WELL AND AQUIFER EVALUATION REPORT
PROPOSED 3000-LOT
RECREATIONAL VEHICLE DEVELOPMENT
SANDY POINT 01 AND 12-01-041-01-W4M
GULL LAKE, ALBERTA

Submitted To:

Frank Wilson
Gull Lake, Alberta

Submitted By:

Waterline Resources Inc.

Calgary, Alberta

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EXECUTIVE SUMMARY

Waterline Resources Inc. (Waterline) was retained by Frank Wilson (the Developer) to prepare a groundwater evaluation report in support of a subdivision development approval for a proposed 3000-lot recreational vehicle (RV) subdivision development. The proposed RV subdivision development is to be located in 01 and 12-041-01-W5M at Sandy Point on Gull Lake, Alberta. The Developer is proposing to manage the source-water through the development of a community groundwater supply. The proposed development is located on the west side of Gull Lake, approximately 5 km north of the Village of Bentley, Alberta.

The development is to be a seasonal resort, occupied for approximately 140 days each year. For assessment purposes, the estimated daily water requirement for the proposed RV development is calculated based on the maximum diversion of 200 liters (L) of water per day allocated to each RV lot. Therefore, the total daily source-water requirement is estimated at 600 m^3 and total annual source-water requirement is estimated at 84,000 m^3.

Three production wells were constructed and tested in 2002 as part of the previous development proposal. Well-A is completed in a shallow Paskapoo Formation sandstone aquifer. Well–B and Well-C are completed in a deeper Paskapoo Formation sandstone aquifer that is apparently isolated from the shallow system.

Testing demonstrated that the deep aquifer can sustain the water requirements of the proposed RV development. Therefore, groundwater diversion from the shallow aquifer is not required to sustain the water demand of the proposed development.

The 140-day predicted drawdown following the resort operating season, as calculated at nearest operating well defined during the previous investigation and located 1,600 m from the pumping center is estimated at 0.83 m in the deep aquifer. The 20-year predicted drawdown 1,600 m from the pumping center is estimated at 0.47 m in the deep aquifer.

The groundwater chemistry of the shallow aquifer is characterized as a sodium/bicarbonate water. The groundwater chemistry of the deep aquifer is characterized as a sodium/bicarbonate-sulphate water.

Aquifer testing and analysis has confirmed that groundwater diversion from the tested wells, at the rates required for the proposed RV development will not unreasonably interfere with each other or existing users of the groundwater source; negatively impact the aquifer or other aquifers and surface water bodies; and, harm the environment in general, if managed appropriately.

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1.0 INTRODUCTION

Waterline Resources Inc. (Waterline) was retained by Frank Wilson (the Developer) to prepare a groundwater evaluation report in support of a subdivision development approval for a proposed 3000-lot recreational vehicle (RV) subdivision development. The proposed RV subdivision development is to be located in 01 and 12-041-01-W5M at Sandy Point on Gull Lake, Alberta (the Site). The Developer is proposing to manage the source-water through the development of a community groundwater supply. The proposed development is located on the west side of Gull Lake, approximately 5 km north of the Village of Bentley, Alberta (Figure 1).

Hydrogeological information for the site, and the surrounding area was assembled and reviewed as part of the aquifer evaluation. Information sources included the Alberta Environment (AENV) water well record database and relevant and readily attainable published geology and hydrogeology maps and reports.

In 2003 Waterline completed an aquifer evaluation report in support of a Water Act license application for a residential development proposed for the site by a previous land owner. The drilling and aquifer testing completed as part of the 2003 investigation provided the foundation for the current investigation.

The estimated daily water requirement for the proposed RV development is calculated based on the maximum diversion required at full resort capacity. The development is to be a seasonal resort, occupied for approximately 140 days each year. For assessment purposes, 200 liters (L) of water per day was allocated to each RV lot. Table 1 presents the calculations used in assigning an annual water diversion of 84,000 m^3 at a maximum daily diversion of 600 m^3 for the fully occupied development.

Table 1: Estimated Maximum Groundwater Use at the Resort

Maximum Number of Units	Water Requirement (L/day/unit)	Total Water Requirement (m^3/day)	Estimated Annual Days of Operation	Annual Water Requirement (m^3)
3000	**200**	**600**	**140**	**84,000**

Therefore, aquifers underlying the proposed RV development are required to sustain production of up to 600 m^3/day for the period of 140 days, or an annual diversion rate of 84,000 m^3/year or averaged at 230 m^3/day over the entire year (600 m^3/day x 140/365).

2.0 OBJECTIVES AND SCOPE OF WORK

Waterline's objectives were to undertake a hydrogeological investigation and aquifer analysis in regards to the proposed 3000-lot recreational vehicle (RV) subdivision development, as required for subdivision approval. Specifically, Waterline's objectives included:

- A review of available water well records, reports and references required to assess the expected geology, hydrogeology and groundwater use in the area;

- A review of the results of a field-verified well survey (2003) completed by a third party;

- A review of the well construction details presented by Alken Basin Drilling Ltd. (Alken) of Bentley, Alberta;

- A review of the constant-rate aquifer tests, and of recovery tests, as conducted by Alken, and analysis of the production data to estimate the expected long-term sustainable yield of the proposed water supply wells;

- An assessment of the expected impact of the proposed groundwater use at the subject property on current water users in the area;

- Review and comment on water quality analysis for the subject wells; and,

- Complete a summary report in support of the subdivision approval. The report should determine if an adequate supply exists to meet the demand of the proposed 3000-lot recreational vehicle (RV) subdivision development. The report must also address whether the proposed diversion of groundwater will unreasonably interfere with existing household users, licensees, or traditional agriculture users in the vicinity of the Site.

3.0 REGIONAL GEOLOGY AND HYDROGEOLOGY

3.1 QUATERNARY AND BEDROCK GEOLOGY

The shallow Quaternary geology in the majority of the subject area is mapped as: coarse lacustrine sediment (sand and silt) with local ice-rafted stones, up to 40 m thick, deposited mainly in proglacial lakes, and also including undifferentiated recent lake sediment, with moderately undulating topography modified in places by wind (Shetsen, 1990). On the west side of the Site, the shallow Quaternary geology is mapped as: draped moraine sediments which have been deposited on bedrock uplands and plains, discontinuous till over bedrock which has been slightly modified by ice and stream erosion and is generally less than 3 m thick, flat to undulating topography (Shetsen, 1990). Bedrock beneath the site is mapped as the Paskapoo Formation; a thick bedded, calcareous, cherty sandstone; siltstone and mudstone with some coal occurring near the base of the formation (Tokarsky, 1970).

The geology listed on water well completion records (AENV, April 2008) is consistent with the regional geologic mapping (Shetsen, 1990 and Tokarsky, 1970), and is logged as a variable thickness of gravel, sand and clay, underlain by layers of shale and sandstone, with some coal. Figure 2 presents a geological fence diagram (cross-section) orientated approximately west-east passing through the subject area. The axial trace of the cross-section is shown on Figure 1. The cross-section includes soil and bedrock stratigraphy data obtained from five water

wells; AENV Well No. 435949 (Park), 393515 (Johnson), 466368 (Christiansen), 466369 (Domex) and 435955 (Sandy Point), completed in close proximity to the proposed development.

3.2 HYDROGEOLOGY

3.2.1 AENV Water Well Database

The AENV database lists 35 water well records for the subject lands and surrounding area. The database area searched includes section 08-041-28-W4M, section 01 and 12-041-01-W5M, and part of the sections that are within the proximity of 1 km of the subject area which include: sections 02, 11, 13, 14-041-01-W5M, and section 35 and 36-040-01-W5M. However, only a subset of the records listed in the AENV database typically represent water wells currently in operation. Information for all records is summarized, in tabular format, in Appendix A. Full records are also provided in Appendix A for logs used to construct the geological cross-section, and for selected other well records in the subject area. The records indicate that present groundwater use in the area is primarily for domestic or domestic/stock purposes (19 records), with lesser use indicated for industrial oil field requirements (9 records), observation wells (6 records), and one record reported as unknown proposed well use.

3.2.2 Well Completion Depth and Static Water Level

Several well records are identified as AENV shallow observation wells complete to approximately 3 m depth. Three records are associated with deep industrial or exploratory wells completed to depths greater than 300 m. Excluding the shallow observation well records and deep exploratory well records, all other water well records identified within the study area define the completed well depth range between 15.24 and 67.06 m below ground level (bGL), with a calculated average depth of 37.69 m bGL, in sandstone units of the Paskapoo Formation (AENV, April 2008). Static water levels, measured in area wells following construction, were commonly in the 0 (flowing) to 32.0 m below top of casing (bTOC), with a calculated average static water level depth of 8.61 m bTOC. Shallow groundwater is expected to flow to the east towards Gull Lake (Tokarsky, 1970). Upward hydraulic gradients, and springs are also mapped on the west side of Gull Lake (Tokarsky, 1970).

3.2.3 Aquifer Depth and Well Yield

The main water bearing units beneath the Site are fractured sandstones in the Paskapoo Formation, with the safe yield of wells being mapped as 23-114 L/min based on aquifer test results (Tokarsky, 1970). West of the subject area, in 041-02-W5M, the safe yield of wells is mapped as 114-455 L/min based on estimates made from the flow regime and lithologic interpretation (Tokarsky, 1970). The existing hydrogeology data at, and adjacent to the subject property suggests that domestic groundwater supplies in the immediate area of the proposed development have been mainly developed from multiple, fractured sandstone aquifers in the Paskapoo Formation.

Limited duration well tests completed by the well drillers, following construction of wells located within 08-041-28-W4M, sections 01 and 12-041-01-W5M, and part of the sections 02, 11, 13,

14-041-01-W5M, sections 35 and 36-040-01-W5M, have been conducted in the range of 20.5-318.0 L/min, with a calculated average test rate of 140.5 L/min. The well tests indicate that the single well yields fall within the range of the safe yields mapped for the area.

3.2.4 Regional Groundwater Quality

Based on Tokarsky (1970), the groundwater quality at the site is mapped as having a total dissolved solids (TDS) concentration of 500-1,000 milligrams (mg)/L which is considered non-saline in Alberta for which the use is governed by the Water Act. Tokarsky (1970) indicates that groundwater in the area is a sodium-bicarbonate type water, with iron concentrations in the range of 0.5-1.0 mg/L, and fluoride concentrations less than 0.5 mg/L.

One water chemistry record for wells located within 08-041-28-W4M, sections 01 and 12-041-01-W5M, and part of the sections 02, 11, 13, 14-041-01-W5M, sections 35 and 36-040-01-W5M was obtained from the provincial water well database (AENV, April 2008). Although the data provided on the record is limited, it appears to support the regional mapping, indicating that sodium-bicarbonate type groundwater predominates in the area. The recorded TDS concentration was 684 mg/L. A copy of the water chemistry records is provided in Appendix A.

4.0 FIELD PROGRAM

4.1 2003 FIELD VERIFIED WELL SURVEY

As part of the Waterline 2003 groundwater diversion license application, a field verified survey of active water wells located in the vicinity of the development property was completed. At that time only water well located with a 1 km radius of the proposed community water supply wells was identified and was also owned by the previous developer, Sandy Point Farms. The well is located in 04-12-041-01-W5M and listed under AENV Well No. 0435955 (Figure 3 and Appendix A). This well was constructed in 1983 as a multiple aquifer completion. Therefore, the well was not considered for use as a community water supply and was to be reclaimed. The closest operating domestic well was located approximately 1.6 km southwest of the proposed community water supply wells in 13-36-040-01-W5M (Figure 3). This domestic well is owned by Simpson and listed under AENV Well No. 380562 (Appendix A).

4.2 WATER WELL CONSTRUCTION

4.2.1 Well-A Construction

Well-A was constructed on November 13, 2002 by Alken, using an air rotary drill equipped with casing driver. The well site is located at 15-01-041-01-W5M (Figure 3). A 141 mm outside diameter (OD) (6.5 mm wall thickness) surface casing was driven to 11.28 m bGL in shale bedrock. The borehole was advanced beyond the surface casing by open hole drilling to a total depth of 27.43 m bGL. Interbedded sandstone and shale units were encountered below the drive shoe. Significant groundwater production was observed from a sandstone layer intersected between 22.25-24.69 m bGL. The borehole was completed with a 102 mm inside diameter (ID) PVC liner, perforated from 21.33-24.38 m bGL with 13 mm drilled holes. Borehole

construction details were interpreted by Waterline from the Alken water well drilling report (Appendix B).

4.2.2 Well-B Construction

Well-B was constructed on November 13, 2002 by Alken using an air rotary drill equipped with a casing driver. The well site is located approximately 8 m northwest of Well-A (Figure 3). A 141 mm OD (6.5 mm wall thickness) surface casing was driven to 29.56 m bGL in shale bedrock. The borehole was advanced beyond the surface casing by open hole drilling to a total depth of 54.86 m bGL. Interbedded sandstone and shale units were encountered below the drive shoe. Significant groundwater production was observed from a sandstone layer intersected between 32.61-51.81 m bGL. The borehole was completed with a 102 mm ID PVC liner, perforated from 36.57-51.81 m bGL with 13 mm drilled holes. Borehole construction details were interpreted by Waterline from the Alken water well drilling report (Appendix B).

4.2.3 Well-C Construction

Well-C was constructed on November 20, 2002 by Alken using an air rotary drill equipped with a casing driver. The well site is located approximately 100 m northwest of Well-B (Figure 3). A 219 mm OD (9.3 mm wall thickness) surface casing was driven to 31.70 m bGL in shale bedrock. The borehole was advanced beyond the surface casing by open hole drilling to a total depth of 54.86 m bGL. Interbedded sandstone and shale units were encountered below the drive shoe. Significant groundwater production was observed from a sandstone layer intersected between 32.31-51.81 m bGL. The borehole was completed with a 153 mm ID PVC liner, perforated from 36.57-48.77 m bGL with 13 mm drilled holes. Borehole construction details were interpreted from the water well drilling report (Appendix B).

4.3 AQUIFER TESTING

4.3.1 Wells A and B Production Tests

Alken started the Well-A constant-rate production test on November 13, 2002 at 11:30. The pre-pumping water level was measured at 7.15 m bTOC. The production rate was fixed at 130.9 m^3/day (90.9 L/min). Production continued for 24 hours at which time the pump was shut down and water level recovery was monitored for an additional 24 hours (Figure 4).

At 7:30 on November 14, 2002 Alken started a constant-rate aquifer test on Well-B, located approximately 8 m northwest of Well-A (Figure 3). The pre-pumping water level was measured at 7.44 m bTOC. The production rate was fixed at 274.9 m^3/day. The Well-A and Well-B production constant-rate tests overlapped during the final 240 minutes of the Well-A test (Figure 4). Well-B production continued for 24 hours, at which time the pump was shut down and water level recovery was monitored for an additional 24 hours.

4.3.2 Well-C Production Test

Alken started a constant rate aquifer test on Well-C on November 27, 2002. Well-C is located 100 m northwest of Well-B (Figure 3). The pre-pumping water level was measured at 6.53 m

bTOC. The production rate was fixed at 556.4 m^3/day. Production continued for 24 hours at which time the pump was shut down and water level recovery was monitored for an additional 24 hours (Figure 5). During the pumping and recovery periods water levels were recorded in both Well-A and Well-B (Figure 5).

4.3.3 Production Testing Summary

Although Well-A and Well-B are completed in two distinctive aquifers, there appears to be minor hydraulic communication between the aquifers as evident by the small pressure change observed at the point the Well-A production test was shut down (1,200 minutes; see Figure 4). The effect on the Well-B water level may have resulted from pressure leakage down the Well-B borehole, through the annulus between the surface casing and borehole wall. The hydraulic communication may be influenced by an imperfect annular seal, as well as the close spacing between the two wells (8 m separation). It is unlikely that the pressure response is communicated across the intervening confining unit by other pathways. The drawdown observed in both wells decreased to near steady-state within the 24 hour production periods.

The water level changes observed in Well-B during the Well-C production test (Figure 5) indicate that Well-B and Well-C are completed in the same aquifer and have a strong hydraulic communication. The water level recorded in Well-A did not change during the Well-C production test. This indicates that Well-A is completed in an aquifer locally isolated from Well-B and Well-C with no apparent natural, hydraulic connection across the confining unit. This observation supports the theory of borehole leakage as an explanation for the communication observed between Well-A and Well-B, described above. Both the water levels recorded in Well-C and Well-B during the Well-C production test stabilized by the end of the 24 hour production period (Figure 5).

4.4 WATER QUALITY TESTING

Groundwater samples were collected from Wells A, B and C by Alken during the production tests. The water samples were submitted to WSH Labs (1992) Ltd., of Calgary, Alberta for chemical characterization.

5.0 RESULTS

5.1 AQUIFER TEST EVALUATION

Pumping test analyses were completed using AQTESOLV, Version 4.50-Professional, Aquifer Test Design and Analysis Computer Software (1996-2007 HydroSOLVE Inc.). This aquifer test solver provides analytical solutions for evaluating hydraulic parameters in confined, unconfined, leaky, or fractured aquifer systems. In this analysis, Waterline was able to evaluate the aquifer test data by visual curve matching to determine the “best fit”, and in turn, select the most appropriate interpretation to represent aquifer conditions at the site.

The confined aquifer Cooper-Jacob (1946) straight-line solution was utilized for analysis of the pumping cycle and the recovery cycle. The Agarwal (1980) time transformation procedure was applied to the Cooper-Jacob solution for analysis of the recovery cycle. Although specific

assumptions are made with regard to aquifer characteristics using the data evaluation methods, the following assumptions are implicit with the use of all parametric solutions:

- Aquifer is homogeneous, isotropic and of uniform thickness;
- Aquifer potentiometric surface is initially horizontal;
- Pumping well is fully penetrating;
- Flow to pumping well is horizontal;
- Aquifer is confined;
- Water is released instantaneously from storage with decline of hydraulic head;
- Diameter of pumping well is very small so that storage in the well can be neglected; and,
- The distance from the pumping well is small and the pumping interval is relatively long.

Since these assumptions are not realized in nature, there will invariably be some discrepancy between predicted (i.e., theoretical) and measured drawdown. For example, since most aquifers receive some recharge, Cooper-Jacob and Theis-type predictive analysis often over-predicts drawdown, and are inherently conservative. However, such conservatism is typically viewed as beneficial in terms of water resources management and protection for current and future generations.

Table 2 presents a summary of the aquifer parameters values obtained from the analysis of the test data. The test analysis is provided for reference in Appendix C.

Table 2: Summary of Pumping Test Analysis

Well	Confined Solution	Test Cycle	Time Interval Analyzed	Transmissivity (m^2/min)	Storativity
Well-A (pumping well)	Cooper-Jacob	Pumping	Full	0.0214	NA
	Cooper-Jacob (Agarwal)	Recovery	Full	0.0602	NA
Well-B (pumping well)	Cooper-Jacob	Pumping	Full	0.1772	NA
	Cooper-Jacob (Agarwal)	Recovery	Full	0.2264	NA
Well-B (observation well; Well-C pumping)	Cooper-Jacob	Pumping	Full	0.5530	NA
	Cooper-Jacob (Agarwal)	Recovery	Full	0.3930	0.00002
Well-C (pumping well)	Cooper-Jacob	Pumping	Full	0.3533	NA
	Cooper-Jacob (Agarwal)	Recovery	Full	0.3537	NA

Notes: NA denotes not applicable

Based on the evaluation of the test data summarized in table 2, the geometric mean of transmissivity values for the shallow aquifer developed in Well-A is estimated at 0.036 m^2/min (51.7 m^2/day). The geometric mean of transmissivity values for the deep aquifer developed in

Wells B and C is estimated at 0.321 m^2/min (461.9 m^2/day). A storativity value of 0.00002 (determined from the Well-B observation data collected during the Well-C production test) was used in all calculations.

