Geo-Logic
ASSOCIATES
Geologists, Hydrogeologists and Engineers

Date: November 8, 2010
Project No.: 2010-0005

To: John Hower, CEG
Sarah Battelle, CHG

From: Mark Vincent, CHG

Regarding: **Observations and Analyses of Aquifer Characteristics**
Thing Valley, San Diego County, California

INTRODUCTION

This memo presents a summary of observations and analyses made following a stepped and a constant rate aquifer pumping and recovery test in wells located in Thing Valley located approximately 10 miles north of I-8 off La Posta Truck Trail/Thing Valley Road in the Ewiiaapaayp Reservation, in eastern San Diego County, California. The tests were performed to determine whether sufficient volumes of water are available [redacted]. Analyses performed included calculation of transmissivity, hydraulic conductivity, and storativity for a pumping well and observation wells.

WELL AND AQUIFER CONDITIONS

A well labeled as South Well was used as the pumping well for this test. Another well labeled as North Well is located 61.5 feet to the west of the pumping well and was monitored and analyzed as an observation well. A third well identified as Thing Valley Well is located approximately 5,517 feet south-southeast of the pumping well and was also used as an observation well (Figure 1).

Records for drilling and construction of the wells used for these pumping tests are incomplete or nonexistent. A well identified on Department of Water Resources (DWR) records as the "Cuyapaipe Community Well" (identified as Form No. 058539) is believed to be the log for South Well. No records are available for North Well or Thing Valley Well.

Although DWR records indicate that slotted well casing was installed to a depth of 122 feet, they do not indicate whether or not casing exists below that depth or if the casing was installed prior to drilling the well to a total depth of 400 feet. The North and South Wells used in this pumping test have existing electric submersible pumps installed in them. Based on the production rates achieved during the tests performed, the wells are likely to be outfitted with four-inch diameter electric submersible pumps. Based on the depth and pressure head on the transducers installed in the wells for the test, it was assumed that all of the boreholes are 400 feet deep and are 10-inches in diameter. It was

further assumed that the wells were constructed with 6-inch diameter well casing and that they are perforated or screened over the entire saturated thickness. Details of well construction could not be verified in the field because of the presence of pumps, discharge pipes, electrical wires, and surface sanitary seals.

The area immediately around North Well and South Well is underlain by alluvium comprised of poorly sorted sand, gravel, and silt derived from the crystalline basement rock exposed on the adjacent canyon sidewalls. The crystalline basement rocks are classified as tonalite and yield groundwater from fractures. The well log reportedly recorded for South Well indicates that there are about 12 to 15 feet of alluvium overlying the tonalite. An alternative interpretation of the log is that some of the materials described in the log to a depth of 50 feet could also be coarse-grained alluvium locally derived from the surrounding tonalite. Groundwater was measured at a depth of 54.81 feet below the top of sanitary seal on North Well (approximately 8-inches above ground surface) and was measured at a depth of 49.34 feet below the sanitary seal in South Well (also about 8-inches above ground surface). Groundwater was measure at a depth of 77.62 feet below the top of the conductor casing on Thing Valley Well (the conductor casing extends approximately 6-inches above ground surface).

TEST METHODS

Observations of groundwater elevation were recorded in a pumping well and two observation wells in Thing Valley. Data was collected using pressure transducers connected to data loggers. Barometric pressure changes were recorded during the test and corrections were made to the pressure head data collected during the tests.

A stepped aquifer pumping test was performed using North Well to determine the optimum pumping rate for a longer duration test. The pressure transducers were deployed and began recording data on August 12, 2010 to perform the stepped pumping test. The stepped pumping test was performed at pumping rates of 72 gallons per minute (gpm), 88 gpm, and 90 gpm. The pump could not be throttled down below 72 gpm without water exiting a by-pass / check valve and had a maximum yield of 90 gpm. A semi-logarithmic plot of elapsed time versus drawdown for the stepped pumping test is shown on Figure 2.

The constant rate pumping and recovery test was performed from August 16 through 19, 2010. The pump was powered-down on August 19, 2010 and allowed to recover until August 23, 2010 when the pressure transducers were removed from the wells. South Well was initially pumped at an average rate of 88 gpm and was corrected to 80 gpm during a period from about 1 to 2 hours into the test. Recovery tests were performed by turning off the pumps and recording the increasing head levels over time.

DATA ANALYSIS

Changes in groundwater level data recorded during this test were corrected for barometric pressure changes and used to generate a file containing tabulated time and changes in pressure head. The data was used to generate time-drawdown graphs for the pumping

and observation wells and imported into computer software used to calculate the transmissivity and storativity of the fractured tonalite.

The stepped pump test analysis consists of plotting the drawdown versus time for each pumping rate on a time versus drawdown plot with time plotted on a logarithmic scale. Forward projections of each segment representing a different pumping rate can be used to predict the likely drawdown for the pumping well during for the selected duration of the test. A pumping rate of 80 gpm was selected as the target pumping rate because it would allow for ample drawdown without the well running dry during the test.

The method of Schafer (1978) was employed to determine how much of the data set for North Well was impacted by casing storage effects. The method is a simplification of the method first developed by Papadopulos and Cooper (1967) but does not require prior knowledge of the transmissivity or well efficiency. The point at which casing storage effects are overcome was calculated to occur approximately 12 to 14 minutes into the test based on the assumptions about well construction practices, pumping rates, and drawdown. Very early pumping data was ignored in the analyses described below due to casing storage effects and the non-uniform drawdown curve caused by the change in the pumping rate from 88 to 80 gpm.

Time versus drawdown plots were prepared for the pumping and observation wells for the pumping and recovery portions of the test. The plots are shown with the time axis plotted on a logarithmic scale and drawdown on a linear scale.

Figure 3 shows the time-drawdown plot for North Well during pumping. The first 12 to 14 minutes of the test show the effects of attempting to establish a constant pumping rate and casing storage effects. A slight recovery in the drawdown is noted from around 14 minutes to approximately 33 minutes due to a reduction in the pumping rate from 88 to 80 gpm. The North Well drawdown plots as a straight line on the time-drawdown chart representing constant aquifer properties during that portion of the drawdown cone development. A sudden change in the drawdown curve starts at approximately 1,700 minutes and changes again at approximately 3,000 minutes. The steepening of the time drawdown curve noted at approximately 1,700 and 3,000 minutes likely indicates a negative boundary effect.

A residual drawdown plot for the North Well is shown on Figure 4. The plot shows the change in drawdown versus the ratio of the time since the pump test started divided by the time since the recovery portion of the test started (t/t`). An inflection point is noted at approximately t/t`=100 possibly due to some type of boundary effect. The residual drawdown at a t/t` ratio of 1 extends through the origin and there is no discernable change in storage noted in the pumping well over the course of the pumping and recovery portions of the aquifer stress test.

A time-drawdown plot of South Well located 61.5 feet away from the pumping well shows a sharp decrease in drawdown from approximately 51 minutes to approximately 65 minutes which is considered to be the result of the decrease in pumping rate from 88 to 80 gpm (Figure 5). The South Well plot shows a slight increasing slope to the semi-logarithmic plot but shows a very strong inflection point at approximately 1,700 minutes

into the test. This is interpreted to be the result of a negative boundary effect similar to that observed on the time-drawdown plot from North Well (compare Figures 3 and 5).

The South Well recovery portion of the test is plotted as the residual drawdown versus t/t` shows a concave upwards curvature to the semi-logarithmic plot (Figure 6) indicative of changing aquifer conditions from a t/t` ratio of about 10 to 200 into the recovery test period. The line segment from a t/t` ratio of 200 the end of the test is a straight line plot indicative of constant aquifer conditions. The residual drawdown value measured for a t/t` ratio of 1 is about -3.5 feet. Though this value is not within about one half of a foot as would be expected from a successful test, it may not be especially significant for an observation well when the pumping well shows no changes in storage effect.

The Thing Valley Well located approximately 5,517 feet south of the pumping well was monitored for changes in head. A possible cumulative drawdown of approximately 0.25 feet was observed from approximately 400 minutes until the end of the test (Figure 7). The recovery portion of the well is shown on Figure 8 and is shows a large sudden change in measured head near the end of the monitoring period. This is interpreted as a slippage of the transducer cable and is probably not a valid recovery curve.

Water level drawdown data were evaluated using the computer software program AquiferTest version 3.5 (Waterloo Hydrogeologic, 2002). The program performs curve matching of the time drawdown data to calculate transmissivity, hydraulic conductivity, and storativity using different methods. The methods employed included Cooper-Jacob (1946), Moench (1993), Neuman (1975), and Theis (1935).

DISCUSSION

As shown on Table 1, the calculated hydraulic conductivity values for all of the analytical methods employed ranged from a low of 0.285 feet/day for data collected from North Well using Neuman's method for the data collected from the end of the data set to a high of 2.39 feet/day for the early time recovery phase of South Well using the Theis Recovery method. An average conductivity of 1.122 feet/day was calculated from all methods from both South Well and North Well. The Storativity values range from a low of 3.33E-09 for North Well middle to late time data and a high of 4.19E+01 for a match to the very late time data recorded in South Well.

All of the analytical results show a higher transmissivity and hydraulic conductivity value for matches to the early time drawdown data and show lower values for matches to late time drawdown data. This is most likely the result of a higher degree of fracturing in the rock around the wells. North Well and South Well are located in a portion of Thing Valley which is entirely covered in up to 50 feet of alluvium (Figure 9). Inspection of aerial photographs from Google Earth show the local canyons and drainages are controlled by large scale joint sets. Areas of maximum fracturing will have higher transmissivity and hydraulic conductivity associated with them and also will be more prone to erosion.

During the pumping test, a cone of depression developed radially around the well until the cone intercepted lower transmissivity/less fractured rock at the canyon side walls (the

negative boundary effect observed approximately 1,700 minutes into the test). After that time, the majority of the water entering the wells is coming from directly up and down canyon. A later stage negative boundary effect near the 3,000 minute mark observed in North Well may be a secondary negative boundary effect associated with translation of the cone of depression outside the portions of the canyon overlain by alluvium. Although the alluvium was not thought to be saturated during the test it is likely to act like a sponge slowing the downgradient flow of groundwater.

Because the fractures in the bedrock appear to be of aerially limited extent, the actual volume of groundwater available may be limited with larger volumes of groundwater available within the canyon areas where fracturing may be most prevalent.

CLOSURE

This summary of observations and analyses has been prepared in general accordance with accepted professional geotechnical and hydrogeologic principles and practices. This report makes no other warranties, either expressed or implied as to the professional advice or information included in it. Our firm should be notified of any pertinent change in the project, or if conditions are found to differ from those described herein, because this may require a reevaluation of the conclusions. This report has not been prepared for use by parties or projects other than those named or described herein. It may not contain sufficient information for other parties or purposes.

Geo-Logic Associates

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Senior Geologist

Attachments: Table 1 - Aquifer Stress Test Results
Figure 1 - Well Location Plan
Figure 2 - Step Test Time Drawdown Plot
Figure 3 - North Well Time Drawdown Plot Pumping
Figure 4 - North Well Time Drawdown Plot Recovery
Figure 5 - South Well Time Drawdown Plot Pumping
Figure 6 - South Well Time Drawdown Plot Recovery
Figure 7 - Thing Valley Well Time Drawdown Pumping
Figure 8 - Thing Valley Well Time Drawdown Recovery
Figure 9 - Geologic Map
Appendix A - Analytical Results from Aquifer Test Program

REFERENCES

Cooper, H.H., Jr. and Jacob, C.E., 1946, A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well Field History, *Transactions, American Geophysical Union*, Vol. 27, No. 4.

Driscoll, D.G., 1986, Groundwater and Wells, Johnson Filtration Systems Inc., St. Paul, Minnesota.

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Neuman S.P., 1975, Analysis of Pumping Test Data from Anisotropic Unconfined Aquifers Considering Delayed Yield, *Water Resources Research*, Vol. 11, No. 2, pp. 329-342.

Papadopulos, I.S. and Cooper, H.H., Jr., 1967, Drawdown in a well of large diameter, *Water Resources Research*, vol. 3, pp 241-244.

Schafer, D.C., 1978, Casing Storage Can Affect Pumping Test Data, *Johnson Drillers' Journal*, Jan/Feb, Johnson Division, UOP Inc., St. Paul, Minnesota.

Theis, C.V., 1935, The Relation Between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Groundwater Storage, *American Geophysical Union Transactions*, Vol. 16, pp. 519-524.

Waterloo Hydrogeologic (co-developed with Thomas Roerich), 2002, AquiferTest version 3.5, Advanced Pumping Test and Slug Test Analytical Software.

