

# **Results of Aquifer Test Analysis**

for the

## **Four Seasons**

### **Well No. 3 - Lower Trinity Aquifer**

**(HGCD Permit No. P0042; HGCD Well No. 1641)**

for

Aqua Texas, Inc.

512 Rodriguez Street

Kerrville, TX 78028

WRGS Project No. 006-008-09

March 17, 2010



**Wet Rock Groundwater Services, L.L.C.**

*Groundwater Specialists*

TBPG Firm No: 50038

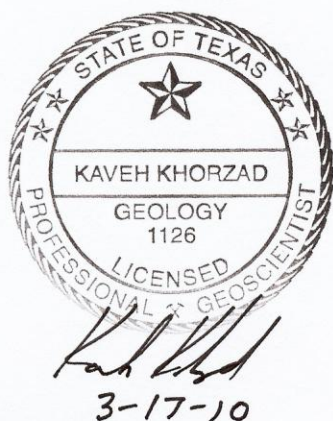
P.O. Box 163144

Austin, Texas 78716

Ph: 512-773-3226 Fax: 512-879-6809

[www.wetrockgs.com](http://www.wetrockgs.com)

The seal appearing on this document was authorized on March 17, 2010 by:



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Kaveh Khorzad, P.G.  
License No. 1126

Wet Rock Groundwater Services, LLC  
TBPG Firm Registration No. 50038



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**Aqua Texas, Inc.**

Four Seasons

Well No. 3 - Lower Trinity Aquifer

HGCD Permit No. P0042; HGCD Well No. 1641

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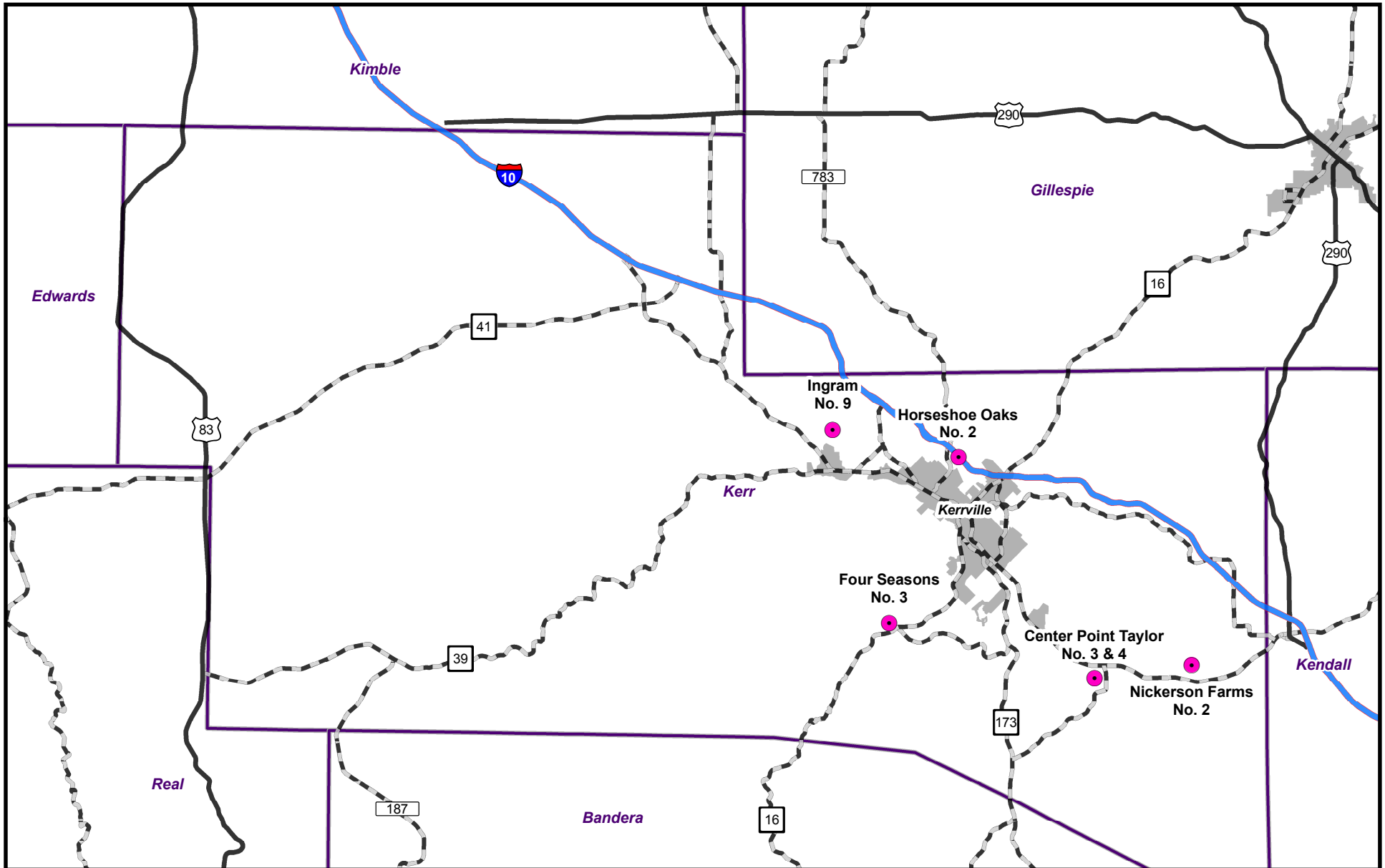




# **Attachment 1**

## Well Location Map



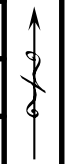


SCALE: 1 in = 6 miles

DRAWN BY: CAM DATE: 3/10

REVISED BY: DATE:

PROJECTION: UTM NAD 83 Zone 14



**Aqua Texas, Inc.**  
Kerr County, Texas

**Well Location Map**



**Wet Rock Groundwater Services, L.L.C.**  
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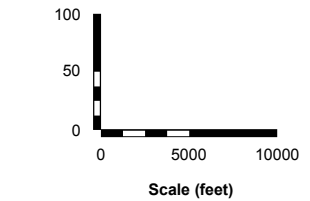
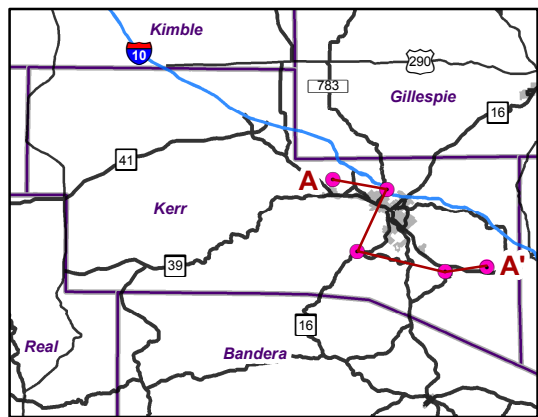
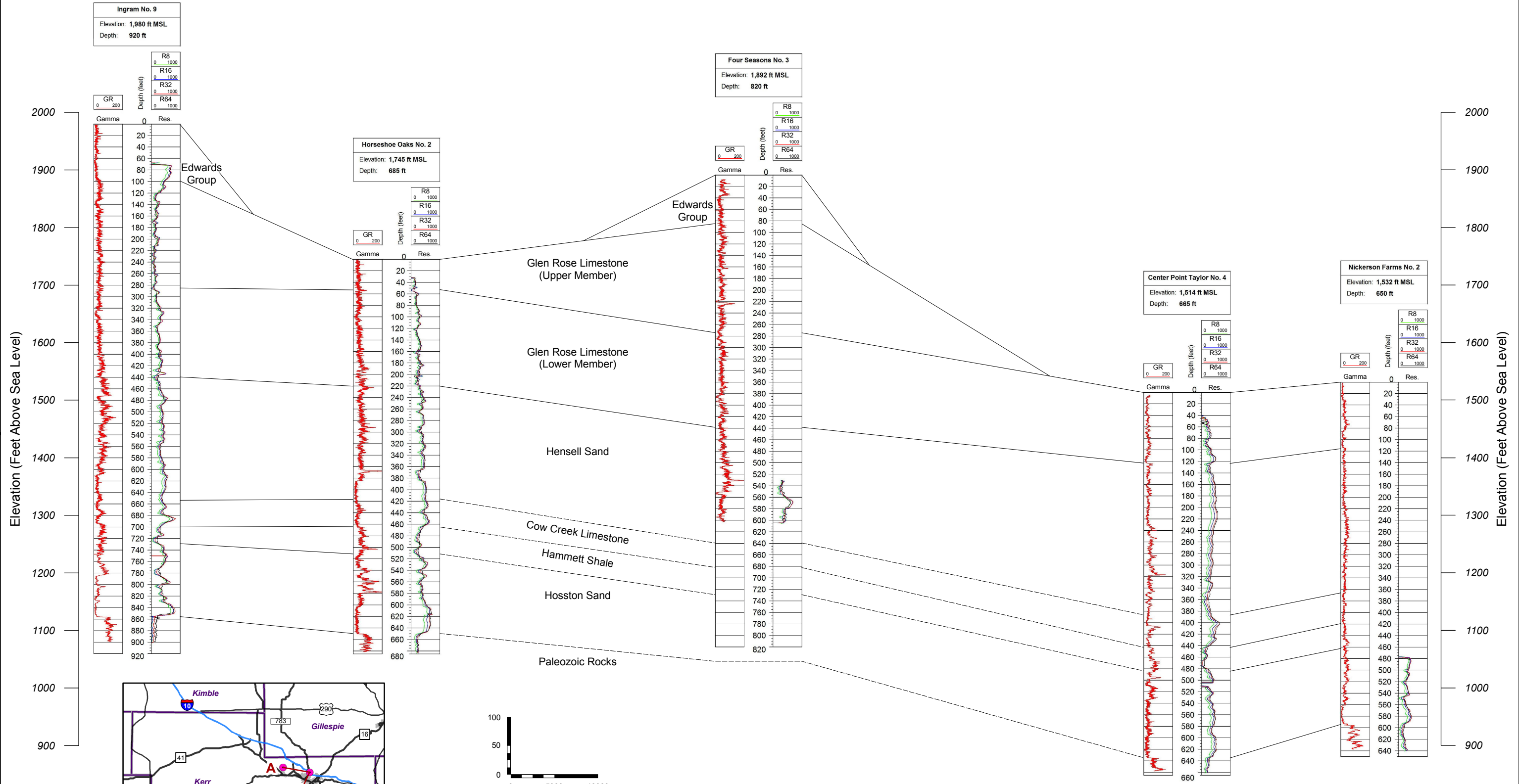
## **Attachment 2**

### Geological Cross Section



A

A'

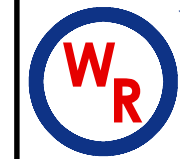


VERTICAL EXAGGERATION = 66X

**Geological Cross Section A-A'**

<b>DRAWN BY:</b> CAM	<b>DATE:</b> 3/10
<b>REVISED BY:</b>	<b>DATE:</b>
<b>PROJECTION:</b> UTM NAD 83 Zone 14	

