

Fifth Quarterly Monitoring Report

for

Town of Hamilton Well 14
Stone Eden Well
Hamilton, Virginia

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Town of Hamilton

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1.0 INTRODUCTION

This 5th Quarterly Monitoring Report (QMR5) presents the results of the monitoring activities performed during the months of September – December 2010 of active pumping operation in Well 14 by the Town of Hamilton. This report is submitted to the Loudoun County Department of Building and Development, in substantial compliance with the approved Town’s Pumping, Monitoring, and Mitigation Plan (PMMP, November 2008). The PMMP addresses the groundwater monitoring requirements of Section 6.240, G., I., J., and K. of the Loudoun County Facility Standards Manual (FSM).

This report includes the water level data and water quality field-testing from the following reports previously submitted by ASI:

- “Background and Initial Pump Start-up (30-day) Monitoring Report”, dated October 13, 2009 (“30-Day Report”),
- “First Quarterly Monitoring Report” (QMR1), dated November 15, 2009,
- “Second and Third Quarterly Monitoring Report” (QMR3), dated May 10, 2010, and the
- “Fourth Quarterly Monitoring Report” (QMR4), dated September 29, 2010.

Please refer to the 30-Day Report for details regarding monitoring well information, installation of the probes, and the water quality sampling methods. Relevant information on the monitored wells is summarized in Table 1 below.

**Table 1
 Domestic Well Monitoring Locations**

Well ID	Residence Address	PIN	Well Yield (gpm)	Total Depth (feet)	Depth to Bedrock (feet)	Static Water Level (feet)	Water-Bearing Depths (feet)
4	Gaston and Kapsang Gutierrez 38286 Alfalfa Ct	419157282	50	380	20	30	180 (2), 365 (48)
5	Robert and Lori Gammache 38280 Alfalfa Ct	419155183	30	400	10	12	190 (4), 360 (26)
6	Hemadri and AparnaDasari 38274 Alfalfa Ct	419153482	30	275	10	30	253
7	Edward and Courtney Cooke 38268 Alfalfa Ct	419150980	50	250	8	0	225
9	B. and J. Dedekind 17936 Manassas Gap Ct	454105978	60	383	50	30	381
12	James and Amy Walton 17979 Sands Road	454297930	15	380	25	2	365
13	Brian and Sherri Omara 17969 Sands Road	454302227	15	260	51	40	235
32	Maureen A. Omara 17899 Sands Road	454204465	50	260	20	2	235

2.0 WATER QUALITY MONITORING

Section 4.5 of the PMMP recommended that the monitoring program should include an evaluation of water quality. Laboratory results from the sampling of all the initial monitored domestic wells were reported later in the 30-Day Report. The laboratory results from Well 32 were reported in the QMR1. The water samples were tested by calibrated field instrumentation for the following parameters: pH, specific conductivity, turbidity and temperature.

2.1 Field Parameters

Due to freezing air temperatures, the outside spigots of the residences were not operating during the time of the site visit on December 14, 2010; therefore, new field parameters data were not collected during this monitoring period. The historical parameter data for the monitored sites are provided in Appendix A.

2.2 Laboratory Analysis

During this monitoring period, monitoring began at three additional wells in the area. These wells are identified in Figure 1 as Well 2, Well 18, and Well 29A, which are located in the eastern and southeastern portions of the site. Water samples were collected from Well 2 and Well 18 for laboratory analyses during the fifth quarter of active pumping at Well 14. Analysis has not yet not been conducted for Well 29A because outside spigots have been turned off for the winter at that location. ASI staff met with the property owner in the residence, but a suitable sampling point that bypassed the filtration system was not identified.

The analytical results indicate that no analytes (including Total Coliform) were reported at or above enforceable EPA Maximum Contaminant Levels (MCL). The laboratory reports for Well 2 and Well 18 are provided in Appendix B. Note that the laboratory report for Well 18 is incorrectly labeled as Well 33.

