WATER SUPPLY SOURCE ASSESSMENT
Strang's Shore Seasonal Camping Inc.
1639 Route 955
Little Shemogue, (Murray Corner), NB
PID No. 00837088

Our File No.: 278-17
January, 2018

Prepared for:

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January 19, 2018

Jerry and Linda Strang
Strang's Shore Seasonal Camping Inc.
89 Moore Road Ext.
Otter Creek, NB E4M 3V5

Our File No.: 278-17-C[1]

Mr. and Mrs. Strang:

Subject: Water Supply Source Assessment
Strang's Shore Seasonal Camping Inc.
1639 Route 955
Little Shemogue (Murray Corner), NB
PID No. 00837088

We are pleased to present you with the water supply source assessment for Strang's Shore Seasonal Camping Inc. in Little Shemogue (Murray Corner), New Brunswick.

The assessment has determined that there is an adequate supply of water to support the existing campground facility and the proposed future expansion. It is recommended that production well PW1 be operated at a rate not to exceed 20 Igpm (131 m^3/day) for a maximum of 14 hours per day and a flow meter be installed on the well to monitor actual water consumption. Water quality samples should be collected on a monthly basis (at a minimum) and analyzed for conductivity to monitor for possible saltwater intrusion.

Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Yours truly,

Gina Burtt

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ENVIRONMENTAL Engineer

GB/jb/sl
Enc.

[1] 278-17 Pump Test Report Jan 2018.doc

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APPENDICES

1.0 INTRODUCTION

Jerry and Linda Strang, on behalf of Strang's Shore Seasonal Camping Inc., retained the services of Roy Consultants to complete a water supply source assessment for the existing campground in Little Shemogue (Murray Corner), New Brunswick (PID Nos. 00837088, 70188826 and 70563457), herein referred to as the "subject property". Refer to Figure 1 in Appendix A for the site location plan.

This report has been prepared in accordance with the New Brunswick Department of Environment and Local Government's (NBDELG) Environmental Impact Assessment *Water Supply Source Assessment Guidelines* (April 2017). These guidelines are used to assist proponents engaging in projects that require a Water Supply Source Assessment (WSSA) through the Environmental Impact Assessment (EIA) process. A WSSA includes, but is not limited to, an evaluation of the sustainability of the water supply, an assessment of water quality, an evaluation of potential impacts to existing water users and an assessment of the potential for saltwater intrusion. The WSSA guidelines are enclosed in Appendix G.

1.1 Project Description

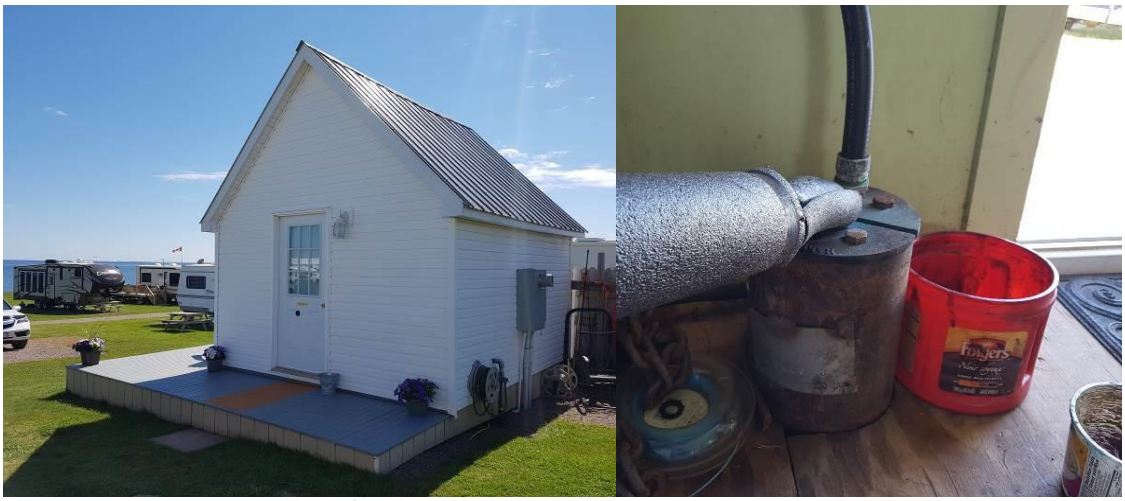
Strang's Shore Seasonal Camping Inc. (hereinafter "the proponent") currently operates a campground with 115 serviced lots at 1639 Route 955, Little Shemogue (Murray Corner), New Brunswick (Westmorland County). The campground began operating in 2012 and includes three parcels of land identified by Service New Brunswick as PID Nos. 00837088, 70188826 and 70563457. For a campground with water and sewer hook-ups, the NBDELG recommends 450 L per space per day for water usage. The estimated current water demand is 52 m^3/day. The campground will expand in the future for a total of 150 serviced lots with an approximate water demand of 68 m^3/day. Currently, the actual water usage is unknown. As limited information is available on current water usage, the objective of the water supply source assessment is to complete a pump test on the existing production well to determine its recommended safe yield.

2.0 EXISTING SITE CONDITIONS

2.1 Site Description

The campground is located in a rural area surrounded by cottage/residential buildings. The subject property, identified by the Service New Brunswick (SNB) parcel identification (PID) number 00837088, is zoned "rural zone" according to the Tantramar Rural Zoning Map Schedule A. Development in the area includes residences and/or cottages to the east, south and west and the Northumberland Strait borders the northern property line. Refer to Figure 1 in Appendix A.

The pumping well (PW1) is located on PID No. 00837088, which covers an area of 3.43 hectares. The observation well (OW1) is located on PID No. 70188826, which has an area of 1.13 hectares. No wells are located on the third parcel of land comprising the campground, PID No. 70563457, which has an area of 3.27 ha. SNB documentation is enclosed in Appendix B. The nearest neighbouring domestic well is located approximately 130 metres east and cross gradient of PW1, along Highway 955 (PID No. 70063144).



Photos 1 and 2: Photo at left shows the well house (looking northeast). Photo at right shows production well PW1 located inside the well house (July 5, 2017).

Photo 3: View of observation well OW1 looking south towards Highway 955 (October 16, 2017)

2.2 Current Groundwater Use

There are two (2) existing on-site potable wells (PW1 and OW1); however, only PW1 services the campground. The wells are located approximately 216 m from each other. PW1 is equipped with a Pentek® 2 horsepower submersible pump with a capacity of 25 USgpm (21 Igpm). OW1 is not hooked up to the water supply system. This well is a remnant from a mobile home that previously occupied PID No. 70188826 prior to that land parcel's purchase by Strang's Shore Seasonal Camping Inc.

2.3 Well Construction

PW1 was constructed on August 2, 2010 (Well ID 24773). The well is 150 mm (6 inches) in diameter and completed to a depth of 32 metres (105 feet). Based on the well driller's report, the predominant bedrock is comprised of alternating layers of grey sandstone and red shale. Depth to the bedrock level is 6.4 metres below ground surface (bgs). OW1 was constructed on August 13, 2014 (Well ID 30194). The well is 150 mm (6 inches) in diameter and completed to a depth of 19.8 metres (65 feet). OW1 was deepened to a depth of 32 metres (105 feet) on October 16, 2017 by Charlie Herman Chappell Well Drilling, out of Colpitts Settlement, NB. All well locations are shown on Figure 1 in Appendix A. The well driller reports for PW1 and OW1 are enclosed in Appendix C.

Table 1: Summary of On-site Potable Well Information

Well ID	GPS Coordinates		Date Drilled	Well Depth (btoc) (m)	Casing Depth (btoc) (m)	Driller's Estimated Safe Yield (Igpm)	Static Water Level (btoc) (m)
	Northing	Easting					
PW1	7467524.674	2695018.638	August 2010	32	10.97	20	4.13*
OW1	7467310.055	2694998.413	August 2014	32	12.19	35	3.465*

(*) as measured on November 19, 2017

3.0 HYDROGEOLOGICAL CONDITIONS

3.1 Topography and Drainage

The subject property is located within the New Brunswick Lowlands physiographic unit. Based on the well elevation survey completed by Roy Consultants in November 2017, the ground surface elevations noted at PW1 and OW1 were 6.74 m and 7.7 m above mean sea level, respectively. The property was noted to gently slope north towards the Northumberland Strait. Surface water drainage across the subject property is northerly via overland flow. No drainage ditches were noted on the subject site. Drainage is good, evidenced by no mapped wetlands on the subject site. Standing water and wet areas were not observed during field work completed in November 2017. The area to the south, which could potentially contribute groundwater to the study area, is a mix of developed residential and vacant/wooded lots.

3.2 Geology

The surficial geology for the area consists of Late Wisconsinan morainal sediments blanket deposits consisting of loamy lodgment till, minor ablation till, silt, sand, gravel and rubble generally 0.5 m to 3 m thick (Rampton, 1984). According to the well driller's log for PW1, the underlying site stratigraphy (from top to bottom) consists of clay and sand at depths from 0 to 6.4 metres bgs and sand present from 6.4 m to 9.1 metres bgs.

The bedrock underlying the subject property is comprised of Late Carboniferous-aged sedimentary rocks comprised of the Pictou Group, Richibucto Formation consisting of grey and brownish red, commonly micaceous lithic and arkosic sandstone, pebbly sandstone and intraformational mudstone-clast conglomerate, brownish red to brick-red and lesser grey siltstone and mudstone, minor intraformational limestone-cobble conglomerate and thin laterally extensive limestone beds and minor thin coal seams (Smith, 2007). According to the well driller's log for PW1, grey sandstone was encountered at a depth of 12.5 metres bgs. Refer to Appendix C for the well driller's report.

3.3 Hydrogeology

Based on a review of seven (7) water well logs within 500 metres of the subject property (PID 00837088), the local aquifer is comprised of a fractured sandstone bedrock aquifer. According to well drillers' reports, several major water-bearing fractures are noted at depths of approximately 17 m, 25 m and 29 m. Well depths range between 19.8 m and 73.5 m and well yields range from 3 Igpm to 25 Igpm (19.6 m^3/day to 163.6 m^3/day). Most well logs indicate a confined aquifer scenario of sandstone bedrock interbedded with layers of shale. Refer to well driller's reports in Appendix C for further details.

The subject property is located immediately adjacent to the Northumberland Strait, which is under tidal influence. Water levels in the area are expected to be influenced to some degree by high and low tides. Potential recharge sources to the wells on the subject site include direct infiltration from precipitation and groundwater flow from upland areas.

4.0 HYDRAULIC TESTING

Hydraulic testing was completed at PW1 from November 19 to November 22, 2017. A 72-hour constant rate pumping test was completed in accordance with NBDELG's WSSA guidelines. During the test, groundwater from PW1 was contained and discharged through approximately 75 m of 4-inch diameter PVC pipe into the Northumberland Strait. Refer to Photos 4 and 5. The site topography slopes northward, away from the pumping well, towards the Northumberland Strait. The discharge location of the pumped water did not allow artificial recharge to PW1 and OW1.

Photo 4: View of water discharge line directing pumped water towards the Northumberland Strait (November 19, 2017).

Photo 5: View of water discharge (November 19, 2017)

4.1 Step Test

Prior to commencement of the 72-hour continuous pumping test, a step test was conducted to determine the optimal pumping rates for the long-term test at PW1. The existing pump in PW1 was pulled prior to the test and a 5-horsepower pump was installed by Charlie Herman Chappell Well Drilling. Installation of a larger pump allowed for higher pump rate at which to step test the well. The pump was installed at a depth of 27.4 m (90 feet). Step test intervals were 30 minutes in length, each having a higher pumping rate than the previous interval. Three steps were completed at 10 Igpm, 20 Igpm and 30 Igpm, respectively. Pumping rates were verified by the driller using a 20-gallon bucket and stopwatch. Water levels were allowed to recover following completion of each step. Leveloggers were installed in both the pumping and observation wells to record water levels in addition to collecting manual water measurements. Drawdown and recovery data for PW1 throughout the step test are shown in Figure 1.

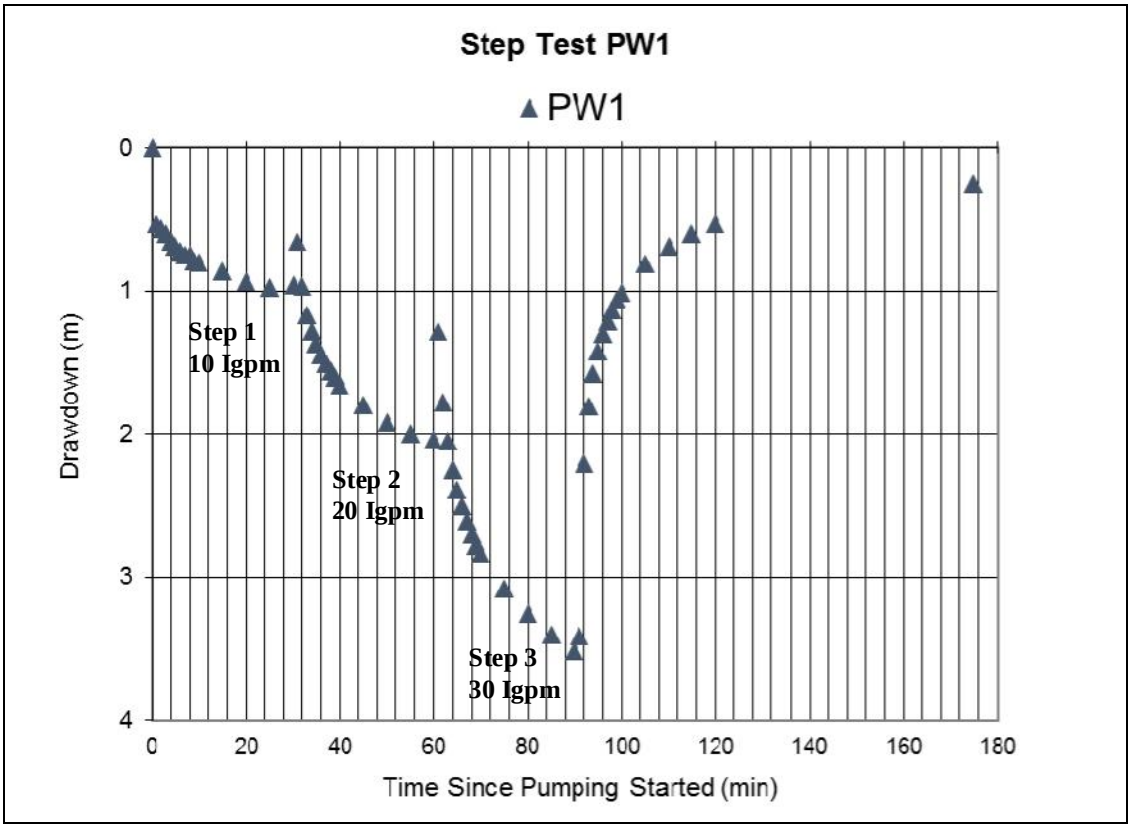


Figure 1: Step Test Data PW1 – Drawdown vs Time

At the beginning of the step test, the static water level in PW1 was 3.56 m bgs. During the first step, at a pumping rate of 10 Igpm, drawdown stabilized at approximately 4.52 m bgs. During the second step, at a pumping rate of 20 Igpm, the pumping water level stabilized at approximately 5.61 m. At the end of the third step, at a pumping rate of 30 Igpm, the pumping water level was 7.08 m bgs and did not appear to have stabilized. The maximum drawdown observed in OW1 during the pumping portion of the step test was 0.029 m (water level of 2.924 m bgs). The water level recovery in PW1 was 94 % recovery after 30 minutes of the end of the last step. Based on the results of the step test, a pumping rate of 20 Igpm (131 m^3/day) was selected for PW1 for the constant rate test. All step test data and plots are enclosed in Appendix D.

4.2 72-hour Pumping Test

The 72-hour constant rate test was started at 2:30 p.m. on November 19, 2017, and the pump was shut off at 2:30 p.m. on November 22, 2017. The average flow rate measured over the duration of the test was 20 Igpm (131 m^3/day) from PW1. The flow rate was monitored regularly throughout the duration of the pump test by the driller using a 20-gallon bucket and stopwatch.

Results from the pumping well and observation well during the 72-hour pumping test are presented in Table 2. Water level data are shown in Figure 2 and drawdown data is presented in Figure 3. Refer to the pumping test data and graphs in Appendix D for further details.

Table 2: Summary of 72-hour Constant Rate Test Data

Well ID	Well Type	Distance from Pumped Well (m)	Ground Surface Elevation (m)	Static Water Elevation (m)	Maximum Observed Drawdown (m)	Time of Maximum Observed Drawdown (Hour into Pumping Test)
PW1	Pumping	N/A	6.74	3.563 (bgs) 3.177 (amsl)	4.69	67
OW1	Observation	216	7.70	2.895 (bgs) 4.805 (amsl)	0.29	66

bgs = below ground surface
amsl = above mean sea level

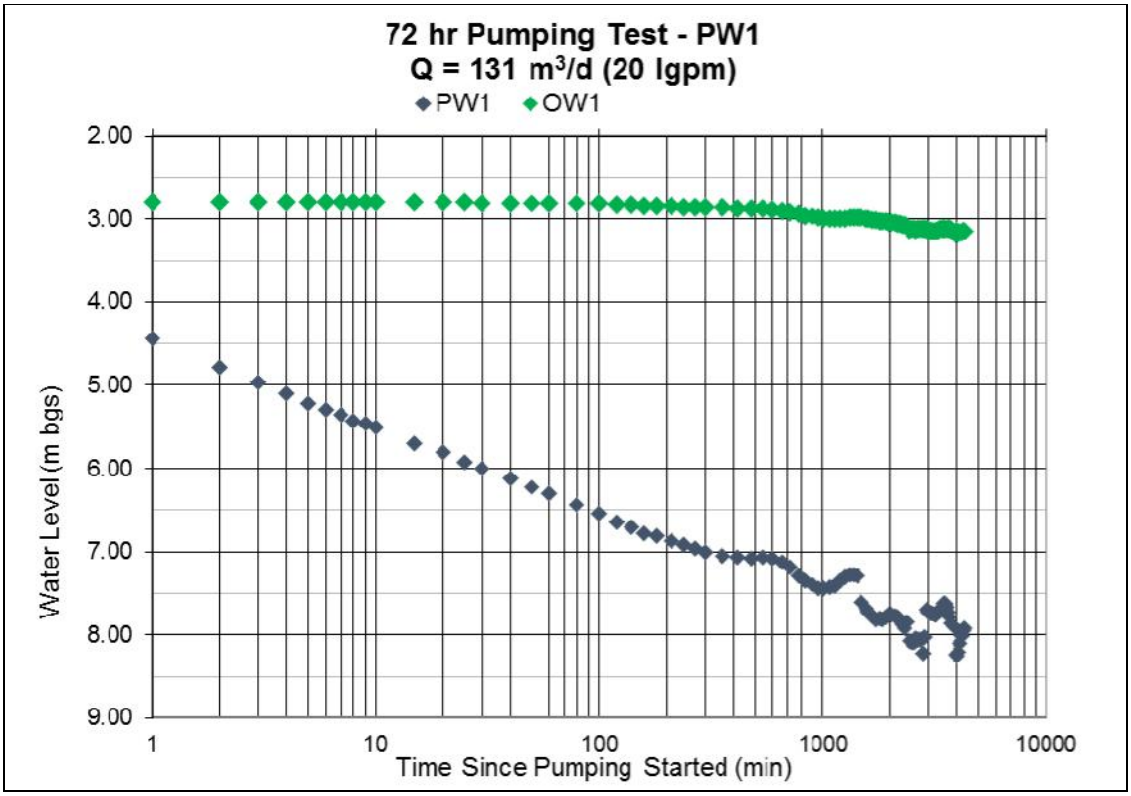


Figure 2: 72-hour Constant Rate Test Water Level Data

The water level in PW1 appeared to stabilize over the duration of the pumping test. However, fluctuations in drawdown were noted which are attributed to pumping rate adjustments made by the driller and tidal effect. The pumping rate had to be adjusted after 37 hours of pumping (2220 minutes), 44 hours (2640 minutes), 50 hours (3000 minutes), 52 hours (3120 minutes) and 63 hours (3780 minutes).

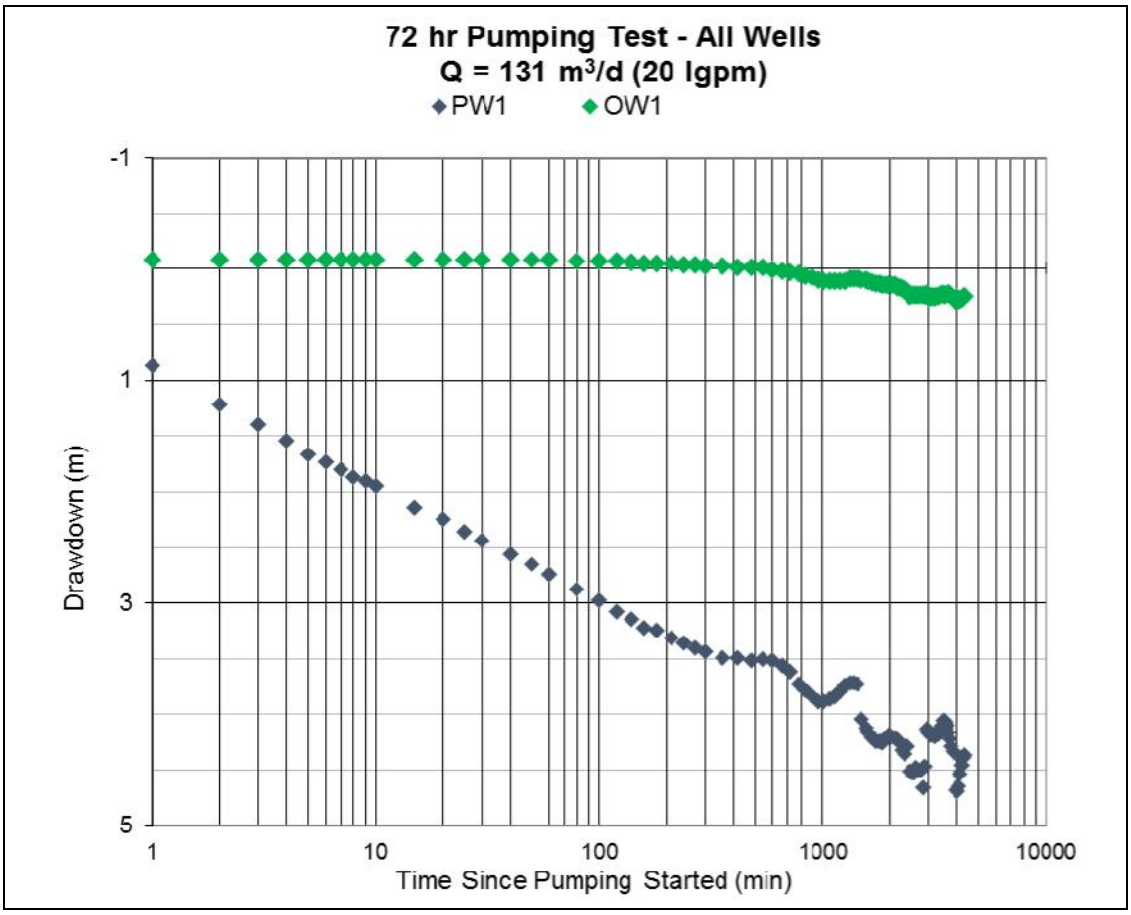


Figure 3: 72-hour Constant Rate Test Drawdown Data

The maximum drawdown in PW1 was 4.69 m, which corresponds to a pumping water level of approximately 1.51 m below sea level (bsl). The maximum drawdown observed in OW1 was 0.29 m, which corresponds to a water level of 4.515 m above sea level (asl). Water levels in OW1 remained above sea level throughout the duration of the pumping test.

Some minor fluctuations in water levels are noted in the drawdown data for both wells and are attributed to tidal effects. Fluctuations correlate with the tide schedules for Cape Tormentine. Based on the drawdown data, drawdowns of approximately 0.17 m in PW1 and 0.02 m in OW1 are attributed to tidal influence during the pumping test. Refer to Appendix F for tide tables.

Following completion of the pumping test, recovery in both wells was very good. In PW1, water levels recovered 71 %, 92 % and 100 % within 1 hour, 10 hours and 26 hours, respectively, of shutting off the pump. In OW1, 100 % water level recovery was noted within 23 hours of shutting off the pump (at 4320 minutes). Refer to Figure 4 for drawdown and recovery data for both wells.

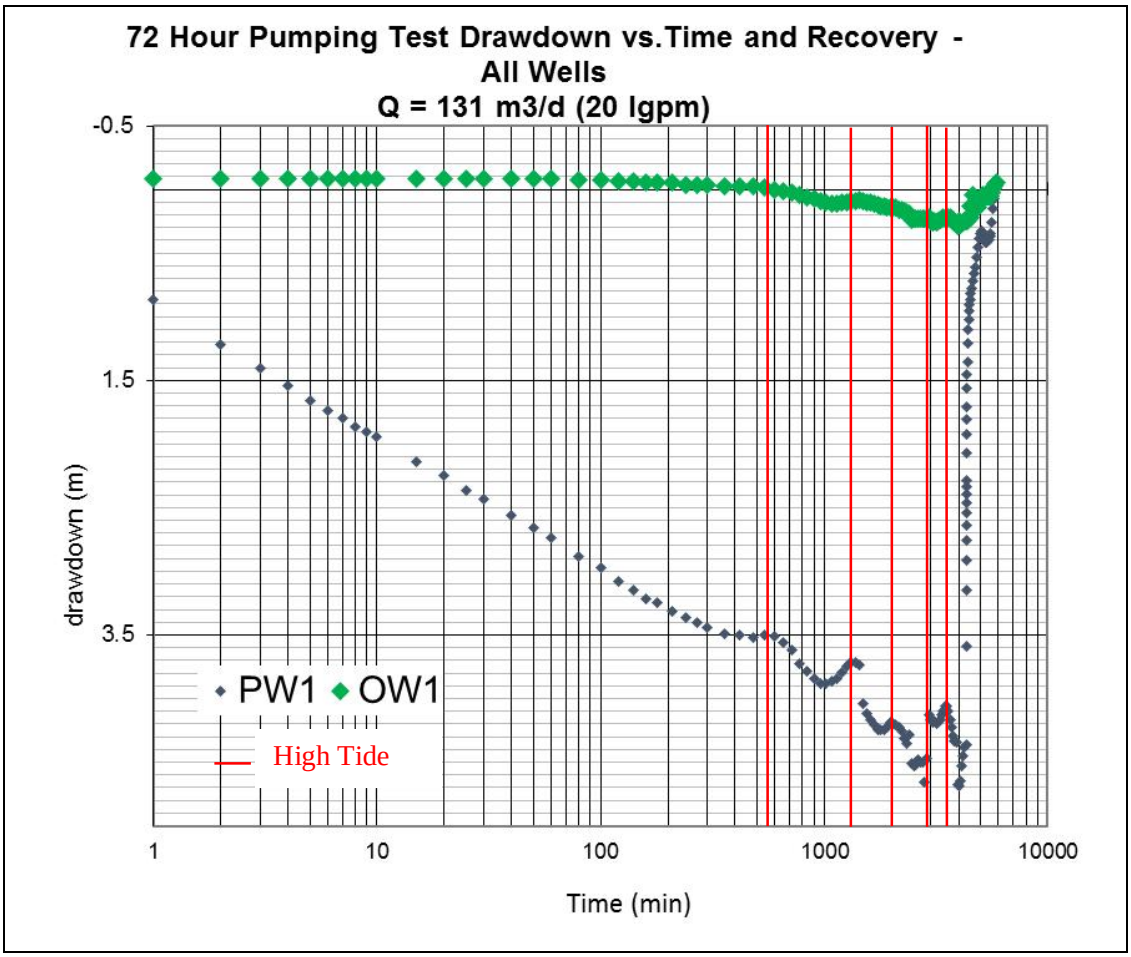


Figure 4: Drawdown and Recovery Data – All Wells

Water levels recovered 100 % in PW1 within 26 hours of the end of the pump test. In OW1, 100 % water level recovery was achieved within 23 hours of shutting off the pump. It was noted during the recovery period that water levels in PW1 and OW1 fluctuated due to tidal effects. Fluctuations were more pronounced in PW1 and water levels fluctuated between 0.09 m and 0.45 m due to tidal effects. Refer to Figures 5 and 6 for recovery data. From Figure 5, it appears that residual drawdown reaches '0' near t/t'=2, indicating complete recovery, although interpretation is made difficult due to fluctuations in residual drawdowns, which are attributed to tidal effects.

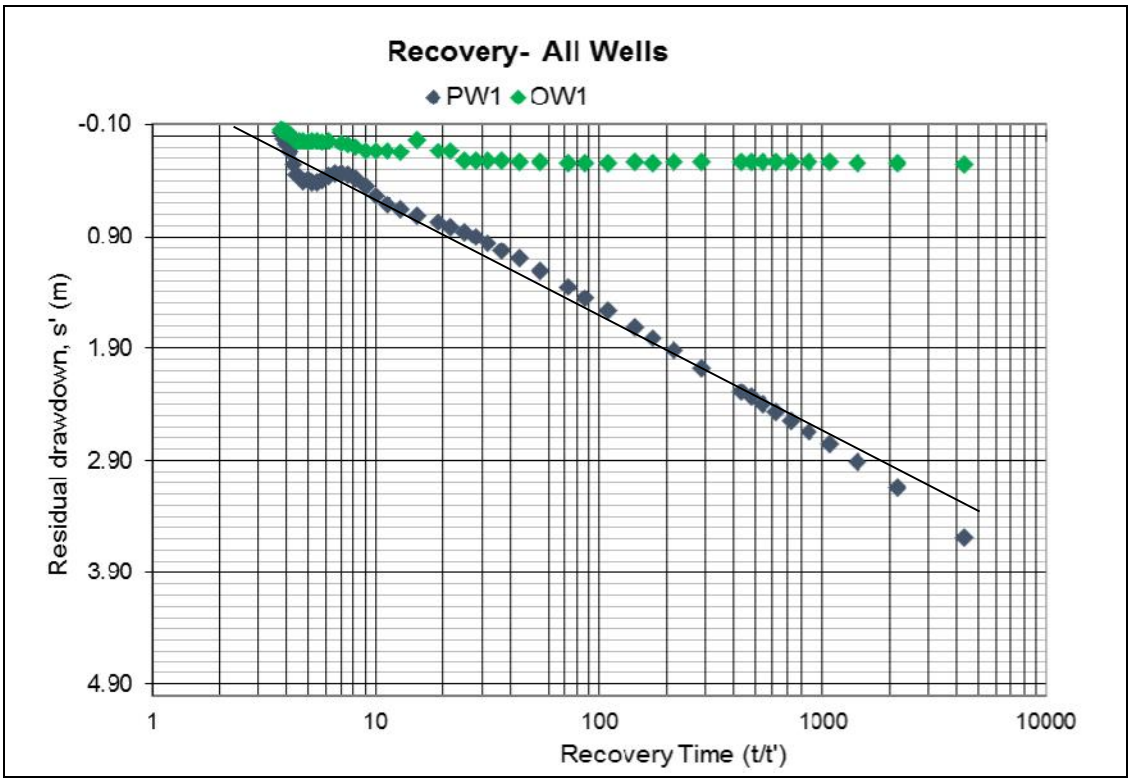


Figure 5: Residual Drawdown Recovery Data – All Wells

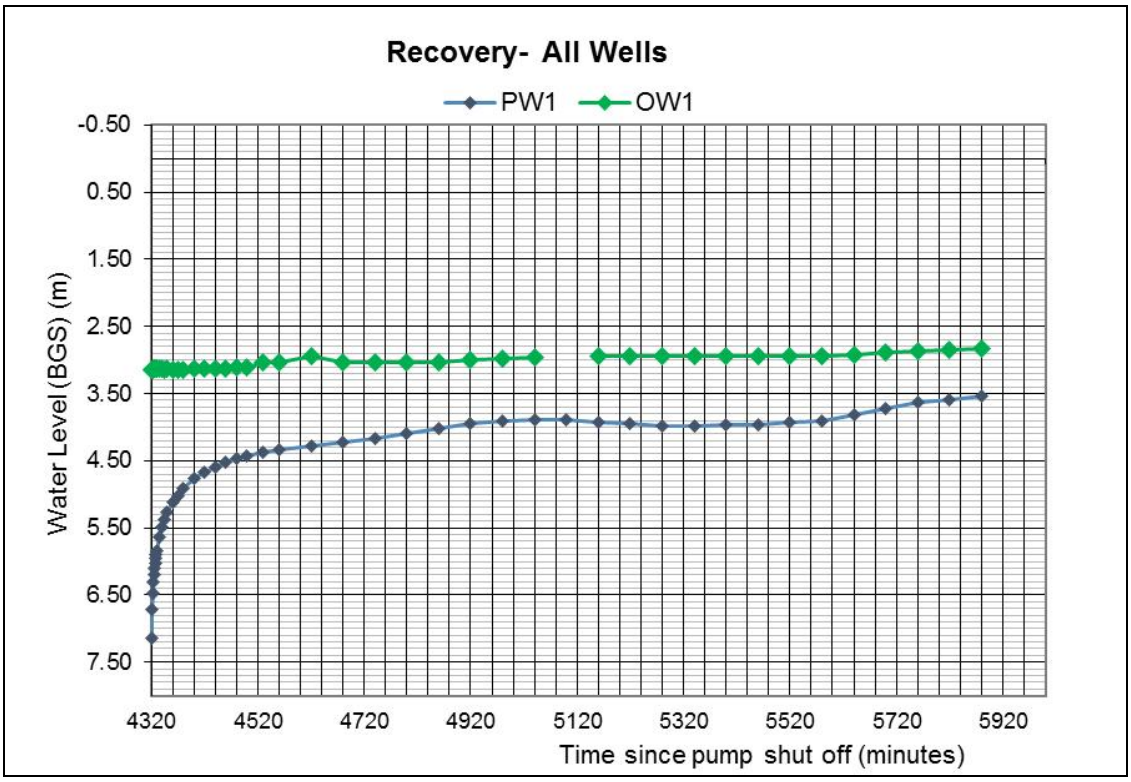


Figure 6: Water Level Recovery Data – All Wells

4.2.1 Pumping Test Analysis

After completion of the 72-hour pumping test, transmissivity was calculated from the drawdown and recovery data from pumping well PW1 using the Cooper-Jacob straight line method. The log time versus drawdown plots are shown in Appendix D. The calculated transmissivities for PW1 are shown in Table 3.

Table 3: Transmissivity Values

Well No.	Drawdown		Recovery	
	Transmissivity (minimum) m^2/day	Transmissivity (maximum) m^2/day	Transmissivity (minimum) m^2/day	Transmissivity (maximum) m^2/day
PW1	23.2	30.9	19.96	34.22

Transmissivities calculated based on the recovery data are considered more representative of the aquifer than data collected under pumping conditions. Based on the distance-drawdown plot, the maximum radius of influence extends approximately 230 metres from PW1. Refer to Figures 6 and 7 in Section 5.1 for the distance-drawdown data.

The specific capacity calculated for PW1 during the pumping test was 24.23 m^3/day/m. A storativity value of 0.0014 was calculated using time drawdown data obtained from OW1. According to Driscoll (1986), the coefficient of storage for confined aquifers ranges from 10^{-5} to 10^{-3}, and from 0.01 to 0.3 for unconfined aquifers. The calculated storativity value is reflective of a confined aquifer.

4.2.2 Recommended Sustainable Yield (PW1)

PW1's specific capacity after 100 days of pumping was calculated using the pumping rate of 20 Igpm (131 m^3/day) and extrapolating the drawdown at 100 days from the Time vs. Drawdown graph. The drawdown at 100 days is 5.4 m and the pumping well's specific capacity is 24.23 m^3/d/m. The total available drawdown in the well is calculated using the depth from the static water level (3.56 m bgs) to mean sea level (6.74 m bgs). Based on available site information, the total available drawdown in the well is 3.2 m (to mean sea level). The long-term sustainable yield (Q) is calculated based on the following formula:

Q = Specific Capacity at 100 days x available drawdown in the well
Q = 24.23 m^3/day/m x 3.2 m
Q = 78 m^3/day or 12 Igpm

PW1, operating at a continuous rate of 78 m^3/day (12 Igpm) over a 24-hour period, corresponds to the same water withdrawal as operating at a pumping rate of 20 Igpm for a maximum of 14 hours per day. Based on the pump test, pumping PW1 at a rate of 131 m^3/day (20 Igpm) resulted in a drawdown of 3.78 m after 14 hours of continuous pumping which corresponds to a pumping water level below sea level (refer to Figure 7). However, it should be noted that the casing in PW1 extends below sea level and the drawdown is likely more pronounced due to the casing length. It is likely that the well construction of PW1 has more influence on the pumping water level than does the actual pumping rate. The potential for saltwater intrusion into PW1 is considered unlikely at a pumping rate of 20 Igpm based on the assessment outlined in Section 5.2.

It should be noted that PW1 would be operated on a cycle basis and would not pump continuously throughout the day while the campground is operating. It should also be noted that the campground operates from May to October and water withdrawal would be restricted to this time period. Based on the above, it is recommended that PW1 be pumped at a rate not to exceed 20 Igpm (131 m^3/day) for a maximum of 14 hours per day, which equates to a daily maximum water withdrawal of 76.4 m^3/day.

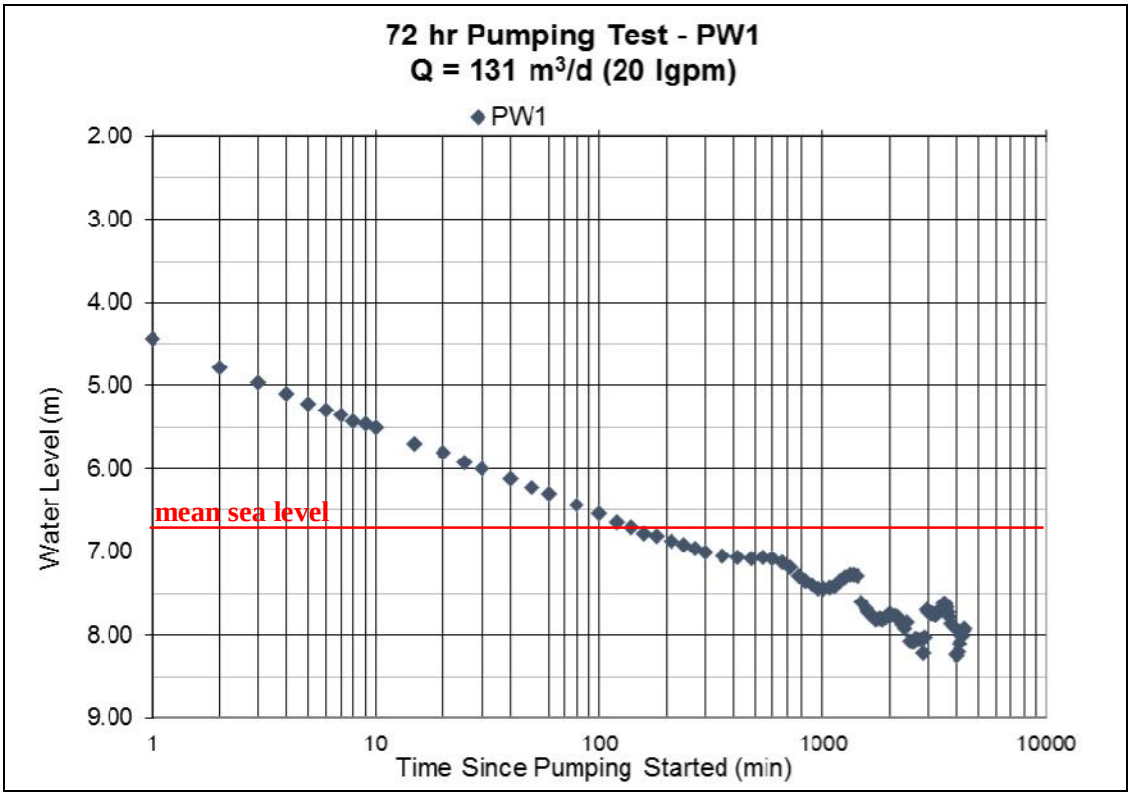


Figure 7: PW1 Water Level vs Time

4.2.5 Groundwater Quality

Groundwater samples were collected from the pumping well (PW1) towards the beginning (24 hours), middle (48 hours) and near the end (69 hours) of the pump test. All samples were submitted to AGAT Laboratories in Dartmouth, Nova Scotia, for general chemistry, trace metals and microbiological analyses. Laboratory certificates are enclosed in Appendix E.

General chemistry and trace metals results for the samples collected at the beginning and end of the pump test are all within the *Canadian Drinking Water Quality Guidelines* (CDWQ) and *New Brunswick Drinking Water Guidelines* (NB) potable guideline values with the exception of turbidity and manganese. The turbidity value of 1.3 NTU (48 hours) slightly exceeds the CDWQ guideline range of 0.1 to 1.0 NTU and the NB guideline of 1.0 NTU. It should be noted that turbidity values in PW1 were below guidelines at 24 hours and 69 hours into the pump test. The levels of turbidity in the well may be related to sediment dislodged during removal of the pump and installation of the driller's pump for completion of the pump test. Furthermore, an iron build-up was noted on the casing and discoloured the water level tape used to collect manual readings throughout the test. The friction of the tape against the casing may also have contributed to

sediments in the well water. The reported turbidity levels are not considered a concern for human health and turbidity levels should decrease over time with continued well use.

Manganese in PW1 exceeded the CDWQ guideline of less than or equal to 50 µg/L towards the beginning of the test (24 hours) and decreased to below the CDWQ guideline for the remainder of the pump test (48 hours and 69 hours). It is likely that elevated manganese was associated with sediment content present in the well at the start of the test. With further pumping, manganese concentrations decreased to within the acceptable guideline.

Microbiological results for the samples collected towards the beginning, middle and end of the pump test indicate no counts for total coliforms or *E.coli*. All results meet the CDWQ and NB guideline values of 0 MPN/100 ml for both total coliforms and *E.coli*. Following completion of the pumping test, the water quality in the pumping well meets potable guidelines. Water quality results for PW1 are shown in Table 4.

Table 4: PW1 Groundwater Quality

Parameter	Units	CDWQ	NB	24 h	48 h	69 h
General Chemistry						
Ammonia (as N)	mg/L			0.03	0.05	<0.03
pH	units	7.0-10.5		8.01	7.96	8.09
Alkalinity (as CaCO3)	mg/L			117	118	118
Chloride	mg/L	≤ 250	250	24	24	25
Colour	TCU	15		6	5	14
Fluoride	mg/L		1.5	<0.12	<0.12	<0.12
Sulfate	mg/L	≤ 500	500	7	7	7
Nitrate (as N)	mg/L	45	45	1.88	2.03	1.91
Nitrite (as N)	mg/L	3		<0.05	<0.05	<0.05
o-Phosphate (as P)	mg/L			<0.01	<0.01	<0.01
Phosphorus	mg/L			<0.02	<0.02	<0.02
r-Silica (as SiO2)	mg/L			10.8	9.0	11.7
Total Organic Carbon	mg/L			<0.5	<0.5	<0.5
Turbidity	NTU	0.1-1.0	1.0	0.5	**1.3**	0.8
Conductivity	µS/cm			332	322	332
Total Dissolved Solids	mg/L	≤ 500		177	174	178
Trace Metals						
Aluminum	µg/L	<100		<5	11	<5
Antimony	µg/L	6	6	<2	<2	<2
Arsenic	µg/L	10	10	<2	<2	<2
Barium	µg/L	1000	1000	431	421	413
Beryllium	µg/L			<2	<2	<2
Bismuth	µg/L			<2	<2	<2
Boron	µg/L	5000	5000	34	32	28
Cadmium	µg/L	5	5	<0.017	<0.017	<0.017
Calcium	µg/L			44700	42800	43700
Chromium	µg/L	50	50	3	3	<1
Cobalt	µg/L			<1	<1	<1
Copper	µg/L	≤ 1000	1000	<2	<2	<2
Iron	µg/L	≤ 300	300	<50	<50	<50
Lead	µg/L	10	10	<0.5	<0.5	<0.5
Magnesium	µg/L			3900	3600	4100
Manganese	µg/L	≤ 50		**72**	22	21
Molybdenum	µg/L			<2	<2	<2
Nickel	µg/L			<2	<2	<2
Potassium	µg/L			1600	1500	1700
Selenium	µg/L	50	10	<1	<1	<1
Silver	µg/L			<0.1	<0.1	<0.1
Sodium	µg/L	≤ 200,000	200,000	17300	15600	17700
Strontium	µg/L			633	583	521
Thallium	µg/L			<0.1	<0.1	<0.1
Tin	µg/L			<2	<2	<2
Titanium	µg/L			<2	<2	<2
Uranium	µg/L	20	20	2.3	2.2	2.1
Vanadium	µg/L			4	4	4
Zinc	µg/L	≤5000		8	9	<5
Microbiology						
Total Coliforms	MPN/100 mL	Absent	Absent	Absent	<1	<1
E. Coli	MPN/100 mL	Absent	Absent	Absent	<1	<1

"Bold" exceeds applicable guideline criteria

5.0 DISCUSSION

5.1 Neighbouring Water Users

Based on the results of the hydraulic testing, the radius of influence for PW1 extends approximately 230 metres when the production well is operating at a rate of 131 m^3/day (20 Igpm) (refer to Figure 8). OW1 is located at a distance of 216 m from PW1. Approximately 0.29 m of drawdown was observed in OW1 during the pumping test. The closest neighbouring residential well (PID 70063144) is located approximately 130 metres east of PW1 and eight (8) private wells are located on neighbouring properties within 230 metres of PW1. Based on the Distance-Drawdown plot (see Figure 8), 2 m of drawdown is estimated at a distance of 130 metres from the pumping well. Note that the drawdown also includes interferences from tidal effects. Throughout the pumping test and recovery period, no residents in the area contacted the proponent or Roy Consultants' personnel with complaints regarding water quality or quantity. Surrounding land use within 500 m of the campground is residential (primarily seasonal cottages). No potentially adverse impacts on the groundwater supply are anticipated due to current or historical land uses.

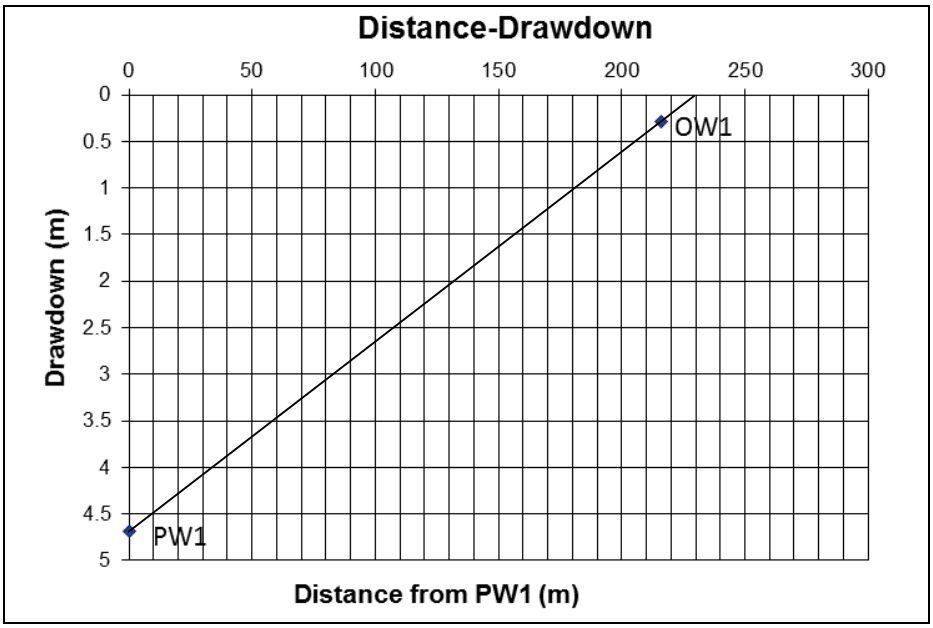


Figure 8: Distance-drawdown Data from the 72-hour Constant Rate Pump Test

At the recommended pumping rate of 20 Igpm for a maximum of 14 hours per day, the maximum drawdown at PW1 is approximately 3.78 m based on the pump test data. Operating at 20 Igpm for a continuous 14-hour period will slightly reduce the radius of influence to 220 metres (refer to Figure 9). The corresponding drawdown in the nearest neighbouring well (130 m away) is approximately 2 m. However, upon further review of the pump test data, water level drawdown (0.10 metre) in OW1 did not occur until after 10 hours of continuous pumping at 20 Igpm. It should be noted that PW1 would be operated on a cycle basis and would not pump continuously throughout the day while the campground is operating. As a result, the radius of influence is expected to be less than 220 metres and the corresponding drawdown of 2 metres in the nearest neighbouring well is also expected to be less. The operation of the production well is expected to have minimal interference with neighbouring water users. Based on the above, it is

recommended that PW1 be pumped at a rate not to exceed 20 Igpm (131 m^3/day) for a maximum of 14 hours per day.