Table 1
Aquifer Stress Test Results
Thing Valley

Well Designation	Condition	Distance From Pumping Well (feet)	Groundwater Depth from TOC (feet)	Groundwater Depth from Ground Surface (feet)	Assumed Aquifer Thickness (feet)	Average Pumping Rate (gpm)	Analytical Method	Transmissivity (feet^2/day)	Conductivity (feet/day)	Storativity	Comments
North Well	Pumping	1	54.81	54.14	350	81	Cooper-Jacob	488	1.390	3.33E-09	Match to mid-late data.
North Well	Pumping	1	54.81	54.14	350	81	Cooper-Jacob	176	0.502	3.05E-02	Match to late data.
North Well	Pumping	1	54.81	54.14	350	81	Moench	261	0.741	4.45E-04	Match to late data.
North Well	Pumping	1	54.81	54.14	350	81	Neuman	**99.8 Minimum**	**0.285 Minimum**	3.82E-04	Match to late data.
North Well	Pumping	1	54.81	54.14	350	81	Theis	256	0.733	3.57E-04	Match to late data.
North Well	Pumping	1	54.81	54.14	350	81	Walton	115	0.327	2.41E-02	Match to late data.
North Well	Recovery	1	54.81	54.14	350	81	Theis Recovery	669	1.910	NA	Match to early data.
North Well	Recovery	1	54.81	54.14	350	81	Theis Recovery	473	1.350	NA	Match to middle data.
North Well	Recovery	1	54.81	54.14	350	81	Theis Recovery	337	0.963	NA	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Cooper-Jacob	513	1.470	8.29E+00	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Cooper-Jacob	294	0.841	4.19E+01	Match to very late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Moench	467	1.330	1.35E-05	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Neuman	469	1.340	9.12E-04	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Theis	477	1.360	2.10E-03	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Walton	477	1.360	8.76E+00	Match to late data.
South Well	Recovery	61.5	49.34	48.67	350	81	Theis Recovery	**835 Maximum**	**2.39 Maximum**	NA	Match to early data.
South Well	Recovery	61.5	49.34	48.67	350	81	Theis Recovery	508	1.450	NA	Match to middle data.
South Well	Recovery	61.5	49.34	48.67	350	81	Theis Recovery	311	0.888	NA	Match to late data.
							Average Values	**393**	**1.122**	**3.88E-03**	

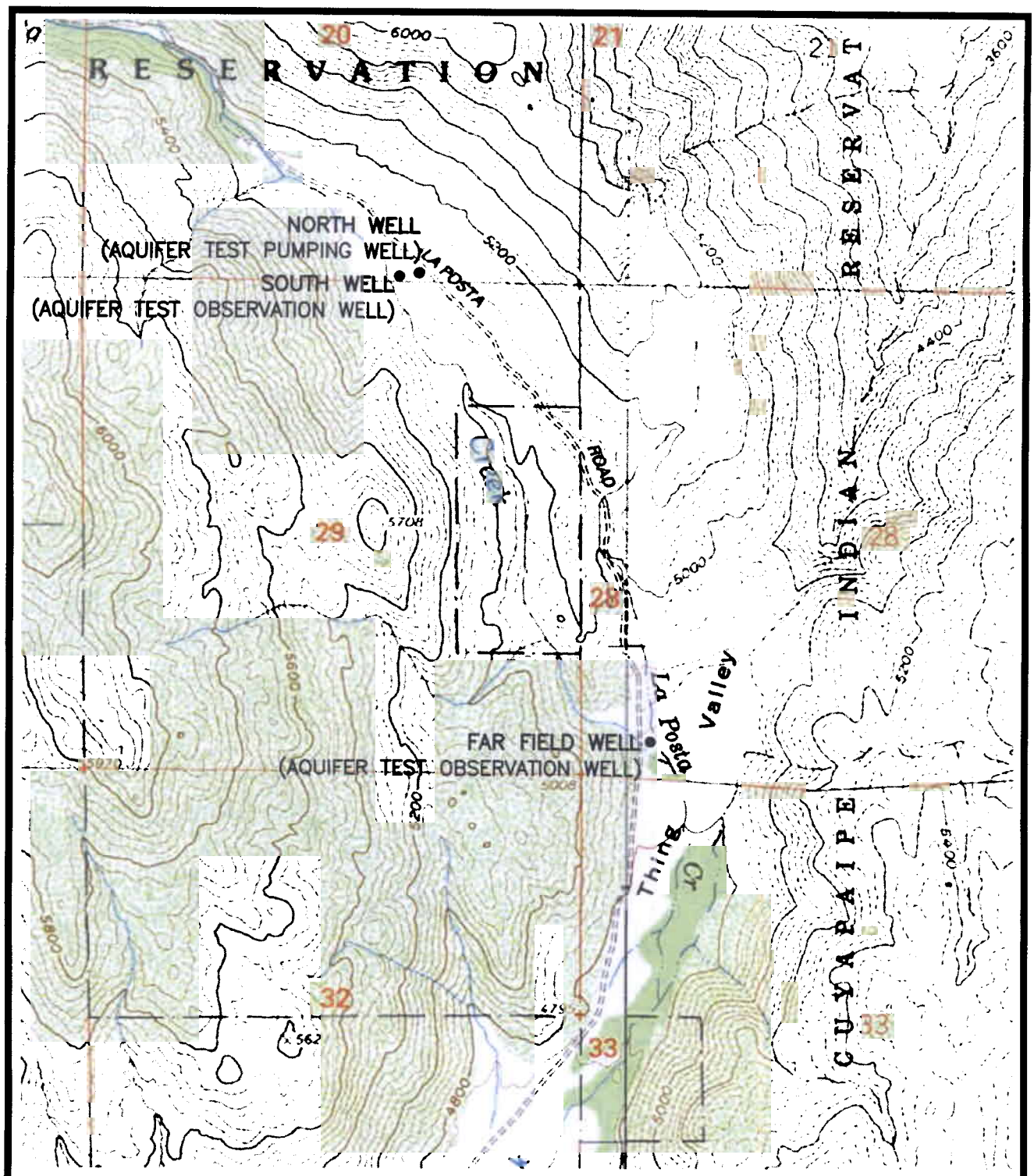

FIGURE 1

GRAPHIC SCALE
750 0 375 750 1500
(in feet)
1 inch = 1500 ft.

N

REFERENCE: 7.5 MINUTE SERIES (TOPOGRAPHIC) MOUNT LAGUNA (1997) AND SOMBRERO PEAK (1975) CALIFORNIA QUADRANGLES

WELL LOCATION MAP
THING VALLEY AQUIFER TEST SITE

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

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Geologists, Hydrogeologists, and Engineers

