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Department of Energy
Carlsbad Field Office
P. O. Box 3090
Carlsbad, New Mexico 88221

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NMED Hazardous Waste Bureau

Mr. John E. Kieling, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 E. Rodeo Park Dr. Bldg. 1
Santa Fe, New Mexico 87505-6303

Subject: Transmittal of the Waste Isolation Pilot Plant May 2013 Semi-Annual Groundwater Surface Elevation Report

Dear Mr. Kieling:

The purpose of this letter is to submit the Waste Isolation Pilot Plant May 2013 Semi-Annual Groundwater Surface Elevation Report. This report is required by Permit Part 5, Permit Condition 5.10.2.2 of the Hazardous Waste Facility Permit No. NM4890139088-TSDF.

We certify under penalty of law that this document and all enclosures were prepared under our direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on our inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of our knowledge and belief, true, accurate and complete. We are aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Please contact Mr. George Basabilvazo at (575) 234-7488 if you have any questions regarding this data transmittal.

Sincerely,

George T. Basabilvazo for
Jose R. Franco, Manager
Carlsbad Field Office

M. F. Sharif, Project Manager
Nuclear Waste Partnership LLC

Enclosure

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UNITED STATES DEPARTMENT OF ENERGY

WASTE ISOLATION PILOT PLANT

CARLSBAD, NEW MEXICO

Semi-Annual Groundwater Surface Elevation Report

WLMP Data Collection, September 2012 – February 2013

SUBMITTED TO THE

NEW MEXICO ENVIRONMENT DEPARTMENT

May 2013

This report has been reviewed and approved by:

R. A. Salness, Mgr. EM&H

3/11/13

Date

Table of Contents

1.0 Introduction 2

2.0 Summary of Groundwater Activities..... 2

2.1 Plugging and Abandonment, Drilling, and Well Maintenance.....3

2.2 Pumping/Testing and Other Activities that Impacted Culebra Water Levels 3

3.0 Fluid Density Survey..... 4

4.0 Groundwater Trends..... 4

5.0 References..... 4

Appendix 1 Annotated Hydrographs..... 6

Appendix 2 Culebra Groundwater Levels..... 56

1.0 Introduction

The Waste Isolation Pilot Plant (WIPP) Hazardous Waste Facility Permit (Permit), Part 5.10.2.2 and Attachment L, Section L-5c requires a Semiannual Groundwater Surface Elevation Report by May 31 and November 30. Changes in Detection Monitoring Well (DMW) water levels greater than two feet for a calendar year and a potentiometric flow map will be discussed in the November report. The Culebra Member (Culebra) of the Rustler Formation (Rustler) is the most transmissive hydrologic unit in the WIPP site area and is considered the most significant potential hydrologic pathway for a hazardous waste release to the point of compliance. The reporting period covered by this semiannual report is September 1, 2012 through February 28, 2013.

The transmissivity of the Culebra varies spatially over ten orders of magnitude from east to west in the vicinity of the WIPP site. Transmissivities have been calculated at 1×10^{-7} square feet per day (1×10^{-13} square meters per second) at well SNL-15 east of the WIPP site to 1×10^{3} square feet per day (1×10^{-3} square meters per second) at well H-7 in Nash Draw (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)). The regional flow direction of groundwater in the Culebra is generally south. Figure 1 shows a map of the current Culebra monitoring well locations.

2.0 Summary of Groundwater Activities

Permit required routine groundwater monitoring activities include groundwater quality sampling, groundwater level monitoring, and the pressure density survey. Supporting activities during this reporting period included well maintenance and reference elevation surveys. Table 1 contains a list of the active Culebra wells monitored through February 2013.

Monthly groundwater level data and yearly pressure density data were gathered from 43 Culebra wells across the WIPP region. Well C-2737 is equipped with a production-injection packer (PIP) to allow groundwater level surveillance of different hydrologic zones within the same well. The 6 redundant wells on the H-19 pad are measured quarterly for water level and annually for fluid density. Monthly water levels were not taken where access was poor, or in certain wells when testing equipment was present, blocking access to the well.

Table 1 - Culebra Wells Monitored September 2012 - February 2013

AEC-7	C-2737(PIP)	ERDA-9	H-02b2	H-03b2	H-04bR	H-05b
H-06bR	H-07b1	H-09bR	H-10c	H-11b4R	H-12	H-15R
H-16	H-17	H-19b0	H-19b2[1]	H-19b3[1]	H-19b4[1]	H-19b5[1]
H-19b6[1]	H-19b7[1]	I-461	SNL-01	SNL-02	SNL-03	SNL-05
SNL-06	SNL-08	SNL-09	SNL-10	SNL-12	SNL-13	SNL-14
SNL-15	SNL-16	SNL-17	SNL-18	SNL-19	WIPP-11	WIPP-13
WIPP-19	WQSP-1	WQSP-2	WQSP-3	WQSP-4	WQSP-5	WQSP-6
1: Redundant wells on H-19 pad, measured quarterly						

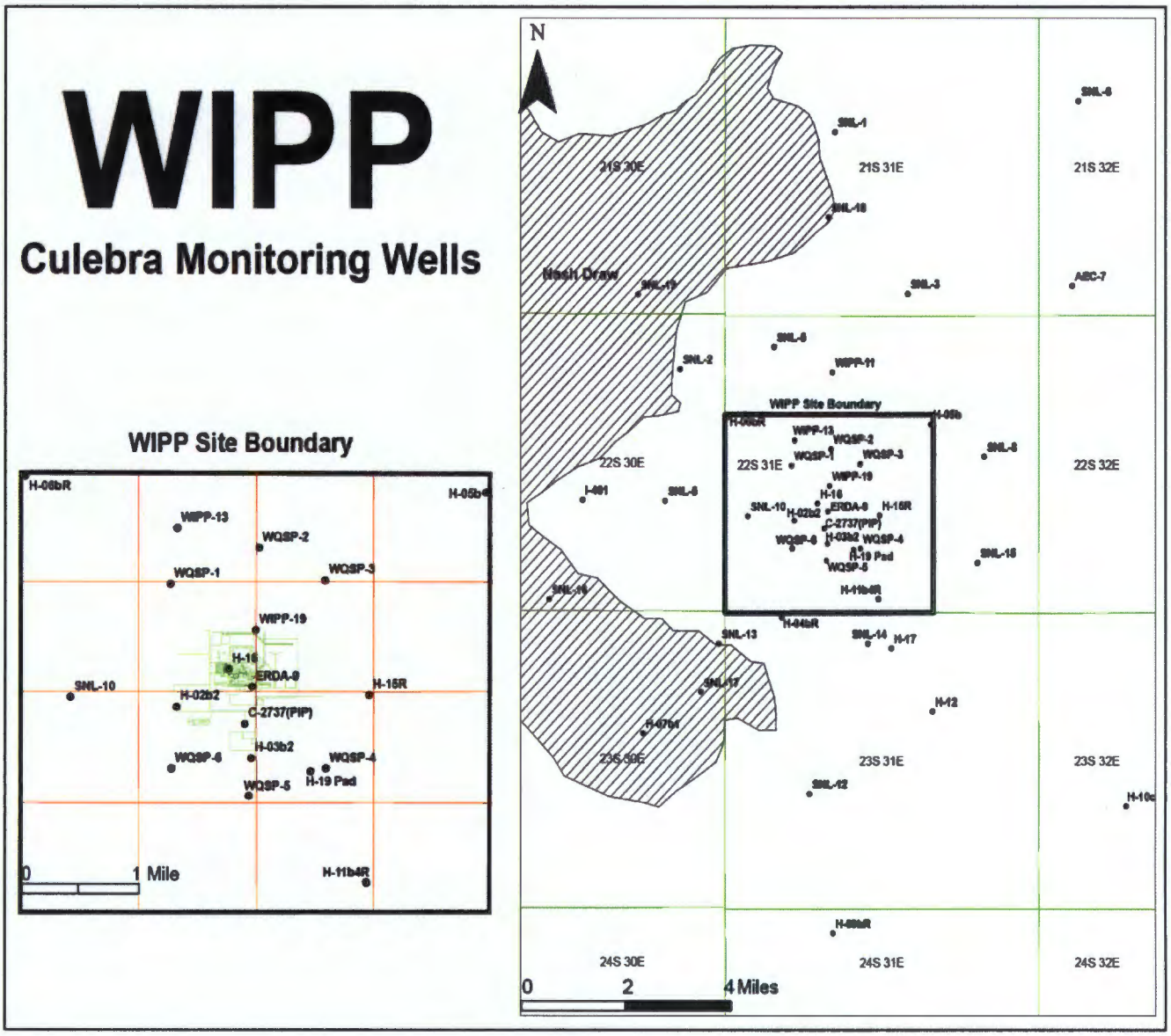


Figure 1 - Culebra Monitoring Wells

2.1 Plugging and Abandonment, Drilling, and Well Maintenance

There were no well plugging, drilling, or maintenance activities during the reporting period.

2.2 Pumping/Testing and Other Activities that Impacted Culebra Water Levels

A pump test at H-9bR in August 2012 affected wells in the southern half of the monitoring network. This is marked on the hydrographs in Appendix 1. Well SNL-13 was affected by oil/gas well drilling approximately 200 yards north of the well during the reporting period. The well has not recovered to pre-drilling levels as of February 2013.

3.0 Fluid Density Survey

Around the WIPP facility, variable total dissolved solids (TDS) concentrations result in variability in groundwater fluid density. The Permittees measure the density of well-bore fluids in Culebra monitoring wells to adjust water levels to their equivalent freshwater head values. This allows more accurate determination of relative heads between wells. In 2012, fluid densities were derived from 49 wells, as shown in Table 2.

Prior to 2007 fluid density was obtained using a mobile trailer-mounted system that obtained data at each well. After 2007 Sandia National Laboratories (SNL) installed a dedicated pressure transducer in each well. This approach employs several calibrated pressure measuring transducers dedicated to given wells at varying times during the year. For the DMP wells (WQSP wells in Table 1), field hydrometer measurements are used. Fluid densities have been adjusted to 70°F since 2009, when it was determined that 70°F is the average Culebra water temperature.

Previous years are also shown in Table 2 for comparison. When historical fluid densities are plotted back to the beginning of SNL continuous measurements in 2007, there does not appear to be overall trends between years. In general, wells to the south and west (i.e. H-9bR and SNL-16) of the WIPP facility tend to have lower fluid densities compared to eastern wells (i.e. H-12 and SNL-15).

4.0 Groundwater Trends

Over the last year (Feb.'12-Feb.'13) Culebra water levels have generally been decreasing across the monitoring region. This may be attributed to a decreasing pressure-head throughout the Culebra system. A larger decrease is seen in wells to the west of WIPP near Nash Draw compared to eastern wells (see hydrographs of SNL-1 & SNL-3 compared to H-5b and H-12).

A few individual wells have shown interesting trends over the past year. SNL-13 has shown the most notable change due to increased oil/gas drilling nearby in the past two years. The well had two noticeable jumps in water level while new oil/gas wells were drilled nearby (see hydrograph). Changes can be attributed to the pressure differential created when the drill penetrated through the Culebra/Rustler zones. SNL-16 and I-461 were affected by a potash mine roof collapse in March 2012 and are slowly recovering to pre-collapse levels.

H-16 has shown a trend of drawdown and recovery cycles each year since it was reconfigured to a Culebra only well in 2008. This may be attributed to its close proximity to the WIPP Air Intake Shaft (AIS). The water level decrease has started in the winter months and the well recovers by mid spring each year.

Hydrographs

The annotated hydrographs as required by the Permit are included in Appendix 1.

Groundwater Level Data

Groundwater data and equivalent freshwater heads recorded for this reporting period are in Appendix 2.

5.0 References

NM4890139088-TSDF. 2012. *Waste Isolation Pilot Plant Hazardous Waste Facility Permit.* New Mexico Environment Department, Santa Fe, New Mexico.

U.S. Department of Energy (DOE). 2009. *WIPP Hazardous Waste Facility Permit Amended Renewal Application.* Carlsbad, New Mexico.

Table 2 – Fluid Density Survey for 2012

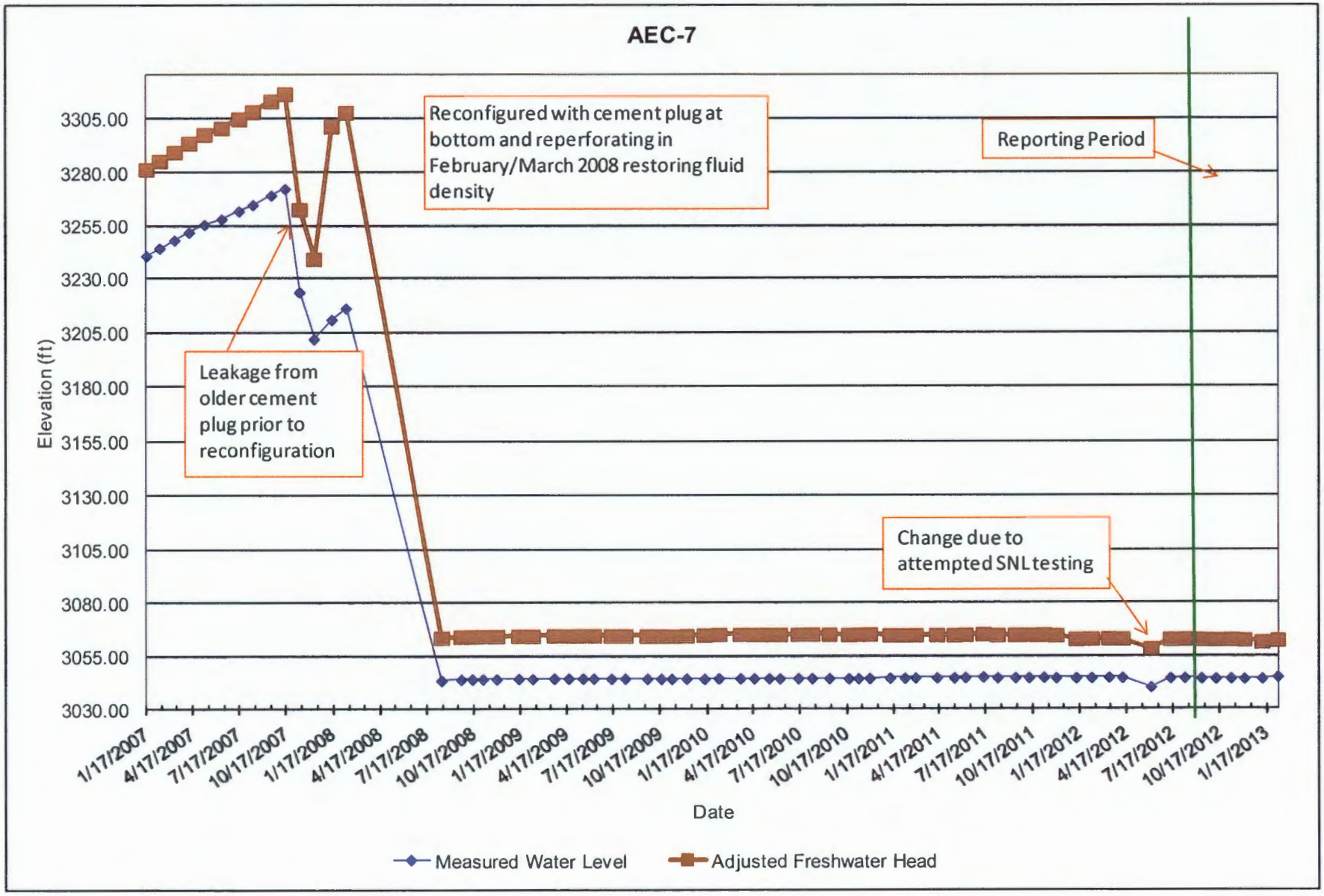
	2010 Fluid Density Survey Result	2010 Conversion to Specific Gravity at 70° F	2011 Fluid Density Survey Result	2011 Conversion to Specific Gravity at 70° F	2012 Fluid Density Survey Result	2012 Conversion to Specific Gravity at 70° F	Notes for 2010-2012 Fluid Density Survey
Well I.D.	Density (g/cc)	Density (g/cc)	Density (g/cc)	Density (g/cc)	Density (g/cc)	Density (g/cc)	
AEC-7	1.076	1.078	1.069	1.071	1.065	1.067	
C-2737	1.025	1.027	1.025	1.027	1.021	1.023	
ERDA-9	1.070	1.072	1.071	1.073	1.071	1.073	
H-02b2	1.011	1.013	1.010	1.012	1.010	1.012	
H-03b2	1.041	1.043	1.039	1.041	1.034	1.036	
H-04bR	1.016	1.018	1.015	1.017	1.015	1.017	
H-05b	1.091	1.093	1.095	1.097	1.093	1.095	
H-06bR	1.035	1.037	1.036	1.038	1.036	1.038	
H-07b1	1.004	1.006	1.004	1.006	1.005	1.007	
H-09c	1.004	1.006	NA	NA	NA	NA	Plugged back to Magenta only in October 2010
H-9bR	NA	NA	1.000*	1.000*	1.000*	1.000*	Replacement well for H-09c-Culebra, drilled in 2010, * Rounded up to 1.000 for 2011 & 2012
H-10c	1.089	1.091	1.092	1.094	1.092	1.094	
H-11b4	1.049	1.051	1.039	1.041	NA	NA	Plugged and abandoned in Nov. 2011
H-11b4R	NA	NA	NA	NA	1.074	1.076	New replacement well to H-11b4 drilled in 2011
H-12	1.105	1.107	1.105	1.107	1.111	1.113	
H-15R	1.117	1.119	1.117	1.119	1.116	1.118	
H-16	1.035	1.037	1.035	1.037	1.035	1.037	
H-17	1.134	1.136	1.134	1.136	1.131	1.133	
H-19b0	1.066	1.068	1.064	1.066	1.064	1.066	
H-19b2	1.068	1.070	1.059	1.061	1.060	1.062	
H-19b3	1.069	1.071	1.052	1.054	1.064	1.066	
H-19b4	1.063	1.065	1.054	1.056	1.065	1.067	
H-19b5	1.066	1.068	1.062	1.064	1.067	1.069	
H-19b6	1.073	1.075	1.061	1.063	1.068	1.070	
H-19b7	1.071	1.073	1.062	1.064	1.070	1.072	
I-461	1.003	1.005	1.000*	1.000*	1.000*	1.000*	* Rounded up to 1.000 for 2011 & 2012
SNL-01	1.026	1.028	1.029	1.031	1.027	1.029	
SNL-02	1.007	1.009	1.007	1.009	1.007	1.009	
SNL-03	1.026	1.028	1.026	1.028	1.026	1.028	
SNL-05	1.006	1.008	1.007	1.009	1.007	1.009	
SNL-06	1.231	1.233	1.239	1.241	1.241	1.243	
SNL-08	1.092	1.094	1.092	1.094	1.092	1.094	
SNL-09	1.016	1.018	1.016	1.018	1.016	1.018	
SNL-10	1.007	1.009	1.007	1.009	1.007	1.009	
SNL-12	1.003	1.005	1.003	1.005	1.004	1.006	
SNL-13	1.021	1.023	1.023	1.025	1.016	1.018	
SNL-14	1.044	1.046	1.045	1.047	1.044	1.046	
SNL-15	1.226	1.228	1.230	1.232	1.227	1.229	
SNL-16	1.007	1.009	1.006	1.008	1.007	1.009	
SNL-17	1.002	1.004	1.004	1.006	1.003	1.005	
SNL-18	1.004	1.006	1.005	1.007	1.003	1.005	
SNL-19	1.004	1.006	1.004	1.006	1.005	1.007	
WIPP-11	1.035	1.037	1.036	1.038	1.036	1.038	
WIPP-13	1.042	1.044	1.041	1.043	1.039	1.041	
WIPP-19	1.049	1.051	1.050	1.052	1.050	1.052	
WQSP-1	1.047	1.049	1.047	1.049	1.049	1.051	Average Round 34, field hydrometer
WQSP-2	1.045	1.047	1.046	1.048	1.046	1.048	Average Round 34, field hydrometer
WQSP-3	1.144	1.146	1.143	1.146	1.145	1.147	Average Round 34, field hydrometer
WQSP-4	1.076	1.078	1.074	1.076	1.075	1.077	Average Round 34, field hydrometer
WQSP-5	1.026	1.028	1.025	1.027	1.025	1.027	Average Round 34, field hydrometer
WQSP-6	1.014	1.016	1.015	1.017	1.013	1.015	Average Round 34, field hydrometer

