

November 21, 2017

Mr. John Atkinson Project Officer 2 Planning, Property and Development City of Winnipeg

Dear Mr. Atkinson,

### Subject Hydrogeological Test Drilling Results and Analysis La Barrière Park – 4403 Waverley St. - City of Winnipeg, Manitoba

Friesen Drillers Limited is pleased to present this letter detailing the results and analysis of our hydrogeological test drilling for a potential groundwater supply for washroom facilities at La Barrière Park. The work included hydrogeological test drilling and groundwater sampling to confirm the on site hydrogeological conditions. The following paragraphs outline the results of the work undertaken.

### Project Background and Site Setting

Friesen Drillers was retained by the City of Winnipeg to undertake a preliminary hydrogeological investigation for a potential groundwater supply for new public washroom facilities in the La Barrière Park. The preliminary desktop investigation indicated that the bedrock aquifers at the site were expected to produce salty groundwater. In addition, regional geologic mapping suggested a potential for inter till sand and gravel deposits to be present at the site.

Friesen Drillers was subsequently retained by the City of Winnipeg to conduct on site test drilling and water sampling to assess the local hydrogeological conditions. A Groundwater Exploration Permit (GEP) was obtained from Manitoba Sustainable Development (MSD) on behalf of the City of Winnipeg prior to the commencement of test drilling activities. A copy of the GEP is attached.

La Barrière Park is located along the La Salle River, a few miles south of the City of Winnipeg on Waverley Street. The park encompasses approximately 320 acres in a region with relatively low topographical relief. Surface drainage is towards the La Salle and the Red Rivers. The park is host to various amenities which include picnic shelters, nature trails, and baseball diamonds. It is our understanding that the existing park washrooms have been closed and that outhouses have been placed on site. The location of the park is shown below in Figure 1.



Figure 1 – La Barrière Park site along the La Salle River, south of the City of Winnipeg. (source – Google Earth, 2017) 307 PTH 12 N, Steinbach, MB R5G 1T8 204-326-2485 Toll Free 1-888-794-9355 friesendrillers.com

### Regional Geological/ Hydrogeological Setting

From regional maps, the geology underlying La Barrière Park consists of silty grey clay, approximately 40 to 50 feet thick, overlying a 5 to 10 foot thick deposit of calcareous grey clay till. The till is noted to contain some layers of sand and gravel. Underlying the clay till unit in some locations is a fractured carbonate rock rubble zone. The thickness of the rubble zone varies within a few feet across the area. Some karstic features have also been noted in the area. The rubble zone gradually changes into the more competent, fractured carbonate rock of the Fort Garry Member of the Red River Formation. The Red River formation typically consists of alternating layers of limestone and dolostone with basal shale layers. The Red River Formation is in turn underlain by the Winnipeg Formation clastic (sandstone and shale) unit, and Precambrian basal bedrock (Render, 1970). A geological cross section is shown below as Figure 2.

Some of the well logs in the area around La Barrière Park indicate the presence of a sand and gravel layer, up to 30 feet thick, that was intersected approximately 40 feet below grade. The sand and gravel is not likely to be continuous throughout the area.

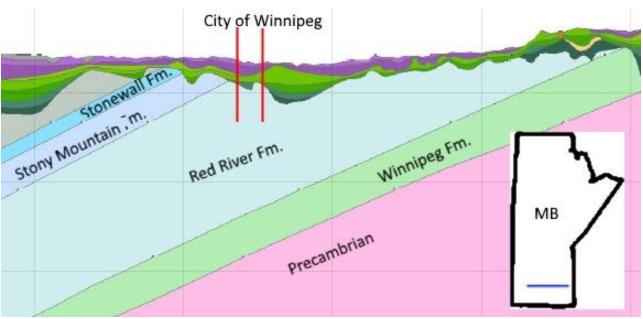


Figure 2 – Geological cross section through Southern Manitoba (source – Manitoba Geological Survey, 2013)

The general hydrogeological conditions of the area were determined from a review of the applicable hydrogeological reports and information available through Manitoba Sustainable Development (MSD). Groundwater aquifers in the Winnipeg area can be found in the overburden till (in specific places), the Red River Formation carbonate, and in the Winnipeg Formation sandstone (Betcher et. al, 1995). Regional mapping conducted in the area by Betcher (1995), identified a regional groundwater quality boundary in the major bedrock aquifers. The groundwater quality maps indicate that groundwater in the both the carbonate and sandstone bedrock aquifers is saline in the region west from the Red River.

From regional mapping it is apparent that La Barrière Park is located in an area where the groundwater quality in the bedrock aquifers is known to be brackish to saline. In these saline areas, groundwater quality typically deteriorates with increasing depth below the surface. It is therefore recommended to pursue a groundwater supply from either the intra-till sand and gravel deposits or the shallow carbonate bedrock aquifer.

Figure 3, shown on the following page, contains the general distribution of sand and gravel aquifers in the area south of the City of Winnipeg. From Figure 3, La Barrière Park is located in an area with few widely scattered sand and gravel aquifers. This result is supported by the sand and gravel layers intersected in some of the nearby private wells and not in others. It is further noted from Figure 3 that major buried sand and gravel aquifers appear to terminate in the area just north and west of the park.

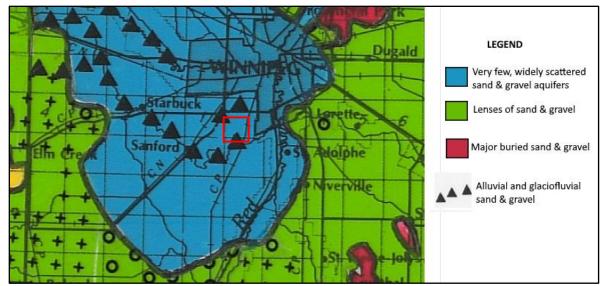
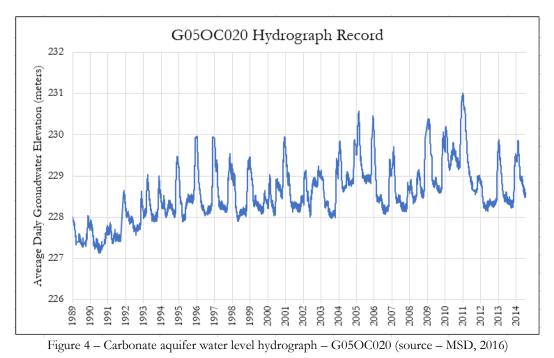


Figure 3 – Distribution of surficial sand and gravel aquifers in the Winnipeg area; location of La Barrière Park indicated in red. (source – Rutulis, 1986)

The nearest maintained monitoring station (G05OC020) to the park site is located approximately four miles east-southeast of the park along the Red River. Figure 4, shown below, contains a plot of the hydrograph record since the late 1980s. A review of the Figure 4 reveals seasonal fluctuations of groundwater levels, with a typical water level between 228 to 231 meters Geodetic. The approximate ground elevation is 233 m Geodetic. Over the past twenty years, the hydrograph record has reflected seasonal and climatic fluctuations, with water levels being relatively stable. Since 2000, water levels have been on a progressive rise, although there was a minor change into a slightly declining trend after 2011. Past 2012, water levels appear to be rising again.



The geochemistry of groundwater in the carbonate aquifer was assessed through a review of available provincial and private monitoring wells, including the results from the closest provincial station (G05OC020). The groundwater from this analysis plots as chloride/sulfate type

### Regional Geological/Hydrogeological Setting (cont'd)

groundwater, which indicates moderate-poor groundwater quality. It should be noted that G05OC020 is located east of the park and that groundwater quality in the bedrock aquifers generally deteriorates in the westerly direction and vertically with depth. In addition, groundwater quality often gets worse with pumping.

## **Field Investigations**

## Hydrogeological Test Drilling

Friesen Drillers mobilized to La Barriere Park on August 7-8, 2017, and drilled three test holes at the site. The locations of the test holes are shown below in Figure 5. Underground utility clearances were obtained prior to drilling activity. The first test hole (TH-01) was drilled near to the proposed location of the washroom facility. The two remaining test holes were drilled at locations away from TH-01 in an attempt to intersect suitable sand and gravel layers. The details of the test holes are shown below as Table 1. The drillers logs are also attached.



Figure 5 - Three test well locations at La Barriere Park. (source - Google Earth, 2017)

		L	T a Barrière Park – 4403 W	Table est Hole I averley S	Details	innipeg, Mar	iitoba							
Well ID														
TH-01	5 inch PVC	62 ft.	62-67 ft. Sand pack 55-71 ft.	71 ft.	Bentonite	0-95 ft.	631593.95 m E	5509088.34 m N						
TH-02	N/A	N/A	N/A	66 ft.	Bentonite	0-66 ft.	631427.82 m E	5509098.76 m N						
TH-03	N/A	N/A	N/A	76 ft.	Bentonite	0-76 ft.	631586.94 m E	5508694.39 m N						

Table 1 - Test hole details - La Barriere Park.

### Hydrogeological Test Drilling (Cont'd)

The bedrock aquifers underlying La Barriere Park are known to produce saline groundwater. Consequently, the highest quality groundwater in the area will be from either local sand and gravel deposits which may or may not be present in the overburden, or from the shallowest regions of the carbonate bedrock aquifer. Based on these conditions, the first test hole (TH-01) was drilled proximal to the washroom facility to reduce any potential hookup costs. Since the drilling of TH-01 did not intersect sand and gravel layers, a PVC test well was installed into the rubble zone at the top of the bedrock to test the groundwater quality and capacity of the bedrock at the site. As hydrogeological data on the bedrock aquifer would be available from TH-01, the following test holes (TH-02 and TH-03) did not require PVC wells to be constructed, and the test holes were drilled down to the bedrock in an attempt to intersect sand and gravel. If test holes, TH-02 or TH-03 would have intersected sand and gravel, a screened well would have been constructed. In the absence of sand and gravel, TH-02 and TH-03 were sealed as per provincial regulations.