3.0 GROUNDWATER LEVEL MONITORING

ASI personnel mobilized to the site on the following dates to check the operation of the probes and to download data from the probes:

- November 17, 2009
- December 28, 2009
- January 29, 2010
- February 24, 2010
- March 24, 2010, and
- April 30, 2010.
- May 25, 2010

- August 25, 2010
- December 14, 2010

Water level monitoring began at Well 32 on November 17, 2009. Water level monitoring began at Wells 2, 18, and 29A on December 14, 2010. Water level measurements were automatically recorded by all probes on an hourly basis. Water level data collected during September, October, November, and December, 2010, have been plotted for each monitor well. The plots of background phase and the previous pumping periods have been presented in previous reports. Graphs for each individual monitor well have been included in Appendix C. An electronic copy of the monitoring data has been included in Appendix E.

3.1 Additional Monitoring Locations

On December 14, 2010, dataloggers were installed in three additional wells in properties that were selected in response to a request by the Loudon County Department of Building and Development to expand the monitoring network. Dataloggers were installed in the domestic supply wells identified as Well 2 and Well 18. Well 2 is located approximately 1,000 feet east of Well 14. Well 18 is located approximately 500 feet east of Well 4. A third datalogger was also installed in Well 29A, located approximately 700 feet south of Well 4. Well 29A is not currently used for domestic supply, and is one of two wells on the property. In each case, the pumping assembly caused a partial obstruction and prevented the full length of cable to be installed; however, sufficient submergence of the probes was accomplished for data collection. All monitored wells, including the newly active wells, are identified in Figure 1. The information concerning these wells is summarized in Table 2 below.

Table 2.
Construction Summary of Additional Monitored Wells

Well #	Residence Address	PIN	Well Yield (gpm)	Total Depth (feet)	Depth to Bedrock (feet)	Static Water Level (feet)	Water-Bearing Depths (feet)**
2	W. Allen Cochran 17889 Sands Road	419260463	30	200	10	30	134
18	Mark and YufenZhaHyett 38344 Midnight Sky Place	419163547	15	225	20	30	195
29A	Michael and Nancy Dowgiello 17997 Taylor Road	419153482	30	275	10	30	253

3.2 Discussion of Water Level Monitoring Results

This 5th Quarterly Monitoring Report includes data from the second year of water supply production from Well 14. Water levels fluctuations in the monitored wells during this quarter were consistent with the historical data of the pumping period. As reported previously, significant water level fluctuations in Wells 4, 5, 6, and 32 appear to occur approximately simultaneously during the 5th quarter of Well 14 pumping, as shown in Figure 2. These simultaneous drawdown events appear to closely match the dates of Well 14 operation, as discussed in Section 4.2 below. Withdrawals from Well 14 appear to have a lesser impact on Wells 9 and 12 (shown in Figure 3) than on the other five historically monitored wells. The operation of Well 14 has continued to be sporadically timed, with variable time-intervals between events.

The new monitoring sites (Wells 2, 18, and 29A, installed on December 14, 2010) appeared to have different responses to Well 14 withdrawals. Water level fluctuations in these new wells during this monitoring period are shown in Figure 4. Well 29A was not active during this period, so major water level fluctuations can be easily identified (Figure 4). Each of the five major drawdown events in the Well 29A level data, which range from approximately seven feet to ten feet of drawdown, are very closely correlated with Well 14 pumping events. The data from Well 18 show drawdown events that range from approximately three feet to over twenty feet; however, in contrast to Well 29A, the major drawdowns often do not occur on the same dates as Well 14 pumping events. In further contrast with both Wells 18 and 29A, fluctuations in Well 2 water level are generally less than five feet.

Recoveries in all of the monitored wells continue to be relatively rapid, with water levels usually re-stabilizing at pre-drawdown levels in most wells. This continued rapid recovery pattern suggests that production from Well 14 has not appeared to significantly impact recharge of the monitored wells by the local aquifer.