5.2 Q_{20} CALCULATIONS

The theoretical 20-year safe yield (Q_{20}) of the well can be determined by applying the following formula: Q_{20} = (0.68) (T) (H) (0.7) (Farvolden 1959, referenced in AENV, February 5, 2003);

Where:

T Coefficient of transmissivity (m^2/day) of the aquifer;
H Distance, m, between the top of the aquifer, or the top of the production interval, whichever is less, and the static pre-pumping water level in the well;
0.7 Arbitrary safety factor to allow for well losses, etc.

Well-A: where T = 51.7 m^2/day; H = 15.19 m, Q_{20} is calculated at 374m^3/day.

Well-B: where T = 461.9 m^2/day; H = 26.37 m, Q_{20} is calculated at 5,798 m^3/day.

Well-C: where T = 461.9 m^2/day; H = 26.69 m, Q_{20} is calculated at 5,868 m^3/day.

5.3 PREDICTED DRAWDOWN AFTER 140 DAYS, 5, 10, AND 20 YEARS OF PUMPING

AQTESOLV, Version 4.50-Professional aquifer test design and analysis computer software (1996-2007 HydroSOLVE Inc.) forward solution was used to provide an assessment of the cumulative effects of simultaneously pumping Well-B and well-C. The Theis (1935) Solution for a pumping test in a confined aquifer was applied in forward solution analysis to predict the theoretical response of an ideal aquifer over the seasonal operating period (140 days), in addition to the long term 5, 10 and 20 year assessments. The analytical forward solution employed Equations 1 and 2, as follows:

$$u = \frac{r^2 S}{4Tt} \quad \textit{Theis, 1935} \qquad (1)$$

$$s = \frac{QW(u)}{4\pi T} \quad \textit{Theis, 1935} \qquad (2)$$

The variables are described as follows:

r	=	distance from the pumping well
S	=	assumed storativity
T	=	estimated transmissivity
t	=	elapsed time since pumping started

s = drawdown at the distance r
Q = pumping rate
W(u) = well function of u

An assessment of the commutative effects of the 140-day seasonal groundwater diversion at 600 m^3/day was completed by simulating production from Well-B at 200 m^3/day and Well-C at 400 m^3/day. In order to assess the long term 5, 10 and 20 year effects of the resort water use, the seasonal water consumption was averaged over the entire year equivalent to 230 m^3/day. The 5, 10 and 20 year predictions were completed by simulating production from Well-B at 80 m^3/day and Well-C at 150 m^3/day.

The drawdown was simulated at distances of 500 m (approximate distance to Gull Lake), 900 m (approximate distance to the 04-12-041-01-W5M Well; AENV I.D. 435955) and 1,600 m (approximate distance to the 13-36-040-01-W5M Well; AENV I.D. 380562) from the Well -B and Well-C approximate pumping center. Table 3 presents the results of the cumulative effects analysis. The results of the well interference calculations are also presented graphically in Figure 6 and 7.

Table 3: Summary of Predicted Drawdown – forward solution

Production Well Hydraulic Parameters	Elapsed Time	Distance from Well; r (m)	Calculated Drawdown (m)
Well-B; Q = 200 m^3/day Well-C; Q = 400 m^3/day T = 461.9 m^2/day S = 0.00002	140 days	100	1.99
		500	1.08
		900	0.95
		1,600	0.83
		3,000	0.70
		4,000	0.64
		5,000	0.59
Well-B; Q = 80 m^3/day Well-C; Q = 150 m^3/day T = 461.9 m^2/day S = 0.00002	5 years	100	0.87
		500	0.52
		900	0.46
		1,600	0.42
		3,000	0.37
		4,000	0.34
		5,000	0.33

Production Well Hydraulic Parameters	Elapsed Time	Distance from Well; r (m)	Calculated Drawdown (m)
	10 years	100	0.90
		500	0.55
		900	0.50
		1,600	0.45
		3,000	0.39
		4,000	0.37
		5,000	0.35
	20 years	100	0.93
		500	0.57
		900	0.52
		1,600	0.47
		3,000	0.42
		4,000	0.40
		5,000	0.38

Based on the forward solution analysis, the drawdown predicted after combined pumping the deep aquifer continuously for the 140-day seasonal operation from Well-B and C, at a rate of 200 and 400 m^3/day respectively, is estimated to be 0.83 m within the same aquifer, at a distance of 1,600 m from the pumping center (approximate distance to nearest operating domestic well located in 13-36-040-01-W5M, AENV Well No. 380562, believed to be completed within the deep aquifer).

Based on the forward solution analysis, the 20-year average effect on the deep aquifer caused by pumping the wells at the annual rate averaged daily, was estimated at 0.47 m at a distance of 1,600 m from the pumping center. Therefore, groundwater diversion for seasonal resort use would have a greater effect at the end of each season as compared to the average annual effect following 20-years of operation. This occurs because the system is allowed to recover each year once the seasonal operation is shut down.

5.4 GROUNDWATER CHEMISTRY

Table 3 presents the dominant laboratory tested parameter concentrations analyzed from the groundwater samples collected from Wells A, B and C. The complete laboratory chemistry reports are presented in Appendix D.

Table 4: Laboratory Tested Dominant Chemical Parameters

PARAMETER	WELL-A	WELL-B	WELL-C	Guidelines for Canadian Drinking Water Quality
Date Sampled	Nov 15/2002	Nov 15/2002	Nov 28/2002	
Hardness	41 mg/L	7 mg/L	17 mg/L	N/A
PH	**8.51**	**8.59**	**8.55**	6.5-8.5 (AO)
Electrical Conductivity	950 uS/cm	2,130 uS/cm	1,950 US/cm	N/A
Total Dissolved Solids (TDS)	**568 mg/L**	**1,290 mg/L**	**1,160 mg/L**	≤ 500 mg/L (AO)
Bicarbonate (HCO3)	531 mg/L	452 mg/L	444 mg/L	N/A
Sulphate (SO4)	67 mg/L	**584 mg/L**	494 mg/L	≤ 500 mg/L (AO)
Chloride (Cl)	1.1 mg/L	7.5 mg/L	6.0 mg/L	≤ 250 mg/L (AO)
Fluoride (F)	0.2 mg/L	0.4 mg/L	0.5 mg/L	1.5 mg/L (MAC)
Calcium (Ca)	11.3 mg/L	2.8 mg/L	5.0 mg/L	N/A
Magnesium (Mg)	3.1 mg/L	0.1 mg/L	1.0 mg/L	N/A
Sodium (Na)	**214 mg/L**	**460 mg/L**	**420 mg/L**	≤ 200 mg/L (AO)
Dissolved Iron (Fe)	0.014 mg/L	0.005 mg/L	<0.002 mg/L	≤ 0.3 mg/L (AO)
Dissolved Manganese (Mn)	0.009 mg/L	<0.0006 mg/L	<0.0006 mg/L	≤ 0.05 mg/L (AO)
Nitrate	<0.2 mg/L	<0.2 mg/L	< 0.2 mg/L	45* (MAC)
Nitrite	<0.3 mg/L	<0.3 mg/L	<0.3 mg/L	NA
Coliform (fecal)	0 CFU/100 ml	0 CFU/100 ml	**13 CFU/100ml**	0 CFU/100 ml (MAC)
Coliform (total)	0 CFU/100 ml	**1 CFU/100 ml**	**2 CFU/100 ml**	0 CFU/100 ml (MAC)

Notes: NA denotes not applicable (i.e., no guideline value established), Underlined and **bolded** values indicate exceedance of the CWQG. * denotes equivalent to 10 mg/L as nitrate-nitrogen

The groundwater chemistry of the shallow aquifer is characterized as sodium/bicarbonate water. The groundwater chemistry of the deep aquifer is characterized as sodium/bicarbonate-sulphate water. Groundwater sampled from Well-A, completed in the shallow aquifer, is a higher quality groundwater than that sampled from the deep aquifer. This quality difference is reflected in the

TDS concentration of the groundwater sampled from Well-B and Well-C that is twice that of the TDS concentration of the groundwater sampled from Well-A.

The Guidelines for Canadian Drinking Water Quality (GCDWQ, 2007) set standards based on *Aesthetic Objectives (AOs)*, and on *acceptable concentrations, either maximum (MACs) or interim (IMACs)*. Aesthetic objectives apply to certain substances or characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good-quality water. For certain parameters, both AOs and health-related guidelines (e.g., MACs) have been derived. Where only AOs are specified, these values are below those considered to constitute a health hazard. However, if concentrations in drinking water are well above an AO, there is a possibility of a health hazard. Maximum Acceptable Concentrations (MAC) were established for certain substances that are known or suspected to cause adverse effects on health. Each MAC has been derived to safeguard health, assuming life-long consumption of drinking water containing the substance at that concentration (GCDWQ, 2007).

With the exception of **coliform** bacteria, no parameters analyzed as part of the 2003 sampling program, exceeded the GCDWQ MAC (2007). Both fecal and total coliforms were detected in the water samples collected from the deep aquifer wells. However, it is unlikely that these organisms would live in this environment. Although the MAC for coliform bacteria in drinking water is zero organisms detectable per 100 mL, because coliforms are not uniformly distributed in water and are subject to considerable variation in enumeration, and the wells are not being used at present as a drinking water supply. The wells should be shock-chlorinated and retested before any further attempt is made to define the source of the bacteria.

The **TDS** concentration of 568, 1,290, and 1,160 mg/L measured in the production wells A, B, and C respectively. These concentrations exceed the 500 mg/L AO guideline. TDS refers mainly to the inorganic substances dissolved in the water. The most important aspect of TDS with respect to drinking water quality is its effect on taste while other effects can be included as mineral deposition and corrosion of highly mineralized water. The health effect of TDS on drinking water quality depends on the level of its individual components and excessive hardness, (GCDWQ, 2007).

The **pH** of the groundwater sampled from the production well-A, B, and C, measured at 8.51, 8.59, and 8.55 respectively. These values exceed the GCDWQ AO range of 6.5 to 8.5. With increasing pH levels, the frequency of incrustation and scaling problems may be increased above pH 8.5. There is also a progressive decrease in the efficiency of chlorine disinfection processes in higher level of pH (GCDWQ, 2007).

Sodium concentration of the groundwater water sampled from both the shallow and deep aquifer exceeds the GCDWQ AO of 200 mg/L while the concentration of sodium in the deep aquifer (>400 mg/L) is significantly higher than that sampled from the shallow aquifer (215 mg/L). Sodium is not considered a toxic element. However, the taste of drinking water is generally considered offensive at sodium concentrations above the aesthetic objective. The average intake of sodium from water is only a small fraction of that consumed in a normal diet (diet - about 5 grams (g)/day). However, persons suffering from hypertension, congestive heart

failure may require a sodium-restricted diet (about 500 milligrams (mg)/day), in which case the intake of sodium from drinking water could be significant. If it is assumed that sodium from drinking water should make up only 10% of the sodium intake of persons on sodium restricted diets, and assuming a daily intake of 1.5 L of drinking water, then concentrations in drinking water would have to be 33 mg/L (GCDWQ, 2007).

The groundwater sampled from the deep aquifer from Well-B and Well-C is also elevated in **sulphate** at Well-B (584 mg/L vs. maximum AO of 500 mg/L). Sulphate is one of the least toxic anions and the aesthetic objective (AO) for sulphate in drinking water is ≤500 mg/L, based on taste consideration. However, because of the possibility of adverse physiological effects at higher concentrations, it is recommended that health authorities be notified of sources of drinking water that contain sulphate concentrations in excess of 500 mg/L (GCDWQ, 2007). The major physiological effects resulting from the ingestion of large quantities of sulphate are catharsis (purgation[1]) and gastrointestinal irritation. These effects are enhanced when sulphate is consumed with magnesium. Water containing magnesium sulphate at levels above 1000 mg/L acts as a purgative in human adults. Lower concentrations may affect new users and children (GCDWQ, 2007).

Waterline believes that groundwater samples were not filtered and preserved in the field prior to shipment to the lab. Therefore, the iron and manganese concentration do not likely represent accurate dissolved phase concentrations of these elements, as these elements likely precipitated in contact with oxygen during transit. Preservation with nitric acid, or filtering and preservation, must be completed in the field in order to accurately determine iron and manganese concentrations in groundwater.

The groundwater sampled from both aquifers is characteristic of the Paskapoo Formation. The differences in quality suggest that the two aquifers are hydraulically isolated from one another. The relatively high TDS concentration in the shallow aquifer also indicate that the shallow groundwater system is likely isolated from the lake under baseline conditions.

6.0 HYDROGEOLOGICAL DISCUSSION

The water-source wells proposed to service the Sandy Point development are completed in the Paskapoo Formation, characterized by a layered sequence of sandstone and shale. Groundwater is transmitted through fracture permeability within the sandstone units. Fracturing within the inter-layered shale units typically does not remain open to active groundwater flow and the units behave as aquitards, inhibiting vertical flow. This hypothesis is supported by the defined variation in groundwater chemistry with depth that evolves from the fresh Gull Lake surface water, with a marked increase in salinity with depth as defined by the difference in water quality between the shallow aquifer in which Well-A is completed and the deeper aquifer in which Wells B and C are completed.

[1] Purgation – The act of purging; catharsis. Tending to purge; especially, precipitating a bowel movement.

The relatively high permeability of the aquifer systems located adjacent to, and underlying Gull Lake indicate that regional stress fields and erosional or glacial stress relief have lead to high fracture permeability in the bedrock adjacent to and underlying the lake. Although the regional aquifers are all affected by the same structural conditions, their hydraulic isolation from Gull Lake is supported by the difference in chemical character of the aquifers and surface water.

Testing has demonstrated that the deep aquifer can sustain the water requirements of the proposed development. Therefore, the groundwater diversion from the shallow aquifer is not required to augment the deep source.

7.0 SUMMARY OF PRODUCTION WELL COMPLETION DETAILS

The following tables present a summary of the construction details and well performance specifications based on the production tests completed by Alken.

Table 5-A: Well-A Completion and Testing Summary

Quarter Section Location	15-01-041-01-W5M
GPS Location NAD83 Grid Zone 12	NA
Construction Date	November 13, 2002
Well Site Elevation	914 m aSL
Drilling Depth	27.43 m bGL
Completion Depth	24.38 m bGL
Production Interval	Sandstone intersected between 24.69 and 27.43 m bGL
Surface Casing Stick-up	1.0 m aGL
Casing Material	PVC
Casing Outside Diameter	141 mm
Screen Type	13 mm (0.5 in) drilled holes
Screened Interval	21.33 – 24.38 m bGL
Static Water Level/Date	7.15 m bTOC (November 13, 2002)
Available Drawdown (to top of formation)	15.19 m
Production Tested Rate	130.9 m^3/day (90.9 L/min)
Production Test Duration	24 hours
Drawdown in Well-A at End of Production Test	6.27 m
Drawdown in Observation Well at End of Production Test	NT

Note: NT, denotes to not tested

Table 5-B: Well-B Completion and Testing Summary

Quarter Section Location	15-01-041-01-W5M
GPS Location NAD83 Grid Zone 12	NA
Construction Date	November 13, 2002
Well Site Elevation	914 m MaSL
Drilling Depth	54.86 m bGL
Completion Depth	51.82 m bGL
Production Interval	Sandstone intersected between 32.61 and 51.82 m bGL
Surface Casing Stick-up	1.2 m aGL
Casing Material	PVC
Casing Outside Diameter	141 mm
Screen Type	13 mm (0.5 in) drilled holes
Screened Interval	36.58-51.81 m bGL
Static Water Level/Date	7.44 m bTOC (November 14, 2002)
Available Drawdown (to top of formation)	24.56 m
Production Tested Rate	274.9 m^3/day (190.9 L/min)
Production Test Duration	24 hours
Drawdown in Well-B at End of Production Test	12.82 m
Drawdown in Observation Well at End of Production Test	NT

Note: NT, denotes to not tested

Table 5-C: Well-C Completion and Testing Summary

Quarter Section Location	15-01-041-01-W5M
GPS Location NAD83 Grid Zone 12	NA
Construction Date	November 20, 2002
Well Site Elevation	914 m MaSL
Drilling Depth	54.86 m bGL
Completion Depth	48.77 m bGL
Production Interval	Sandstone intersected between 32.31 and 51.82 m bGL
Surface Casing Stick-up	0.91 m aGL
Casing Material	PVC
Casing Outside Diameter	219 mm
Screen Type	13 mm (0.5 in) drilled holes
Screened Interval	36.58-48.77 m bGL
Static Water Level/Date	6.53 m bTOC (November 27, 2002)
Available Drawdown (to top of formation)	25.60 m

Production Tested Rate	556.4 m^3/day (386.4 L/min)
Production Test Duration	24 hours
Drawdown in Well-C at End of Production Test	5.8 m
Drawdown in Observation Wells at End of Production Test	0.0 m @ Well-A and 0.62 m @ Well-B

8.0 CONCLUSIONS AND RECOMMENDATIONS

Waterline has reached the following conclusions with respect to the water supply wells for the proposed RV subdivision development:

- Well-A is completed in a shallow Paskapoo Fomation sandstone aquifer. Well–B and Well-C are completed in a deeper Paskapoo Formation sandstone aquifer that is apparently isolated from the shallow system.

- The shallow aquifer transmissivity, based on the Well-A pumping test analysis, was estimated to be 51.7 m^2/day. A storativity value of 0.00002 was calculated for this shallow aquifer.

- The deep aquifer transmissivity, based on the Well-B and Well-C pumping test analysis, was estimated to be 461.9 m^2/day. This transmissivity estimate was used to predict 140-day, 5, 10, and 20 year drawdown using the Theis equation through forward solution analysis. A calculated storativity value of 0.00002 calculated from the Well-B observation data was used in the predictive calculations.

- Testing has demonstrated that the deep aquifer can sustain the water requirements of the proposed development. Therefore, groundwater diversion from the shallow aquifer is not required to augment the deep water source, and consequently, cumulative effects analysis was not completed on the shallow aquifer.

- The 140-day predicted drawdown following the resort operating season, as calculated at nearest operating well defined during the Waterline 2003 investigation, located 1,600 m from the pumping center is estimated at 0.83 m in the deep aquifer.

- The 20-year predicted drawdown as averaged annually and calculated at nearest operating well defined during the Waterline 2003 investigation, located 1,600 m from the pumping center is estimated at 0.47 m in the deep aquifer. Therefore, groundwater diversion for seasonal resort use would have a greater effect at the end of each season as compared to the average annual effect following 20-years of operation. This occurs because the system is allowed to recover each year once the seasonal operation is shut down.

- The groundwater chemistry of the shallow aquifer is characterized as a sodium/bicarbonate water. The groundwater chemistry of the deep aquifer is characterized as a sodium/bicarbonate-sulphate water.

- The groundwater sampled from both aquifers exceeds the AO for TDS and sodium, and the groundwater sampled from the deep aquifer also exceeds the AO for sulphate. Groundwater obtained from the deeper aquifer has a high dissolved mineral content than the groundwater sampled from the shallow aquifer, supporting the hypothesis that the aquifers are hydraulically isolated from each other and from surface water (i.e. Gull lake).