The test holes were drilled until either a sand layer or the carbonate bedrock was intersected, resulting in total borehole depths of 66-77 feet. The stratigraphy between the test holes was similar and generally consisted of clay from surface down to 40 feet below grade. Below the clay, a layer of glacial till was intersected, with a total thickness of approximately 25-30 feet, which lay directly upon the carbonate bedrock. The depth to bedrock was shown to increase towards the south of the site. It should be noted that there were no significant sand or gravel deposits intersected during the test drilling.

A rubble zone was encountered at the upper bedrock surface in TH-01 and TH-02. This rubble zone was screened off in the construction of test well TH-01. There was no significant rubble zone intersected in TH-03.

Test hole TH-01 was constructed using 5 inch diameter PVC casing through the overburden and was drilled open hole in the carbonate bedrock to final depth. The PVC casing was grouted in place with bentonite. A 4 inch diameter, 15 slot, stainless steel wire wound screen was installed in the rubble zone over the interval of 62 to 67 feet below grade. The screen was set in place and a sand pack was poured into the annular space over the interval of 55 to 71 feet below grade. Based on manufacturers specifications, the screen is designed for a maximum flow rate of 44 U.S. Gallons Per Minute (U.S.G.P.M.). This flow rate assumes a maximum entrance velocity of 0.1 ft./second. Pumping at higher rates may cause sand and other sediment to be pumped through the screen.

Upon completion of the test drilling work, test holes TH-02 and TH-03 were sealed according to provincial regulations.

### Pumping Test and Aquifer Characterization

Following the installation of TH-01, a short term pumping test was conducted to assess the well capacity. The results of the test are summarized below in Table 2. The pumping test was conducted using a 1 HP pump, with power supplied by an on site generator. The discharge rate was measured by timing known volumes of discharged water. The water levels in the well were measured manually at regular intervals using a depth sounder.

			Table 2		
	W	ater Level Drawdow	vns Observed Durin	ng Testing	
	La Barriè	re Park – 4403 Wave	rley St City of Wi	nnipeg, Manitob	a
Pumping Well	Static Water Level	Pumping Water	Pumping Rate	Drawdown	Specific Capacity
		Level			
TH-01	20.6 ft.	55.8 ft.	24 U.S.G.P.M.	35.2 feet	0.68 U.S.G.P.M./ft.
	77:11	2 D			

Table 2 - Pumping test parameters for TH-01, La Barriere Park.

The pumping test results indicate that the well should be capable of producing approximately 25 U.S.G.P.M. This estimate assumes a static groundwater level of 21 feet below grade and a pump set at the bottom of the casing. It is likely that this amount of water would be sufficient for the proposed washroom facilities.

An estimation of aquifer transmissivity was undertaken as part of the site assessment. The specific capacity results from TH-01 were applied using the method developed by Razack and Huntley (1991) to estimate the transmissivity of the carbonate aquifer at La Barriere Park. The calculated results are shown in Table 3, shown on the following page.

Pumping Test and Aquifer Characterization

		Table 3	
	Α	quifer Transmissivity	
La B	arrière Park – 4403	8 Waverley St City of V	Winnipeg, Manitoba
Method	Pumping Rate	Specific Capacity	Transmissivity
Razack and Huntley (1991)	24 U.S.G.P.M.	0.68 U.S.G.P.M./ft.	6,800 U.S.G.P.D./ft.
Regional Mapping (Baracose, 1988)	-	-	10,000-20,000 U.S.G.P.D./ft.

Table 3 - Estimate of transmissivity from specific capacity; regional transmissive values provided for comparison -La Barriere Park.

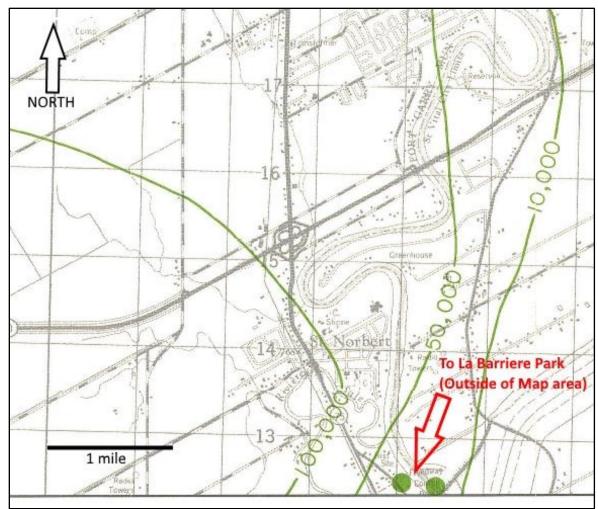


Figure 6 – Regional transmissivity (U.S.G.P.D./ft.) mapping of the Winnipeg area; Location of La Barriere Park is a few miles outside the map area to the south as indicated by red arrow. (source – Baracose, 1983)

The results of the transmissivity estimation from TH-01 are similar, though somewhat lower than the results indicated by the regional transmissivity mapping. The lower transmissivity value could be attributed to a number of factors. First, the construction of TH-01 is designed to essentially skim the shallowest groundwater from the aquifer. Consequently, the well does not intersect many water bearing fractures and would likely underestimate the aquifer transmissivity. Second, the regional mapping was conducted for the Winnipeg area, with the results extrapolated to the La Barriere Park site. It is possible, given the apparent trend of the isograd lines in Figure 6, that regional mapping at the site may estimate transmissivity to be below 10,000 U.S.G.P.D./ft. Ultimately, a transmissivity value in the range of 10,000 U.S.G.P.D./ft. is considered to be reasonable for the La Barriere Park site.

Well Inventory

To fulfill the conditions set out in the GEP, an inventory of all private and commercial wells within a one mile radius of the location of test drilling was conducted. The inventory was conducted using the MSD GWDRILL database (2016). The results of the inventory are shown below in Table 4. In total, one domestic well was identified within the mile radius from TH-01. It should be noted that the current status of the identified well is not known and the location of the well was not verified.

The well log indicates steel casing to a depth of 96 feet below grade and have a total depth of 109 ft. The bedrock aquifer was noted to become salty at 105 feet below grade.

			Well	Tab Inventory	ole 4 – 1 mile radius					
		La Bar	rière Park –	4403 Wav	erley St City of	Winnipe	g, Manito	ba		
No.	Location	Owner	Driller	Well	Depth of	Date	Depth	S.W.L.	P.W.L.	Rate
				Use	Casing (ft.)		(ft.)	(ft.)	(ft.)	igpm
			Mondor							
1	NW-36-8-2E	M Sherwood	Drillers	Р	96.0	1970	109.0	21.0	24.0	6.0
Notes	Friesen Drillers	a sourced from Ma s Limited has not v l have not been ve:	erified or field	ld confirme	ed any data present	t in this ta	ble. All yi	elds and sta		
	S.W.L. – Static	water level; P.W.L			; N.A. – Not prov			; P – Produ	iction;	

Table 4 - Well inventory results, 1 mile radius. (Source- MSD, 2016)

### Groundwater Analytical Sampling

A groundwater sample collected from TH-01 was sent to an accredited laboratory for routine geochemical analysis. A trilinear plot of major ion concentrations is shown on the following page as Figure 6. The groundwater chemistry from a nearby provincial monitoring well is included for comparison. A copy of the laboratory report is also attached (L1972633).

The samples plot as moderate to poor quality sodium/potassium/chloride type groundwater. Highlights of the results are as follows:

- Total Dissolved Solids 4,990 mg/L
- Chloride 2,210 mg/L
- Hardness 1,440 mg/L (analysis may be biased high as per laboratory comments)
- Iron 2.7 mg/L

The concentration of nitrate was below detection limits in the sample from TH-01. The confined aquifer conditions at the site offer good protection to the bedrock aquifers in the tested area.

Results from the testing indicate that groundwater quality at the site is saline and relatively poor. The suitability of the groundwater quality for use at the site should be assessed by those designing the washroom facility. It should also be noted that the water quality could get worse with pumping.

