Clearwater Geosciences, LLP
Ground Water Development and Exploration

October 4, 2010

Mr. Dennis Dunn
Idaho Department of Water Resources
900 North Skyline Drive, Suite A
Idaho Falls, ID 83402-1718

RE: AQUIFER TEST DATA FOR LEX SMITH WATER RIGHT PERMIT 15-7307, MALAD BASIN

Dear Mr. Dunn:

A pumping test was conducted on August 18, 2010 on the Lex Smith Well in Woodruff, Idaho. The purpose of the pumping test was to either confirm or deny aquifer properties used in computer modeling suggesting that the potential drawdown impacts from the Smith well on neighboring wells might be excessive if the water right is approved. This letter transmits the results of my analysis.

The Smith Well and three observation wells were equipped with INSITU brand downhole pressure transducers and data loggers for collecting automated water levels during the pumping test (Figure 1). The pumping test began at noon on August 18, 2010 and the Smith well was pumped at a steady rate of 220 gpm for 24 hours. Plots of the raw data for all wells can be found in Attachment 1 and the particulars regarding the wells can be found in Table 1. The Smith well experienced about 26 ft of drawdown from static during the test. The observation well data are noisy primarily because they are also domestic house wells, which were in use at the time of the pumping test. There also appears to be some background aquifer fluctuations probably caused by irrigation pumping in nearby wells. The observation wells were processed as follows. OB1 early time data was extremely noisy and the drawdown portion of the data was discarded in favor of the recovery data, which is more regular. Spikes in the OB1 data caused by the pump cycling on and off were removed and a plot of the processed OB1 data is presented in Attachment 1. OB2 drawdown data was better, having fewer cycles of the pump being turned on and off. The data from this well was processed by removing the spikes caused by the pump cycling. OB3 well data were the most problematic. This well services two households and the pump cycles frequently. After removing the major spikes in the data, a 5 point running average was taken of the data to smooth out the data as much as possible. The plot of the processed data for OB3 is presented in Attachment 1. The data are suspect and although they are included in the pumping test analyses the results are given less weight than wells OB1 and OB2.

The well logs for the Smith Well, OB1 and OB2 are presented in Attachment 2. The well log for OB3 could not be located. On the basis of the Smith well log, the aquifer was assumed to be 140 ft thick. Several curve matching methods were conducted using the AQTESOLV aquifer test software. Output plots from the AQTESOLV analyses are presented in Attachment 3. Figure 3-1 shows the match of the late time data to the drawdown curve of the Smith well to the Theis confined solution. The well appears to be somewhat inefficient as the drawdown distorts the match to the observation wells. The calculated transmissivity is about 3×10^4 ft^2/day and the storativity is meaningless because it is a match to only the pumping well data. The drawdown data for the Smith Well was removed from the AQTESOLV plots and matches were made to OB1 and OB2 using both the confined and unconfined Theis solutions. The results are presented in Figures 3-2 through 3-4. Transmissivity ranges from 1.9 to 3.9×10^4 ft^2/day and the storativity ranges from 3.6×10^{-7} to 0.0012. In my opinion, the best match to the data at the largest radial distance is the confined Theis solution match to OB2, Figure 3-3. The larger radial distance integrates a larger volume of the aquifer and is more appropriate for making large scale predictions for long term pumping. In this case, the best measurement of aquifer transmissivity is 3.5×10^4 ft^2/day and the storativity is 0.0012.

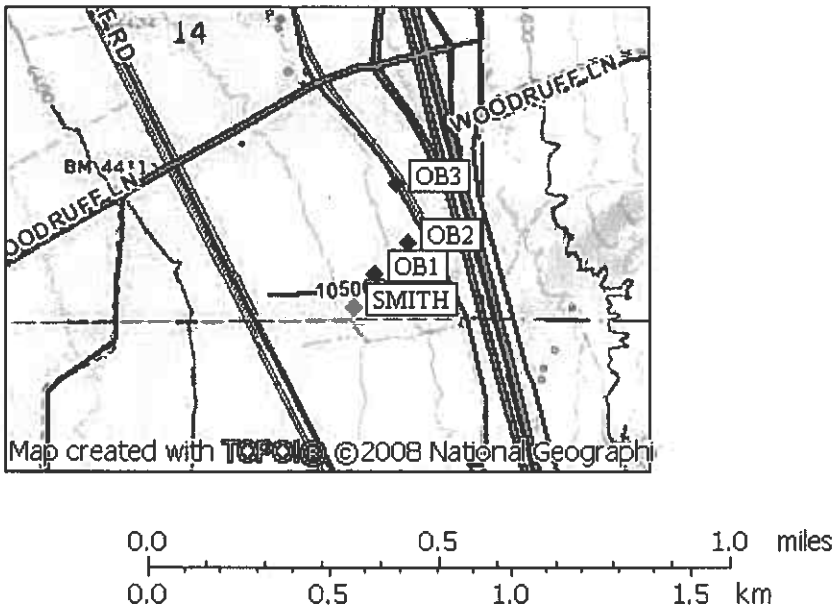


Figure 1. Map of pumped well (Smith) and observation wells for the Lex Smith Pumping Test

Table 1 Wells used in the Lex Smith Pumping Test.

Well Name	Owner Name	Tag #	Coords	Elevation	Radial Distance
Smith Well	Lex Smith	D0051338	12 T 399554 4653861	4437 ft	0
OB1	Allred	D0036075	12 T 399612 4653951	4455 ft	370 ft
OB2	Fullmer	D0026863	12 T 399708 4654040	4481 ft	800 ft
OB3	Richardson	N/A	12 T 399677 4654204	4496 ft	1200 ft

Clearwater Geosciences, LLP
Ground Water Development and Exploration

To estimate the long-term drawdown and impact to neighboring wells from pumping of the Smith Well I used the forward solution capabilities of the AQTESOLV program in a similar manner as has been presented to you in the past. I input an aquifer transmissivity is 3.5 x 10^4 ft^2/day and storativity of 0.0012. I also used the identical radial offsets, partial penetration and aquifer thickness of 140 feet as employed in the previously described aquifer test analysis. I assumed a fault spacing of 12,000 ft (Mr. McVay's number) and continuous pumping for 180 days at a rate of 290 gpm. As I described previously to you in my letter dated June 9, 2010, I think that these parameters are too conservative, but as you will see they have little impact on the calculated results. The AQTESOLV plot for this pumping and aquifer scenario is presented in Figure 3-5. The drawdown curves for the Smith, OB1, OB2 and OB3 are shown in the figure. The calculated drawdown for the Smith Well should be ignored because it assumes a perfectly efficient well and it will be greater. The calculated drawdown for the three observation wells is about 2 ft. The drawdown curves flatten at late time in the plot and I think his is because constant head boundaries were used to represent the north and south extent of the 12,000 ft wide neck in the mouth of the Malad Basin Aquifer created by the two bounding faults. To the north and the south the Malad Basin Aquifer opens up and the constant head boundary is a reasonable assumption for the behavior of the aquifer at the two ends of the model.

It is my professional opinion that Mr. Lex Smith's water right will not excessively impact his neighbors' right to divert water. For several reasons I believe that the calculated drawdown over estimates the actual drawdown to be expected. I present these reasons in my June 9, 2020 letter but basically they amount to the fact that no one pumps continuously during the irrigation season (thus 6 months continuous pumping is much too high), it is likely that Mr. Smith will pump at a lower rate than 290 gpm because he is only irrigating 20 acres and I believe that the fault spacing is more on the order of 15,000 ft than 12,000 ft.

On behalf of the Smith's I humbly request that you expedite approval of their water right application PERMIT 15-7307. Please do not hesitate to call me if you have any questions about this letter or the calculations presented herein. I will transmit to you electronically the data files collected during the test and the processed data.