- Aquifer testing and analysis has confirmed that groundwater diversion from the tested wells, at the assessed RV development requirement, will not unreasonably interfere with each other or existing users of the groundwater source; negatively impact the aquifer or other aquifers and surface water bodies; and, harm the environment in general, if managed appropriately.

9.0 CLOSURE

The findings presented in this report are based upon the Waterline 2003 investigation and a review of published maps and reports, information available from the AENV water well database. This report is intended for use in support of the application for subdivision under the Municipal Government Act

This work was carried out in accordance with accepted hydrogeological practices. No other warranty, expressed or implied, is made as to the professional services provided to the client. Any use which a third party makes of this report, or any reliance on or decisions to be made based upon it, are the responsibility of such third parties. Waterline accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

It should be noted that Waterline does not employ health care professionals, and any health related questions with regards to chemical parameter exceedances should be discussed with the local health authority.

Respectfully submitted,

Waterline Resources Inc.
APEGGA Permit To Practice No. P07329

S. Negari

PROFESSIONAL GEOLOGIST ALBERTA
Steven L. Foley
May 26/2008

Shermin Negari, M.Eng.
Project Hydrogeologist

Steve Foley, M.Sc., P.Geol.
Principal Hydrogeologist

10.0 REFERENCES

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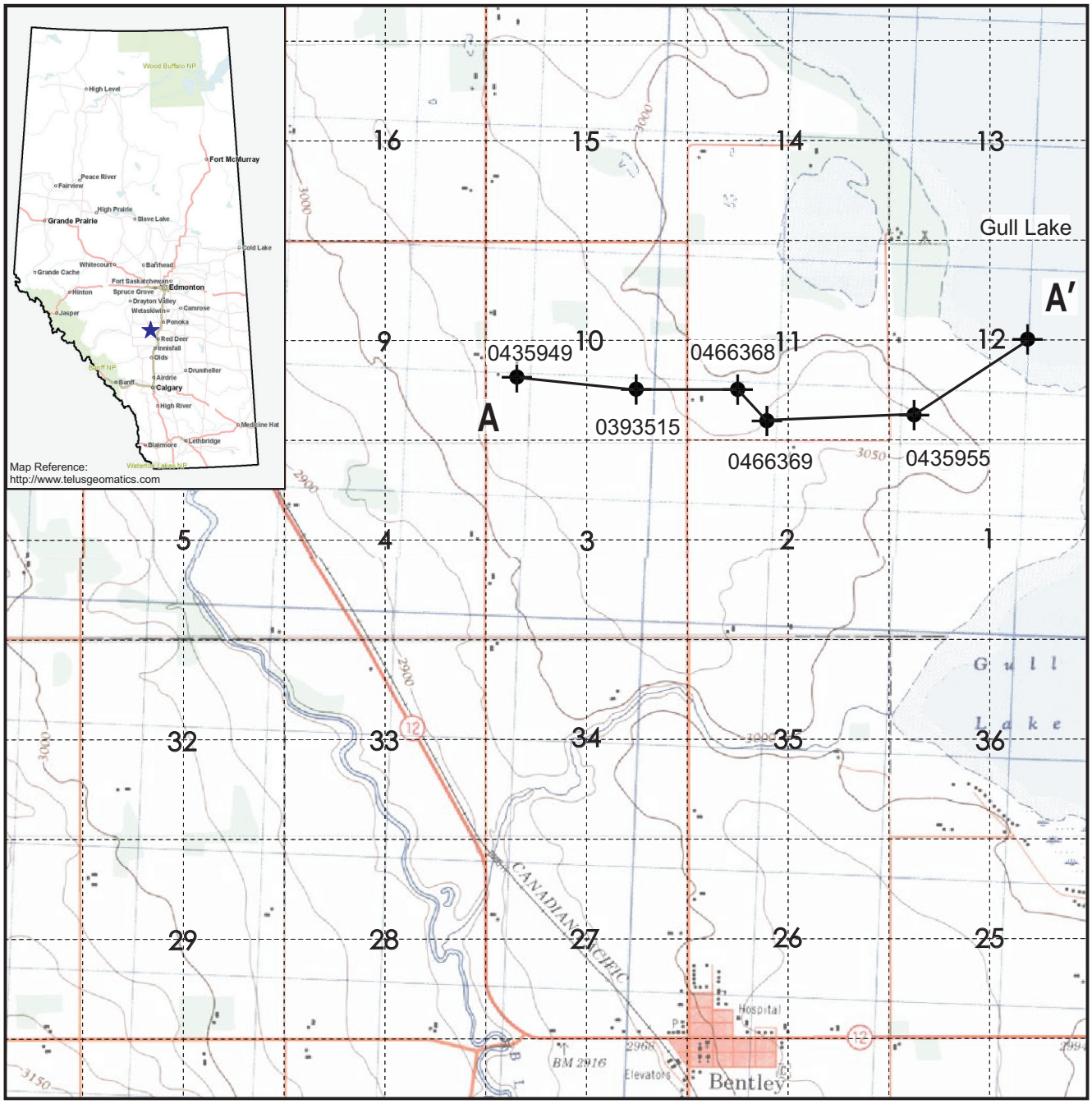
FIGURES



MAP REFERENCE: 1 : 50 000, 83 B/9, 83 P/8 (ETOPO)

LEGEND:

0435949 AENV WATER WELL ID #

APPROXIMATE WATER WELL LOCATION

A——A′ CROSS-SECTION TRACE

APPROXIMATE SITE LOCATION

SCALE = 1 : 50 000

0 m 1000 m 2000 m

PROJECT

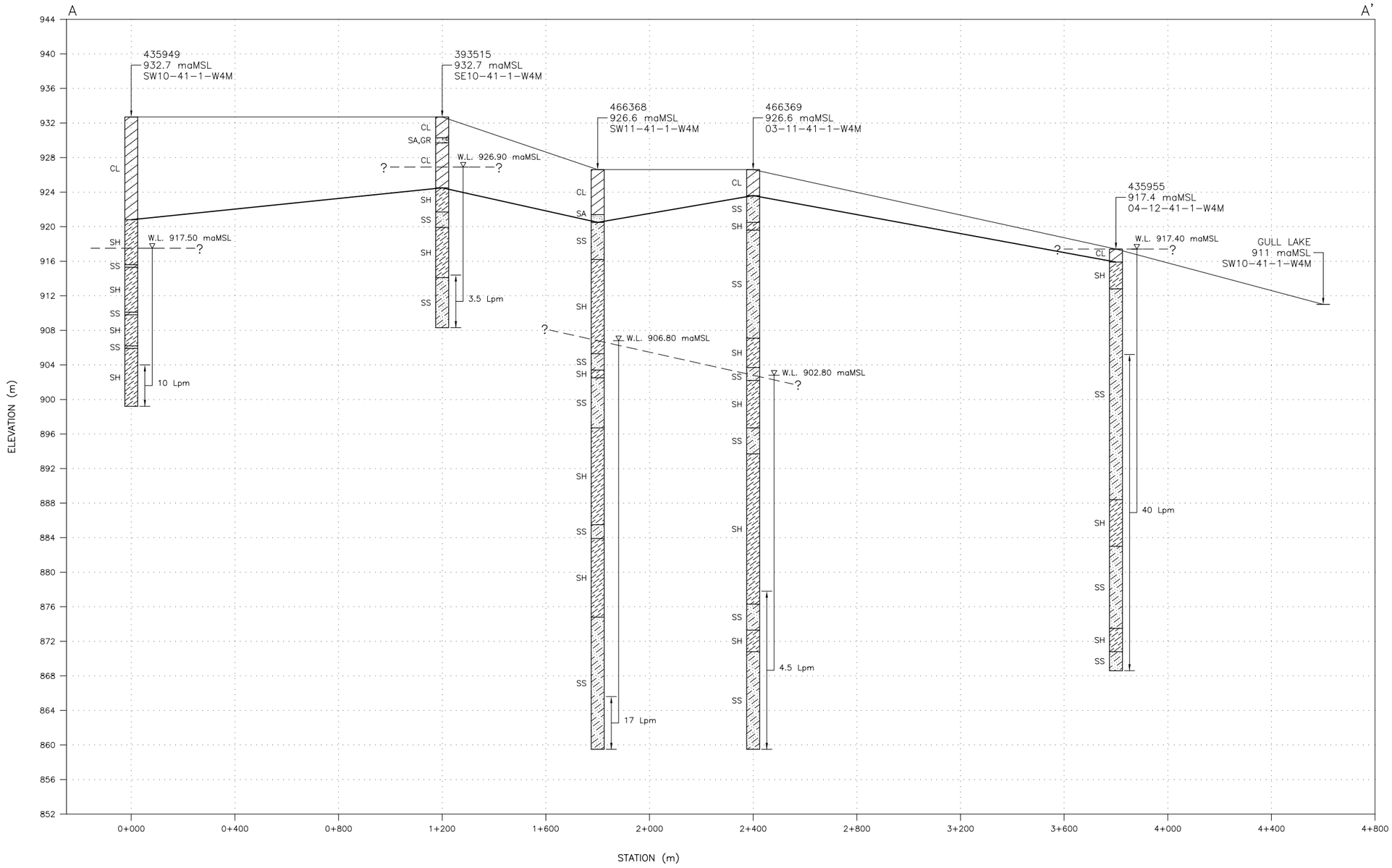
WELL AND AQUIFER EVALUATION REPORT
Proposed 3000-Lot Recreational Vehicle Development
Sandy Point 01 and 12-041-01-W5M, near Gull Lake, Alberta
Submitted to: Frank Wilson

TITLE

SITE LOCATION

Waterline Resources Inc.
Groundwater Resource and Environmental Consultants

PREPARED BY: WATERLINE RESOURCES INC.	
PROJECT: WL08-1403	
COMPILED BY: SN	**FIGURE:** 1
REVIEWED BY: SF	
DATE ISSUED: APRIL 2008	



LEGEND:

- INTERPRETED GROUND SURFACE
- INTERPRETED BEDROCK SURFACE
- INTERPRETED WATER TABLE/PEIZOMETRIC SURFACE CONFIGURATION

- CLAY
- SAND
- GRAVEL
- SANDSTONE
- SHALE

40 Lpm — WATER REMOVAL DURING DRILL'S PRODUCTION TESTING (LITERS PER MINUTE).

STATIC WATER LEVEL AT THE TIME OF COMPLETION.

SCREENED INTERVAL.

maMSL — METERS ABOVE MEAN SEA LEVEL

NOTES:

1. WELLS LABELED BY WELL I.D. ON DRILL LOGS AND SECTION LOCATION.
2. WELL LOCATIONS APPROXIMATED WITHIN THE QUARTER SECTION. SURFACE ELEVATIONS ESTIMATED FROM 1:50,000 CONTOUR MAP.
3. VERTICAL SCALE HAS 33.33 EXAGGERATION.
4. DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT THE BOREHOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN BOREHOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.

HL. Scale: 0 — 500 m

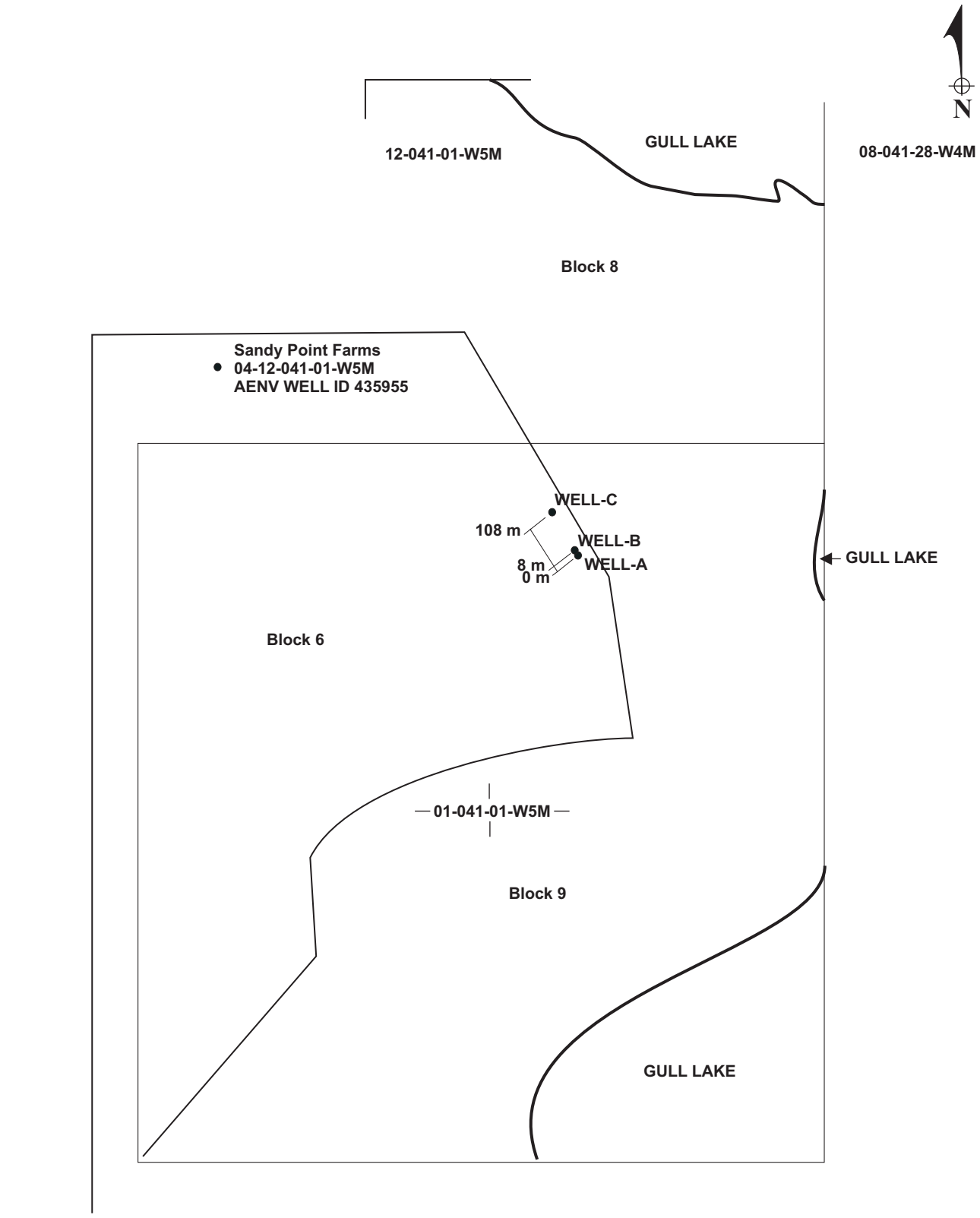
Frank Wilson
Well and Aquifer Evaluation Report
Sandy Point 01 and 12-41-01-W5M

LOCAL HYDROGEOLOGICAL CROSS SECTION A-A'

Waterline Resources Inc.
Groundwater Resource and Environmental Consultants

PREPARED BY:	WATERLINE RESOURCES INC.
PROJECT:	WL08-1403
COMPILED BY:	---
REVIEWED BY:	---
DATE:	MAY 2008

FIGURE 2



PROJECT

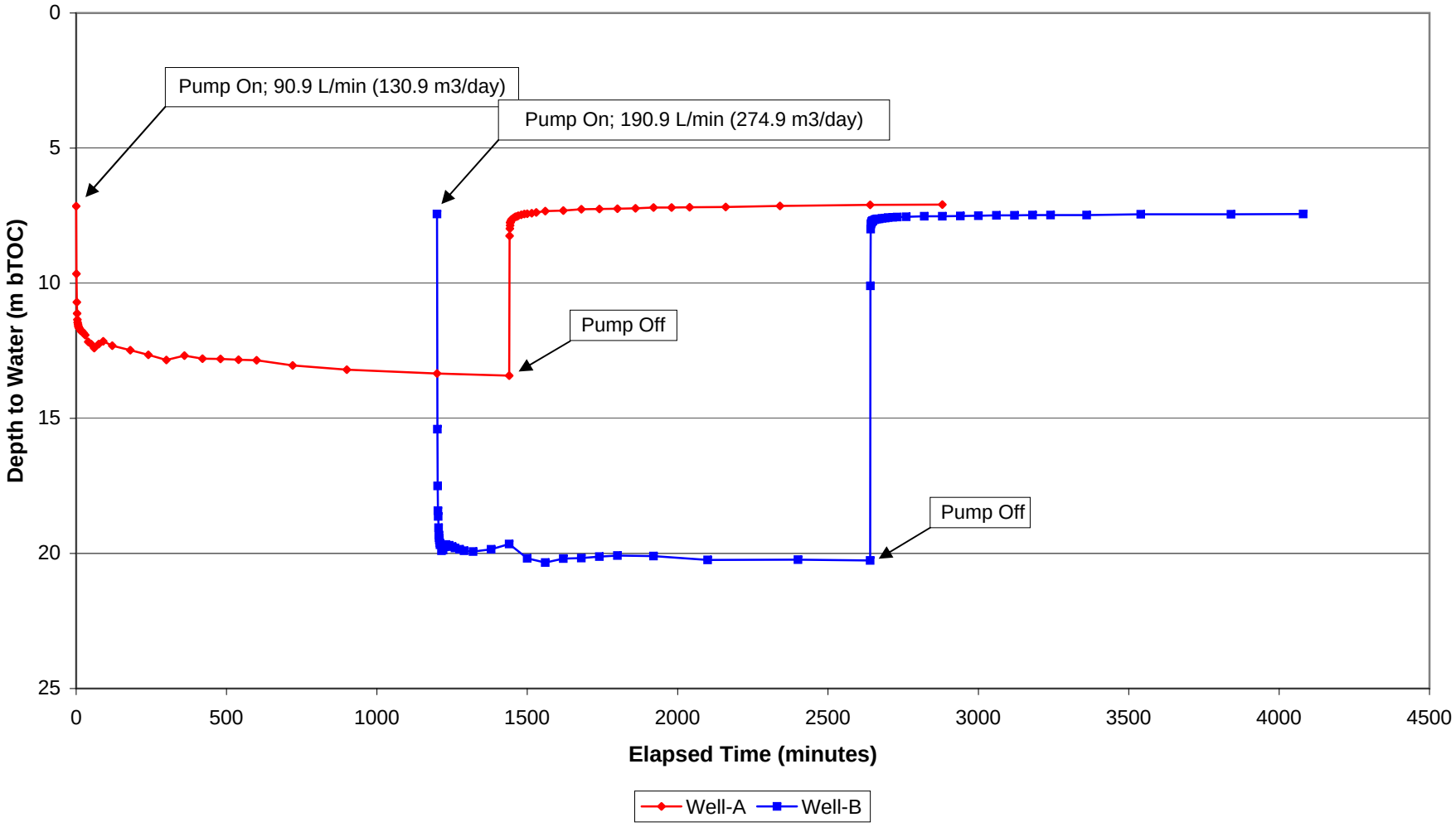
Well and Aquifer Evaluation Report
Proposed 3000-Lot Recreational Vehicle Development
Sandy Point 01 and 12-041-01-W5M, Gull Lake, Alberta
Submitted to Frank Wilson