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VL	NOVEMBER 2010	2010-005

Figure 2
North Well
(Pumping Well)
Time Drawdown Plot for Stepped Pump Test

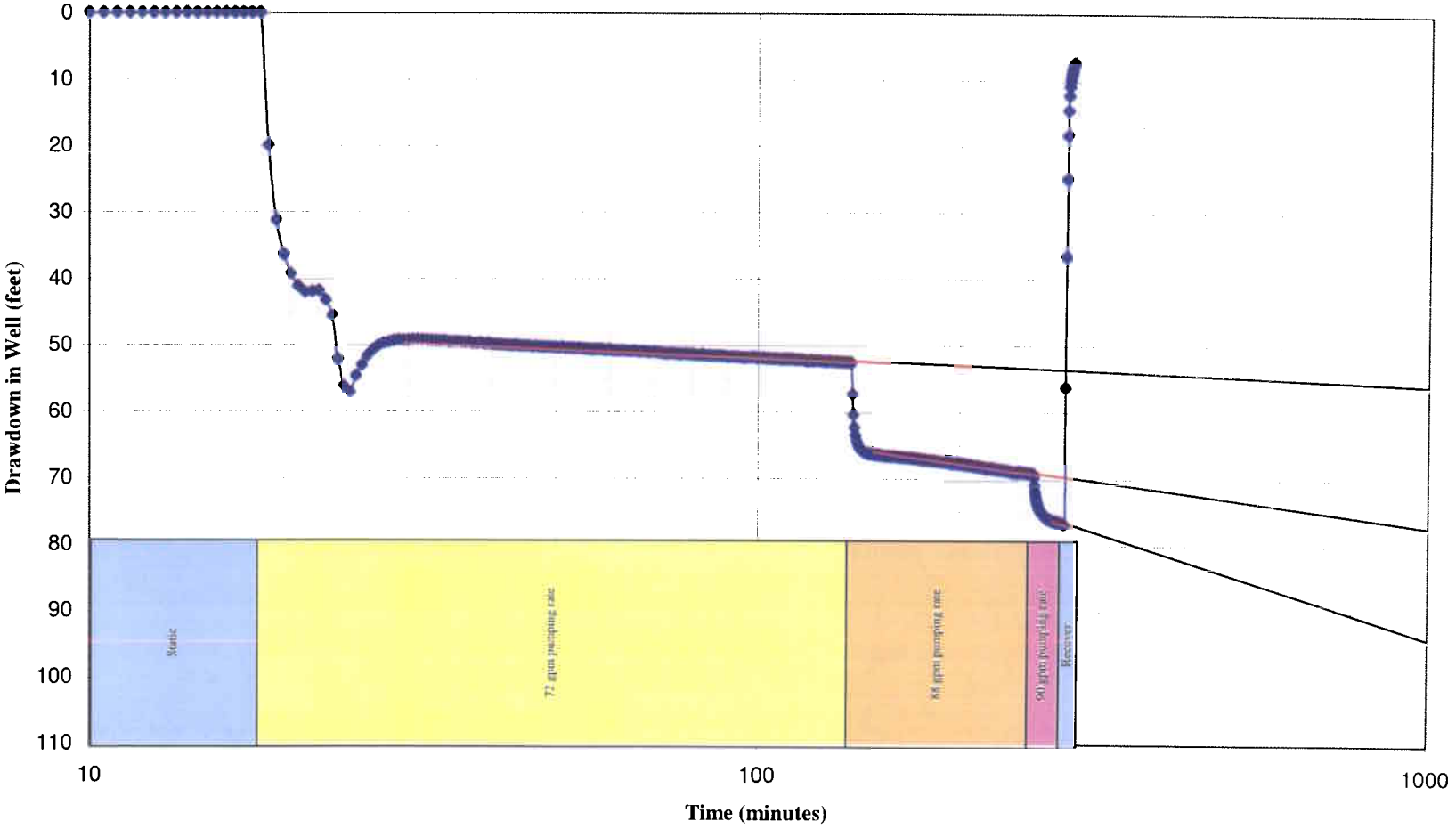


Figure 3
North Well
(Pumping Well)
Time-Drawdown Plot

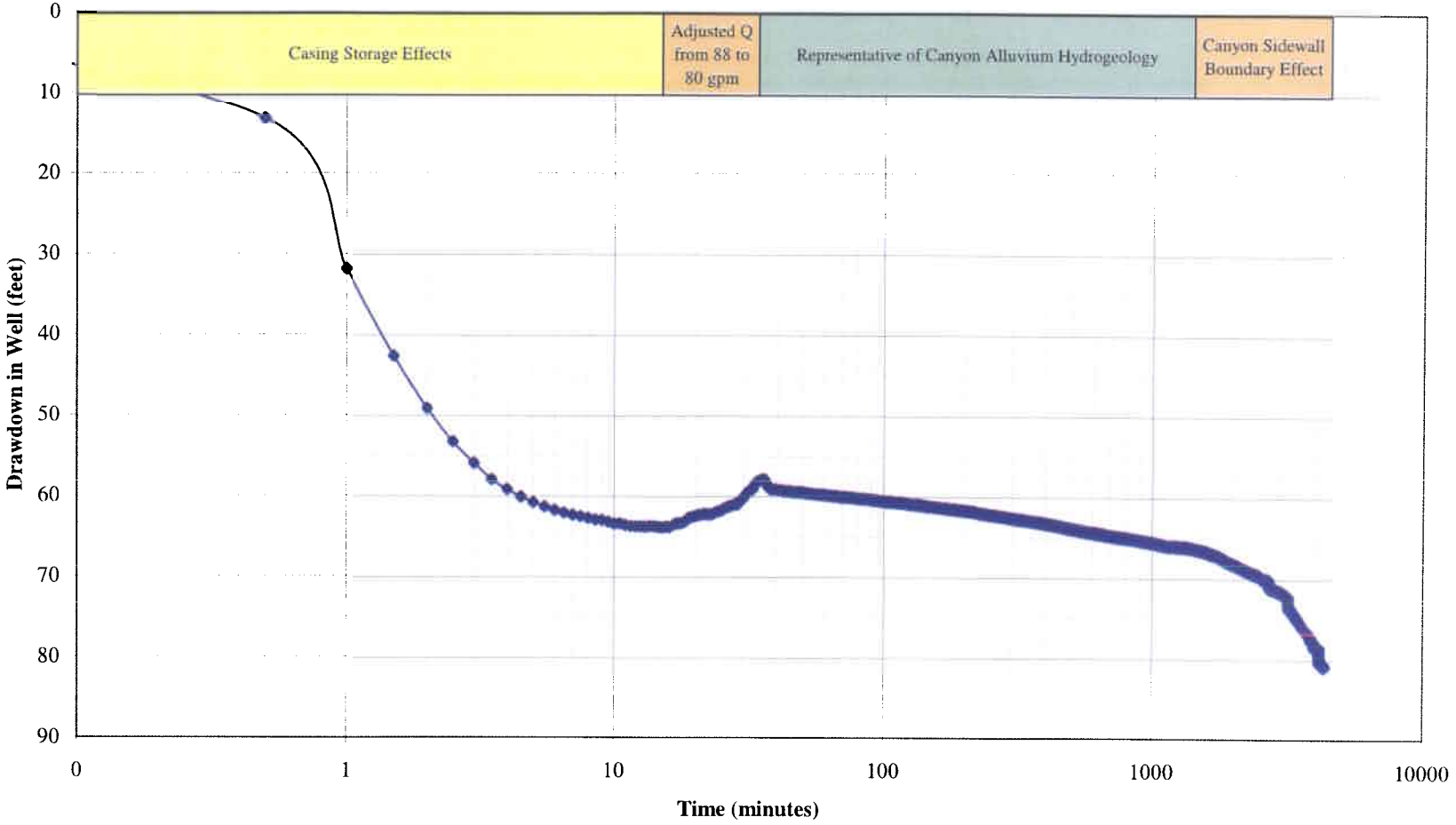


Figure 4
North Well
Recovery
Time-Drawdown Plot

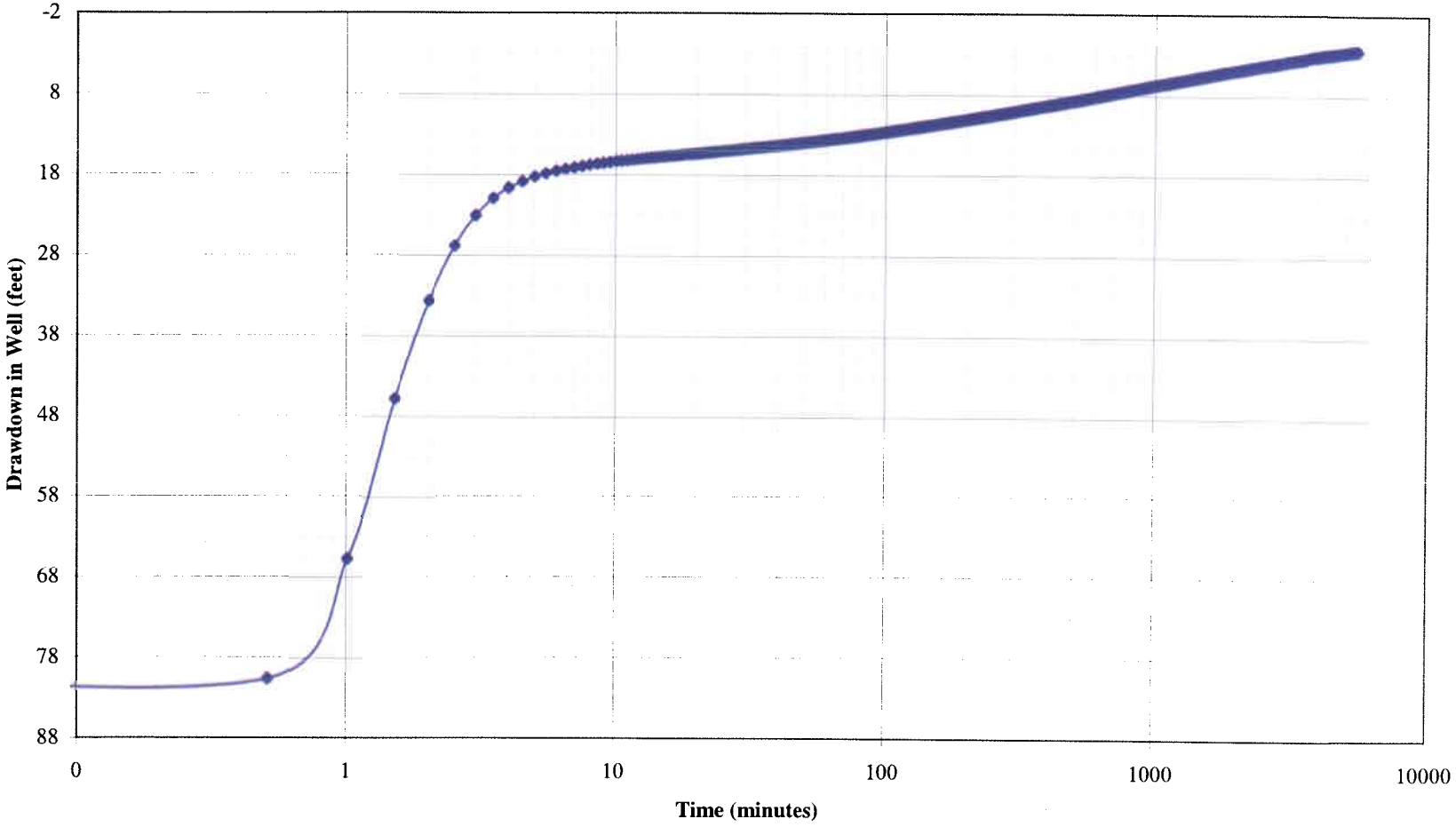


Figure 5
South Well
(Observation Well)
Time-Drawdown Plot

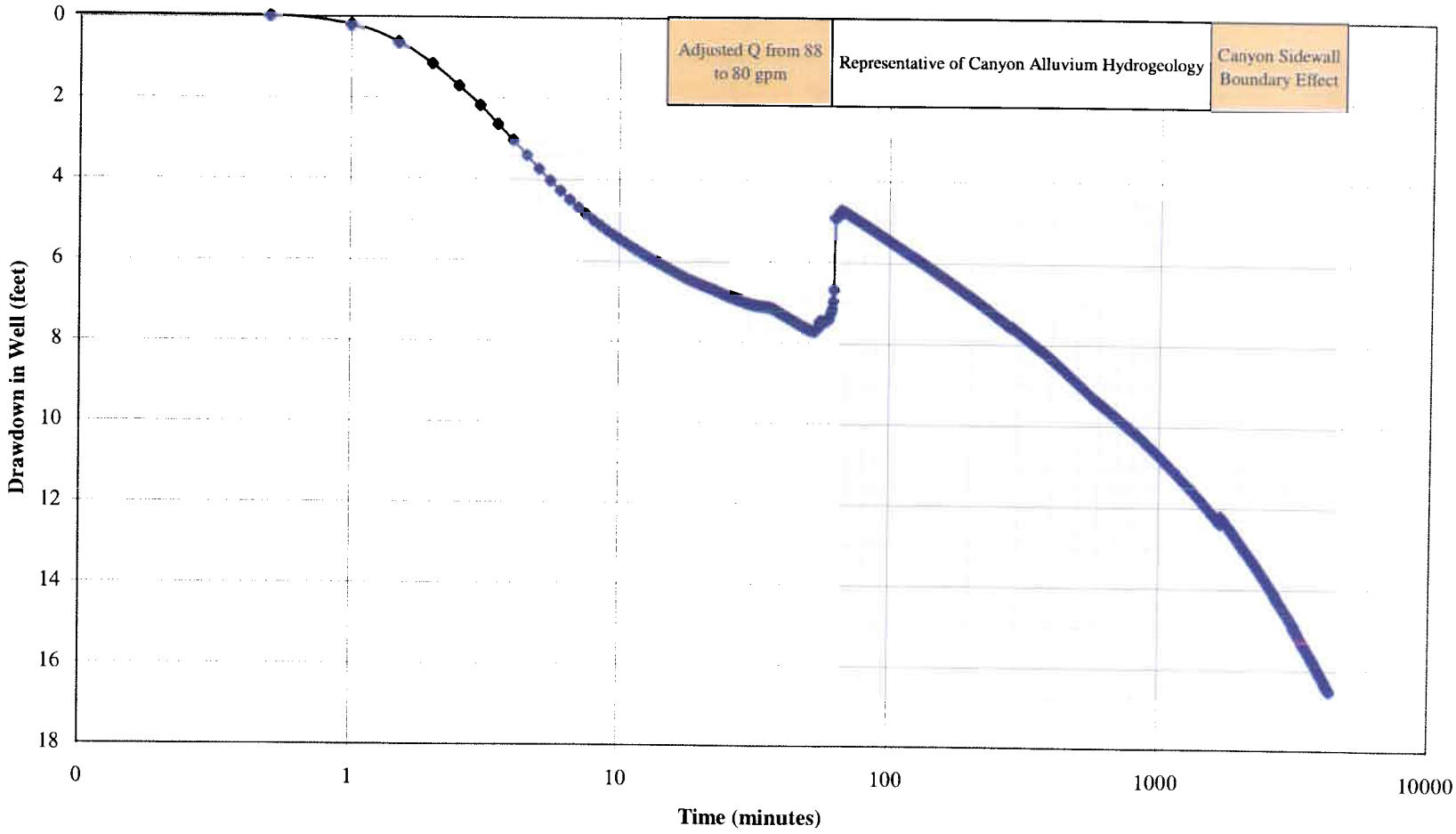


Figure 6
South Well
(Observation Well)
Recovery Time-Drawdown Plot

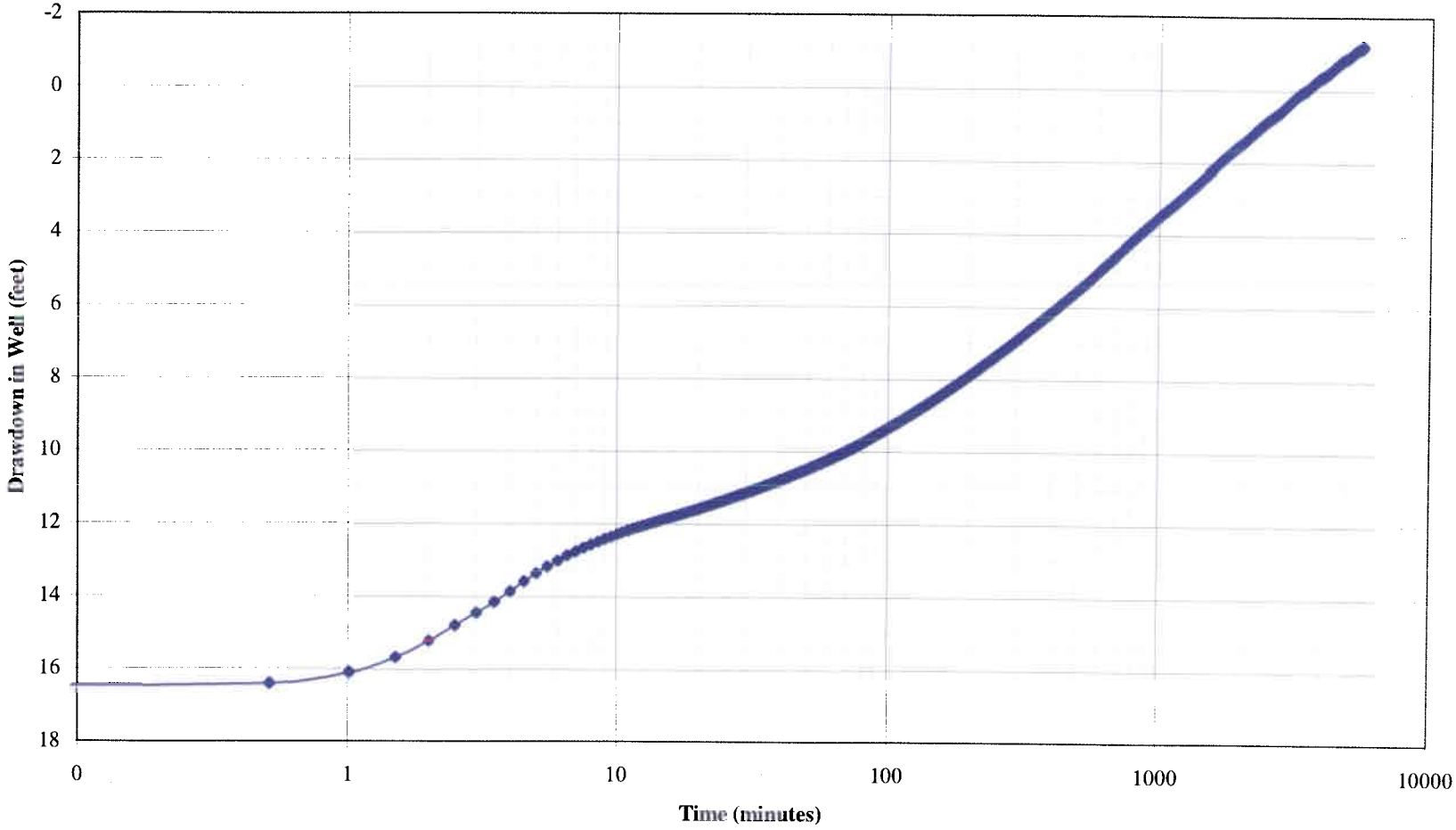


Figure 7
Thing Valley Well
(Observation Well)
Time-Drawdown Plot

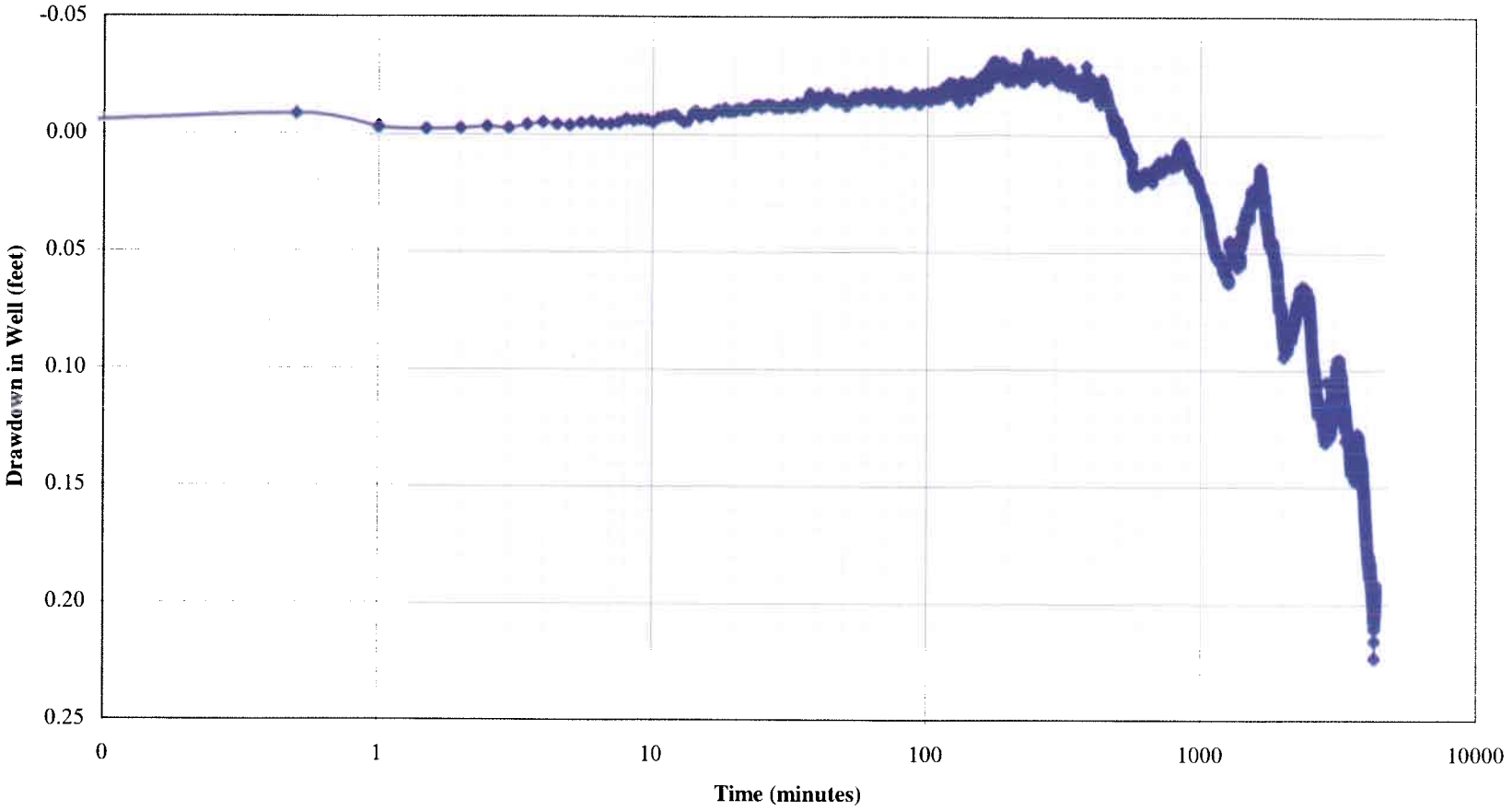
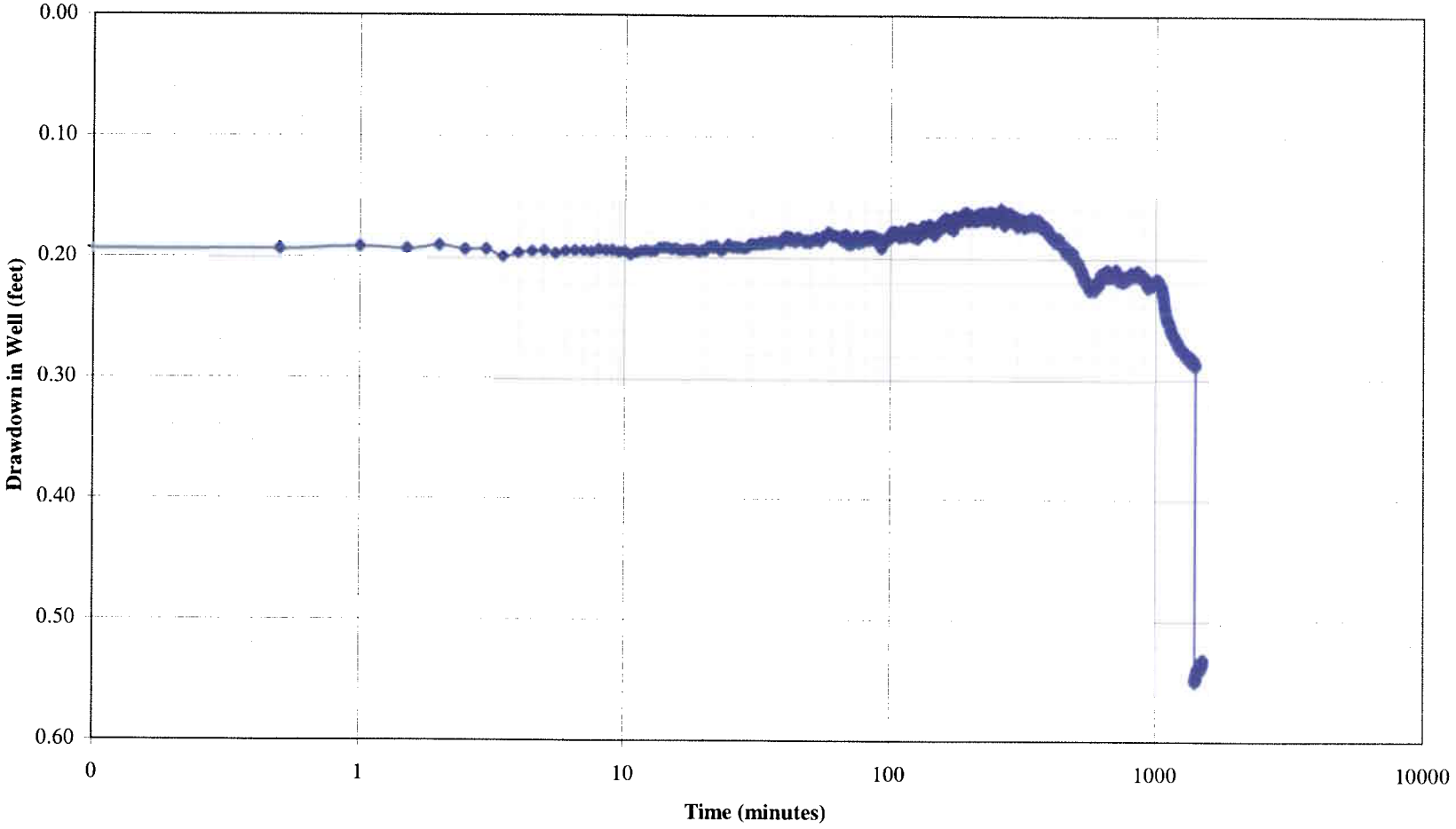
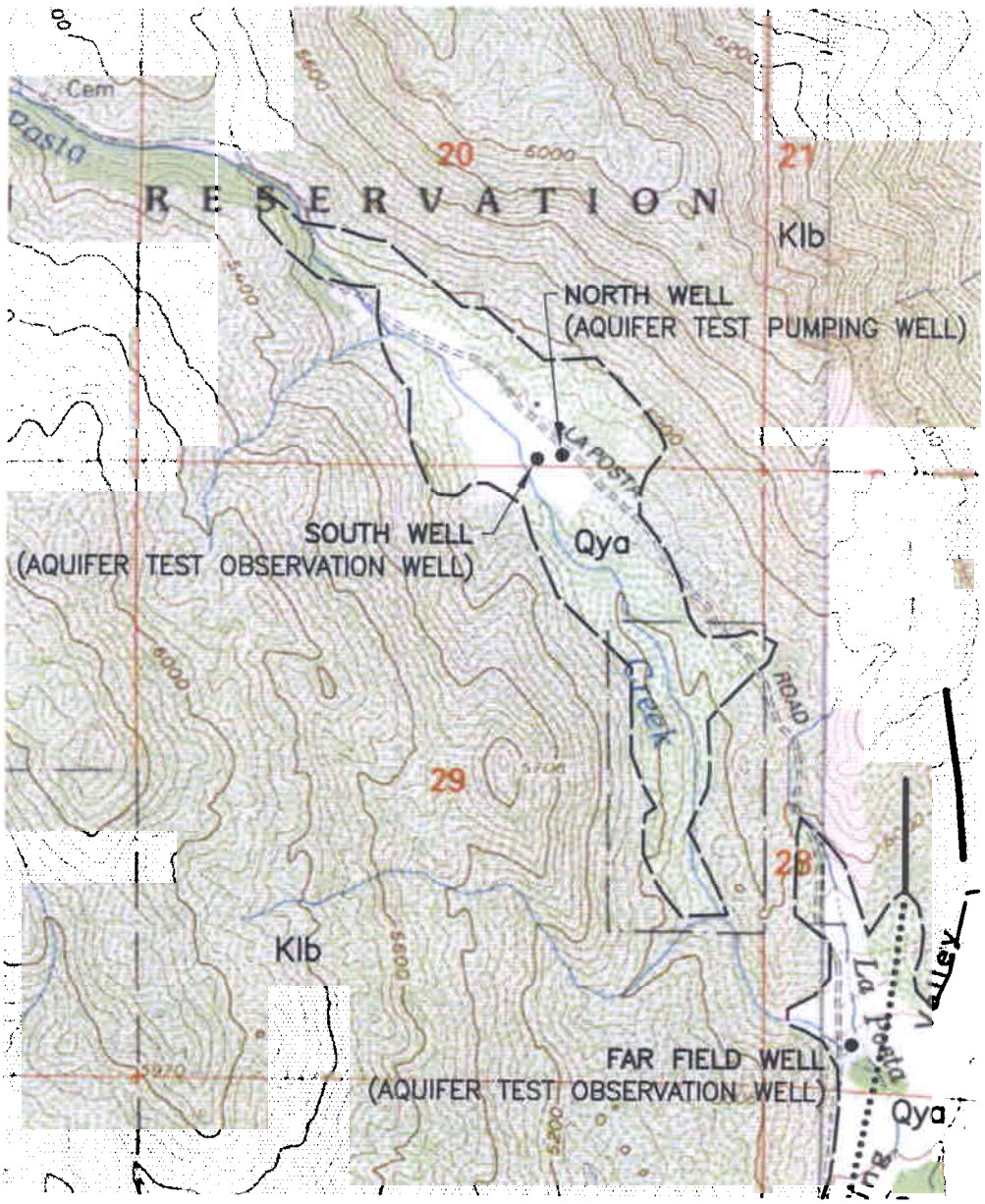


Figure 8
Thing Valley Well
Recovery
Time-Drawdown Plot





EXPLANATION:

Qya	YOUNG ALLUVIUM (HOLOCENE)
Klb	TONALITE OF LAS BANCAS (EARLY CRETACEOUS)
— — — —	APPROXIMATE GEOLOGIC CONTACT