**Aqua Texas, Inc.**  
Kerr County, Texas

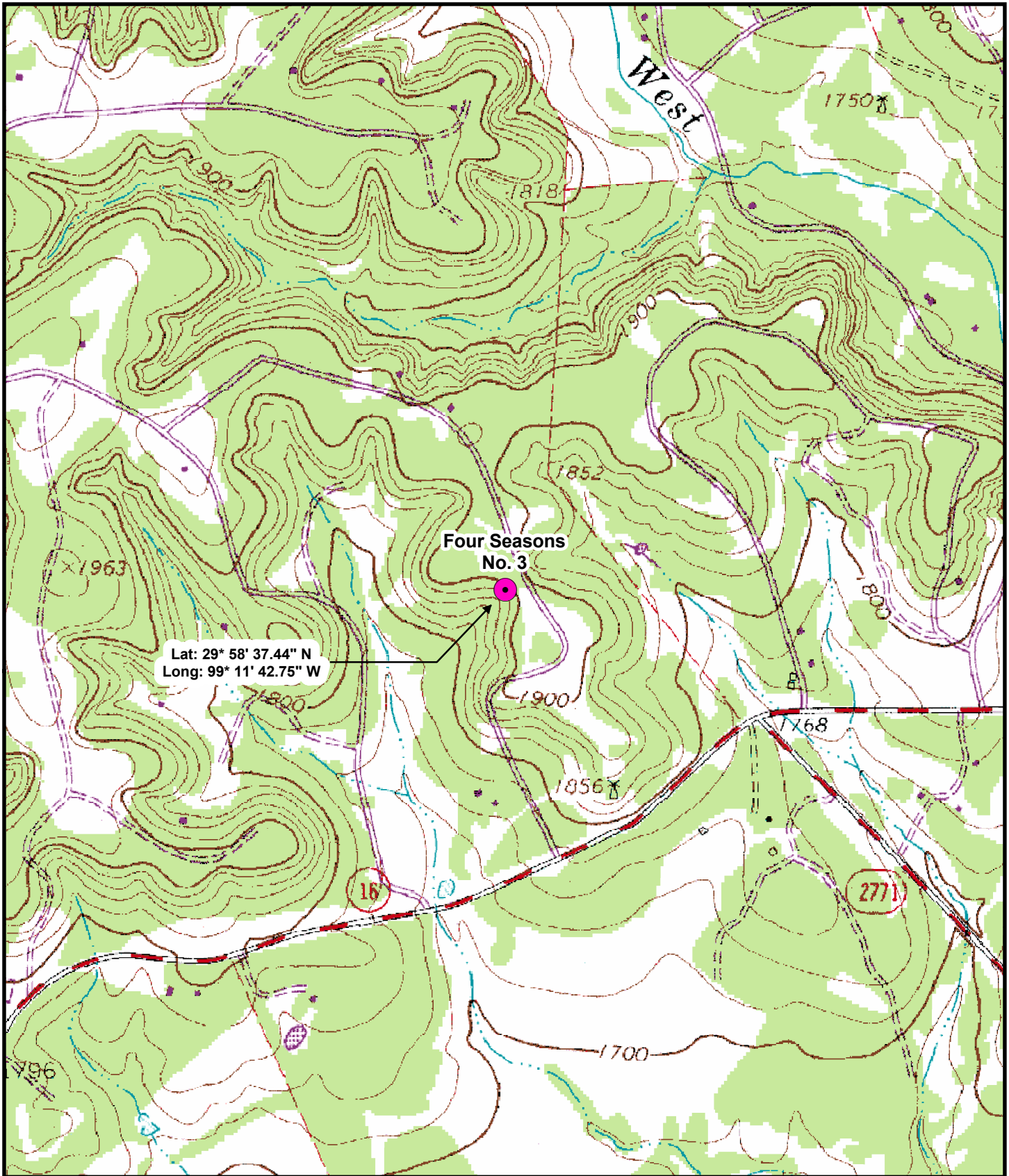


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## **Attachment 3**

U.S. Geological Survey Topographic Map





SCALE: 1 in = 1,000 ft	<b>Four Seasons No. 3 Topo Map</b>	
DRAWN BY: CAM DATE: 3/10	 <p><b>Aqua Texas, Inc.</b>  <b>Four Seasons          No. 3</b>  <b>Kerr County, Texas</b></p>	 <p><b>Wet Rock Groundwater Services, L.L.C.</b>  <b>Groundwater Specialists</b>          TBPG Firm No: 50038          P.O. Box 163144 Austin, Texas 78716          PH: 512-773-3226 FAX: 512-879-6809  <a href="http://www.wetrockgs.com">www.wetrockgs.com</a></p>
REVISED BY: DATE:		
PROJECTION: UTM NAD 83 Zone 14		

## **Attachment 4**

Log Plot: Four Seasons Well No. 3







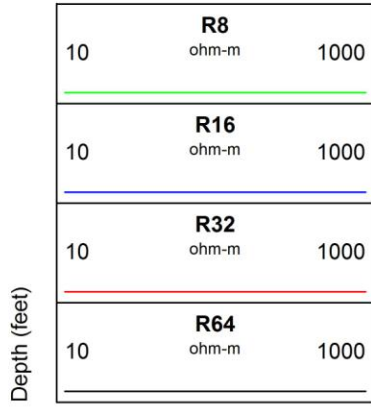
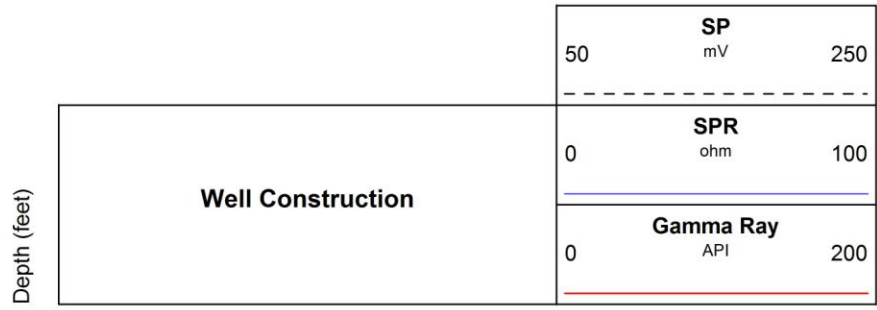
**Wet Rock Groundwater Services, LLC**  
*Groundwater Specialists*