WELL LOCATION PLAN

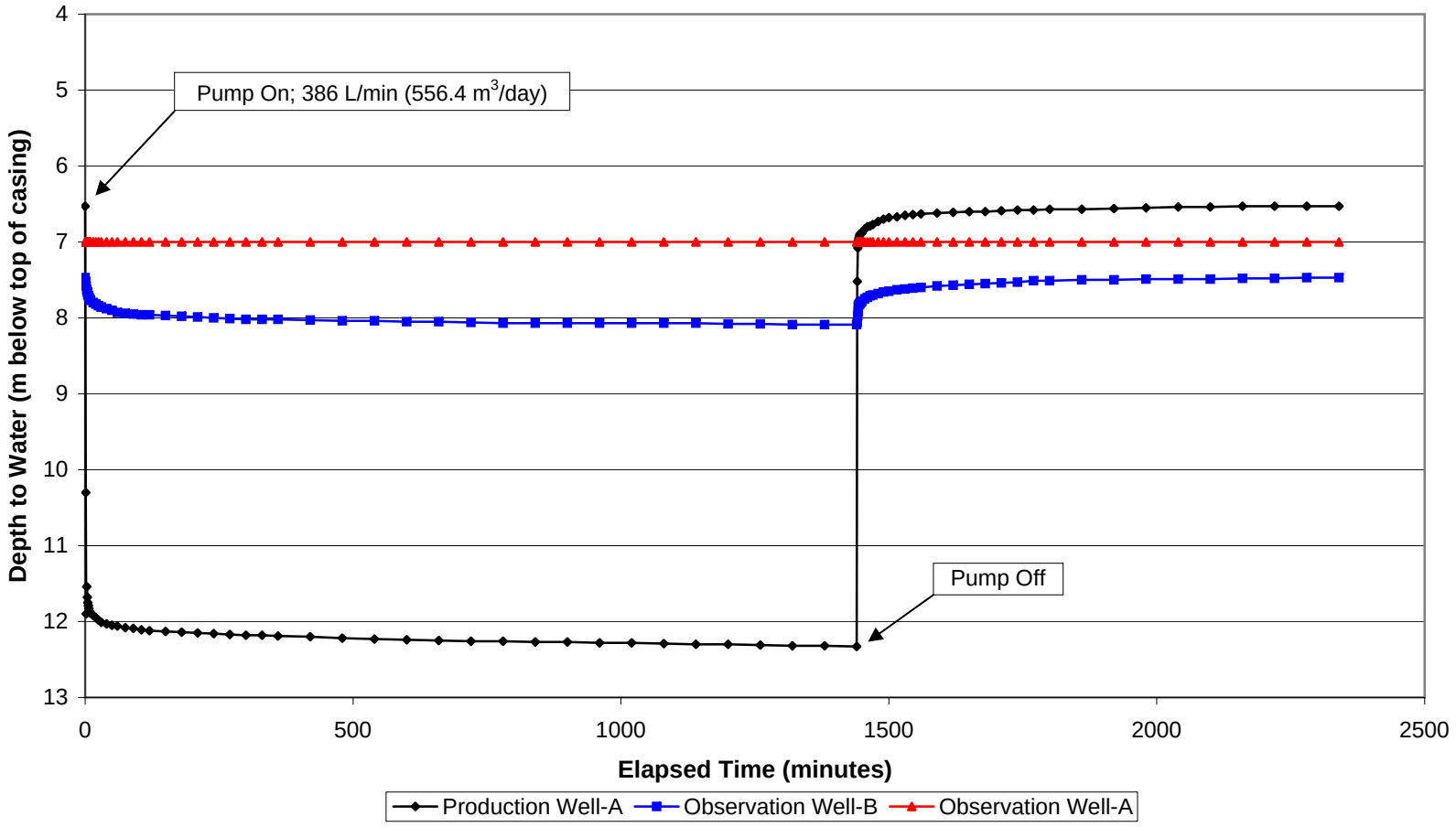
Waterline Resources Inc.
Groundwater Resource and Environmental Consultants

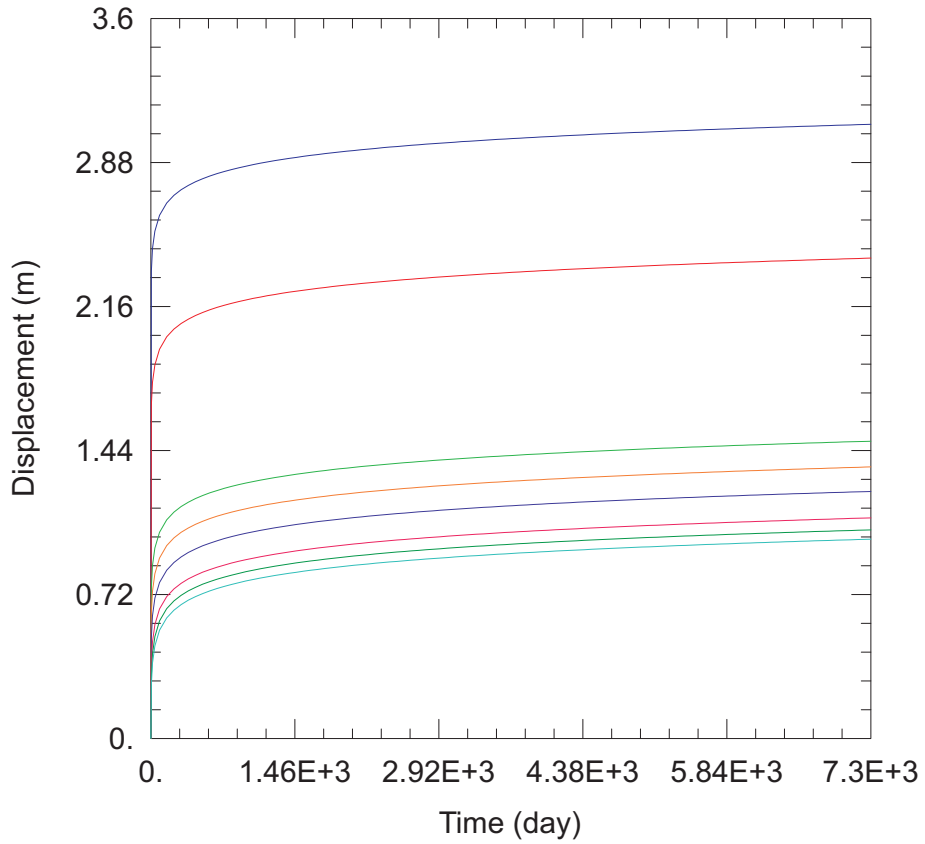
PREPARED BY: WATERLINE RESOURCES INC.	
PROJECT: WL08-1403	
COMPILED BY: –	**FIGURE:** 3
REVIEWED BY: SF	
DATE ISSUED: MAY 2008	

24-hour Aquifer Test- "Well-A" and "Well-B"



24-hour Aquifer test - "Well-C" Pumping Test (Well-A & Well-B Obs. Wells)





WELL TEST ANALYSIS

Data Set: P:\...\Forward Solution (seasonal rates).aqt
Date: 05/07/08 Time: 09:50:52

PROJECT INFORMATION

Company: Waterline
Client: Frontier Energy Inc.
Project: WL08-1403
Location: Gull Lake
Test Well: Well C
Test Date: November 27, 2002

SOLUTION

Aquifer Model: Confined
Solution Method: Theis (Step Test)

T = 461.9 m^2/day
S = 2.0E-5
Sw = 0.
C = 0. day^2/m^5
P = 2.

Step Test Model: Jacob-Rorabaugh
Time (t) = 1. day Rate (Q) in cu. m/day
s(t) = 0.005378Q + 0.Q^2
W.E. = 100.% (Q from last step)

AQUIFER DATA

Saturated Thickness: 19.5 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Observation Wells

Well Name	X (m)	Y (m)
Well C	0	0
Well B	100	0
500m	500	0
900m	900	0
1600m	1600	0
3000m	3000	0
4000m	4000	0
5000m	5000	0

Pumping Wells

Well Name	X (m)	Y (m)
Well C	0	0
Well B	100	0

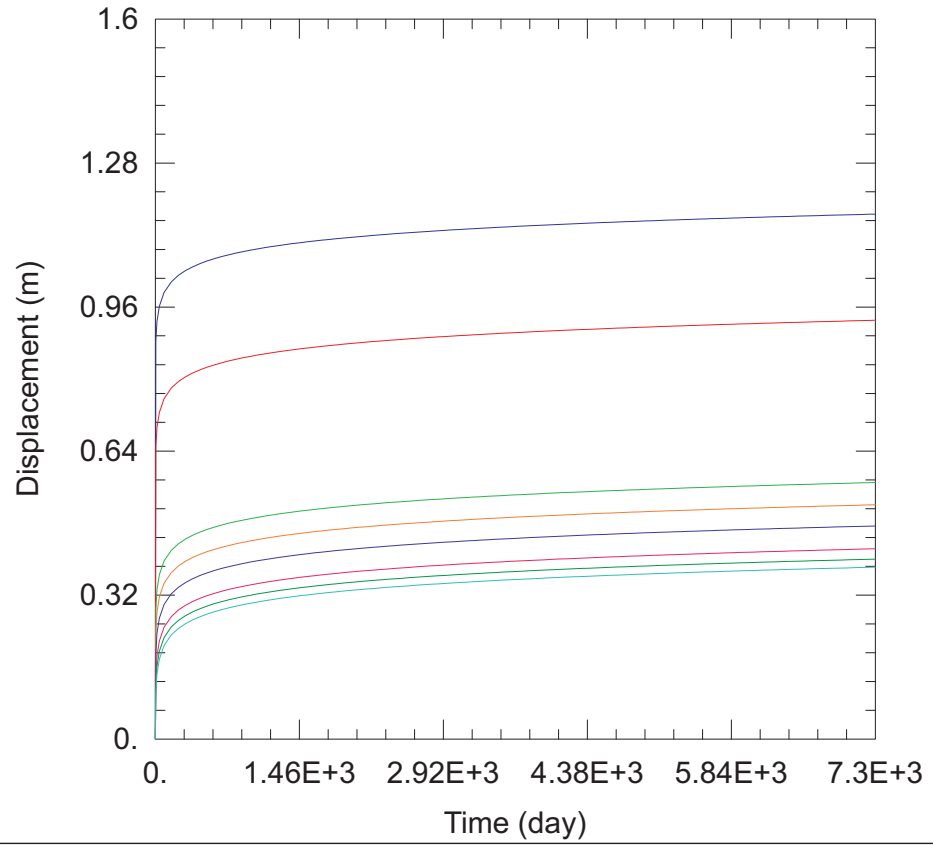
PROJECT
Well and Aquifer Evaluation Report
Proposed 3000-Lot Recreational Vehicle Development
Sandy Point 01 and 12-041-01-W5M, Gull Lake, Alberta
Submitted to Frank Wilson

TITLE
PREDICTED DRAWDOWN VS. TIME THEIS EQUATION THROUGH " FORWARD SOLUTION" (SEASONAL PUMPING RATE)

Waterline Resources Inc.
Groundwater Resource and Environmental Consultants

PREPARED BY: WATERLINE RESOURCES INC.
PROJECT: WL08-1403
COMPILED BY: CGD
REVIEWED BY:
DATE ISSUED: MAY 2008

FIGURE: 6



WELL TEST ANALYSIS

Data Set: P:\...\Forward Solution (Annual rates).aqt
Date: 05/07/08 Time: 16:08:48

PROJECT INFORMATION

Company: Waterline
Client: Frontier Energy Inc.
Project: WL08-1403
Location: Gull Lake
Test Well: Well C
Test Date: November 27, 2002

SOLUTION

Aquifer Model: Confined
Solution Method: Theis (Step Test)

T = 461.9 m^2/day
S = 2.0E-5
Sw = 0.
C = 0. day^2/m^5
P = 2.

Step Test Model: Jacob-Rorabaugh
Time (t) = 1. day Rate (Q) in cu. m/day
s(t) = 0.005427Q + 0.Q^2
W.E. = 100.% (Q from last step)

AQUIFER DATA

Saturated Thickness: 19.5 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Observation Wells

Well Name	X (m)	Y (m)
Well C	0	0
Well B	100	0
500m	500	0
900m	900	0
1600m	1600	0
3000m	3000	0
4000m	4000	0
5000m	5000	0

Pumping Wells

Well Name	X (m)	Y (m)
Well C	0	0
Well B	100	0

PROJECT
Well and Aquifer Evaluation Report
Proposed 3000-Lot Recreational Vehicle Development
Sandy Point 01 and 12-041-01-W5M, Gull Lake, Alberta
Submitted to Frank Wilson

TITLE
PREDICTED DRAWDOWN VS. TIME THEIS EQUATION THROUGH " FORWARD SOLUTION" (ANNUAL PUMPING RATE)

Waterline Resources Inc.
Groundwater Resource and Environmental Consultants

PREPARED BY: WATERLINE RESOURCES INC.
PROJECT: WL08-1403
COMPILED BY: CGD
REVIEWED BY:
DATE ISSUED: MAY 2008

FIGURE: 7

APPENDIX A

AENV Water Well Database Records, AENV Drilling and Groundwater Chemistry Reports

Table A1: Reconnaissance Report For Water Well Records Located Within Approximately 1.0 kilometer of the Development Site around 01 and 12-041-01-W5M

WELL ID	W_M	RGE	TWP	SEC	LSD	DRILLING COMPANY	DATE COMPLETED M/D/YR	DEPTH (m b GL)	USE	CHM	LT	PT	WELL OWNER	STATIC LEVEL (m bTOC)	TEST RATE (L/min)	CASING PERFS FROM (m bGL)	CASING PERFS TO (m bGL)
341921	5	1	41	1	10	ALKEN BASIN DRILLING LTD.	11/20/2002	54.864	Stock	0	9	24	SANDY POINT FARMS	6.7056	227.3	36.576	48.768
341922	5	1	41	1	10	ALKEN BASIN DRILLING LTD.	11/13/2002	54.864	Stock	0	12	20	SANDY POINT FARMS	7.3152	227.3	36.576	51.816
341923	5	1	41	1	10	ALKEN BASIN DRILLING LTD.	11/13/2002	27.432	Stock	0	13	20	SANDY POINT FARMS	7.0104	90.92	21.336	24.384
354465	5	1	41	12	NW	UNKNOWN DRILLER		38.1	Domestic	3	0	0	NORVIA, P.				
355320	5	1	41	1	6	ALKEN BASIN DRILLING LTD.	2/23/1988	18.288	Industrial	0	2	0	TRILOGY	4.572	204.57		
435633	5	1	41	1	13	UNKNOWN DRILLER	6/29/1953	329.184	Unknown	0	0	0	CALIFORNIA STANDARD CO#THE-500				
435853	5	1	41	2	15	UNKNOWN DRILLER		60.96	Domestic & Stock	0	5	0	HARRSTAD, EVERTT	32.004	68.19	54.864	60.96
435855	5	1	41	2	NE	UNKNOWN DRILLER		30.48	Domestic	0	0	0	MORRISON, H.G.				
435954	5	1	41	12	SW	UNKNOWN DRILLER		17.3736	Domestic & Stock	0	0	0	DICKAU, R.O.	6.096			
435955	5	1	41	12	4	FLINN DRILLING LTD.	5/5/1983	48.768	Stock	0	13	0	SANDY POINT FARMS	0	181.84	12.192	48.768
435956	5	1	41	12	12	ERICKSON DRILLING	1/1/1950	15.24	Domestic	1	0	0	NORRILA, P.				
435957	5	1	41	12	12	GERMAN R E	1/1/1963	15.24	Stock	0	0	0	NORRILA, PAUL				
435958	5	1	41	13	1	UNKNOWN DRILLER	10/31/1952		Industrial	0	0	0	IMPERIAL OIL LTD				
435962	5	1	41	13	4	UNKNOWN DRILLER	9/17/1952	304.8	Industrial	0	0	0	CALIFORNIA STANDARD CO #THE500				
436169	5	1	41	11	6	ALKEN BASIN DRILLING LTD.	9/20/1987	48.768	Industrial	0	4	0	GEO SEARCH 5	18.288	181.84		
466369	5	1	41	11	3	ALKEN BASIN DRILLING LTD.	8/19/1996	67.056	Industrial	0	15	16	DOMEX/CACTUS 7#RIG	23.7744	20.457	48.768	67.056
478956	5	1	41	12	NW	ERICKSON DRILLING	1/1/1946	36.576	Domestic & Stock	0	0	0	NORVILLA, C.	4.572			
497115	5	1	41	12	6	TALL PINE DRILLING LTD.	8/22/2000	48.768	Industrial	0	5	11	FOUNDERS ENERGY LTD	12.8016	250.03	36.576	48.768
1735102	5	1	41	2	1	TALL PINE DRILLING LTD.	10/29/2002	30.48	Industrial				PROGRESS ENERGY	4.8768	318.22	24.384	30.48
361599	5	1	40	35	0	UNKNOWN DRILLER			Domestic	1	0	0	ROSE, DOUGLAS M				
380562	5	1	40	36	13	J.C. DRILLING	11/16/1995	49.3776	Domestic	0	15	20	SIMPSON, FRED/JOANE	6.5532	45.46	43.2816	49.3776
442317	5	1	40	35	7	WATER RESOURCES	6/1/1971	3.048	Observation	0	4	0	ALTA ENV #GL34				
442318	5	1	40	35	7	WATER RESOURCES	6/1/1971	1.8288	Observation	0	3	0	ALTA ENV #GL35				
442319	5	1	40	35	7	WATER RESOURCES	6/1/1971	3.048	Observation	0	3	0	ALTA ENV #GL36				
442322	5	1	40	35	6	WATER RESOURCES	6/1/1971	3.048	Observation	0	2	0	ALTA ENV #GL31				
442323	5	1	40	35	6	WATER RESOURCES	6/1/1971	3.048	Observation	0	1	0	ALTA ENV #GL32				
442324	5	1	40	35	6	WATER RESOURCES	6/1/1971	3.048	Observation	0	2	0	ALTA ENV #GL33				
442339	5	1	40	36	6	ERICKSON ERNFRED	8/4/1958	29.2608	Domestic	0	3	0	DAVIS, R.O.	6.7056	45.46		
442342	5	1	40	36	6	NELSON DRILLING & PLUMBING	7/1/1983	45.72	Domestic	0	9	0	PALMER, PERCY	7.62			
442344	5	1	40	36	NW	ALBERTA WW SERVICE	8/17/1976	28.0416	Domestic	0	12	0	ANDERS, H.	7.62	27.276	12.192	28.0416
442345	5	1	40	36	13	UNKNOWN DRILLER	1/31/1953	306.0192	Industrial	0	0	0	CALIFORNIA STANDARD OIL #K8				
443867	5	1	40	36	12	J.C. DRILLING	2/14/1996	45.1104	Domestic	0	8	25	SIMPSON, BILL/FRED	1.95072	68.19	20.7264	26.8224
494629	5	1	40	36	7	RANKIN DRILLING	9/3/1999	23.7744	Domestic	0	7	0	TAYLOR, BILL	8.2296	45.46	17.0688	23.1648
1060453	5	1	40	35	15	ALKEN BASIN DRILLING LTD.	10/4/2004	24.384	Industrial				MURPHY OIL/PD 621	3.048	318.22	12.192	18.288
1440002	5	1	40	36	NW	LAST CHANCE DRILLING	6/5/2003	45.72	Domestic				SIMPSON, FRED	2.4384	68.19	36.576	45.72

Source: Alberta Environment Water Well Database.