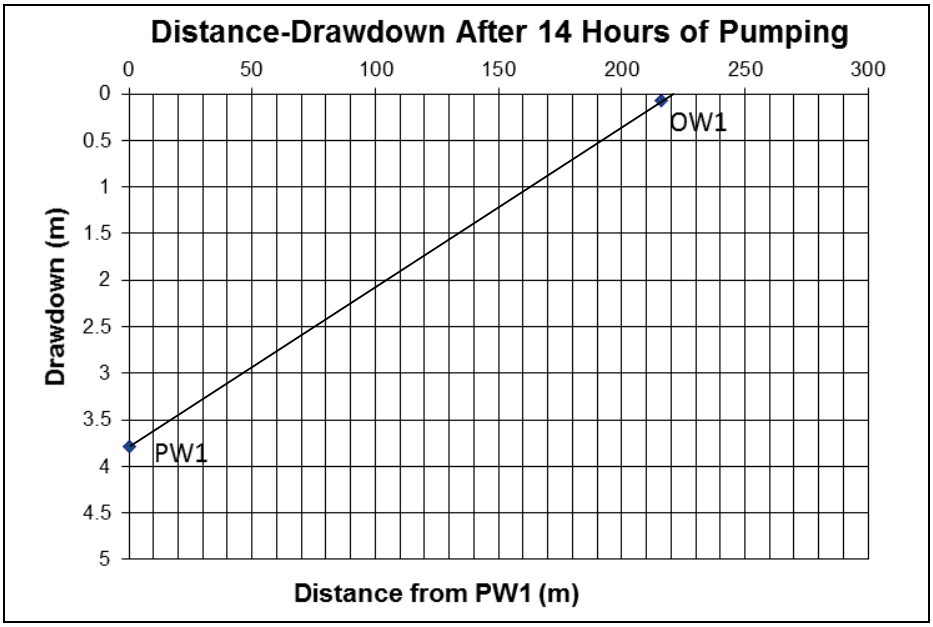


Figure 9: Distance-drawdown Data after 14 Hours of Continuous Pumping at 20 Igpm

5.2 Potential for Saltwater Intrusion

The production well is located approximately 75 metres from the Northumberland Strait. A review of water quality data during the pump test was completed to assess any observable trends in certain parameters that may indicate saltwater intrusion. According to Drever (1988), the parameters listed in Table 5 are some of the major elements that comprise sea water. Parameters listed in Table 5 are listed in order from most concentrated to least concentrated in seawater. For example, chloride is the parameter with the highest concentration in seawater and strontium has a lower concentration. Concentrations for major solutes (chloride and sodium) remained relatively constant throughout the pump test. The water quality observed during the pumping test does not suggest that saltwater intrusion into the aquifer is occurring. It should be also be noted that PW1 has been supplying the campground since 2012 with no reported water quality issues.

Table 5: PW1 Water Quality Results – Parameters Associated with Saltwater

Parameter	PW1 (24 h)	PW1 (48 h)	PW1 (69 h)
Chloride (mg/L)	24	24	25
Sodium (mg/L)	17.3	15.6	17.7
Sulfate (mg/L)	7	7	7
Magnesium (mg/L)	3.9	3.6	4.1
Calcium (mg/L)	44.7	42.8	43.7
Potassium (mg/L)	1.6	1.5	1.7
Bicarbonate (mg/L)	117	118	118
Strontium (µg/L)	633	583	521
Boron (µg/L)	34	32	28
r-Silica (mg/L)	10.8	9.0	11.7

As pumping well PW1 is located within 500 m of a saltwater source (Northumberland Strait), an evaluation of the potential for saltwater intrusion was undertaken. A review of available literature was completed. Rivard et al. (2008) completed a regional hydrogeological characterization of the south-central part of the Maritimes Basin which included a geophysical survey along Cap Brûlé Road near Shediac, NB, which is located approximately 40 km west of the campground. This area is underlain by the same geological formation (Richibucto Formation) as the campground. The survey did not detect any zones of very low resistivity, suggesting that saline water does not occur within 40 m of the surface. From the 72-hour pump test, it was determined that PW1 is situated in a confined aquifer and the maximum drawdown observed during the pump test was 4.69 m. If we use 40 m as the distance from surface to the top of the fresh water/salt water interface (to be conservative), operating the well at 20 Igpm will result in a maximum drawdown of 4.69 m, correlating to a distance of 31.75 m above the fresh water/salt water interface. Therefore, operating the well at a pumping rate of 20 Igpm will not result in a drawdown that will induce saltwater intrusion.

5.3 Groundwater under the Direct Influence off Surface Water (GUDI)

An evaluation was completed for the potential influence of surface water on the groundwater source. Groundwater is considered under the direct influence of surface water if there is:

- a direct hydraulic connection to the surface or surface water by way of local geology or well construction; and/or
- Significant and relative rapid shifts in water characteristics such as temperature, turbidity, conductivity and pH which closely correlate with climatological events; and/or
- Significant occurrence of micro-organisms.

The closest surface water body to the production well is the Northumberland Strait located approximately 75 m north of the well. The nearest freshwater surface water bodies are watercourses: Trout Brook (1.05 km west of the campground) and Scott Brook (1.2 km east). The area surrounding the well head consists of developed RV lots with gravel pads and grass cover and gravel access roads. No standing water is present near the well house. The construction of PW1 includes 10.97 m (36 feet) of steel casing and the well is drilled to a depth of 32 m. The local geology consists of interbedded layers of shale and sandstone bedrock. The well draws its water from a confined sandstone bedrock aquifer with major water-bearing fractures noted at depths of 18.3 m (15 Igpm), 24.38 m (10 Igpm) and 27.7 m (10 Igpm).

According to Environment Canada's daily climate data from the Moncton International Airport, there were 38.4 mm of precipitation during the 14 days preceding the pump test. An estimated 46.6 mm of precipitation were noted during the pump test from November 19 to 22, 2017. An estimated 5.8 mm of precipitation were noted during the recovery period on November 23, 2017. Water level data in PW1 and OW1 do not show a spike in water levels associated with the rainfall events. Water level fluctuations are attributed to tidal effects. Considering both wells have over 10 m (30 feet) of casing each, any surface recharge to the wells during the pump test is considered minimal. Further, temperature readings measured throughout the test by the dataloggers do not show any fluctuations. Refer to Appendix F for the Environment Canada Daily Data Report for November 2017 and Appendix D for temperature readings.

A review of raw groundwater quality data collected from PW1 at 24 hours, 48 hours and 69 hours into the pump test does not indicate any significant changes in turbidity, conductivity and pH. Reported levels for all parameters were consistent for all three sampling events. Refer to Section 4.2.5 for further discussion. No detection of microbiological parameters (total coliforms and E. coli) was reported for all three sampling events. Further, water quality sampling was previously

completed in May 2017 for PW1 and no detection of total coliforms or E. coli were reported. Refer to Appendix E for laboratory certificates.

PW1 is a deep well drawing groundwater from a confined aquifer. The well is located more than 60 m from the nearest freshwater surface water body. The well casing extends more than 6 m and has an appropriate sized drive shoe. Water quality data collected throughout the duration of the pump test indicates no detection of total coliforms or E. coli bacteria and other indicator parameters (pH, turbidity, conductivity and temperature) do not show any obvious signs of surface water influence. Based on the above, groundwater supplying PW1 is not considered under the influence of surface water.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Roy Consultants supervised the 72-hour constant rate test for PW1 completed in November 2017. The objective of the pump test was to determine the maximum sustainable yield of the water supply for the Strang's Shore Campground. To accommodate the existing and future lots (a total of 150 lots), the estimated water demand is approximately 10 Igpm (68 m^3/day).

PW1 was pumped at a rate of 20 Igpm (131 m^3/day) and a maximum observed drawdown of 4.69 m was noted. The calculated transmissivities of the aquifer from the recovery portion of the pump test range from 19.96 m^2/d to 34.22 m^2/d. Following the end of the pumping test, water levels in PW1 recovered 100 % within 26 hours after the pump was shut off.

Groundwater results for general chemistry, trace metals and microbiological analyses from the pumping well indicate turbidity and manganese exceedances of CDWQ and NB Drinking Water guidelines. The turbidity level was slightly above the CDWQ and NB guidelines in the middle of the test, but was below guidelines towards the beginning and end of the pump test. Turbidity levels typically decrease over time with continued well use. The manganese concentration exceeded the CDWQ guideline towards the beginning of the test, but decreased to below the guideline for the remainder of the test. Both parameters are attributed to sediment content in the well and should decrease over time with continued well use. Based on the water quality results observed throughout the pump test, there is no indication that saltwater intrusion is occurring.

Based on the results of the pump test, a pumping rate of 20 Igpm (131 m^3/day) operating for a maximum of 14 hours per day is recommended for PW1. Pumping at 20 Igpm for 14 hours per day equates to a maximum daily withdrawal of 76.4 m^3/day which meets the future estimated water demand of 68 m^3/day. It is also recommended that a flow meter be installed and water usage recorded over an operating season (May to October) to determine actual water consumption. Water quality samples should also be collected on a monthly basis (at a minimum) and analyzed for conductivity to monitor for possible saltwater intrusion.

7.0 CLOSURE

This report was prepared by Roy Consultants for the exclusive use of Strang's Shore Seasonal Camping Inc. The data contained herein may not be used by any other person or entity without the express written consent of Roy Consultants and Strang's Shore Seasonal Camping Inc. While this report provides an overview of environmental conditions, the assessment is limited by the availability of information at the time of the study. Field work was carried out by Mr. Abram Lee, EIT, and Ms. Gina Burtt, P.Eng., P.Geo. Reporting was carried out by Ms. Gina Burtt, P.Eng., P.Geo.

8.0 REFERENCES

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APPENDICES

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WATER SUPPLY SOURCE ASSESSMENT
Strang's Shore Seasonal Camping Inc.
1639 Route 955
Little Shemogue, (Murray Corner), NB
PID No. 00837088

Our File No.: 278-17
January, 2018

Prepared for:

Jerry and Linda Strang
89 Moore Road Ext.
Otter Creek, NB E4M 3V5

Prepared by:

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January 19, 2018

Jerry and Linda Strang
Strang's Shore Seasonal Camping Inc.
89 Moore Road Ext.
Otter Creek, NB E4M 3V5

Our File No.: 278-17-C[1]

Mr. and Mrs. Strang:

Subject: Water Supply Source Assessment
Strang's Shore Seasonal Camping Inc.
1639 Route 955
Little Shemogue (Murray Corner), NB
PID No. 00837088

We are pleased to present you with the water supply source assessment for Strang's Shore Seasonal Camping Inc. in Little Shemogue (Murray Corner), New Brunswick.

The assessment has determined that there is an adequate supply of water to support the existing campground facility and the proposed future expansion. It is recommended that production well PW1 be operated at a rate not to exceed 20 Igpm (131 m^3/day) for a maximum of 14 hours per day and a flow meter be installed on the well to monitor actual water consumption. Water quality samples should be collected on a monthly basis (at a minimum) and analyzed for conductivity to monitor for possible saltwater intrusion.

Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Yours truly,

Gina Burtt

Gina Burtt, M.Sc., P.Eng. P.Geo.
ENVIRONMENTAL Engineer

GB/jb/sl
Enc.

[1] 278-17 Pump Test Report Jan 2018.doc

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APPENDICES

1.0 INTRODUCTION

Jerry and Linda Strang, on behalf of Strang's Shore Seasonal Camping Inc., retained the services of Roy Consultants to complete a water supply source assessment for the existing campground in Little Shemogue (Murray Corner), New Brunswick (PID Nos. 00837088, 70188826 and 70563457), herein referred to as the "subject property". Refer to Figure 1 in Appendix A for the site location plan.

This report has been prepared in accordance with the New Brunswick Department of Environment and Local Government's (NBDELG) Environmental Impact Assessment *Water Supply Source Assessment Guidelines* (April 2017). These guidelines are used to assist proponents engaging in projects that require a Water Supply Source Assessment (WSSA) through the Environmental Impact Assessment (EIA) process. A WSSA includes, but is not limited to, an evaluation of the sustainability of the water supply, an assessment of water quality, an evaluation of potential impacts to existing water users and an assessment of the potential for saltwater intrusion. The WSSA guidelines are enclosed in Appendix G.

1.1 Project Description

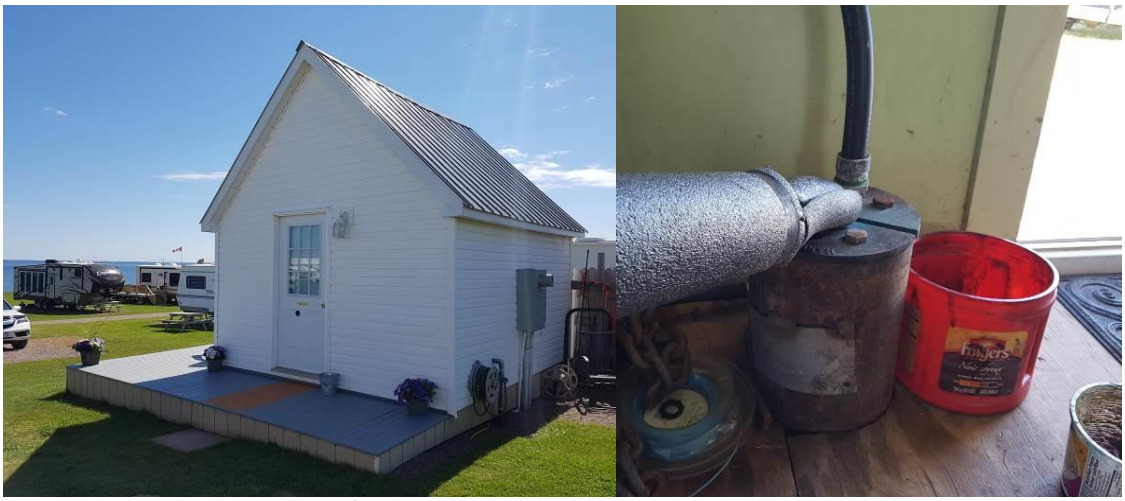
Strang's Shore Seasonal Camping Inc. (hereinafter "the proponent") currently operates a campground with 115 serviced lots at 1639 Route 955, Little Shemogue (Murray Corner), New Brunswick (Westmorland County). The campground began operating in 2012 and includes three parcels of land identified by Service New Brunswick as PID Nos. 00837088, 70188826 and 70563457. For a campground with water and sewer hook-ups, the NBDELG recommends 450 L per space per day for water usage. The estimated current water demand is 52 m^3/day. The campground will expand in the future for a total of 150 serviced lots with an approximate water demand of 68 m^3/day. Currently, the actual water usage is unknown. As limited information is available on current water usage, the objective of the water supply source assessment is to complete a pump test on the existing production well to determine its recommended safe yield.

2.0 EXISTING SITE CONDITIONS

2.1 Site Description

The campground is located in a rural area surrounded by cottage/residential buildings. The subject property, identified by the Service New Brunswick (SNB) parcel identification (PID) number 00837088, is zoned "rural zone" according to the Tantramar Rural Zoning Map Schedule A. Development in the area includes residences and/or cottages to the east, south and west and the Northumberland Strait borders the northern property line. Refer to Figure 1 in Appendix A.

The pumping well (PW1) is located on PID No. 00837088, which covers an area of 3.43 hectares. The observation well (OW1) is located on PID No. 70188826, which has an area of 1.13 hectares. No wells are located on the third parcel of land comprising the campground, PID No. 70563457, which has an area of 3.27 ha. SNB documentation is enclosed in Appendix B. The nearest neighbouring domestic well is located approximately 130 metres east and cross gradient of PW1, along Highway 955 (PID No. 70063144).



Photos 1 and 2: Photo at left shows the well house (looking northeast). Photo at right shows production well PW1 located inside the well house (July 5, 2017).

Photo 3: View of observation well OW1 looking south towards Highway 955 (October 16, 2017)

2.2 Current Groundwater Use

There are two (2) existing on-site potable wells (PW1 and OW1); however, only PW1 services the campground. The wells are located approximately 216 m from each other. PW1 is equipped with a Pentek® 2 horsepower submersible pump with a capacity of 25 USgpm (21 Igpm). OW1 is not hooked up to the water supply system. This well is a remnant from a mobile home that previously occupied PID No. 70188826 prior to that land parcel's purchase by Strang's Shore Seasonal Camping Inc.

2.3 Well Construction

PW1 was constructed on August 2, 2010 (Well ID 24773). The well is 150 mm (6 inches) in diameter and completed to a depth of 32 metres (105 feet). Based on the well driller's report, the predominant bedrock is comprised of alternating layers of grey sandstone and red shale. Depth to the bedrock level is 6.4 metres below ground surface (bgs). OW1 was constructed on August 13, 2014 (Well ID 30194). The well is 150 mm (6 inches) in diameter and completed to a depth of 19.8 metres (65 feet). OW1 was deepened to a depth of 32 metres (105 feet) on October 16, 2017 by Charlie Herman Chappell Well Drilling, out of Colpitts Settlement, NB. All well locations are shown on Figure 1 in Appendix A. The well driller reports for PW1 and OW1 are enclosed in Appendix C.

Table 1: Summary of On-site Potable Well Information

Well ID	GPS Coordinates		Date Drilled	Well Depth (btoc) (m)	Casing Depth (btoc) (m)	Driller's Estimated Safe Yield (Igpm)	Static Water Level (btoc) (m)
	Northing	Easting					
PW1	7467524.674	2695018.638	August 2010	32	10.97	20	4.13*
OW1	7467310.055	2694998.413	August 2014	32	12.19	35	3.465*

(*) as measured on November 19, 2017

3.0 HYDROGEOLOGICAL CONDITIONS

3.1 Topography and Drainage

The subject property is located within the New Brunswick Lowlands physiographic unit. Based on the well elevation survey completed by Roy Consultants in November 2017, the ground surface elevations noted at PW1 and OW1 were 6.74 m and 7.7 m above mean sea level, respectively. The property was noted to gently slope north towards the Northumberland Strait. Surface water drainage across the subject property is northerly via overland flow. No drainage ditches were noted on the subject site. Drainage is good, evidenced by no mapped wetlands on the subject site. Standing water and wet areas were not observed during field work completed in November 2017. The area to the south, which could potentially contribute groundwater to the study area, is a mix of developed residential and vacant/wooded lots.

3.2 Geology

The surficial geology for the area consists of Late Wisconsinan morainal sediments blanket deposits consisting of loamy lodgment till, minor ablation till, silt, sand, gravel and rubble generally 0.5 m to 3 m thick (Rampton, 1984). According to the well driller's log for PW1, the underlying site stratigraphy (from top to bottom) consists of clay and sand at depths from 0 to 6.4 metres bgs and sand present from 6.4 m to 9.1 metres bgs.

The bedrock underlying the subject property is comprised of Late Carboniferous-aged sedimentary rocks comprised of the Pictou Group, Richibucto Formation consisting of grey and brownish red, commonly micaceous lithic and arkosic sandstone, pebbly sandstone and intraformational mudstone-clast conglomerate, brownish red to brick-red and lesser grey siltstone and mudstone, minor intraformational limestone-cobble conglomerate and thin laterally extensive limestone beds and minor thin coal seams (Smith, 2007). According to the well driller's log for PW1, grey sandstone was encountered at a depth of 12.5 metres bgs. Refer to Appendix C for the well driller's report.

3.3 Hydrogeology

Based on a review of seven (7) water well logs within 500 metres of the subject property (PID 00837088), the local aquifer is comprised of a fractured sandstone bedrock aquifer. According to well drillers' reports, several major water-bearing fractures are noted at depths of approximately 17 m, 25 m and 29 m. Well depths range between 19.8 m and 73.5 m and well yields range from 3 Igpm to 25 Igpm (19.6 m^3/day to 163.6 m^3/day). Most well logs indicate a confined aquifer scenario of sandstone bedrock interbedded with layers of shale. Refer to well driller's reports in Appendix C for further details.

The subject property is located immediately adjacent to the Northumberland Strait, which is under tidal influence. Water levels in the area are expected to be influenced to some degree by high and low tides. Potential recharge sources to the wells on the subject site include direct infiltration from precipitation and groundwater flow from upland areas.

4.0 HYDRAULIC TESTING

Hydraulic testing was completed at PW1 from November 19 to November 22, 2017. A 72-hour constant rate pumping test was completed in accordance with NBDELG's WSSA guidelines. During the test, groundwater from PW1 was contained and discharged through approximately 75 m of 4-inch diameter PVC pipe into the Northumberland Strait. Refer to Photos 4 and 5. The site topography slopes northward, away from the pumping well, towards the Northumberland Strait. The discharge location of the pumped water did not allow artificial recharge to PW1 and OW1.

Photo 4: View of water discharge line directing pumped water towards the Northumberland Strait (November 19, 2017).

Photo 5: View of water discharge (November 19, 2017)

4.1 Step Test

Prior to commencement of the 72-hour continuous pumping test, a step test was conducted to determine the optimal pumping rates for the long-term test at PW1. The existing pump in PW1 was pulled prior to the test and a 5-horsepower pump was installed by Charlie Herman Chappell Well Drilling. Installation of a larger pump allowed for higher pump rate at which to step test the well. The pump was installed at a depth of 27.4 m (90 feet). Step test intervals were 30 minutes in length, each having a higher pumping rate than the previous interval. Three steps were completed at 10 Igpm, 20 Igpm and 30 Igpm, respectively. Pumping rates were verified by the driller using a 20-gallon bucket and stopwatch. Water levels were allowed to recover following completion of each step. Leveloggers were installed in both the pumping and observation wells to record water levels in addition to collecting manual water measurements. Drawdown and recovery data for PW1 throughout the step test are shown in Figure 1.

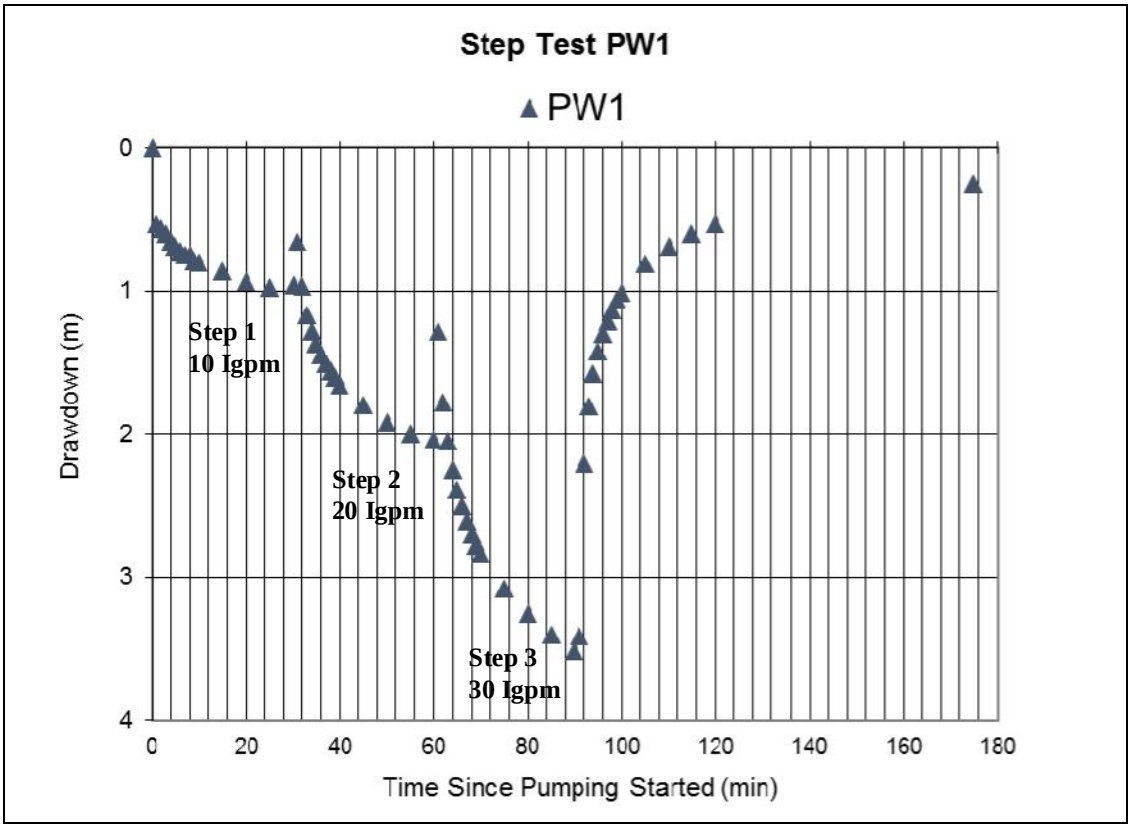


Figure 1: Step Test Data PW1 – Drawdown vs Time

At the beginning of the step test, the static water level in PW1 was 3.56 m bgs. During the first step, at a pumping rate of 10 Igpm, drawdown stabilized at approximately 4.52 m bgs. During the second step, at a pumping rate of 20 Igpm, the pumping water level stabilized at approximately 5.61 m. At the end of the third step, at a pumping rate of 30 Igpm, the pumping water level was 7.08 m bgs and did not appear to have stabilized. The maximum drawdown observed in OW1 during the pumping portion of the step test was 0.029 m (water level of 2.924 m bgs). The water level recovery in PW1 was 94 % recovery after 30 minutes of the end of the last step. Based on the results of the step test, a pumping rate of 20 Igpm (131 m^3/day) was selected for PW1 for the constant rate test. All step test data and plots are enclosed in Appendix D.

4.2 72-hour Pumping Test

The 72-hour constant rate test was started at 2:30 p.m. on November 19, 2017, and the pump was shut off at 2:30 p.m. on November 22, 2017. The average flow rate measured over the duration of the test was 20 Igpm (131 m^3/day) from PW1. The flow rate was monitored regularly throughout the duration of the pump test by the driller using a 20-gallon bucket and stopwatch.

Results from the pumping well and observation well during the 72-hour pumping test are presented in Table 2. Water level data are shown in Figure 2 and drawdown data is presented in Figure 3. Refer to the pumping test data and graphs in Appendix D for further details.

Table 2: Summary of 72-hour Constant Rate Test Data

Well ID	Well Type	Distance from Pumped Well (m)	Ground Surface Elevation (m)	Static Water Elevation (m)	Maximum Observed Drawdown (m)	Time of Maximum Observed Drawdown (Hour into Pumping Test)
PW1	Pumping	N/A	6.74	3.563 (bgs) 3.177 (amsl)	4.69	67
OW1	Observation	216	7.70	2.895 (bgs) 4.805 (amsl)	0.29	66

bgs = below ground surface
amsl = above mean sea level

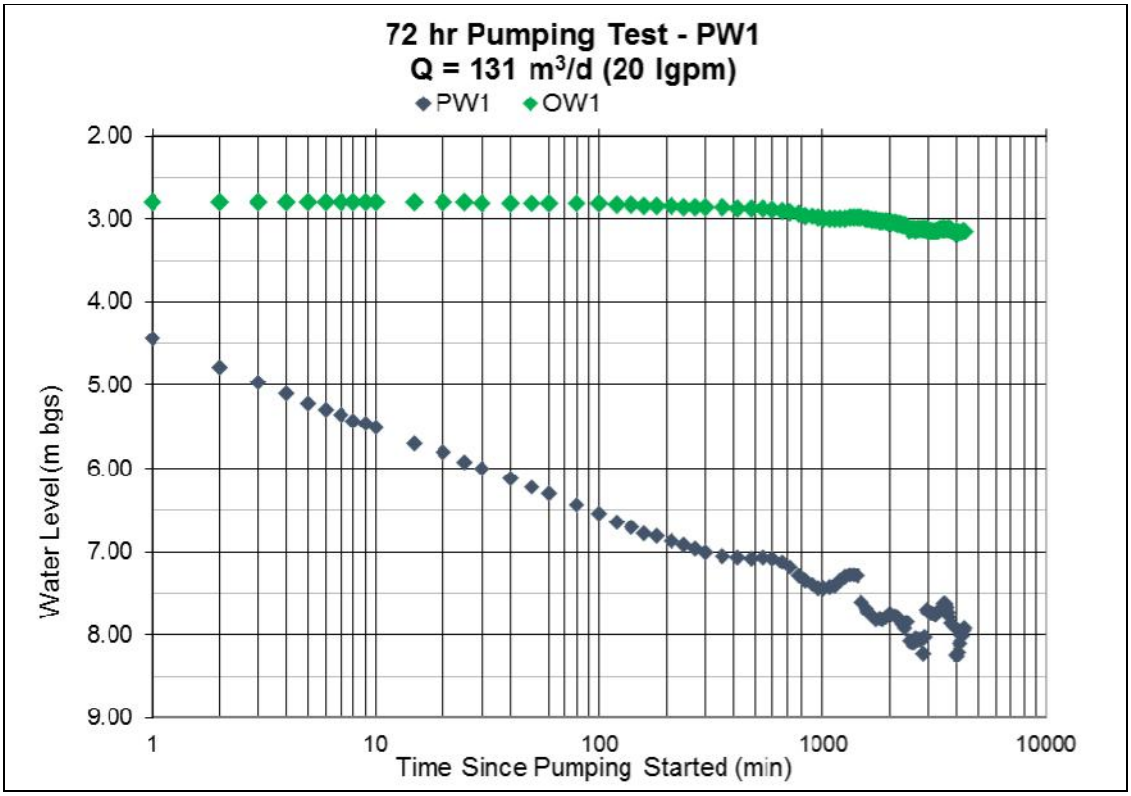


Figure 2: 72-hour Constant Rate Test Water Level Data

The water level in PW1 appeared to stabilize over the duration of the pumping test. However, fluctuations in drawdown were noted which are attributed to pumping rate adjustments made by the driller and tidal effect. The pumping rate had to be adjusted after 37 hours of pumping (2220 minutes), 44 hours (2640 minutes), 50 hours (3000 minutes), 52 hours (3120 minutes) and 63 hours (3780 minutes).

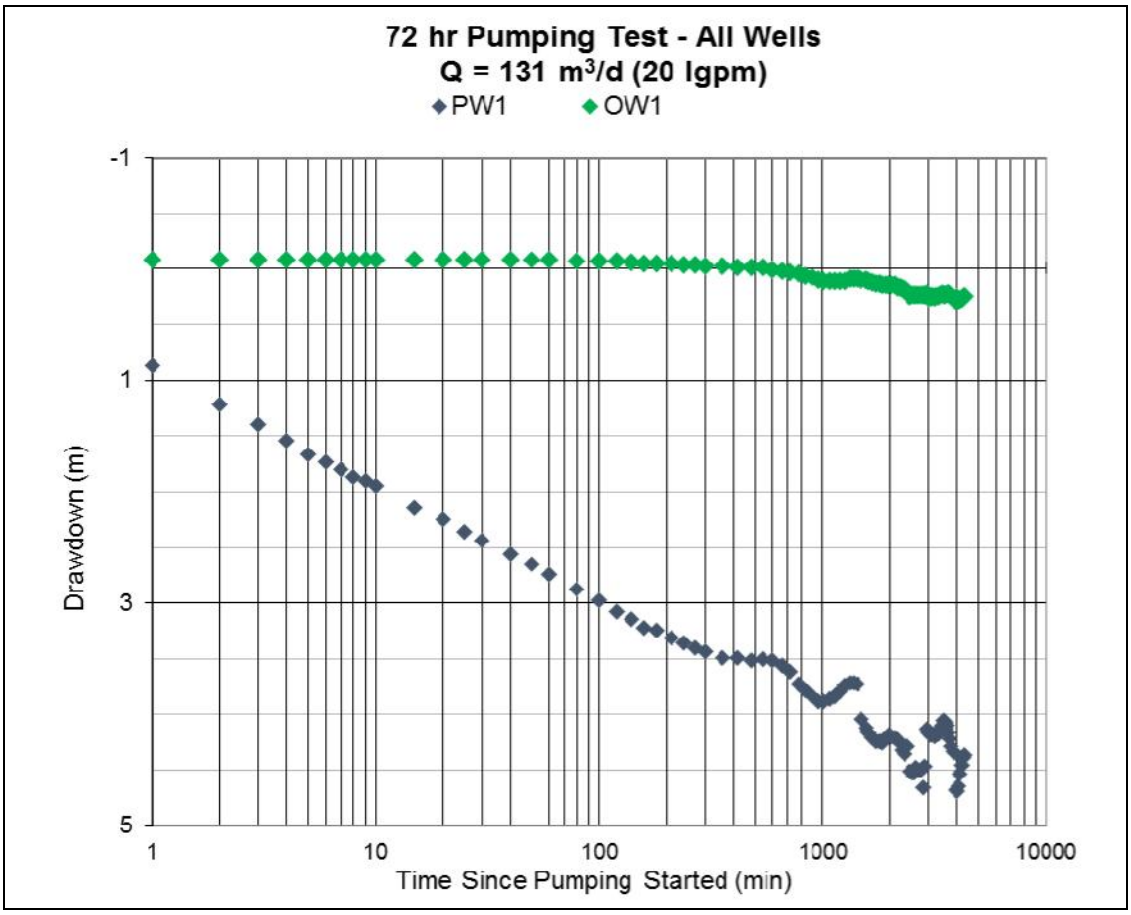


Figure 3: 72-hour Constant Rate Test Drawdown Data

The maximum drawdown in PW1 was 4.69 m, which corresponds to a pumping water level of approximately 1.51 m below sea level (bsl). The maximum drawdown observed in OW1 was 0.29 m, which corresponds to a water level of 4.515 m above sea level (asl). Water levels in OW1 remained above sea level throughout the duration of the pumping test.

Some minor fluctuations in water levels are noted in the drawdown data for both wells and are attributed to tidal effects. Fluctuations correlate with the tide schedules for Cape Tormentine. Based on the drawdown data, drawdowns of approximately 0.17 m in PW1 and 0.02 m in OW1 are attributed to tidal influence during the pumping test. Refer to Appendix F for tide tables.

Following completion of the pumping test, recovery in both wells was very good. In PW1, water levels recovered 71 %, 92 % and 100 % within 1 hour, 10 hours and 26 hours, respectively, of shutting off the pump. In OW1, 100 % water level recovery was noted within 23 hours of shutting off the pump (at 4320 minutes). Refer to Figure 4 for drawdown and recovery data for both wells.

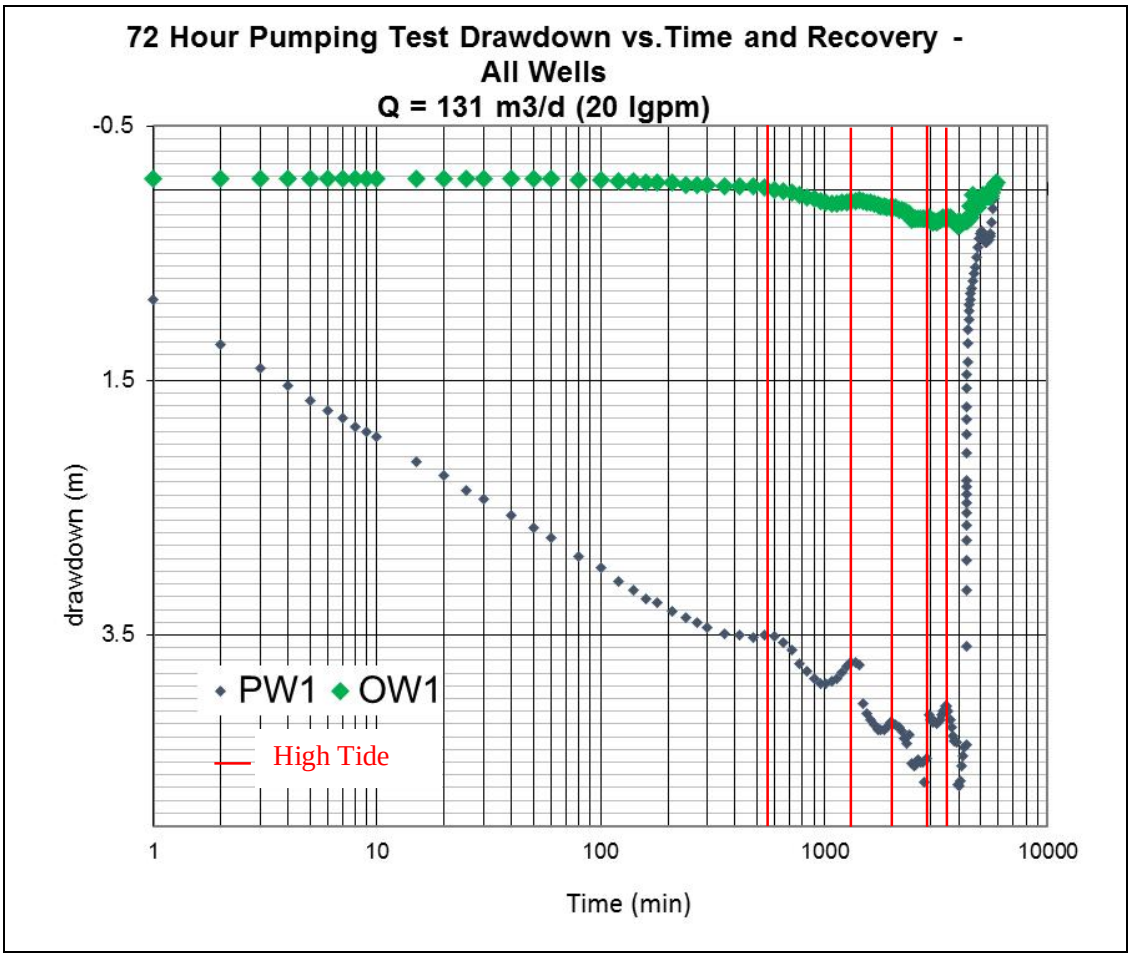


Figure 4: Drawdown and Recovery Data – All Wells

Water levels recovered 100 % in PW1 within 26 hours of the end of the pump test. In OW1, 100 % water level recovery was achieved within 23 hours of shutting off the pump. It was noted during the recovery period that water levels in PW1 and OW1 fluctuated due to tidal effects. Fluctuations were more pronounced in PW1 and water levels fluctuated between 0.09 m and 0.45 m due to tidal effects. Refer to Figures 5 and 6 for recovery data. From Figure 5, it appears that residual drawdown reaches '0' near t/t'=2, indicating complete recovery, although interpretation is made difficult due to fluctuations in residual drawdowns, which are attributed to tidal effects.

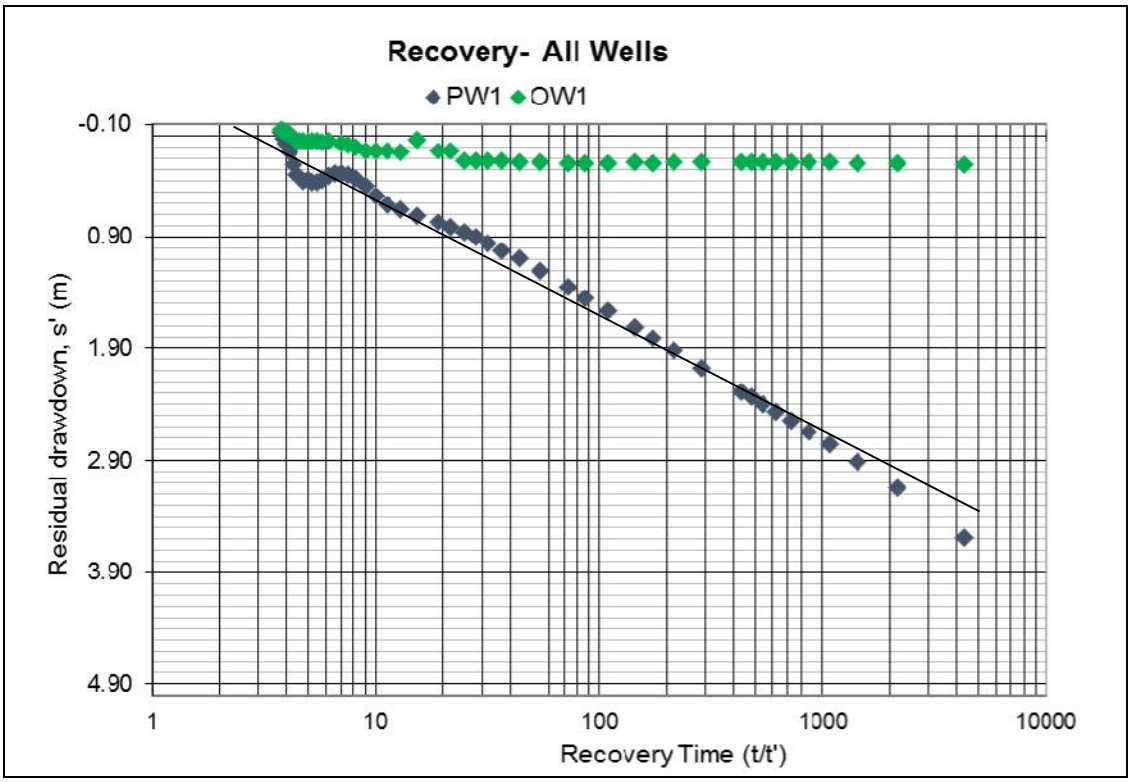


Figure 5: Residual Drawdown Recovery Data – All Wells

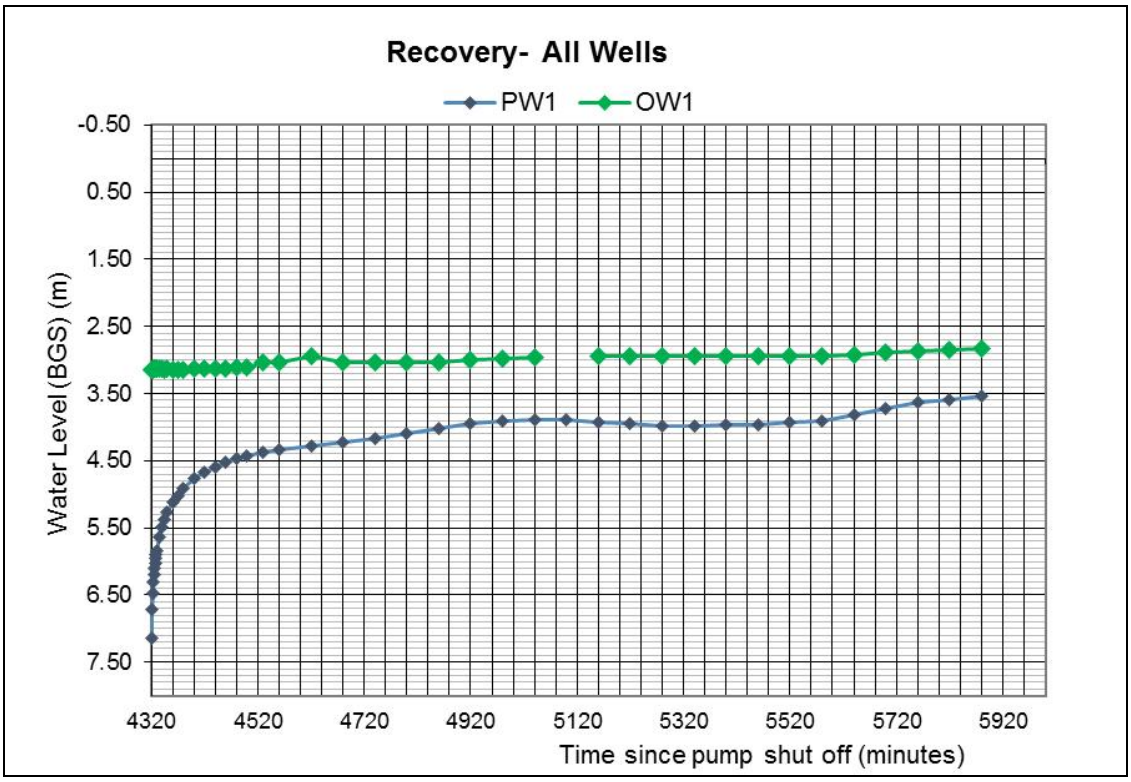


Figure 6: Water Level Recovery Data – All Wells

4.2.1 Pumping Test Analysis

After completion of the 72-hour pumping test, transmissivity was calculated from the drawdown and recovery data from pumping well PW1 using the Cooper-Jacob straight line method. The log time versus drawdown plots are shown in Appendix D. The calculated transmissivities for PW1 are shown in Table 3.

Table 3: Transmissivity Values

Well No.	Drawdown		Recovery	
	Transmissivity (minimum) m^2/day	Transmissivity (maximum) m^2/day	Transmissivity (minimum) m^2/day	Transmissivity (maximum) m^2/day
PW1	23.2	30.9	19.96	34.22

Transmissivities calculated based on the recovery data are considered more representative of the aquifer than data collected under pumping conditions. Based on the distance-drawdown plot, the maximum radius of influence extends approximately 230 metres from PW1. Refer to Figures 6 and 7 in Section 5.1 for the distance-drawdown data.

The specific capacity calculated for PW1 during the pumping test was 24.23 m^3/day/m. A storativity value of 0.0014 was calculated using time drawdown data obtained from OW1. According to Driscoll (1986), the coefficient of storage for confined aquifers ranges from 10^{-5} to 10^{-3}, and from 0.01 to 0.3 for unconfined aquifers. The calculated storativity value is reflective of a confined aquifer.

4.2.2 Recommended Sustainable Yield (PW1)

PW1's specific capacity after 100 days of pumping was calculated using the pumping rate of 20 Igpm (131 m^3/day) and extrapolating the drawdown at 100 days from the Time vs. Drawdown graph. The drawdown at 100 days is 5.4 m and the pumping well's specific capacity is 24.23 m^3/d/m. The total available drawdown in the well is calculated using the depth from the static water level (3.56 m bgs) to mean sea level (6.74 m bgs). Based on available site information, the total available drawdown in the well is 3.2 m (to mean sea level). The long-term sustainable yield (Q) is calculated based on the following formula:

Q = Specific Capacity at 100 days x available drawdown in the well
Q = 24.23 m^3/day/m x 3.2 m
Q = 78 m^3/day or 12 Igpm

PW1, operating at a continuous rate of 78 m^3/day (12 Igpm) over a 24-hour period, corresponds to the same water withdrawal as operating at a pumping rate of 20 Igpm for a maximum of 14 hours per day. Based on the pump test, pumping PW1 at a rate of 131 m^3/day (20 Igpm) resulted in a drawdown of 3.78 m after 14 hours of continuous pumping which corresponds to a pumping water level below sea level (refer to Figure 7). However, it should be noted that the casing in PW1 extends below sea level and the drawdown is likely more pronounced due to the casing length. It is likely that the well construction of PW1 has more influence on the pumping water level than does the actual pumping rate. The potential for saltwater intrusion into PW1 is considered unlikely at a pumping rate of 20 Igpm based on the assessment outlined in Section 5.2.

It should be noted that PW1 would be operated on a cycle basis and would not pump continuously throughout the day while the campground is operating. It should also be noted that the campground operates from May to October and water withdrawal would be restricted to this time period. Based on the above, it is recommended that PW1 be pumped at a rate not to exceed 20 Igpm (131 m^3/day) for a maximum of 14 hours per day, which equates to a daily maximum water withdrawal of 76.4 m^3/day.

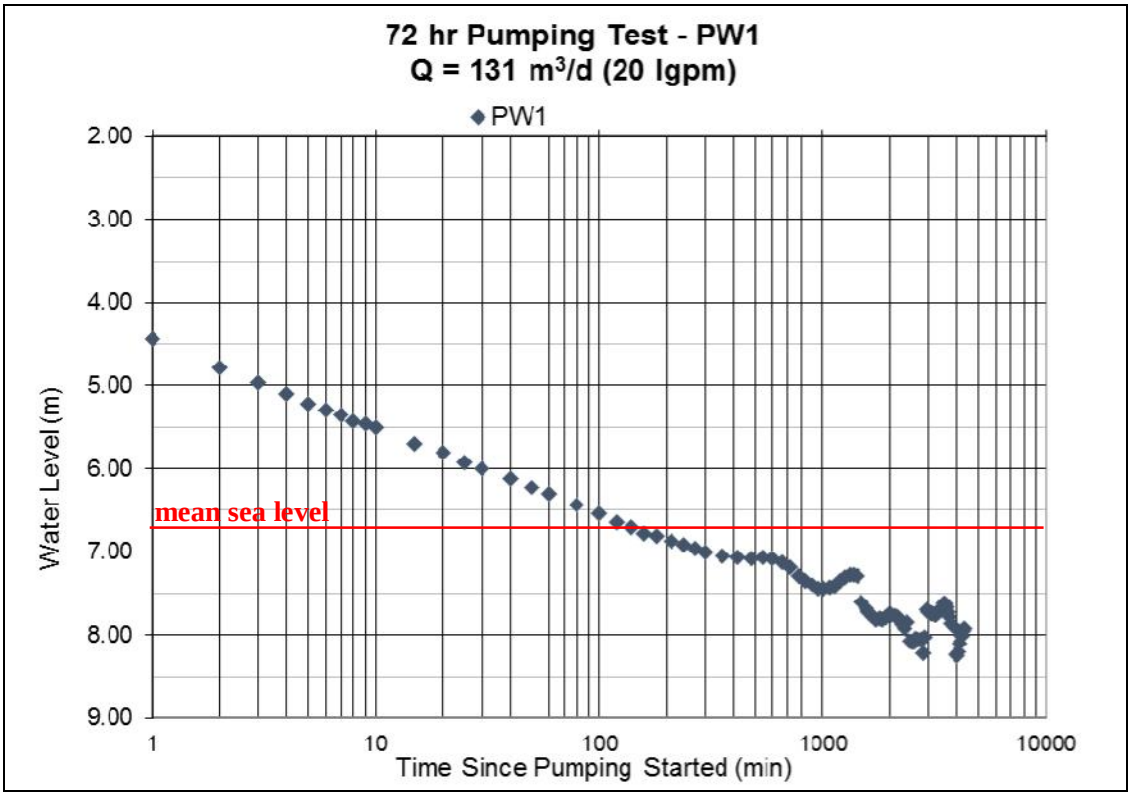


Figure 7: PW1 Water Level vs Time

4.2.5 Groundwater Quality

Groundwater samples were collected from the pumping well (PW1) towards the beginning (24 hours), middle (48 hours) and near the end (69 hours) of the pump test. All samples were submitted to AGAT Laboratories in Dartmouth, Nova Scotia, for general chemistry, trace metals and microbiological analyses. Laboratory certificates are enclosed in Appendix E.

General chemistry and trace metals results for the samples collected at the beginning and end of the pump test are all within the *Canadian Drinking Water Quality Guidelines* (CDWQ) and *New Brunswick Drinking Water Guidelines* (NB) potable guideline values with the exception of turbidity and manganese. The turbidity value of 1.3 NTU (48 hours) slightly exceeds the CDWQ guideline range of 0.1 to 1.0 NTU and the NB guideline of 1.0 NTU. It should be noted that turbidity values in PW1 were below guidelines at 24 hours and 69 hours into the pump test. The levels of turbidity in the well may be related to sediment dislodged during removal of the pump and installation of the driller's pump for completion of the pump test. Furthermore, an iron build-up was noted on the casing and discoloured the water level tape used to collect manual readings throughout the test. The friction of the tape against the casing may also have contributed to

sediments in the well water. The reported turbidity levels are not considered a concern for human health and turbidity levels should decrease over time with continued well use.

Manganese in PW1 exceeded the CDWQ guideline of less than or equal to 50 µg/L towards the beginning of the test (24 hours) and decreased to below the CDWQ guideline for the remainder of the pump test (48 hours and 69 hours). It is likely that elevated manganese was associated with sediment content present in the well at the start of the test. With further pumping, manganese concentrations decreased to within the acceptable guideline.