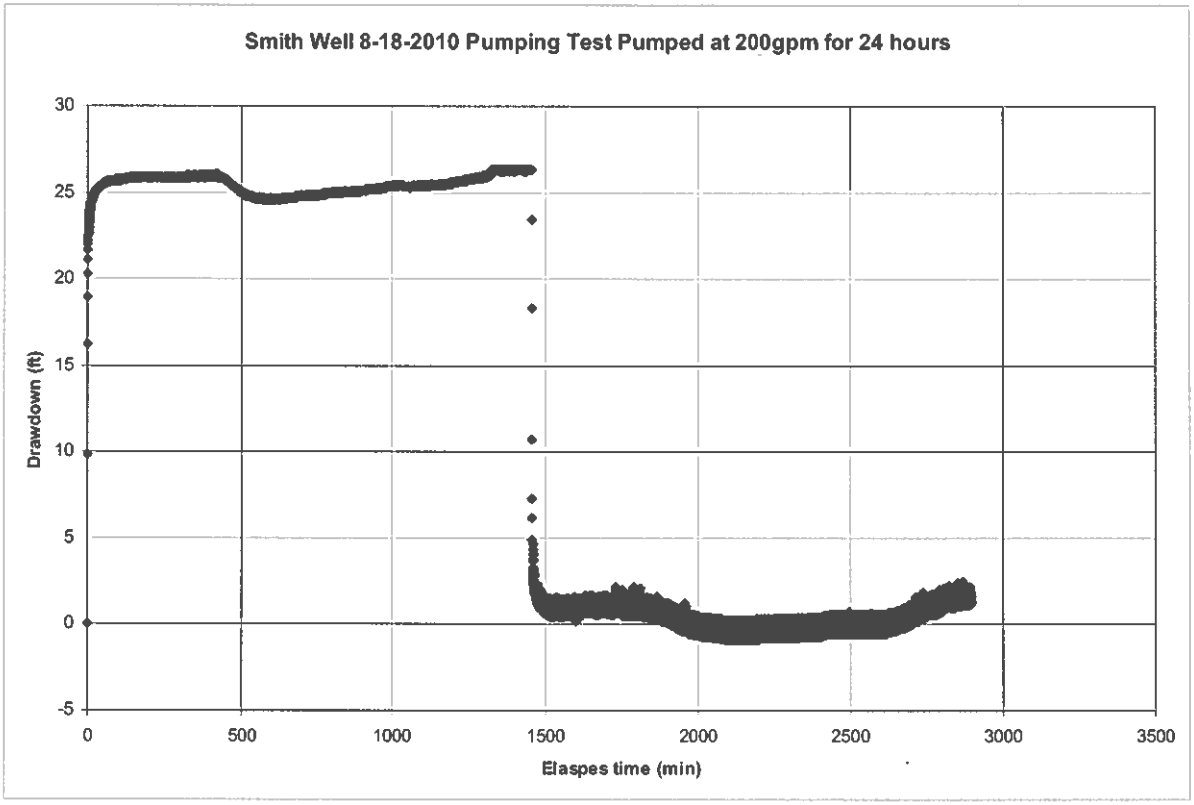
Respectfully,

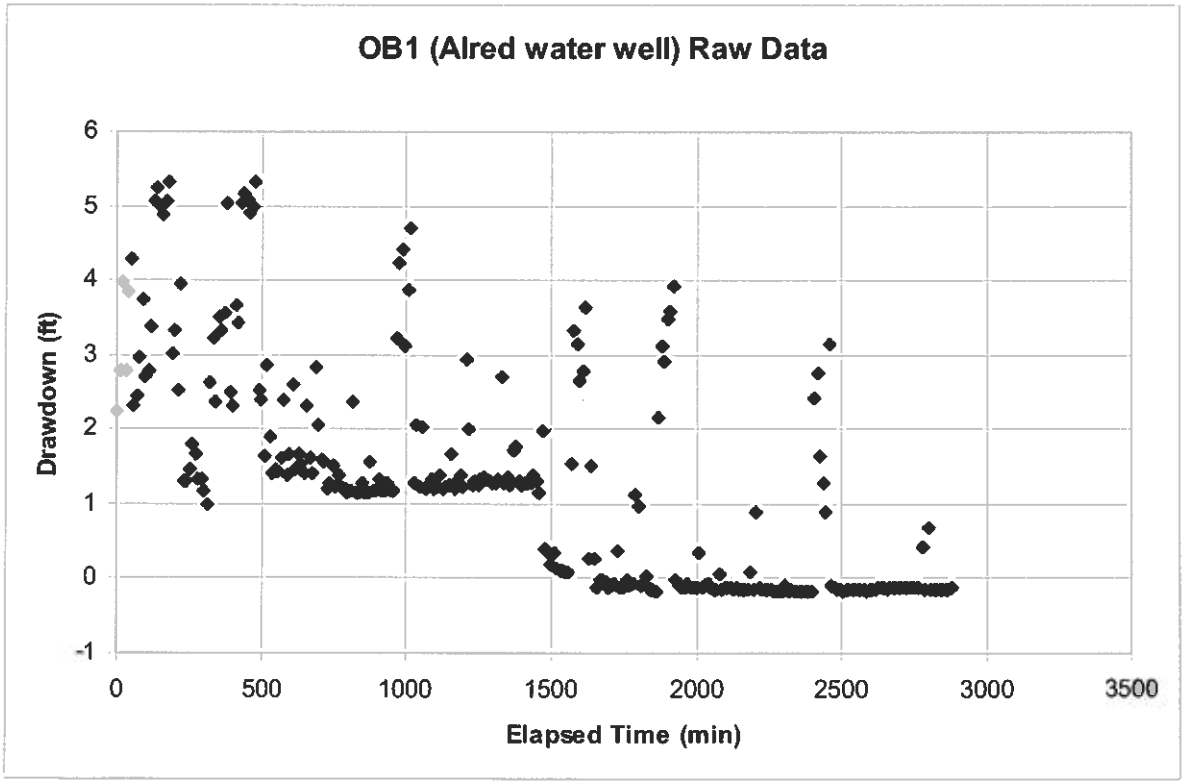
Thomas R. Wood, PhD, PG

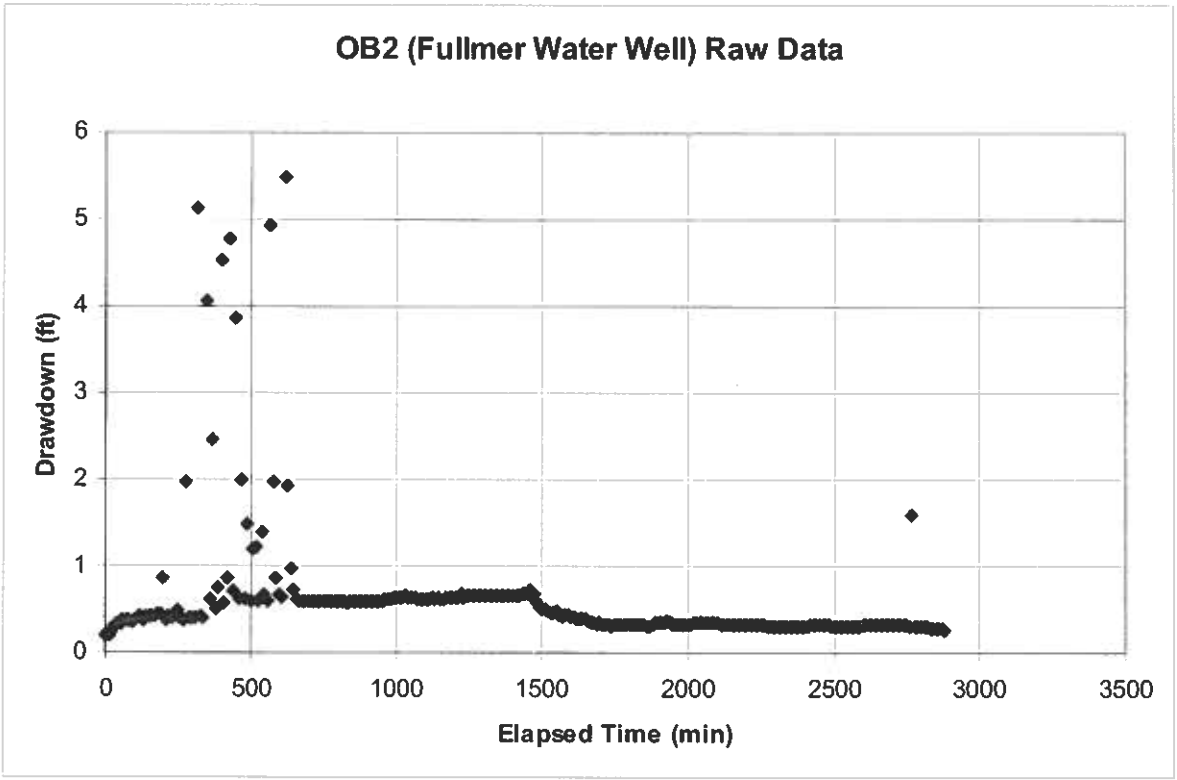
cc Lex and Bo Smith, 1655 E 10500 S, Malad, Idaho 83252