Groundwater Analytical Sampling (Cont'd)

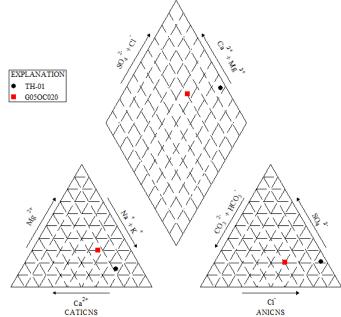


Figure 6 - Trilinear plot of water sample collected from TH-01. (source - ALS Laboratories, L1972633; MSD, 2017))

### **Conclusions and Recommendations**

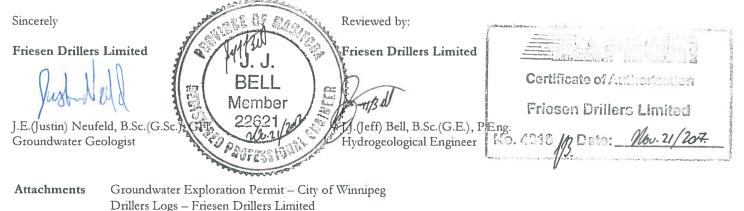
Based on the results of the hydrogeological test drilling, the following conclusions and recommendations can be made with regard to a potential groundwater supply at La Barrière Park:

- La Barrière Park is located in a region where the underlying bedrock aquifers are saline. Consequently, the best options for a groundwater supply are the intra-till sand and gravel deposits (if present) or the shallow carbonate bedrock aquifer.
- Test drilling at the site did not intersect any significant deposits of sand and gravel.
- Test well TH-01 was constructed with a screened section through the rubble zone at the upper bedrock surface.
- Based on the pumping test conducted on TH-01, the well should be capable of producing up to 25 U.S.G.P.M.
- Results from the groundwater sample analysis confirm that saline conditions are present in the bedrock aquifer at the site. Although the groundwater quality is poor, it may be suitable for certain uses at the site. The chemistry results should be reviewed by the designers of the facility. All aspects of the piping and processing should make this point paramount. The system will produce saline water that will be very hard on connected plumbing fixtures.
- It should be noted that the groundwater from TH-01 is likely to be the best quality groundwater available at the site. Due to the site conditions, it is possible that groundwater quality may become worse with pumping, as deeper, saltier groundwater may be drawn up into the well.
- If the well is to be mechanized, the pumping rate should be kept as low as possible to reduce the upwelling of poorer quality groundwater.
- The on site conditions should be monitored regularly for changes in groundwater levels and groundwater quality.
- The well will likely require maintenance from time to time.
- The well should remain permanently vented. Conclusions and Recommendations (Cont'd)

• A copy of this report should be sent to MSD- Water Use Licensing Section.

We thank you for the opportunity to be of service to the City of Winnipeg and to work with you on this project.

Should you require anything further or have any additional questions, please call me at 204-326-2485.



Groundwater Chemistry Analysis Report – ALS Laboratories (L1972633)

### References

Baracose, A., 1983. Transmissivity of the Upper Carbonate Aquifer: Geological Engineering Report for Urban Development Winnipeg. University of Manitoba.

Betcher, R.N., Grove, G., and Pupp, C, 1995. Groundwater in Manitoba. NHRI Contribution No. CS-93017

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Manitoba Geological Survey, 2013. Unpublished cross sections of Manitoba.

Razack, M. and Huntley, D. 1991. Assessing Transmissivity from Specific Capacity in a Large and Heterogeneous Alluvial Aquifer National Groundwater Association, Volume 29, Issue 6, November 1991, pp. 856–861. Doi:10.1111/j.1745-6584.1991.tb00572.x

Rutulis M., 1986. Aquifer Maps of Southern Manitoba, Manitoba Natural Resources, Water Resources Branch.

The scope of this report is limited to the matters expressly covered and is intended solely for the client to whom it is addressed. Friesen Drillers Limited makes no warranties, expressed or implied, including without limitation, as to the marketability of the site, or fitness to a particular use. The assessment was conducted using standard engineering and scientific judgment, principles, and practices, within a practical scope and budget. It is based partially on the observations of the assessor during the site visit in conjunction with archival information obtained from a number of sources, which is assumed to be correct. Except as provided, Friesen Drillers Limited has made no independent investigations to verify the accuracy or completeness of the information obtained from secondary sources or personal interviews. Generally, the findings, conclusions, and recommendations are based on a limited amount of data (e.g. number of boreholes drilled or water quality samples submitted for laboratory analysis) interpolated between sampling points and the actual conditions on the site may vary from that described above. Any findings regarding the site conditions different from those described above upon which this report was based will consequently change Friesen Drillers Limited's conclusions and recommendations.

### Disclaimer

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Water Use Licensing Section Box 16, 200 Saulteaux Crescent Winnipeg, Manitoba, Canada R3J 3W3 T 204-945-6118 F 204-948-2357 Rob.Matthews@gov.mb.ca

July 26, 2017

File: Winnipeg, The City of -43

John Atkinson Project Officer, City of Winnipeg 4<sup>th</sup> Floor, 185 King Street, Winnipeg, MB R3B 1J1

Dear Mr. Atkinson:

Attached herewith is a **Groundwater Exploration Permit** issued in response to an application you submitted on behalf of the City of Winnipeg, registered on July 13, 2017, for a licence to construct well(s) and divert groundwater on **Outer Two Mile Lot 059 to 065**, **Parish of St. Norbert, La Barriere Park, La Salle, Manitoba**, for other - recreation purposes.

The Groundwater Exploration Permit authorizes The City of Winnipeg to carry out exploration test well drilling, install wells and conduct pumping test. The purpose of the pump testing is to determine if sufficient water is available from the aquifer to support the project and to determine water level impacts on existing local wells and/or registered projects with earlier precedence dates than the proposed project. Please note that during testing, pumping must cease if any local water supplies are negatively impacted as a result of testing. The City of Winnipeg would further be responsible to correct any water supply problems or provide temporary water supply to anyone whose water supplies are negatively impacted as a result of testing the aquifer. Please familiarize yourself with the terms and conditions of the Groundwater Exploration Permit.

A licensing decision on this project will be held pending submission of the required information. Please note that diversion of water without a Water Rights Licence or written authorization would constitute a violation of *The Water Rights Act* and may be subject to enforcement.

One important condition of any licence that may be issued for this project, in due course, is that a water use monitoring device must be installed on the pipeline from the supply well(s), positioned to accurately measure instantaneous pumping rate and accumulative withdrawals.

Please contact Ronaldo Miranda directly at 204-945-6475 should you have any questions regarding the requirements outlined in this letter and the attached permit or the water rights licensing aspects of this project.

Yours truly,

Rob Matthews Manager Water Use Licensing Section

Cc: Justin Neufeld, G.I.T., Friesen Drillers Ltd. Ronaldo Miranda (SD)



FORM F

## **Groundwater Exploration Permit**

Pursuant to The Water Rights Act

## The City of Winnipeg (La Barriere Park)

is hereby permitted to explore for and construct a groundwater well or wells on the following described lands, Outer Two Mile Lot 059 to 065, Parish of St. Norbert, La Barriere Park, La Salle, Manitoba, for other – recreation purposes, subject, however, to the following conditions:

- 1. The permittee must have legal access to the site where the exploration work and project wells are to be located.
- 2. This Authorization is not transferable or assignable to any other party.
- Prior to undertaking any work or construction of any works authorized by this permit the permittee is required to retain the services of a hydrogeologist registered with Association of Professional Engineers and Geoscientists of Manitoba (APEGM), who would be required to:
  - Plan and supervise the drilling of boreholes, test wells, production and observation well(s) and well pump testing as authorized by this permit.
  - Conduct a constant rate pumping test on proposed production well(s) in accordance with Form H (http://www.gov.mb.ca/conservation/waterstewardship/licensing/wlb/pdf/form\_h\_july\_2013.pdf).
  - Conduct a recovery test for a period equal to pump test or 90% recovery.
  - Carry out an inventory of private and commercial wells within a 1 mile radius of the project well site. The inventory may need to be expanded based on the assessment of the expected area of water level drawdown impact resulting from future pumping.
  - Prepare and submit to the Water Use Licensing Section a technical report on drilling of boreholes and wells, pump testing of well, well inventory and water quality sampling. The report would contain, but not limited to, such things as: well driller's reports for test wells, production and observation wells; a plan showing the location of these wells on the property and/or GPS locations of the wells; an analysis of aquifer pumping tests; calculations of transmissivity; and a description of the amount of water level interference that would be expected to occur at existing local wells that are located within a 1 mile radius of the project well site. <u>Two copies of the report shall be submitted</u>, one hardcopy and one digital copy.
- 4. During any pumping tests that may be conducted, pumping must cease immediately if any local water supplies are negatively impacted as a result of the tests. The permittee is also responsible to correct any water supply problems or provide temporary water supply to anyone whose water supplies are negatively impacted as a result of the tests.
- 5. This permit expires within twelve (12) months of the date of issuance.
- 6. Please note that diversion of water without a Water Rights Licence or written authorization would constitute a violation of *The Water Rights Act* and may be subject to enforcement.

Issued at the City of Winnipeg in the Province of Manitoba, this 26 day of July, A.D. 2017
Tab Mathems

for The Honourable Minister of Sustainable Development



FRIESEN DRILLERS LTD ATTN: JEFF BELL 307 PTH 12 N STEINBACH MB R5G 1L9 Date Received: 10-AUG-17 Report Date: 15-AUG-17 11:24 (MT) Version: FINAL