P.O. Box 163144 Austin, TX 78716  
 Ph: 512.799.5875 Fax: 512.879.6809  
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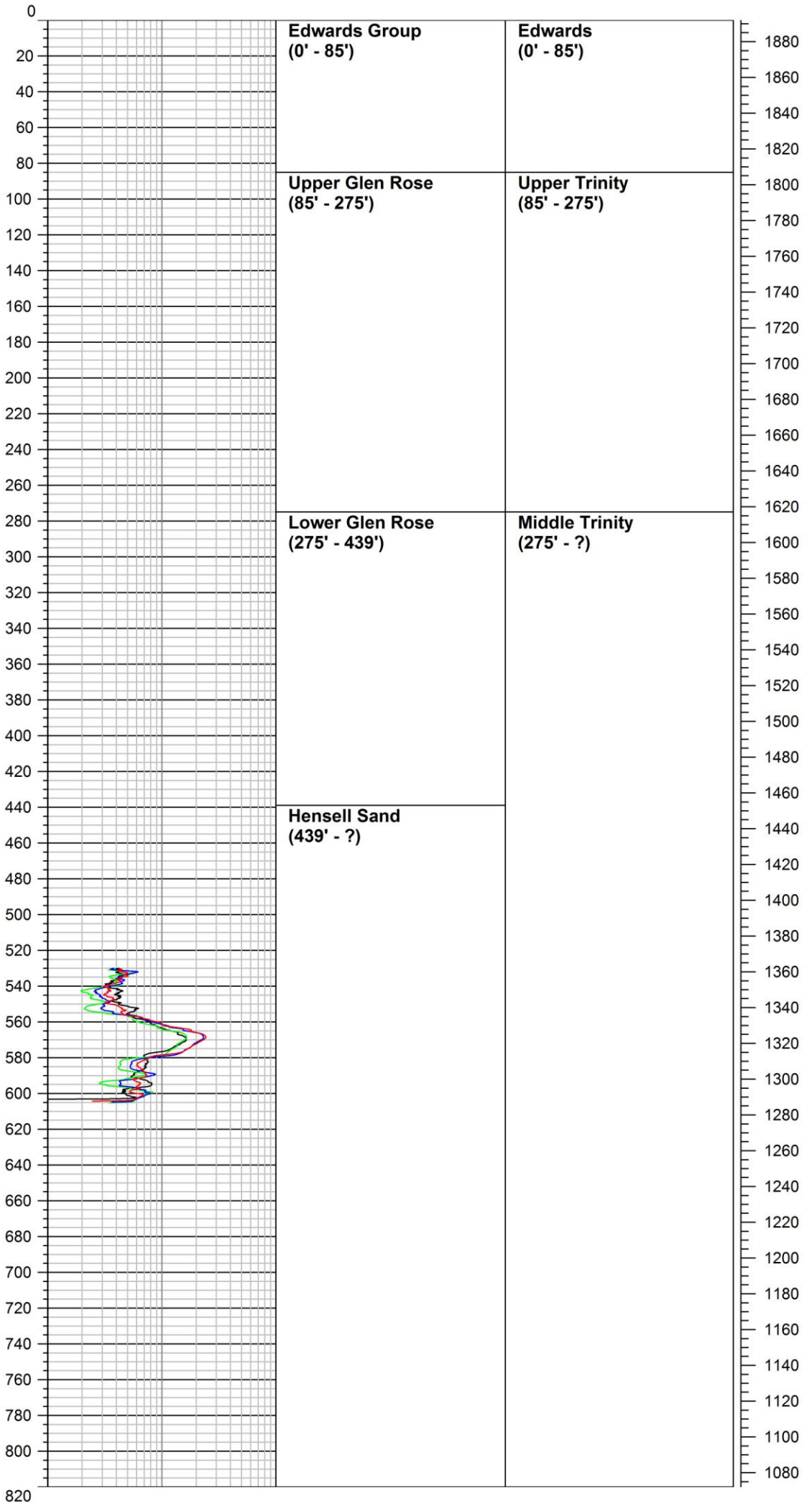
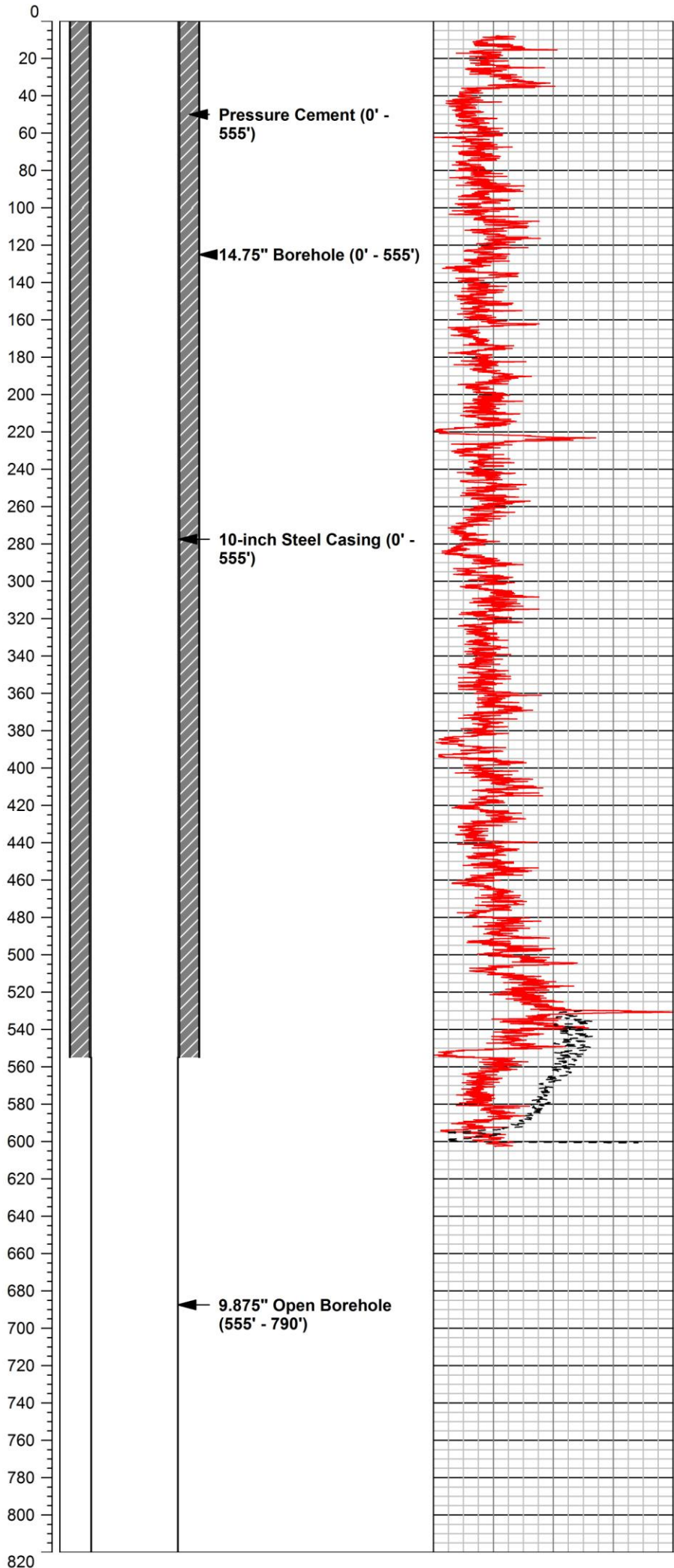
**Four Seasons No. 3**

Client: **Aqua Texas, Inc.**  
 Date Started: **10/8/2008**  
 Date Completed: **11/3/2008**  
 Drilled By: **Davenport Drilling & Pump Service**  
 Drilling Type: **Air Rotary**

Location: **Kerr County, TX**  
 Elevation: **1,892 ft MSL**  
 Total Depth: **820 ft**  
 Latitude: **29.977083 (WGS84)**  
 Longitude: **-99.195222 (WGS84)**



Geologic Units	Aquifer
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# **Attachment 5**

State of Texas Well Report



Send original copy by certified mail to: TNRCC, P.O. Box 13087, Austin, TX 78711-3087

Please use black ink.

ATTENTION OWNER: Confidentiality Privilege Notice on Reverse Side

State of Texas WELL REPORT

Texas Water Well Drillers Advisory Council P.O. Box 13087 Austin, TX 78711-3087 512-239-0530

1) OWNER AQUA TEXAS ADDRESS 1106 CLAYTON LANE AUSTIN TX 78723

2) ADDRESS OF WELL: County KERR FOUR SEASONS WATER SYSTEM GRID # N29\* 58' 37.5" W99\* 11' 42.8"

3) TYPE OF WORK (Check): New Well, Deepening, Reconditioning, Plugging, 4) PROPOSED USE (Check): Monito, Environmental Soil Boding, Domestic, Industrial, Irrigation, Injection, Public Supply, De-watering, Testwell

6) WELL LOG: Date Drilling: Started 10-08 20 08 Completed 11-03 20 08 DIAMETER OF HOLE Dia. (in.) From (ft.) To (ft.) 14 3/4 SURFACE 555 9 7/8 555 790 7) DRILLING METHOD (Check): Air Rotary, Air Hammer, Other

Table with 3 columns: From (ft.), To (ft.), Description and color of formation material. Rows include limestone, shale, sand & limestone, and conglomerate.

8) Borehole Completion (Check): Open Hole, Straight Wall, Underreamed, Gravel Packed, Other

Table for CASING, BLANK PIPE, AND WELL SCREEN DATA with columns for Dia., New/Used, Steel/Perf./Screen Mfg., Setting (ft.), and Gage Casting/Screen.