Microbiological results for the samples collected towards the beginning, middle and end of the pump test indicate no counts for total coliforms or *E.coli*. All results meet the CDWQ and NB guideline values of 0 MPN/100 ml for both total coliforms and *E.coli*. Following completion of the pumping test, the water quality in the pumping well meets potable guidelines. Water quality results for PW1 are shown in Table 4.

Table 4: PW1 Groundwater Quality

Parameter	Units	CDWQ	NB	24 h	48 h	69 h
General Chemistry						
Ammonia (as N)	mg/L			0.03	0.05	<0.03
pH	units	7.0-10.5		8.01	7.96	8.09
Alkalinity (as CaCO3)	mg/L			117	118	118
Chloride	mg/L	≤ 250	250	24	24	25
Colour	TCU	15		6	5	14
Fluoride	mg/L		1.5	<0.12	<0.12	<0.12
Sulfate	mg/L	≤ 500	500	7	7	7
Nitrate (as N)	mg/L	45	45	1.88	2.03	1.91
Nitrite (as N)	mg/L	3		<0.05	<0.05	<0.05
o-Phosphate (as P)	mg/L			<0.01	<0.01	<0.01
Phosphorus	mg/L			<0.02	<0.02	<0.02
r-Silica (as SiO2)	mg/L			10.8	9.0	11.7
Total Organic Carbon	mg/L			<0.5	<0.5	<0.5
Turbidity	NTU	0.1-1.0	1.0	0.5	**1.3**	0.8
Conductivity	µS/cm			332	322	332
Total Dissolved Solids	mg/L	≤ 500		177	174	178
Trace Metals						
Aluminum	µg/L	<100		<5	11	<5
Antimony	µg/L	6	6	<2	<2	<2
Arsenic	µg/L	10	10	<2	<2	<2
Barium	µg/L	1000	1000	431	421	413
Beryllium	µg/L			<2	<2	<2
Bismuth	µg/L			<2	<2	<2
Boron	µg/L	5000	5000	34	32	28
Cadmium	µg/L	5	5	<0.017	<0.017	<0.017
Calcium	µg/L			44700	42800	43700
Chromium	µg/L	50	50	3	3	<1
Cobalt	µg/L			<1	<1	<1
Copper	µg/L	≤ 1000	1000	<2	<2	<2
Iron	µg/L	≤ 300	300	<50	<50	<50
Lead	µg/L	10	10	<0.5	<0.5	<0.5
Magnesium	µg/L			3900	3600	4100
Manganese	µg/L	≤ 50		**72**	22	21
Molybdenum	µg/L			<2	<2	<2
Nickel	µg/L			<2	<2	<2
Potassium	µg/L			1600	1500	1700
Selenium	µg/L	50	10	<1	<1	<1
Silver	µg/L			<0.1	<0.1	<0.1
Sodium	µg/L	≤ 200,000	200,000	17300	15600	17700
Strontium	µg/L			633	583	521
Thallium	µg/L			<0.1	<0.1	<0.1
Tin	µg/L			<2	<2	<2
Titanium	µg/L			<2	<2	<2
Uranium	µg/L	20	20	2.3	2.2	2.1
Vanadium	µg/L			4	4	4
Zinc	µg/L	≤5000		8	9	<5
Microbiology						
Total Coliforms	MPN/100 mL	Absent	Absent	Absent	<1	<1
E. Coli	MPN/100 mL	Absent	Absent	Absent	<1	<1

"Bold" exceeds applicable guideline criteria

5.0 DISCUSSION

5.1 Neighbouring Water Users

Based on the results of the hydraulic testing, the radius of influence for PW1 extends approximately 230 metres when the production well is operating at a rate of 131 m^3/day (20 Igpm) (refer to Figure 8). OW1 is located at a distance of 216 m from PW1. Approximately 0.29 m of drawdown was observed in OW1 during the pumping test. The closest neighbouring residential well (PID 70063144) is located approximately 130 metres east of PW1 and eight (8) private wells are located on neighbouring properties within 230 metres of PW1. Based on the Distance-Drawdown plot (see Figure 8), 2 m of drawdown is estimated at a distance of 130 metres from the pumping well. Note that the drawdown also includes interferences from tidal effects. Throughout the pumping test and recovery period, no residents in the area contacted the proponent or Roy Consultants' personnel with complaints regarding water quality or quantity. Surrounding land use within 500 m of the campground is residential (primarily seasonal cottages). No potentially adverse impacts on the groundwater supply are anticipated due to current or historical land uses.

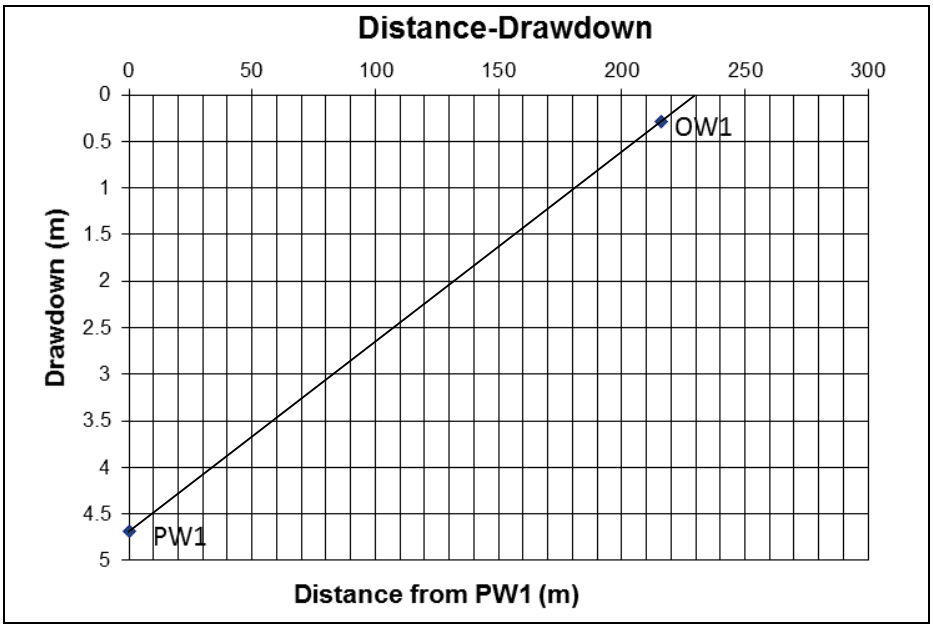


Figure 8: Distance-drawdown Data from the 72-hour Constant Rate Pump Test

At the recommended pumping rate of 20 Igpm for a maximum of 14 hours per day, the maximum drawdown at PW1 is approximately 3.78 m based on the pump test data. Operating at 20 Igpm for a continuous 14-hour period will slightly reduce the radius of influence to 220 metres (refer to Figure 9). The corresponding drawdown in the nearest neighbouring well (130 m away) is approximately 2 m. However, upon further review of the pump test data, water level drawdown (0.10 metre) in OW1 did not occur until after 10 hours of continuous pumping at 20 Igpm. It should be noted that PW1 would be operated on a cycle basis and would not pump continuously throughout the day while the campground is operating. As a result, the radius of influence is expected to be less than 220 metres and the corresponding drawdown of 2 metres in the nearest neighbouring well is also expected to be less. The operation of the production well is expected to have minimal interference with neighbouring water users. Based on the above, it is

recommended that PW1 be pumped at a rate not to exceed 20 Igpm (131 m^3/day) for a maximum of 14 hours per day.

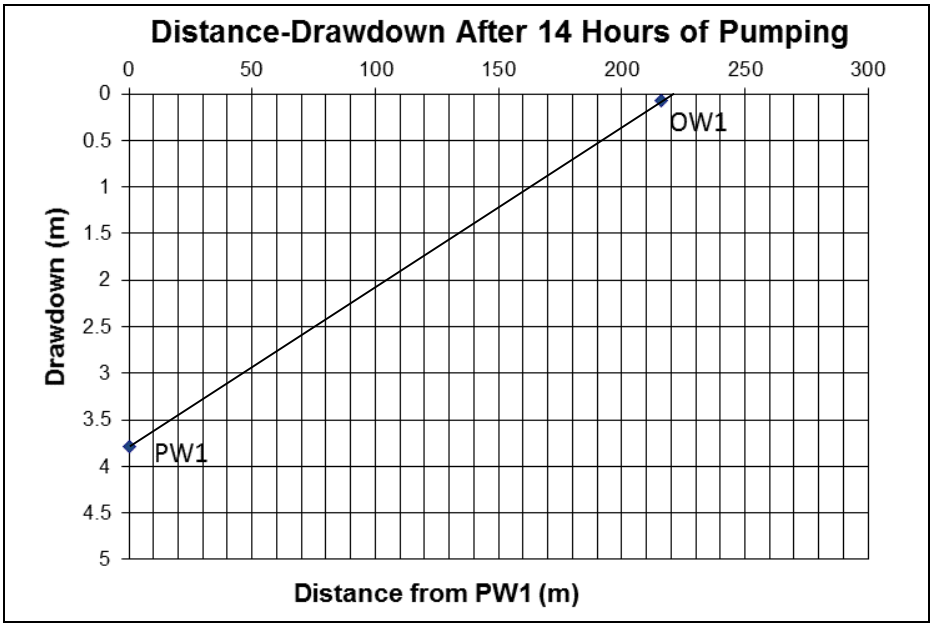


Figure 9: Distance-drawdown Data after 14 Hours of Continuous Pumping at 20 Igpm

5.2 Potential for Saltwater Intrusion

The production well is located approximately 75 metres from the Northumberland Strait. A review of water quality data during the pump test was completed to assess any observable trends in certain parameters that may indicate saltwater intrusion. According to Drever (1988), the parameters listed in Table 5 are some of the major elements that comprise sea water. Parameters listed in Table 5 are listed in order from most concentrated to least concentrated in seawater. For example, chloride is the parameter with the highest concentration in seawater and strontium has a lower concentration. Concentrations for major solutes (chloride and sodium) remained relatively constant throughout the pump test. The water quality observed during the pumping test does not suggest that saltwater intrusion into the aquifer is occurring. It should be also be noted that PW1 has been supplying the campground since 2012 with no reported water quality issues.

Table 5: PW1 Water Quality Results – Parameters Associated with Saltwater

Parameter	PW1 (24 h)	PW1 (48 h)	PW1 (69 h)
Chloride (mg/L)	24	24	25
Sodium (mg/L)	17.3	15.6	17.7
Sulfate (mg/L)	7	7	7
Magnesium (mg/L)	3.9	3.6	4.1
Calcium (mg/L)	44.7	42.8	43.7
Potassium (mg/L)	1.6	1.5	1.7
Bicarbonate (mg/L)	117	118	118
Strontium (µg/L)	633	583	521
Boron (µg/L)	34	32	28
r-Silica (mg/L)	10.8	9.0	11.7

As pumping well PW1 is located within 500 m of a saltwater source (Northumberland Strait), an evaluation of the potential for saltwater intrusion was undertaken. A review of available literature was completed. Rivard et al. (2008) completed a regional hydrogeological characterization of the south-central part of the Maritimes Basin which included a geophysical survey along Cap Brûlé Road near Shediac, NB, which is located approximately 40 km west of the campground. This area is underlain by the same geological formation (Richibucto Formation) as the campground. The survey did not detect any zones of very low resistivity, suggesting that saline water does not occur within 40 m of the surface. From the 72-hour pump test, it was determined that PW1 is situated in a confined aquifer and the maximum drawdown observed during the pump test was 4.69 m. If we use 40 m as the distance from surface to the top of the fresh water/salt water interface (to be conservative), operating the well at 20 Igpm will result in a maximum drawdown of 4.69 m, correlating to a distance of 31.75 m above the fresh water/salt water interface. Therefore, operating the well at a pumping rate of 20 Igpm will not result in a drawdown that will induce saltwater intrusion.

5.3 Groundwater under the Direct Influence off Surface Water (GUDI)

An evaluation was completed for the potential influence of surface water on the groundwater source. Groundwater is considered under the direct influence of surface water if there is:

- a direct hydraulic connection to the surface or surface water by way of local geology or well construction; and/or
- Significant and relative rapid shifts in water characteristics such as temperature, turbidity, conductivity and pH which closely correlate with climatological events; and/or
- Significant occurrence of micro-organisms.

The closest surface water body to the production well is the Northumberland Strait located approximately 75 m north of the well. The nearest freshwater surface water bodies are watercourses: Trout Brook (1.05 km west of the campground) and Scott Brook (1.2 km east). The area surrounding the well head consists of developed RV lots with gravel pads and grass cover and gravel access roads. No standing water is present near the well house. The construction of PW1 includes 10.97 m (36 feet) of steel casing and the well is drilled to a depth of 32 m. The local geology consists of interbedded layers of shale and sandstone bedrock. The well draws its water from a confined sandstone bedrock aquifer with major water-bearing fractures noted at depths of 18.3 m (15 Igpm), 24.38 m (10 Igpm) and 27.7 m (10 Igpm).

According to Environment Canada's daily climate data from the Moncton International Airport, there were 38.4 mm of precipitation during the 14 days preceding the pump test. An estimated 46.6 mm of precipitation were noted during the pump test from November 19 to 22, 2017. An estimated 5.8 mm of precipitation were noted during the recovery period on November 23, 2017. Water level data in PW1 and OW1 do not show a spike in water levels associated with the rainfall events. Water level fluctuations are attributed to tidal effects. Considering both wells have over 10 m (30 feet) of casing each, any surface recharge to the wells during the pump test is considered minimal. Further, temperature readings measured throughout the test by the dataloggers do not show any fluctuations. Refer to Appendix F for the Environment Canada Daily Data Report for November 2017 and Appendix D for temperature readings.

A review of raw groundwater quality data collected from PW1 at 24 hours, 48 hours and 69 hours into the pump test does not indicate any significant changes in turbidity, conductivity and pH. Reported levels for all parameters were consistent for all three sampling events. Refer to Section 4.2.5 for further discussion. No detection of microbiological parameters (total coliforms and E. coli) was reported for all three sampling events. Further, water quality sampling was previously

completed in May 2017 for PW1 and no detection of total coliforms or E. coli were reported. Refer to Appendix E for laboratory certificates.

PW1 is a deep well drawing groundwater from a confined aquifer. The well is located more than 60 m from the nearest freshwater surface water body. The well casing extends more than 6 m and has an appropriate sized drive shoe. Water quality data collected throughout the duration of the pump test indicates no detection of total coliforms or E. coli bacteria and other indicator parameters (pH, turbidity, conductivity and temperature) do not show any obvious signs of surface water influence. Based on the above, groundwater supplying PW1 is not considered under the influence of surface water.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Roy Consultants supervised the 72-hour constant rate test for PW1 completed in November 2017. The objective of the pump test was to determine the maximum sustainable yield of the water supply for the Strang's Shore Campground. To accommodate the existing and future lots (a total of 150 lots), the estimated water demand is approximately 10 Igpm (68 m^3/day).

PW1 was pumped at a rate of 20 Igpm (131 m^3/day) and a maximum observed drawdown of 4.69 m was noted. The calculated transmissivities of the aquifer from the recovery portion of the pump test range from 19.96 m^2/d to 34.22 m^2/d. Following the end of the pumping test, water levels in PW1 recovered 100 % within 26 hours after the pump was shut off.

Groundwater results for general chemistry, trace metals and microbiological analyses from the pumping well indicate turbidity and manganese exceedances of CDWQ and NB Drinking Water guidelines. The turbidity level was slightly above the CDWQ and NB guidelines in the middle of the test, but was below guidelines towards the beginning and end of the pump test. Turbidity levels typically decrease over time with continued well use. The manganese concentration exceeded the CDWQ guideline towards the beginning of the test, but decreased to below the guideline for the remainder of the test. Both parameters are attributed to sediment content in the well and should decrease over time with continued well use. Based on the water quality results observed throughout the pump test, there is no indication that saltwater intrusion is occurring.

Based on the results of the pump test, a pumping rate of 20 Igpm (131 m^3/day) operating for a maximum of 14 hours per day is recommended for PW1. Pumping at 20 Igpm for 14 hours per day equates to a maximum daily withdrawal of 76.4 m^3/day which meets the future estimated water demand of 68 m^3/day. It is also recommended that a flow meter be installed and water usage recorded over an operating season (May to October) to determine actual water consumption. Water quality samples should also be collected on a monthly basis (at a minimum) and analyzed for conductivity to monitor for possible saltwater intrusion.

7.0 CLOSURE

This report was prepared by Roy Consultants for the exclusive use of Strang's Shore Seasonal Camping Inc. The data contained herein may not be used by any other person or entity without the express written consent of Roy Consultants and Strang's Shore Seasonal Camping Inc. While this report provides an overview of environmental conditions, the assessment is limited by the availability of information at the time of the study. Field work was carried out by Mr. Abram Lee, EIT, and Ms. Gina Burtt, P.Eng., P.Geo. Reporting was carried out by Ms. Gina Burtt, P.Eng., P.Geo.

8.0 REFERENCES

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APPENDICES

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NBDELG Documentation

WATER SUPPLY SOURCE ASSESSMENT
Strang's Shore Seasonal Camping Inc.
1639 Route 955
Little Shemogue, (Murray Corner), NB
PID No. 00837088

Our File No.: 278-17
January, 2018

Prepared for:

Jerry and Linda Strang
89 Moore Road Ext.
Otter Creek, NB E4M 3V5

Prepared by:

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January 19, 2018

Jerry and Linda Strang
Strang's Shore Seasonal Camping Inc.
89 Moore Road Ext.
Otter Creek, NB E4M 3V5

Our File No.: 278-17-C[1]

Mr. and Mrs. Strang:

Subject: Water Supply Source Assessment
Strang's Shore Seasonal Camping Inc.
1639 Route 955
Little Shemogue (Murray Corner), NB
PID No. 00837088

We are pleased to present you with the water supply source assessment for Strang's Shore Seasonal Camping Inc. in Little Shemogue (Murray Corner), New Brunswick.

The assessment has determined that there is an adequate supply of water to support the existing campground facility and the proposed future expansion. It is recommended that production well PW1 be operated at a rate not to exceed 20 Igpm (131 m^3/day) for a maximum of 14 hours per day and a flow meter be installed on the well to monitor actual water consumption. Water quality samples should be collected on a monthly basis (at a minimum) and analyzed for conductivity to monitor for possible saltwater intrusion.

Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Yours truly,

Gina Burtt

Gina Burtt, M.Sc., P.Eng. P.Geo.
ENVIRONMENTAL Engineer

GB/jb/sl
Enc.

[1] 278-17 Pump Test Report Jan 2018.doc

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APPENDICES

1.0 INTRODUCTION

Jerry and Linda Strang, on behalf of Strang's Shore Seasonal Camping Inc., retained the services of Roy Consultants to complete a water supply source assessment for the existing campground in Little Shemogue (Murray Corner), New Brunswick (PID Nos. 00837088, 70188826 and 70563457), herein referred to as the "subject property". Refer to Figure 1 in Appendix A for the site location plan.

This report has been prepared in accordance with the New Brunswick Department of Environment and Local Government's (NBDELG) Environmental Impact Assessment *Water Supply Source Assessment Guidelines* (April 2017). These guidelines are used to assist proponents engaging in projects that require a Water Supply Source Assessment (WSSA) through the Environmental Impact Assessment (EIA) process. A WSSA includes, but is not limited to, an evaluation of the sustainability of the water supply, an assessment of water quality, an evaluation of potential impacts to existing water users and an assessment of the potential for saltwater intrusion. The WSSA guidelines are enclosed in Appendix G.

1.1 Project Description

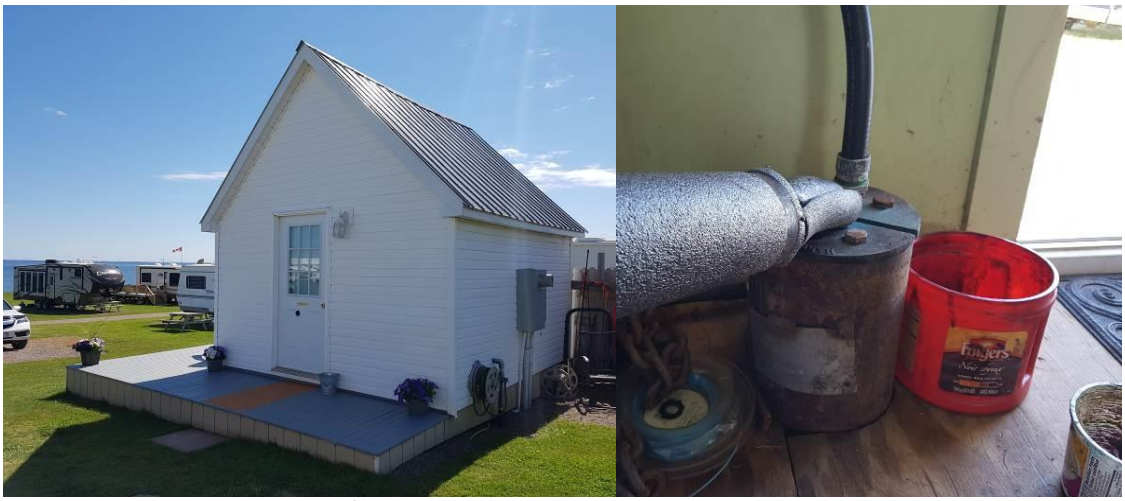
Strang's Shore Seasonal Camping Inc. (hereinafter "the proponent") currently operates a campground with 115 serviced lots at 1639 Route 955, Little Shemogue (Murray Corner), New Brunswick (Westmorland County). The campground began operating in 2012 and includes three parcels of land identified by Service New Brunswick as PID Nos. 00837088, 70188826 and 70563457. For a campground with water and sewer hook-ups, the NBDELG recommends 450 L per space per day for water usage. The estimated current water demand is 52 m^3/day. The campground will expand in the future for a total of 150 serviced lots with an approximate water demand of 68 m^3/day. Currently, the actual water usage is unknown. As limited information is available on current water usage, the objective of the water supply source assessment is to complete a pump test on the existing production well to determine its recommended safe yield.

2.0 EXISTING SITE CONDITIONS

2.1 Site Description

The campground is located in a rural area surrounded by cottage/residential buildings. The subject property, identified by the Service New Brunswick (SNB) parcel identification (PID) number 00837088, is zoned "rural zone" according to the Tantramar Rural Zoning Map Schedule A. Development in the area includes residences and/or cottages to the east, south and west and the Northumberland Strait borders the northern property line. Refer to Figure 1 in Appendix A.

The pumping well (PW1) is located on PID No. 00837088, which covers an area of 3.43 hectares. The observation well (OW1) is located on PID No. 70188826, which has an area of 1.13 hectares. No wells are located on the third parcel of land comprising the campground, PID No. 70563457, which has an area of 3.27 ha. SNB documentation is enclosed in Appendix B. The nearest neighbouring domestic well is located approximately 130 metres east and cross gradient of PW1, along Highway 955 (PID No. 70063144).



Photos 1 and 2: Photo at left shows the well house (looking northeast). Photo at right shows production well PW1 located inside the well house (July 5, 2017).

Photo 3: View of observation well OW1 looking south towards Highway 955 (October 16, 2017)

2.2 Current Groundwater Use

There are two (2) existing on-site potable wells (PW1 and OW1); however, only PW1 services the campground. The wells are located approximately 216 m from each other. PW1 is equipped with a Pentek® 2 horsepower submersible pump with a capacity of 25 USgpm (21 Igpm). OW1 is not hooked up to the water supply system. This well is a remnant from a mobile home that previously occupied PID No. 70188826 prior to that land parcel's purchase by Strang's Shore Seasonal Camping Inc.

2.3 Well Construction

PW1 was constructed on August 2, 2010 (Well ID 24773). The well is 150 mm (6 inches) in diameter and completed to a depth of 32 metres (105 feet). Based on the well driller's report, the predominant bedrock is comprised of alternating layers of grey sandstone and red shale. Depth to the bedrock level is 6.4 metres below ground surface (bgs). OW1 was constructed on August 13, 2014 (Well ID 30194). The well is 150 mm (6 inches) in diameter and completed to a depth of 19.8 metres (65 feet). OW1 was deepened to a depth of 32 metres (105 feet) on October 16, 2017 by Charlie Herman Chappell Well Drilling, out of Colpitts Settlement, NB. All well locations are shown on Figure 1 in Appendix A. The well driller reports for PW1 and OW1 are enclosed in Appendix C.

Table 1: Summary of On-site Potable Well Information

Well ID	GPS Coordinates		Date Drilled	Well Depth (btoc) (m)	Casing Depth (btoc) (m)	Driller's Estimated Safe Yield (Igpm)	Static Water Level (btoc) (m)
	Northing	Easting					
PW1	7467524.674	2695018.638	August 2010	32	10.97	20	4.13*
OW1	7467310.055	2694998.413	August 2014	32	12.19	35	3.465*

(*) as measured on November 19, 2017

3.0 HYDROGEOLOGICAL CONDITIONS

3.1 Topography and Drainage

The subject property is located within the New Brunswick Lowlands physiographic unit. Based on the well elevation survey completed by Roy Consultants in November 2017, the ground surface elevations noted at PW1 and OW1 were 6.74 m and 7.7 m above mean sea level, respectively. The property was noted to gently slope north towards the Northumberland Strait. Surface water drainage across the subject property is northerly via overland flow. No drainage ditches were noted on the subject site. Drainage is good, evidenced by no mapped wetlands on the subject site. Standing water and wet areas were not observed during field work completed in November 2017. The area to the south, which could potentially contribute groundwater to the study area, is a mix of developed residential and vacant/wooded lots.

3.2 Geology

The surficial geology for the area consists of Late Wisconsinan morainal sediments blanket deposits consisting of loamy lodgment till, minor ablation till, silt, sand, gravel and rubble generally 0.5 m to 3 m thick (Rampton, 1984). According to the well driller's log for PW1, the underlying site stratigraphy (from top to bottom) consists of clay and sand at depths from 0 to 6.4 metres bgs and sand present from 6.4 m to 9.1 metres bgs.

The bedrock underlying the subject property is comprised of Late Carboniferous-aged sedimentary rocks comprised of the Pictou Group, Richibucto Formation consisting of grey and brownish red, commonly micaceous lithic and arkosic sandstone, pebbly sandstone and intraformational mudstone-clast conglomerate, brownish red to brick-red and lesser grey siltstone and mudstone, minor intraformational limestone-cobble conglomerate and thin laterally extensive limestone beds and minor thin coal seams (Smith, 2007). According to the well driller's log for PW1, grey sandstone was encountered at a depth of 12.5 metres bgs. Refer to Appendix C for the well driller's report.

3.3 Hydrogeology

Based on a review of seven (7) water well logs within 500 metres of the subject property (PID 00837088), the local aquifer is comprised of a fractured sandstone bedrock aquifer. According to well drillers' reports, several major water-bearing fractures are noted at depths of approximately 17 m, 25 m and 29 m. Well depths range between 19.8 m and 73.5 m and well yields range from 3 Igpm to 25 Igpm (19.6 m^3/day to 163.6 m^3/day). Most well logs indicate a confined aquifer scenario of sandstone bedrock interbedded with layers of shale. Refer to well driller's reports in Appendix C for further details.

The subject property is located immediately adjacent to the Northumberland Strait, which is under tidal influence. Water levels in the area are expected to be influenced to some degree by high and low tides. Potential recharge sources to the wells on the subject site include direct infiltration from precipitation and groundwater flow from upland areas.

4.0 HYDRAULIC TESTING

Hydraulic testing was completed at PW1 from November 19 to November 22, 2017. A 72-hour constant rate pumping test was completed in accordance with NBDELG's WSSA guidelines. During the test, groundwater from PW1 was contained and discharged through approximately 75 m of 4-inch diameter PVC pipe into the Northumberland Strait. Refer to Photos 4 and 5. The site topography slopes northward, away from the pumping well, towards the Northumberland Strait. The discharge location of the pumped water did not allow artificial recharge to PW1 and OW1.

Photo 4: View of water discharge line directing pumped water towards the Northumberland Strait (November 19, 2017).

Photo 5: View of water discharge (November 19, 2017)

4.1 Step Test

Prior to commencement of the 72-hour continuous pumping test, a step test was conducted to determine the optimal pumping rates for the long-term test at PW1. The existing pump in PW1 was pulled prior to the test and a 5-horsepower pump was installed by Charlie Herman Chappell Well Drilling. Installation of a larger pump allowed for higher pump rate at which to step test the well. The pump was installed at a depth of 27.4 m (90 feet). Step test intervals were 30 minutes in length, each having a higher pumping rate than the previous interval. Three steps were completed at 10 Igpm, 20 Igpm and 30 Igpm, respectively. Pumping rates were verified by the driller using a 20-gallon bucket and stopwatch. Water levels were allowed to recover following completion of each step. Leveloggers were installed in both the pumping and observation wells to record water levels in addition to collecting manual water measurements. Drawdown and recovery data for PW1 throughout the step test are shown in Figure 1.

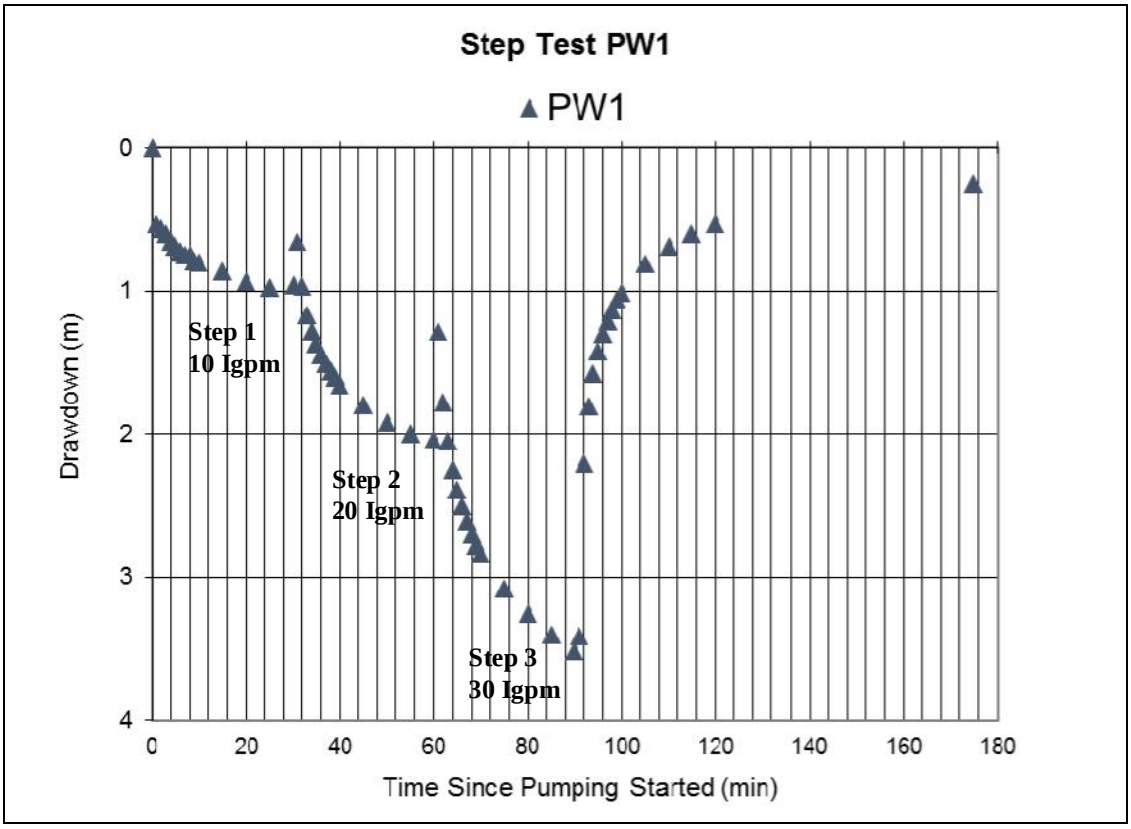


Figure 1: Step Test Data PW1 – Drawdown vs Time

At the beginning of the step test, the static water level in PW1 was 3.56 m bgs. During the first step, at a pumping rate of 10 Igpm, drawdown stabilized at approximately 4.52 m bgs. During the second step, at a pumping rate of 20 Igpm, the pumping water level stabilized at approximately 5.61 m. At the end of the third step, at a pumping rate of 30 Igpm, the pumping water level was 7.08 m bgs and did not appear to have stabilized. The maximum drawdown observed in OW1 during the pumping portion of the step test was 0.029 m (water level of 2.924 m bgs). The water level recovery in PW1 was 94 % recovery after 30 minutes of the end of the last step. Based on the results of the step test, a pumping rate of 20 Igpm (131 m^3/day) was selected for PW1 for the constant rate test. All step test data and plots are enclosed in Appendix D.

4.2 72-hour Pumping Test

The 72-hour constant rate test was started at 2:30 p.m. on November 19, 2017, and the pump was shut off at 2:30 p.m. on November 22, 2017. The average flow rate measured over the duration of the test was 20 Igpm (131 m^3/day) from PW1. The flow rate was monitored regularly throughout the duration of the pump test by the driller using a 20-gallon bucket and stopwatch.

Results from the pumping well and observation well during the 72-hour pumping test are presented in Table 2. Water level data are shown in Figure 2 and drawdown data is presented in Figure 3. Refer to the pumping test data and graphs in Appendix D for further details.

Table 2: Summary of 72-hour Constant Rate Test Data

Well ID	Well Type	Distance from Pumped Well (m)	Ground Surface Elevation (m)	Static Water Elevation (m)	Maximum Observed Drawdown (m)	Time of Maximum Observed Drawdown (Hour into Pumping Test)
PW1	Pumping	N/A	6.74	3.563 (bgs) 3.177 (amsl)	4.69	67
OW1	Observation	216	7.70	2.895 (bgs) 4.805 (amsl)	0.29	66

bgs = below ground surface
amsl = above mean sea level

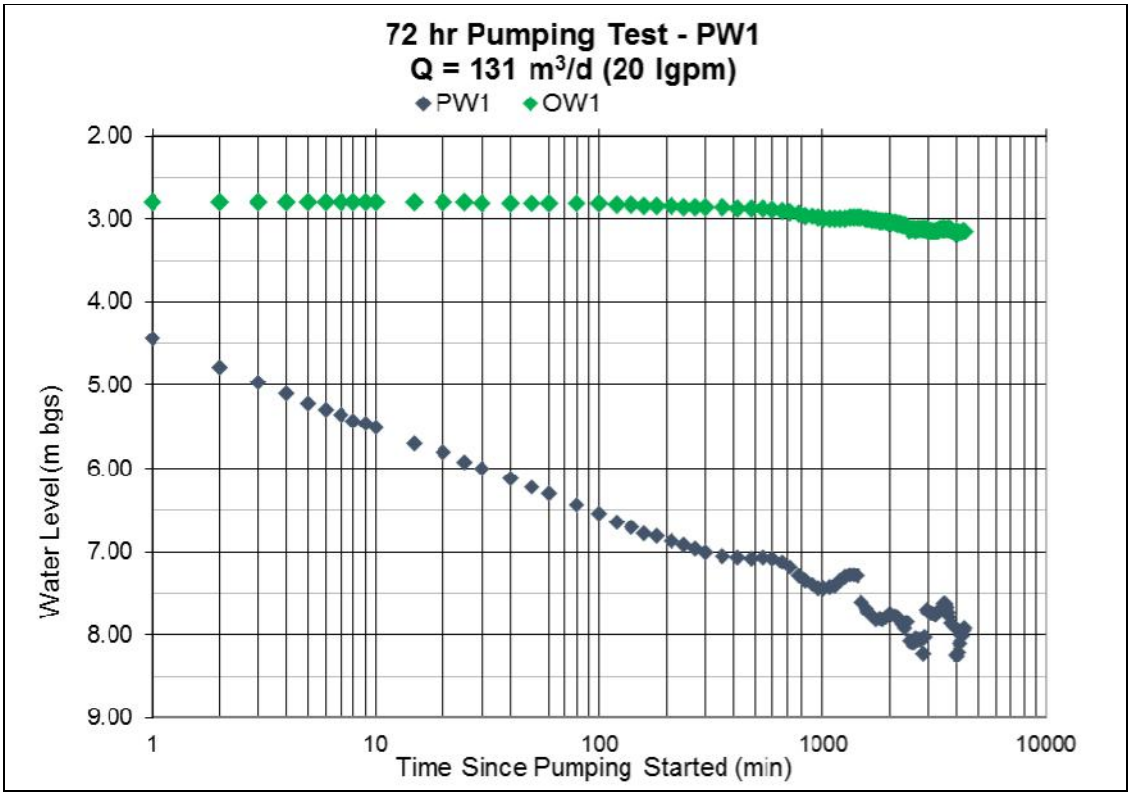


Figure 2: 72-hour Constant Rate Test Water Level Data

The water level in PW1 appeared to stabilize over the duration of the pumping test. However, fluctuations in drawdown were noted which are attributed to pumping rate adjustments made by the driller and tidal effect. The pumping rate had to be adjusted after 37 hours of pumping (2220 minutes), 44 hours (2640 minutes), 50 hours (3000 minutes), 52 hours (3120 minutes) and 63 hours (3780 minutes).

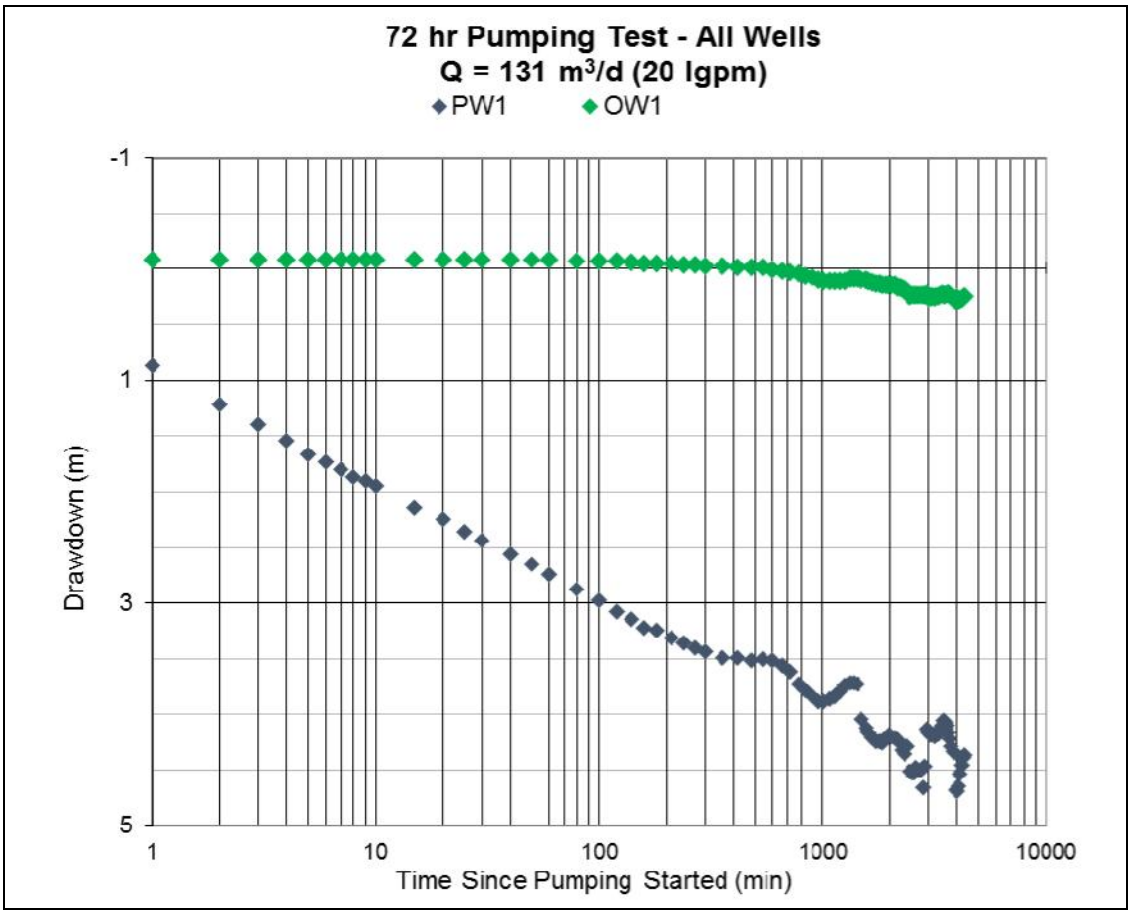


Figure 3: 72-hour Constant Rate Test Drawdown Data

The maximum drawdown in PW1 was 4.69 m, which corresponds to a pumping water level of approximately 1.51 m below sea level (bsl). The maximum drawdown observed in OW1 was 0.29 m, which corresponds to a water level of 4.515 m above sea level (asl). Water levels in OW1 remained above sea level throughout the duration of the pumping test.

Some minor fluctuations in water levels are noted in the drawdown data for both wells and are attributed to tidal effects. Fluctuations correlate with the tide schedules for Cape Tormentine. Based on the drawdown data, drawdowns of approximately 0.17 m in PW1 and 0.02 m in OW1 are attributed to tidal influence during the pumping test. Refer to Appendix F for tide tables.

Following completion of the pumping test, recovery in both wells was very good. In PW1, water levels recovered 71 %, 92 % and 100 % within 1 hour, 10 hours and 26 hours, respectively, of shutting off the pump. In OW1, 100 % water level recovery was noted within 23 hours of shutting off the pump (at 4320 minutes). Refer to Figure 4 for drawdown and recovery data for both wells.

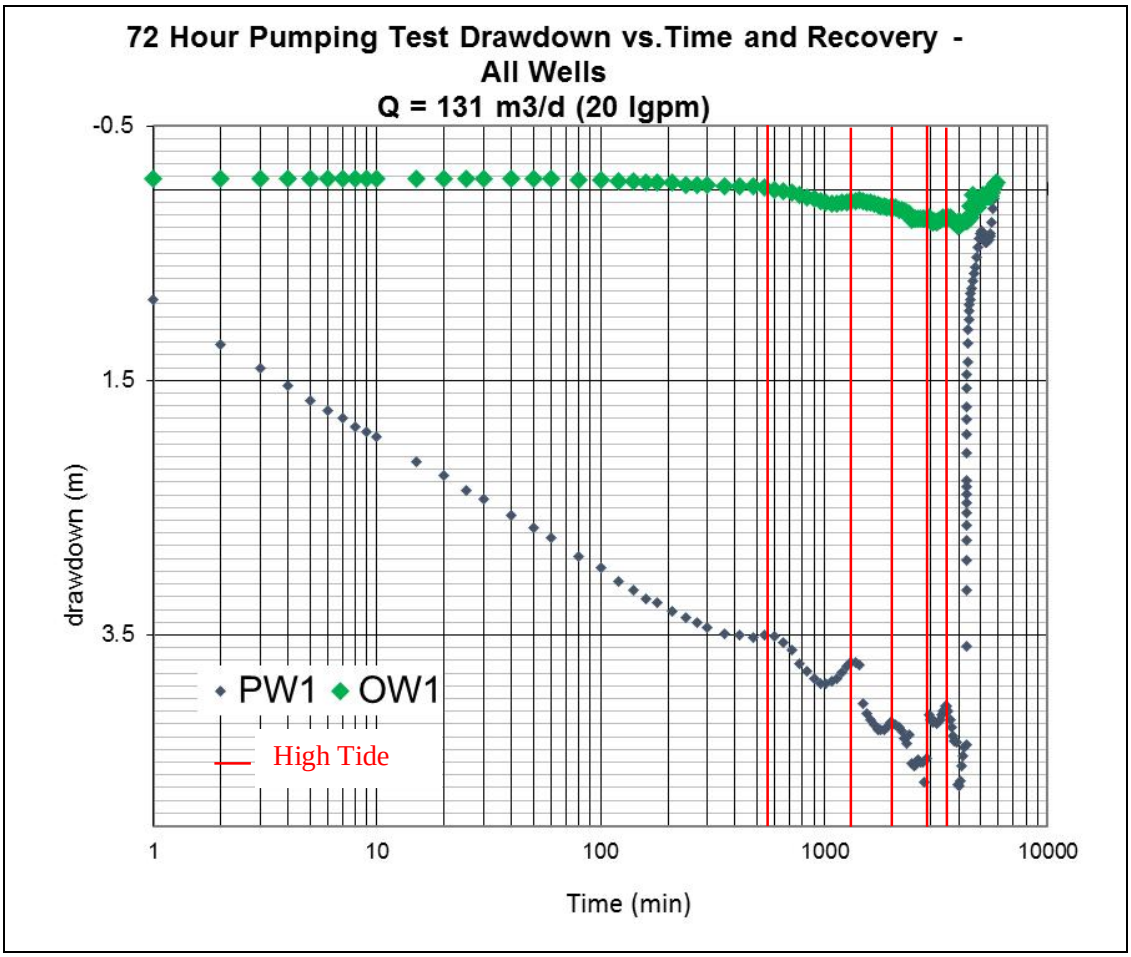


Figure 4: Drawdown and Recovery Data – All Wells

Water levels recovered 100 % in PW1 within 26 hours of the end of the pump test. In OW1, 100 % water level recovery was achieved within 23 hours of shutting off the pump. It was noted during the recovery period that water levels in PW1 and OW1 fluctuated due to tidal effects. Fluctuations were more pronounced in PW1 and water levels fluctuated between 0.09 m and 0.45 m due to tidal effects. Refer to Figures 5 and 6 for recovery data. From Figure 5, it appears that residual drawdown reaches '0' near t/t'=2, indicating complete recovery, although interpretation is made difficult due to fluctuations in residual drawdowns, which are attributed to tidal effects.

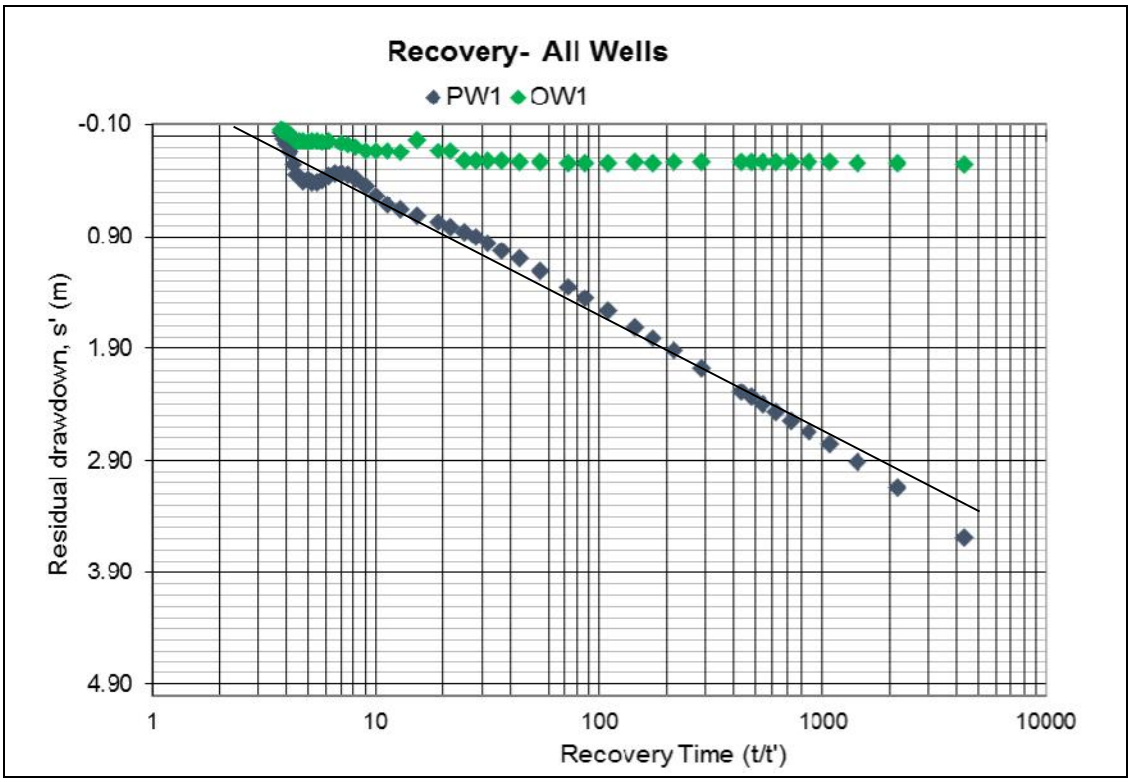


Figure 5: Residual Drawdown Recovery Data – All Wells

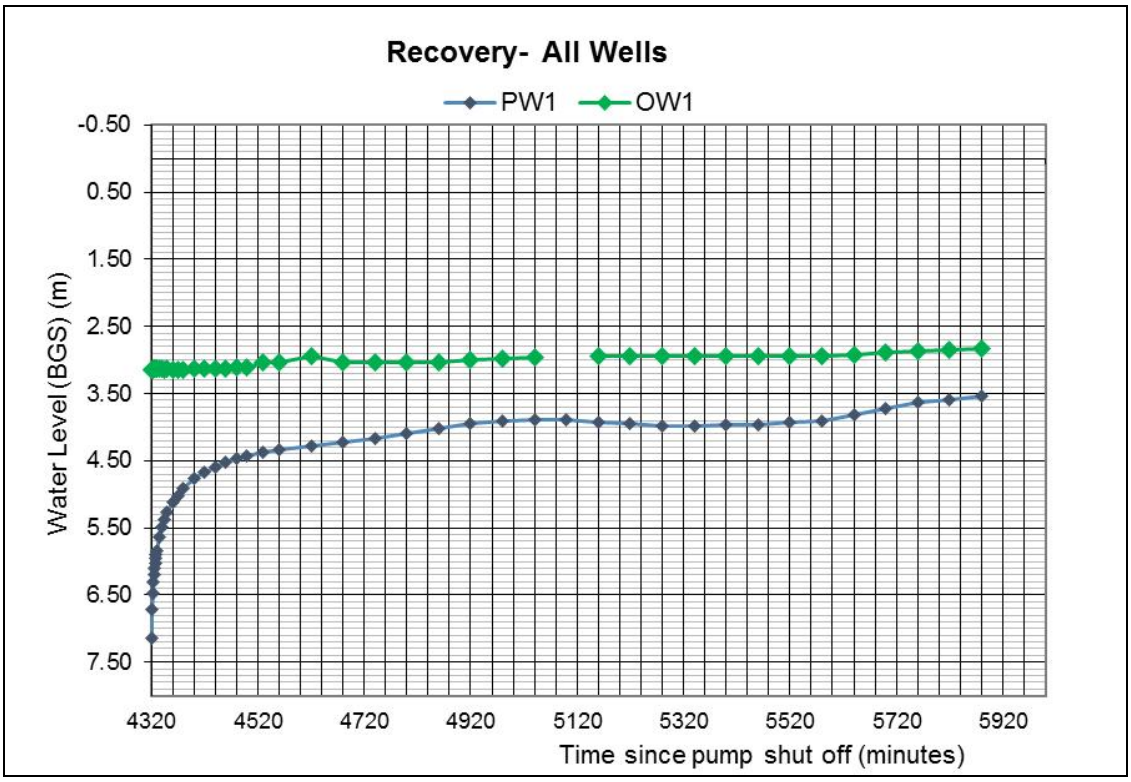


Figure 6: Water Level Recovery Data – All Wells

4.2.1 Pumping Test Analysis

After completion of the 72-hour pumping test, transmissivity was calculated from the drawdown and recovery data from pumping well PW1 using the Cooper-Jacob straight line method. The log time versus drawdown plots are shown in Appendix D. The calculated transmissivities for PW1 are shown in Table 3.

