

Cox, Sharla

From: Tom Wood [thomaswood@gmail.com]
Sent: Saturday, April 11, 2015 12:20 PM
To: Cefalo, James; Cox, Sharla; Lindsey Edwards
Subject: Revised Aquifer impact Report - Edwards Application
Attachments: Edwards Water Right Hydrological Report update.pdf

Please find attached my updated aquifer impact assessment for the subject application.

Thank you,

Tom Wood



April 10, 2015

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

RE: HYDROLOGICAL ASSESSMENT FOR JUSTIN AND LINDSEY EDWARDS WATER RIGHTS APPLICATION-UPDATE

Dear Mr. Cefalo:

A groundwater impact assessment is provided in this letter report for Justin and Lindsey Edwards Water Right Application. They have approximately 285 acres of land northwest of Malad City, Idaho (Figure 1) and their application is for 5.7 cfs. I submitted an earlier report in January on the first POD location. To address a protest by the canal company, they found it necessary to move the POD about ½ mile to the northeast of the first location. This report is an update to the first report.

A pumping test was conducted on June 20-24, 2005 in a well about 2.95 miles southeast of the proposed drill site, labeled the Jeff Thomas Test Well in Figure 1. The parameters from the aquifer test are used in a computer simulation to predict the potential impacts to neighboring wells within ½ mile of the proposed point of diversion (POD). The results of the computer analysis show that the proposed diversion rate will have a minimal or negligible impact on neighboring wells.

Nearby PODs

The proposed well location is 14S, 35E, 1 SE NW as shown in Figure 2. A search was made for all existing points of diversions (PODs), i.e. water rights near the Edwards property. In Figures 3 and 4 a blue circle is shown with a ½ mile radius centered on the proposed Edwards well location. The circle encompasses portions of sections 1 and 2, T14S, R35E and sections 35 and 36 T13S R35E. A search of the IDWR on-line database for PODs in these sections indicates that the only groundwater permit is in Section 36 T14S R35E. The results of the water right search are provided in Tables 1 through 3. It should be noted that there are no surface water rights in these sections. It should also be noted that the interactive map generator on the IDWR website shows none of these within a half mile radius of the Edwards proposed POD.

Nearby Wells

A search was performed of the IDWR drillers' log database for wells within ½ mile of the proposed well location. Seven representative well logs are provided in Attachment 1 to show the local hydrogeology. The average depth of the wells in sections 1 and 2, T14S, R35E and section 36 T13S R35E is 488 ft and the average depth to water is 224 ft.

Hydrogeology



The Malad Valley is surrounded by mountains made of old crystalline rock, which were up-lifted and formed a deep valley between them. During the ice ages, the entire Salt Lake Basin was filled with water forming a vast inland lake on several occasions. The water extended into the area of the subject property. During periods of high water fine sediment and sand were deposited. During periods of low water the sediments were incised by surface streams, which also deposited coarse sands and gravels. Two of the most prominent lake levels were the Bonneville at about 5200 ft and the Provo at about 4800 ft above mean sea level. The elevation of the subject property is about 4820 ft, so it is expected that fine lake bed sediments from the Provo and Bonneville Lake Levels exist in the shallow subsurface below the property. In this area the lake bed sediments may have cut by the ancestral Malad River. This stream also may have deposited sands and gravels as reported on the well drillers logs.

The lithology in this area is a series of unconsolidated sands, gravels and clays. There is not a marker layer or geologic unit that can be correlated over distances between wells (~ ½ mile), at least, as described in the lithology on the well logs. The inability to correlate geologic layers is consistent with the area being situated in a cut and fill sequence of the Malad River. It is further complicated by waxing and waning cycles of ancient Lake Bonneville. For the purposes of this investigation it is assumed that the aquifer thickness is 220 ft in this area. This is based on driller log for the Jeff Thomas Test Well and regional considerations of the hydrogeology although the aquifer may be thinning northward of the Thomas location away from the basin center. It should be noted that the aquifer is a sequence of permeable lens of sand and gravel stringers, which are primarily confined or semi-confined. Locally the aquifer may be unconfined.

Pumping Test

An irrigation well was completed to a depth of 489 feet on the Thomas Property, T14S, 35E, Section 24, on May 20, 2005. It is perforated from 280 ft to 481 feet in order to draw water from a deeper part of the aquifer. The geology beneath the Jeff Thomas property consists of interlayered sediment ranging from unconsolidated sands and gravel to brown sticky clay. With depth, the layers of sand are reported to be lithified into harder more competent sandstone intervals.

A four-day pumping test was conducted June 20-24, 2005 at a rate of 1,000 gpm. Water levels were monitored in nine surrounding wells, using electronic pressure transducers. The radial distance between the Thomas Well and the observation wells ranged from 528 feet to 3,168 feet. On the basis of the depth to water measurements, there appears to be at least three sub-units to the aquifer: 1) a shallow zone with depth to water between 7 and 10 feet, 2) a middle aquifer sub-unit with depth to water measurements between 73 and 76 feet and a deeper sub-unit with depth to water measuring between 97 and 104 feet.

Drawdown plots for the observation wells can be found in Attachment 2. The effects of pumping the new well could not be seen definitively in any of the observation wells. The pumping test was conducted when other nearby irrigation wells were pumping, which tended to make the aquifer data “noisy”. Nevertheless, if drawdown from pumping the Jeff Thomas well impacted the observation wells it was minimal and could not be defined.



Aquifer test analyses could only be performed on the pumped well because drawdown was not observed in any of the observation wells. Attachment 3 contains the aquifer test analyses performed using the AQTESOLV computer program for a leaky confined aquifer (Hantush, 1960). The first two plots are the drawdown and recovery curves. The transmissivity is 1392 ft²/day using the leaky confined aquifer solution. In the third plot, a match to the Theis solution for a confined aquifer is provided in Attachment 3. As can be noted, the match to the confined Theis solution is not as good as the match to the leaky confined solution. Below the plots in Attachment 3 are listed the residual statistics for each match using the automatic curve matching option in AQTESOLV. The objective function that is minimized during automatic curve matching is the sum of the squared residuals. Automatic curve matching seeks to minimize the residual sum of squares, residual variance and standard deviation and obtain a residual mean close to zero. As can be seen by the residual statistics, the variance and the standard error are significantly less for the leaky confined match than for the confined solution. This indicates that in this area the aquifer is under leaky confined conditions. This was a significant test (i.e. 1000 gpm for 4 days with many observation wells) and it represents one of the best measures of aquifer properties for the Malad Valley.

Because the observation wells did not show measurable drawdown, a reasonable storativity value could not be calculated from the test itself. It was taken as 0.01, which is within the range of average values quoted by Freeze and Cherry (pg. 60) for confined aquifers.

Impact Assessment

Mr. and Mrs. Edwards wish to irrigate 285 acres and per IDWR estimates of usage this will require 0.02 cfs per acre or 2558 gpm (5.7 cfs). To estimate the long-term drawdown and impact to neighboring wells from pumping of the proposed Edwards well, the forward solution capability of the AQTESOLV program was employed. Boundaries in AQTESOLV were enabled to represent Malad Valley. As depicted in Figure 4-1 and listed in Table 4-1 the model is 25,000 ft wide and 40,000 ft long. Because the Malad Valley is bounded by mountains consisting of Paleozoic and Mesozoic sedimentary rock that do not provide much water compared to the unconsolidated valley fill, the northwest, northeast and southeast boundaries are set as impermeable or “no flow” boundaries. Water is allowed to enter the model domain only through the southwest boundary.

In the model domain the 2nd proposed POD well is located 14,900 ft southeast of the northwest boundary and 33050 ft northeast of the southwest boundary. The northwest, northeast and southeast boundaries are no flow boundaries in the model. No flow boundaries do not allow water to enter the domain, having the effect of increasing drawdown. The southwest boundary is a constant head boundary and it does allow water to enter the model domain. An imaginary well is placed in the model ½ mile southwest of the proposed diversion to simulate drawdown impacts from the maximum proposed pumping.

Figure 4-2 shows the AQTESOLV[®] output plot of the forward calculation for the proposed well pumping at 2558 gpm or 5.7 cfs constantly for 6 months (April 15 to Oct 15). At the end of the time period the predicted drawdown is estimated to be about 180 feet in the proposed POD. This assumes a perfectly efficient well. The calculated drawdown for a well ½ mile southwest of the POD and pumping from the same aquifer is predicted to be 0. Water supplying the well comes



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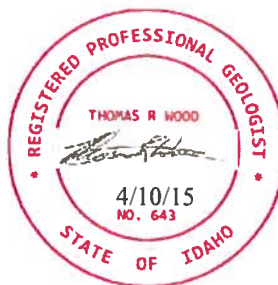
from leakage from overlying confining layers and aquifers. Because it is uncertain if leaky conditions will exist at the proposed POD, a second model run was conducted to evaluate the possibility that the aquifer is perfectly confined. Figure 4-3 shows the results of that calculation. As can be seen in the plot the anticipated drawdown is greatly increased under this scenario, to about 300 ft. However, the predicted drawdown to a hypothetical well ½ mile away is small, about 2.8 ft. If the aquifer is confined in the location of the new POD, the Edwards may have trouble producing the desired yield from a single well, but if they can, the impacts to neighboring users will be minimal.

It is my professional opinion that Mr. ^{Edwards's} ~~Evans~~ water right application will not excessively impact his neighbors' right to divert water. I believe that the calculated drawdown over estimates the actual drawdown to be expected for the following reasons: 1) Mr. and Mrs. Edwards will never pump continuously at the maximum rate for 180 days; 2) the Paleozoic/Mesozoic rocks of the mountains are not totally impermeable this is especially true of the area along the Malad River (toward Daniels reservoir) and to the south toward Malad. These are two areas of the model that were simulated as no flow boundaries and in actuality will provide some water to the system, thus reducing drawdown; 3) several canals and the Malad River are within the domain of the model and no credit for recharge/leakage is taken in the model; and 4) the calculated impact used semi-confined aquifer conditions for the entire domain, while it is known that unconfined conditions exist over large parts of the area, which will have a greater storage coefficient. All of these factors will reduce the predicted drawdown.