Note: W_M - West of Meridian; TWP - Township; RGE - Range; SEC - Section; LSD - Legal Subdivision; bGL - below ground level; bTOC - below top of casing; L/min liters per minute; CHM - No. of chemistry reports; LT - lines of lithology; PT - lines of pump test

Minimum	1.83						0.00	20.46		
Maximum	329.18						32.00	318.22		
Average	56.42						8.61	140.52		

Statistical analysis excluding shallow observation wells and deep inductrial exploration wells

Minimum	15.24						0.00	20.46		
Maximum	67.06						32.00	318.22		
Average	37.69						8.61	140.52		

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0435949
Map Verified: Map
Date Report Received: 1971/10/25
Measurements: Metric

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER
Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN
City or Town: UNKNOWN AB CA
Postal Code:
WellOwner's Name: PARK, L.
Well Location Identifier:
P.O. Box Number:
Mailing Address: BENTLEY
Postal Code:
City:
Province:
Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
SW	10	041	01	5

Location in Quarter
0 M from Boundary
0 M from Boundary
Lot Block Plan
Well Elev: M
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed:
Materials Used:
Proposed well use: Domestic
Anticipated Water Requirements/day 0 Liters
Method of Drilling: Rotary
Flowing Well: No
Rate: Liters
Gas Present: No
Oil Present: No

4. Formation Log

Depth from ground level (meters)	Lithology Description
4.57	Brown Clay
11.89	Blue Clay
17.07	Blue Shale
17.37	Sandstone
22.56	Blue Shale
22.86	Sandstone
26.52	Blue Shale
26.82	Sandstone
29.26	Blue Water Bearing Shale
33.53	Blue Shale

5. Well Completion

Date Started(yyyy/mm/dd): 1971/01/01
Date Completed(yyyy/mm/dd): 1971/08/01
Well Depth: 33.53 M
Borehole Diameter: 0 CM
Casing Type: Galvanized Steel
Liner Type:
Size OD: 5.08 CM
Size OD: 0 CM
Wall Thickness: 0 CM
Wall Thickness: 0 CM
Bottom at: 28.65 M
Top: 0 M Bottom: 0 M
Perforations
from: 0 M to: 0 M
from: 0 M to: 0 M
from: 0 M to: 0 M
Perforations Size:
0 CM x 0 CM
0 CM x 0 CM
0 CM x 0 CM
Perforated by:
Seal: Driven
from: 0 M to: 0 M
Seal:
from: 0 M to: 0 M
Seal:
from: 0 M to: 0 M
Screen Type:
from: 0 M to: 0 M
Screen ID: 0 CM
Slot Size: 0 CM
Screen Type:
from: 0 M to: 0 M
Screen ID: 0 CM
Slot Size: 0 CM
Screen Installation Method:
Fittings
Top:
Bottom:
Pack:
Grain Size:
Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: Yes
Held: 0
Documents Held: 1
Pitless Adapter Type:
Drop Pipe Type:
Length: M
Diameter: CM
Comments:
DRILLER REPORTS SOFT WATER.

6. Well Yield

Test Date (yyyy/mm/dd): 1971/08/01
Start Time: 11:00 AM
Test Method: Pump
Non pumping static level: 15.24 M
Rate of water removal: 45.46 Liters/Min
Depth of pump intake: 0 M
Water level at end of pumping: 15.24 M
Distance from top of casing to ground level: CM
Depth To water level (meters)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 0 M
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: 0 Liters/Min
Recommended pump intake: 0 M
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.:
This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.
Signature Yr Mo Day

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0393515
Map Verified:	Not Verified
Date Report Received:	1994/10/26
Measurements:	Metric

1. Contractor & Well Owner Information

Company Name: ALBERTA EAGLE DRILLING LTD.		Drilling Company Approval No.: 117793
Mailing Address: BOX 9036	City or Town: SYLVAN LAKE AB CA	Postal Code: T4S 1S6
WellOwner's Name: JOHNSON, EDWARD	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 2428 VISTA CRES NE, CALGARY	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
SE	10	041	01	5

Location in Quarter
0 M from Boundary
0 M from Boundary

Lot Block Plan

Well Elev: M
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed:
Materials Used:
Method of Drilling: Combination
Flowing Well: No
Gas Present: No
Rate: Liters
Oil Present: No
Proposed well use: Domestic
Anticipated Water Requirements/day 4546 Liters

4. Formation Log

Depth from ground level (meters)	Lithology Description
2.44	Brown Silty Till
3.05	Sand & Gravel
5.18	Brown Clay
8.23	Gray Till
9.14	Brown Shale
10.97	Gray Shale
12.8	Gray Fine Grained Sandstone
18.59	Gray Shale
24.38	Gray Water Bearing Sandstone

5. Well Completion

Date Started(yyyy/mm/dd): 1994/07/27
Date Completed(yyyy/mm/dd): 1994/07/27
Well Depth: 24.38 M
Borehole Diameter: 0 CM
Casing Type: Plastic
Liner Type: Plastic
Size OD: 14.12 CM
Size OD: 11.43 CM
Wall Thickness: 0.95 CM
Wall Thickness: 0.54 CM
Bottom at: 17.37 M
Top: 16.76 M Bottom: 24.38 M
Perforations
from: 18.29 M to: 24.38 M
from: 0 M to: 0 M
from: 0 M to: 0 M
Perforations Size:
0.05 CM x 0 CM
0 CM x 0 CM
0 CM x 0 CM
Perforated by: Machine
Seal: Driven & Bentonite
from: 9.14 M to: 17.37 M
Seal:
from: 0 M to: 0 M
Seal:
from: 0 M to: 0 M
Screen Type:
from: 0 M to: 0 M
Screen ID: 0 CM
Slot Size: 0 CM
Screen Type:
from: 0 M to: 0 M
Screen ID: 0 CM
Slot Size: 0 CM
Screen Installation Method:
Fittings
Top:
Bottom:
Pack:
Grain Size:
Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: Yes
Held: 0
Documents Held: 1
Pitless Adapter Type:
Drop Pipe Type:
Length: M
Diameter: CM
Comments:
DRILLER REPORTS 5GR HARD, 8 PH, IRON-TRACE.

6. Well Yield

Test Date (yyyy/mm/dd): 1994/07/27
Start Time: 11:00 AM
Test Method: Air
Non pumping static level: 5.79 M
Rate of water removal: 159.11 Liters/Min
Depth of pump intake: 24.38 M
Water level at end of pumping: 24.38 M
Distance from top of casing to ground level: CM

Depth To water level (meters)

Elapsed Time Drawdown	Minutes:Sec	Recovery
	1:00	11.1
	2:00	7.65
	3:00	6.78
	4:00	6.44
	5:00	6.28
	6:00	6.19
	7:00	6.12
	8:00	6.07
	9:00	6.04
	10:00	6.02

Total Drawdown: 18.59 M
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: 45.46 Liters/Min
Recommended pump intake: 18.29 M
Type Pump Installed
Pump Type: SUB
Pump Model: 10S05-9
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.: 11184A
This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.
Signature Yr Mo Day

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0466368
Map Verified:	Not Verified
Date Report Received:	1996/12/02
Measurements:	Metric

1. Contractor & Well Owner Information

Company Name: ALKEN BASIN DRILLING LTD.		Drilling Company Approval No.: 38394
Mailing Address: BOX 47	City or Town: BENTLEY AB CANADA	Postal Code: T0C 0J0
WellOwner's Name: CHRISTIANSEN, LAWRENCE	Well Location Identifier:	
P.O. Box Number: 625	Mailing Address: BENTLEY	Postal Code: T0C 0J0
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
SW	11	041	01	5

Location in Quarter
0 M from Boundary
0 M from Boundary

Lot Block Plan

Well Elev: M
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed:
Materials Used:

Proposed well use: Domestic
Anticipated Water Requirements/day 1818.4 Liters

Method of Drilling: Rotary

Flowing Well: No
Gas Present: No
Rate: Liters
Oil Present: No

4. Formation Log

Depth from ground level (meters)	Lithology Description
5.18	Brown Clay & Rocks
6.1	Brown Sand
9.14	Brown Sandstone
10.36	Gray Sandstone
21.34	Gray Shale
23.16	Gray Sandstone
24.08	Gray Shale
29.87	Gray Sandstone
41.15	Gray Shale
42.67	Gray Sandstone
51.82	Gray Shale
67.06	Gray Sandstone

5. Well Completion

Date Started(yyyy/mm/dd): 1996/11/13	Date Completed(yyyy/mm/dd): 1996/11/13
Well Depth: 67.06 M	Borehole Diameter: 0 CM
Casing Type: Steel	Liner Type: Plastic
Size OD: 13.97 CM	Size OD: 11.43 CM
Wall Thickness: 0.62 CM	Wall Thickness: 0.54 CM
Bottom at: 30.18 M	Top: 12.19 M Bottom: 67.06 M
Perforations from: 60.96 M to: 67.06 M from: 0 M to: 0 M from: 0 M to: 0 M	Perforations Size: 0.95 CM x 0.95 CM 0 CM x 0 CM 0 CM x 0 CM
Perforated by: Hand Drill	
Seal: Drive Shoe from: 0 M	to: 30.18 M
Seal: from: 0 M	to: 0 M
Seal: from: 0 M	to: 0 M
Screen Type: from: 0 M to: 0 M	Screen ID: 0 CM Slot Size: 0 CM
Screen Type: from: 0 M to: 0 M	Screen ID: 0 CM Slot Size: 0 CM
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length: M	Diameter: CM
Comments: DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GROUND LEVEL: 1'.5".	

6. Well Yield

Test Date (yyyy/mm/dd): 1996/11/13	Start Time: 11:00 AM
Test Method: Air	
Non pumping static level:	19.81 M
Rate of water removal:	77.28 Liters/Min
Depth of pump intake:	67.06 M
Water level at end of pumping:	67.06 M
Distance from top of casing to ground level:	CM

Depth To water level (meters)
Elapsed Time

Drawdown	Minutes:Sec	Recovery
	4:00	6.71
	5:00	60.35
	6:00	53.95
	7:00	48.77
	8:00	45.11
	9:00	41.76
	10:00	38.71
	12:00	35.97
	14:00	33.22
	16:00	30.78
	20:00	28.35
	25:00	26.52
	30:00	24.99
	35:00	23.77
	40:00	22.56
	50:00	21.64
	60:00	20.73
	75:00	20.12
	90:00	19.81
	120:00	19.81

Total Drawdown: 47.24 M

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 45.46 Liters/Min

Recommended pump intake: 33.53 M

Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.: 5881AD

This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.

Signature Yr Mo Day

Report 1 Pump Test 1 page1

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0466369
Map Verified:	Not Verified
Date Report Received:	1996/08/26
Measurements:	Metric

1. Contractor & Well Owner Information

Company Name: ALKEN BASIN DRILLING LTD.		Drilling Company Approval No.: 38394
Mailing Address: BOX 47	City or Town: BENTLEY AB CANADA	Postal Code: T0C 0J0
WellOwner's Name: DOMEX/CACTUS 7#RIG	Well Location Identifier:	
P.O. Box Number:	Mailing Address: SUITE 1660 717 7 AVE SW, CALGARY	Postal Code: T2P 0Z3
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
03	11	041	01	5

Location in Quarter
0 M from Boundary
0 M from Boundary

Lot Block Plan

Well Elev: M
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed:
Materials Used:
Method of Drilling: Rotary
Flowing Well: No
Gas Present: No
Rate: Liters
Oil Present: No
Proposed well use: Industrial
Anticipated Water Requirements/day 40914 Liters

6. Well Yield

Test Date (yyyy/mm/dd): 1996/08/19
Start Time: 11:00 AM
Test Method: Air

Non pumping static level:	23.77 M
Rate of water removal:	20.46 Liters/Min
Depth of pump intake:	67.06 M
Water level at end of pumping:	67.06 M
Distance from top of casing to ground level:	CM

Depth To water level (meters)
Elapsed Time

Drawdown	Minutes:Sec	Recovery
	4:00	67.06
	5:00	60.35
	6:00	53.95
	7:00	48.46
	8:00	44.2
	9:00	40.23
	10:00	36.27
	12:00	32.92
	14:00	29.87
	16:00	27.13
	20:00	24.99
	25:00	23.77
	30:00	23.77
	60:00	23.77
	90:00	23.77
	120:00	23.77

Total Drawdown: 43.28 M

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 159.11 Liters/Min

Recommended pump intake: 57.91 M

Type Pump Installed
Pump Type: SUB
Pump Model: GOULDS
H.P.: 3
Any further pumptest information?

4. Formation Log

Depth from ground level (meters)	Lithology Description
3.05	Brown Clay & Rocks
6.1	Brown Sandstone
7.01	Brown Shale
9.14	Brown Sandstone
10.67	Gray Sandstone
12.19	Gray Sandstone
19.51	Gray Sandstone
22.86	Gray Shale
24.38	Gray Hard Sandstone
29.87	Gray Shale
32.92	Gray Sandstone
50.29	Gray Shale
53.34	Gray Sandstone
55.78	Gray Lost Circulation Shale
67.06	Gray Lost Circulation Sandstone

5. Well Completion

Date Started(yyyy/mm/dd): 1996/08/19	Date Completed(yyyy/mm/dd): 1996/08/19
Well Depth: 67.06 M	Borehole Diameter: 0 CM
Casing Type: Steel	Liner Type: Steel
Size OD: 13.97 CM	Size OD: 11.43 CM
Wall Thickness: 0.62 CM	Wall Thickness: 0.4 CM
Bottom at: 5.79 M	Top: 0.61 M Bottom: 67.06 M
Perforations from: 48.77 M to: 67.06 M from: 0 M to: 0 M from: 0 M to: 0 M	Perforations Size: 0.95 CM x 0.95 CM 0 CM x 0 CM 0 CM x 0 CM
Perforated by: Torch	
Seal: Drive Shoe from: 0 M	to: 5.79 M
Seal: from: 0 M	to: 0 M
Seal: from: 0 M	to: 0 M
Screen Type: from: 0 M to: 0 M	Screen ID: 0 CM Slot Size: 0 CM
Screen Type: from: 0 M to: 0 M	Screen ID: 0 CM Slot Size: 0 CM
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length: M	Diameter: CM

Comments:
DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GROUND LEVEL: 2'.

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.: 5881AD
This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.
Signature Yr Mo Day

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0435955
Map Verified: Map
Date Report Received: 1983/05/30
Measurements: Metric

1. Contractor & Well Owner Information

Company Name: FLINN DRILLING LTD.
Drilling Company Approval No.: ZZZZZZ
Mailing Address: GENERAL DELIVERY
City or Town: LACOMBE AB CA
Postal Code:
WellOwner's Name: SANDY POINT FARMS
Well Location Identifier:
P.O. Box Number:
Mailing Address: ST ALBERT
Postal Code:
City:
Province:
Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
04	12	041	01	5

Location in Quarter
0 M from Boundary
0 M from Boundary
Lot Block Plan
Well Elev: M
How Obtain: Not Obtain

3. Drilling Information

Type of Work: Test Hole
Reclaimed Well
Date Reclaimed:
Materials Used:
Proposed well use: Stock
Anticipated Water Requirements/day 0 Liters
Method of Drilling: Cable Tool
Flowing Well: No
Gas Present: No
Rate: Liters
Oil Present: No

4. Formation Log

Depth from ground level (meters)	Lithology Description
1.52	Sand & Till
4.57	Yellow Clay & Shale
7.62	Greenish Yellow Shale
8.53	Sand & Till
12.19	Gray Shale
14.02	Gray Shale & Rocks
17.68	Gray Sand
27.13	Gray Shale
28.96	Gray Sand
34.44	Blue Gray Shale
43.89	Light Gray Sand
46.63	Brownish Gray Shale
48.77	Gray Sand

5. Well Completion

Date Started(yyyy/mm/dd): 1983/05/03
Date Completed(yyyy/mm/dd): 1983/05/05
Well Depth: 48.77 M
Borehole Diameter: 0 CM
Casing Type: Steel
Liner Type: Steel
Size OD: 14.12 CM
Size OD: 11.43 CM
Wall Thickness: 0.48 CM
Wall Thickness: 0 CM
Bottom at: 12.19 M
Top: 0 M Bottom: 48.77 M
Perforations
from: 12.19 M to: 48.77 M
from: 0 M to: 0 M
from: 0 M to: 0 M
Perforations Size:
0.32 CM x 45.72 CM
0 CM x 0 CM
0 CM x 0 CM
Perforated by: Torch
Seal: Driven
from: 0 M to: 12.19 M
Seal:
from: 0 M to: 0 M
Seal:
from: 0 M to: 0 M
Screen Type:
from: 0 M to: 0 M
Screen ID: 0 CM
Slot Size: 0 CM
Screen Type:
from: 0 M to: 0 M
Screen ID: 0 CM
Slot Size: 0 CM
Screen Installation Method:
Fittings
Top:
Bottom:
Pack:
Grain Size:
Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0
Documents Held: 1
Pitless Adapter Type:
Drop Pipe Type:
Length: M
Diameter: CM
Comments:

6. Well Yield

Test Date (yyyy/mm/dd): 1983/05/05
Start Time: 11:00 AM
Test Method: Bailer
Non pumping static level: 0 M
Rate of water removal: 181.84 Liters/Min
Depth of pump intake: 3.66 M
Water level at end of pumping: M
Distance from top of casing to ground level: CM
Depth To water level (meters)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 8.53 M
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: 0 Liters/Min
Recommended pump intake: 0 M
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.:
This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.
Signature Yr Mo Day

Report 1 Pump Test 1 page1

ALBERTA ENVIRONMENT
CHEMICAL ANALYSIS REPORT

WELL NAME: NORRILA, P.
LOCATION: LSD 12 SEC 12 TWP 041 RG 01 M 5
WELL DEPTH: 50
AQUIFER:
SAMPLING DATE: TIME: 0

WELL ID No:0435956
SAMPLE No: 223
WATER LEVEL: -9
LABORATORY: RC
PRINT DATE: 4/18/2008

FIELD:	MG/L	FIELD:	MG/L
BICARBONATE	-9	CARBONATE	-9
CHLORIDE	-9	CONDUCTIVITY	-9
DISSOLVED OXYGEN	-9	EH	-9
IRON	-9	MANGANESE	-9
PH	-9	SULPHATE	-9
S2	-9	TEMPERATURE°C	-9
TOTAL ALKALINITY	-9	TOTAL HARDNESS	-9
LABORATORY: Analysis Date: 12/9/1969			
COD	-9	CONDUCTIVITY	-9
DIC	-9	FLUORIDE	0.14
ION BALANCE	-9	PH	8.6
SAR	-9	SIO2	-9
TOTAL ALKALINITY	402	TC	-9
TDS	684	TN	-9
DOC	-9		
AMMONIUM-N	-9	BICARBONATE	435.8572
CALCIUM	19.96	CARBONATE	26.001
CHLORIDE	8.01235	MAGNESIUM	12.010432
NITRATE-N	-9	NITRITE-N	-9
PHOSPHATE	-9	POTASSIUM	0
SODIUM	186.001	SULPHATE	88.944
$NO_2 + NO_3$	-9	TOTAL HARDNESS	99
ALUMINUM	-9	ARSENIC	-9
BARIUM	-9	BERYLIUM	-9
CADMIUM	-9	CHROMIUM	-9
COBALT	-9	COPPER	-9
IRON	0	LEAD	-9
MANGANESE	-9	MERCURY	-9
MOLYBDENUM	-9	NICKEL	-9
SELENIUM	-9	STRONTIUM	-9
VANADIUM	-9	ZINC	-9
HYDROCARBONS	-9	PESTICIDES	-9
PHENOLICS	-9	OTHER 3	0

Remarks: TRACE IRON. NA=SODIUM & POTASSIUM.
-9 indicates that no analysis was done for this parameter
*Indicates concentrations less than.
Temperature reported in Degree Centigrade. Conductivity reported in microsiemens/cm, pH in pH units. Alkalinity and Hardnes expressed as Calcium Carbonate. FE, VA, PB, AL, AG expressed as extractable. FE in field measurements and all remaining metals expressed as total.