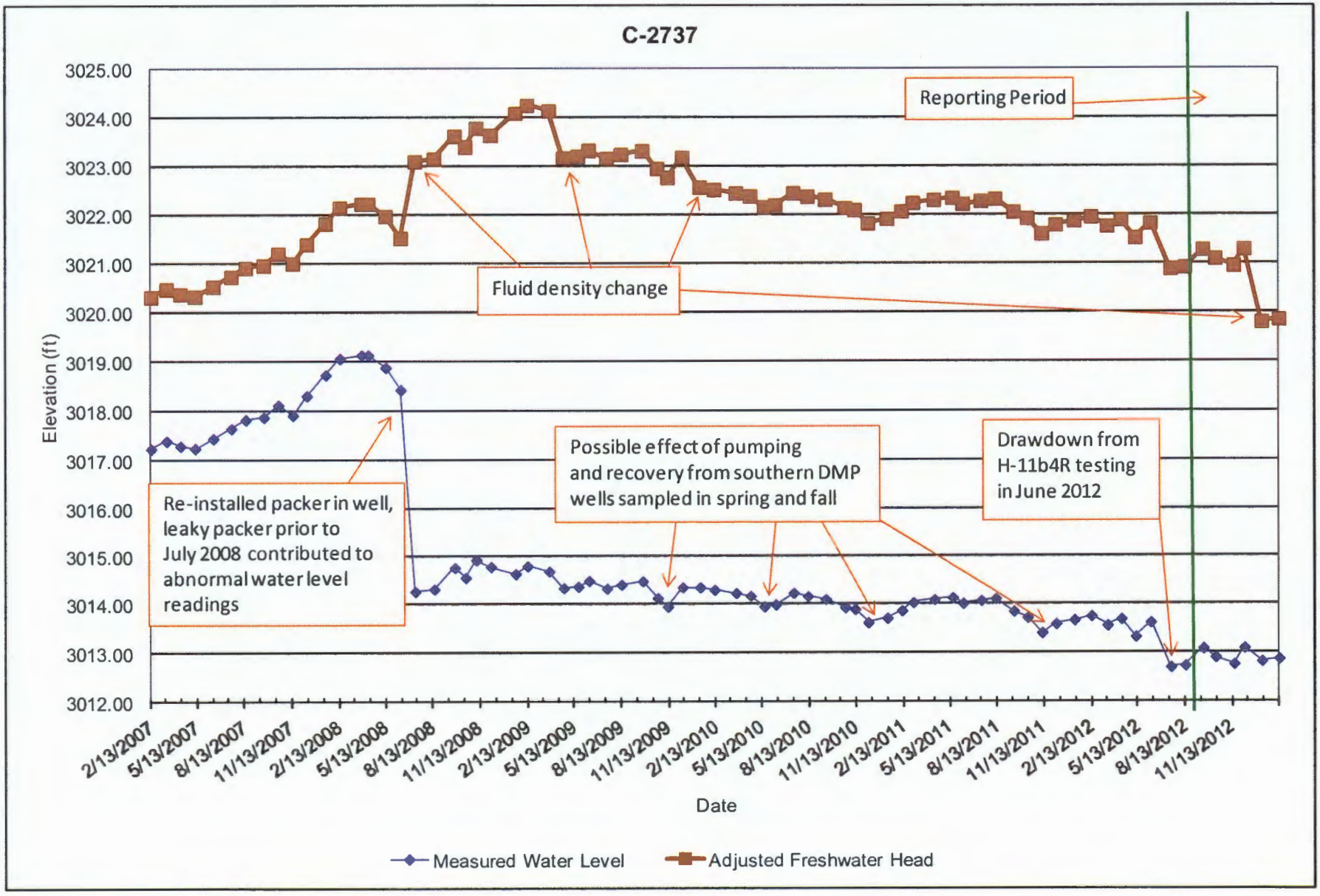
NA: no available measurement

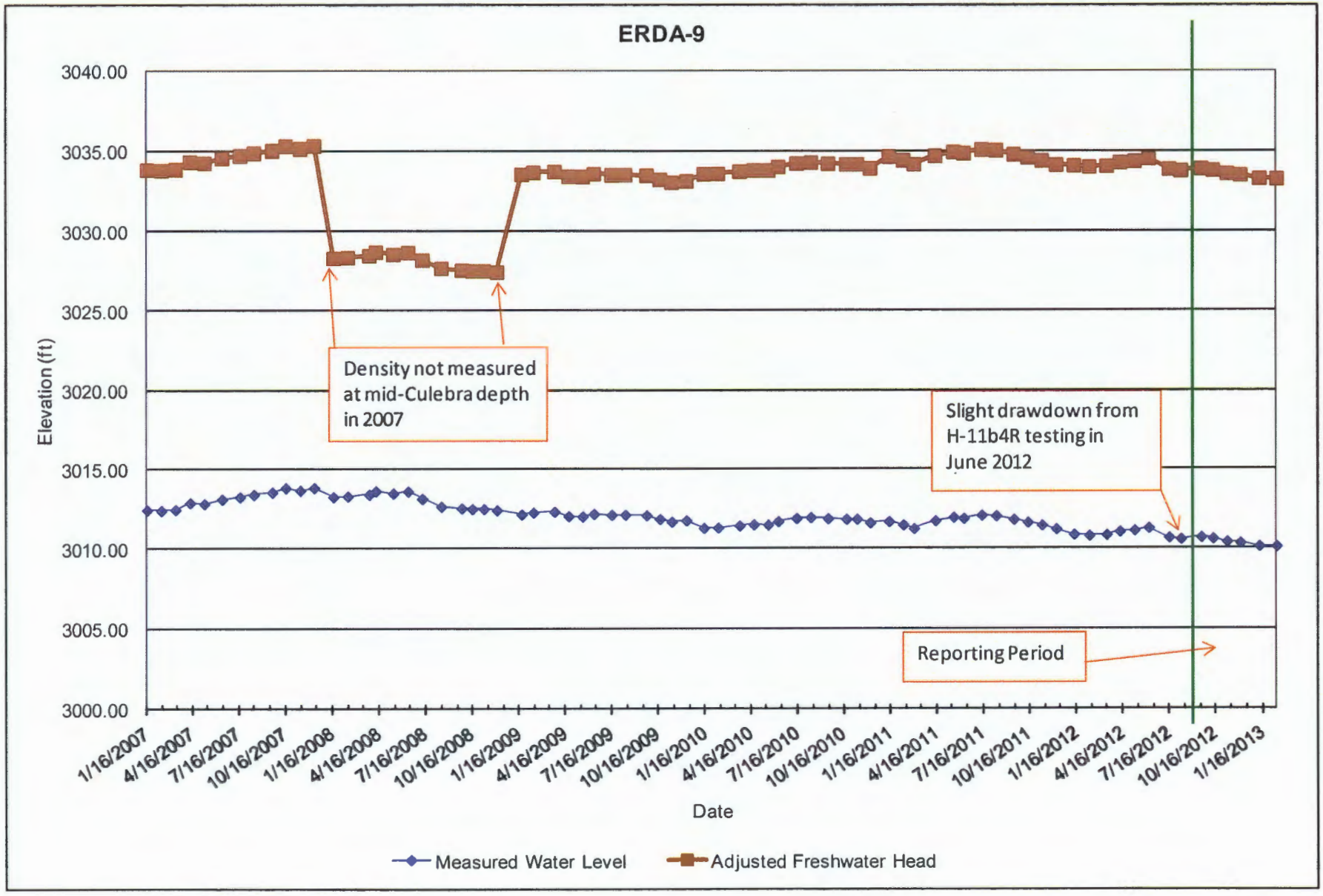
g/cc: grams per cubic centimeter

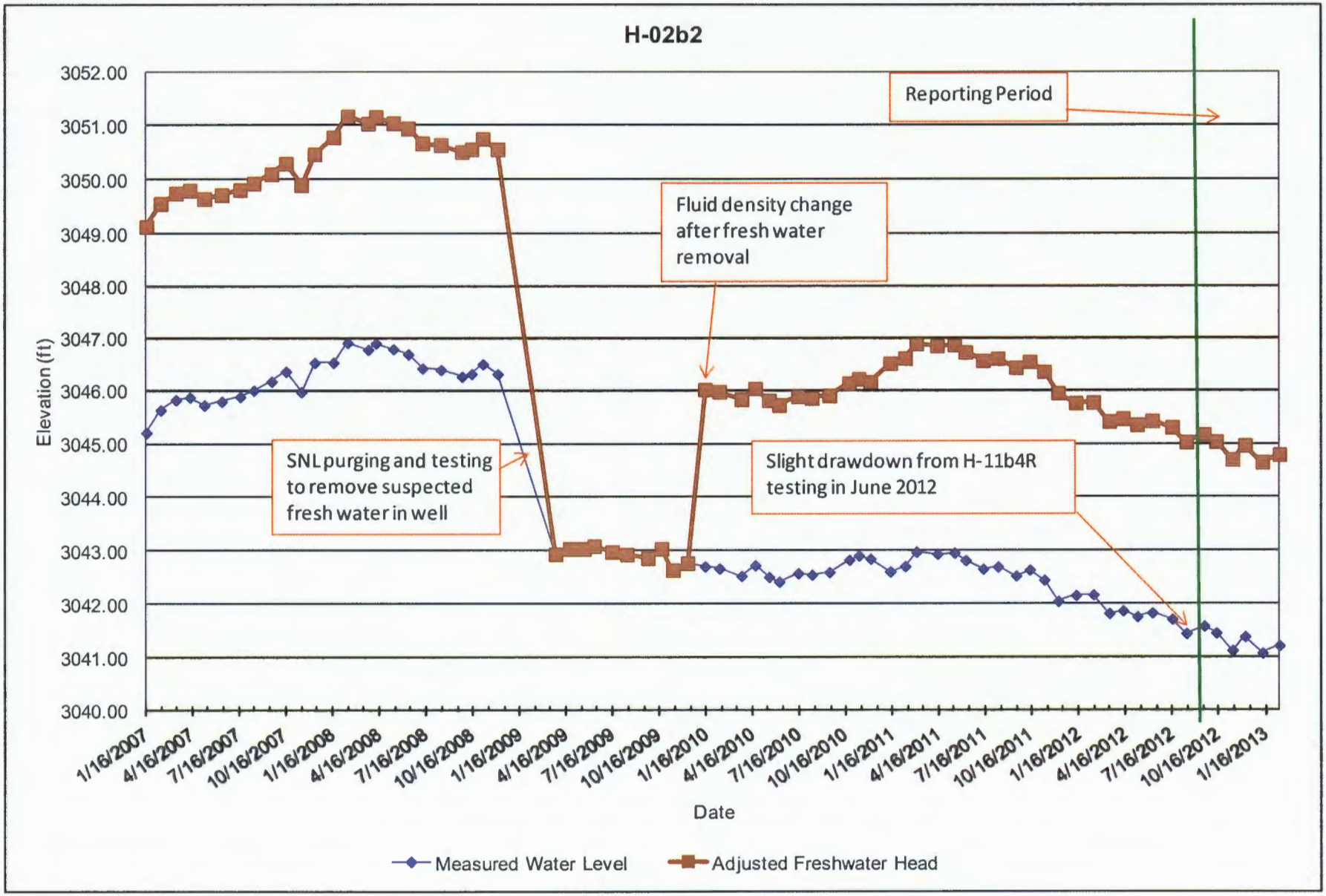
Appendix 1

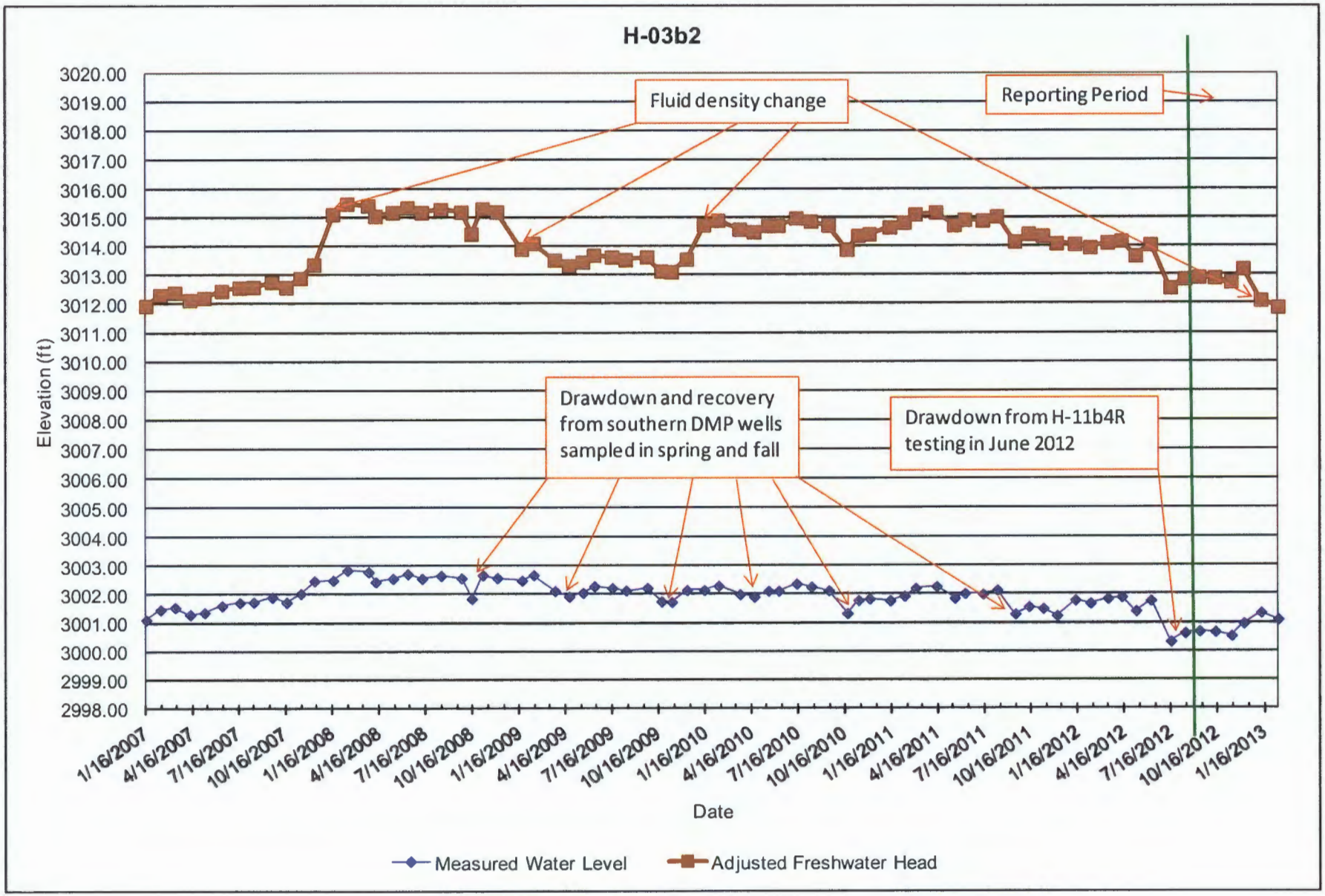
Annotated Hydrographs

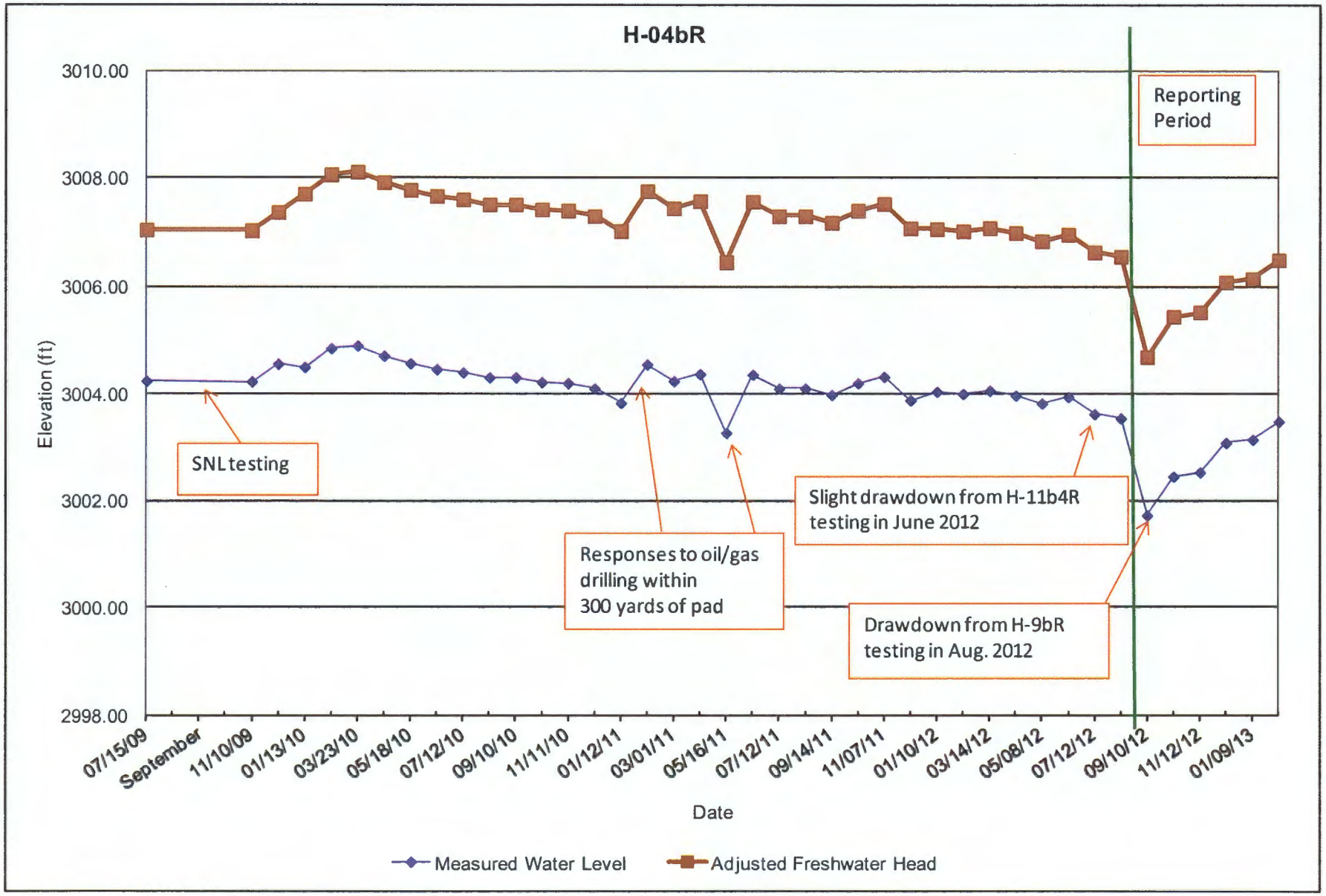

AEC-7
Reconfigured with cement plug at bottom and reperforating in February/March 2008 restoring fluid density
Reporting Period
Leakage from older cement plug prior to reconfiguration
Change due to attempted SNL testing
Elevation (ft)
3305.00
3280.00
3255.00
3230.00
3205.00
3180.00
3155.00
3130.00
3105.00
3080.00
3055.00
3030.00
1/17/2007
4/17/2007
7/17/2007
10/17/2007
1/17/2008
4/17/2008
7/17/2008
10/17/2008
1/17/2009
4/17/2009
7/17/2009
10/17/2009
1/17/2010
4/17/2010
7/17/2010
10/17/2010
1/17/2011
4/17/2011
7/17/2011
10/17/2011
1/17/2012
4/17/2012
7/17/2012
10/17/2012
1/17/2013
Date
Measured Water Level
Adjusted Freshwater Head

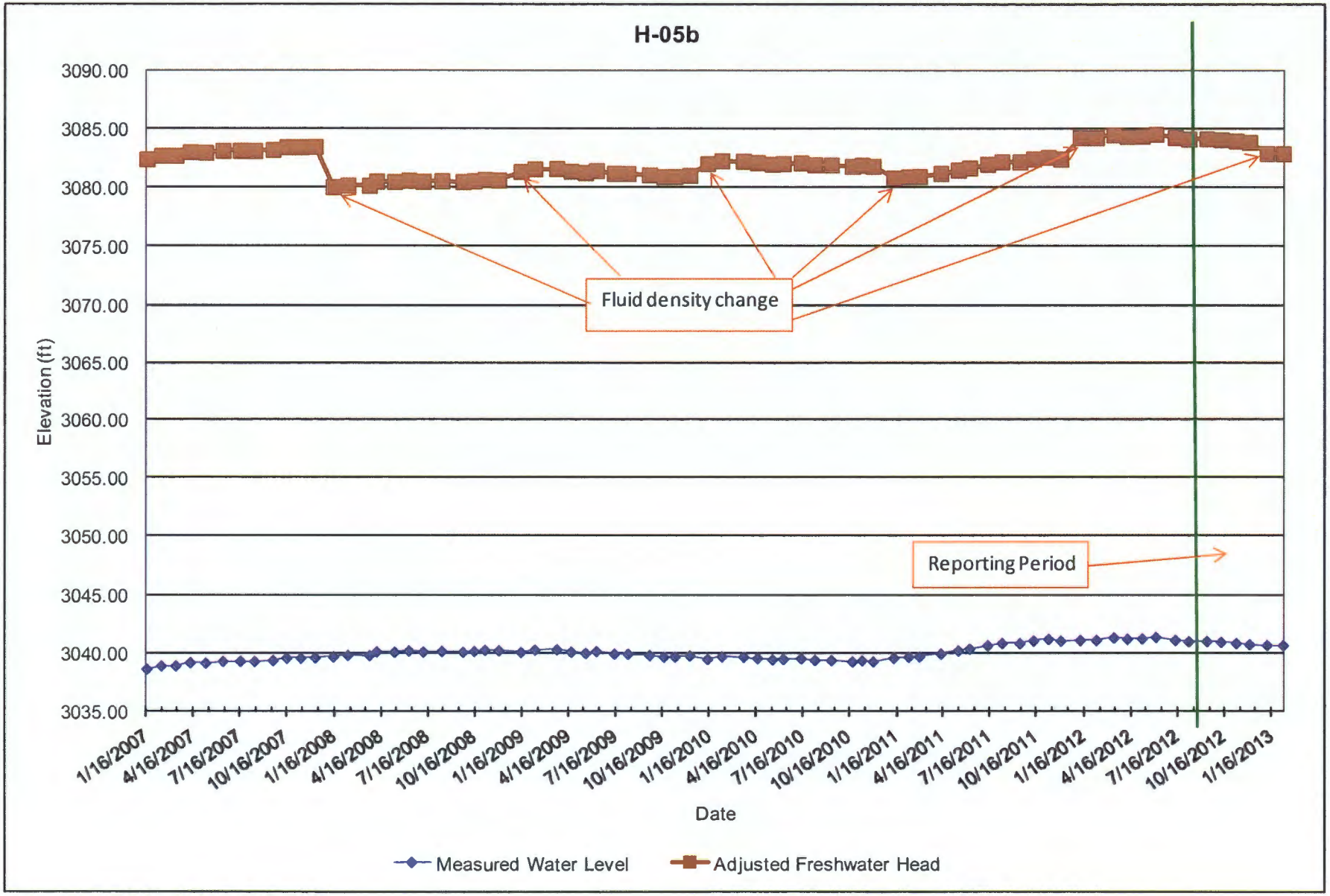

C-2737
Elevation (ft)
3025.00
3024.00
3023.00
3022.00
3021.00
3020.00
3019.00
3018.00
3017.00
3016.00
3015.00
3014.00
3013.00
3012.00
Reporting Period
Fluid density change
Re-installed packer in well, leaky packer prior to July 2008 contributed to abnormal water level readings
Possible effect of pumping and recovery from southern DMP wells sampled in spring and fall
Drawdown from H-11b4R testing in June 2012
2/13/2007
5/13/2007
8/13/2007
11/13/2007
2/13/2008
5/13/2008
8/13/2008
11/13/2008
2/13/2009
5/13/2009
8/13/2009
11/13/2009
2/13/2010
5/13/2010
8/13/2010
11/13/2010
2/13/2011
5/13/2011
8/13/2011
11/13/2011
2/13/2012
5/13/2012
8/13/2012
11/13/2012
Date
Measured Water Level
Adjusted Freshwater Head