Table 3: Transmissivity Values

Well No.	Drawdown		Recovery	
	Transmissivity (minimum) m^2/day	Transmissivity (maximum) m^2/day	Transmissivity (minimum) m^2/day	Transmissivity (maximum) m^2/day
PW1	23.2	30.9	19.96	34.22

Transmissivities calculated based on the recovery data are considered more representative of the aquifer than data collected under pumping conditions. Based on the distance-drawdown plot, the maximum radius of influence extends approximately 230 metres from PW1. Refer to Figures 6 and 7 in Section 5.1 for the distance-drawdown data.

The specific capacity calculated for PW1 during the pumping test was 24.23 m^3/day/m. A storativity value of 0.0014 was calculated using time drawdown data obtained from OW1. According to Driscoll (1986), the coefficient of storage for confined aquifers ranges from 10^{-5} to 10^{-3}, and from 0.01 to 0.3 for unconfined aquifers. The calculated storativity value is reflective of a confined aquifer.

4.2.2 Recommended Sustainable Yield (PW1)

PW1's specific capacity after 100 days of pumping was calculated using the pumping rate of 20 Igpm (131 m^3/day) and extrapolating the drawdown at 100 days from the Time vs. Drawdown graph. The drawdown at 100 days is 5.4 m and the pumping well's specific capacity is 24.23 m^3/d/m. The total available drawdown in the well is calculated using the depth from the static water level (3.56 m bgs) to mean sea level (6.74 m bgs). Based on available site information, the total available drawdown in the well is 3.2 m (to mean sea level). The long-term sustainable yield (Q) is calculated based on the following formula:

Q = Specific Capacity at 100 days x available drawdown in the well
Q = 24.23 m^3/day/m x 3.2 m
Q = 78 m^3/day or 12 Igpm

PW1, operating at a continuous rate of 78 m^3/day (12 Igpm) over a 24-hour period, corresponds to the same water withdrawal as operating at a pumping rate of 20 Igpm for a maximum of 14 hours per day. Based on the pump test, pumping PW1 at a rate of 131 m^3/day (20 Igpm) resulted in a drawdown of 3.78 m after 14 hours of continuous pumping which corresponds to a pumping water level below sea level (refer to Figure 7). However, it should be noted that the casing in PW1 extends below sea level and the drawdown is likely more pronounced due to the casing length. It is likely that the well construction of PW1 has more influence on the pumping water level than does the actual pumping rate. The potential for saltwater intrusion into PW1 is considered unlikely at a pumping rate of 20 Igpm based on the assessment outlined in Section 5.2.

It should be noted that PW1 would be operated on a cycle basis and would not pump continuously throughout the day while the campground is operating. It should also be noted that the campground operates from May to October and water withdrawal would be restricted to this time period. Based on the above, it is recommended that PW1 be pumped at a rate not to exceed 20 Igpm (131 m^3/day) for a maximum of 14 hours per day, which equates to a daily maximum water withdrawal of 76.4 m^3/day.

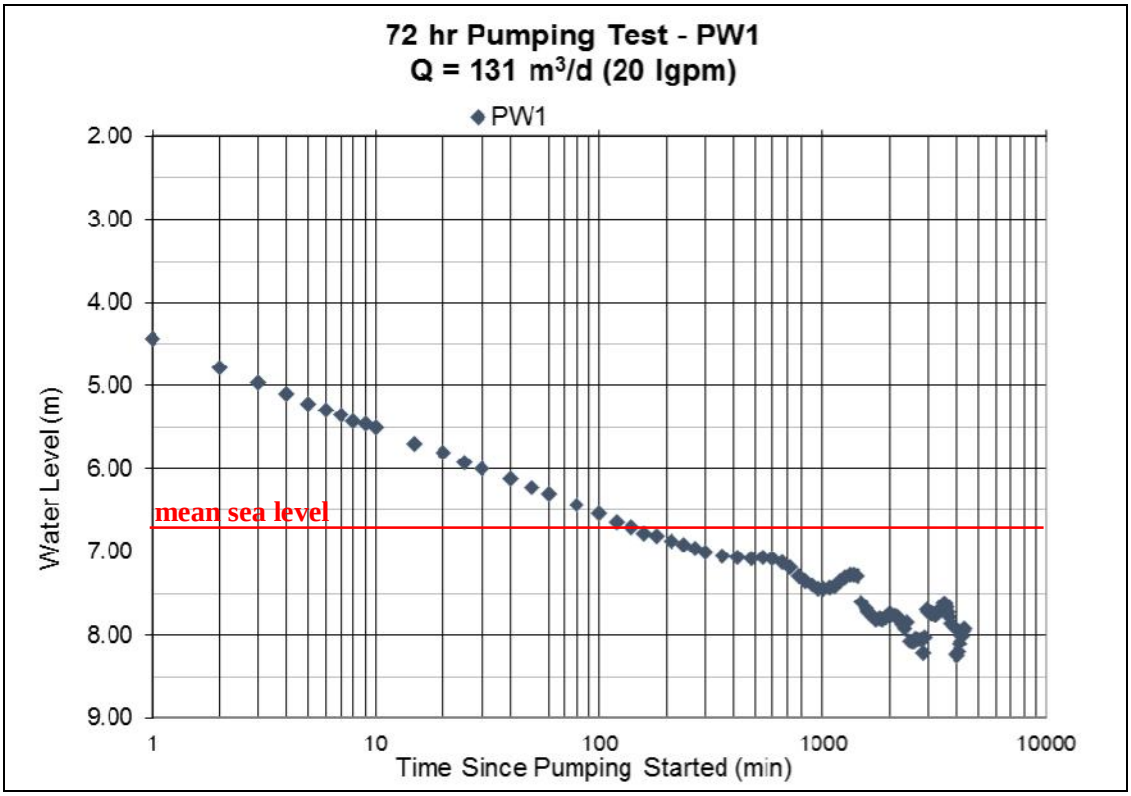


Figure 7: PW1 Water Level vs Time

4.2.5 Groundwater Quality

Groundwater samples were collected from the pumping well (PW1) towards the beginning (24 hours), middle (48 hours) and near the end (69 hours) of the pump test. All samples were submitted to AGAT Laboratories in Dartmouth, Nova Scotia, for general chemistry, trace metals and microbiological analyses. Laboratory certificates are enclosed in Appendix E.

General chemistry and trace metals results for the samples collected at the beginning and end of the pump test are all within the *Canadian Drinking Water Quality Guidelines* (CDWQ) and *New Brunswick Drinking Water Guidelines* (NB) potable guideline values with the exception of turbidity and manganese. The turbidity value of 1.3 NTU (48 hours) slightly exceeds the CDWQ guideline range of 0.1 to 1.0 NTU and the NB guideline of 1.0 NTU. It should be noted that turbidity values in PW1 were below guidelines at 24 hours and 69 hours into the pump test. The levels of turbidity in the well may be related to sediment dislodged during removal of the pump and installation of the driller's pump for completion of the pump test. Furthermore, an iron build-up was noted on the casing and discoloured the water level tape used to collect manual readings throughout the test. The friction of the tape against the casing may also have contributed to

sediments in the well water. The reported turbidity levels are not considered a concern for human health and turbidity levels should decrease over time with continued well use.

Manganese in PW1 exceeded the CDWQ guideline of less than or equal to 50 µg/L towards the beginning of the test (24 hours) and decreased to below the CDWQ guideline for the remainder of the pump test (48 hours and 69 hours). It is likely that elevated manganese was associated with sediment content present in the well at the start of the test. With further pumping, manganese concentrations decreased to within the acceptable guideline.

Microbiological results for the samples collected towards the beginning, middle and end of the pump test indicate no counts for total coliforms or *E.coli*. All results meet the CDWQ and NB guideline values of 0 MPN/100 ml for both total coliforms and *E.coli*. Following completion of the pumping test, the water quality in the pumping well meets potable guidelines. Water quality results for PW1 are shown in Table 4.

Table 4: PW1 Groundwater Quality

Parameter	Units	CDWQ	NB	24 h	48 h	69 h
General Chemistry						
Ammonia (as N)	mg/L			0.03	0.05	<0.03
pH	units	7.0-10.5		8.01	7.96	8.09
Alkalinity (as CaCO3)	mg/L			117	118	118
Chloride	mg/L	≤ 250	250	24	24	25
Colour	TCU	15		6	5	14
Fluoride	mg/L		1.5	<0.12	<0.12	<0.12
Sulfate	mg/L	≤ 500	500	7	7	7
Nitrate (as N)	mg/L	45	45	1.88	2.03	1.91
Nitrite (as N)	mg/L	3		<0.05	<0.05	<0.05
o-Phosphate (as P)	mg/L			<0.01	<0.01	<0.01
Phosphorus	mg/L			<0.02	<0.02	<0.02
r-Silica (as SiO2)	mg/L			10.8	9.0	11.7
Total Organic Carbon	mg/L			<0.5	<0.5	<0.5
Turbidity	NTU	0.1-1.0	1.0	0.5	**1.3**	0.8
Conductivity	µS/cm			332	322	332
Total Dissolved Solids	mg/L	≤ 500		177	174	178
Trace Metals						
Aluminum	µg/L	<100		<5	11	<5
Antimony	µg/L	6	6	<2	<2	<2
Arsenic	µg/L	10	10	<2	<2	<2
Barium	µg/L	1000	1000	431	421	413
Beryllium	µg/L			<2	<2	<2
Bismuth	µg/L			<2	<2	<2
Boron	µg/L	5000	5000	34	32	28
Cadmium	µg/L	5	5	<0.017	<0.017	<0.017
Calcium	µg/L			44700	42800	43700
Chromium	µg/L	50	50	3	3	<1
Cobalt	µg/L			<1	<1	<1
Copper	µg/L	≤ 1000	1000	<2	<2	<2
Iron	µg/L	≤ 300	300	<50	<50	<50
Lead	µg/L	10	10	<0.5	<0.5	<0.5
Magnesium	µg/L			3900	3600	4100
Manganese	µg/L	≤ 50		**72**	22	21
Molybdenum	µg/L			<2	<2	<2
Nickel	µg/L			<2	<2	<2
Potassium	µg/L			1600	1500	1700
Selenium	µg/L	50	10	<1	<1	<1
Silver	µg/L			<0.1	<0.1	<0.1
Sodium	µg/L	≤ 200,000	200,000	17300	15600	17700
Strontium	µg/L			633	583	521
Thallium	µg/L			<0.1	<0.1	<0.1
Tin	µg/L			<2	<2	<2
Titanium	µg/L			<2	<2	<2
Uranium	µg/L	20	20	2.3	2.2	2.1
Vanadium	µg/L			4	4	4
Zinc	µg/L	≤5000		8	9	<5
Microbiology						
Total Coliforms	MPN/100 mL	Absent	Absent	Absent	<1	<1
E. Coli	MPN/100 mL	Absent	Absent	Absent	<1	<1

"Bold" exceeds applicable guideline criteria

5.0 DISCUSSION

5.1 Neighbouring Water Users

Based on the results of the hydraulic testing, the radius of influence for PW1 extends approximately 230 metres when the production well is operating at a rate of 131 m^3/day (20 Igpm) (refer to Figure 8). OW1 is located at a distance of 216 m from PW1. Approximately 0.29 m of drawdown was observed in OW1 during the pumping test. The closest neighbouring residential well (PID 70063144) is located approximately 130 metres east of PW1 and eight (8) private wells are located on neighbouring properties within 230 metres of PW1. Based on the Distance-Drawdown plot (see Figure 8), 2 m of drawdown is estimated at a distance of 130 metres from the pumping well. Note that the drawdown also includes interferences from tidal effects. Throughout the pumping test and recovery period, no residents in the area contacted the proponent or Roy Consultants' personnel with complaints regarding water quality or quantity. Surrounding land use within 500 m of the campground is residential (primarily seasonal cottages). No potentially adverse impacts on the groundwater supply are anticipated due to current or historical land uses.

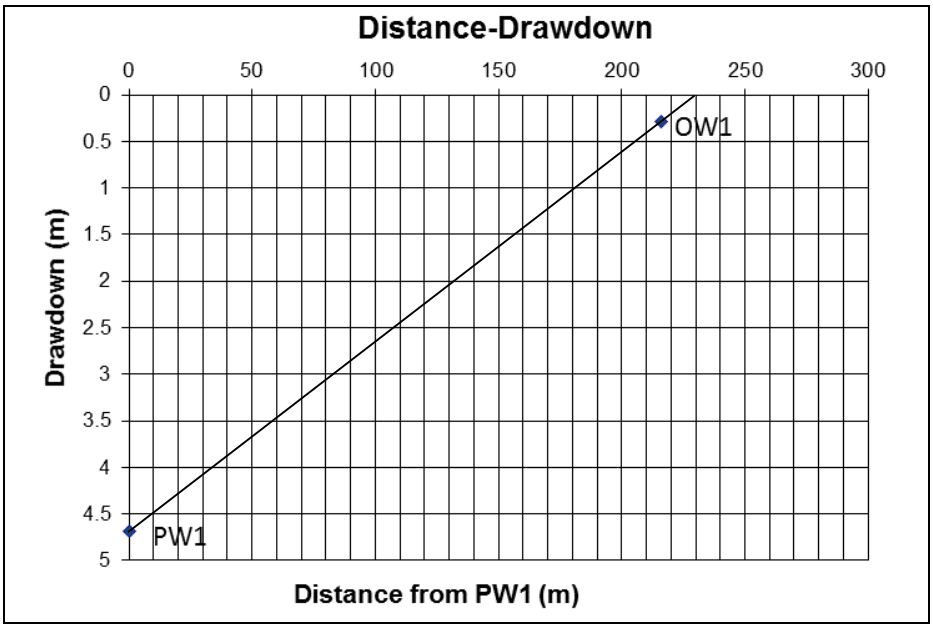


Figure 8: Distance-drawdown Data from the 72-hour Constant Rate Pump Test

At the recommended pumping rate of 20 Igpm for a maximum of 14 hours per day, the maximum drawdown at PW1 is approximately 3.78 m based on the pump test data. Operating at 20 Igpm for a continuous 14-hour period will slightly reduce the radius of influence to 220 metres (refer to Figure 9). The corresponding drawdown in the nearest neighbouring well (130 m away) is approximately 2 m. However, upon further review of the pump test data, water level drawdown (0.10 metre) in OW1 did not occur until after 10 hours of continuous pumping at 20 Igpm. It should be noted that PW1 would be operated on a cycle basis and would not pump continuously throughout the day while the campground is operating. As a result, the radius of influence is expected to be less than 220 metres and the corresponding drawdown of 2 metres in the nearest neighbouring well is also expected to be less. The operation of the production well is expected to have minimal interference with neighbouring water users. Based on the above, it is

recommended that PW1 be pumped at a rate not to exceed 20 Igpm (131 m^3/day) for a maximum of 14 hours per day.

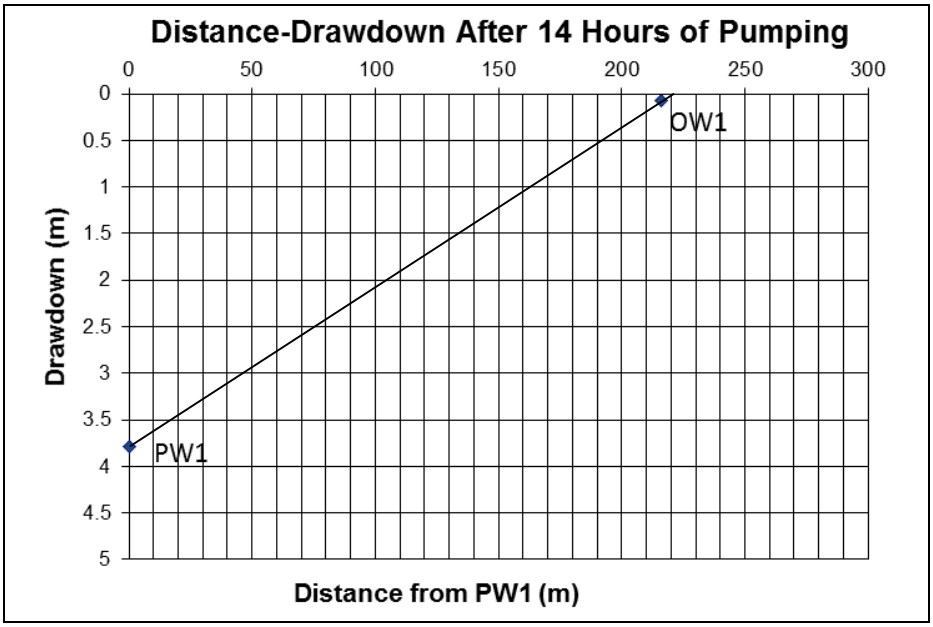


Figure 9: Distance-drawdown Data after 14 Hours of Continuous Pumping at 20 Igpm

5.2 Potential for Saltwater Intrusion

The production well is located approximately 75 metres from the Northumberland Strait. A review of water quality data during the pump test was completed to assess any observable trends in certain parameters that may indicate saltwater intrusion. According to Drever (1988), the parameters listed in Table 5 are some of the major elements that comprise sea water. Parameters listed in Table 5 are listed in order from most concentrated to least concentrated in seawater. For example, chloride is the parameter with the highest concentration in seawater and strontium has a lower concentration. Concentrations for major solutes (chloride and sodium) remained relatively constant throughout the pump test. The water quality observed during the pumping test does not suggest that saltwater intrusion into the aquifer is occurring. It should be also be noted that PW1 has been supplying the campground since 2012 with no reported water quality issues.

Table 5: PW1 Water Quality Results – Parameters Associated with Saltwater

Parameter	PW1 (24 h)	PW1 (48 h)	PW1 (69 h)
Chloride (mg/L)	24	24	25
Sodium (mg/L)	17.3	15.6	17.7
Sulfate (mg/L)	7	7	7
Magnesium (mg/L)	3.9	3.6	4.1
Calcium (mg/L)	44.7	42.8	43.7
Potassium (mg/L)	1.6	1.5	1.7
Bicarbonate (mg/L)	117	118	118
Strontium (µg/L)	633	583	521
Boron (µg/L)	34	32	28
r-Silica (mg/L)	10.8	9.0	11.7

As pumping well PW1 is located within 500 m of a saltwater source (Northumberland Strait), an evaluation of the potential for saltwater intrusion was undertaken. A review of available literature was completed. Rivard et al. (2008) completed a regional hydrogeological characterization of the south-central part of the Maritimes Basin which included a geophysical survey along Cap Brûlé Road near Shediac, NB, which is located approximately 40 km west of the campground. This area is underlain by the same geological formation (Richibucto Formation) as the campground. The survey did not detect any zones of very low resistivity, suggesting that saline water does not occur within 40 m of the surface. From the 72-hour pump test, it was determined that PW1 is situated in a confined aquifer and the maximum drawdown observed during the pump test was 4.69 m. If we use 40 m as the distance from surface to the top of the fresh water/salt water interface (to be conservative), operating the well at 20 Igpm will result in a maximum drawdown of 4.69 m, correlating to a distance of 31.75 m above the fresh water/salt water interface. Therefore, operating the well at a pumping rate of 20 Igpm will not result in a drawdown that will induce saltwater intrusion.

5.3 Groundwater under the Direct Influence off Surface Water (GUDI)

An evaluation was completed for the potential influence of surface water on the groundwater source. Groundwater is considered under the direct influence of surface water if there is:

- a direct hydraulic connection to the surface or surface water by way of local geology or well construction; and/or
- Significant and relative rapid shifts in water characteristics such as temperature, turbidity, conductivity and pH which closely correlate with climatological events; and/or
- Significant occurrence of micro-organisms.

The closest surface water body to the production well is the Northumberland Strait located approximately 75 m north of the well. The nearest freshwater surface water bodies are watercourses: Trout Brook (1.05 km west of the campground) and Scott Brook (1.2 km east). The area surrounding the well head consists of developed RV lots with gravel pads and grass cover and gravel access roads. No standing water is present near the well house. The construction of PW1 includes 10.97 m (36 feet) of steel casing and the well is drilled to a depth of 32 m. The local geology consists of interbedded layers of shale and sandstone bedrock. The well draws its water from a confined sandstone bedrock aquifer with major water-bearing fractures noted at depths of 18.3 m (15 Igpm), 24.38 m (10 Igpm) and 27.7 m (10 Igpm).

According to Environment Canada's daily climate data from the Moncton International Airport, there were 38.4 mm of precipitation during the 14 days preceding the pump test. An estimated 46.6 mm of precipitation were noted during the pump test from November 19 to 22, 2017. An estimated 5.8 mm of precipitation were noted during the recovery period on November 23, 2017. Water level data in PW1 and OW1 do not show a spike in water levels associated with the rainfall events. Water level fluctuations are attributed to tidal effects. Considering both wells have over 10 m (30 feet) of casing each, any surface recharge to the wells during the pump test is considered minimal. Further, temperature readings measured throughout the test by the dataloggers do not show any fluctuations. Refer to Appendix F for the Environment Canada Daily Data Report for November 2017 and Appendix D for temperature readings.

A review of raw groundwater quality data collected from PW1 at 24 hours, 48 hours and 69 hours into the pump test does not indicate any significant changes in turbidity, conductivity and pH. Reported levels for all parameters were consistent for all three sampling events. Refer to Section 4.2.5 for further discussion. No detection of microbiological parameters (total coliforms and E. coli) was reported for all three sampling events. Further, water quality sampling was previously

completed in May 2017 for PW1 and no detection of total coliforms or E. coli were reported. Refer to Appendix E for laboratory certificates.

PW1 is a deep well drawing groundwater from a confined aquifer. The well is located more than 60 m from the nearest freshwater surface water body. The well casing extends more than 6 m and has an appropriate sized drive shoe. Water quality data collected throughout the duration of the pump test indicates no detection of total coliforms or E. coli bacteria and other indicator parameters (pH, turbidity, conductivity and temperature) do not show any obvious signs of surface water influence. Based on the above, groundwater supplying PW1 is not considered under the influence of surface water.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Roy Consultants supervised the 72-hour constant rate test for PW1 completed in November 2017. The objective of the pump test was to determine the maximum sustainable yield of the water supply for the Strang's Shore Campground. To accommodate the existing and future lots (a total of 150 lots), the estimated water demand is approximately 10 Igpm (68 m^3/day).

PW1 was pumped at a rate of 20 Igpm (131 m^3/day) and a maximum observed drawdown of 4.69 m was noted. The calculated transmissivities of the aquifer from the recovery portion of the pump test range from 19.96 m^2/d to 34.22 m^2/d. Following the end of the pumping test, water levels in PW1 recovered 100 % within 26 hours after the pump was shut off.

Groundwater results for general chemistry, trace metals and microbiological analyses from the pumping well indicate turbidity and manganese exceedances of CDWQ and NB Drinking Water guidelines. The turbidity level was slightly above the CDWQ and NB guidelines in the middle of the test, but was below guidelines towards the beginning and end of the pump test. Turbidity levels typically decrease over time with continued well use. The manganese concentration exceeded the CDWQ guideline towards the beginning of the test, but decreased to below the guideline for the remainder of the test. Both parameters are attributed to sediment content in the well and should decrease over time with continued well use. Based on the water quality results observed throughout the pump test, there is no indication that saltwater intrusion is occurring.

Based on the results of the pump test, a pumping rate of 20 Igpm (131 m^3/day) operating for a maximum of 14 hours per day is recommended for PW1. Pumping at 20 Igpm for 14 hours per day equates to a maximum daily withdrawal of 76.4 m^3/day which meets the future estimated water demand of 68 m^3/day. It is also recommended that a flow meter be installed and water usage recorded over an operating season (May to October) to determine actual water consumption. Water quality samples should also be collected on a monthly basis (at a minimum) and analyzed for conductivity to monitor for possible saltwater intrusion.

7.0 CLOSURE

This report was prepared by Roy Consultants for the exclusive use of Strang's Shore Seasonal Camping Inc. The data contained herein may not be used by any other person or entity without the express written consent of Roy Consultants and Strang's Shore Seasonal Camping Inc. While this report provides an overview of environmental conditions, the assessment is limited by the availability of information at the time of the study. Field work was carried out by Mr. Abram Lee, EIT, and Ms. Gina Burtt, P.Eng., P.Geo. Reporting was carried out by Ms. Gina Burtt, P.Eng., P.Geo.

8.0 REFERENCES

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APPENDICES

APPENDIX A: Figures
APPENDIX B: SNB Documentation
APPENDIX C: Well Driller's Reports
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APPENDIX F: Environment Canada Daily Data Report and Tide Tables
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APPENDIX A

Figures

WELL COORDINATES			
WELL	NORTHING	EASTING	GROUND ELEVATION
PW1	7467524.674	2695018.638	6.74m
OW1	7467310.055	2694998.413	7.70m

No.	date	revisions	by/par

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project/projet: STRANG'S SHORE SEASONAL CAMPING INC.

title/titre: FIGURE 1
SITE LOCATION PLAN

design by/design par	check by/verifie par

scale/echelle	date	drawn by/dessine par	No.:	rev.
AS SHOWN	DEC. 17	A.LEE	278–17–00	A

APPENDIX B

SNB Documentation

Parcel Information

PID:	837088	**County:**	Westmorland
Status:	Active	**Active Date/Time:**	1970-01-01 01:01:01
Land Related Description:	Land	**Management Unit:**	NB1423
Area:	3.43	**Area Unit:**	Hectares
Date Last Updated:	2016-08-24 11:16:44	**Harmonization Status:**	Harmonized
Land Titles Status:	Land Titles	**Land Titles Date/Time:**	2004-05-21 13:10:30
Date of Last CRO:	2014-12-19 15:44:41	**Manner of Tenure:**	Not Applicable
Land Gazette Information:	NO		
Description of Tenure:			

Public Comments:

MAP/CARTE 11L04X1

Parcel Interest Holders

Owner	Qualifier	Interest Type
Strang's Shore Seasonal Camping Inc.		Owner

Assessment Reference

PAN	PAN Type	Taxing Authority Code	Taxing Authority
6509191		640	L.S.D. of/D.S.L. de Murray Corner

Parcel Locations

Civic Number	Street Name	Street Type	Street Direction	Place Name
1641	955	Highway		Little Shemogue

County Parish

County	Parish
Westmorland	Botsford

Documents

Number	Registration Date	Book	Page	Code	Description
34494873	2014-12-19			1100	Deed/Transfer
28639269	2010-04-28			6110	Discharge of Mortgage
28133925	2009-12-08			1100	Deed/Transfer
18738790	2004-07-16			5100	Mortgage
18380478	2004-05-21			3800	Land Titles First Notice
18380460	2004-05-21			3720	Land Titles First Order

Documents (cont.)

Number	Registration Date	Book	Page	Code	Description
18378068	2004-05-21			3900	Land Titles First Application
615127	1995-12-01	2409	523	101	Deed
433742	1983-01-01	891	406	101	Deed
414253	1981-01-01	792	34	101	Deed
170020	1946-01-01	X13	334	105	Will

Plans

Number	Suffix	Registation Date	Code	Description	Lot Information	Orientation
28082114		2009-11-26	9050	Subdivision & Amalgamations	Lot	Provincial Grid
14086		1983-05-20	9040	Retracement & Plan or Return of Survey	Parcel A	Provincial Grid

Parcel Relations

Related PID	Type Of Relation	Lot Information
963215	Infant	Parcel B
70188826	Infant	Lot 87-1
70517206	Infant	Lot 09-1

Non-Registered Instruments

No Records Returned

PAN Information

PAN:	6509191	**Status:**	Open
Assessed Owner(s):	STRANG'S SHORE SEASONAL CAMPING INC.	**Mailing Address:**	89 MOORE RD EXT OTTERCREEK NB
Assessment Year:	2017	**Postal Code:**	E4M 3V5
Current Assessment:	$ 611,300	**Current Levy:**	$ 10,619.76
Location:	1639 RTE 955	**County:**	Westmorland
Property Description:	RV PARK & CAMPGROUND	**Tax Class:**	Fully Taxable
Property Type Code:	532	**Property Type Name:**	
Taxing Authority Code:	640	**Neighbourhood Code:**	01
Taxing Authority Description:	L.S.D. of/D.S.L. de Murray Corner	**Neighbourhood Description:**	MURRAY CORNER LSD
Sequence Number:	A105C	**Sub Unit:**	0
Harmonization:	COMPLETED (PAN consists of Assessment amalgamated parcels except those for building stradding parcels)	**Farm Land Identifiation Program:**	No
PID:	70563457	**PID (2nd):**	837088
More PID(s):	No		

Sale Price Information

No Records Returned

Map Scale / Échelle cartographique 1 : 4239

While this map may not be free from error or omission, care has been taken to ensure the best possible quality. This map is a graphical representation of property boundaries which approximates the size, configuration and location of properties. It is not a survey and is not intended to be used for legal descriptions or to calculate exact dimensions or area.

Même si cette carte n'est peut-être pas libre de toute erreur ou omission, toutes les précautions ont été prises pour en assurer la meilleure qualité possible. Cette carte est une représentation graphique approximative des terrains (limites, dimensions, configuration et emplacement). Elle n'a aucun caractère officiel et ne doit donc pas servir à la rédaction de la description officielle d'un terrain ni au calcul de ses dimensions exactes ou de sa superficie.

Parcel Information

PID:	70188826	**County:**	Westmorland
Status:	Active	**Active Date/Time:**	1987-08-25 00:00:00
Land Related Description:	Land	**Management Unit:**	NB1423
Area:	1.13	**Area Unit:**	Hectares
Date Last Updated:	2016-05-31 13:28:27	**Harmonization Status:**	Harmonized
Land Titles Status:	Land Titles	**Land Titles Date/Time:**	2003-06-16 16:39:36
Date of Last CRO:	2016-05-31 13:28:34	**Manner of Tenure:**	Not Applicable
Land Gazette Information:	NO		

Description of Tenure:

Public Comments:

MAP/CARTE 11L04X1

Parcel Interest Holders

Owner	Qualifier	Interest Type
STRANG'S SHORE SEASONAL CAMPING INC.		Owner

Assessment Reference

PAN	PAN Type	Taxing Authority Code	Taxing Authority
3876426		640	L.S.D. of/D.S.L. de Murray Corner

Parcel Locations

Civic Number	Street Name	Street Type	Street Direction	Place Name
1645	955	Highway		Murray Corner

County Parish

County	Parish
Westmorland	Botsford

Documents

Number	Registration Date	Book	Page	Code	Description
35975771	2016-05-31			1100	Deed/Transfer
31683940	2012-07-09			1100	Deed/Transfer
16451982	2003-06-18			1100	Deed/Transfer
16443179	2003-06-16			3800	Land Titles First Notice
16443161	2003-06-16			3720	Land Titles First Order
16442379	2003-06-16			3900	Land Titles First Application

Documents (cont.)

Number	Registration Date	Book	Page	Code	Description
494041	1987-08-08	1279	3	101	Deed

Plans

Number	Suffix	Registation Date	Code	Description	Lot Information	Orientation
16171		1987-08-12	9050	Subdivision & Amalgamations	Lot 87-1	Provincial Grid

Parcel Relations

Related PID	Type Of Relation	Lot Information
837088	Parent	Parcel A

Non-Registered Instruments

No Records Returned

PAN Information

PAN:	3876426	**Status:**	Open
Assessed Owner(s):	Strang's Shore Seasonal Camping Inc.	**Mailing Address:**	89 MOORE EXT. ROAD OTTERCREEK NB
Assessment Year:	2017	**Postal Code:**	E4M 3V5
Current Assessment:	$ 17,400	**Current Levy:**	$ 301.96
Location:	1645 RTE 955	**County:**	Westmorland
Property Description:	VACANT LOT	**Tax Class:**	Fully Taxable
Property Type Code:	105	**Property Type Name:**	Mobile/Mini Homes and Land
Taxing Authority Code:	640	**Neighbourhood Code:**	01
Taxing Authority Description:	L.S.D. of/D.S.L. de Murray Corner	**Neighbourhood Description:**	MURRAY CORNER LSD
Sequence Number:	A105B	**Sub Unit:**	0
Harmonization:	COMPLETED (One to one match of parcels)	**Farm Land Identifiation Program:**	No
PID:	70188826	**PID (2nd):**	-
More PID(s):	No		

Sale Price Information

Price:	$90,000	**Date:**	2016-05-31
Price:	$1	**Date:**	2012-07-09
Price:	$28,000	**Date:**	2011-05-16

Service New Brunswick

Service Nouveau-Brunswick

Map Scale / Échelle cartographique 1 : 2137

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Parcel Information

PID:	70563457	**County:**	Westmorland
Status:	Active	**Active Date/Time:**	2012-08-27 12:20:51
Land Related Description:	Land	**Management Unit:**	NB1423
Area:	3.27	**Area Unit:**	Hectares
Date Last Updated:	2016-08-24 11:16:18	**Harmonization Status:**	Harmonized
Land Titles Status:	Land Titles	**Land Titles Date/Time:**	2012-09-18 10:34:47
Date of Last CRO:	2015-09-11 09:51:52	**Manner of Tenure:**	Not Applicable
Land Gazette Information:	NO		
Description of Tenure:			

Public Comments:

MAP/CARTE 11L04U3 11L04X1

Parcel Interest Holders

Owner	Qualifier	Interest Type
STRANG'S SHORE SEASONAL CAMPING INC.		Owner

Assessment Reference

PAN	PAN Type	Taxing Authority Code	Taxing Authority
6509191		640	L.S.D. of/D.S.L. de Murray Corner

Parcel Locations

Civic Number	Street Name	Street Type	Street Direction	Place Name
	Stright Beach	Road		Murray Corner

County Parish

County	Parish
Westmorland	Botsford

Documents

Number	Registration Date	Book	Page	Code	Description
35230599	2015-09-10			2200	Easement
35213298	2015-09-03			2200	Easement
31967715	2012-09-20			1100	Deed/Transfer
31956734	2012-09-18			3800	Land Titles First Notice
31956726	2012-09-18			3720	Land Titles First Order
31955876	2012-09-18			3900	Land Titles First Application

Documents (cont.)

Number	Registration Date	Book	Page	Code	Description
22394374	2006-07-10			1900	Deed of a Partial Interest

Plans

Number	Suffix	Registation Date	Code	Description	Lot Information	Orientation
31877427		2012-08-27	9050	Subdivision & Amalgamations	Lot 12-2	Provincial Grid

Parcel Relations

Related PID	Type Of Relation	Lot Information
70061395	Parent	Lot

Non-Registered Instruments

No Records Returned

PAN Information

PAN:	6509191	**Status:**	Open
Assessed Owner(s):	STRANG'S SHORE SEASONAL CAMPING INC.	**Mailing Address:**	89 MOORE RD EXT OTTERCREEK NB
Assessment Year:	2017	**Postal Code:**	E4M 3V5
Current Assessment:	$ 611,300	**Current Levy:**	$ 10,619.76
Location:	1639 RTE 955	**County:**	Westmorland
Property Description:	RV PARK & CAMPGROUND	**Tax Class:**	Fully Taxable
Property Type Code:	532	**Property Type Name:**	
Taxing Authority Code:	640	**Neighbourhood Code:**	01
Taxing Authority Description:	L.S.D. of/D.S.L. de Murray Corner	**Neighbourhood Description:**	MURRAY CORNER LSD
Sequence Number:	A105C	**Sub Unit:**	0
Harmonization:	COMPLETED (PAN consists of Assessment amalgamated parcels except those for building stradding parcels)	**Farm Land Identifiation Program:**	No
PID:	70563457	**PID (2nd):**	837088
More PID(s):	No		

Sale Price Information

No Records Returned

Map Scale / Échelle cartographique 1 : 3664

While this map may not be free from error or omission, care has been taken to ensure the best possible quality. This map is a graphical representation of property boundaries which approximates the size, configuration and location of properties. It is not a survey and is not intended to be used for legal descriptions or to calculate exact dimensions or area.

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APPENDIX C

Well Driller's Reports

New Nouveau Brunswick

Environment

Report Number **6807**

Well Driller's Report

Date printed **6/8/2017**

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	**New Well**	**Rotary**	**07/08/2003**

Casing Information — Casing above ground **2ft** — Drive Shoe Used? **Yes**

Well Log	Casing Type	Diameter	From	End	Slotted?
6807	**Steel**	**6 inch**	**0ft**	**80ft**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	**0ft**	**3 igpm**	**1hr**	**105ft**	**3 igpm**	**No**	**0 igpm**

(BTC - Below top of casing)

Well Grouting

There is no Grout information.

Drilling Fluids Used
None

Disinfectant
N/A

Qty **0 ig**

Pump Installed
N/A

Intake Setting (BTC)
0ft

Driller's Log

Well Log	From	End	Colour	Rock Type
6807	**0ft**	**2ft**	**Unknown Rock Colour**	**Overburden**
6807	**2ft**	**15ft**	**Brown**	**Clay and Shale**
6807	**15ft**	**18ft**	**Grey**	**Sandstone**
6807	**18ft**	**21ft**	**Brown**	**Clay and Shale**
6807	**21ft**	**30ft**	**Grey**	**Sandstone**
6807	**30ft**	**42ft**	**Brown**	**Clay and Shale**
6807	**42ft**	**45ft**	**Grey**	**Sandstone**
6807	**45ft**	**56ft**	**Brown**	**Clay and Shale**
6807	**56ft**	**67ft**	**Grey**	**Sandstone**
6807	**67ft**	**76ft**	**Brown**	**Clay and Shale**
6807	**76ft**	**110ft**	**Grey**	**Sandstone**
6807	**110ft**	**177ft**	**Brown**	**Clay and Shale**
6807	**177ft**	**183ft**	**Brown**	**Sandstone**
6807	**183ft**	**199ft**	**Brown**	**Clay and Shale**
6807	**199ft**	**206ft**	**Brown**	**Sandstone**
6807	**206ft**	**214ft**	**Unknown Rock Colour**	**Soapstone**
6807	**214ft**	**241ft**	**Brown**	**Clay and Shale**

Overall Well Depth
241ft

Bedrock Level
76ft

Water Bearing Fracture Zone

Well Log	Depth	Rate
6807	**88ft**	**3 igpm**

Setbacks

There is no Setback information.

New Nouveau Brunswick

Environment

Report Number **15242**

Well Driller's Report

Date printed **6/8/2017**

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	**New Well**	**Rotary**	**02/13/2007**

Casing Information

Casing above ground **2ft** — Drive Shoe Used? **Yes**

Well Log	Casing Type	Diameter	From	End	Slotted?
15242	Steel	6 inch	0ft	29ft	
15242	PVC	5 1/2 Inch	29ft	70ft	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	**19ft**	**10 igpm**	**0hr**	**19ft**	**10 igpm**	**No**	**0 igpm**

(BTC - Below top of casing)

Well Grouting

There is no Grout information.

Drilling Fluids Used
None

Disinfectant
Chlorine Pucks

Qty **0 ig**

Pump Installed
N/A

Intake Setting (BTC)
0ft

Driller's Log

Well Log	From	End	Colour	Rock Type
15242	0ft	9ft	Brown	Overburden
15242	9ft	25ft	Brown	Clay
15242	25ft	35ft	Grey	Sandstone
15242	35ft	40ft	Brown	Clay and Shale
15242	40ft	83ft	Grey	Sandstone
15242	83ft	85ft	Brown	Clay and Shale

Overall Well Depth
85ft

Bedrock Level
25ft

Water Bearing Fracture Zone

Well Log	Depth	Rate
15242	32ft	5 igpm
15242	54ft	5 igpm

Setbacks

Well Log	Distance	Setback From
15242	85ft	Septic Tank
15242	90ft	Leach Field
15242	200ft	Right of any Public Way Road

New Nouveau Brunswick

Environment

Report Number **24773**

PW1 (Campground Production Well)

Well Driller's Report

Date printed **6/8/2017**

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	**New Well**	**Cable Tool**	**08/02/2010**

Casing Information

Casing above ground **2ft 10in** Drive Shoe Used? **Yes**

Well Log	Casing Type	Diameter	From	End	Slotted?
24773	**Steel**	**6 inch**	**0ft**	**36ft**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Bailer	**16ft**	**20 igpm**	**1hr**	**20ft**	**20 igpm**	**No**	**0 igpm**
	(BTC - Below top of casing)						

Well Grouting

There is no Grout information.

Drilling Fluids Used
None

Disinfectant
Chlorine Pucks

Qty **0 ig**

Pump Installed
Submersible
Intake Setting (BTC)
0ft

Driller's Log

Well Log	From	End	Colour	Rock Type
24773	**0ft**	**10ft**	**Brown**	**Clay and Sand**
24773	**10ft**	**21ft**	**Red**	**Clay and Sand**
24773	**21ft**	**30ft**	**Brown**	**Sand**
24773	**30ft**	**41ft**	**Red**	**Soft Shale**
24773	**41ft**	**53ft**	**Grey**	**Sandstone**
24773	**53ft**	**80ft**	**Red**	**Shale**
24773	**80ft**	**105ft**	**Dark brown**	**Sandstone**

Overall Well Depth
105ft

Bedrock Level
21ft

Water Bearing Fracture Zone

Well Log	Depth	Rate
24773	**60ft**	**15 lgpm**
24773	**80ft**	**10 igpm**
24773	**91ft**	**10 igpm**

Setbacks

Well Log	Distance	Setback From
24773	**600ft**	**Right of any Public Way Road**

New Nouveau Brunswick

Environment

Report Number **27209**

Well Driller's Report

Date printed **6/8/2017**

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	**New Well**	**Rotary**	**09/03/2009**

Casing Information

Casing above ground **1ft 6in** Drive Shoe Used? **Yes**

Well Log	Casing Type	Diameter	From	End	Slotted?
27209	**Steel**	**6 inch**	**0ft**	**30ft**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	**15ft**	**60 igpm**	**1hr**	**15ft**	**5 igpm**	**No**	**0 igpm**
	(BTC - Below top of casing)						

Well Grouting

There is no Grout information.

Drilling Fluids Used
None

Disinfectant
Chlorine Pucks

Qty **0 ig**

Pump Installed
N/A

Intake Setting (BTC)
0ft

Driller's Log

Well Log	From	End	Colour	Rock Type
27209	**0ft**	**3ft**	**Brown**	**Topsoil**
27209	**3ft**	**10ft**	**Brown**	**Fill**
27209	**10ft**	**28ft**	**Red**	**Clay**
27209	**28ft**	**45ft**	**Brown**	**Fine Sandstone**
27209	**45ft**	**70ft**	**Grey**	**Medium Sandstone**
27209	**70ft**	**105ft**	**Brown**	**Fine Sandstone**

Overall Well Depth
105ft

Bedrock Level
0ft

Water Bearing Fracture Zone

Well Log	Depth	Rate
27209	**60ft**	**3 igpm**
27209	**101ft**	**57 Igpm**

Setbacks

Well Log	Distance	Setback From
27209	**65ft**	**Septic Tank**
27209	**90ft**	**Leach Field**
27209	**300ft**	**Right of any Public Way Road**

New Nouveau Brunswick

Environment

Report Number **30194**

OW1 (Observation Well)

Well Driller's Report

Date printed **6/8/2017**

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	**New Well**	**Rotary**	**08/13/2014**

Casing Information

Casing above ground **2ft** — Drive Shoe Used? **Yes**

Well Log	Casing Type	Diameter	From	End	Slotted?
30194	**Steel**	**6 inch**	**0ft**	**40ft**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	**5ft**	**15 igpm**	**1hr**	**30ft**	**15 igpm**	**No**	**0 igpm**
	(BTC - Below top of casing)						

Well Grouting

Well Log	Grout Type	From	End
30194	**Bentonite**	**35ft**	**40ft**

Drilling Fluids Used
None

Disinfectant
Bleach (Javex)

Qty **0 ig**

Pump Installed
N/A

Intake Setting (BTC)
0ft

Driller's Log

Well Log	From	End	Colour	Rock Type
30194	**0ft**	**15ft**	**Brown**	**Till**
30194	**15ft**	**20ft**	**Brown**	**Sandstone**
30194	**20ft**	**51ft**	**Grey**	**Sandstone**
30194	**51ft**	**57ft**	**Brown**	**Shale**
30194	**57ft**	**65ft**	**Brown**	**Sandstone**

Overall Well Depth
65ft

Bedrock Level
0ft

Water Bearing Fracture Zone

Well Log	Depth	Rate
30194	**50ft**	**5 igpm**
30194	**60ft**	**10 igpm**
30194	**62ft**	**1 igpm**

Setbacks

Well Log	Distance	Setback From
30194	**65ft**	**Septic Tank**
30194	**80ft**	**Leach Field**
30194	**200ft**	**Center of road**

New Brunswick Nouveau Brunswick

ENVIRONMENT & LOCAL GOVERNMENT

WATER WELL DRILLER'S REPORT

00036282

OW1

OFFICE USE ONLY
FIELD NO.

HEALTH CODE | LAB NO.
HEALTH OFFICE | EVENT NO.
SAMPLE RECEIVED DATE (YR MO DAY)
SAMPLE RECEIVED BY:

TESTING VOUCHER INFORMATION — **MANDATORY FOR WATER TEST**
SEE BACK FOR DETAILS **PLEASE PRINT**
INFORMATION INCLUDED HEREIN SHOULD BE THE WELL OWNER AT TIME OF SAMPLING

FIRST NAME | LAST NAME
ADDRESS (MAIL RESULTS TO:)
CITY/TOWN/VILLAGE | PROV. | POSTAL CODE
DAYTIME PHONE | FAX NO.
TEL. NO. | SAMPLE COLLECTED YR MO DAY HR MIN AM PM

DO YOU NEED A SAMPLE FOR YOUR MORTGAGE? SEE BACK FOR DETAILS

IF YOU WISH THE RESULTS TO BE RELEASED TO A MORTGAGE INSTITUTION PLEASE INCLUDE THE FOLLOWING CONTACT INFORMATION:

ATTENTION OF:
TEL NO. | FAX NO.
SIGNATURE OF WELL OWNER

WAS THE COST OF THIS WELL FINANCED BY NB HOUSING?
YES ☐ NO ☑

WELL / WATER USE:

INDUSTRIAL ☐	ABANDONED ☐	DOMESTIC ☐
EXPLORATORY ☐	MUNICIPAL ☐	MONITORING ☑
HEAT PUMP ☐	OBSERVATION ☐	OTHER ☐

TYPE OF WORK COMPLETED: NEW WELL ☐ DEEPENED ☑
OTHER: _____

METHOD:
CABLE TOOL ☐ ROTARY ☑ OTHER _____

CASING INSTALLED:
LENGTH OF CASING ABOVE GROUND: 2 FT. 0 IN.
STEEL: 6 IN DIAM. FROM 0 FT. TO 50 FT.
PVC: _____ IN DIAM. FROM _____ FT. TO _____ FT.
SLOTTED _____ IN DIAM. FROM _____ FT. TO _____ FT.

SCREENS: TYPE: _____ SLOT SIZE _____
_____ IN DIAM. FROM _____ FT. TO _____ FT.
DRIVE SHOE: YES ☑ NO ☐

SETBACKS: SEE BACK FOR DETAILS
SEPTIC TANK (1) None FT.
SEPTIC TANK (2) _____ FT. FIELD (2) _____ FT. FIELD (1) _____ FT.
*RIGHT OF WAY OF ANY PUBLIC ROAD ☐ (1) _____ ROAD (2) _____
CENTER OF ROAD ☑ (1) 300 (2) _____
SETBACKS MEASURED _____ (NEW CONSTRUCTION)
APPROXIMATE SETBACKS AS INDICATED BY HOMEOWNER _____ (EXISTING CONST.)

FLOWING WELL? YES ☐ NO ☑ IF YES - RATE: _____ igpm (approx.)

AQUIFER TEST: METHOD: AIR ☑ BAILER ☐ PUMP ☐
INITIAL WATER LEVEL: 12 FT BELOW TOP OF CASING
PUMPING RATE 30 igpm DURATION: 1 hrs. 0 min.
FINAL WATER LEVEL: 40 FT. BELOW TOP OF CASING
ESTIMATED SAFE YIELD: 35 igpm

WELL GROUTED? YES ☐ NO ☐
FROM _____ FT. TO _____ FT. GROUT TYPE: _____
DRILLING FLUIDS USED: YES ☐ NO ☐
TYPE: _____

P.I.D. NO. 70188826 **WELL I.D. NO.** 6056066

WELL OWNER INFORMATION
INFORMATION INCLUDED HEREIN SHOULD BE THE WELL OWNER AT TIME OF DRILLING
FIRST NAME | LAST NAME: Strang's Shore Camping Inc
ADDRESS: 1645 Highway 955
CITY/TOWN/VILLAGE | PROVINCE | POSTAL CODE

WELL LOCATION: SAME AS ABOVE ..... OR
CIVIC NUMBER | STREET NAME
CITY/TOWN/VILLAGE | WELL PAID FOR BY PROVINCIAL DEPT. OF _____
WELL ON RESERVE? YES ☐ NO ☑ | WELL ALREADY TAGGED? YES ☐ NO ☑ | OLD WELL I.D.

DRILLER'S LOG *

FROM (FT.)	TO (FT.)	COLOUR	ROCK TYPE
Ground Level	0		
65	90	Red	Shale
90	105	grey	Sandstone

IF INSUFFICIENT SPACE PLEASE USE ADDITIONAL SHEETS

TOTAL WELL DEPTH: 105 FT. DEPTH TO BEDROCK: 30 FT.
WATER BEARING 1 20 igpm AT 90 FT. 2 — igpm AT — FT.
FRACTURE ZONES: 3 — igpm AT — FT. 4 — igpm AT — FT.