Client Phone: 204-326-2485

# Certificate of Analysis

Lab Work Order #: L1972633 Project P.O. #: NOT SUBMIT

Job Reference: C of C Numbers: Legal Site Desc: NOT SUBMITTED BARRIERE PARK

boro

Barb Bayer, B.Sc. General Manager, Winnipeg

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# ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1972633-1 TH-01							
Sampled By: CL on 09-AUG-17 @ 13:30							
1 ,							
Matrix: WATER							
ROU4W total							
Alkalinity, Bicarbonate	0.10					44 4110 47	
Bicarbonate (HCO3) Alkalinity, Carbonate	210		1.2	mg/L		14-AUG-17	
Carbonate (CO3)	<0.60		0.60	mg/L		14-AUG-17	
Alkalinity, Hydroxide							
Hydroxide (OH)	<0.34		0.34	mg/L		14-AUG-17	
Alkalinity, Total (as CaCO3)							<b>D - - - - - - - - - -</b>
Alkalinity, Total (as CaCO3)	172		1.0	mg/L		11-AUG-17	R3796362
Chloride in Water by IC Chloride (Cl)	2210		10	mg/L		10-AUG-17	R3797626
Conductivity			-				
Conductivity	7130		1.0	umhos/cm		11-AUG-17	R3796362
Fluoride in Water by IC		DIM	0.40			40 4110 17	D0707655
Fluoride (F) Hardness Calculated	0.45	DLM	0.40	mg/L		10-AUG-17	R3797626
Hardness Calculated Hardness (as CaCO3)	1440	нтс	1.3	mg/L		15-AUG-17	
Nitrate in Water by IC							
Nitrate (as N)	<0.40	DLM	0.40	mg/L		10-AUG-17	R3797626
Nitrate+Nitrite							
Nitrate and Nitrite as N	<0.45		0.45	mg/L		14-AUG-17	
Nitrite in Water by IC Nitrite (as N)	<0.20	DLM	0.20	mg/L		10-AUG-17	R3797626
Sulfate in Water by IC	10.20		0.20				110101020
Sulfate (SO4)	822		6.0	mg/L		10-AUG-17	R3797626
TDS calculated							
TDS (Calculated)	4990		5.0	mg/L		15-AUG-17	
Total Metals by ICP-MS Calcium (Ca)-Total	322		0.50	mg/L	14-AUG-17	14-AUG-17	R3799320
Iron (Fe)-Total	2.17		0.10	mg/L	14-AUG-17	14-AUG-17	R3799320
Magnesium (Mg)-Total	155		0.050	mg/L	14-AUG-17	14-AUG-17	R3799320
Manganese (Mn)-Total	0.0959		0.0010	mg/L	14-AUG-17	14-AUG-17	R3799320
Potassium (K)-Total	33.2		0.50	mg/L	14-AUG-17	14-AUG-17	R3799320
Sodium (Na)-Total	1340		0.50	mg/L	14-AUG-17	14-AUG-17	R3799320
<b>Turbidity</b> Turbidity	101		0.10	NTU		11-AUG-17	R3796768
pH			0.10	NIU		11-400-17	101 901 00
pH	7.89		0.10	pH units		11-AUG-17	R3796362

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

## **Reference Information**

## **Qualifiers for Sample Submission Listed:**

Qualifier	Description	ļ	
LPML	Lab-Preserv	ed for Total Metals. Sample received	with $pH > 2$ and preserved at the lab. Total Metals results may be biased low
Sample Parameter Qua			
Qualifier Descrip	tion		
DLM Detection	on Limit Adju	sted due to sample matrix effects (e.	g. chemical interference, colour, turbidity).
HTC Hardnes	ss was calcu	llated from Total Ca and/or Mg conce	ntrations and may be biased high (dissolved Ca/Mg results unavailable).
MS-B Matrix S	pike recove	ry could not be accurately calculated	due to high analyte background in sample.
Test Method Reference	es:		
ALS Test Code	Matrix	Test Description	Method Reference**
ALK-CO3CO3-CALC-WP	Water	Alkalinity, Carbonate	CALCULATION
The Alkalinity of water is a	a measure o		ty is imparted by bicarbonate, carbonate and hydroxide components of water.
ALK-HCO3HCO3-CALC- WP	Water	Alkalinity, Bicarbonate	CALCULATION
		f its acid neutralizing capacity.Alkalini y bicarbonate is calculated and report	ty is imparted by bicarbonate, carbonate and hydroxide components of water. ed as mg HCO3-/L $$
ALK-OHOH-CALC-WP	Water	Alkalinity, Hydroxide	CALCULATION
		f its acid neutralizing capacity.Alkalini y hydroxide is calculated and reported	ty is imparted by bicarbonate, carbonate and hydroxide components of water. d as mg OH-/L.
ALK-TITR-WP	Water	Alkalinity, Total (as CaCO3)	APHA 2320B
			ity is imparted by bicarbonate, carbonate and hydroxide components of ral acid to the successive HCO3- and H2CO3 endpoints indicated
CL-IC-N-WP	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are anal	yzed by Ion	Chromatography with conductivity and	d/or UV detection.
EC-WP	Water	Conductivity	APHA 2510B
Conductivity of an aqueou and chemically inert elect		efers to its ability to carry an electric c	urrent. Conductance of a solution is measured between two spatially fixed
ETL-SOLIDS-CALC-WP	Water	TDS calculated	CALCULATION
F-IC-N-WP	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analy	yzed by Ion	Chromatography with conductivity and	d/or UV detection.
HARDNESS-CALC-WP	Water	Hardness Calculated	APHA 2340B
		ess) is calculated from the sum of Ca oncentrations are preferentially used f	lcium and Magnesium concentrations, expressed in CaCO3 equivalents. or the hardness calculation.
IONBALANCE-CALC-WP	Water	Ion Balance Calculation	APHA 1030E
			based on guidance from APHA Standard Methods (1030E Checking sutral, the calculated ion balance (% difference of cations minus anions)
included where data is pre-	esent. Ion B		and anions. Dissolved species are used where available. Minor ions are alculated accurately for waters with very low electrical conductivity (EC), and is calculated as:
Ion Balance (%) = [Cation	Sum-Anion	Sum] / [Cation Sum+Anion Sum]	
		T / 1 / / 1 / 105 / 10	
MET-T-MS-WP	Water	Total Metals by ICP-MS	EPA 200.2/6020A (mod.) High LOR

## **Reference Information**

#### **Test Method References:** ALS Test Code Matrix Method Reference\*\* **Test Description** Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method. NO2+NO3-CALC-WP Water Nitrate+Nitrite CALCULATION NO2-IC-N-WP Nitrite in Water by IC EPA 300.1 (mod) Water Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection. NO3-IC-N-WP Nitrate in Water by IC Water EPA 300.1 (mod) Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection. PH-WP Water pН **APHA 4500H** The pH of a sample is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode. SO4-IC-N-WP Water Sulfate in Water by IC EPA 300.1 (mod) Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection. TURBIDITY-WP Water Turbidity APHA 2130B (modified) Turbidity in aqueous matrices is determined by the nephelometric method. \*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

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

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

### Chain of Custody Numbers:

#### **GLOSSARY OF REPORT TERMS**

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there. mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wut - milligrams per kilogram based on uty weight of sample

mg/kg wwt - minigrams per knogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

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

# ALS Laboratory Group ANALYTICAL CHEMISTRY & TESTING SERVICES

**Environmental Division** 

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10-029209 Page <u>1</u> of <u>1</u>

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REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORM	MATION		WHITE - LABO	RATORY COPY	YELLO	W - CLIE	NT CO	PY			1	GENF 18	.01 Fron	ıt.