ERDA-9
3040.00
3035.00
3030.00
3025.00
3020.00
3015.00
3010.00
3005.00
3000.00
Elevation (ft)
Density not measured at mid-Culebra depth in 2007
Slight drawdown from H-11b4R testing in June 2012
Reporting Period
1/16/2007
4/16/2007
7/16/2007
10/16/2007
1/16/2008
4/16/2008
7/16/2008
10/16/2008
1/16/2009
4/16/2009
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
1/16/2012
4/16/2012
7/16/2012
10/16/2012
1/16/2013
Date
Measured Water Level
Adjusted Freshwater Head


H-02b2
Reporting Period
Fluid density change after fresh water removal
SNL purging and testing to remove suspected fresh water in well
Slight drawdown from H-11b4R testing in June 2012
Elevation (ft)
3052.00
3051.00
3050.00
3049.00
3048.00
3047.00
3046.00
3045.00
3044.00
3043.00
3042.00
3041.00
3040.00
1/16/2007
4/16/2007
7/16/2007
10/16/2007
1/16/2008
4/16/2008
7/16/2008
10/16/2008
1/16/2009
4/16/2009
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
1/16/2012
4/16/2012
7/16/2012
10/16/2012
1/16/2013
Date
Measured Water Level
Adjusted Freshwater Head


H-03b2
Fluid density change
Reporting Period
Drawdown and recovery from southern DMP wells sampled in spring and fall
Drawdown from H-11b4R testing in June 2012
Elevation (ft)
3020.00
3019.00
3018.00
3017.00
3016.00
3015.00
3014.00
3013.00
3012.00
3011.00
3010.00
3009.00
3008.00
3007.00
3006.00
3005.00
3004.00
3003.00
3002.00
3001.00
3000.00
2999.00
2998.00
1/16/2007
4/16/2007
7/16/2007
10/16/2007
1/16/2008
4/16/2008
7/16/2008
10/16/2008
1/16/2009
4/16/2009
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
1/16/2012
4/16/2012
7/16/2012
10/16/2012
1/16/2013
Date
Measured Water Level
Adjusted Freshwater Head


H-04bR
3010.00
3008.00
3006.00
3004.00
3002.00
3000.00
2998.00
Elevation (ft)
Reporting Period
SNL testing
Responses to oil/gas drilling within 300 yards of pad
Slight drawdown from H-11b4R testing in June 2012
Drawdown from H-9bR testing in Aug. 2012
07/15/09
September
11/10/09
01/13/10
03/23/10
05/18/10
07/12/10
09/10/10
11/11/10
01/12/11
03/01/11
05/16/11
07/12/11
09/14/11
11/07/11
01/10/12
03/14/12
05/08/12
07/12/12
09/10/12
11/12/12
01/09/13
Date
Measured Water Level
Adjusted Freshwater Head


H-05b
3090.00
3085.00
3080.00
3075.00
3070.00
3065.00
3060.00
3055.00
3050.00
3045.00
3040.00
3035.00
Elevation (ft)
Fluid density change
Reporting Period
1/16/2007
4/16/2007
7/16/2007
10/16/2007
1/16/2008
4/16/2008
7/16/2008
10/16/2008
1/16/2009
4/16/2009
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
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4/16/2012
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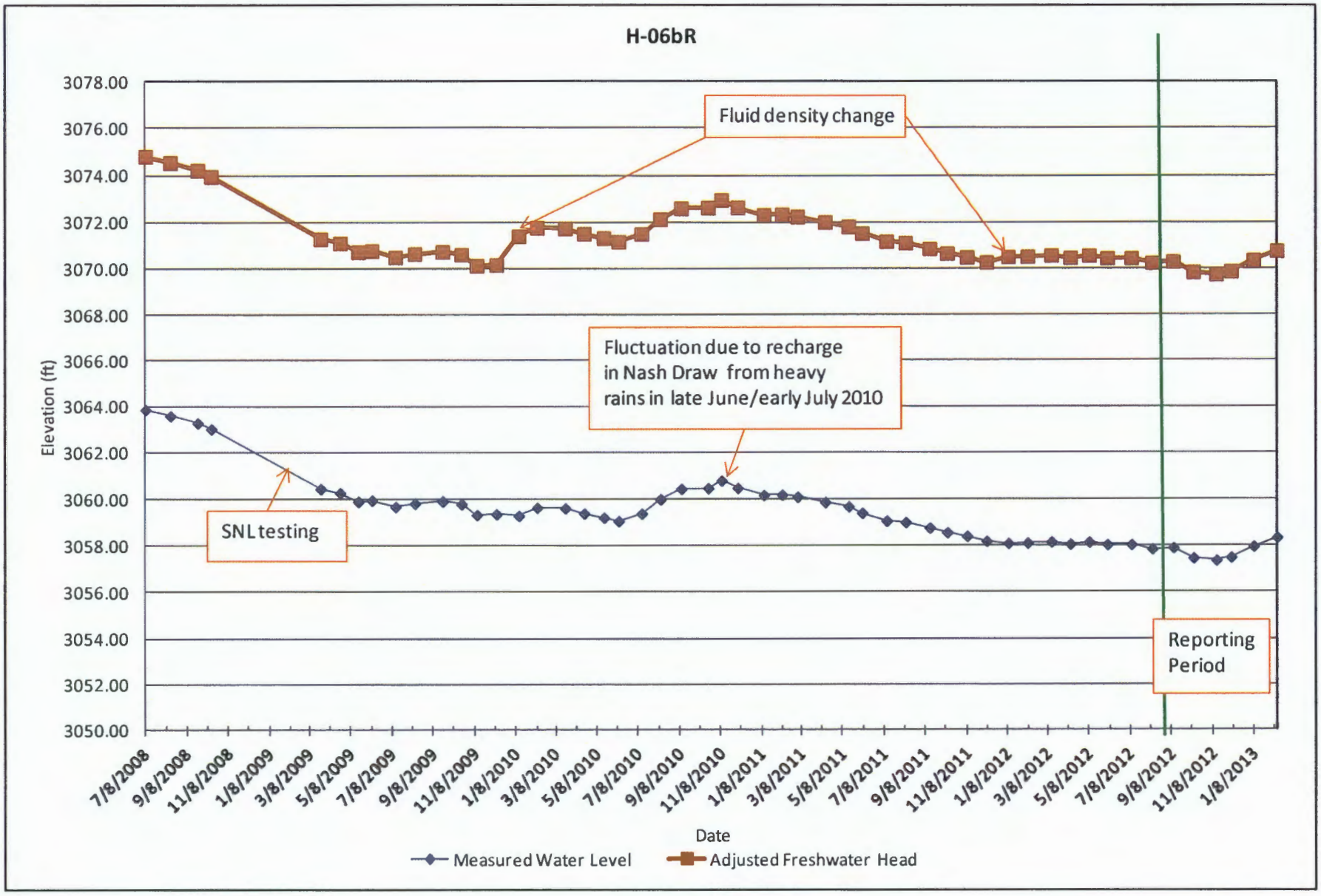
10/16/2012
1/16/2013
Date
Measured Water Level
Adjusted Freshwater Head


H-06bR
Fluid density change
Fluctuation due to recharge in Nash Draw from heavy rains in late June/early July 2010
SNL testing
Reporting Period
Elevation (ft)
3078.00
3076.00
3074.00
3072.00
3070.00
3068.00
3066.00
3064.00
3062.00
3060.00
3058.00
3056.00
3054.00
3052.00
3050.00
7/8/2008
9/8/2008
11/8/2008
1/8/2009
3/8/2009
5/8/2009
7/8/2009
9/8/2009
11/8/2009
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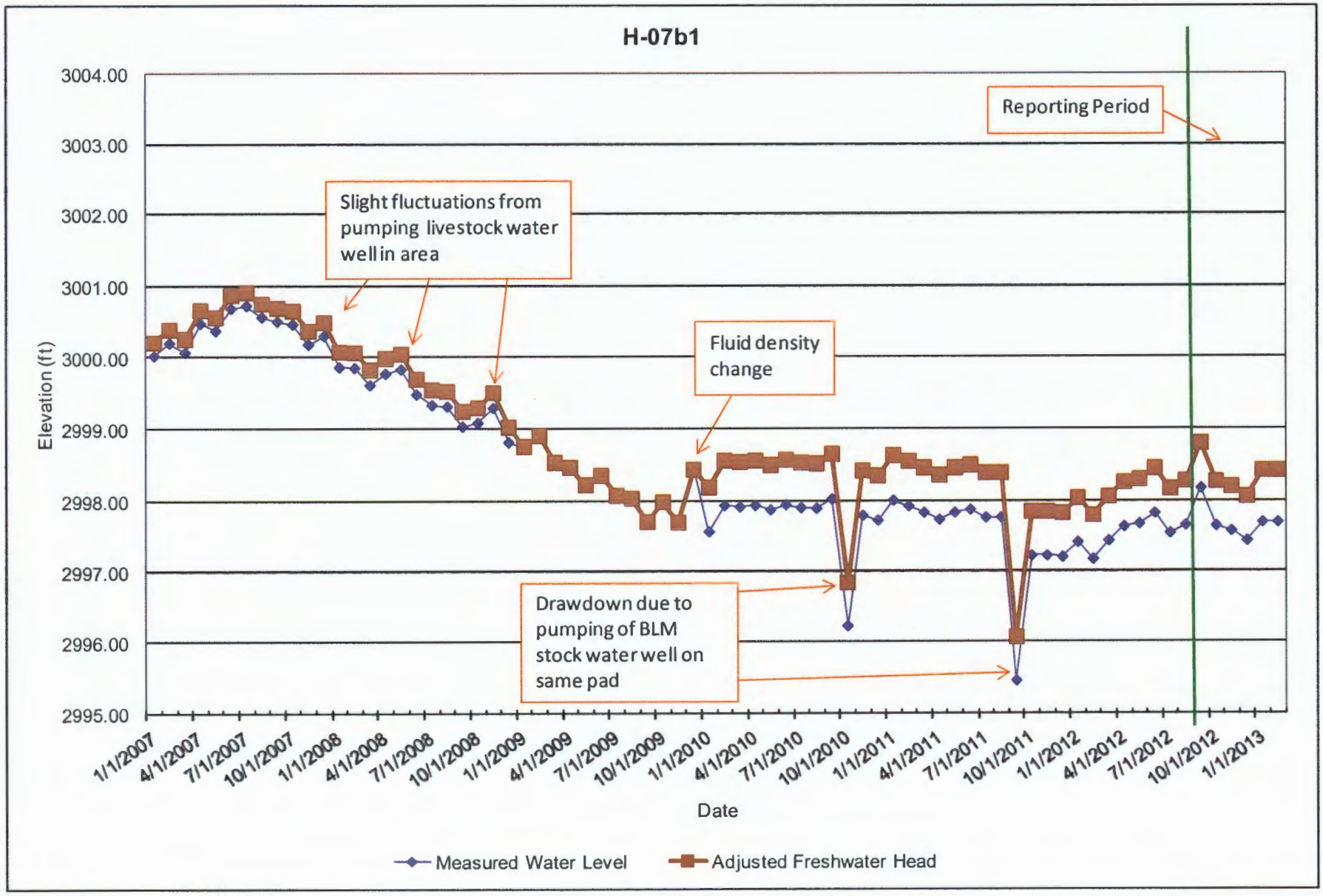
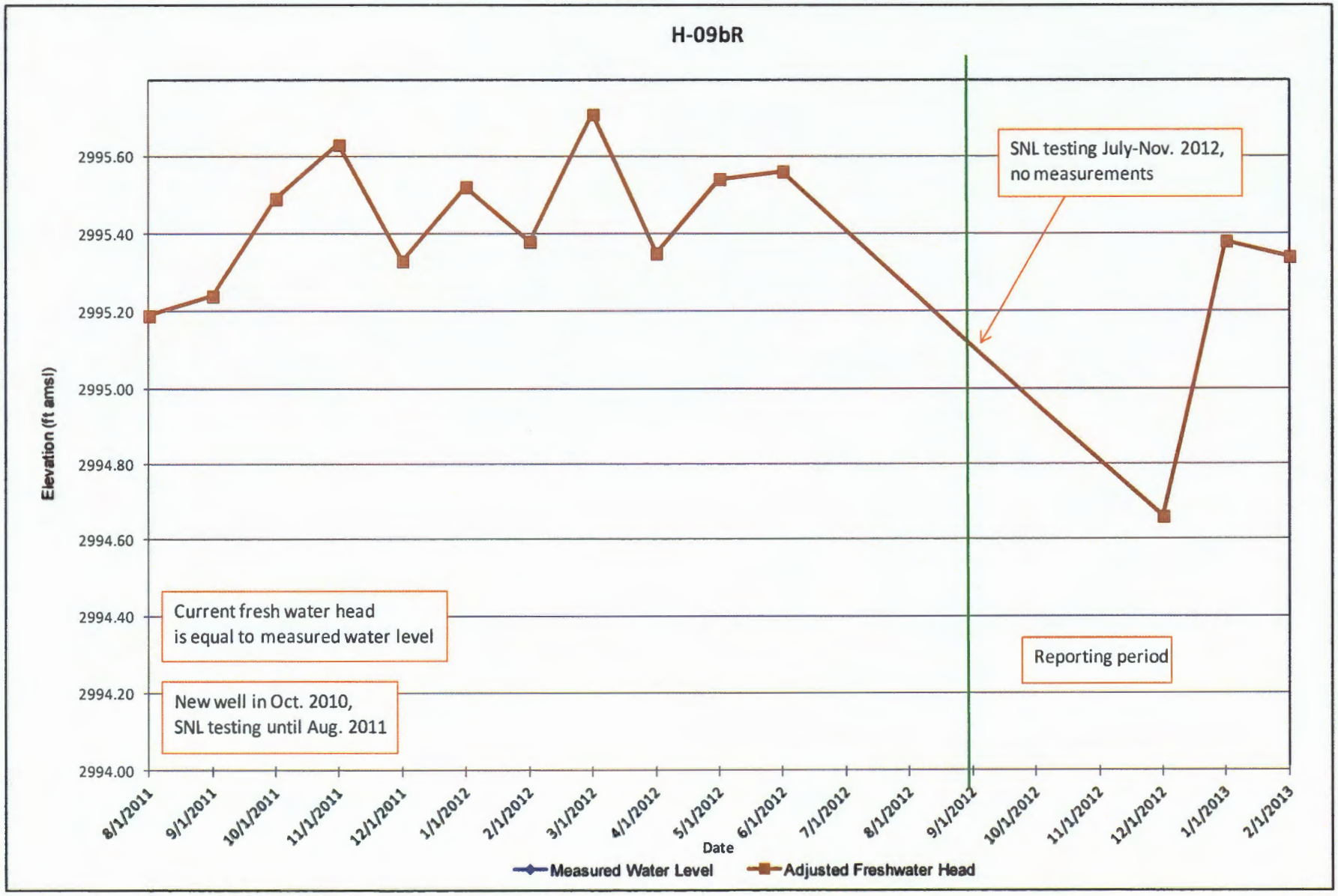
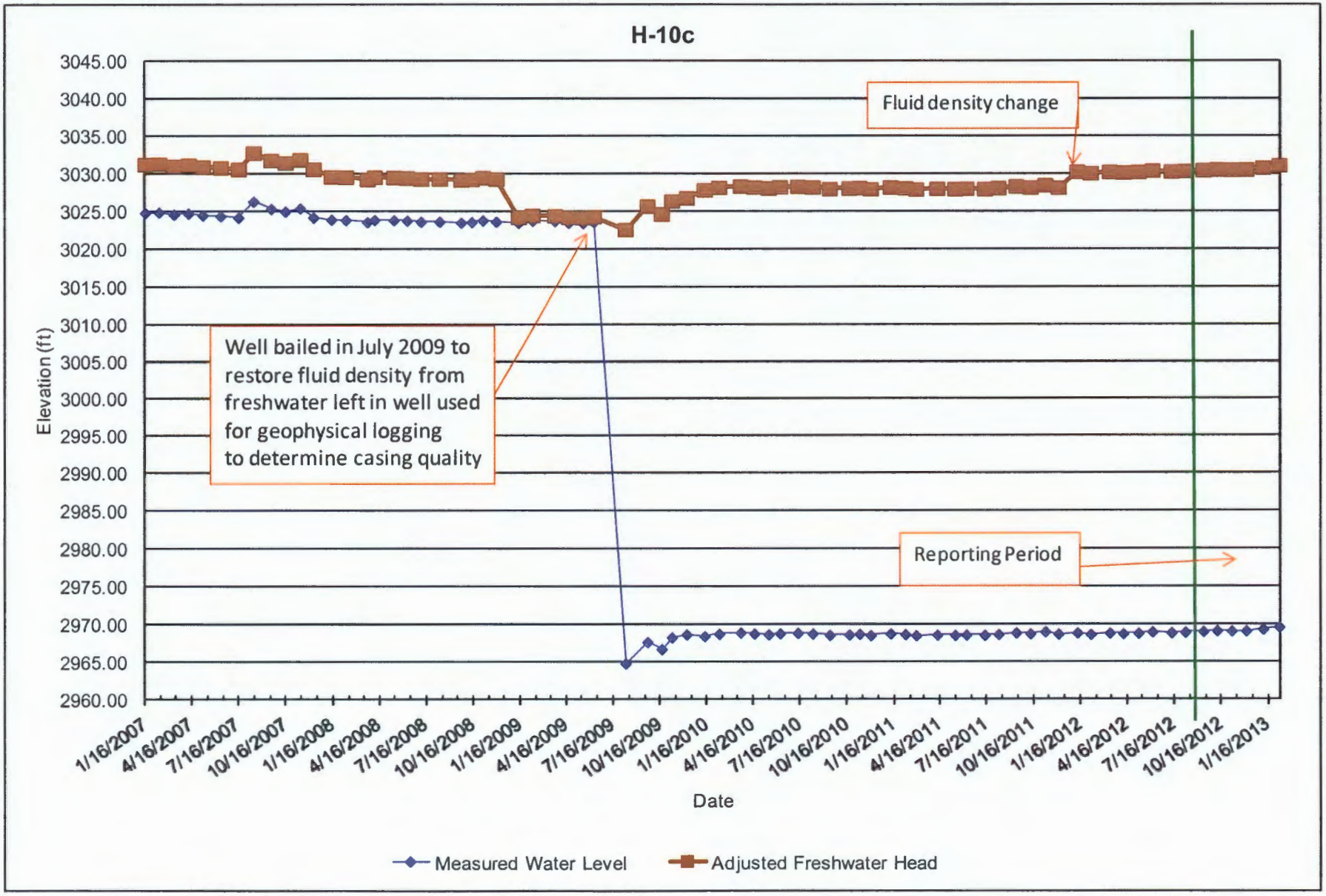
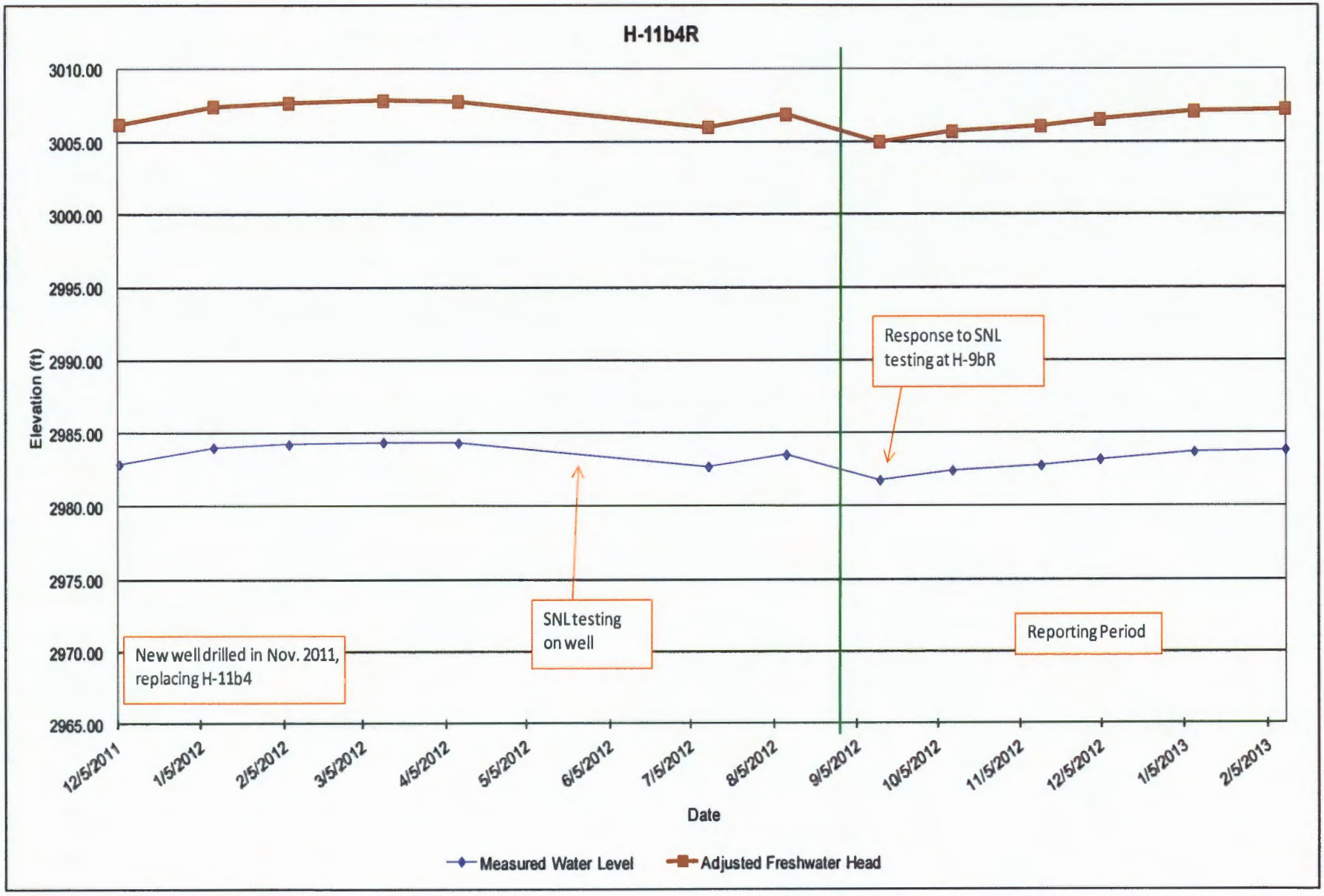
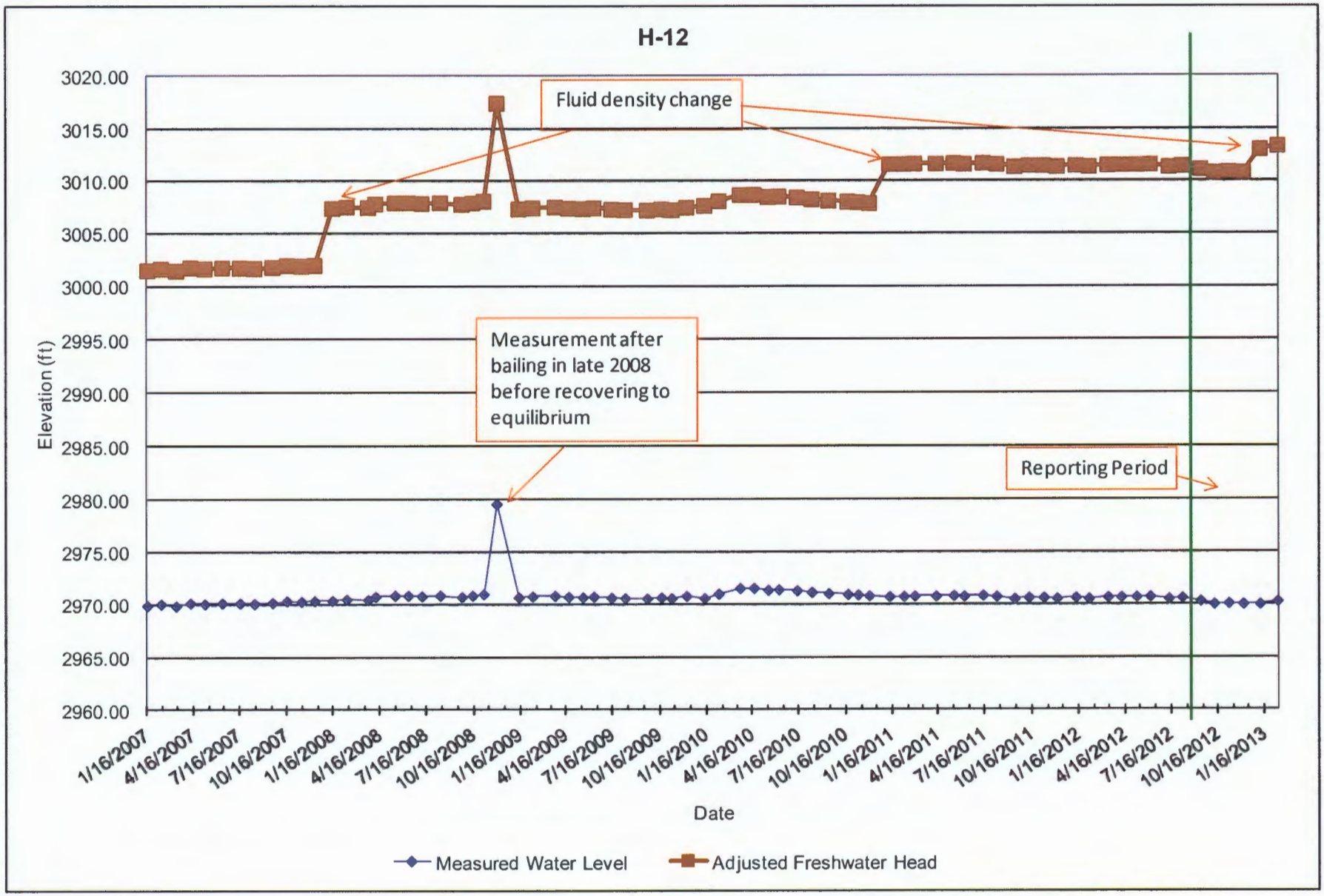
11/8/2010
1/8/2011
3/8/2011
5/8/2011
7/8/2011
9/8/2011
11/8/2011
1/8/2012
3/8/2012
5/8/2012
7/8/2012
9/8/2012
11/8/2012
1/8/2013
Date
Measured Water Level
Adjusted Freshwater Head