3.3 Discharge Data from Well 14

Well 14 discharge data were obtained from the Hamilton Water Treatment Plant (WTP) for the period of September 2010 through December 2010. In response to comments received from the Loudoun County Department of Building and Development, dated March 31, 2010, ASI has continued discussions with WTP staff regarding appropriate methods to collect the data requested by the county. ASI continues discussions with the WTP staff regarding the best methods to record Well 14 water level data, as well as the clock-times of Well 14 pumping events (i.e. time of day on, and time of day off). The data provided to ASI for the period September through December 2010 are indicated below.

Data provided by the WTP staff indicate that water withdrawals took place on 44 days during the period of September through December 2010, for a total of 42.2 hours. The 44 events resulted in a total estimated withdrawal of approximately 766,000 gallons. The average pumping duration for the four months was slightly less than one hour per day, the

maximum pumping duration was 2.9 hours, which occurred on September 23, 2010. Totals for each month during the pumping period are summarized below in Table 2. The pumping data, including daily pumping durations and volumes, are provided in Appendix D. Appendix D contains data identified as "Level" which is the readout of feet of water over the transducer in the well; however, the time associated with these readouts are not known, limiting the value of the data.

**Table 3. Well 14
 Pumping Data Summary**

Month	Pumping Days	Total Hours	Pumpage (gal)
October '09	12	17.7	287,800
November '09	14	20	294,300
December '09	9	14	231,500
January '10	14	14.4	209,900
February '10	7	9	156,300
March '10	14	23	373,900
April '10	10	15	243,300
May '10	11	10.7	167,100
June '10	10	14.9	313,281
July '10	6	15.1	317,486
August '10	5	3.6	75,692
September '10	5	9.6	79,700
October '10	16	12.3	256,800
November '10	11	8.9	193,300
December '10	12	11.4	236,200
Total	156	199.6	3,436,559

4.0 CONCLUSIONS AND RECOMMENDATIONS

This report documents the monitoring of water levels in ten residential wells during the period since pumping operations began in Well 14 in August 2009, including three new monitored wells identified in this report as Wells 2, 18, and 29A. Approximately simultaneous drops in well water levels during numerous occasions in four (Wells 4, 5, 6, and 32) of the monitored residential wells are believed to be associated with the withdrawal of groundwater from Well 14. Recoveries in all wells continue to be strong. Wells 2, 9, and 12 appear to experience relatively minor impacts from the pumping operations. Water levels in the monitored wells have continued to recover to approximately background levels; however, additional monitoring data will be needed to evaluate more long term effects following the continued active operation of Well 14.

ASI continues to work with the Hamilton staff to obtain the Well 14 data requested by the Loudoun County Department of Building and Development in their letter to TRIAD Engineering, dated March 31, 2010. ASI has met with Hamilton staff at the WTP to discuss methods and equipment of data collection. Hamilton staff has indicated that

equipment repairs have recently been made that may allow recording of water levels fluctuations in Well 14. ASI has also discussed potential equipment that may allow the recording of start and stop times of the Well 14 pump.

ASI will continue to discuss potential equipment and data collection methods that should improve recording of pump start-times and stop-times along with the corresponding water level fluctuations in Well 14.

5.0 LIMITATIONS

The work performed in conjunction with this project, and the data developed, are intended as a description of available information at the sample locations indicated and the dates specified. Generally accepted industry standards were used in the preparation of this report.

Laboratory data are intended to approximate actual conditions at the time of sampling. Results from future sampling and testing may vary significantly as a result of natural conditions, a changing environment, or the limits of analytical capabilities. This report does not warrant against future operations or conditions, nor does it warrant against operations or conditions present of a type or at a specific location not investigated. The limited sampling conducted was intended to approximate subsurface conditions by extrapolation between data points. Actual conditions may vary.