# Well Construction Report



ell Name: (if applicable)_La Barrier Park TH-01       GPS: (see note 4), Accuracy +/- 24	heet 1	_of_1_		F	or P	DF s	ubm	issio	on: R	ероі	t must	be prir	nted on legal si	ize pap	oer (8.5 x 14 inches) ar	nd be signed in in	k. Form	No. WELLCON-V01-PD
alling Address 105 - 1105 Performance Address Address 105 - 1105 Performance Address 105 - 1105 Performance Address 105 Performance	Owner	Name: C	ity c	of W	innip	beg									Well Location: (	see note 3; att	ach sketch if nece	essary)
wm/CKy_Winness_NB       QuarterSettionTromshiptangeE E W         auliar Code RES 3P1	Mailing			- 11	55 F	Pacif	ic Av	venu	е	La	st						reet, Winnipeg	
Statl Code RDE 3P1       Phone       Parish       Type & Lot No.         ell Namer 574       GPS (see note 4). Accuracy V.       24       M feet I metres         statl of any RAME of a casing stick-up       GPS (see note 4). Accuracy V.       24       M feet I metres         statl of targe RAME of a casing stick-up       GPS (see note 4). Accuracy V.       24       M feet I metres         statl of targe RAME of a casing stick-up       Backboord of See RAME (see note 5). Sealed I ves I No gg       Method of Construction:       Water Will Construction:       Water Will Construction:       I was any I interval       I was any I	0																	
adii       GP3: (see note 4). Accuracy -/24iii feetiii	Postal C	code R3	E 31	<b>P</b> 1			_ I	Pho	ne									
attractive of the production 3 or a strate of the constraint of the strate of t	Email																	
as definitionation frag with the de casing stick-up       Longitude (decimal degrees) 97.77435         Cotter (specify)       Cotter (specify)         St Hole (see note 5) - Sealed    Yes    No gr       Method of Construction:       Water Use: (Deck alt that supl)         Bid on status (Specify)       If on status (Specify)       Water Use: (Deck alt that supl)       If domestic    public/semi-public    irrigation         production/source    rechting    geotechnical       World of the status (Specify)       If domestic    public/semi-public    irrigation         other (specify)       Cotter (specify)       Cotter (specify)       Observations         other (specify)       Cotter (specify)       Cotter (specify)       Observations         other (specify)       Cotter (specify)       If good (specify)       Observations         other (specify)       Cotter (specify)       If good (specify)       If good (specify)         other (specify)       If good (specify)       If good (specif										I-01								feet 🗆 metres
call on of Trg:       Reckwood Sensitive Area:: T Ves - Permit No IP	Well Ide	entificati	on 1	Гад	Nur	mbe	er <u>5</u>	574										
at Hole (see note 5) - Sealed UYes IN0 are UVes (Inc. at Hux appl)       Water Use: (Inc. at Hux appl)         all Use: If test well - Sealed UYes IN0 are UVes (Incl. at Hux appl)       Description: (Incl. at Hux appl)         and uver UVes (Incl. at Hux appl)       Description: (Incl. at Hux appl)         monitoring are dewatering geotechnical       Description: (Incl. at Hux appl)         and the operation: (Incl. at Hux appl)       Description: (Incl. at Hux appl)         at the operation: (Incl. at Hux appl)       Description: (Incl. at Hux appl)         at the operation: (Incl. at Hux appl)       Description: (Incl. at Hux appl)         at the operation: (Incl. at Hux appl)       Description: (Incl. at Hux appl)         at the operation: (Incl. at Hux appl)       Description: (Incl. at Hux appl)         at the operation: (Incl. at Hux appl)       Description: (Incl. at Hux appl)         at the operation: (Incl. at Hux appl)       Description: (Incl. at Hux appl)         at the operation: (Incl. at Hux appl)       Description: (Incl. at Hux appl)         at the operation: (Incl. at Hux appl)       Description: (Incl. at Hux appl)         at the operation: (Incl. at Hux appl)       Description: (Incl. at Hux appl)         at the operation: (Incl. at Hux appl)       Description: (Incl. at Hux appl)         at the operation: (Incl. at Hux appl)       Description: (Incl. at Hux appl)         at the operation: (Incl. at Hux appl) <td>Locatio</td> <td>n of Tag</td> <td>×A</td> <td>tta</td> <td>che</td> <td>d to</td> <td>o ca</td> <td>sing</td> <td>; sti</td> <td>ck-u</td> <td>р</td> <td></td> <td></td> <td></td> <td></td> <td>0 / =</td> <td></td> <td></td>	Locatio	n of Tag	×A	tta	che	d to	o ca	sing	; sti	ck-u	р					0 / =		
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production/source = recharge/return monitoring = dewatering = geotechnical if is rotary (mud) = rotary (air) = other (specify) = other (sp	Test Ho	le (see n	ote	5) -	Se	aleo	d 🗆	Yes	5 🗆	No	<u>or</u>	Me	ethod of Cor	nstru	ction:	Water Use:	(Check all that apply)	
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other (specify)       other (specify)       other (specify)         ihologic Description: (see notes 6 and 7) - Measure From/To depths from ground surface. Attach another sheet if needed.         01       33       Orgy         03       33       Orgy         04       44       44         05       71       Brown         1       Immetore Robble       Immetore Robble         07       71       Brown       Limestone Robble         07       71       Brown       Limestone Robble         0       Immetore Robble       Immetore Robble       Immetore Robble	•	-																
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om       To       Colour       Material Description (use recommended names on guide)       Observations         0       43       64       Brown       Till       Clay       Clay <td></td> <td>_</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>											_							
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43       94       Brown       Till         44       47       Brown       Limestone         71       Brown       Limestone         0       Bottom of Hole	(ft)			Col	our	•			Ma	ater	ial De	script	t <b>ion</b> (use rec	comm	nended names on	guide)	Obser	vations
64       67       Brown       Limestone Rubble         67       71       Brown       Limestone         71       Extension       Brown       Limestone         0       Image: Comparison of Hole       Image: Comparison of Hole       Image: Comparison of Hole         0       Image: Comparison of Hole       Image: Comparison of Hole       Image: Comparison of Hole         0       Image: Comparison of Hole       Image: Comparison of Hole       Image: Comparison of Hole         0       Image: Comparison of Hole       Image: Comparison of Hole       Image: Comparison of Hole         0       Image: Comparison of Hole       Image: Comparison of Hole       Image: Comparison of Hole         0       Image: Comparison of Hole       Image: Comparison of Hole       Image: Comparison of Hole         0       Image: Comparison of Hole       Image: Comparison of Hole       Image: Comparison of Hole         0       Image: Comparison of Hole       Image: Comparison of Hole       Image: Comparison of Hole         0       Image: Comparison of Hole       Image: Comparison of Hole       Image: Comparison of Hole         0       Image: Comparison of Hole       Image: Comparison of Hole       Image: Comparison of Hole         0       Image: Comparison of Hole       Image: Comparison of Hole       Image: Co	0													-				
6T       71       Brown       Limestone         71       Brown       Bottom of Hole         0       Image: Construction:       Gee note 8) - Measure From/To depths from ground surface. Attach another sheet if needed.         0       Image: Construction:       Gee note 8) - Measure From/To depths from ground surface. Attach another sheet if needed.         0       Image: Construction:       Gee note 8) - Measure From/To depths from ground surface. Attach another sheet if needed.         0       Image: Construction:       Gee note 8) - Measure From/To depths from ground surface. Attach another sheet if needed.         0       To       Image: Construction:       Gee note 8) - Measure From/To depths from ground surface. Attach another sheet if needed.         0       To       Image: Construction:       Gee note 8) - Measure From/To depths from ground surface. Attach another sheet if needed.         0       To       Image: Construction:       Gee conterplay is a state of surface sate from state of surface sate from ground.       Method of Placement (exc: consign and size of surface sate Play is a state of or surface water is go from ground.       Poured         0       71       Image: Das:       X       Image: Das:       Source of Drilling Water: Image: Groundwater is go from ground surface.         0       55       Image: Das:       X       Image: Das:       Source of Drilling Water: Image: Groundwater is go from ground surface.<	43 64		-												hle			
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To (P)       9 <td>Well Co</td> <td>nstructi</td> <td>on:</td> <td>(see</td> <td>e no</td> <td>ote</td> <td>8) -</td> <td>Me</td> <td>asu</td> <td>re F</td> <td>rom/</td> <td>Fo dep</td> <td>oths from gr</td> <td>round</td> <td>l surface. Attach a</td> <td>nother sheet i</td> <td>f needed.</td> <td></td>	Well Co	nstructi	on:	(see	e no	ote	8) -	Me	asu	re F	rom/	Fo dep	oths from gr	round	l surface. Attach a	nother sheet i	f needed.	
0       71       X       1       77/8       Insert Glued PVC         0       62       X       4       4/4       Stainless Steel Wirewond - 15 Slot         55       71       4       4       4/4       Stainless Steel Wirewond - 15 Slot         0       55       4       4       4/4       Stainless Steel Wirewond - 15 Slot         0       55       4       4       4/4       Stainless Steel Wirewond - 15 Slot         0       55       4       4       4/4       Stainless Steel Wirewond - 15 Slot         0       55       4       4       4/4       Stainless Steel Wirewond - 15 Slot         0       55       4       4       4/4       Stainless Steel Wirewond - 15 Slot         0       55       4       4       4/4       Stainless Steel Wirewond - 15 Slot         0       55       6       4       4       4       Suicce of Drilling Water: IR Groundwater       Poured         0       55       1       4       4/4       5       Suice of Drilling Water: IR Groundwater       Suiface water         0       6       6       5       5       Suita Sain       Suita Sain       Poured         1       Big Worbit						٩	en 1	eal		×	() ()	(se						
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ell disinfected: I Yes       No;       Well cover installed: I Yes       No         Name/Location of water source_Friesen Drillers Ltd.								_							-			
tetss adapter/unit installed atfeet bgs; XNot installed																	<b>.</b>	
iiling Additives Used: I Yes (list type & quantity) 1 Bag Wyo-Ben Extra High Yield Bentonite       I No         ell Yield Test (see note 9), ate of Test: Day 8 Month August Year 2017       Well Development: I air lifting surging pumping jetting bailing hydrofracturing other (specify).         X Same as date of well completion atic Water Level Before Test 20.7 feet I bgs ags ethod of Test: I pumping air lift bailing recovery other (specify).       Well Development: I air lifting surging pumping jetting bailing hydrofracturing other (specify).         Ater level at end of test 55.9 feet III bgs ags ngth of test 4 hours minutes timated rate of discharge 20 IIGPM USGPM       I GPM USGPM Nanular space cemented: Yes No Flow control device installed: Yes No Does water leak from around the outside of the casing: Yes III No ecommended Pumping Rate: 15 IIGPM USGPM with pump intake at 58 feet bgs; ill your company be installing a pump?: Yes III No emarks (see note 10) Iron: 0.6 Well must be vented.														Na	me/Location of wa	ater source		J
will interview (istrip e equation)       image interview (istrip e equation)         eil Yield Test (see note 9),       MonthYear 20_17         ate of Test: Day 8MonthYear 20_17       image interview (istrip e equation)         ate of Test: Day 8MonthYear 20_17       image interview (istrip e equation)         ate of Test: Day 8MonthYear 20_17       image interview (istrip e equation)         atic Water Level Before Test20.7feet ist bgs in ags ethod of Test: Repumping interview (istrip e equation)       image interview (istrip e equation)         other (specify)ater level at end of test55.9feet ist bgs in ags ingth of test4 hoursminutes timated rate of discharge20MIGPM interview (istrip e equation)       image interview (istrip e equation)         ecommended Pumping Rate:15									_					<u> </u>	ab Viold Ponta-ite			
ate of Test: Day 8 Month August Year 20 17   Same as date of well completion atic Water Level Before Test 20.7 feet I bgs ags   atic Water (specify) atic ifft bailing recovery   other (specify) ater level at end of test 55.9 feet II bgs ags   atter level at end of test 20 IIGPM USGPM USGPM   bill your company be installing a pump?: Yes II Yes II Yes II Yes III   bill your company be installing a pump?: Yes III Yes IIII Yes IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII							s (lis	t typ	e &	quar	itity)	т вад	vvyo-Ben Ex	ua Hi				🗆 No
Same as date of well completion         atic Water Level Before Test20.7feet I bgs    ags         ethod of Test: Impumping    air lift    bailing    recovery         other (specify)ater level at end of test55.9feet II bgs    ags         ngth of test4 hoursminutes         timated rate of discharge20 IIGPM    USGPM         commended Pumping Rate:15IIGPM    USGPM with pump intake at58feet bgs;         ill your company be installing a pump?:    Yes IIN 0         emarks (see note 10) Iron: 0.6Well must be vented.         ell Drilling Contractor: Company Name_Friesen Drillers Ltd         ell Drilling: Contractor: Company Name_Friesen Drillers Ltd         billing Christ Loeppky							h	A١	Jaus	st	Ven	r 20 1	7			0		, ,
atic Water Level Before Test       20.7       feet I bgs       gas         ethod of Test: Impumping       air lift       bailing       recovery         other (specify)			·		-					-	_ 100	. 20_			<b>o</b> ,			
ethod of Test: Impumping lair lift loailing lrecovery         other (specify)											feet 🛙	a bgs		ater	Quality Character	istics:	🛛 salty 🗆 clear	□ cloudy
Image: State of the state of test												•	Ŭ	□ se	diment 🗆 odour (	specify)		
ater level at end of test 55.9 feet III bgs ags   ngth of test 4 hours minutes   flow control device installed: I Yes No Flow control device installed: I Yes No Does water leak from around the outside of the casing: I Yes III No Commended Pumping Rate: 15 IIGPM I USGPM with pump intake at 58 feet bgs; ill your company be installing a pump?: I Yes III No emarks (see note 10) Iron: 0.6 Well must be vented. Well must be vented. Licence No. 607-17 ell Driller: Print Name Chris Loeppky Signature			•			•		-					Flo					
Ingth of test 4 hours minutes   Flow control device installed: □ Yes □ No Does water leak from around the outside of the casing: □ Yes ■ No Does water leak from around the outside of the casing: □ Yes ■ No Commended Pumping Rate: 15 IGPM □ USGPM with pump intake at58 feet bgs; ill your company be installing a pump?: □ Yes ■ No emarks (see note 10)tron: 0.6 Well must be vented. Well must be vented. Licence No. 607-17 ell Drilling Contractor: Company Name Friesen Drillers Ltd Licence No. 607-17								.9		fee	t 🗷 bi	gs 🗆 a	ags flo	ow	□IGPM □	USGPM Anr	ular space cemen	ited: 🗆 Yes 🗆 No
commended Pumping Rate:       15       IIGPM       USGPM with pump intake at58       feet bgs;         ill your company be installing a pump?:       Yes       No         emarks (see note 10)tron:       0.6       Well must be vented.         eell Drilling Contractor:       Company Name       Friesen Drillers Ltd       Licence No.         ell Driller:       Print Name       Chris Loeppky       Signature	Length	of test		4		ł	nou	rs _				minu	lies					
ill your company be installing a pump?: □ Yes INO         emarks (see note 10) ron: 0.6       Well must be vented.         ell Drilling Contractor: Company Name_Friesen Drillers Ltd       Licence No. 607-17         ell Driller: Print Name_Chris Loeppky       Signature	Estimat	ed rate c	of di	sch	arg	e		20		×	IGPM	□ U	SGPM Do	oes w	ater leak from aro	ound the outsi	de of the casing: [	Yes 🗷 No
emarks (see note 10) (ron: 0.6       Well must be vented.         Vell Drilling Contractor: Company Name Friesen Drillers Ltd       Licence No. 607-17         ell Driller: Print Name Chris Loeppky       Signature	Recom	mended	Pur	npiı	ng F	late	::		15		∎IG	PM 🗆	USGPM wit	th pu	mp intake at	58feet b	igs;	
ell Drilling Contractor: Company Name_Friesen Drillers Ltd       Licence No. 607-17         ell Driller: Print Name_Chris Loeppky       Signature	Will you	ur compa	iny	be i	nsta	allir	ng a	pur	mpî	<b>?</b> : □	Yes	× No						
ell Driller: Print Name_Chris LoeppkySignatureSignature	Remark	see no	ote	10)	Iron	: 0.	6	W	ell r	nus	t be ve	ented.						
ell Driller: Print Name_Chris LoeppkySignatureSignature																		
ell Driller: Print Name_Chris LoeppkySignatureSignature								-		E-	iecon	Drillor	:   td					 607_17
										e	100011	Simers			Cigneture		Licence No	
										edge	the inf	ormatio	on provided her	rein is	•		e Groundwater and M	Vater Well Act.

