Investigation of Aquifers in the Leroy Area
Leroy, Saskatchewan

File R3215 23 May 2002

Prepared for:

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Funded by:

The Canada-Saskatchewan Farm Livestock Watering Program
Strategic Initiatives

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1.0 Introduction

1.1 General

The Rural Municipality (R.M.) of Leroy, which is located approximately 120 km east of Saskatoon, conducted an inventory of the water wells and groundwater resources in the R.M. in order to develop value-added industries within the R.M. and address ongoing water quality issues. An analysis of the information identified two areas within the R.M. for further investigation. The first area was a potential extension of the regional Hatfield Valley Aquifer System immediately west of the Town of Leroy. The Hatfield Valley Aquifer System consists of stratified sand and gravel of the Empress Group. The second area was located approximately 6.5 km south of town in an area where previous attempts to find good quality groundwater had failed. The study area west of Leroy includes 16 sections with an area approximately 6.5 km by 6.5 km. The south Leroy study area includes 12 sections with an area approximately 5 km by 6.5 km. Figure 1.1 shows the location of the study area in relation to the regional Hatfield Valley Aquifer System. Drawing No. R3215-1 shows the detailed site plan of the west and south Leroy study areas.

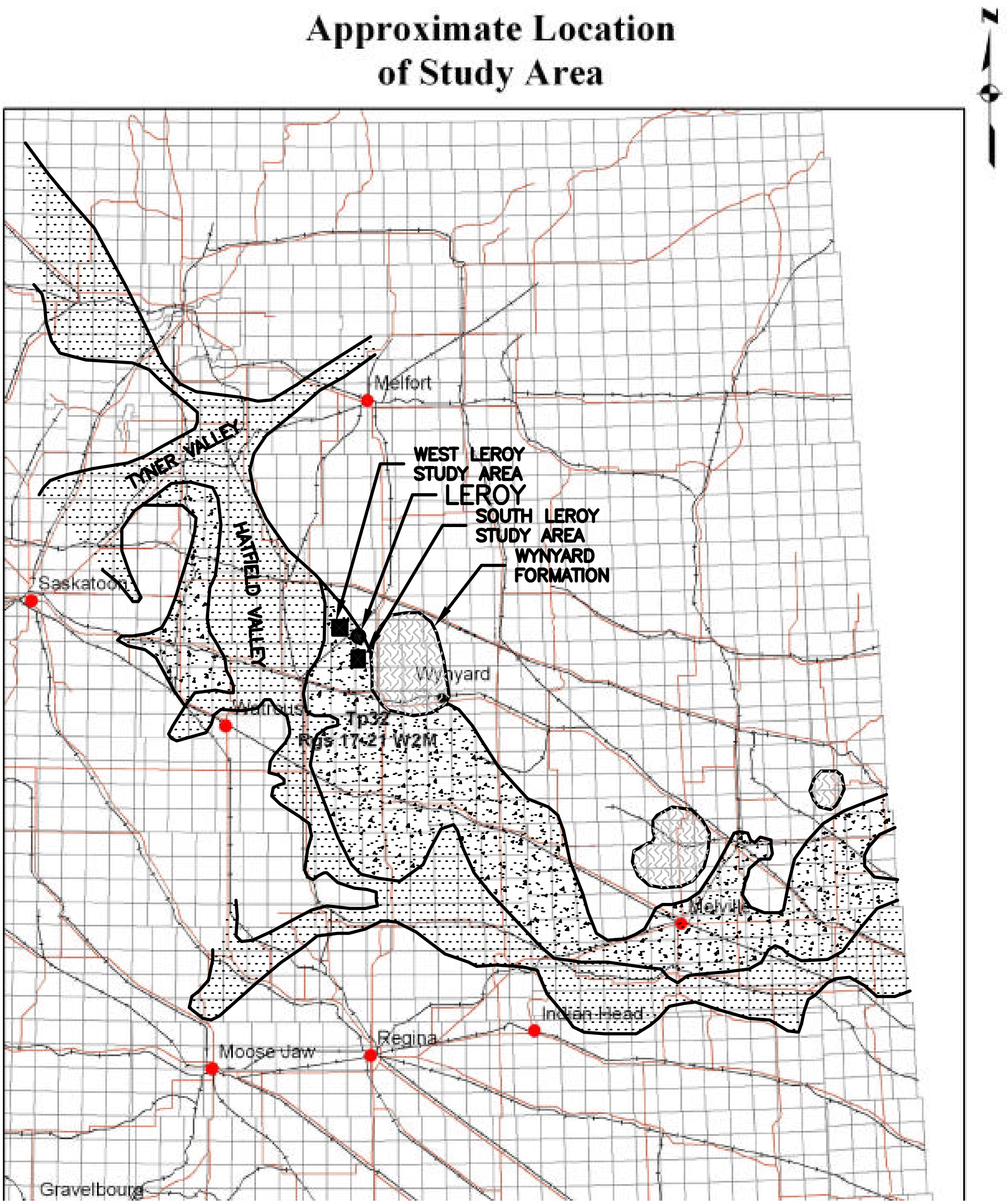
The Town of Leroy was also reviewing their water supply options at the same time because of problems with the existing water supply and treatment system. The Town of Leroy and a local intensive livestock operation are interested in operating a 100 Igpm demineralization treatment plant using the Empress Group west of town as a groundwater source. Delineation of the aquifer in the west Leroy study area would determine whether the treatment plant was feasible.

In the south Leroy study area, the R.M. of Leroy requires a tankloader source of 46 Igpm to replace a surface water loader at Jansen Lake. A local intensive livestock operator also requires water sources greater than 20 Igpm for a large hog feeder operation. Drilling would assist in locating appropriate water sources for these operations.

In the south Leroy study area, preliminary drilling by PFRA in 2001 identified an aquifer with significantly better water quality than wells completed in the Hatfield Valley. There was a possibility the aquifer was a lobe of the Wynyard Formation Aquifer.

In consideration of the aforementioned groundwater requirements and preliminary drilling results, there was a need for further investigation to better define the yield and water quality in

Approximate Location of Study Area



LEGEND:

WYNYARD FORMATION AQUIFERS

UPPER EMPRESS GROUP AQUIFERS

LOWER EMPRESS GROUP AQUIFERS

LOCATION PLAN

CLIFTON ASSOCIATES LTD. PROJECT NO: R3215 FIGURE NO: 1.1

R3215\FIGURE1.1.DWG

the area. PFRA issued a Request for Proposal to investigate aquifers in the Leroy Area on 18 January 2002. Clifton Associates Ltd. was awarded the project on 30 January 2002. The project was under the Canada-Saskatchewan Farm Livestock Watering Program.

1.2 Objectives

The objectives of the aquifer investigation study are to better define and characterize the extent, well yield, and water quality of the Empress Group Aquifer. The results of the evaluation will be used to aid in planning future developments within the R.M.

1.3 Scope

The original scope was outlined in the request for proposals provided by PFRA and dated 18 January 2002. The work requirements for both study areas are summarized below:

- Hydrogeological compilation and review of existing data from Sask Water Corporation (SWC), Saskatchewan Research Council (SRC), and Prairie Farm Rehabilitation Administration (PFRA).
- Identify test drilling sites for potential production sites based on the hydrogeological compilation and review.
- Design and carry out field investigation including:
    - Drilling of four wet rotary bore holes in the west Leroy study area and five wet rotary bore holes in the south Leroy study area.
    - Installation of piezometers in the Empress Formation.
    - Electric logging of the bore holes.
    - Water sampling of installed piezometers for major ions, manganese and iron.
    - GPS survey of all piezometers to $\pm$ 0.5 m accuracy.
- Prepare a hydrogeologic evaluation report on the groundwater potential for both areas. Seven hard copies of the report and one digital copy would be issued.

Clifton Associates Ltd.'s proposal dated 22 January 2002 discusses the above scope in greater detail.

2.0 Background Information

2.1 Terminology

The terms Wynyard Aquifer and Wynyard Formation Aquifer are the source of confusion when discussing the geology and hydrogeology of the area. This is partly because of the similarity of the names and partly because of the similarity in the textural and lithologic character of the units. The Wynyard Aquifer is a term used originally by the SRC to describe the Empress Group sediments which lie on the northwest flank of the Hatfield Valley and form a broad blanket aquifer at a higher stratigraphic level than the coarse Empress Group sediments that occupy the bottom of the main Hatfield Valley. The base of the Empress Group sediments is variable and often lower than the Wynyard Formation Aquifer. The lithologic and textural composition of the Empress Group sediments is typically coarser and more heterogeneous than the Wynyard Formation. The term Wynyard Aquifer will not be used in this report to avoid confusion with the Wynyard Formation Aquifer; instead, the term Upper Empress Group Aquifer is used to refer the blanket deposits that occur on the flank of the Hatfield Valley in the study area. The stratigraphic relationships between the Wynyard Formation and Empress Group sediments is discussed further in Section 2.3.

2.2 Regional Geologic History

The geology of the region is dominated by the Pierre Shale (previously referred to as the Riding Mountain Formation), the Wynyard Formation and the Hatfield Valley. The late Cretaceous Pierre Shale forms the bedrock throughout the two study areas and is the base of exploration for the Leroy area aquifer investigation. The Pierre Shale is composed of a highly plastic, non-calcareous, marine clay. East of the south Leroy study area, the Tertiary-aged Wynyard Formation overlies the Pierre Shale and forms the youngest bedrock unit in the area. The Wynyard Formation is comprised of fine sand, silt, clay and gravel deposits. Sand and gravel deposits typically occur in the lower portions of the Formation and the upper portions of the Formation are typically comprised of silt and clay. The rock types found in the coarse clastic components of the Lower Wynyard Formation are typically quartzite and chert. The gravel occurs at the base of the succession, directly overlying the Pierre Shale. The Wynyard Formation has been eroded over most of the province but erosional remnants, termed outliers, occur in the Wynyard and Yorkton areas. The outlier in the Wynyard region underlies most of the Quill Lakes and covers an area of approximately 800 km^2.

Prior to the first glaciation, erosion on the bedrock surface formed a "badland like" topography consisting of a major valley, termed the Hatfield Valley, and numerous tributary valleys, plateaus and mesas adjacent to the main valley. The Hatfield Valley is a major feature that extends northwesterly across Saskatchewan and a portion of the valley runs west and south of the Wynyard area. Figure 1.1 shows the regional location of the Hatfield Valley in relation to the two study areas.

The main valley and tributary valleys were subsequently partially filled with sand, gravel, silt and clay materials deposited by rivers. The fluvial sediments that infill the Hatfield Valley are termed the Empress Group sediments. The lithologies found in the coarse clastic components of the pre-glacial sand and gravel deposits are typically quartzite and chert. Coarser deposits of sand and gravel that occupy the lowermost portion of the valley structure are informally termed Lower Empress Group.

As the first glaciation approached the sediment loads carried by proglacial meltwater channels emptying into the Hatfield Valley increased substantially, resulting in further infilling of the bedrock valleys. This was also accompanied by further erosion of the bedrock, in particular the Wynyard Formation, by glacial processes. The erosion and redeposition of the Wynyard Formation along portions of the Hatfield Valley formed broad blanket deposits of reworked sand, gravel, silt and clay. These deposits typically overlie both the Lower Empress Group deposits and the bedrock clay shale deposits marginal to the main Hatfield Valley. They are informally termed the Upper Empress Group deposits.

The Lower Empress Group deposits are often overlain by thick sequences of silt and clay which are stratigraphically equivalent to sand and gravel deposits occurring on the flanks of the valley. The silt and clay deposits within the valley and the sand the gravel deposits on the flanks are interpreted as facies equivalents of the Upper Empress Group. The lithologies found in the coarse clastic components of the Upper Empress typically include igneous, metamorphic and carbonate rock types as well as the quartzite and chert.

WateResearch Corporation completed a groundwater characterization of the area in 2002. In this study, they arbitrarily selected the elevation 427 m bedrock contour as the eastern shoulder of the Hatfield Valley in the study areas. Upper Empress Group sediments above elevation 427 m are considered blanket deposits, while Upper Empress Group sediments below this contour are considered part of the Hatfield Valley deposits. For simplification, both blanket and valley sand and gravel deposits of the Upper Empress Group will not be differentiated but will be referred to collectively as the Upper Empress Group Aquifer.

Subsequent glaciations further eroded both the Empress Group sediments and the bedrock formations during the glacial advances and deposited vast amounts of glacial till during the glacial recessions. The glacial tills which cover much of southern Saskatchewan have been divided into two broad groups termed the Sutherland Group and the Saskatoon Group. Both groups are comprised predominantly of unstratified deposits of eroded bedrock from many sources from Precambrian aged igneous and metamorphic rocks to Paleozoic aged limestone and dolomite to Cretaceous aged clay shale. The Sutherland Group is the earlier till and has a higher proportion of shale bedrock fragments and clay within its matrix. The Saskatoon Group is the later till and has a higher proportion of calcareous material derived from the limestone and dolomite. Thin and isolated deposits of stratified sediments often occur within both the Saskatoon Group and the Sutherland Group. More widespread deposits of stratified materials often occur at the interglacial boundary between the Saskatoon and Sutherland Groups. Figure 2.1 shows a stratigraphic chart for the regional stratigraphy.

2.3 Regional Stratigraphic Relationships

The Wynyard Formation was deposited prior to the Empress Group sediments and the development of the Hatfield Valley. It was deposited disconformably over the Pierre Shale. Both the Wynyard Formation and the Pierre Shale were subject to erosion during the development of the Hatfield Valley. The Wynyard Formation occurs as erosional remnants on structurally high areas of the Pierre Shale. The base of the Wynyard Formation is typically between elevations of 450 m and 470 m ASL. East of the south Leroy study area, the base of Wynyard Formation is approximately 460 m.

2.4 Regional Physiography and Hydrogeology

The study area lies within the Quill Lakes Plain physiographic region, a gently rolling, till plain with glacio-fluvial deposits on the surface. Elevations in the R.M. of Leroy vary from 533 m in the southeast portion of the municipality to 595 m in the northwest corner of Twp36-Rge21 W2M. The main stream in the area is Lanigan Creek which dissects the upland area and flows through the R.M. exiting in the southwest corner. The largest surface body of water is Jansen Lake, which has formed in a partially buried glacial meltwater channel. Jansen Lake is located mainly in Twp34-Rge20 W2M.

The study area lies within the Quill Lakes drainage basin. This is a broad area of regional groundwater discharge in central Saskatchewan flanked by the Touchwood Hills to the south and the Nut Mountain Uplands to the north. The surface topography has been shaped primarily from the last glaciation. The surface water quality in the Quill Lakes region is very

TIME UNITS		STRATIGRAPHIC UNITS	
QUATERNARY	HOLOCENE	SASKATOON GROUP	GLACIAL TILL AND INTERGLACIAL DEPOSITS
	PLEISTOCENE	SUTHERLAND GROUP	GLACIAL TILL
TERTIARY	EOCENE	EMPRESS GROUP	FLUVIAL, LACUSTRINE AND COLLUVIAL SAND, GRAVEL, SILT AND CLAY
			WYNYARD FORMATION
CRETACEOUS	LATE CRETACEOUS	MONTANA GROUP	PIERRE SHALE (RIDING MOUNTAIN FORMATION)

STRATIGRAPHIC CHART

CLIFTON ASSOCIATES LTD. PROJECT NO: R3215 FIGURE NO: 2.1

R3215\FIGURE2.1.DWG

poor due to the discharge of mineralized groundwaters and concentration of salts through evaporative processes at surface. Much of the groundwater discharge originates from two major confined aquifers of the region, the Hatfield Valley Aquifer System and the Wynyard Formation Aquifer.

The Hatfield Valley crosses the province in a northwest to southeast direction. There is no surface expression of the valley because the Empress Group sediments that infill the valley are covered by clay rich glacial till deposits that are typically greater than 100 m thick. Where the buried valley intersects topographically low areas, the normally sub-artesian head elevations in the aquifer become flowing artesian resulting in groundwater discharge. This is the case within the Quill Lakes region.

The Wynyard Formation underlies the immediate areas surrounding the Quill Lakes proper. The lower portions of this formation also form a regional aquifer. This aquifer is exploited by the Town of Wynyard and several other agricultural and industrial users in the area immediately east of the study area (Range 16, Township 32). The Wynyard Formation aquifer is also a confined aquifer with sub-artesian and flowing artesian head elevations. Flowing artesian discharge from this aquifer occurs in the topographically low area surrounding the Quill Lakes.

Groundwater discharge from the Hatfield and Wynyard Formation aquifers in the Quill Lakes region contribute significantly to the surface water in the Quill Lakes. The high net evaporation, characteristic of the prairie region, and closed drainage from the Quill Lake basin combined with mineralized groundwater discharge results in the highly alkaline nature of the surface water and shallow groundwater resources surrounding the lakes. Deeper groundwater sources are therefore essential sources of supply for domestic and industrial use in the region.

2.5 Data Sources

The primary sources of data for the geological compilation were the test hole logs and E-logs from the Sask Water Corporation (SWC) water well database. There are approximately 100 water well records for the two study areas and adjacent areas. All of these records were reviewed and any record that had an E-log associated with it was ordered in hard copy from SWC. Logs were also obtained from PFRA and the Town of Leroy. Water chemistry data was obtained from the Saskatchewan Research Council (SRC), PFRA and Town of Leroy.

The Geology and Hydrostratigraphy maps of the Wynyard Area (72P) published by SRC in June 2000 and the Geology and Hydrostratigraphy maps of the Melfort Area (73A) published by SRC in May 1988 were also utilized in the preliminary compilation to provide a regional context for the study. The SRC report entitled *Hatfield Valley Aquifer System in the Wynyard Region, Saskatchewan, 1982* by Maathuis and Schreiner, was also used as a reference for descriptions of various formations and hydrogeologic characterization.

Base maps were produced from portions of 1:50,000 scale NTS maps 72P/9 and 73A/2.

3.0 Field Program Design

A preliminary geologic and hydrogeologic assessment was conducted in order to identify targets for the drill program and design the field program. Information from the Sask Water database, SRC, and four PFRA bore holes drilled adjacent the study areas were used to compile the extent and thickness of the Upper Empress Group Aquifer. An isopach of the Upper Empress Group Aquifer was prepared for generating potential drill targets.

In the West Leroy study area, the extent of the Upper Empress Group Aquifer was tested by offsetting the first two bore holes, BH101LW and BH102LW, approximately 2 km further north from bore holes where the Empress Group had been previously identified. The location of BH103LW was chosen based upon the results of the first two bore holes. Bore Hole No. BH104LW was located on the west side of the study area to provide coverage of the study area.

The Upper Empress Group Aquifer was believed to be present throughout the South Leroy study area; therefore, the bore hole locations were chosen to provide complete coverage of the study area.

The location of the nine potential drill targets was finalized during a meeting on 18 February 2002 in Leroy. Personnel from the Town of Leroy, R.M. of Leroy and PFRA provided feedback on the project and proposed bore hole locations. The locations were slightly modified to optimize access and satisfy landowner issues. A number of the proposed locations were inspected after the meeting to identify preferential sites for drilling and any potential problems with access. The locations of the bore holes are included in Drawing No. R3215-1. Additional information on the Town of Leroy municipal wells was also obtained at the meeting.

The drilling program was to be completed by early March; therefore, it was decided to use two wet rotary drilling rigs drilling simultaneously to complete the field investigation in a timely manner. The utility locates were organized between the 19 and 21 of February and drilling commenced on 22 February 2002.

4.0 Field Investigation

4.1 Drill Program and Piezometer Construction

Four bore holes were completed in the West Leroy study area between 22 February and 18 March 2002. Five bore holes were completed in the South Leroy study area between 14 March and 21 March 2002. The nine bore hole logs are appended. Hayter Drilling Ltd. of Watrous, Saskatchewan was contracted to complete the drill program with two wet rotary drill rigs. Clifton Associates Ltd. personnel supervised the drilling and completed field logging of the bore holes. Each bore hole was logged from samples taken at 0.76 m depth intervals. Each bore hole was terminated after it had intersected a minimum of 3 m of bedrock shale beneath the Empress Group. Each bore hole was electric logged with a single point resistivity and spontaneous potential logging tool. The electric logs are included on the appended bore hole logs.

Piezometers were installed in each bore hole. In the case of BH102LW, the piezometer was pulled after water sampling. Bore Hole No. BH102LW was decommissioned by filling the bore hole with bentonite chips to 6 m below ground surface and filling the remaining bore hole to surface with drill cuttings. The piezometer completion details are shown on each bore hole log. The target depth for setting the piezometer screens was within the coarsest zone within the Empress Group Aquifer as interpreted from the resistivity logs. Piezometers were constructed with 50 mm diameter, Schedule 40 steel casing with a 0.76 m long steel, 15 slot, Johnson screen and washdown valve attached to the base. Once the screens were in place, the piezometer was backwashed with clean water to remove drilling fluids from the bore hole. After backwashing, silica sand was placed around the screens. The piezometer was then air-lifted to remove backwash fluids and pumped with air for several hours to further remove fines and ensure formation water was entering the piezometer. During the air-lifting period, the yield of the piezometer was estimated by measuring the time required to fill a 5 gallon (20 litre) pail. This measurement provides a preliminary indication of formation yield.

Table 4.1 provides a summary of bore hole locations, elevations, depths and water levels.

Table 4.1
Bore Hole Summary – West and South Leroy Sites

Bore Hole	Land Location Sec-Twp-Rge-M	Latitude dd-mm-ss.ss	Longitude dd-mm-ss.ss	Top Elev. (m)	Grd. Elev. (m)	Total Depth (m)	Piezo Tip Elev. (m)	Water Elev.* (m)
101LW	NE20-35-20-W2	N52-01-37.59	W104-48-52.21	551.72	550.81	146.3	416.5	542.48
102LW	NE15-35-20-W2	N52-00-46.37	W104-46-03.23	-	548.07	121.9	Pulled	-
103LW	NW22-35-20-W2	N52-01-34.00	W104-46-46.43	551.68	550.28	152.4	404.7	543.18
104LW	NE32-35-20-W2	N52-02-56.91	W104-48-52.59	553.60	552.69	157.9	405.6	545.36
101LS	SE24-34-20-W2	N51-55-30.56	W104-41-53.92	543.51	542.60	91.4	459.5	530.32
102LS	SW17-34-19-W2	N51-55-04.51	W104-40-25.92	540.86	539.95	125.9	444.1	529.61
103LS	NW12-34-20-W2	N51-54-36.58	W104-42-38.83	545.67	544.73	103.0	448.9	530.50
104LS	SW08-34-19-W2	N51-53-46.06	W104-40-27.23	538.08	536.98	88.4	463.8	526.48
105LS	SE12-34-20-W2	N51-53-47.16	W104-42-09.32	543.75	542.81	109.4	447.0	530.10

* Water Level as of 25 March 2002

4.2 Response Testing

Rising head tests were performed on each piezometer after air-lifting to obtain an estimate of the hydraulic conductivity of the Upper Empress Group Aquifer. In the case of piezometer 103LW, a rising head test could not be performed because of equipment problems. After the piezometer was developed through air-lifting, the air line was quickly removed and a water level indicator was run down the piezometer in an attempt to measure the water level as it was recovering. In piezometers 101LW and 101LS through 104LS, the water had usually recovered to more than 90 percent of the static water level within 10 minutes of shutting off the air. These recoveries indicate very high hydraulic conductivities.

A summary of piezometer details including screen length, test interval and calculated or estimated hydraulic conductivity is presented in Table 4.2, along with the measured yields from air-lifting. Raw data and calculations of hydraulic conductivity are presented in Appendix A.

The air-lifting yield and hydraulic conductivities varied considerably for some of the piezometers. There is a correlation between the amount of drilling mud required to drill the bore hole and the yield and hydraulic conductivity. Drilling mud was used to reduce the loss of drilling fluids into permeable strata during drilling. The piezometers with the lowest yields and hydraulic conductivities, 102LW, 103LW, and 105LS, also required the greatest amount of drilling mud to maintain drilling fluid circulation. Even though the piezometers were backwashed and developed through air-lifting there may have been sufficient drilling mud left behind to plug the aquifer and reduce yields. This was evident in the developing of piezometer 101LW where the yield was initially 5 Igpm after air-lifting. The piezometer was left to sit over the weekend and continued air-lifting after the weekend increased the yield to 25 Igpm. A pump rate of 25 Igpm is approaching the maximum flow that can be delivered through a two inch piezometer pipe using the air compressor on a conventional rotary rig.

The lower yields and hydraulic conductivities measured by some of the piezometers are not believed to be representative of the Upper Empress Group Aquifer. Maathuis and Schreiner (1982) indicated the average hydraulic conductivity of the Empress Group Aquifer in the Wynyard area is between 1 $x10^{-4}$ m/s and $3x10^{-4}$ m/s. Additional development of the low yielding piezometers would likely increase the yields and hydraulic conductivities. Hydraulic conductivities for the Upper Empress Group Aquifer in the range of $5x10^{-5}$ m/s and $1x10^{-4}$m/s would not be unreasonable estimates for the Leroy West and South study areas.

Table 4.2
Response Testing Summary – West and South Leroy Sites

Piezometer	Screen Length (m)	Aquifer Thickness (m)	Flow Rate on Air-lifting (IGPM)/(L/min)	Hydraulic Conductivity (m/s)
101LW	0.76	14.0	25/114	$1.3x10^{-5}$
102LW	0.76	19.6	1/5	$7.0x10^{-8}$*
103LW	0.76	22.2	0.25/1	-
104LW	0.76	13.4	2.5/11	$2.7x10^{-6}$*
101LS	0.76	23.5	10/45	$9.8x10^{-5}$
102LS	0.76	42.7	10/45	$7.0x10^{-5}$
103LS	0.76	10.6	15/68	$2.4x10^{-6}$*
104LS	0.76	27.0	20/91	$6.4x10^{-6}$*
105LS	0.76	18.3	0.5/2	$8.6x10^{-7}$*

*Hydraulic conductivity may be too low because of drilling mud remaining in the formation or insufficient data points from fast recovering wells.

4.3 Water Sampling

A water sample was obtained from each piezometer and submitted to Enviro-Test Laboratories for major ion, iron and manganese analysis. The major ion package includes major cations, major anions, fluoride, nitrate, iron, manganese, total alkalinity, hardness, total dissolved solids, electric conductivity and pH. The piezometers were purged of drilling fluids during air-lifting prior to sampling and one additional well volume was removed by bailing prior to sampling. The analytical results will be discussed in Section 7.0 of this report.

4.4 GPS Survey

Two Trimble GPS receivers were used to obtain piezometer coordinates and elevations. The GPS base station was referenced to geodetic bench mark 795047 which was located in the northeast corner of NE36-33-19W2. The NAD83 UTM coordinates for the bench mark are 530,490.156 m East, 5,747,981.344 m North, Zone 13, Elevation 524.460 m. All bore hole coordinates are referenced to this bench mark. The survey provided ± 0.5 m vertical accuracy. Three bench marks were surveyed to determine the accuracy of the GPS survey. The results of the vertical bench mark measurements are included in Table 4.3. The latitude and longitude for each bore hole is listed in Table 4.1. The NAD83 UTM coordinates for each bore hole are included on the appended bore hole logs.

Table 4.3
GPS Vertical Bench Mark Measurements

Bench Mark	Reported Elevation (m)	Measured Elevation (m)	Difference (m)
BM84S477	529.607	529.087	-0.520
BM66S2062	544.741	545.189	+0.448
BM84S470	525.311	525.242	-0.069

5.0 Geology

5.1 General

The geological interpretation presented in this section is based upon the combined information from the existing water well and test hole records plus the additional information obtained from BH101LW to BH104LW and BH101LS to BH105LS during the recent field investigation. Test holes designated TH1 to TH4 were completed by PFRA in 2001. A stratigraphic summary of the bore holes is included in Table 5.1.

Table 5.1
Stratigraphic Summary – West and South Leroy Sites

Bore Hole	Empress Group Aquifer Depth Interval (m)	Thickness of Empress Group Aquifer (m)	Top of Pierre Shale Elevation (m)
101LW	128.0 to 142.0	14.0	408.8
102LW	81.0 to 100.6	19.6	447.5
103LW	126.8 to 149.0	22.2	401.3
104LW	141.4 to 154.8	13.4	397.9
101LS	64.6 to 88.1	23.5	454.5
102LS	74.4 to 117.0	42.7	416.2
103LS	90.0 to 100.6	10.6	444.2
104LS	55.5 to 82.5	27.0	454.5
105LS	81.7	18.3	437.4

5.2 Structure on the Top of Bedrock

The structure on the top of the Pierre Shale provides useful information to help differentiate between the Empress Group and the Wynyard Formation. The structure contour on the top of the Pierre Shale is presented in Drawing No. R3215-8. The plan shows a large bedrock low between elevation 420 m and 440 m extending eastward from BH102LS. On the north and south side of the bedrock low, the bedrock rises to 460 m and 454.5 m, respectively. The top of the shale is below elevation 460 m elevation, which is the base of the Wynyard Formation, throughout most of the South Leroy study area. The Wynyard Formation has been eroded away in the South Leroy study area. Along the northern boundary of South Leroy study area, adjacent TH3, the bedrock surface is at the Pierre Shale – Wynyard Formation boundary elevation. There potentially may be Wynyard Formation north of the South Leroy study area.

The bedrock contours in the South Leroy study area are generally above elevation 427 m, the boundary between the blanket and valley deposits of the Upper Empress Group Aquifer. Therefore, Upper Empress Group Aquifer deposits in the South Leroy study area are mainly blanket deposits.

In the West Leroy study area, there is a bedrock high from BH102LW to SE16-35-20 W2M. The bedrock high has elevations ranging from 448 m to 455 m. The bedrock surface drops quickly towards the north to an elevation just below 400 m. By definition, the upper two-thirds and the southwest corner of the west Leroy study area is below elevation 427 m and are classified as part of the valley deposits of the Upper Empress Group.

5.3 Stratigraphy

Five geologic sections have been constructed through the study area to define the stratigraphic setting. Sections A-A’ to E-E’ are shown in Drawing Nos. R3215-2 to R3215-6. The locations of the sections are indicated in Drawing No. R3215-1.

The stratigraphic units are described below beginning with the clay shale of the Pierre Shale, which constitutes the base of exploration in the study areas. Descriptions of various strata are developed from a combination of previous reports, driller’s water well logs, SRC geologic logs and the geologic logs from the recent drill program. Refer to Figure 2.1 for a schematic representation of the stratigraphic column in the study area.

Pierre Shale

The Pierre Shale is a non-calcareous, dark grey, clay shale. It occurs throughout the area at depths varying between 93 m to 154 m in the west Leroy study and 80 m to 117 m in the south Leroy study area.

Wynyard Formation

The Wynyard Formation has been divided into two distinct units, lower and upper. The lower unit directly overlies Pierre Shale and often has a coarse gravel at the base of the unit which is up to 8 m thick. Fine to medium sand overlies the gravel. The gravel is not always present. The gravel is composed of quartzite and chert. The total thickness of the Lower Wynyard varies from 10 m to 40 m.

The Upper Wynyard Formation directly overlies the lower unit and is composed of silt and clay. The unit has been intensely oxidized in places and has distinct red, pink, light grey and brown colorations in the oxidized zones and a light grey color in the unoxidized zones.

The Wynyard Formation has been eroded away from the West and South Leroy study area, but can be found approximately 6.5 km east of the South Leroy area at Lampard.

Empress Group

The Empress Group consists of fluvial, lacustrine and colluvial sand, gravel, silt and clay sediments located between bedrock and the first glacial deposits. The Empress Group is informally divided into the Upper and Lower Empress Group. The Lower Empress Group consists of coarser deposits of sand and gravel that occupy the lowermost portion of the Hatfield Valley structure. The Upper Empress Group sediments overlie both the Lower Empress Group deposits and the bedrock clay shale deposits marginal to the main Hatfield Valley.

Sediments of the Upper Empress Group form an aquifer, the Upper Empress Group Aquifer, which is present throughout both study areas. Depths to the top of the Upper Empress Group Aquifer in the West Leroy study area vary from 81 m to 141 m with thicknesses from 5 m to 24 m. In the South Leroy study area, the depths to the top of the Upper Empress Group Aquifer range from 49 m to 90 m with thicknesses ranging from 10 m to 43 m. Drawing No. R3215-7 shows the depth to the top and thickness of the Upper Empress Group Aquifer .

Sutherland Group

The Sutherland Group consists primarily of clay rich glacial till within the study area. The top of the Sutherland Group is often marked by an oxidized till zone or directly underlies a thin, but widespread interglacial sand and gravel zone that separates the Sutherland Group from the Saskatoon Group. The Sutherland Group is also well defined on the E-logs by the lower resistivity than the Saskatoon Group. This results from the higher clay content of the Sutherland Group tills. The top of the Sutherland Group occurs at depths of 40 m to 70 m in the West Leroy study area and 25 m to 50 m in the South Leroy study area. The thickness of the Sutherland Group ranges from 50 m to 90 m in the West Leroy study area and 8 m to 47 m in the South Leroy study area.

Saskatoon Group

The Saskatoon Group is the uppermost geologic unit identified in the area and it is comprised predominantly of glacial till. The base of the Saskatoon Group is often marked by the presence of interglacial stratified sediments. Local lenses of stratified sediments are also found throughout the Saskatoon Group. The till of the Saskatoon Group characteristically has a higher carbonate content than the Sutherland Group tills. The thickness of the Saskatoon Group ranges from 40 m to 70 m in the West Leroy study area to 25 m to 50 m in the South Leroy study area.

6.0 Hydrogeology of Empress Group Aquifer

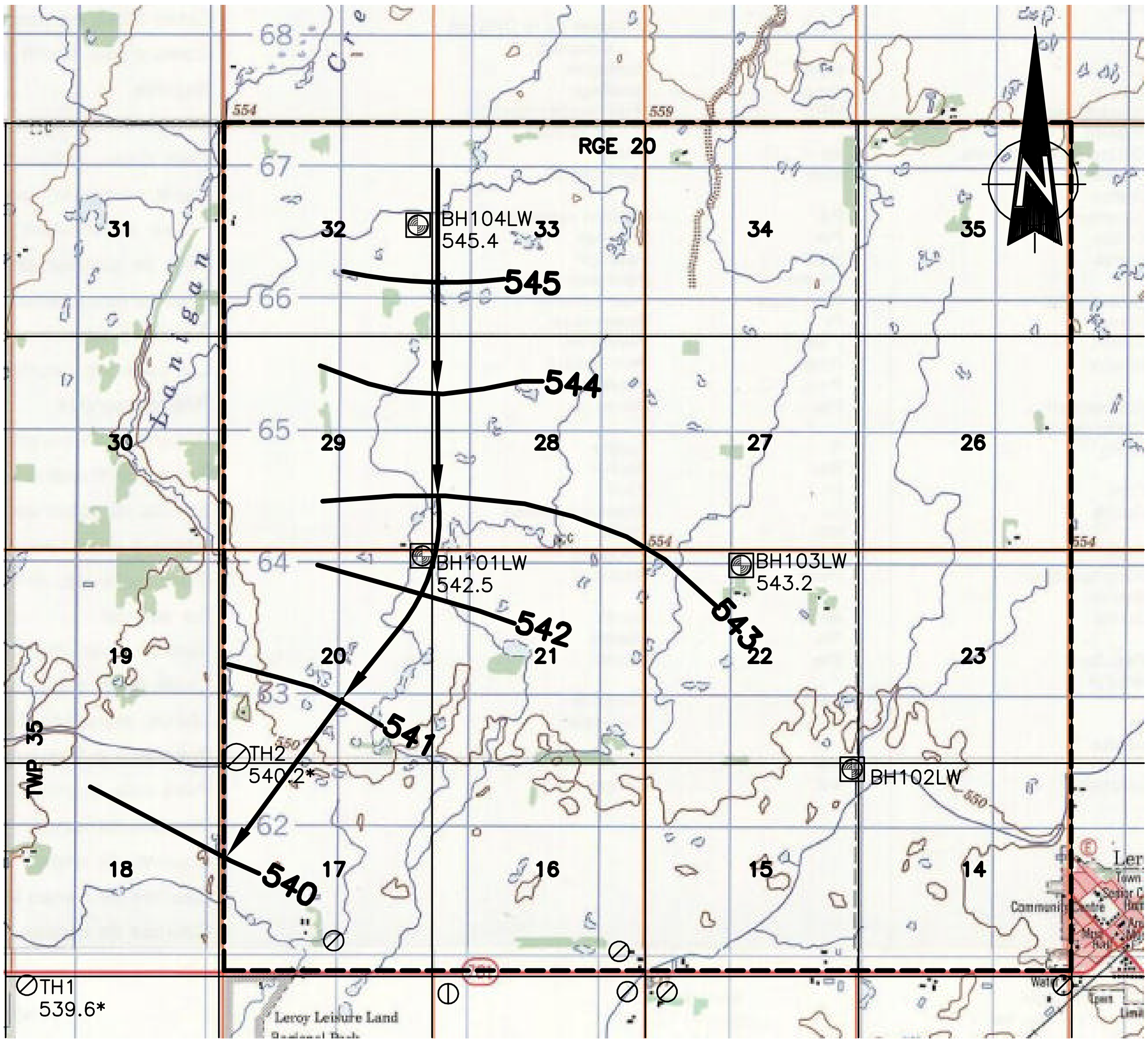
6.1 West Leroy Study Area

The Upper Empress Group Aquifer had previously been identified along the southern edge of the West Leroy study area at depths between 88 m and 118 m and thicknesses of 5 m to 24 m. The four bore holes drilled in the study area as part of this investigation intersected the Upper Empress Group Aquifer in all four bore holes at depths between 81 m and 141 m and thicknesses of 13 m to 22 m. The extent and thickness of this aquifer are shown in Cross Sections A-A', B-B' and C-C', Drawing Nos. R3215-2 through R3215-4, and the isopach of the Upper Empress Group Aquifer, Drawing No. R3215-7. The Upper Empress Group Aquifer is generally less than 20 m thick in the study area; however, the aquifer thickens in SW17-35-20 W2M and NW22-35-20 W2M. The presence and thickness of the Upper Empress Group Aquifer in the northeast corner of the study area was not investigated and requires further delineation.

Contours of the piezometric surface in Figure 6.1 show groundwater flow south to southwest. A horizontal gradient of approximately 1.2 x 10^{-3} m/m and 6.2 x 10^{-4} m/m is indicated between piezometers 104LW and 101LW and 104LW and 103LW, respectively.

Maathuis and Schreiner (1982) reported the blanket aquifer of the Upper Empress Group has a range of hydraulic conductivities between 1.0 x 10^{-4} m/s and 4.0 x 10^{-4} m/s. The hydraulic conductivities from Upper Empress Group Aquifer piezometers in the west study area, 101LW through 104LW, range from 7.0 x 10^{-8} m/s to 1.3 x 10^{-5} m/s, which is significantly lower than the values reported by Maathuis and Schreiner. The hydraulic conductivities and flow rates from the piezometers are indicated in Table 4.2.

As discussed in Section 4.2, the lower hydraulic conductivities in piezometers 101LW and 104LW may improve with additional pumping and development of the piezometers. Piezometer 101LW recovered very quickly; therefore, it was difficult to obtain an adequate number of readings to accurately calculate the hydraulic conductivity of the aquifer. The high pump rate of 25 Igpm and fast recovery of piezometer 101LW suggests a hydraulic conductivity in the order of 10^{-5} m/s is not unreasonable. An average of the three highest hydraulic conductivities from piezometers 101LW, 101LS, and 102LS, 6.0 x 10^{-5} m/s, was used to calculate the hydraulic conductivity of the Upper Empress Group Aquifer. The head tests are provided in Appendix A.



LEGEND:

DRILLER'S LOG

E-LOG, DRILLER'S LOG

PIEZOMETER LOCATION — BH101LW

STUDY AREA

CONTOUR (m) — 540

FLOW DIRECTION

WATER LEVEL JUNE 2001 — 540.2*

0 0.5 1.0 2.0 4.0 Km

NOTES:

1. DRAWING REFERENCED FROM NTS MAP 72P/15 AND 73A/2.

WEST LEROY STUDY AREA
PIEZOMETRIC SURFACE
25 MARCH 2002

CLIFTON ASSOCIATES LTD. PROJECT NO: R3215 FIGURE NO: 6.1

R3215\FIGURE6.1.DWG

There were few historical pump tests records for the Upper Empress Group Aquifer in the West or South Leroy study areas. The results of the pump tests are summarized in Table 6.1. The recommended pump rates from the pump tests were 15 Igpm and 60 Igpm for the West Leroy study area.

Table 6.1
Historical Pump Test Summary – West and South Leroy Sites

Location	Screen Depth (m)	Aquifer Thickness (m)	Pump Test Rate (Igpm)	Pump Test Duration (hrs)	Pump Test Drawdown (m)	Recommended Pump Rate (Igpm)
West Leroy						
SE16-35-20-W2	88.4 to 91.4	5.5	60	3	13.7	60
NW09-35-20-W2	102.1 to 109.7	11.9	60	22	39.9	60
NW10-35-20-W2	99.4 to 102.4	12.8	15	3	4.6	15
South Leroy						
NW11-34-19-W2	77.4 to 80.5	34.1	15	3	45.7	15

Using the average hydraulic conductivity of 6×10^{-5} m/s and a storage coefficient of 1.5×10^{-4} m/s from Maathuis and Schreiner (1982), a Theis analysis was completed for a theoretical well constructed in the vicinity of the four piezometers in the West Leroy study area. The results of the analysis are shown in Table 6.2. The estimated maximum sustainable yields are based on these aquifer characteristics, the available drawdown minus 20 m for well losses due to inefficiency and well degradation, 20 years of continuous pumping and screening the entire thickness of the aquifer. The estimated sustainable yields with a 10 m screen length are also provided in Table 6.2. Output of the Theis analysis for maximum sustainable yield is included in Appendix B. The analysis does not include boundary affects near the edge of the aquifer.

The Theis analysis with a 10 m screen estimated sustainable yields in the range of 205 Igpm to 435 Igpm for wells completed at the four investigated sites within the West Leroy study area. The yields would be higher if the Upper Empress Group Aquifer had a higher hydraulic conductivity than the 6×10^{-5} m/s used in the analysis. Conversely, the yields would drop off if the aquifer hydraulic conductivity was lower or boundary affects from aquifer edge became important. Although the edge of the Upper Empress Group Aquifer was not identified in the West Leroy study area, there is a greater chance of boundary affects the further north and east one goes within the study area. A 24 hour pump test and observation well would be required to further define the aquifer characteristics and boundary effects at specific locations.

The R.M. of Leroy and Town of Leroy are interested in a water source for a demineralization plant. Definition of the Upper Empress Group Aquifer extent west of town and aquifer yield rates are important to this proposal. Water quality is of less concern for this project. The greatest estimated yields are at piezometers 101LW, 103LW and 104LW and; however, piezometers 103 LW and 104LW may be susceptible to boundary affects and piezometer 104 LW is located furthest away from the Town of Leroy. The Upper Empress Group Aquifer at piezometer 101LW and the deposits in section 17-35-20 W2M may be better suited for this facility.

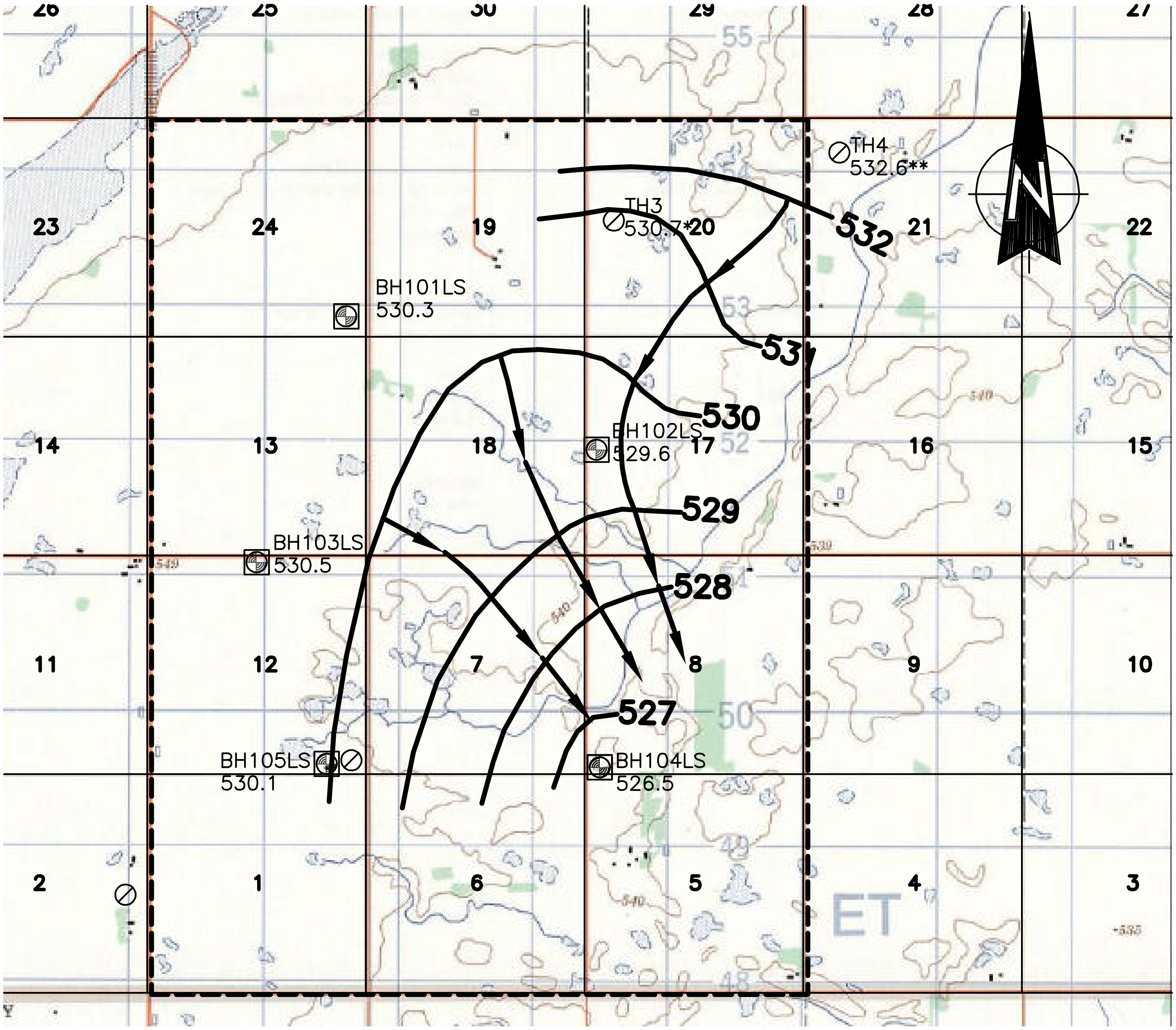
Table 6.2
Aquifer Yield – West and South Leroy Sites

Piezometer	Available Drawdown (m)	Aquifer Thickness (m)	Yield with Entire Aquifer Screened (IGPM)	Yield with 10 m Screen (IGPM)
101LW	100	14.0	535	380
102LW	55	19.6	405	205
103LW	100	22.2	830	375
104LW	115	13.4	585	435
101LS	30	23.5	265	115
102LS	45	42.7	700	165
103LS	55	10.6	225	210
104LS	40	27.0	190	70
105LS	50	18.3	345	190

6.2 South Leroy Study Area

All five bore holes drilled in the South Leroy study area intersected the Upper Empress Group Aquifer between the depths of 49 m and 90 m. The thickness of the Upper Empress Group Aquifer ranged from 10 m to 43 m with the greatest thickness located at BH102LS. The extent and thickness of this aquifer are shown in Cross Sections D-D’ and E-E’, Drawing Nos. R3215-5 through R3215-6, and the isopach of the Upper Empress Group Aquifer, Drawing No. R3215-7. The Empress Group aquifer is generally thicker in the northeast portion of the south Leroy study area with thicknesses greater than 20 m. The Empress Group in the south and west portions of the study area are generally less than 20 m thick.