FIGURES



Figure 1: Site Location Map

Legend

-  Pumping Well
-  Existing Monitoring Well Locations



0 250 500 1,000
 Feet

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Figure 2. Well 4, 5, 6 and 32: 5th Quarter

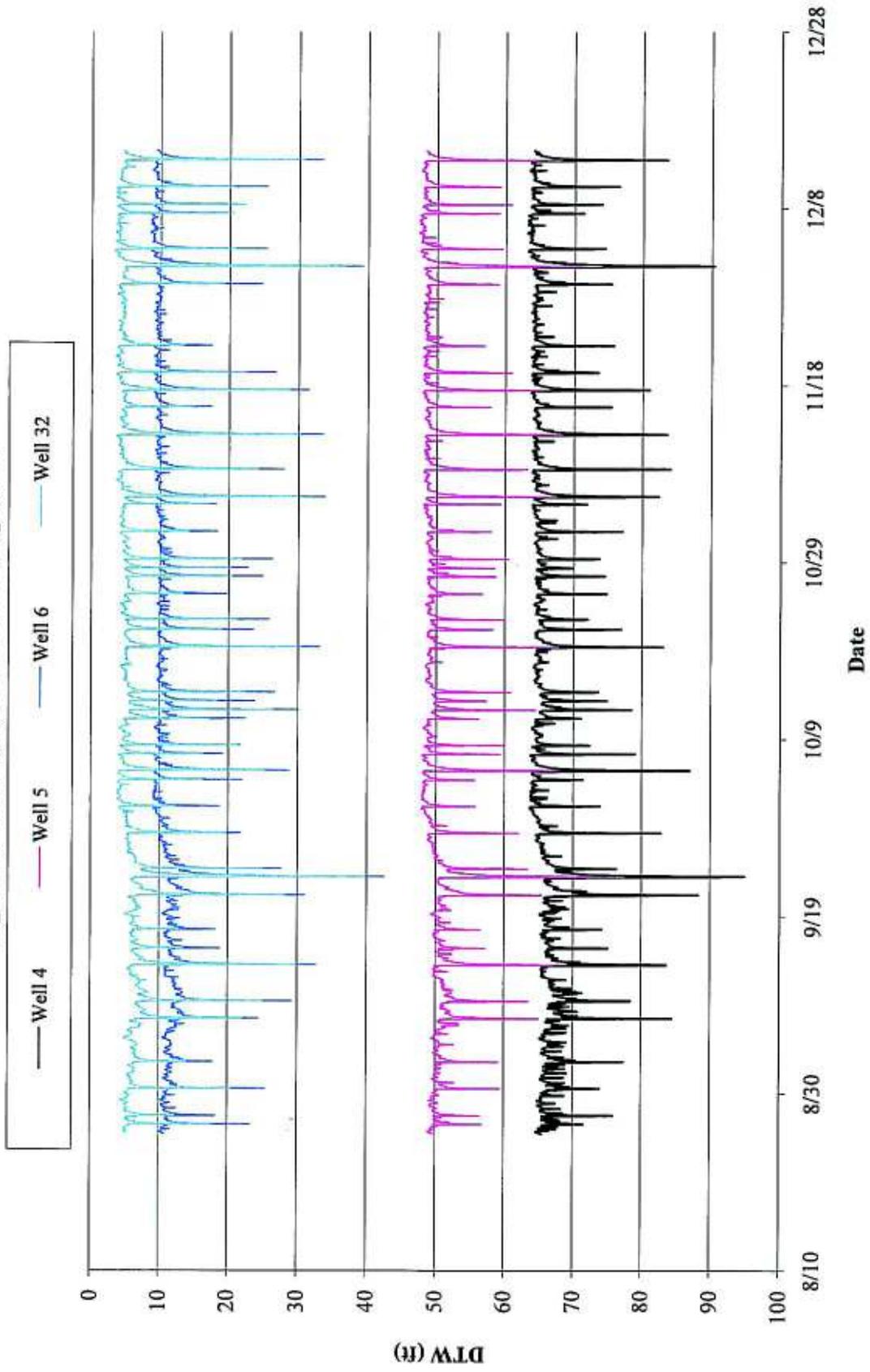


Figure 3. Wells 9, 12, and 13: 5th Quarter

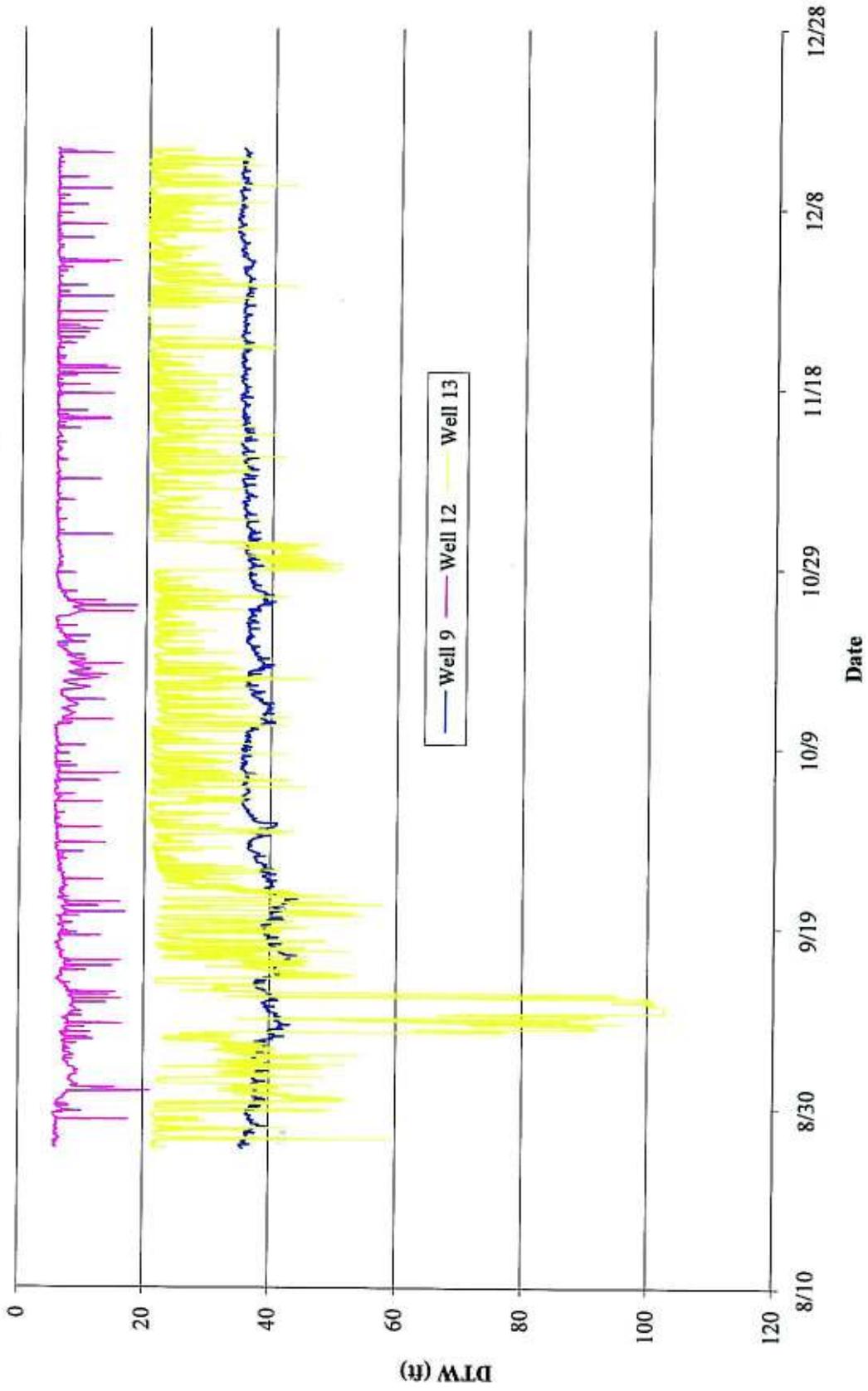