9) CEMENTING DATA [Rule 338.44(1)] Cemented from 555 Ft. to 0 ft. No. of sacks used 330 Method used PRESSURE Cemented by SCHLUMBERGER

13) TYPE PUMP: Turbine, Jet, Submersible, Cylinder, Other, Depth to pump bowls, cylinder, jet, etc., 588 ft.

10) SURFACE COMPLETION: Specified Surface Slab Installed, Specified Steel Sleeve Installed, Pitless Adapter Used, Approved Alternative Procedure Used

14) WELL TESTS: Type Test: Pump, Bailer, Jetted, Estimated Yield: 130 gpm with 53 ft. drawdown after 36 hrs.

11) WATER LEVEL: Static Level 530 ft. below land surface Date 10-10-08 Artesian flow gpm Date

15) WATER QUALITY: Did you knowingly penetrate any strata which contained undesirable constituents? Type of water? GOOD Depth of strata Was a chemical analysis made? Yes No

12) PACKERS: Type Depth N/A

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

COMPANY NAME DAVENPORT DRILLING & PUMP SERVICE WELL DRILLER'S LICENSE NO. 2669 ADDRESS 11844 BANDERA RD. RMB 711 HELOTES TEXAS 78023 (Signed) DEAN DAVENPORT (Signed) CASEY COWART

Please attach electric log, chemical analysis, and other pertinent information, if available.

## **Attachment 6**

Table 1 - Well Construction Summary

Table 2 - Aquifer Testing Summary

Table 3 - Summary of Aquifer Testing Analyses



**Table 1 - Well Construction Summary**

<u>Well</u>	<u>Hole Diameter (inches)</u>	<u>From (ft)</u>	<u>To (ft)</u>	<u>Casing Type</u>	<u>Casing Diameter (inches)</u>	<u>From (ft)</u>	<u>To (ft)</u>
Four Seasons No. 3	14.75	0	555	Steel Casing	10	0	555
	9.875	555	790				

**Table 2 - Aquifer Testing Summary**

<u>Well</u>	<u>Static Water Level (ft MSL)</u>	<u>Q (gpm)</u>	<u>Drawdown (ft)</u>	<u>SC (gpm/ft)</u>	<u>Pumping Duration (minutes)</u>	<u>Δ t (°F)</u>	<u>T<sub>R90</sub> (minutes)</u>
Four Seasons No. 3	1,396.0	130	53.0	2.46	2,728	-0.46	n/a

Notes: Q = discharge; SC = specific capacity; r = distance from pumping well; Δt = change in temperature; T<sub>R90</sub> = Time pumping well Recovered 90%

**Table 3 - Summary of Aquifer Testing Analyses**

<u>Analysis</u>	<u>b* (ft)</u>	<u>T (ft<sup>2</sup>/day)</u>	<u>K</u>
Theis	150	194	1.30
Theis Recovery	150	151	1.01
<b>Average:</b>	150	173	1.16

Notes: b = aquifer thickness; r = distance from pumping well; T = transmissivity; S = storativity; K = hydraulic conductivity

\*Actual aquifer thickness is unknown; average aquifer thickness was used for calculation of K

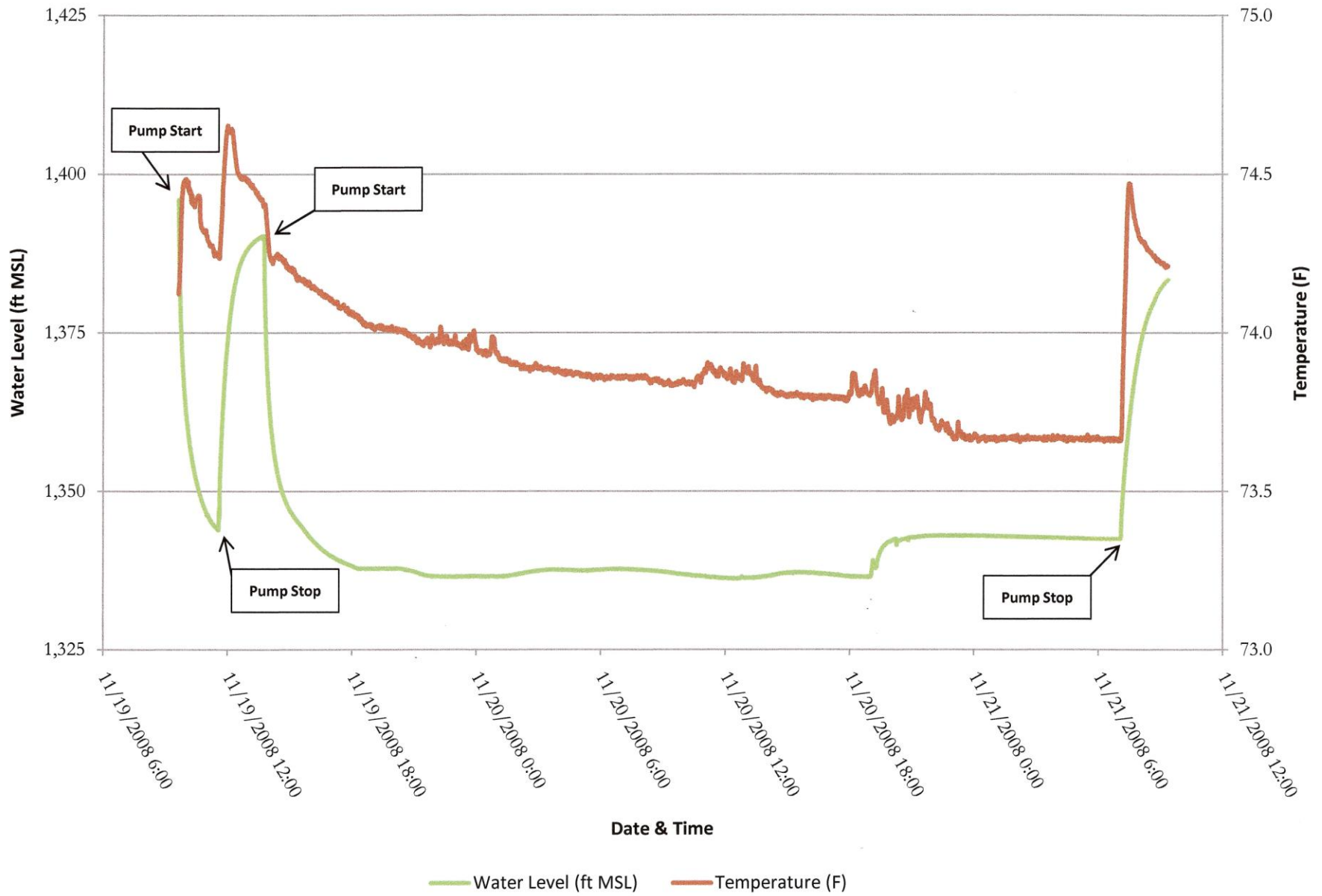


## **Attachment 7**

Aquifer Test Drawdown and Temperature Curves



# Four Seasons No. 3 Aquifer Test - 11/19/2008



# **Attachment 8**

## Aquifer Test Analyses





**Wet Rock Groundwater Services, LLC**  
**Groundwater Specialists**  
 P.O. Box 163144 Austin, Texas 78716  
 Ph: 512.773.3226 Fax: 512.879.6809  
 www.wetrockgs.com

