3500313	02-Sep-64	22.6	7.6	1.8	Water Supply	Domestic	TOPSOIL, MEDIUM SAND,	0		6 ft
3500313	02-Sep-64	22.6	7.6	1.8	Water Supply	Domestic	SANDSTONE,,	6		74 ft
3500314	12-Aug-66	28	10.7	0	Water Supply	Livestock	SANDSTONE,,	0		92 ft
3500315	26-Mar-59	18.3	5.2	0.9	Water Supply	Domestic	TOPSOIL, MEDIUM SAND,	0		3 ft
3500315	26-Mar-59	18.3	5.2	0.9	Water Supply	Domestic	SHALE,,	3		7 ft
3500315	26-Mar-59	18.3	5.2	0.9	Water Supply	Domestic	SANDSTONE,,	7		60 ft
3500318	28-Oct-59	23.5	3.7	1.5	Water Supply	Domestic	TOPSOIL, STONES,	0		5 ft
3500318	28-Oct-59	23.5	3.7	1.5	Water Supply	Domestic	LIMESTONE,,	5		77 ft
3500319	14-May-60	21.6	3.7	1.2	Water Supply	Domestic	TOPSOIL, MEDIUM SAND,	0		4 ft
3500319	14-May-60	21.6	3.7	1.2	Water Supply	Domestic	MEDIUM SAND, SHALE,	4		12 ft
3500319	14-May-60	21.6	3.7	1.2	Water Supply	Domestic	SANDSTONE,,	12		71 ft
3500320	25-Jul-63	22.9	5.5	3.7	Water Supply	Domestic	CLAY, TOPSOIL,	0		12 ft
3500320	25-Jul-63	22.9	5.5	3.7	Water Supply	Domestic	SANDSTONE,,	12		75 ft
3502343	26-Apr-68	20.1	2.4	0.6	Water Supply	Domestic	CLAY, TOPSOIL,	0		2 ft
3502343	26-Apr-68	20.1	2.4	0.6	Water Supply	Domestic	SANDSTONE,,	2		66 ft
3502416	04-Mar-69	18.9	5.5	0.6	Water Supply	Commerical	GRAVEL, TOPSOIL,	0		2 ft
3502416	04-Mar-69	18.9	5.5	0.6	Water Supply	Commerical	LIMESTONE,,	2		57 ft
3502416	04-Mar-69	18.9	5.5	0.6	Water Supply	Commerical	SANDSTONE,,	57		62 ft
3502816	13-Jul-71	23.2	10.4	1.2	Water Supply	Domestic	MEDIUM SAND,,	0		4 ft
3502816	13-Jul-71	23.2	10.4	1.2	Water Supply	Domestic	SANDSTONE,,	4		76 ft
3502881	18-Aug-71	24.4	12.2	0.9	Water Supply	Domestic	TOPSOIL, MEDIUM SAND, STONES	0		3 ft
3502881	18-Aug-71	24.4	12.2	0.9	Water Supply	Domestic	SANDSTONE,,	3		20 ft
3502881	18-Aug-71	24.4	12.2	0.9	Water Supply	Domestic	SANDSTONE, LIMESTONE,	20		70 ft
3502881	18-Aug-71	24.4	12.2	0.9	Water Supply	Domestic	SANDSTONE, MEDIUM SAND,	70		80 ft
3502883	17-Jul-71	25.9	8.2	1.5	Water Supply	Domestic	TOPSOIL, MEDIUM SAND, STONES	0		5 ft
3502883	17-Jul-71	25.9	8.2	1.5	Water Supply	Domestic	SANDSTONE,,	5		21 ft
3502883	17-Jul-71	25.9	8.2	1.5	Water Supply	Domestic	LIMESTONE, SANDSTONE,	21		68 ft
3502883	17-Jul-71	25.9	8.2	1.5	Water Supply	Domestic	SANDSTONE, LIMESTONE,	68		85 ft
3503274	29-Sep-72	30.5	9.1	0.3	Water Supply	Domestic	FILL,,	0		1 ft
3503274	29-Sep-72	30.5	9.1	0.3	Water Supply	Domestic	LIMESTONE,,	1		40 ft
3503274	29-Sep-72	30.5	9.1	0.3	Water Supply	Domestic	SANDSTONE,,	40		58 ft
3503274	29-Sep-72	30.5	9.1	0.3	Water Supply	Domestic	SANDSTONE,,	58		65 ft
3503274	29-Sep-72	30.5	9.1	0.3	Water Supply	Domestic	SANDSTONE,,	65		72 ft
3503274	29-Sep-72	30.5	9.1	0.3	Water Supply	Domestic	SANDSTONE,,	72		100 ft
3503383	27-Jun-73	27.4	10.7	0.3	Water Supply	Domestic	TOPSOIL,,	0		1 ft
3503383	27-Jun-73	27.4	10.7	0.3	Water Supply	Domestic	LIMESTONE,,	1		60 ft
3503383	27-Jun-73	27.4	10.7	0.3	Water Supply	Domestic	SANDSTONE,,	60		90 ft
3503454	06-Jul-73	22.9	6.1	1.8	Water Supply	Domestic	TOPSOIL,,	0		6 ft
3503454	06-Jul-73	22.9	6.1	1.8	Water Supply	Domestic	LIMESTONE, SANDY,	6		75 ft
3503664	15-Oct-73	25.9	5.5	0.3	Water Supply	Domestic	CLAY, TOPSOIL,	0		1 ft
3503664	15-Oct-73	25.9	5.5	0.3	Water Supply	Domestic	SANDSTONE,,	1		85 ft
3503718	10-May-74	27.4	0.3	0.3	Water Supply	Domestic	CLAY,,	0		1 ft
3503718	10-May-74	27.4	0.3	0.3	Water Supply	Domestic	SANDSTONE,,	1		90 ft
3503763	15-Jul-74	21.9	9.4	1.2	Water Supply	Domestic	TOPSOIL,,	0		4 ft
3503763	15-Jul-74	21.9	9.4	1.2	Water Supply	Domestic	LIMESTONE, SAND,	4		72 ft
3504268	14-Aug-75	25.9	10.1	0.6	Water Supply	Domestic	SAND, STONES, LOOSE	0		2 ft
3504268	14-Aug-75	25.9	10.1	0.6	Water Supply	Domestic	SANDSTONE, SAND, LAYERED	2		16 ft
3504268	14-Aug-75	25.9	10.1	0.6	Water Supply	Domestic	LIMESTONE, HARD,	16		73 ft
3504268	14-Aug-75	25.9	10.1	0.6	Water Supply	Domestic	LIMESTONE, SAND, LAYERED	73		85 ft
3504368	21-May-76	33.5	6.1	0	Water Supply	Domestic	LIMESTONE,,	0		40 ft
3504368	21-May-76	33.5	6.1	0	Water Supply	Domestic	SANDSTONE,,	40		110 ft
3504536	26-Oct-76	23.2	5.5	0.6	Water Supply	Domestic	TOPSOIL,,	0		2 ft
3504536	26-Oct-76	23.2	5.5	0.6	Water Supply	Domestic	SANDSTONE,,	2		76 ft

MECP Well Data - Geology

3504537	27-Oct-76	29	5.5	0.3	Water Supply	Domestic	TOPSOIL,STONES,	0	1 ft
3504537	27-Oct-76	29	5.5	0.3	Water Supply	Domestic	SANDSTONE,,	1	30 ft
3504537	27-Oct-76	29	5.5	0.3	Water Supply	Domestic	LIMESTONE,,	30	95 ft
3504815	23-Nov-77	27.7	1.2	0.6	Water Supply	Domestic	TOPSOIL,,	0	2 ft
3504815	23-Nov-77	27.7	1.2	0.6	Water Supply	Domestic	LIMESTONE,,	2	20 ft
3504815	23-Nov-77	27.7	1.2	0.6	Water Supply	Domestic	SANDSTONE,,	20	91 ft
3505131	04-Jul-78	27.4	10.7	0.3	Water Supply	Domestic	TOPSOIL,,	0	1 ft
3505131	04-Jul-78	27.4	10.7	0.3	Water Supply	Domestic	LIMESTONE,,	1	45 ft
3505131	04-Jul-78	27.4	10.7	0.3	Water Supply	Domestic	SANDSTONE,,	45	90 ft
3505618	01-Nov-79	27.4	5.5	0	Water Supply	Domestic	SANDSTONE,,	0	90 ft
3505792	15-Apr-80	22.9	6.1	0	Water Supply	Domestic	SANDSTONE,,	0	15 ft
3505792	15-Apr-80	22.9	6.1	0	Water Supply	Domestic	SANDSTONE,,	15	75 ft
3506595	04-Oct-83	24.4	12.2	1.5	Water Supply	Livestock	FILL,,	0	5 ft
3506595	04-Oct-83	24.4	12.2	1.5	Water Supply	Livestock	LIMESTONE,SANDY,	5	25 ft
3506595	04-Oct-83	24.4	12.2	1.5	Water Supply	Livestock	SANDSTONE,,	25	80 ft
3506603	10-Jan-83	25.6	10.7	0	Water Supply	Domestic	SANDSTONE,,	0	84 ft
3508675	07-Sep-88	23.2	7.6	0.6	Water Supply	Domestic	FILL,,	0	2 ft
3508675	07-Sep-88	23.2	7.6	0.6	Water Supply	Domestic	LIMESTONE,,	2	56 ft
3508675	07-Sep-88	23.2	7.6	0.6	Water Supply	Domestic	SANDSTONE,,	56	76 ft
3509074	26-Oct-89	24.4	13.7	0.6	Water Supply	Domestic	GRAVEL,TOPSOIL,LOOSE	0	2 ft
3509074	26-Oct-89	24.4	13.7	0.6	Water Supply	Domestic	SANDSTONE,HARD,	2	80 ft
3510822	03-Sep-93	27.4	12.5	1.8	Water Supply	Domestic	TOPSOIL,SANDY,DRY	0	6 ft
3510822	03-Sep-93	27.4	12.5	1.8	Water Supply	Domestic	SANDSTONE,VERY,HARD	6	90 ft
3511553	06-Jul-95	29	7.6	0.9144	Water Supply	Domestic	ROCK,FILL,	0	3 ft
3511553	06-Jul-95	29	7.6	0.9144	Water Supply	Domestic	SANDSTONE,,	3	95 ft
3512519	22-Oct-98	30.5	9.4	3.4	Water Supply	Domestic	CLAY,,	0	11 ft
3512519	22-Oct-98	30.5	9.4	3.4	Water Supply	Domestic	LIMESTONE,,	11	30 ft
3512519	22-Oct-98	30.5	9.4	3.4	Water Supply	Domestic	SANDSTONE,,	30	100 ft
3512844	29-Oct-99	29.3	4.3	1.2336	Water Supply	Domestic	ROCK,FILL,	0	4 ft
3512844	29-Oct-99	29.3	4.3	1.2336	Water Supply	Domestic	LIMESTONE,,	4	63 ft
3512844	29-Oct-99	29.3	4.3	1.2336	Water Supply	Domestic	SANDSTONE,,	63	96 ft
3514514	12-Apr-04	21.3	6.2	0.9	Water Supply	Domestic	FILL,,	0	0.91 m
3514514	12-Apr-04	21.3	6.2	0.9	Water Supply	Domestic	SANDSTONE,,	0.91	21.3 m
3514558	19-May-04	30.5	8.8	0.9	Water Supply	Domestic	FILL,,	0	0.91 m
3514558	19-May-04	30.5	8.8	0.9	Water Supply	Domestic	LIMESTONE,SANDSTONE,	0.91	30.5 m
3515533	20-Oct-06	39.6	0.5	0.6	Water Supply	Domestic	TOPSOIL,,	0	0.6 m
3515533	20-Oct-06	39.6	0.5	0.6	Water Supply	Domestic	LIMESTONE,,	0.6	39.6 m
7126066	11-Jun-06	24.4	3.2	0.3084	Water Supply		TOPSOIL,,	0	1 m
7126066	11-Jun-06	24.4	3.2	0.3084	Water Supply		SANDSTONE,,	1	24.4 m
7131322	17-Sep-09	24.4	4.9	0.3048	Water Supply	Domestic	SAND,,	0	1 ft
7131322	17-Sep-09	24.4	4.9	0.3048	Water Supply	Domestic	LIMESTONE,,	1	80 ft
7148253	24-Jun-10	24.4		0.9144	Water Supply	Domestic	CLAY,STONES,	0	3 ft
7148253	24-Jun-10	24.4		0.9144	Water Supply	Domestic	SANDSTONE,,	3	76 ft
7148253	24-Jun-10	24.4		0.9144	Water Supply	Domestic	SANDSTONE,,	76	80 ft
3508666	29-Feb-88	29	4.6	0.6	Water Supply	Domestic	TOPSOIL,,	0	2 ft
3508666	29-Feb-88	29	4.6	0.6	Water Supply	Domestic	LIMESTONE,,	2	35 ft
3508666	29-Feb-88	29	4.6	0.6	Water Supply	Domestic	SANDSTONE,,	35	95 ft
3508672	21-Sep-88	23.8	12.2	0.6	Water Supply	Domestic	TOPSOIL,STONES,	0	2 ft
3508672	21-Sep-88	23.8	12.2	0.6	Water Supply	Domestic	SHALE,,	2	8 ft
3508672	21-Sep-88	23.8	12.2	0.6	Water Supply	Domestic	LIMESTONE,,	8	36 ft
3508672	21-Sep-88	23.8	12.2	0.6	Water Supply	Domestic	SANDSTONE,,	36	78 ft
3508676	13-Sep-88	25	12.2	0	Water Supply	Domestic	LIMESTONE,,	0	30 ft
3508676	13-Sep-88	25	12.2	0	Water Supply	Domestic	SANDSTONE,,	30	82 ft
3509139	22-Nov-89	33.5	5.5	0	Water Supply	Domestic	LIMESTONE,,	0	20 ft
3509139	22-Nov-89	33.5	5.5	0	Water Supply	Domestic	SANDSTONE,,	20	110 ft
3510402	29-Jul-92	21.3	4.6	0	Water Supply	Domestic	SHALE,,	0	7 ft
3510402	29-Jul-92	21.3	4.6	0	Water Supply	Domestic	SANDSTONE,,	7	70 ft
3512946	03-Apr-00	36.6	4.3	0.3	Water Supply	Domestic	CLAY,,	0	1 ft
3512946	03-Apr-00	36.6	4.3	0.3	Water Supply	Domestic	LIMESTONE,,	1	120 ft
3513366	22-May-01	31.4	4.6	0.9	Water Supply	Domestic	SAND,,	0	3 ft
3513366	22-May-01	31.4	4.6	0.9	Water Supply	Domestic	SANDSTONE,,	3	103 ft
7169696	16-Aug-11	24.7	5.6	1.2192	Water Supply	Domestic	SAND,GRAVEL,	0	4 ft
7169696	16-Aug-11	24.7	5.6	1.2192	Water Supply	Domestic	SANDSTONE,LIMESTONE,	4	71 ft
7169696	16-Aug-11	24.7	5.6	1.2192	Water Supply	Domestic	SANDSTONE,LIMESTONE,	71	75 ft
7169696	16-Aug-11	24.7	5.6	1.2192	Water Supply	Domestic	SANDSTONE,LIMESTONE,	75	81 ft
7186914	03-Aug-12	15.2		0.9144	Observation Wells	Monitoring and Test Hole	SAND,TOPSOIL,DRY	0	3 ft
7186914	03-Aug-12	15.2		0.9144	Observation Wells	Monitoring and Test Hole	LIMESTONE,SAND,LAYERED	3	50 ft
7228030	26-Aug-14	30.8	8.9	0.6144	Water Supply	Domestic	SAND,FILL,	0	3 ft
7228030	26-Aug-14	30.8	8.9	0.6144	Water Supply	Domestic	SANDSTONE,,	3	73 ft
7228030	26-Aug-14	30.8	8.9	0.6144	Water Supply	Domestic	SANDSTONE,,	73	78 ft
7228030	26-Aug-14	30.8	8.9	0.6144	Water Supply	Domestic	SANDSTONE,,	78	91 ft
7228030	26-Aug-14	30.8	8.9	0.6144	Water Supply	Domestic	SANDSTONE,,	91	101 ft
7235413	03-Dec-14	24.4		0	Water Supply	Domestic	SANDSTONE,,	0	54 ft
7235413	03-Dec-14	24.4		0	Water Supply	Domestic	SANDSTONE,,	54	56 ft
7235413	03-Dec-14	24.4		0	Water Supply	Domestic	SANDSTONE,,	56	74 ft
7235413	03-Dec-14	24.4		0	Water Supply	Domestic	SANDSTONE,,	74	80 ft
7292087	19-Jul-17	36.6		0.6096	Water Supply	Domestic	CLAY,GRAVEL,	0	2 ft
7292087	19-Jul-17	36.6		0.6096	Water Supply	Domestic	SANDSTONE,,	2	120 ft

MECP Well Records - Pump Test Data

WELL_ID	COMPLETED	WELL DEPTH (m)	STATIC WATER LEVEL (m)	DEPTH TO BEDROCK (m)	FINAL STATUS	USE1	PUMPING RATE	RECOM RATE
2410073	07-Aug-04	34.7	2	4.3	Water Supply	Domestic	44 LPM	30LPM
3500134	01-Apr-63	22.9	0	0.9	Water Supply	Domestic	10 GPM	5GPM
3500298	25-May-61	14.9	5.5	0	Water Supply	Domestic	7 GPM	7GPM
3500299	08-Mar-62	30.5	10.7	0.6	Water Supply	Domestic	5 GPM	5GPM
3500300	23-Jul-65	26.2	11.3	0.6	Water Supply	Domestic	15 GPM	5GPM
3500301	24-Apr-62	16.8	3.4	0.3	Water Supply	Domestic	10 GPM	10GPM
3500307	26-Nov-59	15.2	7.9	1.2	Water Supply	Domestic	5 GPM	5GPM
3500308	29-Oct-55	25.6	7.6	0.3	Water Supply	Domestic	13 GPM	GPM
3500309	24-Sep-56	21	4.6	0	Water Supply	Domestic	8 GPM	GPM
3500310	19-Mar-59	22.9	5.5	0.3	Water Supply	Domestic	30 GPM	5GPM
3500311	08-May-59	21	6.1	0.3	Water Supply	Domestic	8 GPM	8GPM
3500312	25-Jul-61	22.3	6.7	1.2	Water Supply	Domestic	10 GPM	10GPM
3500313	02-Sep-64	22.6	7.6	1.8	Water Supply	Domestic	8 GPM	8GPM
3500314	12-Aug-66	28	10.7	0	Water Supply	Livestock	10 GPM	5GPM
3500315	26-Mar-59	18.3	5.2	0.9	Water Supply	Domestic	30 GPM	10GPM
3500318	28-Oct-59	23.5	3.7	1.5	Water Supply	Domestic	7 GPM	5GPM
3500319	14-May-60	21.6	3.7	1.2	Water Supply	Domestic	25 GPM	5GPM
3500320	25-Jul-63	22.9	5.5	3.7	Water Supply	Domestic	10 GPM	10GPM
3502343	26-Apr-68	20.1	2.4	0.6	Water Supply	Domestic	8 GPM	5GPM
3502416	04-Mar-69	18.9	5.5	0.6	Water Supply	Commerical	3 GPM	3GPM
3502816	13-Jul-71	23.2	10.4	1.2	Water Supply	Domestic	4 GPM	4GPM
3502881	18-Aug-71	24.4	12.2	0.9	Water Supply	Domestic	15 GPM	5GPM
3502883	17-Jul-71	25.9	8.2	1.5	Water Supply	Domestic	15 GPM	5GPM
3503274	29-Sep-72	30.5	9.1	0.3	Water Supply	Domestic	15 GPM	15GPM
3503383	27-Jun-73	27.4	10.7	0.3	Water Supply	Domestic	15 GPM	15GPM
3503454	06-Jul-73	22.9	6.1	1.8	Water Supply	Domestic	10 GPM	5GPM
3503664	15-Oct-73	25.9	5.5	0.3	Water Supply	Domestic	6 GPM	5GPM
3503718	10-May-74	27.4	0.3	0.3	Water Supply	Domestic	7 GPM	7GPM
3503763	15-Jul-74	21.9	9.4	1.2	Water Supply	Domestic	5 GPM	5GPM
3504268	14-Aug-75	25.9	10.1	0.6	Water Supply	Domestic	15 GPM	5GPM
3504368	21-May-76	33.5	6.1	0	Water Supply	Domestic	8 GPM	8GPM
3504536	26-Oct-76	23.2	5.5	0.6	Water Supply	Domestic	12 GPM	12GPM
3504537	27-Oct-76	29	5.5	0.3	Water Supply	Domestic	12 GPM	12GPM
3504815	23-Nov-77	27.7	1.2	0.6	Water Supply	Domestic	8 GPM	8GPM
3505131	04-Jul-78	27.4	10.7	0.3	Water Supply	Domestic	10 GPM	10GPM
3505618	01-Nov-79	27.4	5.5	0	Water Supply	Domestic	12 GPM	12GPM
3505792	15-Apr-80	22.9	6.1	0	Water Supply	Domestic	8 GPM	5GPM
3506595	04-Oct-83	24.4	12.2	1.5	Water Supply	Livestock	20 GPM	20GPM
3506603	10-Jan-83	25.6	10.7	0	Water Supply	Domestic	10 GPM	10GPM
3508675	07-Sep-88	23.2	7.6	0.6	Water Supply	Domestic	7 GPM	7GPM
3509074	26-Oct-89	24.4	13.7	0.6	Water Supply	Domestic	12 GPM	15GPM
3510822	03-Sep-93	27.4	12.5	1.8	Water Supply	Domestic	15 GPM	5GPM
3511553	06-Jul-95	29	7.6	0	Water Supply	Domestic	10 GPM	10GPM
3512519	22-Oct-98	30.5	9.4	3.4	Water Supply	Domestic	15 GPM	15GPM
3512844	29-Oct-99	29.3	4.3	0	Water Supply	Domestic	14 GPM	14GPM
3514514	12-Apr-04	21.3	6.2	0.9	Water Supply	Domestic	91 LPM	91LPM
3514558	19-May-04	30.5	8.8	0.9	Water Supply	Domestic	91 LPM	91LPM
3515533	20-Oct-06	39.6	0.5	0.6	Water Supply	Domestic	23 LPM	23LPM
7126066	11-Jun-06	24.4	3.2	0	Water Supply		67 LPM	50LPM
7131322	17-Sep-09	24.4	4.9	0	Water Supply	Domestic	20 GPM	20GPM
7148253	24-Jun-10	24.4	0	0	Water Supply	Domestic	14 GPM	15GPM
3508666	29-Feb-88	29	4.6	0.6	Water Supply	Domestic	14 GPM	14GPM
3508672	21-Sep-88	23.8	12.2	0.6	Water Supply	Domestic	12 GPM	12GPM
3508676	13-Sep-88	25	12.2	0	Water Supply	Domestic	20 GPM	20GPM
3509139	22-Nov-89	33.5	5.5	0	Water Supply	Domestic	12 GPM	12GPM
3510402	29-Jul-92	21.3	4.6	0	Water Supply	Domestic	18 GPM	18GPM
3512946	03-Apr-00	36.6	4.3	0.3	Water Supply	Domestic	30 GPM	30GPM
3513366	22-May-01	31.4	4.6	0.9	Water Supply	Domestic	7 GPM	7GPM
7169696	16-Aug-11	24.7	5.6	0	Water Supply	Domestic	20 GPM	20GPM
7186914	03-Aug-12	15.2	0	0	Observation Wells	Monitoring and Test Hole		
7228030	26-Aug-14	30.8	8.9	0	Water Supply	Domestic	20 GPM	20GPM
7228037	04-Sep-14	0	0	0	Abandoned-Other			
7235413	03-Dec-14	24.4	0	0	Water Supply	Domestic	20 GPM	20GPM
7292087	19-Jul-17	36.6	0	0	Water Supply	Domestic	20 GPM	20GPM