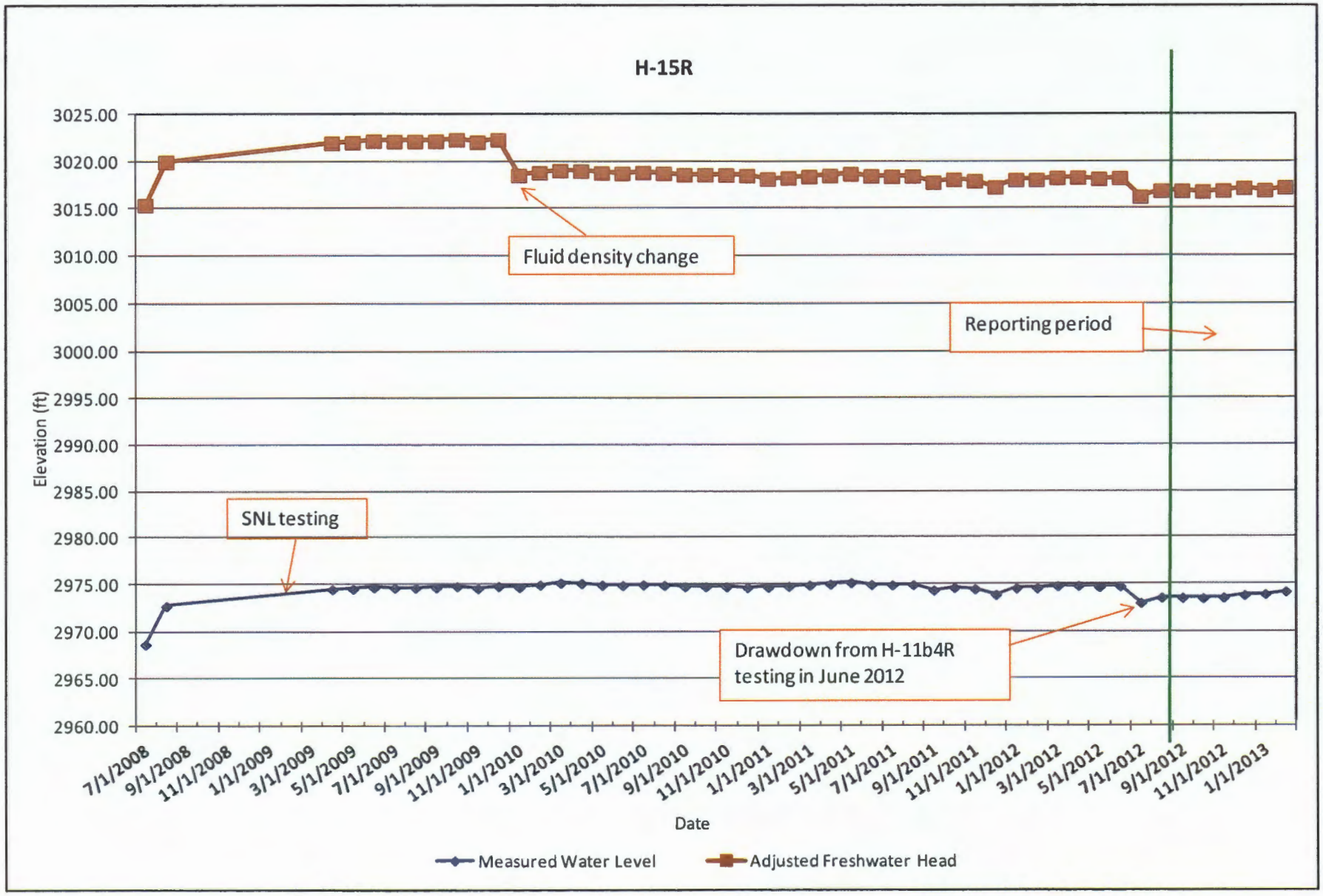

H-07b1
Reporting Period
Slight fluctuations from pumping livestock water well in area
Fluid density change
Drawdown due to pumping of BLM stock water well on same pad
Elevation (ft)
3004.00
3003.00
3002.00
3001.00
3000.00
2999.00
2998.00
2997.00
2996.00
2995.00
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head

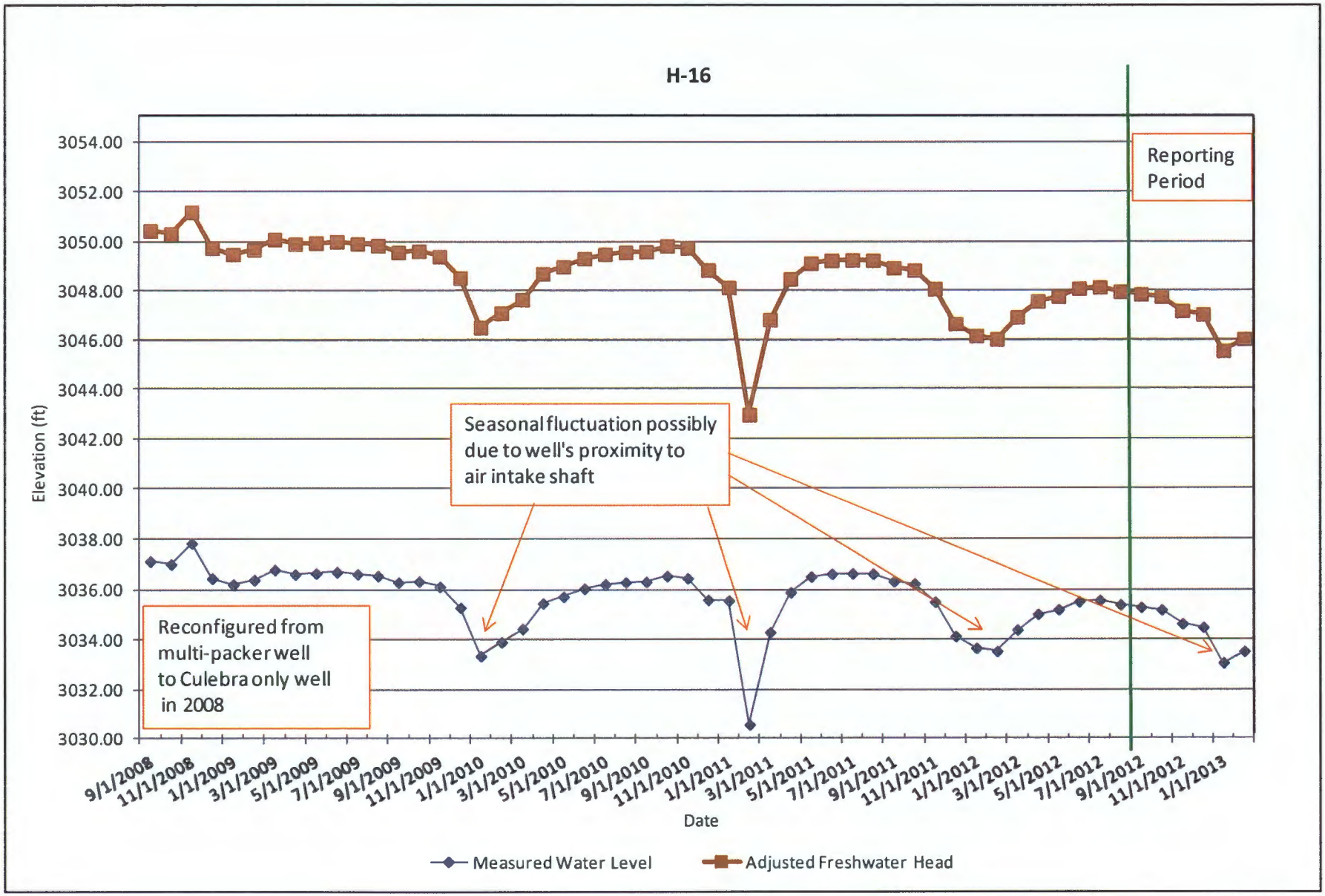

H-09bR
Elevation (ft amsl)
2995.60
2995.40
2995.20
2995.00
2994.80
2994.60
2994.40
2994.20
2994.00
8/1/2011
9/1/2011
10/1/2011
11/1/2011
12/1/2011
1/1/2012
2/1/2012
3/1/2012
4/1/2012
5/1/2012
6/1/2012
7/1/2012
8/1/2012
9/1/2012
10/1/2012
11/1/2012
12/1/2012
1/1/2013
2/1/2013
Date
SNL testing July-Nov. 2012, no measurements
Current fresh water head is equal to measured water level
New well in Oct. 2010, SNL testing until Aug. 2011
Reporting period
Measured Water Level
Adjusted Freshwater Head

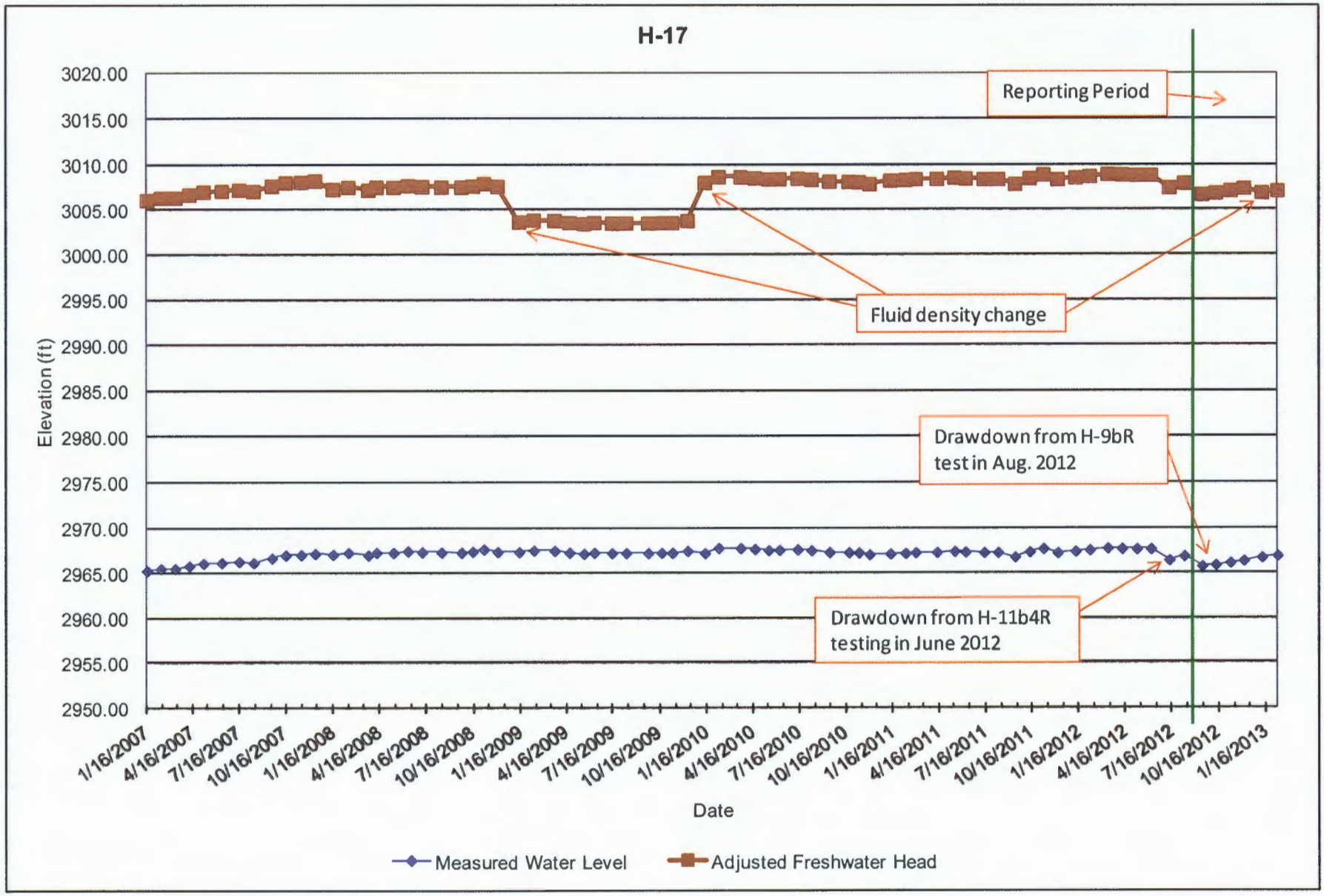

H-10c
Elevation (ft)
3045.00
3040.00
3035.00
3030.00
3025.00
3020.00
3015.00
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
2975.00
2970.00
2965.00
2960.00
Fluid density change
Well bailed in July 2009 to restore fluid density from freshwater left in well used for geophysical logging to determine casing quality
Reporting Period
1/16/2007
4/16/2007
7/16/2007
10/16/2007
1/16/2008
4/16/2008
7/16/2008
10/16/2008
1/16/2009
4/16/2009
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
1/16/2012
4/16/2012
7/16/2012
10/16/2012
1/16/2013
Date
Measured Water Level
Adjusted Freshwater Head

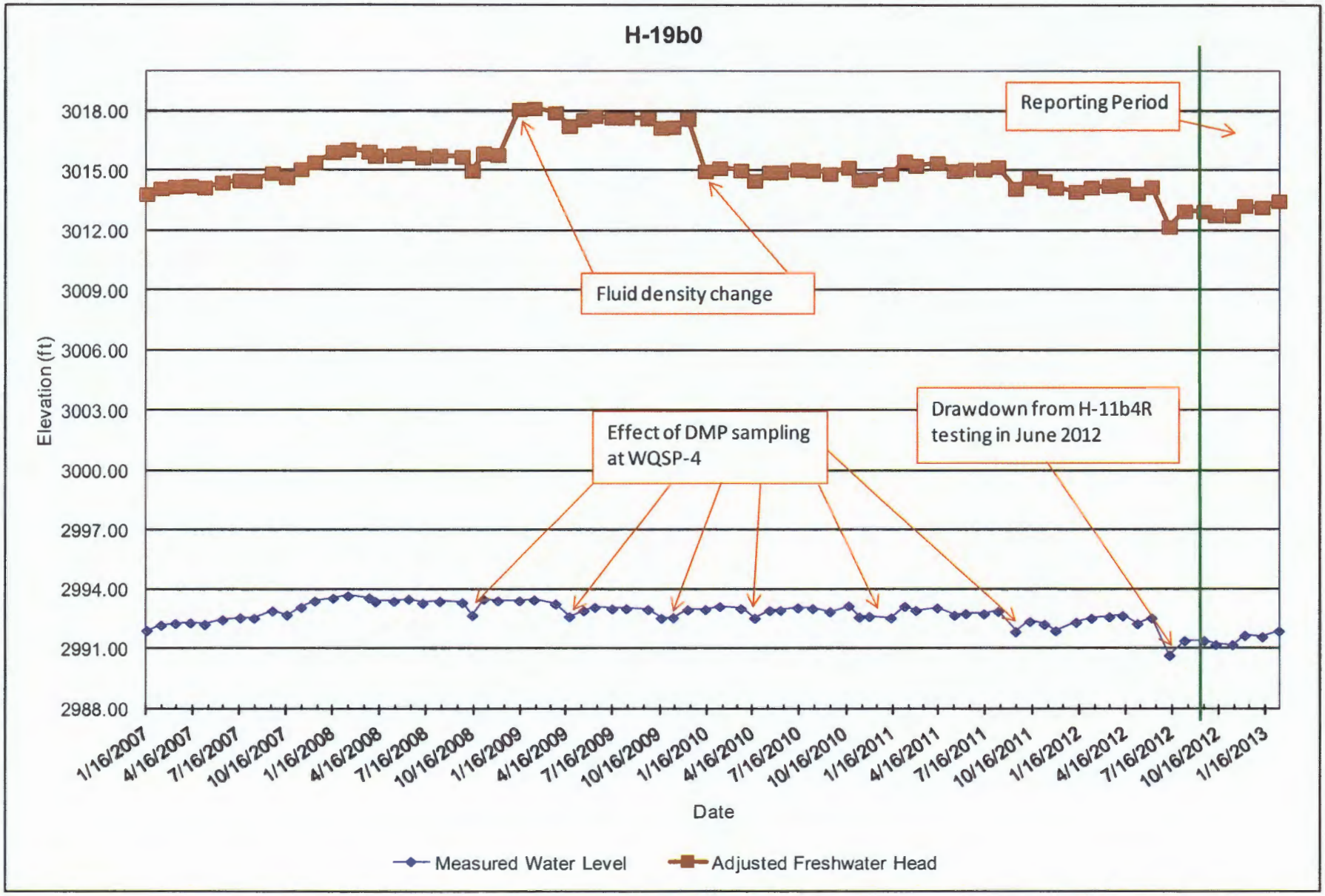

H-11b4R
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
2975.00
2970.00
2965.00
Elevation (ft)
12/5/2011
1/5/2012
2/5/2012
3/5/2012
4/5/2012
5/5/2012
6/5/2012
7/5/2012
8/5/2012
9/5/2012
10/5/2012
11/5/2012
12/5/2012
1/5/2013
2/5/2013
Date
Response to SNL testing at H-9bR
SNL testing on well
Reporting Period
New well drilled in Nov. 2011, replacing H-11b4
Measured Water Level
Adjusted Freshwater Head