EH - Oxidation-Reduction Potential
DIC - Dissolved Inorganic Carbon
DOC - Dissolved Organic Carbon
TDS - Total Dissolved Solids
SAR - Sodium Adsorption Ratio
COD - Chemical Oxygen Demand
TN - Total Particulate Nitrogen
TC - Total Particulate Carbon

NOTE: This data may not be fully checked.
The Province disclaims all responsibility for its accuracy

Report 1

APPENDIX B

Alken Basin Ltd. Water Well Drilling Reports

Alberta ENVIRONMENT

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy. All information on this report will be retained in a public database.

Well I.D. WELL-A
Map verified
Date report received:

1 Contractor & Well Owner Information

Company Name: Alken Basin Drilling Approval No.: 966
Mailing Address: Box 47 City or Town: Bentley Alb Postal Code: T0C-0S0
Well Owner's Name: Sandy Point Farms Well Owner has a copy of this report: ☑ Yes ☐ No
Mailing Address: Box 119 City or Town: Bentley Alb Postal Code: T0C-0S0

2 Well Location

LSD or LSD	Sec	Twp	Rge	Meridian
10	1	41	1	W5

Location of Quarter: ____ m/ft from ☐ N ☐ S
____ m/ft from ☐ E ☐ W
Lot ____ Block ____ Plan ____

3 Drilling Information

Type of Work: ☐ Testhole ☑ New Well ☐ Reconditioned ☐ Deepened
☐ Reclaimed well Date reclaimed: Yr ____ Mo ____ Day ____
Materials Used: ☐ Cement ☐ Bentonite Product ☐ Other:
Proposed well use: ☐ Household (up to 1250 m³ per year with a residence on the property) ☐ Other Specify:
Method of Drilling: ☐ Auger ☑ Rotary ☐ Boring ☐ Combination ☐ Cable tool ☐ Backhoe ☐ Other:

4 Formation Log

Depth from ground level	Lithology Description	Water Bearing?
0-17	Clay Brown	
17-24	SS/Brown	
24-30	Shale Brown	
30-34	SS Brown & Green	
34-37	Shale Green & Brown Frac	
37-40	Shale Gray	
40-44	SS Gray Hrd	
44-56	Shale Gray	
56-59	SS Gray	
59-70	Shale Gray	
70-73	Shale Green	
73-81	SS Gray	
81-90	Shale Gray	

Geophysical Log taken: ☐ Electric ☐ Gamma
Did you encounter: ☐ Mineralized water more than 4000 ppm TDS ☐ Gas
If so, what depth:
Remedial action taken:

5 Well Completion

Date Started: Yr 02 Mo 11 Day 13 Date Completed: Yr 02 Mo 11 Day 13
Are measurements in metric or imperial?
Well Depth: 90' Borehole diameter: 5"
Casing type: Steel Liner type: PVC
Size OD: 5 9/16 Size OD: 4 1/2"
Wall thickness: .258 Wall thickness: SDR-21 (0.214")
Bottom at: 37' Top: 30' Bottom: 90'
Perforations: from: 70' to: 80'
from: to:
Perforation size: 1/2" x 1/2"
Perforated by: ☐ Saw ☐ Torch ☐ Machine ☑ Other: Drill
Seals: ☑ Bentonite product ☑ Driven ☐ Cement / Grout ☐ Other:
Sealed interval: Drive Shoe, from: 0 to: 37'
Screen type: Size OD:
Intervals: from: to: slot size:
from: to: slot size
Installation: ☐ Attached to casing ☐ Telescoped
Fittings: Top ☐ Packer ☐ Coupler Bottom ☐ Wash-down ☐ Bail ☐ Plug
Pack: ☐ Artificial/Mechanical ☐ Natural
Grain size: Amount:

6 Well Yield

Test Date: Yr 02 Mo 11 Day 13 Start Time:
Test method: ☐ Pump ☐ Bailer ☑ Air
Non pumping static water level: 23'
Rate of water removal: 20 GPM
Depth of pump intake if pump tested: 80'
Depth bailed or air tested from: 90'
Distance from top of casing to ground level: 3'

Depth to water level: Pumping	Elapsed Time minutes	Recovery
	0	
9.65	1	8.25
10.70	2	7.98
11.12	3	7.86
11.35	4	7.76
11.45	5	7.75
11.52	6	7.73
11.58	7	7.69
11.62	8	7.67
11.64	9	7.64
11.66	10	7.63
	12	
11.76	14	7.58
	16	
11.78	20	7.54
11.85	25	7.53
11.92	30	7.50
	35	
12.17	40	7.47
12.25	50	7.44
12.40	60	7.43
12.25	75	7.41
12.15	90	7.38
	105	
12.31	120	7.33

Total Drawdown: 5.16 M
If water removal was less than 2 hr. duration, reason why:
Recommended pumping rate: 20 GPM
Recommended pump intake: 70'
Pump installed ☐ Yes Depth:
Type:
Any further pumptest information? ☑ ☐

7 Contractor Certification

Driller's Name: Leonard Blair (R)
Certification No.: UA 3129
This well was constructed in accordance with the *Water (Ministerial) Regulation* of the *Water Act*. All information in this report is true.
Signature Yr 02 Mo 11 Day 13

Contact - Waterline Resources 273-3564

(WR 11/01) White copy: Alberta Environment Yellow copy: Well Owner Pink copy: Contractor

Alberta ENVIRONMENT

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy. All information on this report will be retained in a public database.

Well I.D. WELL-B
Map verified
Date report received:

1 Contractor & Well Owner Information

Company Name: Alken Basin Drilling — Approval No.: 966
Mailing Address: Box 47 — City or Town: Bentley Ab — Postal Code: T0C-0J0
Well Owner's Name: Sandy Point Farms — Well Owner has a copy of this report: ☑ Yes ☐ No
Mailing Address: Box 119 — City or Town: Bentley Ab — Postal Code: T0C-0J0

2 Well Location

Lsd or LSD	Sec.	Twp.	Rge.	W of Meridian
10	1	41	1	W5

Location in Quarter Section: ☐ m/ft from ☐ N ☐ S ☐ m/ft from ☐ E ☐ W
Lot: Block: Plan:

3 Drilling Information

Type of Work: ☐ Testhole ☑ New Well ☐ Reconditioned ☐ Deepened ☐ Reclaimed well
Date reclaimed: Yr Mo Day
Materials Used: ☐ Cement ☐ Bentonite Product ☐ Other:
Proposed well use: ☐ Household (up to 1250 m³ per year with a residence on the property) ☐ Other Specify:
Method of Drilling: ☐ Auger ☑ Rotary ☐ Boring ☐ Combination ☐ Cable tool ☐ Backhoe ☐ Other:

4 Formation Log

Depth from ground level	Lithology Description	Water Bearing? Yes/No
0-14	Clay Brown	
14-24	SS Brown	
24-36	Shale Brown	
36-39	Shale Gray	
39-45	SS Gray	
45-48	Shale Gray	
48-58	SS Gray	
58-72	Shale Gray	
72-81	SS Gray	
81-107	Shale Gray	
107-170	SS Gray	
170-180	Shale Gray	

Geophysical Log taken: ☐ Electric ☐ Gamma
Did you encounter: ☐ Mineralized water more than 4000 ppm TDS ☐ Gas
At what depth:
Remedial action taken:

5 Well Completion

Date Started: Yr 02 Mo 11 Day 13 — Date Completed: Yr 02 Mo 11 Day 13
Are measurements in metric or imperial?
Well Depth: 180' — Borehole diameter: 5"
Casing type: Steel — Liner type: PVC
Size OD: 5 9/16" — Size OD: 4 1/2"
Wall thickness: .258" — Wall thickness: SDR-21
Bottom at: 97' — Top: 80' Bottom: 180'
Perforations: from: 120' to: 170'
from: to:
Perforation size: 1/2" x 1/2"
Perforated by: ☐ Saw ☐ Machine ☐ Torch ☑ Other: Drill
Seal: ☑ Bentonite product ☐ Cement / Grout ☑ Driven ☐ Other:
Sealed interval: from: Drive Shoe to: 97'
Screen type: Size OD:
Intervals: from: to: slot size:
from: to: slot size:
Installation: ☐ Attached to casing ☐ Telescoped
Fittings: Top ☐ Packer ☐ Coupler Bottom ☐ Wash-down ☐ Ball ☐ Plug
Pack: ☐ Artificial ☐ Mechanical ☐ Natural
Grain size: Amount:

6 Well Yield

Test Date: Yr 02 Mo 11 Day 13 — Start Time:
Test method: ☐ Pump ☐ Bailer ☑ Air
Are measurements in metric or imperial?
Non pumping static water level: 24'
Rate of water removal: 50 GPM
Depth of pump intake if pump tested: 170'
Depth bailed or air tested from: 180'
Distance from top of casing to ground level: 3'

Depth to water level	Elapsed Time minutes	Recovery
Pumping	0	
15.40	1	10.10
17.50	2	8.00
18.42	3	7.81
18.63	4	7.77
19.05	5	7.74
19.32	6	7.72
19.42	7	7.71
19.51	8	7.70
19.61	9	7.69
19.68	10	7.68
	12	
19.90	14	7.65
	16	
19.87	20	7.63
19.76	25	7.62
19.67	30	7.62
	35	
19.70	40	7.60
19.75	50	7.59
19.80	60	7.57
19.85	75	7.56
19.90	90	7.55
	105	
19.93	120	7.54

Total Drawdown: 12.49'
If water removal was less than 2 hr. duration, reason why:
Recommended pumping rate: 50 GPM
Recommended pump intake: 170 ft
Pump installed ☐ Yes Depth:
Type:
Any further pumptest information? ☑ No

7 Contractor Certification

Driller's Name: Leonard Blair (R)
Certification No.: WA3129
This well was constructed in accordance with the Water (Ministerial) Regulation of the Water Act. All information in this report is true.
Signature — Yr 02 Mo 11 Day 13

Contact Waterline Resources 273-3564

ENVIR 11/01) White copy: Alberta Environment Yellow copy: Well Owner Pink copy: Contractor

Alberta ENVIRONMENT

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy. All information on this report will be retained in a public database.

Well I.D. WELL-C
Map verified
Date report received:

1 Contractor & Well Owner Information

Company Name: Alken Basin Drilling Ltd Approval No: 964
Mailing Address: Box 47 City or Town: Beatty, AB Postal Code: T0C 0J0
Well Owner's Name: Sunny Point Farms Well Owner has a copy of this report: ☑ Yes ☐ No
Mailing Address: Box 119 City or Town: Beatty, AB Postal Code: T0C 0J0

2 Well Location

LSD	Sec	Twp	Rge	W of Meridian
10	1	41	1	5

Location of well: ___ m/ft from ☐ N ☐ S
___ m/ft from ☐ E ☐ W
Lot: Block: Plan:

3 Drilling Information

Type of Work: ☐ Testhole ☑ New Well ☐ Reconditioned ☐ Deepened
☐ Reclaimed well Date reclaimed: Yr Mo Day
Materials Used: ☐ Cement ☐ Bentonite Product ☐ Other:
Proposed well use: ☐ Household (up to 1250 m³ per year with a residence on the property) ☐ Other Specify:
Method of Drilling: ☐ Auger ☑ Rotary ☐ Boring ☐ Combination ☐ Cable tool ☐ Backhoe ☐ Other:

4 Formation Log

Depth from ground level | Description

0 - 12	Clay
12 - 35	Sandy Clay
35 - 42	Sandy Clay
42 - 50	Sandy Clay
50 - 70	Sandy Clay
70 - 79	Sandy Clay
79 - 106	Sandy Clay
106 - 170	Sandy Clay
170 180	Sandy Clay

Geophysical Log taken: ☐ Electric ☐ Gamma
Did you encounter: ☐ Mineralized water more than 4000 ppm TDS ☐ Gas
At what depth: No
Remedial action taken: Drilling water taken from Shop well

5 Well Completion

Date Started: Yr 2002 Mo 11 Day 12 Date Completed: Yr 2002 Mo 11 Day 12
All measurements in metres / millimetres

Well Depth: 180 ft	Borehole diameter: 7 7/8
Casing type: Steel	Liner type: PVC
Size OD: 5 5/8	Size OD: 4 1/2
Wall thickness: 365	Wall thickness: .383
Bottom at: 104 ft	Top: 80 ft Bottom: 180 ft

Perforations: from: 120 ft to: 160 ft
from: to:
Perforation size: 1/2 x 1/2
Perforated by: ☐ Saw ☐ Torch ☐ Machine ☑ Other: Drill
Seal: ☑ Bentonite product ☐ Cement / Grout ☑ Driven ☐ Other: Drive Shoe
Sealed interval: from: 0 to: 104 ft
Screen type: Size OD:

Intervals: from:	to:	Slot size:
from:	to:	Slot size:

Installation: ☐ Attached to casing ☐ Telescoped
Fittings: Top ☐ Packer ☐ Coupler Bottom ☐ Wash-down ☐ Ball ☐ Plug
Pack: ☐ Artificial/Mechanical ☐ Natural
Grain size: Amount:

6 Well Yield

Test Date: Yr 2002 Mo 11 Day 12 Start Time:
Test method: ☐ Pump ☐ Bailer ☑ Air
All measurements in metres / millimetres

Non pumping static water level: 22 ft
Rate of water removal: 50 gpm
Depth of pump intake if pump tested: 160 ft
Depth bailed or air tested from: 180 ft
Distance from top of casing to ground level: 3 ft

Depth to water level Pumping	Elapsed Time minutes	Recovery
	0	
15.10	1	10.10
17.50	2	8.60
18.42	3	7.81
18.63	4	7.7
19.05	5	7.74
19.22	6	7.78
19.41	7	7.71
19.52	8	7.70
19.62	9	7.69
19.69	10	7.68
19.80	12	7.66
19.82	14	7.65
19.84	16	7.64
19.87	20	7.63
19.75	25	7.62
19.74	30	7.62
19.72	35	7.61
19.72	40	7.60
19.77	50	7.59
19.82	60	7.57
19.87	75	7.55
19.92	90	7.54
19.93	105	7.53
19.95	120	7.52

Total Drawdown:
If water removal was less than 2 hr. duration, reason why:
Recommended pumping rate: 50 gpm
Recommended pump intake: 160 ft
Pump installed ☐ Yes Depth:
Type:
Any further pumptest information? ☑ No:

7 Contractor Certification

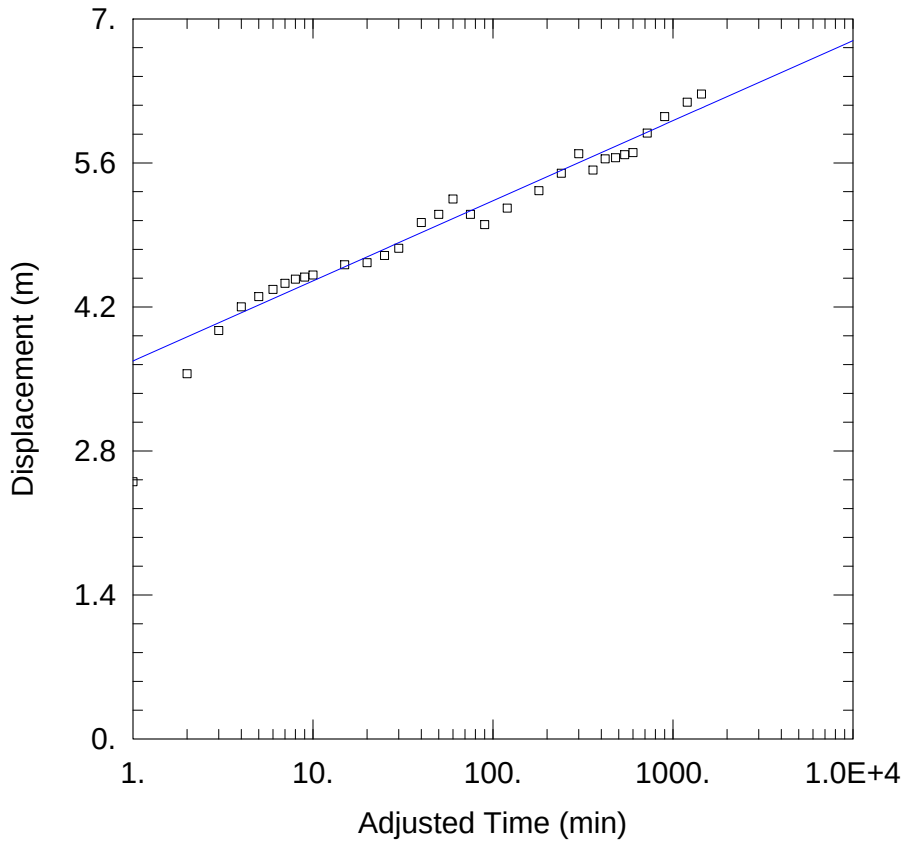
Driller's Name: Kelly Hartman
Certification No.: 1235-92
This well was constructed in accordance with the *Water (Ministerial) Regulation* of the *Water Act*. All information in this report is true.
Signature: Kelly Hartman Yr 2002 Mo 12 Day 14

ENVIR 11 01) White copy: Alberta Environment Yellow copy: Well Owner Pink copy: Contractor

Contact Water Line Resources 1-403-273-3524

APPENDIX C

Aquifer Test Data, AQTESOLV Results and Drawdown and Cone of Depression Calculations for 140-day and 1 to 20 years



WELL TEST ANALYSIS

Data Set: P:\...\Well A Pumping CJ.aqt
Date: 05/26/08 Time: 11:56:13

PROJECT INFORMATION

Company: Waterline Resources Inc.
Client: Frank Wilson
Project: WL08-1403
Location: Gull Lake
Test Well: Well A
Test Date: Nov. 14, 2002

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Jacob

T = 0.02141 m^2/min
S = 0.0003412

AQUIFER DATA

Saturated Thickness: 2.44 m

Anisotropy Ratio (Kz/Kr): 1.