Contours of the piezometric surface in Figure 6.2 indicate groundwater flow south to southeast toward Big Quill Lake (elevation 516 m ASL). A horizontal gradient of



LEGEND:

DRILLER'S LOG	⦶
E-LOG, DRILLER'S LOG	⊘
PIEZOMETER LOCATION	BH103LS
STUDY AREA	
CONTOUR (m)	530
FLOW DIRECTION	
WATER LEVEL JULY 2001	530.7*
WATER LEVEL OCTOBER 2001	532.6**

0 0.5 1.0 2.0 4.0 Km

NOTES:

1. DRAWING REFERENCED FROM NTS MAP 72P/15 AND 73A/2.

SOUTH LEROY STUDY AREA
PIEZOMETRIC SURFACE
25 MARCH 2002

CLIFTON ASSOCIATES LTD. **PROJECT NO: R3215** **FIGURE NO: 6.2**

R3215\FIGURE6.2.DWG

approximately 1.4 x 10^{-3} m/m southeast is indicated between piezometers 103LS and 104LS. The gradient between piezometers 101LS and 102LS is 3.6 x 10^{-4} m/m to the southeast and Quill Lake.

The Upper Empress Group Aquifer hydraulic conductivities for piezometers 101LS through 104LS range from 8.6 x 10^{-7} m/s to 9.8 x 10^{-5} m/s, which is higher than the values reported for the West Leroy area, but are still lower than the values reported by Maathuis and Schreiner for the blanket aquifer of the Upper Empress Group. The South Leroy hydraulic conductivities are indicated in Table 4.2.

The South Leroy piezometers generally flowed at a higher rate when air-lifted compared to the West Leroy piezometers; therefore, it was difficult to obtain an adequate number of readings to accurately calculate the hydraulic conductivity of the aquifer. An average of the three highest hydraulic conductivities from piezometers 101LW, 101LS, and 102LS, 6.0 x 10^{-5} m/s, was used to calculate the hydraulic conductivity of the Upper Empress Group Aquifer. The head tests are provided in Appendix A.

There was only one pump test identified for the Upper Empress Group Aquifer in the South Leroy study area. The results of the pump test is summarized in Table 6.1. The recommended pump rate was 15 Igpm.

Using the average hydraulic conductivity of 6 x 10^{-5} m/s and a storage coefficient of 1.5 x 10^{-4} m/s from Maathuis and Schreiner (1982), a Theis analysis was completed for a theoretical well constructed in the vicinity of the five piezometers in the south Leroy study area. The results of the analysis are shown in Table 6.2. The estimated maximum sustainable yields are based on these aquifer characteristics, the available drawdown minus 20 m for well losses due to inefficiency and well degradation, 20 years of continuous pumping and screening the entire thickness of the aquifer. The estimated sustainable yields with a 10 m screen length are also provided in Table 6.2. Output of the Theis analysis for maximum sustainable yield is included in Appendix B. The analysis does not include boundary affects near the edge of the aquifer.

The Theis analysis with a 10 m screen estimated sustainable yields in the range of 70 Igpm to 210 Igpm for wells completed at the five investigated sites within the South Leroy study area. The yields are lower than the West Leroy study area because the aquifer at South Leroy is shallower and there is less available drawdown. The yields would be higher if the Upper Empress Group Aquifer had a higher hydraulic conductivity than the 6 x 10^{-5} m/s used in the analysis. Conversely, the yields would drop off if the aquifer hydraulic conductivity was lower or boundary affects from aquifer edge became important. Although the edge of the Upper Empress Group Aquifer was not identified in the West Leroy study area, there is a greater chance of boundary affects along the eastern boundary of the study area. A 24 hour pump test and observation well would be required to further define the aquifer characteristics and boundary effects at specific locations.

The R.M. of Leroy requires a tank loader source which will yield 46 Igpm (3.5 L/s) and a water source for a hog feeder operation which will yield 20 Igpm (>1.5 L/s). Given the assumptions of the Theis analysis, all five locations could provide the required yields. Water quality may be used as the deciding factor for the location of the aforementioned facilities.

7.0 Water Chemistry

7.1 Introduction

The PFRA and WateResearch Corporation at the time of this investigation were completing a groundwater characterization in the R.M. of Leroy. As part of the characterization, a water well inventory including a database of water quality chemistry was compiled. Most of the wells completed in the study areas were completed as shallow drift wells above the Upper Empress Group Aquifer. The few records which had water quality information on the Upper Empress Group Aquifer are summarized in Tables 7.1 and 7.2 for the West and South Leroy study areas, respectively. The total dissolved solids (TDS) concentrations for these records are shown in Figure 7.1. A copy of the database is included in Appendix C. Other sources such as the Sask Water database, the Saskatchewan Research Council database, PFRA, and Maathuis and Schreiner (1982) report on the Hatfield Valley Aquifer System in the Wynyard Region were also used.

Water samples were also obtained from all nine piezometers, 101LW through 104LW in the West Leroy study area and 101LS through 105LS in the South Leroy study area. The samples were analyzed for major ions, iron, manganese and nitrate as per the terms of reference. The results are listed in Table 7.3. Table 7.3 also shows the Canadian Drinking Water Guidelines for comparison.

The historic data has been plotted on a trilinear diagram along with the data from the current samples to characterize the water samples and determine the sources of the groundwater. Trilinear diagrams are useful because they plot the major cations and major anions in %meq/L. Milliequivalents per litre (meq/L) are equal to the molecular weight of the major

Table 7.1
Historic Water Quality West Leroy
Upper Empress Group Aquifer

File R3215

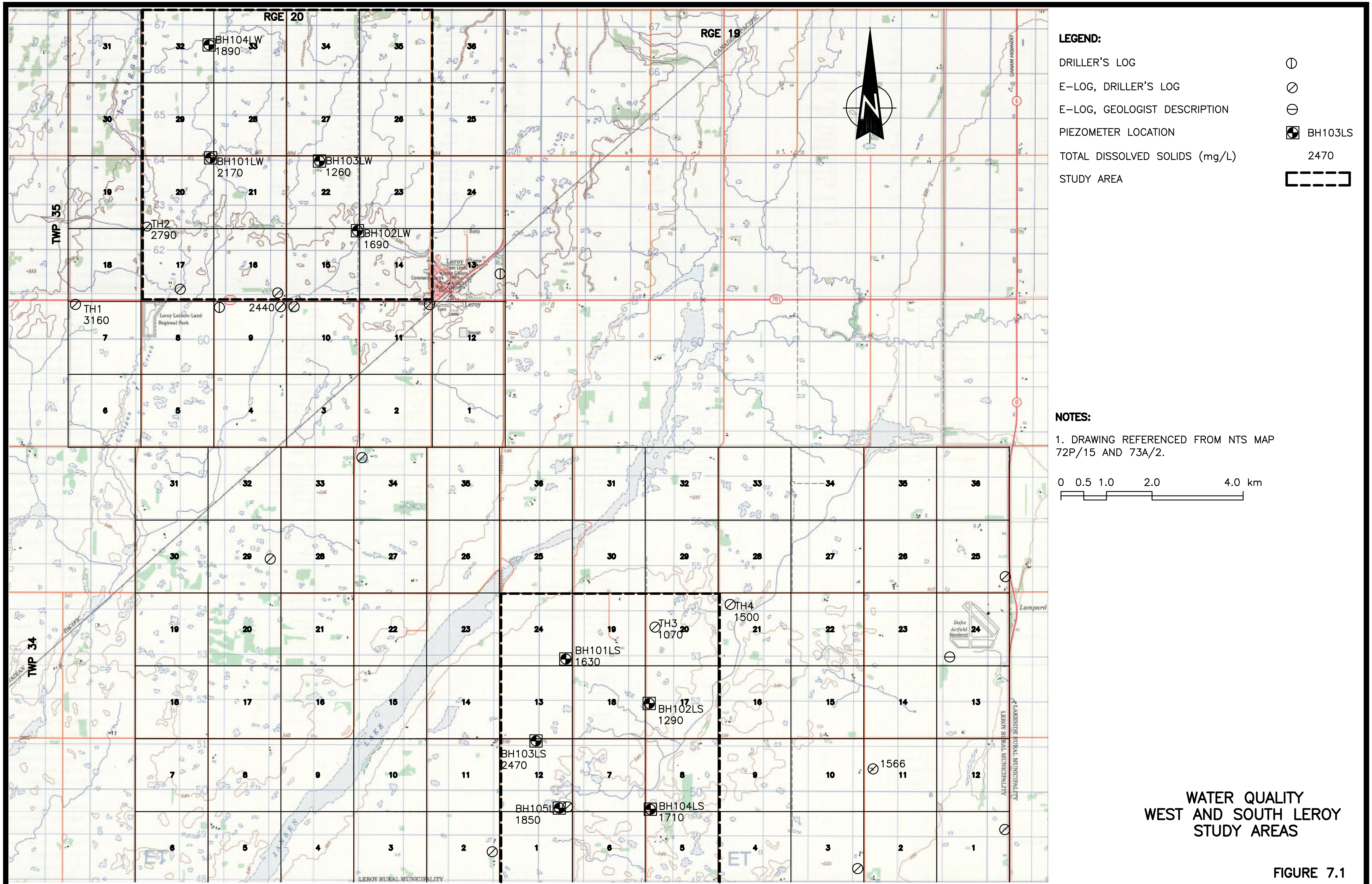
Parameter	Units	Water Chemistry Test Results		
Piezometer No.		Town of Leroy	PFRA TH1	PFRA TH2
Location		NE9-35-20-W2	NW7-35-20-W2	NW17-35-20-W2
Depth (m)		115	128	128
Date Sampled	y/m/d		27-Jun-01*	26-Jul-01
Physical Properties				
Conductivity	μS/cm	2760	3810	3410
Laboratory pH	pH	7.74	7.88	7.65
Total Alkalinity	mg/L	513	415	340
Total Hardness	mg/L	823	995	1070
Total Dissolved Solids	mg/L	2440	3160	2790
Major Ions				
Calcium	mg/L	170	221	220
Magnesium	mg/L	97	108	127
Sodium	mg/L	415	586	459
Potassium	mg/L	9.4	10.0	21.0
Iron	mg/L	3.2	**8.0**	1.1
Manganese	mg/L	0.18	**1.10**	0.43
Fluoride	mg/L	0.21	-	-
Nitrate	mg/L	15	<0.4	<0.4
Chloride	mg/L	32	85	186
Bicarbonate	mg/L	626	506	415
Sulfate	mg/L	1080	1640	1360

* Bolded chemistry from 27 July 2001

Table 7.2
Historic Water Quality South Leroy
Upper Empress Group Aquifer

File R3215

Parameter	Units	Water Chemistry Test Results					
Piezometer No.						PFRA TH3	PFRA TH4
Location		NW3-1-33-19-W2	SE11-15-33-19-W2	SE7-33-33-19-W2	SW12-11-34-19-W2	NW20-34-19-W2	NW21-34-19-W2
Depth (m)		72	87	85	80	91	72
Date Sampled/Reported	y/m/d					11-Jul-01	11-Nov-01
Physical Properties							
Conductivity	µS/cm	2800	2760	2360	1620	1270	1720
Laboratory pH	pH	7.6	7.86	7.57	7.67	8.06	7.46
Total Alkalinity	mg/L	348	422	469	387	365	376
Total Hardness	mg/L	869	828	960	660	362	554
Total Dissolved Solids	mg/L	2500	2400	2220	1566	1070	1500
Major Ions							
Calcium	mg/L	190	190	206	141	76	110
Magnesium	mg/L	96	87	109	76	42	68
Sodium	mg/L	406	392	258	208	161	222
Potassium	mg/L	11	9.6	9.2	6.9	5.4	10.0
Iron	mg/L	3.1	8.4	3.0	0.3	0.66	0.49
Manganese	mg/L	0.11	0.15	0.11	0.30	0.32	0.34
Fluoride	mg/L	0.12	0.12	0.09	0.22	-	-
Nitrate	mg/L	6.6	1.6	5.5	0.92	<0.04	<0.04
Chloride	mg/L	88	62	30	19	20	24
Bicarbonate	mg/L	425	515	572	473	445	459
Sulfate	mg/L	1280	1140	1030	640	324	601



WATER QUALITY
WEST AND SOUTH LEROY
STUDY AREAS

FIGURE 7.1

R3215/FIGURE7.1.DWG

Table 7.3
Water Quality Summary
Leroy Hydrogeologic Investigation

Parameter	Units	Detection Limits	Water Chemistry Test Results									Canadian Drinking Water Quality Guidelines 1998
Piezometer No.			101LW	102LW	103LW	104LW	101LS	102LS	103LS	104LS	105LS	
Depth (m)												
Date Sampled	y/m/d		2/3/25	2/3/25	2/3/25	2/3/25	2/3/25	2/3/25	2/3/25	2/3/25	2/3/25	
Physical Properties												
Conductivity	µS/cm	10	2570	2280	1950	2350	2050	1740	3070	2140	2320	-
Laboratory pH	pH	0.1	7.1	7.6	9.8	6.8	7.4	7.6	7.7	7.5	7.6	6.5 - 8.5
Total Alkalinity	mg/L	5	390	250	92	202	206	329	337	445	259	-
Total Hardness	mg/L	-	1290	529	34	1090	823	604	747	971	727	-
Total Dissolved Solids	mg/L	-	2170	1690	1260	1890	1630	1290	2470	1710	1850	≤500
Major Ions												
Calcium	mg/L	1	266	85	7	187	148	123	141	201	141	-
Magnesium	mg/L	1	152	77	4	151	110	72	96	114	91	-
Potassium	mg/L	1	10	9	8	12	16	8	6	7	10	-
Sodium	mg/L	1	221	387	434	231	219	219	568	214	341	≤200
Carbonate	mg/L	5	<5	<5	39	<5	<5	<5	<5	<5	<5	-
Bicarbonate	mg/L	5	475	305	33	247	252	401	411	543	316	-
Hydroxide	mg/L	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	-
Chloride	mg/L	1	18	20	169	17	24	20	87	12	31	≤250
Sulphate	mg/L	0.5	1270	957	584	1280	983	651	1370	894	1080	≤500
Fluoride	mg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	0.2	<0.2	0.2	1.5
Nitrate	mg/L	0.05	0.4	0.40	0.5	0.5	0.4	0.4	0.4	0.5	0.4	45
Nitrite	mg/L	0.1	<0.05	0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	3.2
Nitrate+Nitrite	mg/L	0.05	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.5	0.4	-
Iron	mg/L	0.005	18.1	5.69	0.746	17.7	5.39	3.39	2.00	4.60	3.35	≤0.3
Manganese	mg/L	0.001	1.26	0.642	0.005	0.961	0.765	0.649	0.847	0.735	0.767	≤0.05

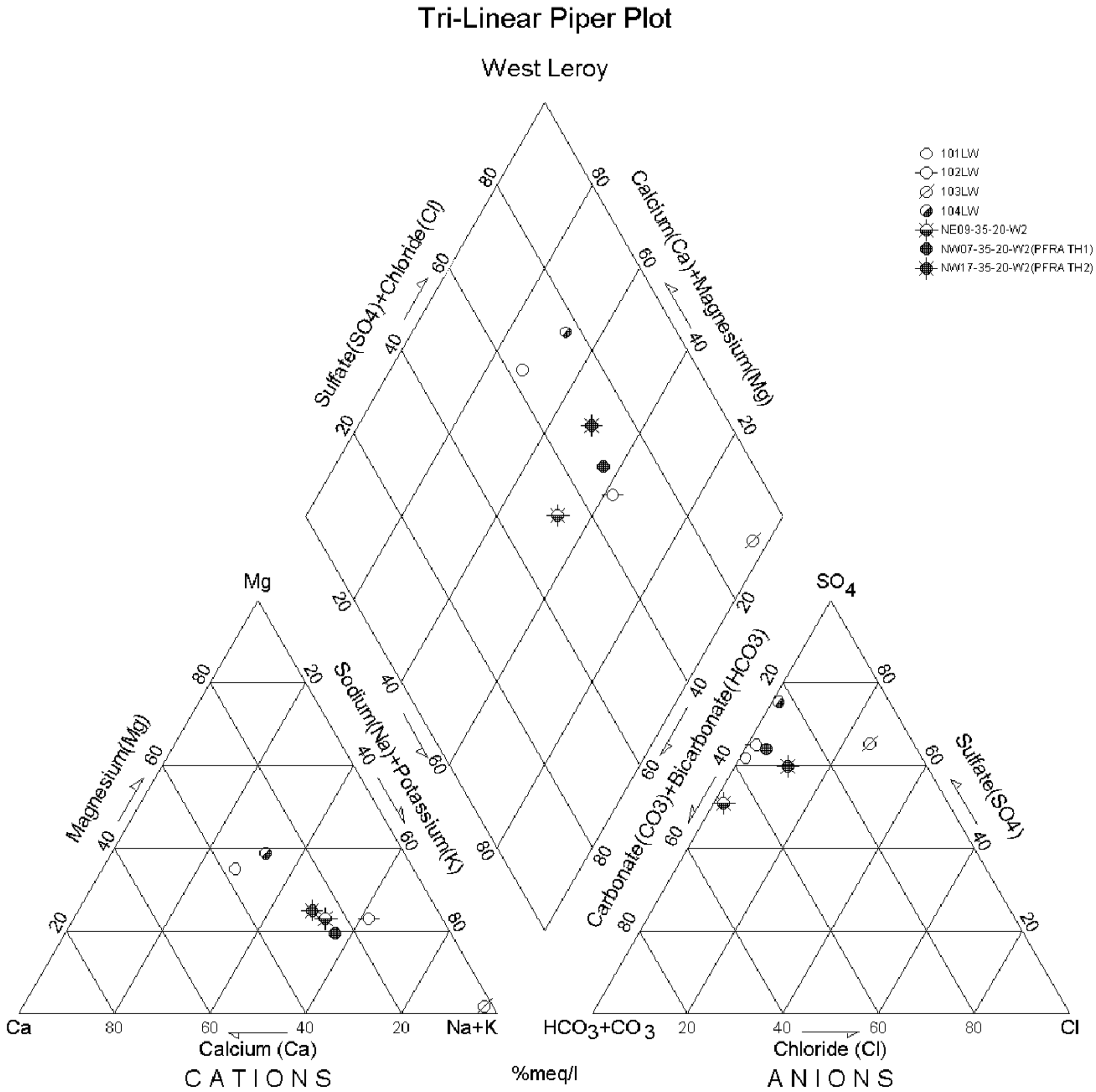
ion multiplied by the concentration in mg/L. Water samples from similar origins tend to plot within similar fields when expressed in meq/L regardless of the concentrations in mg/L.

7.2 West Leroy Water Quality

All samples from the four piezometers exceed the Canadian Drinking Water Guidelines in TDS, sodium, sulphate, iron and manganese except piezometer 103LW which is below the guidelines for manganese but above the guidelines for pH. The chemical analysis results for groundwater from piezometer 103LW are anomalous compared to the other three samples taken from the West Leroy study area. Groundwater from piezometer 103LW has a lower total alkalinity, total hardness, total dissolved solids, calcium, magnesium, bicarbonate, sulphate, iron and manganese concentrations but higher pH, sodium, carbonate, and chloride concentrations. Piezometer 103LW also had one of the lowest flow volumes during air-lifting, less than 1 Igpm, which may not have flushed all the drilling fluid from the aquifer prior to sampling. The presence of drilling fluid in the aquifer may have influenced the water quality chemistry of the sample; therefore, the groundwater obtained from piezometer 103LW is not representative. Piezometer 102LW, which also had a low flow rate of 1Igpm during air-lifting, does not have anomalous water quality chemistry because more water was removed from the well prior to sampling.

The groundwater sample from piezometer 102LW has the best water quality in the West Leroy study area compared to the two piezometers, 101LW and 104LW, and the historical records in Table 7.1. The plot of TDS in Figure 7.1 shows the lowest TDS at 102LW (aside from 103LW which is not representative) and higher TDS and poorer water quality southwest towards the valley of the Hatfield Valley Aquifer System. Groundwater from 102LW has the lowest total dissolved solids (TDS), sulphate, iron and manganese. Piezometer 102LW is located on a bedrock high, but still has a thick unit of Upper Empress Group Aquifer, 19.6 m. The depth to the Upper Empress Group Aquifer at piezometer 102LS is the shallowest, 81.0 m, of any of the Empress Group bore holes identified in the West Leroy study area. The Empress Group at piezometer 102LW is closer to surface recharge than any of the other piezometers which may explain why the water quality is better at piezometer 102LW compared to other wells and piezometers in the area.

Figure 7.2 shows the trilinear plot comparing the groundwater from piezometers 101LW through 104LW to the historic Upper Empress Group Aquifer data for the area. The historical Upper Empress Group groundwater data and groundwater sample from piezometers 101LW, 102LW, and piezometer 104LW plots within the sodium - sulphate type area of the trilinear



WEST LEROY PIPER PLOT

CLIFTON ASSOCIATES LTD. PROJECT NO: R3215 FIGURE NO: 7.2

R3215\FIGURE7.2.DWG

plot. However, the groundwater from piezometer 103LW plots well outside this area indicating the groundwater sample from piezometer 103LW is not representative of groundwater from the Upper Empress Group Aquifer.

7.3 South Leroy Water Quality

All groundwater samples from the five piezometers, 101LS through 105LS, exceed the Canadian Drinking Water Guidelines in TDS, sodium, sulphate, iron and manganese. The groundwater sample from piezometer 102LS has the best water quality of the five piezometers sampled. The historical Upper Empress Group water quality data in the South Leroy study area, Table 7.2, indicates the groundwater from TH3 is even better with lower TDS, sulphate, iron and manganese concentrations. The northeast portion of the study area in the vicinity of piezometers TH3, TH4 and 102LS and downgradient at SW12-11-34-19 W2M appears to be the areas with the best water quality. The plot of TDS in Figure 7.1 shows low TDS in the northeast portion of the study area with higher TDS and poorer water quality west towards the Hatfield Valley. Southward and downgradient from TH3 towards piezometers 102LS and 104LS, the TDS progressively increases.

Drawing No. R3215-8 indicates TH3 and TH4 are located along a high bedrock ridge where the depth to the Upper Empress Group Aquifer is the shallowest at 49 m to 56 m, Drawing No. R3215-7, yet the aquifer is still up to 25 m thick. Piezometer 102LS is located downgradient in a large bedrock low where the Upper Empress Group Aquifer is the thickest in the study area at 42.7 m. The bedrock is generally lower along the western portion of the study area compared to the east. The bedrock structure appears to influence the groundwater quality because the water quality progressively degrades towards the west side of the study area where the depth to Upper Empress Group Aquifer is the greatest.

The water quality in the northeast portion of the study area is better than expected for the Upper Empress Group Aquifer. It was hypothesized that there may be an erosional remnant of the Wynyard Formation located within the South Leroy area that may be responsible for the improved water quality. Table 7.4 shows groundwater from the Wynyard Formation typically has lower sodium and sulphate concentrations compared to the Upper Empress Group Aquifer. The South Leroy study area is immediately west of the Wynyard Formation Aquifer, which is present at Lampard, approximately 6.5 km to the east. The geological model developed for the South Leroy study area in Section 5.2 discounted the presence of the Wynyard Formation within the study area; however, a hydraulic connection between the Upper Empress Group Aquifer and the Wynyard Formation may be responsible for the improved groundwater quality. The Wynyard Formation must be upgradient to influence the water quality of the South Leroy study area. The Wynyard Formation at Lampard, which is east of the study area, is not upgradient according to the south to southeast groundwater flow directions indicated in Figure 6.2; however, there may be an unidentified lobe of the Wynyard Formation north of the study area.

A trilinear Piper plot was used to assess the source of the groundwater from piezometers TH3, TH4, and 102LS. Figure 7.3 shows the trilinear plot comparing the groundwater samples from piezometers 101LS to 105LS to the historic Wynyard Formation and Empress Group data for the region. Historical water quality data was obtained for six samples from the Upper Empress Group Aquifer and ten samples from the Wynyard Formation Aquifer in the region for comparison to groundwater samples from piezometers 101LS to 105LS. The historic data is listed in Tables 7.2 and 7.4.

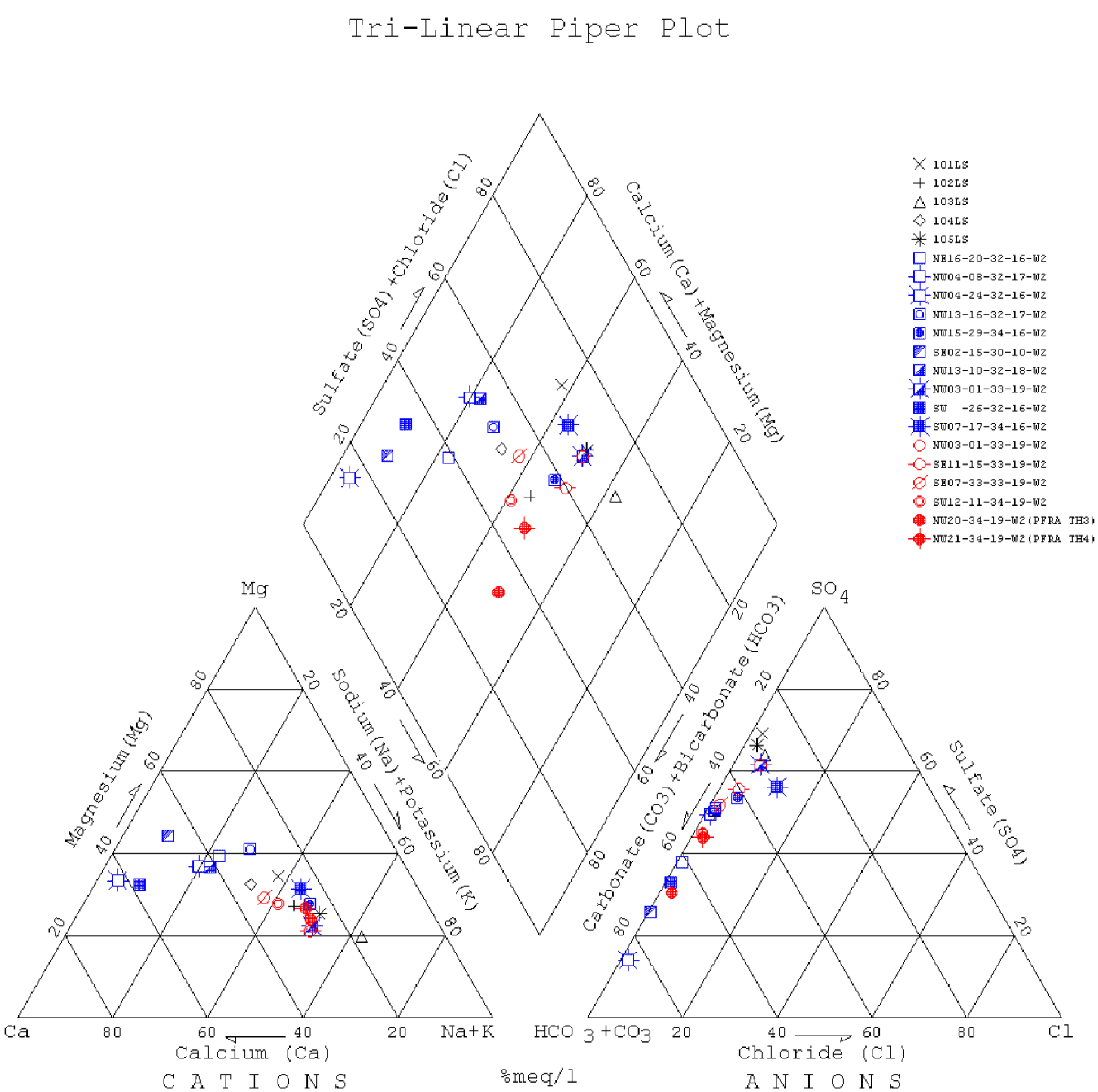
Figure 7.3 indicates that Wynyard Formation groundwater, data points in blue, are typically Ca-Mg bicarbonate type while Upper Empress Group groundwaters, data points in red, are typically sodium - sulphate type water. There is a trend or continuum between the two water types with a progressive increase in sulphate and sodium while calcium and bicarbonate decrease. There is also a slight decrease in magnesium as the sodium increases and a slight increase in chloride as the bicarbonate decreases.

Groundwater samples from piezometers 101LS through 105LS all plot within the field defined by the Upper Empress Group Aquifer; however, there is a progressive increase in sulphate and TDS within this field, which can be attributed to groundwater recharge and discharge. Surface water upon entering or recharging the groundwater flow system has a low TDS and sulphate concentration. As the groundwater moves along its flow path within the soil, it starts to dissolve minerals from the soil; thereby increasing the TDS and sulphate

Table 7.4
Historic Water Quality
Wynyard Formation Aquifer

File R3215

Parameter	Units	Water Chemistry Test Results									
Piezometer No.		NE16-20-32-16-W2	NW4-8-32-17-W2	NW4-24-32-16-W2	NW13-16-32-17-W2	NW15-29-34-16-W2	SE2-15-30-10-W2	NW13-10-32-18-W2	NW3-1-33-19-W2	SW26-32-16-W2	SW7-17-34-16-W2
Depth (m)		90	79	90	66	45	21	83	72	51	16
Date Sampled	y/m/d	85/04/22	81/09/16	81/09/16	85/04/22	85/04/22	70/02/20			66/12/14	70/03/06
Phys. Prop.											
Conductivity	µs/cm	1890	2170	607	2400	2820	1480	2290	2800	1380	2650
Major Ions											
Calcium	mg/L	177	255	89	188	167	170	258	190	192	162
Magnesium	mg/L	112	131	29	153	114	99	139	96	65	125
Sodium	mg/L	122	133	7.1	200	370	40	152	406	36	330
Bicarbonate	mg/L	651	581	323	608	556	663	587	425	503	380
Chloride	mg/L	12	16	7	25	76	3	24	88	9.1	167
Sulfate	mg/L	646	932	86	1020	1150	370	1010	1280	402	1070



SOUTH LEROY PIPER PLOT

CLIFTON ASSOCIATES LTD. PROJECT NO: R3215 FIGURE NO: 7.3

R3215\FIGURE7.3.DWG

concentration of the groundwater. The length of the flowpath from recharge to discharge determines how mineralized the groundwater will become. The groundwater in the northeast portion of the study area appears to be influenced by groundwater recharge. The shallow Upper Empress Group Aquifer along the bedrock high is closer to surface recharge than the deeper Upper Empress Group Aquifer to the west; therefore, the groundwater is less mineralized. Groundwater recharging into the Upper Empress Group Aquifer at piezometers TH3 and TH4 flows towards piezometer 102LS and SW12-11-34-19 W2M, thus improving the water quality of deeper portions of the Upper Empress Group Aquifer downgradient.

8.0 Discussion

The geologic compilation of the SWC database, PFRA test holes, SRC test holes and the new information provided by BH101LW through BH104LW and BH101LS and BH105LS has identified the Upper Empress Group Aquifer throughout the areas investigated. No Wynyard Formation was identified in the two study areas.

The area in the vicinity of piezometer 101LW and 17-35-20 W2M offers the highest yields for development of a demineralization treatment plant in the West Leroy area. Developments sensitive to water quality should preferentially locate in the northeast corner of the south Leroy area where there are reasonable aquifer yields and the best Upper Empress Group Aquifer water quality of the two study areas.

Historic water chemistry compiled for the area indicates that the Wynyard Formation Aquifer water is calcium-magnesium bicarbonate type while the Upper Empress Group Aquifer is sodium - sulphate type. The trilinear Piper plots for the West and South Leroy study areas indicate the water quality is typical of the Upper Empress Group Aquifer and not the Wynyard Formation. The water quality of the Upper Empress Group Aquifer in the South Leroy study area is better than the water quality in the West Leroy study area. The best water quality is located on the bedrock highs in both study areas.

9.0 Conclusions and Recommendations

The following conclusions can be drawn from the investigations:

- The Upper Empress Group Aquifer is present throughout the areas investigated in the West and South Leroy study areas.

- The Wynyard Formation is not present in the South Leroy study area.

- Potential sustainable aquifer yields of the Upper Empress Group Aquifer range from 205 Igpm to 435 Igpm for the West Leroy study area and 70 Igpm to 210 Igpm for the South Leroy study area using a 10 m screen, storage coefficient of 1.5 x 10^{-4}m/s and a hydraulic conductivity of 6.0 x 10^{-5}m/s. Under ideal conditions, a well design using a 10 m long, 150 mm diameter, 20 slot (0.50mm) Johnson screen with a 12-20 frac sand filter pack should accommodate yields up to 450 Igpm. A filter pack is particularly important in screening silty and fine sand intervals.

- The best Upper Empress Group Aquifer water quality is found on the bedrock highs in the southeast corner of the West Leroy study area and the bedrock high in the northeast corner of the South Leroy study area.

- The groundwater from the west and south study areas was characteristic of the Upper Empress Group Aquifer; however, the Upper Empress Group Aquifer water quality is better in the South Leroy study area than the West Leroy study area because of groundwater recharge. All groundwater samples from the Upper Empress Group Aquifer exceed the Canadian Drinking Water Guidelines for TDS, sodium, sulphate, iron and manganese.

The following recommendations are provided for consideration of future developments in the study areas.

- The Upper Empress Group Aquifer was not delineated in the northeast corner of the West Leroy study area. A bore hole located at SW34-35-20 W2M would provide information on this portion of the study area.

- Additional wells and piezometers would better define the Upper Empress Group Aquifer properties and boundary affects in the two study areas.

- Piezometers 103LW, 104LW and 105LS would benefit from additional air-lifting or pumping to develop the wells. This would provide a better estimate of aquifer hydraulic conductivity and yields using rising head tests. Piezometer 103LW could be resampled to confirm the anomalous water quality analysis.

- The area in the vicinity of piezometer 101LW and section 17-35-20 W2M offers the highest yields for development of a demineralization treatment plant in the West Leroy area. Sustainable yields using a 10 m long screen are estimated to be 380 Igpm. Developments sensitive to water quality should preferentially locate in the northeast corner of the South Leroy area where there is an estimated sustainable yield at piezometer 102LS of 165 Igpm with a 10 m long screen and the best Upper Empress Group Aquifer water quality of the two study areas.

- Abandonment of all the piezometers except piezometer 102LS is recommended unless municipal governments are willing to take over the responsibility for them. A hog barn is being constructed near piezometer 102LS, therefore, this piezometer may be used as an observation well during the pump test. The responsibility for the observation well could be transferred to the developer in this case.

10.0 Closure

The preceding report provides an evaluation of groundwater supply potential for the two study areas within the R.M. of Leroy. The report was based on existing information and information obtained during the drilling investigation. Clifton Associates Ltd. maintains no responsibility for the accuracy or quality of the information obtained from third party sources. The bore holes and associated laboratory testing indicate subsurface and groundwater conditions only at the specific locations and times investigated, only to the depth penetrated and only for the water quality parameters tested. The subsurface conditions may vary between the bore holes and with time.

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Clifton Associates Ltd. engineering science technology	**Symbols & Terms**

Soil Descriptive Terms

A soil description for geotechnical applications includes a description of the following properties:

- texture
- color, oxidation
- consistency and condition
- primary and secondary structure

Texture

The soil texture refers to the size, size distribution and shape of the individual soil particles which comprise the soil. The Unified Soil Classification System (ASTM D2487-00) is a quantitative method of describing the soil texture. The basis of this system is presented overleaf. The following terms are commonly used to describe the soil texture.

Particle Size (ASTM D2487-00)

Boulder	300 mm plus
Cobble	75 - 300 mm
Gravel	4.75 - 75 mm
Coarse	19 - 75 mm
Fine	4.75 - 19 mm
Sand	0.075 - 4.75 mm
Coarse	2 - 4.75 mm
Medium	0.425 - 2 mm
Fine	0.075 - 0.425 mm
Silt and Clay	Smaller than 0.075 mm

Relative Proportions (CFEM, 3rd Ed., 1992)

Trace	1 - 10 %
Some	10 - 20 %
Gravelly, sandy, silty, clayey, etc.	20 - 35 %
And	>35 %
Gravel, Sand, Silt, Clay	>35 % and main fraction

Gradation

Well Graded	Having a wide range of grain sizes and substantial amount of all intermediate sizes.
Uniform or Poorly Graded	Possessing particles of predominantly one size.
Gap Graded	Possessing particles of two distinct sizes.

Particle Shape

Angular	Sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Similar to 'angular' but have rounded edges.
Subrounded	Well-rounded corners and edges, nearly plane sides.
Rounded	No edges and smoothly curved sides.

Also may be flat, elongated or both.

The term “TILL” may be used as a textural term to describe a soil which has been deposited by glaciers and contains an unsorted, wide range of particle sizes.

Color And Oxidation

The soil color at its natural moisture content is described by common colors and, quantitatively, in terms of the Munsell color notation; (eg. 5Y 3/1). The notation combines three variables, hue, value and chroma to describe the soil color. The hue indicates its relation to red, yellow, green, blue and purple. The value indicates its lightness. The chroma indicates its strength of departure from a neutral of the same lightness.

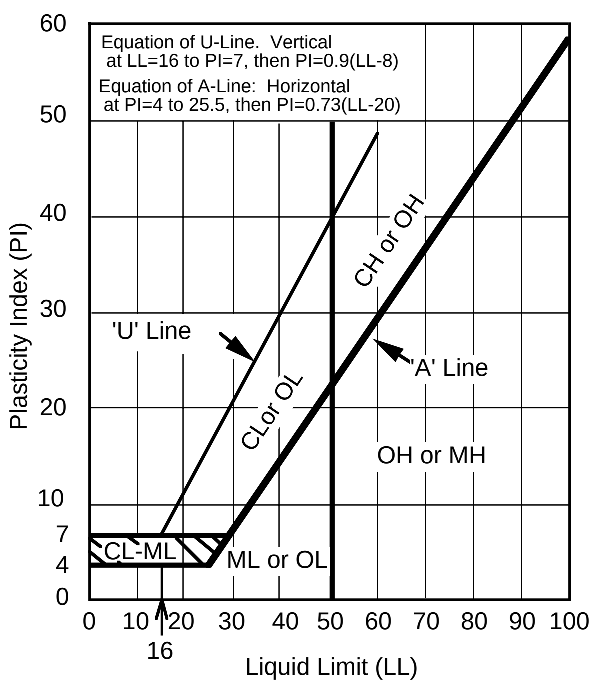
Departure of the soil color from a neutral color indicates the soil has been oxidized. Oxidation of a soil occurs in a oxygen rich environment where most commonly metallic iron, oxidizes and turns a neutral colored soil 'rusty' or reddish brown. Oxidized manganese gives a purplish tinge to the soil. Oxidation may occur throughout the entire soil mass or on fracture/joint/fissure surfaces.

Classification of Soils for Engineering Purposes

ASTM Designation D 2487-00 (Unified Soil Classification System)

Major divisions			Group Symbols	Typical names	Classification criteria			
Coarse-grained soils More than 50% retained on No. 200 sieve* (>0.075 mm)	Gravels More than 50% of coarse fraction retained on No. 4 sieve(≥4.75 mm)	Clean gravels <5% fines	GW	Well-graded gravel	If ≥ 15% sand add "with sand" to group name	Classification on basis of percentage of fines Less than 5% pass No. 200 sieve.......GW, GP, SW, SP More than 12% pass No. 200 sieve.....GM, GC, SM, SC 5 to 12% pass No. 200 sieve.......Borderline classifications requiring use of dual symbols	$C_u = \frac{D_{60}}{D_{10}} \geq 4$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravel			Not meeting either C_u or C_c criteria for GW	
		Gravels with fines >12% fines	GM	Silty gravel			Atterberg limits below "A" line or PI less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravel			Atterberg limits on or above "A" line and PI > 7	If fines are organic add "with orgnic fines" to group name
	Sands 50% or more of coarse fraction passes No. 4 sieve(<4.75 mm)	Clean sands <5% fines	SW	Well-graded sand	If ≥ 15% gravel add "with gravel to group name		$C_u = \frac{D_{60}}{D_{10}} \geq 6$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sand			Not meeting either C_u or C_c criteria for SW	
		Sands with fines >12% fines	SM	Silty sand			Atterberg limits below "A" line or PI less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sand			Atterberg limits on or above "A" line and PI > 7	If fines are organic add "with orgnic fines" to group name
Fine-grained soils 50% or more passes No. 200 sieve* (≤0.075 mm)	Silts and Clays Liquid limit <50%	Inorganic	ML	Silt	If 15 to 29% coarse-grained, add "with sand" or "with gravel" as appropriate If > 30% coarse-grained , add "sandy" or "gravelly" as appropriate Class as organic when oven dried liquid limit is < 75% of undried liquid limit	Plasticity Chart		
			CL	Lean Clay -low plasticity				
		Organic	OL	Organic clay or silt (Clay plots above 'A' Line)				
	Silts and Clays Liquid limit ≥50%	Inorganic	MH	Elastic silt				
			CH	Fat Clay -high plasticity				
		Organic	OH	Organic clay or silt (Clay plots above 'A' Line)				
	Highly organic soils		PT	Peat, muck and other highly organic soils				

Plasticity Chart



*Based on the material passing the 3 in.(75 mm) sieve, if field samples contain cobbles or boulders, add "with cobbles or boulders" to group name

Consistency And Condition

The consistency of a cohesive soil is a qualitative description of its resistance to deformation and can be correlated with the undrained shear strength of the soil. The condition of a coarse grained soil qualitatively describes the soil compactness and can be correlated with the standard penetration resistance (ASTM D1586-99).

Consistency Of Cohesive Soil (CFEM, 3rd Edit., 1992)

Consistency	Undrained Shear Strength (kPa) (CFEM, 3rd Edt., 1992)	Field Identification (ASTM D 2488-00)
Very Soft	<12	Thumb will penetrate soil more than 25 mm.
Soft	12-25	Thumb will penetrate soil about 25 mm.
Firm	25-50	Thumb will indent soil about 6 mm.
Stiff	50-100	Thumb will indent, but penetrate only with great effort (CFEM).
Very Stiff	100-200	Readily indented by thumbnail (CFEM).
Hard	>200	Thumb will not indent soil but readily indented with thumbnail.
Very Hard	N/A	Thumbnail will not indent soil.

Condition Of Coarse Grained Soil (CFEM, 3rd Edt., 1992)

Compactness Condition	SPT N - Index (Blows/300mm)
Very Loose	0 - 4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	over 50

Moisture Conditions (ASTM D2488-00)

Description	Criteria
Dry	Absence of moisture, dusty, dry to touch
Moist	Damp but no visible water
Wet	Visible, free water, usually soil is below water table

Structure

The soil structure is the manner in which the individual soil particles are assembled to form the soil mass. The primary soil structure is the arrangement of soil particles as originally deposited. The secondary soil structure refers to any rearrangement of the soil such as deformation and cracking which has taken place since deposition.

Primary Soil Structure (Depositional)

A. Geometry

Stratum	-	A single sedimentary 'layer', greater than 10 mm in thickness, visibly separable from other strata by a discrete change in lithology and/or sharp physical break.
Homogeneous	-	Same color and appearance throughout.
Stratified	-	Consisting of a sequence of layers which are generally of contrasting texture or color.
Laminated	-	Stratified with layer thicknesses between 2 mm and 10 mm.
Thinly laminated	-	Stratified with layer thickness less than 2 mm.
Bedded	-	Stratified with layer thicknesses greater than 10 mm.
Very Thinly Bedded (Flaggy)	-	Stratified with layer thicknesses between 10 and 50 mm.
Thinly Bedded (Slabby)	-	Stratified with layer thicknesses between 50 and 600 mm.
Thickly Bedded (Blocky)	-	Stratified with layer thicknesses between 600 and 1200 mm.
Thick-Bedded (Massive)	-	Stratified with layer thicknesses greater than 1200 mm.
Lensed	-	Inclusions of small pockets of different soils, such as small lenses of sand material throughout a mass of clay.

B. Bedding Structures

Cross-bedding	-	Internal 'bedding' inclined to the general bedding plane.
Ripple-bedding	-	Internal 'wavy bedding'.
Graded-bedding	-	Internal gradation of grain size from coarse at base to finer at top of bed.
Horizontal bedded	-	Internal bedding is parallel and flat lying

Secondary Soil Structure (Post-Depositional)

A. Accretionary Structures

Includes nodules, concretions, crystal aggregates, veinlets, color banding and

Cementation	-	Chemically precipitated material, commonly calcite ($CaCO_3$), binds the grains of soil, usually sandstone. Described as weak, moderate, strong (ASTM D2488-00).
Salt Crystals	-	Groundwater flowing through the soil/rock often precipitates visible amounts of salts. Calcite ($CaCO_3$), glauber salts ($Na_2Ca(SO_4)_2$), and gypsum ($CaSO_4 * 2H_2O$) are common.

B. Fracture Structures

Fracture	-	A break or discontinuity in the soil or rock mass caused by stress exceeding the materials strength.
Joint	-	A fracture along which no displacement has occurred.
Fissure	-	A gapped fracture, which may open and close seasonally. Usually an extensive network of closely spaced fractures, giving the soil a 'nuggetty' structure.
Slickensides	-	Fractures in a clay that are slick and glossy in appearance, caused by shear movements.
Brecciated	-	Contains randomly oriented angular fragments in a finer mass, usually associated with shear displacements in soils.
Fault	-	A fracture or fracture zone along which there has been displacement.
Blocky	-	A cohesive soil that can be broken down into small angular lumps which resist further breakdown.