PUMP INSTALLATION: INSTALLED ☐ NOT INSTALLED ☐
PUMP INTAKE SETTING: _____ FT. BELOW TOP OF CASING (Recommended)
PUMP TYPE: SUBMERSIBLE ☐ JET ☐ TURBINE ☐
OTHER _____
WELL DISINFECTED? YES ☐ NO ☐
TYPE _____

DRILLER'S COMMENTS: This well was Deepened From 65 to 105 Hit more water around 90 Fact this was Done to make it into a monitoring Well For Strangs Camp Ground. To see The In put. On North Nakauiji or my wells

DRILLING COMPANY: CHC well drilling.
COMPLETION DATE: 17 (YR. MO. DAY)
LICENSE NO. 217

G.P.S. (OPTIONAL)

I CERTIFY THAT THE WELL HEREIN DESCRIBED HAS BEEN CONSTRUCTED IN ACCORDANCE WITH THE WATER WELL REGULATION UNDER THE NEW BRUNSWICK CLEAN WATER ACT.

Signature of Driller _____ Signature of Helper _____

WHITE - NBELG
BLUE - Homeowner / Voucher
YELLOW - Homeowner
PINK - Drilling Company

KEEP THIS REPORT WITH YOUR IMPORTANT DOCUMENTS

ENVS-C7183-Well Drilling Log V20080813

New Nouveau Brunswick

Environment

Report Number **33345**

Well Driller's Report

Date printed **6/8/2017**

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	**New Well**	**Rotary**	**10/13/2013**

Casing Information

Casing above ground **2ft** — Drive Shoe Used? **Yes**

Well Log	Casing Type	Diameter	From	End	Slotted?
33345	**Steel**	**6 inch**	**0ft**	**31ft**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	**10ft**	**20 igpm**	**1hr 10min**	**40ft**	**25 igpm**	**No**	**0 igpm**
	(BTC - Below top of casing)						

Well Grouting

Well Log	Grout Type	From	End
33345	**Bentonite**	**20ft**	**30ft**

Drilling Fluids Used
None

Disinfectant
Bleach (Javex)

Qty **0 ig**

Pump Installed
N/A

Intake Setting (BTC)
0ft

Driller's Log

Well Log	From	End	Colour	Rock Type
33345	**0ft**	**10ft**	**Red**	**Sand**
33345	**23ft**	**28ft**	**Grey**	**Clay and Sand**
33345	**28ft**	**57ft**	**Red**	**Sandstone**
33345	**57ft**	**76ft**	**Brown**	**Sandstone**
33345	**10ft**	**23ft**	**Brown**	**Clay and Sand**

Overall Well Depth
76ft

Bedrock Level
0ft

Water Bearing Fracture Zone

Well Log	Depth	Rate
33345	**50ft**	**15 lgpm**
33345	**60ft**	**10 igpm**
33345	**62ft**	**10 igpm**
33345	**68ft**	**1 lgpm**

Setbacks

Well Log	Distance	Setback From
33345	**60ft**	**Septic Tank**
33345	**80ft**	**Leach Field**
33345	**100ft**	**Center of road**

New Nouveau Brunswick

Environment

Report Number **90386900**

Well Driller's Report

Date printed **6/8/2017**

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	**New Well (NEW WELL)**	**Rotary (ROTARY)**	**08/31/1995**

Casing Information

Casing above ground **2ft** — Drive Shoe Used? **Yes**

Well Log	Casing Type	Diameter	From	End	Slotted?
90386900	**Steel**	**6 inch**	**0ft**	**42ft**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	**0ft**	**5 igpm**	**1hr**	**20ft**	**5 igpm**	**No**	**0 igpm**

(BTC - Below top of casing)

Well Grouting

There is no Grout information.

Drilling Fluids Used
None

Disinfectant
N/A

Qty **0 ig**

Pump Installed
N/A

Intake Setting (BTC)
0ft

Driller's Log

Well Log	From	End	Colour	Rock Type
90386900	**0ft**	**29ft**	**Brown**	**Sand**
90386900	**29ft**	**31ft**	**Brown**	**Broken Sandstone**
90386900	**31ft**	**82ft**	**Grey**	**Sandstone**
90386900	**82ft**	**84ft**	**Grey**	**Shale**
90386900	**84ft**	**93ft**	**Brown**	**Clay and Shale**
90386900	**93ft**	**96ft**	**Brown**	**Sandstone**
90386900	**96ft**	**105ft**	**Brown**	**Clay and Shale**

Overall Well Depth
105ft

Bedrock Level
0ft

Water Bearing Fracture Zone

Well Log	Depth	Rate
90386900	**50ft**	**2 igpm**
90386900	**77ft**	**3 igpm**

Setbacks

There is no Setback information.

APPENDIX D

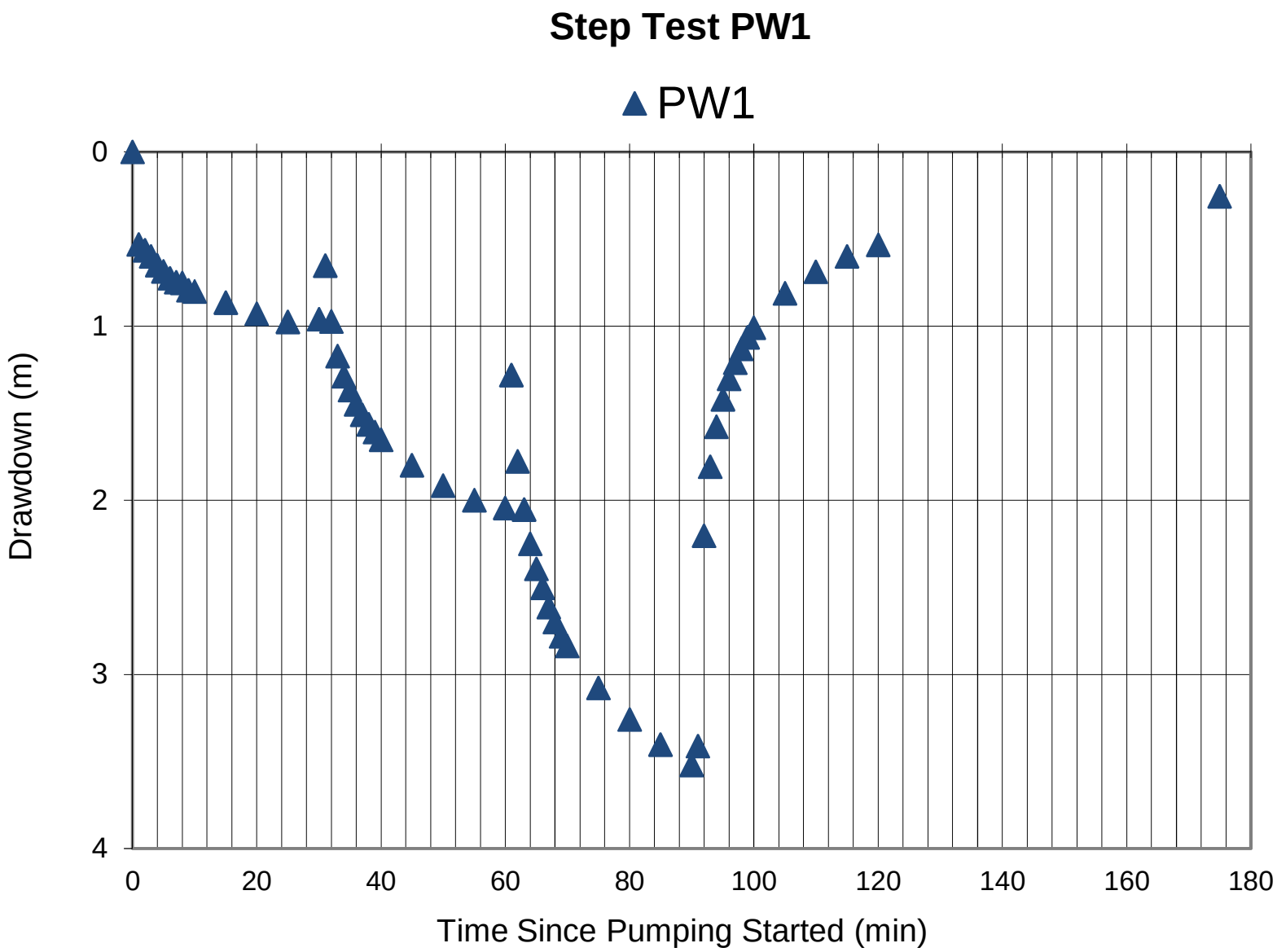
Pumping Test Data for Pumping Well and Observation Well

ROY CONSULTANTS

Step Test

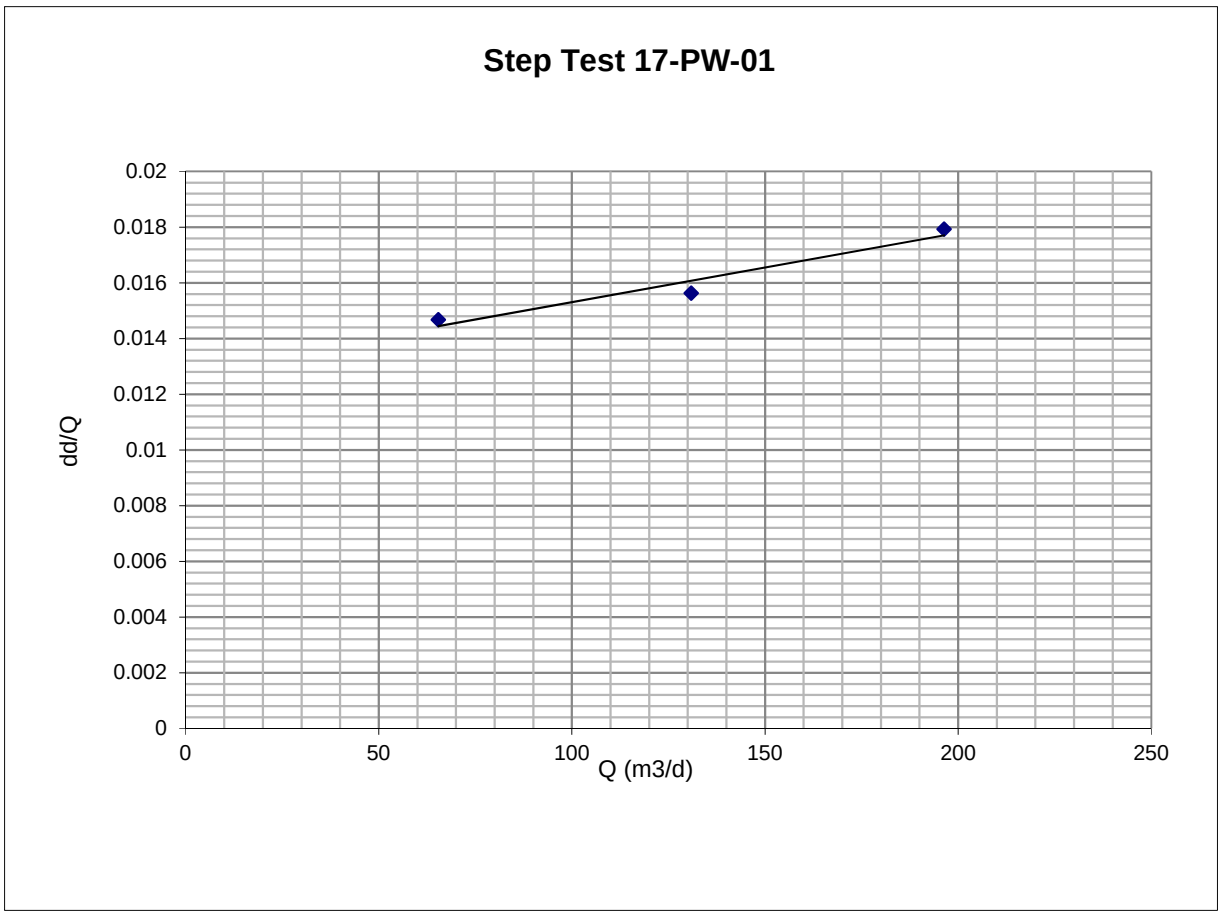
Well = PW1 Well = OW1
SWL = 4.13 m btoc ; 3.563 m bgs SWL= 3.46 m btoc; 2.89 m bgs

Step	Elapsed Time (min)		PW1 water level (m)	PW1 drawdown (m)	OW1 water level (m)	OW1 drawdown (m)
Step 1	0		4.13	0	3.46	0
10 lgpm	1		4.6619	0.5319	3.4687	0.0087
	2		4.6938	0.5638	3.4695	0.0095
	3		4.7312	0.6012	3.4693	0.0093
	4		4.7817	0.6517	3.4675	0.0075
	5		4.8169	0.6869	3.4681	0.0081
	6		4.8561	0.7261	3.4675	0.0075
	7		4.8781	0.7481	3.4672	0.0072
	8		4.8827	0.7527	3.4681	0.0081
	9		4.9259	0.7959	3.4676	0.0076
	10		4.9309	0.8009	3.4676	0.0076
	15		4.9956	0.8656	3.4675	0.0075
	20		5.0609	0.9309	3.4654	0.0054
	25		5.1058	0.9758	3.4677	0.0077
	30		5.0903	0.9603	3.4666	0.0066
Step 2	31		4.7843	0.6543	3.469	0.009
20 lgpm	32		5.1031	0.9731	3.4693	0.0093
	33		5.3027	1.1727	3.4689	0.0089
	34		5.4172	1.2872	3.4698	0.0098
	35		5.4969	1.3669	3.4703	0.0103
	36		5.5796	1.4496	3.4716	0.0116
	37		5.6388	1.5088	3.4711	0.0111
	38		5.6938	1.5638	3.4719	0.0119
	39		5.7393	1.6093	3.4709	0.0109
	40		5.7843	1.6543	3.4725	0.0125
	45		5.9284	1.7984	3.4709	0.0109
	50		6.0474	1.9174	3.4721	0.0121
	55		6.131	2.001	3.4729	0.0129
	60		6.1753	2.0453	3.4739	0.0139
Step 3	61		5.4126	1.2826	3.4762	0.0162
30 lgpm	62		5.9077	1.7777	3.4774	0.0174
	63		6.1848	2.0548	3.4779	0.0179
	64		6.3801	2.2501	3.4794	0.0194
	65		6.5237	2.3937	3.4787	0.0187
	66		6.6339	2.5039	3.4793	0.0193
	67		6.7439	2.6139	3.4795	0.0195
	68		6.83	2.7	3.4793	0.0193
	69		6.9106	2.7806	3.4801	0.0201
	70		6.9663	2.8363	3.4795	0.0195
	75		7.2079	3.0779	3.4878	0.0278
	80		7.3898	3.2598	3.4865	0.0265
	85		7.5333	3.4033	3.4868	0.0268
	90		7.651	3.521	3.4889	0.0289
Recovery	91		7.543	3.413	3.488	0.028
	92		6.3346	2.2046	3.4896	0.0296
	93		5.9392	1.8092	3.4888	0.0288
	94		5.7081	1.5781	3.4893	0.0293
	95		5.5506	1.4206	3.4901	0.0301
	96		5.4331	1.3031	3.4914	0.0314
	97		5.3398	1.2098	3.491	0.031
	98		5.2615	1.1315	3.4901	0.0301
	99		5.1956	1.0656	3.4912	0.0312
	100		5.1396	1.0096	3.4899	0.0299
	105		4.9418	0.8118	3.4913	0.0313
	110		4.8185	0.6885	3.4935	0.0335
	115		4.7307	0.6007	3.4939	0.0339
	120		4.6647	0.5347	3.4971	0.0371
	175		4.385	0.255	3.5111	0.0511


Step Test PW1
PW1
Drawdown (m)
0
1
2
3
4
0
20
40
60
80
100
120
140
160
180
Time Since Pumping Started (min)

PW1

Step	Q (igpm)	Q (m3/d)	dd (m)	dd/Q	SC	1/SC
1	10	65.44503	0.9603	0.014673	68.15061	0.014673
2	20	130.8901	2.0453	0.015626	63.99553	0.015626
3	30	196.3351	3.521	0.017934	55.76117	0.017934



Total Available Drawdown = 3.178 m
B = 0.013
C = 2.50E-05
SAD = 2.2246 m 70% of TAD
$s=BQ + CQ^2$
$2.2246= 0.013Q+2.5E-5Q^2$
Q = 135.707 or -655.707 m3/day
(21 Igpm)

Pumping Rate of 20 Igpm selected for 72 Hour Constant Rate Test

ROY CONSULTANTS

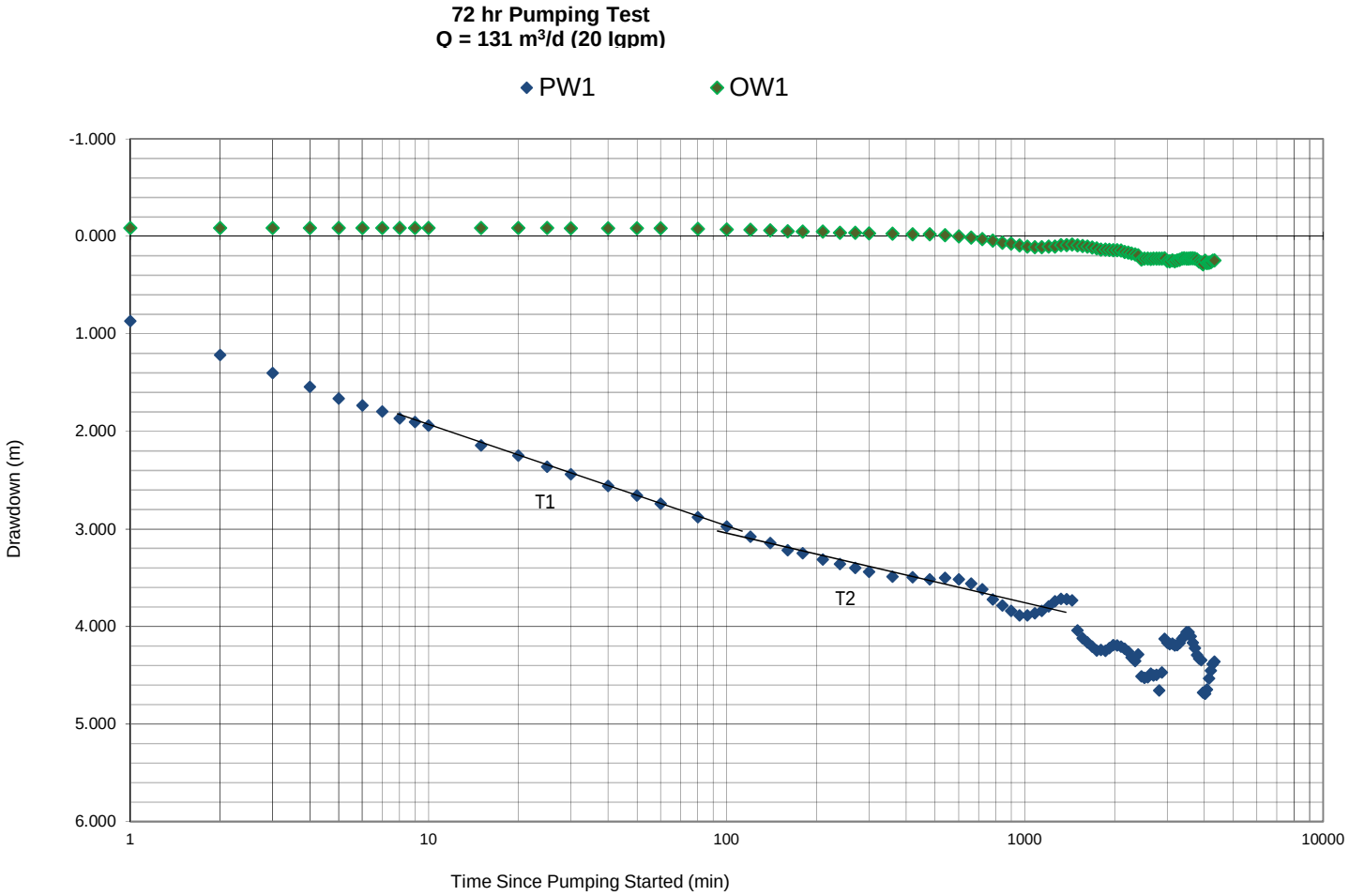
Pumping Test Data

Static Water Levels:
PW1 = 3.563 m bgs
OW1 = 2.895 m bgs

location: Murray Corner
date: November 19 to 22, 2017 Q = 20 lgpm

		PW1		OW1	
		water level	drawdown	water level	drawdown
hours	**Time (min)**	**(m)**	**(m)**	**(m)**	**(m)**
	1	4.43	0.868	2.81	**-0.088**
	2	4.78	1.2171	2.81	**-0.088**
	3	4.96	1.4016	2.81	**-0.088**
	4	5.10	1.541	2.81	**-0.088**
	5	5.22	1.6614	2.81	**-0.088**
	6	5.30	1.7329	2.81	**-0.088**
	7	5.36	1.7954	2.81	**-0.088**
	8	5.43	1.8666	2.81	**-0.088**
	9	5.47	1.9028	2.81	**-0.088**
	10	5.50	1.9401	2.81	**-0.088**
	15	5.70	2.1414	2.81	**-0.086**
	20	5.81	2.248	2.81	**-0.087**
	25	5.93	2.362	2.81	**-0.086**
	30	6.00	2.4372	2.81	**-0.085**
	40	6.12	2.5584	2.81	**-0.084**
	50	6.22	2.6559	2.81	**-0.082**
1	60	6.30	2.7411	2.81	**-0.082**
	80	6.44	2.8795	2.82	**-0.076**
	100	6.54	2.9745	2.82	**-0.071**
2	120	6.64	3.0782	2.83	**-0.067**
	140	6.71	3.1444	2.83	**-0.062**
	160	6.78	3.2177	2.84	**-0.054**
3	180	6.81	3.2495	2.84	**-0.051**
	210	6.88	3.3139	2.84	**-0.051**
4	240	6.92	3.3588	2.86	**-0.036**
	270	6.96	3.3978	2.86	**-0.036**
5	300	7.00	3.4394	2.86	**-0.032**
6	360	7.05	3.4872	2.87	**-0.027**
7	420	7.06	3.4961	2.87	**-0.021**
8	480	7.08	3.5166	2.87	**-0.021**
9	540	7.06	3.5	2.88	**-0.012**
10	600	7.08	3.515	2.90	**0.001**
11	660	7.12	3.5579	2.91	**0.0129**
12	720	7.18	3.6192	2.92	**0.0278**
13	780	7.28	3.7215	2.94	**0.0437**
14	840	7.35	3.7848	2.96	**0.0647**
15	900	7.40	3.8388	2.97	**0.0739**
16	960	7.45	3.8852	2.99	**0.0934**
17	1020	7.45	3.8853	3.00	**0.104**
18	1080	7.43	3.8645	3.00	**0.109**
19	1140	7.40	3.841	3.00	**0.109**
20	1200	7.36	3.7938	3.00	**0.104**

21	1260	7.30	3.741	3.00	**0.104**
22	1320	7.28	3.7171	2.98	**0.0888**
23	1380	7.28	3.7202	2.98	**0.0888**
24	1440	7.29	3.7315	2.98	**0.0827**
25	1500	7.60	4.041	2.99	**0.0921**
26	1560	7.68	4.1195	2.99	**0.0979**
27	1620	7.73	4.163	3.00	**0.104**
28	1680	7.77	4.2068	3.01	**0.115**
29	1740	7.81	4.2463	3.02	**0.124**
30	1800	7.80	4.2401	3.03	**0.135**
31	1860	7.81	4.249	3.03	**0.136**
32	1920	7.78	4.2209	3.03	**0.138**
33	1980	7.75	4.1907	3.04	**0.14**
34	2040	7.76	4.1927	3.04	**0.141**
35	2100	7.77	4.2071	3.04	**0.144**
36	2160	7.79	4.2265	3.05	**0.159**
37	2220	7.82	4.259	3.06	**0.166**
38	2280	7.88	4.3157	3.07	**0.174**
39	2340	7.92	4.3544	3.08	**0.184**
40	2400	7.85	4.2857	3.09	**0.193**
41	2460	8.07	4.5108	3.13	**0.238**
42	2520	8.09	4.5254	3.12	**0.226**
43	2580	8.08	4.5215	3.12	**0.229**
44	2640	8.05	4.4823	3.13	**0.232**
45	2700	8.06	4.5011	3.12	**0.229**
46	2760	8.06	4.4964	3.12	**0.227**
47	2820	8.22	4.655	3.12	**0.227**
48	2880	8.03	4.4696	3.12	**0.226**
49	2940	7.69	4.1261	3.12	**0.223**
50	3000	7.73	4.1658	3.15	**0.253**
51	3060	7.74	4.1817	3.15	**0.256**
52	3120	7.74	4.174	3.14	**0.247**
53	3180	7.76	4.1949	3.15	**0.256**
54	3240	7.75	4.1897	3.14	**0.247**
55	3300	7.73	4.17	3.13	**0.239**
56	3360	7.69	4.1269	3.12	**0.229**
57	3420	7.66	4.1017	3.12	**0.223**
58	3480	7.62	4.0572	3.12	**0.226**
59	3540	7.62	4.0592	3.12	**0.229**
60	3600	7.66	4.1002	3.12	**0.223**
61	3660	7.73	4.1652	3.12	**0.223**
62	3720	7.79	4.2227	3.12	**0.229**
63	3780	7.86	4.292	3.13	**0.238**
64	3840	7.89	4.3286	3.15	**0.259**
65	3900	7.91	4.3438	3.16	**0.269**
66	3960	8.24	4.6783	3.18	**0.287**
67	4020	8.25	4.6884	3.15	**0.25**
68	4080	8.21	4.647	3.17	**0.275**
69	4140	8.10	4.5333	3.17	**0.272**
70	4200	8.02	4.4534	3.16	**0.263**
71	4260	7.95	4.3838	3.15	**0.25**
72	4320	7.92	4.3607	3.14	**0.247**



Pumping Rate = 20 lgpm (131 m3/day)

Cooper-Jacob Analysis

PW1

Δs_1 = 1.03 m

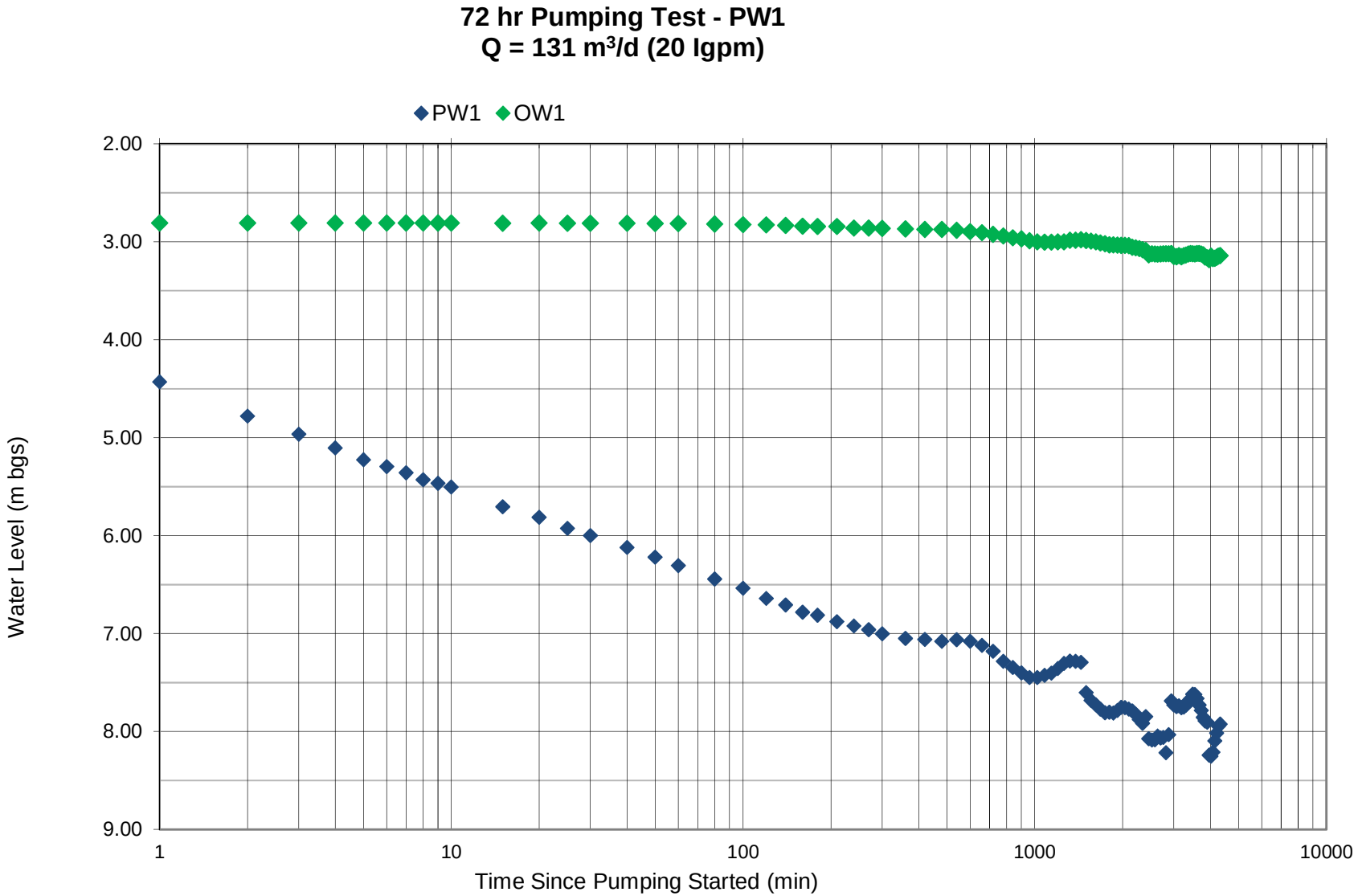
$$T_1 = \frac{2.3\ Q}{4\pi\Delta s} = \boxed{23.2\ m^2/day}$$

Cooper-Jacob Analysis

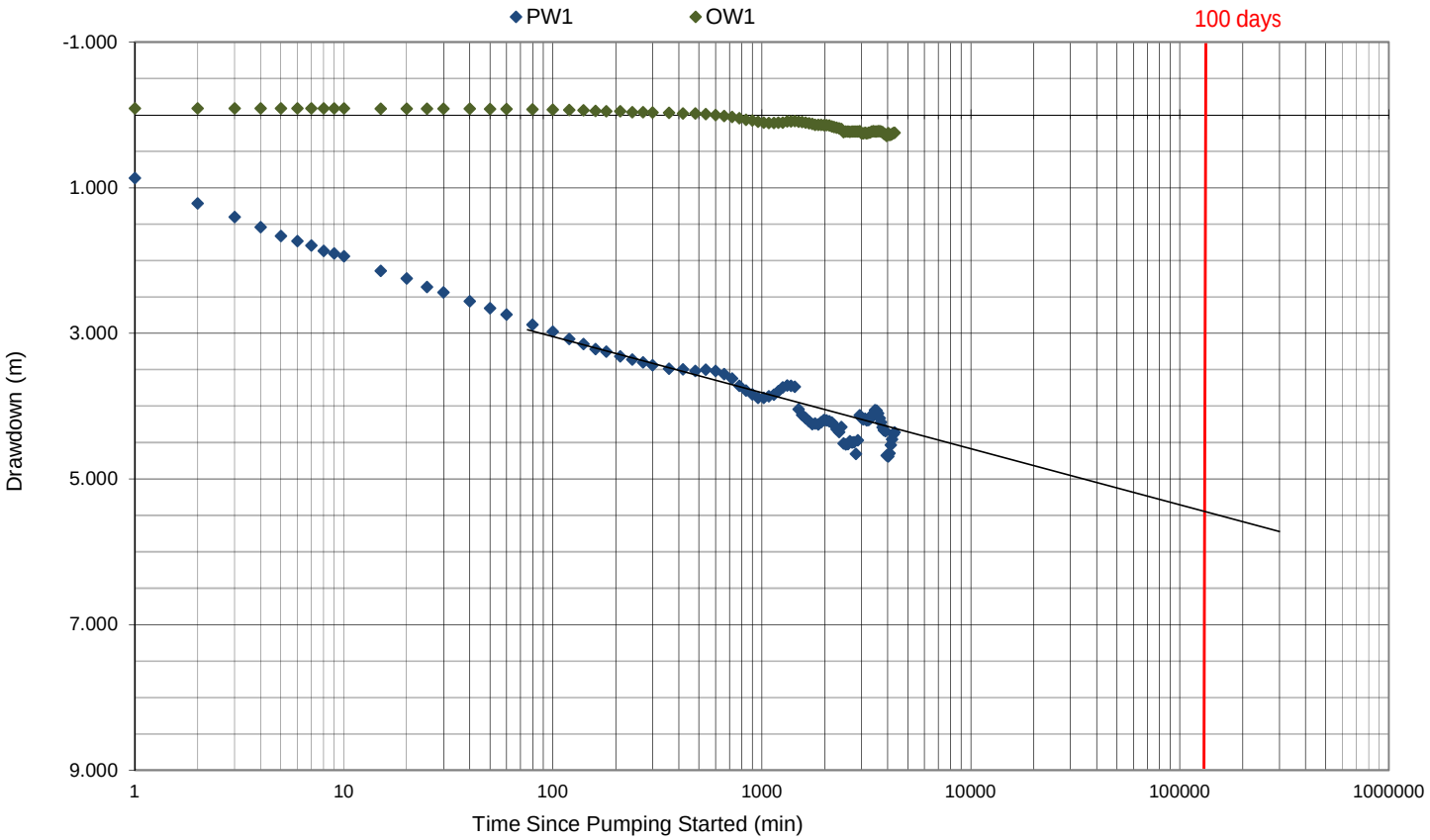
PW1

Δs_2 = 0.78 m

$$T_2 = \frac{2.3\ Q}{4\pi\Delta s} = \boxed{30.9\ m^2/day}$$


72 hr Pumping Test - PW1
Q = 131 m³/d (20 Igpm)
PW1
OW1
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
Water Level (m bgs)
1
10
100
1000
10000
Time Since Pumping Started (min)

72 hr Pumping Test - All Wells
Q = 131 m^3/d (20 Igpm)



Specific Capacity (100 days) = $\frac{Q}{s\ (100\ days)}$

$= \frac{131\ m^3/day}{5.4\ m}$

$= 24.23\ m^3/day/m$

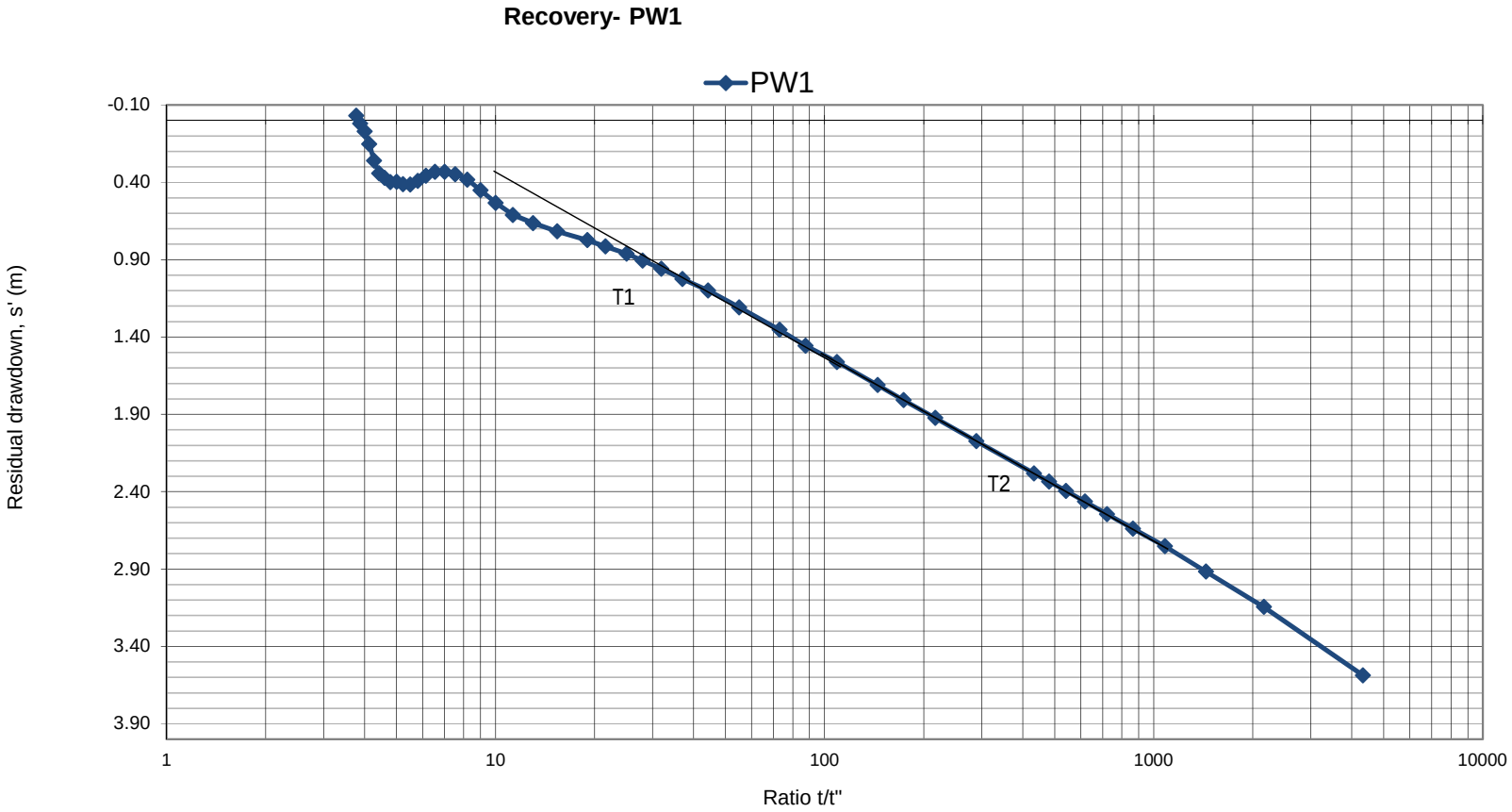
ROY CONSULTANTS

Recovery Data

Static Water Levels:
PW1 = 3.563 m bgs
OW1 = 2.895 m bgs

location: Murray Corner
date: November 19 to 22, 2017

hours	Time since pump started t (min)	Time since pump stopped t' (min)	t/t'	PW1 Water Level (m)	residual drawdown s' (m)	OW1 Water Level (m)	residual drawdown s'
	0	**0**		3.563		2.895	
	4321	1	4321	7.15	3.59	3.15	0.253
	4322	2	2161	6.71	3.14	3.139	0.244
	4323	3	1441	6.48	2.92	3.139	0.244
	4324	4	1081	6.32	2.75	3.14	0.241
	4325	5	865	6.20	2.64	3.136	0.241
	4326	6	721	6.11	2.54	3.136	0.241
	4327	7	618	6.03	2.46	3.136	0.241
	4328	8	541	5.96	2.39	3.136	0.241
	4329	9	481	5.90	2.33	3.136	0.241
	4330	10	433	5.84	2.28	3.136	0.241
	4335	15	289	5.64	2.07	3.136	0.241
	4340	20	217	5.49	1.92	3.136	0.241
	4345	25	174	5.37	1.81	3.142	0.247
	4350	30	145	5.27	1.71	3.136	0.241
	4360	40	109	5.12	1.56	3.138	0.243
	4370	50	87	5.02	1.46	3.139	0.24
1	4380	60	73	4.92	1.35	3.138	0.24
	4400	80	55	4.77	1.21	3.133	0.24
	4420	100	44	4.66	1.10	3.129	0.23
2	4440	120	37	4.59	1.02	3.124	0.23
	4460	140	32	4.52	0.96	3.124	0.23
	4480	160	28	4.47	0.91	3.118	0.22
3	4500	180	25	4.42	0.86	3.118	0.22
	4530	210	22	4.38	0.81	3.026	0.13
4	4560	240	19	4.34	0.77	3.026	0.13
5	4620	300	15	4.28	0.72	2.935	0.04
6	4680	360	13	4.23	0.66	3.042	0.15
7	4740	420	11	4.17	0.61	3.036	0.14
8	4800	480	10	4.10	0.53	3.036	0.14
9	4860	540	9	4.01	0.45	3.036	0.14
10	4920	600	8	3.95	0.38	3.002	0.11
11	4980	660	8	3.91	0.35	2.978	0.08
12	5040	720	7	3.90	0.33	2.959	0.06
13	5100	780	7	3.89	0.33		
14	5160	840	6	3.92	0.36	2.938	0.04
15	5220	900	6	3.95	0.39	2.950	0.06
16	5280	960	6	3.98	0.42	2.941	0.05
17	5340	1020	5	3.98	0.41	2.944	0.05
18	5400	1080	5	3.96	0.40	2.947	0.05
19	5460	1140	5	3.96	0.40	2.944	0.05
20	5520	1200	5	3.93	0.37	2.944	0.05
21	5580	1260	4	3.905	0.34	2.944	0.05
22	5640	1320	4	3.8229	0.26	2.915	0.02
23	5700	1380	4	3.7149	0.15	2.890	-0.005
24	5760	1440	4	3.6331	0.07	2.865	-0.03
25	5820	1500	4	3.5832	0.02	2.853	-0.04
26	5880	1560	4	3.5315	-0.03	2.837	-0.06



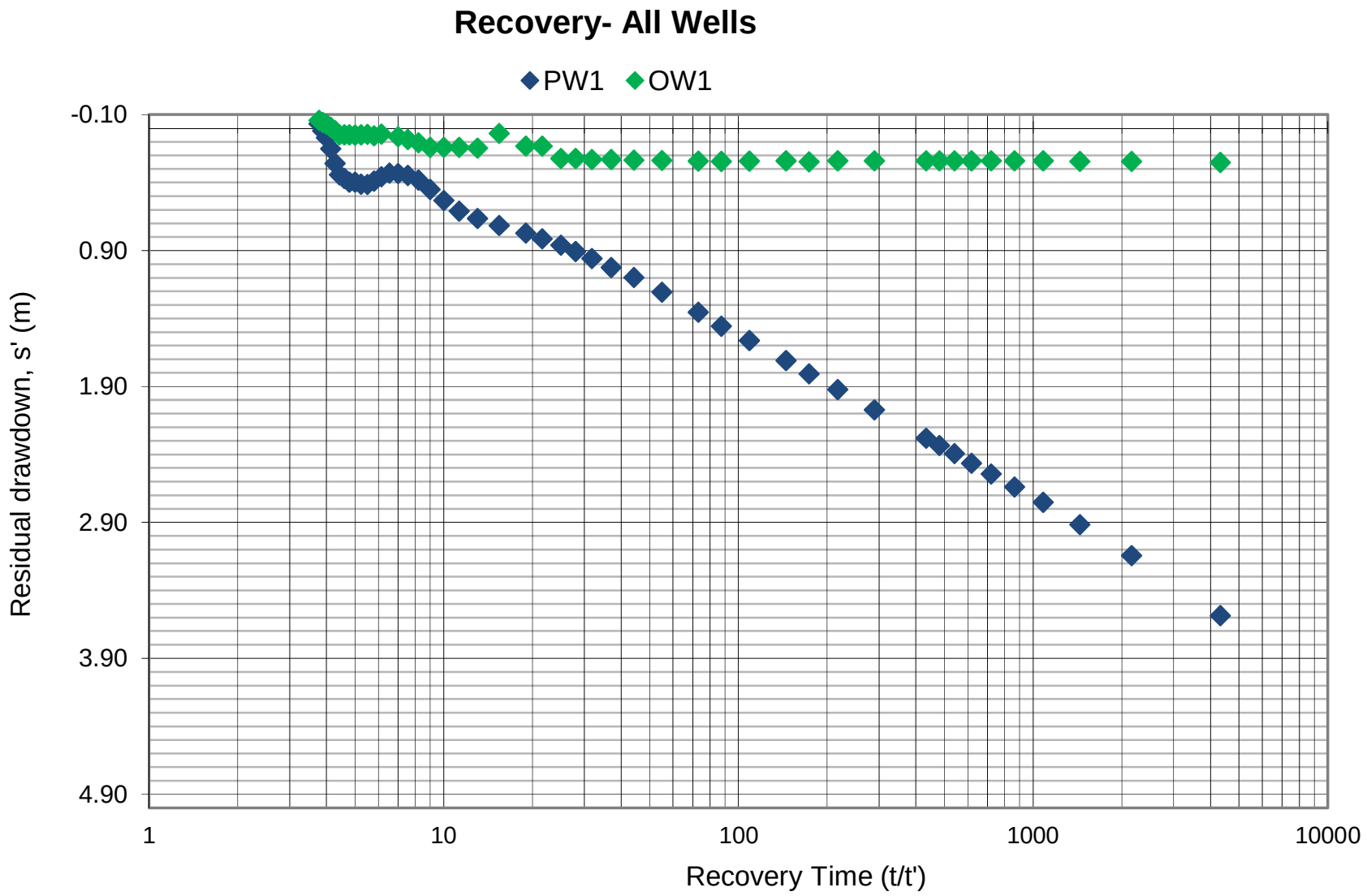
PW1

$\Delta s_1 = 0.70$ m

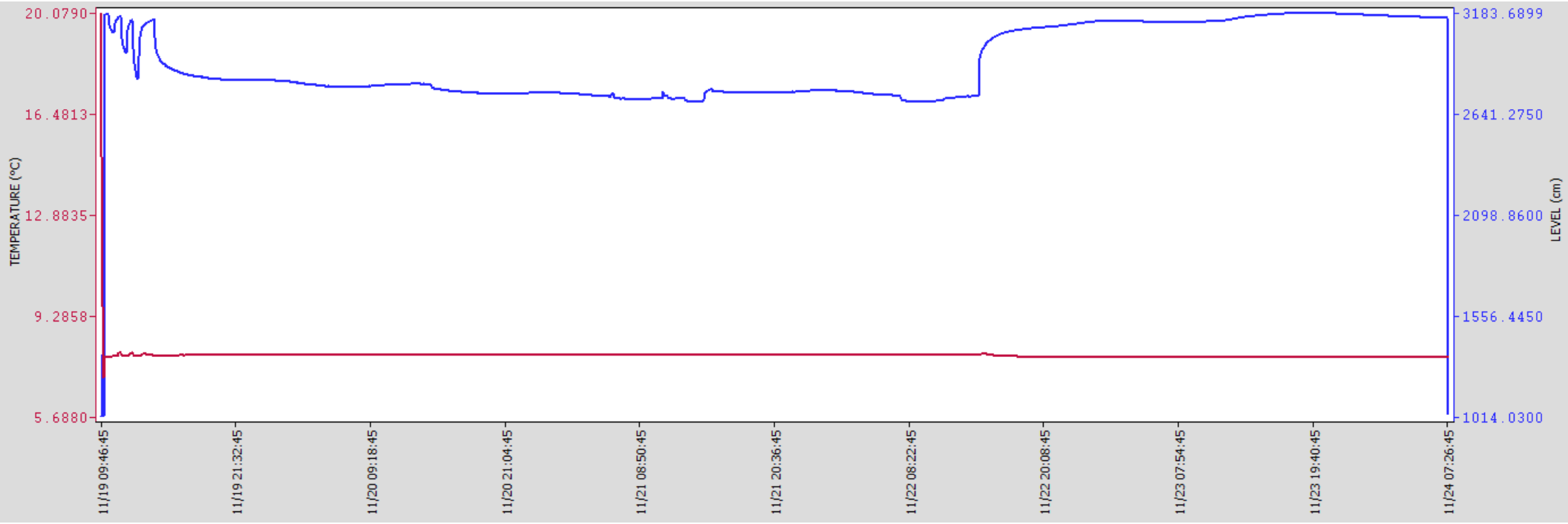
$T_{1\ Rec} = \frac{2.3\ Q}{4\pi\Delta s} =$ 34.22 m^2/day

$\Delta s_2 = 1.2$ m

$T_{2\ Rec} = \frac{2.3\ Q}{4\pi\Delta s} =$ 19.96 m^2/day


Recovery- All Wells
PW1
OW1
-0.10
0.90
1.90
2.90
3.90
4.90
Residual drawdown, s' (m)
1
10
100
1000
10000
Recovery Time (t/t')

PW1 - Levelogger Temperature Readings (red)



APPENDIX E

Laboratory Certificates

Report/Rapport: 234480-MB
Date: 12-May-17
Date Received/Reçu: 11-May-17

CERTIFICATE OF ANALYSIS / CERTIFICAT D'ANALYSE

for/pour
Strang Shore Camping Inc
Linda Strang
89 Moore Rd Exten
Otter Creek, NB E4M3V5
506-538-1015

rpc
150 Lutz St
Moncton NB
Canada E1C 5E9
Tel: 506.855.6472
Fax: 506.855.8294
www.rpc.ca

Project/Job #: HZ: 01, ST: 21, RN: 10
Location: EA327101

Examination of Water/Examen de l'eau

RPC Sample ID/No. d'échantillon de RPC:				234480-1
Client Sample ID/ID d'échantillon du client:				1639 Route 955 Little Shemogue NB E4M3J5
Date collected/Date du prélèvement:				10-May-17
Time sampled/Heure du prélèvement:				8:45:00 AM
Analytes/Paramètre(s)	**Method Méthode**	**Date Analyzed Date Analysé**	**Units Unités**	
Total Coliforms/Coliformes totaux	MB02	11-May-17	cfu/100mL	0
E. coli	MB02	11-May-17	cfu/100mL	0

This report relates only to the sample(s) and information provided to the laboratory.

Tests were performed according to the corresponding Compendium of Analytical Methods, Health Protection Branch and/or AOAC Official Methods.

Le présent rapport ne s'applique qu'aux échantillons et à l'information transmis au laboratoire.

Les analyses ont été menées conformément au Compendium de méthodes pour l'analyse correspondant ou aux méthodes officielles de la Direction générale de la protection de la santé ou de l'Association of Official Analytical Chemists (AOAC).