# Well Construction Report



Well Name: (if applicable) La Barrier Park TH-02       GPS: (see note 4), Accuracy +/50 is feet □ metres         Well Identification Tag Number 0       Latitude (decimal degrees) <u>97.17665</u>	heet 1	<sub>of</sub> _1_		F	or P	DF s	ubm	issic	on: R	еро	t must	be prii	nted on le	gal size	e pap	oer (8.5 x 14 inches) ar	ıd be signed in in	<b>k.</b> Form	No. WELLCON-V01-PD
Walling Address, Ito::::::::::::::::::::::::::::::::::::	Owner	Name: C	ity c	of W	inni	peg													essary)
Torum (Ling) Mininger, MB       Construction:       Torum (Ling) Manger, MB         Optical Code (TABE 3P)       Phone       Phone       Pariah       Type & Lot No.         Mell Name: (TapsRichte) La Barrer Park TH=22       Construction:       Garrer	Mailing			- 11	55 F	Pacif	ic A	venu	e	La	st							reet, Winnipeg	
cosal Gote 3B3 B1       Phone       Phone <td></td>																			
Bindle       GPS: (see note 4). Accuracy 4/- 50 get feet							_	Pho	ne										
Article and Local and Link	Email																		
Control Tog Nuthexable Tog Nuthexab									k T⊦	1-02									feet 🗆 metres
Acadio of Tag * Attached to casing side-up       Reckwood Sensitive Area: "is - Permit No	Well Ide	entificati	on 1	Гад	Nu	mbe	er (	)											
Fert Hole (see note 5) - Scaled IE Yes I No gr       Method of Construction:       Water Use: (OneA at Mut apply)       Image: I back hold (upper)         Production/Source I encharge/return       I auge: I borde I back hold (upper)       III dual notary (an)       IIII dual notary (an)       III dual not	Locatio	n of Tag	×A	tta	che	d to	o ca	sing	g stie	ck-ı	р					, , , , , , , , , , , , , , , , , , ,	0 / =		
Well Use:	🗆 Otl	ner (spec	ify)													Rockwood Sensi	tive Area: 🗖 `	Yes - Permit No	🗷 No
production/source       recharge/return       B       return       commercial/industrial       Ilvestock/poultry         montioning       ewatering       getechnical       dual rotary       drive       commercial/industrial       Ilvestock/poultry         inter (peerly)       dual rotary       drive       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)         ither (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)         ither (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)         ither (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)         ither (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)         ither (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)         ithe (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)       distre (peerly)         vest of t	Test Ho	<mark>le</mark> (see n	ote	5) ·	- Se	aleo	d 🗷	Yes	s 🗆	No	<u>or</u>	M	ethod of	Con	stru	ction:	Water Use:	(Check all that apply)	
anonitoring       dewatering       geotechnical       dual rotary       girtle       getter (specify)         anonitoring       dewatering       geotechnical       dual rotary       girtle       girtle <td>Well Us</td> <td>e: 🗆 tes</td> <td>st w</td> <td>ell ·</td> <td>- Se</td> <td>aleo</td> <td>⊐ b</td> <td>Yes</td> <td>s 🗆</td> <td>No</td> <td></td> <td></td> <td>auger 🗆</td> <td>bor</td> <td>ed</td> <td>backhoe/dug</td> <td>🗷 domestic</td> <td>public/semi-p</td> <td>ublic 🗆 irrigation</td>	Well Us	e: 🗆 tes	st w	ell ·	- Se	aleo	⊐ b	Yes	s 🗆	No			auger 🗆	bor	ed	backhoe/dug	🗷 domestic	public/semi-p	ublic 🗆 irrigation
Other (specify)         Other (specify)         Other (specify)         Other (specify)           Ithologic Description: (see notes 6 and 7) - Measure From/To depths from ground surface. Attach another sheet if needed.         Observations         Observations           0         43         01         Bown         Till         Observations         Observations           0         0         0         0         0         Observations         Observations         Observations           0         0         0         0         0         Observations <td>□ prod</td> <td>uction/so</td> <td>our</td> <td>ce (</td> <td>⊐ re</td> <td>ech</td> <td>arge</td> <td>e/re</td> <td>etur</td> <td>n</td> <td></td> <td>×</td> <td>rotary (r</td> <td>nud)</td> <td></td> <td>rotary (air)</td> <td></td> <td></td> <td></td>	□ prod	uction/so	our	ce (	⊐ re	ech	arge	e/re	etur	n		×	rotary (r	nud)		rotary (air)			
Athologic Description: (see notes 6 and 7) - Measure From/To depths from ground surface. Attach another sheet if needed.         From       To       Colour       Material Description (use recommended names on guide)       Observations         0       43       Grey       Clay       Image: Clay	🗆 moni	toring [	∃ de	ewa	teri	ing		geo	tecł	nnic	al			-		-			ing)
From (1)       To (1)       Colour       Material Description (use recommended names on guide)       Observations         0       4-3       Giny       Cay									_			_							
(th)         Colour         Waterial Description (use recommended names on gunde)         Uservations           0         43         61         Brown         T#			ipti	on:	(se	e n	otes	s 6 a	and	7) -	Meas	ure F	rom/To	deptl	ns fr	om ground surfac	e. Attach ano	ther sheet if need	ed.
0       4.3       Gray       Cay       T#         4.3       Bit Brown       T#       Imatoro Rubble         05       66       Crange       Limetoro Rubble         05       66       Crange       Limetoro Rubble         0       1       1       1       1         0       1       1       1       1       1         0       1       1       1       1       1       1         0       1       1       1       1       1       1       1         0       1       1       1       1       1       1       1       1         0       1<				Col	our				Ma	ater	ial De	scrip	tion (use	e reco	mm	nended names on	guide)	Obser	vations
B1       B5       Orange       Limestone Rubble         B5       B6       Orange       Limestone         B6       Bottom of Hole       Image and the second of Hole       Image and the second of Hole         0       Image and the second of Hole       Image and the second of Hole       Image and the second of Hole         0       Image and the second of Hole       Image and the second of Hole       Image and the second of Hole         0       Image and the second of Hole       Image and the second of Hole       Image and the second of Hole         Vell Construction: (see note 8) - Measure From/To depths from ground surface. Attach another sheet if needed.       Method of Pilocemont         from (n)       gift gift gift gift gift gift gift gift	0			G	rey														
65       66       Orange       Linestone         66       Bottom of Hole       Bottom of Hole         0       Image: Construction: (see note 8) - Measure From/To depths from ground surface. Attach another sheet if needed.         Type of Material         Well Construction: (see note 8) - Measure From/To depths from ground surface. Attach another sheet if needed.         Trom       To       gift gift gift gift gift gift gift gift				Bro	own		⊢						1.5-			bla			
66       Bottom of Hele         0       Bottom of Hele <td></td> <td></td> <td>_</td> <td>Ora</td> <td>inde</td> <td></td> <td>ble</td> <td></td> <td></td> <td></td>			_	Ora	inde											ble			
0       0				510	90		┢									e			
Bit of the sector       Source of Drilling Water:       Groundwater       Surface water         Well Completion: Day 9       Month       August       Year 2017         Year Year Year Year Year Year Year Year																			
0       0       Netl Construction: (see note 8) - Measure From/To depths from ground surface. Attach another sheet if needed.         Year Construction: (see note 8) - Measure From/To depths from ground surface. Attach another sheet if needed.       Year of Material         Year Construction: (see note 8) - Measure From/To depths from ground surface. Attach another sheet if needed.       Method of Placement         Year Construction: (see note 8) - Measure From/To depths from ground surface seal/annular fill/filter pack material)       Method of Placement         Year Construction: Construction: Construction: Seale State Taps. packers, screen blanks or tail pipes, and type and size of surface seal/annular fill/filter pack material)       Method of Placement         Well Completion: Day 9       Month       August       Year 20.17         Neel disinfected: IR Yes       No       Neel constance       No         Neel disinfected: IR Yes       No       Neel constance       No         Neel Viels adapter/unit Installed at feet bgs; Not installed       Year 20	-																		
o       Medit Construction: (see note 8) - Measure From/To depths from ground surface. Attach another sheet if needed.         From (n)       a       a       b       Measure From/To depths from ground surface. Attach another sheet if needed.         From (n)       a       a       b       b       b       b       b       b       b       B	-																		
To (H)       To (H)      To (H)       To (H)																			
From (tt)       To (tt)       Bit Signed Sig	Well Co	nstructi	on:	(see	e no	ote	8) -	Me	asu	re F	rom/ <sup>-</sup>	Fo de	pths fror	n gro	und	surface. Attach a	nother sheet i	f needed.	
Top of casing inches wass = bgs; Well vented: W Yes = No   Well disinfected: W Yes = No; Well cover installed: W Yes = No   Pittless adapter/unit installed at feet bgs; =Not installed   Drilling Additives Used: Yes (list type & quantity)   Well Yield Test (see note 9),   Date of Test: Day Month Year 20   Same as date of well completion   Static Water Level Before Test feet wass = age   Other (specify)   Water level at end of test feet wass = minutes   Nother (specify)   Water level at end of test feet wass = minutes   BigerM = USGPM   Recommended Pumping Rate: WIGPM = USGPM   Will your company be installing a pump?: Yes W No   Remarks (see note 10) No well constructed.	From (ft)		Borehole	Casing	Liner	Open Hole	Well Screen	Surface Seal	Annular Fill	Filter Pack	ID (inches)	OD (inches)	use o	of sha	ale t	nd screen materia raps , packers, scr	l, screen type een blanks or	tail pipes, and	Placement (ex: poured,