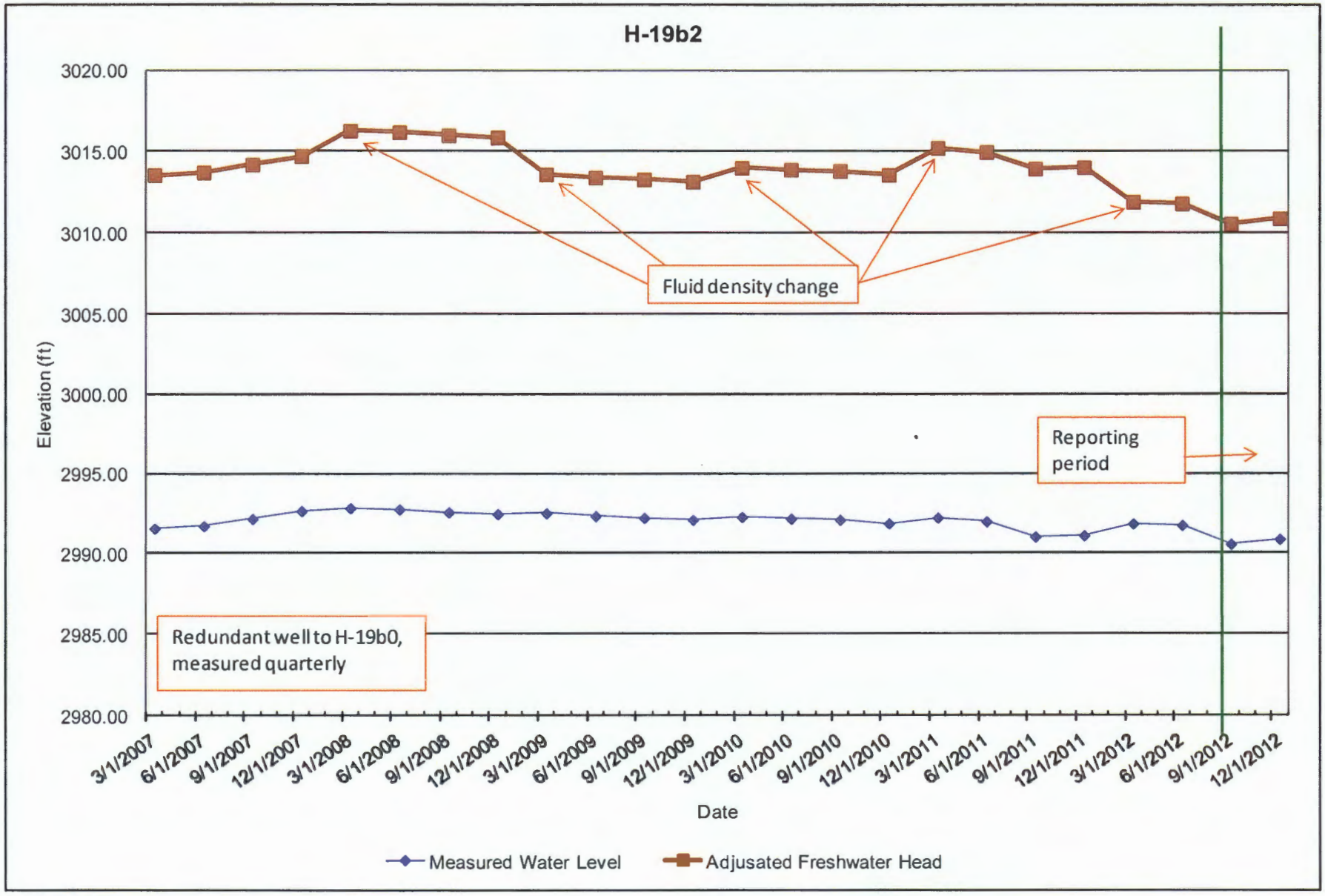

H-12
Fluid density change
Measurement after bailing in late 2008 before recovering to equilibrium
Reporting Period
Elevation (ft)
3020.00
3015.00
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
2975.00
2970.00
2965.00
2960.00
1/16/2007
4/16/2007
7/16/2007
10/16/2007
1/16/2008
4/16/2008
7/16/2008
10/16/2008
1/16/2009
4/16/2009
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
1/16/2012
4/16/2012
7/16/2012
10/16/2012
1/16/2013
Date
Measured Water Level
Adjusted Freshwater Head

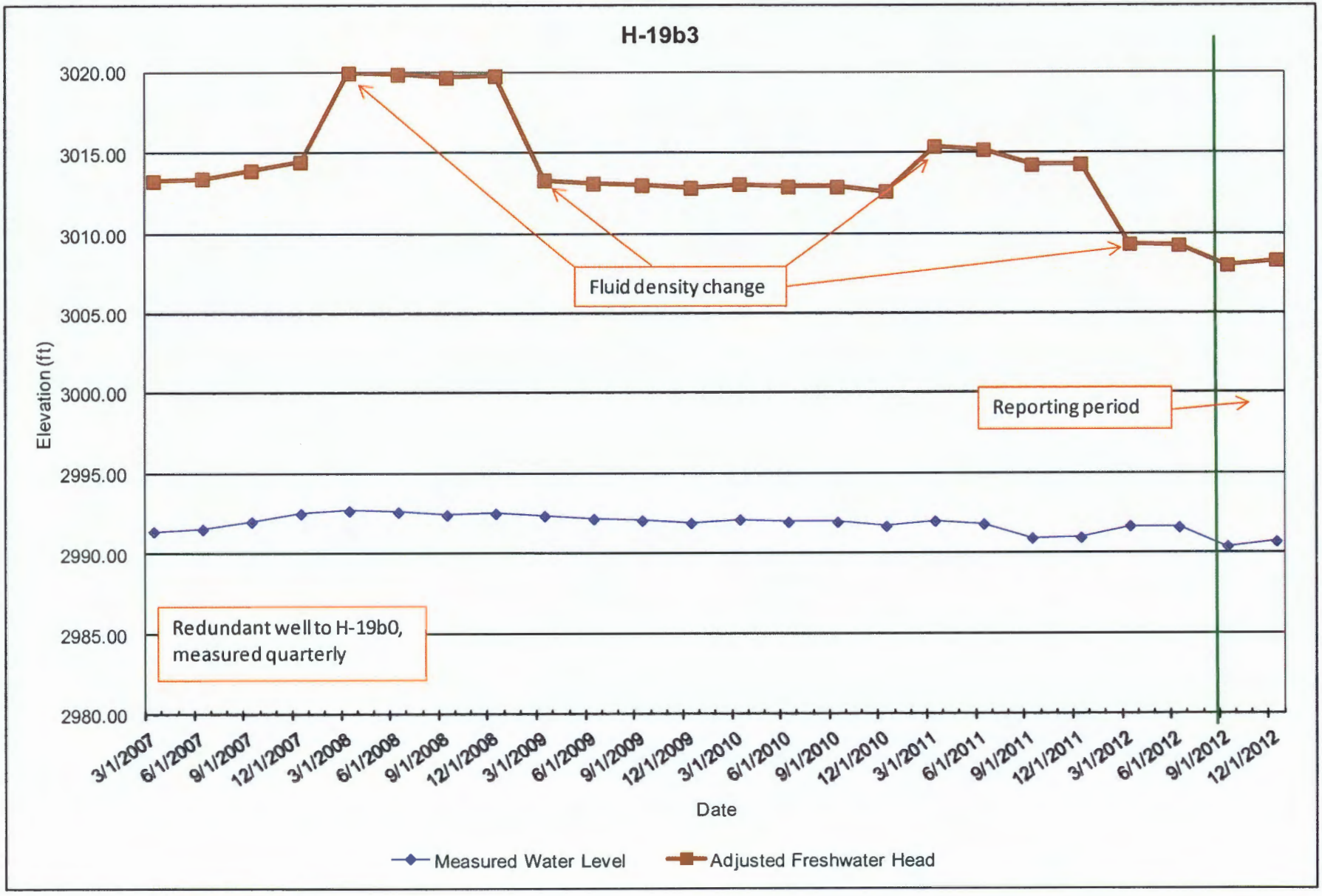

H-15R
3025.00
3020.00
3015.00
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
2975.00
2970.00
2965.00
2960.00
Elevation (ft)
Fluid density change
Reporting period
SNL testing
Drawdown from H-11b4R testing in June 2012
7/1/2008
9/1/2008
11/1/2008
1/1/2009
3/1/2009
5/1/2009
7/1/2009
9/1/2009
11/1/2009
1/1/2010
3/1/2010
5/1/2010
7/1/2010
9/1/2010
11/1/2010
1/1/2011
3/1/2011
5/1/2011
7/1/2011
9/1/2011
11/1/2011
1/1/2012
3/1/2012
5/1/2012
7/1/2012
9/1/2012
11/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head

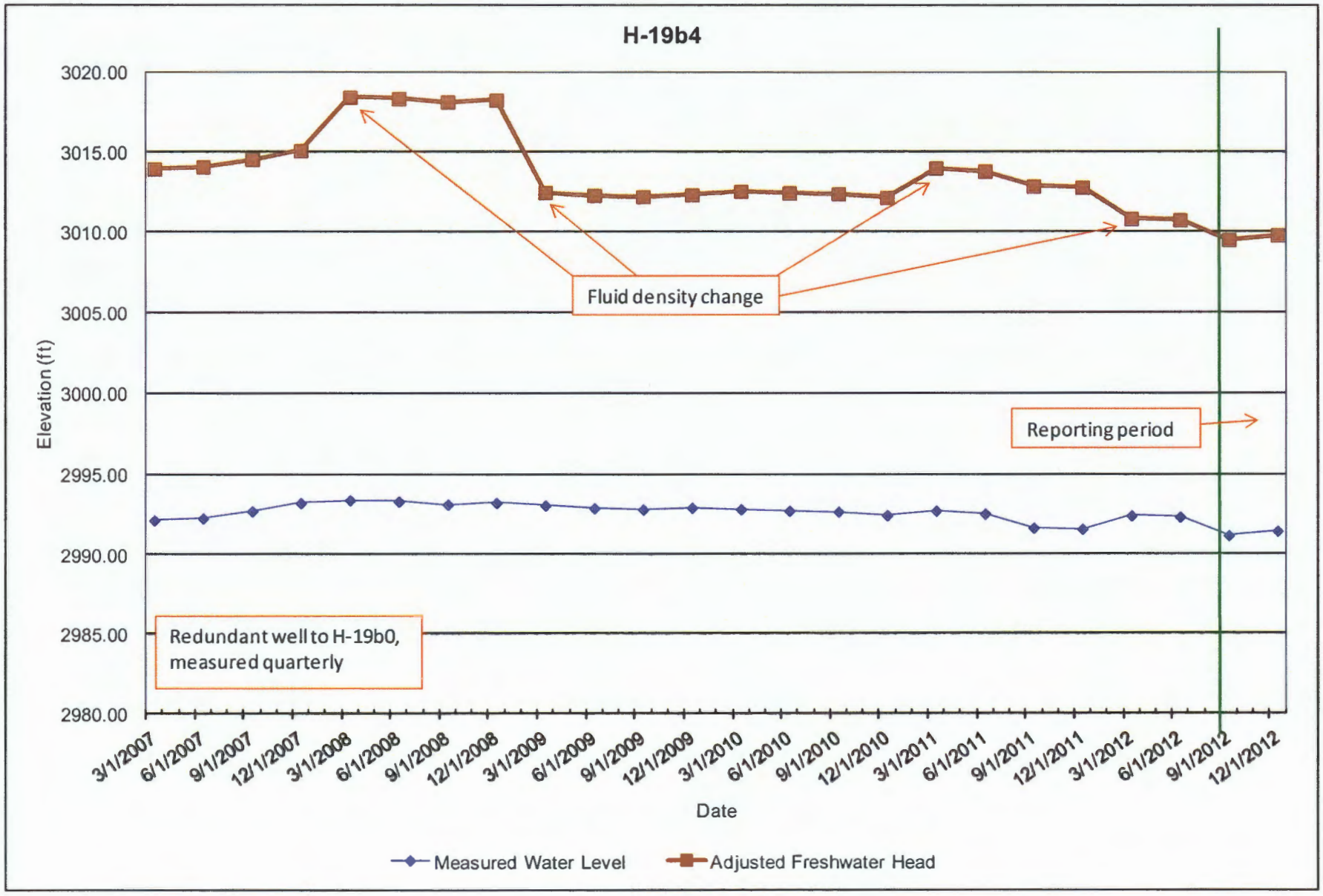

H-16
Reporting Period
Seasonal fluctuation possibly due to well's proximity to air intake shaft
Reconfigured from multi-packer well to Culebra only well in 2008
Elevation (ft)
3054.00
3052.00
3050.00
3048.00
3046.00
3044.00
3042.00
3040.00
3038.00
3036.00
3034.00
3032.00
3030.00
9/1/2008
11/1/2008
1/1/2009
3/1/2009
5/1/2009
7/1/2009
9/1/2009
11/1/2009
1/1/2010
3/1/2010
5/1/2010
7/1/2010
9/1/2010
11/1/2010
1/1/2011
3/1/2011
5/1/2011
7/1/2011
9/1/2011
11/1/2011
1/1/2012
3/1/2012
5/1/2012
7/1/2012
9/1/2012
11/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head

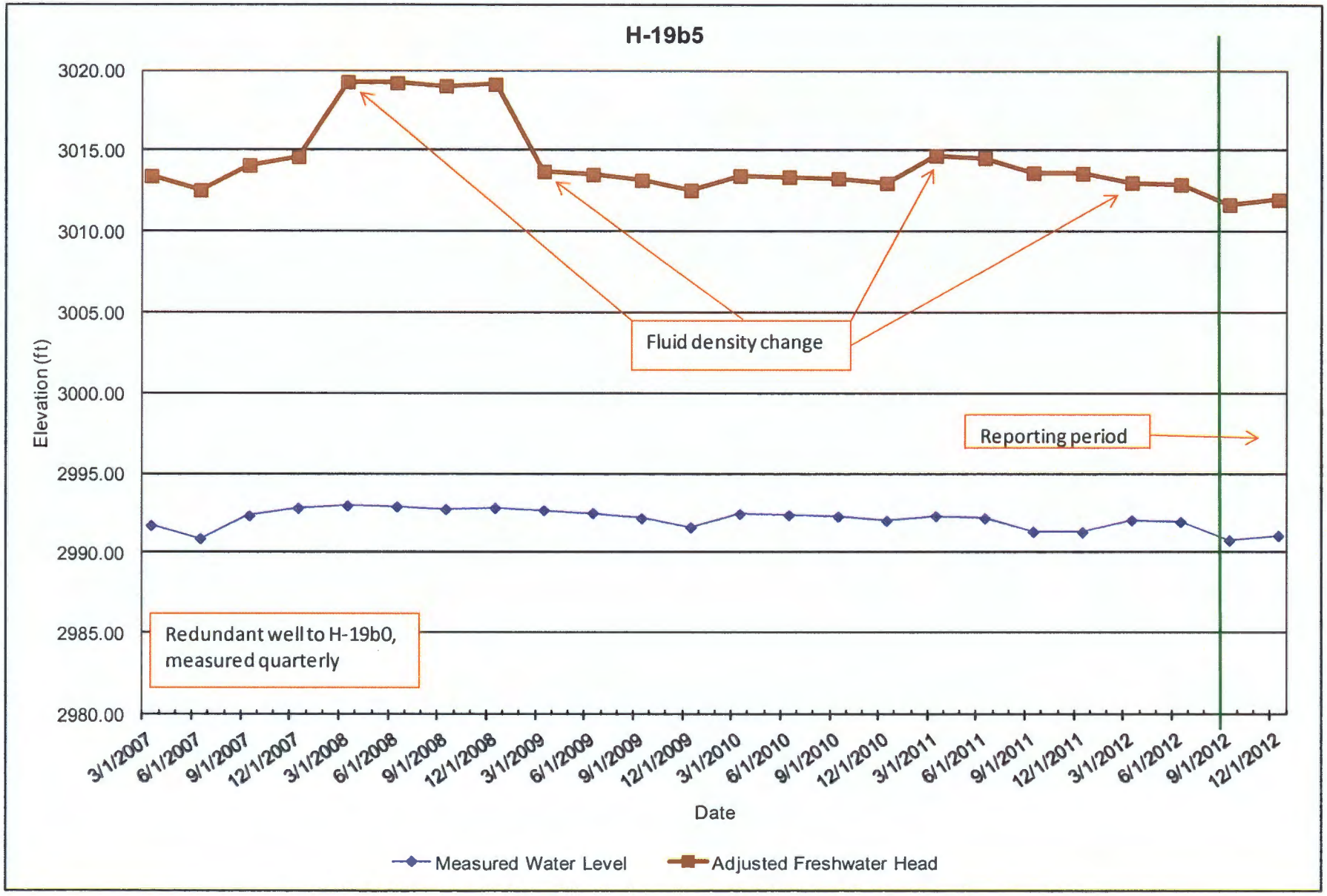

H-17
Reporting Period
Fluid density change
Drawdown from H-9bR test in Aug. 2012
Drawdown from H-11b4R testing in June 2012
Elevation (ft)
3020.00
3015.00
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
2975.00
2970.00
2965.00
2960.00
2955.00
2950.00
1/16/2007
4/16/2007
7/16/2007
10/16/2007
1/16/2008
4/16/2008
7/16/2008
10/16/2008
1/16/2009
4/16/2009
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
1/16/2012
4/16/2012
7/16/2012
10/16/2012
1/16/2013
Date
Measured Water Level
Adjusted Freshwater Head

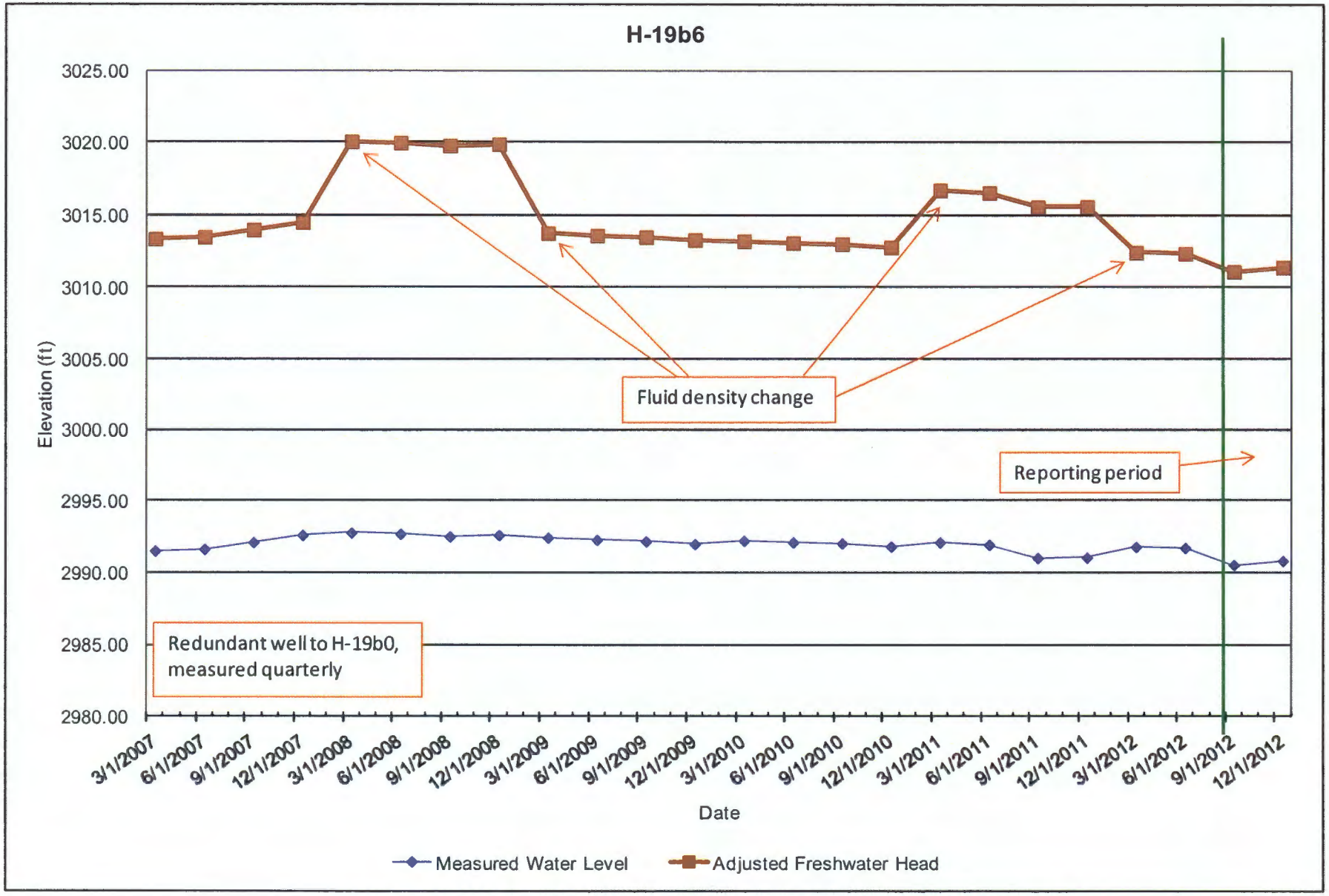

H-19b0
Reporting Period
Fluid density change
Effect of DMP sampling at WQSP-4
Drawdown from H-11b4R testing in June 2012
Elevation (ft)
3018.00
3015.00
3012.00
3009.00
3006.00
3003.00
3000.00
2997.00
2994.00
2991.00
2988.00
1/16/2007
4/16/2007
7/16/2007
10/16/2007
1/16/2008
4/16/2008
7/16/2008
10/16/2008
1/16/2009
4/16/2009
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
1/16/2012
4/16/2012
7/16/2012
10/16/2012
1/16/2013
Date
Measured Water Level
Adjusted Freshwater Head

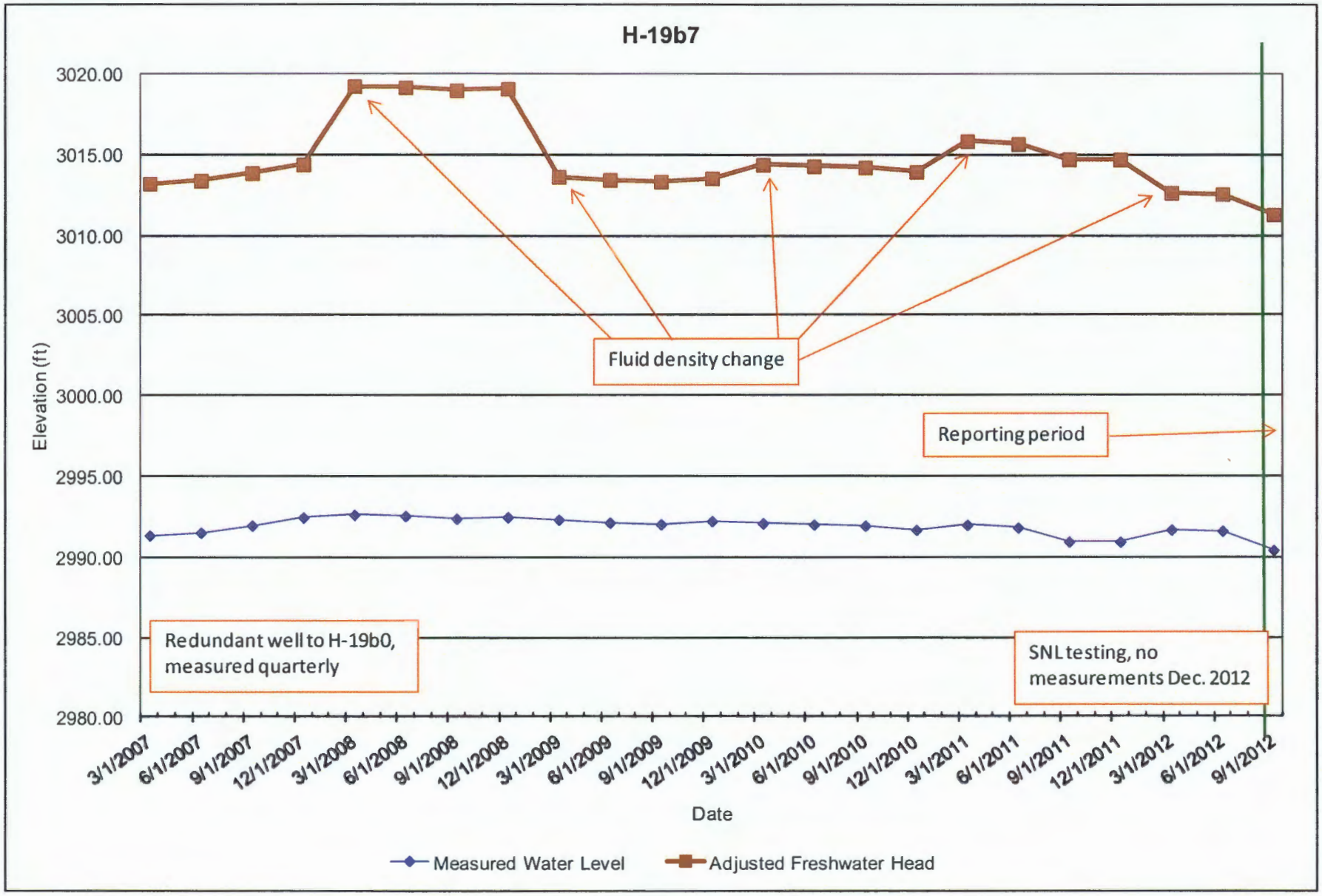

H-19b2
3020.00
3015.00
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
Elevation (ft)
Fluid density change
Reporting period
Redundant well to H-19b0, measured quarterly
3/1/2007
6/1/2007
9/1/2007
12/1/2007
3/1/2008
6/1/2008
9/1/2008
12/1/2008
3/1/2009
6/1/2009
9/1/2009
12/1/2009
3/1/2010
6/1/2010
9/1/2010
12/1/2010
3/1/2011
6/1/2011
9/1/2011
12/1/2011
3/1/2012
6/1/2012
9/1/2012
12/1/2012
Date
Measured Water Level
Adjusated Freshwater Head