Symbols Used on Bore Hole Logs

Lithology Type

CLAY	TILL-oxidized	COAL	CLAY SHALE
SILT	TILL-unoxidized	FILL (Undifferentiated)	SANDSTONE
SAND	PEAT	CONCRETE	MUDSTONE
GRAVEL	TOPSOIL or ORGANIC SOIL	ASPHALT	BEDROCK (Undifferentiated)
COBBLES			

Borehole Completion and Backfill Materials

Bentonite	Cuttings	Slough
Concrete	Grout	Solid Pipe
Cover	Sand	Slotted Pipe

Soil Sample Type

Thin Walled Tube	Disturbed	No Recovery
Driven Spoon	Core (any type)	

Groundwater Symbols

▼ Piezometric elevation as determined by a piezometer installation

▽ Water levels measured in borings at the time and under the conditions noted

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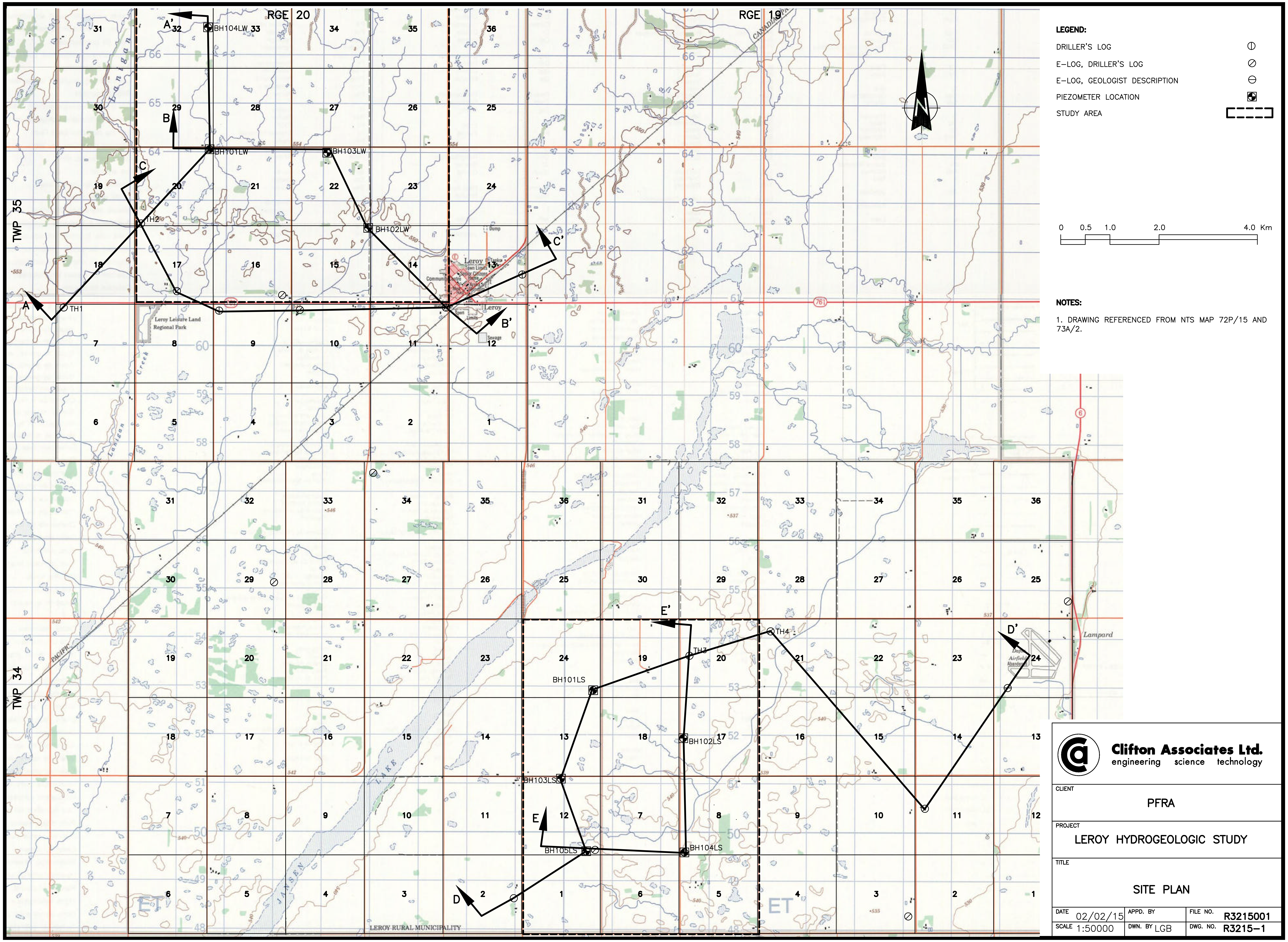
Drawings



RGE 20
RGE 19
TWP 35
TWP 34
A
A'
B
B'
C
C'
D
D'
E
E'
BH101LW
BH102LW
BH103LW
BH104LW
BH101LS
BH102LS
BH103LS
BH104LS
BH105LS
TH1
TH2
TH3
TH4
Leroy
Leroy Leisure Land Regional Park
Lampard
LEROY RURAL MUNICIPALITY
LEGEND:
DRILLER'S LOG
E-LOG, DRILLER'S LOG
E-LOG, GEOLOGIST DESCRIPTION
PIEZOMETER LOCATION
STUDY AREA
0 0.5 1.0 2.0 4.0 Km
NOTES:
1. DRAWING REFERENCED FROM NTS MAP 72P/15 AND 73A/2.
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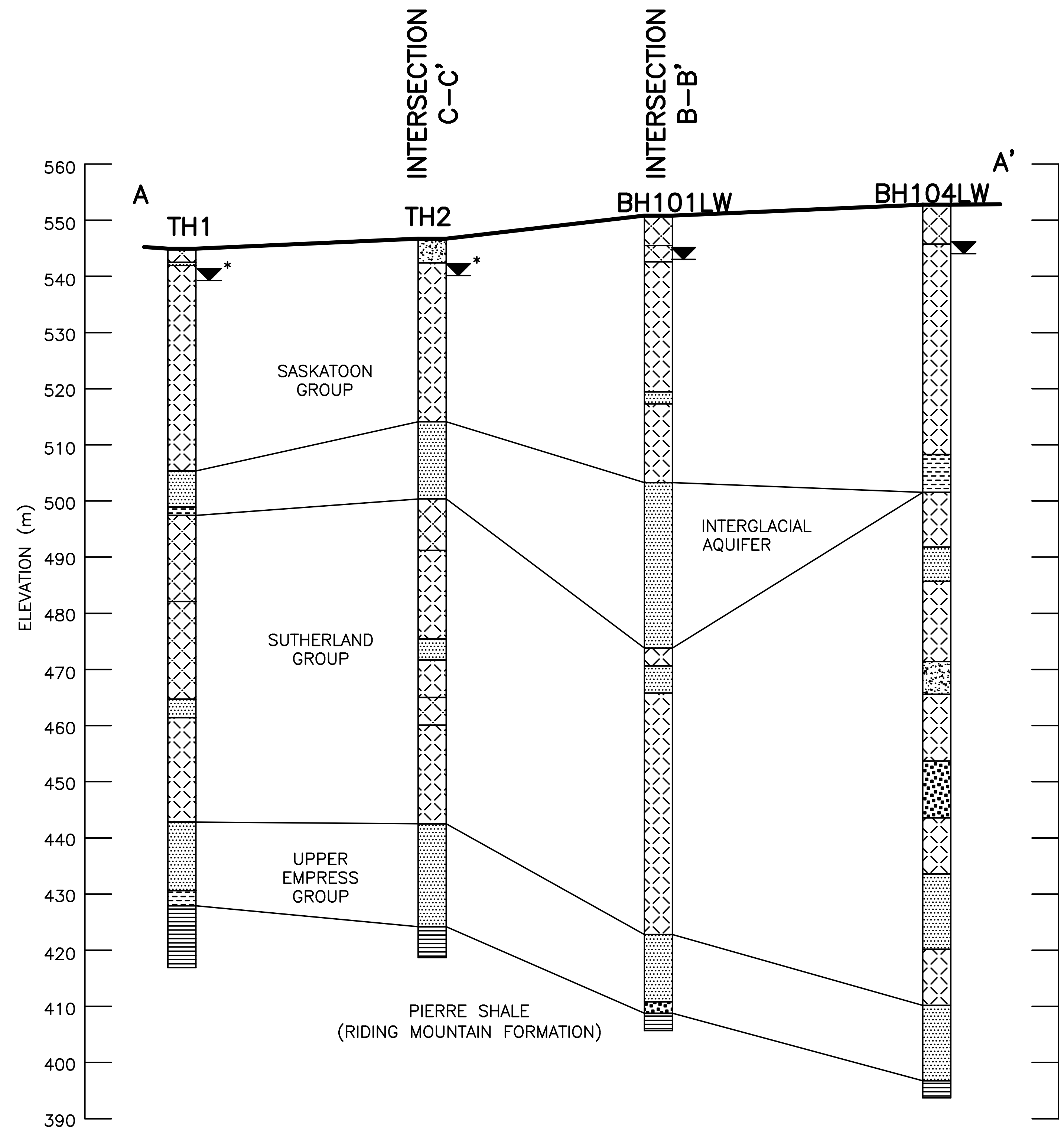
CLIENT
PFRA
PROJECT
LEROY HYDROGEOLOGIC STUDY
TITLE
SITE PLAN
DATE 02/02/15
APPD. BY
FILE NO. R3215001
SCALE 1:50000
DWN. BY LGB
DWG. NO. R3215-1



STRATIGRAPHIC CROSS SECTION A–A'

SCALE: HORIZ 1:50000
VERT 1:1000

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

LEGEND:

WATER LEVEL JUNE 2001 *

NOTES:

1. WATER LEVELS TAKEN 25 MARCH 2002 UNLESS OTHERWISE INDICATED.

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PROJECT: LEROY HYDROGEOLOGIC STUDY

TITLE: STRATIGRAPHIC CROSS SECTION A–A'

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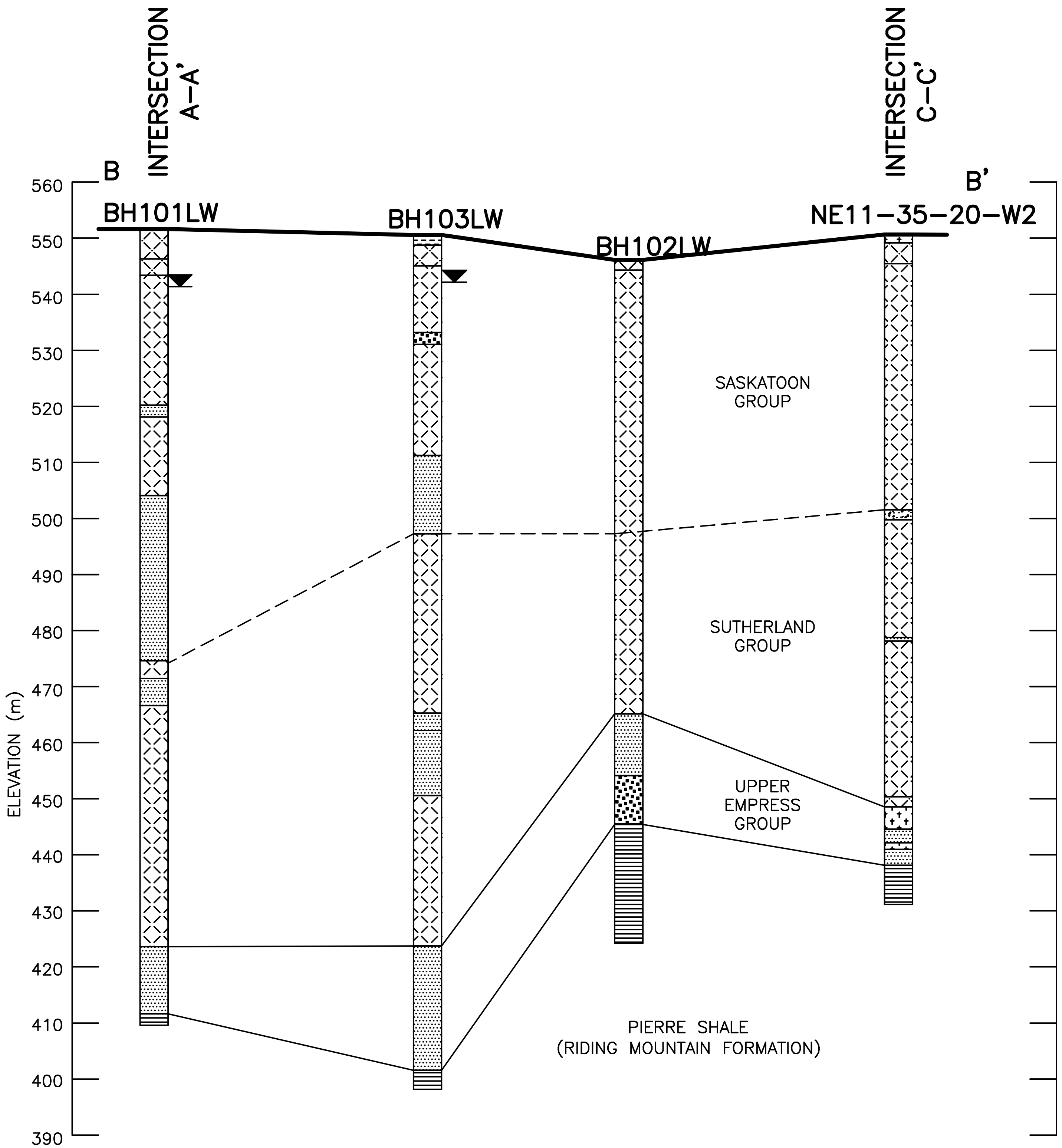

STRATIGRAPHIC CROSS SECTION B–B'

SCALE: HORIZ 1:50000
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THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

NOTES:

1. WATER LEVELS TAKEN 25 MARCH 2002 UNLESS OTHERWISE INDICATED.

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CLIENT	PFRA
PROJECT	LEROY HYDROGEOLOGIC STUDY
TITLE	STRATIGRAPHIC CROSS SECTION B–B'

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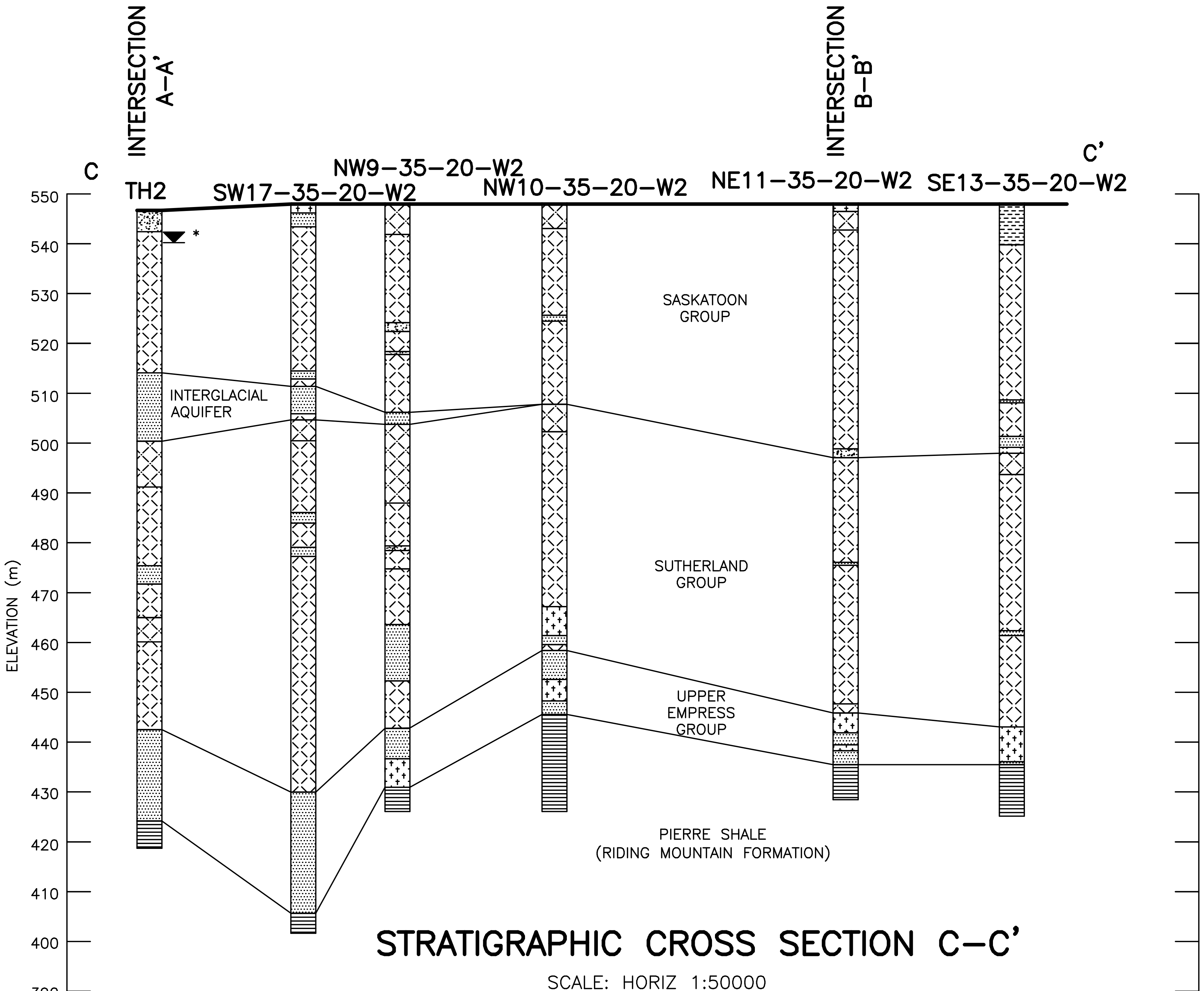

STRATIGRAPHIC CROSS SECTION C–C'

SCALE: HORIZ 1:50000
VERT 1:1000

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

LEGEND:

WATER LEVEL JUNE 2001 *

NOTES:

1. WATER LEVELS TAKEN 25 MARCH 2002 UNLESS OTHERWISE INDICATED.

REV	DESCRIPTION	BY	APP	DATE

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CLIENT: PFRA

PROJECT: LEROY HYDROGEOLOGIC STUDY

TITLE: STRATIGRAPHIC CROSS SECTION C–C'

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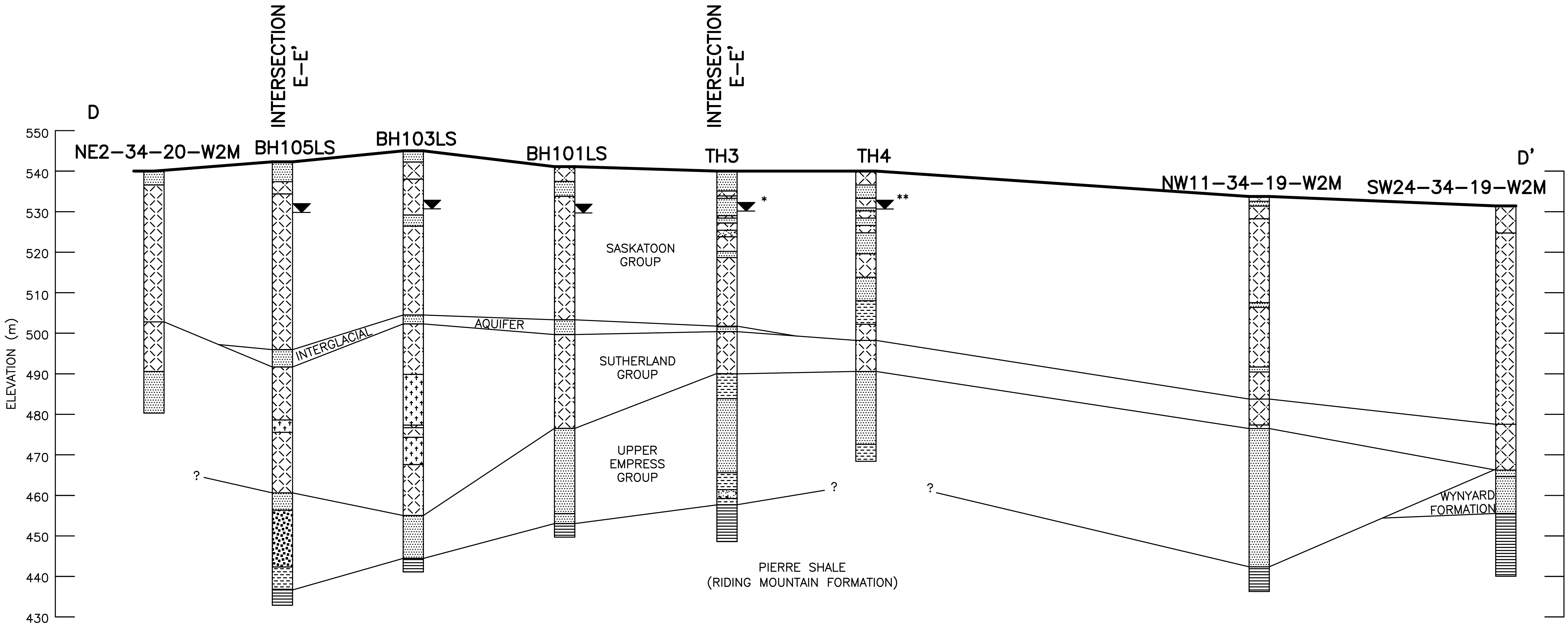


STRATIGRAPHIC CROSS SECTION D–D'

SCALE: HORIZ 1:50000
VERT 1:1000

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

LEGEND:

WATER LEVEL JULY 2001 *

WATER LEVEL OCTOBER 2001 **

NOTES:

1. WATER LEVELS TAKEN 25 MARCH 2002 UNLESS OTHERWISE INDICATED.

REV	DESCRIPTION	BY	APP	DATE

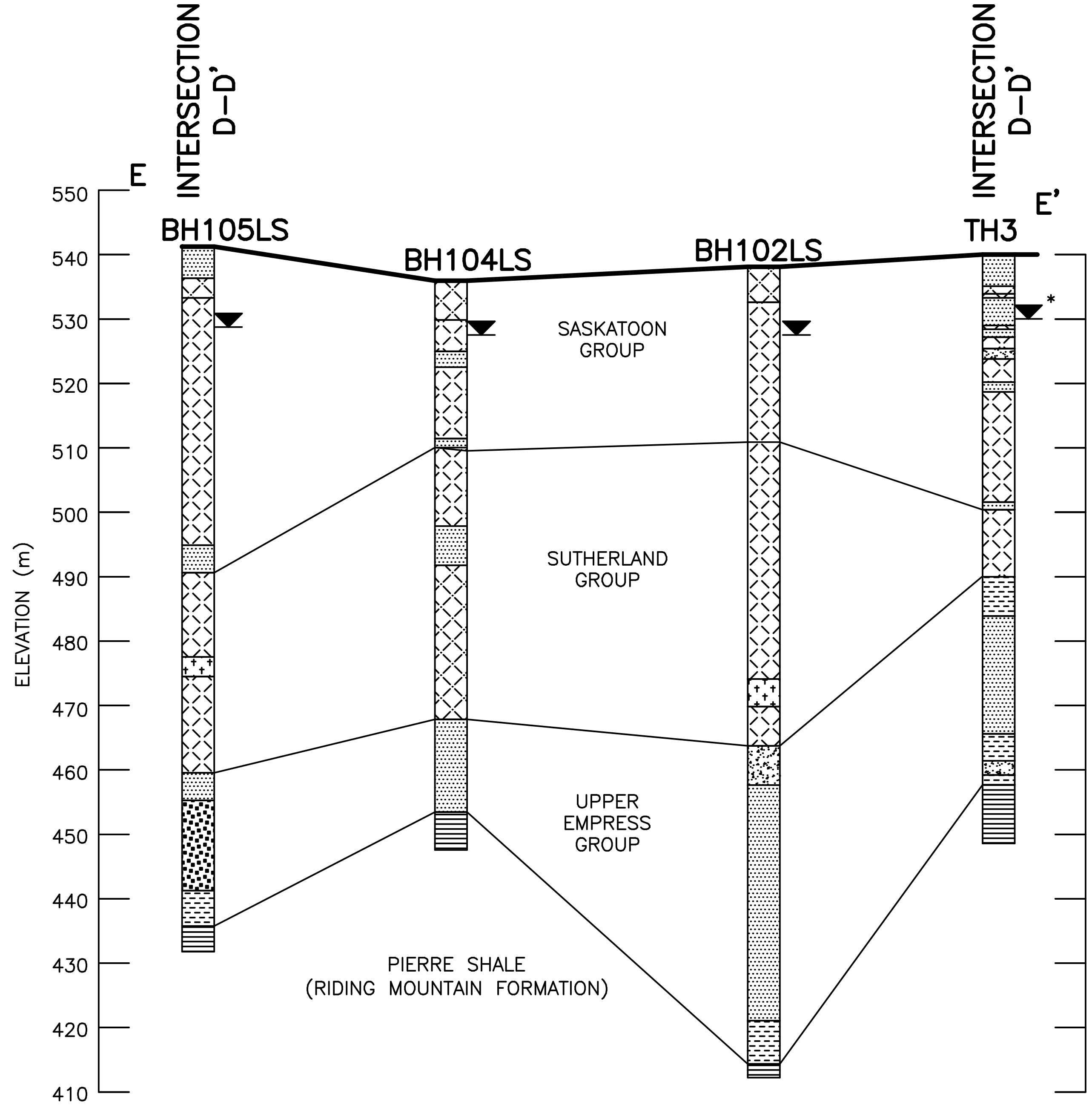
Clifton Associates Ltd.
engineering science technology

CLIENT: PFRA

PROJECT: LEROY HYDROGEOLOGIC STUDY

TITLE: STRATIGRAPHIC CROSS SECTION D–D'

DATE 02/02/15	APPD. BY	FILE NO. R3215005
SCALE AS NOTED	DWN. BY LGB	DWG. NO. R3215-5



STRATIGRAPHIC CROSS SECTION E–E'

SCALE: HORIZ 1:50000
VERT 1:1000

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

LEGEND:

WATER LEVEL JULY 2001 *

NOTES:

1. WATER LEVELS TAKEN 25 MARCH 2002 UNLESS OTHERWISE INDICATED.

REV	DESCRIPTION	BY	APP	DATE

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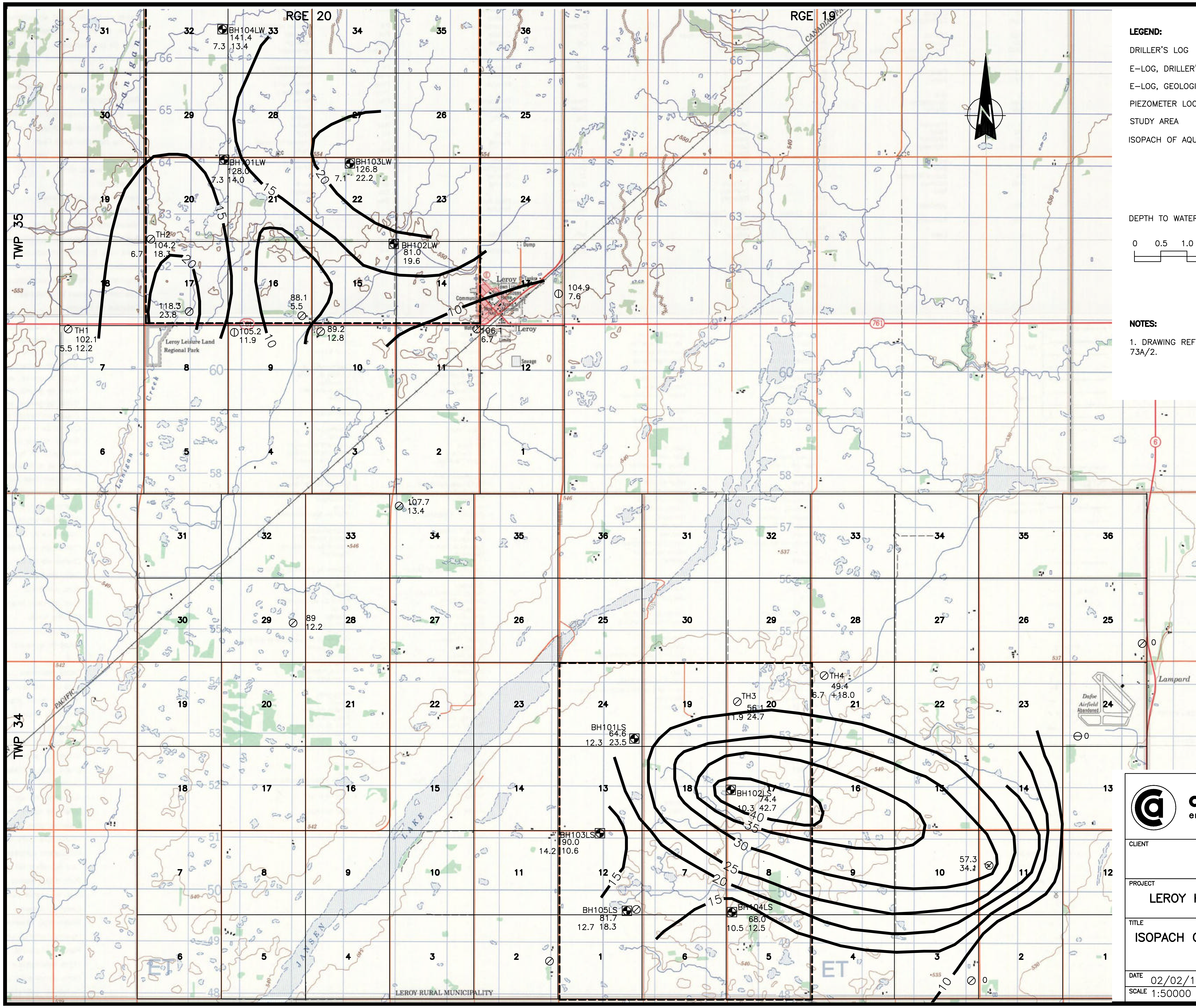
CLIENT
PFRA

PROJECT
LEROY HYDROGEOLOGIC STUDY

TITLE
STRATIGRAPHIC CROSS SECTION E–E'

DATE 02/02/15	APPD. BY	FILE NO. R3215006
SCALE AS NOTED	DWN. BY LGB	DWG. NO. R3215-6



LEGEND:

DRILLER'S LOG	⦶
E–LOG, DRILLER'S LOG	⊘
E–LOG, GEOLOGIST DESCRIPTION	⊖
PIEZOMETER LOCATION	⊠
STUDY AREA	⌐ - - ¬
ISOPACH OF AQUIFER THICKNESS	—15—

DEPTH TO TOP (m)
7.3 ⊖ 128.0 / 14.0
DEPTH TO WATER (m)
THICKNESS (m)

0 0.5 1.0 2.0 4.0 Km

NOTES:

1. DRAWING REFERENCED FROM NTS MAP 72P/15 AND 73A/2.

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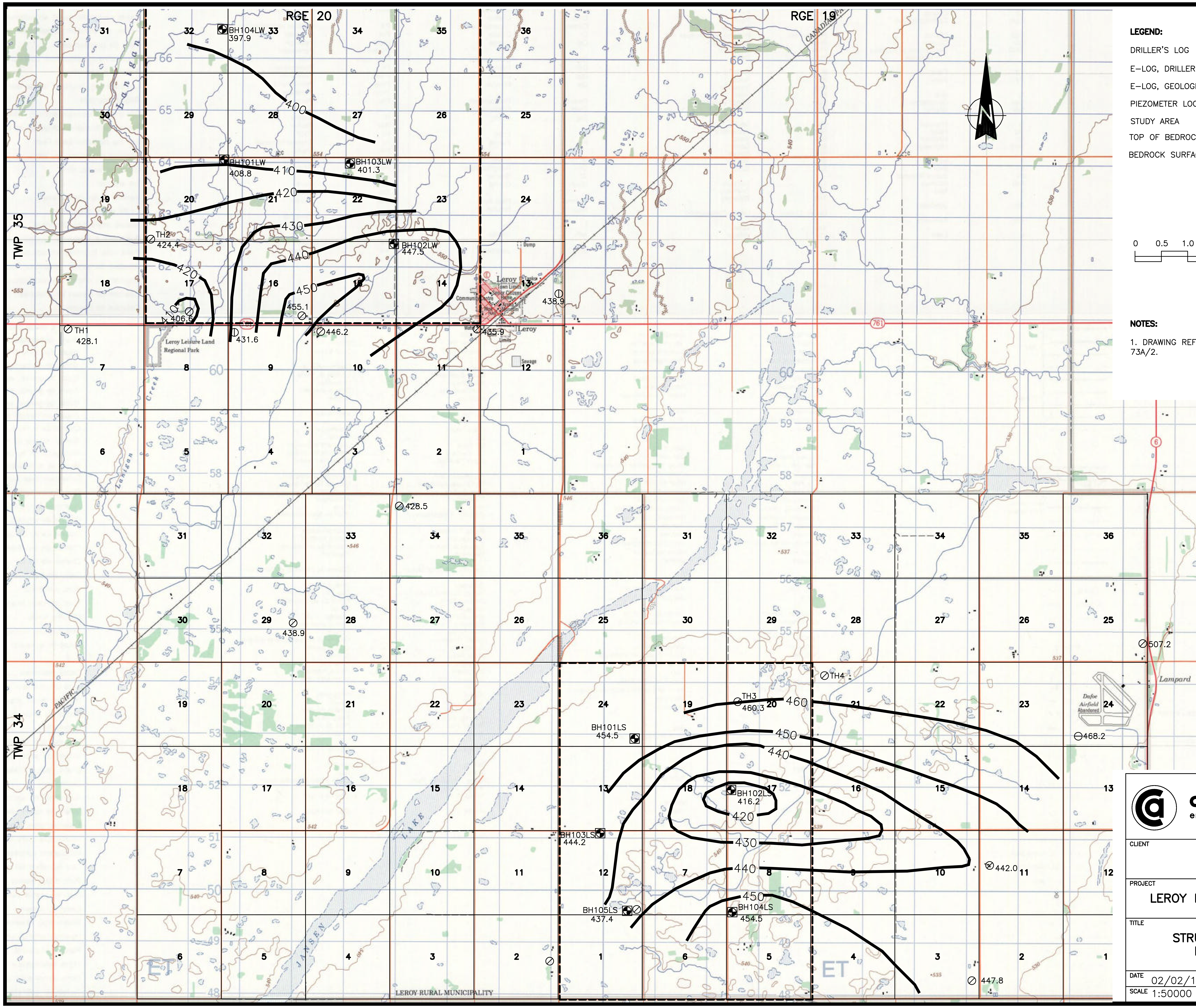
CLIENT	PFRA
PROJECT	LEROY HYDROGEOLOGIC STUDY
TITLE	ISOPACH OF UPPER EMPRESS GROUP AQUIFER

DATE	APPD. BY	FILE NO.
02/02/15		R3215001
SCALE 1:50000	DWN. BY LGB	DWG. NO. R3215–7



LEGEND:

DRILLER'S LOG	⦶
E-LOG, DRILLER'S LOG	⊘
E-LOG, GEOLOGIST DESCRIPTION	⊖
PIEZOMETER LOCATION	◙
STUDY AREA	▭ (dashed)
TOP OF BEDROCK ELEVATION (m)	437.4
BEDROCK SURFACE CONTOUR	420

0 0.5 1.0 2.0 4.0 Km

NOTES:

1. DRAWING REFERENCED FROM NTS MAP 72P/15 AND 73A/2.

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CLIENT
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PROJECT
LEROY HYDROGEOLOGIC STUDY

TITLE
STRUCTURAL CONTOUR OF BEDROCK SURFACE

DATE	APPD. BY	FILE NO.
02/02/15		R3215001
SCALE 1:50000	DWN. BY LGB	DWG. NO. R3215-8

B	**Geological Logs, E-Logs and Piezometer Details**

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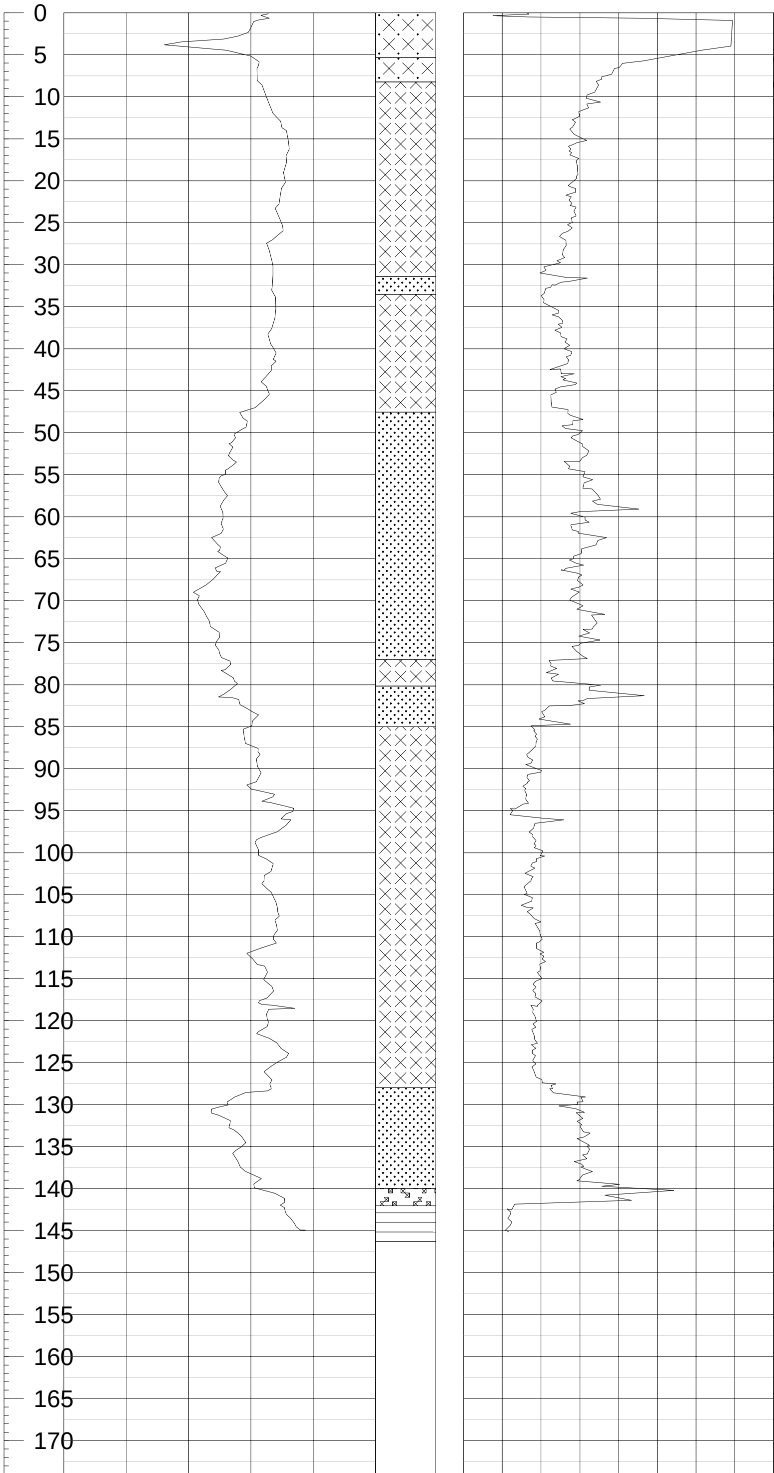
BORE HOLE LOG

Bore Hole: **101LW**
Page: 1 of 1

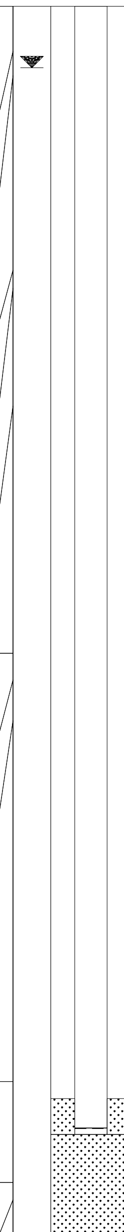
Client:	P.F.R.A.	Northing:	5764069.5- UTM	Contractor:	Hayter Drilling Ltd.
Project:	Leroy Area Aquifer Investigation	Easting:	512726.8- UTM	Drill:	Unit #29
Location:	NE20-35-20 W2	Ground Elev.:	550.81 msl	Drilling Method:	Rotary
Project No.:	R3215	Date Drilled:	22 February 2002	Logged by:	S. Gardner

Depth (m) | Spontaneous Potential, Sp. Cond.: Water - 1400, 24 mV/Division (-120 to 0) | Symbol | Sample | Resistivity, Sp. Cond.: Mud - 2010, 15ohms\Division (0 to 120) | Soil Description | PIezometer Construction Details



Soil Description

- TILL, OXIDIZED: Sandy, little silt and clay, brown ,calcareous, little cohesion
- TILL, OXIDIZED: Silty clay matrix, some sand, brown, calcareous, stiff
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff, boulder @ 14.5m, sand seam @ 32.5m
- SAND: Medium grained, brown, oxidized
- TILL, UNOXIDIZED: Clay, silty some sand, grey, calcareous, stiff, mostly massive
- SAND: Coarse grained, little silt, brown, oxidized, boulder @ 59m
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff
- SAND: Coarse grained, few gravel, silt and clay, grey, unoxidized
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff
- SAND: Medium to coarse grained, brown, oxidized
- COBBLES: Cobble and boulder lag
- CLAY SHALE: H.P.Clay, little silt, grey, unoxidized, noncalcareous, hard
- NOTES: E-log, piezometer installed, air lifted



Piezometer Construction Details

- Pipe stickup - 0.91 m
- Static w.l. @ 7.33 25 Mar 02
- 2" diameter sched. 40 Steel casing
- 2" diameter 15 slot Johnston Screen c/w foot valve
- 0.5 mm filter sand pack

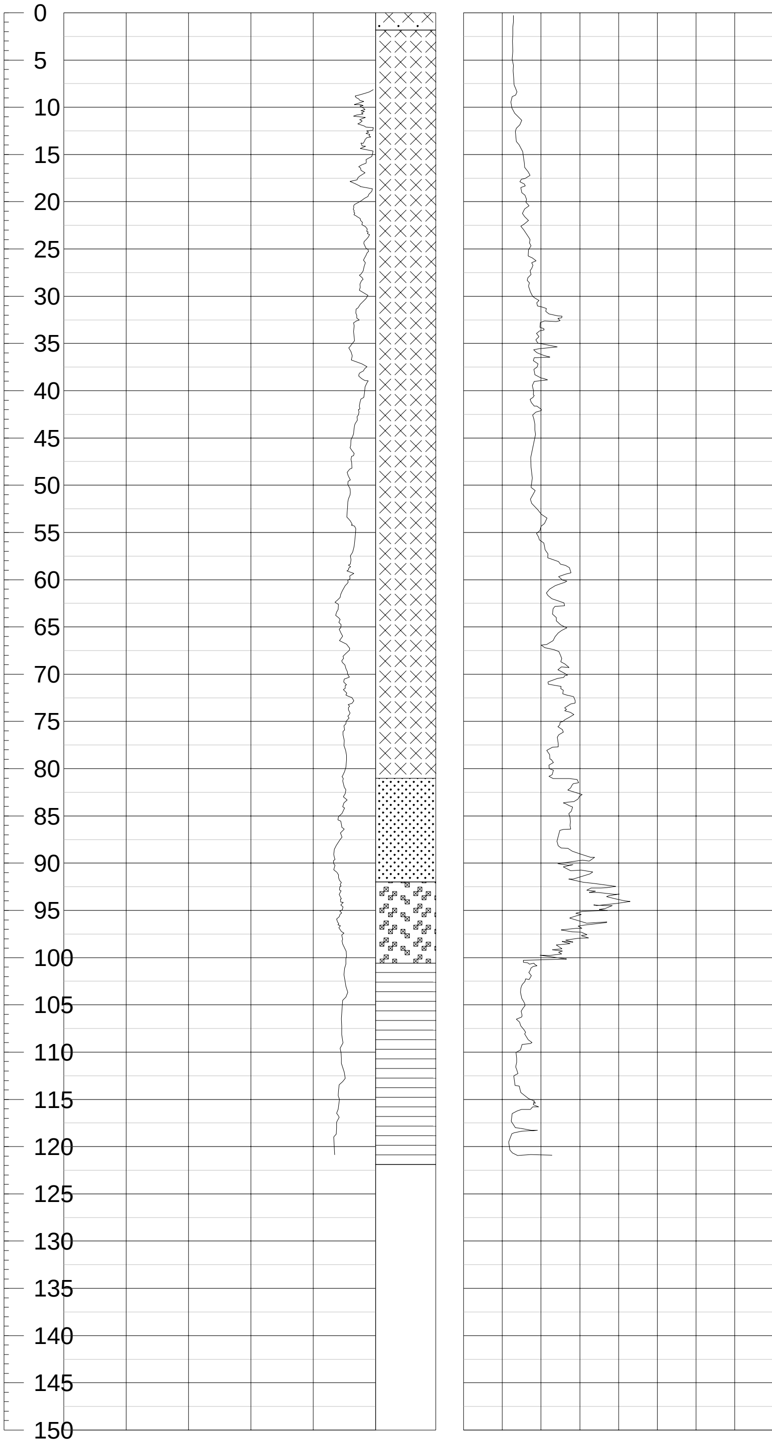
BORE HOLE LOG

Clifton Associates Ltd.
engineering science technology

Bore Hole: 102LW
Page: 1 of 1

Client:	P.F.R.A.	Northing:	5762496.3- UTM	Contractor:	Hayter Drilling Ltd.
Project:	Leroy Area Aquifer Investigation	Easting:	515952.3- UTM	Drill:	Unit #29
Location:	NE15-35-20 W2	Ground Elev.:	548.07 msl	Drilling Method:	Rotary
Project No.:	R3215	Date Drilled:	04 March 2002	Logged by:	D.Willfong

Depth (m)	Spontaneous Potential Sp. Cond.: Water - - 24 mV/Division -120 … 0	Symbol	Sample	Resistivity Sp. Cond.: Mud - - 15ohms\Division 0 … 120	Soil Description	PIezometer Construction Details



TILL, OXIDIZED: Silty clay matrix, some sand, brown, firm, Fe

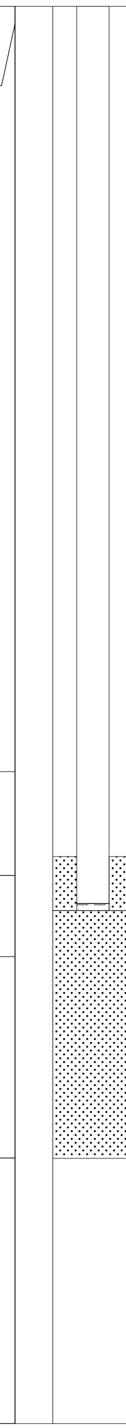
TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, stiff, sand seam @32.6 m, boulder @ 39.6 m