Please do not hesitate to call me if you have any questions about this letter or the calculations presented.

Respectfully,

Thomas R. Wood, PhD, PG



cc

Lindsey and Justin Edwards 3825 N 3900 W Malad City Idaho 83252

References

- Hantush, M.S., Modification of the theory of leaky aquifers, Jour. of Geophysical Research, 65(11), 3713-3725, 1960.
- Freeze, R.A. and J.A. Cherry, 1979, Groundwater, ISBN 0-13-365312-9, Prentice-Hall, Inc., Englewood Cliffs, New Jersey 07632.

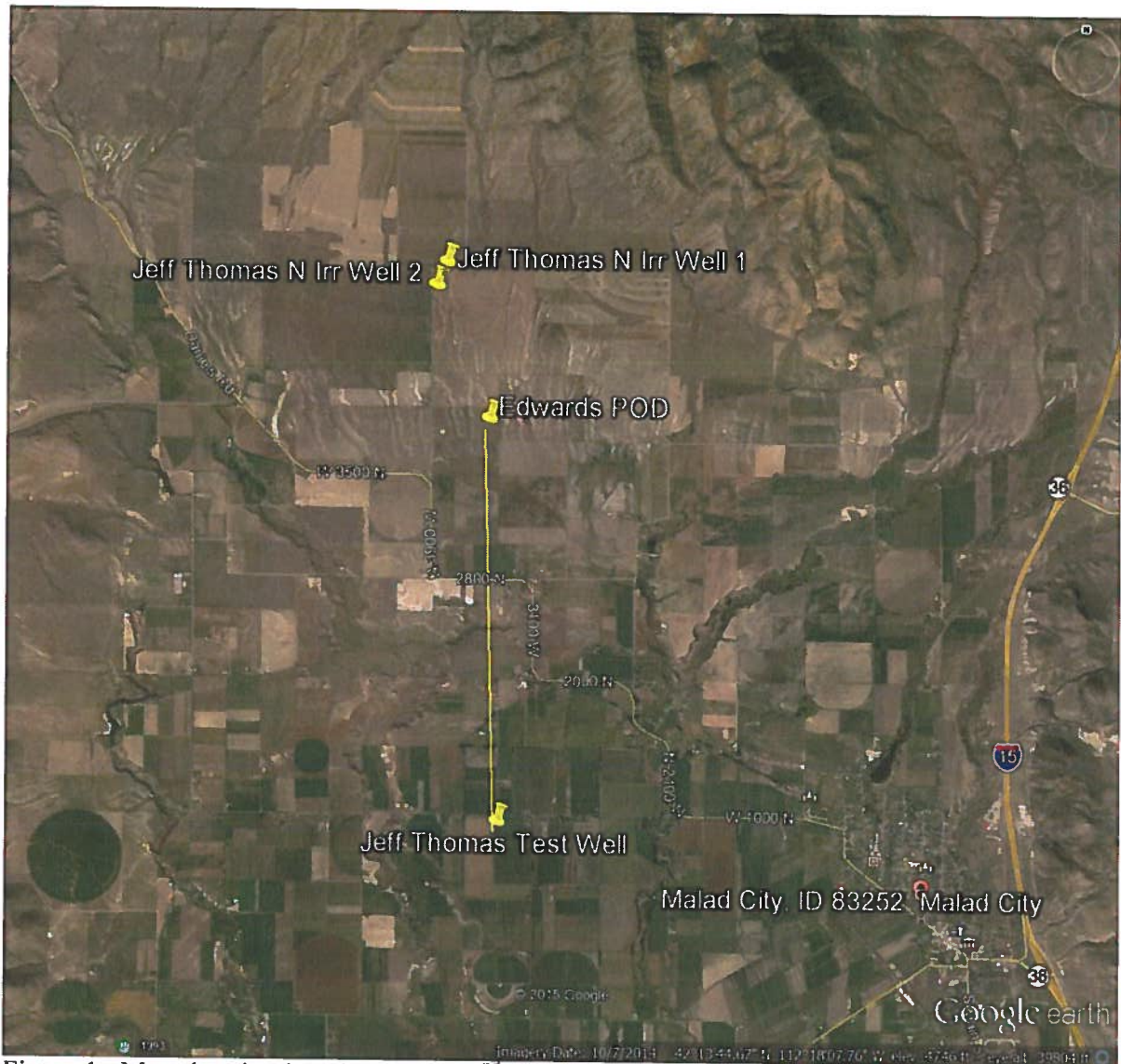
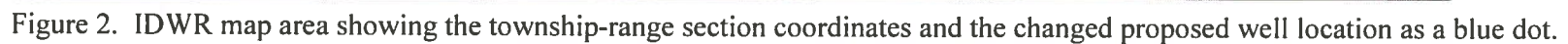


Figure 1. Map showing locations of the 2nd proposed Edwards well location, the Jeff Thomas Irrigation/Test Well and a line 2.95 miles long.



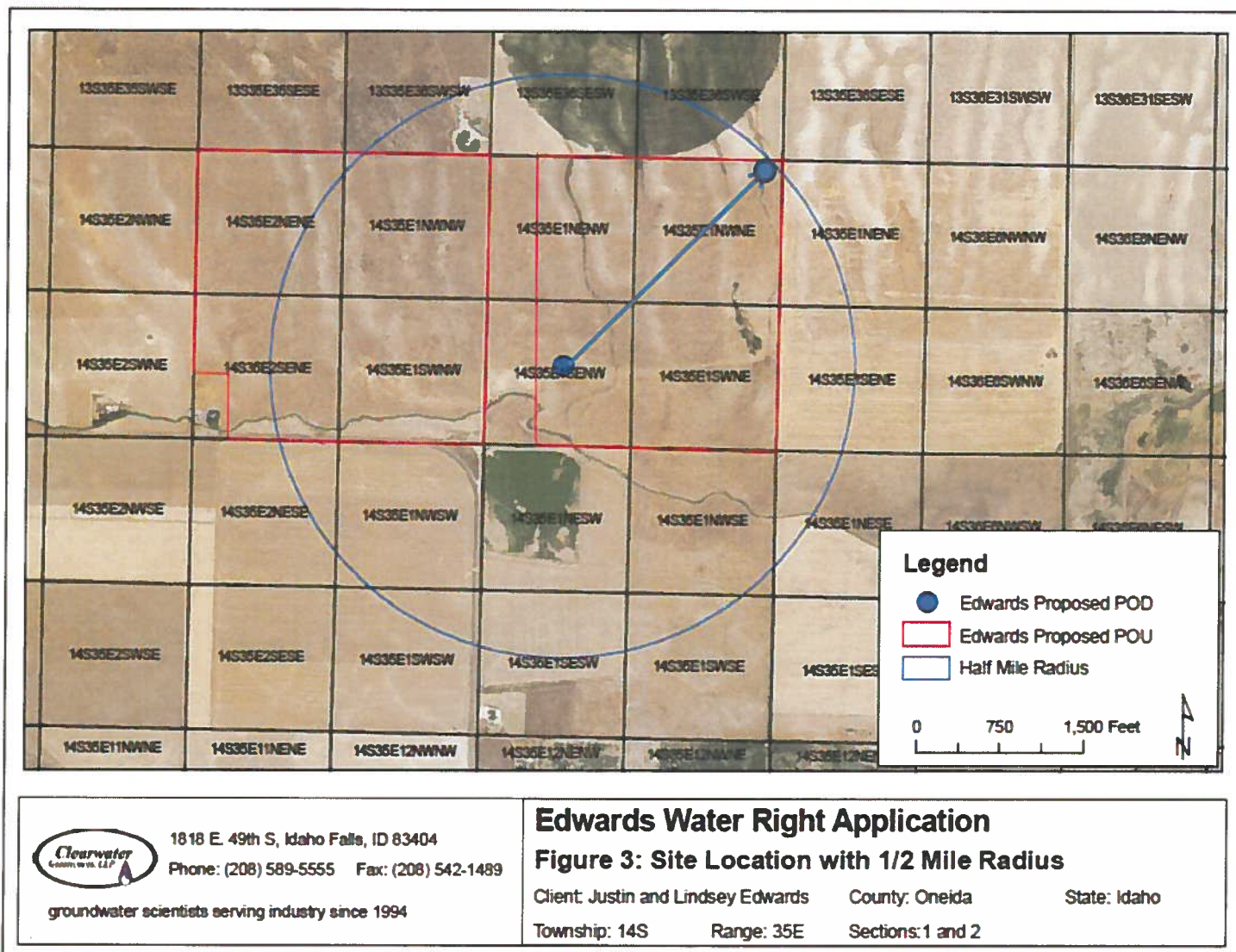


Figure 3. Edwards property with blue circle showing approximate 1/2 mile radius, but center moved northeast to new POD location.