Top of casing inches wass = bgs; Well vented: W Yes = No   Well disinfected: W Yes = No; Well cover installed: W Yes = No   Pittless adapter/unit installed at feet bgs; =Not installed   Drilling Additives Used: Yes (list type & quantity)   Well Yield Test (see note 9),   Date of Test: Day Month Year 20   Same as date of well completion   Static Water Level Before Test feet wass = age   Other (specify)   Water level at end of test feet wass = minutes   Nother (specify)   Water level at end of test feet wass = minutes   BigerM = USGPM   Recommended Pumping Rate: WIGPM = USGPM   Will your company be installing a pump?: Yes W No   Remarks (see note 10) No well constructed.																			
Top of casing inches wass = bgs; Well vented: W Yes = No   Well disinfected: W Yes = No; Well cover installed: W Yes = No   Pittless adapter/unit installed at feet bgs; =Not installed   Drilling Additives Used: Yes (list type & quantity)   Well Yield Test (see note 9),   Date of Test: Day Month Year 20   Same as date of well completion   Static Water Level Before Test feet wass = age   Other (specify)   Water level at end of test feet wass = minutes   Nother (specify)   Water level at end of test feet wass = minutes   BigerM = USGPM   Recommended Pumping Rate: WIGPM = USGPM   Will your company be installing a pump?: Yes W No   Remarks (see note 10) No well constructed.																			
Top of casing inches wass = bgs; Well vented: W Yes = No   Well disinfected: W Yes = No; Well cover installed: W Yes = No   Pittless adapter/unit installed at feet bgs; =Not installed   Drilling Additives Used: Yes (list type & quantity)   Well Yield Test (see note 9),   Date of Test: Day Month Year 20   Same as date of well completion   Static Water Level Before Test feet wass = age   Other (specify)   Water level at end of test feet wass = minutes   Nother (specify)   Water level at end of test feet wass = minutes   BigerM = USGPM   Recommended Pumping Rate: WIGPM = USGPM   Will your company be installing a pump?: Yes W No   Remarks (see note 10) No well constructed.								-	-	-									
Top of casing inches wass = bgs; Well vented: W Yes = No   Well disinfected: W Yes = No; Well cover installed: W Yes = No   Pittless adapter/unit installed at feet bgs; =Not installed   Drilling Additives Used: Yes (list type & quantity)   Well Yield Test (see note 9),   Date of Test: Day Month Year 20   Same as date of well completion   Static Water Level Before Test feet wass = age   Other (specify)   Water level at end of test feet wass = minutes   Nother (specify)   Water level at end of test feet wass = minutes   BigerM = USGPM   Recommended Pumping Rate: WIGPM = USGPM   Will your company be installing a pump?: Yes W No   Remarks (see note 10) No well constructed.			_						-										
Top of casing inches wass = bgs; Well vented: W Yes = No   Well disinfected: W Yes = No; Well cover installed: W Yes = No   Pittless adapter/unit installed at feet bgs; =Not installed   Drilling Additives Used: Yes (list type & quantity)   Well Yield Test (see note 9),   Date of Test: Day Month Year 20   Same as date of well completion   Static Water Level Before Test feet wass = age   Other (specify)   Water level at end of test feet wass = minutes   Nother (specify)   Water level at end of test feet wass = minutes   BigerM = USGPM   Recommended Pumping Rate: WIGPM = USGPM   Will your company be installing a pump?: Yes W No   Remarks (see note 10) No well constructed.	Well Co	mpletio	n: D	) av	9	I N	Nor	nth		Aug	ust	Yea	ar 20 <sup>17</sup>	Ĩ	Sol	urce of Drilling Wa	ter: 🗷 Groun	dwater 🗆 Surfac	a water
Drilling Additives Used:       Yes (list type & quantity)       Image: No         Well Yeid Test (see note 9),       Well Development:       air lifting       surging       pumping       jetting         Date of Test:       Day       Month       Year 20       Well Development:       air lifting       surging       pumping       jetting         Date of Test:       Day       Month       Year 20       Well Development:       air lifting       surging       pumping       jetting         Static Water Level Before Test       feet       bgs       ags         Method of Test:       pumping       air lift       bailing       recovery         Other (specify)       feet       bgs       ags         Mater level at end of test       hours       minutes       feet       bgs       ags         Stimated rate of discharge       IMIGPM       USGPM       USGPM       Dees water leak from around the outside of the casing:       Yes       No         Recommended Pumping Rate:       IMIGPM       USGPM with pump intake at       feet bgs;       Mo         Will your company be installing a pump?:       Yes       No       No         Remarks (see note 10)       No well constructed.       Licence No. 607-17       Mell Driller:       S	Top of o	asing		inc	hes	×a	igs l	🗆 bį	gs;	We	ll vent				Wa	iter contains a mir	nimum of 10 n	ng/L free chlorine	: 🗷 Yes 🗆 No
Well Test (see note 9),         Date of Test: DayMonthYear 20         Same as date of well completion         Static Water Level Before Testfeet IN bgs I ags         Method of Test: Dumping I il ft I bailing Incovery         Other (specify)	Pitless a	adapter/	unit	: ins	tall	ed a	at		_fe	et b	gs; □	Not ir	nstalled						
Date of Test: DayMonthYear 20   Same as date of well completion   Static Water Level Before Testfeet I bgs ags   Method of Test: apumping air lift abiling arccovery   other (specify)	Drilling	Additive	es U	sed	: 🗆	Yes	S (lis	t typ	e &	quar	itity)								× No
□ Same as date of well completion         Static Water Level Before Testfeet I bgs □ ags         Method of Test: □pumping □air lift □bailing □recovery         □ other (specify)         Water level at end of testfeet I bgs □ ags         uength of testhours minutes         Estimated rate of discharge IGPM □ USGPM         Water level at end of test feet II bgs □ ags         Length of test hours minutes         Estimated rate of discharge IIGPM □ USGPM         Water level at end of test feet II bgs □ ags         Length of test hours minutes         Estimated rate of discharge IIGPM □ USGPM         Water level at end of test feet II bgs □ ags         Hild prilling Contractor: Company be installing a pump?: □ Yes II NO         Remarks (see note 10) No well constructed.         Well Drilling Contractor: Company Name Friesen Drillers Ltd         Well Driller: Print Name_Chris Loeppky							h				V	- 20		We	ll De	evelopment: 🗆 ai	r lifting 🗆 sur	ging 🗆 pumping	□ jetting
Static Water Level Before Test feet is bgs in ags   Method of Test: inpumping inair lift inbailing incovery   In other (specify)											_ rea	1 20_				<b>o</b> ,		· · · · <u></u>	
Method of Test: pumping air lift bailing recovery   other (specify) feet bgs ags   Water level at end of test feet bgs ags   ength of test hours minutes   Estimated rate of discharge IIGPM USGPM   Will your company be installing a pump?: Yes No      Remarks (see note 10) No well constructed.   Well Drilling Contractor: Company Name   Friesen Drillers Ltd Signature Signature											feet I	l høs	🗆 ags					🗆 salty 🗆 clear	□ cloudy
□ other (specify)															se	diment 🗆 odour (	specify)		
Water level at end of testfeet I bgsags  ength of testhours  minutesFlow control device installed: □ Yes □ No   Estimated rate of dischargeIIGPM □ USGPM			•			•							-						
Length of test hours   hours minutes   Estimated rate of discharge IGPM   USGPM USGPM   Does water leak from around the outside of the casing:   Yes   No   Does water leak from around the outside of the casing: Yes No No Remarks (see note 10) No well constructed. Nell Drilling Contractor: Company Name Friesen Drillers Ltd Vell Driller: Print Name Chris Loeppky Signature													ags						nted: 🗆 Yes 🗆 No
Recommended Pumping Rate:       IGPM       USGPM with pump intake atfeet bgs;         Will your company be installing a pump?:       Yes       No         Remarks (see note 10) No well constructed.																			
Will your company be installing a pump?: □ Yes I No         Remarks (see note 10) No well constructed.         Well Drilling Contractor: Company Name Friesen Drillers Ltd         Licence No. 607-17         Well Driller: Print Name Chris Loeppky         Signature	Estimat	ed rate c	of di	isch	arg	e				×	IGPM		SGPM	Doe	es w	ater leak from arc	und the outsi	de of the casing:	🗆 Yes 🗷 No
Remarks (see note 10) No well constructed.         Nell Drilling Contractor: Company Name_Friesen Drillers Ltd         Licence No. 607-17         Well Driller: Print Name_Chris Loeppky         Signature	Recom	mended	Pur	npi	ng F	Rate	e:				⊠IG	PM 🗆	USGPN	1 with	n pu	mp intake at	feet b	ogs;	
Well Drilling Contractor: Company Name Friesen Drillers Ltd       Licence No. 607-17         Well Driller: Print Name Chris Loeppky       Signature	Will you	ır compa	iny	be i	nst	allir	ng a	pui	mpî	?:□	Yes	× No							
Nell Driller: Print Name       Chris Loeppky         Signature	Remark	<mark>s</mark> (see no	ote	10)	No	we	ll cc	onst	ruct	ed.			-						
Nell Driller: Print Name       Chris Loeppky         Signature																			
Nell Driller: Print Name       Chris Loeppky         Signature										_ F•	ipeen	Drillor	sltd					11	607-17
										e	103011							Licence No.	
										edge	the inf	ormatio	on provide	d here	ein is	0		e Groundwater and V	Vater Well Act.