HYDROGEOLOGICAL ASSESSMENT AND TERRAIN ANALYSIS GRIZZLY HOMES SUBDIVISION, BECKWITH, ONTARIO



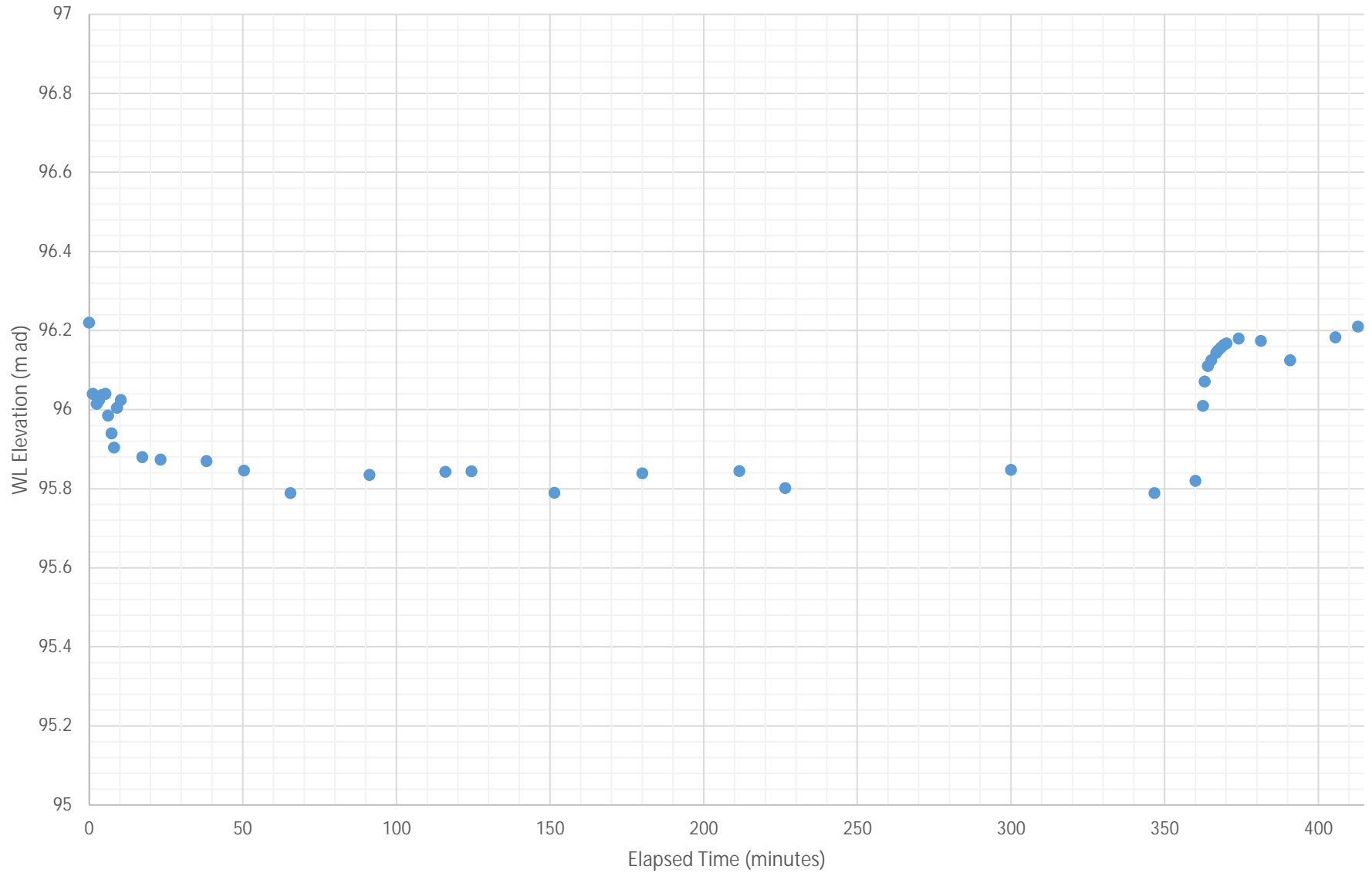
APPENDIX E: PUMPING TEST DATA

Summary of Water Level Data
Pumping Test - TW1 - January 18, 2022

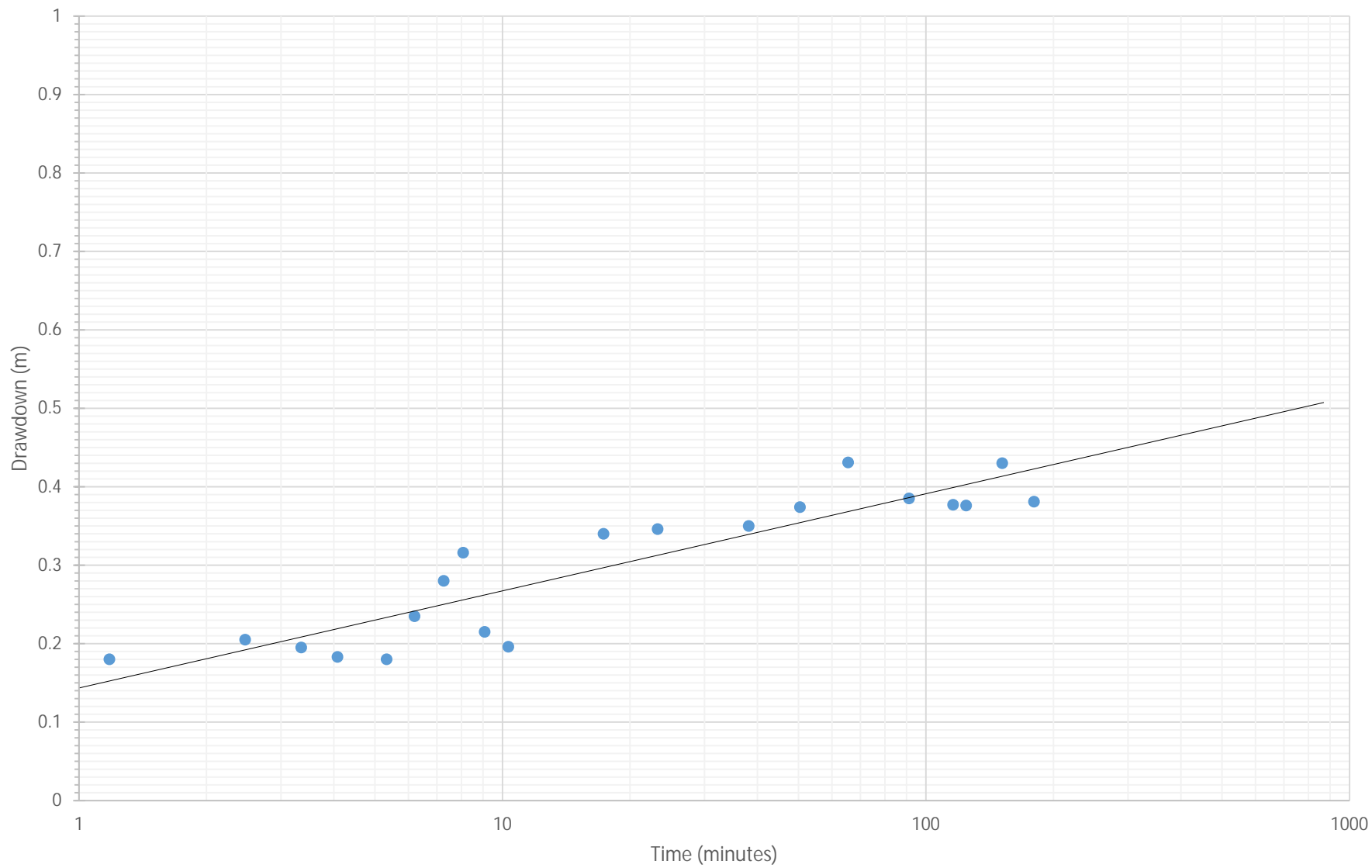
TOC Elevation (assumed)	100 m AD (Above Datum)
Static Water Level	3.78 m BTOC
Static Water Elevation	96.22 m AD (Above Datum)
95% Recovery	3.80155 m BTOC
	96.19845 m AD (Above Datum)

Elapsed Time (minutes)	Elapsed Time (Recovery)	T/T'	Water Level (m BTOC)	Water Level (m ASL)	Drawdown (m)	Notes
0			3.78	96.22	0	Pumping rate = 21 l/min
1.18			3.96	96.04	0.18	
2.47			3.985	96.015	0.205	
3.35			3.975	96.025	0.195	
4.08			3.963	96.037	0.183	
5.33			3.96	96.04	0.18	
6.2			4.015	95.985	0.235	
7.27			4.06	95.94	0.28	
8.08			4.096	95.904	0.316	
9.08			3.995	96.005	0.215	
10.33			3.976	96.024	0.196	
17.33			4.12	95.88	0.34	
23.25			4.126	95.874	0.346	
38.17			4.13	95.87	0.35	
50.42			4.154	95.846	0.374	
65.5			4.211	95.789	0.431	
91.25			4.165	95.835	0.385	
115.92			4.16	95.843	0.377	
124.42			4.156	95.844	0.376	
151.4			4.21	95.79	0.43	
180			4.161	95.839	0.381	
211.6			4.155	95.845	0.375	
226.5			4.198	95.802	0.418	
300			4.152	95.848	0.372	
346.67			4.211	95.789	0.431	
360			4.18	95.82	0.4	
362.42	0.42	862.9048	3.99	96.01	0.21	Pump off at 362 min
363	1	363	3.929	96.071	0.149	
364.08	2.08	175.0385	3.89	96.11	0.11	
365.12	3.12	117.0256	3.875	96.125	0.095	
366.73	4.73	77.53277	3.856	96.144	0.076	
367.35	5.35	68.66355	3.85	96.15	0.07	
368.28	6.28	58.64331	3.843	96.157	0.063	
369.23	7.23	51.06916	3.836	96.164	0.056	
370.1	8.1	45.69136	3.832	96.168	0.052	
374.08	12.08	30.96689	3.82	96.18	0.04	
381.33	19.33	19.72737	3.826	96.174	0.046	
390.83	28.83	13.55636	3.875	96.125	0.095	
405.5	43.5	9.321839	3.817	96.183	0.037	
412.83	50.83	8.121778	3.79	96.21	0.01	

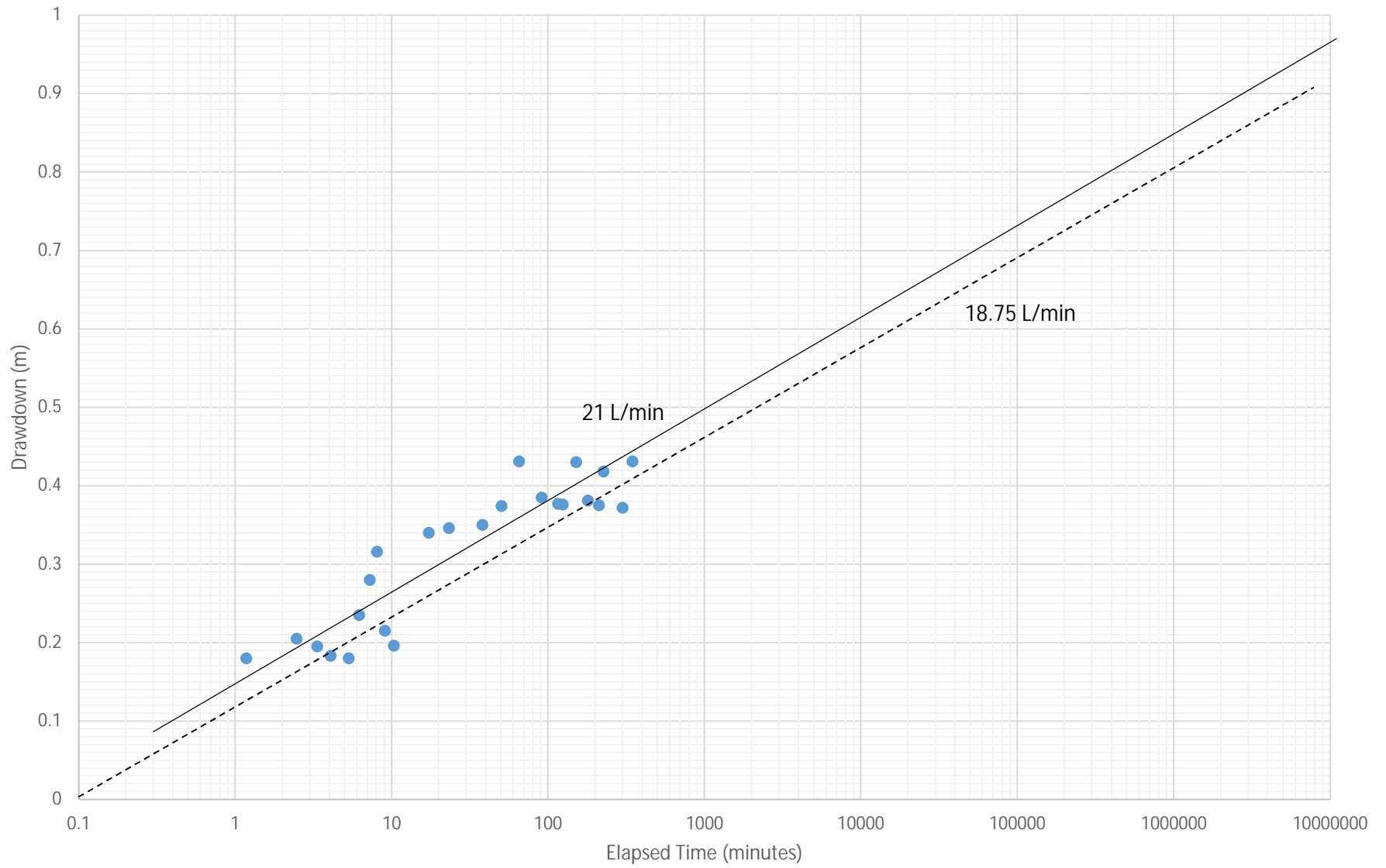
Drawdown vs Time
TW1 Pumping Test (Drawdown), January 22, 2022
2030 Fourth Line Road, Franktown, ON



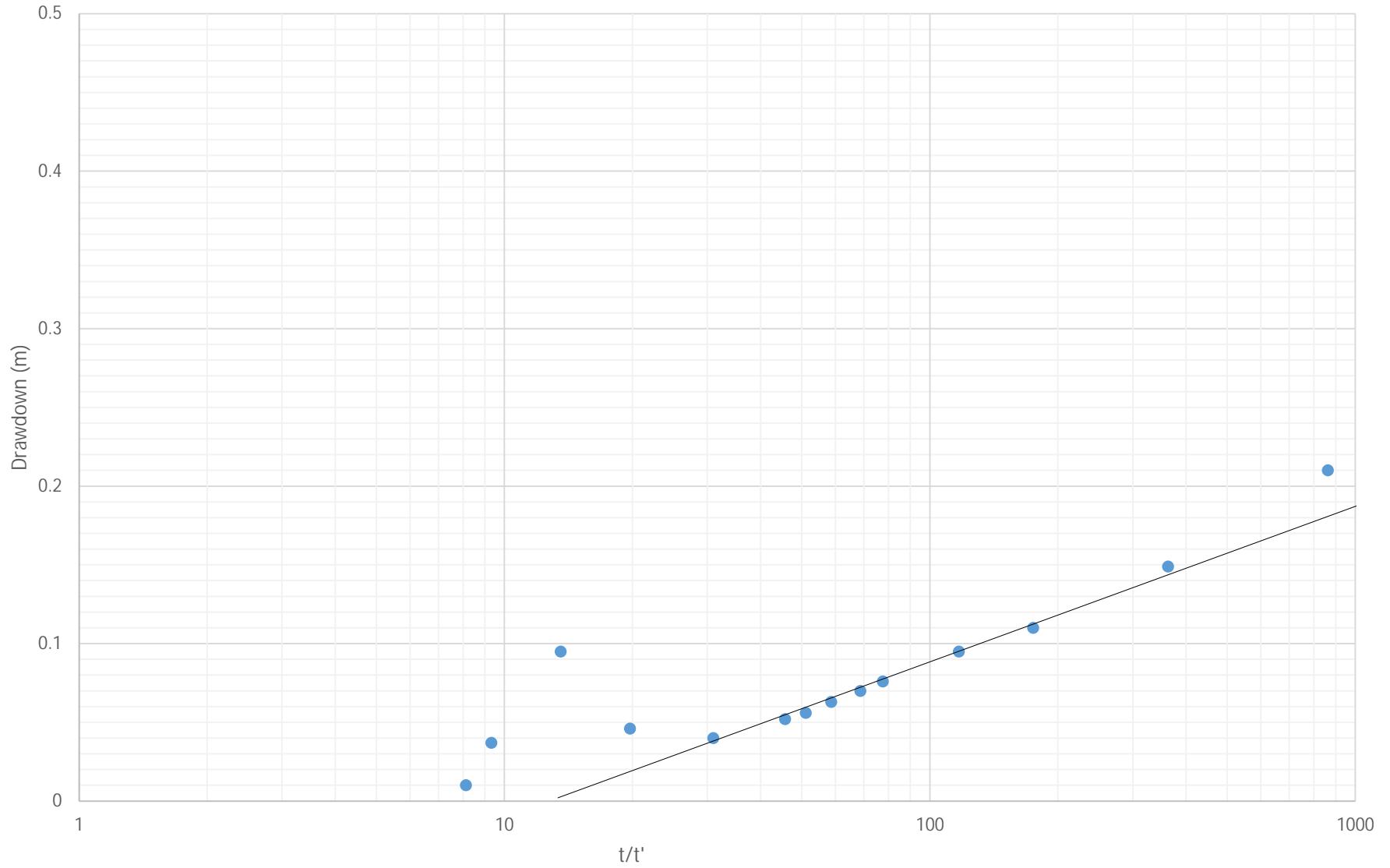
Drawdown vs Log Time
TW1 Pumping Test (Drawdown), January 18, 2022
2030 Fourth Line Road, FranktownON



Drawdown vs Log Time
TW1 Pumping Test (Long-Term), January 18, 2022
2030 Fourth Line Road, Franktown ON



Drawdown vs Log Time
TW1 Pumping Test (Recovery), January 18, 2022
2030 Fourth Line Road, Franktown ON