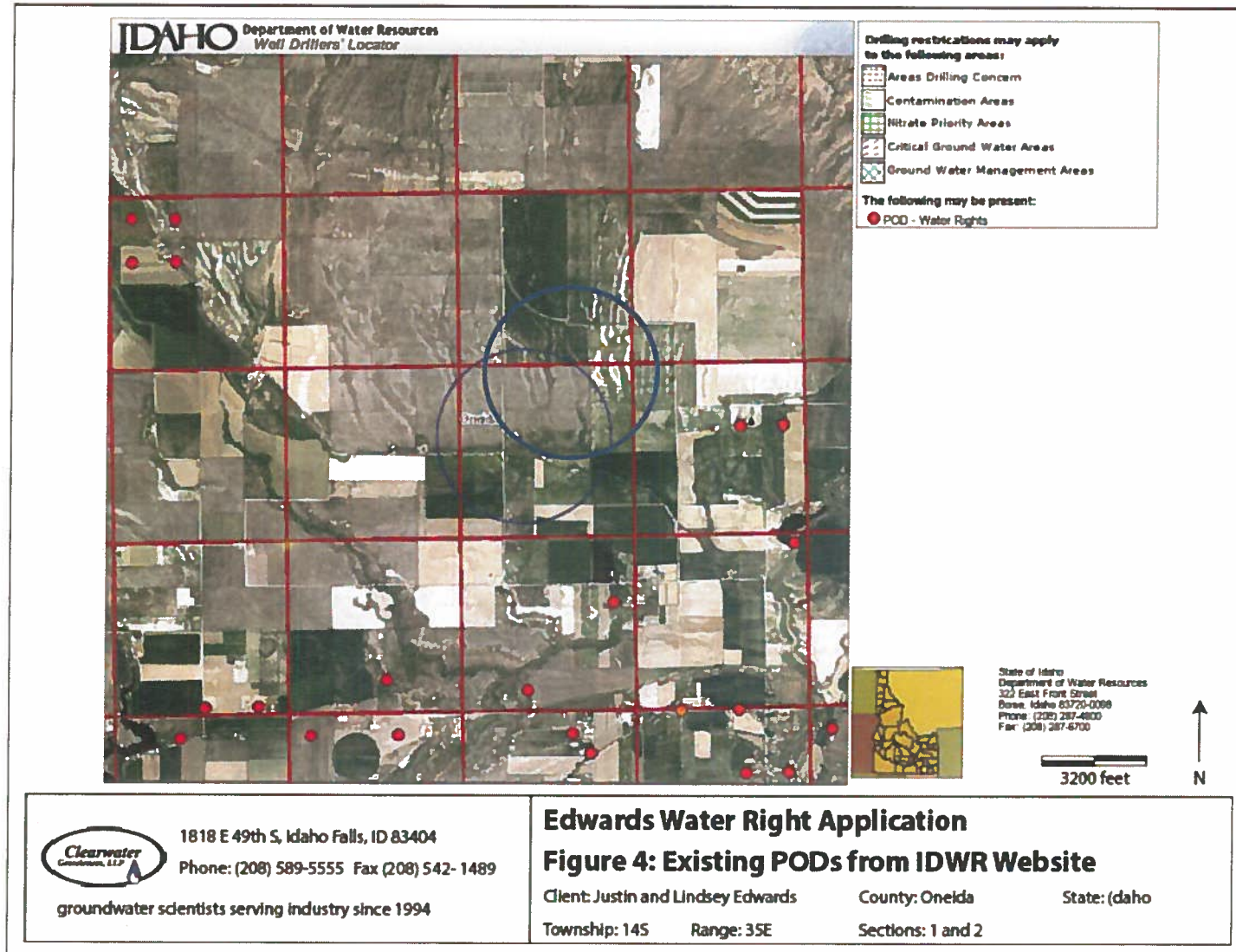


Figure 4. Existing PODs; from IDWR website and blue circle 1/2 mile diameter, moved to the northeast due to new POD location.

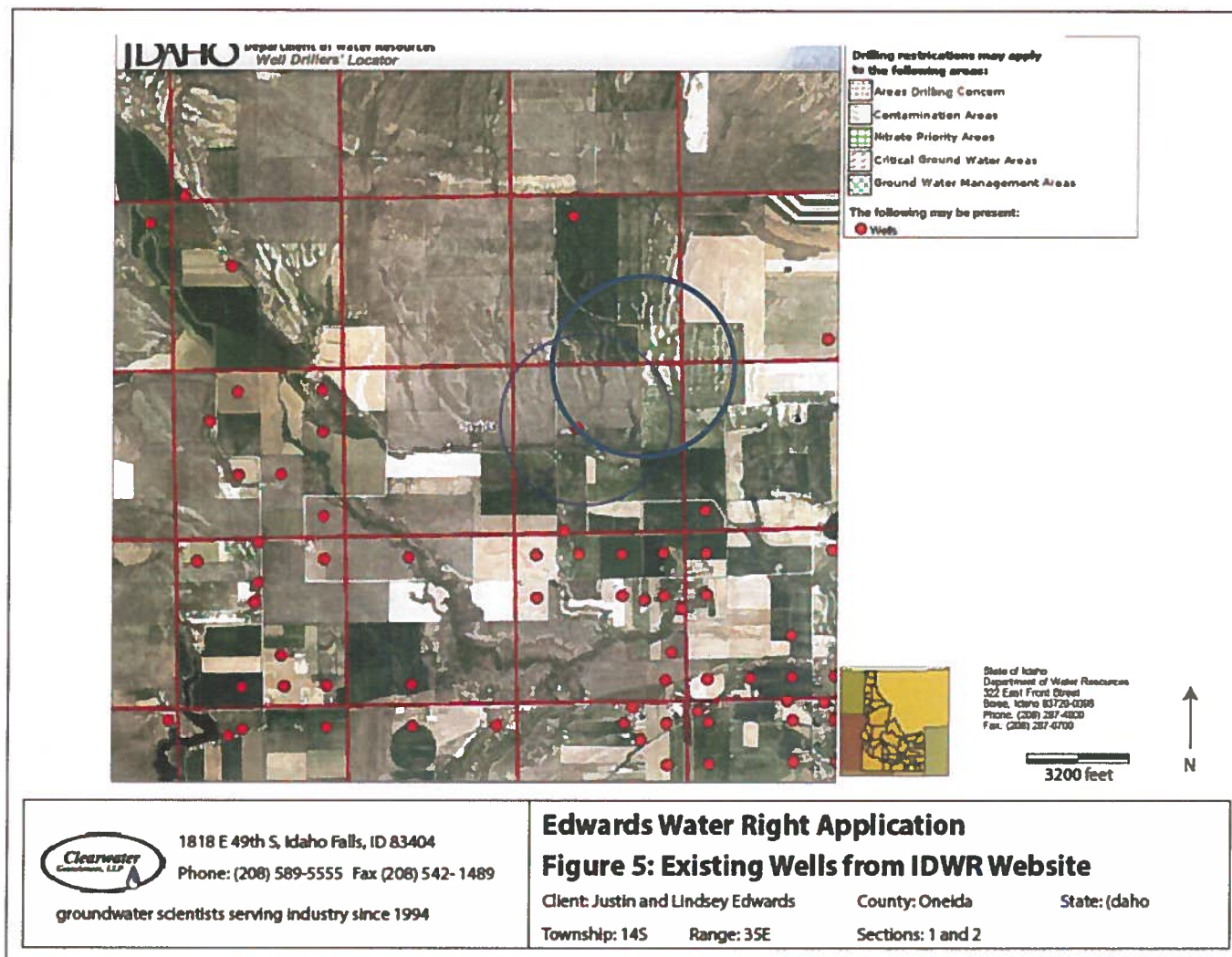


Figure 5. Existing wells; from IDWR website and blue circle ½ mile diameter. The one well within the ½ mile radius is the Edwards' domestic well. Blue circle to northeast is location ½ radius centered on new POD.

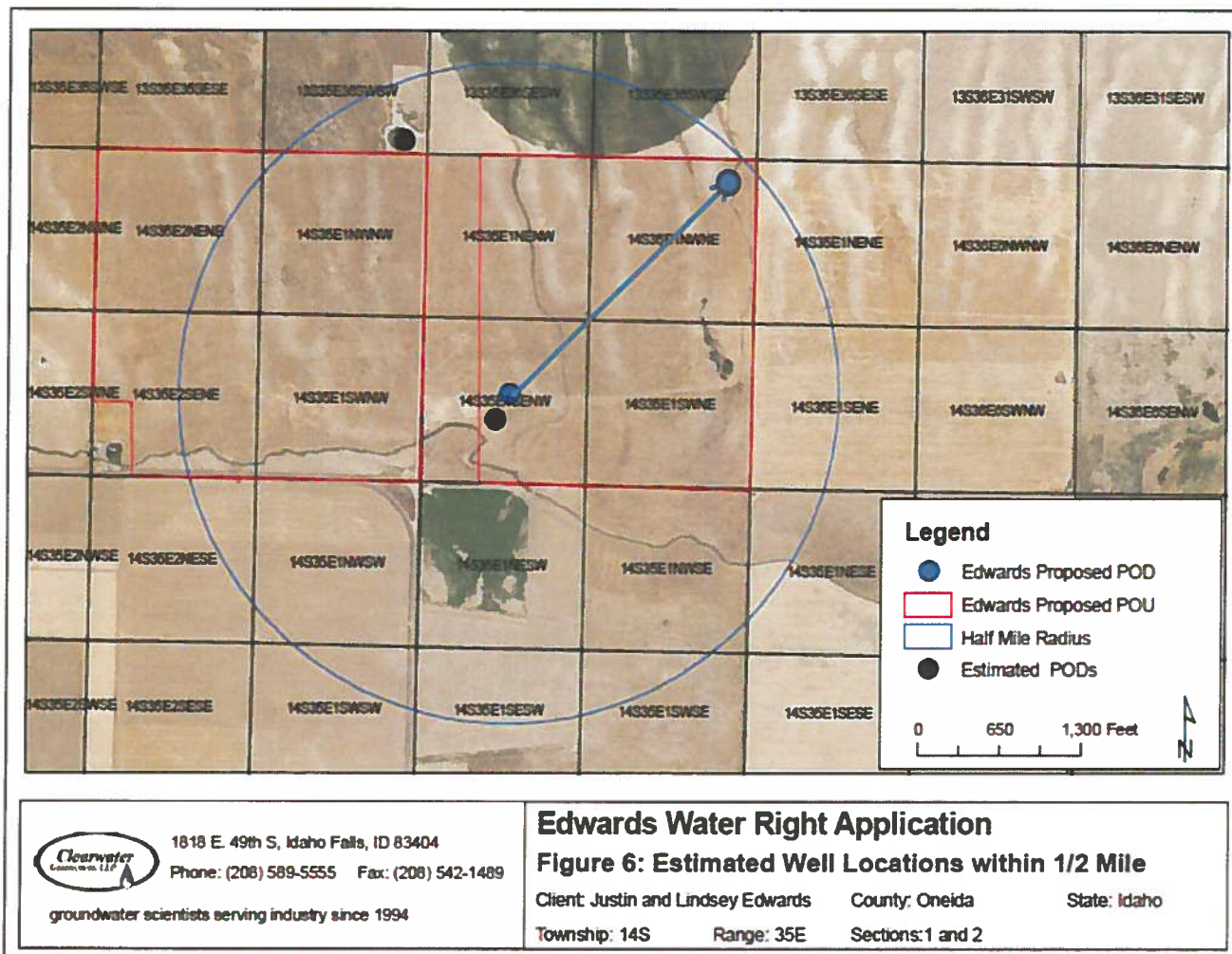


Figure 6. Estimated well locations within ½ mile of Edwards proposed location. Edwards POD is shown as a blue dot and the black dot near it in 14S 35E 1 SE NW is for the Edwards Water Right Application (this application). The black dot to the north in 13S 35E 36 SW SW is for the Jeff Thomas existing water right. Arrow shows center of new POD location.