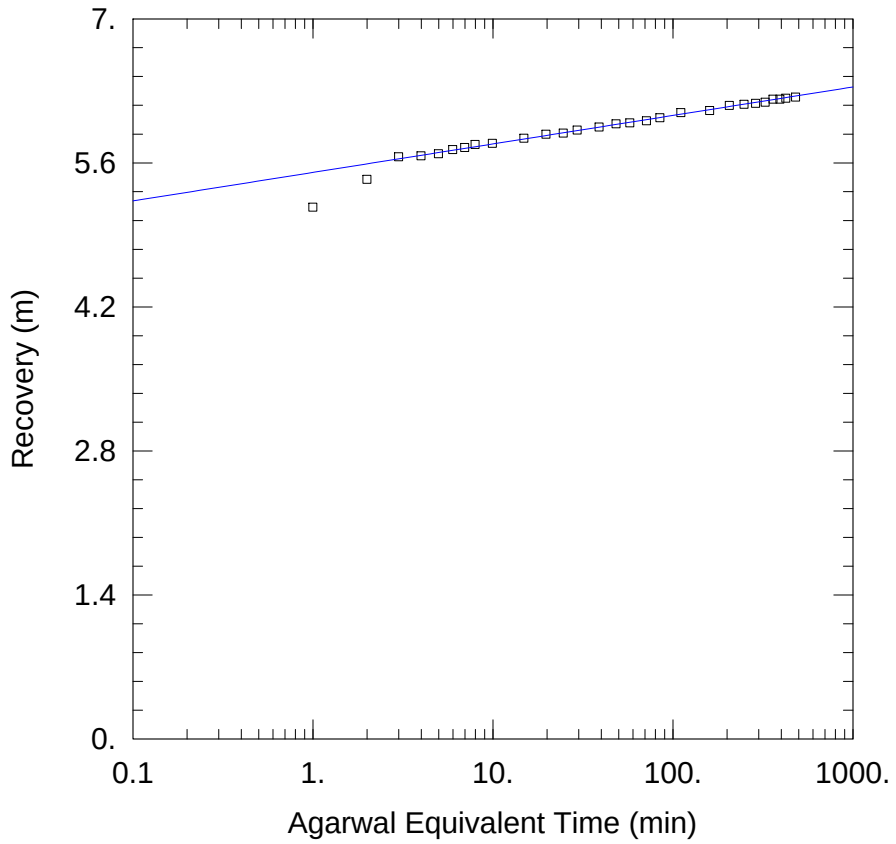
WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Well A	0	0

Observation Wells

Well Name	X (m)	Y (m)
Well A	0	0



WELL TEST ANALYSIS

Data Set: P:\...\Well A Recovery CJ (Agarwal).aqt
Date: 05/26/08 Time: 11:57:08

PROJECT INFORMATION

Company: Waterline Resources Inc.
Client: Frank Wilson
Project: WL08-1403
Location: Gull Lake
Test Well: Well A
Test Date: Nov 14, 2002

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Jacob

T = 0.0602 m^2/min
S = 6.514E-19

AQUIFER DATA

Saturated Thickness: 2.44 m

Anisotropy Ratio (Kz/Kr): 1.

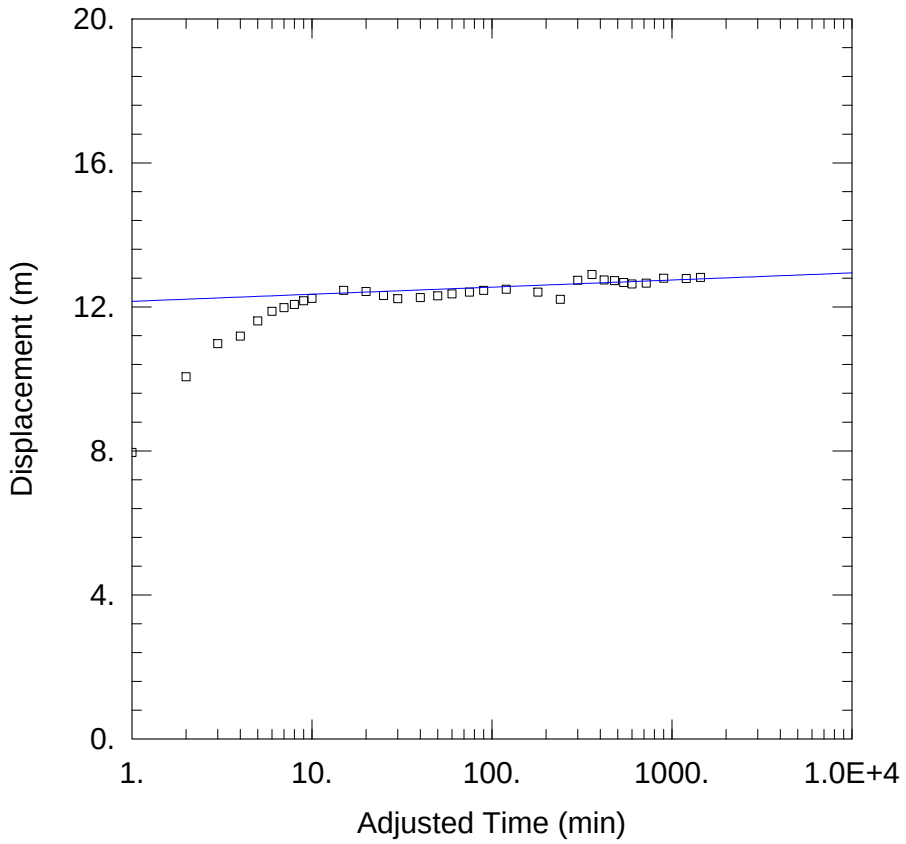
WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Well A	0	0

Observation Wells

Well Name	X (m)	Y (m)
▫ Well A	0	0



WELL TEST ANALYSIS

Data Set: P:\...\Well B Pumping CJ.aqt
Date: 05/26/08 Time: 11:58:06

PROJECT INFORMATION

Company: Waterline Resources Inc
Client: Frank Wilson
Project: WL08-1403
Location: Gull Lake
Test Well: Well B
Test Date: November 14, 2002

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Jacob

T = 0.1772 m^2/min
S = 4.141E-60

AQUIFER DATA

Saturated Thickness: 19.2 m

Anisotropy Ratio (Kz/Kr): 1.

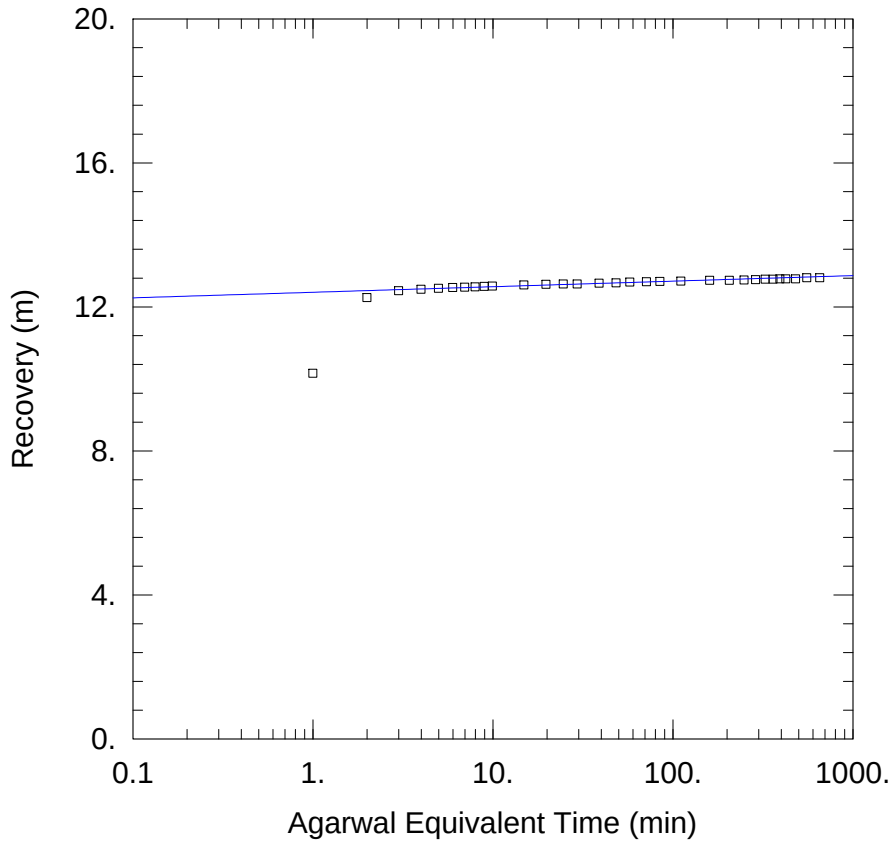
WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Well B	0	0

Observation Wells

Well Name	X (m)	Y (m)
▫ Well B	0	0



WELL TEST ANALYSIS

Data Set: P:\...\Well B Recovery CJ (Agarwal).aqt
Date: 05/26/08 Time: 11:58:51

PROJECT INFORMATION

Company: Waterline Resources Inc.
Client: Frank Wilson
Project: WL08-1403
Location: Gull Lake
Test Well: Well B
Test Date: November 14, 2002

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Jacob

T = 0.2264 m^2/min
S = 1.077E-78

AQUIFER DATA

Saturated Thickness: 19.2 m

Anisotropy Ratio (Kz/Kr): 1.

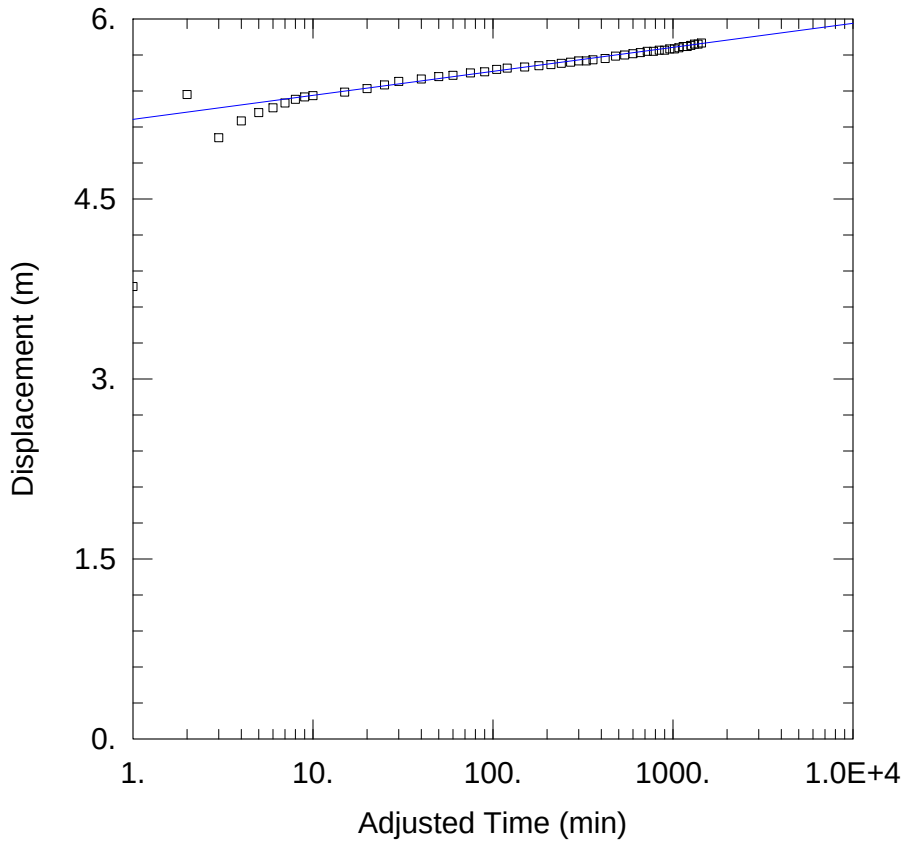
WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Well B	0	0

Observation Wells

Well Name	X (m)	Y (m)
▫ Well B	0	0



WELL TEST ANALYSIS

Data Set: P:\...\Well C Pumping CJ.aqt
Date: 05/26/08 Time: 12:02:02

PROJECT INFORMATION

Company: Waterline Resources Inc
Client: Frank Wilson
Project: WL08-1403
Location: Gull Lake
Test Well: Well C
Test Date: November 27, 2002

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Jacob

T = 0.3533 m^2/min
S = 2.079E-24

AQUIFER DATA

Saturated Thickness: 19.5 m

Anisotropy Ratio (Kz/Kr): 1.

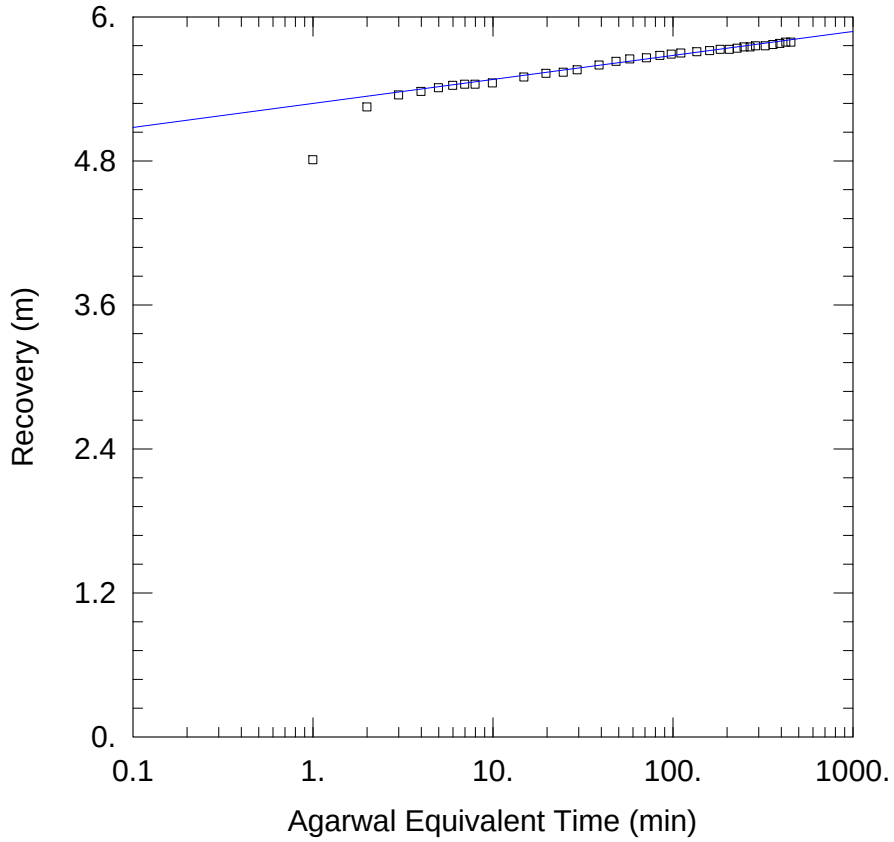
WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Well C	0	0

Observation Wells

Well Name	X (m)	Y (m)
▫ Well C	0	0



WELL TEST ANALYSIS

Data Set: P:\...\Well C Recovery CJ (Agarwal).aqt
Date: 05/26/08 Time: 12:03:19

PROJECT INFORMATION

Company: Waterline Resources Inc.
Client: Frank Wilson
Project: WL08-1403
Location: Gull Lake
Test Well: Well C
Test Date: November 27, 2002

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Jacob

T = 0.3537 m^2/min
S = 5.098E-25

AQUIFER DATA

Saturated Thickness: 19.5 m

Anisotropy Ratio (Kz/Kr): 1.

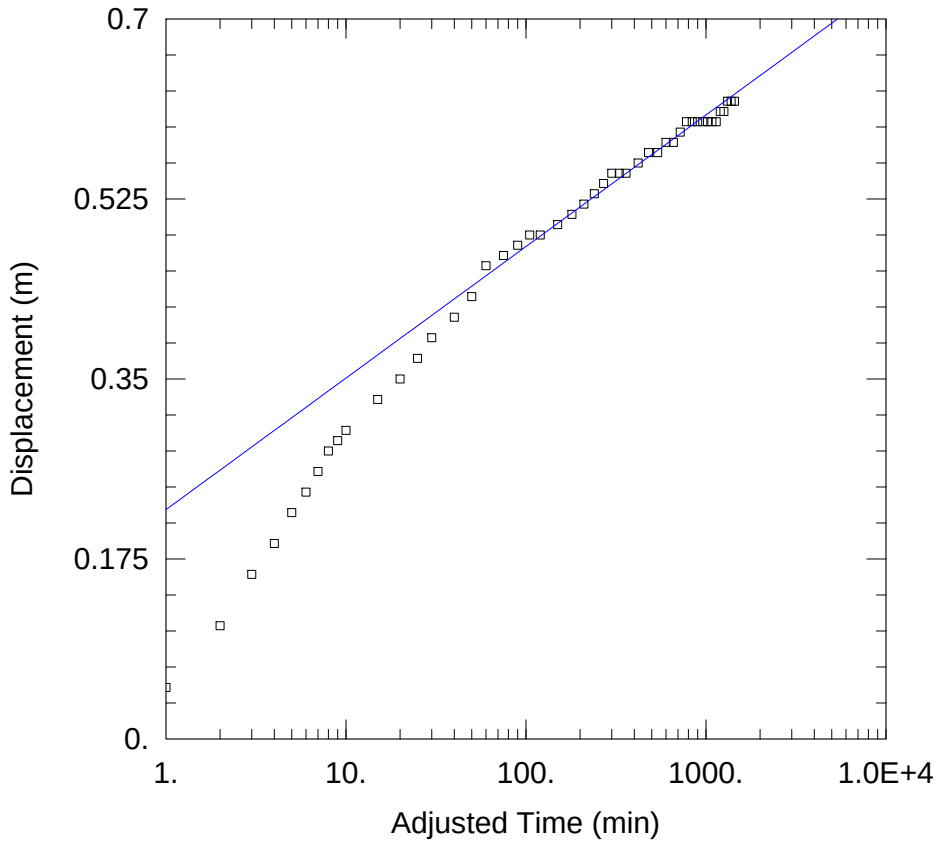
WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Well C	0	0

Observation Wells

Well Name	X (m)	Y (m)
▫ Well C	0	0



WELL TEST ANALYSIS

Data Set: P:\...\Well C (Pump) - Well B (Obs.) CJ.aqt
Date: 05/26/08 Time: 12:01:12

PROJECT INFORMATION

Company: Waterline Resources Inc
Client: Frank Wilson
Project: WL08-1403
Location: Gull Lake
Test Well: Well C
Test Date: November 27, 2002

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Jacob

T = 0.553 m^2/min
S = 2.248E-6

AQUIFER DATA

Saturated Thickness: 19.5 m

Anisotropy Ratio (Kz/Kr): 1.