——•••••	FAULT, DOTTED WHERE CONCEALED

GRAPHIC SCALE
750 0 375 750 1500
(in feet)
1 inch = 1500 ft.

REFERENCE: PRELIMINARY GEOLOGIC MAP OF EL CAJON 30' x 60' QUADRANGLE, SOUTHERN CALIFORNIA, V. R. TODD, 2004

FIGURE 9

GEOLOGIC MAP
THING VALLEY AQUIFER TEST SITE

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

Geo-Logic Associates
Geologists, Hydrogeologists, and Engineers

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VL	NOVEMBER 2010	2010-005

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
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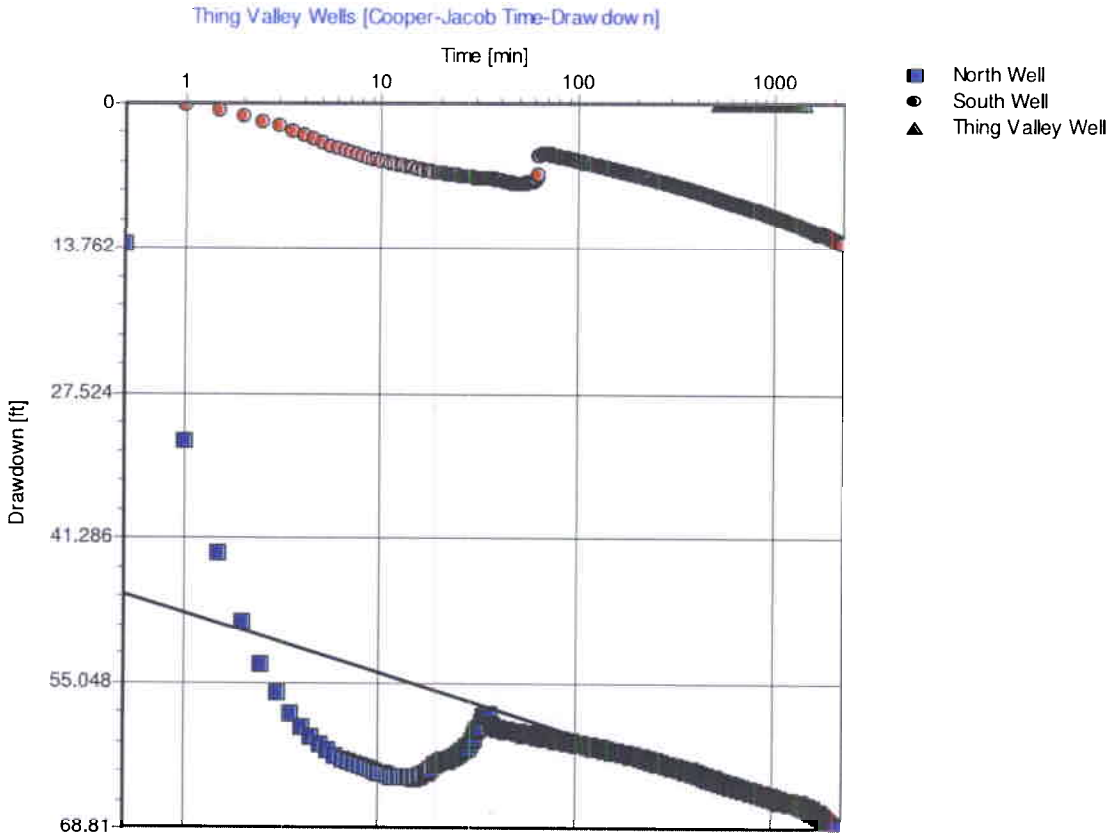
Pumping Test Analysis Report

Project: Thing Valley

Number: 2010-0005

Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Cooper-Jacob Time-Drawdown**

Analysis Results:	Transmissivity:	4.88E+2 [ft²/d]	Conductivity:	1.39E+0 [ft/d]
	Storativity:	3.33E-9		
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		

Comments: North Well Match to mid-late data.