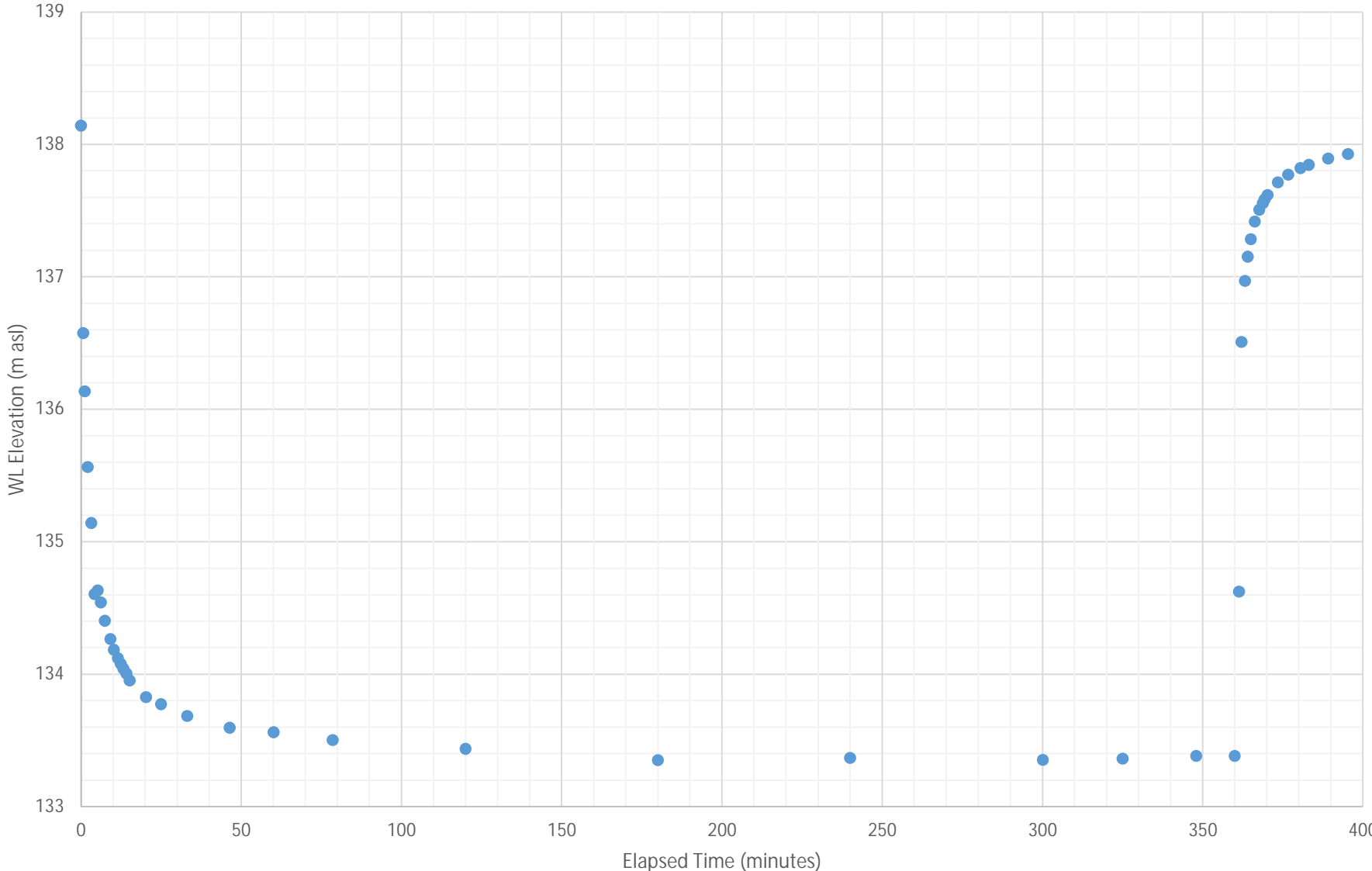


Summary of Water Level Data
Pumping Test - TW2 - July 13, 2021

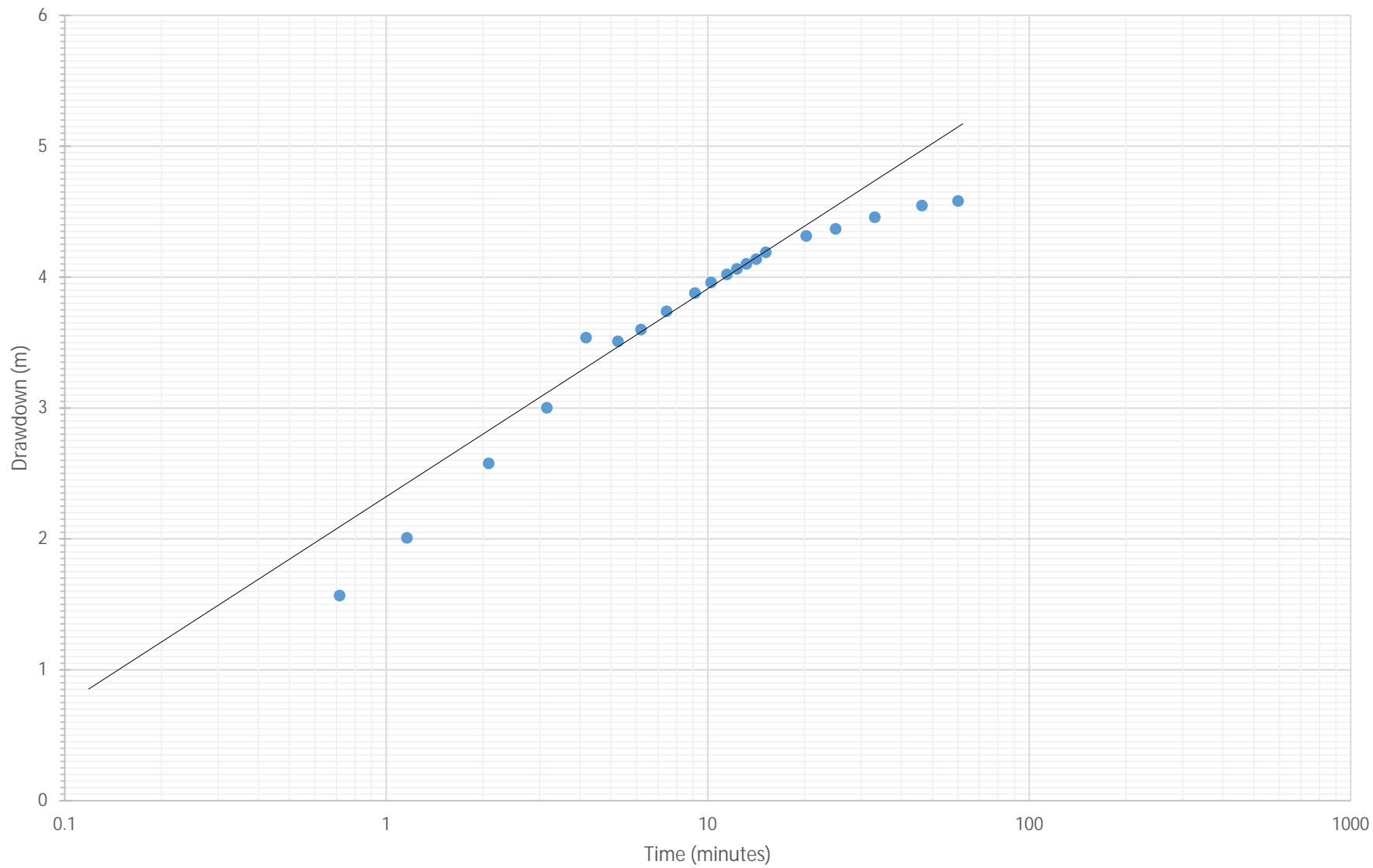
TOC Elevation	142.904 m ASL
Static Water Level	4.762 m BTOC
Stick up (m)	0.626
Static Water Elevation	138.142 m ASL
95% Recovery	5.00155 m BTOC
	137.90245 m ASL

Elapsed Time (minutes)	Elapsed Time (Recovery)	T/T'	Water Level (m BTOC)	Water Level (m ASL)	Drawdown (m)	Notes
0			4.762	138.142	0	Pumping rate = 87.3 L/min
0.716			6.329	136.575	1.567	
1.16			6.769	136.135	2.007	
2.083			7.339	135.565	2.577	
3.16			7.763	135.141	3.001	
4.183			8.299	134.605	3.537	
5.26			8.271	134.633	3.509	
6.2			8.361	134.543	3.599	
7.45			8.5	134.404	3.738	
9.13			8.639	134.265	3.877	
10.25			8.721	134.183	3.959	
11.48			8.782	134.122	4.02	
12.33			8.824	134.08	4.062	
13.2			8.863	134.041	4.101	
14.16			8.899	134.005	4.137	
15.16			8.951	133.953	4.189	
20.26			9.076	133.828	4.314	
25			9.13	133.774	4.368	
33.11			9.219	133.685	4.457	
46.41			9.308	133.596	4.546	
60.11			9.343	133.561	4.581	Sample TW2-1 @ 9:30 am
78.5			9.402	133.502	4.64	
120			9.467	133.437	4.705	
180			9.553	133.351	4.791	
240			9.536	133.368	4.774	
300.08			9.551	133.353	4.789	
325.03			9.541	133.363	4.779	Sample TW2-2 @ 2:05 pm
348			9.52	133.384	4.758	
360			9.52	133.384	4.758	
361.28	1.28	282.25	8.28	134.624	3.518	Pump off @ 361 min
362.11	2.11	171.6161	6.395	136.509	1.633	
363.16	3.16	114.9241	5.933	136.971	1.171	
364.06	4.06	89.66995	5.752	137.152	0.99	
365.01	5.01	72.85629	5.619	137.285	0.857	
366.25	6.25	58.6	5.486	137.418	0.724	
367.66	7.66	47.99739	5.398	137.506	0.636	
368.73	8.73	42.23711	5.348	137.556	0.586	
369.33	9.33	39.58521	5.319	137.585	0.557	
370.25	10.25	36.12195	5.285	137.619	0.523	
373.5	13.5	27.66667	5.19	137.714	0.428	
376.66	16.66	22.60864	5.131	137.773	0.369	
380.5	20.5	18.56098	5.083	137.821	0.321	
383.08	23.08	16.59792	5.058	137.846	0.296	
389.16	29.16	13.34568	5.01	137.894	0.248	
395.33	35.33	11.18964	4.976	137.928	0.214	

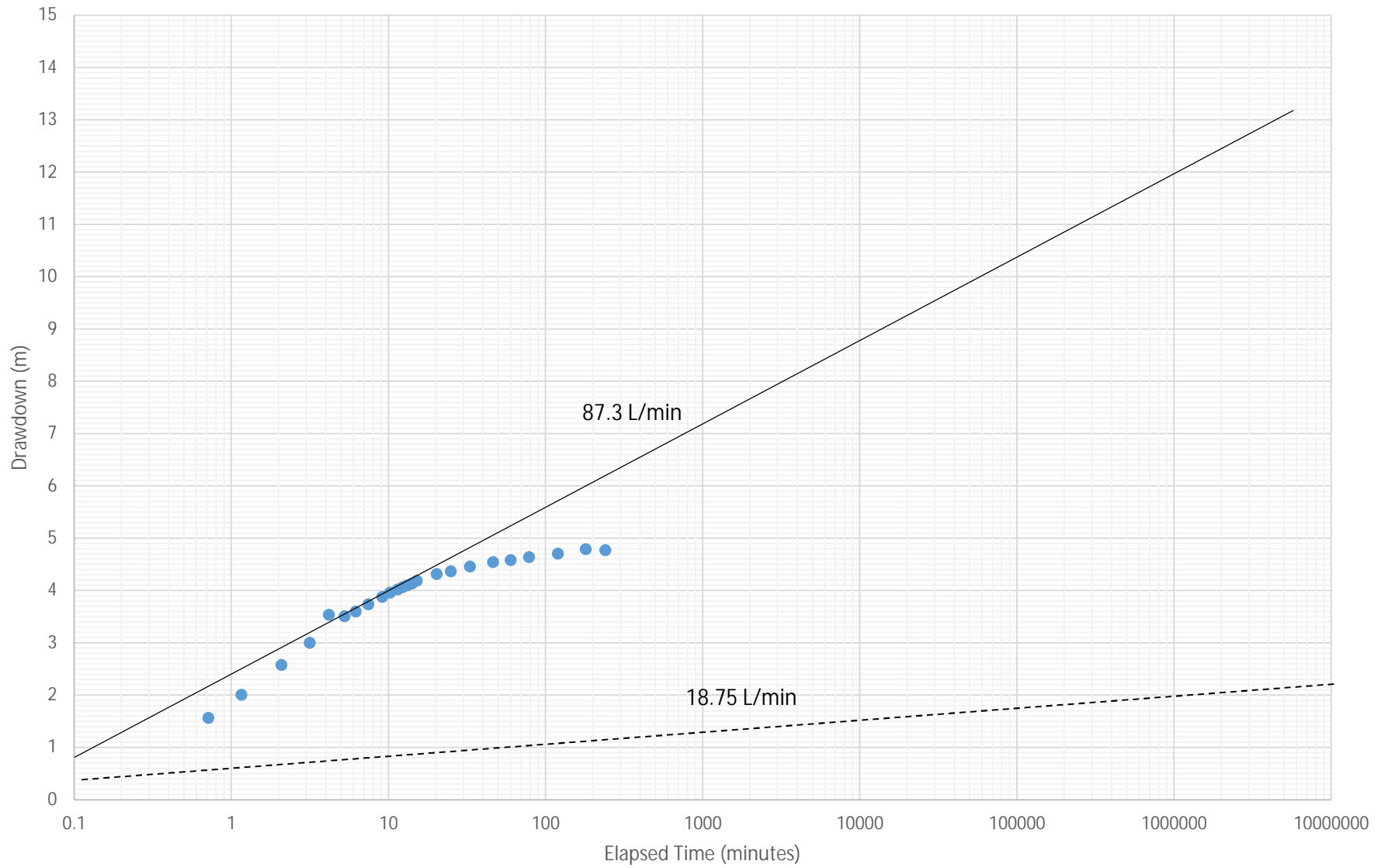
Drawdown vs Time
TW2 Pumping Test (Drawdown), July 13, 2021
Grizzly Homes, Franktown, ON



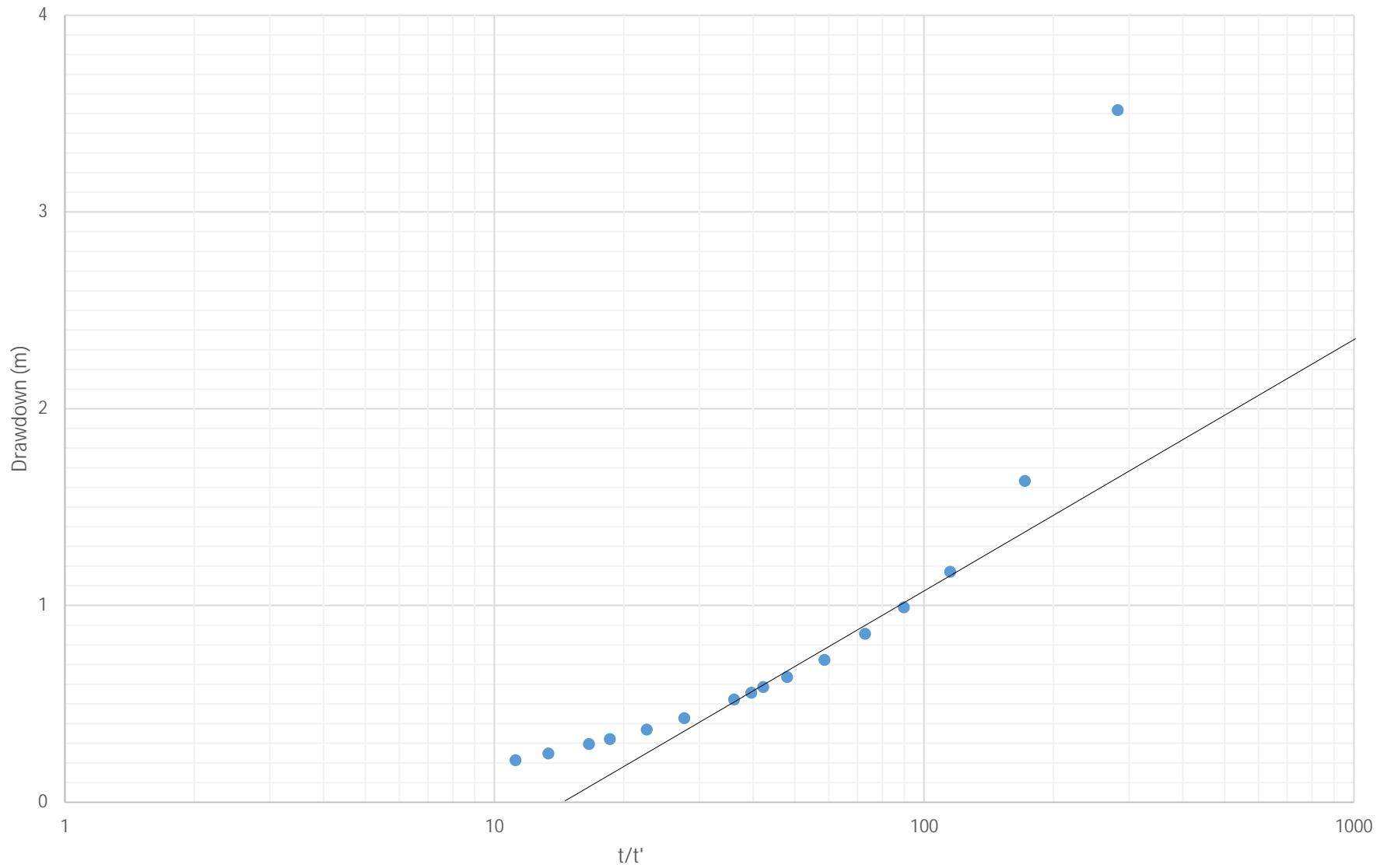
Drawdown vs Log Time
TW2 Pumping Test (Drawdown), July 13, 2021
Grizzly Homes, FranktownON



Drawdown vs Log Time
TW2 Pumping Test (Long-Term), July 13, 2021
Grizzly Homes, Franktown ON



Drawdown vs Log Time
TW2 Pumping Test (Recovery), July 13, 2021
Grizzly Homes, Franktown ON

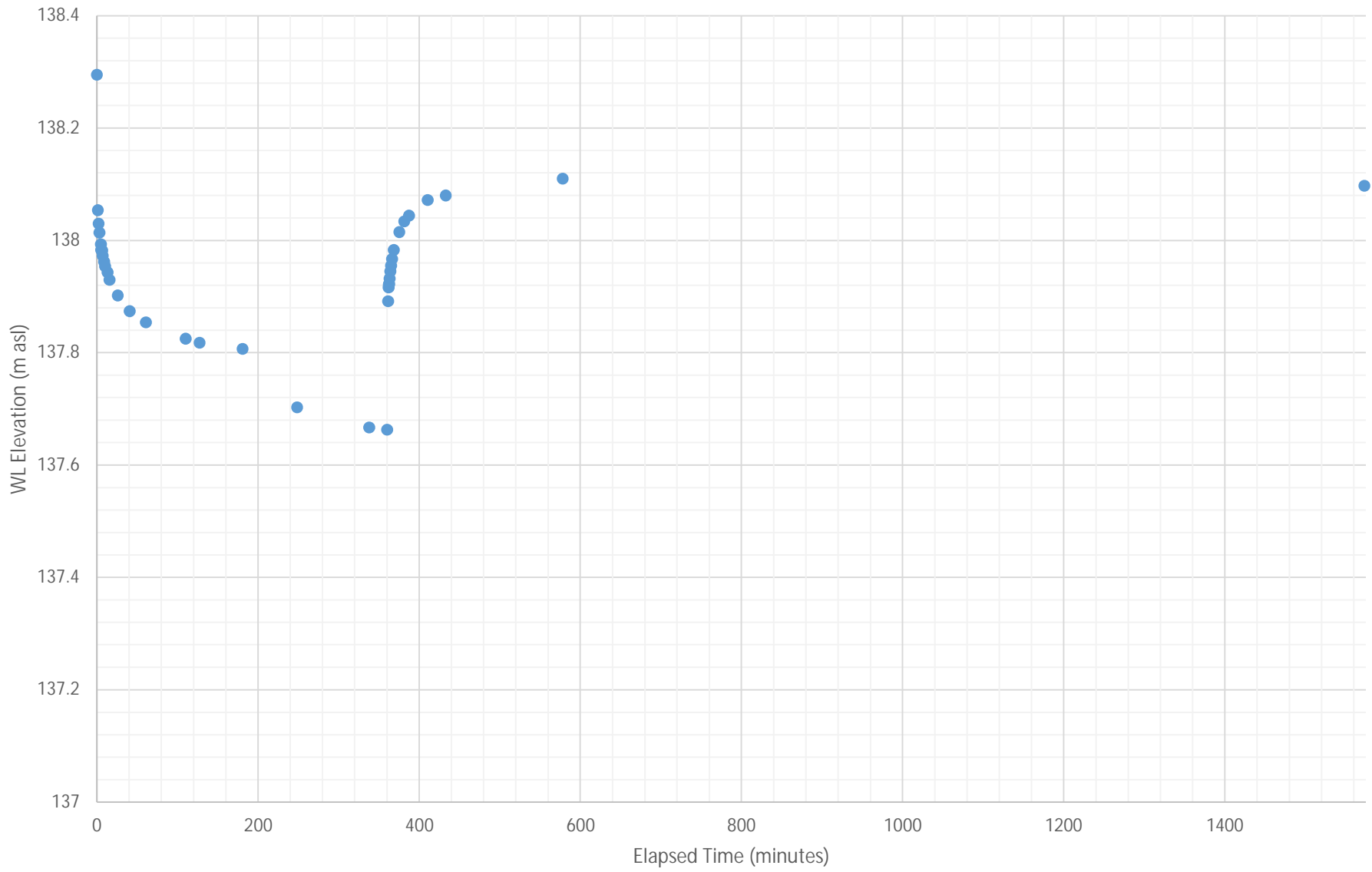


Summary of Water Level Data
Pumping Test - TW3 - July 14, 2021

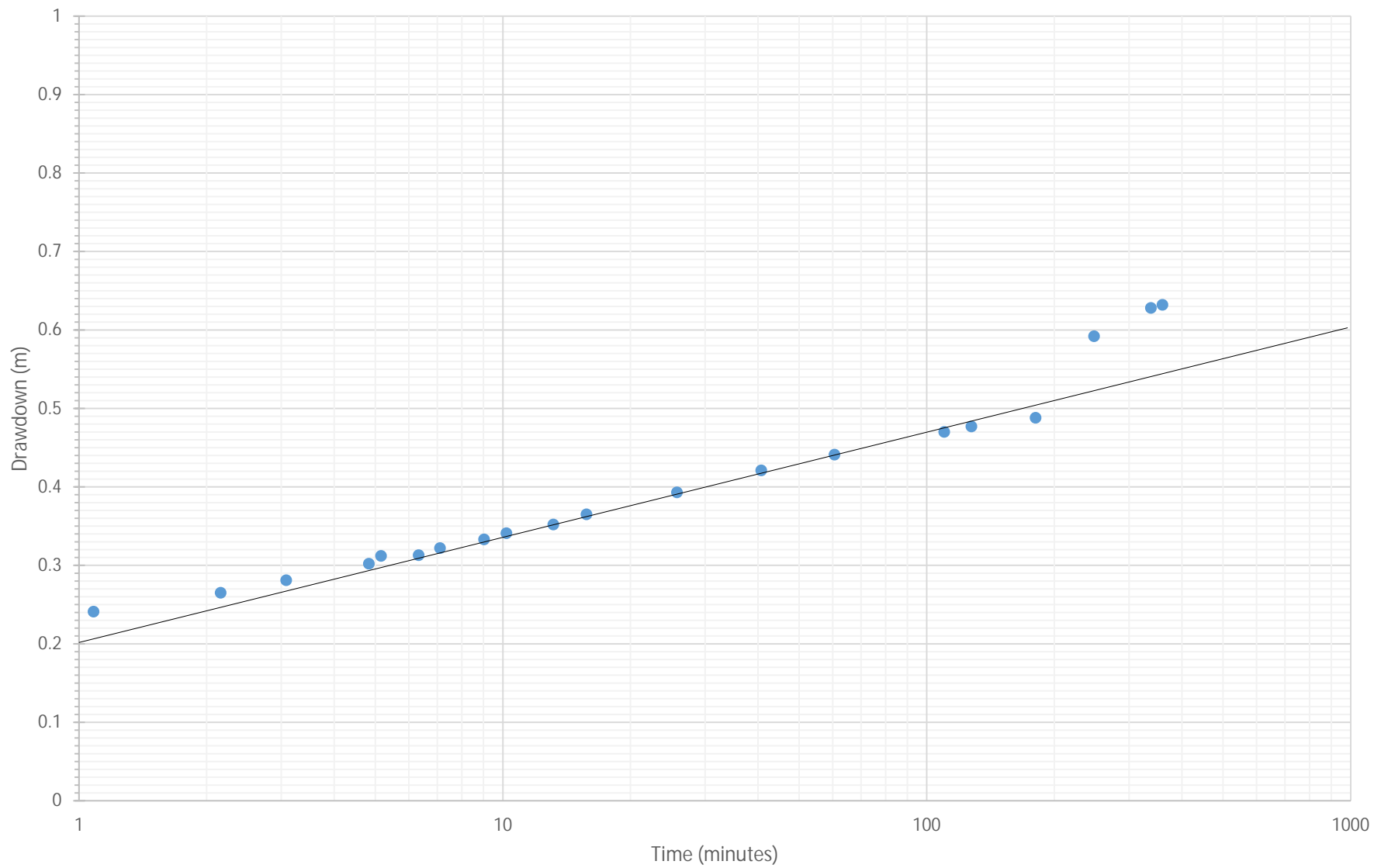
TOC Elevation	147.776 m ASL
Static Water Level	9.481 m BTOC
Stick up	0.637 m
Static Water Elevation	138.295 m ASL
95% Recovery	9.5126 m BTOC
	138.2634 m ASL