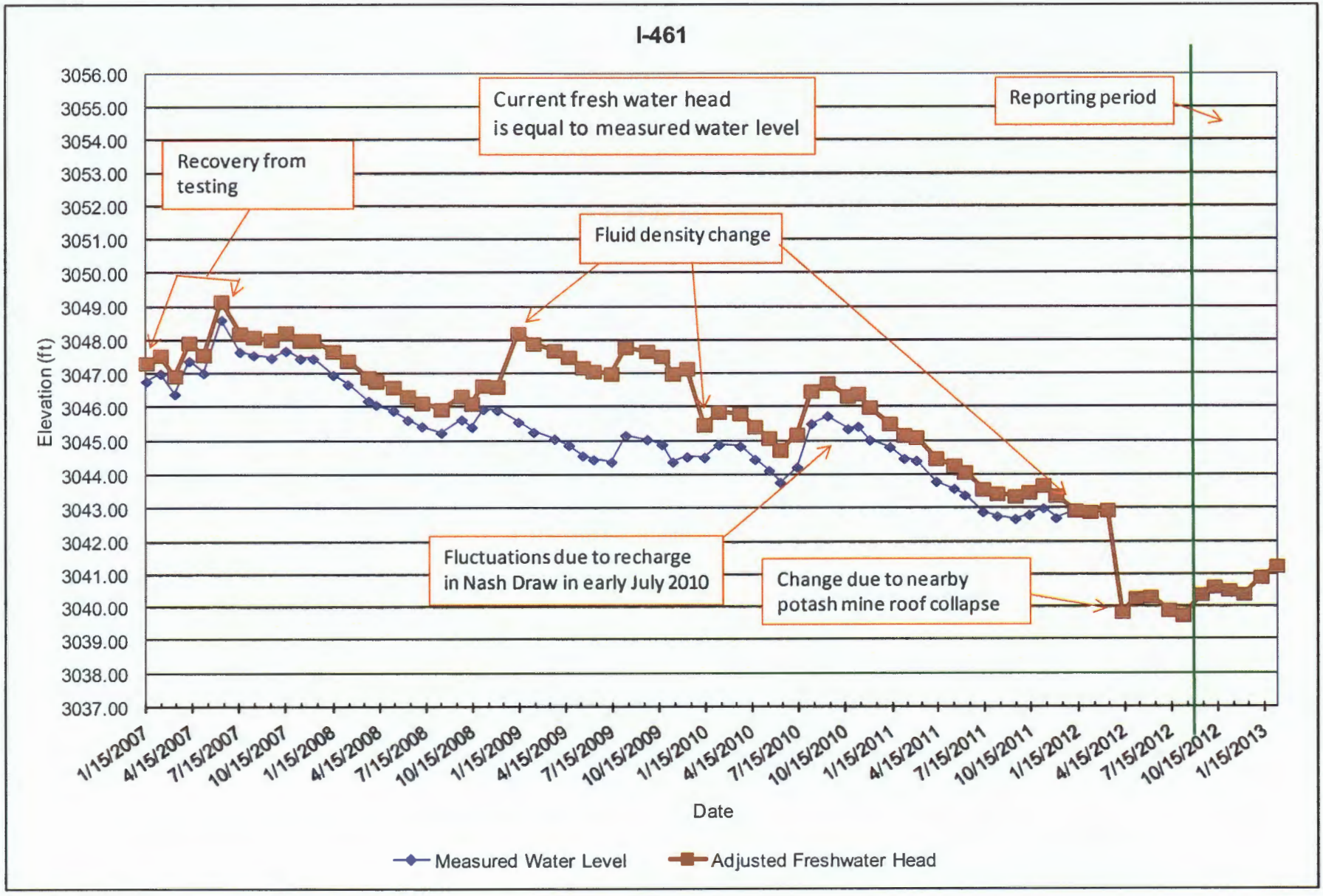

H-19b3
3020.00
3015.00
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
Elevation (ft)
Fluid density change
Reporting period
Redundant well to H-19b0, measured quarterly
3/1/2007
6/1/2007
9/1/2007
12/1/2007
3/1/2008
6/1/2008
9/1/2008
12/1/2008
3/1/2009
6/1/2009
9/1/2009
12/1/2009
3/1/2010
6/1/2010
9/1/2010
12/1/2010
3/1/2011
6/1/2011
9/1/2011
12/1/2011
3/1/2012
6/1/2012
9/1/2012
12/1/2012
Date
Measured Water Level
Adjusted Freshwater Head

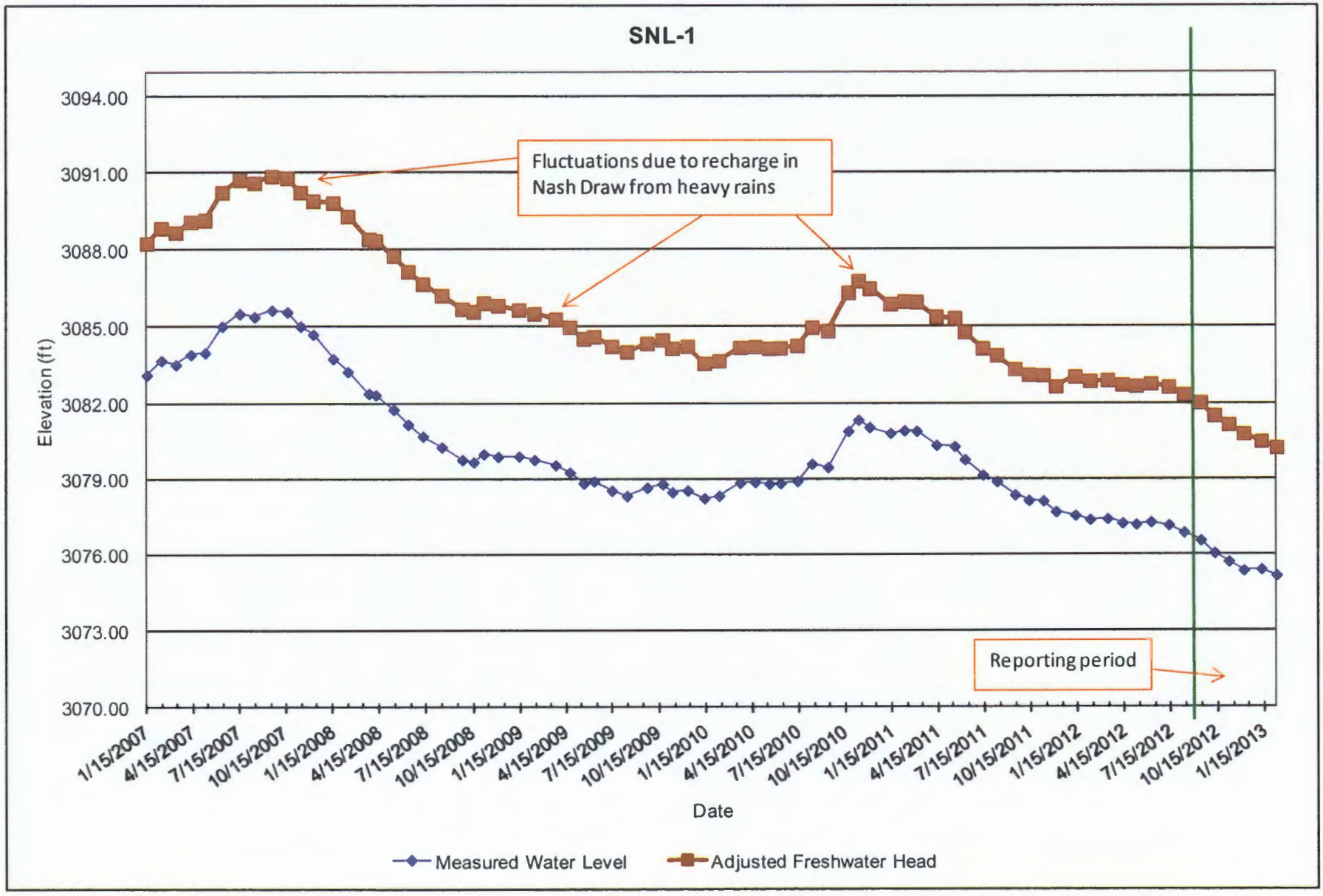

H-19b4
3020.00
3015.00
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
Elevation (ft)
Fluid density change
Reporting period
Redundant well to H-19b0, measured quarterly
3/1/2007
6/1/2007
9/1/2007
12/1/2007
3/1/2008
6/1/2008
9/1/2008
12/1/2008
3/1/2009
6/1/2009
9/1/2009
12/1/2009
3/1/2010
6/1/2010
9/1/2010
12/1/2010
3/1/2011
6/1/2011
9/1/2011
12/1/2011
3/1/2012
6/1/2012
9/1/2012
12/1/2012
Date
Measured Water Level
Adjusted Freshwater Head

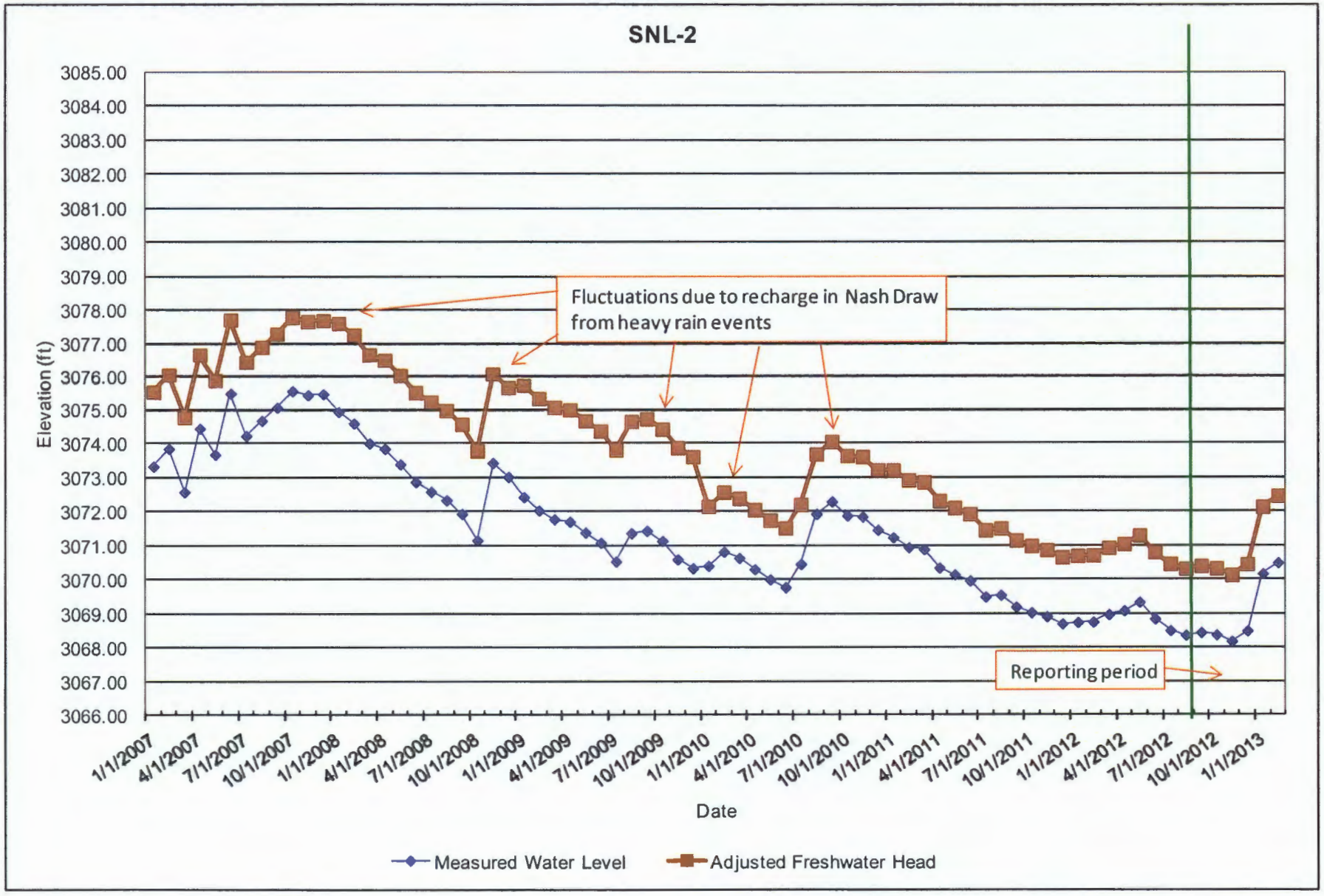

H-19b5
3020.00
3015.00
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
Elevation (ft)
Fluid density change
Reporting period
Redundant well to H-19b0, measured quarterly
3/1/2007
6/1/2007
9/1/2007
12/1/2007
3/1/2008
6/1/2008
9/1/2008
12/1/2008
3/1/2009
6/1/2009
9/1/2009
12/1/2009
3/1/2010
6/1/2010
9/1/2010
12/1/2010
3/1/2011
6/1/2011
9/1/2011
12/1/2011
3/1/2012
6/1/2012
9/1/2012
12/1/2012
Date
Measured Water Level
Adjusted Freshwater Head

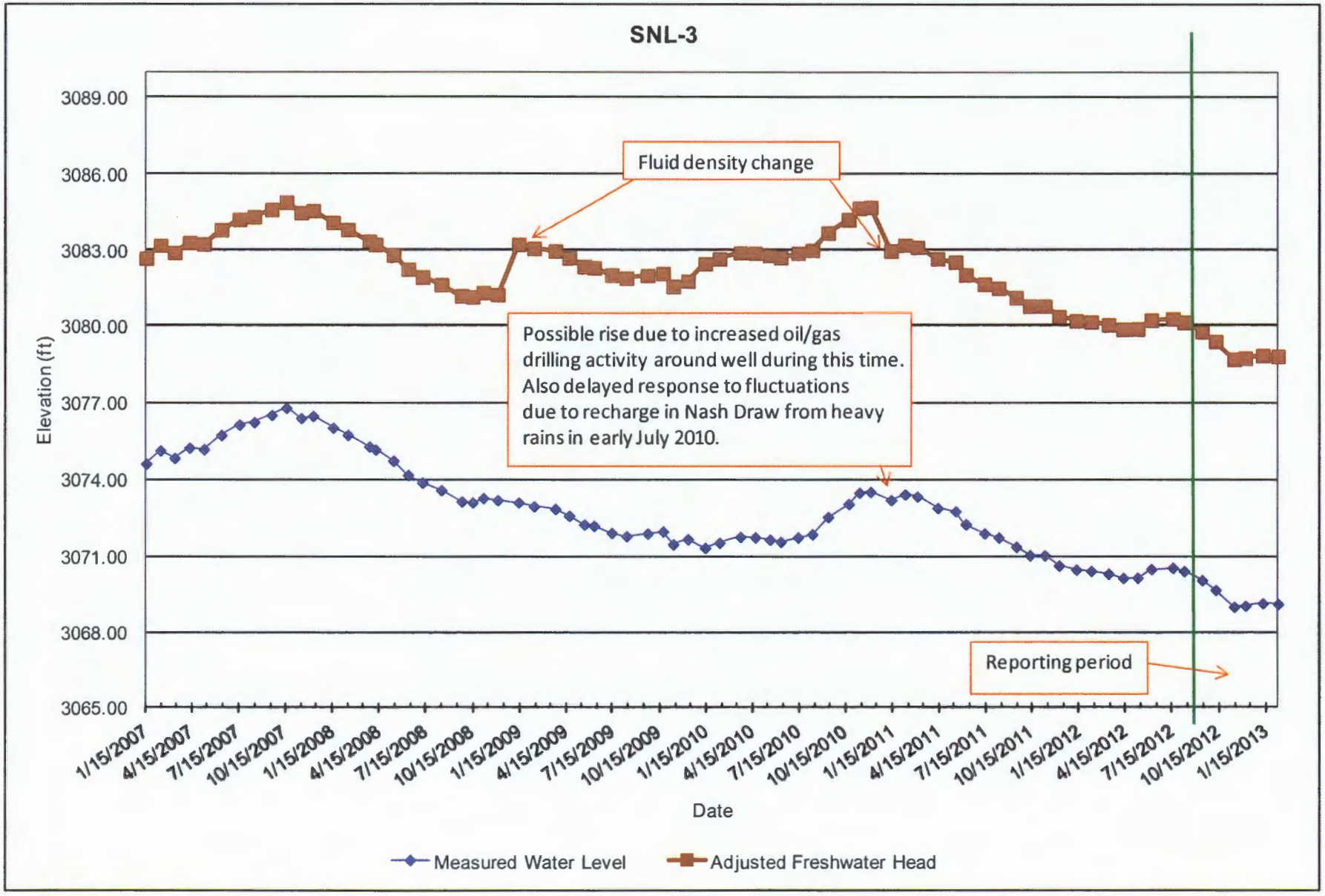

H-19b6
3025.00
3020.00
3015.00
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
Elevation (ft)
Fluid density change
Reporting period
Redundant well to H-19b0, measured quarterly
3/1/2007
6/1/2007
9/1/2007
12/1/2007
3/1/2008
6/1/2008
9/1/2008
12/1/2008
3/1/2009
6/1/2009
9/1/2009
12/1/2009
3/1/2010
6/1/2010
9/1/2010
12/1/2010
3/1/2011
6/1/2011
9/1/2011
12/1/2011
3/1/2012
6/1/2012
9/1/2012
12/1/2012
Date
Measured Water Level
Adjusted Freshwater Head

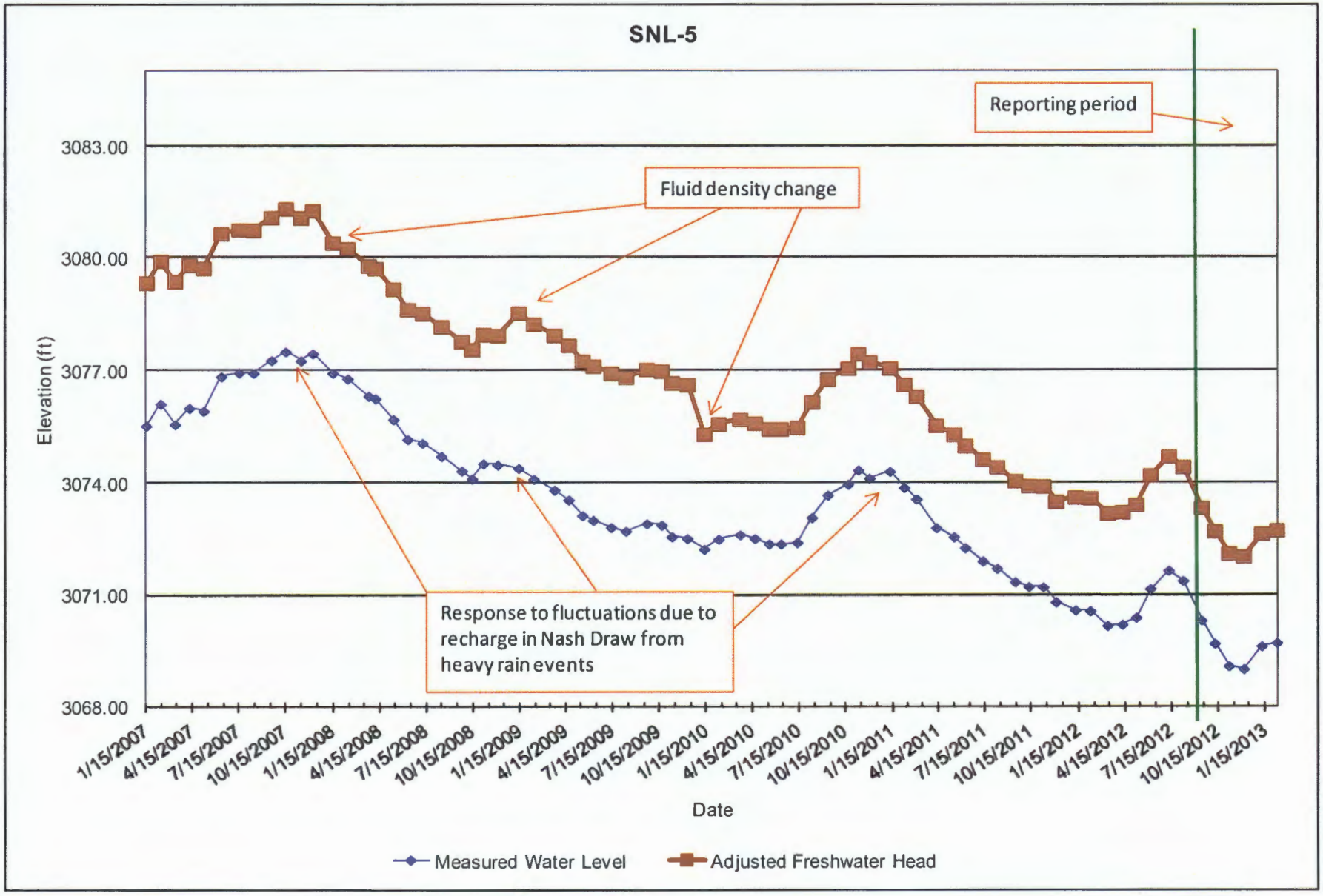

H-19b7
3020.00
3015.00
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
Elevation (ft)
Fluid density change
Reporting period
Redundant well to H-19b0, measured quarterly
SNL testing, no measurements Dec. 2012
3/1/2007
6/1/2007
9/1/2007
12/1/2007
3/1/2008
6/1/2008
9/1/2008
12/1/2008
3/1/2009
6/1/2009
9/1/2009
12/1/2009
3/1/2010
6/1/2010
9/1/2010
12/1/2010
3/1/2011
6/1/2011
9/1/2011
12/1/2011
3/1/2012
6/1/2012
9/1/2012
Date
Measured Water Level
Adjusted Freshwater Head