Table 1 IDWR Search results for point of diversions in T14S, R35E, Section 1

Type	Basin	Sequence	Suffix	Application Number	Status	Priority Date	Div. Rate (cfs)	Source	Water Use	Owner
Water Application	15	7393		79716	Active	11/26/2014	5.7	Ground Water	Irrigation	Edwards, Justin, Edwards, Lindsey

Table 2 IDWR Search results for point of diversions in T14S, R35E, Section 2

Type	Basin	Sequence	Suffix	Application Number	Status	Priority Date	Div. Rate (cfs)	Source	Water Use	Owner
Water Permit	15	7215			Active	10/12/2001	4	Ground Water	Irrigation	Thomas, Thomas G

Table 3 IDWR Search results for point of diversions in T13S, R35E, Section 36

Type	Basin	Sequence	Suffix	Application Number	Status	Priority Date	Div. Rate (cfs)	Source	Water Use	Owner
Water Right	15	7193			Active	12/1/2000	8.8	Ground Water	Irrigation	Thomas, Jeffery J



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Table 4 IDWR Search results for wells in T14S, R35E, Section 1

Contact	Use	TWP	RNG	Tract	Well Address	Gallons Per Minute	Static Water Level	Total Depth	Casing Depth	CSG Dia.	Construction Date
Justin Edwards	Domestic	14S	35E	1	346 N 200 W	20	101	160	180	6"	3/2/2012
Harold Casey Jr	Domestic	14S	35E	1	39 Bush Ave	15-20	228	281	271	6"	7/18/2010

Table 5 IDWR Search results for wells in T14S, R35E, Section 2

Contact	Use	TWP	RNG	Tract	Well Address	Gallons Per Minute	Static Water Level	Total Depth	Casing Depth	CSG Dia.	Construction Date
Richard and Diane Aiden	Domestic	14S	35E	2	RDA Farms	25	256	345	345	6"	3/18/2014

Table 6 IDWR Search results for wells in T13S, R36E, Section 36

Contact	Use	TWP	RNG	Tract	Well Address	Gallons Per Minute	Static Water Level	Total Depth	Casing Depth	CSG Dia.	Construction Date
Jeffery J Thomas	Domestic	13S	35E	36	270 W 2000 N		65	470	420	16"	9/3/2001
Jeffery J Thomas	Irrigation	13S	35E	36	270 W 2000 N		275	523	264	20"	12/9/2002
Jeffery J Thomas	Irrigation	13S	35E	36	270 W 2000 N		110	450	450	16"	12/20/2002
Jeffery J Thomas	Irrigation	13S	35E	36	270 W 2000 N		520	1145	open hole		8/16/2010



Attachment 1

REPRESENTATIVE WELL LOGS



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Form 238-7
6/07

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

15

1. WELL TAG NO. D0062501
Drilling Permit No. 50866-2
Water right or injection well # _____

2. OWNER: Justin Edwards
Name _____
Address 3416 N 200W
City Malad State ID Zip 83252

3. WELL LOCATION:
Twp. 19 North ☐ or South ☒ Rge 35 East ☒ or West ☐
Sec. 1 1/4 SE 1/4 NW 1/4

Gov't Lot _____ County Oneida
Lat. 42 ° 14 ' 33 " (Deg. and Decimal minutes)
Long. 112 ° 19 ' 23 " (Deg. and Decimal minutes)
Address of Well Site 4200 N 3900 W City Malad
(Use as legal name of well - reference to State of Idaho)
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 (lb or ft) Placement method/procedure
Cement 0 38 2 bags gravel bore

8. CASING/LINER:
Diameter (inches) From (ft) To (ft) Gauge/Schedule Material Casing liner Threaded Welded
6 0 160 250 Steel ☒ ☐ ☐ ☒

Was drive shoe used? ☒ Y ☐ N Shoe Depth(s) 180

9. PERFORATIONS/SCREENS:
Perforations ☒ Y ☐ N Method Torch
Manufactured screen ☐ Y ☐ N Type _____
Method of installation _____

10. FILTER PACK:
Filter Material From (ft) To (ft) Quantity (lb or ft) Placement method
160 180 1/4 to 3/8 30 6" Steel 250

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

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) 105 Static water level (ft) 101
Water temp. (°F) 56 Bottom hole temp. (°F) _____
Describe access port well cap

Well test:
Drawdown (feet) Discharge or yield (gpm) Test duration (minutes)
_____ 30 _____
Test method:
Pump ☐ Bailor ☐ Air ☒ Flowing ☐

Water quality test or comments: good

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	N
10	0	35	Brn clay		X
10	35	38	Brn clay gravel		X
6	38	70	Brn clay		X
6	70	85	Gravel Brn clay		X
6	85	95	Brn clay		X
6	95	105	Brn clay gravel		X
6	105	115	Brn clay gravel sand	X	
6	115	130	Gravel	X	
6	130	160	Gravel Brn clay	X	
6	160	170	Gravel	X	
6	170	175	Gravel Brn clay	X	
6	175	180	Brn clay gravel		X

RECEIVED

MAY 22 2012

Department of Water Resources
Eastern Region

Completed Depth (Measurable): 180
Date Started: 3-27-12 Date Completed: 3-28-12

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 Northwest Well Drilling Co. No. 543
*Principal Driller Miles Frandson Date 4-15-12
*Driller Justin Edwards Date 4-1-12
*Operator II _____ Date _____
Operator I _____ Date _____
*Signature of Principal Driller and rig operator are required

Figure 1-1 Well log for Justin Edwards



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Form 238-7
6/07

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

RECEIVED

Location Corrected by IDWR To
T14S R35E Sec 1 SWSESW
By mclscell 2013-09-11

1. WELL TAG NO. D D0058503

Drilling Permit No. _____

Water right or injection well # _____

2. OWNER: Harold Casey Jr.

Name _____

Address 39 Bush Lane

City Malad State ID Zip 83252

3. WELL LOCATION:

Twp 14 North ☐ or South ☒ Rge 35 East ☒ or West ☐

Sec. 1 SW 1/4 SW 1/4 SW 1/4

Gov't Lot _____ County Oneida

Lat. N 42° 13' 71" (Deg and Decimal minutes)

Long. W 112° 19' 22" (Deg and Decimal minutes)

Address of Well Site 3062 N 3900th

City Malad

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 _____

8. CASING/LINER:

Diameter (inches) _____ From (ft) _____ To (ft) _____ Gauge/Schedule _____ Material _____ Casing Liner Threaded Welded

6" 11' 22' 250 3 Steel ☒ ☐ ☐ ☐

☐ ☐ ☐ ☐

☐ ☐ ☐ ☐

☐ ☐ ☐ ☐

Was drive shoe used? ☒ Y ☐ N Shoe Depth(s) 221'

9. PERFORATIONS/SCREENS:

Perforations ☒ Y ☐ N Method Machine

Manufactured screen ☐ Y ☒ N Type _____

Method of installation _____

From (ft) _____ To (ft) _____ Slot size _____ Number _____ Diameter (inches) _____ Material _____ Gauge or Schedule _____

211 221 1/4 160 _____ _____ _____

☐ ☐ ☐ ☐

☐ ☐ ☐ ☐

☐ ☐ ☐ ☐

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 _____

☐ ☐ ☐ ☐

☐ ☐ ☐ ☐

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) 39 Static water level 228'

Water temp (°F) _____ Bottom hole temp. (F) _____

Describe access point Top

Well test:

Drawdown (ft) _____ Discharge or Well (gpm) _____ Test duration (minutes) _____ Test method:

☐ Pump ☐ Bailer ☒ Air ☐ Packer

Water quality test or comments: APPROX 15-2000 PM 5 HRS

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 N
10 1/2	0	36	Brown sticky clay	✓
	36	39	Orange-brown clay	✓
8"	39	66	Sticky gray clay	✓
	66	88	Black clay	✓
	88	100	tan clay	✓
	100	118	Brown sand	✓
	118	140	some gravel	✓
	140	172	Sticky brown clay	✓
	172	190	gravel, some sand, clay	✓
	190	209	Sticky brown clay	✓
	209	220	gravel, some sand, clay	✓
	220	236	Sticky gray clay	✓
	236	249	Brown clay & sand	✓
	249	261	gravel	✓
	261	273	Sticky clay	✓
	273	285	gravel	✓
	285	295	Sticky clay	✓
	295	300	gravel	✓
	300	306	Sticky clay	✓

Completed Depth (Measurable): 228'

Date Started: 6-25-10 Date Completed: 7-16-10

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: Harold Casey Jr. Co. No. 553

Principal Driller: Sam Jensen Date: 7-16-10

Driller: _____ Date: _____

Operator II: _____ Date: _____

Operator I: _____ Date: _____

* Signature of Principal Driller and rig operator are required.