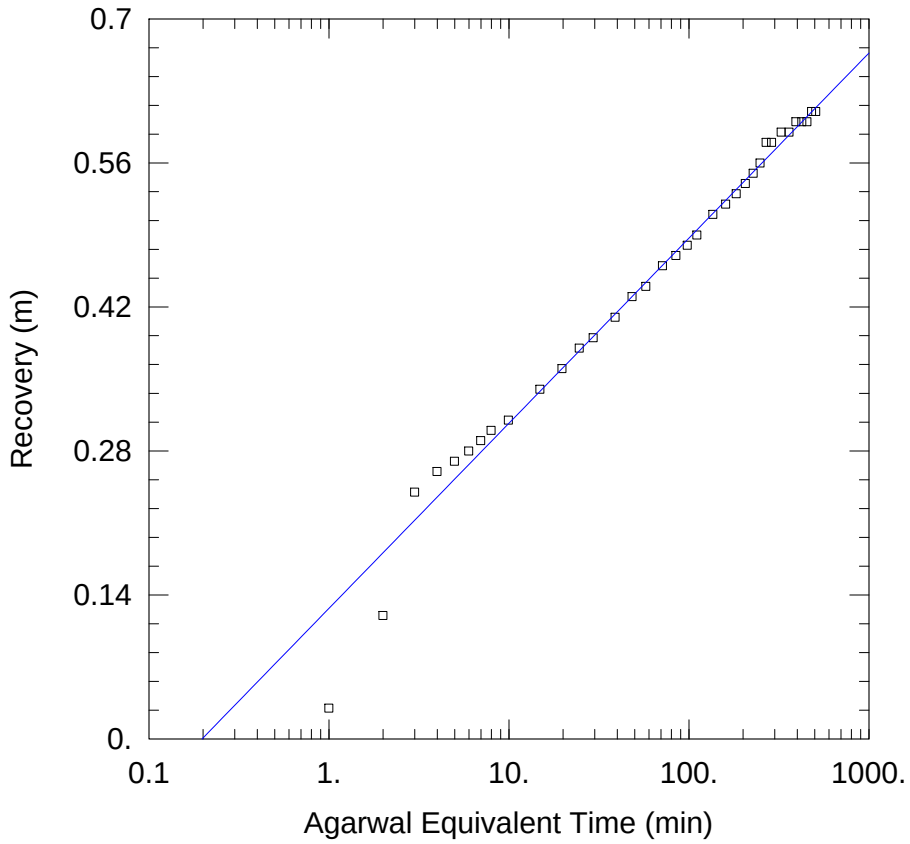
WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Well C	0	0

Observation Wells

Well Name	X (m)	Y (m)
▫ Well B	100	0



WELL TEST ANALYSIS

Data Set: P:\...\Well C (Pump) - Well B (Obs.) CJ (Recovery
Date: 05/26/08 Time: 12:00:00

PROJECT INFORMATION

Company: Waterline Resources Inc.
Client: Frank Wilson
Project: WL08-1403
Location: Gull Lake
Test Well: Well C
Test Date: November 27, 2002

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Jacob

T = 0.393 m^2/min
S = 1.743E-5

AQUIFER DATA

Saturated Thickness: 19.5 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Well C	0	0

Observation Wells

Well Name	X (m)	Y (m)
▫ Well B	100	0

Data Set: P:\2008 PROJECTS\WL081403 Sandy Point RV Park Development\Data\Aqtesolv data\Refined set (Agarwal)\Well C (Pump) - Well B
Title: Well Test Analysis
Date: 05/26/08
Time: 12:06:13

PROJECT INFORMATION

Company: Waterline Resources Inc.
Client: Frank Wilson
Project: WL08-1403
Location: Gull Lake
Test Date: November 27, 2002
Test Well: Well C

AQUIFER DATA

Saturated Thickness: 19.5 m
Anisotropy Ratio (Kz/Kr): 1.

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: Well C

X Location: 0. m
Y Location: 0. m

Casing Radius: 0.1 m
Well Radius: 0.079 m

Fully Penetrating Well

No. of pumping periods: 2

Pumping Period Data

Time (min)	Rate (cu. m/min)	Time (min)	Rate (cu. m/min)
0.	0.386	1440.	0.

OBSERVATION WELL DATA

No. of observation wells: 1

Observation Well No. 1: Well B

X Location: 100. m
Y Location: 0. m

Radial distance from Well C: 100. m

Fully Penetrating Well

No. of Observations: 82

Observation Data

Time (min)	Displacement (m)	Time (min)	Displacement (m)
1.	0.05	1140.	0.6
2.	0.11	1200.	0.61
3.	0.16	1260.	0.61
4.	0.19	1320.	0.62
5.	0.22	1380.	0.62
6.	0.24	1440.	0.62
7.	0.26	1441.	0.59
8.	0.28	1442.	0.5
9.	0.29	1443.	0.38
10.	0.3	1444.	0.36
15.	0.33	1445.	0.35
20.	0.35	1446.	0.34
25.	0.37	1447.	0.33
30.	0.39	1448.	0.32
40.	0.41	1450.	0.31
50.	0.43	1455.	0.28
60.	0.46	1460.	0.26
75.	0.47	1465.	0.24
90.	0.48	1470.	0.23
105.	0.49	1480.	0.21
120.	0.49	1490.	0.19
150.	0.5	1500.	0.18
180.	0.51	1515.	0.16
210.	0.52	1530.	0.15
240.	0.53	1545.	0.14
270.	0.54	1560.	0.13
300.	0.55	1590.	0.11
330.	0.55	1620.	0.1
360.	0.55	1650.	0.09
420.	0.56	1680.	0.08
480.	0.57	1710.	0.07
540.	0.57	1740.	0.06
600.	0.58	1770.	0.04
660.	0.58	1800.	0.04
720.	0.59	1860.	0.03
780.	0.6	1920.	0.03
840.	0.6	1980.	0.02
900.	0.6	2040.	0.02
960.	0.6	2100.	0.02
1020.	0.6	2160.	0.01
1080.	0.6	2220.	0.01

SOLUTION

Pumping Test
Aquifer Model: Confined
Solution Method: Cooper-Jacob

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.393	m^2/min
S	1.743E-5	

K = T/b = 0.02015 m/min (0.03359 cm/sec)
Ss = S/b = 8.939E-7 1/m

Data Set: P:\2008 PROJECTS\WL081403 Sandy Point RV Park Development\Data\Aqtesolv data\Forward S
Date: 05/26/08
Time: 11:52:36

PROJECT INFORMATION

Company: Waterline
Client: Frank Wilson
Project: WL08-1403
Location: Gull Lake
Test Date: November 27, 2002
Test Well: Well C

AQUIFER DATA

Saturated Thickness: 19.5 m
Anisotropy Ratio (Kz/Kr): 1.

PUMPING WELL DATA

No. of pumping wells: 2

Pumping Well No. 1: Well C

X Location: 0. m
Y Location: 0. m

Casing Radius: 0.1 m
Well Radius: 0.079 m

Partially Penetrating Well
Depth to Top of Screen: 4.26 m
Depth to Bottom of Screen: 16.46 m

No. of pumping periods: 1

Pumping Period Data

Time (day)	Rate (m^3/day)
0.	400.

Pumping Well No. 2: Well B

X Location: 100. m
Y Location: 0. m

Casing Radius: 0.064 m
Well Radius: 0.052 m

Partially Penetrating Well
Depth to Top of Screen: 3.96 m
Depth to Bottom of Screen: 19.2 m

No. of pumping periods: 1

Pumping Period Data

Time (day)	Rate (m^3/day)
0.	200.

OBSERVATION WELL DATA

No. of observation wells: 8

Observation Well No. 1: Well C

X Location: 0. m
Y Location: 0. m

Radial distance from Well C: 0. m
Radial distance from Well B: 100. m

Partially Penetrating Well
Depth to Top of Screen: 4.26 m
Depth to Bottom of Screen: 16.46 m

No. of Observations: 0

Observation Well No. 2: Well B

X Location: 100. m
Y Location: 0. m

Radial distance from Well C: 100. m
Radial distance from Well B: 0. m

Partially Penetrating Well
Depth to Top of Screen: 3.96 m
Depth to Bottom of Screen: 19.2 m

No. of Observations: 0

Observation Well No. 3: 500m

X Location: 500. m
Y Location: 0. m

Radial distance from Well C: 500. m
Radial distance from Well B: 400. m

Fully Penetrating Well

No. of Observations: 0

Observation Well No. 4: 900m

X Location: 900. m
Y Location: 0. m

Radial distance from Well C: 900. m
Radial distance from Well B: 800. m

Fully Penetrating Well

No. of Observations: 0

Observation Well No. 5: 1600m

X Location: 1600. m
Y Location: 0. m

Radial distance from Well C: 1600. m
Radial distance from Well B: 1500. m

Fully Penetrating Well

No. of Observations: 0

Observation Well No. 6: 3000m

X Location: 3000. m
Y Location: 0. m

Radial distance from Well C: 3000. m
Radial distance from Well B: 2900. m

Fully Penetrating Well

No. of Observations: 0

Observation Well No. 7: 4000m

X Location: 4000. m
Y Location: 0. m

Radial distance from Well C: 4000. m
Radial distance from Well B: 3900. m

Fully Penetrating Well

No. of Observations: 0

Observation Well No. 8: 5000m

X Location: 5000. m
Y Location: 0. m

Radial distance from Well C: 5000. m
Radial distance from Well B: 4900. m

Fully Penetrating Well

No. of Observations: 0

SOLUTION

Pumping Test
Aquifer Model: Confined
Solution Method: Theis (Step Test)

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	461.9	m^2/day
S	2.0E-5	
Sw	0.	
C	0.	day^2/m^5
P	2.	

K = T/b = 23.69 m/day (0.02742 cm/sec)
Ss = S/b = 1.026E-6 1/m

STEP TEST ANALYSIS RESULTS

Jacob-Rorabaugh Step Test Model: $s(t) = BQ + CQ^P$
t = 1.day
Q in cu.m/day
B = 0.005378
C = 0.
P = 2.

Eden-Hazel Step Test Model: $s(t) = (a + b \log_{10}(t))Q + CQ^P$
Q in cu.m/day
a = 0.003936
b = 0.0003968
C = 0.
P = 2.

Well Efficiency: 100.% (Q from last step)

Data Set: P:\2008 PROJECTS\WL081403 Sandy Point RV Park Development\Data\Aqtesolv data\Forward S
Date: 05/26/08
Time: 11:54:01

PROJECT INFORMATION

Company: Waterline
Client: Frank Wilson
Project: WL08-1403
Location: Gull Lake
Test Date: November 27, 2002
Test Well: Well C

AQUIFER DATA

Saturated Thickness: 19.5 m
Anisotropy Ratio (Kz/Kr): 1.

PUMPING WELL DATA

No. of pumping wells: 2

Pumping Well No. 1: Well C

X Location: 0. m
Y Location: 0. m

Casing Radius: 0.1 m
Well Radius: 0.079 m

Partially Penetrating Well
Depth to Top of Screen: 4.26 m
Depth to Bottom of Screen: 16.46 m

No. of pumping periods: 1

Pumping Period Data

Time (day)	Rate (m^3/day)
0.	150.

Pumping Well No. 2: Well B

X Location: 100. m
Y Location: 0. m

Casing Radius: 0.064 m
Well Radius: 0.052 m

Partially Penetrating Well
Depth to Top of Screen: 3.96 m
Depth to Bottom of Screen: 19.2 m

No. of pumping periods: 1

Pumping Period Data

Time (day)	Rate (m^3/day)
0.	80.

OBSERVATION WELL DATA

No. of observation wells: 8

Observation Well No. 1: Well C

X Location: 0. m
Y Location: 0. m

Radial distance from Well C: 0. m
Radial distance from Well B: 100. m

Partially Penetrating Well
Depth to Top of Screen: 4.26 m
Depth to Bottom of Screen: 16.46 m

No. of Observations: 0

Observation Well No. 2: Well B

X Location: 100. m
Y Location: 0. m

Radial distance from Well C: 100. m
Radial distance from Well B: 0. m

Partially Penetrating Well
Depth to Top of Screen: 3.96 m
Depth to Bottom of Screen: 19.2 m

No. of Observations: 0

Observation Well No. 3: 500m

X Location: 500. m
Y Location: 0. m

Radial distance from Well C: 500. m
Radial distance from Well B: 400. m

Fully Penetrating Well

No. of Observations: 0

Observation Well No. 4: 900m

X Location: 900. m
Y Location: 0. m

Radial distance from Well C: 900. m
Radial distance from Well B: 800. m

Fully Penetrating Well

No. of Observations: 0

Observation Well No. 5: 1600m

X Location: 1600. m
Y Location: 0. m

Radial distance from Well C: 1600. m
Radial distance from Well B: 1500. m

Fully Penetrating Well

No. of Observations: 0

Observation Well No. 6: 3000m

X Location: 3000. m
Y Location: 0. m

Radial distance from Well C: 3000. m
Radial distance from Well B: 2900. m

Fully Penetrating Well

No. of Observations: 0

Observation Well No. 7: 4000m

X Location: 4000. m
Y Location: 0. m

Radial distance from Well C: 4000. m
Radial distance from Well B: 3900. m

Fully Penetrating Well

No. of Observations: 0

Observation Well No. 8: 5000m

X Location: 5000. m
Y Location: 0. m

Radial distance from Well C: 5000. m
Radial distance from Well B: 4900. m

Fully Penetrating Well

No. of Observations: 0

SOLUTION

Pumping Test
Aquifer Model: Confined
Solution Method: Theis (Step Test)

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	461.9	m^2/day
S	2.0E-5	
Sw	0.	
C	0.	day^2/m^5
P	2.	

K = T/b = 23.69 m/day (0.02742 cm/sec)
Ss = S/b = 1.026E-6 1/m

STEP TEST ANALYSIS RESULTS

Jacob-Rorabaugh Step Test Model: $s(t) = BQ + CQ^P$
t = 1.day
Q in cu.m/day
B = 0.005427
C = 0.
P = 2.

Eden-Hazel Step Test Model: $s(t) = (a + b \log_{10}(t))Q + CQ^P$
Q in cu.m/day
a = 0.003936
b = 0.0003968
C = 0.
P = 2.

Well Efficiency: 100.% (Q from last step)

APPENDIX D

Laboratory Chemistry Reports

WSH Labs (1992) LTD.
336 - 5 - 21 Street N.E.
Calgary, Alberta
Canada T2E6T5
Ph: (403) 250-9164
Fax: (403) 291-4597
Website: www.wshlabs.com

Alken Basin Drilling	P.O #	Client I.D	Sandy Point Farms
Box 47	Lab # 37068	Legal	10-1-41-1-W5
Bentley, AB T0C 0J0	Ph 403-748-4340	Location	Well #1
Attn Waterline Resources	Fax 403-748-2880	Date Received	11/15/02
		Date Reported	11/20/02

WELL-A

Water Report

Cations	mg/L	Anions	mg/L	General Parameters	mg/L	
Saturation Index	0.7	Bicarbonates	531	E.C (us/cm)	950	
Calcium	11.3	Bromides	<0.6	Coliforms,Total	0	CFU/100ml
Iron	0.014	Carbonates	7	Coliform,Fecal (*E.coli*)	0	CFU/100ml
Magnesium	3.1	Chlorides	1.1	H.P.C		(MPN/ mL)
Manganese	0.009	Fluorides	0.2	Hardness ($CaCO_3$)	41	*Soft*
Potassium	0.8	Nitrates	<0.2	pH	8.51	
Silicon		Nitrites	<0.3	Sulfides (S)		
Sodium	214	NO_3+ NO_2	<0.2	T. Alkalinity ($CaCO_3$)	450	
Ammonium	<0.1	Phosphates	N/A	TDS (Calculated)	568	
		Sulfates	67	Turbidity (N.T.U)		
				T.K.N		
				T.P		
				NH_3		
				T.O.C		
				Color (T.C.U)		

Sum of Cations	10.14
Sum of Anions	10.38
Ionic Balance	0.98
% Difference	-1.16
T.D.S. / E.C. Ratio	0.60
SAR	14.54 *(May limit plant growth)*

Silty samples may account for higher iron, manganese and silicon content.
TDS : Total Dissolved Solids
TNTC : Too Numerous To Count
SAR : Sodium Adsorption Ratio
< Denotes less than Detection Limit
Please See Reverse Side For Canadian Drinking Water Quality Guidelines
** Please call our Water Treatment Department for any questions you may have*

Certified By

WSH Labs (1992) LTD.
Calgary Alberta
Canada T2E6T5
Phone (403) 250-9764
Fax (403) 291-4597
Website: www.wshlabs.com

Alken Basin Drilling	P.O #	Client I.D	Sandy Point Farms
Box 47	Lab # 37069	Legal	10-1-41-1-W5
Bentley, AB T0C 0J0	Ph 403-748-4340	Location	Well #2
Attn Waterline Resources	Fax 403-748-2830	Date Received	11/15/02
		Date Reported	11/20/02

WELL-B

Water Report

Cations	mg/L	Anions	mg/L	General Parameters	mg/L	
Saturation Index	0.0	Bicarbonates	452	E.C (us/cm)	2130	
Calcium	2.8	Bromides	<0.6	Coliforms, Total	1	CFU/100ml
Iron	0.005	Carbonates	9	Coliform, Fecal (*E.coli*)	0	CFU/100ml
Magnesium	0.1	Chlorides	7.5	H.P.C		(MPN/ mL)
Manganese	<0.0006	Fluorides	0.4	Hardness ($CaCO_3$)	7	*Soft*
Potassium	1.1	Nitrates	<0.2	pH	8.59	
Silicon		Nitrites	<0.3	Sulfides (S)		
Sodium	460	NO_3+NO_2	<0.2	T. Alkalinity ($CaCO_3$)	390	
Ammonium	<0.1	Phosphates	N/A	TDS (Calculated)	1290	
		Sulfates	584	Turbidity (N.T.U)		
				T.K.N		
				T.P		
				NH_3		
				T.O.C		
				Color (T.C.U)		

Sum of Cations	20.18
Sum of Anions	20.13
Ionic Balance	1.00
% Difference	0.11
T.D.S. / E.C. Ratio	0.61
SAR	73.47 *(May limit plant growth)*

Silty samples may account for higher iron, manganese and silicon content.
TDS : Total Dissolved Solids
TNTC : Too Numerous To Count
SAR : Sodium Adsorption Ratio
< Denotes less than Detection Limit
Please See Reverse Side For Canadian Drinking Water Quality Guidelines
* *Please call our Water Treatment Department for any questions you may have*

Certified By

WSH Labs (1992) LTD.
3851B - 21 Street N.E.
Calgary Alberta
Canada T2E6T5
Ph: (403) 250-9164
Fax: (403) 291-4597
Website: www.wshlabs.com

Alken Basin Drilling	P.O #	Client ID	production well 160 ft.
Box 47	Lab # 37262	Legal	10-1-41-4-W5
Bentley, AB T0C 0J0	Ph 403-748-4340	Date Sampled	11/28/02
Attn Sandy Point Farms	Fax 403-748-2880	Date Received	11/29/02
		Date Reported	12/5/02

WELL-C

Water Report

Cations	mg/L	Anions	mg/L	General Parameters	mg/L	
Saturation Index	0.3	Bicarbonates	444	R.C (us/cm)	1950	
Calcium	5.0	Bromides	<0.6	Coliform,Total	13	CFU/100ml
Iron	<0.002	Carbonates	8	Coliform,Fecal (*E.coli*)	2	CFU/100ml
Magnesium	1.0	Chlorides	6.0	H.P.C		(MPN/ mL)
Manganese	<0.0006	Fluorides	0.5	Hardness ($CaCO_3$)	17	*Soft*
Potassium	0.8	Nitrates	<0.2	pH	8.55	
Silicon		Nitrites	<0.3	Sulfides (*S*)		
Sodium	420	NO_3+NO_2	<0.2	T. Alkalinity ($CaCO_3$)	380	
Ammonium	<0.1	Phosphates	N/A	TDS (Calculated)	1160	
		Sulfates	494	Turbidity (N.T.U)		
				T.K.N		
				T.P		
				NH_3		
				T.O.C		
				Color (T.C.U)		

Sum of Cations	18.61
Sum of Anions	18.03
Ionic Balance	1.03
% Difference	1.60
T.D.S. / E.C. Ratio	0.59
SAR	44.82 *(May limit plant growth)*

Certified By

Silty samples may account for higher iron, manganese and silicon content.
TDS : Total Dissolved Solids
TNTC : Too Numerous To Count
SAR : Sodium Adsorption Ratio
< Denotes less than Detection Limit
Please See Reverse Side For Canadian Drinking Water Quality Guidelines
* *Please call our Water Treatment Department for any questions you may have*