RL/SD = Reporting Limit/Seuil de déclaration cfu/ufc = Colony Forming Units/Unités formant des colonies

Nadine Godin
Microbiology Supervisor
Moncton Laboratory/Laboratoire de Moncton

SHANNON GARDNER
Microbiology Technician
Moncton Laboratory/Laboratoire de Moncton

Report/Rapport: 234480-MB
Date: 12-May-17
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CERTIFICATE OF ANALYSIS / CERTIFICAT D'ANALYSE

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RPC Sample ID/No. d'échantillon de RPC:	234480-1
Client Sample ID/ID d'échantillon du client:	1639 Route 955 Little Shemogue NB E4M3J5
Date collected/Date du prélèvement:	10-May-17
Time sampled/Heure du prélèvement:	8:45:00 AM

✓ Acceptable/Acceptable

_____ Coliforms (non-faecal) present. These bacteria are not by themselves considered harmful to human health. They do however indicate a possible route of contamination of a water supply. Further sampling or investigation is necessary to better understand the drinking water supply.
Coliformes (non fécaux) présents. Ces bacteries seules ne sont pas considérées comme nocives pour la santé des humains. Elles rélevents cependant un risque de contamination de la source d'approvisionnement en eau. Il faut prélever d'autres échantillons pour mieux comprendre la qualité de l'eau potable.

_____ Unacceptable/Inacceptable

_____ Authorization/Autorisation

Contact Date\Date de contact ___ _____ Comments\Commentaires: _____

_____

_____

RPC Submission Reference: 234480

Strang Shore Camping Inc
Linda Strang
89 Moore Rd Exten
Otter Creek, NB E4M3V5
506-538-1015

Health Region: Moncton (01)
Sample Type: Drilled Well (21)
Reason: Accreditation / Licensing (10)

New Nouveau Brunswick

OFFICE OF THE CHIEF MEDICAL OFFICER OF HEALTH
NEW BRUNSWICK DEPARTMENT OF HEALTH

INTERPRETATION OF BACTERIAL WATER TEST RESULTS

Water analysis done at the RPC Laboratory

The lab report will indicate if any **Total** coliform or **E-coli** bacteria were detected in your water sample. The box of the report shows the type and number of bacteria detected in 100 ml of water. The last column of this box shows the number of organisms detected or may have the letters **A** or **ND** indicating absent or none detected or, the letter **P** indicating a presence of the organism was detected. The end of the report will have a check mark indicating the microbiological safety of the water sample.

Results

Acceptable. If this line is checked off, this indicates the water is safe to drink.

Coliforms (non-faecal) present. If this line is checked off this indicates that there was a presence of Total coliform bacteria. Your water supply should be re-tested as soon as possible to determine if the Total coliform bacteria persist or if they were possibly introduced into the water sample at the time of sampling. (one coliform negative result after the presence of Total coliform is required to deem the water acceptable.)

Unacceptable. If this line is checked off, this indicates that:

- there were *E-coli* bacteria detected (bacteria that comes from the intestinal tract of humans and warm-blooded animals), or
- this is your first coliform negative result after a presence of E. coli. (two coliform negative results are required to deem the water acceptable after the presence of *E. coli*), or
- that this is the second consecutive water sample from your water supply showing the presence of Total coliform. **YOU SHOULD IMMEDIATELY BOIL DRINKING WATER AS PER THE ENCLOSED INFORMATION SHEET ON BOIL ADVISORIES**. In order to better understand the well water quality problem, you may wish to speak to a Public Health Inspector at your local Health Protection Branch.

NOTE : A single acceptable bacteriological report does not necessarily indicate that the water supply is always safe. It is recommended that private wells be tested for bacteria two times per year or after any event that may have contaminated the well or, if you detect a noticeable change in odor, color or taste of the water.

Because shallow wells, dug wells and springs have shallow protective soil cover over the water bearing formation, these types of water supplies are much more vulnerable to surface water infiltration than drilled wells. Regardless of the bacteria test results, this type of water supply is more at risk of being contaminated by microorganisms and consideration should be given to replacing these systems with properly constructed drilled wells or installing appropriate water treatment devices

If you have any questions or would like additional information, please contact a Public Health Inspector at 506-856-2814.

New Nouveau Brunswick

BUREAU DU MÉDECIN-HYGIÉNISTE EN CHEF
MINISTÈRE DE LA SANTÉ DU NOUVEAU-BRUNSWICK

INTERPRÉTATION DES RÉSULTATS DES ESSAIS BACTÉRIOLOGIQUES

Analyse de l'eau effectuée au laboratoire de RPC

Le rapport de laboratoire indiquera s'il y a présence de coliformes **totaux** ou de la bactérie ***E. coli*** dans votre échantillon d'eau. La boîte du rapport indique le type et le nombre de bactéries détectées dans une quantité de 100 ml d'eau. La dernière colonne de cette boîte indique le nombre d'organismes détectés ou pourrait porter les lettres **A** ou **ND** indiquant qu'il y absence d'organismes ou qu'aucun organisme n'a été détecté ou encore la lettre **P** indiquant la présence d'organismes. La fin du rapport portera un crochet indiquant la sécurité microbiologique de l'échantillon d'eau.

Résultats

Acceptable. Si cette ligne est cochée, l'eau est potable.

Coliformes (non fécaux) présents. Si cette ligne est cochée, des bactéries de coliformes totaux ont été détectées. Votre source d'approvisionnement en eau devrait être vérifiée à nouveau dès que possible afin de déterminer si les bactéries de coliformes totaux persistent ou si elles ont pu être introduites dans l'échantillon d'eau au moment de l'échantillonnage. (Il faut obtenir un résultat négatif pour les coliformes après que des coliformes totaux aient été détectés pour que l'eau soit jugée acceptable.)

Inacceptable. Si cette ligne est cochée :

- des bactéries *E. coli* ont été détectées (bactéries qui vivent seulement dans le tractus intestinal des humains et des animaux à sang chaud);
- c'est votre premier résultat négatif pour les coliformes après que la bactérie *E. coli* ait été détectée (Il faut obtenir deux résultats négatifs pour les coliformes après que la bactérie *E. coli* ait été détectée pour que l'eau soit jugée acceptable.);
- il s'agit du second échantillon d'eau consécutif de votre source d'approvisionnement en eau indiquant la présence de coliformes totaux. **VOUS DEVRIEZ IMMÉDIATEMENT FAIRE BOUILLIR L'EAU DE CONSOMMATION CONFORMÉMENT AU FEUILLET D'INFORMATION CI-ANNEXÉ CONCERNANT L'AVIS DE SÉCURITÉ.** Afin de mieux comprendre le problème quant à la qualité de l'eau de puits, vous devriez parler à un inspecteur de la santé publique au bureau local de la Protection de la santé.

NOTE : Un seul résultat acceptable aux essais bactériologiques n'indique pas nécessairement que la source d'approvisionnement en eau est toujours sécuritaire. Il est recommandé que les puits privés fassent l'objet d'une épreuve bactériologique deux fois par année ou après chaque situation qui aurait pu contaminer le puits ou encore si vous détectez un changement notable de l'odeur, de la couleur ou du goût de l'eau.

Étant donné que les puits peu profonds, les puits creusés et les sources naturelles n'ont qu'une mince couverture de sol protecteur au-dessus de la couche aquifère, ces types d'approvisionnement en eau sont plus vulnérables à l'infiltration des eaux de surface que les puits forés à la sondeuse. Peu importe les résultats des essais bactériologiques, ce type d'approvisionnement en eau est plus à risque d'être contaminé par les micro-organismes. Il faudrait envisager de remplacer ces systèmes par des puits forés bien aménagés ou d'installer des dispositifs de traitement de l'eau appropriés.

Si vous avez des questions ou si vous désirez de plus amples renseignements, veuillez communiquer avec un inspecteur de la santé publique au 506- 856-2814.

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

CLIENT NAME: ROY CONSULTANTS
548 KING AVE
BATHURST, NB E2A 4Z1
506-546-4484

ATTENTION TO: GINA BURTT

PROJECT: 278-17

AGAT WORK ORDER: 17X286210

MICROBIOLOGY ANALYSIS REVIEWED BY: Laura Baker, Inorganics Data Reporter

WATER ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganics Supervisor

DATE REPORTED: Nov 30, 2017

PAGES (INCLUDING COVER): 11

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 17X286210

PROJECT: 278-17

CLIENT NAME: ROY CONSULTANTS

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

Total Coliforms and E.coli (MPN)

DATE RECEIVED: 2017-11-21

DATE REPORTED: 2017-11-22

		SAMPLE DESCRIPTION:		PW-1 24 Hr
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2017-11-20
Parameter	**Unit**	**G / S**	**RDL**	**8921784**
Total Coliforms (MPN)	MPN/100 mL		1	ABSENT
E. Coli (MPN)	MPN/100 mL		1	ABSENT

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 17X286210

PROJECT: 278-17

CLIENT NAME: ROY CONSULTANTS

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

MTL - TOC in Water

DATE RECEIVED: 2017-11-21

DATE REPORTED: 2017-11-27

		SAMPLE DESCRIPTION:		PW-1 24 Hr
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2017-11-20
Parameter	Unit	G / S	RDL	8921784
Total Organic Carbon	mg/L		0.5	<0.5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8921784 TOC analysed at AGAT Montreal.

Certified By:

AGAT Laboratories
11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17X286210

PROJECT: 278-17

CLIENT NAME: ROY CONSULTANTS

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

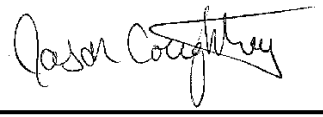
Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2017-11-21

DATE REPORTED: 2017-11-27

		SAMPLE DESCRIPTION:		PW-1 24 Hr
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2017-11-20
Parameter	Unit	G / S	RDL	8921784
pH				8.01
Reactive Silica as SiO2	mg/L		0.5	10.8
Chloride	mg/L		1	24
Fluoride	mg/L		0.12	<0.12
Sulphate	mg/L		2	7
Alkalinity	mg/L		5	117
True Color	TCU		5	6
Turbidity	NTU		0.1	0.5
Electrical Conductivity	umho/cm		1	332
Nitrate + Nitrite as N	mg/L		0.05	1.88
Nitrate as N	mg/L		0.05	1.88
Nitrite as N	mg/L		0.05	<0.05
Ammonia as N	mg/L		0.03	0.03
Ortho-Phosphate as P	mg/L		0.01	<0.01
Dissolved Sodium	mg/L		0.1	17.3
Dissolved Potassium	mg/L		0.1	1.6
Dissolved Calcium	mg/L		0.1	44.7
Dissolved Magnesium	mg/L		0.1	3.9
Bicarb. Alkalinity (as CaCO3)	mg/L		5	117
Carb. Alkalinity (as CaCO3)	mg/L		10	<10
Hydroxide	mg/L		5	<5
Calculated TDS	mg/L		1	177
Hardness	mg/L			128
Langelier Index (@20C)	NA			0.12
Langelier Index (@ 4C)	NA			-0.20
Saturation pH (@ 20C)	NA			7.89
Saturation pH (@ 4C)	NA			8.21
Anion Sum	me/L			3.30
Cation sum	me/L			3.35
% Difference/ Ion Balance (NS)	%			0.8

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 17X286210

PROJECT: 278-17

CLIENT NAME: ROY CONSULTANTS

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2017-11-21

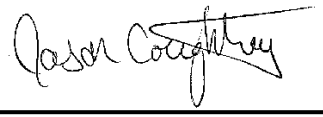
DATE REPORTED: 2017-11-27

		SAMPLE DESCRIPTION:		PW-1 24 Hr
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2017-11-20
Parameter	Unit	G / S	RDL	8921784
Dissolved Aluminum	ug/L		5	<5
Dissolved Antimony	ug/L		2	<2
Dissolved Arsenic	ug/L		2	<2
Dissolved Barium	ug/L		5	431
Dissolved Beryllium	ug/L		2	<2
Dissolved Bismuth	ug/L		2	<2
Dissolved Boron	ug/L		5	34
Dissolved Cadmium	ug/L		0.017	<0.017
Dissolved Chromium	ug/L		1	3
Dissolved Cobalt	ug/L		1	<1
Dissolved Copper	ug/L		2	<2
Dissolved Iron	ug/L		50	<50
Dissolved Lead	ug/L		0.5	<0.5
Dissolved Manganese	ug/L		2	72
Dissolved Molybdenum	ug/L		2	<2
Dissolved Nickel	ug/L		2	<2
Dissolved Phosphorus	mg/L		0.02	<0.02
Dissolved Selenium	ug/L		1	<1
Dissolved Silver	ug/L		0.1	<0.1
Dissolved Strontium	ug/L		5	633
Dissolved Thallium	ug/L		0.1	<0.1
Dissolved Tin	ug/L		2	<2
Dissolved Titanium	ug/L		2	<2
Dissolved Uranium	ug/L		0.1	2.3
Dissolved Vanadium	ug/L		2	4
Dissolved Zinc	ug/L		5	8

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8921784 Metals analysis completed on a filtered sample.

Certified By:



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http://www.agatlabs.com

Quality Assurance

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X286210

PROJECT: 278-17

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date:			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Standard Water Analysis + Dissolved Metals															
pH	8921196		6.65	6.63	0.3%	<	102%	80%	120%	NA	80%	120%	NA	80%	120%
Reactive Silica as SiO2	1	8921784	10.8	10.8	0.0%	< 0.5	105%	80%	120%		80%	120%	84%	80%	120%
Chloride	8921780		60	61	0.8%	< 1	97%	80%	120%	NA	80%	120%	NA	80%	120%
Fluoride	8921780		0.28	0.31	NA	< 0.12	112%	80%	120%	NA	80%	120%	97%	80%	120%
Sulphate	8921780		3	3	NA	< 2	110%	80%	120%	NA	80%	120%	96%	80%	120%
Alkalinity	8921196		94	93	0.8%	< 5	101%	80%	120%	NA	80%	120%	NA	80%	120%
True Color	8921202		11	13	NA	< 5	120%	80%	120%	NA			NA		
Turbidity	8921202		22.9	23.2	1.3%	< 0.1	99%	80%	120%	NA			NA		
Electrical Conductivity	8921196		3820	3810	0.3%	< 1	103%	80%	120%	NA	80%	120%	NA	80%	120%
Nitrate as N	8921780		<0.05	<0.05	NA	< 0.05	98%	80%	120%	NA	80%	120%	90%	80%	120%
Nitrite as N	8921780		0.08	0.09	NA	< 0.05	95%	80%	120%	NA	80%	120%	108%	80%	120%
Ammonia as N	1	8916528	0.04	0.06	NA	< 0.03	115%	80%	120%		80%	120%	118%	80%	120%
Ortho-Phosphate as P	1	8921784	<0.01	<0.01	NA	< 0.01	91%	80%	120%		80%	120%	116%	80%	120%
Dissolved Sodium	8921784	8921784	17.3	15.7	9.4%	< 0.1	107%	80%	120%	104%	80%	120%	NA	70%	130%
Dissolved Potassium	8921784	8921784	1.6	1.7	5.1%	< 0.1	108%	80%	120%	102%	80%	120%	NA	70%	130%
Dissolved Calcium	8921784	8921784	44.7	42.0	6.2%	< 0.1	105%	80%	120%	102%	80%	120%	NA	70%	130%
Dissolved Magnesium	8921784	8921784	3.9	3.9	0.5%	< 0.1	106%	80%	120%	103%	80%	120%	NA	70%	130%
Bicarb. Alkalinity (as CaCO3)	8921196		94	93	0.8%	< 5	NA	80%	120%	NA	80%	120%	NA	80%	120%
Carb. Alkalinity (as CaCO3)	8921196		<10	<10	NA	< 10	NA	80%	120%	NA	80%	120%	NA	80%	120%
Hydroxide	8921196		<5	<5	NA	< 5	NA	80%	120%	NA	80%	120%	NA	80%	120%
Dissolved Aluminum	8921784	8921784	<5	<5	NA	< 5	103%	80%	120%	103%	80%	120%	94%	70%	130%
Dissolved Antimony	8921784	8921784	<2	<2	NA	< 2	93%	80%	120%	100%	80%	120%	103%	70%	130%
Dissolved Arsenic	8921784	8921784	<2	<2	NA	< 2	98%	80%	120%	97%	80%	120%	105%	70%	130%
Dissolved Barium	8921784	8921784	431	419	2.8%	< 5	100%	80%	120%	101%	80%	120%	NA	70%	130%
Dissolved Beryllium	8921784	8921784	<2	<2	NA	< 2	107%	80%	120%	107%	80%	120%	115%	70%	130%
Dissolved Bismuth	8921784	8921784	<2	<2	NA	< 2	106%	80%	120%	110%	80%	120%	NA	70%	130%
Dissolved Boron	8921784	8921784	34	34	0.3%	< 5	104%	80%	120%	96%	80%	120%	105%	70%	130%
Dissolved Cadmium	8921784	8921784	<0.017	<0.017	NA	< 0.017	99%	80%	120%	98%	80%	120%	102%	70%	130%
Dissolved Chromium	8921784	8921784	3	3	NA	< 1	95%	80%	120%	91%	80%	120%	89%	70%	130%
Dissolved Cobalt	8921784	8921784	<1	<1	NA	< 1	98%	80%	120%	97%	80%	120%	95%	70%	130%
Dissolved Copper	8921784	8921784	<2	<2	NA	< 2	100%	80%	120%	102%	80%	120%	100%	70%	130%
Dissolved Iron	8921784	8921784	<50	<50	NA	< 50	94%	80%	120%	94%	80%	120%	76%	70%	130%
Dissolved Lead	8921784	8921784	<0.5	<0.5	NA	< 0.5	104%	80%	120%	103%	80%	120%	97%	70%	130%
Dissolved Manganese	8921784	8921784	72	72	0.0%	< 2	96%	80%	120%	94%	80%	120%	NA	70%	130%
Dissolved Molybdenum	8921784	8921784	<2	<2	NA	< 2	95%	80%	120%	95%	80%	120%	84%	70%	130%
Dissolved Nickel	8921784	8921784	<2	<2	NA	< 2	98%	80%	120%	97%	80%	120%	101%	70%	130%
Dissolved Phosphorus	8921784	8921784	<0.02	<0.02	NA	< 0.02	101%	80%	120%	104%	80%	120%	71%	70%	130%
Dissolved Selenium	8921784	8921784	<1	<1	NA	< 1	99%	80%	120%	98%	80%	120%	102%	70%	130%
Dissolved Silver	8921784	8921784	<0.1	<0.1	NA	< 0.1	99%	80%	120%	102%	80%	120%	95%	70%	130%

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Quality Assurance

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X286210

PROJECT: 278-17

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

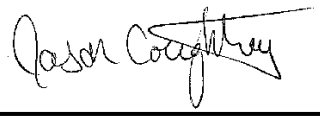
RPT Date:			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Dissolved Strontium	8921784	8921784	633	599	5.5%	< 5	94%	80%	120%	91%	80%	120%	NA	70%	130%
Dissolved Thallium	8921784	8921784	<0.1	<0.1	NA	< 0.1	106%	80%	120%	109%	80%	120%	106%	70%	130%
Dissolved Tin	8921784	8921784	<2	<2	NA	< 2	98%	80%	120%	98%	80%	120%	90%	70%	130%
Dissolved Titanium	8921784	8921784	<2	<2	NA	< 2	104%	80%	120%	103%	80%	120%	89%	70%	130%
Dissolved Uranium	8921784	8921784	2.3	2.3	2.8%	< 0.1	104%	80%	120%	105%	80%	120%	NA	70%	130%
Dissolved Vanadium	8921784	8921784	4	4	NA	< 2	92%	80%	120%	92%	80%	120%	101%	70%	130%
Dissolved Zinc	8921784	8921784	8	7	NA	< 5	97%	80%	120%	101%	80%	120%	116%	70%	130%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

MTL - TOC in Water

Total Organic Carbon	2		NA	NA	NA	< 0.5	NA	80%	120%	92%	80%	120%	NA	80%	120%

Certified By:



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Method Summary

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X286210

PROJECT: 278-17

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Total Coliforms (MPN)	MIC-121-7000	Based on SM 9223B	INCUBATOR
E. Coli (MPN)	MIC-121-7000	Based on SM 9223B	INCUBATOR

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Method Summary

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X286210

PROJECT: 278-17

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Organic Carbon	INOR-101-6049F	MA.300-C1.0	DÉTECTION INFRAROUGE
pH	INOR-121-6001	SM 4500 H+B	PC TITRATE
Reactive Silica as SiO2	INORG-121-6028	SM 4110 B	COLORIMETER
Chloride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Alkalinity	INOR-121-6001	SM 2320 B	
True Color	INORG-121-6014	EPA 110.2	NEPHELOMETER
Turbidity	INOR-121-6022	SM 2130 B	NEPHELOMETER
Electrical Conductivity	INOR-121-6001	SM 2510 B	PC TITRATE
Nitrate + Nitrite as N	INORG-121-6005	SM 4110 B	CALCULATION
Nitrate as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INORG-121-6003	SM 4500-NH3 G	COLORIMETER
Ortho-Phosphate as P	INORG-121-6005	SM 4110 B	COLORIMETER
Dissolved Sodium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Potassium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Calcium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Magnesium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Bicarb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Carb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Hydroxide	INORG-121-6001	SM 2320 B	PC-TITRATE
Calculated TDS	CALCULATION	SM 1030E	CALCULATION
Hardness	CALCULATION	SM 2340B	CALCULATION
Langelier Index (@20C)	CALCULATION	CALCULATION	CALCULATION
Langelier Index (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 20C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Anion Sum	CALCULATION	SM 1030E	CALCULATION
Cation sum	CALCULATION	SM 1030E	CALCULATION
% Difference/ Ion Balance (NS)	CALCULATION	SM 1030E	CALCULATION
Dissolved Aluminum	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Antimony	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Arsenic	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Barium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Beryllium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Bismuth	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Boron	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Cadmium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS

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Method Summary

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X286210

PROJECT: 278-17

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Dissolved Chromium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Cobalt	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Copper	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Iron	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Lead	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Manganese	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Molybdenum	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Nickel	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Phosphorus	MET-121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Selenium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Silver	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Strontium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Thallium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Tin	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Titanium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Uranium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Vanadium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Zinc	MET121-6104 & MET-121-6105	SM 3125	ICP-MS

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Chain of Custody Record

Laboratory Use Only
Arrival Condition: ☐ Good ☐ Poor (see notes)
Arrival Temperature: 8°
Hold Time:
AGAT Job Number: 17X286210
Notes: 100ml- MPN.

Report Information
Company: Roy Consultants
Contact: Gina Burtt
Address: 364 York St Suite 201
Fredericton NB E3B 3P7
Phone: 506 470-7473 Fax:
Client Project #: 278-17
AGAT Quotation: 174907
Please Note: If quotation number is not provided client will be billed full price for analysis.

Report Information (Please print):
1. Name: Gina Burtt
Email: gina.burtt@royconsultants.ca
2. Name: Abram Lee
Email: abram.lee@royconsultants.ca

Report Format
☐ Single Sample per page
☒ Multiple Samples per page
☒ Excel Format Included
☐ Export

Turnaround Time Required (TAT)
Regular TAT ☒ 5 to 7 working days
Rush TAT ☐ Same day ☐ 1 day ☐ 2 days ☐ 3 days
Date Required:

Regulatory Requirements (Check):
☐ List Guidelines on Report ☐ Do not list Guidelines on Report
☐ PIRI
☐ Tier 1 ☐ Res ☐ Pot ☐ Coarse
☐ Tier 2 ☐ Com ☐ N/Pot ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Industrial ☐ NSEQS-Cont Sites
☐ Commercial ☐ HRM 101
☐ Res/Park ☐ Storm Water
☐ Agricultural ☐ Waste Water
☐ FWAL
☐ Sediment ☐ Other

Drinking Water Sample: ☐ Yes ☐ No **Salt Water Sample** ☐ Yes ☐ No
Reg. No.:

Invoice To Same Yes ☒ / No ☐
Company:
Contact:
Address:
Phone: Fax:
PO/Credit Card#:

Sample Identification	Date/Time Sampled	Sample Matrix	# Containers	Comments – Site/Sample Info. Sample Containment
PW-1 24hr	20/11/17, 14:30	Water	3	Murray Corner
TC+EC	Preserved			
Metals	preserved			

Field Filtered/Preserved	Standard Water Analysis	Metals: ☐ Total ☒ Diss ☐ Available	Mercury	☐ BOD ☐ CBOD	pH	☐ TSS ☐ TDS ☐ VSS	TKN	Total Phosphorus	Phenols	Tier 1: TPH/BTEX (PIRI) ☐ low level	Tier 2: TPH/BTEX Fractionation	CCME-CWS TPH/BTEX	VOC	THM	HAA	PAH	PCB	TC + EC ☐ P/A ☒ MPN ☐ MF	☐ HPC ☐ Pseudomonas	Fecal Coliform ☐ MPN ☐ MF	Other:	Other:	Hazardous (Y/N)
	X	X																X					

Samples Relinquished By (Print Name): Abram Lee
Date/Time: 20/11/17 1545
Samples Relinquished By (Sign):
Date/Time: Same
Samples Received By (Print Name): Tania Donald
Date/Time: 21-NOV
Samples Received By (Sign):
Date/Time: 08:25

Pink Copy - Client
Yellow Copy - AGAT
White Copy- AGAT

Page 1 of 1
N°: 57452

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CLIENT NAME: **ROY CONSULTANTS**
548 KING AVE
BATHURST, NB E2A 4Z1
506-546-4484

ATTENTION TO: **GINA BURTT**

PROJECT:

AGAT WORK ORDER: **17X286678**

MICROBIOLOGY ANALYSIS REVIEWED BY: **Laura Baker, Inorganics Data Reporter**

WATER ANALYSIS REVIEWED BY: **Laura Baker, Inorganics Data Reporter**

DATE REPORTED: **Nov 29, 2017**

PAGES (INCLUDING COVER): **11**

VERSION*: **1**

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

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Certificate of Analysis

AGAT WORK ORDER: 17X286678

PROJECT:

CLIENT NAME: ROY CONSULTANTS

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

Total Coliforms and E.coli (MPN)

DATE RECEIVED: 2017-11-22

DATE REPORTED: 2017-11-29

		SAMPLE DESCRIPTION:		PW-1 48hr
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2017-11-21
Parameter	**Unit**	**G / S**	**RDL**	**8924691**
Total Coliforms (MPN)	MPN/100 mL		1	<1
E. Coli (MPN)	MPN/100 mL		1	<1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 17X286678

PROJECT:

CLIENT NAME: ROY CONSULTANTS

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

MTL - TOC in Water

DATE RECEIVED: 2017-11-22

DATE REPORTED: 2017-11-29

		SAMPLE DESCRIPTION:		PW-1 48hr
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2017-11-21
Parameter	Unit	G / S	RDL	8924691
Total Organic Carbon	mg/L		0.5	<0.5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8924691 TOC analysed at AGAT Montreal.

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 17X286678

PROJECT:

CLIENT NAME: ROY CONSULTANTS

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2017-11-22

DATE REPORTED: 2017-11-29

		SAMPLE DESCRIPTION:		PW-1 48hr
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2017-11-21
Parameter	Unit	G / S	RDL	8924691
pH				7.96
Reactive Silica as SiO2	mg/L		0.5	9.0
Chloride	mg/L		1	24
Fluoride	mg/L		0.12	<0.12
Sulphate	mg/L		2	7
Alkalinity	mg/L		5	118
True Color	TCU		5	5
Turbidity	NTU		0.1	1.3
Electrical Conductivity	umho/cm		1	322
Nitrate + Nitrite as N	mg/L		0.05	2.03
Nitrate as N	mg/L		0.05	2.03
Nitrite as N	mg/L		0.05	<0.05
Ammonia as N	mg/L		0.03	0.05
Ortho-Phosphate as P	mg/L		0.01	<0.01
Dissolved Sodium	mg/L		0.1	15.6
Dissolved Potassium	mg/L		0.1	1.5
Dissolved Calcium	mg/L		0.1	42.8
Dissolved Magnesium	mg/L		0.1	3.6
Bicarb. Alkalinity (as CaCO3)	mg/L		5	118
Carb. Alkalinity (as CaCO3)	mg/L		10	<10
Hydroxide	mg/L		5	<5
Calculated TDS	mg/L		1	174
Hardness	mg/L			122
Langelier Index (@20C)	NA			0.05
Langelier Index (@ 4C)	NA			-0.27
Saturation pH (@ 20C)	NA			7.91
Saturation pH (@ 4C)	NA			8.23
Anion Sum	me/L			3.33
Cation sum	me/L			3.16
% Difference/ Ion Balance (NS)	%			2.6

Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 17X286678

PROJECT:

CLIENT NAME: ROY CONSULTANTS

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2017-11-22

DATE REPORTED: 2017-11-29

		SAMPLE DESCRIPTION:		PW-1 48hr
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2017-11-21
Parameter	Unit	G / S	RDL	8924691
Dissolved Aluminum	ug/L		5	11
Dissolved Antimony	ug/L		2	<2
Dissolved Arsenic	ug/L		2	<2
Dissolved Barium	ug/L		5	421
Dissolved Beryllium	ug/L		2	<2
Dissolved Bismuth	ug/L		2	<2
Dissolved Boron	ug/L		5	32
Dissolved Cadmium	ug/L		0.017	<0.017
Dissolved Chromium	ug/L		1	3
Dissolved Cobalt	ug/L		1	<1
Dissolved Copper	ug/L		2	<2
Dissolved Iron	ug/L		50	<50
Dissolved Lead	ug/L		0.5	<0.5
Dissolved Manganese	ug/L		2	22
Dissolved Molybdenum	ug/L		2	<2
Dissolved Nickel	ug/L		2	<2
Dissolved Phosphorus	mg/L		0.02	<0.02
Dissolved Selenium	ug/L		1	<1
Dissolved Silver	ug/L		0.1	<0.1
Dissolved Strontium	ug/L		5	583
Dissolved Thallium	ug/L		0.1	<0.1
Dissolved Tin	ug/L		2	<2
Dissolved Titanium	ug/L		2	<2
Dissolved Uranium	ug/L		0.1	2.2
Dissolved Vanadium	ug/L		2	4
Dissolved Zinc	ug/L		5	9

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8924691 Metals analysis completed on a filtered sample.

Certified By:

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Quality Assurance

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X286678

PROJECT:

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Nov 29, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Standard Water Analysis + Dissolved Metals															
pH	8922706		7.11	7.13	0.3%	<	102%	80%	120%	NA	80%	120%	NA	80%	120%
Reactive Silica as SiO2	1	8923613	17.7	18.3	3.3%	< 0.5	114%	80%	120%		80%	120%	107%	80%	120%
Chloride	8924691	8924691	24	24	0.7%	< 1	97%	80%	120%	NA	80%	120%	NA	80%	120%
Fluoride	8924691	8924691	<0.12	<0.12	NA	< 0.12	111%	80%	120%	NA	80%	120%	104%	80%	120%
Sulphate	8924691	8924691	7	7	NA	< 2	111%	80%	120%	NA	80%	120%	93%	80%	120%
Alkalinity	8922706		93	93	0.6%	< 5	100%	80%	120%	NA	80%	120%	NA	80%	120%
True Color	8923386		13	11	NA	< 5	120%	80%	120%	NA			NA		
Turbidity	8923386		47.4	48.4	2.1%	< 0.1	99%	80%	120%	NA			NA		
Electrical Conductivity	8922706		191	191	0.1%	< 1	102%	80%	120%	NA	80%	120%	NA	80%	120%
Nitrate as N	8924691	8924691	2.03	1.99	2.0%	< 0.05	98%	80%	120%	NA	80%	120%	NA	80%	120%
Nitrite as N	8924691	8924691	<0.05	<0.05	NA	< 0.05	95%	80%	120%	NA	80%	120%	103%	80%	120%
Ammonia as N	1	8923613	0.06	0.11	NA	< 0.03	118%	80%	120%		80%	120%	120%	80%	120%
Ortho-Phosphate as P	1	8916528	<0.01	<0.01	NA	< 0.01	103%	80%	120%		80%	120%	111%	80%	120%
Dissolved Sodium	8924691	8924691	15.6	15.5	0.7%	< 0.1	102%	80%	120%	104%	80%	120%	NA	70%	130%
Dissolved Potassium	8924691	8924691	1.5	1.5	0.5%	< 0.1	104%	80%	120%	102%	80%	120%	NA	70%	130%
Dissolved Calcium	8924691	8924691	42.8	44.7	4.5%	< 0.1	103%	80%	120%	100%	80%	120%	NA	70%	130%
Dissolved Magnesium	8924691	8924691	3.6	3.7	1.5%	< 0.1	104%	80%	120%	104%	80%	120%	NA	70%	130%
Bicarb. Alkalinity (as CaCO3)	8922706		93	93	0.6%	< 5	NA	80%	120%	NA	80%	120%	NA	80%	120%
Carb. Alkalinity (as CaCO3)	8922706		<10	<10	NA	< 10	NA	80%	120%	NA	80%	120%	NA	80%	120%
Hydroxide	8922706		<5	<5	NA	< 5	NA	80%	120%	NA	80%	120%	NA	80%	120%
Dissolved Aluminum	8924691	8924691	11	5	NA	< 5	104%	80%	120%	101%	80%	120%	88%	70%	130%
Dissolved Antimony	8924691	8924691	<2	<2	NA	< 2	90%	80%	120%	97%	80%	120%	103%	70%	130%
Dissolved Arsenic	8924691	8924691	<2	<2	NA	< 2	96%	80%	120%	97%	80%	120%	115%	70%	130%
Dissolved Barium	8924691	8924691	421	424	0.8%	< 5	99%	80%	120%	99%	80%	120%	NA	70%	130%
Dissolved Beryllium	8924691	8924691	<2	<2	NA	< 2	107%	80%	120%	109%	80%	120%	118%	70%	130%
Dissolved Bismuth	8924691	8924691	<2	<2	NA	< 2	104%	80%	120%	108%	80%	120%	78%	70%	130%
Dissolved Boron	8924691	8924691	32	33	3.4%	< 5	103%	80%	120%	107%	80%	120%	112%	70%	130%
Dissolved Cadmium	8924691	8924691	<0.017	<0.017	NA	< 0.017	96%	80%	120%	95%	80%	120%	103%	70%	130%
Dissolved Chromium	8924691	8924691	3	3	NA	< 1	99%	80%	120%	100%	80%	120%	85%	70%	130%
Dissolved Cobalt	8924691	8924691	<1	<1	NA	< 1	100%	80%	120%	100%	80%	120%	98%	70%	130%
Dissolved Copper	8924691	8924691	<2	<2	NA	< 2	102%	80%	120%	103%	80%	120%	91%	70%	130%
Dissolved Iron	8924691	8924691	<50	<50	NA	< 50	101%	80%	120%	103%	80%	120%	88%	70%	130%
Dissolved Lead	8924691	8924691	<0.5	<0.5	NA	< 0.5	102%	80%	120%	101%	80%	120%	95%	70%	130%
Dissolved Manganese	8924691	8924691	22	22	1.5%	< 2	98%	80%	120%	98%	80%	120%	NA	70%	130%
Dissolved Molybdenum	8924691	8924691	<2	<2	NA	< 2	96%	80%	120%	97%	80%	120%	83%	70%	130%
Dissolved Nickel	8924691	8924691	<2	<2	NA	< 2	100%	80%	120%	100%	80%	120%	96%	70%	130%
Dissolved Phosphorus	8924691	8924691	<0.02	<0.02	NA	< 0.02	106%	80%	120%	97%	80%	120%	70%	70%	130%
Dissolved Selenium	8924691	8924691	<1	1	NA	< 1	97%	80%	120%	96%	80%	120%	113%	70%	130%
Dissolved Silver	8924691	8924691	<0.1	<0.1	NA	< 0.1	97%	80%	120%	98%	80%	120%	91%	70%	130%

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Quality Assurance

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X286678

PROJECT:

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date: Nov 29, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Dissolved Strontium	8924691	8924691	583	601	3.1%	< 5	94%	80%	120%	93%	80%	120%	NA	70%	130%
Dissolved Thallium	8924691	8924691	<0.1	<0.1	NA	< 0.1	104%	80%	120%	106%	80%	120%	103%	70%	130%
Dissolved Tin	8924691	8924691	<2	<2	NA	< 2	94%	80%	120%	96%	80%	120%	93%	70%	130%
Dissolved Titanium	8924691	8924691	<2	<2	NA	< 2	101%	80%	120%	101%	80%	120%	87%	70%	130%
Dissolved Uranium	8924691	8924691	2.2	2.2	1.4%	< 0.1	101%	80%	120%	101%	80%	120%	NA	70%	130%
Dissolved Vanadium	8924691	8924691	4	4	NA	< 2	93%	80%	120%	94%	80%	120%	98%	70%	130%
Dissolved Zinc	8924691	8924691	9	6	NA	< 5	104%	80%	120%	107%	80%	120%	112%	70%	130%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

MTL - TOC in Water

Total Organic Carbon	8932716		7.2	7.0	1.9%	< 0.5	NA	80%	120%	94%	80%	120%	NA	80%	120%

Certified By:

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Method Summary

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X286678

PROJECT:

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Total Coliforms (MPN)	MIC-121-7000	Based on SM 9223B	INCUBATOR
E. Coli (MPN)	MIC-121-7000	Based on SM 9223B	INCUBATOR

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Method Summary

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X286678

PROJECT:

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Organic Carbon	INOR-101-6049F	MA.300-C1.0	DÉTECTION INFRAROUGE
pH	INOR-121-6001	SM 4500 H+B	PC TITRATE
Reactive Silica as SiO2	INORG-121-6028	SM 4110 B	COLORIMETER
Chloride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Alkalinity	INOR-121-6001	SM 2320 B	
True Color	INORG-121-6014	EPA 110.2	NEPHELOMETER
Turbidity	INOR-121-6022	SM 2130 B	NEPHELOMETER
Electrical Conductivity	INOR-121-6001	SM 2510 B	PC TITRATE
Nitrate + Nitrite as N	INORG-121-6005	SM 4110 B	CALCULATION
Nitrate as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INORG-121-6003	SM 4500-NH3 G	COLORIMETER
Ortho-Phosphate as P	INORG-121-6005	SM 4110 B	COLORIMETER
Dissolved Sodium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Potassium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Calcium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Magnesium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Bicarb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Carb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Hydroxide	INORG-121-6001	SM 2320 B	PC-TITRATE
Calculated TDS	CALCULATION	SM 1030E	CALCULATION
Hardness	CALCULATION	SM 2340B	CALCULATION
Langelier Index (@20C)	CALCULATION	CALCULATION	CALCULATION
Langelier Index (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 20C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Anion Sum	CALCULATION	SM 1030E	CALCULATION
Cation sum	CALCULATION	SM 1030E	CALCULATION
% Difference/ Ion Balance (NS)	CALCULATION	SM 1030E	CALCULATION
Dissolved Aluminum	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Antimony	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Arsenic	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Barium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Beryllium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Bismuth	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Boron	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Cadmium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS

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Method Summary

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X286678

PROJECT:

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Dissolved Chromium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Cobalt	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Copper	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Iron	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Lead	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Manganese	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Molybdenum	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Nickel	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Phosphorus	MET-121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Selenium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Silver	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Strontium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Thallium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Tin	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Titanium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Uranium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Vanadium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Zinc	MET121-6104 & MET-121-6105	SM 3125	ICP-MS

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Chain of Custody Record

Laboratory Use Only
Arrival Condition: ☐ Good ☐ Poor (see notes)
Arrival Temperature: 4°
Hold Time:
AGAT Job Number: 17X286678
Notes: 100ml - MPN.

Report Information
Company: ROY CONSULTANTS
Contact: GINA BURTT
Address: 364 YORK ST SUITE 201
FREDERICTON NB E3B 3P7
Phone: 506 470-7473 Fax:
Client Project #:
AGAT Quotation:
Please Note: If quotation number is not provided client will be billed full price for analysis.

Report Information (Please print):
1. Name: GINA BURTT
Email: gina.burtt@royconsultants.ca
2. Name: ABRAM LEE
Email: abram.lee@royconsultants.ca

Report Format
☐ Single Sample per page
☒ Multiple Samples per page
☒ Excel Format Included
☐ Export

Turnaround Time Required (TAT)
Regular TAT ☒ 5 to 7 working days
Rush TAT ☐ Same day ☐ 1 day ☐ 2 days ☐ 3 days
Date Required:

Invoice To Same Yes ☒ / No ☐
Company:
Contact:
Address:
Phone: Fax:
PO/Credit Card#:

Regulatory Requirements (Check):
☐ List Guidelines on Report ☐ Do not list Guidelines on Report
☐ PIRI
☐ Tier 1 ☐ Res ☐ Pot ☐ Coarse
☐ Tier 2 ☐ Com ☐ N/Pot ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Industrial ☐ NSEQS-Cont Sites
☐ Commercial ☐ HRM 101
☐ Res/Park ☐ Storm Water
☐ Agricultural ☐ Waste Water
☐ FWAL
☐ Sediment ☐ Other

Drinking Water Sample: ☐ Yes ☐ No **Salt Water Sample** ☐ Yes ☐ No
Reg. No.:

Sample Identification	Date/Time Sampled	Sample Matrix	# Containers	Comments – Site/Sample Info. Sample Containment
PW1 48hr	21/11/17 14:30	Water	3	MURRAY CORNER
TC+ EC PRESERVED				
METALS PRESERVED				

Field Filtered/Preserved	Standard Water Analysis	Metals: ☐ Total ☒ Diss ☐ Available	Mercury	☐ BOD ☐ CBOD	pH	☐ TSS ☐ TDS ☐ VSS	TKN	Total Phosphorus	Phenols	Tier 1: TPH/BTEX (PIRI) ☐ low level	Tier 2: TPH/BTEX Fractionation	CCME-CWS TPH/BTEX	VOC	THM	HAA	PAH	PCB	TC + EC ☐ P/A ☒ MPN ☐ MF	☐ HPC ☐ Pseudomonas	Fecal Coliform ☐ MPN ☐ MF	Other:	Other:	Hazardous (Y/N)
	X	X																X				

Samples Relinquished By (Print Name):	Date/Time	Samples Received By (Print Name):	Date/Time
ABRAM LEE	21/11/17	TMcDonald	22-NOV
Samples Relinquished By (Sign):	**Date/Time**	**Samples Received By (Sign):**	**Date/Time**
	1545		08:45

Pink Copy - Client
Yellow Copy - AGAT
White Copy- AGAT

Page 1 of 1
N°: 57453

AGAT Laboratories

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CLIENT NAME: ROY CONSULTANTS
548 KING AVE
BATHURST, NB E2A 4Z1
506-546-4484

ATTENTION TO: GINA BURTT

PROJECT: 278-17

AGAT WORK ORDER: 17X287561

MICROBIOLOGY ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganics Supervisor

WATER ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganics Supervisor

DATE REPORTED: Dec 01, 2017

PAGES (INCLUDING COVER): 11

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 17X287561

PROJECT: 278-17

CLIENT NAME: ROY CONSULTANTS

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

Total Coliforms and E.coli (MPN)

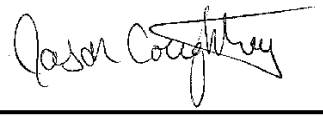
DATE RECEIVED: 2017-11-23

DATE REPORTED: 2017-12-01

		SAMPLE DESCRIPTION:		PW-1 69hr
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2017-11-22
Parameter	**Unit**	**G / S**	**RDL**	**8929649**
Total Coliforms (MPN)	MPN/100 mL		1	<1
E. Coli (MPN)	MPN/100 mL		1	<1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 17X287561

PROJECT: 278-17

CLIENT NAME: ROY CONSULTANTS

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

MTL - TOC in Water

DATE RECEIVED: 2017-11-23

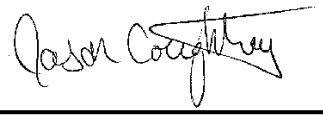
DATE REPORTED: 2017-12-01

		SAMPLE DESCRIPTION:		PW-1 69hr
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2017-11-22
Parameter	**Unit**	**G / S**	**RDL**	**8929649**
Total Organic Carbon	mg/L		0.5	<0.5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8929649 TOC analysed at AGAT Montreal.

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 17X287561

PROJECT: 278-17

CLIENT NAME: ROY CONSULTANTS

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

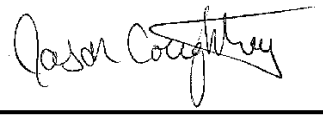
Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2017-11-23

DATE REPORTED: 2017-12-01

		SAMPLE DESCRIPTION:		PW-1 69hr
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2017-11-22
Parameter	Unit	G / S	RDL	8929649
pH				8.09
Reactive Silica as SiO2	mg/L		0.5	11.7
Chloride	mg/L		1	25
Fluoride	mg/L		0.12	<0.12
Sulphate	mg/L		2	7
Alkalinity	mg/L		5	118
True Color	TCU		5	14
Turbidity	NTU		0.1	0.8
Electrical Conductivity	umho/cm		1	332
Nitrate + Nitrite as N	mg/L		0.05	1.91
Nitrate as N	mg/L		0.05	1.91
Nitrite as N	mg/L		0.05	<0.05
Ammonia as N	mg/L		0.03	<0.03
Ortho-Phosphate as P	mg/L		0.01	<0.01
Dissolved Sodium	mg/L		0.1	17.7
Dissolved Potassium	mg/L		0.1	1.7
Dissolved Calcium	mg/L		0.1	43.7
Dissolved Magnesium	mg/L		0.1	4.1
Bicarb. Alkalinity (as CaCO3)	mg/L		5	118
Carb. Alkalinity (as CaCO3)	mg/L		10	<10
Hydroxide	mg/L		5	<5
Calculated TDS	mg/L		1	178
Hardness	mg/L			126
Langelier Index (@20C)	NA			0.19
Langelier Index (@ 4C)	NA			-0.13
Saturation pH (@ 20C)	NA			7.90
Saturation pH (@ 4C)	NA			8.22
Anion Sum	me/L			3.35
Cation sum	me/L			3.33
% Difference/ Ion Balance (NS)	%			0.2

Certified By:



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TEL (902)468-8718
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Certificate of Analysis

AGAT WORK ORDER: 17X287561

PROJECT: 278-17

CLIENT NAME: ROY CONSULTANTS

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2017-11-23

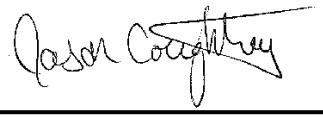
DATE REPORTED: 2017-12-01

		SAMPLE DESCRIPTION:		PW-1 69hr
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2017-11-22
Parameter	Unit	G / S	RDL	8929649
Dissolved Aluminum	ug/L		5	<5
Dissolved Antimony	ug/L		2	<2
Dissolved Arsenic	ug/L		2	<2
Dissolved Barium	ug/L		5	413
Dissolved Beryllium	ug/L		2	<2
Dissolved Bismuth	ug/L		2	<2
Dissolved Boron	ug/L		5	28
Dissolved Cadmium	ug/L		0.017	<0.017
Dissolved Chromium	ug/L		1	<1
Dissolved Cobalt	ug/L		1	<1
Dissolved Copper	ug/L		2	<2
Dissolved Iron	ug/L		50	<50
Dissolved Lead	ug/L		0.5	<0.5
Dissolved Manganese	ug/L		2	21
Dissolved Molybdenum	ug/L		2	<2
Dissolved Nickel	ug/L		2	<2
Dissolved Phosphorus	mg/L		0.02	<0.02
Dissolved Selenium	ug/L		1	<1
Dissolved Silver	ug/L		0.1	<0.1
Dissolved Strontium	ug/L		5	521
Dissolved Thallium	ug/L		0.1	<0.1
Dissolved Tin	ug/L		2	<2
Dissolved Titanium	ug/L		2	<2
Dissolved Uranium	ug/L		0.1	2.1
Dissolved Vanadium	ug/L		2	4
Dissolved Zinc	ug/L		5	<5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8929649 Metals analysis completed on a filtered sample.