Elapsed Time (minutes)	Elapsed Time (Recovery)	T/T'	Water Level (m BTOC)	Water Level (m ASL)	Drawdown (m)	Notes
0			9.481	138.295	0	Pump on @ 8:10
1.083			9.722	138.054	0.241	90 L/min
2.16			9.746	138.03	0.265	
3.083			9.762	138.014	0.281	
4.83			9.783	137.993	0.302	
5.16			9.793	137.983	0.312	
6.33			9.794	137.982	0.313	
7.11			9.803	137.973	0.322	
9.03			9.814	137.962	0.333	
10.2			9.822	137.954	0.341	
13.16			9.833	137.943	0.352	
15.75			9.846	137.93	0.365	
25.76			9.874	137.902	0.393	
40.71			9.902	137.874	0.421	
60.61			9.922	137.854	0.441	Sample 3-1 @ 9:07 (57 min)
110.01			9.951	137.825	0.47	
127.53			9.958	137.818	0.477	
180.66			9.969	137.807	0.488	
248.26			10.073	137.703	0.592	
338			10.109	137.667	0.628	Sample 3-2 @ 1:55 (345 min)
360			10.113	137.663	0.632	
361.36	1.36	265.7059	9.884	137.892	0.403	Pump off @ 361 min
361.81	1.81	199.895	9.86	137.916	0.379	
362.2	2.2	164.6364	9.855	137.921	0.374	
362.66	2.66	136.3383	9.853	137.923	0.372	
363.25	3.25	111.7692	9.844	137.932	0.363	
364.05	4.05	89.88889	9.831	137.945	0.35	
364.95	4.95	73.72727	9.821	137.955	0.34	
366.26	6.26	58.50799	9.809	137.967	0.328	
368.36	8.36	44.0622	9.793	137.983	0.312	
375.25	15.25	24.60656	9.761	138.015	0.28	
381.36	21.36	17.85393	9.742	138.034	0.261	
387.2	27.2	14.23529	9.732	138.044	0.251	
410.5	50.5	8.128713	9.704	138.072	0.223	
432.88	71.88	6.022259	9.696	138.08	0.215	
578	217	2.663594	9.666	138.11	0.185	
1573	1212	1.297855	9.679	138.097	0.198	

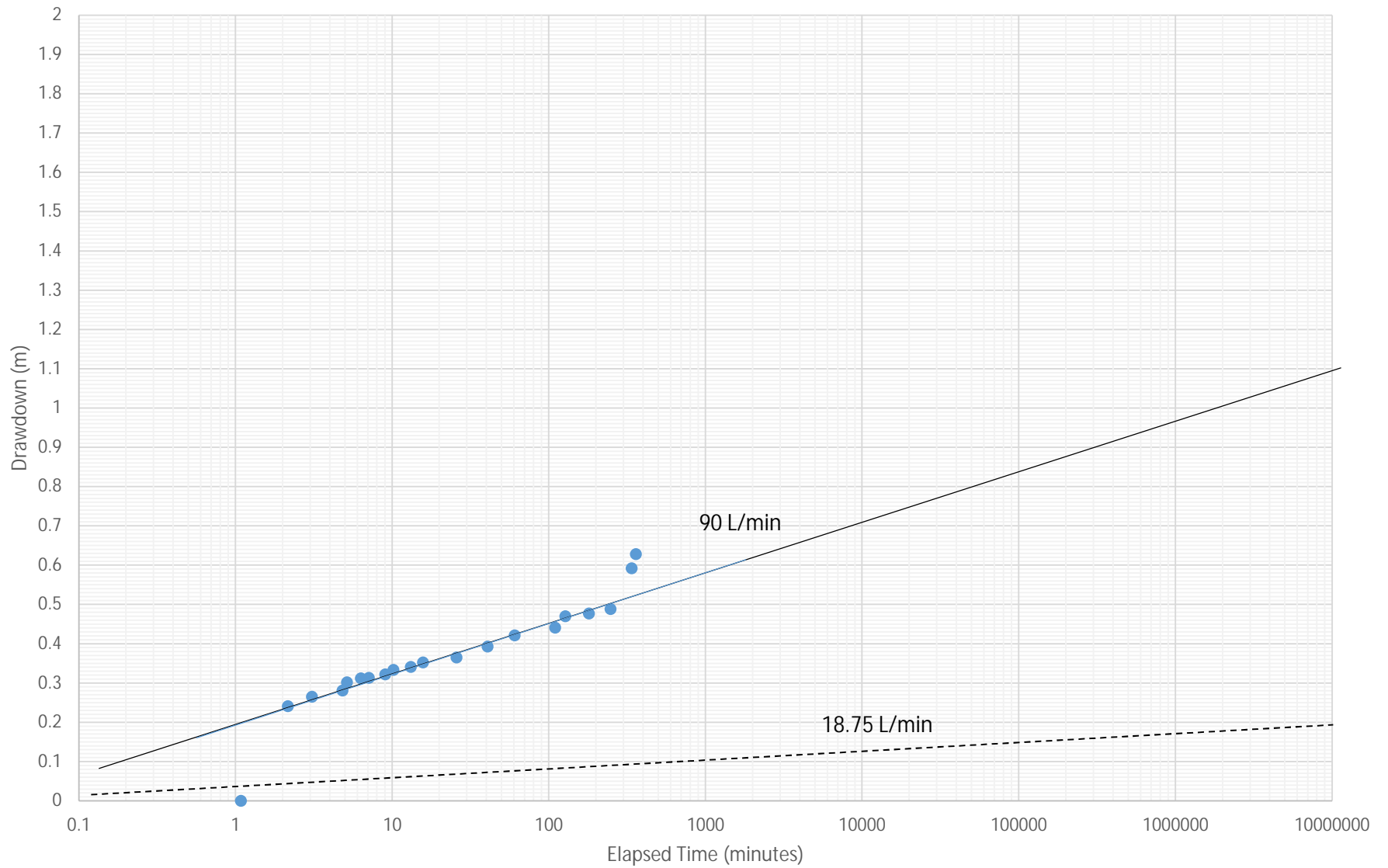
Drawdown vs Time
TW3 Pumping Test (Drawdown), July 14, 2021
Grizzly Homes, Franktown, ON



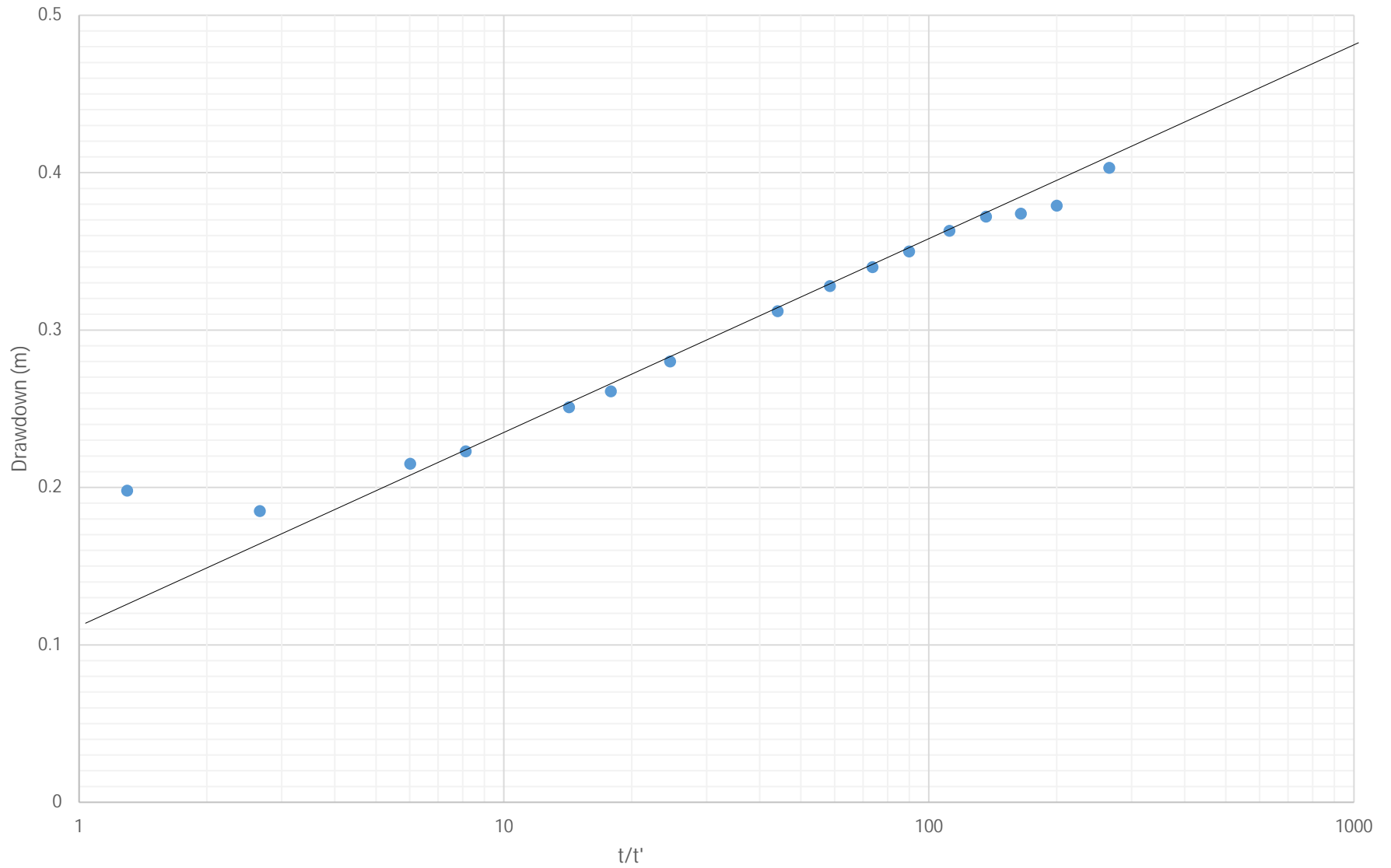
Drawdown vs Log Time
TW3 Pumping Test (Drawdown), July 14, 2021
Grizzly Homes, FranktownON



Drawdown vs Log Time
TW3 Pumping Test (Long-Term), July 14, 2021
Grizzly Homes, Franktown ON



Drawdown vs Log Time
TW3 Pumping Test (Recovery), July 14, 2021
Grizzly Homes, Franktown ON

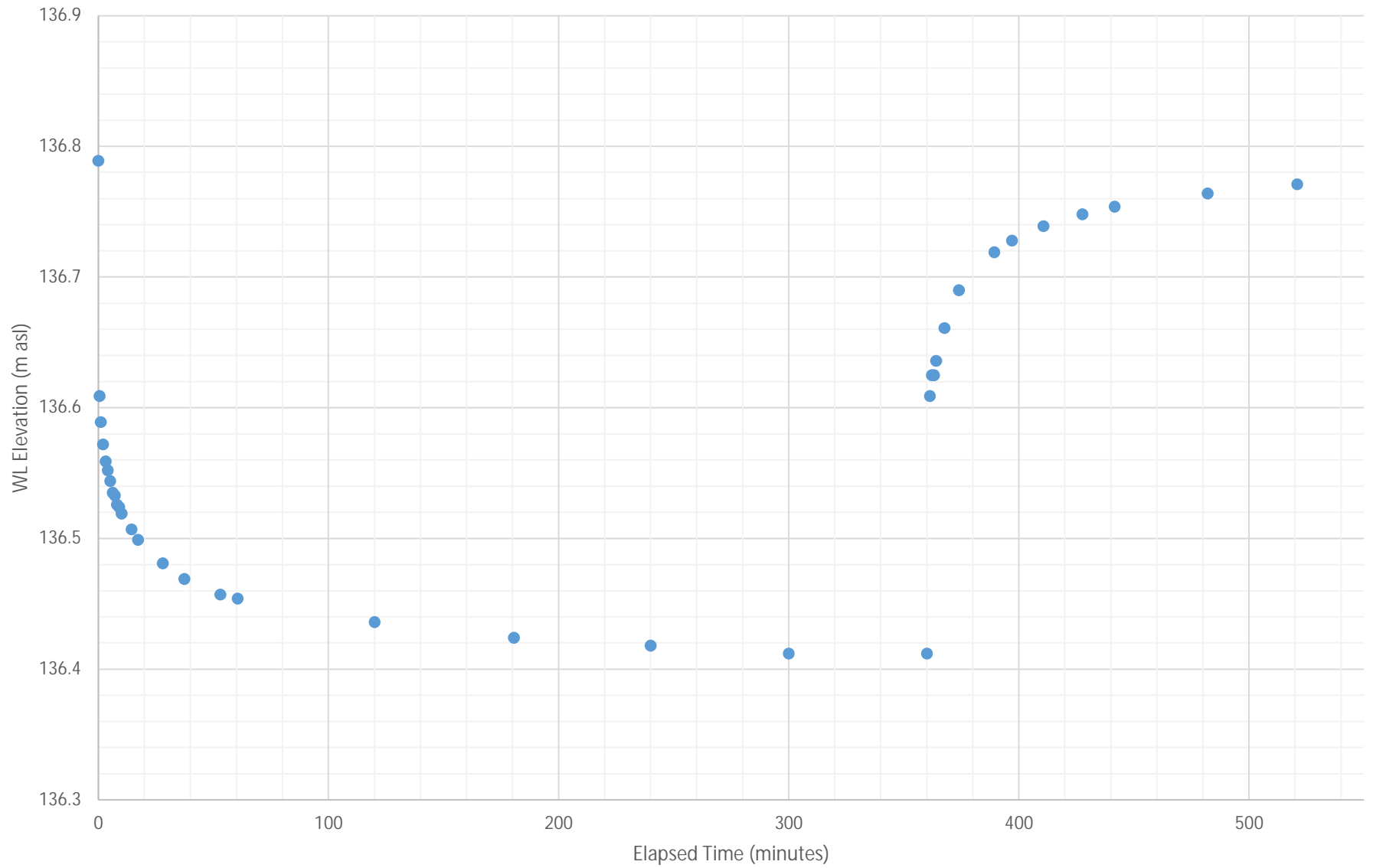


Summary of Water Level Data
Pumping Test - TW4- September 9, 2021

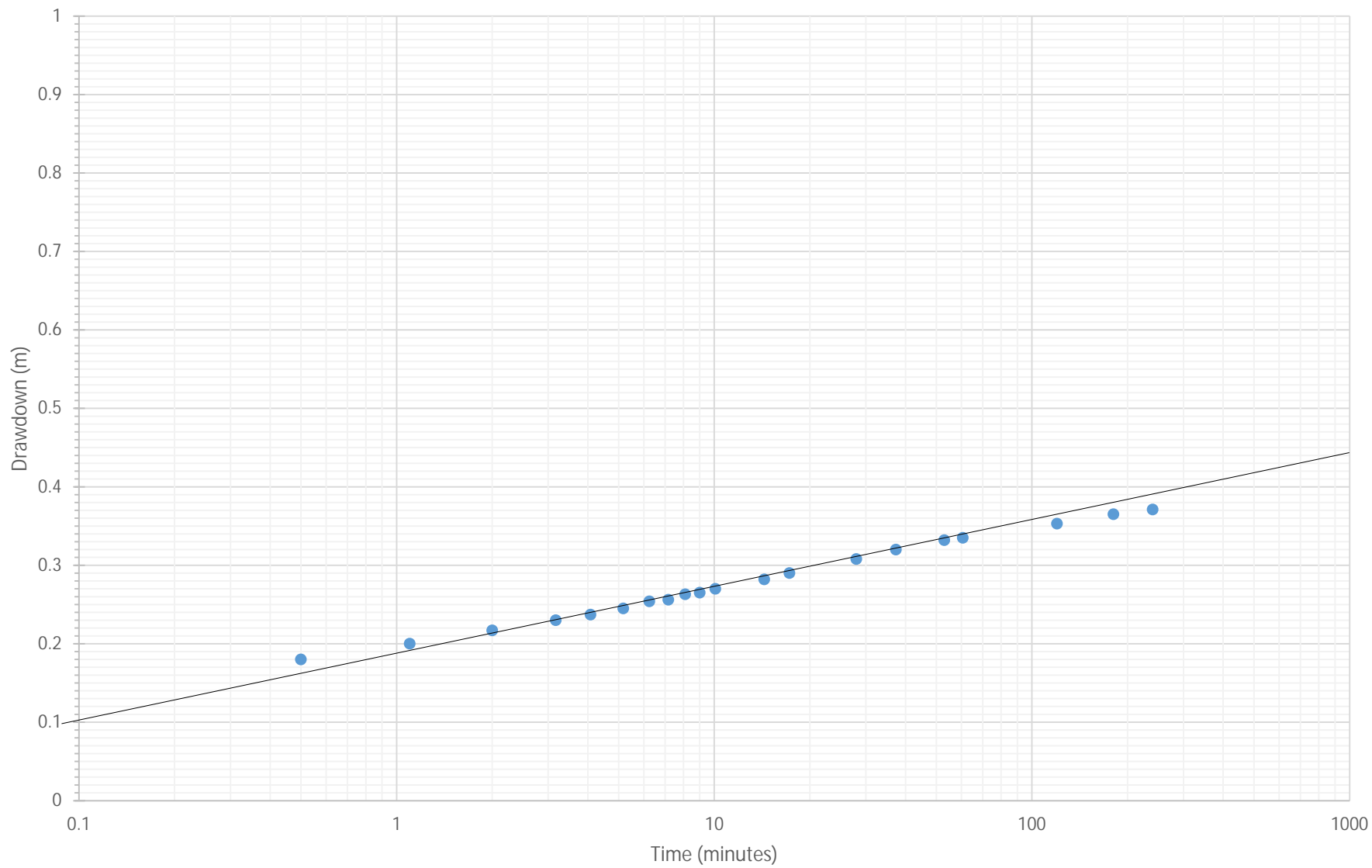
TOC Elevation	148.299 m ASL
Static Water Level	11.51 m BTOC
Stick up	0.648 m
Static Water Elevation	136.789 m ASL
95% Recovery	11.529 m BTOC
	136.77015 m ASL

Elapsed Time (minutes)	Elapsed Time (Recovery)	T/T'	Water Level (m BTOC)	Water Level (m ASL)	Drawdown (m)	Notes
0			11.51	136.789	0	
0.5			11.69	136.609	0.18	Pumping rate = 90 L/min
1.1			11.71	136.589	0.2	
2			11.727	136.572	0.217	
3.17			11.74	136.559	0.23	
4.08			11.747	136.552	0.237	
5.17			11.755	136.544	0.245	
6.25			11.764	136.535	0.254	
7.17			11.766	136.533	0.256	
8.1			11.773	136.526	0.263	
9			11.775	136.524	0.265	
10.08			11.78	136.519	0.27	
14.37			11.792	136.507	0.282	
17.25			11.8	136.499	0.29	
28			11.818	136.481	0.308	
37.33			11.83	136.469	0.32	
53			11.842	136.457	0.332	
60.58			11.845	136.454	0.335	
120			11.863	136.436	0.353	
180.58			11.875	136.424	0.365	
240			11.881	136.418	0.371	
300			11.887	136.412	0.377	
360			11.887	136.412	0.377	
361.33	1.33	271.6767	11.69	136.609	0.18	
362.17	2.17	166.8986	11.674	136.625	0.164	
363.22	3.22	112.8012	11.674	136.625	0.164	
364.02	4.02	90.55224	11.663	136.636	0.153	
367.67	7.67	47.93611	11.638	136.661	0.128	
374	14	26.71429	11.609	136.69	0.099	
389.33	29.33	13.27412	11.58	136.719	0.07	
397	37	10.72973	11.571	136.728	0.061	
410.67	50.67	8.104796	11.56	136.739	0.05	
427.63	67.63	6.323081	11.551	136.748	0.041	
441.67	81.67	5.407983	11.545	136.754	0.035	
482	122	3.95082	11.535	136.764	0.025	
521	161	3.236025	11.528	136.771	0.018	

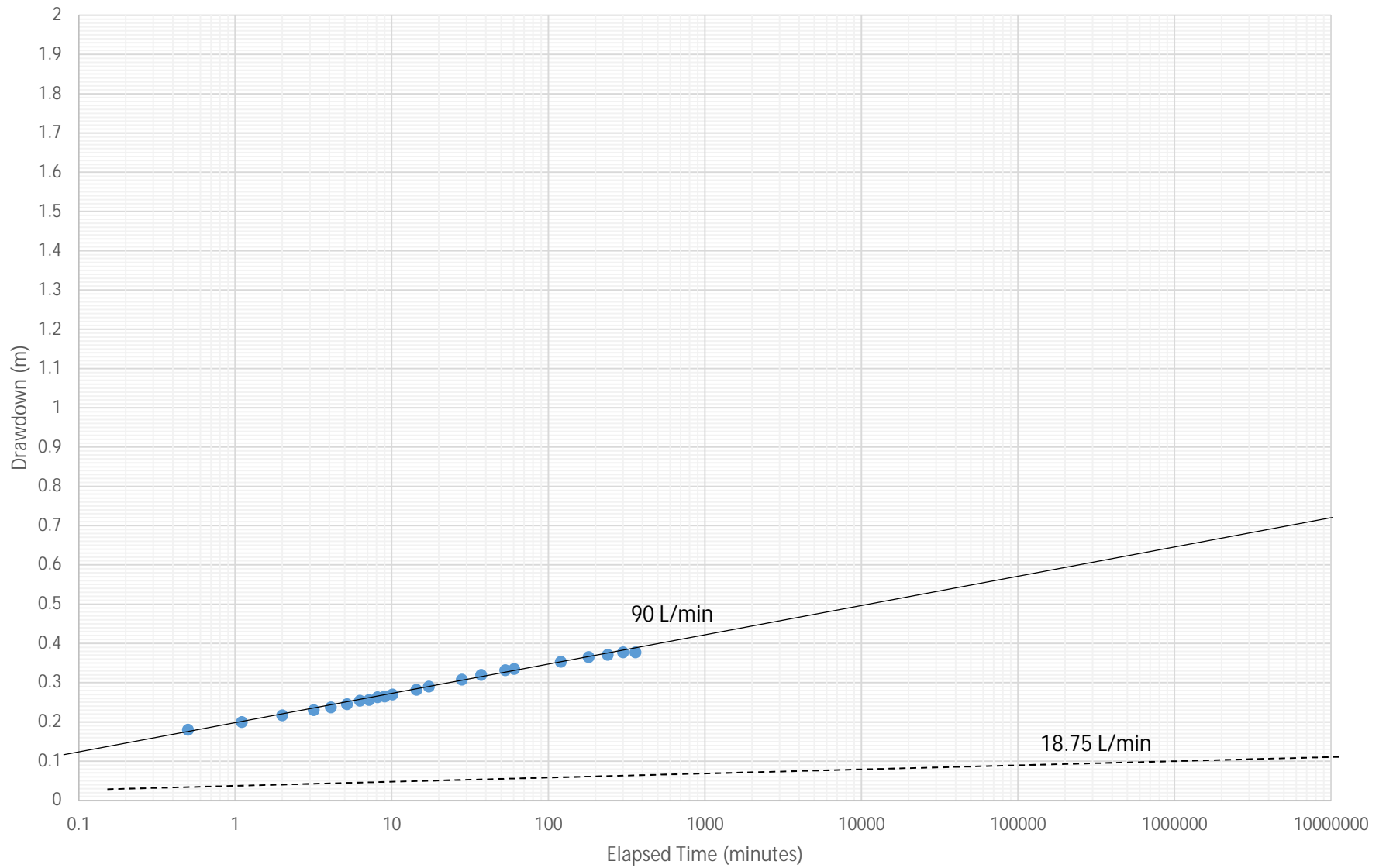
Drawdown vs Time
TW4 Pumping Test (Drawdown), September 9, 2021
Grizzly Homes, Franktown, ON