SAND: Fine Grained, brown, oxidized

COBBLES: Medium grained, oxidized, with boulders, slow drilling

CLAY SHALE: H.P. Clay, little silt, dark grey, unoxidized, non-calcareous, hard

NOTES: E-Log, piezometer installed, air lifted, piezometer pulled



2" diameter sched. 40 Steel casing

2" diameter 15 slot Johnston Screen c/w foot valve

0.5 mm filter sand pack

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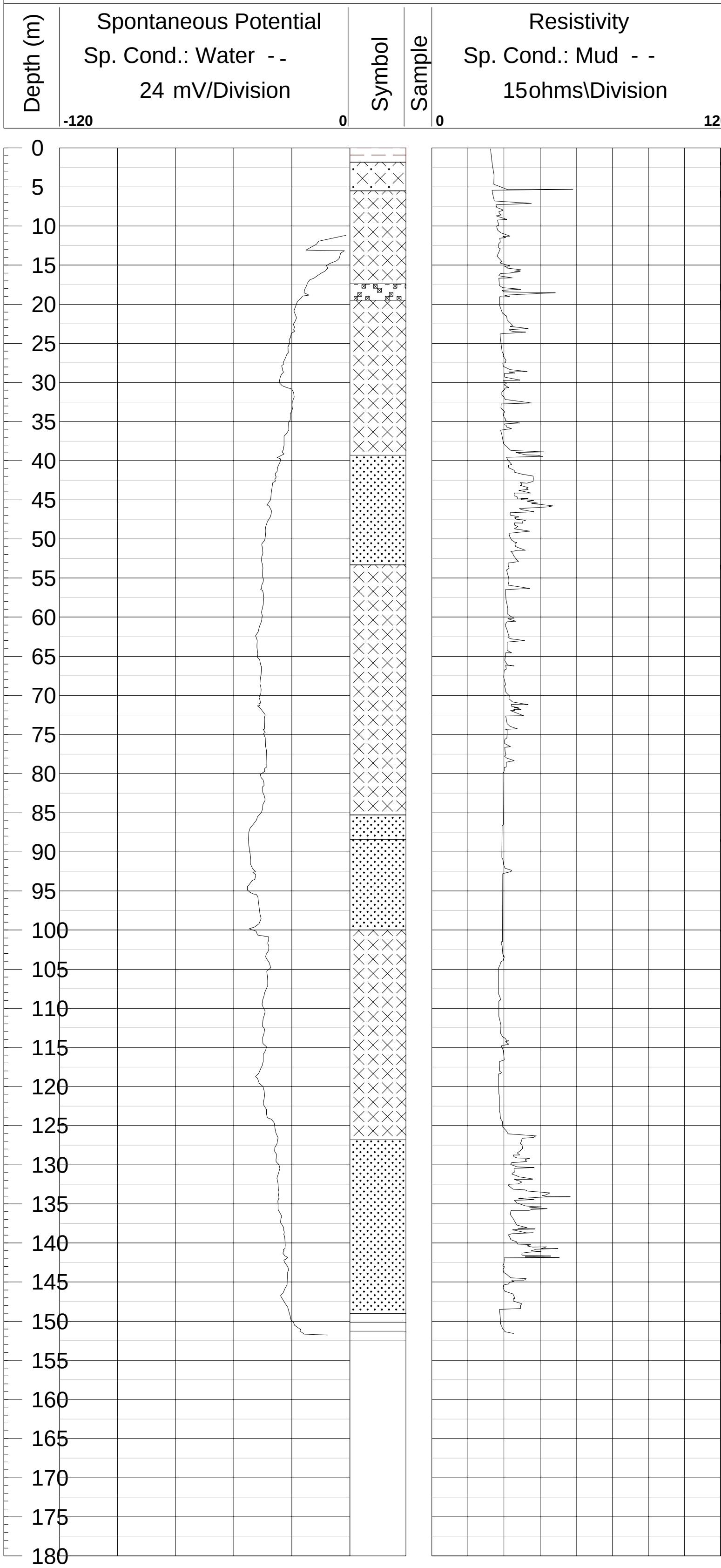
BORE HOLE LOG

Bore Hole: 103LW
Page: 1 of 1

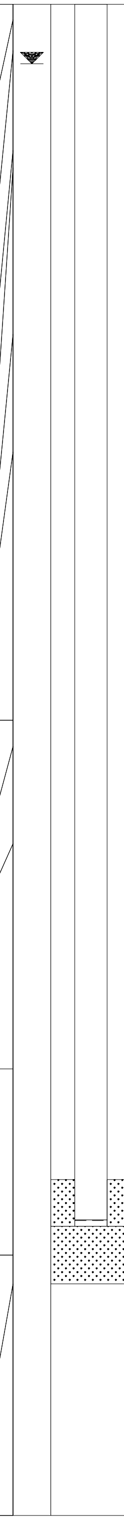
Client:	P.F.R.A.	Northing:	5763965.4- UTM	Contractor:	Hayter Drilling Ltd.
Project:	Leroy Area Aquifer Investigation	Easting:	515124.3- UTM	Drill:	Unit #29
Location:	NW22-35-20 W2	Ground Elev.:	550.28 msl	Drilling Method:	Rotary
Project No.:	R3215	Date Drilled:	04 March 2002	Logged by:	D.Willfong



Soil Description

- CLAY: Little silt, brown, oxidized, calcareous, laminated, stiff, Fe
- TILL, OXIDIZED: Silty clay matrix, some sand, brown, calcareous, jointed, stiff, Fe
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, mostly massive
- COBBLES: With boulders, slow drilling
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, mostly massive
- SAND: Coarse grained, with gravel seams and cobble
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, mostly massive
- SAND: Coarse grained, some silt, cobble, hard drilling
- SAND: Coarse grained, some silt, easy drilling
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, mostly massive
- SAND: Coarse grained
- CLAY SHALE: H.P. Clay, little silt, dark grey, unoxidized, non-calcareous, hard
- NOTES: E-Log, piezometer installed, air lifted, piezometer pulled

PIezometer Construction Details



- Pipe stickup - 1.4 m
- Static w.l. @ 7.10 m 25 Mar 2002
- 2" diameter sched. 40 Steel casing
- 2" diameter 15 slot Johnston Screen c/w foot valve
- 0.5 mm filter sand pack

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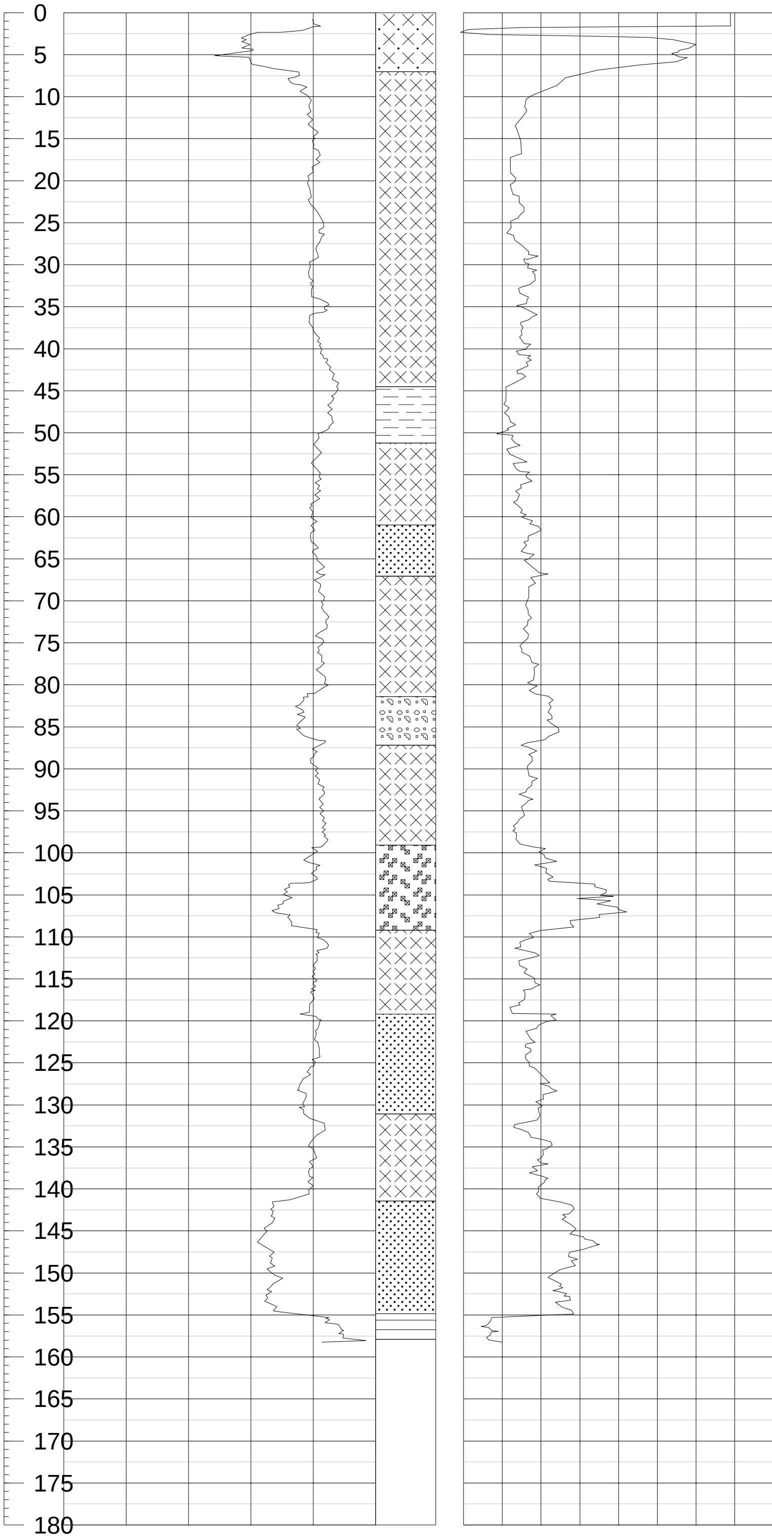
BORE HOLE LOG

Bore Hole: 104LW
Page: 1 of 1

Client:	P.F.R.A.	Northing:	5766520.2- UTM	Contractor:	Hayter Drilling Ltd.
Project:	Leroy Area Aquifer Investigation	Easting:	512703.4- UTM	Drill:	Unit #29
Location:	NE32-35-20 W2	Ground Elev.:	552.69 msl	Drilling Method:	Rotary
Project No.:	R3215	Date Drilled:	11 March 2002	Logged by:	S. Gardner

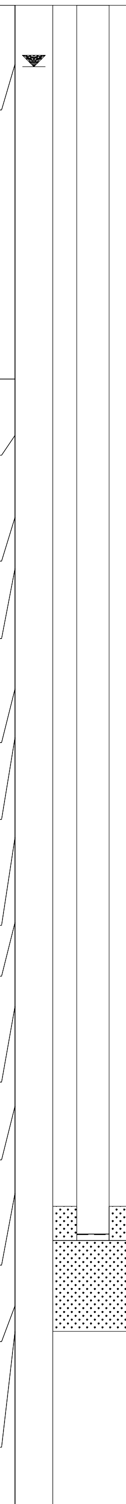
Depth (m) | Spontaneous Potential, Sp. Cond.: Water - 1510, 24 mV/Division (-120 to 0) | Symbol | Sample | Resistivity, Sp. Cond.: Mud - 1630, 15ohms\Division (0 to 120) | Soil Description | PIezometer Construction Details



Soil Description

- TILL, OXIDIZED: Silty clay matrix, some sand, brown, calcareous, firm, blocky
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff, mostly massive
- CLAY: Little silt, brown, oxidized, calcareous, stiff, thinly laminated
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff, mostly massive
- SAND: Coarse grained, little silt and clay, grey, unoxidized
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff, mostly massive
- GRAVEL: Some coarse sand, subangular, oxidized
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff, mostly massive, odd silty stringer
- COBBLES: cobble and boulder lag
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff, mostly massive
- SAND: Coarse grained, subrounded, grey, unoxidized
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff, mostly massive
- SAND: Medium grained, brown, oxidized
- CLAY SHALE: H.P. Clay, little silt, dark grey, unoxidized, non-calcareous, hard
- NOTES: E-log, piezometer installed, air lifted

Piezometer Construction Details



Pipe stickup - 0.91 m

Static w.l. @ 7.33 25 Mar 02

2" diameter sched. 40 Steel casing

2" diameter 15 slot Johnston Screen c/w foot valve

0.5 mm filter sand pack

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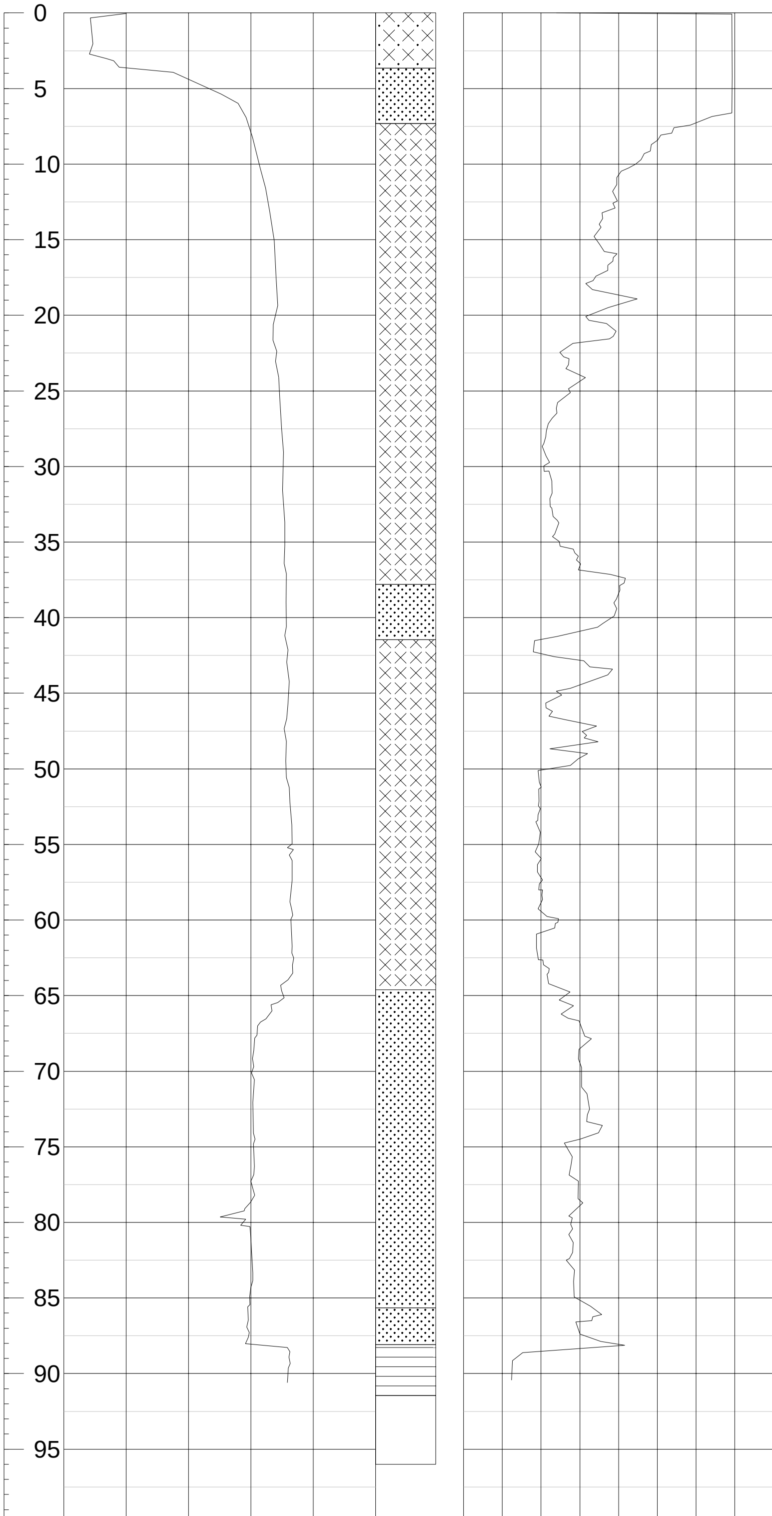
BORE HOLE LOG

Bore Hole: 101LS
Page: 1 of 1

Client:	P.F.R.A.	Northing:	5752756.8- UTM	Contractor:	Hayter Drilling Ltd.
Project:	Leroy Area Aquifer Investigation	Easting:	520745.7- UTM	Drill:	Unit #29
Location:	SE24-34-20 W2	Ground Elev.:	542.60 msl	Drilling Method:	Rotary
Project No.:	R3215	Date Drilled:	14 MARCH 2002	Logged by:	S. Gardner

Depth (m)	Spontaneous Potential Sp. Cond.: Water - 2320 24 mV/Division -120 … 0	Symbol	Sample	Resistivity Sp. Cond.: Mud - 1530 15ohms\Division 0 … 120	Soil Description	PIezometer Construction Details



TILL, OXIDIZED: Silty clay matrix, some sand, yellow-brown, oxidized, calcareous, stiff, blocky, Fe stains, boulder @ 1.2 m

SAND: medium grained, reddish brown, oxidized

TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff, mostly massive, sand seams from 13.4 m to 22.86 m

SAND: Medium grained, oxidized

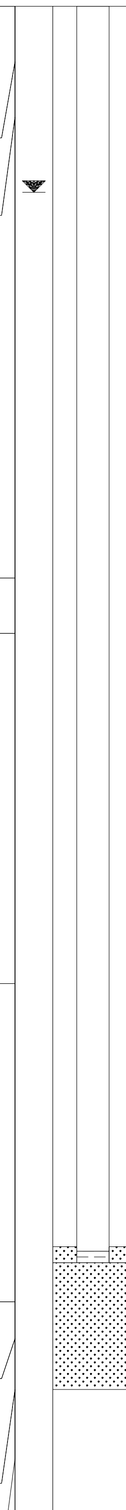
TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff, mostly massive

SAND: Fine grained, some silt, no cuttings on #20 screen

SAND: Coarse grained, some gravel and cobble, brown, oxidized

CLAY SHALE: H.P. Clay, little silt, dark grey, unoxidized, hard, non-calcareous

NOTES: E-Log, piezometer installed, air lifted



Pipe stickup - 0.91 m

Static w.l. @ 12.28 m 25 Mar 02

2" diameter sched. 40 Steel casing

2" diameter 15 slot Johnston Screen c/w foot valve

0.5 mm filter sand pack

Geoph Piez Log m CAL V2.ldf

Clifton Associates Ltd. engineering science technology

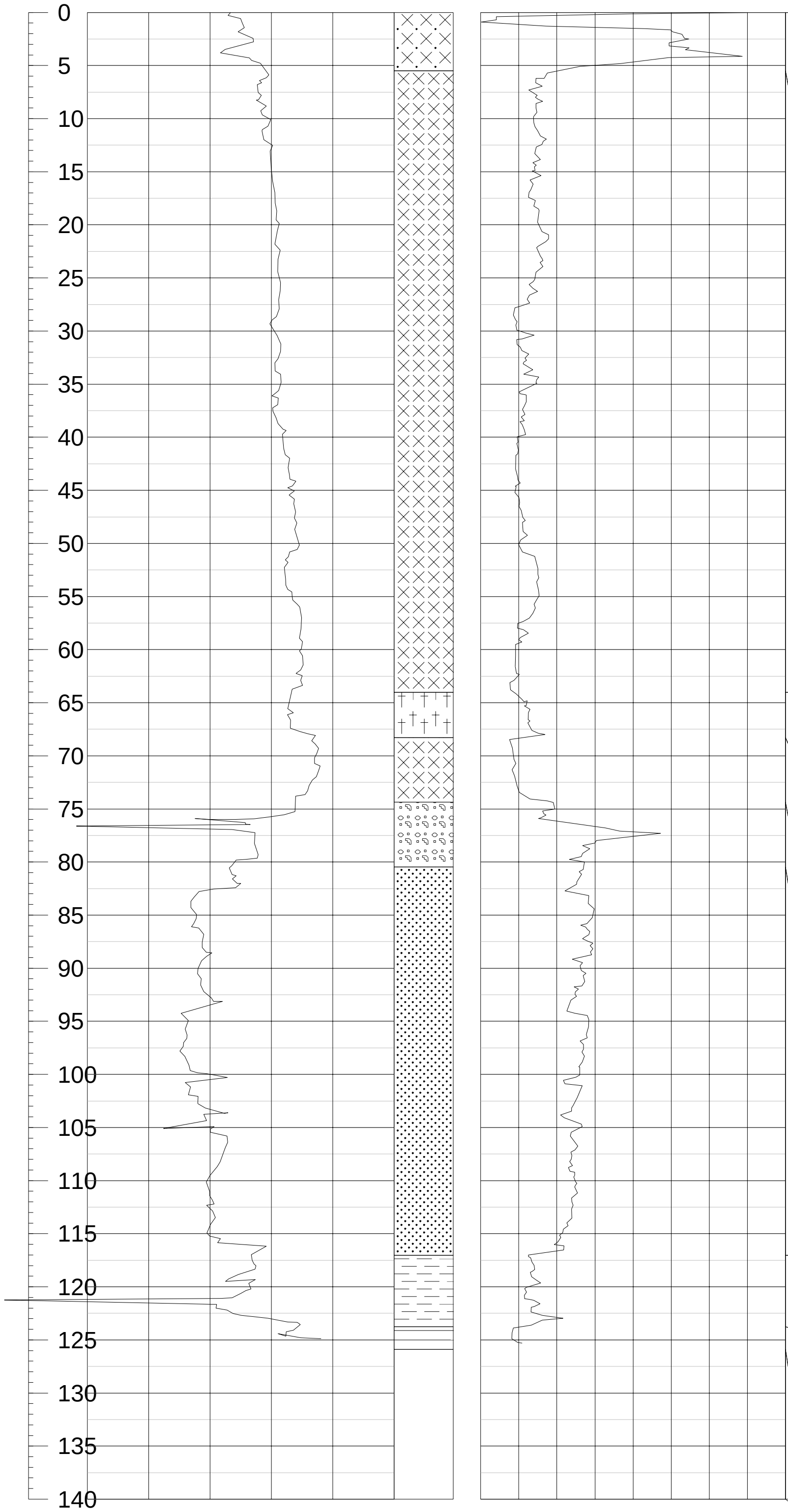
BORE HOLE LOG

Bore Hole: **102LS**

Page: 1 of 1

Client:	P.F.R.A.	Northing:	5751959.2- UTM	Contractor:	Hayter Drilling Ltd.
Project:	Leroy Area Aquifer Investigation	Easting:	522430.0- UTM	Drill:	Unit #29
Location:	SW17-34-19 W2	Ground Elev.:	539.95 msl	Drilling Method:	Rotary
Project No.:	R3215	Date Drilled:	21 March 2002	Logged by:	S. Gardner

Depth (m)	Spontaneous Potential Sp. Cond.: Water - 1550 24 mV/Division -120 … 0	Symbol	Sample	Resistivity Sp. Cond.: Mud - 1810 15ohms\Division 0 … 120	Soil Description	PIezometer Construction Details



Soil Description

TILL, OXIDIZED: Silty clay matrix, some sand, yellow-brown, calcareous, stiff, blocky, Fe stains, boulders @ 3.6 m and 4.6 m

TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, mostly massive, sand seams @ 12.2 m and 30.5m, gravel seam @ 21 m, silt seam @56.5m

SILT: Few clay, grey, unoxidized, little cohesion, blocky

TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, mostly massive

GRAVEL: Coarse grained, cobbles boulders, and coarse sand

SAND: Fine grained, some silt, brown, oxidized, few cuttings on #20 screen

CLAY: Silty clay matrix, some sand, grey, calcareous, mostly massive

CLAY SHALE: H.P. Clay, little silt, dark grey, unoxidized, non-calcareous, hard

NOTES: E-Log, piezometer installed, air lifted

Piezometer Construction Details

Pipe stickup - 0.91 m

Static w.l. @ 10.34 m 25 Mar 02

2" diameter sched. 40 Steel casing

2" diameter 15 slot Johnston Screen c/w foot valve

0.5 mm filter sand pack

Geoph Piez Log m CAL V2.ldf

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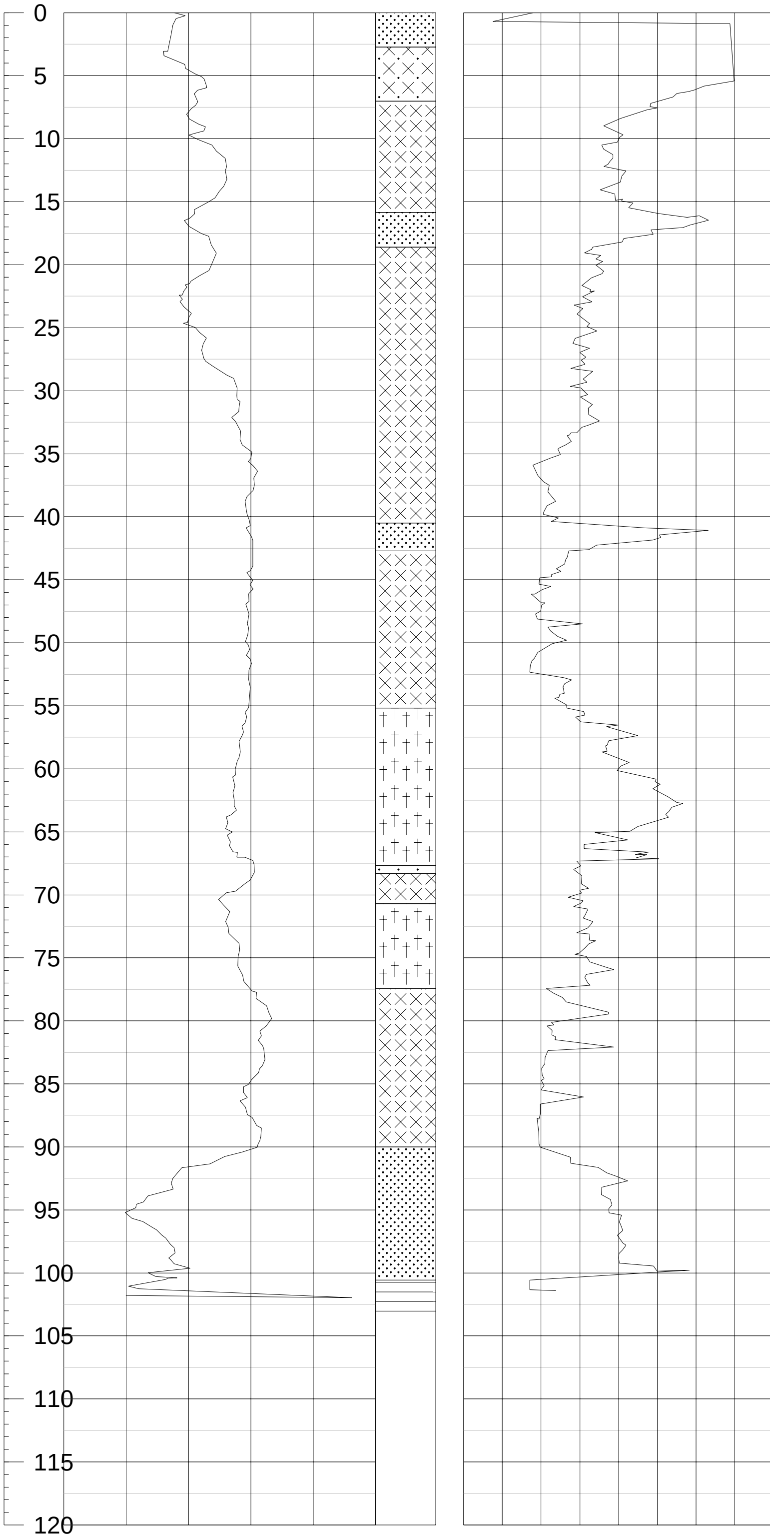
BORE HOLE LOG

Bore Hole: 103LS
Page: 1 of 1

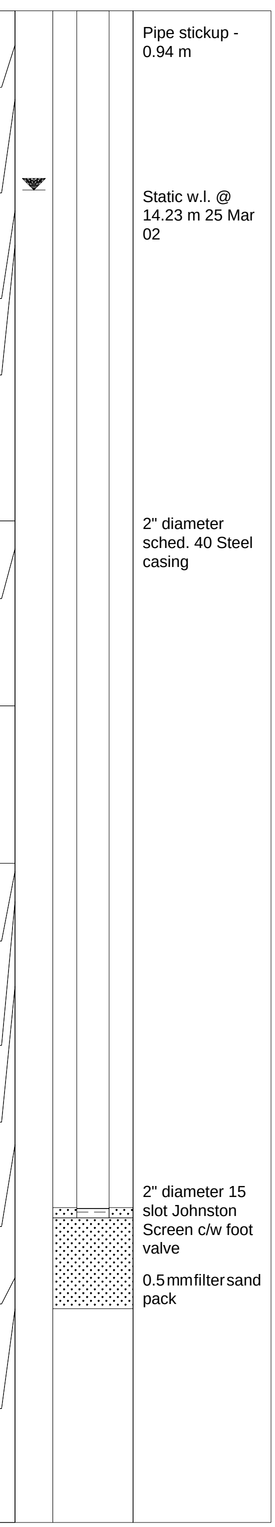
Client:	P.F.R.A.	Northing:	5751085.8- UTM	Contractor:	Hayter Drilling Ltd.
Project:	Leroy Area Aquifer Investigation	Easting:	519894.4- UTM	Drill:	Unit #29
Location:	NW12-34-20 W2	Ground Elev.:	544.73 msl	Drilling Method:	Rotary
Project No.:	R3215	Date Drilled:	18 MARCH 2002	Logged by:	S. Gardner

Depth (m) | Spontaneous Potential, Sp. Cond.: Water - 2760, 24 mV/Division (-120 to 0) | Symbol | Sample | Resistivity, Sp. Cond.: Mud - 1530, 15ohms\Division (0 to 120) | Soil Description | PIezometer Construction Details



Soil Description

- SAND: Some silt and clay, brown, oxidized, stiff, blocky
- TILL, OXIDIZED: Silty clay matrix, some sand, brown, calcareous, stiff, mostly massive
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff, mostly massive
- SAND: Coarse grained, some gravel, oxidized
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff, mostly massive
- SAND: Coarse grained, some gravel, oxidized
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff, mostly massive
- SILT: Little clay, grey, unoxidized, firm, easy drilling
- TILL, OXIDIZED: Some silt and clay, brown, oxidized, stiff, mostly massive
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff, mostly massive
- SILT: Little clay, grey, unoxidized, firm, easy drilling
- TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, stiff, mostly massive
- SAND: Fine grained, no cuttings on #20 screen, boulders @ 99.7m
- CLAY SHALE: H.P. Clay, little silt, dark grey, unoxidized, non-calcareous, hard
- NOTES: E-Log, piezometer installed, air lifted



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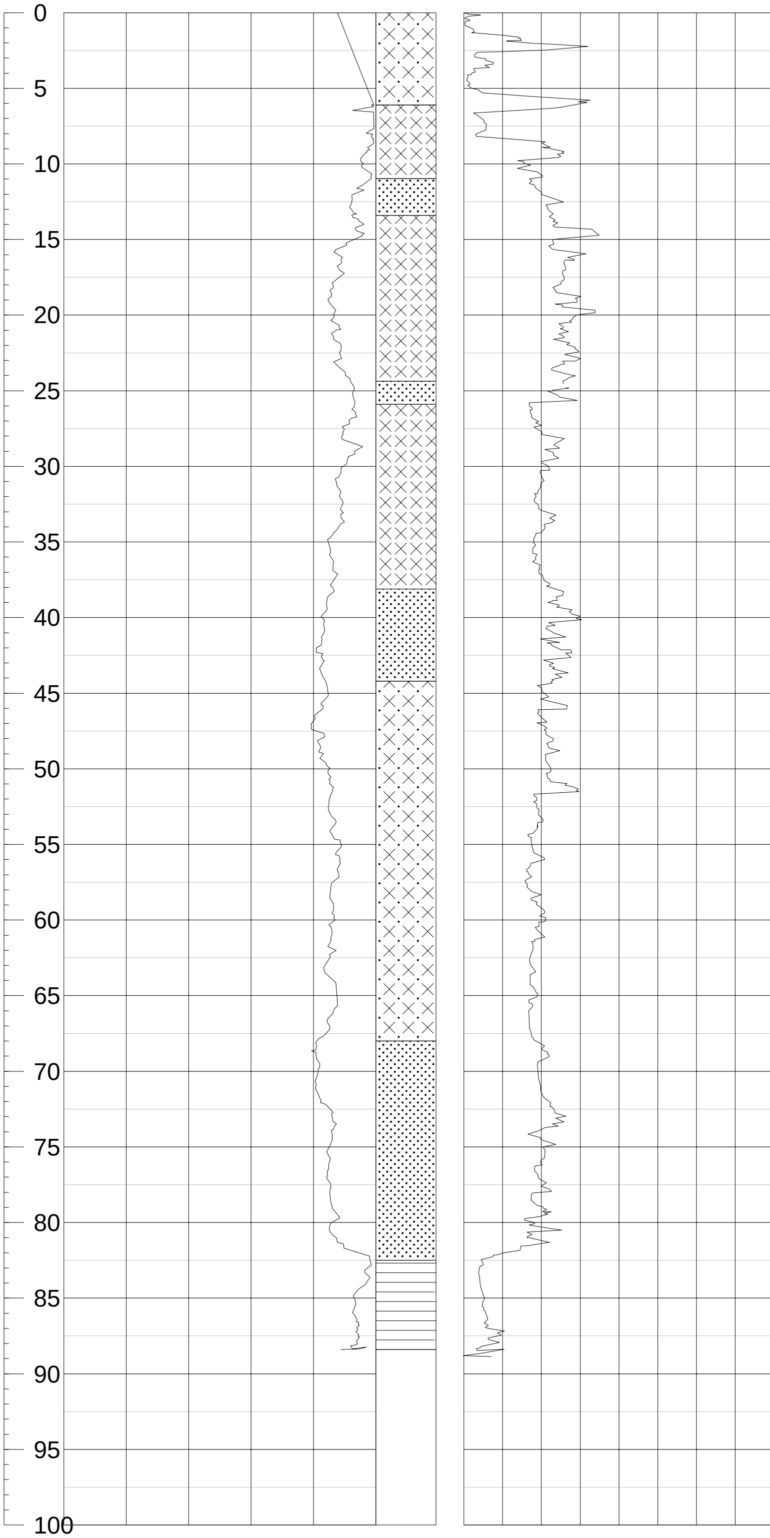
BORE HOLE LOG

Bore Hole: 104LS
Page: 1 of 1

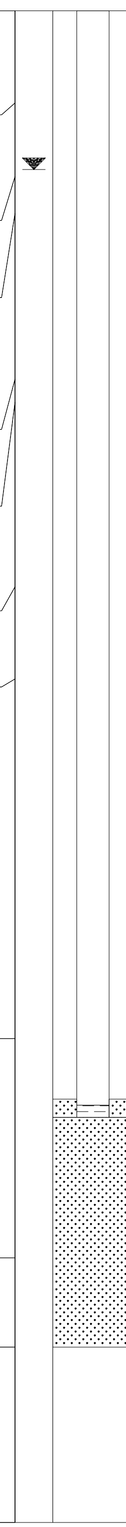
Client:	P.F.R.A.	Northing:	5749535.6- UTM	Contractor:	Hayter Drilling Ltd.
Project:	Leroy Area Aquifer Investigation	Easting:	522415.9- UTM	Drill:	Unit #29
Location:	SW08-34-19 W2	Ground Elev.:	536.98 msl	Drilling Method:	Rotary
Project No.:	R3215	Date Drilled:	19 - March - 2002	Logged by:	S. Gardner

Depth (m) | Spontaneous Potential, Sp. Cond.: Water - 1920, 24 mV/Division (-120 to 0) | Symbol | Sample | Resistivity, Sp. Cond.: Mud - 2200, 15ohms\Division (0 to 120) | Soil Description | PIezometer Construction Details



Soil Description:

- TILL, OXIDIZED: Silty clay matrix, some sand and gravel, brown, calcareous, firm, Fe along fissures
- TILL, UNOXIDIZED: Silty clay matrix, some sand and gravel, grey, calcareous, stiff, mostly massive
- SAND: Coarse grained, some silt, little gravel
- TILL, UNOXIDIZED: Silty clay matrix, some sand and gravel, grey, calcareous, stiff, sand seam @ 21.3m
- SAND: Some silt, trace gravel, few cuttings on # 20 screen
- TILL, UNOXIDIZED: Silty clay matrix, some sand and gravel, grey, calcareous, stiff
- SAND: Some silt, trace gravel, few cuttings on # 20 screen
- TILL, OXIDIZED: Clay, little silt, trace gravel, olive brown, calcareous, @ 48.8 m dark greyish brown, @ 54.9 m dark brownish grey
- SAND: Fine, @ 82.3 m gravel
- CLAY SHALE: H.P. Clay, little silt, dark grey, hard, non-calcareous
- NOTES: E-Log, piezometer installed, air lifted



Piezometer Construction Details:

- Pipe stickup - 1.10 m
- Static w.l. @ 10.50 m 25 Mar 02
- 2" diameter sched. 40 Steel casing
- 2" diameter 15 slot Johnston Screen c/w foot valve
- 0.5 mm filter sand pack

Geoph Piez Log m CAL V2.ldf

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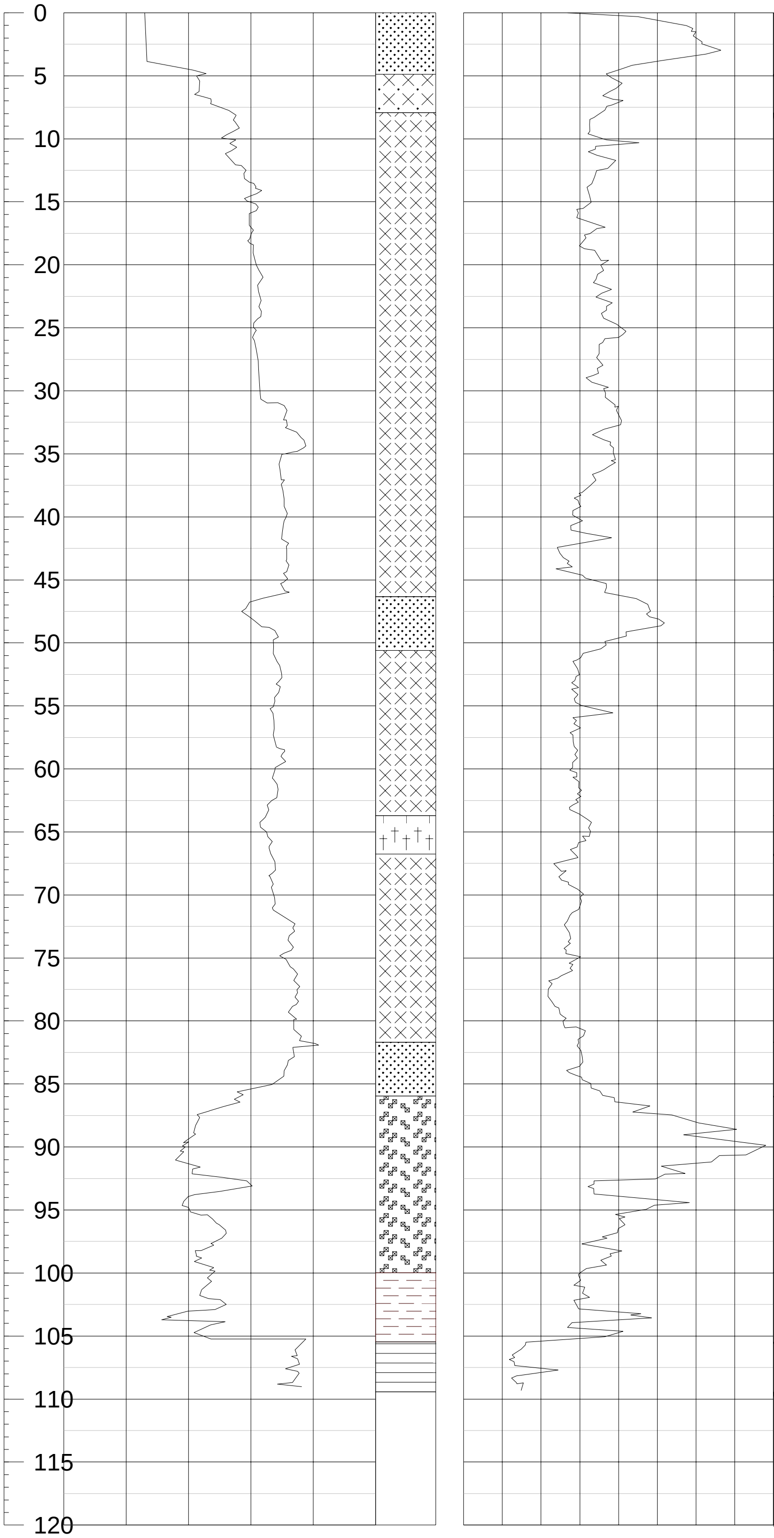
BORE HOLE LOG

Bore Hole: 105LS
Page: 1 of 1

Client:	P.F.R.A.	Northing:	5749561.1- UTM	Contractor:	Hayter Drilling Ltd.
Project:	Leroy Area Aquifer Investigation	Easting:	520464.4- UTM	Drill:	Unit #29
Location:	SE12-34-20 W2	Ground Elev.:	542.81 msl	Drilling Method:	Rotary
Project No.:	R3215	Date Drilled:	19 - March - 2002	Logged by:	S. Gardner

Depth (m)	Spontaneous Potential Sp. Cond.: Water - 2080 24 mV/Division (-120 to 0)	Symbol	Sample	Resistivity Sp. Cond.: Mud - 1580 15ohms\Division (0 to 120)	Soil Description	PIezometer Construction Details



SAND: Little silt and clay, brown, oxidized, stiff, nuggetty, boulder @ 0.76 m

TILL, OXIDIZED: Silty clay matrix, some sand and gravel, brown, calcareous, firm, Fe along fissures

TILL, UNOXIDIZED: Silty clay matrix, some sand and gravel, grey, calcareous, stiff, massive, sand seam @ 33m

SAND: Coarse grained, oxidized

TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, firm, mostly massive

SILT: No cuttings on #20 screen, easy drilling

TILL, UNOXIDIZED: Silty clay matrix, some sand, grey, calcareous, firm, mostly massive, stiff below 76 m

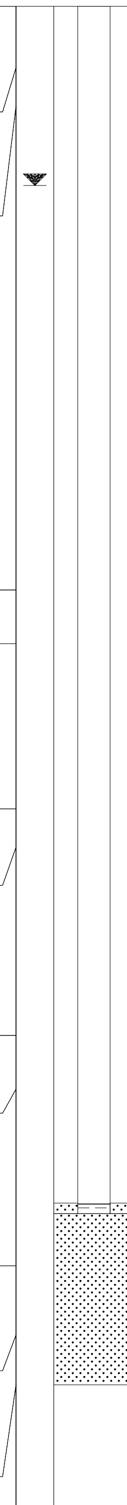
SAND: No cuttings on #20 screen, easy drilling

COBBLES: Cobbles with boulders and coarse gravel leading into coarse sand

CLAY: Silty clay matrix, some sand, brown, calcareous, stiff, mostly massive

CLAY SHALE: H.P. Clay, little silt, dark grey, unoxidized, non-calcareous, hard

NOTES: E-Log, piezometer installed, air lifted



Pipe stickup - 0.94 m

Static w.l. @ 12.71 m 25 Mar 02

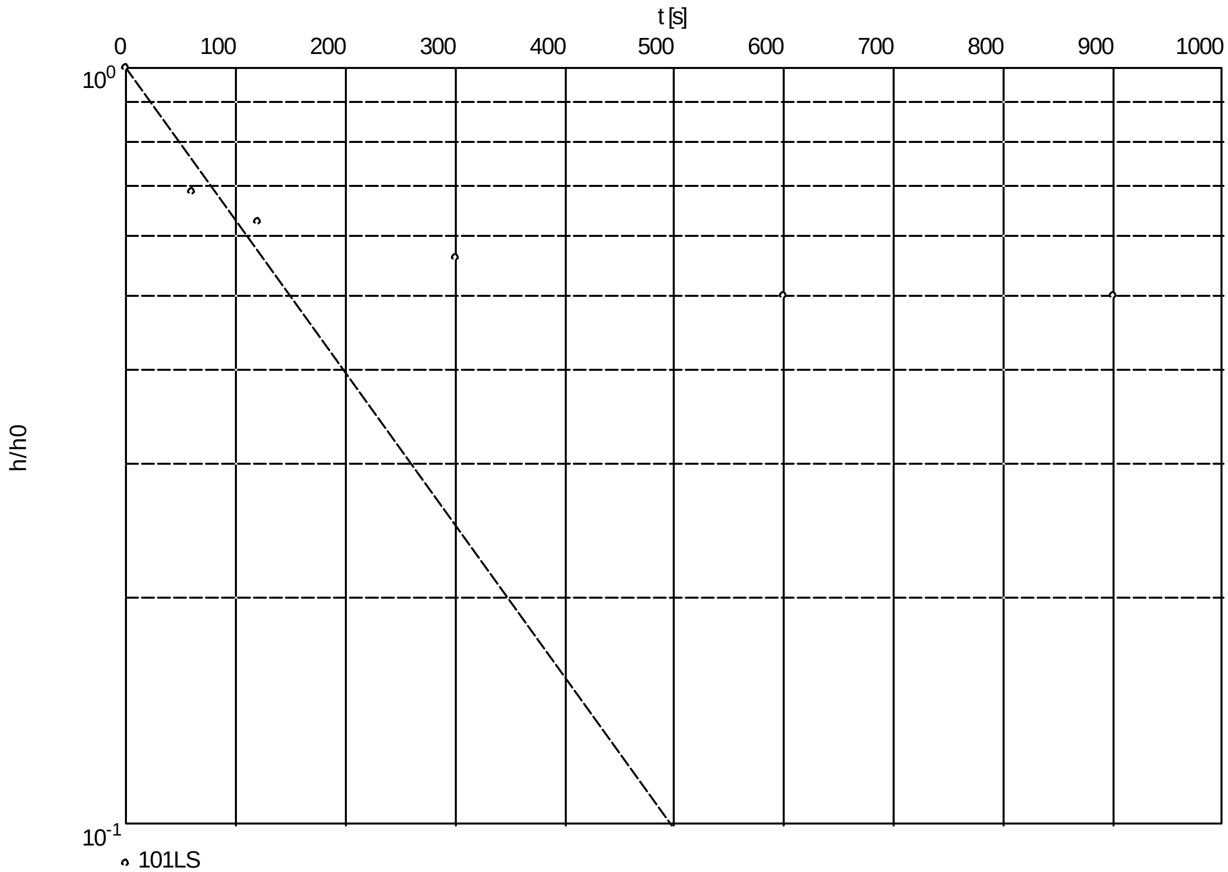
2" diameter sched. 40 Steel casing

2" diameter 15 slot Johnston Screen c/w foot valve

0.5 mm filter sand pack

Clifton Associates Ltd. engineering science technology	**Appendix A**

Clifton Associates Ltd 340 Maxwell Crescent Regina, Saskatchewan ph.(306) 721-7611	slug/bail test analysis HVORSLEV's method	Date: 25.04.2002	Page 1
		Project: Leroy Area Aquifer Investigation	
		Evaluated by: ajk	
Slug Test No.		Test conducted on: 22 February 2002	
101LW			