Certified By:



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Quality Assurance

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X287561

PROJECT: 278-17

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Dec 01, 2017

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Standard Water Analysis + Dissolved Metals															
pH	8929720		7.99	8.06	0.9%	<	102%	80%	120%	NA	80%	120%	NA	80%	120%
Reactive Silica as SiO2	1	8916529	4.2	5.2	21.3%	< 0.5	120%	80%	120%		80%	120%	105%	80%	120%
Chloride	8929649	8929649	25	24	2.3%	< 1	100%	80%	120%	NA	80%	120%	NA	80%	120%
Fluoride	8929649	8929649	<0.12	<0.12	NA	< 0.12	113%	80%	120%	NA	80%	120%	105%	80%	120%
Sulphate	8929649	8929649	7	7	NA	< 2	112%	80%	120%	NA	80%	120%	93%	80%	120%
Alkalinity	8929720		170	170	0.1%	< 5	102%	80%	120%	NA	80%	120%	NA	80%	120%
True Color	8927417		26	22	NA	< 5	115%	80%	120%	NA			NA		
Turbidity	8927417		93.9	94.4	0.5%	< 0.1	99%	80%	120%	NA			NA		
Electrical Conductivity	8929720		915	916	0.1%	< 1	105%	80%	120%	NA	80%	120%	NA	80%	120%
Nitrate as N	8929649	8929649	1.91	1.85	3.0%	< 0.05	101%	80%	120%	NA	80%	120%	NA	80%	120%
Nitrite as N	8929649	8929649	<0.05	<0.05	NA	< 0.05	97%	80%	120%	NA	80%	120%	101%	80%	120%
Ammonia as N	1	8929649	<0.03	<0.03	NA	< 0.03	99%	80%	120%		80%	120%	88%	80%	120%
Ortho-Phosphate as P	1	8916529	<0.01	<0.01	NA	< 0.01	102%	80%	120%		80%	120%	103%	80%	120%
Dissolved Sodium	8929649	8929649	17.7	14.9	17.1%	< 0.1	105%	80%	120%	104%	80%	120%	NA	70%	130%
Dissolved Potassium	8929649	8929649	1.7	1.6	6.4%	< 0.1	105%	80%	120%	106%	80%	120%	NA	70%	130%
Dissolved Calcium	8929649	8929649	43.7	42.2	3.5%	< 0.1	103%	80%	120%	103%	80%	120%	NA	70%	130%
Dissolved Magnesium	8929649	8929649	4.1	3.7	11.4%	< 0.1	105%	80%	120%	106%	80%	120%	NA	70%	130%
Bicarb. Alkalinity (as CaCO3)	8929720		170	170	0.1%	< 5	NA	80%	120%	NA	80%	120%	NA	80%	120%
Carb. Alkalinity (as CaCO3)	8929720		<10	<10	NA	< 10	NA	80%	120%	NA	80%	120%	NA	80%	120%
Hydroxide	8929720		<5	<5	NA	< 5	NA	80%	120%	NA	80%	120%	NA	80%	120%
Dissolved Aluminum	8929649	8929649	<5	<5	NA	< 5	105%	80%	120%	107%	80%	120%	92%	70%	130%
Dissolved Antimony	8929649	8929649	<2	<2	NA	< 2	92%	80%	120%	101%	80%	120%	101%	70%	130%
Dissolved Arsenic	8929649	8929649	<2	<2	NA	< 2	99%	80%	120%	98%	80%	120%	101%	70%	130%
Dissolved Barium	8929649	8929649	413	406	1.8%	< 5	100%	80%	120%	100%	80%	120%	NA	70%	130%
Dissolved Beryllium	8929649	8929649	<2	<2	NA	< 2	109%	80%	120%	111%	80%	120%	113%	70%	130%
Dissolved Bismuth	8929649	8929649	<2	<2	NA	< 2	106%	80%	120%	108%	80%	120%	NA	70%	130%
Dissolved Boron	8929649	8929649	35	33	7.8%	< 5	104%	80%	120%	106%	80%	120%	100%	70%	130%
Dissolved Cadmium	8929649	8929649	<0.017	<0.017	NA	< 0.017	98%	80%	120%	99%	80%	120%	102%	70%	130%
Dissolved Chromium	8929649	8929649	2	1	NA	< 1	91%	80%	120%	95%	80%	120%	87%	70%	130%
Dissolved Cobalt	8929649	8929649	2	<1	NA	< 1	96%	80%	120%	99%	80%	120%	82%	70%	130%
Dissolved Copper	8929649	8929649	<2	<2	NA	< 2	99%	80%	120%	99%	80%	120%	101%	70%	130%
Dissolved Iron	8929649	8929649	<50	<50	NA	< 50	90%	80%	120%	95%	80%	120%	73%	70%	130%
Dissolved Lead	8929649	8929649	<0.5	<0.5	NA	< 0.5	100%	80%	120%	100%	80%	120%	88%	70%	130%
Dissolved Manganese	8929649	8929649	21	21	0.0%	< 2	91%	80%	120%	91%	80%	120%	NA	70%	130%
Dissolved Molybdenum	8929649	8929649	<2	<2	NA	< 2	91%	80%	120%	94%	80%	120%	83%	70%	130%
Dissolved Nickel	8929649	8929649	<2	<2	NA	< 2	97%	80%	120%	100%	80%	120%	96%	70%	130%
Dissolved Phosphorus	8929649	8929649	<0.02	<0.02	NA	< 0.02	98%	80%	120%	103%	80%	120%	111%	70%	130%
Dissolved Selenium	8929649	8929649	1	<1	NA	< 1	101%	80%	120%	95%	80%	120%	110%	70%	130%
Dissolved Silver	8929649	8929649	<0.1	<0.1	NA	< 0.1	99%	80%	120%	101%	80%	120%	88%	70%	130%

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Quality Assurance

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X287561

PROJECT: 278-17

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

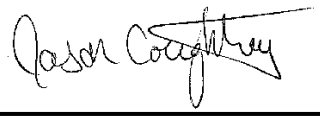
RPT Date: Dec 01, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Dissolved Strontium	8929649	8929649	521	519	0.4%	< 5	87%	80%	120%	88%	80%	120%	NA	70%	130%
Dissolved Thallium	8929649	8929649	<0.1	<0.1	NA	< 0.1	108%	80%	120%	111%	80%	120%	99%	70%	130%
Dissolved Tin	8929649	8929649	<2	<2	NA	< 2	99%	80%	120%	98%	80%	120%	90%	70%	130%
Dissolved Titanium	8929649	8929649	<2	<2	NA	< 2	105%	80%	120%	106%	80%	120%	92%	70%	130%
Dissolved Uranium	8929649	8929649	2.2	2.2	0.2%	< 0.1	105%	80%	120%	106%	80%	120%	NA	70%	130%
Dissolved Vanadium	8929649	8929649	4	4	NA	< 2	90%	80%	120%	92%	80%	120%	96%	70%	130%
Dissolved Zinc	8929649	8929649	<5	<5	NA	< 5	95%	80%	120%	98%	80%	120%	116%	70%	130%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

MTL - TOC in Water

Total Organic Carbon	8932716		7.2	7.0	1.9%	< 0.5	NA	80%	120%	94%	80%	120%	NA	80%	120%

Certified By:



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Method Summary

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X287561

PROJECT: 278-17

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Total Coliforms (MPN)	MIC-121-7000	Based on SM 9223B	INCUBATOR
E. Coli (MPN)	MIC-121-7000	Based on SM 9223B	INCUBATOR

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Method Summary

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X287561

PROJECT: 278-17

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Organic Carbon	INOR-101-6049F	MA.300-C1.0	DÉTECTION INFRAROUGE
pH	INOR-121-6001	SM 4500 H+B	PC TITRATE
Reactive Silica as SiO2	INORG-121-6028	SM 4110 B	COLORIMETER
Chloride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Alkalinity	INOR-121-6001	SM 2320 B	
True Color	INORG-121-6014	EPA 110.2	NEPHELOMETER
Turbidity	INOR-121-6022	SM 2130 B	NEPHELOMETER
Electrical Conductivity	INOR-121-6001	SM 2510 B	PC TITRATE
Nitrate + Nitrite as N	INORG-121-6005	SM 4110 B	CALCULATION
Nitrate as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INORG-121-6003	SM 4500-NH3 G	COLORIMETER
Ortho-Phosphate as P	INORG-121-6005	SM 4110 B	COLORIMETER
Dissolved Sodium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Potassium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Calcium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Magnesium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Bicarb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Carb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Hydroxide	INORG-121-6001	SM 2320 B	PC-TITRATE
Calculated TDS	CALCULATION	SM 1030E	CALCULATION
Hardness	CALCULATION	SM 2340B	CALCULATION
Langelier Index (@20C)	CALCULATION	CALCULATION	CALCULATION
Langelier Index (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 20C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Anion Sum	CALCULATION	SM 1030E	CALCULATION
Cation sum	CALCULATION	SM 1030E	CALCULATION
% Difference/ Ion Balance (NS)	CALCULATION	SM 1030E	CALCULATION
Dissolved Aluminum	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Antimony	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Arsenic	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Barium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Beryllium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Bismuth	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Boron	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Cadmium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS

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Method Summary

CLIENT NAME: ROY CONSULTANTS

AGAT WORK ORDER: 17X287561

PROJECT: 278-17

ATTENTION TO: GINA BURTT

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Dissolved Chromium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Cobalt	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Copper	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Iron	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Lead	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Manganese	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Molybdenum	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Nickel	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Phosphorus	MET-121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Selenium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Silver	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Strontium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Thallium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Tin	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Titanium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Uranium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Vanadium	MET121-6104 & MET-121-6105	SM 3125	ICP-MS
Dissolved Zinc	MET121-6104 & MET-121-6105	SM 3125	ICP-MS

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Chain of Custody Record

Laboratory Use Only
Arrival Condition: ☐ Good ☐ Poor (see notes)
Arrival Temperature: 5°
Hold Time:
AGAT Job Number: 17X287561
Notes: 100mls - MPN

Report Information
Company: ROY CONSULTANTS
Contact: GINA BURTT
Address: 364 YORK ST SUITE 201
FREDERICTON NB E3B 3P7
Phone: 506 470-7473 Fax:
Client Project #: 278-17
AGAT Quotation: 174907
Please Note: If quotation number is not provided client will be billed full price for analysis.

Report Information (Please print):
1. Name: GINA BURTT
Email: gina.burtt@royconsultants.ca
2. Name: ABRAM LEE
Email: abram.lee@royconsultants.ca

Report Format
☐ Single Sample per page
☒ Multiple Samples per page
☒ Excel Format Included
☐ Export

Turnaround Time Required (TAT)
Regular TAT ☒ 5 to 7 working days
Rush TAT ☐ Same day ☐ 1 day ☐ 2 days ☐ 3 days
Date Required:

Invoice To Same Yes ☒ / No ☐
Company:
Contact:
Address:
Phone: Fax:
PO/Credit Card#:

Regulatory Requirements (Check):
☐ List Guidelines on Report ☐ Do not list Guidelines on Report
☐ PIRI
☐ Tier 1 ☐ Res ☐ Pot ☐ Coarse
☐ Tier 2 ☐ Com ☐ N/Pot ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Industrial ☐ NSEQS-Cont Sites
☐ Commercial ☐ HRM 101
☐ Res/Park ☐ Storm Water
☐ Agricultural ☐ Waste Water
☐ FWAL
☐ Sediment ☐ Other

Drinking Water Sample: ☐ Yes ☐ No **Salt Water Sample** ☐ Yes ☐ No
Reg. No.:

Sample Identification	Date/Time Sampled	Sample Matrix	# Containers	Comments – Site/Sample Info, Sample Containment	Field Filtered/Preserved	Standard Water Analysis	Metals: ☐ Total ☒ Diss ☐ Available	Mercury	☐ BOD ☐ CBOD	pH	☐ TSS ☐ TDS ☐ VSS	TKN	Total Phosphorus	Phenols	Tier 1: TPH/BTEX (PIRI) ☐ low level	Tier 2: TPH/BTEX Fractionation	CCME-CWS TPH/BTEX	VOC	THM	HAA	PAH	PCB	TC + EC ☐ P/A ☒ MPN ☐ MF	☐ HPC ☐ Pseudomonas	Fecal Coliform ☐ MPN ☐ MF	Other:	Other:	Hazardous (Y/N)
PW-1	22/11/17 11:45	water	3	Murray Corner		X	X																X				
TCHEC PRESERVED																											
METALS PRESERVED.																											

Samples Relinquished By (Print Name): ABRAM LEE
Date/Time: 22/11/17
Samples Relinquished By (Sign):
Date/Time: 1240
Samples Received By (Print Name): TimMacDonald
Date/Time: 23-NOV
Samples Received By (Sign):
Date/Time: 08:45

Pink Copy - Client
Yellow Copy - AGAT
White Copy - AGAT

Page 1 of 1
N°: 57454

APPENDIX F

Environment Canada Daily Data Report and Tide Tables

Daily Data Report for November 2017

MONCTON INTL A
NEW BRUNSWICK

Latitude:	46°06'44.000" N
Longitude:	64°40'43.000" W
Elevation:	70.70 m
Climate ID:	8103201
WMO ID:	71705
TC ID:	YQM

	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days	Cool Deg Days	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's deg	Spd of Max Gust km/h
DAY											
01 ‡	10.0	-0.8	4.6	13.4	0.0	0.0	0.0	0.0		23	43
02 ‡	14.5	1.5	8.0	10.0	0.0	0.2	0.0	0.2		15	39
03 ‡	19.7	5.8	12.8	5.2	0.0	9.2	0.0	9.2		20	61
04 ‡	8.7	-2.5	3.1	14.9	0.0	0.0	0.0	0.0		32	50
05 ‡	11.9	-3.5	4.2	13.8	0.0	0.0	0.0	0.0		17	59
06 ‡	19.8	2.3	11.1	6.9	0.0	23.0	0.0	23.0		21	72
07 ‡	5.2	-0.4	2.4	15.6	0.0	0.2	0.4	1.4		32	33
08 ‡	M	-1.2E	M	M	M	0.0	0.0	0.0		1	33
09 ‡	6.0	-3.4	1.3	16.7	0.0	0.0	0.0	0.0		24	20
10 ‡	10.3	-6.9	1.7	16.3	0.0	4.2	0.2	4.2		25	69
11 ‡	1.5	-7.2	-2.9	20.9	0.0	0.0	0.0	0.0		24	57
12 ‡	-0.3	-9.0	-4.7	22.7	0.0	0.0	0.0	0.0		28	26
13 ‡	4.6	-9.0	-2.2	20.2	0.0	0.0	0.0	0.0		21	15

	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days	Cool Deg Days	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's deg	Spd of Max Gust km/h
14 ‡	3.5	0.1	1.8	16.2	0.0	T	0.0	T		1	50
15 ‡	1.5	-2.8	-0.7	18.7	0.0	T	0.0	T		35	24
16 ‡	5.8	-3.3	1.3	16.7	0.0	4.8	0.0	4.8		7	44
17 ‡	7.7	-2.2	2.8	15.2	0.0	4.5	0.5	5.0		28	59
18 ‡	2.2	-3.9	-0.9	18.9	0.0	0.0	0.0	0.0		26	48
19 ‡	14.8	-0.1	7.4	10.6	0.0	9.8	0.0	9.8		26	57
20 ‡	1.2	-8.0	-3.4	21.4	0.0	0.0	0.0	0.0		25	56
21 ‡	6.5	-9.7	-1.6	19.6	0.0	0.0	0.0	0.0		24	50
22 ‡	14.4	3.2	8.8	9.2	0.0	36.8	0.0	36.8		34	56
23 ‡	3.4	-4.5	-0.6	18.6	0.0	3.6	1.8	5.8	2	28	63
24 ‡	4.4	-4.2	0.1	17.9	0.0	0.0	0.0	0.0	1	26	39
25 ‡	12.7	3.8	8.3	9.7	0.0	0.0	0.0	0.0		21	56
26 ‡	6.5	-4.4	1.1	16.9	0.0	4.5	0.3	4.7	T	29	59
27 ‡	-1.9	-8.1	-5.0	23.0	0.0	0.2	T	0.2	T	25	48
28 ‡	3.2	-10.6	-3.7	21.7	0.0	0.0	0.0	0.0		20	44
29 ‡	10.1	-3.7	3.2	14.8	0.0	0.8	0.0	0.8		23	56
30 ‡	1.5	-6.4	-2.5	20.5	0.0	0.0	0.0	0.0		29	28
Sum				466.2^	0.0^	101.8	3.2	105.9			
Avg	7.2^	-3.3	1.9^								
Xtrm	19.8^	-10.6								21	72

Summary, average and extreme values are based on the data above.

Legend

- A = Accumulated
- C = Precipitation occurred, amount uncertain
- E = Estimated
- F = Accumulated and estimated
- L = Precipitation may or may not have occurred
- M = Missing
- N = Temperature missing but known to be > 0

- S = More than one occurrence
- T = Trace
- Y = Temperature missing but known to be < 0

CAPE TORMENTINE AST Z+4 — 2017 — TIDE TABLES

January-janvier

Day	Time	Metres	Feet	jour	heure	mètres	pieds
1	0013	**2.2**	7.2	**16**	0111	**2.3**	7.5
	0733	**0.8**	2.6		0808	**0.6**	2.0
SU	1420	**2.0**	6.6	MO	1446	**2.1**	6.9
DI	1943	**1.6**	5.2	LU	2042	**1.1**	3.6
2	0056	**2.2**	7.2	**17**	0203	**2.2**	7.2
	0807	**0.9**	3.0		0849	**0.7**	2.3
MO	1450	**2.1**	6.9	TU	1522	**2.1**	6.9
LU	2027	**1.5**	4.9	MA	2126	**1.1**	3.6
3	0143	**2.2**	7.2	**18**	0253	**2.1**	6.9
	0844	**0.9**	3.0		0927	**0.9**	3.0
TU	1523	**2.1**	6.9	WE	1553	**2.0**	6.6
MA	2115	**1.4**	4.6	ME	2209	**1.1**	3.6
4	0235	**2.1**	6.9	**19**	0345	**2.0**	6.6
	0925	**1.0**	3.3		1003	**1.1**	3.6
WE	1559	**2.1**	6.9	TH	1623	**2.0**	6.6
ME	2207	**1.3**	4.3	JE	2253	**1.1**	3.6
5	0335	**2.0**	6.6	**20**	0444	**1.9**	6.2
	1009	**1.1**	3.6		1040	**1.2**	3.9
TH	1637	**2.2**	7.2	FR	1654	**2.0**	6.6
JE	2303	**1.3**	4.3	VE	2342	**1.1**	3.6
6	0447	**2.0**	6.6	**21**	0552	**1.8**	5.9
	1057	**1.2**	3.9		1124	**1.4**	4.6
FR	1718	**2.2**	7.2	SA	1732	**2.0**	6.6
VE				SA			
7	0004	**1.2**	3.9	**22**	0042	**1.1**	3.6
	0611	**1.9**	6.2		0712	**1.8**	5.9
SA	1150	**1.3**	4.3	SU	1219	**1.5**	4.9
SA	1802	**2.2**	7.2	DI	1819	**2.0**	6.6
8	0110	**1.1**	3.6	**23**	0151	**1.1**	3.6
	0735	**1.9**	6.2		0838	**1.9**	6.2
SU	1248	**1.4**	4.6	MO	1330	**1.6**	5.2
DI	1850	**2.3**	7.5	LU	1913	**2.0**	6.6
9	0215	**0.9**	3.0	**24**	0258	**1.1**	3.6
	0852	**1.9**	6.2		0955	**1.9**	6.2
MO	1352	**1.5**	4.9	TU	1453	**1.7**	5.6
LU	1941	**2.3**	7.5	MA	2009	**2.0**	6.6
10	0315	**0.8**	2.6	**25**	0355	**1.0**	3.3
	0959	**2.0**	6.6		1053	**2.0**	6.6
TU	1459	**1.5**	4.9	WE	1602	**1.7**	5.6
MA	2036	**2.3**	7.5	ME	2102	**2.1**	6.9
11	0410	**0.6**	2.0	**26**	0442	**0.9**	3.0
	1056	**2.1**	6.9		1137	**2.0**	6.6
WE	1607	**1.5**	4.9	TH	1650	**1.7**	5.6
ME	2131	**2.4**	7.9	JE	2151	**2.1**	6.9
12	0501	**0.5**	1.6	**27**	0523	**0.9**	3.0
	1148	**2.1**	6.9		1210	**2.0**	6.6
TH	1710	**1.4**	4.6	FR	1728	**1.6**	5.2
JE	2228	**2.4**	7.9	VE	2237	**2.2**	7.2
13	0550	**0.4**	1.3	**28**	0559	**0.9**	3.0
	1236	**2.2**	7.2		1238	**2.0**	6.6
FR	1808	**1.3**	4.3	SA	1803	**1.6**	5.2
VE	2323	**2.4**	7.9	SA	2323	**2.2**	7.2
14	0637	**0.4**	1.3	**29**	0635	**0.9**	3.0
	1322	**2.2**	7.2		1305	**2.0**	6.6
SA	1903	**1.3**	4.3	SU	1842	**1.5**	4.9
SA				DI			
15	0018	**2.3**	7.5	**30**	0009	**2.3**	7.5
	0724	**0.5**	1.6		0712	**0.9**	3.0
SU	1406	**2.2**	7.2	MO	1335	**2.1**	6.9
DI	1954	**1.2**	3.9	LU	1924	**1.4**	4.6
				31	0058	**2.3**	7.5
					0750	**0.9**	3.0
				TU	1408	**2.1**	6.9
				MA	2009	**1.3**	4.3

February-février

Day	Time	Metres	Feet	jour	heure	mètres	pieds
1	0148	**2.2**	7.2	**16**	0240	**2.1**	6.9
	0829	**0.9**	3.0		0858	**1.1**	3.6
WE	1442	**2.2**	7.2	TH	1501	**2.1**	6.9
ME	2055	**1.2**	3.9	JE	2134	**1.0**	3.3
2	0239	**2.2**	7.2	**17**	0330	**2.0**	6.6
	0909	**1.0**	3.3		0930	**1.2**	3.9
TH	1518	**2.2**	7.2	FR	1528	**2.0**	6.6
JE	2142	**1.1**	3.6	VE	2214	**1.0**	3.3
3	0335	**2.1**	6.9	**18**	0425	**1.9**	6.2
	0950	**1.1**	3.6		1004	**1.4**	4.6
FR	1554	**2.2**	7.2	SA	1557	**2.0**	6.6
VE	2232	**1.1**	3.6	SA	2259	**1.1**	3.6
4	0437	**2.0**	6.6	**19**	0532	**1.9**	6.2
	1032	**1.2**	3.9		1043	**1.5**	4.9
SA	1634	**2.2**	7.2	SU	1631	**2.0**	6.6
SA	2326	**1.0**	3.3	DI	2354	**1.1**	3.6
5	0549	**1.9**	6.2	**20**	0651	**1.8**	5.9
	1118	**1.3**	4.3		1132	**1.6**	5.2
SU	1718	**2.2**	7.2	MO	1715	**2.0**	6.6
DI				LU			
6	0029	**1.0**	3.3	**21**	0102	**1.1**	3.6
	0709	**1.9**	6.2		0822	**1.8**	5.9
MO	1213	**1.4**	4.6	TU	1241	**1.7**	5.6
LU	1810	**2.3**	7.5	MA	1814	**2.0**	6.6
7	0138	**0.9**	3.0	**22**	0217	**1.1**	3.6
	0828	**1.9**	6.2		0943	**1.9**	6.2
TU	1320	**1.5**	4.9	WE	1422	**1.8**	5.9
MA	1910	**2.3**	7.5	ME	1926	**2.0**	6.6
8	0247	**0.8**	2.6	**23**	0320	**1.1**	3.6
	0939	**2.0**	6.6		1030	**1.9**	6.2
WE	1437	**1.5**	4.9	TH	1538	**1.7**	5.6
ME	2015	**2.3**	7.5	JE	2034	**2.0**	6.6
9	0350	**0.7**	2.3	**24**	0409	**1.1**	3.6
	1038	**2.0**	6.6		1057	**2.0**	6.6
TH	1553	**1.5**	4.9	FR	1623	**1.7**	5.6
JE	2119	**2.3**	7.5	VE	2134	**2.1**	6.9
10	0445	**0.6**	2.0	**25**	0451	**1.0**	3.3
	1129	**2.1**	6.9		1120	**2.0**	6.6
FR	1659	**1.4**	4.6	SA	1700	**1.5**	4.9
VE	2220	**2.4**	7.9	SA	2228	**2.2**	7.2
11	0536	**0.5**	1.6	**26**	0530	**1.0**	3.3
	1215	**2.1**	6.9		1145	**2.0**	6.6
SA	1756	**1.3**	4.3	SU	1739	**1.4**	4.6
SA	2318	**2.4**	7.9	DI	2319	**2.3**	7.5
12	0624	**0.5**	1.6	**27**	0609	**1.0**	3.3
	1257	**2.1**	6.9		1215	**2.1**	6.9
SU	1847	**1.2**	3.9	MO	1821	**1.3**	4.3
DI				LU			
13	0012	**2.3**	7.5	**28**	0010	**2.3**	7.5
	0708	**0.6**	2.0		0650	**1.0**	3.3
MO	1334	**2.1**	6.9	TU	1249	**2.1**	6.9
LU	1933	**1.1**	3.6	MA	1904	**1.1**	3.6
14	0103	**2.3**	7.5				
	0748	**0.7**	2.3				
TU	1407	**2.1**	6.9				
MA	2016	**1.0**	3.3				
15	0152	**2.2**	7.2				
	0825	**0.9**	3.0				
WE	1435	**2.1**	6.9				
ME	2056	**1.0**	3.3				

March-mars

Day	Time	Metres	Feet	jour	heure	mètres	pieds
1	0059	**2.3**	7.5	**16**	0141	**2.2**	7.2
	0731	**1.0**	3.3		0756	**1.1**	3.6
WE	1324	**2.2**	7.2	TH	1343	**2.1**	6.9
ME	1948	**1.0**	3.3	JE	2024	**0.9**	3.0
2	0149	**2.3**	7.5	**17**	0228	**2.1**	6.9
	0811	**1.0**	3.3		0829	**1.2**	3.9
TH	1400	**2.2**	7.2	FR	1410	**2.1**	6.9
JE	2032	**1.0**	3.3	VE	2101	**0.9**	3.0
3	0238	**2.2**	7.2	**18**	0318	**2.0**	6.6
	0850	**1.1**	3.6		0902	**1.3**	4.3
FR	1436	**2.2**	7.2	SA	1438	**2.1**	6.9
VE	2115	**0.9**	3.0	SA	2140	**0.9**	3.0
4	0329	**2.1**	6.9	**19**	0413	**1.9**	6.2
	0929	**1.2**	3.9		0936	**1.5**	4.9
SA	1513	**2.2**	7.2	SU	1505	**2.0**	6.6
SA	2200	**0.9**	3.0	DI	2221	**1.0**	3.3
5	0424	**2.0**	6.6	**20**	0517	**1.9**	6.2
	1009	**1.3**	4.3		1012	**1.6**	5.2
SU	1554	**2.2**	7.2	MO	1533	**2.0**	6.6
DI	2251	**0.9**	3.0	LU	2308	**1.1**	3.6
6	0529	**1.9**	6.2	**21**	0631	**1.9**	6.2
	1055	**1.4**	4.6		1054	**1.7**	5.6
MO	1642	**2.2**	7.2	TU	1606	**2.0**	6.6
LU	2352	**0.9**	3.0	MA			
7	0643	**1.9**	6.2	**22**	0005	**1.2**	3.9
	1152	**1.4**	4.6		0750	**1.9**	6.2
TU	1741	**2.2**	7.2	WE	1159	**1.8**	5.9
MA				ME	1701	**1.9**	6.2
8	0105	**0.9**	3.0	**23**	0115	**1.2**	3.9
	0802	**1.9**	6.2		0852	**1.9**	6.2
WE	1305	**1.5**	4.9	TH	1347	**1.8**	5.9
ME	1850	**2.2**	7.2	JE	1842	**1.9**	6.2
9	0221	**0.8**	2.6	**24**	0223	**1.2**	3.9
	0914	**2.0**	6.6		0926	**1.9**	6.2
TH	1429	**1.5**	4.9	FR	1504	**1.7**	5.6
JE	2003	**2.2**	7.2	VE	2014	**2.0**	6.6
10	0330	**0.7**	2.3	**25**	0321	**1.2**	3.9
	1014	**2.0**	6.6		0952	**2.0**	6.6
FR	1545	**1.4**	4.6	SA	1552	**1.5**	4.9
VE	2113	**2.3**	7.5	SA	2124	**2.1**	6.9
11	0428	**0.7**	2.3	**26**	0411	**1.1**	3.6
	1103	**2.1**	6.9		1020	**2.0**	6.6
SA	1648	**1.3**	4.3	SU	1634	**1.4**	4.6
SA	2217	**2.3**	7.5	DI	2223	**2.2**	7.2
12	0519	**0.7**	2.3	**27**	0457	**1.1**	3.6
	1145	**2.1**	6.9		1052	**2.1**	6.9
SU	1740	**1.1**	3.6	MO	1717	**1.2**	3.9
DI	2314	**2.3**	7.5	LU	2317	**2.3**	7.5
13	0605	**0.7**	2.3	**28**	0542	**1.1**	3.6
	1220	**2.1**	6.9		1127	**2.1**	6.9
MO	1826	**1.0**	3.3	TU	1759	**1.0**	3.3
LU				MA			
14	0005	**2.3**	7.5	**29**	0008	**2.3**	7.5
	0646	**0.8**	2.6		0626	**1.1**	3.6
TU	1250	**2.1**	6.9	WE	1204	**2.2**	7.2
MA	1908	**0.9**	3.0	ME	1843	**0.9**	3.0
15	0054	**2.2**	7.2	**30**	0057	**2.3**	7.5
	0723	**1.0**	3.3		0709	**1.1**	3.6
WE	1317	**2.1**	6.9	TH	1241	**2.2**	7.2
ME	1947	**0.9**	3.0	JE	1925	**0.8**	2.6
				31	0145	**2.3**	7.5
					0750	**1.2**	3.9
				FR	1319	**2.2**	7.2
				VE	2007	**0.8**	2.6

TABLE DES MARÉES **2017** **CAPE TORMENTINE** HNA Z+4

April-avril

Day	Time	Metres	Feet	jour	heure	mètres	pieds
1	0233	**2.2**	7.2	**16**	0311	**2.0**	6.6
	0830	**1.2**	3.9		0840	**1.5**	4.9
SA	1357	**2.3**	7.5	SU	1354	**2.1**	6.9
SA	2049	**0.7**	2.3	DI	2111	**0.9**	3.0
2	0321	**2.1**	6.9	**17**	0406	**2.0**	6.6
	0910	**1.3**	4.3		0915	**1.6**	5.2
SU	1438	**2.3**	7.5	MO	1420	**2.0**	6.6
DI	2133	**0.7**	2.3	LU	2147	**1.0**	3.3
3	0413	**2.1**	6.9	**18**	0503	**1.9**	6.2
	0952	**1.3**	4.3		0950	**1.7**	5.6
MO	1523	**2.2**	7.2	TU	1446	**2.0**	6.6
LU	2224	**0.8**	2.6	MA	2224	**1.1**	3.6
4	0513	**2.0**	6.6	**19**	0559	**1.9**	6.2
	1043	**1.4**	4.6		1030	**1.7**	5.6
TU	1617	**2.2**	7.2	WE	1519	**2.0**	6.6
MA	2324	**0.8**	2.6	ME	2309	**1.1**	3.6
5	0622	**1.9**	6.2	**20**	0651	**1.9**	6.2
	1145	**1.4**	4.6		1136	**1.7**	5.6
WE	1721	**2.2**	7.2	TH	1617	**1.9**	6.2
ME				JE			
6	0036	**0.9**	3.0	**21**	0007	**1.2**	3.9
	0735	**1.9**	6.2		0733	**1.9**	6.2
TH	1301	**1.4**	4.6	FR	1308	**1.7**	5.6
JE	1837	**2.1**	6.9	VE	1813	**1.9**	6.2
7	0154	**0.9**	3.0	**22**	0117	**1.3**	4.3
	0843	**2.0**	6.6		0810	**2.0**	6.6
FR	1423	**1.4**	4.6	SA	1425	**1.6**	5.2
VE	1956	**2.1**	6.9	SA	1959	**1.9**	6.2
8	0306	**0.9**	3.0	**23**	0226	**1.3**	4.3
	0941	**2.0**	6.6		0847	**2.0**	6.6
SA	1534	**1.3**	4.3	SU	1521	**1.4**	4.6
SA	2109	**2.2**	7.2	DI	2115	**2.1**	6.9
9	0406	**0.9**	3.0	**24**	0327	**1.3**	4.3
	1026	**2.0**	6.6		0925	**2.1**	6.9
SU	1631	**1.1**	3.6	MO	1610	**1.2**	3.9
DI	2212	**2.2**	7.2	LU	2217	**2.2**	7.2
10	0456	**0.9**	3.0	**25**	0422	**1.2**	3.9
	1102	**2.1**	6.9		1003	**2.2**	7.2
MO	1719	**1.0**	3.3	TU	1655	**1.0**	3.3
LU	2307	**2.2**	7.2	MA	2312	**2.3**	7.5
11	0539	**1.0**	3.3	**26**	0513	**1.2**	3.9
	1132	**2.1**	6.9		1043	**2.2**	7.2
TU	1801	**0.9**	3.0	WE	1739	**0.8**	2.6
MA	2356	**2.2**	7.2	ME			
12	0617	**1.1**	3.6	**27**	0003	**2.3**	7.5
	1159	**2.1**	6.9		0600	**1.3**	4.3
WE	1840	**0.8**	2.6	TH	1122	**2.3**	7.5
ME				JE	1821	**0.7**	2.3
13	0043	**2.2**	7.2	**28**	0052	**2.3**	7.5
	0653	**1.2**	3.9		0645	**1.3**	4.3
TH	1226	**2.1**	6.9	FR	1202	**2.3**	7.5
JE	1918	**0.8**	2.6	VE	1903	**0.6**	2.0
14	0131	**2.1**	6.9	**29**	0139	**2.3**	7.5
	0728	**1.3**	4.3		0728	**1.3**	4.3
FR	1256	**2.1**	6.9	SA	1243	**2.3**	7.5
VE	1956	**0.8**	2.6	SA	1944	**0.6**	2.0
15	0220	**2.1**	6.9	**30**	0225	**2.2**	7.2
	0803	**1.4**	4.6		0811	**1.3**	4.3
SA	1326	**2.1**	6.9	SU	1326	**2.3**	7.5
SA	2034	**0.8**	2.6	DI	2027	**0.6**	2.0

May-mai

Day	Time	Metres	Feet	jour	heure	mètres	pieds
1	0313	**2.2**	7.2	**16**	0354	**2.0**	6.6
	0855	**1.3**	4.3		0859	**1.7**	5.6
MO	1412	**2.3**	7.5	TU	1346	**2.1**	6.9
LU	2113	**0.6**	2.0	MA	2117	**0.9**	3.0
2	0403	**2.1**	6.9	**17**	0437	**2.0**	6.6
	0944	**1.3**	4.3		0934	**1.7**	5.6
TU	1503	**2.2**	7.2	WE	1418	**2.0**	6.6
MA	2204	**0.7**	2.3	ME	2149	**1.0**	3.3
3	0459	**2.0**	6.6	**18**	0514	**1.9**	6.2
	1038	**1.3**	4.3		1018	**1.7**	5.6
WE	1601	**2.2**	7.2	TH	1501	**2.0**	6.6
ME	2302	**0.8**	2.6	JE	2228	**1.1**	3.6
4	0559	**2.0**	6.6	**19**	0549	**2.0**	6.6
	1142	**1.4**	4.6		1119	**1.6**	5.2
TH	1709	**2.1**	6.9	FR	1609	**1.9**	6.2
JE				VE	2321	**1.2**	3.9
5	0009	**0.9**	3.0	**20**	0626	**2.0**	6.6
	0703	**2.0**	6.6		1235	**1.6**	5.2
FR	1254	**1.3**	4.3	SA	1801	**1.9**	6.2
VE	1827	**2.0**	6.6	SA			
6	0122	**1.0**	3.3	**21**	0027	**1.3**	4.3
	0804	**2.0**	6.6		0708	**2.1**	6.9
SA	1409	**1.3**	4.3	SU	1348	**1.4**	4.6
SA	1947	**2.0**	6.6	DI	1944	**1.9**	6.2
7	0233	**1.1**	3.6	**22**	0137	**1.3**	4.3
	0855	**2.0**	6.6		0752	**2.1**	6.9
SU	1515	**1.2**	3.9	MO	1451	**1.2**	3.9
DI	2100	**2.1**	6.9	LU	2103	**2.0**	6.6
8	0334	**1.1**	3.6	**23**	0244	**1.4**	4.6
	0936	**2.0**	6.6		0837	**2.2**	7.2
MO	1608	**1.1**	3.6	TU	1545	**1.0**	3.3
LU	2203	**2.1**	6.9	MA	2208	**2.1**	6.9
9	0424	**1.2**	3.9	**24**	0346	**1.4**	4.6
	1009	**2.0**	6.6		0920	**2.3**	7.5
TU	1654	**0.9**	3.0	WE	1633	**0.8**	2.6
MA	2257	**2.1**	6.9	ME	2304	**2.2**	7.2
10	0506	**1.2**	3.9	**25**	0441	**1.4**	4.6
	1039	**2.1**	6.9		1002	**2.3**	7.5
WE	1735	**0.8**	2.6	TH	1717	**0.7**	2.3
ME	2346	**2.2**	7.2	JE	2355	**2.2**	7.2
11	0545	**1.3**	4.3	**26**	0532	**1.4**	4.6
	1110	**2.1**	6.9		1045	**2.3**	7.5
TH	1815	**0.7**	2.3	FR	1801	**0.6**	2.0
JE				VE			
12	0035	**2.1**	6.9	**27**	0043	**2.2**	7.2
	0624	**1.4**	4.6		0620	**1.4**	4.6
FR	1143	**2.2**	7.2	SA	1130	**2.3**	7.5
VE	1854	**0.7**	2.3	SA	1843	**0.5**	1.6
13	0124	**2.1**	6.9	**28**	0129	**2.2**	7.2
	0703	**1.5**	4.9		0707	**1.4**	4.6
SA	1217	**2.2**	7.2	SU	1216	**2.3**	7.5
SA	1933	**0.7**	2.3	DI	1926	**0.5**	1.6
14	0215	**2.1**	6.9	**29**	0215	**2.2**	7.2
	0743	**1.5**	4.9		0755	**1.3**	4.3
SU	1249	**2.2**	7.2	MO	1305	**2.3**	7.5
DI	2011	**0.8**	2.6	LU	2011	**0.5**	1.6
15	0306	**2.0**	6.6	**30**	0302	**2.2**	7.2
	0822	**1.6**	5.2		0845	**1.3**	4.3
MO	1319	**2.1**	6.9	TU	1357	**2.3**	7.5
LU	2046	**0.8**	2.6	MA	2058	**0.6**	2.0
				31	0350	**2.1**	6.9
					0937	**1.3**	4.3
				WE	1451	**2.2**	7.2
				ME	2148	**0.7**	2.3

June-juin

Day	Time	Metres	Feet	jour	heure	mètres	pieds
1	0440	**2.1**	6.9	**16**	0423	**2.0**	6.6
	1031	**1.3**	4.3		1001	**1.6**	5.2
TH	1551	**2.1**	6.9	FR	1502	**2.0**	6.6
JE	2241	**0.8**	2.6	VE	2203	**1.1**	3.6
2	0531	**2.0**	6.6	**17**	0455	**2.1**	6.9
	1130	**1.3**	4.3		1058	**1.5**	4.9
FR	1657	**2.0**	6.6	SA	1614	**1.9**	6.2
VE	2339	**1.0**	3.3	SA	2252	**1.2**	3.9
3	0623	**2.0**	6.6	**18**	0533	**2.1**	6.9
	1234	**1.3**	4.3		1203	**1.4**	4.6
SA	1812	**1.9**	6.2	SU	1751	**1.9**	6.2
SA				DI	2350	**1.3**	4.3
4	0042	**1.1**	3.6	**19**	0617	**2.2**	7.2
	0712	**2.0**	6.6		1312	**1.3**	4.3
SU	1341	**1.2**	3.9	MO	1926	**1.9**	6.2
DI	1931	**1.9**	6.2	LU			
5	0147	**1.2**	3.9	**20**	0055	**1.4**	4.6
	0757	**2.0**	6.6		0704	**2.2**	7.2
MO	1445	**1.1**	3.6	TU	1419	**1.1**	3.6
LU	2045	**2.0**	6.6	MA	2047	**2.0**	6.6
6	0249	**1.3**	4.3	**21**	0202	**1.4**	4.6
	0837	**2.0**	6.6		0752	**2.3**	7.5
TU	1539	**1.0**	3.3	WE	1517	**0.9**	3.0
MA	2150	**2.0**	6.6	ME	2155	**2.1**	6.9
7	0343	**1.4**	4.6	**22**	0307	**1.5**	4.9
	0915	**2.1**	6.9		0840	**2.3**	7.5
WE	1627	**0.9**	3.0	TH	1609	**0.7**	2.3
ME	2246	**2.1**	6.9	JE	2253	**2.1**	6.9
8	0430	**1.4**	4.6	**23**	0407	**1.5**	4.9
	0953	**2.1**	6.9		0928	**2.3**	7.5
TH	1711	**0.8**	2.6	FR	1656	**0.6**	2.0
JE	2339	**2.1**	6.9	VE	2344	**2.2**	7.2
9	0515	**1.5**	4.9	**24**	0504	**1.5**	4.9
	1031	**2.2**	7.2		1017	**2.4**	7.9
FR	1753	**0.7**	2.3	SA	1742	**0.5**	1.6
VE				SA			
10	0029	**2.1**	6.9	**25**	0031	**2.2**	7.2
	0559	**1.5**	4.9		0558	**1.4**	4.6
SA	1110	**2.2**	7.2	SU	1109	**2.4**	7.9
SA	1835	**0.7**	2.3	DI	1827	**0.4**	1.3
11	0119	**2.1**	6.9	**26**	0116	**2.2**	7.2
	0643	**1.6**	5.2		0651	**1.4**	4.6
SU	1147	**2.2**	7.2	MO	1201	**2.4**	7.9
DI	1914	**0.7**	2.3	LU	1912	**0.4**	1.3
12	0207	**2.0**	6.6	**27**	0201	**2.2**	7.2
	0725	**1.6**	5.2		0743	**1.3**	4.3
MO	1222	**2.2**	7.2	TU	1255	**2.3**	7.5
LU	1950	**0.8**	2.6	MA	1959	**0.5**	1.6
13	0251	**2.0**	6.6	**28**	0245	**2.2**	7.2
	0803	**1.6**	5.2		0834	**1.2**	3.9
TU	1255	**2.1**	6.9	WE	1349	**2.3**	7.5
MA	2022	**0.8**	2.6	ME	2045	**0.6**	2.0
14	0326	**2.0**	6.6	**29**	0329	**2.1**	6.9
	0838	**1.6**	5.2		0924	**1.2**	3.9
WE	1329	**2.1**	6.9	TH	1444	**2.2**	7.2
ME	2051	**0.9**	3.0	JE	2132	**0.7**	2.3
15	0356	**2.0**	6.6	**30**	0412	**2.1**	6.9
	0915	**1.6**	5.2		1015	**1.2**	3.9
TH	1410	**2.0**	6.6	FR	1541	**2.1**	6.9
JE	2123	**1.0**	3.3	VE	2218	**0.9**	3.0

CAPE TORMENTINE AST Z+4 — 2017 — TIDE TABLES

July-juillet

Day	Time	Metres	Feet	jour	heure	mètres	pieds
1	0453	**2.0**	6.6	**16**	0409	**2.2**	7.2
	1106	**1.2**	3.9		1032	**1.3**	4.3
SA	1642	**2.0**	6.6	SU	1616	**2.0**	6.6
SA	2304	**1.1**	3.6	DI	2229	**1.2**	3.9
2	0532	**2.0**	6.6	**17**	0448	**2.2**	7.2
	1200	**1.2**	3.9		1130	**1.2**	3.9
SU	1751	**1.9**	6.2	MO	1738	**1.9**	6.2
DI	2354	**1.2**	3.9	LU	2320	**1.3**	4.3
3	0611	**2.0**	6.6	**18**	0532	**2.2**	7.2
	1301	**1.2**	3.9		1235	**1.1**	3.6
MO	1906	**1.9**	6.2	TU	1905	**1.9**	6.2
LU				MA			
4	0049	**1.4**	4.6	**19**	0017	**1.4**	4.6
	0653	**2.0**	6.6		0619	**2.2**	7.2
TU	1405	**1.1**	3.6	WE	1343	**1.0**	3.3
MA	2024	**1.9**	6.2	ME	2027	**1.9**	6.2
5	0151	**1.5**	4.9	**20**	0121	**1.5**	4.9
	0739	**2.0**	6.6		0711	**2.3**	7.5
WE	1507	**1.0**	3.3	TH	1447	**0.9**	3.0
ME	2137	**1.9**	6.2	JE	2138	**2.0**	6.6
6	0257	**1.6**	5.2	**21**	0230	**1.6**	5.2
	0827	**2.1**	6.9		0806	**2.3**	7.5
TH	1601	**0.9**	3.0	FR	1544	**0.7**	2.3
JE	2239	**2.0**	6.6	VE	2237	**2.0**	6.6
7	0359	**1.6**	5.2	**22**	0339	**1.5**	4.9
	0916	**2.1**	6.9		0903	**2.3**	7.5
FR	1650	**0.8**	2.6	SA	1636	**0.6**	2.0
VE	2334	**2.0**	6.6	SA	2327	**2.1**	6.9
8	0454	**1.6**	5.2	**23**	0444	**1.5**	4.9
	1002	**2.2**	7.2		1000	**2.4**	7.9
SA	1735	**0.8**	2.6	SU	1725	**0.5**	1.6
SA				DI			
9	0023	**2.0**	6.6	**24**	0013	**2.2**	7.2
	0542	**1.6**	5.2		0542	**1.4**	4.6
SU	1046	**2.2**	7.2	MO	1058	**2.4**	7.9
DI	1816	**0.8**	2.6	LU	1813	**0.5**	1.6
10	0107	**2.0**	6.6	**25**	0056	**2.2**	7.2
	0624	**1.6**	5.2		0637	**1.3**	4.3
MO	1127	**2.2**	7.2	TU	1154	**2.4**	7.9
LU	1854	**0.8**	2.6	MA	1859	**0.5**	1.6
11	0145	**2.0**	6.6	**26**	0139	**2.2**	7.2
	0702	**1.6**	5.2		0729	**1.2**	3.9
TU	1205	**2.2**	7.2	WE	1250	**2.3**	7.5
MA	1927	**0.8**	2.6	ME	1945	**0.6**	2.0
12	0215	**2.0**	6.6	**27**	0220	**2.2**	7.2
	0737	**1.6**	5.2		0817	**1.1**	3.6
WE	1245	**2.2**	7.2	TH	1344	**2.3**	7.5
ME	1958	**0.9**	3.0	JE	2029	**0.7**	2.3
13	0241	**2.0**	6.6	**28**	0258	**2.1**	6.9
	0813	**1.5**	4.9		0904	**1.1**	3.6
TH	1326	**2.1**	6.9	FR	1436	**2.2**	7.2
JE	2030	**0.9**	3.0	VE	2111	**0.8**	2.6
14	0306	**2.1**	6.9	**29**	0332	**2.1**	6.9
	0853	**1.4**	4.6		0948	**1.0**	3.3
FR	1414	**2.1**	6.9	SA	1529	**2.0**	6.6
VE	2105	**1.0**	3.3	SA	2149	**1.0**	3.3
15	0335	**2.1**	6.9	**30**	0403	**2.0**	6.6
	0940	**1.4**	4.6		1032	**1.1**	3.6
SA	1508	**2.0**	6.6	SU	1624	**2.0**	6.6
SA	2144	**1.1**	3.6	DI	2226	**1.2**	3.9
				31	0433	**2.0**	6.6
					1118	**1.1**	3.6
				MO	1726	**1.9**	6.2
				LU	2305	**1.3**	4.3

August-août

Day	Time	Metres	Feet	jour	heure	mètres	pieds
1	0508	**2.0**	6.6	**16**	0449	**2.2**	7.2
	1212	**1.1**	3.6		1156	**1.0**	3.3
TU	1840	**1.8**	5.9	WE	1841	**1.9**	6.2
MA	2353	**1.5**	4.9	ME	2345	**1.5**	4.9
2	0551	**2.0**	6.6	**17**	0538	**2.2**	7.2
	1318	**1.1**	3.6		1303	**0.9**	3.0
WE	2004	**1.8**	5.9	TH	2001	**1.9**	6.2
ME				JE			
3	0056	**1.6**	5.2	**18**	0049	**1.5**	4.9
	0646	**2.0**	6.6		0637	**2.2**	7.2
TH	1431	**1.1**	3.6	FR	1413	**0.8**	2.6
JE	2127	**1.9**	6.2	VE	2113	**1.9**	6.2
4	0220	**1.7**	5.6	**19**	0204	**1.6**	5.2
	0747	**2.0**	6.6		0742	**2.3**	7.5
FR	1535	**1.0**	3.3	SA	1518	**0.7**	2.3
VE	2235	**1.9**	6.2	SA	2213	**2.0**	6.6
5	0342	**1.7**	5.6	**20**	0322	**1.5**	4.9
	0847	**2.1**	6.9		0848	**2.3**	7.5
SA	1629	**0.9**	3.0	SU	1616	**0.6**	2.0
SA	2325	**2.0**	6.6	DI	2303	**2.1**	6.9
6	0440	**1.7**	5.6	**21**	0431	**1.4**	4.6
	0942	**2.1**	6.9		0953	**2.3**	7.5
SU	1714	**0.9**	3.0	MO	1709	**0.6**	2.0
DI				LU	2347	**2.1**	6.9
7	0004	**2.0**	6.6	**22**	0530	**1.3**	4.3
	0524	**1.6**	5.2		1054	**2.4**	7.9
MO	1031	**2.2**	7.2	TU	1758	**0.6**	2.0
LU	1753	**0.9**	3.0	MA			
8	0034	**2.0**	6.6	**23**	0029	**2.2**	7.2
	0559	**1.6**	5.2		0622	**1.1**	3.6
TU	1115	**2.2**	7.2	WE	1151	**2.4**	7.9
MA	1828	**0.9**	3.0	ME	1844	**0.6**	2.0
9	0058	**2.0**	6.6	**24**	0108	**2.2**	7.2
	0633	**1.5**	4.9		0710	**1.0**	3.3
WE	1158	**2.2**	7.2	TH	1245	**2.3**	7.5
ME	1901	**0.9**	3.0	JE	1928	**0.7**	2.3
10	0122	**2.0**	6.6	**25**	0143	**2.1**	6.9
	0708	**1.4**	4.6		0755	**1.0**	3.3
TH	1243	**2.2**	7.2	FR	1337	**2.2**	7.2
JE	1935	**0.9**	3.0	VE	2008	**0.9**	3.0
11	0148	**2.1**	6.9	**26**	0214	**2.1**	6.9
	0748	**1.3**	4.3		0837	**0.9**	3.0
FR	1329	**2.2**	7.2	SA	1426	**2.1**	6.9
VE	2010	**1.0**	3.3	SA	2045	**1.0**	3.3
12	0218	**2.1**	6.9	**27**	0242	**2.1**	6.9
	0830	**1.2**	3.9		0916	**0.9**	3.0
SA	1418	**2.2**	7.2	SU	1515	**2.0**	6.6
SA	2048	**1.0**	3.3	DI	2118	**1.2**	3.9
13	0252	**2.2**	7.2	**28**	0308	**2.1**	6.9
	0916	**1.1**	3.6		0954	**0.9**	3.0
SU	1512	**2.1**	6.9	MO	1606	**2.0**	6.6
DI	2127	**1.1**	3.6	LU	2150	**1.3**	4.3
14	0328	**2.2**	7.2	**29**	0336	**2.0**	6.6
	1004	**1.1**	3.6		1036	**1.0**	3.3
MO	1612	**2.0**	6.6	TU	1706	**1.9**	6.2
LU	2209	**1.2**	3.9	MA	2226	**1.5**	4.9
15	0406	**2.2**	7.2	**30**	0409	**2.0**	6.6
	1057	**1.0**	3.3		1126	**1.0**	3.3
TU	1722	**1.9**	6.2	WE	1819	**1.8**	5.9
MA	2254	**1.3**	4.3	ME	2312	**1.6**	5.2
				31	0452	**2.0**	6.6
					1231	**1.1**	3.6
				TH	1946	**1.8**	5.9
				JE			