Figure 4. Wells 2, 18 & 29A: 5th Quarter

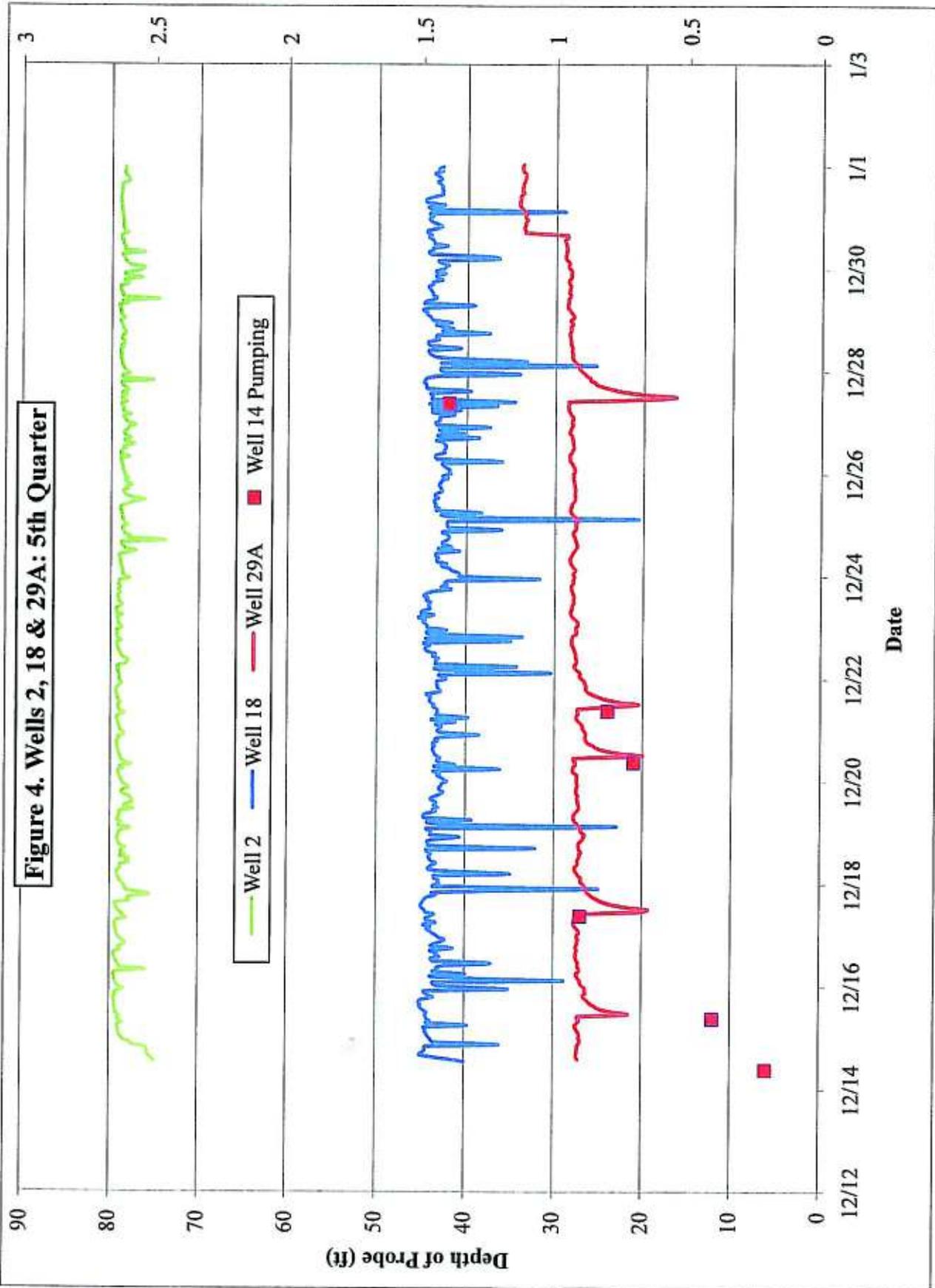
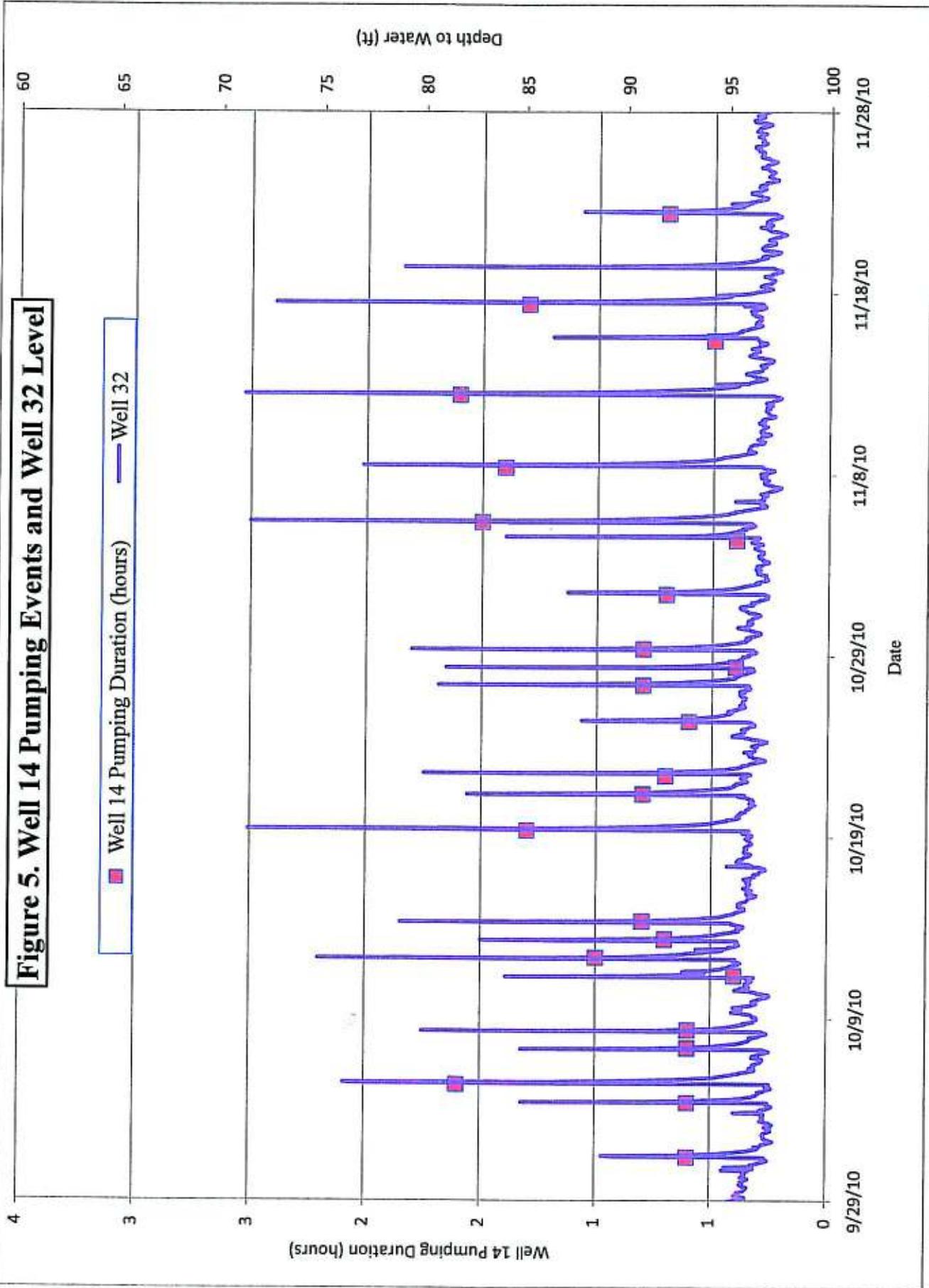