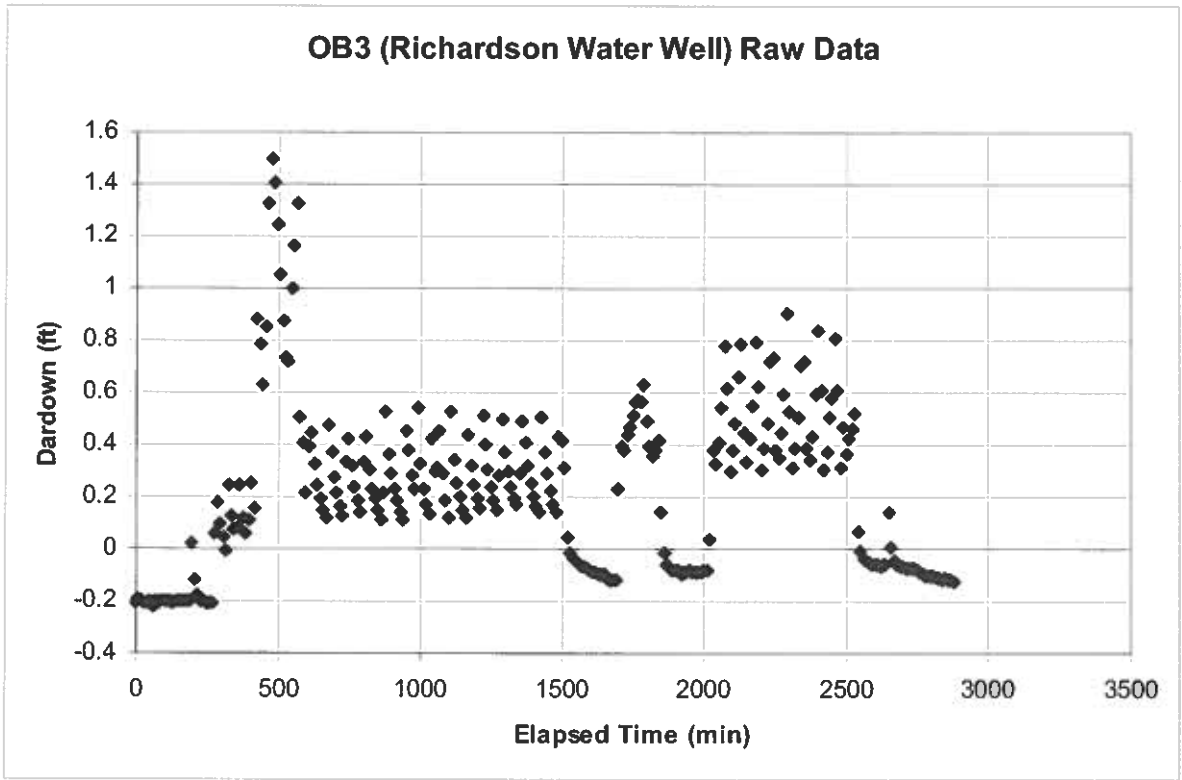
Attachment 1
DATA PLOTS

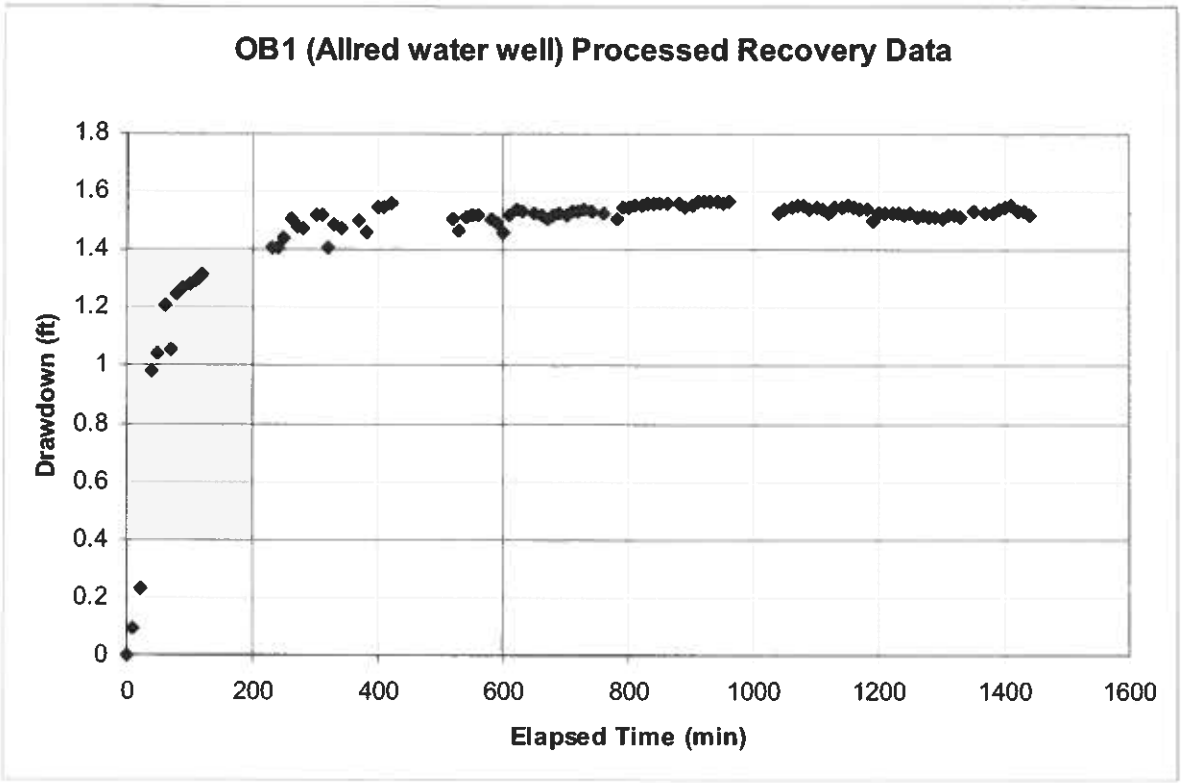
1818 East 49th South, Idaho Falls, ID 83404, Ph. 208-589-5555 Fax 542-1489