Evaluated by: MWV

Evaluation Date: 10/29/2010

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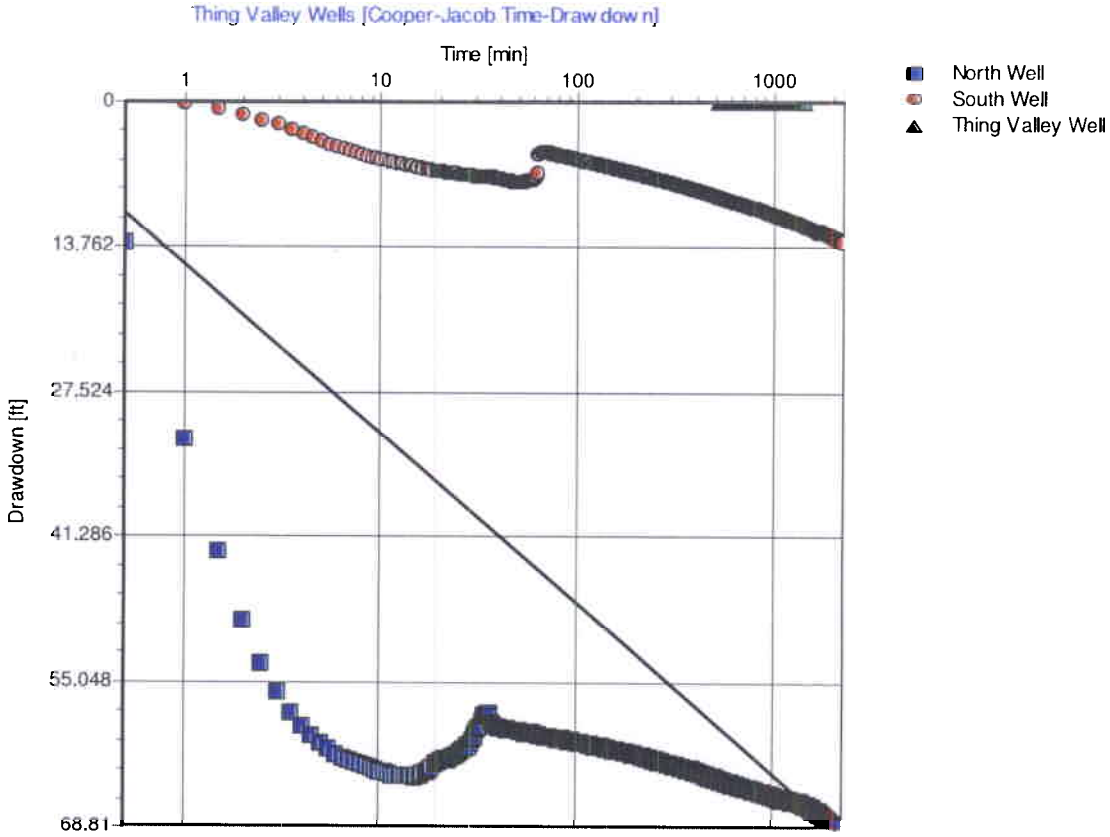

Pumping Test: **Thing Valley Wells**

Analysis Method: **Cooper-Jacob Time-Drawdown**

Analysis Results:	Transmissivity:	1.76E+2 [ft²/d]	Conductivity:	5.02E-1 [ft/d]
	Storativity:	3.05E-2		
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		

Comments: North Well match to late data.

Evaluated by: MWV
Evaluation Date: 10/29/2010

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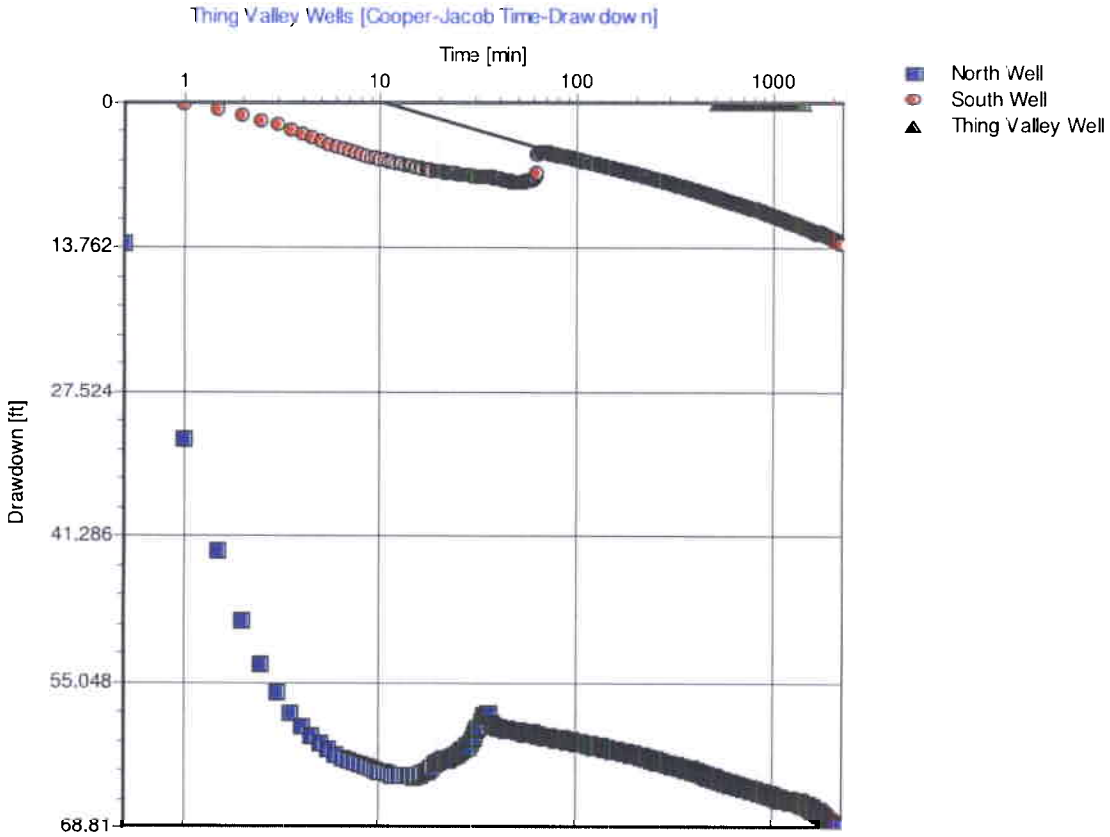

Pumping Test: **Thing Valley Wells**

Analysis Method: **Cooper-Jacob Time-Drawdown**

Analysis Results:	Transmissivity:	5.13E+2 [ft²/d]	Conductivity:	1.47E+0 [ft/d]
	Storativity:	8.29E+0		
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		

Comments: South Well match to late data.

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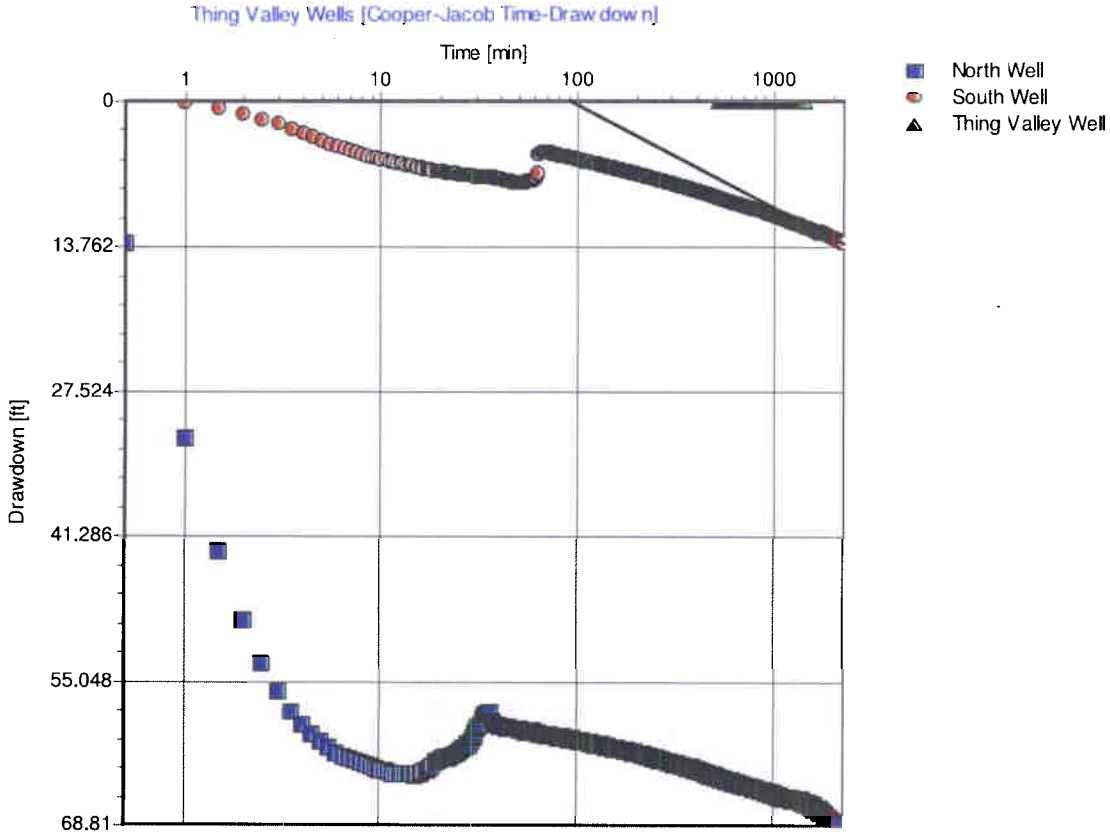

Pumping Test: **Thing Valley Wells**

Analysis Method: **Cooper-Jacob Time-Drawdown**

Analysis Results:	Transmissivity:	2.94E+2 [ft²/d]	Conductivity:	8.41E-1 [ft/d]
	Storativity:	4.19E+1		
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		

Comments: South Well match to very late data.

Evaluated by: MWV

Evaluation Date: 10/29/2010

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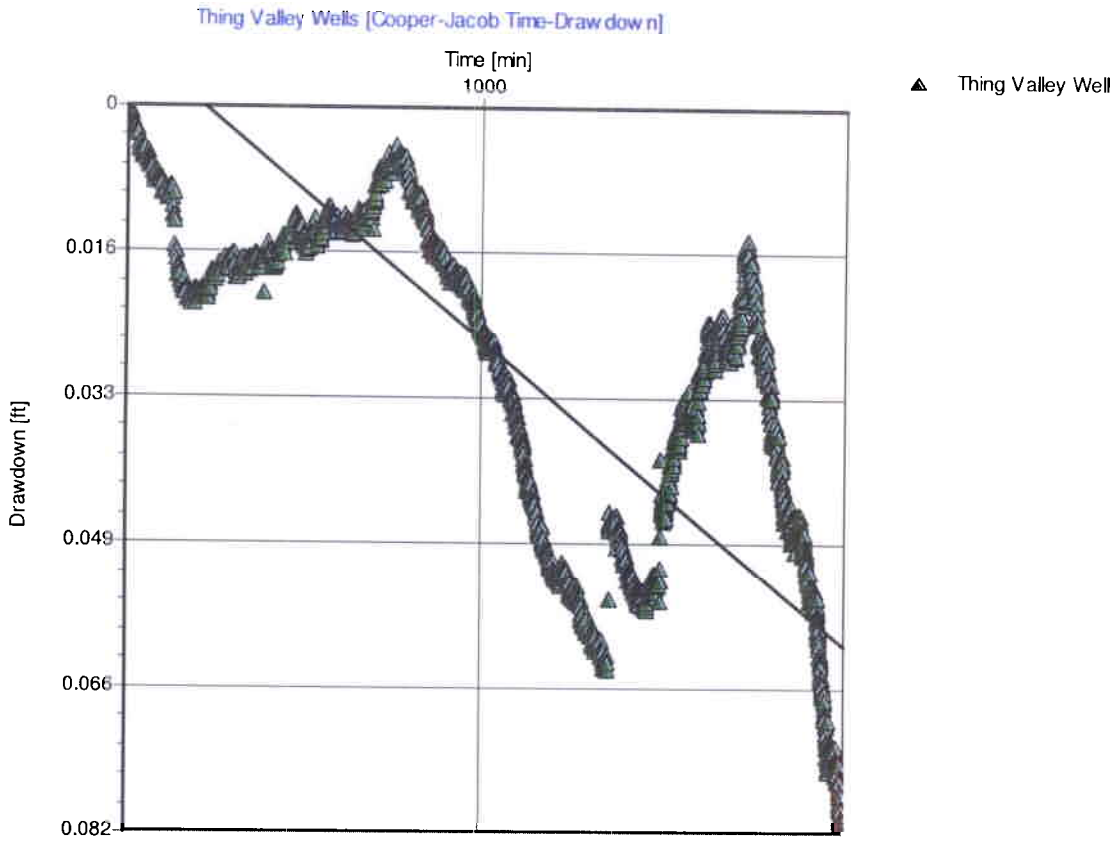

Pumping Test: **Thing Valley Wells**

Analysis Method: **Cooper-Jacob Time-Drawdown**

Analysis Results:	Transmissivity:	2.41E+4 [ft²/d]	Conductivity:	6.88E+1 [ft/d]
	Storativity:	7.34E-4		
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		

Comments: Thing Valley program best fit match.