**Pumping Test Analysis Report**

Project: Headwaters Aquifer Properties

Number: 006-008-09

Client: Headwaters GCD

Location: Kerr County, TX

Pumping Test: Four Seasons No. 3

Pumping Well: Fours Seasons No. 3

Test Conducted by:

Test Date: 11/19/2008

Analysis Performed by: Cassidy Miller

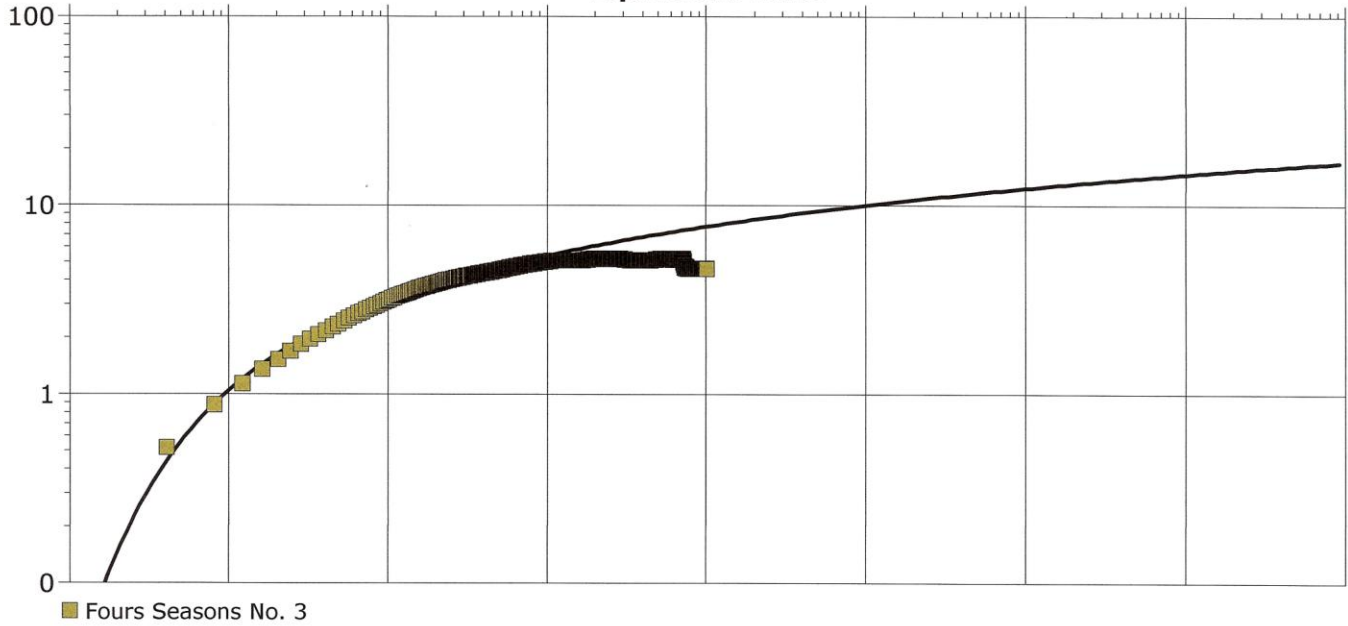
Theis

Analysis Date: 3/5/2010

Aquifer Thickness: 150.00 ft

Discharge: variable, average rate 130.31 [U.S. gal/min]

**Equivalent Time**



Calculation after Theis

Observation Well	Transmissivity [ft <sup>2</sup> /d]	Hydraulic Conductivity [ft/d]	Storage coefficient	Radial Distance to PW [ft]
Fours Seasons No. 3	$1.94 \times 10^2$	$1.30 \times 10^0$		





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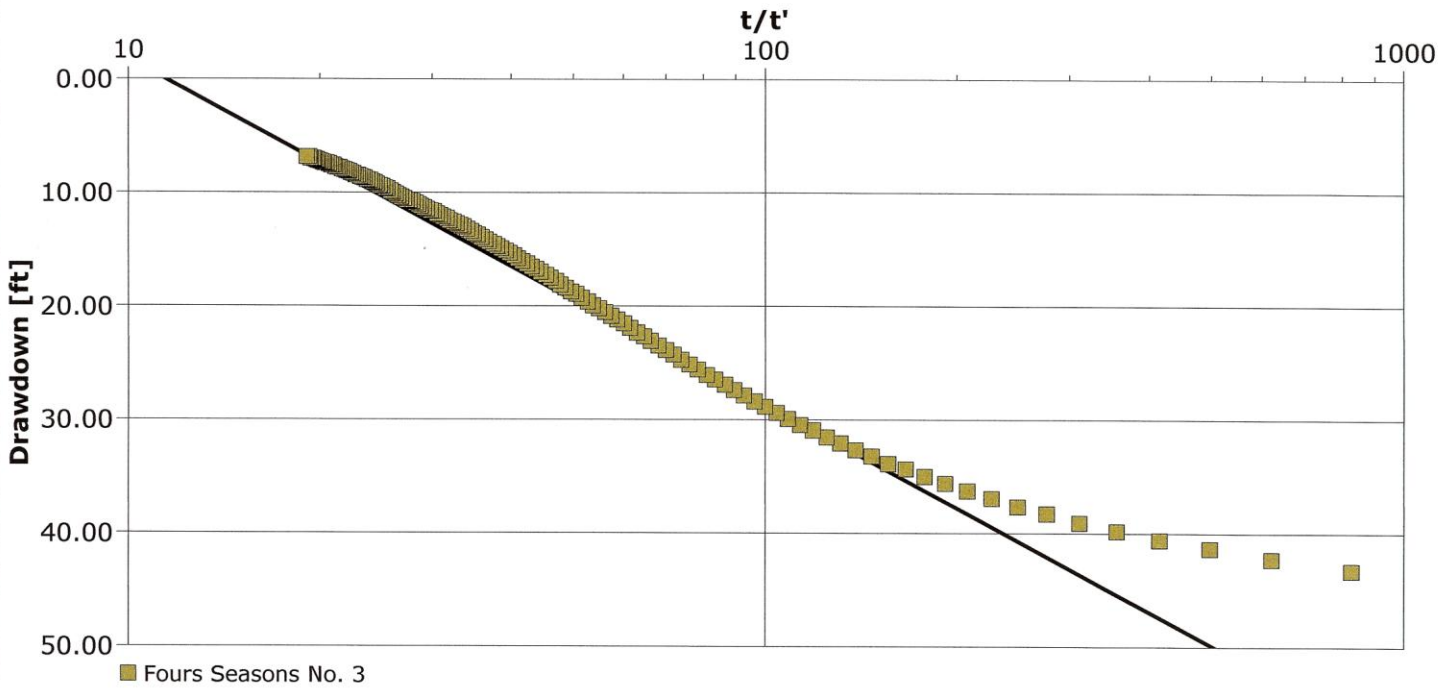
**Pumping Test Analysis Report**