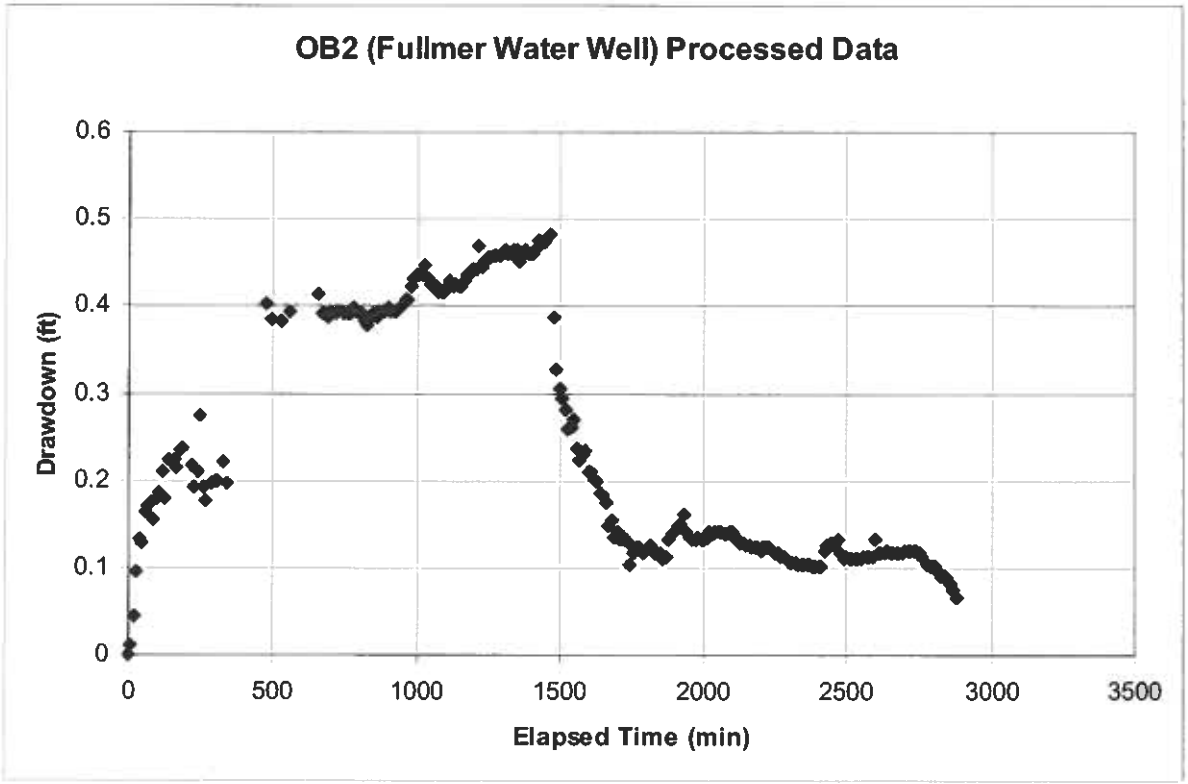

Smith Well 8-18-2010 Pumping Test Pumped at 200gpm for 24 hours
Drawdown (ft)
30
25
20
15
10
5
0
-5
0
500
1000
1500
2000
2500
3000
3500
Elaspes time (min)

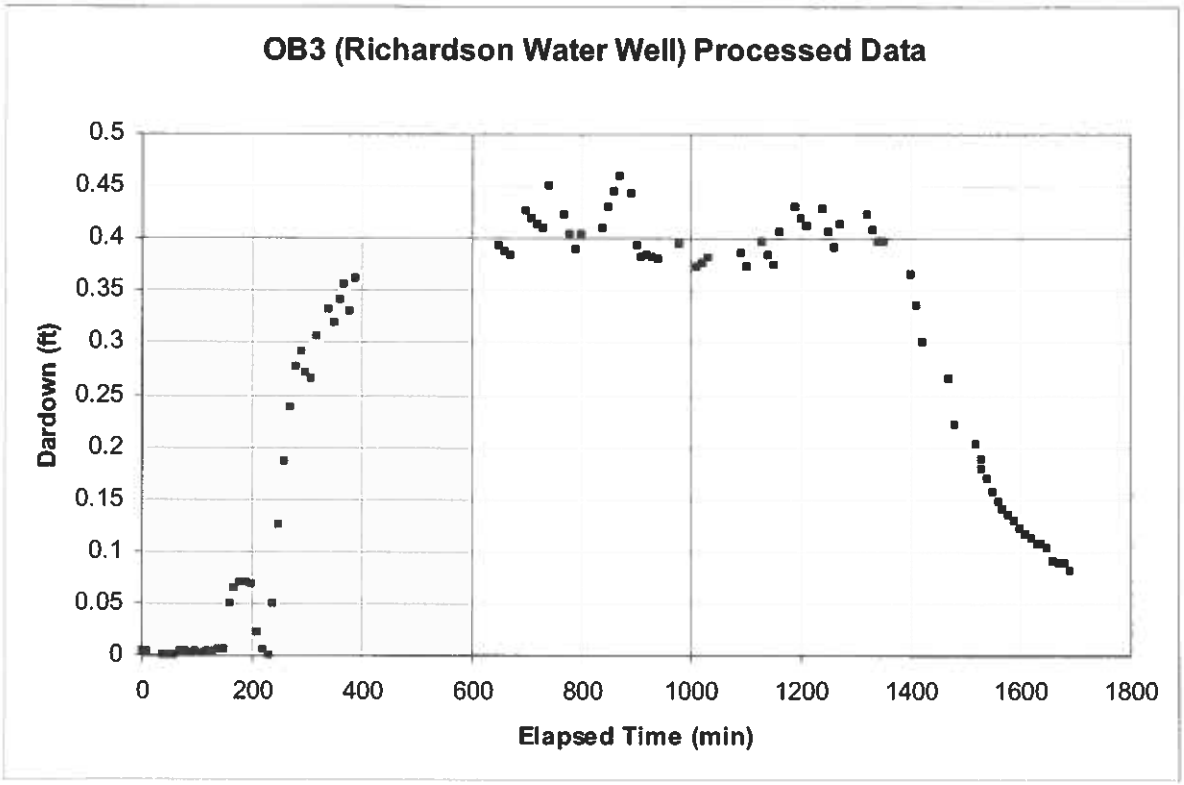

OB1 (Alred water well) Raw Data
Drawdown (ft)
6
5
4
3
2
1
0
-1
0
500
1000
1500
2000
2500
3000
3500
Elapsed Time (min)


OB2 (Fullmer Water Well) Raw Data
Drawdown (ft)
0
1
2
3
4
5
6
0
500
1000
1500
2000
2500
3000
3500
Elapsed Time (min)


OB3 (Richardson Water Well) Raw Data
Dardown (ft)
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
0
500
1000
1500
2000
2500
3000
3500
Elapsed Time (min)


OB1 (Allred water well) Processed Recovery Data
Drawdown (ft)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
200
400
600
800
1000
1200
1400
1600
Elapsed Time (min)


OB2 (Fullmer Water Well) Processed Data
Drawdown (ft)
0.6
0.5
0.4
0.3
0.2
0.1
0
0
500
1000
1500
2000
2500
3000
3500
Elapsed Time (min)


OB3 (Richardson Water Well) Processed Data
Dardown (ft)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
200
400
600
800
1000
1200
1400
1600
1800
Elapsed Time (min)

Attachment 2
WELL LOGS

Clearwater Geosciences, LLP
Ground Water Development and Exploration

Form 238-7
6/07

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

15

1. WELL TAG NO. D 0051338
Drilling Permit No.
Water right or injection well #
2. OWNER: Lex Smith
Name Lex Smith
Address 11696 S 19000 W
City Malad State ID Zip 83252
3. WELL LOCATION:
Twp. 16 North ☐ or South ☒ Rge 31e East ☒ or West ☐
Sec. 14 SE 1/4 SW 1/4 SE 1/4
Gov't Lot County Oneida
Lat. ° (Deg. and Decimal minutes)
Long. ° (Deg. and Decimal minutes)
Address of Well Site 11696 S 19000W
(Give at least name of road + Distance to Road or Landmark) City M
Lot. Blk. Sub. Name
4. USE:
☒ Domestic ☐ Municipal ☐ Monitor ☒ Irrigation ☐ Thermal ☐ Injection
☐ Other
5. TYPE OF WORK:
☒ New well ☐ Replacement well ☐ Modify existing well
☐ Abandonment ☐ Other
6. DRILL METHOD:
☒ Air Rotary ☐ Mud Rotary ☐ Cable ☐ Other
7. SEALING PROCEDURES:

Seal material	From (ft)	To (ft)	Quantity (lbs or ft³)	Placement method/procedure
Bentonite	0	78	27 bags	Overbore