September-septembre

Day	Time	Metres	Feet	jour	heure	mètres	pieds
1	0020	**1.7**	5.6	**16**	0031	**1.5**	4.9
	0552	**2.0**	6.6		0612	**2.2**	7.2
FR	1349	**1.1**	3.6	SA	1341	**0.9**	3.0
VE	2116	**1.9**	6.2	SA	2041	**1.9**	6.2
2	0204	**1.7**	5.6	**17**	0153	**1.5**	4.9
	0710	**2.0**	6.6		0727	**2.2**	7.2
SA	1502	**1.1**	3.6	SU	1452	**0.8**	2.6
SA	2218	**1.9**	6.2	DI	2141	**2.0**	6.6
3	0333	**1.7**	5.6	**18**	0313	**1.4**	4.6
	0825	**2.0**	6.6		0842	**2.2**	7.2
SU	1559	**1.1**	3.6	MO	1555	**0.7**	2.3
DI	2253	**1.9**	6.2	LU	2232	**2.1**	6.9
4	0423	**1.7**	5.6	**19**	0419	**1.3**	4.3
	0928	**2.1**	6.9		0950	**2.3**	7.5
MO	1644	**1.1**	3.6	TU	1650	**0.7**	2.3
LU	2316	**2.0**	6.6	MA	2315	**2.1**	6.9
5	0457	**1.6**	5.2	**20**	0515	**1.1**	3.6
	1020	**2.1**	6.9		1051	**2.3**	7.5
TU	1722	**1.0**	3.3	WE	1739	**0.7**	2.3
MA	2336	**2.0**	6.6	ME	2353	**2.1**	6.9
6	0529	**1.4**	4.6	**21**	0604	**1.0**	3.3
	1108	**2.2**	7.2		1147	**2.3**	7.5
WE	1757	**1.0**	3.3	TH	1824	**0.8**	2.6
ME	2358	**2.0**	6.6	JE			
7	0604	**1.3**	4.3	**22**	0027	**2.1**	6.9
	1155	**2.3**	7.5		0648	**0.9**	3.0
TH	1834	**1.0**	3.3	FR	1239	**2.3**	7.5
JE				VE	1905	**0.9**	3.0
8	0026	**2.1**	6.9	**23**	0057	**2.1**	6.9
	0642	**1.2**	3.9		0729	**0.8**	2.6
FR	1242	**2.3**	7.5	SA	1327	**2.2**	7.2
VE	1911	**1.0**	3.3	SA	1941	**1.1**	3.6
9	0059	**2.1**	6.9	**24**	0124	**2.1**	6.9
	0724	**1.1**	3.6		0807	**0.8**	2.6
SA	1330	**2.3**	7.5	SU	1414	**2.1**	6.9
SA	1950	**1.1**	3.6	DI	2015	**1.2**	3.9
10	0134	**2.2**	7.2	**25**	0150	**2.1**	6.9
	0807	**1.0**	3.3		0844	**0.8**	2.6
SU	1419	**2.2**	7.2	MO	1503	**2.0**	6.6
DI	2030	**1.1**	3.6	LU	2048	**1.3**	4.3
11	0211	**2.2**	7.2	**26**	0218	**2.1**	6.9
	0851	**0.9**	3.0		0921	**0.8**	2.6
MO	1510	**2.1**	6.9	TU	1555	**2.0**	6.6
LU	2109	**1.2**	3.9	MA	2122	**1.5**	4.9
12	0248	**2.2**	7.2	**27**	0248	**2.1**	6.9
	0936	**0.9**	3.0		1001	**0.9**	3.0
TU	1605	**2.1**	6.9	WE	1654	**1.9**	6.2
MA	2149	**1.3**	4.3	ME	2201	**1.6**	5.2
13	0327	**2.2**	7.2	**28**	0319	**2.0**	6.6
	1024	**0.9**	3.0		1047	**1.0**	3.3
WE	1706	**2.0**	6.6	TH	1804	**1.9**	6.2
ME	2232	**1.4**	4.6	JE	2250	**1.7**	5.6
14	0412	**2.2**	7.2	**29**	0355	**2.0**	6.6
	1120	**0.9**	3.0		1144	**1.1**	3.6
TH	1816	**1.9**	6.2	FR	1924	**1.9**	6.2
JE	2324	**1.5**	4.9	VE			
15	0506	**2.2**	7.2	**30**	0004	**1.7**	5.6
	1226	**0.9**	3.0		0449	**1.9**	6.2
FR	1931	**1.9**	6.2	SA	1255	**1.2**	3.9
VE				SA	2038	**1.9**	6.2

TABLE DES MARÉES **2017** **CAPE TORMENTINE** HNA Z+4

October-octobre

Day	Time	Metres	Feet	jour	heure	mètres	pieds
1	0155	**1.7**	5.6	**16**	0146	**1.4**	4.6
	0629	**1.9**	6.2		0719	**2.1**	6.9
SU	1409	**1.2**	3.9	MO	1425	**0.9**	3.0
DI	2122	**1.9**	6.2	LU	2104	**2.0**	6.6
2	0309	**1.7**	5.6	**17**	0302	**1.3**	4.3
	0804	**1.9**	6.2		0838	**2.1**	6.9
MO	1511	**1.2**	3.9	TU	1531	**0.9**	3.0
LU	2145	**1.9**	6.2	MA	2154	**2.1**	6.9
3	0350	**1.6**	5.2	**18**	0404	**1.1**	3.6
	0914	**2.0**	6.6		0947	**2.2**	7.2
TU	1559	**1.2**	3.9	WE	1627	**0.9**	3.0
MA	2206	**2.0**	6.6	ME	2234	**2.1**	6.9
4	0423	**1.4**	4.6	**19**	0457	**1.0**	3.3
	1010	**2.1**	6.9		1047	**2.2**	7.2
WE	1641	**1.2**	3.9	TH	1715	**1.0**	3.3
ME	2231	**2.0**	6.6	JE	2308	**2.1**	6.9
5	0459	**1.2**	3.9	**20**	0542	**0.9**	3.0
	1101	**2.2**	7.2		1140	**2.2**	7.2
TH	1723	**1.2**	3.9	FR	1757	**1.1**	3.6
JE	2302	**2.1**	6.9	VE	2338	**2.1**	6.9
6	0538	**1.1**	3.6	**21**	0623	**0.8**	2.6
	1150	**2.3**	7.5		1230	**2.2**	7.2
FR	1805	**1.2**	3.9	SA	1836	**1.2**	3.9
VE	2337	**2.2**	7.2	SA			
7	0620	**0.9**	3.0	**22**	0007	**2.1**	6.9
	1239	**2.3**	7.5		0702	**0.7**	2.3
SA	1848	**1.2**	3.9	SU	1317	**2.1**	6.9
SA				DI	1912	**1.3**	4.3
8	0015	**2.2**	7.2	**23**	0036	**2.2**	7.2
	0703	**0.8**	2.6		0740	**0.7**	2.3
SU	1328	**2.3**	7.5	MO	1405	**2.1**	6.9
DI	1930	**1.2**	3.9	LU	1947	**1.4**	4.6
9	0054	**2.2**	7.2	**24**	0106	**2.1**	6.9
	0745	**0.8**	2.6		0817	**0.7**	2.3
MO	1416	**2.2**	7.2	TU	1456	**2.0**	6.6
LU	2011	**1.3**	4.3	MA	2025	**1.5**	4.9
10	0133	**2.3**	7.5	**25**	0138	**2.1**	6.9
	0827	**0.7**	2.3		0855	**0.8**	2.6
TU	1505	**2.2**	7.2	WE	1549	**2.0**	6.6
MA	2051	**1.3**	4.3	ME	2106	**1.6**	5.2
11	0213	**2.3**	7.5	**26**	0209	**2.1**	6.9
	0910	**0.7**	2.3		0933	**0.9**	3.0
WE	1555	**2.1**	6.9	TH	1646	**1.9**	6.2
ME	2132	**1.4**	4.6	JE	2150	**1.7**	5.6
12	0256	**2.2**	7.2	**27**	0239	**2.0**	6.6
	0957	**0.8**	2.6		1013	**1.0**	3.3
TH	1651	**2.0**	6.6	FR	1745	**1.9**	6.2
JE	2219	**1.4**	4.6	VE	2242	**1.7**	5.6
13	0345	**2.2**	7.2	**28**	0311	**1.9**	6.2
	1052	**0.8**	2.6		1057	**1.1**	3.6
FR	1753	**2.0**	6.6	SA	1841	**1.9**	6.2
VE	2315	**1.4**	4.6	SA	2350	**1.7**	5.6
14	0445	**2.2**	7.2	**29**	0359	**1.9**	6.2
	1156	**0.8**	2.6		1151	**1.2**	3.9
SA	1859	**2.0**	6.6	SU	1925	**1.9**	6.2
SA				DI			
15	0025	**1.4**	4.6	**30**	0112	**1.7**	5.6
	0558	**2.1**	6.9		0548	**1.8**	5.9
SU	1310	**0.9**	3.0	MO	1256	**1.3**	4.3
DI	2005	**2.0**	6.6	LU	1957	**1.9**	6.2
				31	0218	**1.6**	5.2
					0740	**1.9**	6.2
				TU	1402	**1.3**	4.3
				MA	2027	**2.0**	6.6

November-novembre

Day	Time	Metres	Feet	jour	heure	mètres	pieds
1	0306	**1.4**	4.6	**16**	0344	**1.0**	3.3
	0857	**2.0**	6.6		0939	**2.1**	6.9
WE	1503	**1.3**	4.3	TH	1556	**1.2**	3.9
ME	2059	**2.1**	6.9	JE	2145	**2.1**	6.9
2	0349	**1.2**	3.9	**17**	0434	**0.9**	3.0
	0959	**2.1**	6.9		1039	**2.1**	6.9
TH	1557	**1.3**	4.3	FR	1644	**1.2**	3.9
JE	2136	**2.1**	6.9	VE	2218	**2.1**	6.9
3	0432	**1.0**	3.3	**18**	0518	**0.8**	2.6
	1053	**2.2**	7.2		1131	**2.1**	6.9
FR	1648	**1.3**	4.3	SA	1725	**1.3**	4.3
VE	2215	**2.2**	7.2	SA	2250	**2.2**	7.2
4	0516	**0.9**	3.0	**19**	0559	**0.7**	2.3
	1145	**2.3**	7.5		1221	**2.1**	6.9
SA	1737	**1.3**	4.3	SU	1804	**1.4**	4.6
SA	2256	**2.3**	7.5	DI	2323	**2.2**	7.2
5	0559	**0.7**	2.3	**20**	0638	**0.6**	2.0
	1234	**2.3**	7.5		1310	**2.1**	6.9
SU	1824	**1.3**	4.3	MO	1844	**1.5**	4.9
DI	2337	**2.3**	7.5	LU	2358	**2.2**	7.2
6	0642	**0.6**	2.0	**21**	0718	**0.6**	2.0
	1323	**2.3**	7.5		1359	**2.1**	6.9
MO	1909	**1.4**	4.6	TU	1926	**1.5**	4.9
LU				MA			
7	0019	**2.3**	7.5	**22**	0034	**2.2**	7.2
	0724	**0.6**	2.0		0757	**0.7**	2.3
TU	1410	**2.2**	7.2	WE	1451	**2.0**	6.6
MA	1952	**1.4**	4.6	ME	2010	**1.6**	5.2
8	0102	**2.3**	7.5	**23**	0108	**2.1**	6.9
	0806	**0.6**	2.0		0835	**0.8**	2.6
WE	1456	**2.2**	7.2	TH	1542	**2.0**	6.6
ME	2035	**1.4**	4.6	JE	2056	**1.6**	5.2
9	0147	**2.3**	7.5	**24**	0141	**2.1**	6.9
	0850	**0.6**	2.0		0910	**0.9**	3.0
TH	1543	**2.1**	6.9	FR	1629	**2.0**	6.6
JE	2121	**1.4**	4.6	VE	2140	**1.7**	5.6
10	0235	**2.2**	7.2	**25**	0212	**2.0**	6.6
	0937	**0.7**	2.3		0943	**1.0**	3.3
FR	1634	**2.1**	6.9	SA	1709	**2.0**	6.6
VE	2212	**1.4**	4.6	SA	2224	**1.7**	5.6
11	0330	**2.2**	7.2	**26**	0248	**1.9**	6.2
	1030	**0.7**	2.3		1017	**1.1**	3.6
SA	1728	**2.0**	6.6	SU	1741	**2.0**	6.6
SA	2310	**1.4**	4.6	DI	2314	**1.7**	5.6
12	0434	**2.1**	6.9	**27**	0343	**1.9**	6.2
	1132	**0.8**	2.6		1059	**1.2**	3.9
SU	1827	**2.0**	6.6	MO	1809	**2.0**	6.6
DI				LU			
13	0018	**1.3**	4.3	**28**	0016	**1.6**	5.2
	0549	**2.1**	6.9		0525	**1.8**	5.9
MO	1240	**0.9**	3.0	TU	1155	**1.3**	4.3
LU	1926	**2.0**	6.6	MA	1843	**2.0**	6.6
14	0132	**1.3**	4.3	**29**	0122	**1.5**	4.9
	0711	**2.0**	6.6		0715	**1.9**	6.2
TU	1352	**1.0**	3.3	WE	1302	**1.4**	4.6
MA	2020	**2.0**	6.6	ME	1922	**2.1**	6.9
15	0243	**1.2**	3.9	**30**	0223	**1.3**	4.3
	0830	**2.0**	6.6		0838	**2.0**	6.6
WE	1459	**1.1**	3.6	TH	1410	**1.4**	4.6
ME	2107	**2.0**	6.6	JE	2006	**2.2**	7.2

December-décembre

Day	Time	Metres	Feet	jour	heure	mètres	pieds
1	0318	**1.1**	3.6	**16**	0408	**0.9**	3.0
	0946	**2.1**	6.9		1029	**2.0**	6.6
FR	1515	**1.5**	4.9	SA	1606	**1.4**	4.6
VE	2051	**2.2**	7.2	SA	2131	**2.1**	6.9
2	0408	**0.9**	3.0	**17**	0454	**0.8**	2.6
	1044	**2.2**	7.2		1123	**2.0**	6.6
SA	1614	**1.5**	4.9	SU	1653	**1.5**	4.9
SA	2136	**2.3**	7.5	DI	2211	**2.2**	7.2
3	0455	**0.7**	2.3	**18**	0537	**0.7**	2.3
	1137	**2.2**	7.2		1214	**2.1**	6.9
SU	1708	**1.5**	4.9	MO	1738	**1.5**	4.9
DI	2221	**2.3**	7.5	LU	2251	**2.2**	7.2
4	0540	**0.6**	2.0	**19**	0619	**0.7**	2.3
	1227	**2.2**	7.2		1304	**2.0**	6.6
MO	1759	**1.5**	4.9	TU	1825	**1.6**	5.2
LU	2306	**2.3**	7.5	MA	2332	**2.2**	7.2
5	0623	**0.5**	1.6	**20**	0701	**0.7**	2.3
	1314	**2.2**	7.2		1353	**2.0**	6.6
TU	1847	**1.4**	4.6	WE	1911	**1.6**	5.2
MA	2353	**2.3**	7.5	ME			
6	0706	**0.5**	1.6	**21**	0012	**2.2**	7.2
	1358	**2.2**	7.2		0740	**0.7**	2.3
WE	1934	**1.4**	4.6	TH	1440	**2.0**	6.6
ME				JE	1957	**1.6**	5.2
7	0041	**2.3**	7.5	**22**	0049	**2.2**	7.2
	0750	**0.5**	1.6		0816	**0.8**	2.6
TH	1442	**2.2**	7.2	FR	1520	**2.0**	6.6
JE	2022	**1.3**	4.3	VE	2038	**1.6**	5.2
8	0131	**2.3**	7.5	**23**	0125	**2.1**	6.9
	0835	**0.5**	1.6		0847	**0.9**	3.0
FR	1526	**2.1**	6.9	SA	1551	**2.0**	6.6
VE	2111	**1.3**	4.3	SA	2115	**1.6**	5.2
9	0225	**2.2**	7.2	**24**	0201	**2.0**	6.6
	0922	**0.6**	2.0		0915	**1.0**	3.3
SA	1612	**2.1**	6.9	SU	1615	**2.0**	6.6
SA	2203	**1.3**	4.3	DI	2152	**1.6**	5.2
10	0322	**2.2**	7.2	**25**	0244	**2.0**	6.6
	1013	**0.7**	2.3		0946	**1.1**	3.6
SU	1700	**2.1**	6.9	MO	1637	**2.0**	6.6
DI	2259	**1.2**	3.9	LU	2236	**1.5**	4.9
11	0426	**2.1**	6.9	**26**	0345	**1.9**	6.2
	1108	**0.9**	3.0		1026	**1.2**	3.9
MO	1750	**2.0**	6.6	TU	1706	**2.1**	6.9
LU				MA	2331	**1.4**	4.6
12	0000	**1.2**	3.9	**27**	0514	**1.9**	6.2
	0539	**2.0**	6.6		1117	**1.3**	4.3
TU	1208	**1.0**	3.3	WE	1744	**2.1**	6.9
MA	1840	**2.0**	6.6	ME			
13	0108	**1.2**	3.9	**28**	0036	**1.3**	4.3
	0657	**1.9**	6.2		0652	**1.9**	6.2
WE	1312	**1.2**	3.9	TH	1218	**1.4**	4.6
ME	1928	**2.0**	6.6	JE	1830	**2.2**	7.2
14	0216	**1.1**	3.6	**29**	0144	**1.1**	3.6
	0816	**1.9**	6.2		0819	**1.9**	6.2
TH	1416	**1.3**	4.3	FR	1326	**1.5**	4.9
JE	2012	**2.0**	6.6	VE	1920	**2.2**	7.2
15	0316	**1.0**	3.3	**30**	0247	**1.0**	3.3
	0927	**2.0**	6.6		0932	**2.0**	6.6
FR	1514	**1.4**	4.6	SA	1435	**1.5**	4.9
VE	2052	**2.1**	6.9	SA	2011	**2.3**	7.5
				31	0343	**0.8**	2.6
					1034	**2.1**	6.9
				SU	1541	**1.6**	5.2
				DI	2102	**2.3**	7.5

APPENDIX G

NBDELG Documentation

Submission Checklist for the Hydrogeological Study

Hydrogeological Study – General Requirements		Included in Report? (√ = yes)	Page Number
Site Description	Site Description	Yes	2
	Wellfield Description	N/A	
	Description of Intended Water Use	Yes	1
	Groundwater Withdrawal Details	Yes	1 & 3
	Description of Existing and Previous Water Withdrawal Approvals	N/A	
Description of Hydrogeology	Regional and Local Geology	Yes	4
	Regional and Local Hydrogeology	Yes	4
	Surface Water Features	Yes	4
Pumping Test Information	Pumping Test Description and Analysis	Yes	5 to 12
	Water Quality Analysis	Yes	12 to 14
Evaluation of Potential Impacts	Design Safe Yield	Yes	11 & 12
	Well Interference Effects	Yes	15 & 16
	Water Quality Effects	Yes	12 to 14
	Groundwater Under Direct Influence (GUDI)	Yes	17 & 18
	Salt Water Intrusion	Yes	16 & 17
	Open Loop Earth Energy System Information	N/A	
Supporting Figures and Data	Site Location Map and Site Plan	Yes	Appendix A
	Well Logs	Yes	Appendix C
	Pumping Test Data and Graphs	Yes	6 to 16, App. D
	Laboratory Reports	Yes	Appendix E

Notes on General Requirements:
Water Supply Source Assessments and EIA Registrations are required for groundwater wells with a capacity for water withdrawals greater than 50,000 L/day (50 m^3/day).
Hydrogeological studies must be signed and professionally sealed by a qualified Engineer or Geoscientist registered with the Association of Professional Engineers and Geoscientists of New Brunswick.
Reports and data must be submitted in hard copy and electronic copy.
A constant rate pumping test and analysis is required for each pumping well included in the EIA Registration.
Production well(s) must be pump tested at a rate greater than or equal to the requested withdrawal rate.
Well interference effects should be evaluated for wells within a minimum radius of 500 m.
Salt water intrusion effects should be evaluated if the production well is within 500 m of a salt water body.
Potential for groundwater under the direct influence of surface water (GUDI) should be evaluated for each proposed production well.
Any work that is to be completed within 30 m of a watercourse or regulated wetland first requires a Watercourse and Wetland Alteration (WAWA) Permit.

NEW BRUNSWICK
DEPARTMENT OF ENVIRONMENT AND LOCAL GOVERNMENT

Environmental Impact Assessment

WATER SUPPLY SOURCE ASSESSMENT GUIDELINES

Department of Environment and Local Government
April 2017

Table of Contents

1.0 Introduction

These guidelines have been developed to assist both the public and private sectors engaging in projects requiring a Water Supply Source Assessment (WSSA) through the Environmental Impact Assessment (EIA) process. Projects typically requiring a WSSA include the construction and/or modification of municipal, industrial or communal water supply sources, large scale subdivision developments in unincorporated areas, and open loop earth energy systems using more than 120 m^3 of water/day.

WSSAs are conducted to evaluate the sustainability of the water supply, to assess the water quality, and to evaluate potential impacts to existing water users. These guidelines outline the WSSA process and provide information on the hydrogeological assessment and reporting that is required for various types of projects. These guidelines describe the minimum requirements, however, it is expected that the registered professional engineer or geoscientist responsible for conducting a WSSA will use their professional judgment to determine if any additional requirements are warranted.

1.1 Authority

The legislative authority for evaluating a potential water supply is found in the *Water Quality Regulation (82-126)* and the *Environmental Impact Assessment (EIA) Regulation (87-83)* of the Clean Environment Act.

The *Water Quality Regulation* states that all waterworks using greater than 50 cubic meters of water daily require a permit to operate, except in the case of a domestic well not connected to a distribution system. It also states in **3**(5): "No person shall, without an approval, which approval must include approval of the supply and quality of water, construct, modify or operate or permit the construction, modification or operation of any waterworks".

The *EIA Regulation* (Schedule A) indicates the specific undertakings that require a project to be registered under the *EIA Regulation* and a WSSA to be completed. These undertakings are:

(1) The development of a waterworks with a capacity greater than 50 cubic meters of water daily (Schedule A, Section (s)). This could include, but is not limited to, water supply wells for municipalities or industries, as well as, communal wells for housing developments.

(2) All major residential developments outside incorporated areas (Schedule A, Section (t)). A WSSA would be required in cases where the area is not serviced by a municipal water supply.

Prior to registering a project, it is advisable to discuss it with the Sustainable Development, Planning & Impact Evaluation Branch, Department of Environment and Local Government (see Appendix A for contact information) in order to: a) obtain advice and guidance on the registration submission and the review process, and b) obtain information with respect to the possible timing and duration of the review.

Note: If at any time the proponent requires an additional water supply, a new EIA Registration and WSSA may be required. A WSSA may be required for certain projects, even if the water supply was not the specific EIA trigger.

1.2 Water Supply Source Assessment Process

The WSSA process begins with the submission of an EIA Registration document and a completed WSSA Initial Application (see Section 2.0) for a proposed project. These documents must be submitted to the Manager of the Environmental Assessment Section (see Appendix A for contact information) and an EIA Project Manager will be assigned to the file.

The Initial Application must be reviewed and approved by the Department of Environment and Local Government before commencement of any hydrogeological fieldwork (i.e. cutting access roads, drilling, pumping test). Following approval of the Initial Application, the proponent may proceed to the Hydrogeological Assessment (Section 3.0). The Hydrogeological Assessment includes field work, data analysis and reporting. Upon submission, the Hydrogeological Assessment will be reviewed by a Technical Review Committee (TRC), at which time additional information may be requested. The WSSA process is done concurrently with the EIA review process. Following the review process, an EIA Certificate of Determination will be issued which may contain conditions for the project (i.e. maximum pumping rate, monitoring).

WSSAs must be completed to the satisfaction of the Department of Environment and Local Government. Incomplete or inadequate submissions will be returned to the applicant for completion. The Hydrogeological Assessment and yield testing must be completed under the direct supervision of a qualified Professional Engineer or Geoscientist registered with the Association of Professional Engineers and Geoscientists of New Brunswick. All final work must be signed and professionally sealed.

2.0 WSSA Initial Application

The WSSA Initial Application form can be found in Appendix B. The purpose of the Initial Application is to allow the Department of Environment and Local Government to evaluate the proposed drilling target sites and hydrogeological testing, along with the environment surrounding the proposed water supply prior to the commencement of invasive field work (i.e. clearing, temporary road access, drilling, etc.).

The Initial Application must provide information on the proposed water supply, including the location of proposed drilling targets and the Parcel Identifier Number (PID) for the properties. The Application must discuss the intended use of the water supply, the quantity of water required, and any alternate water supplies that may be available. It must also discuss the hydrogeology of the area as it relates to the project and identify any existing pollution or contamination hazards within a minimum radius of 500 m from the proposed drill targets. Historical land uses (i.e. tannery, industrial, waste disposal, etc.) that might pose a risk of contamination should also be flagged. If groundwater use problems (quantity or quality) have occurred in the area, then these should be identified.

An appropriately scaled map (i.e. 1:10,000) clearly identifying all proposed drill target locations must be included and should also indicate the location of any significant hydrologic features in the area (i.e. watercourses, wetlands, surface water bodies) and existing wells and water users.

2.1 Municipal Water Supplies

It is necessary to consider the implications of the *Wellfield Protected Area Designation Order - Clean Water Act* at the earliest planning stages when locating a new municipal water supply well.

When dealing with the siting of municipal production wells, the proponent should examine and fully exhaust potential locations within the municipal boundaries prior to investigating outside the municipal limits. The Initial Application must provide details of land uses in the vicinity of the proposed production well and outline any land uses that may conflict with the *Wellfield Protected Area Designation Order*.

DELG policy requires that all municipalities formally request Wellfield Protection Designation by passing a Resolution of Council prior to bringing a new municipal well on-line. For more information on this policy and the Wellfield Protection Program, please contact the Drinking Water Source Protection Section of the DELG (see Appendix A for contact information).

2.2 Subdivision Developments

Many subdivision development projects are completed in phases and although an initial phase of the project may not appear to trigger an EIA Registration, the size of the entire potential development must be evaluated for water use. Where there is a reasonable expectation that future phases of the subdivision development project may be undertaken, the future phases must be included in the scope of the subdivision development project being reviewed.

The Initial Application must include a description of the proposed hydrogeological testing that will be undertaken for the initial subdivision development phase. Specific details related to hydraulic testing of potential future phases will be determined as each phase of the project is undertaken.

2.3 Open Loop Earth Energy Systems

Projects with open loop earth energy systems that require more than 120 m^3 of water per day are required to register for an Environmental Impact Assessment and conduct a WSSA according to the Guidelines outlined in this document. A WSSA Initial Application must be submitted and approved before any invasive field work is conducted, including well drilling and aquifer testing.

As part of the WSSA Initial Application, a Contingency Plan must be submitted for review and approval. The Contingency Plan must address such issues as artesian flowing wells, insufficient return well capacity, potential reduced return well capacity due to biofouling, known poor water quality groundwater (e.g. saline groundwater), and leakage of the refrigerant. If there is the potential for saltwater to be encountered during drilling activities, the Contingency Plan must outline the mitigation measures that will be undertaken during well construction, aquifer testing and installation phases to ensure re-injection occurs in the same or similar quality aquifer and to minimize the risk of contaminating freshwater aquifers. The Contingency Plan must be prepared by a Canadian Geo-Exchange Coalition (CGC) certified industry professional in conjunction with either a New Brunswick licensed water well driller or a Professional Engineer and/or Geoscientist registered in New Brunswick.

Additional testing and reporting requirements for open loop earth energy systems are identified in Sections 3.0 and 4.0 of this document.

3.0 Hydrogeological Assessment

Following approval of the Initial Application by the EIA Project Manager, the Hydrogeological Assessment may commence, including field investigations and development of the water supply source. The primary objective of the hydrogeological assessment is to determine if the water supply source can provide adequate water quantity and acceptable water quality for the intended purpose over the short- and long-term. The investigation must collect sufficient site specific data to evaluate the water supply and any potential impacts to existing groundwater users in the area.

Specific requirements for the field component of the Hydrogeological Assessment are presented in this section, while the reporting requirements for the Hydrogeological Assessment are presented in Section 4.0.

3.1 Well Construction and Development

All wells (pumping, observation or test wells) must be identified and clearly labeled on a 1:10,000 scale map. A more detailed site map showing all wells must also be provided. The GPS coordinates of all new wells (pumping, observation and/or test wells) must be included, along with the Parcel Identifier Number (PID) for the property. All test wells should be numbered in a consistent and standard way with no two wells having the same number. The standard for this shall be the year drilled followed by the sequential number of the well drilled on this project. For example, the fifth well in a project occurring in 2011 would be 11-5. All test wells must be constructed by a Water Well Contractor/Driller licensed in the Province of New Brunswick as per the standards outlined in the *Water Well* and *Potable Water Regulations – Clean Water Act*. For a complete list of licensed well drillers contact the DELG Drinking Water Source Protection Section (Appendix A).

Well logs must include, but not be limited to, information on lithology and/or stratigraphy, depth and estimated yields of water-bearing fractures, static water level elevations, and well construction details. Well locations must be surveyed with elevations measured to ground surface and to the top of casing. Well depths should refer to the depth below top of casing (btoc).

Wells should be fully developed before yield tests are performed, with a minimum recommendation of two hours development. The improvement in the well development can be estimated by the change in specific capacity at a fixed pumping rate. These observations should be included with the raw data submitted to the DELG.

3.2 Step Testing

In order to determine the appropriate pumping rate for the constant rate pumping test, a step pumping test (step test) is recommended. This step test shall have a minimum of three steps with increasing pumping rates. Before proceeding to the constant rate test, the water level in the pumped well must be allowed to recover to a static level.

3.3 Constant Rate Pumping Test

The Hydrogeological Assessment must include a minimum of one constant rate pumping test. For all pumping tests the observation wells must be located within the same hydrogeological unit as the pumping well and within the drawdown cone. Constant rate pumping tests shall only be considered to be constant rate if the measured flows fall within ± 5% of the average flow over the entire test.

3.3.1 Municipal, Industrial and Communal Wells

For municipal, industrial, and communal wells a constant rate pumping test with a minimum duration of 72 hours is usually required. In certain situations the length of the constant rate test may be altered with prior approval from the DELG.
For municipal water supplies, drawdown and recovery measurements must be taken in a minimum of two observation wells (exclusive from the production well) within the drawdown cone. For industrial and communal water supplies, a minimum of one observation well is required but more may be necessary depending on the situation. The recovery measurements must be continued until the original static water level is reached, or a period equal to one-half the length of the constant rate pumping test is completed (minimum 24 hours), whichever occurs first.

The DELG does not approve pumping rates for new wells that are higher than the pumping rate used during the constant rate pumping test.

3.3.2 Subdivision Developments

This section refers to subdivision developments where each lot will have an individual water supply well. For subdivision developments where a communal well(s) is proposed, refer to Section 3.3.1.

For subdivision developments with individual water supply wells, a single 72-hour constant rate pumping test may not be appropriate for assessing the suitability of the water supply source. The hydrogeological testing conducted for a proposed subdivision must evaluate if the local aquifer is capable of providing a water supply of sufficient quantity and suitable quality. In addition, the hydrogeological testing must assess the cumulative impacts of the entire subdivision development on the aquifer and neighboring water users. Along with pumping tests, groundwater modelling may be used in order to evaluate the water supply and potential impacts.

For the hydrogeological testing, a minimum of three test wells must be used, with at least one well located on the proposed site (unless otherwise approved by the Department of Environment and Local Government). The total number of wells required for hydrogeological testing is dependent on the hydrogeological conditions of the site and the size of the development. As a general rule, there should be one well for every 10 acres of development. The pumping well and observation wells must be appropriately located spatially to test the various hydrogeological conditions across the site and must also be appropriately grouped to obtain data during the pumping test.

A least one of the wells must be subjected to a constant rate pumping test for 24 hours. The total number of wells requiring a pumping test will depend on site conditions and the size of the development.

The water requirements for a subdivision lot with a single family home are based on a per-person water requirement of 450 L/day with a peak demand rate of 3.75 L/min/person. It is assumed that peak demand occurs for a period of 120 minutes each day. The number of people per household is calculated as the number of bedrooms in the house to be developed plus one. These values should be used when calculating the water requirements of the proposed development.

If groundwater heat pumps are intended to be used in the subdivision, then the water requirements of groundwater heat pumps must be evaluated as part of the hydrogeological study.

3.3.3 Open Loop Earth Energy Systems

For open loop earth energy systems, each water supply well must be subjected to a constant rate pumping test for a minimum of 24 hours. A minimum of one observation well is required but more may be necessary depending on the project. The recovery measurements must be continued until the original static water level is reached, or a period equal to one-half the length of the constant rate pumping test is completed (minimum 24 hours), whichever occurs first. Water from the pumping test must be properly discharged to the environment and not to any return well. If the water supply well is also going to be used as a potable water supply, then the testing needs to account for the water required to supply both the earth energy system and potable water needs.

If the location and construction of the observation well is appropriate, it may be used as a return well for the system.

The capacity of the return well(s) must also be evaluated and discussed in the WSSA report. The site professional should determine the appropriate method for evaluating the capacity of the return well(s) for the earth energy system. The return well(s) must also be constructed so that water is returned to an appropriate location within the aquifer, which is protective of any nearby drinking water wells.

3.4 Timing of Pumping Test(s)

Pumping tests should not be conducted during groundwater recharge seasons, which have historically occurred from October to December and mid-March to the end of May. Given changing climate conditions, these dates may fluctuate and are dependent on actual weather conditions. Pumping tests may be conducted during the dates listed above if it can be clearly documented that groundwater recharge has not begun.

In addition, pumping tests that have been carried out in an unconfined or partially confined aquifer within 10 days of 40 mm of rain or during a month of abnormally (>130 % normal) high rainfall may be considered unsuitable. It is the registered professional's responsibility to ensure that hydrogeological testing is carried out under suitable conditions and to evaluate issues such as spring freshet, snow melt, ground thaw and winter rain storms.

3.5 Water Quality

3.5.1 Municipal, industrial, communal and subdivision wells

As part of the WSSA process, the quality of the proposed water supply must be evaluated. A water sample must be collected from each pumping well at the beginning, middle and end of the pumping test (i.e. at 24, 48 and 72 hours for a 72 hour pumping test). Depending on the situation, water samples may also be required from observation or monitoring wells.

The water quality analysis must include, as a minimum, general chemistry, trace metals and microbiology (total coliforms and E.coli). Water samples must be analysed by an accredited laboratory. The supervising site professional should use their judgment in determining if additional water testing is required due to present or historical land use or contamination issues (i.e. hydrocarbon spill, pesticide application, past industrial use, etc.) or the end use of the water supply (i.e. drinking water, industry, aquaculture, etc.).

Copies of water quality laboratory reports must be included in the WSSA report.

3.5.2 Open Loop Earth Energy Systems

A water quality sample must collected from the water supply well and the return well(s) following completion of the wells. The water quality analysis must include, as a minimum, general chemistry and trace metals. Water samples must be analysed by an accredited laboratory. If the water supply well is also going to be used for potable water, a sample needs to be collected for microbiological analysis.

Copies of the laboratory reports must be included in the WSSA report.

4.0 Reporting Requirements

The Hydrogeological Assessment report should include the information described in this section and summarized in Table 1 (page 14). A submission checklist of the minimum general requirements to be included in the hydrogeological report can be found in Appendix C. The checklist must be completed and submitted with the hydrogeological report. The hydrogeological report must be submitted in both electronic format and hard copy to the Manager of the Environmental Assessment Section or the specific EIA Project Manager (Appendix A) for review. WSSAs must be completed to the satisfaction of the DELG. Incomplete or inadequate submissions will be returned to the applicant for completion.

4.1 Project Description

This section should include a description of the proposed project, intended water use and water requirements.

4.2 Existing Site Conditions

4.2.1 Site Description

A description of the site, including: site location, PID number, topography, drainage, and proximity to surface water bodies (watercourses, wetlands, etc). Also include information on the location of all neighbouring wells, the land use zoning and land use within a minimum radius of 500 m from the proposed project. This information should also be clearly identified on a 1:10 000 scale map.

4.2.2 Current Groundwater Use

The location and description of all existing wells on the property or in the wellfield, including: GPS coordinates of any wells (UTM coordinates - NAD83), well log details, wellhead completion, current water usage, pumping rate(s) and schedule(s), water levels, and history of any well interference or other concerns/complaints.

4.2.3 Geology

A detailed description of the local and regional bedrock and surficial geology, including, but not limited to: stratigraphy, depth of surficial deposits, formation thickness, composition, texture, known relevant weathering/alteration/structural features (i.e. joints, fractures, faults, or bedding planes), water-bearing potential and lateral continuity. Standard geological cross-sections should be included for the proposed site. Whenever possible, soils or geological information generated by the investigation should be described graphically.

4.2.4 Hydrogeology

A detailed description of the local hydrogeology, including, but not limited to: aquifer types, identification of hydrostratigraphic units and the hydraulic characteristics of each unit. The description of hydraulic characteristics must include a discussion of: hydraulic conductivity, porosity, effective porosity, transmissivity, storativity/specific storage, anisotropy, hydraulic head, seasonal fluctuations, vertical and horizontal hydraulic gradients, groundwater flow direction, boundary conditions, recharge, discharge and overall groundwater quality.

4.3 Pumping Test(s)

4.3.1 Description

The details of the pumping test must be outlined in the report and must include the following:

- Name of well driller and supervising site professional
- Construction details of any pumping and observation wells
- Pumping test set-up details (i.e. pump size, pump depth, flow control and water level measuring device, etc.)
- Type of test (step, constant rate, recovery)
- Information on other monitoring stations (i.e. stream station, tidal monitoring, etc.)
- Static water levels for the pumping well and observation wells

- Date and time when pumping started and ended
- Field observations and measurements (i.e. pH, conductivity, temperature)
- Weather observations during tests (i.e. precipitation, barometric pressure, etc.)
- Pumping flow rate ajustements

Logs should be presented in tabular and columnar format including any geophysical logs that may have been collected. Well construction details and information of hydrogeological interest should be combined in a similar way. The report should also indicate whether a well video was taken.

Variations from the approved plan submitted in the WSSA Initial Application should be identified, explained and justified.

4.3.2 Data Presentation

Copies of the original pumping test data sheets should be appended in the report. An electronic copy of the pumping test data should be submitted with the electronic report.

All pumping test data should be presented graphically (i.e. time-drawdown, recovery, and distance-drawdown) and the slope of the graph should be easily measurable in the trend-setting region. Any trend lines drawn for analysis should be clearly marked. All graphs should include test information (date, time, observation point, well identifier, and pumping rate if applicable) and should have clearly labeled axes.

4.3.3 Data Analysis

The step test and constant rate pumping test data should be analysed using standard, accepted data interpretation methods (i.e. Cooper-Jacob method, Theis method, etc.). Describe any assumptions made and deviations from standard methods.

Determine estimates of the following aquifer properties: transmissivity, hydraulic conductivity, storativity and specific yield. Evaluate if the pumping test data indicates any boundary conditions.

The following guidelines may be used to determine the total available drawdown in a well:

- depth to the first water-bearing fracture in bedrock
- bottom of confining layer in a confined aquifer
- sea level (in coastal settings)
- bottom of casing or top of the well screen in unconsolidated aquifers

Safe allowable drawdown is based on the total available drawdown plus an appropriate factor of safety. Use the above information, along with the safe available drawdown in the well, to determine the design safe yield of the pumping well or wells.

In areas that already have substantial water usage, groundwater modelling may be required to assess the safe yield, the potential for well interference and a water balance. Groundwater modelling may also be required for subdivisions in order to assess the potential effects of the entire development on the aquifer.

4.4 Discussion

The report must include discussion of the following items (as applicable): land use, groundwater resource evaluation, well interference, water quality, groundwater under the direct influence of surface water, salt water intrusion and relic sea water, open loop earth energy system information, final well and wellfield design, wellhead protection measures, monitoring and/or contingency plans, and decommissioning plans. These items are described in detail in the following sections.

4.4.1 Land Use

The report should identify any conflicting land uses in the area within a minimum distance of 500 m. Any potentially adverse impacts on the proposed water supply due to current or historical land uses must also be identified and discussed.

4.4.2 Groundwater Resource Evaluation

The report must include a detailed determination and discussion of the design safe yield of any proposed production well(s) as it relates to the geological and hydrogeological characteristics of the aquifer, including any boundary conditions indicated by the hydraulic testing.

The sustainability of the water supply aquifer must be evaluated using all available information (i.e. hydrogeology, available well logs, hydraulic properties of the aquifer, pumping test data, potential boundary conditions, climate variations, etc.). Evaluation of the cumulative effect of all water withdrawals on the aquifer and the potential for effects on surface waters must also be included.

4.4.3 Well Interference

Discuss the relationship between the proposed production well or wells and other water users in the area (i.e. private water wells, industry, commercial, etc.) and the potential for well interference effects.

4.4.4 Water Quality

The *New Brunswick Drinking Water Quality Guidelines* issued by the NB Department of Health are used as the standard for assessing drinking water quality. In the report, water quality results must be tabulated and compared to the appropriate *Drinking Water Quality Guidelines*. If there are exceedances of the Guidelines for health or aesthetic parameters then any potential treatment systems to render the water potable must be discussed along with the potential costs of water treatment.

For open loop earth energy systems, the water quality data must be evaluated for potential impacts to the function of the system and impacts to the groundwater quality from water being returned to the aquifer. If the water supply well is also going to be used as a potable water supply, the water quality (including microbiology) needs to be evaluated according to the guidelines listed in the above paragraph.

4.4.5 Groundwater Under the Direct Influence of Surface Water (GUDI)

The report must include an evaluation of the potential influence of surface water or shallow groundwater on the proposed groundwater source. This must include, as a minimum, an evaluation of the setting of the well and its sensitivity to surface water influence (i.e. spring, infiltration gallery, shallow screened well, horizontal collection well, wells in karst aquifers, wells in unconfined sand and gravel aquifers, fractured bedrock aquifers, floodplains or flood prone aquifers, etc.). The distance between the water supply and the nearest surface water body should be considered, along with the well construction in relation to the hydrogeology of the site and potential for surface water influence. For bedrock wells, the positioning of shallow water-bearing fractures should be evaluated in relation to the well construction and casing length. Finally, assess any initial water quality data from the well to see if there are any early indications of surface water influence.

Additional water quality monitoring and/or sampling parameters may be required where the potential for a direct connection between the surface or surface water and groundwater is possible or indicated.

The potential for flooding should be examined if it may be an issue given the location of the proposed water supply.

4.4.6 Salt Water Intrusion and Relic Seawater

An evaluation of the potential for salt water intrusion and reduction of freshwater head (i.e. Ghyben Herzberg relation) should be provided if the well is located within 500 m of a salt water source. Pumping wells located within 500 m of sea water should not lower the water level below sea level elevation, unless it can be demonstrated that a permanent hydraulic divide exists between the well and the sea water. Salt water sources may include, but are not limited to, the ocean, estuaries, tidal marshes and tidal influenced rivers.

Inland areas that may be affected by relic seawater should also be evaluated.

4.4.7 Open Loop Earth Energy System Information

The report must include information on the open loop earth energy system, such as the well drillers name, type of system, and type of refrigerant to be used.

The report must also include information on the capacity of any return well(s) for the system and discuss any potential for negative impacts to the aquifer or neighbouring water users from returned water.

4.4.8 Final Well Design

Provide final design drawings (including GPS coordinates) of the permanent well structure for municipal, industrial and communal wells. A map indicating the proposed locations of water supply piping may be required.

4.4.9 Well Head Protection Measures

Measures for water supply source protection should be discussed along with any unusual site conditions. It is recommended that a minimum land area of one acre be reserved for each production well and that the well be located toward the center of this land parcel. Well head protection measures could include measures such as locks, gates, well houses, limiting access, etc.

4.4.10 Monitoring and/or Contingency Plan

A water quantity and/or quality monitoring plan should be prepared identifying the type and frequency of parameters to be monitored (i.e. physical, chemical, microbiological, etc.). At a minimum, all water supply wells requiring an Approval to Operate will be required to maintain flow monitoring records. On-going monitoring data may need to be submitted to the DELG.

A contingency plan with specific strategies, actions or mitigation measures may be required to deal with any water supply issues such as malfunctions or service disruptions.

4.4.11 Decommissioning Plans

Wells drilled as part of the WSSA process (including observation and test wells) that will not be used for monitoring or any other reasonable purpose should be decommissioned according to the DELG *Guidelines for the Decommissioning (Abandonment) of Water Wells*.

For open loop earth energy systems, a decommissioning plan must be developed for the system that conforms to the DELG *Guidelines for the Decommissioning (Abandonment) of Water Wells*.

The Guideline may be obtained from the EA Section or found on-line at:

http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Water-Eau/GuidelinesWaterWells.pdf

Table 1. Summary of Hydrogeological Assessment Information

Study Information	Description
1. Site Description	• Site Description • Wellfield Description • Intended Water Use • Groundwater Withdrawal Details • Existing and Previous Approvals
2. Description of Hydrogeology	• Local and Regional Geology • Local and Regional Hydrogeology • Local Surface Water Features
3. Pumping Test Information	• Pumping Test Analysis • Water Quality Analysis
4. Evaluation of Potential Impacts	• Design Safe Yield • Well Interference Effects • Groundwater Quality Effects • Salt Water Intrusion • Groundwater Under the Direct Influence of Surface Water (GUDI)
5. Monitoring and Contingency Plans	• Monitoring Plan (recommendations) • Contingency Plan (recommendations) • Decommissioning Plan
6. Supporting Figures and Data	• Site Location Map • Site Plan and GPS Coordinates of Wells • Aerial Photos • Well Logs (test, pumping & return wells) • Pumping Test Data and Graphs • Laboratory Reports • Groundwater Level Data • Well Production Records

Appendix A

Department of Environment and Local Government
Select Contact Information

For additional EIA information, please contact:

Department of Environment and Local Government
Environmental Assessment Section, c/o Manager
Tel: (506) 444-5382
Fax: (506) 453-2627

Physical Address:
20 McGloin Street, Marysville Place
Fredericton, New Brunswick
E3A 5T8

Mailing Address:
P. O. Box 6000
Fredericton, New Brunswick
E3B 5H1

For questions pertaining to:

EIA Regulations or Submissions	Environmental Assessment	(506) 444-5382
Hydraulic Testing (Pumping Tests)	Water and Wastewater Management	(506) 453-7945
Watercourse and Wetland Alteration Program	Surface Water Protection	(506) 457-4850
Wellfield Protection and Open Loop Earth Energy Systems	Drinking Water Source Protection	(506) 453-2171
Property Searches	Remediation and Materials Management	(506) 453-7945
Land Use Zoning & Subdivision Reviews	Provincial and Community Planning	(506) 453-2171

Appendix B

WSSA Initial Application Form

Water Supply Source Assessment
Initial Application

Please provide the following information:

1) Name of proponent.
2) Location of drill targets (including property PID) and purpose of the proposed water supply.
3) Required water quantity (in m^3/day) and/or required pumping rate.
4) List alternate water supply sources in area (including municipal systems).
5) Discuss area hydrogeology as it relates to the project requirements.
6) Outline the proposed hydrogeological testing and work schedule.
7) Identify any existing pollution or contamination hazards within a minimum radius of 500 m from the proposed drill targets. Historical land use that might pose a contamination hazard (i.e. tannery, industrial, waste disposal, etc.) should also be discussed.
8) Identify any groundwater use problems (quantity or quality) that have occurred in the area.
9) Identify any watercourse(s) (stream, brook, river, wetland, etc.) within 60 m of the proposed drill targets.
10) Identify site supervisory personnel involved in the source development (municipal officials, consultants and drillers).
11) Attach a 1:10000 map and/or recent air photo clearly identifying the following:
    - proposed location of drill targets and property PID
    - domestic or production wells within a 500 m radius from the drill target(s)
    - any potential hazards identified in question 7.
12) Attach a land use/ zoning map of the area (if any). Superimpose drill targets on this map.
13) Contingency plan for open loop earth energy systems (see Section 2.3).

Submit WSSA Initial Application:
c/o Manager
Department of Environment and Local Government
Environmental Assessment Section
Tel: (506) 444-5382
Fax: (506) 453-2627

Mailing Address:
P.O. Box 6000
Fredericton, New Brunswick
E3B 5H1

Physical Address:
20 McGloin Street, Marysville Place
Fredericton, New Brunswick
E3A 5T8

Appendix C

Submission Checklist

Submission Checklist for the Hydrogeological Study

Hydrogeological Study – General Requirements		Included in Report? (√ = yes)	Page Number
Site Description	Site Description		
	Wellfield Description		
	Description of Intended Water Use		
	Groundwater Withdrawal Details		
	Description of Existing and Previous Water Withdrawal Approvals		
Description of Hydrogeology	Regional and Local Geology		
	Regional and Local Hydrogeology		
	Surface Water Features		
Pumping Test Information	Pumping Test Description and Analysis		
	Water Quality Analysis		
Evaluation of Potential Impacts	Design Safe Yield		
	Well Interference Effects		
	Water Quality Effects		
	Groundwater Under Direct Influence (GUDI)		
	Salt Water Intrusion		
	Open Loop Earth Energy System Information		
Supporting Figures and Data	Site Location Map and Site Plan		
	Well Logs		
	Pumping Test Data and Graphs		
	Laboratory Reports		

Notes on General Requirements:
Water Supply Source Assessments and EIA Registrations are required for groundwater wells with a capacity for water withdrawals greater than 50,000 L/day (50 m^3/day).
Hydrogeological studies must be signed and professionally sealed by a qualified Engineer or Geoscientist registered with the Association of Professional Engineers and Geoscientists of New Brunswick.
Reports and data must be submitted in hard copy and electronic copy.
A constant rate pumping test and analysis is required for each pumping well included in the EIA Registration.
Production well(s) must be pump tested at a rate greater than or equal to the requested withdrawal rate.
Well interference effects should be evaluated for wells within a minimum radius of 500 m.
Salt water intrusion effects should be evaluated if the production well is within 500 m of a salt water body.
Potential for groundwater under the direct influence of surface water (GUDI) should be evaluated for each proposed production well.
Any work that is to be completed within 30 m of a watercourse or regulated wetland first requires a Watercourse and Wetland Alteration (WAWA) Permit.