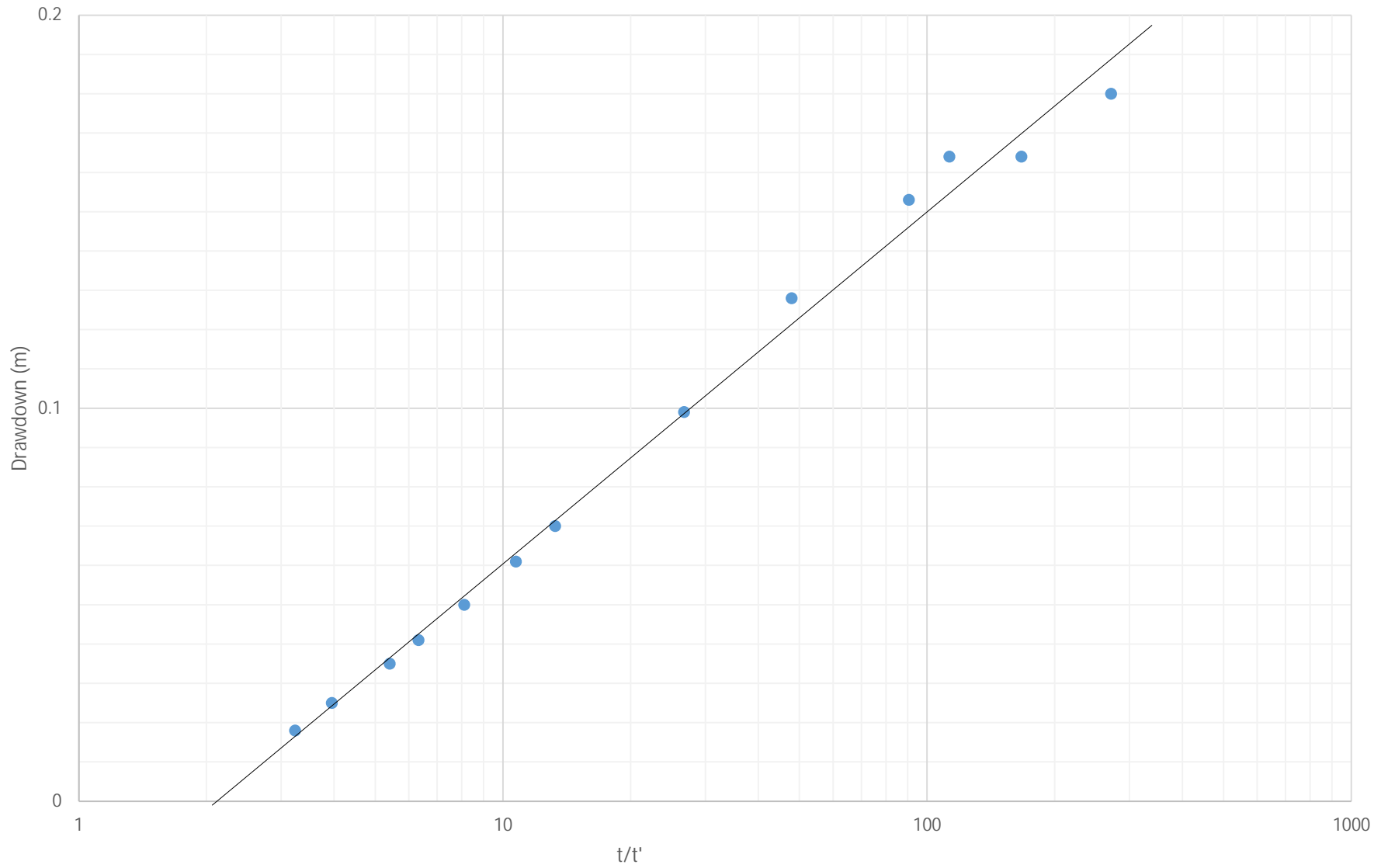
Drawdown vs Log Time
TW4 Pumping Test (Drawdown), September 9, 2021
Grizzly Homes, FranktownON



Drawdown vs Log Time
TW4 Pumping Test (Long-Term), September 9, 2021
Grizzly Homes, Franktown ON



Drawdown vs Log Time
TW4 Pumping Test (Recovery), September 9, 2021
Grizzly Homes, Franktown ON

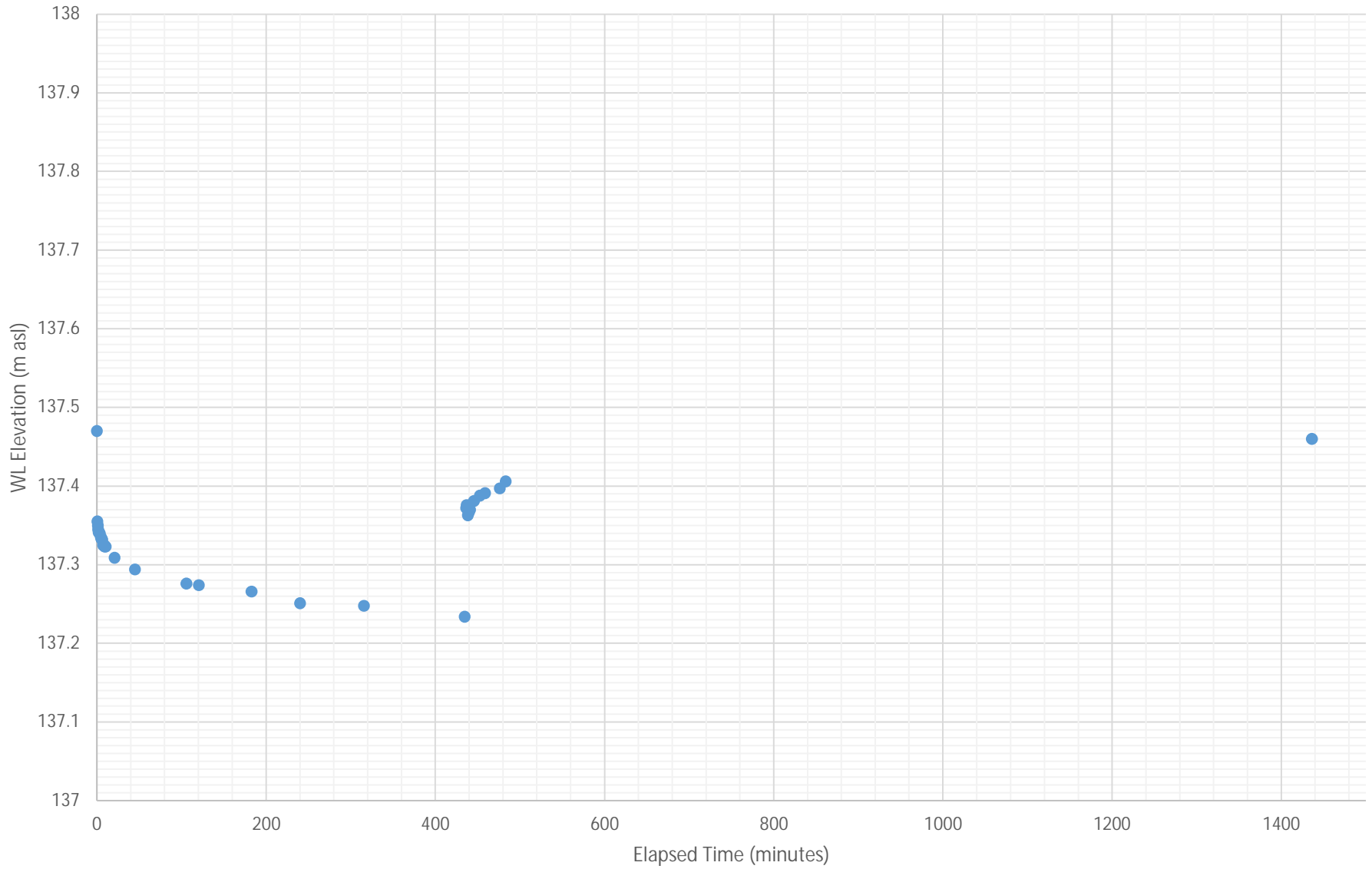


Summary of Water Level Data
Pumping Test - TW5 - July 15, 2021

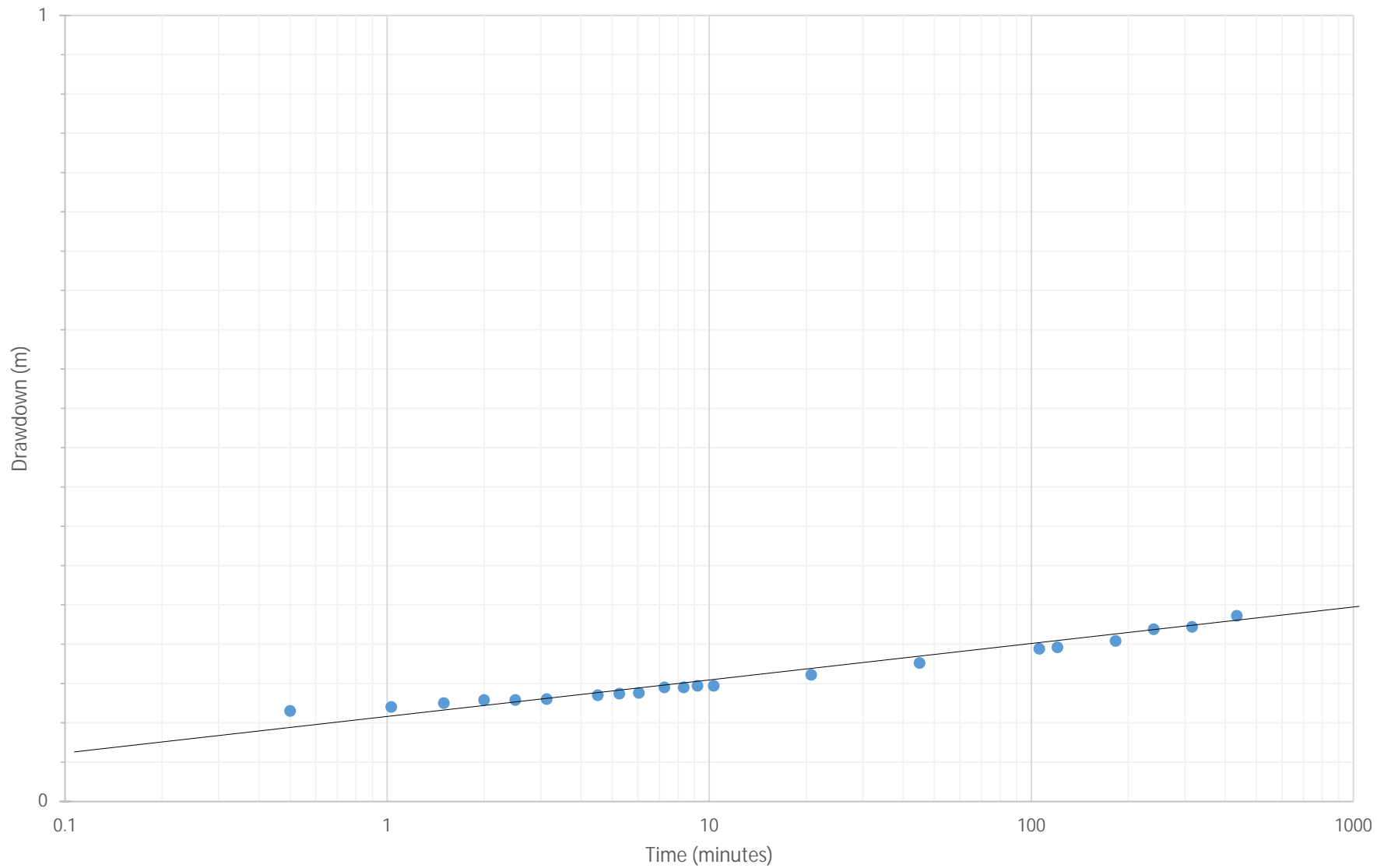
TOC Elevation	148.916 m ASL
Static Water Level	11.446 m BTOC
Stick Up	0.548 m
Static Water Elevation	137.47 m ASL
95% Recovery	11.4578 m BTOC
	137.4582 m ASL

Elapsed Time (minutes)	Elapsed Time (Recovery)	T/T'	Water Level (m BTOC)	Water Level (m ASL)	Drawdown (m)	Notes
0			11.446	137.47	0	Pumping rate = 90 L/min
0.5			11.561	137.355	0.115	
1.03			11.566	137.35	0.12	
1.5			11.571	137.345	0.125	
2			11.575	137.341	0.129	
2.5			11.575	137.341	0.129	
3.13			11.576	137.34	0.13	
4.51			11.581	137.335	0.135	
5.26			11.583	137.333	0.137	
6.05			11.584	137.332	0.138	
7.26			11.591	137.325	0.145	
8.33			11.591	137.325	0.145	
9.2			11.593	137.323	0.147	
10.33			11.593	137.323	0.147	
20.73			11.607	137.309	0.161	
45			11.622	137.294	0.176	Sample TW5-1 @ 8:45 am (50 min)
105.83			11.64	137.276	0.194	
120.6			11.64	137.274	0.196	
182.66			11.65	137.266	0.204	
240			11.665	137.251	0.219	
315.5			11.668	137.248	0.222	Sample TW5-2 @ 1:15 (320 min)
434.61			11.682	137.234	0.236	
436.33			11.544	137.372	0.098	Pump off at 436 min
437	1	437	11.54	137.376	0.094	
438.41	2.41	181.9129	11.553	137.363	0.107	
439.38	3.38	129.9941	11.55	137.366	0.104	
440.83	4.83	91.26915	11.546	137.37	0.1	
445.5	9.5	46.89474	11.535	137.381	0.089	
452.66	16.66	27.17047	11.528	137.388	0.082	
458.7	22.7	20.20705	11.525	137.391	0.079	
476.25	40.25	11.8323	11.519	137.397	0.073	
483.13	47.13	10.25101	11.51	137.406	0.064	
1436	1000	1.436	11.456	137.46	0.01	

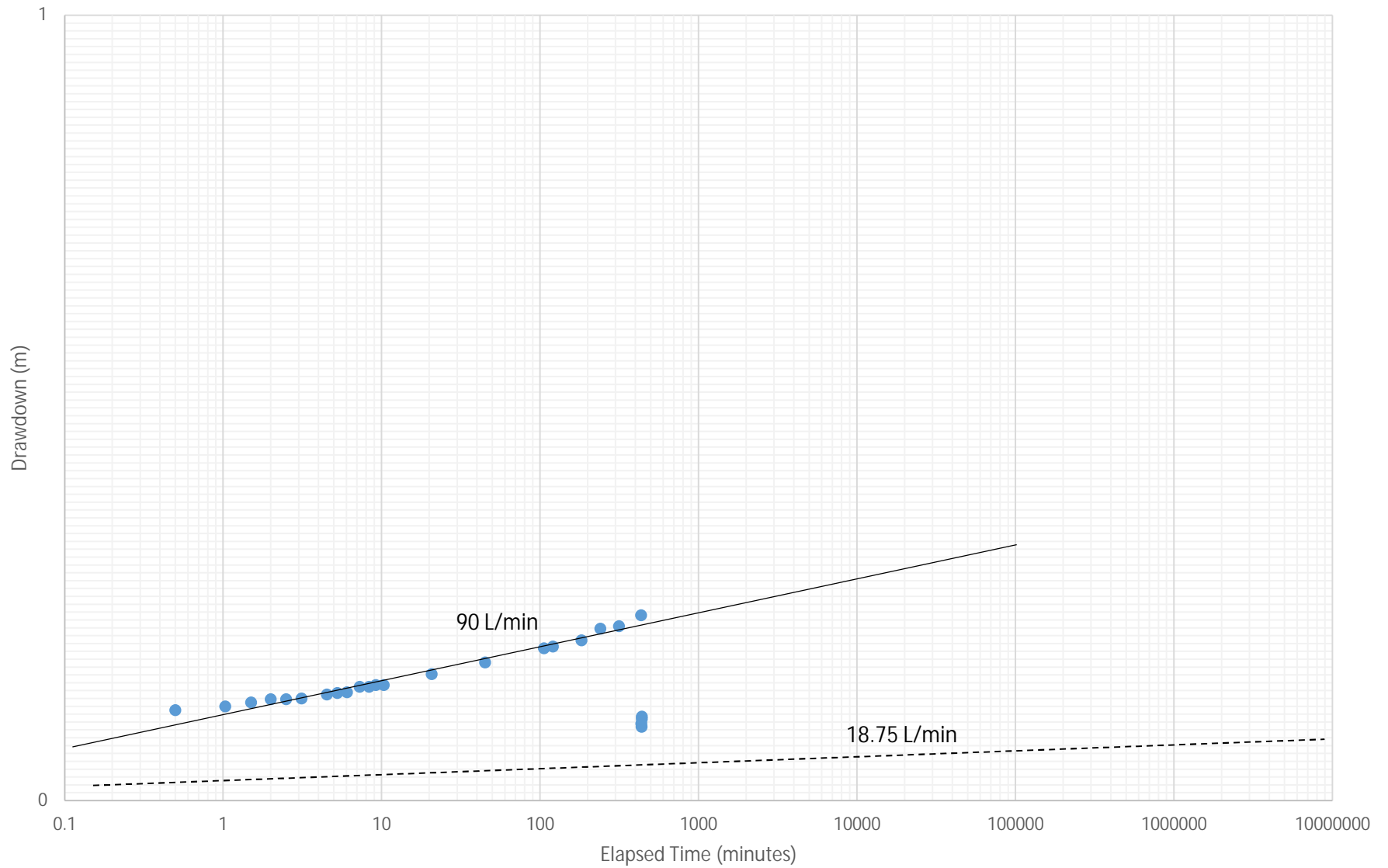
Drawdown vs Time
TW5 Pumping Test (Drawdown), July 15, 2021
Grizzly Homes, Franktown, ON



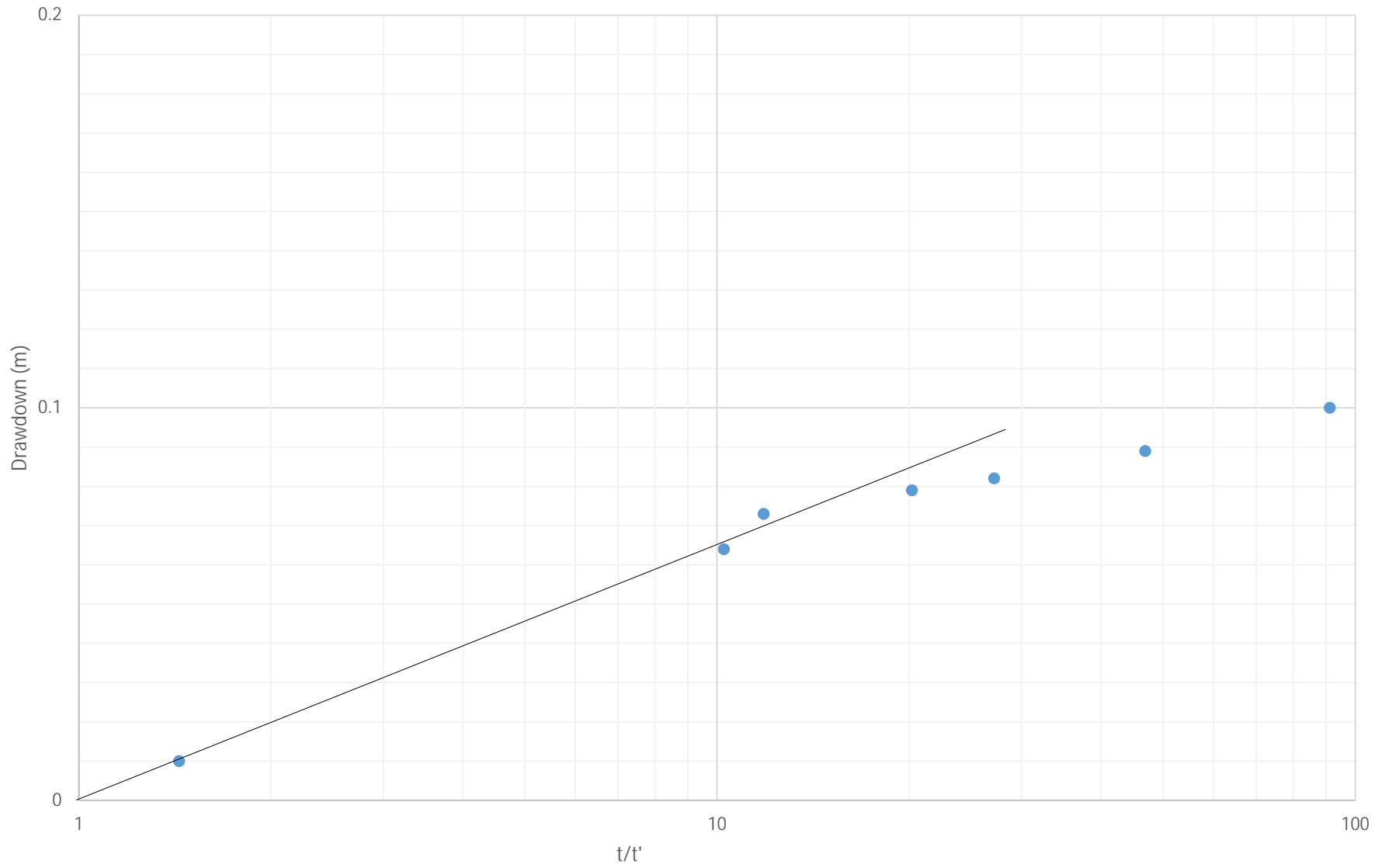
Drawdown vs Log Time
TW5 Pumping Test (Drawdown), July 15, 2021
Grizzly Homes, FranktownON



Drawdown vs Log Time
TW5 Pumping Test (Long-Term), July 15, 2021
Grizzly Homes, Franktown ON



Drawdown vs Log Time
TW5 Pumping Test (Recovery), July 15, 2021
Grizzly Homes, Franktown ON



**HYDROGEOLOGICAL ASSESSMENT AND TERRAIN
ANALYSIS
GRIZZLY HOMES SUBDIVISION, BECKWITH, ONTARIO**



APPENDIX F: LABORATORY CERTIFICATES OF ANALYSIS

Certificate of Analysis

McIntosh Perry Consulting Eng. (Carp)

115 Walgreen Rd.
Carp, ON K0A 1L0
Attn: Monica Black

Client PO: Grizzly Homes
Project: 22-0256
Custody: 15553

Report Date: 25-Jan-2022
Order Date: 19-Jan-2022

Order #: 2204155

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2204155-01	TW1-1
2204155-02	TW1-2

Approved By:



Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 25-Jan-2022

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 19-Jan-2022

Client PO: Grizzly Homes

Project Description: 22-0256

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	19-Jan-22	19-Jan-22
Ammonia, as N	EPA 351.2 - Auto Colour	24-Jan-22	24-Jan-22
Anions	EPA 300.1 - IC	19-Jan-22	19-Jan-22
Colour	SM2120 - Spectrophotometric	19-Jan-22	19-Jan-22
Conductivity	EPA 9050A- probe @25 °C	19-Jan-22	19-Jan-22
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	19-Jan-22	19-Jan-22
E. coli	MOE E3407	19-Jan-22	19-Jan-22
Fecal Coliform	SM 9222D	19-Jan-22	19-Jan-22
Heterotrophic Plate Count	SM 9215C	19-Jan-22	21-Jan-22
Metals, ICP-MS	EPA 200.8 - ICP-MS	20-Jan-22	20-Jan-22
pH	EPA 150.1 - pH probe @25 °C	19-Jan-22	19-Jan-22
Phenolics	EPA 420.2 - Auto Colour, 4AAP	20-Jan-22	20-Jan-22
Hardness	Hardness as CaCO ₃	20-Jan-22	20-Jan-22
Sulphide	SM 4500SE - Colourimetric	24-Jan-22	24-Jan-22
Tannin/Lignin	SM 5550B - Colourimetric	24-Jan-22	24-Jan-22
Total Coliform	MOE E3407	19-Jan-22	19-Jan-22
Total Dissolved Solids	SM 2540C - gravimetric, filtration	20-Jan-22	21-Jan-22
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	21-Jan-22	21-Jan-22
Turbidity	SM 2130B - Turbidity meter	19-Jan-22	19-Jan-22