Hydraulic conductivity [m/s]: 1.28×10^{-5}

Clifton Associates Ltd
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Regina, Saskatchewan
ph.(306) 721-7611

slug/bail test analysis
HVORSLEV's method

Date: 25.04.2002 | Page 2

Project: Leroy Area Aquifer Investigation

Evaluated by: ajk

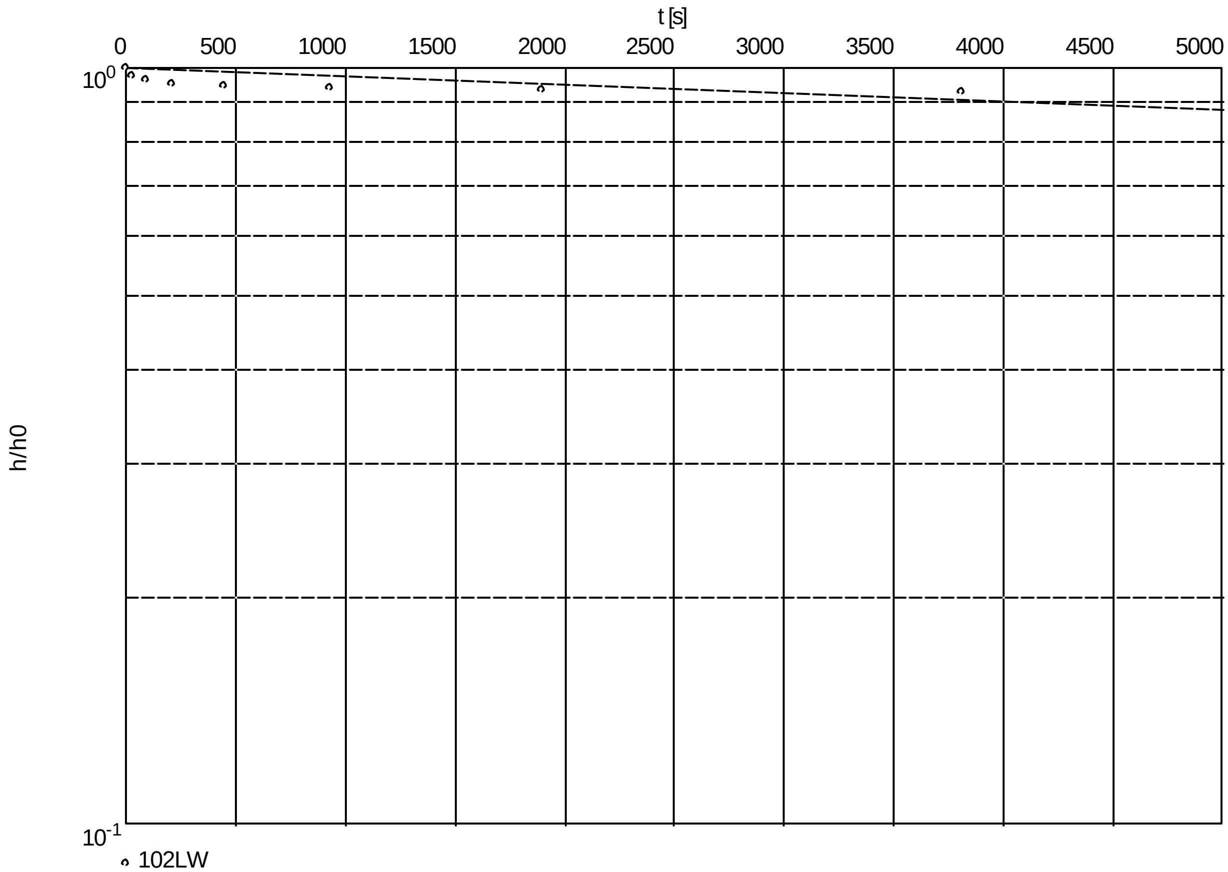
Slug Test No.	Test conducted on: 22 February 2002
101LW	101LS

Static water level: 7.330 m below datum

	Pumping test duration [s]	Water level [m]	Change in Waterlevel [m]	
1	0	7.490	0.160	
2	60	7.440	0.110	
3	120	7.430	0.100	
4	300	7.420	0.090	
5	600	7.410	0.080	
6	900	7.410	0.080	

Clifton Associates Ltd 340 Maxwell Crescent Regina, Saskatchewan ph.(306) 721-7611	slug/bail test analysis HVORSLEV's method	Date: 25.04.2002	Page 1
		Project: Leroy Area Aquifer Investigation	
		Evaluated by: ajk	

Slug Test No.	Test conducted on: 13 March 2002
102LW	



Hydraulic conductivity [m/s]: 7.02×10^{-8}

Clifton Associates Ltd 340 Maxwell Crescent Regina, Saskatchewan ph.(306) 721-7611	slug/bail test analysis HVORSLEV's method	Date: 25.04.2002	Page 2
		Project: Leroy Area Aquifer Investigation	
		Evaluated by: ajk	

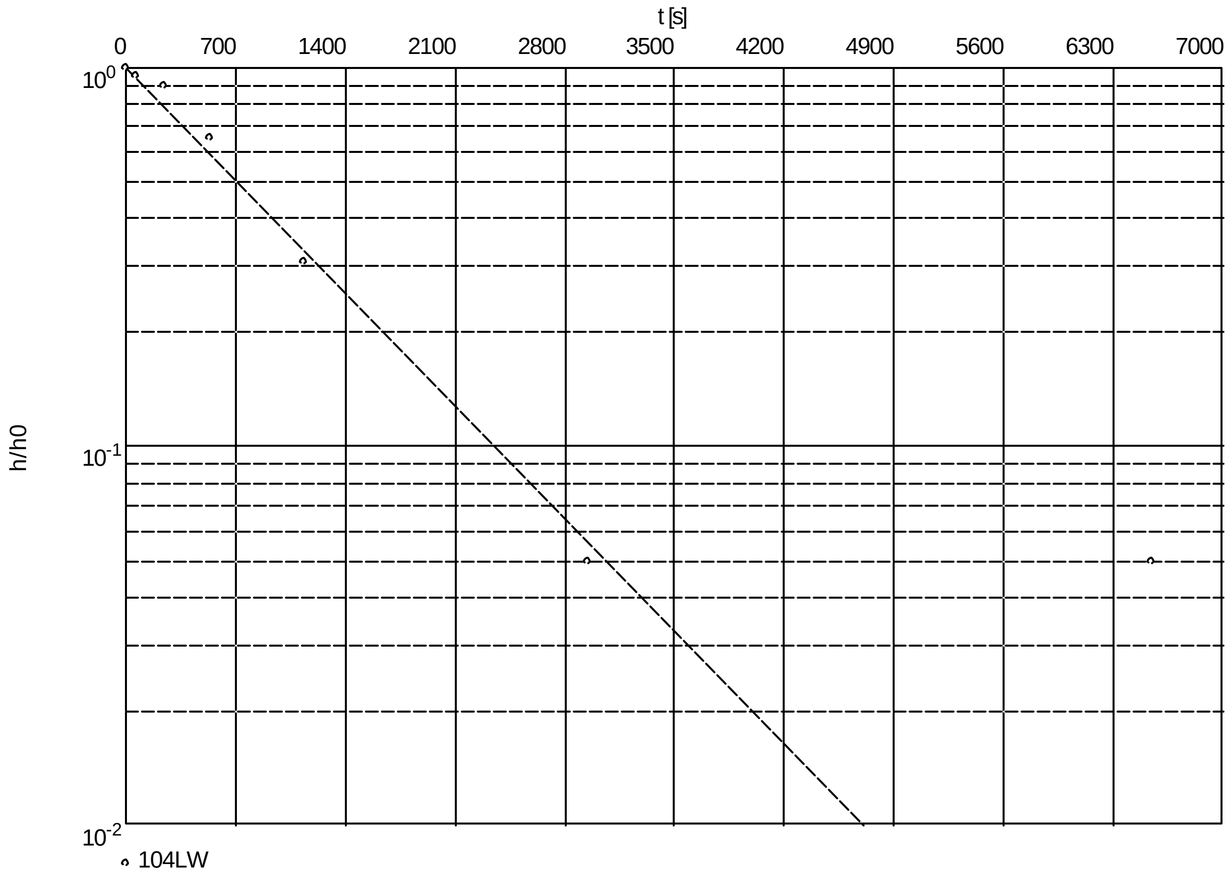
Slug Test No.	Test conducted on: 13 March 2002
102LW	102LW

Static water level: 7.100 m below datum

	Pumping test duration [s]	Water level [m]	Change in Waterlevel [m]	
1	0	78.910	71.810	
2	30	77.020	69.920	
3	90	76.290	69.190	
4	210	75.650	68.550	
5	450	75.220	68.120	
6	930	74.710	67.610	
7	1890	74.070	66.970	
8	3810	73.910	66.810	

Clifton Associates Ltd 340 Maxwell Crescent Regina, Saskatchewan ph.(306) 721-7611	slug/bail test analysis HVORSLEV's method	Date: 25.04.2002	Page 1
		Project: Leroy Area Aquifer Investigation	
		Evaluated by: ajk	

Slug Test No.	Test conducted on: 04 March 2002
104LW	



Hydraulic conductivity [m/s]: 2.70×10^{-6}

Clifton Associates Ltd 340 Maxwell Crescent Regina, Saskatchewan ph.(306) 721-7611	slug/bail test analysis HVORSLEV's method	Date: 25.04.2002	Page 2
		Project: Leroy Area Aquifer Investigation	
		Evaluated by: ajk	

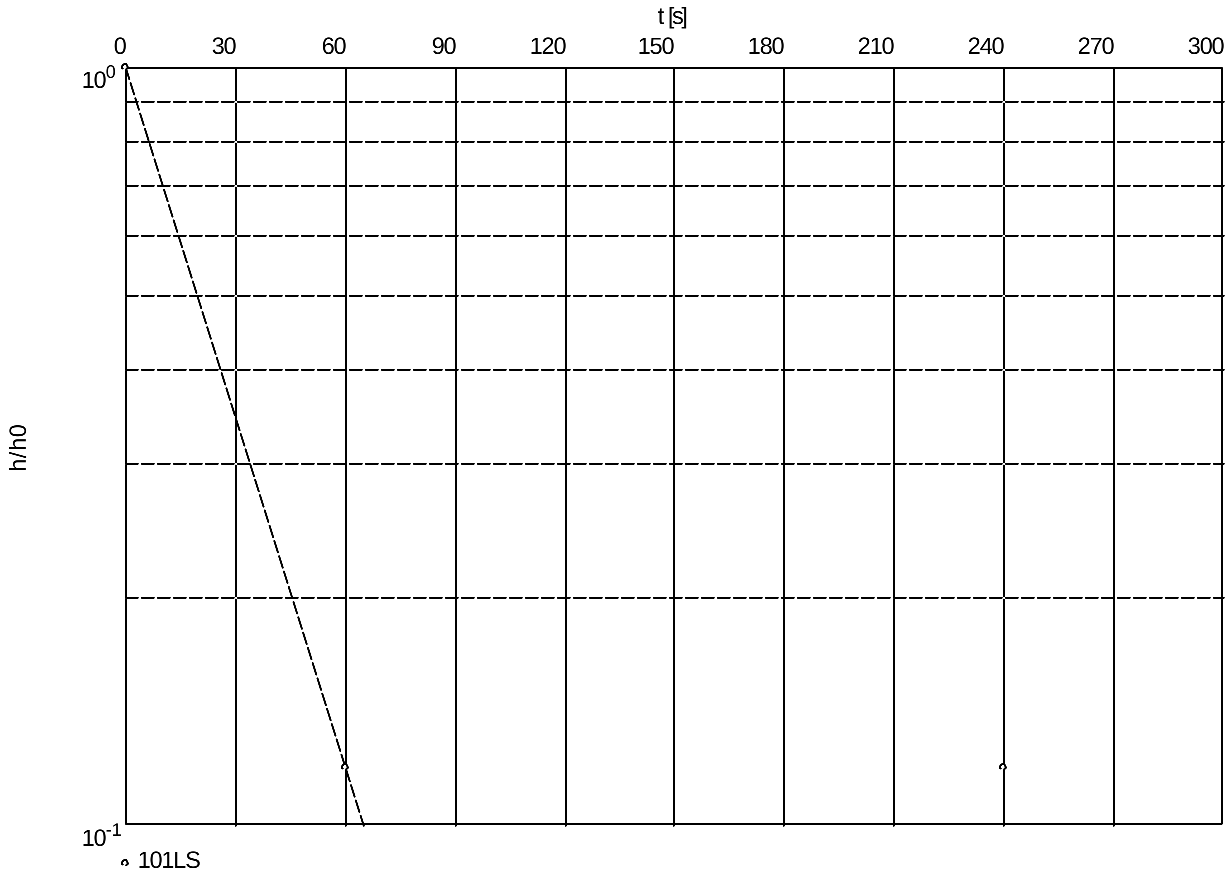
Slug Test No.	Test conducted on: 04 March 2002
104LW	104LW

Static water level: 7.330 m below datum

	Pumping test duration [s]	Water level [m]	Change in Waterlevel [m]	
1	0	71.500	64.170	
2	60	68.200	60.870	
3	240	64.540	57.210	
4	540	49.480	42.150	
5	1140	27.000	19.670	
6	2940	10.530	3.200	
7	6540	10.520	3.190	

Clifton Associates Ltd 340 Maxwell Crescent Regina, Saskatchewan ph.(306) 721-7611	slug/bail test analysis HVORSLEV's method	Date: 25.04.2002	Page 1
		Project: Leroy Area Aquifer Investigation	
		Evaluated by: ajk	

Slug Test No.	Test conducted on: 14 March 2002
101LS	



Hydraulic conductivity [m/s]: 9.77×10^{-5}

Clifton Associates Ltd 340 Maxwell Crescent Regina, Saskatchewan ph.(306) 721-7611	slug/bail test analysis HVORSLEV's method	Date: 25.04.2002	Page 2
		Project: Leroy Area Aquifer Investigation	
		Evaluated by: ajk	

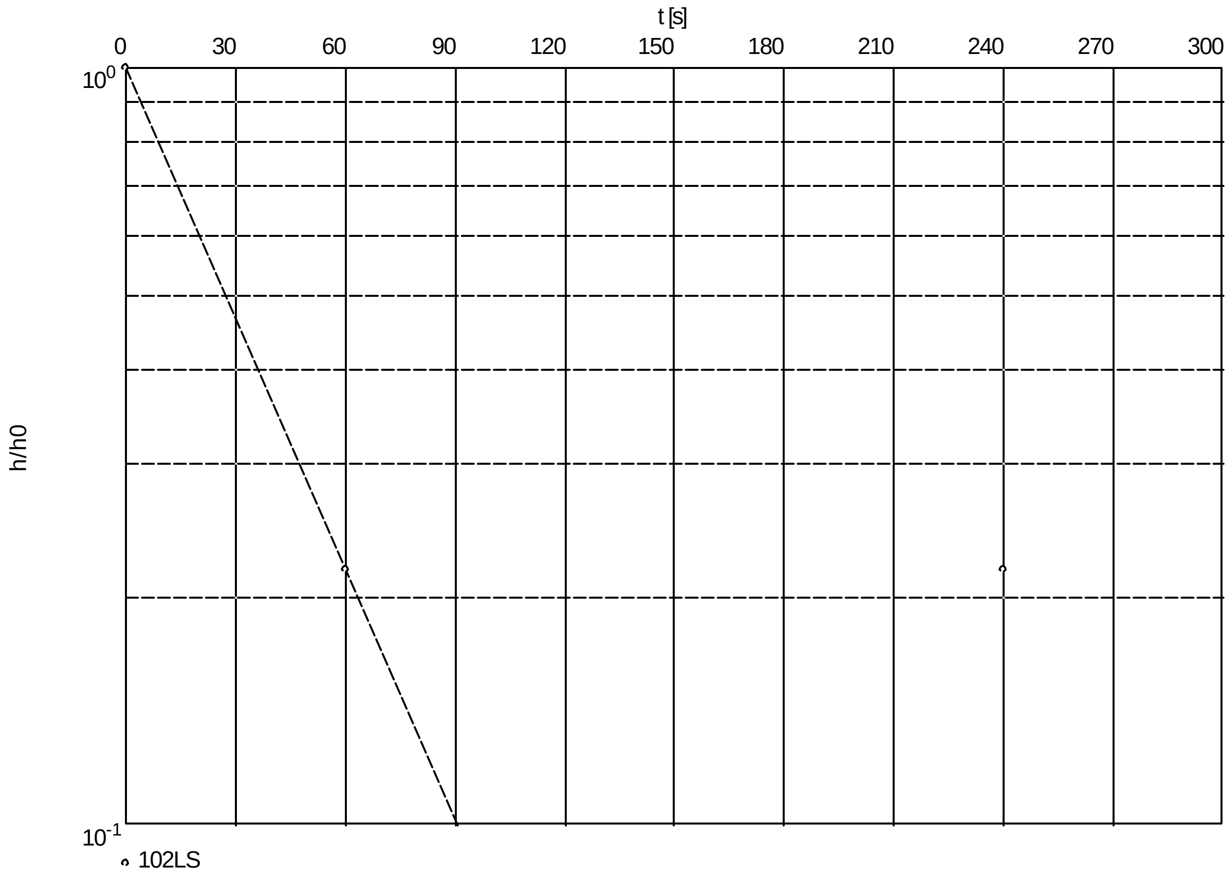
Slug Test No.	Test conducted on: 14 March 2002
101LS	101LS

Static water level: 12.280 m below datum

	Pumping test duration [s]	Water level [m]	Change in Waterlevel [m]	
1	0	12.700	0.420	
2	60	12.330	0.050	
3	240	12.330	0.050	

Clifton Associates Ltd 340 Maxwell Crescent Regina, Saskatchewan ph.(306) 721-7611	slug/bail test analysis HVORSLEV's method	Date: 25.04.2002	Page 1
		Project: Leroy Area Aquifer Investigation	
		Evaluated by: ajk	

Slug Test No.	Test conducted on: 21 March 2002
102LS	



Hydraulic conductivity [m/s]: 7.02×10^{-5}

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slug/bail test analysis
HVORSLEV's method

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Project: Leroy Area Aquifer Investigation

Evaluated by: ajk

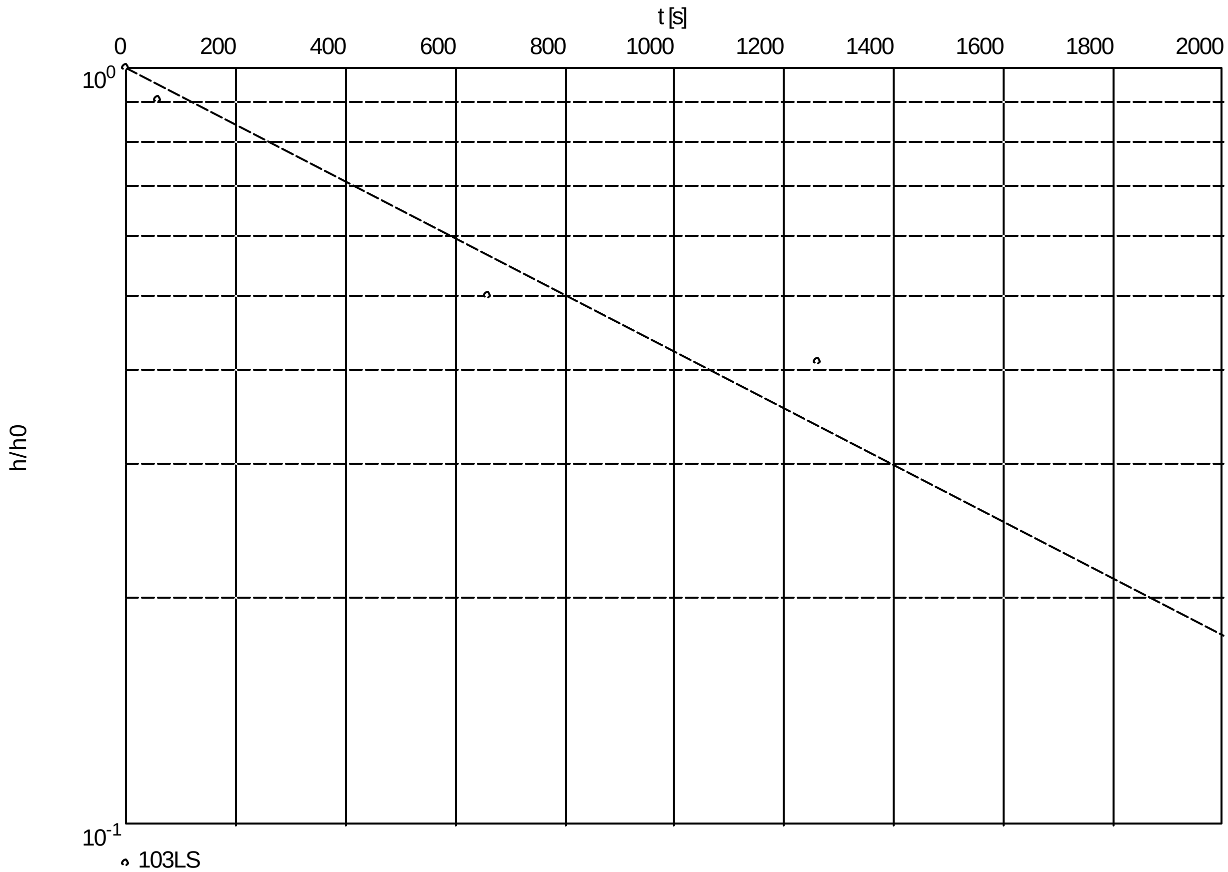
Slug Test No.	Test conducted on: 21 March 2002
102LS	102LS

Static water level: 10.340 m below datum

	Pumping test duration [s]	Water level [m]	Change in Waterlevel [m]	
1	0	10.570	0.230	
2	60	10.390	0.050	
3	240	10.390	0.050	

Clifton Associates Ltd 340 Maxwell Crescent Regina, Saskatchewan ph.(306) 721-7611	slug/bail test analysis HVORSLEV's method	Date: 25.04.2002	Page 1
		Project: Leroy Area Aquifer Investigation	
		Evaluated by: ajk	

Slug Test No.	Test conducted on: 18 March 2002
103LS	



Hydraulic conductivity [m/s]: 2.38×10^{-6}

Clifton Associates Ltd 340 Maxwell Crescent Regina, Saskatchewan ph.(306) 721-7611	slug/bail test analysis HVORSLEV's method	Date: 25.04.2002	Page 2
		Project: Leroy Area Aquifer Investigation	
		Evaluated by: ajk	

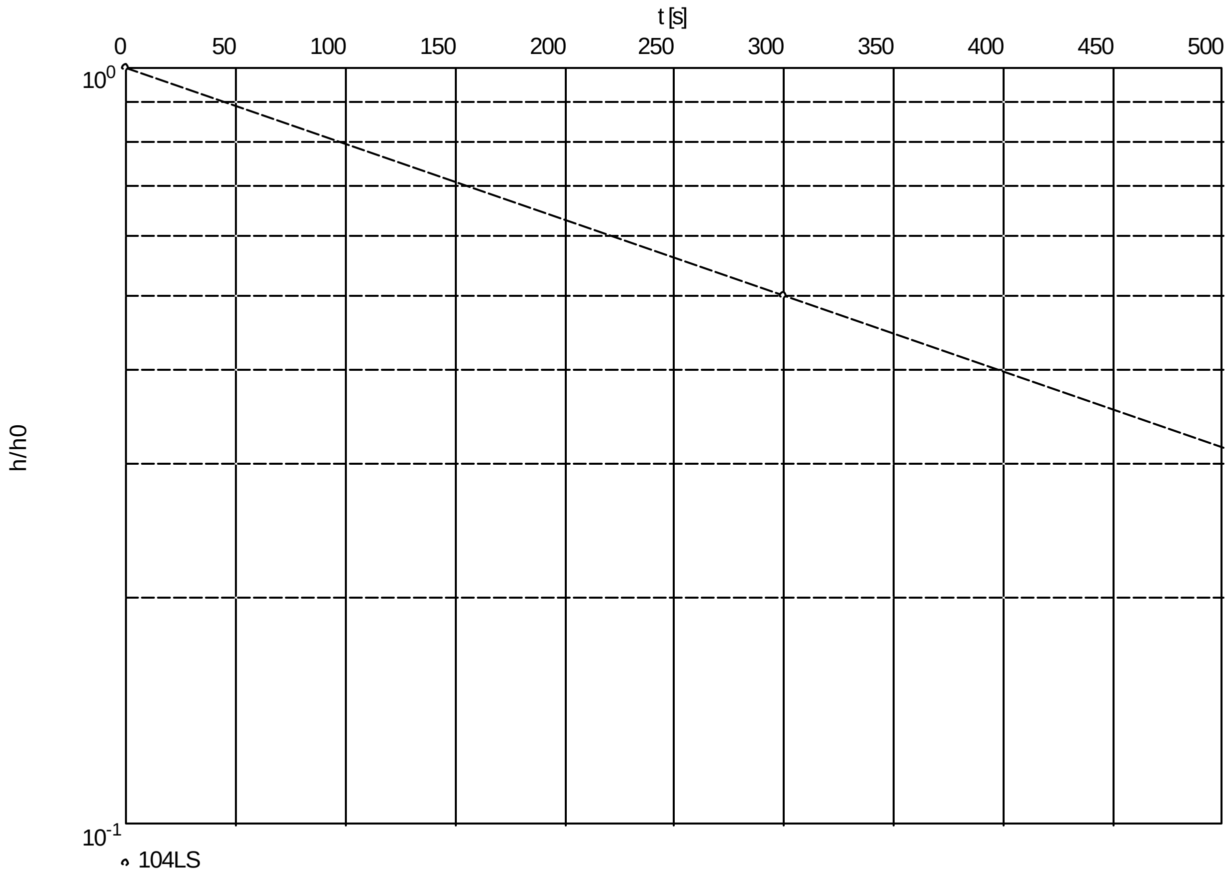
Slug Test No.	Test conducted on: 18 March 2002
103LS	103LS

Static water level: 14.230 m below datum

	Pumping test duration [s]	Water level [m]	Change in Waterlevel [m]	
1	0	14.670	0.440	
2	60	14.630	0.400	
3	660	14.450	0.220	
4	1260	14.410	0.180	

Clifton Associates Ltd 340 Maxwell Crescent Regina, Saskatchewan ph.(306) 721-7611	slug/bail test analysis HVORSLEV's method	Date: 25.04.2002	Page 1
		Project: Leroy Area Aquifer Investigation	
		Evaluated by: ajk	

Slug Test No.	Test conducted on: 19 March 2002
104LS	



Hydraulic conductivity [m/s]: 6.39×10^{-6}

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slug/bail test analysis
HVORSLEV's method

Date: 25.04.2002 | Page 2

Project: Leroy Area Aquifer Investigation

Evaluated by: ajk

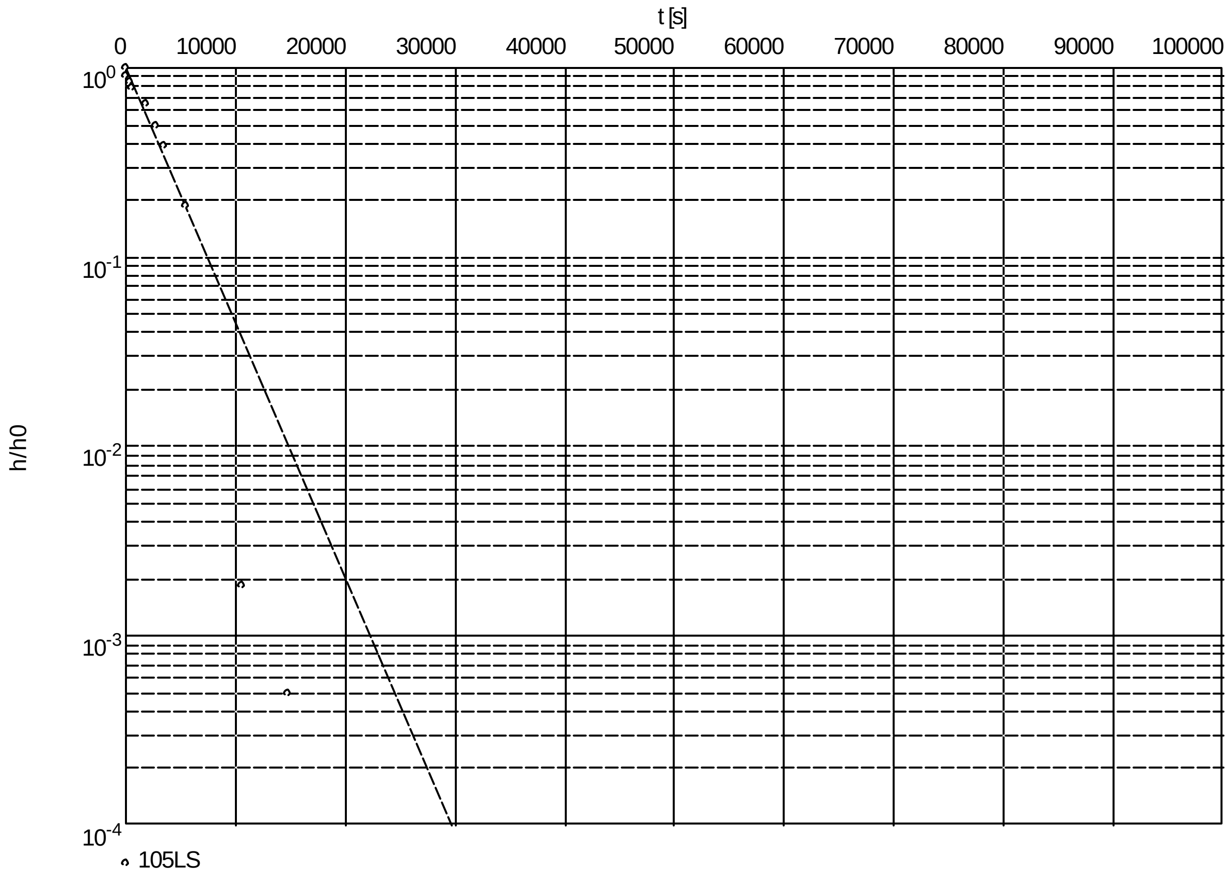
Slug Test No.	Test conducted on: 19 March 2002
104LS	104LS

Static water level: 10.500 m below datum

	Pumping test duration [s]	Water level [m]	Change in Waterlevel [m]	
1	0	10.900	0.400	
2	300	10.700	0.200	

Clifton Associates Ltd 340 Maxwell Crescent Regina, Saskatchewan ph.(306) 721-7611	slug/bail test analysis HVORSLEV's method	Date: 25.04.2002	Page 1
		Project: Leroy Area Aquifer Investigation	
		Evaluated by: ajk	

Slug Test No.	Test conducted on: 19 March 2002
105LS	



Hydraulic conductivity [m/s]: 8.55×10^{-7}

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HVORSLEV's method

Project: Leroy Area Aquifer Investigation

Evaluated by: ajk

Slug Test No.	Test conducted on: 19 March 2002
105LS	105LS

Static water level: 12.710 m below datum

	Pumping test duration [s]	Water level [m]	Change in Waterlevel [m]	
1	0	72.700	59.990	
2	60	67.800	55.090	
3	300	63.700	50.990	
4	600	59.500	46.790	
5	1800	51.600	38.890	
6	2700	42.670	29.960	
7	3480	36.070	23.360	
8	5400	24.040	11.330	
9	10500	12.820	0.110	
10	14700	12.740	0.030	
11	86400	12.710	0.000	

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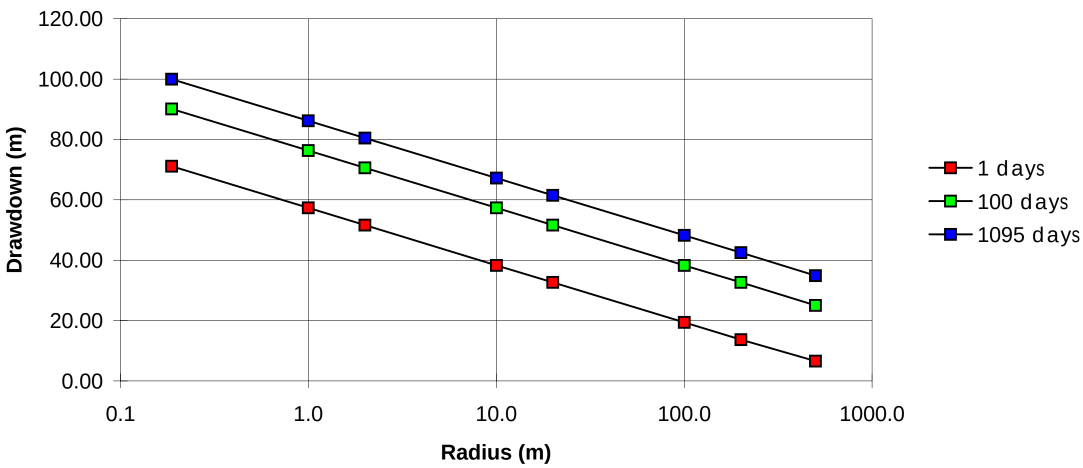
Appendix B

Figure B.1 Theis Single Well Hydraulics for 101LW

Client	PFRA	Pumpage rate	cu m/day	3760	574.4 Igpm
Project	Leroy Area Aquifer Investigation	Aquifer Thickness	m	14	
Project Number	R3215	Hydraulic Conductivit	m/sec	6.00E-05	
Date / Time	1-May-02 17:08:29	Transmissivity	sq. m/day	72.58	
By	AJK	Storage Coefficient		1.50E-04	
Comments	Average k & S from Mathius 1982	Confined Aquifer	(y/n)	y	
	Hatfield Valley Aquifer System in the Wynyard Region				

Drawdown (metres)

Radius (m) / Time (days)	**0.187**	1	**2**	10	**20**	100	200	**500**
0.1	61.63	47.81	42.09	28.82	23.11	10.05	4.93	0.57
0.2	64.49	50.66	44.95	31.68	25.97	12.80	7.39	1.71
0.5	68.27	54.44	48.73	35.46	29.74	16.51	10.92	4.20
1	71.12	57.30	51.58	38.31	32.60	19.35	13.70	6.57
10	80.62	66.79	61.08	47.81	42.09	28.82	23.11	15.60
50	87.25	73.43	67.71	54.44	48.73	35.46	29.74	22.20
100	90.11	76.29	70.57	57.30	51.58	38.31	32.60	25.05
200	92.97	79.14	73.43	60.16	54.44	41.17	35.46	27.90
500	96.75	82.92	77.21	63.94	58.22	44.95	39.23	31.68
1095	99.98	86.15	80.44	67.17	61.45	48.18	42.47	34.91



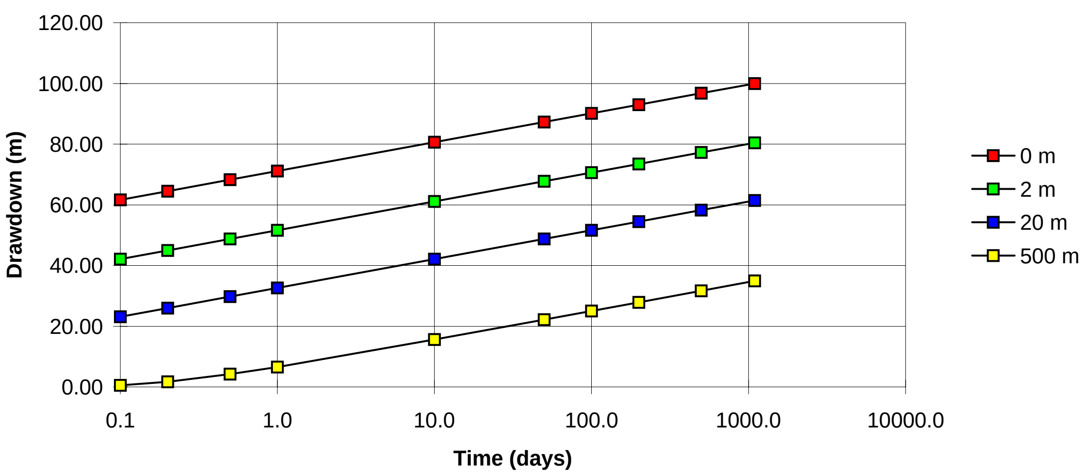
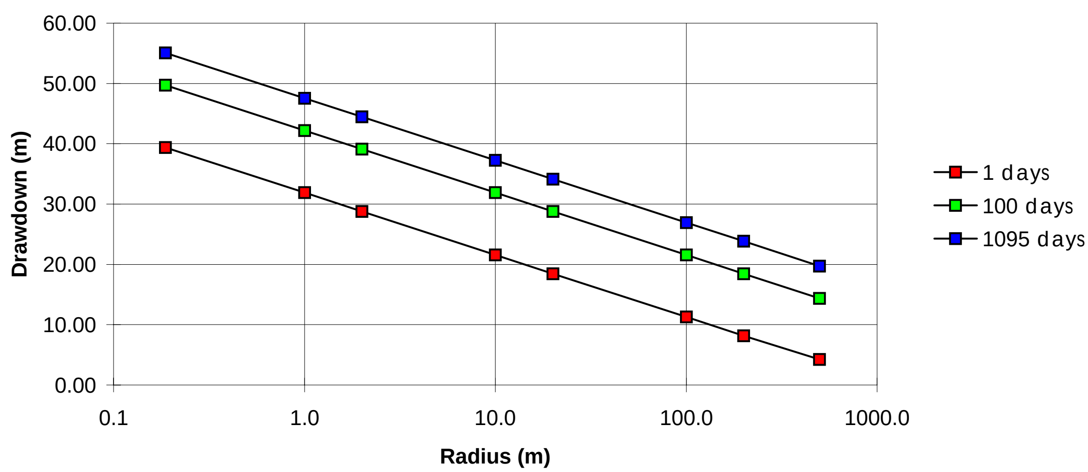


Figure B.1 Theis Single Well Hydraulics for 102LW

Client	PFRA		Pumpage rate	cu m/day	2860	436.9 Igpm
Project	Leroy Area Aquifer Investigation		Aquifer Thickness	m	19.6	
Project Number	R3215		Hydraulic Conductivit	m/sec	6.00E-05	
Date / Time	1-May-02	17:09:45	Transmissivity	sq. m/day	101.61	
By	AJK		Storage Coefficient		1.50E-04	
Comments	Average k & S from Mathius 1982		Confined Aquifer	(y/n)	y	
	Hatfield Valley Aquifer System in the Wynyard Region					

	Drawdown (metres)							
Radius (m) / Time (days)	**0.187**	1	**2**	10	**20**	100	200	**500**
0.1	34.24	26.73	23.62	16.41	13.31	6.18	3.31	0.56
0.2	35.79	28.28	25.18	17.97	14.86	7.69	4.71	1.37
0.5	37.84	30.33	27.23	20.02	16.91	9.72	6.66	2.89
1	39.40	31.89	28.78	21.57	18.47	11.26	8.18	4.25
10	44.55	37.04	33.94	26.73	23.62	16.41	13.31	9.22
50	48.16	40.65	37.54	30.33	27.23	20.02	16.91	12.81
100	49.71	42.20	39.10	31.89	28.78	21.57	18.47	14.36
200	51.26	43.75	40.65	33.44	30.33	23.12	20.02	15.91
500	53.32	45.81	42.70	35.49	32.39	25.18	22.07	17.97
1095	55.07	47.56	44.46	37.25	34.14	26.93	23.83	19.72



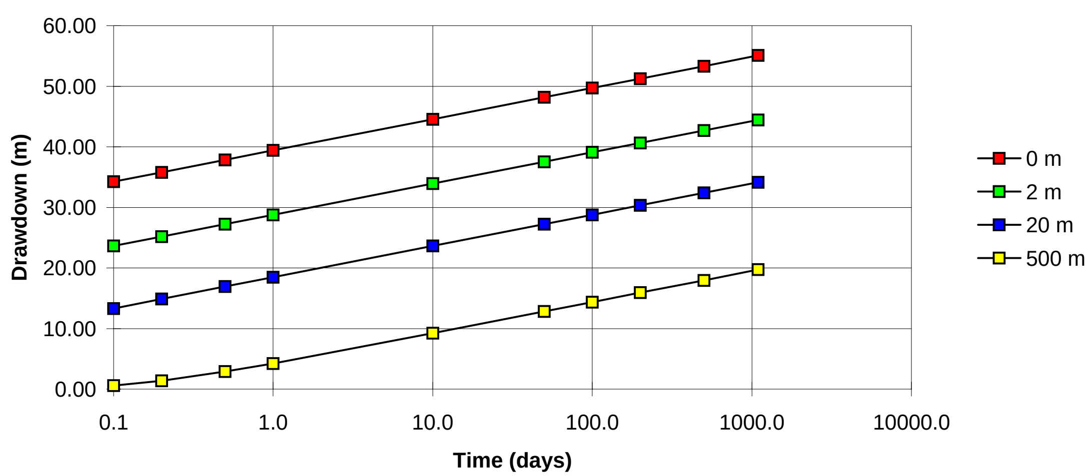
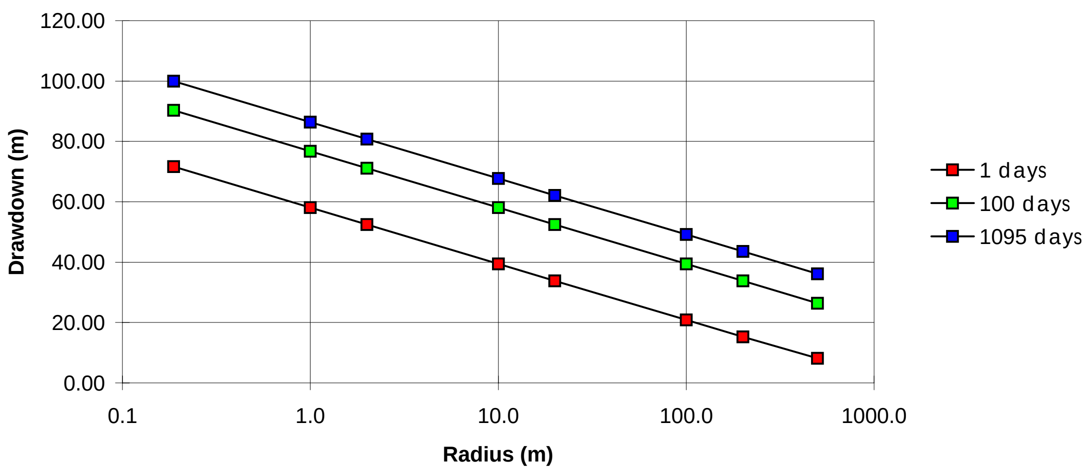


Figure B.1 Theis Single Well Hydraulics for 103LW

Client	PFRA	Pumpage rate	cu m/day	5850	893.8 Igpm
Project	Leroy Area Aquifer Investigation	Aquifer Thickness	m	22.2	
Project Number	R3215	Hydraulic Conductivit	m/sec	6.00E-05	
Date / Time	1-May-02 17:12:08	Transmissivity	sq. m/day	115.08	
By	AJK	Storage Coefficient		1.50E-04	
Comments	Average k & S from Mathius 1982	Confined Aquifer	(y/n)	y	
	Hatfield Valley Aquifer System in the Wynyard Region				

Drawdown (metres)

Radius (m) / Time (days)	**0.187**	1	**2**	10	**20**	100	200	**500**
0.1	62.34	48.77	43.16	30.14	24.54	11.65	6.42	1.22
0.2	65.14	51.58	45.97	32.95	27.34	14.38	8.97	2.79
0.5	68.85	55.28	49.67	36.65	31.05	18.05	12.52	5.64
1	71.65	58.09	52.48	39.46	33.85	20.84	15.27	8.13
10	80.96	67.40	61.79	48.77	43.16	30.14	24.54	17.16
50	87.47	73.91	68.30	55.28	49.67	36.65	31.05	23.64
100	90.28	76.71	71.11	58.09	52.48	39.46	33.85	26.44
200	93.08	79.52	73.91	60.89	55.28	42.26	36.65	29.24
500	96.79	83.22	77.62	64.60	58.99	45.97	40.36	32.95
1095	99.96	86.40	80.79	67.77	62.16	49.14	43.53	36.12



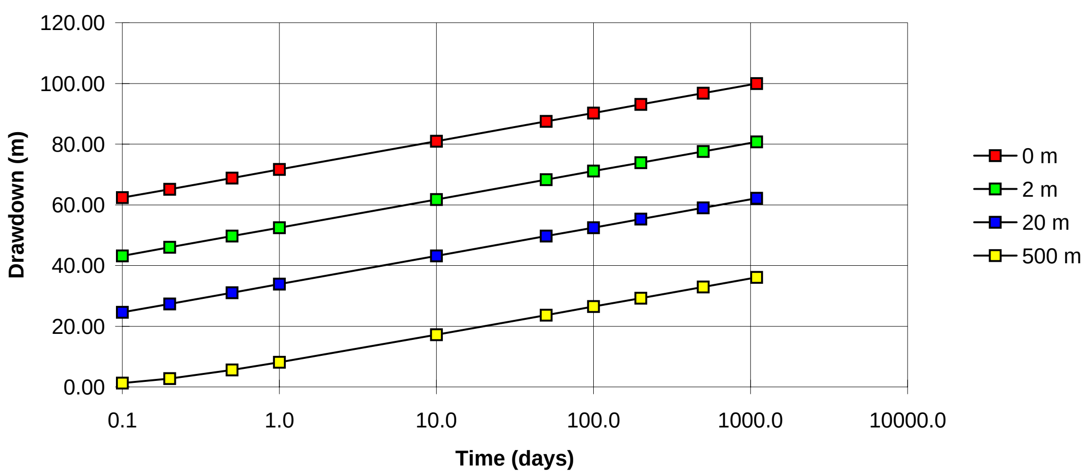
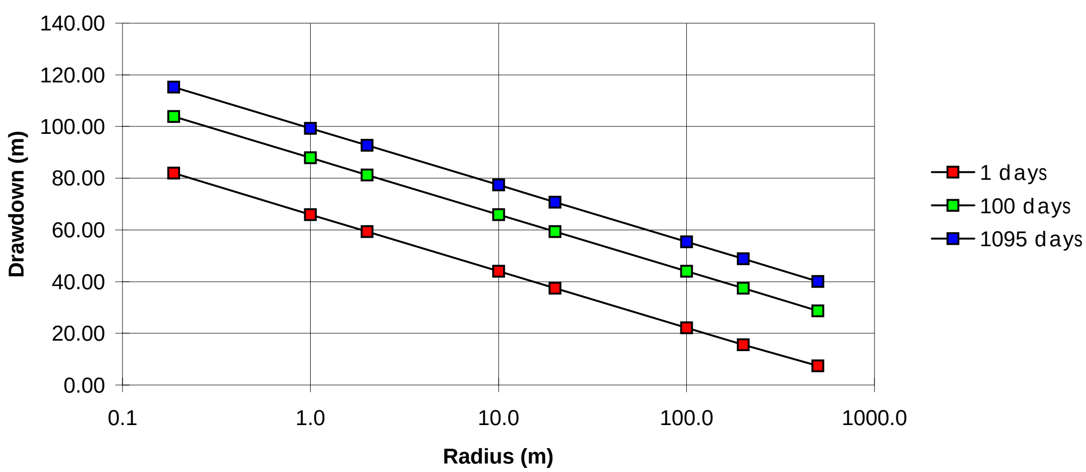