8. CASING/LINER:

Diameter (nominal)	From (ft)	To (ft)	Gauge/ Schedule	Material	Casing	Liner	Threaded	Welded
8"	+2	218	.250	Steel	☒	☐	☒	☒
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Was drive shoe used? ☒ Y ☐ N Shoe Depth(s) 218
9. PERFORATIONS/SCREENS:
Perforations ☒ Y ☐ N Method Knife
Manufactured screen ☐ Y ☐ N Type
Method of installation

From (ft)	To (ft)	Slot size	Number/ft	Diameter (nominal)	Material	Gauge or Schedule
155	216	¼x1½"	11600	8"	steel	.250

Length of Headpipe Length of Tailpipe
Packer ☐ Y ☒ N Type
10. FILTER PACK:

Filter Material	From (ft)	To (ft)	Quantity (lbs or ft³)	Placement method
	NA			

11. FLOWING ARTESIAN:
Flowing Artesian? ☐ Y ☒ N Artesian Pressure (PSIG)
Describe control device

12. STATIC WATER LEVEL and WELL TESTS:
Depth first water encountered (ft) Static water level (ft) 76'
Water temp. (°F) Bottom hole temp. (°F)
Describe access port
Well test:

Drawdown (feet)	Discharge or yield (gpm)	Test duration (minutes)

Test method: Pump ☐ Bailer ☐ Air ☐ Flowing artesian ☐
Water quality test or comments:
13. LITHOLOGIC LOG and/or repairs or abandonment:

Bore Dia. (in)	From (ft)	To (ft)	Remarks, lithology or description of repairs or abandonment, water temp.	Water Y	Water N
10"	0	18	Clay		X
	18	30	Cemented Gravel		X
	30	55	Clay		X
	55	60	Cemented gravel		X
	60	78	Clay		X
8"	78	88	Cemented gravel	X	
	88	93	Clay		X
	93	95	Clay		X
	95	100	Cemented gravel	X	
	100	110	Clay		X
	110	130	Cemented gravel	X	
	130	145	Clay		X
	145	218	Cemented gravel	X	

RECEIVED
SEP 22 2008
Department of Water Resources
Eastern Region

Completed Depth (Measurable): 218'
Date Started: 9-11-08 Date Completed: 9-16-08
14. DRILLER'S CERTIFICATION:
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.
Company Name Vollmer Drilling Co. No. 383
*Principal Driller Date 9-19-08
*Driller Date
*Operator II Joey Vollmer Date 9/19/08
Operator I Date
* Signature of Principal Driller and rig operator are required.

Clearwater Geosciences, LLP
Ground Water Development and Exploration

Form 238-7
6/92

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

15

Office Use Only
Well ID No.
Inspected by
Twp ____ Rge ____ Sec ____
____ 1/4 ____ 1/4 ____ 1/4
Lat: : : Long: : :

1. WELL TAG NO. 0036075
DRILLING PERMIT NO.
Water Right or Injection Well No.

2. OWNER:
Name Robert Allred
Address 1149 E Centennial Circle
City Malad State ID Zip 83252

3. LOCATION OF WELL by legal description:
You must provide address or Lot, Blk, Sub. or Directions to well.
Twp. 10 North ☐ or South ☒
Rge. 31E East ☒ or West ☐
Sec. 14 1/4 NE 1/4 NE 1/4
Gov't Lot ____ County Oneida
Lat: : : Long: : :
Address of Well Site Same
(One of these: name of road + distance to Road or Landmark) City
Lt. ____ Blk. ____ Sub. Name

4. USE:
☒ Domestic ☐ Municipal ☐ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

5. TYPE OF WORK check all that apply (Replacement etc.)
☒ New Well ☐ Modify ☐ Abandonment ☐ Other

6. DRILL METHOD:
☒ Air Rotary ☐ Cable ☐ Mud Rotary ☐ Other

7. SEALING PROCEDURES

Seal Material	From	To	Weight / Volume	Seal Placement Method
Bentonite	0	20	1 bags	Gravity

Was drive shoe used? ☒ Y ☐ N Shoe Depth(s) 160
Was drive shoe seal tested? ☐ Y ☐ N How?

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
6"	0	160	.28	Steel	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Length of Headpipe ____ Length of Tailpipe
Packer ☐ Y ☐ N Type

9. PERFORATIONS/SCREENS PACKER TYPE
Perforation Method torch
Screen Type & Method of Installation

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
140	160	.27	44-6	6"	Steel	☒	☐
						☐	☐
						☐	☐

10. FILTER PACK

Filter Material	From	To	Weight / Volume	Placement Method

11. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
87 ft. below ground Artesian pressure ____ lb.
Depth flow encountered ____ ft. Describe access port or control devices:

12. WELL TESTS:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal./min	Drawdown	Pumping Level	Time
30			

Water Temp. cold Bottom hole temp. cold
Water Quality test or comments good
Depth first Water Encounter 95

13. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
10	0	20	Brn clay some gravel	☒	X
6	20	100	Brn clay some gravel		X
6	100	85	Gravel cobbles clay Br.		X
6	85	95	Brn clay		X
6	95	120	Gravel brn clay	X	
6	120	130	Brown clay		X
6	130	142	Hard pan gravel clay	X	
6	142	150	Brn clay		X
6	150	160	gravel Brn clay	X	

RECEIVED
JUN 14 2005
Department of Water Resources
Eastern Region

Completed Depth 160 (Measurable)
Date Started 5-10-05 Completed 5-10-05

14. DRILLER'S CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.
Company Name Nit West Well Drillers Firm No. 542
Principal Driller Michael Frandsen Date 5-15-05
and
Driller or Operator Miles Frandsen Date 5-15-05
Operator I ____ Date ____
Principal Driller and Rig Operator *Required.*
Operator I must have signature of Driller/Operator II

FORWARD WHITE COPY TO WATER RESOURCES

1818 East 49th South, Idaho Falls, ID 83404, Ph. 208-589-5555 Fax 542-1489

Clearwater Geosciences, LLP
Ground Water Development and Exploration

Form 238-7 6/02

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Office Use Only
Well ID No.
Inspected by
Twp ____ Rge ____ Sec ____
____ 1/4 ____ 1/4 ____ 1/4
Lat: : : Long: : :

1. WELL TAG NO. D 0026863
DRILLING PERMIT NO.
Water Right or Injection Well No.

2. OWNER:
Name Darly Fullmer
Address 10490S old Hwy 91
City Malad State ID Zip 83252

3. LOCATION OF WELL by legal description:
You must provide address or Lot, Blk, Sub. or Directions to well.
Twp. 16 North ☐ or South ☑
Rge. 36 East ☑ or West ☐
Sec. 14, SW 1/4 (10 acres) SW 1/4 (10 acres) 1/4 (160 acres)
Gov't Lot ____ County Oneida
Lat: : : Long: : :
Address of Well Site Same
City
(Give at least name of road + Distance to Road or Landmark)
Lt. ____ Blk. ____ Sub. Name

4. USE:
☑ Domestic ☐ Municipal ☐ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

5. TYPE OF WORK check all that apply (Replacement etc.)
☑ New Well ☐ Modify ☐ Abandonment ☐ Other

6. DRILL METHOD:
☑ Air Rotary ☐ Cable ☐ Mud Rotary ☐ Other

7. SEALING PROCEDURES

Seal Material	From	To	Weight / Volume	Seal Placement Method
Ben-Seal	0	25	slurry	pour

Was drive shoe used? ☑ Y ☐ N Shoe Depth(s)
Was drive shoe seal tested? ☐ Y ☑ N How?