Certificate of Analysis

Report Date: 25-Jan-2022

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 19-Jan-2022

Client PO: Grizzly Homes

Project Description: 22-0256

Client ID:	TW1-1	TW1-2	-	-
Sample Date:	18-Jan-22 09:52	18-Jan-22 14:22	-	-
Sample ID:	2204155-01	2204155-02	-	-
MDL/Units	Drinking Water	Drinking Water	-	-

Microbiological Parameters

E. coli	1 CFU/100mL	ND [2]	ND	-	-
Fecal Coliforms	1 CFU/100mL	ND	ND	-	-
Total Coliforms	1 CFU/100mL	ND [2]	ND	-	-
Heterotrophic Plate Count	10 CFU/mL	170	70	-	-

General Inorganics

Alkalinity, total	5 mg/L	254	252	-	-
Ammonia as N	0.01 mg/L	0.04	0.05	-	-
Dissolved Organic Carbon	0.5 mg/L	2.3	2.3	-	-
Colour	2 TCU	17	16	-	-
Conductivity	5 uS/cm	546	528	-	-
Hardness	mg/L	255	256	-	-
pH	0.1 pH Units	7.5	7.5	-	-
Phenolics	0.001 mg/L	<0.001	<0.001	-	-
Total Dissolved Solids	10 mg/L	288	300	-	-
Sulphide	0.02 mg/L	<0.02	<0.02	-	-
Tannin & Lignin	0.1 mg/L	<0.1	<0.1	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.1	<0.1	-	-
Turbidity	0.1 NTU	7.4	5.7	-	-

Anions

Chloride	1 mg/L	13	12	-	-
Fluoride	0.1 mg/L	0.3	0.3	-	-
Nitrate as N	0.1 mg/L	<0.1	<0.1	-	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	-	-
Sulphate	1 mg/L	15	14	-	-

Metals

Calcium	0.1 mg/L	71.0	70.8	-	-
Iron	0.1 mg/L	0.9	0.9	-	-
Magnesium	0.2 mg/L	18.9	19.3	-	-
Manganese	0.005 mg/L	0.078	0.078	-	-
Potassium	0.1 mg/L	2.5	2.5	-	-
Sodium	0.2 mg/L	5.6	5.5	-	-

Certificate of Analysis

Report Date: 25-Jan-2022

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 19-Jan-2022

Client PO: Grizzly Homes

Project Description: 22-0256

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Calcium	ND	0.1	mg/L						
Iron	ND	0.1	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Potassium	ND	0.1	mg/L						
Sodium	ND	0.2	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100mL						
Fecal Coliforms	ND	1	CFU/100mL						
Total Coliforms	ND	1	CFU/100mL						
Heterotrophic Plate Count	ND	10	CFU/mL						

Certificate of Analysis

Report Date: 25-Jan-2022

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 19-Jan-2022

Client PO: Grizzly Homes

Project Description: 22-0256

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	20.0	1	mg/L	20.1			0.2	10	
Fluoride	0.25	0.1	mg/L	0.24			1.7	10	
Nitrate as N	3.92	0.1	mg/L	3.94			0.5	10	
Nitrite as N	1.69	0.05	mg/L	1.68			0.4	10	
Sulphate	22.0	1	mg/L	22.1			0.3	10	
General Inorganics									
Alkalinity, total	251	5	mg/L	253			1.0	14	
Ammonia as N	0.048	0.01	mg/L	0.048			1.0	17.7	
Dissolved Organic Carbon	1.9	0.5	mg/L	1.4			27.8	37	
Colour	17	2	TCU	16			6.1	12	
Conductivity	574	5	uS/cm	599			4.2	5	
pH	7.6	0.1	pH Units	7.6			0.8	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	146	10	mg/L	152			4.0	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	0.2	0.1	mg/L	0.2			8.7	11	
Total Kjeldahl Nitrogen	0.10	0.1	mg/L	0.10			3.6	16	
Turbidity	7.5	0.1	NTU	7.4			1.2	10	
Metals									
Calcium	90.6	0.1	mg/L	91.3			0.7	20	
Iron	ND	0.1	mg/L	ND			NC	20	
Magnesium	35.1	0.2	mg/L	34.8			0.8	20	
Manganese	0.038	0.005	mg/L	0.037			3.1	20	
Potassium	2.5	0.1	mg/L	2.5			2.0	20	
Sodium	26.5	0.2	mg/L	26.7			0.8	20	
Microbiological Parameters									
Heterotrophic Plate Count	120	10	CFU/mL	170			34.0	30	BAC04

Certificate of Analysis

Report Date: 25-Jan-2022

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 19-Jan-2022

Client PO: Grizzly Homes

Project Description: 22-0256

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	29.5	1	mg/L	20.1	94.5	77-123			
Fluoride	1.18	0.1	mg/L	0.24	93.9	79-121			
Nitrate as N	4.83	0.1	mg/L	3.94	88.7	79-120			
Nitrite as N	2.62	0.05	mg/L	1.68	94.5	84-117			
Sulphate	31.6	1	mg/L	22.1	95.1	74-126			
General Inorganics									
Ammonia as N	0.307	0.01	mg/L	0.048	104	81-124			
Dissolved Organic Carbon	12.4	0.5	mg/L	1.4	110	60-133			
Phenolics	0.025	0.001	mg/L	ND	100	67-133			
Total Dissolved Solids	86.0	10	mg/L	ND	86.0	75-125			
Sulphide	0.54	0.02	mg/L	ND	107	79-115			
Tannin & Lignin	1.1	0.1	mg/L	0.2	91.9	71-113			
Total Kjeldahl Nitrogen	2.33	0.1	mg/L	0.10	111	81-126			
Metals									
Calcium	95800	0.1	mg/L	91300	45.4	80-120			QM-07
Iron	2300	0.1	mg/L	12.4	91.5	80-120			
Magnesium	42100	0.2	mg/L	34800	72.8	80-120			QM-07
Manganese	86.9	0.005	mg/L	36.8	100	80-120			
Potassium	11900	0.1	mg/L	2530	93.3	80-120			
Sodium	34100	0.2	mg/L	26700	73.8	80-120			QM-07

Certificate of Analysis

Report Date: 25-Jan-2022

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 19-Jan-2022

Client PO: Grizzly Homes

Project Description: 22-0256

Qualifier Notes:

Sample Qualifiers :

2 : A2C - Background counts greater than 200

QC Qualifiers :

BAC04 : Duplicate QC data falls within method prescribed 95% confidence limits.

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

Certificate of Analysis

McIntosh Perry Consulting Eng. (Carp)

115 Walgreen Rd.
Carp, ON K0A 1L0
Attn: Monica Black

Client PO: Grizzly Homes Subdivision
Project: 22-0256
Custody: 60213

Report Date: 16-Jul-2021
Order Date: 13-Jul-2021

Order #: 2129274

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Parcel ID	Client ID
2129274-01	TW2-1
2129274-02	TW2-2

Approved By:



Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 16-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 13-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	14-Jul-21	14-Jul-21
Ammonia, as N	EPA 351.2 - Auto Colour	14-Jul-21	14-Jul-21
Anions	EPA 300.1 - IC	14-Jul-21	14-Jul-21
Colour	SM2120 - Spectrophotometric	14-Jul-21	14-Jul-21
Conductivity	EPA 9050A- probe @25 °C	14-Jul-21	14-Jul-21
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	14-Jul-21	14-Jul-21
E. coli	MOE E3407	14-Jul-21	15-Jul-21
Fecal Coliform	SM 9222D	14-Jul-21	15-Jul-21
Heterotrophic Plate Count	SM 9215C	14-Jul-21	16-Jul-21
Metals, ICP-MS	EPA 200.8 - ICP-MS	14-Jul-21	14-Jul-21
pH	EPA 150.1 - pH probe @25 °C	14-Jul-21	14-Jul-21
Phenolics	EPA 420.2 - Auto Colour, 4AAP	14-Jul-21	14-Jul-21
Hardness	Hardness as CaCO ₃	14-Jul-21	14-Jul-21
Sulphide	SM 4500SE - Colourimetric	15-Jul-21	16-Jul-21
Tannin/Lignin	SM 5550B - Colourimetric	15-Jul-21	15-Jul-21
Total Coliform	MOE E3407	14-Jul-21	15-Jul-21
Total Dissolved Solids	SM 2540C - gravimetric, filtration	14-Jul-21	15-Jul-21
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	14-Jul-21	15-Jul-21
Turbidity	SM 2130B - Turbidity meter	14-Jul-21	14-Jul-21

Certificate of Analysis

Report Date: 16-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 13-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Client ID:	TW2-1	TW2-2	-	-
Sample Date:	13-Jul-21 09:30	13-Jul-21 14:05	-	-
Sample ID:	2129274-01	2129274-02	-	-
MDL/Units	Water	Water	-	-

Microbiological Parameters

E. coli	1 CFU/100 mL	ND	ND	-	-
Fecal Coliforms	1 CFU/100 mL	ND	ND	-	-
Total Coliforms	1 CFU/100 mL	ND	ND	-	-
Heterotrophic Plate Count	10 CFU/mL	<10	<10	-	-

General Inorganics

Alkalinity, total	5 mg/L	272	269	-	-
Ammonia as N	0.01 mg/L	0.05	0.06	-	-
Dissolved Organic Carbon	0.5 mg/L	2.0	1.8	-	-
Colour	2 TCU	2	3	-	-
Conductivity	5 uS/cm	620	614	-	-
Hardness	mg/L	293	293	-	-
pH	0.1 pH Units	7.7	7.7	-	-
Phenolics	0.001 mg/L	<0.001	<0.001	-	-
Total Dissolved Solids	10 mg/L	332	314	-	-
Sulphide	0.02 mg/L	<0.02	<0.02	-	-
Tannin & Lignin	0.1 mg/L	<0.1	<0.1	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	<0.1	<0.1	-	-
Turbidity	0.1 NTU	12.5	1.2	-	-

Anions

Chloride	1 mg/L	21	20	-	-
Fluoride	0.1 mg/L	0.2	0.2	-	-
Nitrate as N	0.1 mg/L	0.6	0.5	-	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	-	-
Sulphate	1 mg/L	16	17	-	-

Metals

Calcium	0.1 mg/L	80.0	80.3	-	-
Iron	0.1 mg/L	0.3	<0.1	-	-
Magnesium	0.2 mg/L	22.6	22.4	-	-
Manganese	0.005 mg/L	0.053	0.059	-	-
Potassium	0.1 mg/L	3.0	2.7	-	-
Sodium	0.2 mg/L	9.3	8.5	-	-

Certificate of Analysis

Report Date: 16-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 13-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Calcium	ND	0.1	mg/L						
Iron	ND	0.1	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Potassium	ND	0.1	mg/L						
Sodium	ND	0.2	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						
Heterotrophic Plate Count	ND	10	CFU/mL						

Certificate of Analysis

Report Date: 16-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 13-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	23.4	1	mg/L	23.4			0.1	10	
Fluoride	0.89	0.1	mg/L	0.89			0.9	10	
Nitrate as N	ND	0.1	mg/L	ND			NC	10	
Nitrite as N	ND	0.05	mg/L	ND			NC	10	
Sulphate	47.4	1	mg/L	47.3			0.4	10	
General Inorganics									
Alkalinity, total	30.9	5	mg/L	31.4			1.6	14	
Ammonia as N	0.057	0.01	mg/L	0.049			16.2	17.7	
Dissolved Organic Carbon	2.8	0.5	mg/L	3.2			14.1	37	
Colour	3	2	TCU	3			0.0	12	
Conductivity	151	5	uS/cm	154			1.6	5	
pH	9.1	0.1	pH Units	9.1			0.1	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	80.0	10	mg/L	78.0			2.5	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	ND	0.1	mg/L	ND			NC	11	
Total Kjeldahl Nitrogen	ND	0.1	mg/L	ND			NC	16	
Turbidity	13.0	0.1	NTU	12.5			3.9	10	
Metals									
Calcium	33.2	0.1	mg/L	33.2			0.1	20	
Iron	ND	0.1	mg/L	ND			NC	20	
Magnesium	5.7	0.2	mg/L	6.4			11.0	20	
Manganese	0.108	0.005	mg/L	0.106			1.1	20	
Potassium	1.9	0.1	mg/L	1.9			0.7	20	
Sodium	6.7	0.2	mg/L	6.6			1.0	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100 mL	ND			NC	30	
Total Coliforms	ND	1	CFU/100 mL	ND			NC	30	
Heterotrophic Plate Count	ND	10	CFU/mL	ND			NC	30	

Certificate of Analysis

Report Date: 16-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 13-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	32.7	1	mg/L	23.4	93.8	77-123			
Fluoride	1.84	0.1	mg/L	0.89	95.4	79-121			
Nitrate as N	1.02	0.1	mg/L	ND	102	79-120			
Nitrite as N	0.926	0.05	mg/L	ND	92.6	84-117			
Sulphate	56.5	1	mg/L	47.3	92.6	74-126			
General Inorganics									
Ammonia as N	0.325	0.01	mg/L	0.049	111	81-124			
Dissolved Organic Carbon	15.6	0.5	mg/L	3.2	123	60-133			
Phenolics	0.025	0.001	mg/L	ND	100	69-132			
Total Dissolved Solids	94.0	10	mg/L	ND	94.0	75-125			
Sulphide	0.50	0.02	mg/L	ND	101	79-115			
Tannin & Lignin	1.0	0.1	mg/L	ND	103	71-113			
Total Kjeldahl Nitrogen	1.97	0.1	mg/L	ND	98.7	81-126			
Metals									
Calcium	41000	0.1	mg/L	33200	78.6	80-120			QM-07
Iron	2360	0.1	mg/L	10.5	94.2	80-120			
Magnesium	14400	0.2	mg/L	6410	79.8	80-120			QM-07
Manganese	151	0.005	mg/L	106	88.5	80-120			
Potassium	11200	0.1	mg/L	1910	92.5	80-120			
Sodium	15400	0.2	mg/L	6600	88.1	80-120			

Certificate of Analysis

Report Date: 16-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 13-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Qualifier Notes:

Sample Qualifiers :

QC Qualifiers :

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

Certificate of Analysis

McIntosh Perry Consulting Eng. (Carp)

115 Walgreen Rd.
Carp, ON K0A 1L0
Attn: Monica Black

Client PO: Grizzly Homes Subdivision
Project: 22-0256
Custody: 60211

Report Date: 19-Jul-2021
Order Date: 14-Jul-2021

Revised Report

Order #: 2129422

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Parcel ID	Client ID
2129422-01	TW3-1
2129422-02	TW3-2

Approved By:



Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 19-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 14-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	15-Jul-21	15-Jul-21
Ammonia, as N	EPA 351.2 - Auto Colour	16-Jul-21	16-Jul-21
Anions	EPA 300.1 - IC	15-Jul-21	15-Jul-21
Colour	SM2120 - Spectrophotometric	15-Jul-21	15-Jul-21
Conductivity	EPA 9050A- probe @25 °C	15-Jul-21	15-Jul-21
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	15-Jul-21	15-Jul-21
E. coli	MOE E3407	15-Jul-21	16-Jul-21
Fecal Coliform	SM 9222D	15-Jul-21	16-Jul-21
Heterotrophic Plate Count	SM 9215C	15-Jul-21	17-Jul-21
Metals, ICP-MS	EPA 200.8 - ICP-MS	15-Jul-21	15-Jul-21
pH	EPA 150.1 - pH probe @25 °C	15-Jul-21	15-Jul-21
Phenolics	EPA 420.2 - Auto Colour, 4AAP	16-Jul-21	16-Jul-21
Hardness	Hardness as CaCO ₃	15-Jul-21	15-Jul-21
Sulphide	SM 4500SE - Colourimetric	15-Jul-21	16-Jul-21
Tannin/Lignin	SM 5550B - Colourimetric	15-Jul-21	15-Jul-21
Total Coliform	MOE E3407	15-Jul-21	16-Jul-21
Total Dissolved Solids	SM 2540C - gravimetric, filtration	15-Jul-21	16-Jul-21
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	15-Jul-21	15-Jul-21
Turbidity	SM 2130B - Turbidity meter	15-Jul-21	15-Jul-21

Certificate of Analysis

Report Date: 19-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 14-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Client ID:	TW3-1	TW3-2	-	-
Sample Date:	14-Jul-21 09:07	14-Jul-21 13:55	-	-
Sample ID:	2129422-01	2129422-02	-	-
MDL/Units	Water	Water	-	-

Microbiological Parameters

E. coli	1 CFU/100 mL	ND	ND	-	-
Fecal Coliforms	1 CFU/100 mL	ND	ND	-	-
Total Coliforms	1 CFU/100 mL	ND	ND	-	-
Heterotrophic Plate Count	10 CFU/mL	<10	<10	-	-

General Inorganics

Alkalinity, total	5 mg/L	279	280	-	-
Ammonia as N	0.01 mg/L	0.05	0.05	-	-
Dissolved Organic Carbon	0.5 mg/L	0.9	1.0	-	-
Colour	2 TCU	<2	<2	-	-
Conductivity	5 uS/cm	668	678	-	-
Hardness	mg/L	282	283	-	-
pH	0.1 pH Units	7.7	7.7	-	-
Phenolics	0.001 mg/L	<0.001	<0.001	-	-
Total Dissolved Solids	10 mg/L	334	356	-	-
Sulphide	0.02 mg/L	<0.02	<0.02	-	-
Tannin & Lignin	0.1 mg/L	<0.1	<0.1	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.1	<0.1	-	-
Turbidity	0.1 NTU	30.2	6.3	-	-

Anions

Chloride	1 mg/L	27	28	-	-
Fluoride	0.1 mg/L	<0.1	<0.1	-	-
Nitrate as N	0.1 mg/L	2.5	2.4	-	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	-	-
Sulphate	1 mg/L	15	15	-	-

Metals

Calcium	0.1 mg/L	75.7	75.5	-	-
Iron	0.1 mg/L	0.4	0.1	-	-
Magnesium	0.2 mg/L	22.7	22.9	-	-
Manganese	0.005 mg/L	0.026	0.010	-	-
Potassium	0.1 mg/L	4.2	3.6	-	-
Sodium	0.2 mg/L	13.4	13.3	-	-

Certificate of Analysis

Report Date: 19-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 14-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Calcium	ND	0.1	mg/L						
Iron	ND	0.1	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Potassium	ND	0.1	mg/L						
Sodium	ND	0.2	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						
Heterotrophic Plate Count	ND	10	CFU/mL						

Certificate of Analysis

Report Date: 19-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 14-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	27.5	1	mg/L	27.4			0.1	10	
Fluoride	ND	0.1	mg/L	ND			NC	10	
Nitrate as N	2.47	0.1	mg/L	2.47			0.1	10	
Nitrite as N	ND	0.05	mg/L	ND			NC	10	
Sulphate	14.7	1	mg/L	14.7			0.0	10	
General Inorganics									
Alkalinity, total	230	5	mg/L	233			1.2	14	
Ammonia as N	0.036	0.01	mg/L	0.037			3.0	18	
Dissolved Organic Carbon	3.4	0.5	mg/L	3.2			5.1	37	
Colour	ND	2	TCU	ND			NC	12	
Conductivity	489	5	uS/cm	496			1.3	5	
pH	9.3	0.1	pH Units	9.3			0.0	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	ND	0.1	mg/L	ND			NC	11	
Total Kjeldahl Nitrogen	ND	0.1	mg/L	0.10			NC	16	
Turbidity	6.4	0.1	NTU	6.3			2.2	10	
Metals									
Calcium	ND	0.1	mg/L	ND			NC	20	
Iron	ND	0.1	mg/L	ND			NC	20	
Magnesium	ND	0.2	mg/L	ND			NC	20	
Manganese	ND	0.005	mg/L	ND			NC	20	
Potassium	0.2	0.1	mg/L	0.2			0.2	20	
Sodium	58.7	0.2	mg/L	58.5			0.3	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100 mL	ND			NC	30	
Total Coliforms	ND	1	CFU/100 mL	ND			NC	30	
Heterotrophic Plate Count	ND	10	CFU/mL	ND			NC	30	

Certificate of Analysis

Report Date: 19-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 14-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	36.5	1	mg/L	27.4	90.9	77-123			
Fluoride	1.01	0.1	mg/L	ND	101	79-121			
Nitrate as N	3.39	0.1	mg/L	2.47	92.4	79-120			
Nitrite as N	0.973	0.05	mg/L	ND	97.3	84-117			
Sulphate	24.3	1	mg/L	14.7	96.6	74-126			
General Inorganics									
Ammonia as N	0.313	0.01	mg/L	0.037	110	81-124			
Dissolved Organic Carbon	14.7	0.5	mg/L	3.2	115	60-133			
Phenolics	0.023	0.001	mg/L	ND	91.5	69-132			
Total Dissolved Solids	92.0	10	mg/L	ND	92.0	75-125			
Sulphide	0.52	0.02	mg/L	ND	104	79-115			
Tannin & Lignin	1.0	0.1	mg/L	ND	103	71-113			
Total Kjeldahl Nitrogen	1.99	0.1	mg/L	0.10	94.4	81-126			
Metals									
Calcium	9490	0.1	mg/L	36.0	94.6	80-120			
Iron	2370	0.1	mg/L	3.5	94.6	80-120			
Magnesium	9730	0.2	mg/L	9.2	97.2	80-120			
Manganese	48.4	0.005	mg/L	0.136	96.6	80-120			
Potassium	9710	0.1	mg/L	240	94.7	80-120			
Sodium	63600	0.2	mg/L	58500	50.5	80-120			QM-07

Certificate of Analysis

Report Date: 19-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 14-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Qualifier Notes:

Sample Qualifiers :

QC Qualifiers :

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

Sample Data Revisions

None

Work Order Revisions / Comments:

Revision 1 - This report now includes data for HPC

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

Certificate of Analysis

McIntosh Perry Consulting Eng. (Carp)

115 Walgreen Rd.
Carp, ON K0A 1L0
Attn: Monica Black

Client PO: Grizzly Homes
Project: 22-0256
Custody: 60208

Report Date: 15-Sep-2021
Order Date: 10-Sep-2021

Order #: 2137462

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2137462-01	TW4-1
2137462-02	TW4-2

Approved By:



Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 15-Sep-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 10-Sep-2021