Figure B.1 Theis Single Well Hydraulics for 104LW

Client	PFRA	Pumpage rate	cu m/day	4157	635.1 Igpm
Project	Leroy Area Aquifer Investigation	Aquifer Thickness	m	13.4	
Project Number	R3215	Hydraulic Conductivit	m/sec	6.00E-05	
Date / Time	1-May-02 17:13:33	Transmissivity	sq. m/day	69.47	
By	AJK	Storage Coefficient		1.50E-04	
Comments	Average k & S from Mathius 1982	Confined Aquifer	(y/n)	y	
	Hatfield Valley Aquifer System in the Wynyard Region				

	Drawdown (metres)							
Radius (m) / Time (days)	**0.187**	1	**2**	10	**20**	100	200	**500**
0.1	70.98	55.01	48.41	33.09	26.49	11.41	5.53	0.60
0.2	74.28	58.31	51.71	36.38	29.79	14.58	8.35	1.87
0.5	78.65	62.68	56.08	40.75	34.15	18.87	12.42	4.69
1	81.95	65.98	59.38	44.05	37.45	22.14	15.62	7.41
10	92.91	76.94	70.34	55.01	48.41	33.09	26.49	17.82
50	100.58	84.61	78.01	62.68	56.08	40.75	34.15	25.43
100	103.88	87.91	81.31	65.98	59.38	44.05	37.45	28.73
200	107.18	91.21	84.61	69.28	62.68	47.35	40.75	32.02
500	111.54	95.57	88.97	73.64	67.04	51.71	45.11	36.38
1095	115.27	99.31	92.70	77.38	70.77	55.45	48.84	40.12



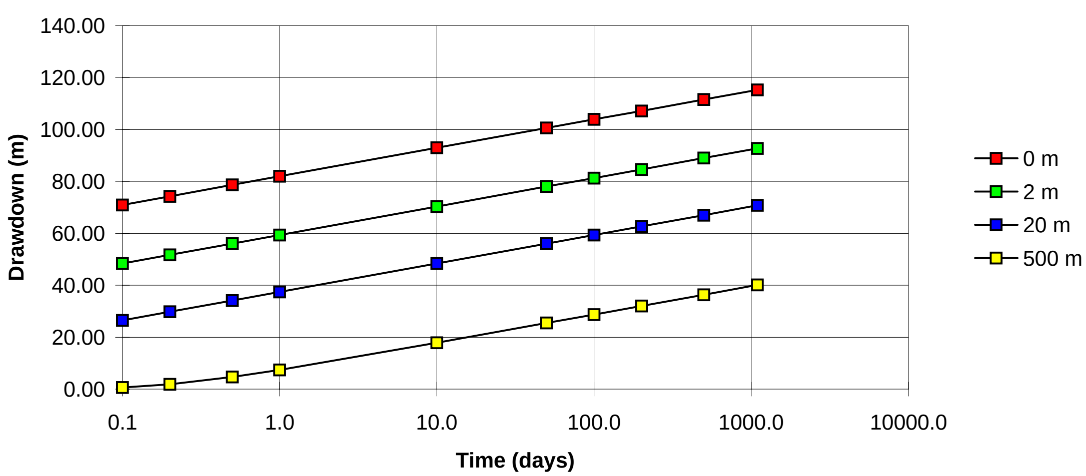
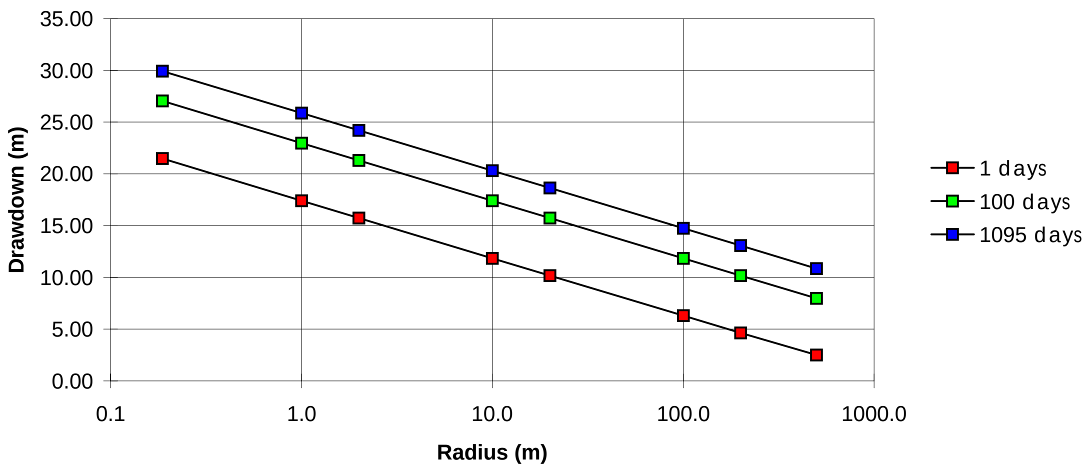


Figure B.1 Theis Single Well Hydraulics for 101LS

Client	PFRA		Pumpage rate	cu m/day	1850	282.6 Igpm
Project	Leroy Area Aquifer Investigation		Aquifer Thickness	m	23.5	
Project Number	R3215		Hydraulic Conductivit	m/sec	6.00E-05	
Date / Time	1-May-02	16:54:24	Transmissivity	sq. m/day	121.82	
By	AJK		Storage Coefficient		1.50E-04	
Comments	Average k & S from Mathius 1982		Confined Aquifer	(y/n)	y	
	Hatfield Valley Aquifer System in the Wynyard Region					

	Drawdown (metres)							
Radius (m) / Time (days)	**0.187**	1	**2**	10	**20**	100	200	**500**
0.1	18.69	14.64	12.96	9.07	7.40	3.55	1.98	0.40
0.2	19.53	15.48	13.80	9.91	8.24	4.37	2.74	0.88
0.5	20.64	16.58	14.91	11.02	9.34	5.46	3.81	1.74
1	21.47	17.42	15.75	11.86	10.18	6.30	4.63	2.49
10	24.26	20.20	18.53	14.64	12.96	9.07	7.40	5.19
50	26.20	22.15	20.47	16.58	14.91	11.02	9.34	7.13
100	27.04	22.99	21.31	17.42	15.75	11.86	10.18	7.97
200	27.88	23.82	22.15	18.26	16.58	12.69	11.02	8.80
500	28.98	24.93	23.26	19.37	17.69	13.80	12.13	9.91
1095	29.93	25.88	24.20	20.31	18.64	14.75	13.07	10.86



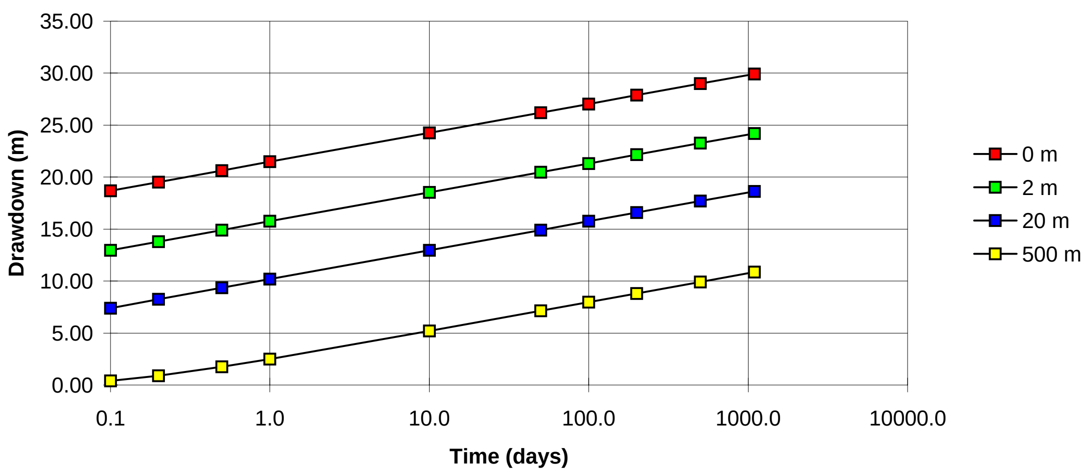
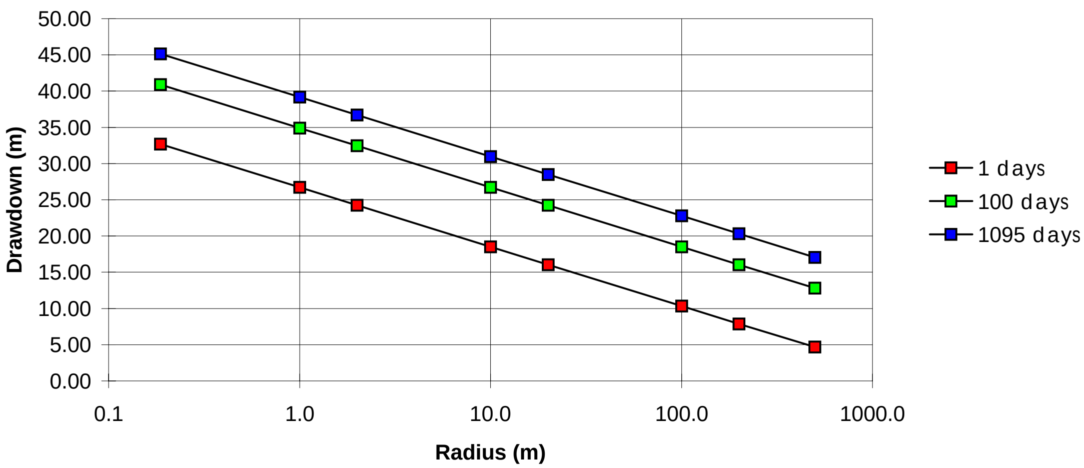


Figure B.1 Theis Single Well Hydraulics for 102LS

Client	PFRA		Pumpage rate	cu m/day	4950	756.3 Igpm
Project	Leroy Area Aquifer Investigation		Aquifer Thickness	m	42.7	
Project Number	R3215		Hydraulic Conductivit	m/sec	6.00E-05	
Date / Time	1-May-02	16:58:39	Transmissivity	sq. m/day	221.36	
By	AJK		Storage Coefficient		1.50E-04	
Comments	Average k & S from Mathius 1982		Confined Aquifer	(y/n)	y	
	Hatfield Valley Aquifer System in the Wynyard Region					

	Drawdown (metres)							
Radius (m) / Time (days)	**0.187**	1	**2**	10	**20**	100	200	**500**
0.1	28.59	22.62	20.15	14.43	11.96	6.26	3.88	1.18
0.2	29.82	23.85	21.39	15.66	13.19	7.48	5.06	2.09
0.5	31.45	25.48	23.02	17.29	14.82	9.10	6.65	3.51
1	32.68	26.72	24.25	18.52	16.06	10.33	7.87	4.67
10	36.78	30.81	28.35	22.62	20.15	14.43	11.96	8.70
50	39.65	33.68	31.21	25.48	23.02	17.29	14.82	11.56
100	40.88	34.91	32.45	26.72	24.25	18.52	16.06	12.79
200	42.11	36.15	33.68	27.95	25.48	19.76	17.29	14.03
500	43.74	37.78	35.31	29.58	27.11	21.39	18.92	15.66
1095	45.14	39.17	36.70	30.98	28.51	22.78	20.31	17.05



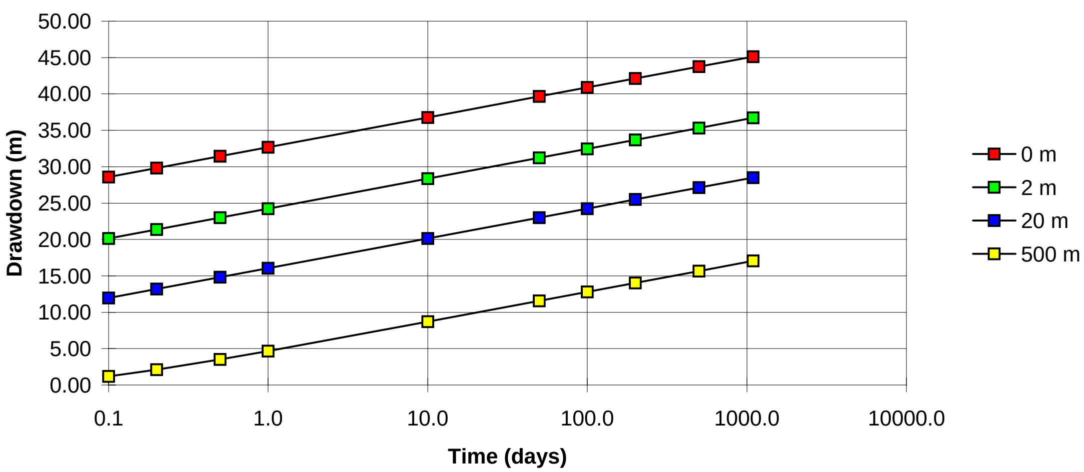
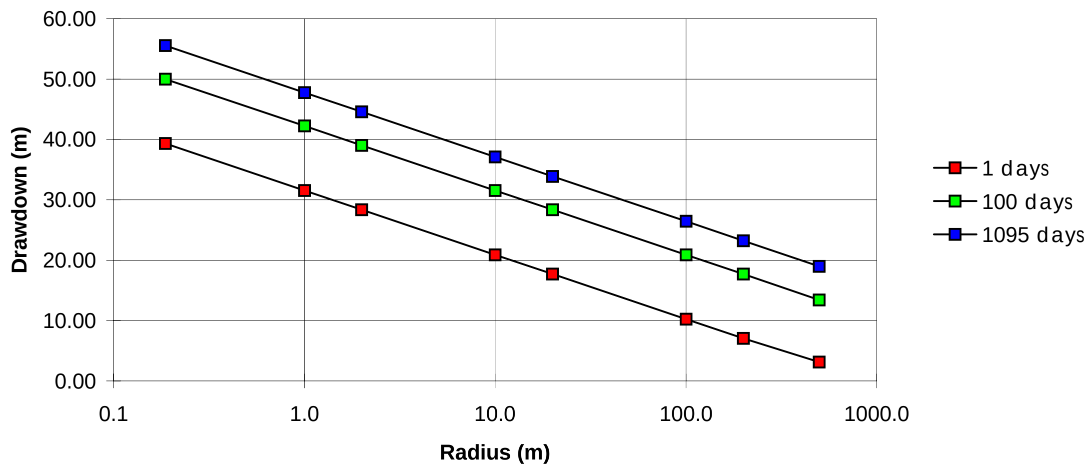


Figure B.1 Theis Single Well Hydraulics for 103LS

Client	PFRA	Pumpage rate	cu m/day	1600	244.4 Igpm
Project	Leroy Area Aquifer Investigation	Aquifer Thickness	m	10.6	
Project Number	R3215	Hydraulic Conductivit	m/sec	6.00E-05	
Date / Time	1-May-02 17:00:26	Transmissivity	sq. m/day	54.95	
By	AJK	Storage Coefficient		1.50E-04	
Comments	Average k & S from Mathius 1982	Confined Aquifer	(y/n)	y	
	Hatfield Valley Aquifer System in the Wynyard Region				

Radius (m) / Time (days)	**0.187**	1	**2**	10	**20**	100	200	**500**
	Drawdown (metres)							
0.1	33.99	26.22	23.01	15.56	12.35	5.04	2.26	0.17
0.2	35.60	27.83	24.62	17.16	13.95		3.58	0.65
0.5	37.72	29.95	26.74	19.28	16.07	8.64	5.52	1.88
1	39.33	31.56	28.35	20.89	17.68	10.23	7.07	3.14
10	44.66	36.89	33.68	26.22	23.01	15.56	12.35	8.13
50	48.39	40.62	37.41	29.95	26.74	19.28	16.07	11.83
100	50.00	42.23	39.02	31.56	28.35	20.89	17.68	13.43
200	51.61	43.84	40.62	33.17	29.95	22.50	19.28	15.04
500	53.73	45.96	42.75	35.29	32.08	24.62	21.41	17.16
1095	55.55	47.78	44.56	37.10	33.89	26.43	23.22	18.98



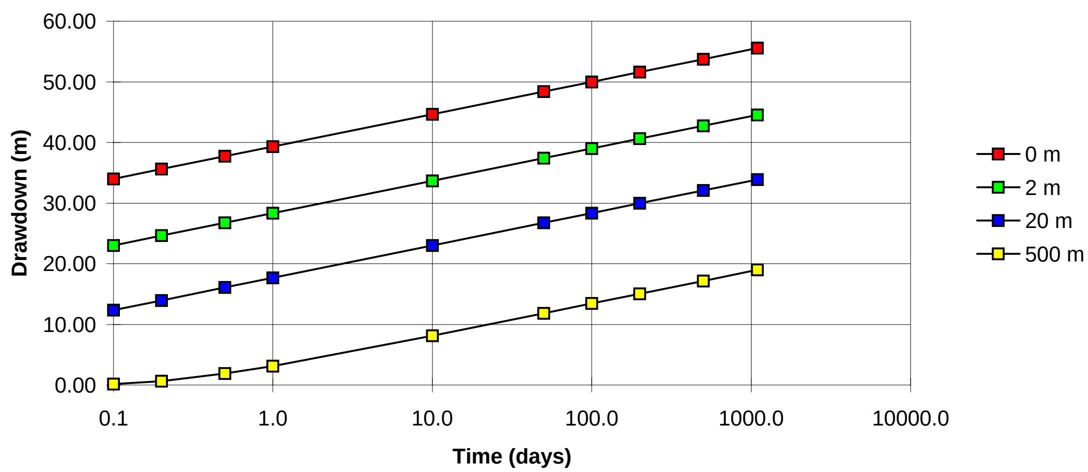
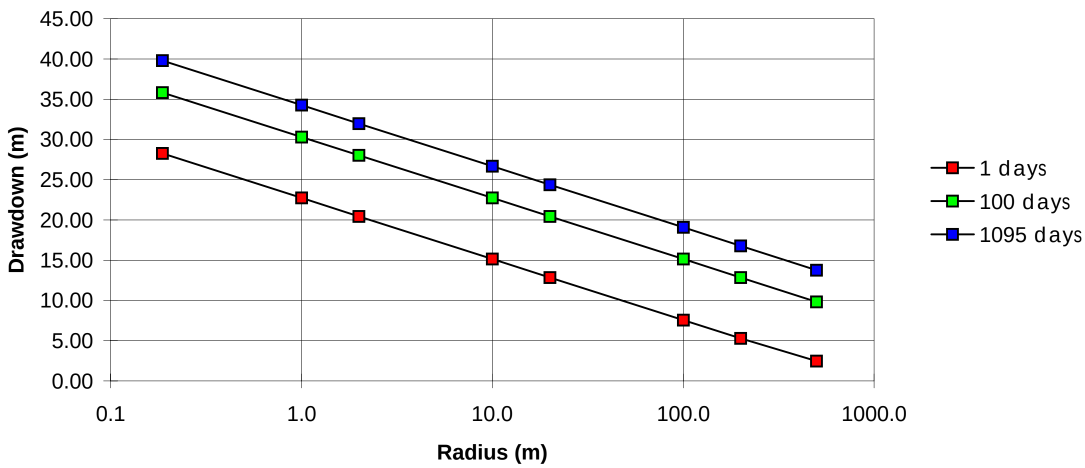


Figure B.1 Theis Single Well Hydraulics for 104LS

Client	PFRA	Pumpage rate	cu m/day	1342	205.0 Igpm
Project	Leroy Area Aquifer Investigation	Aquifer Thickness	m	12.5	
Project Number	R3215	Hydraulic Conductivit	m/sec	6.00E-05	
Date / Time	1-May-02 17:05:01	Transmissivity	sq. m/day	64.80	
By	AJK	Storage Coefficient		1.50E-04	
Comments	Average k & S from Mathius 1982	Confined Aquifer	(y/n)	y	
	Hatfield Valley Aquifer System in the Wynyard Region				

Drawdown (metres)

Radius (m) / Time (days)	**0.187**	1	**2**	10	**20**	100	200	**500**
0.1	24.45	18.92	16.64	11.34	9.05	3.84	1.82	0.18
0.2	25.59	20.07	17.78	12.48	10.19	4.93	2.79	0.59
0.5	27.10	21.58	19.29	13.99	11.70	6.42	4.19	1.54
1	28.25	22.72	20.43	15.13	12.84	7.55	5.29	2.46
10	32.04	26.51	24.23	18.92	16.64	11.34	9.05	6.05
50	34.69	29.17	26.88	21.58	19.29	13.99	11.70	8.69
100	35.83	30.31	28.02	22.72	20.43	15.13	12.84	9.83
200	36.98	31.45	29.17	23.86	21.58	16.27	13.99	10.97
500	38.49	32.96	30.68	25.37	23.09	17.78	15.50	12.48
1095	39.78	34.25	31.97	26.66	24.38	19.07	16.79	13.77



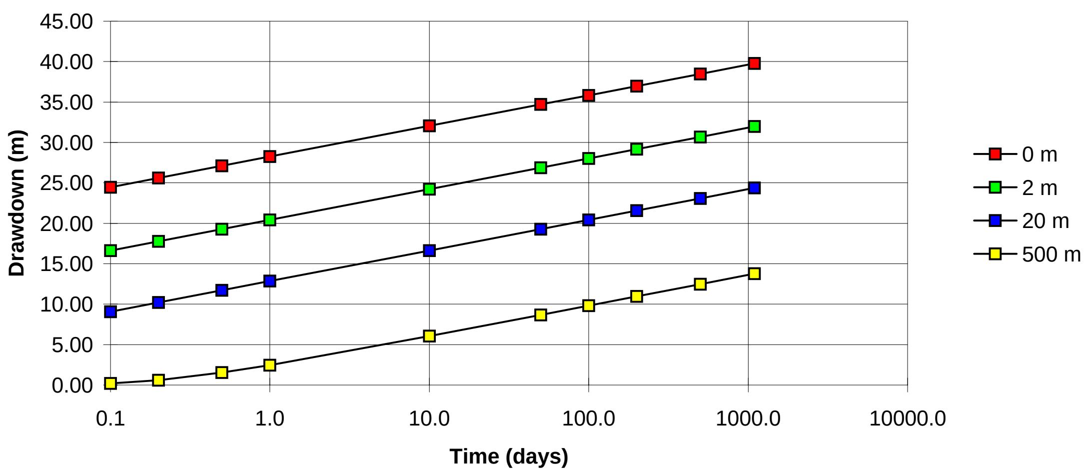
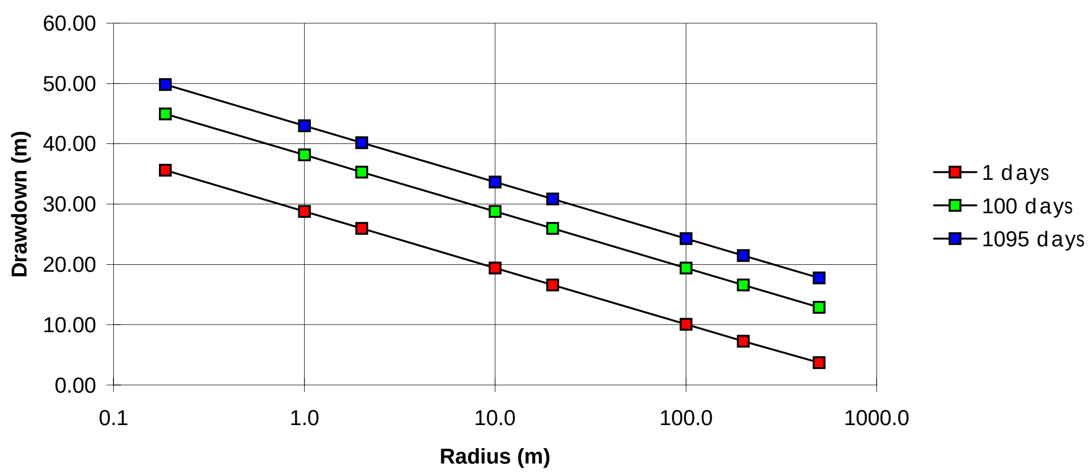
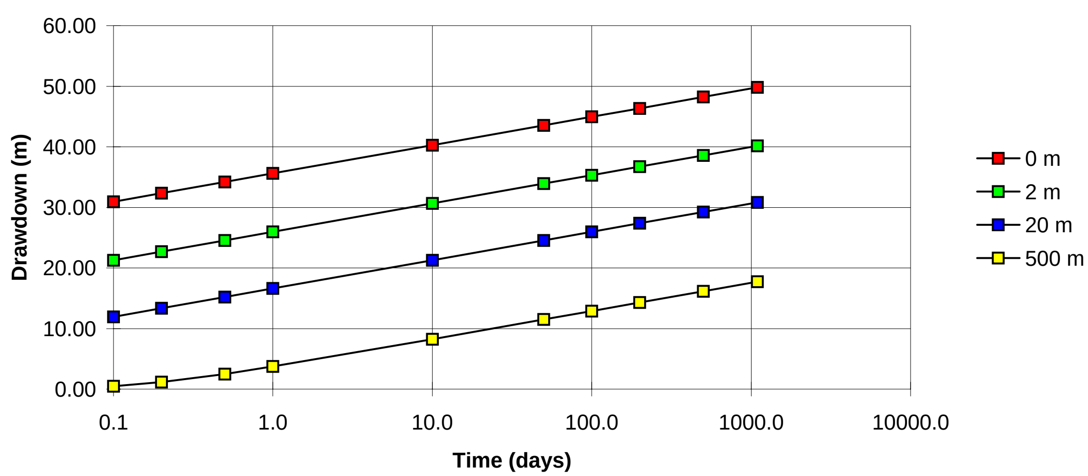


Figure B.1 Theis Single Well Hydraulics for 105LS

Client	PFRA	Pumpage rate	cu m/day	2422	370.0 Igpm
Project	Leroy Area Aquifer Investigation	Aquifer Thickness	m	18.3	
Project Number	R3215	Hydraulic Conductivit	m/sec	6.00E-05	
Date / Time	1-May-02 17:06:34	Transmissivity	sq. m/day	94.87	
By	AJK	Storage Coefficient		1.50E-04	
Comments	Average k & S from Mathius 1982	Confined Aquifer	(y/n)	y	
	Hatfield Valley Aquifer System in the Wynyard Region				

Drawdown (metres)								
Radius (m) / Time (days)	**0.187**	1	**2**	10	**20**	100	200	**500**
0.1	30.92	24.10	21.29	14.75	11.93	5.47	2.88	0.45
0.2	32.32	25.51	22.69	16.16	13.34	6.84	4.14	1.15
0.5	34.19	27.37	24.56	18.02	15.20	8.68	5.91	2.50
1	35.59	28.78	25.96	19.43	16.61	10.08	7.28	3.73
10	40.27	33.46	30.64	24.10	21.29	14.75	11.93	8.23
50	43.54	36.73	33.91	27.37	24.56	18.02	15.20	11.48
100	44.95	38.14	35.32	28.78	25.96	19.43	16.61	12.89
200	46.36	39.55	36.73	30.19	27.37	20.83	18.02	14.29
500	48.22	41.41	38.59	32.05	29.23	22.69	19.88	16.16
1095	49.81	43.00	40.18	33.64	30.83	24.29	21.47	17.75





Clifton Associates Ltd. engineering science technology	**Appendix C**

Table 1
Leroy Water Quality

Source ID	Name	Quarter	Section	Township	Range	M	pH	Iron	Potassium	Magnesium	Manganese	Molybdenum	Sodium	Sulfate	Alkalinity	DOx	AfterNH4N	AfterNO3NO2N	AfterColour
WA00200	Ken Schoettler	SW1/4	33	35	19	2	7.24	5.7	15	95	0.19	0.025	31	480	400	0.12	0.392	0.122	10.759
WA00300	Leonard Krieger	SE1/4	25	34	19	2	6.98	0.12	48	85	0.35	0.01	28	340	368	1.91	0.013	0.258	6.202
WA00400	Roger Laybourne	SE1/4	25	34	19	2	7.18	0.11	3.7	98	0.18	0.004	29	150	540		0.012	0.03	12.531
WA00502	Craig & Charlene Hanson	SE1/4	17	35	19	2	7.29	0.86	22	86	0.66	0.002	770	1820	352	0.12	0.814	0.703	3.671
WA00601	Stan Gorden	SW1/4	9	35	19	2	7.9	0.4	15	430	0.08	0.014	450	2420	470	3.8	0.013	8.035	9.366
WA00602	Stan Gordon	SW1/4	9	35	19	2	7.13	0.019	16	340	0.008	0.006	150	1760	324	4.5	0.014	10.482	3.671
WA00700	Calvin Porten	NW1/4	8	35	19	2	7.57	7.3	20	100	0.39	0.027	330	1380	328	1.09	1.536	0.03	10.632
WA00702	Calvin Porten	NW1/4	8	35	19	2	7.48	5	19	100	0.52	0.017	360	1360	320	1.19	1.48	0.045	30.884
WA00800	Erna Dotschkat	NW1/4	13	34	20	2	7.24	2.1	7.4	24	0.21	0.004	10	83	348	12.5	0.329	0.019	3.038
WA01000	Robert Hamilton	NW1/4	5	34	19	2	7.08	0.25	14	97	0.14	0.005	49	520	516	4.8	0.011	0.202	5.443
WA01100	David Arnst	SW1/4	2	34	19	2	7.35	1	13	50	0.33	0.003	430	970	330	1	0.501	0.956	9.366
WA01200	Walter Block	NE1/4	11	34	20	2	6.75	0.012	39	370	0.36	0.009	70	550	796		0.403	98.905	5.316
WA01300	Donavon Block	NE1/4	2	34	20	2	6.68	13	25	230	0.2	0.014	51	1510	514	0.13	1.6	0.017	3.164
WA01400	Ernest Amendt	NE1/4	27	34	19	2	7.06	0.64	9.2	140	0.67	0.001	26	540	327	0.28	0.01	0.029	11.518
WA01500	L &T Fetter	NW1/4	22	34	19	2	6.78	0.046	11	170	0.017	0.005	21	500	330	0.62	0.012	44.261	7.468
WA01600	K and S Lissel	SW1/4	27	34	20	2	6.84	1.5	19	300	0.46	0.007	45	1740	414	0.31	0.321	1.047	10.379
WA01702	Donald Lissel	SW1/4	36	34	20	2	7.02	2.6	21	420	0.6	0.011	210	1960	438	0.21	0.038	0.055	5.063
WA02001	Ewalt Bach	NE1/4	2	34	20	2	7.92	1	7.2	54	0.001	-0.001	21	71	268		0.012	20.129	7.468
WA02002	Ewalt Bach	NE1/4	2	34	20	2	7.44	2.3	12	32	0.31	0.006	210	460	318	4.64	0.014	1.407	51.641
WA02100	Leon Holfeld	NW1/4	21	34	19	2	7.03	0.2	7.5	170	0.014	-0.001	23	270	425	1.15	0.011	68.338	4.43
WA02300	Norman Otsig	NW1/4	33	35	19	2	7.21	0.31	11	160	0.13	0.008	36	470	380	0.54	0.012	57.193	21.77
WA02400	Ross Barclay	NW1/4	15	35	19	2	7.49	0.044	10	86	0.01	-0.001	32	430	264	4.8	0.014	0.144	24.555
WA02600	Ron and Sandra Kients	NE1/4	13	35	19	2	7.23	0.036	81	98	0.021	0.002	51	220	384		0.011	80.258	5.822
WA02800	Bernard Jansen	NE1/4	10	35	19	2	8.34	3.6	19	120	0.69	0.008	690	1910	448		5.708	0.016	9.493
WA03200	Dale Johnston	NE1/4	12	36	19	2	6.95	6	20	170	0.16	0.003	260	890	700	1.28	0.015	1.365	11.265
WA03300	Joe Behne	SE1/4	16	36	19	2	6.78	0.032	13	310	0.048	0.001	96	1160	486		0.013	88.196	37.339
WA03400	Pat Gabriel	SE1/4	21	36	19	2	7.05	0.015	11	190	0.022	-0.001	42	300	548		0.032	46.204	17.087
WA03500	Ken Seier	SW1/4	20	36	19	2	6.95	1.4	21	290	0.36	0.026	300	2110	405	0.37	0.014	35.679	41.389
WA03600	Ernest Schoettler	NW1/4	5	36	19	2	7.01	0.16	14	77	0.12	0.018	41	490	412	0.56	0.013	0.131	14.809
WA03601	Ernest Schoettler	NW1/4	5	36	19	2	7.07	0.09	180	180	0.35	-0.001	270	600	766	0.44	0.239	85.276	5.189
WA03700	Anthony and Mary Morhart	NE1/4	5	36	19	2	7.16	0.062	14	240	0.005	0.002	100	1390	354	2.49	0.013	97.152	36.706
WA03800	Ralph Leoffler	NE1/4	27	35	19	2	6.98	0.044	23	290	0.019	0.013	73	1570	298		0.042	33.79	9.619
WA03900	D. Bader	NW1/4	3	36	19	2	7	0.049	68	440	0.2	0.006	300	2020	660		0.015	59.05	12.657
WA04000	Brian Bader	SW1/4	3	36	19	2	7.17	0.25	14	330	0.63	0.002	99	1740	364	2.17	0.023	0.041	15.695
WA04100	Debbie Fetter	SE1/4	36	35	19	2	7.55	0.042	15	110	0.001	0.005	39	340	326	6.68	0.015	18.496	5.949
WA04200	Calvin & Joanne Buhs	NW1/4	36	35	19	2	7.39	8.5	24	130	0.18	0.035	450	1670	514		1.755	1.857	24.808
WA04300	Richard Pitka	NW1/4	12	36	20	2	7.03	1.3	31	370	0.32	0.005	130	1480	628		0.018	52.356	9.999
WA04400	E.L.& Murray Steffenson	SW1/4	7	35	19	2	7.03	3.6	25	150	0.78	0.007	260	1630	360	0.13	1.593	0.097	7.468
WA04500	Ronald & Debra Moore	SE1/4	26	35	20	2	7.23	2	20	160	0.14	-0.001	170	990	548	0.32	3.424	4.301	6.835
WA04600	Cecilia Bendil	SW1/4	2	36	20	2	6.93	0.14	13	120	1.9	0.002	31	550	468	0.11	0.073	14.764	10.252
WA04700	John Wilger	NE1/4	26	36	19	2	7.11	0.55	13	110	2.2	0.003	110	730	422		0.84	0.082	8.48
WA04800	David & Kari Moore	NE1/4	26	35	19	2	7.12	5.4	17	120	0.66	-0.001	100	860	476	1.28	3.127	0.043	12.024
WA05000		NW1/4	25	36	19	2	7.3	4.5	13	470	0.22	0.011	100	2110	370		0.016	93.549	7.721
WA05100	Dan Boschner	NE1/4	35	36	20	2	7.16	0.11	24	300	0.007	0.004	85	1070	500		0.013	43.524	19.619
WA05200	Harold Pitka	NW1/4	21	36	19	2	7.18	1.4	21	110	0.21	0.026	52	690	342	0.22	0.013	0.204	29.365
WA05300	Dave Thiemen	SE1/4	20	36	20	2	7.28	0.22	13	330	0.051	-0.001	110	1370	386		0.015	217.788	21.138
WA05500	Gerald McEachern	SE1/4	27	34	21	2	7.34	7.4	21	170	0.57	0.012	390	1730	412	0.12	2.54	0.062	19.492
WA05600	Bernard Dodd	SE1/4	9	34	21	2	6.83	0.022	13	78	0.008	-0.001	13	350	368	3.51	0.014	12.05	6.329
WA05700	Dave Nakoneshny	SE1/4	9	34	21	2	6.66	0.023	12	160	0.002	0.002	36	690	436	0.96	0.018	35.013	11.518
WA05800	Jerome Dunne	NE1/4	26	34	21	2	7.23	5.2	21	120	0.33	0.014	450	1580	426		1.275	0.178	12.91
WA06000	Randolph Classen	NW1/4	33	36	20	2	7.12	4.1	20	110	2.6	-0.001	82	640	408	6.9	0.017	0.117	19.745
WA06100	Jean & Gary Volden	NW1/4	6	35	19	2	7.21	8.7	21	100	0.51	0.015	220	1130	400	0.8	1.529	0.016	18.733
WA06300	Leonard Athmer	NW1/4	36	36	19	2	6.92	2	13	140	1.8	0.005	120	900	430		1.129	0.091	12.277
WA06400	Roger Pomedli	SW1/4	35	36	19	2	7.05	0.16	17	140	1.8	0.009	180	990	502		0.743	4.042	14.176

Table 1
Leroy Water Quality

Source ID	Name	Quarter	Section	Township	Range	M	pH	Iron	Potassium	Magnesium	Manganese	Molybdenum	Sodium	Sulfate	Alkalinity	DOx	AfterNH4N	AfterNO3NO2N	AfterColour
WA06500	Randolph Strunk	SE1/4	34	36	19	2	7.24	1.9	15	120	0.4	0.006	220	1100	436	0.98	3.247	0.028	10.759
WA06600	Donald Martin	SW1/4	34	36	19	2	6.81	0.76	16	140	0.91	0.013	160	1070	430	10.72	0.016	0.034	8.987
WA06700	Andrew & Deanna Rauert	SE1/4	19	36	2	2	2.21	0.24	3.5	94	0.009	0.002	14	75	502		0.02	14.037	12.404
WA07000	Ed Trimmel	SW1/4	31	36	20	2	7.22	0.15	26	980	0.51	0.029	380	4670	460	1.82	0.02	69.895	23.163
WA07100	Agatha Rueve	SE1/4	20	36	21	2	7.08	8.5	18	180	0.52	0.004	140	1500	512		4.11	0.049	12.91
WA07200	Alois Frerichs	SE1/4	36	36	21	2	7.19	6	19	180	1.9	0.013	130	1490	450	0.28	2.639	0.028	35.693
WA07300	Edwin Bunz	SE1/4	34	36	21	2	7.11	0.083	12	270	0.016	0.004	91	1060	478		0.018	84.583	7.215
WA07400	Calvin Gail Michel	NE1/4	7	36	20	2	6.75	13	24	91	1.1	-0.001	48	200	488	0.42	0.021	3.916	3.291
WA07500	Ron Michel	SE1/4	7	36	20	2	6.91	0.068	23	130	0.034	-0.001	37	340	550	2.59	0.014	24.153	9.873
WA07600	Paula Michel	SE1/4	18	36	20	2	6.75	0.038	12	86	0.08	-0.001	18	390	438	1.24	0.014	0.215	6.075
WA07700	Lawrence Mollenbeck	NE1/4	31	36	20	2	6.98	39	24	160	0.51	0.02	150	1430	460		0.014	0.518	11.645
WA07800	Kurt Michel	NW1/4	17	36	20	2	7.04	1.1	14	79	0.29	0.003	17	410	380	2.1	0.014	0.024	10.885
WA07900	Shirley McGrath	SE1/4	9	35	20	2	7.22	0.008	24	87	0.02	0.001	18	420	288		0.014	7.305	25.061
WA08000	Robert Elke	NW1/4	2	35	20	2	7.1	5.4	20	110	0.42	0.018	280	1230	370	0.21	0.014	0.023	4.177
WA08100	Gerald and Jay McGrath	SW1/4	15	35	20	2	6.77	0.02	50	50	0.091	0.001	21	110	374	2.15	0.014	17.895	21.264
WA08200	Elmer & Myrtle Henning	NE1/4	9	35	20	2	7.36	0.006	22	30	0.037	0.001	14	140	196		0.014	1.67	6.961
WA08300	Fred & Norma Staniec	SE1/4	17	35	21	2	7.08	0.052	18	140	3.2	0.009	140	1120	488	0.21	0.014	0.022	12.024
WA08400	Melvin & Doreen Jaeb	NW1/4	21	35	21	2	6.95	6.3	29	170	1	0.013	250	1760	398	8.32	0.014	0.111	10.126
WA08500	Larry Harpauer	NW1/4	14	35	21	2	6.84	3.2	26	160	2.5	0.008	220	1590	304	0.12	0.014	0.014	6.708
WA08600	Mervyn Woods	SW1/4	20	35	20	2	7.33	0.035	13	140	0.005	0.006	53	630	348	3.8	0.014	0.693	8.101
WA08701	Werner and Olga Moellenbeck	SW1/4	1	35	21	2	7.25	4	20	130	0.32	0.019	440	1650	394	0.09	0.014	0.02	8.607
WA08800	Shawn & Lorna McGrath	SW1/4	34	34	21	2	7.21	1.2	20	170	0.45	0.03	610	2690	274	0.18	0.014	0.122	14.682
WA08900	Gerald Carroll	SW1/4	36	34	21	2	7.16	3.8	21	130	0.088	0.011	440	1800	400		0.014	0.147	7.974
WA09000	Ernest Klatt	SE1/4	13	34	21	2	7.57	0.015	4.2	1.8	0.015	0.017	400	560	376		0.014	0.363	8.227
WA09100	John Klatt	NW1/4	5	34	20	2	7.4	3.6	11	65	0.2	0.011	61	340	470	0.18	0.014	0.03	7.847
WA09200	John Thompson	NW1/4	15	34	20	2	7.33	3.9	20	88	0.25	0.016	220	1050	340		0.014	0.05	4.05
WA09300	Terrance &Janet McGrath	SW1/4	17	34	21	2	7.25	4.2	20	110	0.19	0.016	220	1000	380	3.51	0.014	0.186	6.202
WA09400	Walter Staniec	NE1/4	20	34	21	2	7.11	2.8	18	120	0.64	0.007	420	1540	412	0.08	0.014	0.021	8.101
WA09502	Wayne Miller	NE1/4	14	34	21	2	7.2	5.7	25	120	0.32	0.025	270	1350	384	0.65	0.014	0.015	8.48
WA09600	Andrew Carroll	SW1/4	22	34	21	2	7.39	5.3	18	130	0.81	0.012	410	1610	460		0.014	0.011	8.354
WA09700	Robert Koski	SW1/4	4	35	21	2	7.22	0.022	16	52	0.009	-0.001	6.9	13	4.51		0.014	0.034	9.746
WA09800	Maurice Carrol	SW1/4	30	34	20	2	7.32	3.6	18	83	0.33	0.014	210	890	380	0.07	0.014	0.02	3.038
WA09900	Verna & Garry Mundell	NW1/4	13	35	20	2	6.78	0.074	13	210	0.98	0.004	51	910	486	0.43	0.014	2.274	7.847
WA10000	Caroline Lokinger	SE1/4	1	36	19	2	7.05	0.85	19	240	0.17	0.014	400	2420	460		0.014	3.434	9.873
WA10100	Melvin Schmidtkamp	SW1/4	29	36	19	2	7.03	0.18	16	120	0.22	0.026	86	950	350		0.014	3.645	8.733
WA10200	Liesureland	NW1/4	8	35	20	2	7.47	0.28	9.9	31	0.43	0.004	19	140	166		0.014	0.049	10.379
WA10300	Donald Hogemann	NE1/4	8	36	20	2	6.89	0.025	13	180	0.24	0.01	83	760	464	0.88	0.014	6.986	7.088
WA10800	Leroy # 2		0	0	0	2	7	1.8	16	91	0.43	0.006	35	470	292		0.014	0.012	35.567
WA10801	Leroy # 1		0	0	0	2	7.1	3.5	23	87	0.67	0.009	33	460	330		0.014	0.036	8.101
WA10900	Norman Block	NE1/4	6	35	20	2	6.93	0.47	8.1	150	0.19	0.012	51	750	410		0.014	0.025	10.126
WA11000		SW1/4	25	34	19	2	8.11	0.097	25	140	0.2	-0.001	93	690	188		0.014	0.03	13.796
WA11200	Valerie Berger	SW1/4	31	34	20	2	7.14	0.041	10	170	0.021	0.009	36	640	430	2.51	0.014	0.149	6.835
WA11600	R.J Hyde	SE1/4	25	34	19	2	7.26	23	17	110	0.73	0.013	86	760	390	6.43	0.014	0.043	4.177
WA11700	Scott MacDonald	NE1/4	2	35	21	2	7.11	3.7	19	150	0.19	0.005	280	1440	410	0.75	0.014	0.095	12.404
WA11800	Lance Stock-Brugger	SE1/4	5	36	19	2	6.86	3.5	18	150	0.28	0.028	140	1260	354	1.09	0.014	0.076	5.443
WA11900	Dan Reinhart	SE1/4	19	34	19	2	7.01	0.36	8.2	79	0.079	0.002	58	56	298	2.6	0.014	12.422	2.531
WA12000	Gary Stooshnoff	NE1/4	17	36	19	2	7.03	0.039	190	540	0.003	0.004	580	2300	640	3.48	0.014	25.765	11.138
WA12100	Larry Koenig	NE1/4	8	36	19	2	7.37	2.6	14	44	0.024	-0.001	360	42	640		0.014	0.262	38.098
WA12200	Gilbert Thiemann	SW1/4	17	36	20	2	6.75	0.081	12	92	0.25	0.001	15	510	432	0.08	0.014	0.035	12.784
WA12300	Garry Dietrick	SW1/4	17	35	20	2	6.62	4.6	27	300	0.45	0.023	220	2170	304	0.9	0.014	0.205	3.797
WA12400	Kelly Strueby	NE1/4	9	36	19	2	6.88	0.062	20	96	0.084	-0.001	36	540	354	0.58	0.014	0.015	105.181
WA12500	Gorden Block	SW1/4	30	34	19	2	7	0.39	14	73	0.48	-0.001	11	110	396	0.96	0.014	7.492	0
WA12600	Stomp Pork Farms	SE1/4	32	34	20	2	6.86	7.2	26	190	0.62	0.009	170	1600	572		0.014	0.016	6.582
WA12601	Stomp Pork Farms	SW1/4	366	35	21	2	7.18	0.014	15	100	1.7	0.008	390	1190	470		0.014	0.149	12.784