Project: Headwaters Aquifer Properties

Number: 006-008-09

Client: Headwaters GCD

Location: Kerr County, TX	Pumping Test: Four Seasons No. 3	Pumping Well: Fours Seasons No. 3
Test Conducted by:		Test Date: 11/19/2008
Analysis Performed by: Cassidy Miller	Theis Recovery	Analysis Date: 3/5/2010
Aquifer Thickness: 150.00 ft	Discharge: variable, average rate 130.31 [U.S. gal/min]	



Calculation after Theis & Jacob

Observation Well	Transmissivity [ft <sup>2</sup> /d]	Hydraulic Conductivity [ft/d]	Radial Distance to PW [ft]
Fours Seasons No. 3	$1.51 \times 10^2$	$1.01 \times 10^0$	

# **Attachment 9**

Aquifer Test Data



Four Seasons No. 3 Pump Test Summary (11-19-2008)

Date and Time	Time Since Pump Start (min)	Time Since Pump Stop (min)	Temperature (F)	Water Level (ft bgs)	Water Level (ft MSL)	Drawdown (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	TDS	Comments
11/19/2008 9:37	0		74.12	496.03	1,395.97	0.00	150			Pumping Start
11/19/2008 9:38	1		74.14	500.19	1,391.81	4.16	150	36.07		Meter = 77,226
11/19/2008 9:39	2		74.15	504.81	1,387.19	8.79	150	17.07		
11/19/2008 9:40	3		74.19	507.98	1,384.02	11.95	150	12.55		
11/19/2008 9:41	4		74.21	510.52	1,381.48	14.49	146	10.08		
11/19/2008 9:42	5		74.26	512.72	1,379.28	16.69	145	8.69		
11/19/2008 9:43	6		74.31	514.51	1,377.49	18.49				
11/19/2008 9:44	7		74.35	516.13	1,375.87	20.10				
11/19/2008 9:45	8		74.38	517.60	1,374.40	21.57				
11/19/2008 9:46	9		74.41	518.90	1,373.10	22.87				
11/19/2008 9:47	10		74.43	520.11	1,371.89	24.08	145	6.02		
11/19/2008 9:48	11		74.44	521.19	1,370.81	25.16				
11/19/2008 9:49	12		74.46	522.17	1,369.83	26.14				
11/19/2008 9:50	13		74.47	523.19	1,368.81	27.16				
11/19/2008 9:51	14		74.48	524.05	1,367.95	28.03				
11/19/2008 9:52	15		74.48	524.87	1,367.13	28.84	145	4.89	360	
11/19/2008 10:07	30		74.45	533.56	1,358.44	37.53	140	3.69	370	
11/19/2008 10:22	45		74.41	538.67	1,353.33	42.64	138	3.22	380	
11/19/2008 10:37	60		74.43	542.12	1,349.88	46.09	138	2.98	380	
11/19/2008 10:52	75		74.32	544.66	1,347.34	48.64				
11/19/2008 11:07	90		74.27	546.35	1,345.65	50.33	135	2.67	390	
11/19/2008 11:22	105		74.25	547.51	1,344.49	51.49				
11/19/2008 11:33	116		74.24	548.12	1,343.88	52.09				Pump Shut Off
11/19/2008 11:34	117		74.24	546.88	1,345.12	50.85				
11/19/2008 11:35	118		74.24	544.61	1,347.39	48.58				
11/19/2008 11:36	119		74.24	546.14	1,345.87	50.11				
11/19/2008 11:37	120		74.27	540.56	1,351.44	44.54				
11/19/2008 11:38	121		74.29	538.87	1,353.13	42.85				
11/19/2008 11:39	122		74.31	537.35	1,354.65	41.32				
11/19/2008 11:40	123		74.32	535.83	1,356.18	39.80				
11/19/2008 11:41	124		74.34	534.45	1,357.55	38.42				

Note: bgs = below ground surface

MSL = Mean Sea Level

Four Seasons No. 3 Pump Test Summary (11-19-2008)

Date and Time	Time Since Pump Start (min)	Time Since Pump Stop (min)	Temperature (F)	Water Level (ft bgs)	Water Level (ft MSL)	Drawdown (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	TDS	Comments
11/19/2008 11:42	125		74.36	533.15	1,358.85	37.12				
11/19/2008 11:43	126		74.39	531.91	1,360.09	35.88				
11/19/2008 11:44	127		74.41	530.78	1,361.22	34.75				
11/19/2008 11:45	128		74.45	529.63	1,362.37	33.60				
11/19/2008 11:46	129		74.47	528.56	1,363.44	32.53				
11/19/2008 11:47	130		74.49	527.57	1,364.43	31.54				
11/19/2008 12:02	145		74.64	516.54	1,375.46	20.51				
11/19/2008 12:17	160		74.60	510.27	1,381.73	14.25				
11/19/2008 12:32	175		74.50	506.72	1,385.28	10.69				
11/19/2008 12:47	190		74.49	504.69	1,387.31	8.67				
11/19/2008 13:02	205		74.47	503.41	1,388.59	7.39				
11/19/2008 13:17	220		74.45	502.61	1,389.39	6.58				
11/19/2008 13:45	248		74.40	501.75	1,390.25	5.72				Pump Restarted
11/19/2008 13:46	249		74.40	507.10	1,384.90	11.07				
11/19/2008 13:47	250		74.41	510.77	1,381.23	14.75				
11/19/2008 13:48	251		74.40	513.42	1,378.58	17.40				
11/19/2008 13:49	252		74.39	515.64	1,376.37	19.61				
11/19/2008 13:50	253		74.38	517.48	1,374.52	21.45				
11/19/2008 13:51	254		74.36	519.13	1,372.87	23.10				
11/19/2008 13:52	255		74.36	520.56	1,371.44	24.54				
11/19/2008 13:53	256		74.34	521.88	1,370.12	25.85				
11/19/2008 13:54	257		74.32	523.04	1,368.96	27.01				
11/19/2008 13:55	258		74.31	524.10	1,367.90	28.08				
11/19/2008 13:56	259		74.30	525.13	1,366.87	29.10				
11/19/2008 13:57	260		74.28	526.03	1,365.97	30.01				
11/19/2008 14:07	270		74.23	532.80	1,359.20	36.78				
11/19/2008 14:22	285		74.24	538.70	1,353.30	42.68				
11/19/2008 14:37	300		74.24	542.04	1,349.96	46.01				
11/19/2008 15:07	330		74.20	545.62	1,346.38	49.60				
11/19/2008 15:37	360		74.17	547.79	1,344.21	51.76				
11/19/2008 16:37	420		74.12	551.37	1,340.63	55.34				