Evaluated by: MWV
Evaluation Date: 11/4/2010

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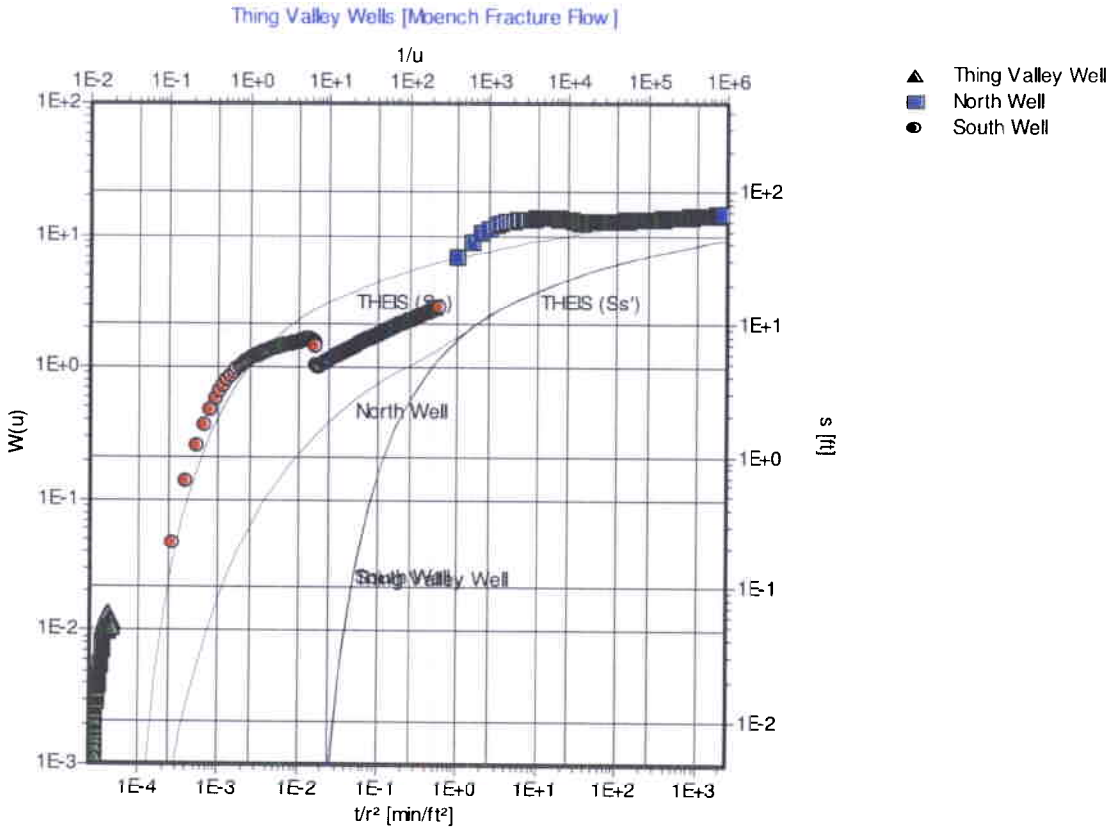
Number: 2010-0005
Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Moench Fracture Flow**

Analysis Results:	Transmissivity:	2.61E+2 [ft²/d]	Conductivity:	7.47E-1 [ft/d]
	Storativity:	4.45E-4		
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	b:	350 [ft]
	Screen length:	350 [ft]	Kv/Kh:	0.1
	Boring radius:	0.42 [ft]	C:	0.554
	Discharge Rate:	80.111574 [U.S. gal/mi	K(block)/K(Skin):	0.1
	Ss(blk)/Ss(fract):	200	K(block)/K(fracture):	0.1

Comments: North Well match to late data.

Evaluated by: MWV
Evaluation Date: 10/29/2010

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
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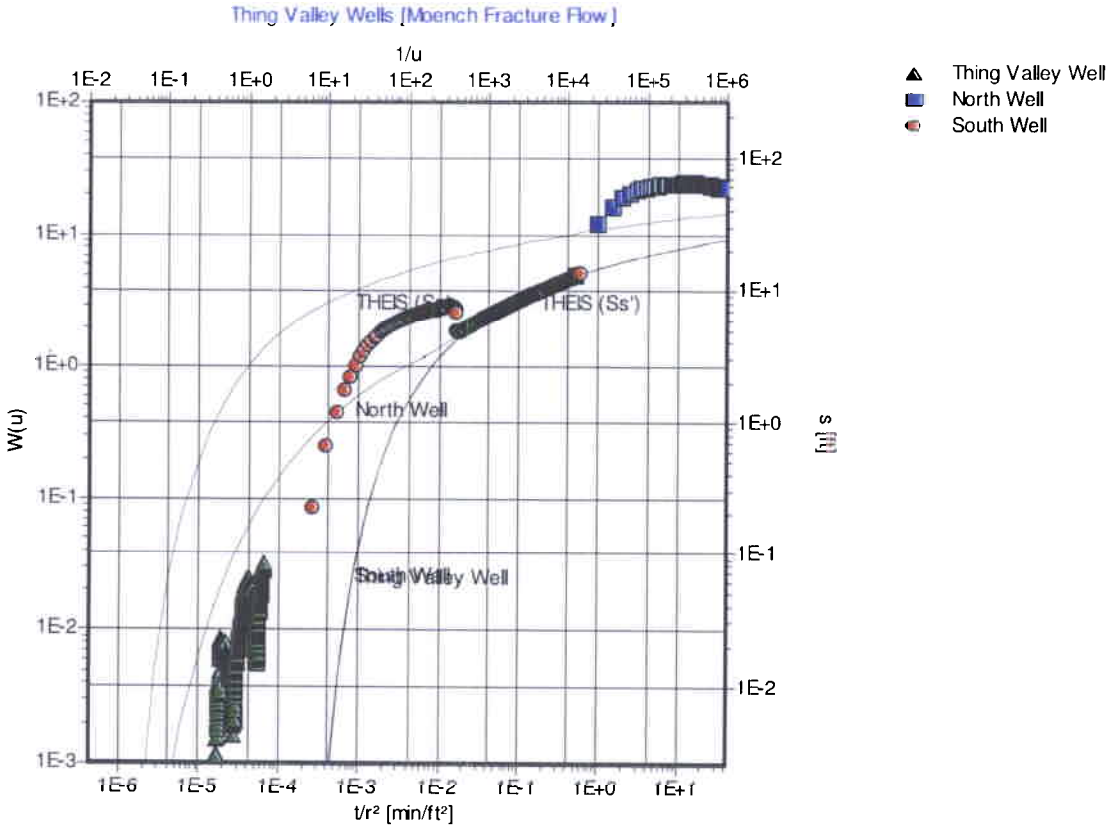
Phone: +1 519 746 1798

Pumping Test Analysis Report

Project: Thing Valley

Number: 2010-0005

Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Moench Fracture Flow**

Analysis Results:	Transmissivity:	4.67E+2 [ft²/d]	Conductivity:	1.33E+0 [ft/d]
	Storativity:	1.35E-5		
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	b:	350 [ft]
	Screen length:	350 [ft]	Kv/Kh:	0.1
	Boring radius:	0.42 [ft]	C:	0.554
	Discharge Rate:	80.111574 [U.S. gal/mi	K(block)/K(Skin):	0.1
	Ss(blk)/Ss(fract):	200	K(block)/K(fracture):	0.1

Comments: South Well match to late data.

Evaluated by: MWV

Evaluation Date: 11/1/2010

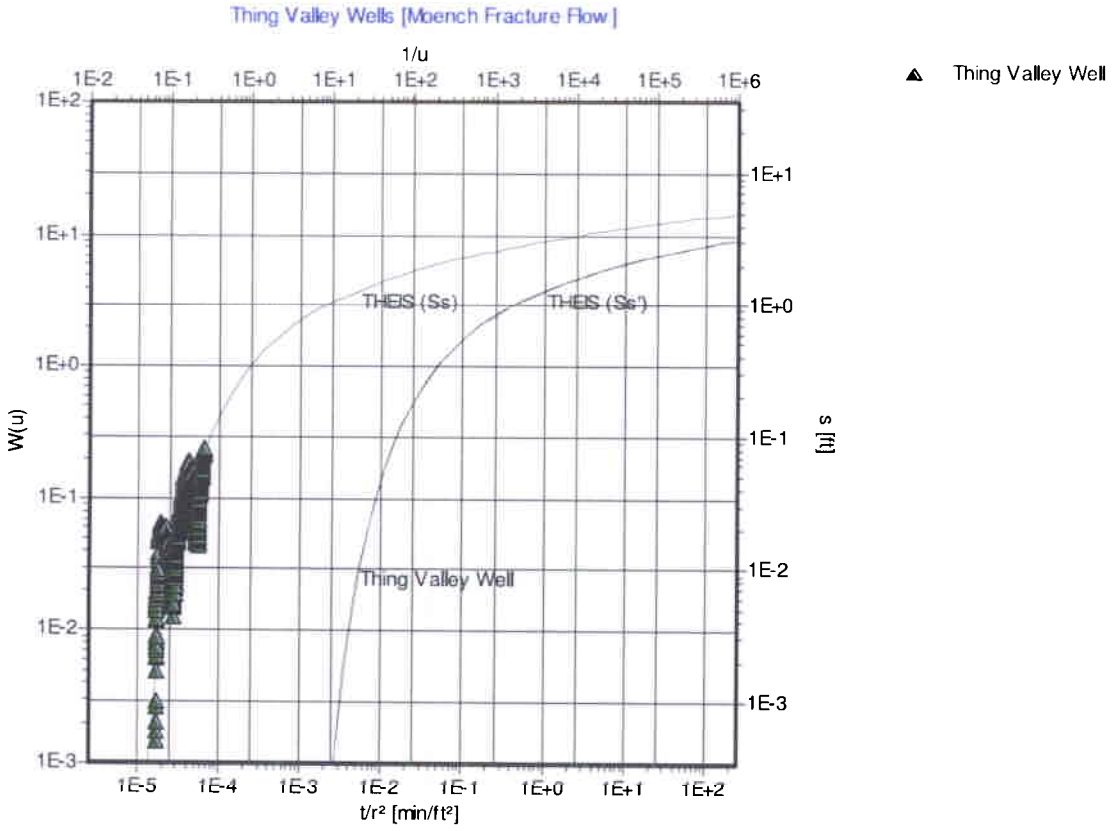
Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report

Project: Thing Valley

Number: 2010-0005

Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Moench Fracture Flow**

Analysis Results:	Transmissivity:	3.61E+3 [ft²/d]	Conductivity:	1.03E+1 [ft/d]
	Storativity:	6.28E-4		
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	b:	350 [ft]
	Screen length:	350 [ft]	Kv/Kh:	0.1
	Boring radius:	0.42 [ft]	C:	0.554
	Discharge Rate:	80.111574 [U.S. gal/mi	K(block)/K(Skin):	0.1
	Ss(blk)/Ss(fract):	200	K(block)/K(fracture):	0.1

Comments: Moench match to Thing Valley Well data.

Evaluated by: MWV

Evaluation Date: 11/4/2010

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
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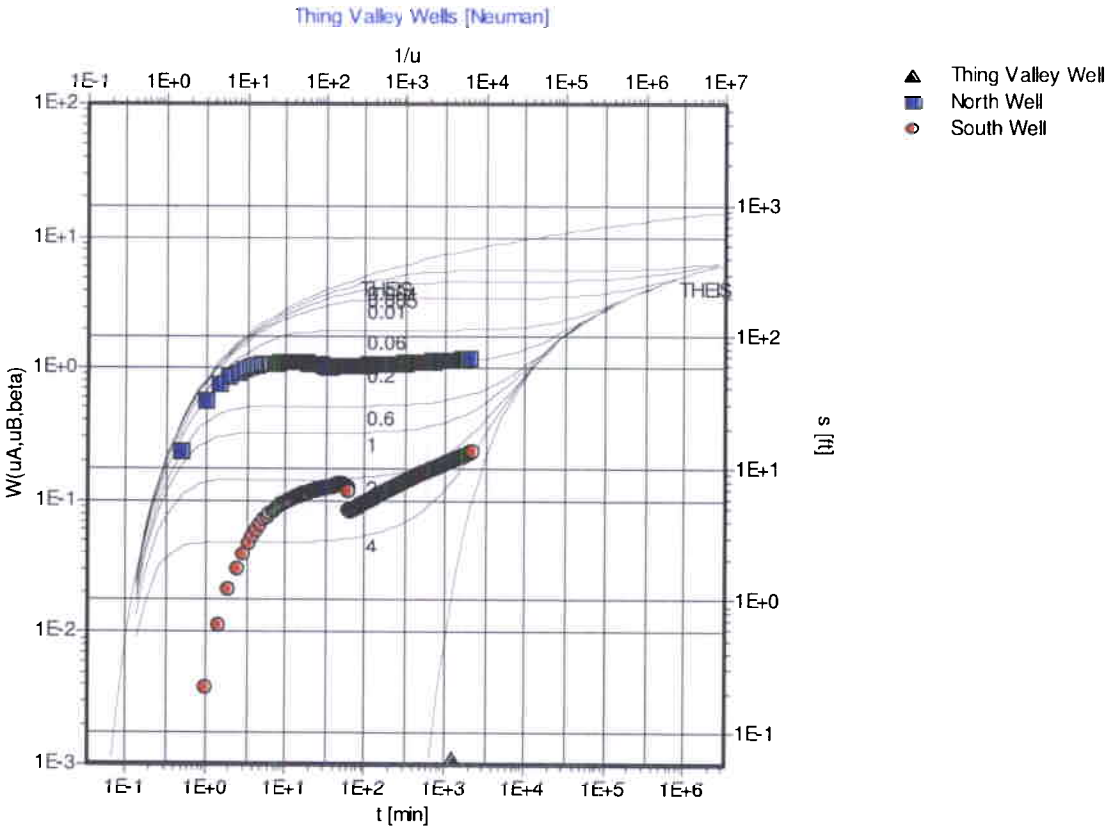
Phone: +1 519 746 1798

Pumping Test Analysis Report

Project: Thing Valley

Number: 2010-0005

Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Neuman**

Analysis Results:	Transmissivity:	2.13E+1 [ft²/d]	Conductivity:	6.09E-2 [ft/d]
	Storativity:	1.96E-2	Specific Yield:	1.96E+2
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Beta:	0.005
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		
	LOG(Sy/S):	4		

Comments: North Well match to all data.