Table 1
Leroy Water Quality

Source ID	Name	AfterDO	AfterDOC	AfterpH	AfterTSS	AfterUV254	AfterTDS	AfterTotalN	AfterTurbidity	SiliconSoluble	NH4N	NO3NO2N	TotalN	Aluminum	Arsenic	Barium	Berylium	Boron
WA00200	Ken Schoettler	8.31	4.13	7.96	39	0.08	744	0.514	61.9	12	0.940	0.015	0.955	-0.005	0.07	0.018	-0.001	0.24
WA00300	Leonard Krieger	9.02	8.909	8.38	10	0.186	670	0.271	0.3	8.1	0.054	0.298	0.352	-0.005	0.002	0.07	-0.001	0.11
WA00400	Roger Laybourne	8.96	9.122	8.16	8	0.187	609	0.041	0.52	9.9	0.010	0.016	0.026	-0.005	-0.002	0.083	-0.001	0.086
WA00502	Craig & Charlene Hanson	8.4	0.461	8.27	69	0.077	2220	1.517	15.9	7.9	1.783	0.014	1.796	0.38	0.002	0.007	-0.001	1.1
WA00601	Stan Gorden	8.7	20.344	8.27	37	0.433	2310	8.048	3.07	9	0.531	7.241	7.772	-0.005	0.006	0.011	-0.001	0.45
WA00602	Stan Gordon	8.77	9.25	8.35	25	0.173	1630	10.497	0.009	11	0.010	10.370	10.380	-0.005	-0.002	0.016	-0.001	0.13
WA00700	Calvin Porten	8.8	7.458	8.15	48	0.13	1420	1.566	114	13	1.648	0.014	1.662	-0.005	0.038	0.006	-0.001	0.88
WA00702	Calvin Porten	8.75	7.629	8.2	31	0.148	139	1.525	63	12	1.710	0.011	1.720	0.014	0.015	0.009	-0.001	0.9
WA00800	Erna Dotschkat	8.91	1.997	8.34	17	0.064	311	0.349	26	12	0.336	0.011	0.347	0.01	0.029	0.027	-0.001	0.065
WA01000	Robert Hamilton	8.61	3.789	7.76	14	0.074	4.29	0.212	2.3	11	0.506	0.076	0.582	0.042	0.01	0.018	-0.001	0.35
WA01100	David Arnst	8.22	3.021	8.07	16	0.087	1280	1.457	6.14	8.8	1.303	0.011	1.314	0.013	0.015	0.006	-0.001	0.65
WA01200	Walter Block	8.41	18.85	7.57	32	0.691	2020	99.308	0.57	13	0.780	127.247	128.027	-0.005	0.002	0.077	-0.001	0.071
WA01300	Donavon Block	8.98	6.263	7.85	99	0.097	1350	1.617	158	13	1.654	0.010	1.664	0.006	0.087	0.005	-0.001	0.41
WA01400	Ernest Amendt	9.03	5.069	8.31	19	0.09	6.97	0.039	5.76	10	0.104	0.014	0.118	-0.005	0.004	0.014	-0.001	0.055
WA01500	L &T Fetter	8.95	4.685	8.17	17	0.115	944	44.272	0.44	11	0.028	44.303	44.331	-0.005	-0.002	0.024	-0.001	0.068
WA01600	K and S Lissel	8.87	8.823	8.11	27	0.126	1560	1.368	14.9	9.2	0.544	1.454	1.998	-0.005	-0.002	0.013	-0.001	0.13
WA01702	Donald Lissel	8.67	4.599	8.26	35	0.189	2110	0.093	40.1	8.2	0.092	0.018	0.110	-0.005	-0.002	0.016	-0.001	0.13
WA02001	Ewalt Bach	8.74	2.679	8.36	9	0.099	411	20.141	0.27	11	0.010	21.293	21.302	-0.005	-0.002	0.12	-0.001	0.077
WA02002	Ewalt Bach	9.01	4.813	8.28	13	0.118	712	1.42	6.69	12	1.045	0.020	1.066	0.01	0.022	0.007	-0.001	0.7
WA02100	Leon Holfeld	875	5.111	8.17	20	0.16	983	68.348	1.05	11	0.017	83.752	83.769	-0.005	-0.002	0.2	-0.001	0.049
WA02300	Norman Otsig	8.88	8.653	8.19	15	0.184	997	57.206	1.3	11	0.136	76.321	76.457	0.006	0.002	0.073	-0.001	0.16
WA02400	Ross Barclay	9.05	2.466	8.24	12	0.07	0.57	0.157	0.46	9.6	0.012	0.096	0.108	0.006	-0.002	0.035	-0.001	0.049
WA02600	Ron and Sandra Kients	9.25	11.725	8.26	18	0.331	0.984	80.268	0.28	10	0.040	112.166	112.206	-0.005	-0.002	0.15	-0.001	0.17
WA02800	Bernard Jansen	8.54	6.263	8.17	62	0.127	2160	5.723	8.33	6.7	6.350	0.015	6.365	0.01	0.003	0.003	-0.001	0.94
WA03200	Dale Johnston	8.89	15.864	8.12	168	0.401	1430	1.38	185	11	1.622	0.486	2.108	1.7	0.021	0.059	-0.001	0.7
WA03300	Joe Behne	8.64	10.658	8	24	0.267	1720	88.209	0.4	11	0.013	101.893	101.906	-0.005	-0.002	0.011	-0.001	0.13
WA03400	Pat Gabriel	8.69	6.989	8.35	14	0.214	1140	46.237	0.21	9.6	0.038	75.883	75.922	-0.005	-0.002	0.089	-0.001	0.1
WA03500	Ken Seier	8.65	11.213	8.1	33	0.358	2390	35.693	11.9	8.5	0.981	37.564	38.545	-0.005	0.004	0.02	-0.001	0.43
WA03600	Ernest Schoettler	8.82	4.215	8.06	14	0.113	718	0.143	0.35	9.1	0.624	0.024	0.648	-0.005	-0.002	0.025	-0.001	0.3
WA03601	Ernest Schoettler	8.91	14.285	7.87	46	0.548	1910	85.515	2.41	11	0.063	109.762	109.824	0.036	-0.002	0.1	-0.001	0.23
WA03700	Anthony and Mary Morhart	8.9	9.89	8.21	29	0.227	1750	97.165	0.49	10	0.011	124.406	124.417	-0.005	-0.002	0.012	-0.001	0.19
WA03800	Ralph Leoffler	8.88	9.037	8.27	24	0.171	1510	33.833	0.3	10	0.024	33.921	33.945	-0.005	-0.002	0.015	-0.001	0.17
WA03900	D. Bader	8.8	13.218	8	50	0.544	2840	59.066	10	12	0.025	66.896	66.921	-0.005	0.002	0.032	-0.001	0.48
WA04000	Brian Bader	8.76	11.085	7.97	25	0.175	1600	0.064	1.28	11	0.037	0.053	0.090	0.007	-0.002	0.033	-0.001	0.11
WA04100	Debbie Fetter	9.06	15.48	8.39	16	0.326	736	18.511	0.17	12	0.017	19.350	19.367	-0.005	-0.002	0.14	-0.001	0.12
WA04200	Calvin & Joanne Buhs	8.52	9.847	7.98	61	0.197	1800	3.613	117	13	3.149	0.012	3.161	-0.005	0.021	0.007	-0.001	0.92
WA04300	Richard Pitka	8.74	11.81	8	49	0.407	2030	52.375	6.02	10	0.761	0.424	1.185	-0.005	0.003	0.021	-0.001	0.35
WA04400	E.L.& Murray Steffenson	8.48	6.69	8.05	31	0.128	1620	1.69	54.6	10	1.619	0.010	1.629	-0.005	-0.002	0.007	-0.001	0.74
WA04500	Ronald & Debra Moore	7.7	9.293	7.93	25	0.158	1240	7.725	9.84	11	5.423	0.127	5.550	-0.005	-0.002	0.011	-0.001	0.57
WA04600	Cecilia Bendil	8.66	4.557	7.91	15	0.098	884	14.837	0.22	12	0.405	21.135	21.540	-0.005	-0.002	0.011	-0.001	0.22
WA04700	John Wilger	8.72	5.794	7.97	15	0.101	906	0.923	5.71	12	1.019	0.021	1.040	0.007	0.004	0.008	-0.001	0.3
WA04800	David & Kari Moore	8.62	4.727	7.84	30	0.095	1010	3.171	85.1	12	2.965	0.016	2.981	-0.005	-0.002	0.007	-0.001	0.53
WA05000		8.78	11.276	8.08	39	0.3	2200	93.565	45.4	11	0.161	110.854	111.016	-0.005	0.002	0.022	-0.001	0.18
WA05100	Dan Boschner	8.9	9.424	8.29	18	0.295	1540	43.537	0.29	12	0.014	0.488	0.502	-0.005	-0.002	0.033	-0.001	0.2
WA05200	Harold Pitka	8.78	11.579	8.25	20	0.136	8.53	0.217	12.8	11	0.499	0.198	0.697	-0.005	0.012	0.012	-0.001	0.2
WA05300	Dave Thiemen	8.78	14.793	8.08	22	0.354	2130	217.803	1.99	11	0.019	213.488	213.507	-0.005	-0.002	0.025	-0.001	0.14
WA05500	Gerald McEachern	8.76	8.406	8.19	43	0.16	1610	2.602	107	12	2.508	0.021	2.530	-0.005	0.026	0.006	-0.001	0.67
WA05600	Bernard Dodd	8.53	2.112	8.2	8	0.065	625	12.063	0.08	10	0.007	10.101	10.108	-0.005	-0.002	0.057	-0.001	0.04
WA05700	Dave Nakoneshny	8.65	3.685	7.89	20	0.097	1030	35.03	0.14	11	0.008	35.287	35.295	-0.005	-0.002	0.025	-0.001	0.039
WA05800	Jerome Dunne	8.26	7.249	8.08	33	0.142	1610	1.453	64.4	12	2.555	0.017	2.573	-0.005	0.024	0.005	-0.001	0.77
WA06000	Randolph Classen	8.85	8.221	8.28	25	0.258	916	0.134	56.2	11	0.978	0.020	0.998	0.009	0.007	0.1	-0.001	0.089
WA06100	Jean & Gary Volden	8.6	6.477	7.98	52	0.107	1270	1.545	125	11	1.622	0.011	1.633	-0.005	0.025	0.007	-0.001	0.88
WA06300	Leonard Athmer	8.71	6.605	8.06	16	0.116	1060	1.22	30	13	1.332	0.012	1.344	-0.005	-0.002	0.006	-0.001	0.29
WA06400	Roger Pomedli	8.52	10.274	8.09	14	0.173	1230	4.785	0.25	10	1.265	4.321	5.585	-0.005	0.003	0.011	-0.001	0.42

Table 1
Leroy Water Quality

Source ID	Name	AfterDO	AfterDOC	AfterpH	AfterTSS	AfterUV254	AfterTDS	AfterTotalN	AfterTurbidity	SiliconSoluble	NH4N	NO3NO2N	TotalN	Aluminum	Arsenic	Barium	Berylium	Boron
WA06500	Randolph Strunk	8.61	9.975	8.14	25	0.179	1290	3.276	18	9.2	3.433	0.014	3.447	-0.005	-0.002	0.015	-0.001	0.42
WA06600	Donald Martin	8.57	6.093	7.99	20	0.148	1330	0.05	0.54	7.4	2.742	0.187	2.929	0.009	-0.002	0.02	-0.001	0.37
WA06700	Andrew & Deanna Rauert	8.65	6.138	8.38	8	0.152	510	14.058	0.86	11	0.012	14.517	14.529	-0.005	0.004	0.079	-0.001	0.061
WA07000	Ed Trimmel	8.52	31.514	8.25	53	0.558	3750	69.916	1.04	8.6	0.027	84.189	84.216	-0.005	-0.002	0.009	-0.001	0.35
WA07100	Agatha Rueve	8.36	8.591	7.89	53	0.132	1390	4.159	129	12	3.910	0.008	3.918	-0.005	-0.002	0.005	-0.001	0.53
WA07200	Alois Frerichs	8.71	10.304	7.99	48	0.163	1420	2.667	101	13	2.631	0.012	2.643	-0.005	0.005	0.005	-0.001	0.5
WA07300	Edwin Bunz	8.74	17.246	8.2	19	0.334	1460	84.601	1.47	9.4	0.015	0.372	0.387	0.027	0.003	0.061	-0.001	0.21
WA07400	Calvin Gail Michel	8.72	3.222	7.84	78	0.14	850	3.938	117	12	0.019	4.329	4.349	0.025	0.009	0.33	-0.001	0.073
WA07500	Ron Michel	8.6	2.482	7.8	18	0.135	937	24.167	0.69	11	0.007	28.457	28.464	0.02	-0.002	0.072	-0.001	0.084
WA07600	Paula Michel	8.76	1.741	8.16	8	0.063	643	0.232	0.11	12	0.010	0.104	0.115	-0.005	-0.002	0.015	-0.001	0.12
WA07700	Lawrence Mollenbeck	8.5	8.869	7.96	30	0.161	1390	0.533	30.7	16	1.780	0.165	1.945	0.005	0.046	0.016	-0.001	0.55
WA07800	Kurt Michel	8.64	3.824	8.16	15	0.096	631	0.038	9.39	12	0.019	0.217	0.236	-0.005	0.003	0.015	-0.001	0.11
WA07900	Shirley McGrath	8.87	3.639	8.12	10	0.098	607	7.319	0.25	8.2	0.022	7.520	7.542	-0.005	-0.002	0.034	-0.001	0.03
WA08000	Robert Elke	8.64	6.694	8.12	30	0.133	1290	1.828	77.8	12	1.724	0.012	1.736	-0.005	0.03	0.006	-0.001	0.8
WA08100	Gerald and Jay McGrath	8.77	7.943	7.86	6	0.272	531	17.913	0.27	10	0.025	18.779	18.804	0.011	0.004	0.066	-0.001	0.15
WA08200	Elmer & Myrtle Henning	8.8	2.482	8.39	5	0.131	309	1.685	0.15	9.3	0.017	1.794	1.810	0.011	-0.002	0.018	-0.001	0.031
WA08300	Fred & Norma Staniec	8.72	3.778	8.05	18	0.084	1170	1.982	0.28	12	1.844	0.010	1.854	-0.005	-0.002	0.007	-0.001	0.69
WA08400	Melvin & Doreen Jaeb	8.57	8.545	8.17	34	0.156	1550	1.859	92.3	13	2.116	0.011	2.127	-0.005	-0.002	0.005	-0.001	0.69
WA08500	Larry Harpauer	8.82	7.11	8.19	25	0.119	1420	2.151	47.9	13	1.967	0.012	1.979	-0.005	-0.002	0.005	-0.001	0.65
WA08600	Mervyn Woods	8.74	5.537	8.35	11	0.115	745	0.714	0.19	10	0.008	0.580	0.588	0.006	0.003	0.024	-0.001	0.094
WA08701	Werner and Olga Moellenbeck	8.52	9.702	8.23	29	0.171	1670	3.048	61.3	12	2.906	0.009	2.915	-0.005	0.027	0.005	-0.001	0.81
WA08800	Shawn & Lorna McGrath	7.8	9.1	8.14	30	0.143	2290	1.757	6.4	11	2.573	0.170	2.743	0.014	0.013	0.005	-0.001	1.2
WA08900	Gerald Carroll	8.59	6.832	8.16	32	0.117	1700	2.404	60.2	12	2.268	0.008	2.276	-0.005	0.007	0.004	-0.001	1.3
WA09000	Ernest Klatt	8.63	4.981	8.53	7	0.124	883	0.384	0.17	11	0.059	0.278	0.337	0.012	0.01	-0.001	-0.001	0.51
WA09100	John Klatt	8.61	1.371	7.96	21	0.058	594	1.027	56.2	11	1.238	0.010	1.248	0.016	0.031	0.014	-0.001	0.38
WA09200	John Thompson	8.6	5.537	8.13	30	0.102	1110	1.628	60.2	12	1.528	0.009	1.537	-0.005	0.022	0.007	-0.001	0.81
WA09300	Terrance &Janet McGrath	8.77	5.768	8.19	31	0.124	1120	2.09	67.5	11	1.821	0.063	1.884	-0.005	0.007	0.006	-0.001	0.62
WA09400	Walter Staniec	8.69	7.434	8.25	22	0.136	1600	3.078	44.7	11	2.847	0.008	2.856	-0.005	0.017	0.005	-0.001	0.66
WA09502	Wayne Miller	8.66	6.925	8.29	28	0.126	1340	1.905	97.5	12	1.649	0.008	1.656	0.02	0.018	0.006	-0.001	0.86
WA09600	Andrew Carroll	8.59	7.666	8.16	33	0.14	1610	2.686	91.3	9.5	2.448	0.011	2.459	-0.005	0.019	0.005	-0.001	0.65
WA09700	Robert Koski	8.51	1.232	8.46	0	0.058	351	0.06	0.27	15	0.005	0.230	0.236	0.014	0.003	0.23	-0.001	0.065
WA09800	Maurice Carrol	8.82	4.703	8.09	32	0.108	1030	1.585	58.3	12	1.352	0.022	1.374	-0.005	0.014	0.007	-0.001	0.86
WA09900	Verna & Garry Mundell	8.61	9.841	8.22	12	0.165	1060	2.302	0.42	7.9	0.021	3.067	3.088	-0.005	0.003	0.031	-0.001	0.066
WA10000	Caroline Lokinger	8.42	11.183	8.09	24	0.155	2160	3.448	7.59	9.3	0.801	3.599	4.400	-0.005	-0.002	0.016	-0.001	0.48
WA10100	Melvin Schmidtkamp	8.37	7.758	8.02	16	0.144	1040	3.865	0.79	8.1	0.987	3.161	4.149	-0.005	-0.002	0.011	-0.001	0.36
WA10200	Liesureland	8.91	3.778	8.25	9	0.195	276	0.184	0.21	7.5	0.152	0.012	0.164	-0.005	-0.002	0.019	-0.001	0.054
WA10300	Donald Hogemann	8.57	7.11	8.42	12	0.134	970	7.014	0.18	10	0.030	8.002	8.032	0.006	0.003	0.01	-0.001	0.11
WA10800	Leroy # 2	8.58	5.675	8.39	12	0.159	639	0.184	15.7	8.5	0.175	0.008	0.183	-0.005	0.004	0.031	-0.001	0.065
WA10801	Leroy # 1	8.52	12.433	8.24	18	0.359	634	0.282	26.7	8.2	0.326	0.009	0.335	-0.005	-0.002	0.07	-0.001	0.063
WA10900	Norman Block	8.63	7.249	8.41	11	0.124	865	0.051	0.68	8.7	0.017	0.012	0.029	-0.005	-0.002	0.028	-0.001	0.084
WA11000		8.68	11.981	8.37	17	0.292	9.38	0.215	4.27	1.4	0.034	0.012	0.046	0.009	0.003	0.048	-0.001	0.1
WA11200	Valerie Berger	8.6	7.064	8.34	10	0.137	861	0.165	0.24	9.6	0.008	0.281	0.290	-0.005	-0.002	0.027	-0.001	0.097
WA11600	R.J Hyde	8.6	5.282	8.13	69	0.084	858	0.774	390	8.2	1.136	0.011	1.147	-0.005	-0.002	0.02	-0.001	0.64
WA11700	Scott MacDonald	8.42	7.943	8.18	30	0.168	1450	4.672	51	11	4.328	0.010	4.338	0.013	0.003	0.007	-0.001	0.49
WA11800	Lance Stock-Brugger	8.07	8.221	8.13	22	0.129	1250	0.083	26	11	0.815	0.032	0.847	-0.005	0.007	0.045	-0.001	0.56
WA11900	Dan Reinhart	8.94	-0.5	7.94	14	0.061	705	12.433	2.56	12	0.008	14.561	14.569	-0.005	-0.002	0.34	-0.001	0.052
WA12000	Gary Stooshnoff	8.5	7.642	8.31	22	0.527	3450	25.778	0.14	10	0.013	29.049	29.063	-0.005	-0.002	0.033	-0.001	0.15
WA12100	Larry Koenig	7.64	42.602	8.36	16	1.318	1170	6.104	9.08	13	5.857	0.111	5.969	0.013	0.007	0.76	-0.001	0.93
WA12200	Gilbert Thiemann	8.09	2.112	7.93	9	0.051	742	0.055	0.38	11	0.007	0.018	0.025	0.005	0.004	0.012	-0.001	0.1
WA12300	Garry Dietrick	8.27	12.061	8.17	33	0.181	1880	1.025	57.1	11	0.981	0.008	0.989	-0.005	0.019	0.011	-0.001	0.3
WA12400	Kelly Strueby	8.3	2.098	8.23	7	0.073	734	0.044	0.37	7.3	0.010	0.009	0.019	-0.005	-0.002	0.071	-0.001	0.046
WA12500	Gorden Block	9.14	6.434	8.19	20	0.14	517	7.503	4.19	8.7	0.013	8.989	9.002	0.009	-0.002	0.14	-0.001	0.034
WA12600	Stomp Pork Farms	8.6	9.748	7.88	59	0.175	1540	3.709	108	12	3.529	0.009	3.539	-0.005	-0.002	0.007	-0.001	0.58
WA12601	Stomp Pork Farms	7.57	4.241	8.05	11	0.092	1420	0.694	0.17	9.2	1.635	0.051	1.686	-0.005	-0.002	0.005	-0.001	0.61

Table 1
Leroy Water Quality

Source ID	Name	Calcium	Cadmium	Cobalt	Chromium	Copper	DOC	Lead	Nickel	Phosphorus	Silver	Strontium	Titanium	Vanadium	Zinc	Zirconium	Temperature	Turbidity	TurbOneHour	TurbOneDay
WA00200	Ken Schoettler	200	-0.001	0.005	-0.001	-0.001	5.358	-0.002	-0.001	0.22	-0.001	0.97	-0.001	-0.001	0.043	-0.001	9.4	16.8	22	66.8
WA00300	Leonard Krieger	150	-0.001	0.003	-0.001	0.012	9.774	-0.002	0.017	0.03	-0.001	0.6	-0.001	-0.001	0.89	-0.001	10.6	1.14	0	0.5
WA00400	Roger Laybourne	140	-0.001	-0.001	-0.001	0.052	9.236	0.003	0.005	0.02	-0.001	0.46	-0.001	-0.001	5.6	-0.001	10.0	2.07	2	1.86
WA00502	Craig & Charlene Hanson	160	-0.001	-0.001	-0.001	0.034	4.623	0.006	0.004	-0.01	-0.001	1.9	0.013	0.002	0.014	0.001	10.0	15.7	12	6.21
WA00601	Stan Gorden	200	-0.001	0.002	-0.001	0.004	21.903	-0.002	0.004	0.05	-0.001	1.5	0.001	-0.001	0.27	0.001	9.9	2.24	2	1.25
WA00602	Stan Gordon	270	-0.001	0.001	-0.001	0.014	12.009	-0.002	0.003	0.01	-0.001	0.86	0.002	-0.001	0.066	-0.001	11.4	0.16	0	0.19
WA00700	Calvin Porten	280	-0.001	0.006	-0.001	-0.001	8.302	-0.002	0.002	0.1	-0.001	1.7	0.001	-0.001	-0.005	-0.001	8.3	6.93	50	77.9
WA00702	Calvin Porten	260	-0.001	-0.001	-0.001	0.002	8.613	-0.002	0.001	0.17	-0.001	1.8	0.002	-0.001	0.041	-0.001	10.4	3.55	12	55.9
WA00800	Erna Dotschkat	100	-0.001	-0.001	-0.001	0.099	3.689	-0.002	-0.001	0.05	-0.001	0.41	-0.001	-0.001	0.092	-0.001	12.0	2.65		21.8
WA01000	Robert Hamilton	210	-0.001	-0.001	-0.001	0.005	4.991	-0.002	0.009	0.02	-0.001	1.2	0.002	-0.001	0.017	-0.001	10.9	5.35	6	
WA01100	David Arnst	120	-0.001	-0.001	-0.001	0.034	5.075	0.002	-0.001	-0.01	-0.001	1	-0.001	-0.001	0.046	-0.001	13.4	2.5	7	
WA01200	Walter Block	400	-0.001	-0.001	-0.001	0.022	27.218	-0.002	0.031	0.13	-0.001	1.1	0.001	-0.001	0.06	0.001	7.4	0.9		0.82
WA01300	Donavon Block	430	-0.001	-0.001	-0.001	0.001	7.368	-0.002	0.002	0.1	-0.001	2.2	0.002	-0.001	0.015	0.002	11.9	7.7	4	155.2
WA01400	Ernest Amendt	140	-0.001	-0.001	-0.001	0.013	5.953	0.003	0.007	0.03	-0.001	0.46	-0.001	-0.001	0.006	-0.001	9.8	8.77	8	7.91
WA01500	L &T Fetter	210	-0.001	-0.001	-0.001	0.003	6.604	0.003	-0.001	0.02	-0.001	0.66	0.001	-0.001	0.068	-0.001	9.7	0.58	1	0.49
WA01600	K and S Lissel	420	-0.001	-0.001	-0.001	0.002	9.774	-0.002	0.003	0.02	-0.001	1.7	0.002	-0.001	0.03	-0.001	7.5	1.2	2	18.6
WA01702	Donald Lissel	320	-0.001	-0.001	-0.001	-0.001	11.528	-0.002	0.008	0.01	-0.001	1.3	-0.001	-0.001	4.5	-0.001	9.0	19.1	21	23.2
WA02001	Ewalt Bach	84	-0.001	-0.001	-0.001	0.14	4.283	0.08	0.002	0.02	-0.001	0.22	-0.001	-0.001	0.18	-0.001	13.1		1	0.69
WA02002	Ewalt Bach	86	-0.001	-0.001	-0.001	0.005	5.528	-0.002	0.001	0.07	-0.001	0.5	-0.001	-0.001	0.017	-0.001	9.2	1.76	5	5.95
WA02100	Leon Holfeld	210	-0.001	-0.001	-0.001	0.064	8.840	0.005	0.002	0.02	-0.001	0.39	-0.001	-0.001	0.023	-0.001	10.8	1.12	1	0.73
WA02300	Norman Otsig	190	-0.001	-0.001	-0.001	0.004	9.858	-0.002	0.006	0.01	-0.001	0.75	-0.001	-0.001	0.012	-0.001	9.6	2.3	1	0.83
WA02400	Ross Barclay	130	-0.001	-0.001	-0.001	0.015	3.943	0.003	-0.001	-0.01	-0.001	0.5	-0.001	-0.001	-0.005	-0.001	9.5	0.53	0	0.3
WA02600	Ron and Sandra Kients	190	-0.001	0.001	-0.001	0.14	12.915	0.003	0.005	0.04	-0.001	0.47	-0.001	-0.001	0.056	-0.001	12.4	0.76	0	0.25
WA02800	Bernard Jansen	170	-0.001	0.007	0.002	0.072	16.425	0.003	0.009	-0.01	-0.001	2	-0.001	0.001	0.037	-0.001	8.5	16.5	15	15.7
WA03200	Dale Johnston	230	-0.001	-0.001	0.008	0.005	18.123	0.003	0.016	0.35	-0.001	1.3	0.081	0.012	0.62	0.006	9.9	55.1	33	40.1
WA03300	Joe Behne	330	-0.001	-0.001	-0.001	0.006	14.642	-0.002	0.006	0.01	-0.001	1.1	0.002	-0.001	-0.005	-0.001	8.1	0.78	1	0.41
WA03400	Pat Gabriel	190	-0.001	-0.001	-0.001	0.003	11.075	-0.002	0.002	0.02	-0.001	0.66	-0.001	-0.001	0.96	-0.001	15.9	0.93	0	0.3
WA03500	Ken Seier	520	-0.001	0.007	-0.001	0.005	19.934	-0.002	0.008	-0.01	0.002	2.1	0.003	-0.001	0.26	0.002	8.3	5.01	5	4.03
WA03600	Ernest Schoettler	210	-0.001	-0.001	-0.001	0.004	5.274	-0.002	0.004	0.01	-0.001	0.89	0.001	-0.001	-0.005	-0.001	7.4	1.89	1	0.93
WA03601	Ernest Schoettler	290	-0.001	-0.001	-0.001	0.014	18.254	-0.002	0.01	0.03	-0.001	0.97	0.003	-0.001	0.18	-0.001	7.2	7.83	5	3.59
WA03700	Anthony and Mary Morhart	450	-0.001	-0.001	-0.001	0.005	10.708	-0.002	0.004	-0.01	-0.001	1.1	0.002	-0.001	0.12	-0.001	9.8	0.88	1	0.56
WA03800	Ralph Leoffler	320	-0.001	0.006	-0.001	0.005	9.208	0.002	0.002	0.03	-0.001	1	0.002	-0.001	0.55	-0.001	8.2	1.02	0	0.45
WA03900	D. Bader	480	-0.001	-0.001	-0.001	0.007	16.032	-0.002	0.012	0.06	-0.001	2.3	0.002	-0.001	0.13	0.002	9.8	0.78	1	0.31
WA04000	Brian Bader	300	-0.001	-0.001	-0.001	0.002	11.613	-0.002	0.003	0.02	-0.001	1	0.001	-0.001	0.14	-0.001	9.8	1.16	1	1.59
WA04100	Debbie Fetter	140	-0.001	0.004	-0.001	0.03	15.377	-0.002	0.002	0.04	-0.001	0.46	-0.001	-0.001	0.049	-0.001	9.6	0.84	0	0.23
WA04200	Calvin & Joanne Buhs	320	-0.001	0.006	-0.001	-0.001	10.877	-0.002	0.002	0.14	0.002	1.9	0.002	-0.001	0.016	0.001	7.8	0.97	46	114.3
WA04300	Richard Pitka	380	-0.001	-0.001	-0.001	0.007	9.939	-0.002	0.007	0.02	-0.001	1.6	0.002	-0.001	0.055	0.001	8.7	15.5	16	11.5
WA04400	E.L.& Murray Steffenson	370	-0.001	-0.001	-0.001	0.002	6.902	-0.002	0.002	-0.01	-0.001	1.8	0.002	-0.001	0.082	-0.001	9.6	5.01	4	4.52
WA04500	Ronald & Debra Moore	240	-0.001	-0.001	-0.001	-0.001	9.037	-0.002	-0.001	0.04	-0.001	1.7	-0.001	-0.001	0.02	-0.001	8.4	24.8	23	11.9
WA04600	Cecilia Bendil	240	-0.001	-0.001	-0.001	0.011	5.187	-0.002	0.007	0.01	-0.001	0.92	-0.001	-0.001	0.013	-0.001	9.2	0.87	0	0.36
WA04700	John Wilger	220	-0.001	0.002	0.002	-0.001	6.300	-0.002	0.003	-0.01	-0.001	0.88	-0.001	-0.001	-0.005	-0.001	9.6	0.85	1	3.25
WA04800	David & Kari Moore	290	-0.001	-0.001	-0.001	-0.001	17.517	-0.002	0.002	0.18	-0.001	1.3	0.001	-0.001	0.018	-0.001	9.3	1.34	19	50.9
WA05000		430	-0.001	-0.001	-0.001	0.3	11.413	-0.002	0.007	0.07	-0.001	1.3	0.003	-0.001	0.18	0.002	9.8	38.5	34	19
WA05100	Dan Boschner	260	-0.001	-0.001	-0.001	0.004	9.729	-0.002	-0.001	0.02	-0.001	1.1	-0.001	-0.001	0.034	-0.001	9.4	0.59	1	0.8
WA05200	Harold Pitka	210	-0.001	-0.001	-0.001	0.001	7.834	-0.002	-0.001	0.03	-0.001	0.88	-0.001	-0.001	0.039	-0.001	12.0	14.9	15	11.1
WA05300	Dave Thiemen	490	-0.001	-0.001	-0.001	0.086	13.939	-0.002	0.005	0.03	-0.001	1.2	0.002	-0.001	1.7	-0.001	15.0	4.7	5	2.82
WA05500	Gerald McEachern	290	-0.001	0.001	-0.001	0.007	8.676	-0.002	0.004	0.15	-0.001	2.3	0.001	-0.001	-0.005	-0.001	9.8	3.35	84	41
WA05600	Bernard Dodd	180	-0.001	-0.001	-0.001	0.005	3.684	-0.002	-0.001	0.02	-0.001	0.26	-0.001	-0.001	0.04	-0.001	10.6	0.05	1	0.12
WA05700	Dave Nakoneshny	260	-0.001	0.002	-0.001	0.009	5.278	-0.002	-0.001	0.02	-0.001	0.52	-0.001	-0.001	-0.005	-0.001	15.0	0.86	0	0.32
WA05800	Jerome Dunne	250	-0.001	0.004	-0.001	0.001	7.864	-0.002	0.002	0.17	0.001	1.9	0.001	-0.001	-0.005	0.001	9.2	6.37	36	38
WA06000	Randolph Classen	200	-0.001	-0.001	0.002	0.049	9.037	-0.002	0.014	0.03	-0.001	0.66	-0.001	-0.001	-0.005	0.001	13.9	33.8	52	48.3
WA06100	Jean & Gary Volden	290	-0.001	-0.001	-0.001	0.002	6.781	-0.002	0.003	0.16	-0.001	1.5	0.002	-0.001	0.006	-0.001	7.9	4.1	18	61.4
WA06300	Leonard Athmer	220	-0.001	-0.001	-0.001	-0.001	6.962	-0.002	-0.001	0.02	-0.001	1	0.001	-0.001	0.008	-0.001	10.0	0.96	2	28.3
WA06400	Roger Pomedli	240	-0.001	0.007	-0.001	0.003	9.729	-0.002	0.004	-0.01	-0.001	1	-0.001	-0.001	0.016	-0.001	16.0	0.95	1	1.41

Table 1
Leroy Water Quality

Source ID	Name	Calcium	Cadmium	Cobalt	Chromium	Copper	DOC	Lead	Nickel	Phosphorus	Silver	Strontium	Titanium	Vanadium	Zinc	Zirconium	Temperature	Turbidity	TurbOneHour	TurbOneDay
WA06500	Randolph Strunk	270	-0.001	0.003	-0.001	0.007	9.759	-0.002	0.002	0.13	-0.001	1	0.001	-0.001	0.046	-0.001	11.2	8.35	16	15.2
WA06600	Donald Martin	320	-0.001	-0.001	0.002	0.013	6.120	-0.002	0.005	0.08	-0.001	1.1	0.003	-0.001	0.01	-0.001	10.1	4.24	3	1.36
WA06700	Andrew & Deanna Rauert	110	-0.001	-0.001	-0.001	0.15	7.323	-0.002	0.004	0.02	-0.001	0.31	-0.001	-0.001	0.17	-0.001	20.1	16.9	98	1.28
WA07000	Ed Trimmel	480	0.002	0.013	-0.001	0.01	30.789	-0.002	0.028	0.01	-0.001	2.6	0.003	-0.001	0.57	0.003	8.0	1.35	1	1.46
WA07100	Agatha Rueve	400	-0.001	0.003	-0.001	0.001	9.187	-0.002	0.002	0.34	-0.001	1.8	0.002	-0.001	-0.005	-0.001	11.3	4.2	68	91.9
WA07200	Alois Frerichs	400	-0.001	0.008	-0.001	0.002	10.360	-0.002	0.007	-0.01	-0.001	1.6	0.002	-0.001	-0.005	0.001	5.9	0.76	17	51.4
WA07300	Edwin Bunz	300	-0.001	-0.001	0.001	0.006	16.315	-0.002	0.004	0.01	-0.001	1.1	0.002	-0.001	2	0.002	8.1	1.75	2	1.14
WA07400	Calvin Gail Michel	240	-0.001	-0.001	-0.001	0.004	5.548	-0.002	0.012	0.07	-0.001	0.35	0.003	0.001	-0.005	0.001	9.2	83.3	80	65.4
WA07500	Ron Michel	210	-0.001	-0.001	-0.001	0.004	4.676	-0.002	0.004	0.02	-0.001	0.55	0.002	-0.001	0.036	-0.001	9.9	1.09	1	0.56
WA07600	Paula Michel	190	-0.001	-0.001	-0.001	0.005	3.954	-0.002	0.003	0.01	-0.001	0.66	-0.001	-0.001	0.089	-0.001	10.5	0.27	0	0.15
WA07700	Lawrence Mollenbeck	400	0.002	0.002	-0.001	0.009	9.458	-0.002	0.003	0.34	0.001	1.9	0.003	0.002	0.24	0.003	9.1	35.2	29	14.8
WA07800	Kurt Michel	190	-0.001	-0.001	-0.001	0.002	4.646	-0.002	-0.001	0.03	-0.001	0.5	-0.001	-0.001	0.12	-0.001	12.4	13.2	14	9.2
WA07900	Shirley McGrath	140	-0.001	-0.001	-0.001	0.048	16.976	-0.002	-0.001	0.02	-0.001	0.39	-0.001	-0.001	0.12	-0.001	13.2	0.82	0	0.41
WA08000	Robert Elke	260	-0.001	-0.001	-0.001	-0.001	7.714	-0.002	0.002	0.02	-0.001	1.3	-0.001	-0.001	0.007	-0.001	9.6			
WA08100	Gerald and Jay McGrath	120	-0.001	-0.001	-0.001	0.029	8.315	-0.002	0.004	0.66	-0.001	0.32	-0.001	0.003	0.009	-0.001	12.1	0.75	1	0.38
WA08200	Elmer & Myrtle Henning	74	-0.001	-0.001	-0.001	0.015	4.195	-0.002	-0.001	0.1	-0.001	0.23	-0.001	-0.001	0.008	-0.001	11.3	0.22	0	0.28
WA08300	Fred & Norma Staniec	310	-0.001	0.008	-0.001	0.002	5.127	-0.002	0.01	0.01	0.004	1.4	0.002	-0.001	0.035	-0.001	6.1	0.15	1	0.19
WA08400	Melvin & Doreen Jaeb	380	-0.001	0.009	-0.001	0.003	9.308	-0.002	0.003	0.19	-0.001	2.2	0.002	-0.001	0.02	-0.001	7.7	2.82	31	58.7
WA08500	Larry Harpauer	340	-0.001	0.007	-0.001	0.002	7.383	-0.002	0.005	-0.01	-0.001	1.6	0.002	-0.001	0.025	0.001	6.5	0.3	1	24.6
WA08600	Mervyn Woods	120	-0.001	0.005	0.002	0.053	6.150	-0.002	0.001	0.02	-0.001	0.4	-0.001	-0.001	0.009	-0.001	8.8	0.25	0	0.18
WA08701	Werner and Olga Moellenbeck	280	-0.001	-0.001	-0.001	-0.001	8.977	-0.002	0.004	0.13	-0.001	2.1	0.002	-0.001	0.1	-0.001	8.7	7.11	12	50.5
WA08800	Shawn & Lorna McGrath	390	-0.001	0.01	0.002	-0.001	8.766	-0.002	0.001	-0.01	-0.001	2.7	0.003	0.001	-0.005	0.002	8.2	5.1	8	9.6
WA08900	Gerald Carroll	300	-0.001	0.006	-0.001	-0.001	7.142	-0.002	0.002	0.02	-0.001	2.7	0.002	-0.001	-0.005	-0.001	11.2	0.95	9	43.1
WA09000	Ernest Klatt	4.5	-0.001	-0.001	-0.001	0.008	5.398	-0.002	-0.001	-0.01	-0.001	0.019	-0.001	-0.001	-0.005	-0.001	9.6	0.22	1	1.11
WA09100	John Klatt	160	-0.001	-0.001	-0.001	0.004	2.932	-0.002	-0.001	0.06	-0.001	0.76	-0.001	-0.001	-0.005	-0.001	6.4	1.1	46	36
WA09200	John Thompson	230	-0.001	-0.001	-0.001	-0.001	6.210	-0.002	0.002	0.03	-0.001	1.4	0.001	-0.001	-0.005	-0.001	8.2	0.58	50	31.6
WA09300	Terrance &Janet McGrath	220	-0.001	0.002	-0.001	-0.001	6.192	-0.002	-0.001	-0.01	-0.001	1.3	-0.001	-0.001	-0.005	-0.001	7.1	1.06	50	53.2
WA09400	Walter Staniec	240	-0.001	-0.001	-0.001	-0.001	7.606	-0.002	0.003	-0.01	-0.001	1.9	0.001	-0.001	-0.005	-0.001	6.9	0.92	8	36.5
WA09502	Wayne Miller	280	-0.001	0.002	0.003	-0.001	7.270	-0.002	-0.001	0.02	-0.001	1.6	0.002	0.003	0.15	0.001	6.4	0.75	47	70.1
WA09600	Andrew Carroll	280	-0.001	0.002	-0.001	-0.001	7.808	-0.002	-0.001	0.03	-0.001	2.1	0.001	-0.001	-0.005	-0.001	9.0	0.62	30	67
WA09700	Robert Koski	85	-0.001	-0.001	-0.001	0.065	2.556	-0.002	-0.001	-0.01	-0.001	0.28	-0.001	-0.001	0.017	-0.001	12.3	0.66	0	0.46
WA09800	Maurice Carrol	220	-0.001	-0.001	-0.001	-0.001	5.721	-0.002	-0.001	0.08	-0.001	1.1	-0.001	-0.001	-0.005	-0.001	5.8	0.19	7	44.5
WA09900	Verna & Garry Mundell	200	-0.001	0.002	-0.001	0.009	9.492	-0.002	0.007	0.03	-0.001	0.47	-0.001	-0.001	1.1	-0.001	12.1	0.68	1	1.28
WA10000	Caroline Lokinger	470	-0.001	-0.001	-0.001	0.004	10.367	-0.002	0.003	-0.01	-0.001	2.1	0.002	-0.001	0.047	0.001	11.4	11.5	11	7.3
WA10100	Melvin Schmidtkamp	300	-0.001	0.011	-0.001	0.022	7.876	-0.002	0.003	-0.01	-0.001	1.1	0.001	-0.001	0.034	-0.001	9.8	4.55	4	2.63
WA10200	Liesureland	57	-0.001	0.003	-0.001	-0.001	4.887	-0.002	-0.001	0.06	-0.001	0.17	0.001	0.002	-0.005	-0.001	11.4	0.4	0	0.47
WA10300	Donald Hogemann	170	-0.001	0.011	0.001	0.003	7.337	-0.002	0.006	-0.01	-0.001	0.5	-0.001	-0.001	0.17	-0.001	7.4	0.45	0	0.19
WA10800	Leroy # 2	140	-0.001	-0.001	-0.001	-0.001	6.260	-0.002	0.011	0.04	-0.001	0.4	-0.001	0.002	-0.005	-0.001		0.42	12	15.8
WA10801	Leroy # 1	150	-0.001	0.01	-0.001	-0.001	12.454	-0.002	0.001	0.28	-0.001	0.42	0.001	0.002	0.005	-0.001		5.24		23.7
WA10900	Norman Block	190	-0.001	0.007	-0.001	0.008	7.263	-0.002	0.004	0.01	-0.001	0.57	-0.001	-0.001	0.082	-0.001	11.7	0.67	1	0.8
WA11000		120	-0.001	-0.001	-0.001	-0.001	14.670	-0.002	0.002	0.03	-0.001	0.5	-0.001	-0.001	-0.005	-0.001	18.2	4.9	5	4.4
WA11200	Valerie Berger	150	-0.001	0.007	-0.001	0.031	7.082	-0.002	0.002	0.03	-0.001	0.5	-0.001	-0.001	-0.005	-0.001	7.0	0.22	0	0.29
WA11600	R.J Hyde	200	0.001	0.002	-0.001	-0.001	6.462	-0.002	0.002	0.06	-0.001	1.4	0.001	-0.001	0.41	0.002	10.3	119	293	183
WA11700	Scott MacDonald	290	-0.001	-0.001	0.001	0.001	7.808	-0.002	-0.001	0.4	-0.001	1.6	0.003	0.002	0.04	0.002	8.0	3.5	21	37
WA11800	Lance Stock-Brugger	340	-0.001	0.003	-0.001	0.021	7.943	-0.002	-0.001	0.02	-0.001	1.4	-0.001	-0.001	0.034	-0.001	8.6	23.5	21	12.6
WA11900	Dan Reinhart	140	-0.001	-0.001	-0.001	0.047	3.660	0.003	0.002	0.02	-0.001	0.32	-0.001	-0.001	0.006	-0.001	12.2			
WA12000	Gary Stooshnoff	230	-0.001	-0.001	-0.001	0.02	5.586	-0.002	0.002	0.02	-0.001	1.2	0.001	-0.001	0.006	-0.001	8.4	0.29	0	0.01
WA12100	Larry Koenig	100	-0.001	0.005	0.002	-0.001	18.254	-0.002	-0.001	0.03	-0.001	0.9	-0.001	0.002	0.019	-0.001	8.2	2.63	8	11.6
WA12200	Gilbert Thiemann	240	-0.001	0.001	-0.001	-0.001	2.960	-0.002	0.001	0.01	-0.001	0.67	-0.001	0.002	-0.005	-0.001	9.8	0.37	0	0.22
WA12300	Garry Dietrick	400	-0.001	0.004	-0.001	-0.001	10.300	-0.002	-0.001	0.02	-0.001	2	0.001	-0.001	0.021	-0.001	7.8	37	52	42.1
WA12400	Kelly Strueby	190	-0.001	-0.001	-0.001	0.002	1.431	-0.002	-0.001	0.01	-0.001	0.62	-0.001	-0.001	0.008	-0.001	9.3	0.43	0	0.38
WA12500	Gorden Block	140	-0.001	-0.001	-0.001	0.009	6.943	-0.002	0.004	0.04	-0.001	0.23	-0.001	-0.001	0.017	-0.001	9.6	1.8	1	1.04
WA12600	Stomp Pork Farms	430	-0.001	0.007	-0.001	-0.001	9.626	-0.002	-0.001	0.36	-0.001	2.4	0.002	-0.001	-0.005	-0.001		15.9		90.5
WA12601	Stomp Pork Farms	190	-0.001	0.005	-0.001	0.051	4.442	-0.002	0.001	-0.01	-0.001	1.5	-0.001	-0.001	-0.005	-0.001		10.2	0	