Figure 5. Well 14 Pumping Events and Well 32 Level



APPENDIX A
SUMMARY TABLE OF FIELD PARAMETERS

APPENDIX A. Field Parameters

Date	1/9/09	8/9/09	8/26/09	10/6/09	10/29/09	11/17/09	12/28/09	1/29/10	2/24/10	3/24/10	4/30/10	5/25/10	8/25/10
Well ID													
pH (Standard Units)													
Well 4	6.79	7.8	7.93	8.17	7.84	7.6	7.66	*	*	*	7.24	7.61	7.57
Well 5	7.27	7.15	7.42	7.1	7.46	7.26	7.44	7.18	*	*	7	6.98	7.15
Well 6	6	7.7	7.77	7.61	7.96	7.68	7.86	*	*	*	7.33	7.4	7.34
Well 7													6.63
Well 9	6.1	7.9	8.16	7.77	8.22	7.89	7.95	*	*	8.11	7.52	7.39	7.28
Well 12	7.71	7.54	7.37	7.53	7.54	7.23	7.47	*	*	7.27	7.08	6.64	6.47
Well 13	7.41	7.4	7.5	7.34	7.42	7.45	7.39	6.96	*	6.94	6.77	6.1	6.16
Well 32						7.6	7.61	*	*	7.18	7.09	6.76	6.45
Specific Conductance (µS)													
Well 4	420	288	524	365	424	321	335	*	*	*	466	384	442
Well 5	342	355	415	390	416	372	381	381	*	*	387	371	431
Well 6	315	271	322	295	290	281	279	*	*	*	282	300	291
Well 7													298
Well 9	270	229	250	263	244	230	254	*	*	281	248	254	231
Well 12	311	286	260	290	277	247	269	*	*	322	278	279	281
Well 13	269	284	255	270	333	275	242	243	*	276	255	240	246
Well 32						234	236	*	*	259	270	262	257
Temperature (°C)													
Well 4	16	17.5	21.9	16.3	15.8	15.3	18.9	*	*	*	17.6	21.2	22.8
Well 5	13.3	19	21	17.8	15.8	16.1	17	14.2	*	*	18.8	19.1	23.5
Well 6	11	21	25.7	18.3	15.9	15.6	21.4	*	*	*	18.3	20.5	23.1
Well 7													23.1
Well 9	11.4	24.5	23.1	19.6	16.9	16.9	17.4	*	*	18.2	18.3	22	21.4
Well 12	12.4	19.5	23.3	18.8	15.7	14.4	12.1	*	*	12.8	17.1	19.8	22.6
Well 13	13.3	21	23.2	19	16.3	14.7	10.8	10	*	13.7	17.3	21.7	21.9
Well 32						16.5	13.8	*	*	17.6	19	22	24.6

APPENDIX A. Field Parameters

Turbidity (NTUs)												
	0.08	0.2	1.38	0.005	0.51	10.96	3.59	*	*	*	*	*
Well 4	0.08	0.2	1.38	0.005	0.51	10.96	3.59	*	*	*	*	0.66
Well 5	0.01	0.55	0.77	2.84	0.46	8.47	0	0.03	*	*	*	1.91
Well 6	0	0.89	0.6	0.61	0.16	10.33	0	*	*	*	*	2
Well 7												2.2
Well 9	1.23	1.82	0.45	0.64	1.09	15.23	0.18	*	*	*	1.64	2.3
Well 12	0.01	0.21	4.5	0.59	0.21	14.22	0.01	*	*	*	0.71	5.9
Well 13	0.06	0.83	0.75	0.86	0.17	15.62	0	0	*	*	2.49	0.56
Well 32						15.92	0	*	*	*	5.29	4.74

Note: * : Outdoor spigots were shut off because of freezing weather. No sample was collected.