# Well Construction Report



heet 1	_of_1_		F	or P	DF s	ubm	issio	on: R	epor	t must	be priı	nted on leg	gal size	e pap	oer (8.5 x 14 inches) ar	ıd be signed in in	k. Form	No. WELLCON-V01-PD	
Owner Name: City of Winnipeg         Well Location: (see note 3; attach sketch if necessary)														essary)					
Mailing	First Last Nailing Address 105 - 1155 Pacific Avenue														Civic Address 4430 Waverley Street, Winnipeg				
	own/City_Winnipeg, MB														(if different than mailing address)				
	code R3					_	Pho	ne							QuarterSectionTownshipRange    ParishType & Lot No				
Email															GPS: (see note 4), Accuracy +/- 27 📧 feet 🗆 metres				
Well Na	ame: (if ap	oplic	able	) La	Bar	rier	Parl	k T⊦	1-03									feet 🗖 metres	
Well Ide	entificati	on T	Гаg	Nur	mbe	er (	)								Latitude (decimal degrees) 49.71636 Longitude (decimal degrees) 97.17458				
Locatio	n of Tag	×A	tta	che	d to	o ca	sing	; sti	ck-u	р									
🗆 Otl	ner (spec	ify)													Rockwood Sensi	tive Area: 🗖 🗎	res - Permit No	× No	
Test Ho	le (see n	ote	5) ·	Se	aleo	×	Yes	5 🗆	No	<u>or</u>		ethod of					(Check all that apply)		
												-			backhoe/dug		public/semi-pu	-	
□ production/source □ recharge/return																	ial/industrial  Iivestock/poultry		
	□ monitoring □ dewatering □ geotechnical □ dual rota														-		rgy (heating/cooling)		
	r (specify)_			1			6								from ground surface. Attach another sheet if needed.				
Litholog From	gic Descr To	Ľ.				otes	502								-				
(ft)	(ft)		Colour Material Description (use recommended names on guide)											Obser	vations				
0 39	39 76	-	Grey Clay Brown Till & Gravel																
39 76	76	-		inge		-	Linestone												
77				~			Bottom of Hole												
0			_	_	_														
0		_																	
0																			
0																			
0																			
Well Co	nstructio	on:	(see	e no	ote a	8) - 	Me	asu 	re F 	rom/	o de	pths fror	n gro	ound	surface. Attach a I Type of M		f needed.	Method of	
From (ft)	To (ft)	(ex: casing and screen mate use of shale traps , packers, s type and size of surface seal/a												nd screen materia raps , packers, scr	l, screen type een blanks or	tail pipes, and	Placement (ex: poured, tremie)		
			_				_												
Well Co	mpletio	n: D	ay_	9	N	Лоп	nth_		Aug	ust	Yea	ar 20 <u>17</u>		Soi	urce of Drilling Wa	ter: 🗷 Groun	dwater 🗆 Surface	e water	
Top of o	casing		inc	hes	×a	gs [	⊒ bį	gs;	We	ll vent	ed: 🗷	Yes 🗆	No		iter contains a mir				
Well dis	sinfected	: 🗙	Yes	5 🗆	No	; \	Wel	l co	ver	instal	ed: 🖪	Yes 🗆	No	Na	me/Location of wa	ater source_Fr	iesen Drillers Lto	J	
Pitless a	adapter/	unit	: ins	tall	ed a	at		_fe	et b	gs; □	Not ir	stalled							
Drilling	Additive	es U	sed	: 🗆	Yes	5 (lis	t typ	e &	quan	tity)								× No	
	eld Test (												We	ell De	evelopment: 🗆 ai	r lifting 🗆 sur	ging 🗆 pumping	□ jetting	
	Date of Test: Day Month Year 20														bailing 🗆 hydrofracturing 🗆 other (specify)				
	ne as dat Vater Lev									foot 🖪	a bac		Wa	ter	r Quality Characteristics:   fresh  salty  clear  cloudy				
	of Test:													se	diment 🗆 odour (	specify)			
	er (specify	•			•					•		- ' 1			g Artesian Well 🗷 No 🗆 Yes - If yes, estimated rate of artesian				
	evel at e											ags			□IGPM □			ted: 🗆 Yes 🗆 No	
	of test														ontrol device insta				
Estimat	ed rate c	of di	isch	arg	e				×	IGPM		SGPM	Doe	es w	ater leak from aro	und the outsi	ae of the casing: [	Yes 🗷 No	
Recom	mended	Pur	npi	ng F	Rate	::				⊠IGI	PM □	USGPN	1 with	n pu	mp intake at	feet b	igs;		
Will you	ır compa	iny	be i	nsta	allir	ng a	pur	mpî	<b>?</b> : □	Yes	× No								
Remark	<mark>(s</mark> ee no	ote	10)	No	we	ll cc	onst	ruct	ed.										
Well Dr	illing Co	ntra	acto	r: C	Com	par	א או	am	e Fr	iesen	Drillers	s Ltd					Licence No	607-17	
	iller: Prin														Signature				
									edge	the inf	ormatio	on provide	d here	ein is	accurate and true and		e Groundwater and W	/ater Well Act.	