Table 2
Leroy Water Well Information

Source ID	Name	Easting	Northing	Elevation	Water Level (m)	Diameter m	Large or Small	comment on	WaterLevel	Latitude	Longitude	ClientID	LSD	Quarter	Section	Township	Range	M	Age	Type	Projectid	InstallMethod
WA00200	Ken Schoettler	522495.655	5766395.858	551.12	6.72	0.81	Large		544.4	52.04759979	-104.6719971	2	0	SW1/4	33	35	19	2	14	Well		Dug/Bored
WA00300	Leonard Krieger	529838.962	5755856.532	534.872	1.51	0.75	Large		533.362	51.95259857	-104.5658035	3	0	SE1/4	25	34	19	2	60	Well		Drilled
WA00400	Roger Laybourne	530365.51	5754529.757	531.238	7.45	0.75	Large		523.788	51.94070053	-104.5582962	4	0	SE1/4	25	34	19	2	18	Well	867817	Dug/Bored
WA00502	Craig & Charlene Hanson	522176.84	5760944.681	538.592	19.87	0.112	Small	PVC well	518.722	51.99900055	-104.677002	5	0	SE1/4	17	35	19	2	1	Well		Drilled
WA00600	Stan Gorden	522644.182	5759553.089	535.601	2.04	0.5	Large		533.561			6								Well		
WA00601	Stan Gorden	522639.762	5759553.089	535.601	3.57	0.15	Small	Well in Pit however was able to get depth	532.031	51.98619843	-104.6704025	6	0	SW1/4	9	35	19	2	18	Well	867614	Drilled
WA00602	Stan Gordon	522585.734	5759583.631	536.087	3.64	0.76	Large		532.447			6	0	SW1/4	9	35	19	2	11	Well	888143	Dug/Bored
WA00700	Calvin Porten	520869.545	5760731.009	545.292	N/A	0.15	Small			51.99679947	-104.6959991	7	0	NW1/4	8	35	19	2	9	Well		Drilled
WA00701	Calvin Porten	520840.276	5760784.582	546.831	2.17	0.9	Large		544.661			7								Well	873576	
WA00702	Calvin Porten	520832.324	5760806.43	546.561	11.3	0.15	Small		535.261	51.99750137	-104.6966019	7	0	NW1/4	8	35	19	2	2	Well	300508	Drilled
WA00800	Erna Dotschkat	519292.531	5752510.907	543.8062	N/A	N/A	Small	well in basement ele. reflects that		51.92290115	-104.7192993	8	0	NW1/4	13	34	20	2	28	Well		Drilled
WA01000	Robert Hamilton	522769.587	5748935.126	545.519	15.04**	Small	Small	well in very steep hill		51.89089966	-104.6691971	10	0	NW1/4	5	34	19	2	59	Well		Dug/Bored
WA01100	David Arnst	527478.773	5748120.49	531.88	3.43	0.15	Small		528.45	51.8832016	-104.6007996	11	0	SW1/4	2	34	19	2	40	Well	820802	Drilled
WA01200	Walter Block	519021.201	5751105.355	545.577	5.48	0.15	Small	North Homestead	540.097	51.91040039	-104.7235031	12	0	NE1/4	11	34	20	2	39	Well	871265	Dug/Bored
WA01300	Donavon Block	518966.658	5750997.17	545.188	5.24	0.15	Small	Close to Corrals	539.948	51.90930176	-104.7242966	13	0	NE1/4	2	34	20	2	19	Well		Drilled
WA01400	Ernest Amendt	526998.881	5755318.282	536.938	2.23	0.95	Large		534.708	51.94789886	-104.6072006	14	0	NE1/4	27	34	19	2	0	Well		Unknown
WA01500	L &T Fetter	526417.855	5754223.799	537.892	3.19	0.75	Large	water rings up to 2.83	534.702	51.93809891	-104.6156998	15	0	NW1/4	22	34	19	2	24	Well		Dug/Bored
WA01600	K and S Lissel	517298.548	5754690.154	540.685	9.28	0.7	Large		531.405	51.94269943	-104.7482986	16	0	SW1/4	27	34	20	2	0	Well		Dug/Bored
WA01700	Donald Lissel	519687.905	5756508.485	536.562	1.7	0.75	Large		534.862	51.95890045	-104.713501	17								Well	859146	
WA01701	Donald Lissel	519821.808	5756424.027	536.466	2.07	0.75	Large		534.396	51.95819855	-104.7115021	17								Well		
WA01702	Donald Lissel	519819.258	5756360.682	536.314	N/A	0.15	Small	Old well access not possible		51.95759964	-104.7116013	17	0	SW1/4	36	34	20	2	20	Well		Drilled
WA01800	Heather Block	519410.935	5757841.918	542.395	N/A	0.6	Large	Old well access not possible		51.97090149	-104.7173996	18								Well		
WA02000	Ewalt Bach	519071.181	5748816.803	541.972	1.74	0.75	Large	very old unused in field	540.232			20								Well		
WA02001	Ewalt Bach	519005.612	5748841.915	542.085	0.85	0.75	Large	In basement	541.235			20	0	NE1/4	2	34	20	2	44	Well		Dug/Bored
WA02002	Ewalt Bach	519005.612	5748828.665	543.914	N/A	N/A	Small	couldn't get top off		51.88999939	-104.7238007	20	0	NE1/4	2	34	20	2	13	Well	882889	Drilled
WA02100	Leon Holfeld	524713.105	5754164.808	539.666	3.43	0.75	Large	South of Garden	536.236	51.93769836	-104.6402969	21	0	NW1/4	21	34	19	2	13	Well	883459	Dug/Bored
WA02101	Leon Holfeld	524713.12	5754077.633	539.232	3.91	1.3	Large	South of House	535.322	51.93690109	-104.6404037	21								Well		
WA02200	Gordon Fetter	528449.104	5756091.978	535.661	2.1336	0.75	Large		533.5274	51.95479965	-104.5859985	22								Well	843142	
WA02300	Norman Otsig	523117.722	5767316.161	550.115	4.29	0.81	Large		545.825	52.05599976	-104.6629028	23	0	NW1/4	33	35	19	2	23	Well	863200	Dug/Bored
WA02400	Ross Barclay	524101.061	5762411.696	534.806	2.2	0.76	Large		532.606	52.01179886	-104.6488037	24	0	NW1/4	15	35	19	2	10	Well	896713	Dug/Bored
WA02500	Norman Gierl	526325.816	5764047.619	536.983	2.23	0.7112	Large		534.753	52.02640152	-104.6163025	25								Well		
WA02600	Ron and Sandra Kients	527484.58	5761833.07	533.567	4.46	0.75	Large		529.107	52.00640106	-104.5996017	26	0	NE1/4	13	35	19	2	55	Well		Dug/Bored
WA02800	Bernard Jansen	525633.567	5760560.466	533.717	3.32	0.125	Small		530.397	51.99509811	-104.6266022	28	0	NE1/4	10	35	19	2	30	Well		Drilled
WA02900	Lorne and Theresa Schroder	527219.452	5760996.196	533.711	1.61	0.6	Large		532.101	51.99900055	-104.6035004	29								Well	820820	
WA03000	G.A.& S.Holfeld	527922.085	5754576.658	538.613	N/A	N/A	Small	Well in Pit		51.94120026	-104.5938034	30								Well	820814	
WA03100	Gerald Schroder	528259.029	5760761.42	529.211	N/A	N/A	Large			51.99679947	-104.5884018	31								Well		
WA03200	Dale Johnston	528855.802	5769897.847	543.351	4.02	0.75	LARGE		539.331	52.07889938	-104.5789032	32	0	NE1/4	12	36	19	2	59	Well		Dug/Bored
WA03300	Joe Behne	523470.254	5770726.763	553.957	2.45	0.75	Large		551.507	52.08660126	-104.6575012	33	0	SE1/4	16	36	19	2	40	Well		Dug/Bored
WA03400	Pat Gabriel	523482.742	5772535.848	556.499	N/A	1.2	Large			52.10290146	-104.6572037	34	0	SE1/4	21	36	19	2	50	Well		Dug/Bored
WA03500	Ken Seier	521524.888	5772598.049	557.152	2.87	0.9	Large		554.282	52.10350037	-104.6856995	35	0	SW1/4	20	36	19	2	50	Well		Dug/Bored
WA03600	Ernest Schoettler	521527.92	5768969.542	555.238	4.8	0.75	Large		550.438			36	0	NW1/4	5	36	19	2	22	Well		Unknown
WA03601	Ernest Schoettler	521505.72	5768931.092	554.858	N/A	0.75	Large			52.07049942	-104.686203	36	0	NW1/4	5	36	19	2	70	Well		Dug/Bored
WA03700	Anthony and Mary Morhart	521990.558	5768327.05	554.817	3.22	0.75	Large	Old wood Cribbing	551.597	52.06510162	-104.6791992	37	0	NE1/4	5	36	19	2	0	Well	868069	Unknown
WA03800	Ralph Leoffler	525347.032	5765644.19	538.475	2.7	0.75	Large		535.775	52.04040146	-104.6299973	38	0	NE1/4	27	35	19	2	0	Well		Unknown
WA03900	D. Bader	524179.313	5768381.326	545.486	2.97	0.75	Large		542.516	52.06549835	-104.6473007	39	0	NW1/4	3	36	19	2	10	Well	847805	Dug/Bored
WA04000	Brian Bader	524954.552	5767516.512	541.06	2.56	0.6	Large		538.5	52.05770111	-104.6360016	40	0	SW1/4	3	36	19	2	25	Well		Dug/Bored
WA04100	Debbie Fetter	528868.985	5766119.998	537.176	2.46	0.9	LARGE	On Map says owner is Herman and Anna Fette	534.716	52.04489899	-104.5791016	41	0	SE1/4	36	35	19	2	22	Well	851286	Dug/Bored
WA04200	Calvin & Joanne Buhs	527799.483	5767230.877	539.459	N/A	N/A	SMALL			52.05500031	-104.5945969	42	0	NW1/4	36	35	19	2	20	Well		Drilled
WA04300	Richard Pitka	517788.458	5770178.956	564.155	5.11	0.6	Large	right beside cattle corral	559.045	52.08190155	-104.7404022	43	0	NW1/4	12	36	20	2	0	Well		Dug/Bored
WA04400	E.L.& Murray Steffenson	519332.617	5759976.498	552.446	N/A	N/A	LARGE	Well on top of small hill relative to farm yard		51.99010086	-104.7184982	44	0	SW1/4	7	35	19	2	79	Well		Dug/Bored
WA04500	Ronald & Debra Moore	517132.098	5764190.805	553.508	4.6	1.1	Large		548.908	52.02809906	-104.7502975	45	0	SE1/4	26	35	20	2	80	Well		Dug/Bored
WA04600	Cecilia Bendil	516672.296	5767400.794	560.182	N/A	N/A	N/A	well in basement-no one home		52.05699921	-104.7567978	46	0	SW1/4	2	36	20	2	40	Well		Dug/Bored
WA04700	John Wilger	527076.631	5775449.506	553.478	N/A	0.15	SMALL			52.12889862	-104.6044998	47	0	NE1/4	26	36	19	2	10	Well		Drilled
WA04800	David & Kari Moore	517426.47	5765074.259	554.113	N/A	0.15	SMALL			52.0359993	-104.7460022	48	0	NE1/4	26	35	19	2	10	Well		Drilled
WA05000										0	0	50	0	NW1/4	25	36	19	2	43	Well		Drilled
WA05100	Dan Boschner	516934.806	5776736.142	477.249	7.33	0.6	Large		469.919	52.14089966	-104.7525024	51	0	NE1/4	35	36	20	2	55	Well		Dug/Bored
WA05200	Harold Pitka	522711.045	5773401.987	556.922	2.6	0.75	Large		554.322	52.1106987	-104.6684036	52	0	NW1/4	21	36	19	2	36	Well		Dug/Bored
WA05300	Dave Thiemen	512393.954	5772790.102	561.589	N/A	0.9	Large			52.10549927	-104.8190002	53	0	SE1/4	20	36	20	2	38	Well	868071	Dug/Bored
WA05301	Dave Thiemen	512427.188	5772823.336	561.589	N/A	N/A	Large					53								Well		
WA05500	Gerald McEachern	506177.925	5754417.803	543.988	N/A	N/A	Small	Well in pit		51.94039917	-104.9101028	55	0	SE1/4	27	34	21	2	35	Well	821113	Drilled
WA05600	Bernard Dodd	506006.356	5750260.57	538.51	N/A	N/A	N/A	Well in Crop field 200 m		51.90309906	-104.9126968	56	0	SE1/4	9	34	21	2	14	Well	883935	Dug/Bored
WA05700	Dave Nakoneshny	506048.482	5750289.058	540.212	3	0.8	Large		537.212	51.90330124	-104.9121017	57	0	SE1/4	9	34	21	2	15	Well		Dug/Bored
WA05800	Jerome Dunne	508429.768	5755313.136	540.686	N/A	0.15	Small			51.94850159	-104.8772964	58	0	NE1/4	26	34	21	2	6	Well	896147	Drilled
WA05900	William Dunne	508035.967	5754456.992	540.975	N/A	N/A	Large	Farmer said well went dry		51.94079971	-104.8831024	59								Well		
WA06000	Randolph Classen	513058.174	5776629.714	564.511	1.5	0.6	Large	looked like petroleum slick on water in well	563.011	52.13999939	-104.8091965	60	0	NW1/4	33	36	20	2	0	Well		Dug/Bored
WA06100	Jean & Gary Volden	519320.011	5758766.446	545.158	N/A	0.15	SMALL	Farmer perferred to not open well		51.97919846	-104.7186966	61	0	NW1/4	6	35	19	2	20	Well	880641	Drilled
WA06200	Myron Johnson	519287.698	5760724.756	548.504	1.41	0.15	SMALL		547.094			62								Well	820818	

Table 2
Leroy Water Well Information

Source ID	Name	Easting	Northing	Elevation	Water Level (m)	Diameter m	Large or Small	comment on	WaterLevel	Latitude	Longitude	ClientID	LSD	Quarter	Section	Township	Range	M	Age	Type	Projectid	InstallMethod
WA06201	Myron Johnson	519295.299	5760732.357	548.504	1.53	0.75	LARGE		546.974	51.99689865	-104.7190018	62								Well	850391	
WA06300	Leonard Athmer	527394.582	5776956.626	555.839	N/A	N/A	SMALL	Well Pit		52.14239883	-104.5997009	63	0	NW1/4	36	36	19	2	10	Well		Unknown
WA06301	Leonard Athmer	527418.405	5776976.616	555.839	3.61	0.75	LARGE	unused	552.229			63								Well		
WA06400	Roger Pomedli	525920.865	5776217.733	554.294	N/A	N/A	LARGE			52.13589859	-104.6212997	64	0	SW1/4	35	36	19	2	40	Well		Dug/Bored
WA06500	Randolph Strunk	524919.982	5775659.898	555.531	1.54	0.87	LARGE		553.991	52.13090134	-104.6359024	65	0	SE1/4	34	36	19	2	79	Well		Dug/Bored
WA06600	Donald Martin	524109.845	5775965.519	557.215	N/A	N/A	SMALL	Well Pit		52.13370132	-104.6477966	66	0	SW1/4	34	36	19	2	9	Well	820838	Drilled
WA06700	Andrew & Deanna Rauert	510820.498	5772874.369	570.944	3.46	1.05	Large		567.484	52.10630035	-104.8420029	67	0	SE1/4	19	36	2	2	0	Well	820972	Dug/Bored
WA07000	Ed Trimmel	509544.731	5775750.025	576.991	4.25	0.9	Large		572.741	52.13219833	-104.8606033	70	0	SW1/4	31	36	20	2	50	Well	820975	Dug/Bored
WA07100	Agatha Rueve	502880.313	5772445.768	585.988	N/A	0.15	Small	Unable to get cover off		52.1026001	-104.957901	71	0	SE1/4	20	36	21	2	20	Well	868043	Drilled
WA07200	Alois Frerichs	509188.719	5775830.054	577.856	4.01	0.15	Small		573.846	52.13290024	-104.865799	72	0	SE1/4	36	36	21	2	4	Well	821142	Drilled
WA07300	Edwin Bunz	505960.71	5775469.061	586.049	2.04	0.6	Large		584.009	52.12969971	-104.9129028	73	0	SE1/4	34	36	21	2	70	Well		Dug/Bored
WA07400	Calvin Gail Michel	511007.363	5769812.817	560.397	3.62	0.81	Large	Water rings at 1.87 m	556.777	52.0788002	-104.8394012	74	0	NE1/4	7	36	20	2	28	Well	814370	Drilled
WA07500	Ron Michel	510969.9	5769666.153	559.805	3.25	0.8	Large		556.555	52.07749939	-104.8398972	75	0	SE1/4	7	36	20	2	20	Well	889181	Dug/Bored
WA07600	Paula Michel	510921.641	5771348.242	565.886	7.07	0.75	Large		558.816	52.09260178	-104.8405991	76	0	SE1/4	18	36	20	2	47	Well		Unknown
WA07700	Lawrence Mollenbeck	510931.469	5776199.301	572.464	N/A	0.15	Small	Well in Pit		52.13619995	-104.8403015	77	0	NE1/4	31	36	20	2	63	Well		Dug/Bored
WA07800	Kurt Michel	511186.49	5771464.277	561.2	3.2	1.75	Large		558	52.09360123	-104.8367004	78	0	NW1/4	17	36	20	2	0	Well		Dug/Bored
WA07900	Shirley McGrath	513938.316	5759927.602	545.49	3.4	0.75	Large		542.09	51.9897995	-104.7969971	79	0	SE1/4	9	35	20	2	18	Well	866808	Dug/Bored
WA08000	Robert Elke	517338.78	5759021.159	549.59	13.7	0.15	SMALL	r	535.89	51.98160172	-104.7474976	80	0	NW1/4	2	35	20	2	10	Well	893715	Drilled
WA08001	Robert Elke	517224.38	5759021.159	548.86	N/A	0.15	SMALL	Steel Casing (1946)				80								Well		
WA08100	Gerald and Jay McGrath	514649.678	5760987.785	545.588	1.93	1.05	LARGE		543.658	51.99940109	-104.7865982	81	0	SW1/4	15	35	20	2	30	Well	866810	Dug/Bored
WA08101	Gerald and Jay McGrath	514642.788	5760989.001	545.588	1.81	0.75	LARGE	Very Close to Used Well	543.778			81								Well		
WA08200	Elmer & Myrtle Henning	514207.352	5760595.77	545.056	2.89	0.81	LARGE		542.166	51.99580002	-104.7930984	82	0	NE1/4	9	35	20	2	38	Well	820936	Dug/Bored
WA08300	Fred & Norma Staniec	502858.596	5760954.391	561.426	N/A	0.15	Small	Trees Surrounding Well		51.99919891	-104.9583969	83	0	SE1/4	17	35	21	2	5	Well	812633	Drilled
WA08400	Melvin & Doreen Jaeb	503259.454	5763962.166	570.41	N/A	0.15	Small	Well in Pit		52.02629852	-104.9524994	84	0	NW1/4	21	35	21	2	2	Well		Drilled
WA08500	Larry Harpauer	506313.24	5761719.204	557.984	N/A	0.15	Small			52.0060997	-104.9079971	85	0	NW1/4	14	35	21	2	3	Well		Drilled
WA08600	Mervyn Woods	511185.803	5762931.896	547.149	2.11	0.81	Large		545.039	52.01689911	-104.836998	86	0	SW1/4	20	35	20	2	11	Well	890544	Dug/Bored
WA08700	Werner and Olga Moellenbeck	508395.327	5757658.824	543.566	N/A	1.5	Large					87								Well		
WA08701	Werner and Olga Moellenbeck	508435.327	5757658.824	543.566	5.5	0.15	Small	Well in Grey Shed	538.066	51.96960068	-104.8771973	87	0	SW1/4	1	35	21	2	3	Well		Drilled
WA08800	Shawn & Lorna McGrath	506375.609	5756061.865	548.321	11.1	0.15	Small	Well under wood box east of house	537.221	51.9552002	-104.9072037	88	0	SW1/4	34	34	21	2	3	Well	107018	Drilled
WA08900	Gerald Carroll	509481.074	5756715.149	541.499	4.9	0.15	Small		536.599	51.96110153	-104.8619995	89	0	SW1/4	36	34	21	2	4	Well	901955	Drilled
WA09000	Ernest Klatt	510468.662	5751253.102	538.262	N/A	N/A	Small	Well in pit		51.91189957	-104.8478012	90	0	SE1/4	13	34	21	2	15	Well	848159	Drilled
WA09100	John Klatt	512706.959	5749141.826	538.975	6	0.15	Small		532.975	51.89289856	-104.8153	91	0	NW1/4	5	34	20	2	25	Well	850310	Drilled
WA09200	John Thompson	516152.844	5752571.327	539.145	N/A	N/A	small	Well in Pit		51.92359924	-104.7650986	92	0	NW1/4	15	34	20	2	22	Well	849389	Drilled
WA09300	Terrance &Janet McGrath	503344.964	5751182.467	544.223	N/A	N/A	Small	Well in Pit		51.91139984	-104.9514008	93	0	SW1/4	17	34	21	2	38	Well	821106	Drilled
WA09301	Terrance &Janet McGrath	503348.276	5751220.322	544.223	2	1.2	Large		542.223			93								Well		
WA09400	Walter Staniec	502988.128	5753647.952	549.225	12.53	0.15	Small		536.695	51.93349838	-104.9564972	94	0	NE1/4	20	34	21	2	10	Well	812632	Drilled
WA09401	Walter Staniec	502982.314	5753631.977	548.715	N/A	N/A	Large					94								Well		
WA09402	Walter Staniec	503040.428	5753678.152	549.655	N/A	N/A	Large	Very old				94								Well		
WA09500	Wayne Miller	509238.459	5752631.978	537.162	2.6	1.1	Large		534.562			95								Well		
WA09501	Wayne Miller	509238.25	5752683.682	536.242	2.9	0.5	Large		533.342			95								Well	854067	
WA09502	Wayne Miller	509238.25	5752625.982	536.942	N/A	0.15	Small			51.92430115	-104.8656998	95	0	NE1/4	14	34	21	2	11	Well		Drilled
WA09600	Andrew Carroll	506364.712	5753558.813	542.258	N/A	0.15	Small			51.93270111	-104.907402	96	0	SW1/4	22	34	21	2	1	Well	109648	Drilled
WA09700	Robert Koski	503327.718	5757796.909	551.332	N/A	N/A	Small	Well in Pit		51.97079849	-104.9515991	97	0	SW1/4	4	35	21	2	10	Well	889200	Dug/Bored
WA09800	Maurice Carrol	511620.572	5755633.12	540.819	3.6	0.15	Small		537.219	51.95130157	-104.8309021	98	0	SW1/4	30	34	20	2	18	Well	870445	Drilled
WA09900	Verna & Garry Mundell	517637.197	5762250.524	550.158	N/A	N/A	Large			52.01060104	-104.7429962	99	0	NW1/4	13	35	20	2	0	Well		Sandpoint
WA10000	Caroline Lokinger	528816.089	5768071.953	539.618	N/A	0.9	Large			52.0625	-104.5796967	100	0	SE1/4	1	36	19	2	24	Well	843143	Dug/Bored
WA10100	Melvin Schmidtkamp	521417.851	5773919.612	559.079	N/A	1	Large	Farmer didn't want lid taken off		52.11539841	-104.6872025	101	0	SW1/4	29	36	19	2	24	Well	847803	Dug/Bored
WA10200	Liesureland	511628.285	5760787.436	545.028	2.93	0.11	small	By the first Hole green	542.098			102	0	NW1/4	8	35	20	2	20	Well	820935	Drilled
WA10300	Donald Hogemann	512036.867	5770447.1	560.444	3.1	0.75	Large		557.344	52.08449936	-104.8243027	103	0	NE1/4	8	36	20	2	18	Well	869516	Dug/Bored
WA10800	Leroy # 2	511639.919	5760865.309	544.228	2.1	0.15	small		542.128			108	0		0	0	0	2	0	Well		Drilled
WA10801	Leroy # 1	511637.853	5760841.699	544.883	N/A	N/A	LARGE			51.99810028	-104.8304977	108	0		0	0	0	2	0	Well	854508	Dug/Bored
WA10900	Norman Block											109	0	NE1/4	6	35	20	2	25	Well		Unknown
WA11000										0	0	110	0	SW1/4	25	34	19	2	18	Well	868116	Unknown
WA11200	Valerie Berger											112	0	SW1/4	31	34	20	2	0	Well		Unknown
WA11600	R.J Hyde	530296.38	5754649.015	532.15	N/A	0.6	Large			51.94169998	-104.5591965	116	0	SE1/4	25	34	19	2	23	Well	848164	Dug/Bored
WA11700	Scott MacDonald	507779.321	5758793.961	546.123	1.55	0.15	Small		544.573	51.97980118	-104.8867035	117	0	NE1/4	2	35	21	2	22	Well	851075	Drilled
WA11800	Lance Stock-Brugger	522196.576	5767651.074	550.591	5.6	0.8	Large		544.991	52.05899811	-104.6762009	118	0	SE1/4	5	36	19	2	23	Well	847804	Dug/Bored
WA11900	Dan Reinhart	521750.793	5753385.212	541.95	2.83	0.12	Small	2.21m to H20 rings	539.12	51.93069839	-104.6837006	119	0	SE1/4	19	34	19	2	16	Well		Dug/Bored
WA11901	Dan Reinhart	521725.991	5753348.108	540.806	1.58	0.6	Large	In shack	539.226	51.93040085	-104.6838989	119								Well	883852	
WA12000	Gary Stooshnoff	522292.012	5772140.655	556.061	2.35	0.8	Large		553.711	52.09939957	-104.6745987	120	0	NE1/4	17	36	19	2	18	Well	868068	Unknown
WA12100	Larry Koenig	522211.444	5770501.275	555.544	N/A	0.9	Large			52.08459854	-104.6757965	121	0	NE1/4	8	36	19	2	11	Well	845200	Dug/Bored
WA12200	Gilbert Thiemann	511229.739	5770621.031	559.326	3	1.1	Large		556.326	52.08599854	-104.8360977	122	0	SW1/4	17	36	20	2	10	Well	301080	Dug/Bored
WA12300	Garry Dietrick	511735.015	5761235.467	546.783	N/A	N/A	Small	Well in Pit		52.00170135	-104.8291016	123	0	SW1/4	17	35	20	2	45	Well		Dug/Bored
WA12400	Kelly Strueby	523981.638	5770262.37	552.473	N/A	0.15	Large			52.08240128	-104.6500015	124	0	NE1/4	9	36	19	2	16	Well	870562	Drilled
WA12500	Gorden Block	521119.177	5754639.017	540.784	1.35	0.6	Large		539.434	51.94179916	-104.6929016	125	0	SW1/4	30	34	19	2	0	Well	856346	Dug/Bored
WA12600	Stomp Pork Farms											126	0	SE1/4	32	34	20	2	3	Well	900801	Unknown
WA12601	Stomp Pork Farms							Was asked to not do GPS survey				126	0	SW1/4	366	35	21	2	6	Well	900801	Unknown
WA20100	Bill & Eileen Block	527122.386	5748653.133	533.33	N/A	0.15	Small					2001								Well		

Table 2
Leroy Water Well Information

Source ID	Name	Easting	Northing	Elevation	Water Level (m)	Diameter m	Large or Small	comment on	WaterLevel	Latitude	Longitude	ClientID	LSD	Quarter	Section	Township	Range	M	Age	Type	Projectid	InstallMethod
WA20101	Bill & Eileen Block	527209.535	5748578.588	533.294	3.08	0.1	Small		530.214	51.88729858	-104.604599	2001								Well	893714	
WA20900	Wackers Ent. Ltd.	519015.349	5748400.323	543.885	N/A	0.15	Small			51.88600159	-104.7236023	2009								Well		
WA21000	Gerald Mcgrath	520475.314	5749563.993	541.44	N/A	0.15	Small			51.89649963	-104.7022018	2010								Well		
WA21600	Joseph Pitka	525589.319	5771617.364	548.753	2.5	0.75	Large		546.253	52.0945015	-104.626503	2016								Well		
WA21800	Debbie Fetter	528885.885	5766136.898	537.176	3.1	0.53	LARGE	very old	534.076			2018								Well		
WA21801	Debbie Fetter	528868.985	5766185.868	537.176	N/A	0.75	LARGE					2018								Well		
WA22400	Nancy Yeo	510895.838	5764195.79	550.467	3.65	0.75	Large		546.817	52.02830124	-104.8412018	2024								Well		
WA22500	Arthur James McIntosh	515055.451	5763754.596	551.371	2.58	0.75	Large		548.791	52.02420044	-104.7806015	2025								Well		
WA22600	E.A.& D.Hartle	519293.089	5762814.76	551.486	0.86	0.15	small		550.626	52.0155983	-104.7189026	2026								Well	808253	
WA22700	Bruce Mundell	517435.476	5760687.87	550.81	6.1	0.13	small	Farm Fuel Tank about 2 m from well	544.71	51.9966011	-104.7460022	2027								Well	820941	
WA22800	Daniel Torwalt	515790.611	5759155.886	548.409	N/A	N/A	small			51.98289871	-104.7701035	2028								Well		
WA22900	E.D.& L.Braitenbach				3.01	0.5	Large					2029								Well		
WA23000	Fred Muller	515810.995	5754247.547	543.729	2.3	0.95	Large		541.429	51.93870163	-104.7699966	2030								Well		
WA23100	Wanda & Linda Zucht	513995.696	5750922.947	539.452	3.72	0.6	Large		535.732	51.90890121	-104.7965012	2031								Well		
WA23200	Ralph Kiefer	509344.696	5768090.864	565.846	N/A	0.127	Small	well in Pit Farmer said well is about 215 ft to bottom		52.06330109	-104.8637009	2032								Well	809480	
WA23300	Darren Kraus	509287.386	5770481.144	571.638	N/A	0.15	Small	Very old. Couldn' t get off		52.08480072	-104.864502	2033								Well		
WA23400	Nora Harder	501169.295	5764186.982	570.439	N/A	0.15	Small	Well in Pit		52.02830124	-104.9830017	2034								Well	821126	
WA23500	Executrix Phylis Bernauer	505968.664	5763470.408	561.095	2.67	1.25	Large		558.425	52.02180099	-104.913002	2035								Well		
WA23600	Gerald Knaus	506187.527	5759871.894	550.805	N/A	N/A	Small	Well in Pit filled with water		51.98949814	-104.9098969	2036								Well		
WA23700	G. & N. Bernhauer	506031.361	5758114.343	549.273	N/A	N/A	Small	Well in Pit		51.97370148	-104.9122009	2037								Well	821119	
WA24100	Gerald &Terrance McGrath	512594.428	5751211.947	541.089	2.6	0.5	Large		538.489	51.91149902	-104.8169022	2041								Well		
WA24700	John Kraus	507707.185	5770240.14	573.662	8.11	0.75	Large		565.552	52.08269882	-104.8874969	2047								Well		
WA24701	John Kraus	507707.185	5770238.14	573.662	N/A	0.15	Small	Well in 15 ft pit				2047								Well	821132	
WA24900	Ralph & Sandy Hinz	508002.028	5769642.453	573.561	N/A	N/a	N/A	Well in pit		52.07730103	-104.8832016	2049								Well	847781	
WA25000	August Binsfield	527433.762	5775395.162	553.46	N/A	0.15	Small	well in 12 ft pit		52.1283989	-104.5991974	2050								Well		
WA25100	Raymond Ehlert	528674.378	5775897.49	550.048	2.03	0.75	Large		548.018			2051								Well		
WA25101	Raymond Ehlert	528666.185	5775803.848	550.048	2.07	0.75	Large		547.978	52.13199997	-104.5811996	2051								Well		
WA25102	Raymond Ehlert	528678.655	5775751.127	550.407	N/A	1	Large			52.13150024	-104.5810013	2051								Well	843145	
WA25400	Neil McGrath	527114.243	5754654.258	539.331	5.1	1	Large		534.231	51.94189835	-104.6054993	2054								Well		
WA25700	Clarence Bendig	526401.72	5751263.707	541.909	4.34	0.125	Small		537.569	51.91149902	-104.6162033	1057								Well	820810	
WA99800	Water Treatment Plant	517550.441	5760836.71	550.908	N/A	N/A	N/A			51.9978981	-104.7444	998								Well		

Table 2
Leroy Water Well Information

Source ID	Name	ScreenType	Depth	CasingDiameter	CasingMaterial	ChemicalType	AerationType	DrinkingSource	SewageDistance	FuelDistance	ProblemFrequency	ChemicalTest	GeneralComments	Water Level
WA00200	Ken Schoettler	Unknown	42	36	Concrete	None	None		More than 100m	More than 100m	Frequent		The one well is west of the house.	544.4
WA00300	Leonard Krieger	Unknown	45	5	Steel	None	None		Less than 50m	More than 100m	Frequent		Well E of house & N of cement pad 100 m	533.362
WA00400	Roger Laybourne	Unknown	103	42	Copper Be	None	None	Buy water	More than 100m	More than 100m	Frequent		Well is west of house.	523.788
WA00502	Craig & Charlene Hanson	Unknown	350	5	Steel	None	None	Buy water	50-100m	More than 100m	Occasional		The well is 200 yards west of house.	518.722
WA00600	Stan Gorden													533.561
WA00601	Stan Gorden	Screen	100	5	Fiberglass	None	None		More than 100m	50-100m	Frequent		well is 100 m E of house by unused well.	532.031
WA00602	Stan Gordon	Slotted Casing	28	30	Fiberglass	None	None	Distiller	More than 100m	More than 100m	Frequent	Hardness,Iron	well at end of the Spruce trees E of house.	532.447
WA00700	Calvin Porten	Screen	190	5	PVC	None	None		More than 100m	50-100m	Frequent		The well is south of the house.	
WA00701	Calvin Porten													544.661
WA00702	Calvin Porten	Screen	186	5	PVC	None	None		More than 100m	More than 100m	Frequent	Iron, Nitrates, Hardness	The well is northwest of the house.	535.261
WA00800	Erna Dotschkat	Slotted Casing	125	8	Steel	None	None		More than 100m	More than 100m	Seldom			
WA01000	Robert Hamilton	Slotted Casing	97	18	Timber	None	None		More than 100m	Less than 50m	Seldom	Iron, Nitrates		
WA01100	David Arnst	Unknown	186	5	Steel	None	None		More than 100m	50-100m	Seldom	Nitrates		528.45
WA01200	Walter Block	Unknown	40	30	Timber	None	None		More than 100m	More than 100m	Seldom			540.097
WA01300	Donavon Block	Screen	69	8	PVC	None	None	Haul, Community well south of Jansen	More than 100m	More than 100m	Occasional	Nitrates		539.948
WA01400	Ernest Amendt	Unknown	0	36	Concrete	None	None		50-100m	Less than 50m	Frequent			534.708
WA01500	L &T Fetter	Unknown	21	30	Galvanized	None	None		More than 100m	More than 100m	Seldom			534.702
WA01600	K and S Lissel	Screen	25	30	Timber	None	None	Buy water	Less than 50m	More than 100m	Seldom			531.405
WA01700	Donald Lissel													534.862
WA01701	Donald Lissel													534.396
WA01702	Donald Lissel	Unknown	34	36	Concrete	None	None		More than 100m	More than 100m	Seldom	Nitrates, hardness		
WA01800	Heather Block													
WA02000	Ewalt Bach													540.232
WA02001	Ewalt Bach	Unknown	8	36	Concrete	None	None		Less than 50m	50-100m	Seldom	Nitrates		541.235
WA02002	Ewalt Bach	Screen	197	8	PVC	None	None		50-100m	More than 100m	Seldom			
WA02100	Leon Holfeld	Screen	19	36	Fiberglass	None	None		Less than 50m	More than 100m	Seldom			536.236
WA02101	Leon Holfeld													535.322
WA02200	Gordon Fetter													533.5274
WA02300	Norman Otsig	Unknown	42	36	Concrete	None	None	Haul water	More than 100m	Less than 50m	Frequent			545.825
WA02400	Ross Barclay	Unknown	26	4					More than 100m	More than 100m	Seldom			532.606
WA02500	Norman Gierl													534.753
WA02600	Ron and Sandra Kients	Unknown	60	36	Timber	None	None		More than 100m	50-100m	Seldom			529.107
WA02800	Bernard Jansen	Slotted Casing	160	5	Iron	None	None	Haul water, both drinking and household	50-100m	50-100m	Frequent			530.397
WA02900	Lorne and Theresa Schroder													532.101
WA03000	G.A.& S.Holfeld													
WA03100	Gerald Schroder													
WA03200	Dale Johnston	Unknown	52	30	Galvanized	None	None		More than 100m	More than 100m	Frequent			539.331
WA03300	Joe Behne	Unknown	130	24	Timber	None	None		More than 100m	50-100m	Frequent			551.507
WA03400	Pat Gabriel	Unknown	25	36	Timber				50-100m	More than 100m	Seldom			
WA03500	Ken Seier	Unknown	40	36	Galvanized	None	None	Rain water,cistern	More than 100m	Less than 50m	Seldom	Hardness, Iron		554.282
WA03600	Ernest Schoettler	Unknown	48	36	Concrete	None	None		50-100m	Less than 50m	Frequent	Iron, Nitrates		550.438
WA03601	Ernest Schoettler	Unknown	0	36	Galvanized	None	None		More than 100m	50-100m	Frequent	Iron, Nitrates		
WA03700	Anthony and Mary Morhart	Unknown	37	24	Timber	None	None	Buy water	More than 100m	More than 100m	Frequent			551.597
WA03800	Ralph Leoffler	Unknown	0	0		None	None		More than 100m	50-100m	Frequent	Bacteria, Iron		535.775
WA03900	D. Bader	Slotted Casing	60	36	Fiberglass	None	None	Buys drinking water	More than 100m	More than 100m	Frequent			542.516
WA04000	Brian Bader	Unknown	19	24	Timber	None	None		More than 100m	More than 100m	Frequent	Iron		538.5
WA04100	Debbie Fetter	Unknown	58	36	Porous Concrete	None	None		50-100m	More than 100m	Occasional			534.716
WA04200	Calvin & Joanne Buhs	Screen	130	4	PVC	None	None		50-100m	50-100m	Frequent			
WA04300	Richard Pitka	Unknown	68	30	PVC & Timber	None	None		More than 100m	50-100m	Frequent			559.045
WA04400	E.L.& Murray Steffenson	Unknown	120	36	Timber	None	None		More than 100m	More than 100m	Frequent			
WA04500	Ronald & Debra Moore	Unknown	200	24	Timber	None	None		50-100m	50-100m	Frequent	Hardness		548.908
WA04600	Cecilia Bendil	Unknown	90	20	Galvanized	None	None		More than 100m	50-100m	Seldom			
WA04700	John Wilger	Screen	70	5	PVC	None	None	Cistern	More than 100m	More than 100m	Seldom	Nitrates		
WA04800	David & Kari Moore	Screen	225	5	PVC	None	None		More than 100m	Less than 50m	Frequent	Iron, hardness		
WA05000		Unknown	90	6	Steel			haul water	More than 100m	More than 100m	Frequently		Steel lined with PVC	
WA05100	Dan Boschner	Unknown	100	26	Timber	None	None		More than 100m	More than 100m	Seldom			469.919
WA05200	Harold Pitka	Unknown	44	36	Concrete	None	None		More than 100m	More than 100m	Frequent			554.322
WA05300	Dave Thiemen	Unknown	22	36	Timber	None	None		More than 100m	More than 100m	Seldom			
WA05301	Dave Thiemen													
WA05500	Gerald McEachern	Unknown	345	4	Steel	None	None	Haul	More than 100m	More than 100m	Frequent			
WA05600	Bernard Dodd	Unknown	36	32	PVC	None	None		More than 100m	More than 100m	Seldom	Nitrates, Iron		
WA05700	Dave Nakoneshny	Unknown	30	36	Concrete	None	None		50-100m	Unknown	Seldom	Nitrates, Iron		537.212
WA05800	Jerome Dunne	Screen	370	5	PVC	None	None	Haul Water	More than 100m	More than 100m	Seldom			
WA05900	William Dunne													
WA06000	Randolph Classen	Slotted Casing	16	36	Fiberglass	None	None	Buy water	More than 100m	More than 100m	Frequent	Nitrates		563.011
WA06100	Jean & Gary Volden	Screen	120	6	PVC	None	None		More than 100m	More than 100m	Seldom			
WA06200	Myron Johnson													547.094

Table 2
Leroy Water Well Information

Source ID	Name	ScreenType	Depth	CasingDiameter	CasingMaterial	ChemicalType	AerationType	DrinkingSource	SewageDistance	FuelDistance	ProblemFrequency	ChemicalTest	GeneralComments	Water Level
WA06201	Myron Johnson													546.974
WA06300	Leonard Athmer			5	PVC	None	None		50-100m	More than 100m	Seldom	Nitrates		
WA06301	Leonard Athmer													552.229
WA06400	Roger Pomedli			36	Timber	None	None		More than 100m	Less than 50m	Seldom	Nitrates		
WA06500	Randolph Strunk			36	Timber	None	None	Buy water	More than 100m	More than 100m	Frequent	Nitrates		553.991
WA06600	Donald Martin			6	PVC	None	None		Less than 50m	Less than 50m	Frequent			
WA06700	Andrew & Deanna Rauert			36	steel,timber	None	None		50-100m	50-100m	Seldom			567.484
WA07000	Ed Trimmel			36	alvanized & Timbe	None	None	Haul water	50-100m	50-100m	Frequent			572.741
WA07100	Agatha Rueve			6	PVC			Haul water	More than 100m	More than 100m	Frequent			
WA07200	Alois Frerichs			6	PVC	None	None		More than 100m	More than 100m	Frequent			573.846
WA07300	Edwin Bunz			30	Timber	None	None		More than 100m	More than 100m	Occasional			584.009
WA07400	Calvin Gail Michel			36	Concrete	None	None		More than 100m	More than 100m	Frequent			556.777
WA07500	Ron Michel			36	Concrete	None	None		More than 100m	More than 100m	Seldom			556.555
WA07600	Paula Michel			36	alvanized & Timbe	None	None		More than 100m	More than 100m	Seldom			558.816
WA07700	Lawrence Mollenbeck										Frequent			
WA07800	Kurt Michel	Unknown	120	30	alvanized & Timbe	None	None	Buy water and use cistern	More than 100m	More than 100m	Seldom	Iron		558
WA07900	Shirley McGrath	Unknown	25	36	alvanized & Timbe	None	None	Buy water	More than 100m	50-100m	Seldom			542.09
WA08000	Robert Elke	Slotted Casing	14	36	Galvanized	None	None		More than 100m	More than 100m	Frequent			535.89
WA08001	Robert Elke	Screen	200	5	PVC	None	None		More than 100m	More than 100m				
WA08100	Gerald and Jay McGrath										Seldom			543.658
WA08101	Gerald and Jay McGrath	Slotted Casing	12	48	Concrete	None	None	Buy	More than 100m	50-100m				543.778
WA08200	Elmer & Myrtle Henning										Seldom			542.166
WA08300	Fred & Norma Staniec	Unknown	16	36	Concrete	None	None		More than 100m	More than 100m	Frequent			
WA08400	Melvin & Doreen Jaeb	Unknown	160	5	PVC				More than 100m	More than 100m	Frequently			
WA08500	Larry Harpauer	Screen	248	5	PVC			haul water	50-100m	50-100m	Frequent			
WA08600	Mervyn Woods	Screen	175	5	PVC				More than 100m	More than 100m	Seldom			545.039
WA08700	Werner and Olga Moellenbeck	Unknown	26	36	Concrete			Haul water	More than 100m	More than 100m				
WA08701	Werner and Olga Moellenbeck										Frequent			538.066
WA08800	Shawn & Lorna McGrath	Screen	380	6	PVC				50-100m	50-100m	Seldom			537.221
WA08900	Gerald Carroll	Unknown	335	5	PVC			Buy water	50-100m	More than 100m	Seldom			536.599
WA09000	Ernest Klatt	Screen	225	6	PVC				More than 100m	More than 100m	Seldom			
WA09100	John Klatt	Screen	116	5	PVC			haul water	More than 100m	More than 100m	Seldom			532.975
WA09200	John Thompson	Screen	160	5	PVC				Less than 50m	Less than 50m	Seldom			
WA09300	Terrance &Janet McGrath	Screen	123	5	PVC				50-100m	More than 100m	Frequent			
WA09301	Terrance &Janet McGrath	Unknown	156	4	Steel				More than 100m	Less than 50m				542.223
WA09400	Walter Staniec										Seldom			536.695
WA09401	Walter Staniec	Screen	360	5	PVC				50-100m	More than 100m				
WA09402	Walter Staniec													
WA09500	Wayne Miller													534.562
WA09501	Wayne Miller													533.342
WA09502	Wayne Miller										Frequent			
WA09600	Andrew Carroll	Screen	175	5	PVC				More than 100m	More than 100m	Frequent			
WA09700	Robert Koski	Screen	360	5	PVC				More than 100m	More than 100m	Seldom			
WA09800	Maurice Carrol	Unknown	30	36	Concrete				More than 100m	More than 100m	Occasional			537.219
WA09900	Verna & Garry Mundell	Screen	135	4	PVC				More than 100m	50-100m	Frequent			
WA10000	Caroline Lokinger	Unknown	18	36					50-100m	More than 100m	Frequent			
WA10100	Melvin Schmidtkamp	Unknown	60	36	Concrete			Watson	More than 100m	More than 100m	Seldom			
WA10200	Liesureland	Unknown	56	36	Concrete				50-100m	50-100m	Seldom			542.098
WA10300	Donald Hogemann	Screen	18	6	Steel	None	None		More than 100m	More than 100m	Seldom			557.344
WA10800	Leroy # 2	Unknown	26	4	Steel				More than 100m	More than 100m	Frequent			542.128
WA10801	Leroy # 1	Screen	30	6	PVC				More than 100m	More than 100m	Frequent			
WA10900	Norman Block	Unknown	25	36	Concrete				More than 100m	More than 100m	Seldom			
WA11000		Unknown	15	48	Concrete				More than 100m	More than 100m	Unknown			
WA11200	Valerie Berger	Unknown	103	42	copper bearing				Unknown	Unknown	Frequently			
WA11600	R.J Hyde	Unknown	0						Unknown	Unknown	Seldom			
WA11700	Scott MacDonald	Unknown	85	37	Galvanized				50-100m	50-100m	Seldom			544.573
WA11800	Lance Stock-Brugger	Screen	180	5	PVC			Ro Buy	More than 100m	50-100m	Frequently			544.991
WA11900	Dan Reinhart	Unknown	40	36	Concrete			Buy	More than 100m	50-100m	Seldom	yes		539.12
WA11901	Dan Reinhart	Slotted Casing	30	30	Fiberglass				50-100m	More than 100m				539.226
WA12000	Gary Stooshnoff										Unknown			553.711
WA12100	Larry Koenig	Unknown	30	36	Concrete				Unknown	Less than 50m	Occasionaly			
WA12200	Gilbert Thiemann	Unknown	40	36	Galvanized				More than 100m	More than 100m	Seldom			556.326
WA12300	Garry Dietrick	Unknown	26	36	Concrete				More than 100m	More than 100m	Occasionaly			
WA12400	Kelly Strueby	Unknown	40	36	Timber			Distilled	More than 100m	50-100m	Frequently			
WA12500	Gorden Block	Screen	310	6	Iron			Haul	More than 100m	More than 100m	Seldom			539.434
WA12600	Stomp Pork Farms	Unknown	18	24	Galvanized				More than 100m	Less than 50m	Unknown			
WA12601	Stomp Pork Farms	Unknown	352	5	PVC				More than 100m	More than 100m	Unknown			
WA20100	Bill & Eileen Block	Unknown	260	5	PVC				Unknown	Unknown				

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Source ID	Name	ScreenType	Depth	CasingDiameter	CasingMaterial	ChemicalType	AerationType	DrinkingSource	SewageDistance	FuelDistance	ProblemFrequency	ChemicalTest	GeneralComments	Water Level
WA20101	Bill & Eileen Block													530.214
WA20900	Wackers Ent. Ltd.													
WA21000	Gerald Mcgrath													
WA21600	Joseph Pitka													546.253
WA21800	Debbie Fetter													534.076
WA21801	Debbie Fetter													
WA22400	Nancy Yeo													546.817
WA22500	Arthur James McIntosh													548.791
WA22600	E.A.& D.Hartle													550.626
WA22700	Bruce Mundell													544.71
WA22800	Daniel Torwalt													
WA22900	E.D.& L.Braitenbach													
WA23000	Fred Muller													541.429
WA23100	Wanda & Linda Zucht													535.732
WA23200	Ralph Kiefer													
WA23300	Darren Kraus													
WA23400	Nora Harder													
WA23500	Executrix Phylis Bernauer													558.425
WA23600	Gerald Knaus													
WA23700	G. & N. Bernhauer													
WA24100	Gerald &Terrance McGrath													538.489
WA24700	John Kraus													565.552
WA24701	John Kraus													
WA24900	Ralph & Sandy Hinz													
WA25000	August Binsfield													
WA25100	Raymond Ehlert													548.018
WA25101	Raymond Ehlert													547.978
WA25102	Raymond Ehlert													
WA25400	Neil McGrath													534.231
WA25700	Clarence Bendig													537.569
WA99800	Water Treatment Plant													