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Figure 1-3 Well log for Richard and Diane Aiden

Form 238-7
1/97

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Office Use Only
Inspected by _____
Twp _____ Rge _____ Sec _____
Lat _____ Long _____
Air _____ Flowing Artesian _____

1. WELL TAG NO. D 6014876
DRILLING PERMIT NO. 768481
Other IDWR No. 15-07192

2. OWNER:
Name Jeffery J Thomas
Address 2705 W 2000 N
City Almo State ID Zip 83412

3. LOCATION OF WELL by legal description:
Sketch map location must agree with written location

11. WELL TESTS:
Pump ☐ Bail ☐ Air ☐ Flowing Artesian ☐
Water Temp. cold Bottom hole temp. cold
Water Quality test or comments good
Depth first Water Encounter 240

12. LITHOLOGIC LOG: (Describe layers or abandonment)

From	To	Remarks Lithology, Water Quality & Temperature	T	N
0	10	Brown clay		X
10	20	Gravel & Clay		X
20	40	Gravel & Cobble		X
40	45	Brown clay		X
45	50	Broken Limestone		X
50	140	Limestone		X
140	240	Broken Limestone	X	X
240	280	Broken Limestone	X	X
280	285	Shell		X
285	295	Gravel	X	X
295	297	Clay		X
297	302	Gravel	X	X
302	340	Clay little Gravel		X
340	440	Clay (Brown)		X
440	460	Shell little Gravel		X
460	480	Clay & Shell		X
480	500	Shell & Clay		X
500	520	Shell & Broken		X
520	520	Shell & Clay		X

13. DRILLER'S CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.
Company Name Mountain West Well Drilling Firm No. 5413
Firm Office Almo, Idaho Date 10-2-01
and
Driller or Operator _____ Date _____
(Sign once if Firm Office & Operator)

Figure 1-4 Well log for Jeffery J Thomas Domestic Well



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Ground Water Development and Exploration

Form 238 6/02 **IDAHO DEPARTMENT OF WATER RESOURCES**
WELL DRILLER'S REPORT

1. WELL TAG NO. D 0021997
DRILLING PERMIT NO. 172937
Water Right or Injection Well No. _____

2. OWNER: Jeff Thomas
Name Jeff Thomas
Address 2705 W. 200th N.
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. 13 North ☐ or South ☒
Rge. 35 East ☒ or West ☐
Sec. 36 NE 1/4 NW 1/4
Gov't Lot _____
County Oneida
Lat. : : Long. : :
Address of Well Site 5 mi. S from Farm
Address City Malad
Blk. _____ Sub-Name St. Johns
Bench

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 Benctonite From 264 To 264 Weight / Volume As Bag Seal Placement Method Overbore
Was drive shoe used? ☒ Y ☐ N Shoe Depth 264'
Was drive shoe seal tested? ☒ Y ☐ N How? Pressure

8. CASING/LINER:
Diameter 20" From 0 To 264' Gauge 316 Material Steel Casing ☒ Liner ☐ Welded ☒ Threaded ☐
Length of Headpipe _____ Length of Tailpipe _____
Packer ☐ Y ☐ N Type NA

9. PERFORATIONS/SCREENS PACKER TYPE
Perforation Method _____
Screen Type & Method of Installation
From NA To _____ Slot Size _____ Number _____ Diameter _____ Material _____ Casing ☐ Liner ☐

10. FILTER PACK
Filter Material NA From _____ To _____ Weight / Volume _____ Placement Method _____

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

Office Use Only
Well ID No. _____
Inspected by _____
Twp. _____ Rge. _____ Sec. _____
Lat. : : Long. : :
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

12. WELL TESTS:

Yield gal/min	Drawdown	Pumping Level	Time

Water Temp. _____ Bottom hole temp. _____

Water Quality test or comments: _____

13. LITHOLOGIC LOG: (Describe repairs or abandonment) Depth first Water Encounter

Remarks: Lithology, Water Quality & Temperature	Y	N
24 0 19 Dirt		X
19 6A Red Clay: Rock		X
6A 230 Brown Clay: Rock		X
230 240 Black lava		X
240 258 Grey lava		X
258 264 Red Clay		X
264 320 Grey Rock		X
320 330 Fractured Rock	X	
330 412 Grey Rock		X
412 434 Fractured Rock	X	
434 445 Grey Rock		X
445 457 Fractured Rock	X	
457 466 Grey Rock		X
466 472 Fractured Rock	X	
472 510 Grey Rock		X
510 523 Fractured Rock	X	

Completed Depth 523 (Measurable)
Date Started 1-14-02 Completed 12/9/02

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 Well Drilling Firm No. 353
Principal Driller [Signature] Date 12/26/02
and [Signature]
Driller or Operator [Signature] Date _____
Operator [Signature] Date 1-29-03
Principal Driller and Rig Operator Required
Operator I must have signature of Driller/Operator II.

FORWARD WHITE COPY TO WATER RESOURCES

Figure 1-5 Well log for Jeffery J Thomas Irrigation Well



Clearwater Geosciences, LLP
Ground Water Development and Exploration

Form 23
5/02

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 2024644
DRILLING PERMIT NO. 779950
Water Right or Injection Well No. _____

2. OWNER: Jeff J. Thomas
Name _____
Address 2725 West 2020 North
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 13 North ☐ or South ☒
Rge 35 East ☐ or West ☐
Sec 36 1/4 NE 1/4 NW 1/4
Gov't Lot _____ County Blaine
Lat: _____ Long: _____
Address of Well Site Rural Area
City Malad

LI _____ Blk _____ Sub Name _____

4. USE:

☐ Domestic ☐ Municipal ☐ Monitor ☒ Irrigation
☐ Thermal ☐ Injection ☐ Other _____

5. TYPE OF WORK check all that apply

☒ New Well ☐ Modify ☐ Abandonment ☐ Other _____ (Replacement etc.)

6. DRILL METHOD:

☒ Air Rotary ☒ Cable ☐ Mud Rotary ☐ Other _____

7. SEALING PROCEDURES

Seal Material	From	To	Weight / Volume	Seal Placement Method
<u>Benetone</u>	<u>0</u>	<u>20</u>	<u>22 bags</u>	<u>Overhead</u>

Was drive shoe used? ☒ Yes ☐ No Shoe Depth(s) 20' - 281' - 430'
Was drive shoe seal tested? ☒ Yes ☐ No How? Pressure

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
<u>20"</u>	<u>18"</u>	<u>20'</u>	<u>20</u>	<u>Steel</u>	☒	☐	☒	☐
<u>18"</u>	<u>18"</u>	<u>281'</u>	<u>20</u>	<u>Steel</u>	☒	☐	☒	☐
<u>16"</u>	<u>400'</u>	<u>430'</u>	<u>20</u>	<u>Steel</u>	☒	☐	☒	☐

Length of Headpipe _____ Length of Tailpipe _____
Packer ☐ Y ☐ N Type NA

9. PERFORATIONS/SCREENS PACKER TYPE

Perforation Method _____

Screen Type & Method of Installation _____

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
<u>NA</u>						☐	☐

10. FILTER PACK

Filter Material	From	To	Weight / Volume	Placement Method
<u>NA</u>				

11. STATIC WATER LEVEL OR ARTESIAN PRESSURE:

110 ft. below ground Artesian pressure _____ lb
Depth flow encountered _____ ft. Describe access port or control devices: _____

12. WELL TESTS:

Yield gal./min.	Drawdown	Pumping Level	Time

Water Temp. _____ Bottom hole temp. _____

Water Quality test or comments: _____

13. LITHOLOGIC LOG: (Describe repairs or abandonment)

Feet	From	To	Remarks: Lithology, Water Quality & Temperature	Y	N
<u>22</u>	<u>0</u>	<u>20</u>	<u>Gravel, Clay & Boulders</u>	☒	☐
<u>20</u>	<u>20</u>	<u>36</u>	<u>Gravel Cemented w/ Brown Clay</u>	☒	☐
<u>36</u>	<u>36</u>	<u>74</u>	<u>Clay</u>	☒	☐
<u>74</u>	<u>74</u>	<u>106</u>	<u>Clay & small bits of Gravel</u>	☒	☐
<u>106</u>	<u>106</u>	<u>160</u>	<u>Sandstone w/ clay streamers</u>	☒	☐
<u>160</u>	<u>160</u>	<u>240</u>	<u>Gravel</u>	☒	☐
<u>240</u>	<u>240</u>	<u>260</u>	<u>Sandy Pebbles</u>	☒	☐
<u>260</u>	<u>260</u>	<u>280</u>	<u>Gravel Boulders</u>	☒	☐
<u>280</u>	<u>280</u>	<u>295</u>	<u>Gravel Conglomerate</u>	☒	☐
<u>295</u>	<u>295</u>	<u>328</u>	<u>Clay</u>	☒	☐
<u>328</u>	<u>328</u>	<u>332</u>	<u>Gravel Cemented</u>	☒	☐
<u>332</u>	<u>332</u>	<u>361</u>	<u>Clay</u>	☒	☐
<u>361</u>	<u>361</u>	<u>372</u>	<u>Gravel Cemented</u>	☒	☐
<u>372</u>	<u>372</u>	<u>418</u>	<u>Clay</u>	☒	☐
<u>418</u>	<u>418</u>	<u>438</u>	<u>Cemented Gravel</u>	☒	☐
<u>438</u>	<u>438</u>	<u>440</u>	<u>Clay</u>	☒	☐
<u>440</u>	<u>440</u>	<u>450</u>	<u>Clay</u>	☒	☐
<u>10</u>	<u>450</u>	<u>940</u>	<u>Clay mixed w/ layers of Gravel streaks of pebbles - Plugged at 450' - water level was lower than upper zone</u>		
			<u>WATER LEVEL OF TEST WELL 383'</u>		

Completed Depth _____ (Measurable)

Date: Started 7-10-02 Completed 12-20-02

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 Volmer Well Drilling Firm No. 353

Principal Driller Paul H. Hagg Date 12/26/02

and Driller or Operator Paul H. Hagg Date 12/26/02

Operator Paul H. Hagg Date _____

Principal Driller and Rig Operator Required
Operator I must have signature of Driller/Operator II

FORWARD WHITE COPY TO WATER RESOURCES

Figure 1-6 Well log for Jeffery J Thomas Irrigation Well

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.	:	:

12. WELL TESTS:

Water Temp. Cold Bottom hole temp. Cold

Water Quality test or comments: Good

3. LOCATION OF WELL by legal description:

You must provide address or Lot, Blk, Sub, or Directions to well.

Twp. 13 North ☐ or South ☒
Rge. 35 East ☒ or West ☐
Sec. 26 1/4 NE 1/4 NW 1/4
Gov't Lot _____
County Quincy 1/4 NW 1/4
Lat: : : Long: : :

Address of Web Site _____

City

(Give at least seven of each - Diagrams in Pencil or Leadpencil)

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

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
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Length of Headpipe _____ Length of Tailpipe _____

Packer ☐ Y ☐ N Type _____

9. PERFORATIONS/SCREENS PACKER TYPE

Perforation Method

Screen Type & Method of Installation

From	To	Slot Size	Number	Diameter	Material	Casing	Length

10. FILTER PACK

Filter Material	From	To	Weight / Volume	Placement Method

11. STATIC WATER LEVEL OR ARTESIAN PRESSURE:

520 ft. below ground Artesian pressure _____ lb.
Depth flow encountered _____ ft. Describe access port or control devices _____

14. DRILLER'S CERTIFICATION

We certify that all minimum well construction standards were complied with at the time the rig was removed.