Client PO: Grizzly Homes

Project Description: 22-0256

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	10-Sep-21	10-Sep-21
Ammonia, as N	EPA 351.2 - Auto Colour	14-Sep-21	14-Sep-21
Anions	EPA 300.1 - IC	10-Sep-21	11-Sep-21
Colour	SM2120 - Spectrophotometric	10-Sep-21	10-Sep-21
Conductivity	EPA 9050A- probe @25 °C	10-Sep-21	10-Sep-21
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	10-Sep-21	10-Sep-21
E. coli	MOE E3407	10-Sep-21	10-Sep-21
Fecal Coliform	SM 9222D	10-Sep-21	10-Sep-21
Metals, ICP-MS	EPA 200.8 - ICP-MS	13-Sep-21	13-Sep-21
pH	EPA 150.1 - pH probe @25 °C	10-Sep-21	10-Sep-21
Phenolics	EPA 420.2 - Auto Colour, 4AAP	10-Sep-21	10-Sep-21
Hardness	Hardness as CaCO ₃	13-Sep-21	13-Sep-21
Sulphide	SM 4500SE - Colourimetric	10-Sep-21	10-Sep-21
Tannin/Lignin	SM 5550B - Colourimetric	14-Sep-21	14-Sep-21
Total Coliform	MOE E3407	10-Sep-21	10-Sep-21
Total Dissolved Solids	SM 2540C - gravimetric, filtration	10-Sep-21	13-Sep-21
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	13-Sep-21	15-Sep-21
Turbidity	SM 2130B - Turbidity meter	10-Sep-21	10-Sep-21

Certificate of Analysis

Report Date: 15-Sep-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 10-Sep-2021

Client PO: Grizzly Homes

Project Description: 22-0256

Client ID:	TW4-1	TW4-2	-	-
Sample Date:	09-Sep-21 08:55	09-Sep-21 13:45	-	-
Sample ID:	2137462-01	2137462-02	-	-
MDL/Units	Drinking Water	Drinking Water	-	-

Microbiological Parameters

E. coli	1 CFU/100 mL	ND	ND	-	-
Fecal Coliforms	1 CFU/100 mL	ND	ND	-	-
Total Coliforms	1 CFU/100 mL	ND	ND	-	-

General Inorganics

Alkalinity, total	5 mg/L	269	272	-	-
Ammonia as N	0.01 mg/L	0.01	0.01	-	-
Dissolved Organic Carbon	0.5 mg/L	1.3	0.9	-	-
Colour	2 TCU	<2	<2	-	-
Conductivity	5 uS/cm	621	643	-	-
Hardness	mg/L	286	292	-	-
pH	0.1 pH Units	7.7	7.7	-	-
Phenolics	0.001 mg/L	<0.001	<0.001	-	-
Total Dissolved Solids	10 mg/L	298	340	-	-
Sulphide	0.02 mg/L	<0.02	<0.02	-	-
Tannin & Lignin	0.1 mg/L	<0.1	<0.1	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	<0.1	<0.1	-	-
Turbidity	0.1 NTU	17.0	0.8	-	-

Anions

Chloride	1 mg/L	30	26	-	-
Fluoride	0.1 mg/L	<0.1	<0.1	-	-
Nitrate as N	0.1 mg/L	1.3	1.6	-	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	-	-
Sulphate	1 mg/L	16	15	-	-

Metals

Calcium	0.1 mg/L	79.5	81.3	-	-
Iron	0.1 mg/L	<0.1	<0.1	-	-
Magnesium	0.2 mg/L	21.2	21.7	-	-
Manganese	0.005 mg/L	0.008	<0.005	-	-
Potassium	0.1 mg/L	3.5	3.4	-	-
Sodium	0.2 mg/L	22.2	19.4	-	-

Certificate of Analysis

Report Date: 15-Sep-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 10-Sep-2021

Client PO: Grizzly Homes

Project Description: 22-0256

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Calcium	ND	0.1	mg/L						
Iron	ND	0.1	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Potassium	ND	0.1	mg/L						
Sodium	ND	0.2	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						

Certificate of Analysis

Report Date: 15-Sep-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 10-Sep-2021

Client PO: Grizzly Homes

Project Description: 22-0256

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	918	5	mg/L	919			0.1	10	
Fluoride	1.16	0.1	mg/L	1.11			4.1	10	
Nitrate as N	0.15	0.1	mg/L	0.15			1.5	10	
Nitrite as N	ND	0.05	mg/L	ND			NC	10	
Sulphate	425	5	mg/L	422			0.6	10	
General Inorganics									
Alkalinity, total	214	5	mg/L	217			1.4	14	
Ammonia as N	0.015	0.01	mg/L	0.014			5.0	17.7	
Dissolved Organic Carbon	ND	0.5	mg/L	ND			NC	37	
Colour	ND	2	TCU	ND			NC	12	
Conductivity	416	5	uS/cm	423			1.7	5	
pH	8.4	0.1	pH Units	8.4			0.1	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	76.0	10	mg/L	74.0			2.7	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	ND	0.1	mg/L	ND			NC	11	
Total Kjeldahl Nitrogen	0.35	0.1	mg/L	0.37			5.1	16	
Turbidity	0.9	0.1	NTU	0.8			3.5	10	
Metals									
Calcium	51.3	0.1	mg/L	52.0			1.4	20	
Iron	0.7	0.1	mg/L	0.7			1.4	20	
Magnesium	14.4	0.2	mg/L	14.5			0.6	20	
Manganese	0.020	0.005	mg/L	0.020			0.2	20	
Potassium	0.8	0.1	mg/L	0.8			1.9	20	
Sodium	6.4	0.2	mg/L	6.3			2.2	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100 mL	ND			NC	30	
Total Coliforms	ND	1	CFU/100 mL	ND			NC	30	

Certificate of Analysis

Report Date: 15-Sep-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 10-Sep-2021

Client PO: Grizzly Homes

Project Description: 22-0256

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	8.98	1	mg/L	ND	89.8	85-115			
Fluoride	0.99	0.1	mg/L	ND	98.7	83-117			
Nitrate as N	0.97	0.1	mg/L	ND	96.7	86-114			
Nitrite as N	1.01	0.05	mg/L	ND	101	85-115			
Sulphate	8.97	1	mg/L	ND	89.7	86-114			
General Inorganics									
Ammonia as N	0.251	0.01	mg/L	0.014	94.9	81-124			
Dissolved Organic Carbon	11.0	0.5	mg/L	ND	110	60-133			
Phenolics	0.026	0.001	mg/L	ND	103	69-132			
Total Dissolved Solids	96.0	10	mg/L	ND	96.0	75-125			
Sulphide	0.54	0.02	mg/L	ND	108	79-115			
Tannin & Lignin	1.1	0.1	mg/L	ND	106	71-113			
Total Kjeldahl Nitrogen	2.28	0.1	mg/L	0.37	95.5	81-126			
Metals									
Calcium	59000	0.1	mg/L	52000	70.9	80-120			QM-07
Iron	2800	0.1	mg/L	667	85.4	80-120			
Magnesium	22500	0.2	mg/L	14500	80.3	80-120			
Manganese	67.0	0.005	mg/L	19.8	94.3	80-120			
Potassium	11300	0.1	mg/L	839	104	80-120			
Sodium	15600	0.2	mg/L	6250	93.3	80-120			

Certificate of Analysis

Report Date: 15-Sep-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 10-Sep-2021

Client PO: Grizzly Homes

Project Description: 22-0256

Qualifier Notes:

Login Qualifiers :

Samples received submerged in water, possibly melted ice. This condition can compromise sample integrity.

Applies to samples: TW4-1

Sample Qualifiers :

QC Qualifiers :

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

Certificate of Analysis

McIntosh Perry Consulting Eng. (Carp)

115 Walgreen Rd.
RR#3 Carp, ON K0A 1L0
Attn: Andrew MacHardy

Client PO: Grizzly Homes Subdivision
Project: 22-0256
Custody: 60212

Report Date: 16-Jul-2021
Order Date: 15-Jul-2021

Order #: 2129521

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2129521-01	TW5-1
2129521-02	TW5-2

Approved By:



Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 16-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 15-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	16-Jul-21	16-Jul-21
Ammonia, as N	EPA 351.2 - Auto Colour	16-Jul-21	16-Jul-21
Anions	EPA 300.1 - IC	15-Jul-21	15-Jul-21
Colour	SM2120 - Spectrophotometric	16-Jul-21	16-Jul-21
Conductivity	EPA 9050A- probe @25 °C	16-Jul-21	16-Jul-21
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	16-Jul-21	16-Jul-21
E. coli	MOE E3407	15-Jul-21	15-Jul-21
Fecal Coliform	SM 9222D	15-Jul-21	15-Jul-21
Metals, ICP-MS	EPA 200.8 - ICP-MS	16-Jul-21	16-Jul-21
pH	EPA 150.1 - pH probe @25 °C	16-Jul-21	16-Jul-21
Phenolics	EPA 420.2 - Auto Colour, 4AAP	16-Jul-21	16-Jul-21
Sulphide	SM 4500SE - Colourimetric	15-Jul-21	16-Jul-21
Tannin/Lignin	SM 5550B - Colourimetric	16-Jul-21	16-Jul-21
Total Coliform	MOE E3407	15-Jul-21	15-Jul-21
Total Dissolved Solids	SM 2540C - gravimetric, filtration	15-Jul-21	16-Jul-21
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	16-Jul-21	16-Jul-21
Turbidity	SM 2130B - Turbidity meter	16-Jul-21	16-Jul-21

Certificate of Analysis

Report Date: 16-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 15-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Client ID:	TW5-1	TW5-2	-	-
Sample Date:	15-Jul-21 08:45	15-Jul-21 13:15	-	-
Sample ID:	2129521-01	2129521-02	-	-
MDL/Units	Water	Water	-	-

Microbiological Parameters

E. coli	1 CFU/100 mL	ND	ND	-	-
Fecal Coliforms	1 CFU/100 mL	ND	ND	-	-
Total Coliforms	1 CFU/100 mL	ND	ND	-	-

General Inorganics

Alkalinity, total	5 mg/L	264	264	-	-
Ammonia as N	0.01 mg/L	0.04	0.04	-	-
Dissolved Organic Carbon	0.5 mg/L	2.5	1.7	-	-
Colour	2 TCU	3	3	-	-
Conductivity	5 uS/cm	662	667	-	-
pH	0.1 pH Units	7.6	7.7	-	-
Phenolics	0.001 mg/L	<0.001	<0.001	-	-
Total Dissolved Solids	10 mg/L	346	338	-	-
Sulphide	0.02 mg/L	<0.02	<0.02	-	-
Tannin & Lignin	0.1 mg/L	<0.1	<0.1	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	<0.1	<0.1	-	-
Turbidity	0.1 NTU	1.6	0.3	-	-

Anions

Chloride	1 mg/L	39	39	-	-
Fluoride	0.1 mg/L	<0.1	<0.1	-	-
Nitrate as N	0.1 mg/L	0.9	0.8	-	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	-	-
Sulphate	1 mg/L	16	16	-	-

Metals

Calcium	100 ug/L	64500	63900	-	-
Iron	100 ug/L	<100	<100	-	-
Magnesium	200 ug/L	19700	19900	-	-
Manganese	5 ug/L	<5	<5	-	-
Potassium	100 ug/L	1370	1400	-	-
Sodium	200 ug/L	23600	24000	-	-

Certificate of Analysis

Report Date: 16-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 15-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Calcium	ND	100	ug/L						
Iron	ND	100	ug/L						
Magnesium	ND	200	ug/L						
Manganese	ND	5	ug/L						
Potassium	ND	100	ug/L						
Sodium	ND	200	ug/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						

Certificate of Analysis

Report Date: 16-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 15-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	27.5	1	mg/L	27.4			0.1	10	
Fluoride	ND	0.1	mg/L	ND			NC	10	
Nitrate as N	2.47	0.1	mg/L	2.47			0.1	10	
Nitrite as N	ND	0.05	mg/L	ND			NC	10	
Sulphate	14.7	1	mg/L	14.7			0.0	10	
General Inorganics									
Alkalinity, total	259	5	mg/L	264			1.6	14	
Ammonia as N	0.036	0.01	mg/L	0.037			3.0	18	
Dissolved Organic Carbon	2.3	0.5	mg/L	2.5			8.7	37	
Colour	3	2	TCU	3			0.0	12	
Conductivity	665	5	uS/cm	662			0.4	5	
pH	7.6	0.1	pH Units	7.6			0.5	3.3	
Phenolics	0.004	0.001	mg/L	ND			NC	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	ND	0.1	mg/L	ND			NC	11	
Total Kjeldahl Nitrogen	1.15	0.1	mg/L	1.16			0.3	16	
Turbidity	1.6	0.1	NTU	1.6			3.8	10	
Metals									
Calcium	28100	100	ug/L	28200			0.3	20	
Iron	ND	100	ug/L	ND			NC	20	
Magnesium	7000	200	ug/L	6800			3.0	20	
Manganese	ND	5	ug/L	ND			NC	20	
Potassium	1300	100	ug/L	1300			0.5	20	
Sodium	13000	200	ug/L	13000			0.3	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND			NC	30	BAC14
Fecal Coliforms	ND	1	CFU/100 mL	ND			NC	30	
Total Coliforms	ND	1	CFU/100 mL	ND			NC	30	BAC14

Certificate of Analysis

Report Date: 16-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 15-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	36.5	1	mg/L	27.4	90.9	77-123			
Fluoride	1.01	0.1	mg/L	ND	101	79-121			
Nitrate as N	3.39	0.1	mg/L	2.47	92.4	79-120			
Nitrite as N	0.973	0.05	mg/L	ND	97.3	84-117			
Sulphate	24.3	1	mg/L	14.7	96.6	74-126			
General Inorganics									
Ammonia as N	0.313	0.01	mg/L	0.037	110	81-124			
Dissolved Organic Carbon	13.2	0.5	mg/L	2.5	107	60-133			
Phenolics	0.025	0.001	mg/L	ND	100	69-132			
Total Dissolved Solids	92.0	10	mg/L	ND	92.0	75-125			
Sulphide	0.50	0.02	mg/L	ND	101	79-115			
Tannin & Lignin	1.0	0.1	mg/L	ND	101	71-113			
Total Kjeldahl Nitrogen	3.03	0.1	mg/L	1.16	93.7	81-126			
Metals									
Calcium	34200	100	ug/L	28200	60.4	80-120			QM-07
Iron	2000	100	ug/L	ND	79.4	80-120			QM-07
Magnesium	14700	200	ug/L	6800	79.2	80-120			QM-07
Manganese	48.9	5	ug/L	ND	94.1	80-120			
Potassium	9330	100	ug/L	1300	80.2	80-120			
Sodium	19800	200	ug/L	13000	67.7	80-120			QM-07

Certificate of Analysis

Report Date: 16-Jul-2021

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 15-Jul-2021

Client PO: Grizzly Homes Subdivision

Project Description: 22-0256

Qualifier Notes:

Sample Qualifiers :

QC Qualifiers :

BAC14 : A2C - Background counts greater than 200

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

HYDROGEOLOGICAL ASSESSMENT AND TERRAIN ANALYSIS GRIZZLY HOMES SUBDIVISION, BECKWITH, ONTARIO



APPENDIX G: CALCULATIONS

Transmissivity Calculations

$$T = \frac{2.3 Q}{4 \pi \Delta s}$$

T is the transmissivity (m²/day)

Q is the pumping rate during the pumping test (L/min); and,

Δs is the differential for residual drawdown for one log cycle (m)

Test Well 1

$$T = 2.3 Q / 4\pi \Delta s$$

$$T = 2.3 (30.24 \text{ m}^3/\text{day}) / 4\pi (1.15 \text{ m})$$

$$T = 43.3 \text{ m}^2/\text{day}$$

$$Q = 21.0 \text{ L/min}$$

$$Q = ((21.0 \text{ L/min}) / (1000 \text{ L})) * (60 \text{ min})(24 \text{ hour})$$

$$Q = 30.24 \text{ m}^3/\text{day}$$

$$\Delta s = 0.128 \text{ m}$$

Test Well 2

$$T = 2.3 Q / 4\pi \Delta s$$

$$T = 2.3 (117.792 \text{ m}^3/\text{day}) / 4\pi (1.15 \text{ m})$$

$$T = 13.9 \text{ m}^2/\text{day}$$

$$Q = 81.8 \text{ L/min}$$

$$Q = ((81.8 \text{ L/min}) / (1000 \text{ L})) * (60 \text{ min})(24 \text{ hour})$$

$$Q = 117.79 \text{ m}^3/\text{day}$$

$$\Delta s = 1.55 \text{ m}$$

Test Well 3

$$T = 2.3 Q / 4\pi \Delta s$$

$$T = 2.3 (129.6 \text{ m}^3/\text{day}) / 4\pi (0.75 \text{ m})$$

$$T = 175.8 \text{ m}^2/\text{day}$$

$$Q = 90 \text{ L/min}$$

$$Q = ((90 \text{ L/min}) / (1000 \text{ L})) * (60 \text{ min})(24 \text{ hour})$$

$$Q = 129.60 \text{ m}^3/\text{day}$$

$$\Delta s = 0.135 \text{ m}$$

Test Well 4

$$T = 2.3 Q / 4\pi \Delta s$$

$$T = 2.3 (129.6 \text{ m}^3/\text{day}) / 4\pi (0.75 \text{ m})$$

$$T = 26.7 \text{ m}^2/\text{day}$$

$$Q = 90 \text{ L/min}$$

$$Q = ((90 \text{ L/min}) / (1000 \text{ L})) * (60 \text{ min})(24 \text{ hour})$$

$$Q = 129.60 \text{ m}^3/\text{day}$$

$$\Delta s = 0.89 \text{ m}$$

Test Well 5

$$T = 2.3 Q / 4\pi \Delta s$$

$$T = 2.3 (129.6 \text{ m}^3/\text{day}) / 4\pi (0.75 \text{ m})$$

$$T = 474.6 \text{ m}^2/\text{day}$$

$$Q = 90 \text{ L/min}$$

$$Q = ((90 \text{ L/min}) / (1000 \text{ L})) * (60 \text{ min})(24 \text{ hour})$$

$$Q = 129.60 \text{ m}^3/\text{day}$$

$$\Delta s = 0.05 \text{ m}$$

Test Well 1 Recovery

$$T = 2.3 Q / 4\pi \Delta s$$

$$T = 2.3 (117.792 \text{ m}^3/\text{day}) / 4\pi (1.29 \text{ m})$$

$$T = 55.4 \text{ m}^2/\text{day}$$

$$Q = 21 \text{ L/min}$$

$$Q = ((21 \text{ L/min}) / (1000 \text{ L})) * (60 \text{ min})(24 \text{ hour})$$

$$Q = 30.24 \text{ m}^3/\text{day}$$

$$\Delta s = 0.10 \text{ m}$$

Test Well 2 Recovery

$$T = 2.3 Q / 4\pi \Delta s$$

$$T = 2.3 (117.792 \text{ m}^3/\text{day}) / 4\pi (1.29 \text{ m})$$

$$T = 16.7 \text{ m}^2/\text{day}$$

$$Q = 81.8 \text{ L/min}$$

$$Q = ((81.8 \text{ L/min}) / (1000 \text{ L})) * (60 \text{ min})(24 \text{ hour})$$

$$Q = 117.792 \text{ m}^3/\text{day}$$

$$\Delta s = 1.29 \text{ m}$$

Test Well 3 Recovery

$$T = 2.3 Q / 4\pi \Delta s$$

$$T = 2.3 (129.6 \text{ m}^3/\text{day}) / 4\pi (0.42)$$

$$T = 192.9 \text{ m}^2/\text{day}$$

$$Q = 90 \text{ L/min}$$

$$Q = ((90 \text{ L/min}) / (1000 \text{ L})) * (60 \text{ min})(24 \text{ hour})$$

$$Q = 129.60 \text{ m}^3/\text{day}$$

$$\Delta s = 0.123 \text{ m}$$

Test Well 4 Recovery

$$T = 2.3 Q / 4\pi \Delta s$$

$$T = 2.3 (129.6 \text{ m}^3/\text{day}) / 4\pi (0.42)$$

$$T = 26.4 \text{ m}^2/\text{day}$$

$$Q = 90 \text{ L/min}$$

$$Q = ((90 \text{ L/min}) / (1000 \text{ L})) * (60 \text{ min})(24 \text{ hour})$$

$$Q = 129.60 \text{ m}^3/\text{day}$$

$$\Delta s = 0.9 \text{ m}$$

Test Well 5 Recovery

$$T = 2.3 Q / 4\pi \Delta s$$

$$T = 2.3 (129.6 \text{ m}^3/\text{day}) / 4\pi (0.42)$$

$$T = 365.1 \text{ m}^2/\text{day}$$

$$Q = 90 \text{ L/min}$$

$$Q = ((90 \text{ L/min}) / (1000 \text{ L})) * (60 \text{ min})(24 \text{ hour})$$

$$Q = 129.60 \text{ m}^3/\text{day}$$

$$\Delta s = 0.065 \text{ m}$$

Farvolden Method - Long Term Yeild Calculations

$Q_{20} = 0.68 T H_a S_f$

Ha= the available water column height (m)
 Sf= safety factor
 T= Transmissivity (m²/day)

Test Well 1

		T= 43.3	m ² /day
		Sf= 0.7	
$Q_{20} = 0.68 (43.3 \text{ m}^2/\text{day})(14.51 \text{ m})(0.7)$		pump at 60 ft =	18.29 m btop
Q20=	299.02 m ³ /day	static WL	3.78 m btop
Q20=	299021.5 L/day	Ha = 18.29 - 3.78 m	
Q20=	207.7 L/min	Ha =	14.51 m

Test Well 2

		T= 13.9	m ² /day
		Sf= 0.7	
$Q_{20} = 0.68 (13.9 \text{ m}^2/\text{day})(23.89 \text{ m})(0.7)$		pump at 80 ft =	24.38 m btop
Q20=	129.8 m ³ /day	static WL	4.762 m btop
Q20=	129827 L/day	Ha = 28.6512 - 4.762 m	
Q20=	90.2 L/min	Ha =	19.62 m

Test Well 3

		T= 175.8	m ² /day
		Sf= 0.7	
$Q_{20} = 0.68 (175.8 \text{ m}^2/\text{day})(21.0 \text{ m})(0.7)$		pump at 100 ft =	30.48 m btop
Q20=	1757.2 m ³ /day	static WL	9.481 m btop
Q20=	1757213.1 L/day	Ha = 33.53 m - 9.481 m	
Q20=	1220.3 L/min	Ha =	21.00 m

Test Well 4

		T= 26.4	m ² /day
		Sf= 0.7	
$Q_{20} = 0.68 (26.4 \text{ m}^2/\text{day})(18.97 \text{ m})(0.7)$		pump at 100 ft =	30.48 m btop
Q20=	238.4 m ³ /day	static WL	11.51 m btop
Q20=	238384.6 L/day	Ha = 30.48 m - 11.51 m	
Q20=	165.5 L/min	Ha =	18.97 m

Test Well 5

		T= 365.1	m ² /day
		Sf= 0.7	
$Q_{20} = 0.68 (365.1 \text{ m}^2/\text{day})(25.13 \text{ m})(0.7)$		pump at 120 ft =	36.58 m btop
Q20=	4366.6 m ³ /day	static WL	11.45 m btop
Q20=	4366587.2 L/day	Ha = 30.48 m - 11.45 m	
Q20=	3032.4 L/min	Ha =	25.13 m

Moell Method - Long Term Yeild Calculations

$$Q_{20} = (Q \text{ Ha Sf}) / (s_{100} + 5 \Delta s)$$

Q= the pumping rate (m³/day)