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
6	0	142	Y4	prim	☑	☐	☑	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Length of Headpipe ____ Length of Tailpipe ____
Packer ☐ Y ☑ N Type

9. PERFORATIONS/SCREENS PACKER TYPE
Perforation Method N/a
Screen Type & Method of Installation

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
						☐	☐
						☐	☐
						☐	☐

10. FILTER PACK

Filter Material	From	To	Weight / Volume	Placement Method

11. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
44 ft. below ground Artesian pressure ____ lb.
Depth flow encountered ____ ft. Describe access port or control devices:

12. WELL TESTS:
☐ Pump ☐ Bailer ☑ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
40	25	71	1 hr.

Water Temp. Cold Bottom hole temp.
Water Quality test or comments: Turns steel green.
116' @ 10 GPM → Depth first Water Encounter

13. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
10	0	3	Top soil		✓
	3	98	white clay		✓
6	98	116	Sand gravel		✓
	116	118	gravel	✓	
	118	137	Blue clay		✓
	137	148	gravel	✓	
	148	160	Blue clay		✓

RECEIVED
AUG 1 1 2003
Department of Water Resources
Eastern Region

Completed Depth 142 (Measurable)
Date: Started 4-21-03 Completed 5-20-03

14. DRILLER'S CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.
Company Name L C Galen Drilling Firm No. 454
Principal Driller and Driller or Operator II Date Aug 4-03
Operator I Date
Principal Driller and Rig Operator Required.
Operator I must have signature of Driller/Operator II.

FORWARD WHITE COPY TO WATER RESOURCES

1818 East 49th South, Idaho Falls, ID 83404, Ph. 208-589-5555 Fax 542-1489

Attachment 3
AQTESOLV PLOTS

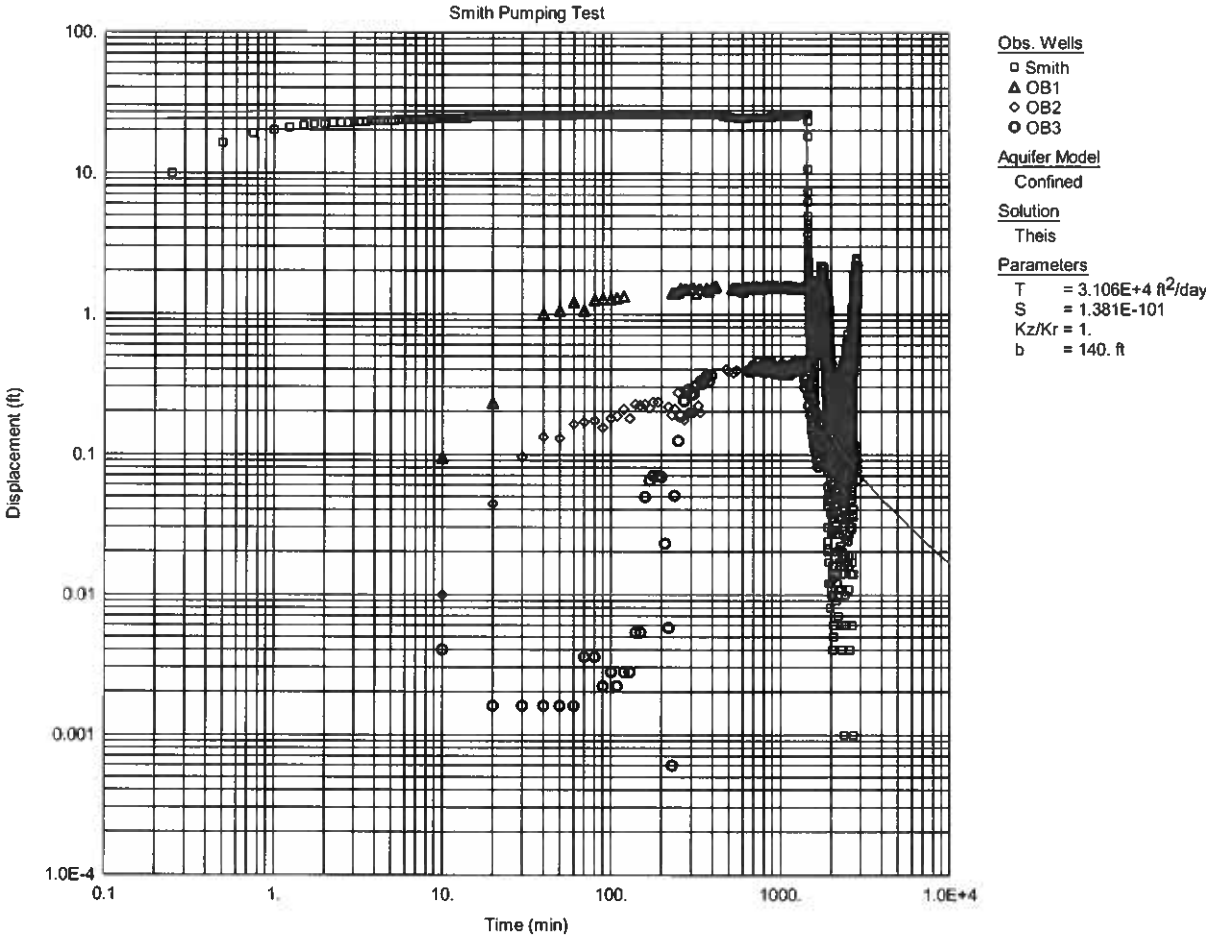


Figure 3-1 Theis confined solution matched to Smith Well.

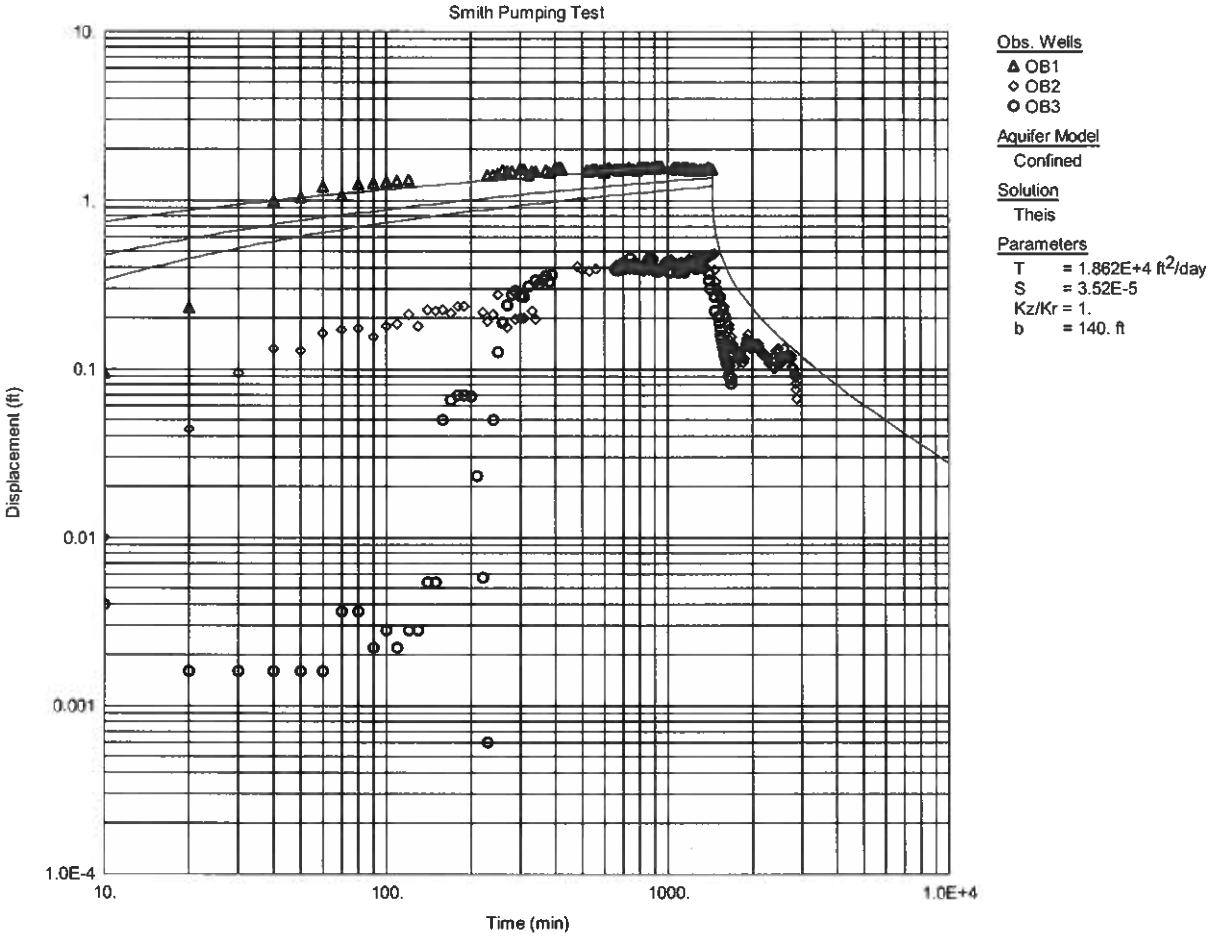


Figure 3-2 Theis confined solution matched to OB1.