Company Name Mt. West Well Drilling Firm No 5413

Principal Driller Michael Thompson Date 8-16-10

Driller or Operator (I) _____ Date _____

Operator: _____ Date: _____

Principal Driller and Rig Operator Required
Operator I must have signature of Driller/Operator II

FORWARD WHITE COPY TO WATER RESOURCES

Figure 1-7 Well log for Jeffery J Thomas Irrigation Well

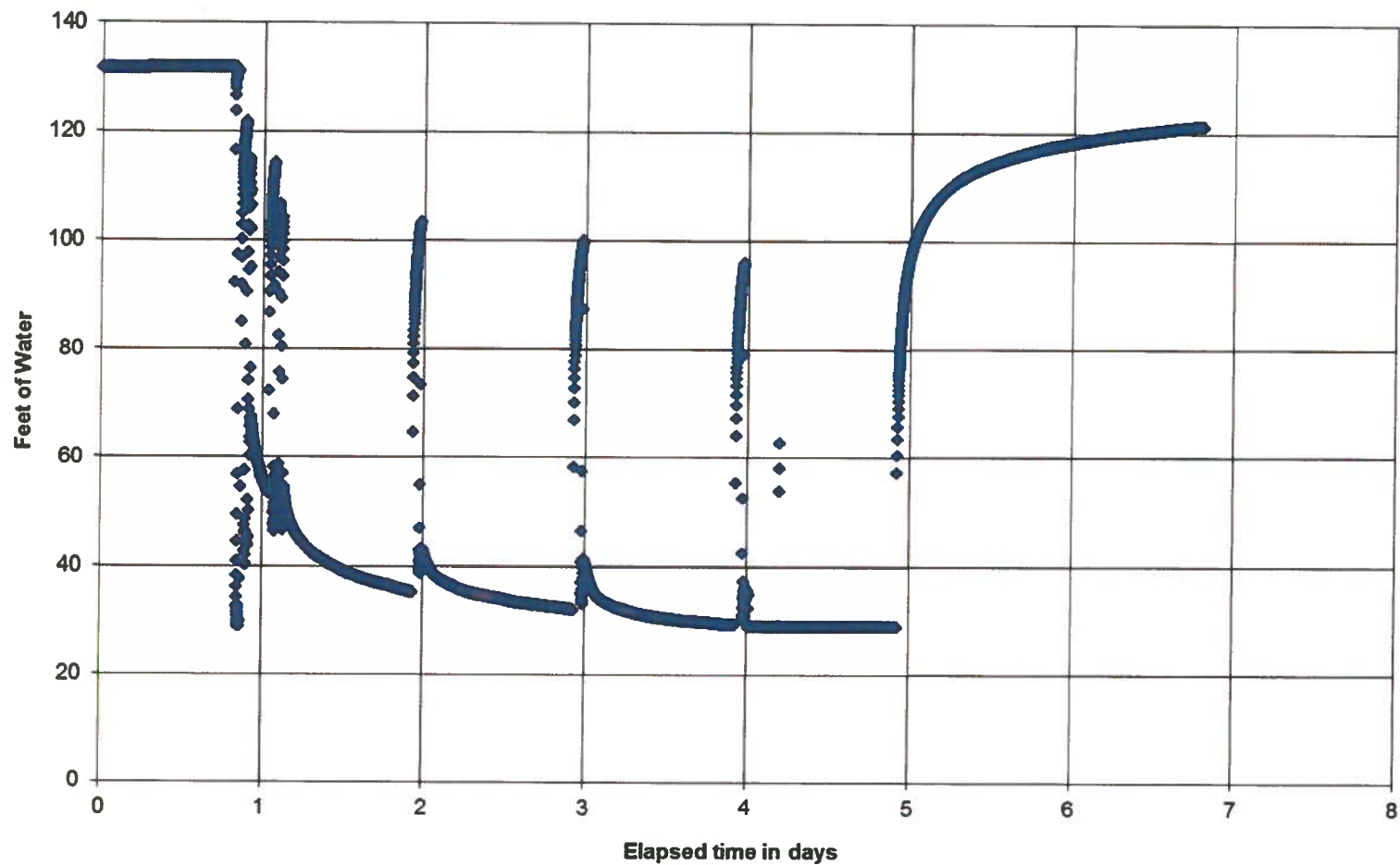


Attachment 2

Water Level Data During Pumping of Jeff Thomas Water Well

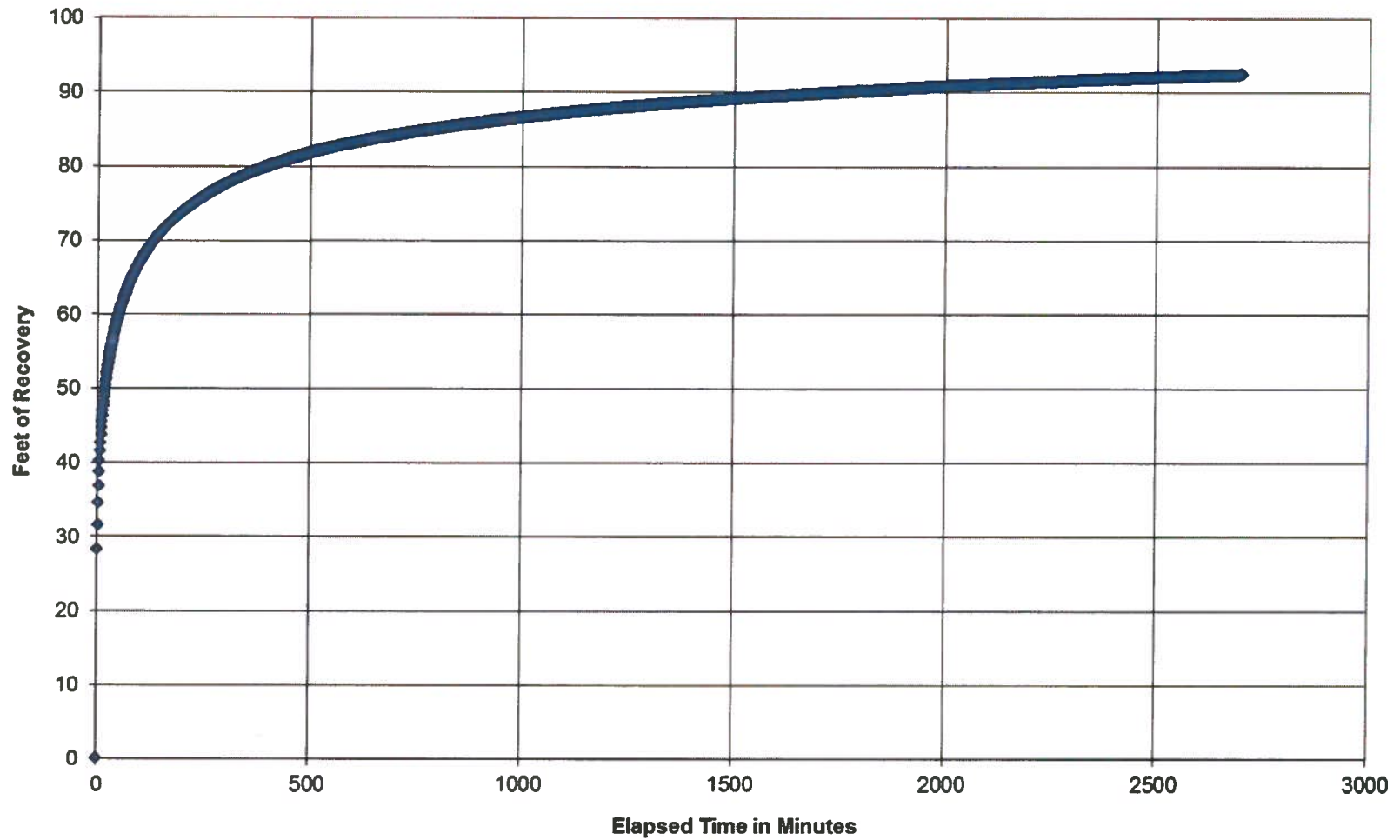


**Jeff Thomas 2005 Irrigation Well Response to Pumping at 1000 gpm,
June 18 through June 25, 2005**





Recovery Test Jeff Thomas Well 1000 gpm





Attachment 3

AQTESOLV PLOTS

Jeff Thomas Water Well



Clearwater Geosciences, LLP
Ground Water Development and Exploration

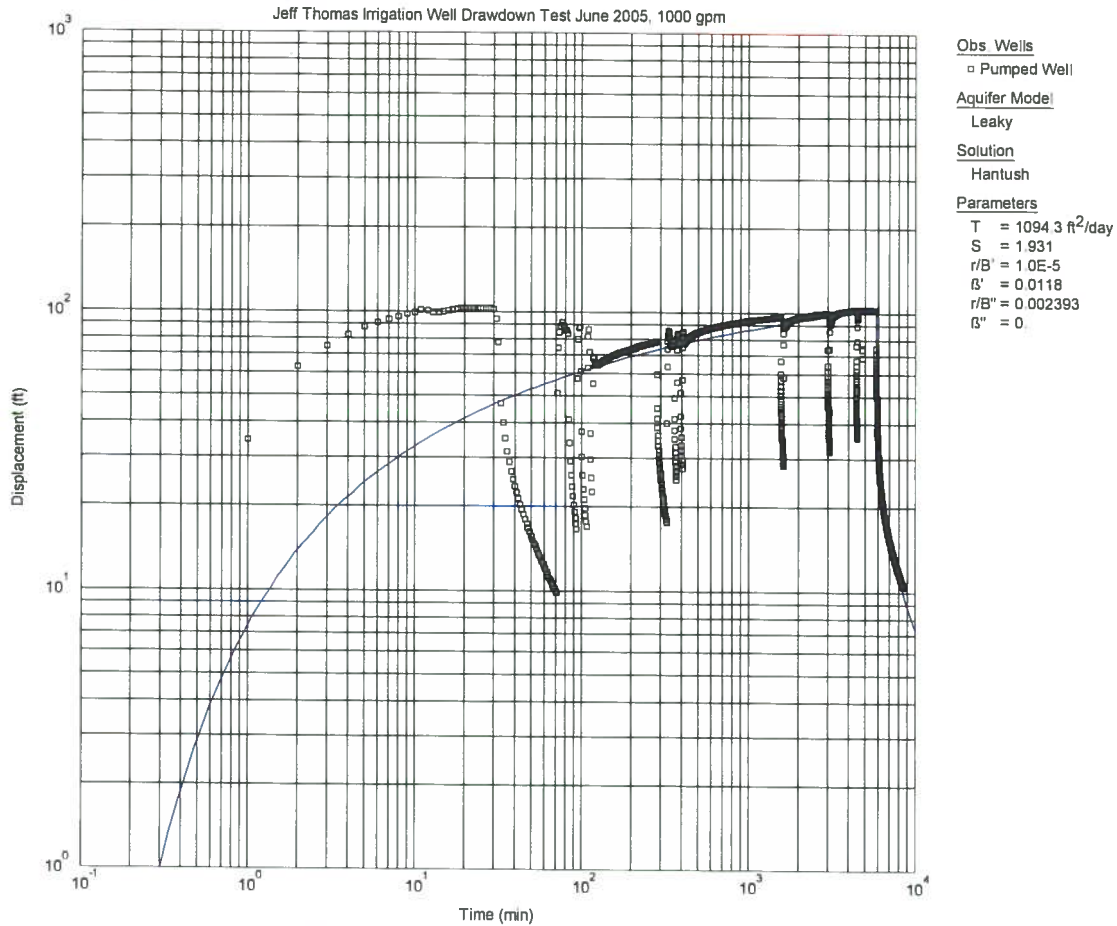