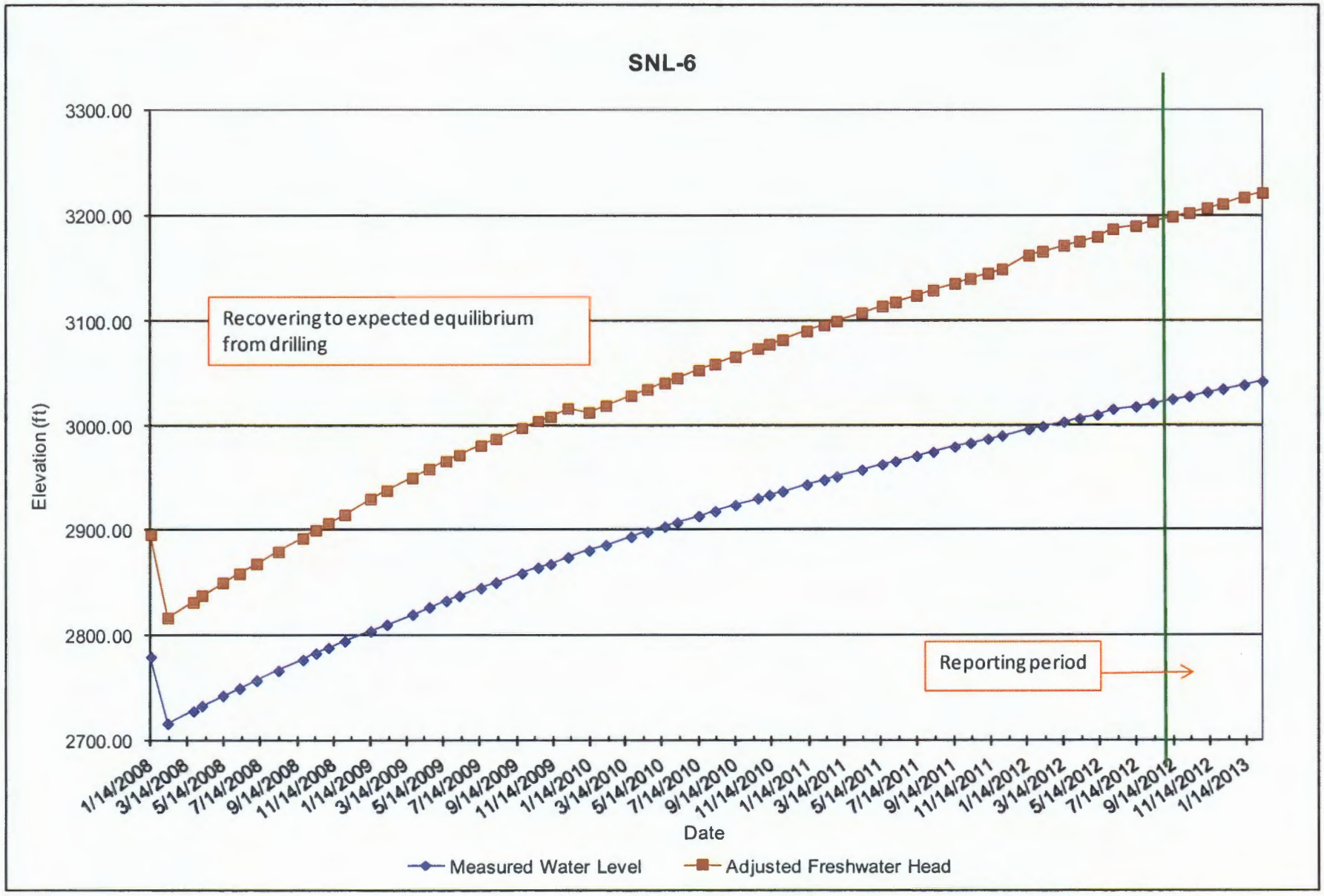

I-461
Current fresh water head is equal to measured water level
Reporting period
Recovery from testing
Fluid density change
Fluctuations due to recharge in Nash Draw in early July 2010
Change due to nearby potash mine roof collapse
Elevation (ft)
3056.00
3055.00
3054.00
3053.00
3052.00
3051.00
3050.00
3049.00
3048.00
3047.00
3046.00
3045.00
3044.00
3043.00
3042.00
3041.00
3040.00
3039.00
3038.00
3037.00
1/15/2007
4/15/2007
7/15/2007
10/15/2007
1/15/2008
4/15/2008
7/15/2008
10/15/2008
1/15/2009
4/15/2009
7/15/2009
10/15/2009
1/15/2010
4/15/2010
7/15/2010
10/15/2010
1/15/2011
4/15/2011
7/15/2011
10/15/2011
1/15/2012
4/15/2012
7/15/2012
10/15/2012
1/15/2013
Date
Measured Water Level
Adjusted Freshwater Head

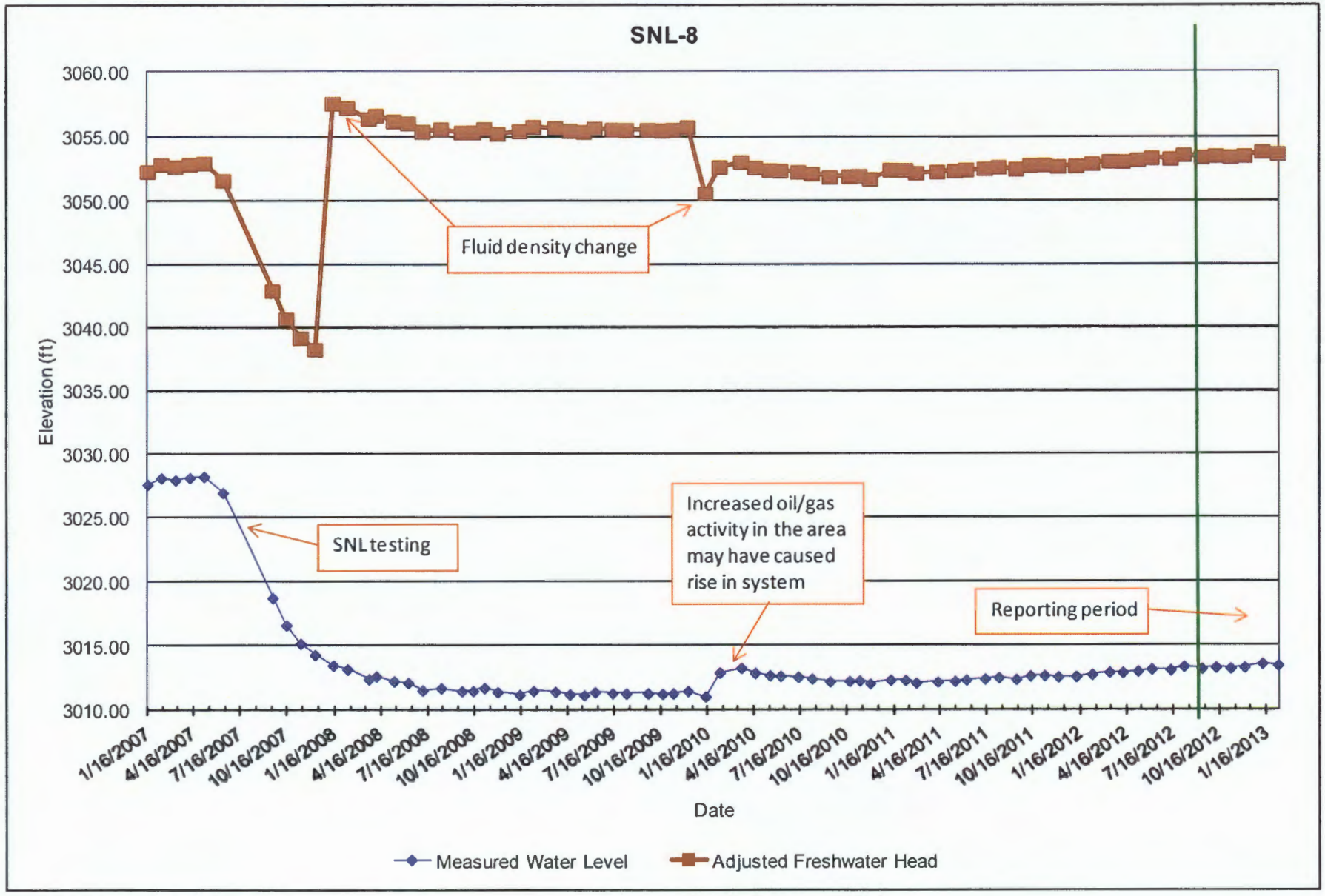

SNL-1
3094.00
3091.00
3088.00
3085.00
3082.00
3079.00
3076.00
3073.00
3070.00
Elevation (ft)
Fluctuations due to recharge in Nash Draw from heavy rains
Reporting period
1/15/2007
4/15/2007
7/15/2007
10/15/2007
1/15/2008
4/15/2008
7/15/2008
10/15/2008
1/15/2009
4/15/2009
7/15/2009
10/15/2009
1/15/2010
4/15/2010
7/15/2010
10/15/2010
1/15/2011
4/15/2011
7/15/2011
10/15/2011
1/15/2012
4/15/2012
7/15/2012
10/15/2012
1/15/2013
Date
Measured Water Level
Adjusted Freshwater Head

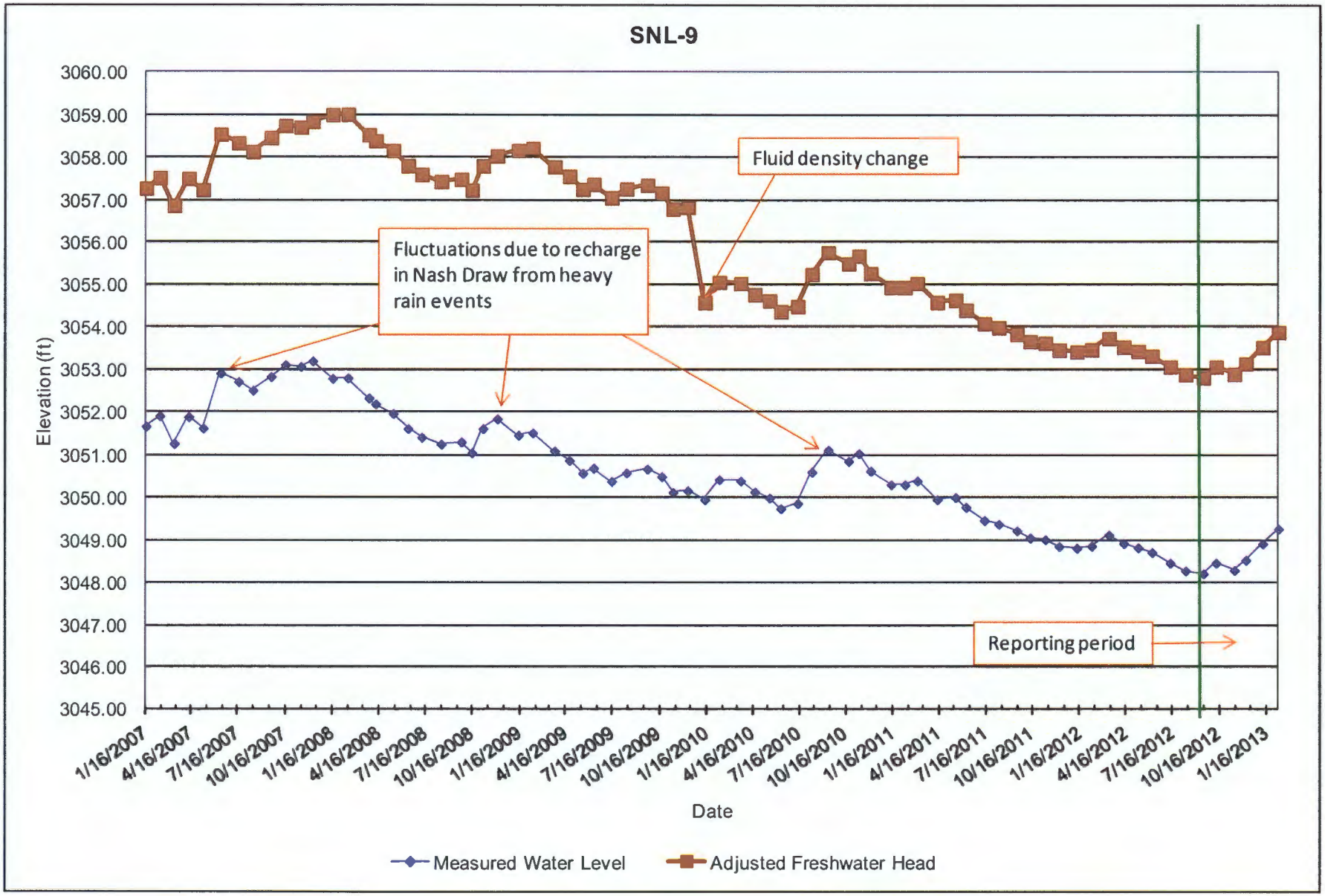

SNL-2
Elevation (ft)
3085.00
3084.00
3083.00
3082.00
3081.00
3080.00
3079.00
3078.00
3077.00
3076.00
3075.00
3074.00
3073.00
3072.00
3071.00
3070.00
3069.00
3068.00
3067.00
3066.00
Fluctuations due to recharge in Nash Draw from heavy rain events
Reporting period
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head

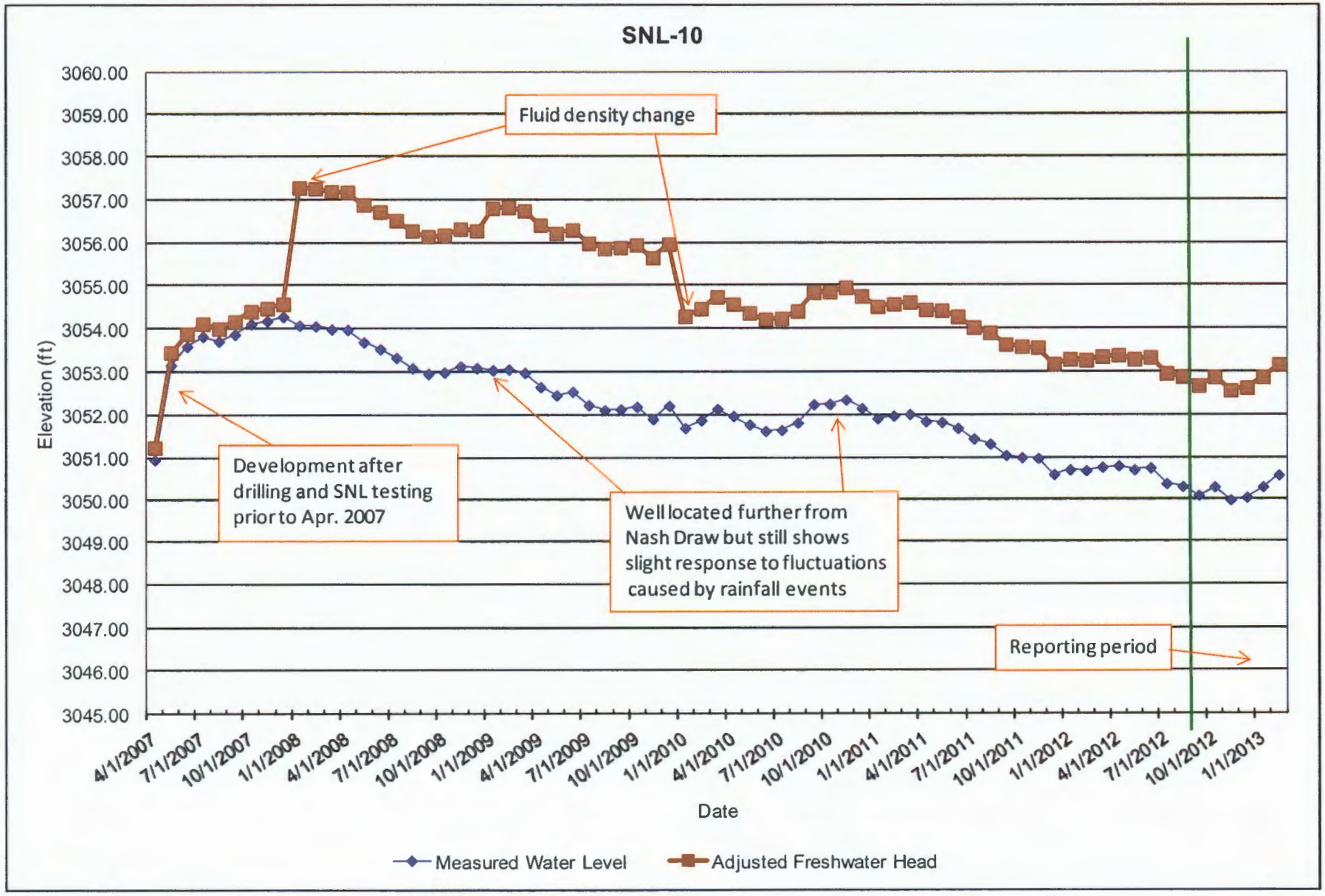

SNL-3
3089.00
3086.00
3083.00
3080.00
3077.00
3074.00
3071.00
3068.00
3065.00
Elevation (ft)
Fluid density change
Possible rise due to increased oil/gas drilling activity around well during this time. Also delayed response to fluctuations due to recharge in Nash Draw from heavy rains in early July 2010.
Reporting period
1/15/2007
4/15/2007
7/15/2007
10/15/2007
1/15/2008
4/15/2008
7/15/2008
10/15/2008
1/15/2009
4/15/2009
7/15/2009
10/15/2009
1/15/2010
4/15/2010
7/15/2010
10/15/2010
1/15/2011
4/15/2011
7/15/2011
10/15/2011
1/15/2012
4/15/2012
7/15/2012
10/15/2012
1/15/2013
Date
Measured Water Level
Adjusted Freshwater Head

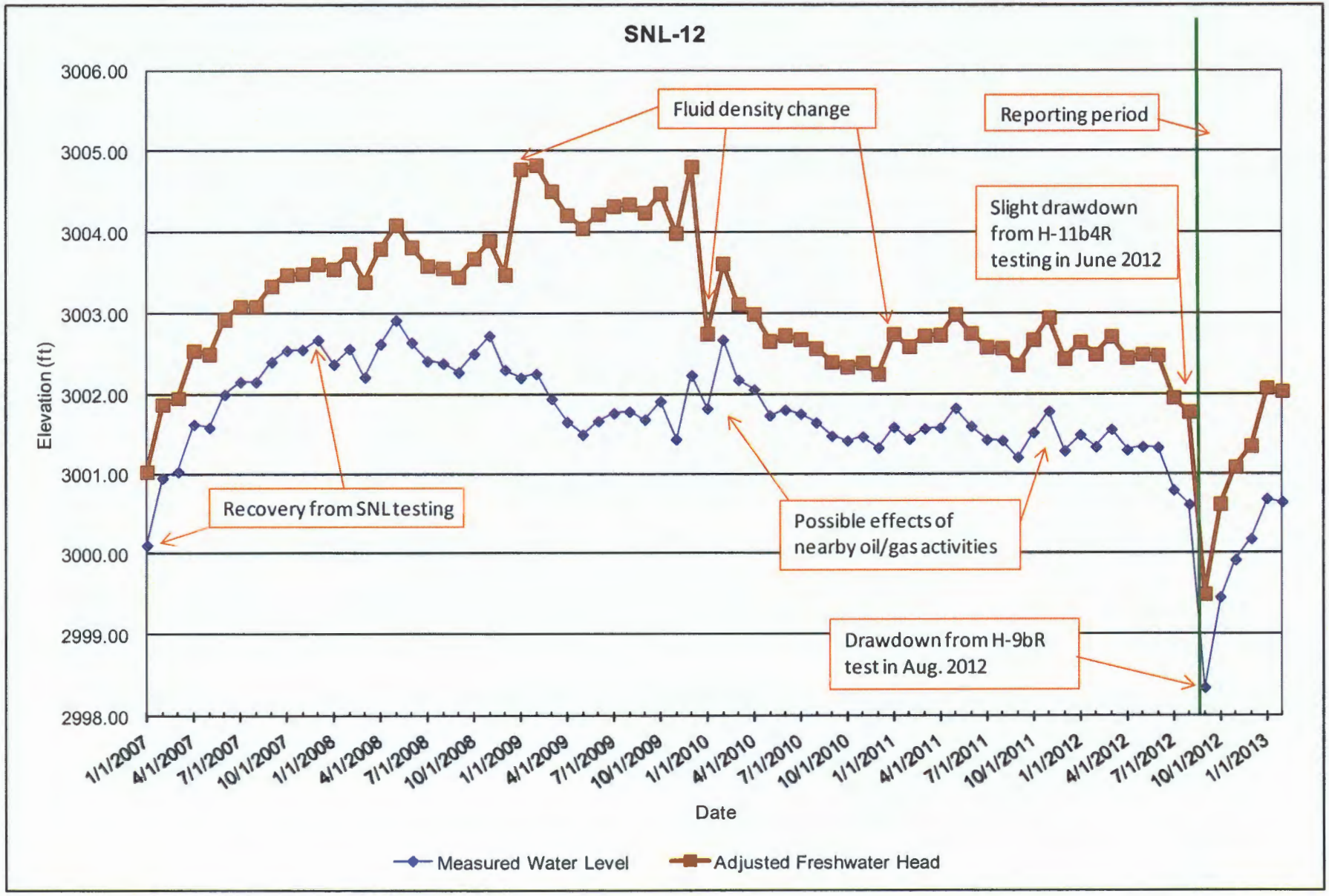

SNL-5
Reporting period
Fluid density change
Response to fluctuations due to recharge in Nash Draw from heavy rain events
Elevation (ft)
3083.00
3080.00
3077.00
3074.00
3071.00
3068.00
1/15/2007
4/15/2007
7/15/2007
10/15/2007
1/15/2008
4/15/2008
7/15/2008
10/15/2008
1/15/2009
4/15/2009
7/15/2009
10/15/2009
1/15/2010
4/15/2010
7/15/2010
10/15/2010
1/15/2011
4/15/2011
7/15/2011
10/15/2011
1/15/2012
4/15/2012
7/15/2012
10/15/2012
1/15/2013
Date
Measured Water Level
Adjusted Freshwater Head