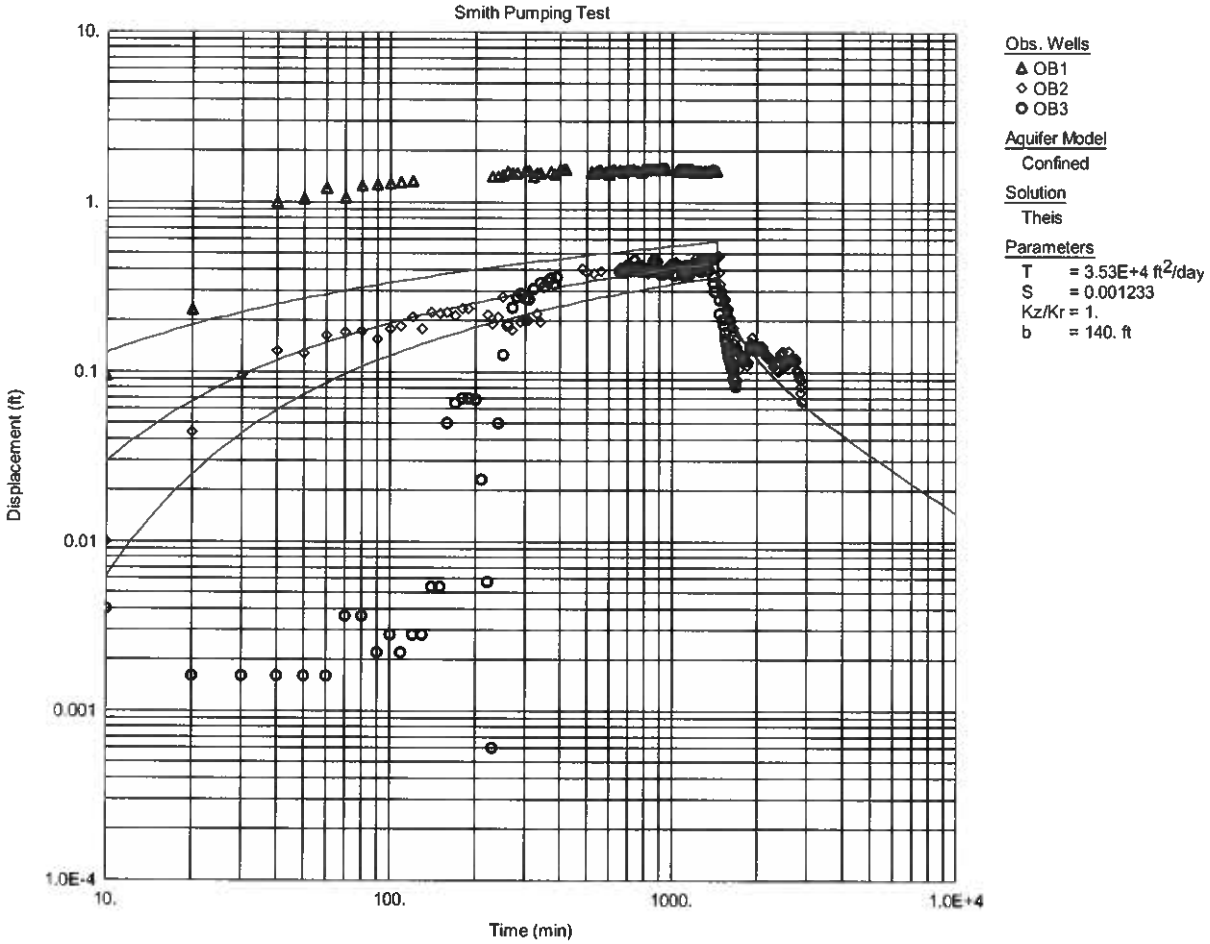


Figure 3-3 Theis confined solution matched to OB2.