Figure 3-1 leaky confined match to drawdown data.

Residual statistics:

Mean = -0.008229

Var. = 134.9

S.E. = 11.61

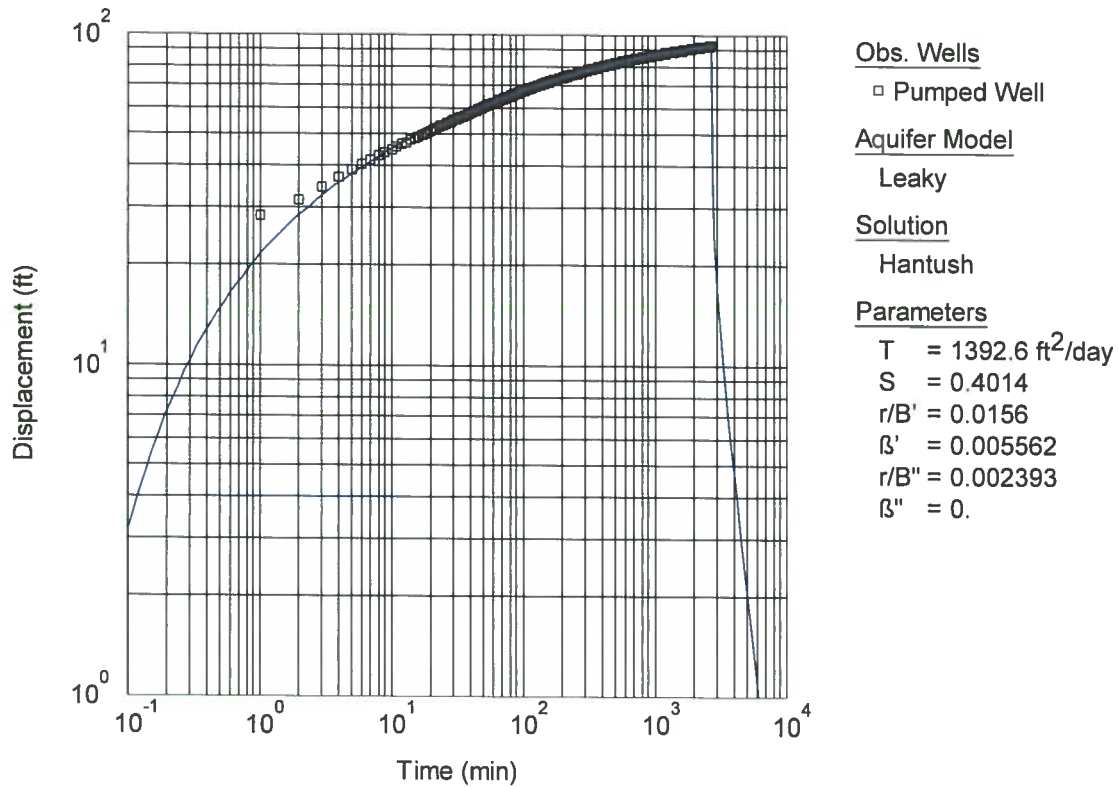
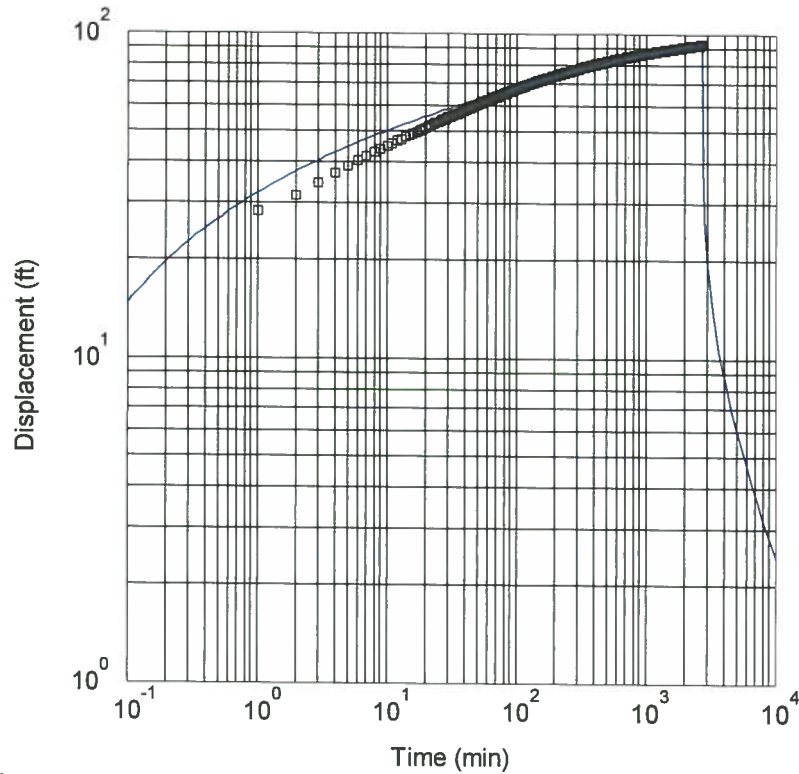


Figure 3-2 leaky confined match to recovery data.

Residual statistics:
Mean = -0.0001279
Var. = 0.08975
S.E. = 0.2996



Obs. Wells

□ Pumped Well

Aquifer Model

Confined

Solution

Theis

Parameters

T = 1958.5 ft²/day

S = 0.06398

Kz/Kr = 0.1023

b = 220. ft

Figure 3-3 Theis confined match to recovery data.

Residual statistics:

Mean = -0.0005663

Var. = 1.046

S.E. = 1.023



Attachment 4

AQUIFER IMPACT ANALYSIS



Table 4-1. Locations for various boundary corners and wells used in the AQESOLV simulation.

Location	x	y
North Corner	0	40,000
East Corner	25,000	40,000
West Corner	0	0
South Corner	25,000	-
Edwards POD	14,900	33,050
Well 0.5 mile South	14,900	30,410