Note: bgs = below ground surface

MSL = Mean Sea Level

Four Seasons No. 3 Pump Test Summary (11-19-2008)

Date and Time	Time Since Pump Start (min)	Time Since Pump Stop (min)	Temperature (F)	Water Level (ft bgs)	Water Level (ft MSL)	Drawdown (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	TDS	Comments
11/19/2008 17:37	480		74.08	553.32	1,338.68	57.29				
11/19/2008 18:37	540		74.03	554.21	1,337.79	58.18				
11/19/2008 19:37	600		74.01	554.23	1,337.77	58.21				
11/19/2008 20:37	660		74.00	554.38	1,337.63	58.35				
11/19/2008 21:37	720		73.98	555.29	1,336.71	59.26				
11/19/2008 22:37	780		73.97	555.52	1,336.48	59.50				
11/19/2008 23:37	840		73.95	555.45	1,336.56	59.42				
11/20/2008 0:37	900		73.93	555.46	1,336.54	59.44				
11/20/2008 1:37	960		73.90	555.30	1,336.70	59.28				
11/20/2008 2:37	1,020		73.89	554.75	1,337.25	58.72				
11/20/2008 3:37	1,080		73.89	554.41	1,337.60	58.38				
11/20/2008 4:37	1,140		73.87	554.53	1,337.47	58.50				
11/20/2008 5:37	1,200		73.86	554.51	1,337.49	58.48				
11/20/2008 6:37	1,260		73.86	554.28	1,337.72	58.26				
11/20/2008 7:37	1,320		73.86	554.38	1,337.62	58.36				
11/20/2008 8:37	1,380		73.85	554.57	1,337.43	58.54				
11/20/2008 9:37	1,440		73.84	555.01	1,337.00	58.98				
11/20/2008 10:37	1,500		73.85	555.32	1,336.68	59.29				
11/20/2008 11:37	1,560		73.87	555.66	1,336.34	59.63				
11/20/2008 12:37	1,620		73.87	555.81	1,336.19	59.79				
11/20/2008 13:37	1,680		73.84	555.60	1,336.41	59.57				
11/20/2008 14:37	1,740		73.80	555.04	1,336.96	59.02				
11/20/2008 15:37	1,800		73.80	554.86	1,337.14	58.83				
11/20/2008 16:37	1,860		73.80	554.99	1,337.01	58.96				
11/20/2008 17:37	1,920		73.80	555.32	1,336.68	59.29				
11/20/2008 18:37	1,980		73.81	555.53	1,336.47	59.51				
11/20/2008 19:37	2,040		73.76	550.74	1,341.26	54.72				
11/20/2008 20:37	2,100		73.75	549.58	1,342.42	53.56				
11/20/2008 21:37	2,160		73.79	549.12	1,342.88	53.09				
11/20/2008 22:37	2,220		73.70	548.97	1,343.03	52.94				
11/20/2008 23:37	2,280		73.68	548.99	1,343.02	52.96				

Note: bgs = below ground surface

MSL = Mean Sea Level

Four Seasons No. 3 Pump Test Summary (11-19-2008)

Date and Time	Time Since Pump Start (min)	Time Since Pump Stop (min)	Temperature (F)	Water Level (ft bgs)	Water Level (ft MSL)	Drawdown (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	TDS	Comments
11/21/2008 0:37	2,340		73.66	549.07	1,342.93	53.05				
11/21/2008 1:37	2,400		73.67	549.21	1,342.79	53.18				
11/21/2008 2:37	2,460		73.67	549.24	1,342.76	53.22				
11/21/2008 3:37	2,520		73.67	549.30	1,342.71	53.27				
11/21/2008 4:37	2,580		73.67	549.37	1,342.63	53.35				
11/21/2008 5:37	2,640		73.67	549.50	1,342.50	53.47				
11/21/2008 6:37	2,700		73.67	549.56	1,342.44	53.53				
11/21/2008 7:05	2,728	0	73.66	548.98	1,343.02	52.95	130	2.46		Start Recovery
11/21/2008 7:06	2,729	1	73.66	547.12	1,344.88	51.10				Meter = 396,428
11/21/2008 7:07	2,730	2	73.68	545.86	1,346.14	49.83				
11/21/2008 7:08	2,731	3	73.71	545.04	1,346.96	49.01				
11/21/2008 7:09	2,732	4	73.77	544.04	1,347.96	48.01				
11/21/2008 7:10	2,733	5	73.83	543.11	1,348.89	47.09				
11/21/2008 7:11	2,734	6	73.88	542.34	1,349.66	46.32				
11/21/2008 7:12	2,735	7	73.91	541.55	1,350.45	45.52				
11/21/2008 7:13	2,736	8	73.96	540.80	1,351.20	44.78				
11/21/2008 7:14	2,737	9	74.00	540.04	1,351.96	44.01				
11/21/2008 7:15	2,738	10	74.04	539.41	1,352.59	43.39				
11/21/2008 7:16	2,739	11	74.08	538.65	1,353.35	42.63				
11/21/2008 7:17	2,740	12	74.11	538.04	1,353.96	42.01				
11/21/2008 7:18	2,741	13	74.15	537.37	1,354.63	41.34				
11/21/2008 7:19	2,742	14	74.19	536.78	1,355.22	40.75				
11/21/2008 7:20	2,743	15	74.23	536.10	1,355.90	40.08				
11/21/2008 7:35	2,758	30	74.44	528.21	1,363.79	32.19				
11/21/2008 7:50	2,773	45	74.34	522.31	1,369.69	26.28				
11/21/2008 8:05	2,788	60	74.29	518.04	1,373.96	22.02				
11/21/2008 8:20	2,803	75	74.27	514.96	1,377.04	18.94				
11/21/2008 8:35	2,818	90	74.25	512.84	1,379.16	16.81				
11/21/2008 8:50	2,833	105	74.23	511.00	1,381.00	14.97				
11/21/2008 9:05	2,848	120	74.22	509.66	1,382.34	13.63				
11/21/2008 9:20	2,863	135	74.21	508.73	1,383.27	12.70				

Note: bgs = below ground surface

MSL = Mean Sea Level