Ha= the available water column height (m)

Sf= safety factor

s₁₀₀= the drawdown at 100 minutes (semi-log long-term graph)

Δs= the change in hydraulic head over one log cycle (drawdown vs. long time)

Test Well 1

$$Q_{20} = \frac{(30.24 \text{ m}^3/\text{day})(14.51 \text{ m})(0.7)}{[(0.395 \text{ m} + 5(0.128 \text{ m}))]}$$

Q₂₀= 296.8 m³/day
 Q₂₀= 296761 L/day
 Q₂₀= 206.1 L/min

Q= 30.24 m³/day
 Ha = 14.51 m
 Sf = 0.7
 s₁₀₀ = 0.395 m
 Δs = 0.128 m

Test Well 2

$$Q_{20} = \frac{(117.79 \text{ m}^3/\text{day})(19.62 \text{ m})(0.7)}{[(5.52 \text{ m} + 5(1.55 \text{ m}))]}$$

Q₂₀= 121.9 m³/day
 Q₂₀= 121910.7 L/day
 Q₂₀= 84.7 L/min

Q= 117.79 m³/day
 Ha = 19.62 m
 Sf = 0.7
 s₁₀₀ = 5.52 m
 Δs = 1.55 m

Test Well 3

$$Q_{20} = \frac{(129.6 \text{ m}^3/\text{day})(21.0 \text{ m})(0.7)}{[(0.47 \text{ m} + 5(0.135 \text{ m}))]}$$

Q₂₀= 1663.9 m³/day
 Q₂₀= 1663860 L/day
 Q₂₀= 1155.5 L/min

Q= 129.60 m³/day
 Ha = 21.00 m
 Sf = 0.7
 s₁₀₀ = 0.47 m
 Δs = 0.135 m

Test Well 4

$$Q_{20} = \frac{(129.6 \text{ m}^3/\text{day})(18.97 \text{ m})(0.7)}{[(0.35 \text{ m} + 5(0.89 \text{ m}))]}$$

Q₂₀= 358.5 m³/day
 Q₂₀= 358533 L/day
 Q₂₀= 249.0 L/min

Q= 129.6 m³/day
 Ha = 18.97 m
 Sf = 0.7
 s₁₀₀ = 0.35
 Δs = 0.89

Test Well 5

$$Q_{20} = \frac{(129.6 \text{ m}^3/\text{day})(25.13 \text{ m})(0.7)}{[(0.2 \text{ m} + 5(0.05 \text{ m}))]}$$

Q₂₀= 5066.2 m³/day
 Q₂₀= 5066208 L/day
 Q₂₀= 3518.2 L/min

Q= 129.6 m³/day
 Ha = 25.13 m
 Sf = 0.7
 s₁₀₀ = 0.2
 Δs = 0.05

Hydraulic Conductivity

$$k = T/B$$

T is the transmissivity (m²/day, the more conservative value is used)

b is the thickness of X m, which corresponds to the interval between the bottom of the casing and the bottom of the well, used as aquifer thickness (m)

TW1	TW2	TW3	TW4	TW5
Casing length 40 ft	Casing length 42 ft	Casing length 42 ft	Casing length 42 ft	Casing length 42 ft
Well Depth 81 ft	Well Depth 100 ft	Well Depth 120 ft	Well Depth 122 ft	Well Depth 140 ft
B= 41 ft 12.5 m	B= 58 ft 17.7 m	B= 78 ft 23.8 m	B= 80 ft 24.4 m	B= 98 ft 29.9 m
T= 43.3 m ² /day	T = 13.9 m ² /day	T=175.8 m ² /day	T=26.4 m ² /day	T=365.1 m ² /day
T= 0.000501157 m ² /s	T= 0.00016088 m ² /s	T= 0.002034722 m ² /s	T= 0.000305556 m ² /s	T= 0.004225694 m ² /s
k= T/B	k= T/B	k= T/B	k= T/B	k= T/B
k= (0.000501157 m ² /s /12.5 m)	k= (0.00012088 m ² /s)/(17.7 m)	k= (0.00203472 m/s)/42.67	k= (0.000306 m/s/24.4 m)	k= (0.004226 m/s/29.9 m)
k= 4.01E-05 m/s	k= 9.10E-06 m/s	k= 8.56E-05 m/s	k= 1.25E-05 m/s	k= 1.41E-04 m/s

$$k \text{ (avg)} = 5.78E-05$$

HYDROGEOLOGICAL ASSESSMENT AND TERRAIN ANALYSIS GRIZZLY HOMES SUBDIVISION, BECKWITH, ONTARIO



APPENDIX H: TEST PIT LOGS

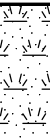


Mcintosh Perry
115 Walgreen Road
Carp K0A 1L0

TEST PIT NUMBER TP1

CLIENT Grizzly Homes
 PROJECT NUMBER CCO-22-0256
 DATE STARTED 21-12-14 COMPLETED 21-12-14
 EXCAVATION CONTRACTOR Grizzly Homes
 EXCAVATION METHOD CAT 303E CR
 LOGGED BY EW CHECKED BY PL
 NOTES _____

PROJECT NAME Franktown Subdivision Review
 PROJECT LOCATION _____
 GROUND ELEVATION _____ TEST PIT SIZE 1m
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION ---
 AT END OF EXCAVATION ---
 AFTER EXCAVATION 0.30 m

DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
			Topsoil
		0.20	Gravelly sand (wet)
	SS 1	0.40	EOH, refusal on bedrock

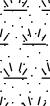
Bottom of test pit at 0.40 m.

TEST PIT NUMBER TP2

MP Mcintosh Perry
115 Walgreen Road
Carp K0A 1L0

CLIENT Grizzly Homes
PROJECT NUMBER CCO-22-0256
DATE STARTED 21-12-14 COMPLETED 21-12-14
EXCAVATION CONTRACTOR Grizzly Homes
EXCAVATION METHOD CAT 303E CR
LOGGED BY EW CHECKED BY PL
NOTES _____

PROJECT NAME Franktown Subdivision Review
PROJECT LOCATION _____
GROUND ELEVATION _____ TEST PIT SIZE 1m
GROUND WATER LEVELS:
AT TIME OF EXCAVATION ---
AT END OF EXCAVATION ---
AFTER EXCAVATION 1.08 m

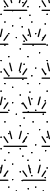

DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
			Topsoil
		0.18	Gravelly sand with cobbles up to 6 inches (wet)
0.5			
1.0			
1.5			
	SS 1	1.70	EOH, refusal on bedrock
			Bottom of test pit at 1.70 m.

GENERAL BH / TP / WELL GRIZZLY HOMES - FRANKTOWN.GPJ GINT STD CANADA.LAB.GDT 22-1-11

MP McIntosh Perry
115 Walgreen Road
Carp K0A 1L0

CLIENT Grizzly Homes
PROJECT NUMBER CCO-22-0256
DATE STARTED 21-12-14 **COMPLETED** 21-12-14
EXCAVATION CONTRACTOR Grizzly Homes
EXCAVATION METHOD CAT 303E CR
LOGGED BY EW **CHECKED BY** PL
NOTES _____

PROJECT NAME Franktown Subdivision Review
PROJECT LOCATION _____
GROUND ELEVATION _____ **TEST PIT SIZE** 1m
GROUND WATER LEVELS:
AT TIME OF EXCAVATION ---
AT END OF EXCAVATION ---
▼ AFTER EXCAVATION 0.80 m

DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
			Topsoil
0.30			Gravelly sand (gravel size ranging from fine grains up to 10 inches, size increasing with depth) (wet)
0.5			
1.0		▼	
1.45	SS 1		EOH, refusal on bedrock
			Bottom of test pit at 1.45 m.

GENERAL BH / TP / WELL GRIZZLY HOMES - FRANKTOWN.GPJ GINT STD CANADA LAB.GDT 22-1-11



Mcintosh Perry
115 Walgreen Road
Carp K0A 1L0

TEST PIT NUMBER TP4

CLIENT Grizzly Homes
 PROJECT NUMBER CCO-22-0256
 DATE STARTED 21-12-14 COMPLETED 21-12-14
 EXCAVATION CONTRACTOR Grizzly Homes
 EXCAVATION METHOD CAT 303E CR
 LOGGED BY EW CHECKED BY PL
 NOTES _____

PROJECT NAME Franktown Subdivision Review
 PROJECT LOCATION _____
 GROUND ELEVATION _____ TEST PIT SIZE 1m
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION ---
 AT END OF EXCAVATION ---
 AFTER EXCAVATION 3.70 m

DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
			Topsoil
		0.20	Gravelly sand
0.5	SS 2	0.55	Gravelly sand, trace clay (wet)
	SS 1	0.70	EOH, refusal on bedrock

Bottom of test pit at 0.70 m.

GENERAL BH / TP / WELL GRIZZLY HOMES - FRANKTOWN.GPJ GINT STD CANADA.LAB.GDT 22-1-11




Mcintosh Perry
115 Walgreen Road
Carp K0A 1L0

TEST PIT NUMBER TP5

CLIENT Grizzly Homes
 PROJECT NUMBER CCO-22-0256
 DATE STARTED 21-12-14 COMPLETED 21-12-14
 EXCAVATION CONTRACTOR Grizzly Homes
 EXCAVATION METHOD CAT 303E CR
 LOGGED BY EW CHECKED BY PL
 NOTES _____

PROJECT NAME Franktown Subdivision Review
 PROJECT LOCATION _____
 GROUND ELEVATION _____ TEST PIT SIZE 1m
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION ---
 AT END OF EXCAVATION ---
 AFTER EXCAVATION ---


DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
			Topsoil
		0.10	Red/ brown sand
	SS 1	0.38	EOH, refusal on bedrock

Bottom of test pit at 0.38 m.

MP McIntosh Perry
115 Walgreen Road
Carp K0A 1L0

CLIENT Grizzly Homes
PROJECT NUMBER CCO-22-0256
DATE STARTED 21-12-14 **COMPLETED** 21-12-14
EXCAVATION CONTRACTOR Grizzly Homes
EXCAVATION METHOD CAT 303E CR
LOGGED BY EW **CHECKED BY** PL
NOTES _____

PROJECT NAME Franktown Subdivision Review
PROJECT LOCATION _____
GROUND ELEVATION _____ **TEST PIT SIZE** 1m
GROUND WATER LEVELS:
AT TIME OF EXCAVATION ---
AT END OF EXCAVATION ---
AFTER EXCAVATION ---

DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
			Topsoil
		0.15	Weathered bedrock breaking off in large chunks (up to 2 ft), surrounded by brown sand
	SS 1	0.45	EOH, refusal on bedrock

Bottom of test pit at 0.45 m.



Mcintosh Perry
115 Walgreen Road
Carp K0A 1L0

TEST PIT NUMBER TP7

CLIENT Grizzly Homes
 PROJECT NUMBER CCO-22-0256
 DATE STARTED 21-12-14 COMPLETED 21-12-14
 EXCAVATION CONTRACTOR Grizzly Homes
 EXCAVATION METHOD CAT 303E CR
 LOGGED BY EW CHECKED BY PL
 NOTES _____

PROJECT NAME Franktown Subdivision Review
 PROJECT LOCATION _____
 GROUND ELEVATION _____ TEST PIT SIZE 1m
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION ---
 AT END OF EXCAVATION ---
 AFTER EXCAVATION 0.60 m

DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
			Topsoil
		0.20	Red sand (wet)
0.5			
	SS 1	0.70	EOH, refusal on bedrock

Bottom of test pit at 0.70 m.





Mcintosh Perry
115 Walgreen Road
Carp K0A 1L0

TEST PIT NUMBER TP8

CLIENT Grizzly Homes
 PROJECT NUMBER CCO-22-0256
 DATE STARTED 21-12-14 COMPLETED 21-12-14
 EXCAVATION CONTRACTOR Grizzly Homes
 EXCAVATION METHOD CAT 303E CR
 LOGGED BY EW CHECKED BY PL
 NOTES _____

PROJECT NAME Franktown Subdivision Review
 PROJECT LOCATION _____
 GROUND ELEVATION _____ TEST PIT SIZE 1m
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION ---
 AT END OF EXCAVATION ---
 AFTER EXCAVATION ---


DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
			0.05 Topsoil
			Sand trace clay trace gravel
	SS 1		0.25 EOH, refusal on bedrock

Bottom of test pit at 0.25 m.

MP McIntosh Perry
115 Walgreen Road
Carp K0A 1L0

CLIENT Grizzly Homes
PROJECT NUMBER CCO-22-0256
DATE STARTED 21-12-14 **COMPLETED** 21-12-14
EXCAVATION CONTRACTOR Grizzly Homes
EXCAVATION METHOD CAT 303E CR
LOGGED BY EW **CHECKED BY** PL
NOTES _____

PROJECT NAME Franktown Subdivision Review
PROJECT LOCATION _____
GROUND ELEVATION _____ **TEST PIT SIZE** 1m
GROUND WATER LEVELS:
AT TIME OF EXCAVATION ---
AT END OF EXCAVATION ---
AFTER EXCAVATION ---

DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
			Topsoil
		0.14	Sand and gravel and trace clay
	SS 1	0.30	EOH, refusal on bedrock

Bottom of test pit at 0.30 m.



Mcintosh Perry
115 Walgreen Road
Carp K0A 1L0

TEST PIT NUMBER TP10

CLIENT Grizzly Homes
PROJECT NUMBER CCO-22-0256
DATE STARTED 21-12-14 **COMPLETED** 21-12-14
EXCAVATION CONTRACTOR Grizzly Homes
EXCAVATION METHOD CAT 303E CR
LOGGED BY EW **CHECKED BY** PL
NOTES _____

PROJECT NAME Franktown Subdivision Review
PROJECT LOCATION _____
GROUND ELEVATION _____ **TEST PIT SIZE** 1m
GROUND WATER LEVELS:
AT TIME OF EXCAVATION ---
AT END OF EXCAVATION ---
AFTER EXCAVATION ---

DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
--------------	-----------------------	----------------	----------------------

			Topsoil
--	--	---	---------

		0.17	EOH, refusal on bedrock Bottom of test pit at 0.17 m.
--	--	------	--




Mcintosh Perry
115 Walgreen Road
Carp K0A 1L0

TEST PIT NUMBER TP11

CLIENT Grizzly Homes
 PROJECT NUMBER CCO-22-0256
 DATE STARTED 21-12-14 COMPLETED 21-12-14
 EXCAVATION CONTRACTOR Grizzly Homes
 EXCAVATION METHOD CAT 303E CR
 LOGGED BY EW CHECKED BY PL
 NOTES _____

PROJECT NAME Franktown Subdivision Review
 PROJECT LOCATION _____
 GROUND ELEVATION _____ TEST PIT SIZE 1m
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION ---
 AT END OF EXCAVATION ---
 AFTER EXCAVATION ---

DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
			Topsoil
		0.10	Brown/ red sand
	SS 1	0.30	EOH, refusal on bedrock

Bottom of test pit at 0.30 m.



Mcintosh Perry
115 Walgreen Road
Carp K0A 1L0

TEST PIT NUMBER TP12

CLIENT Grizzly Homes
 PROJECT NUMBER CCO-22-0256
 DATE STARTED 21-12-14 COMPLETED 21-12-14
 EXCAVATION CONTRACTOR Grizzly Homes
 EXCAVATION METHOD CAT 303E CR
 LOGGED BY EW CHECKED BY PL
 NOTES _____

PROJECT NAME Franktown Subdivision Review
 PROJECT LOCATION _____
 GROUND ELEVATION _____ TEST PIT SIZE 1m
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION ---
 AT END OF EXCAVATION ---
 AFTER EXCAVATION ---

DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
			Topsoil
		0.25	Brown sand trace clay
	SS 1	0.40	Grey clay trace sand trace gravel
0.5			
	SS 2	0.60	

EOH, refusal on bedrock

Bottom of test pit at 0.60 m.

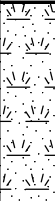


Mcintosh Perry
115 Walgreen Road
Carp K0A 1L0

TEST PIT NUMBER TP13

CLIENT Grizzly Homes
 PROJECT NUMBER CCO-22-0256
 DATE STARTED 21-12-14 COMPLETED 21-12-14
 EXCAVATION CONTRACTOR Grizzly Homes
 EXCAVATION METHOD CAT 303E CR
 LOGGED BY EW CHECKED BY PL
 NOTES _____

PROJECT NAME Franktown Subdivision Review
 PROJECT LOCATION _____
 GROUND ELEVATION _____ TEST PIT SIZE 1m
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION ---
 AT END OF EXCAVATION ---
 ▽ AFTER EXCAVATION 0.73 m

DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
			Topsoil
0.30			Brown sand and gravel
0.5			
0.65			Grey clay trace sand and gravel and cobbles up to 4 inches (wet)
0.85			EOH, refusal on bedrock

Bottom of test pit at 0.85 m.

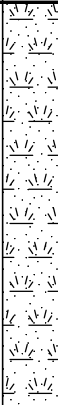




Mcintosh Perry
115 Walgreen Road
Carp K0A 1L0

TEST PIT NUMBER TP14

CLIENT Grizzly Homes
 PROJECT NUMBER CCO-22-0256
 DATE STARTED 21-12-14 COMPLETED 21-12-14
 EXCAVATION CONTRACTOR Grizzly Homes
 EXCAVATION METHOD CAT 303E CR
 LOGGED BY EW CHECKED BY PL
 NOTES _____

PROJECT NAME Franktown Subdivision Review
 PROJECT LOCATION _____
 GROUND ELEVATION _____ TEST PIT SIZE 1m
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION ---
 AT END OF EXCAVATION ---
 AFTER EXCAVATION ---

DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.5			Topsoil
1.0			Clay and gravel (very dry, crumbly)
1.20	SS 1		EOH, refusal on bedrock Bottom of test pit at 1.20 m.

GENERAL_BH / TP / WELL GRIZZLY HOMES - FRANKTOWN.GPJ GINT STD CANADA.LAB.GDT 22-1-11



Mcintosh Perry
115 Walgreen Road
Carp K0A 1L0

TEST PIT NUMBER TP15

CLIENT Grizzly Homes **PROJECT NAME** Franktown Subdivision Review
PROJECT NUMBER CCO-22-0256 **PROJECT LOCATION** _____
DATE STARTED 21-12-14 **COMPLETED** 21-12-14 **GROUND ELEVATION** _____ **TEST PIT SIZE** 1m
EXCAVATION CONTRACTOR Grizzly Homes **GROUND WATER LEVELS:**
EXCAVATION METHOD CAT 303E CR **AT TIME OF EXCAVATION** ---
LOGGED BY EW **CHECKED BY** PL **AT END OF EXCAVATION** ---
NOTES _____ **▼ AFTER EXCAVATION** 0.50 m

DEPTH (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
			Topsoil
		0.25	Gravelly sand with cobbles (wet)
0.5		▼	
	SS 1	0.65	

EOH, refusal on bedrock

Bottom of test pit at 0.65 m.

HYDROGEOLOGICAL ASSESSMENT AND TERRAIN ANALYSIS GRIZZLY HOMES SUBDIVISION, BECKWITH, ONTARIO



APPENDIX I: NITRATE ATTENUATION CALCULATIONS

Nitrate Dilution Calculation

CCO-22-0256
 Grizzly Homes, Franktown, ON
 Nitrate Loading Calculations Aug.22.2022

Land Area

A _{total}	268,562.80	m ²
A _{imperv}	27,119.90	m ²
Infiltrating Area	89.9%	
A _{perv}	241,442.90	m ²

Water Surplus (W_s)

Precipitation	943.4	mm/yr
Evapotranspiration	609.5239	mm/yr

W_s = Precipitation - Evapotranspiration

W _s	333.8761	mm/yr
	0.333876	m/yr

Infiltration Factor (I_f) per MOEE 1995

Topo	0.18750	(0.7% average slope)
Soil	0.26	
Cover	0.15	Mix of woodland and cultivated land

I_f = 0.598

Infiltration (I)

I = W _s * I _f	0.199491	m/yr
Runoff = W _s - I	0.134385	m/yr

Dilution Water Available (D_w)

D _{w,perv} = A _{perv} * I	48165.68	m ³ /yr
	131960.78	L/day
Runoff _{perv} = A _{perv} * W _s * (1 - I _f)	32446.34	m ³ /yr
Runoff _{imperv} = A _{imper} * W _s	9054.69	m ³ /yr
Runoff _{total} = Runoff _{perv} + Runoff _{imper}	41501.03	m ³ /yr
Runoff Reduction % =	0%	(if using LID for stormwater management)
Runoff Reduction =	0.00	m ³ /yr
D _{w (final)} = D _{w,perv} + Runoff Reduction	48165.68	m ³ /yr
	131960.78	L/day

Nitrate Concentrations

Background Nitrate Concentration (C _b)	2.5	mg/L
Max Boundary Nitrate Concentration (C _{boun})	10	mg/L
Effluent Nitrate Concentration (C _e)	40	mg/L
Nitrate Reduction	0%	(if CAN/BNQ 3680-600 N-I or NSF/ANSI 245 applies)
C _{e (final)} =	40	mg/L

Effluent Loading (Q_e)

Q _e =	1000	L/day/Residential Lot
------------------	------	-----------------------

Maximum Allowable Number of Lots (N)

N = [D_w * (C_b - C_{boun})] / [Q_e * (C_{boun} - C_b - C_e)]
 N = 30.452

or

Calculated Nitrate Concentration (C_w)

N = 30 lots
 C_w = [(C_e * Q_e * N) / ((Q_e * N) + D_w)] + C_b
 C_w = 9.909 mg/L
 C_w <= C_{boun}, therefore proposed development will not exceed ODWO at property limit

Potential Evapotranspiration

Thornthwaite Method, "Hydrology & Hydraulic Systems", Gupta

Etmonth = 1.62 (10 * Tm / I) ^ a

where:

a = 675 * 10 ^ -9 * I ^ 3 - 771 * 10 ^ -7 * I ^ 2 + 179 * 10 ^ -4 * I + 492 * 10 ^ -3

I = sum (Tm/5) ^ 1.514

Stn: Ottawa MacDonald -Cartier Int'l A (YOW)
 Site Climate ID: 6106000

Month	Temp C	I	ET (cm) unadjusted	Daylight Factor	ET (cm) adjusted
January	-10.3				
Feb	-8.1				
March	-2.3				
April	6.3	1.4189	2.8610	1.13	3.2330
May	13.3	4.3982	6.4518	1.28	8.2583
June	18.5	7.2487	9.2396	1.29	11.9191
July	21	8.7821	10.6062	1.31	13.8942
Aug	19.8	8.0336	9.9484	1.21	12.0375
Sept	15	5.2767	7.3542	1.04	7.6483
Oct	8	2.0372	3.7105	0.94	3.4879
Nov	1.5	0.1616	0.6001	0.79	0.4741
Dec	-6.2				
I		37.35695	50.7719		60.9524
thus a =		1.0883			

Notes:

-Daylight Factor is an adjustment Factor for possible hours of sunshine based on latitude for Ottawa.

-Monthly temperatures from Environment Canada Climate Normals (1981-2010)

Input data from user
Set value
Site Constant (adjustment for latitude)
Calculated by worksheet