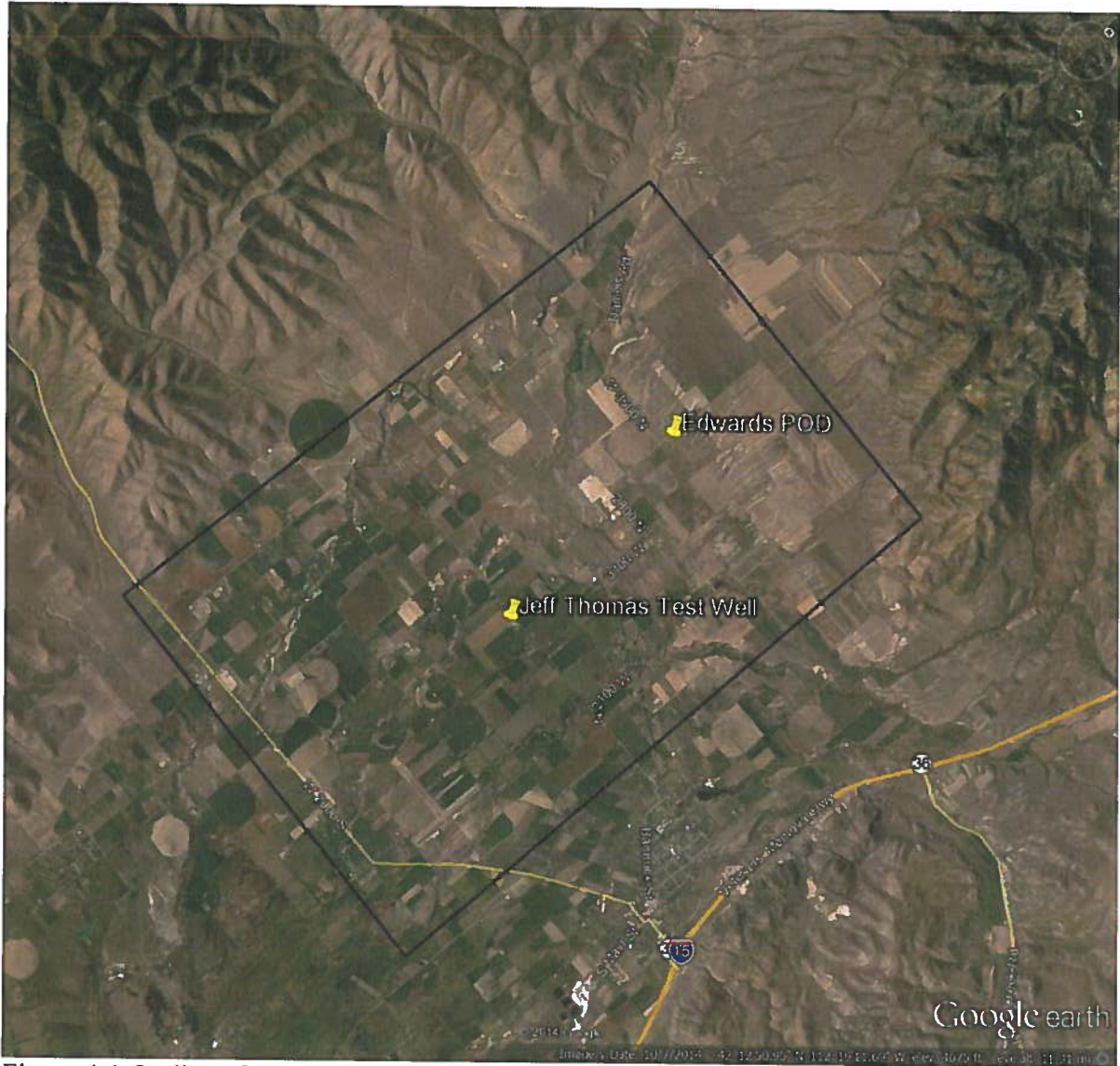


Figure 4-1 Outline of the boundaries used in the AQTESOLV forward solution calculation.

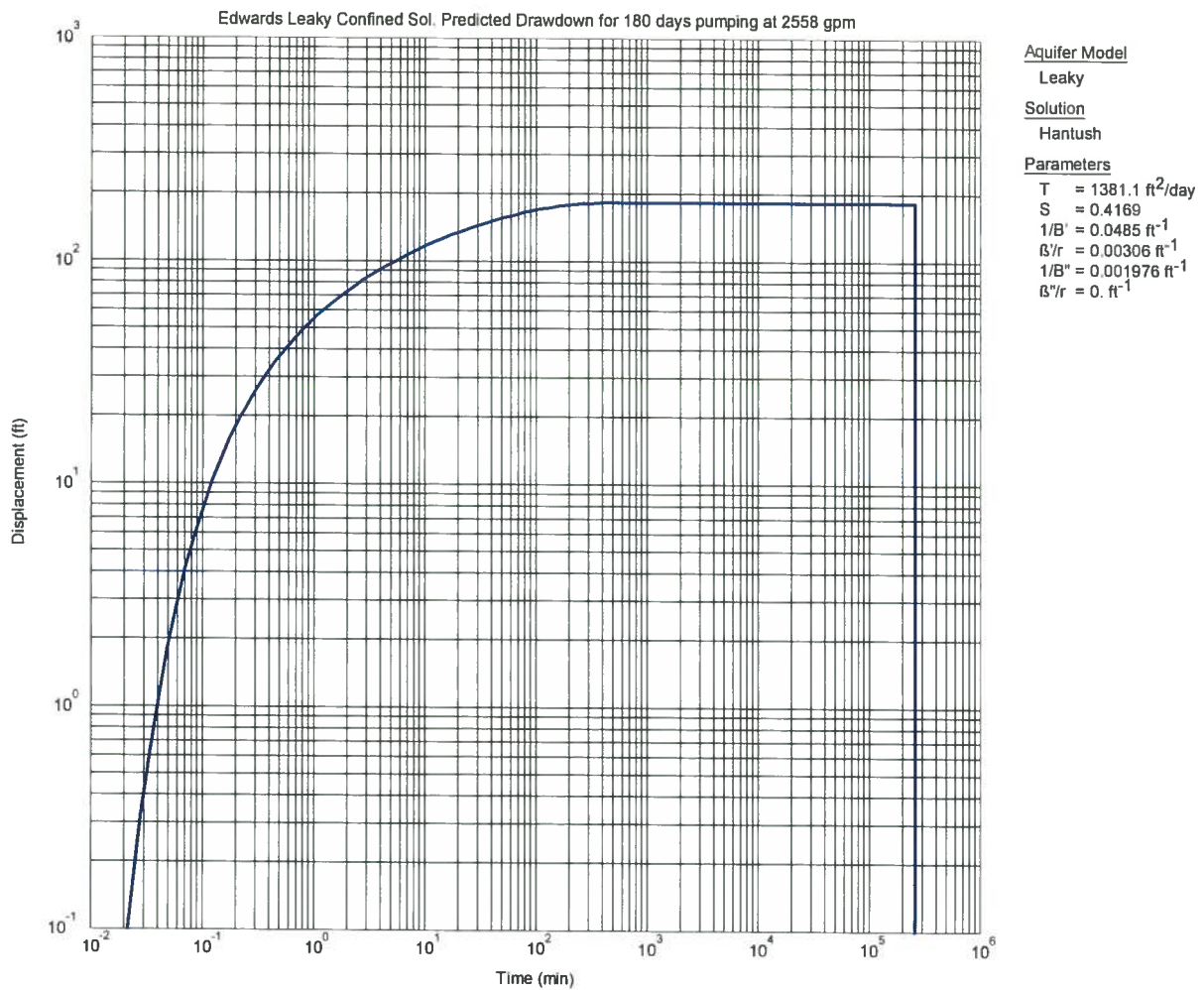


Figure 4-2. Leaky confined predictive plot of drawdown at 2598 gpm or 5.7 cfs for the full period of use 180 days. The blue line is for the water level in the proposed Edwards Well pumping. The aquifer parameters used in this analysis are exactly the same parameters measured in the Jeff Thomas 2005 test.

Key to line colors

Blue Proposed POD for Edwards



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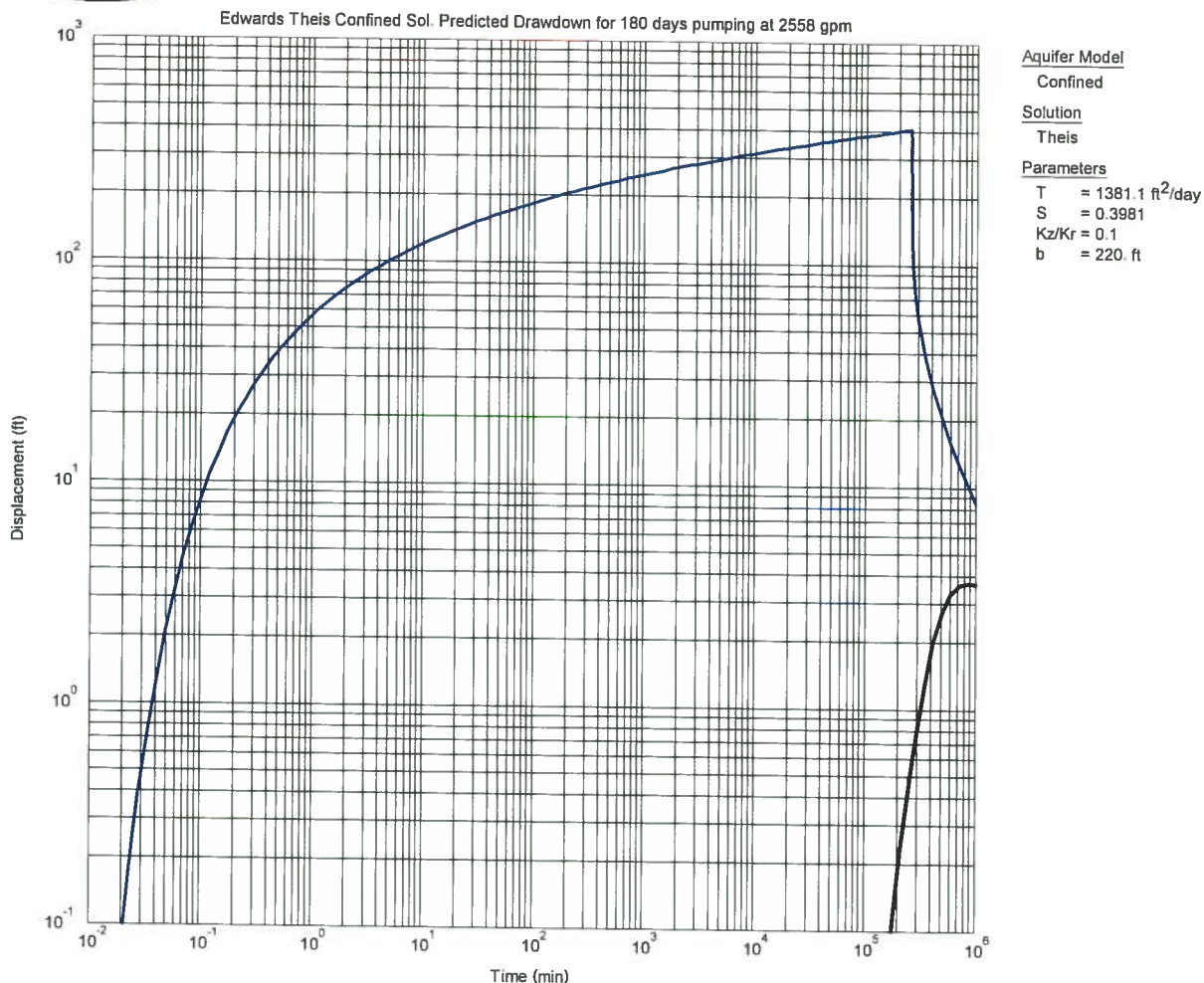


Figure 4-3. Theis confined predictive plot of drawdown at 2598 gpm or 5.7 cfs for the full period of use 180 days. The blue line is for the water level in the proposed Edwards Well pumping and the black line is the water level predicted in a well ½ mile southwest of the proposed Edwards Well. This analysis does not allow for leakage of water from adjacent aquifers to the pumped aquifer.

Key to line colors

Black Imaginary well ½ mile southwest of the proposed POD
 Blue Proposed POD for Edwards