Evaluated by: MWV

Evaluation Date: 10/29/2010

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460 Philip Street - Suite 101
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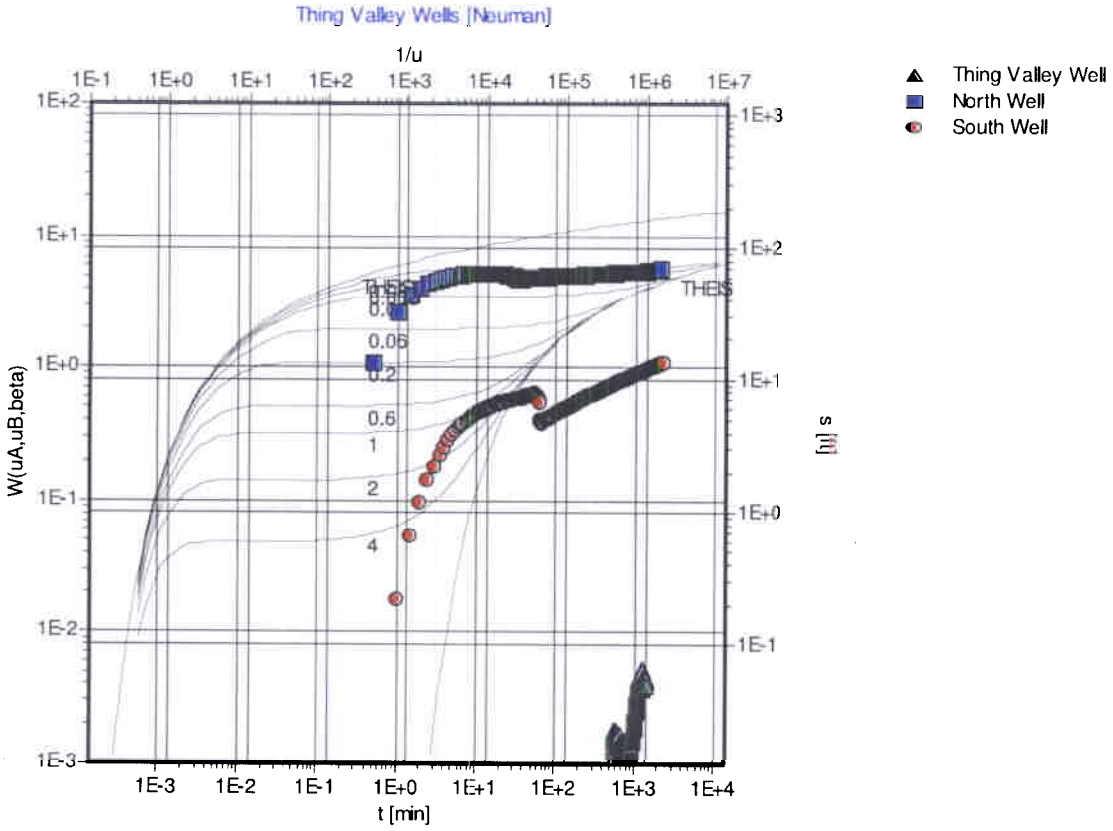
Pumping Test Analysis Report

Project: Thing Valley

Number: 2010-0005

Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Neuman**

Analysis Results:	Transmissivity:	9.98E+1 [ft²/d]	Conductivity:	2.85E-1 [ft/d]
	Storativity:	3.82E-4	Specific Yield:	3.82E+0
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Beta:	0.005
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		
	LOG(Sy/S):	4		

Comments: North Well match to late data.

Evaluated by: MWV

Evaluation Date: 10/29/2010

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460 Philip Street - Suite 101
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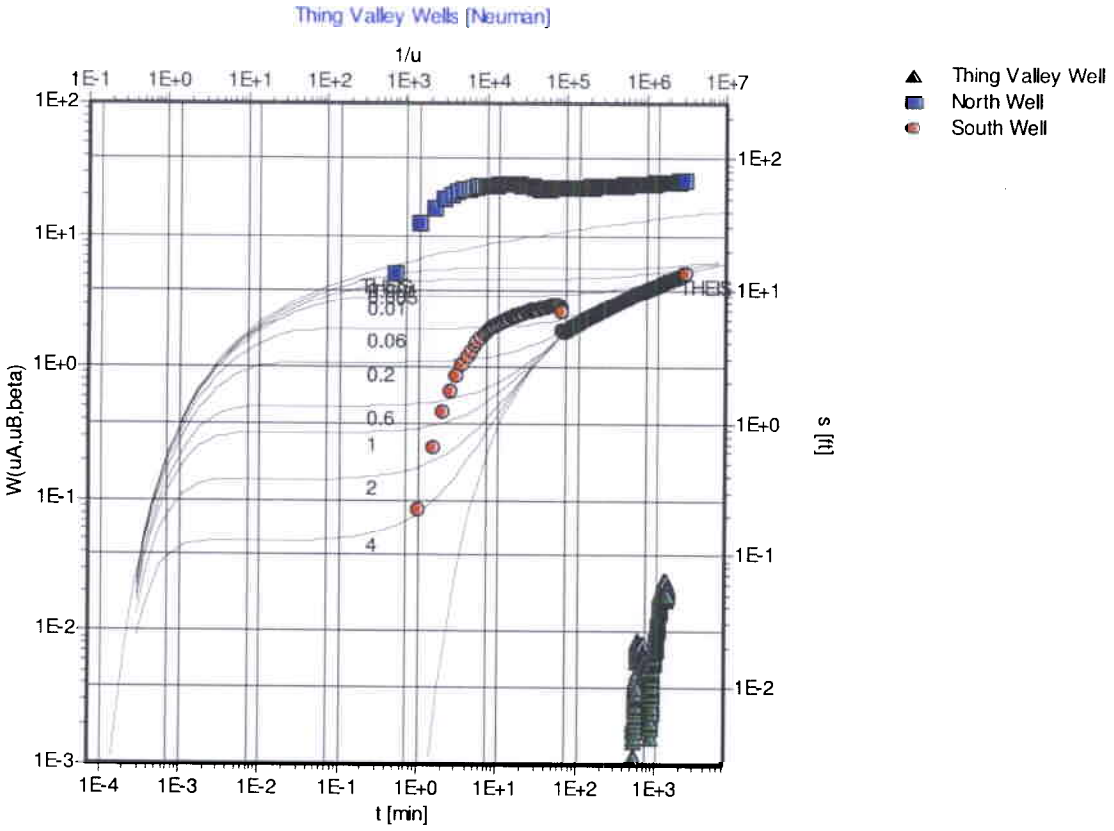
Phone: +1 519 746 1798

Pumping Test Analysis Report

Project: Thing Valley

Number: 2010-0005

Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Neuman**

Analysis Results:	Transmissivity:	4.69E+2 [ft²/d]	Conductivity:	1.34E+0 [ft/d]
	Storativity:	9.12E-4	Specific Yield:	9.12E+0
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Beta:	0.005
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		
	LOG(Sy/S):	4		

Comments: South Well match to late data.

Evaluated by: MWV

Evaluation Date: 10/29/2010

Waterloo Hydrogeologic, Inc.
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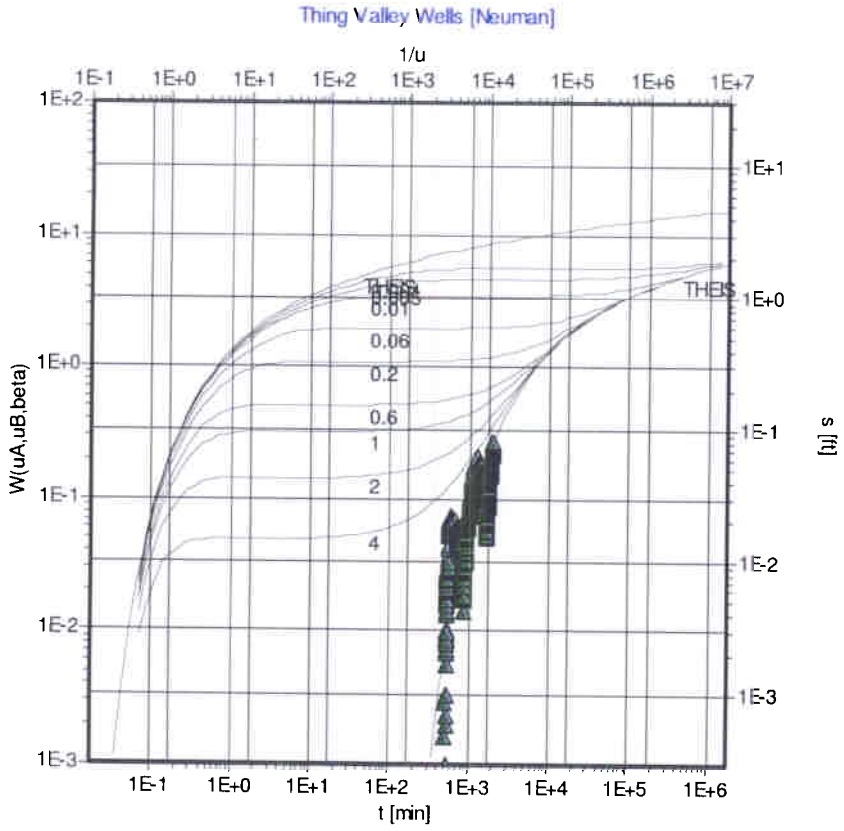
Pumping Test Analysis Report
Project: Thing Valley
Number: 2010-0005
Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Neuman**

Analysis Results:	Transmissivity:	4.06E+3 [ft²/d]	Conductivity:	1.16E+1 [ft/d]

Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Beta:	0.005
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		
	LOG(Sy/S):	4		

Comments: Thing Valley data

Evaluated by: MWV
Evaluation Date: 11/4/2010

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
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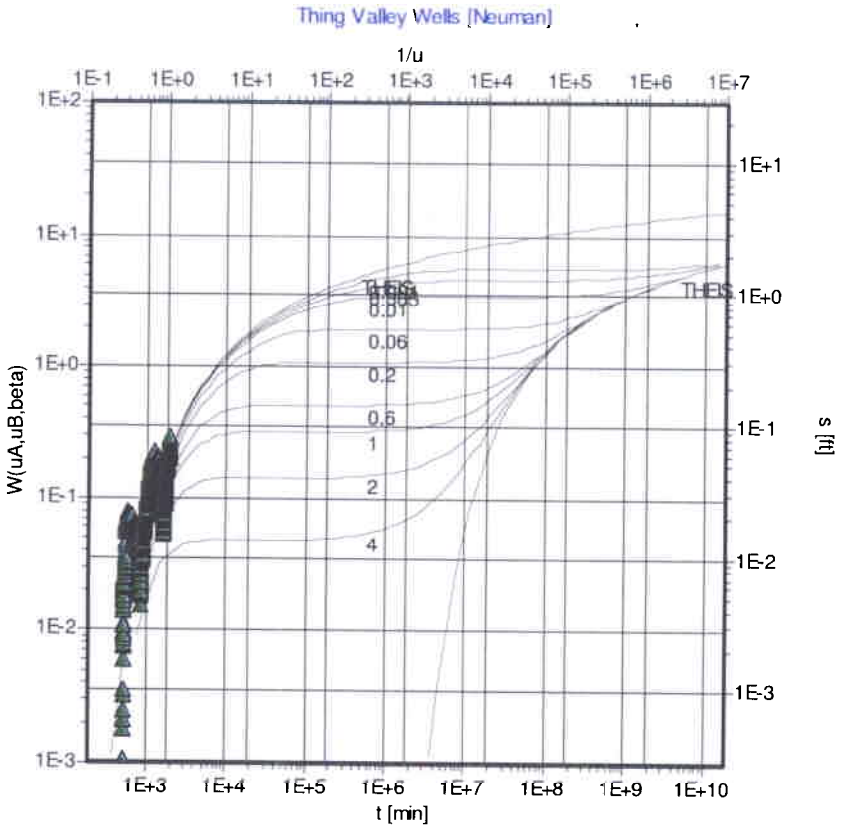
Pumping Test Analysis Report

Project: Thing Valley

Number: 2010-0005

Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Neuman**

Analysis Results:	Transmissivity:	4.35E+3 [ft²/d]	Conductivity:	1.24E+1 [ft/d]

Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Beta:	0.005
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		
	LOG(Sy/S):	4		