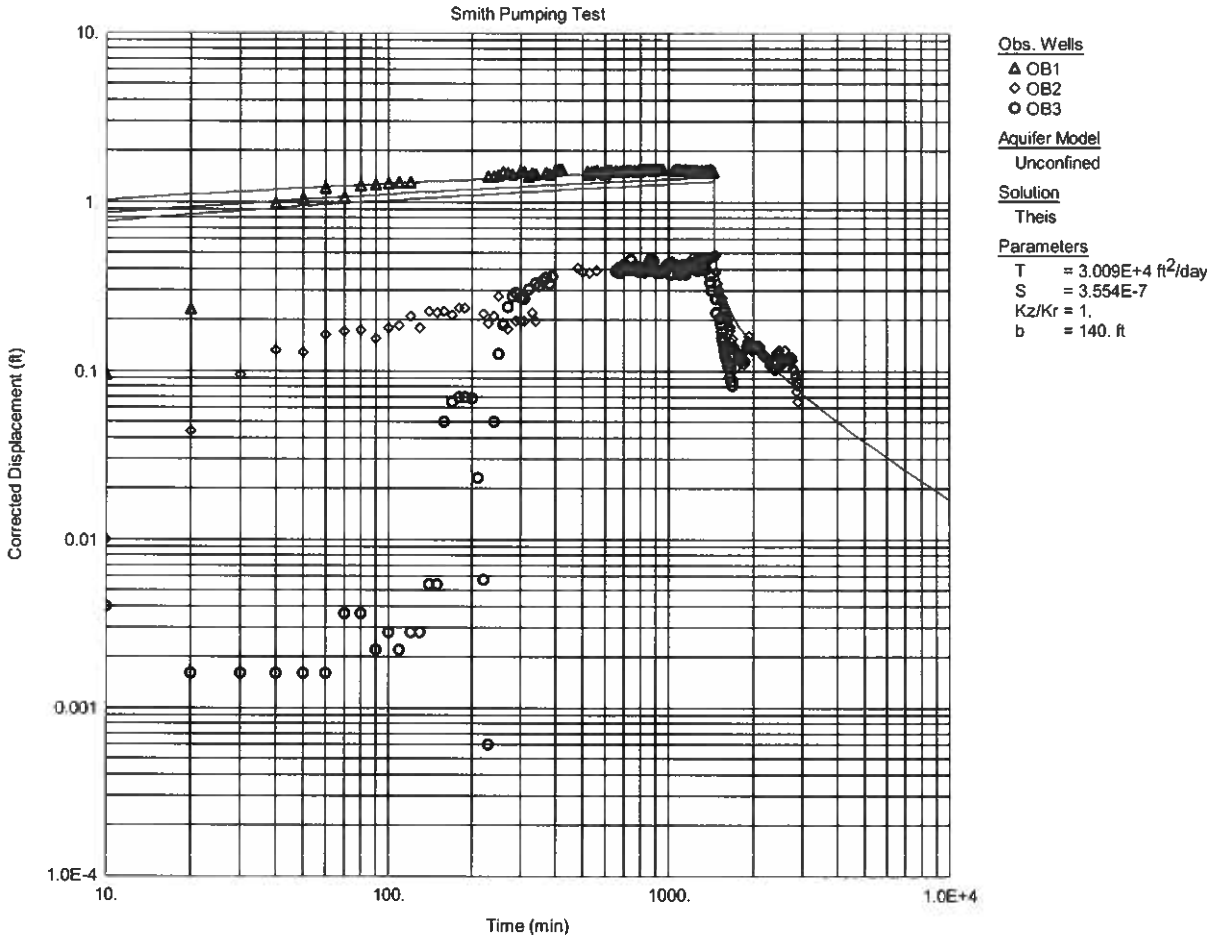


Figure 3-4 Theis unconfined solution matched to OB1

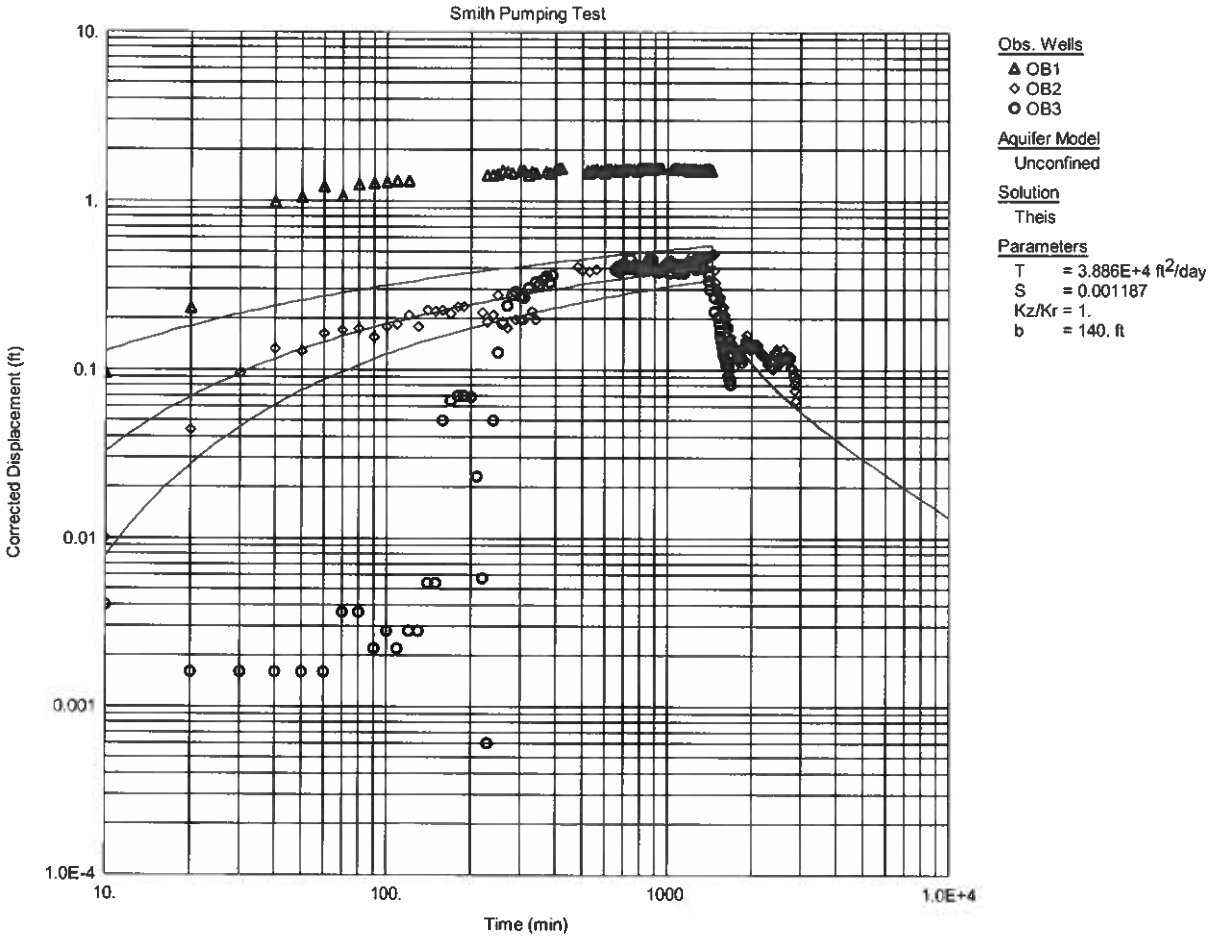


Figure 3-5 Theis unconfined solution matched to OB2.

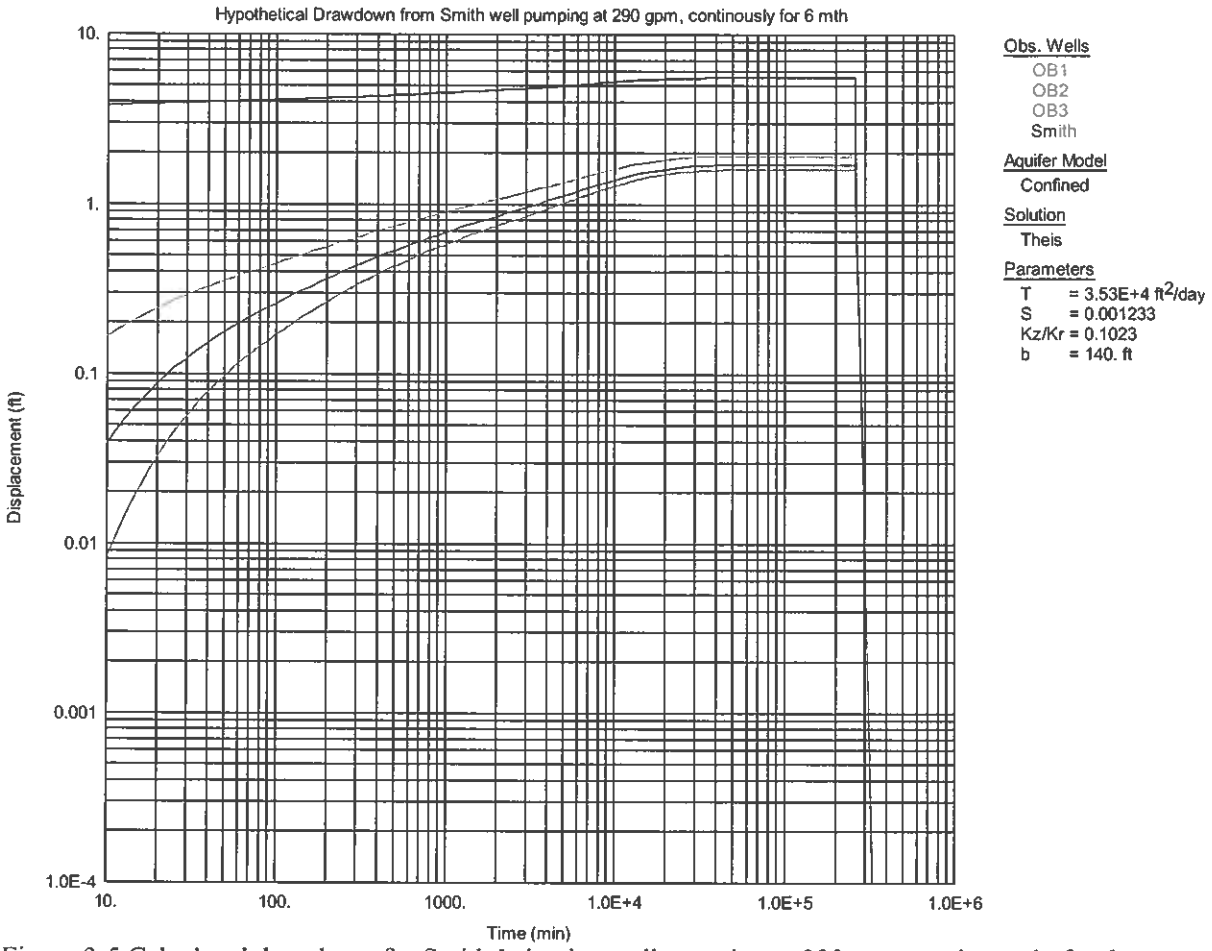


Figure 3-5 Calculated drawdown for Smith Irrigation well pumping at 290 gpm continuously for 6 months. Observation well radial distances are the same as listed in Table 1.