Comments: Thing Valley data

Evaluated by: MWV

Evaluation Date: 11/4/2010

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
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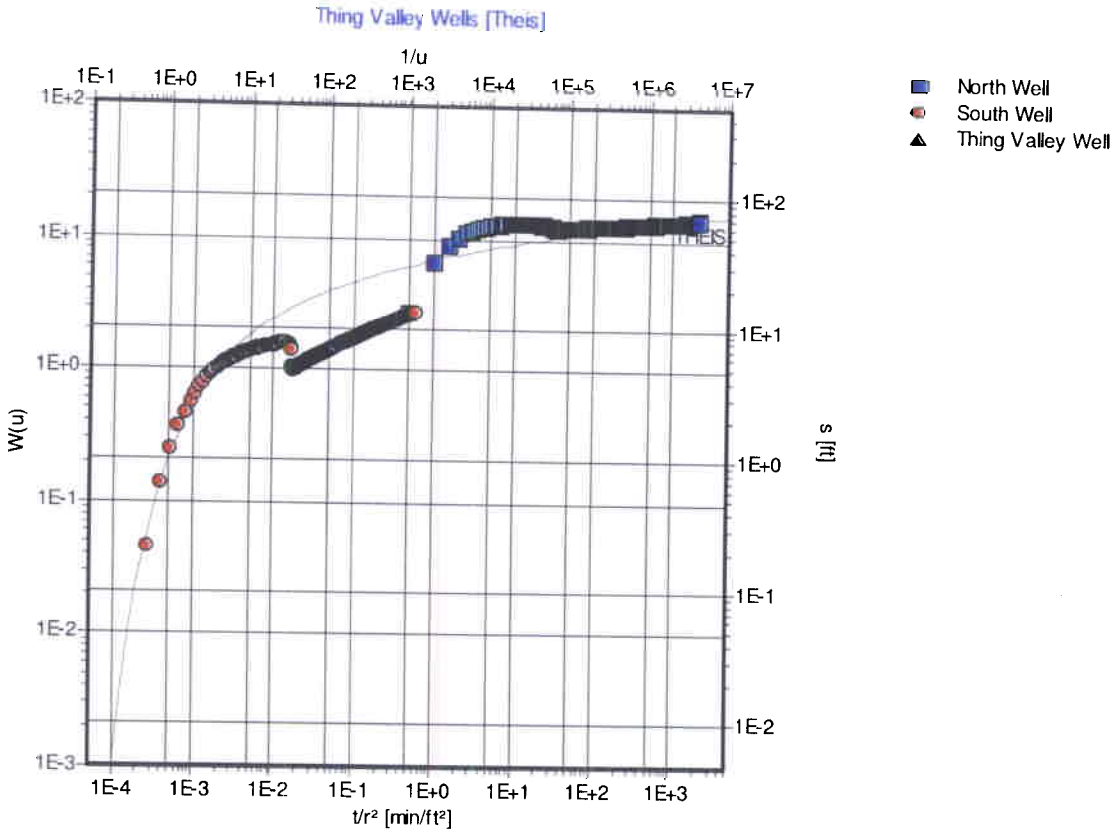
Pumping Test Analysis Report

Project: Thing Valley

Number: 2010-0005

Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Theis**

Analysis Results:	Transmissivity:	2.56E+2 [ft²/d]	Conductivity:	7.33E-1 [ft/d]
	Storativity:	3.57E-4		
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		

Comments: North Well match to late data.
South Well match to early data.

Evaluated by: MWV

Evaluation Date: 10/29/2010

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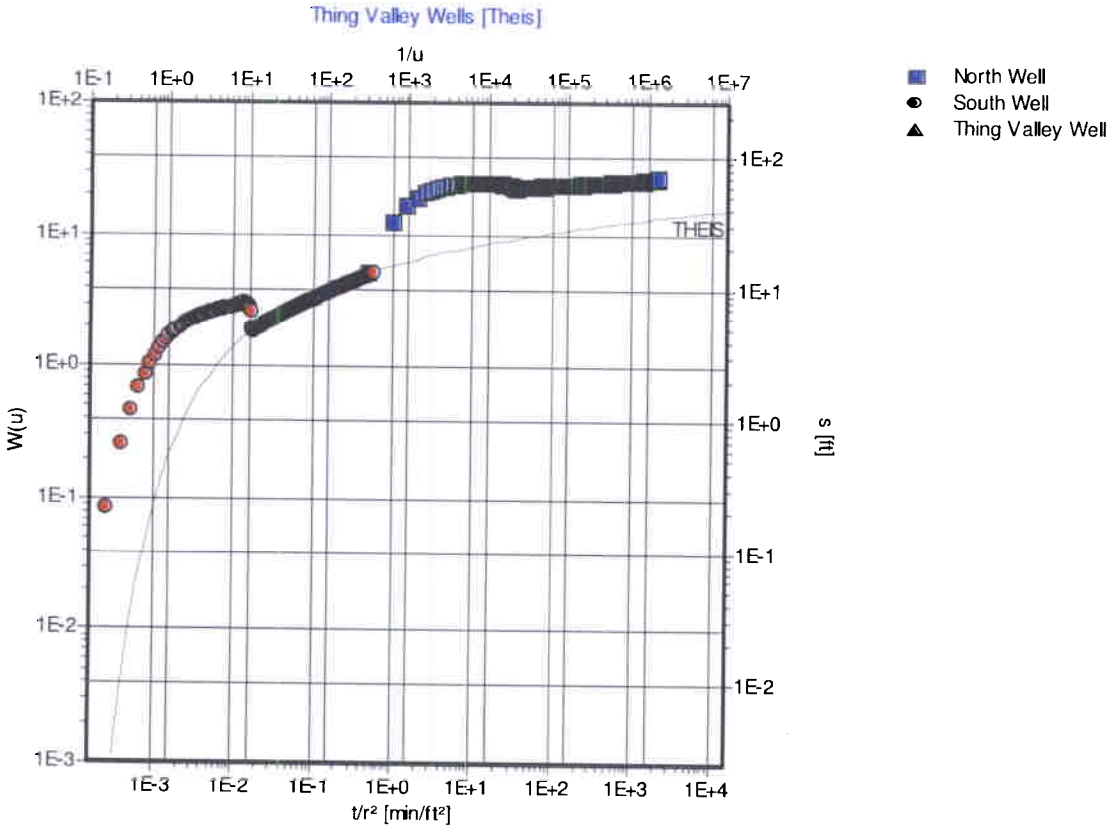
Pumping Test Analysis Report
Project: Thing Valley
Number: 2010-0005
Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Theis**

Analysis Results:	Transmissivity:	4.77E+2 [ft²/d]	Conductivity:	1.36E+0 [ft/d]
	Storativity:	2.10E-3		
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		

Comments: Match to South Well late data.

Evaluated by: MWV

Evaluation Date: 10/29/2010

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460 Philip Street - Suite 101
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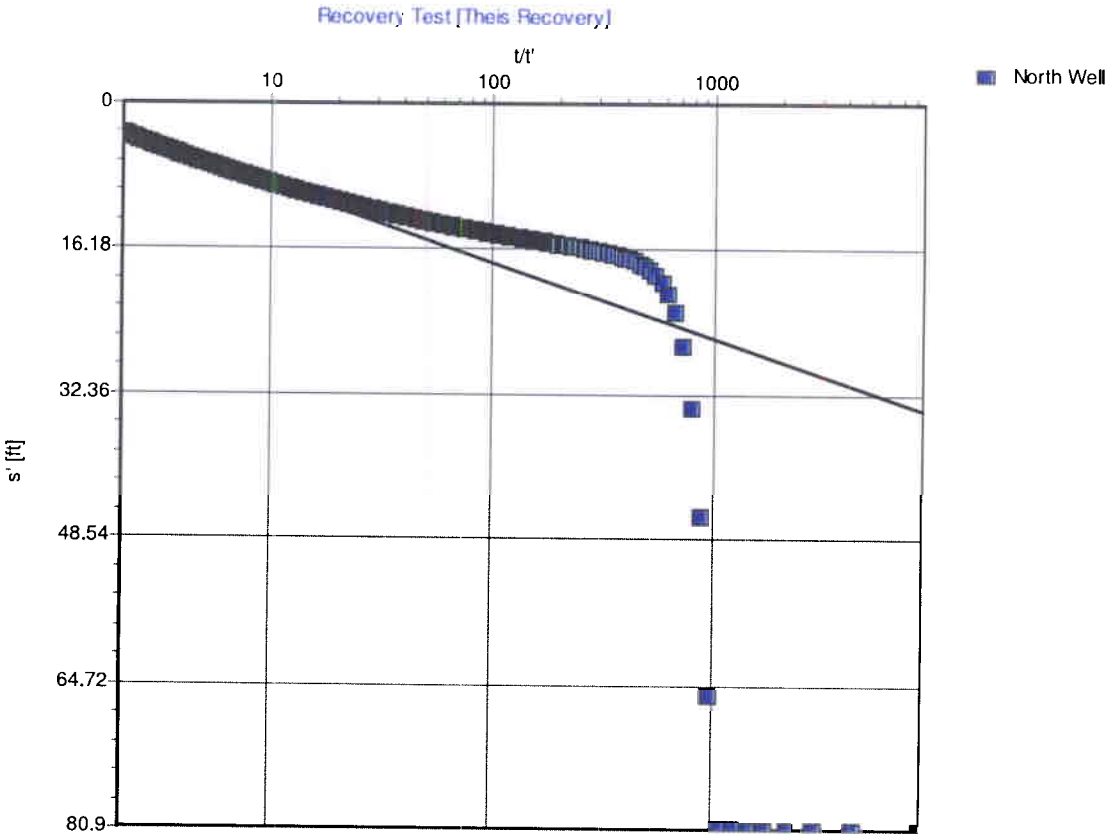
Pumping Test Analysis Report
Project: Thing Valley
Number: 2010-0005
Client:



Pumping Test: **Recovery Test**

Analysis Method: **Theis Recovery**

Analysis Results:	Transmissivity:	3.37E+2 [ft²/d]	Conductivity:	9.63E-1 [ft/d]

Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	81 [U.S. gal/min]		
	Pumping Time	4320 [min]		

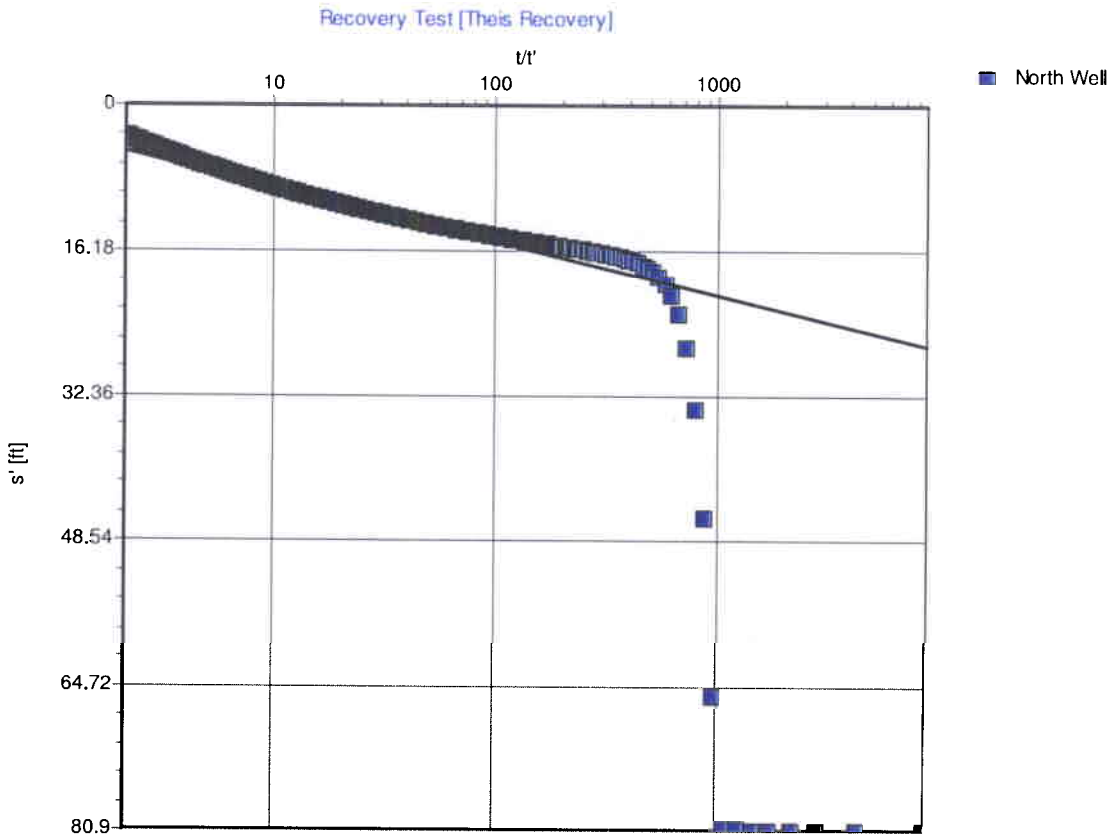
Comments: North Well recovery match to late data.

Evaluated by: MWV

Evaluation Date: 11/2/2010

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report
Project: Thing Valley
Number: 2010-0005
Client:



Pumping Test: **Recovery Test**

Analysis Method: **Theis Recovery**

Analysis Results:	Transmissivity:	4.73E+2 [ft²/d]	Conductivity:	1.35E+0 [ft/d]
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	81 [U.S. gal/min]		
	Pumping Time	4320 [min]		

Comments:

Evaluated by:

Evaluation Date: 11/2/2010