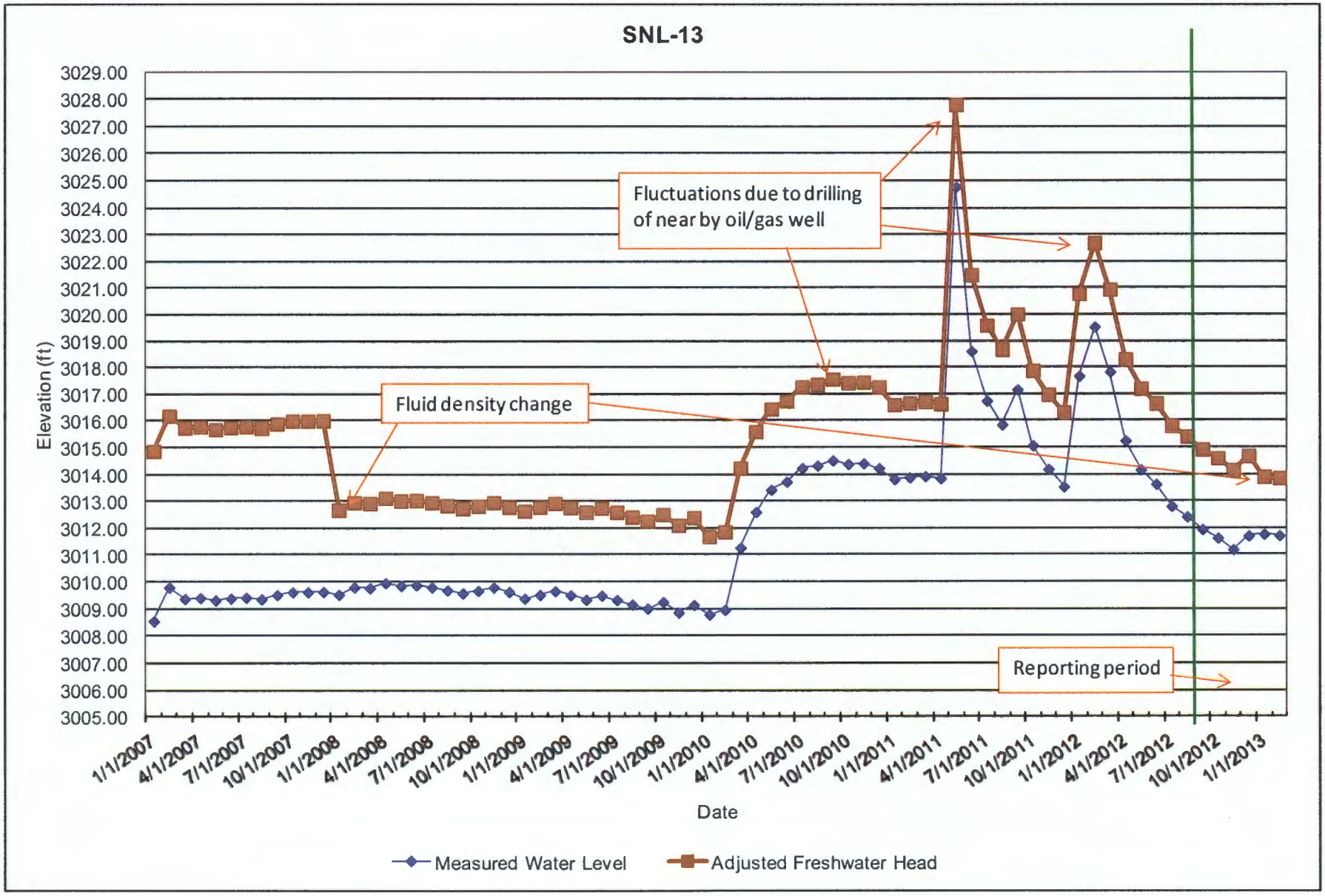

SNL-6
3300.00
3200.00
3100.00
3000.00
2900.00
2800.00
2700.00
Elevation (ft)
Recovering to expected equilibrium from drilling
Reporting period
1/14/2008
3/14/2008
5/14/2008
7/14/2008
9/14/2008
11/14/2008
1/14/2009
3/14/2009
5/14/2009
7/14/2009
9/14/2009
11/14/2009
1/14/2010
3/14/2010
5/14/2010
7/14/2010
9/14/2010
11/14/2010
1/14/2011
3/14/2011
5/14/2011
7/14/2011
9/14/2011
11/14/2011
1/14/2012
3/14/2012
5/14/2012
7/14/2012
9/14/2012
11/14/2012
1/14/2013
Date
Measured Water Level
Adjusted Freshwater Head

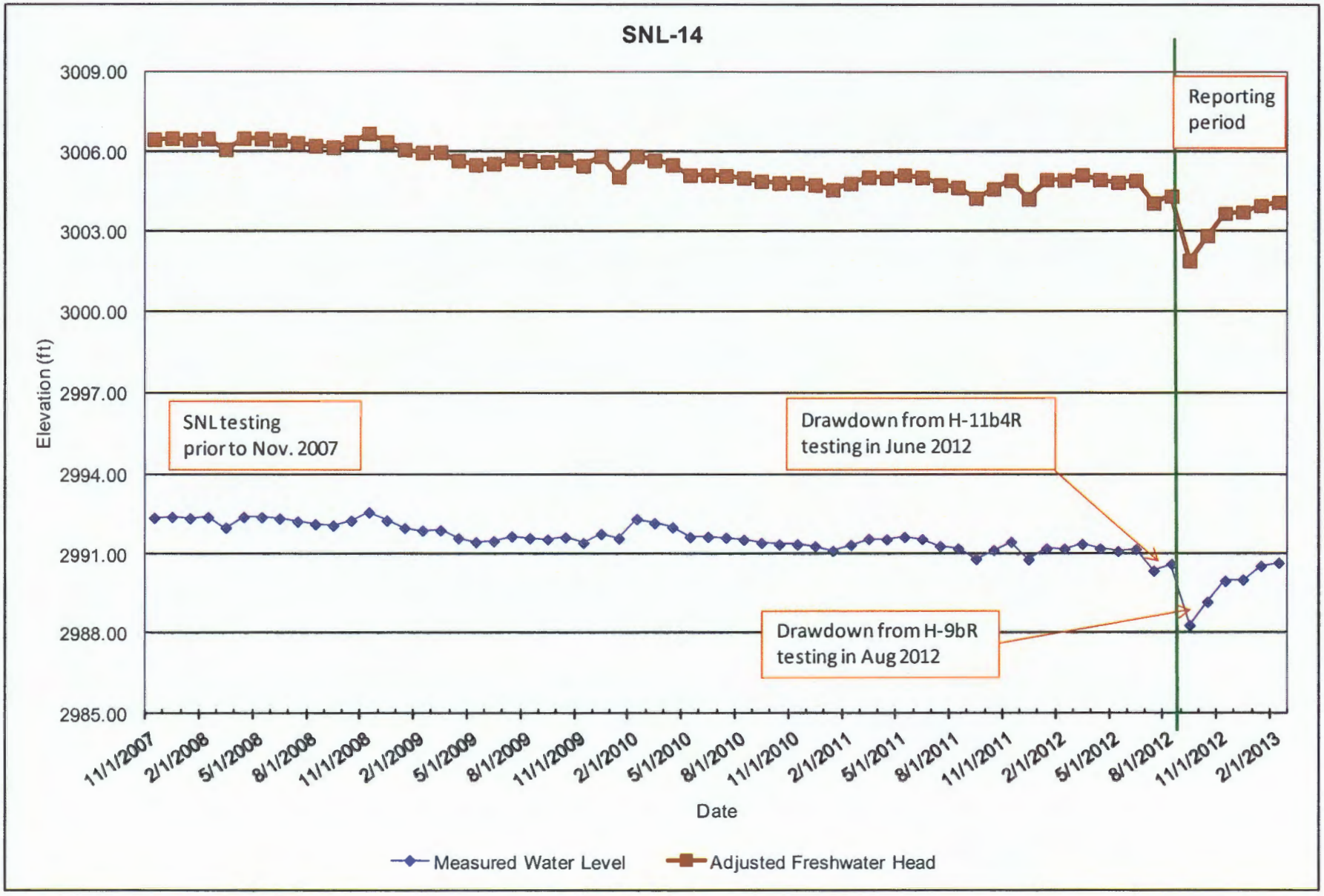

SNL-8
3060.00
3055.00
3050.00
3045.00
3040.00
3035.00
3030.00
3025.00
3020.00
3015.00
3010.00
Elevation (ft)
Fluid density change
SNL testing
Increased oil/gas activity in the area may have caused rise in system
Reporting period
1/16/2007
4/16/2007
7/16/2007
10/16/2007
1/16/2008
4/16/2008
7/16/2008
10/16/2008
1/16/2009
4/16/2009
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
1/16/2012
4/16/2012
7/16/2012
10/16/2012
1/16/2013
Date
Measured Water Level
Adjusted Freshwater Head

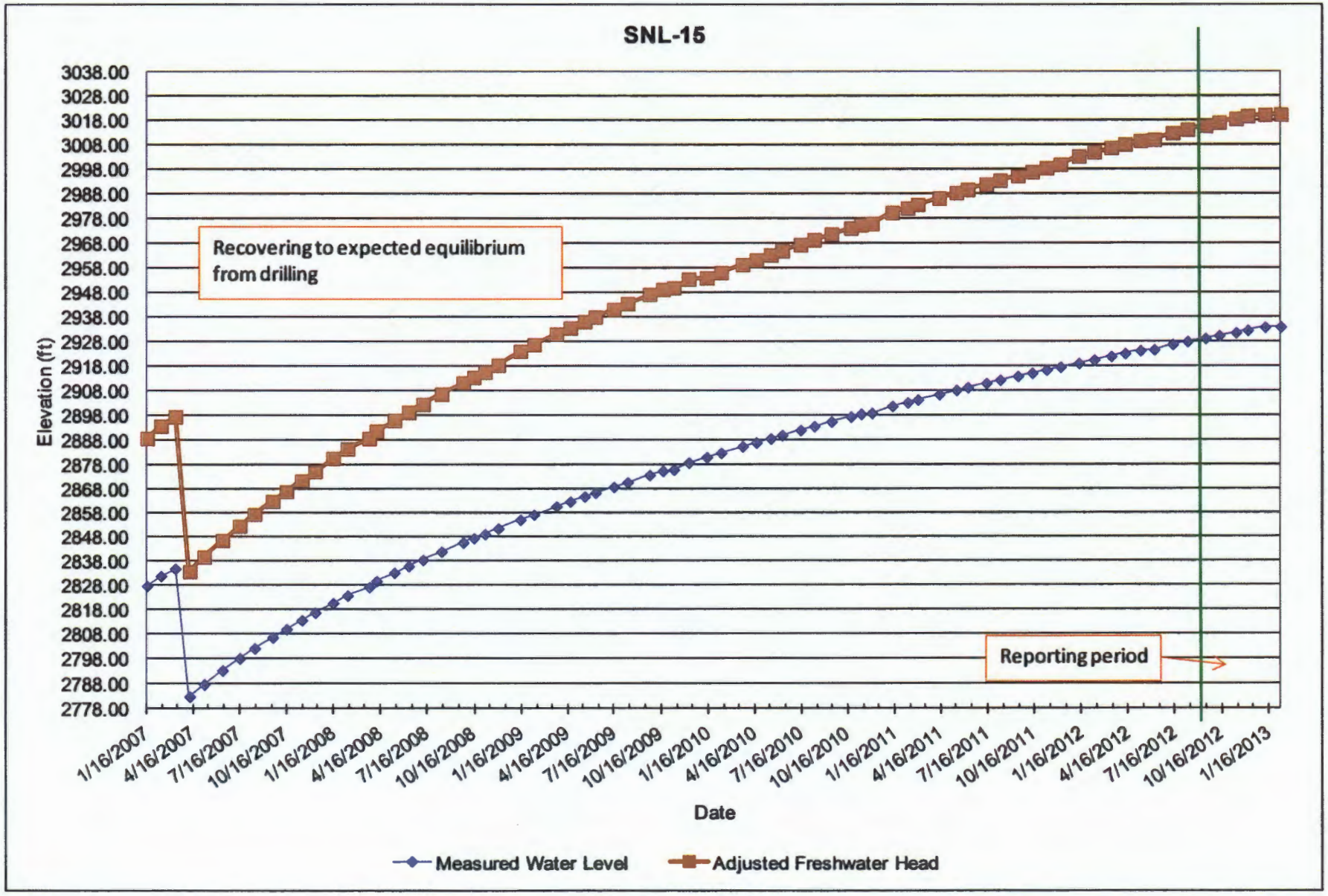

SNL-9
3060.00
3059.00
3058.00
3057.00
3056.00
3055.00
3054.00
3053.00
3052.00
3051.00
3050.00
3049.00
3048.00
3047.00
3046.00
3045.00
Elevation (ft)
Fluid density change
Fluctuations due to recharge in Nash Draw from heavy rain events
Reporting period
1/16/2007
4/16/2007
7/16/2007
10/16/2007
1/16/2008
4/16/2008
7/16/2008
10/16/2008
1/16/2009
4/16/2009
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
1/16/2012
4/16/2012
7/16/2012
10/16/2012
1/16/2013
Date
Measured Water Level
Adjusted Freshwater Head

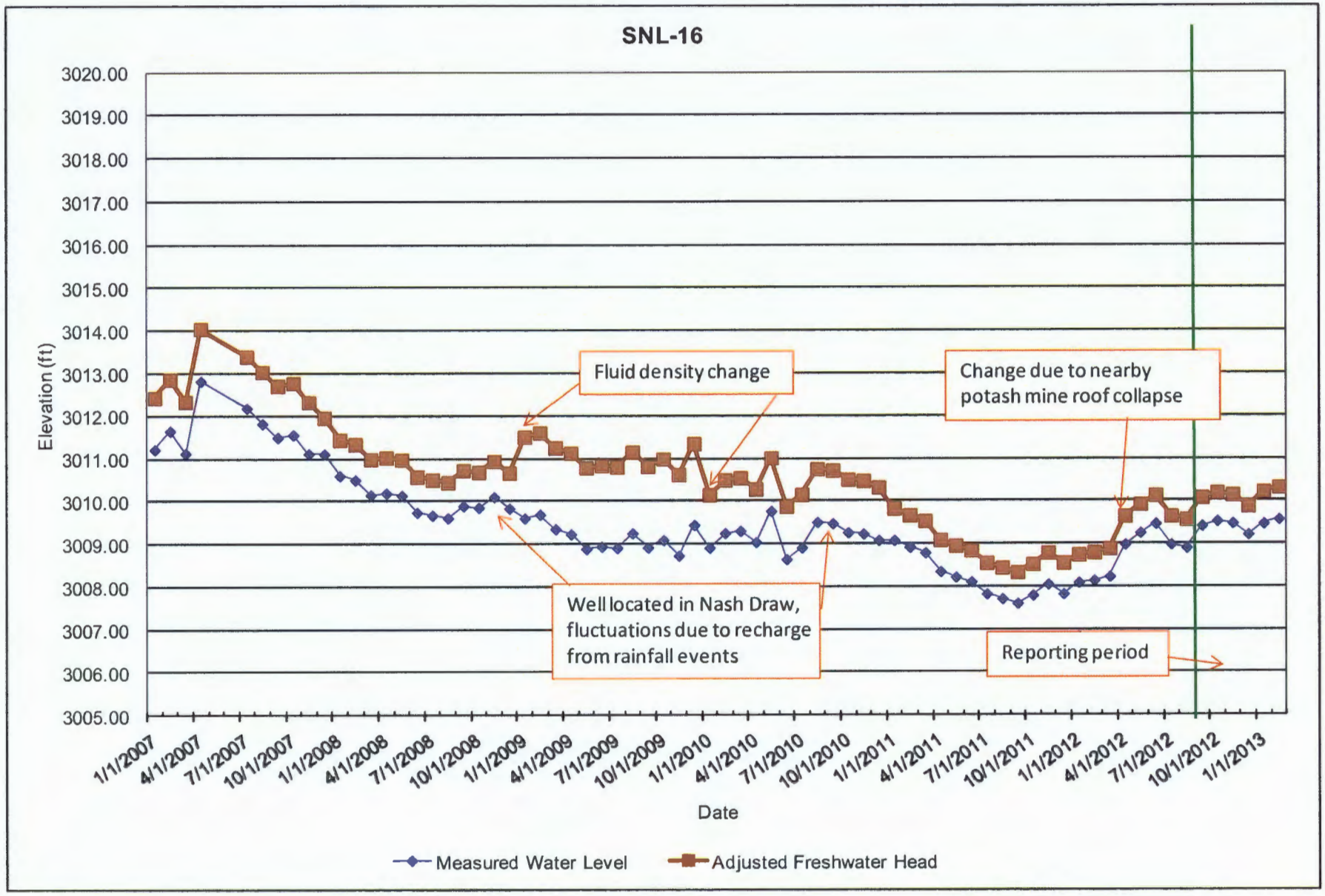

SNL-10
Elevation (ft)
3060.00
3059.00
3058.00
3057.00
3056.00
3055.00
3054.00
3053.00
3052.00
3051.00
3050.00
3049.00
3048.00
3047.00
3046.00
3045.00
Fluid density change
Development after drilling and SNL testing prior to Apr. 2007
Well located further from Nash Draw but still shows slight response to fluctuations caused by rainfall events
Reporting period
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head

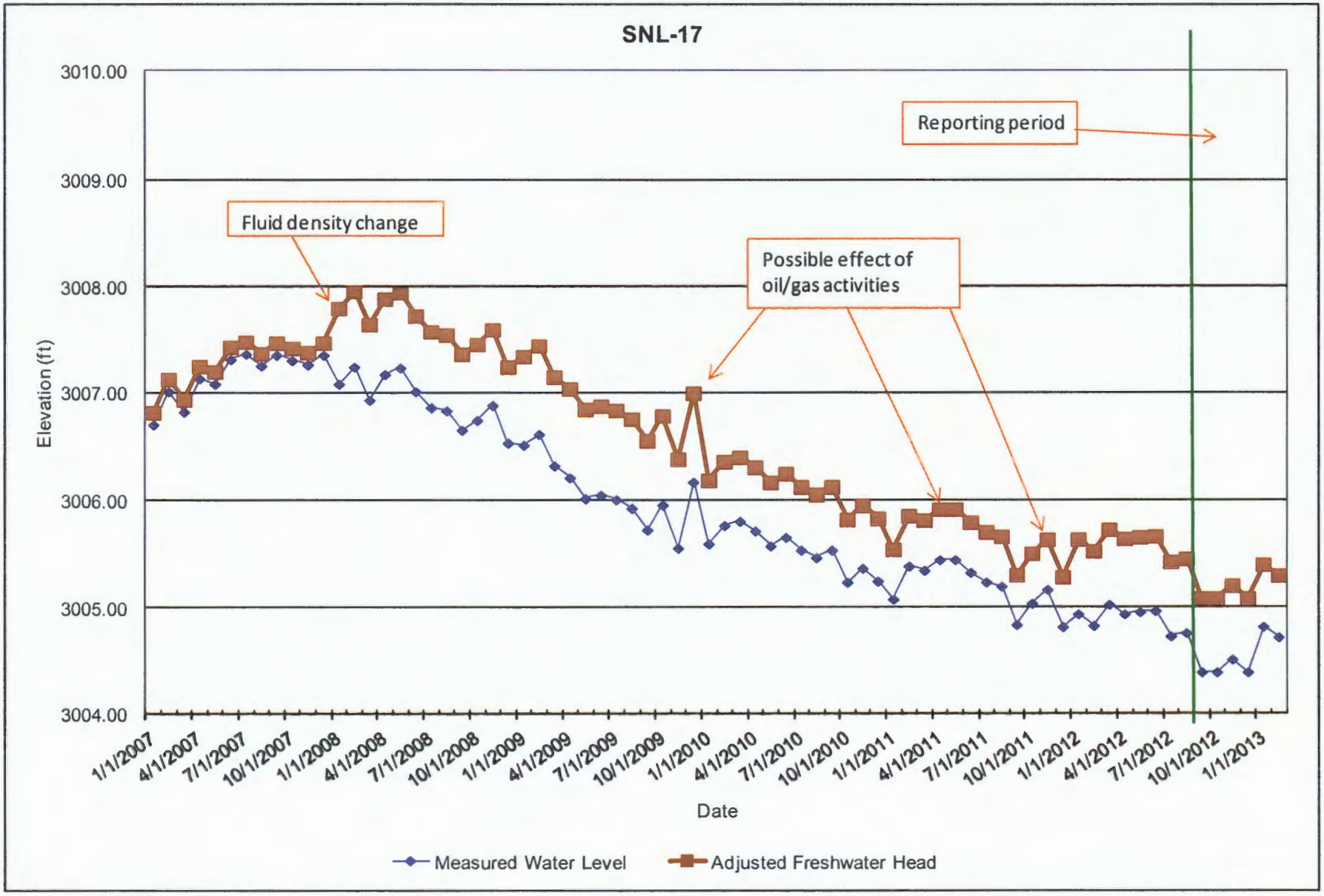

SNL-12
Elevation (ft)
3006.00
3005.00
3004.00
3003.00
3002.00
3001.00
3000.00
2999.00
2998.00
Fluid density change
Reporting period
Slight drawdown from H-11b4R testing in June 2012
Recovery from SNL testing
Possible effects of nearby oil/gas activities
Drawdown from H-9bR test in Aug. 2012
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head

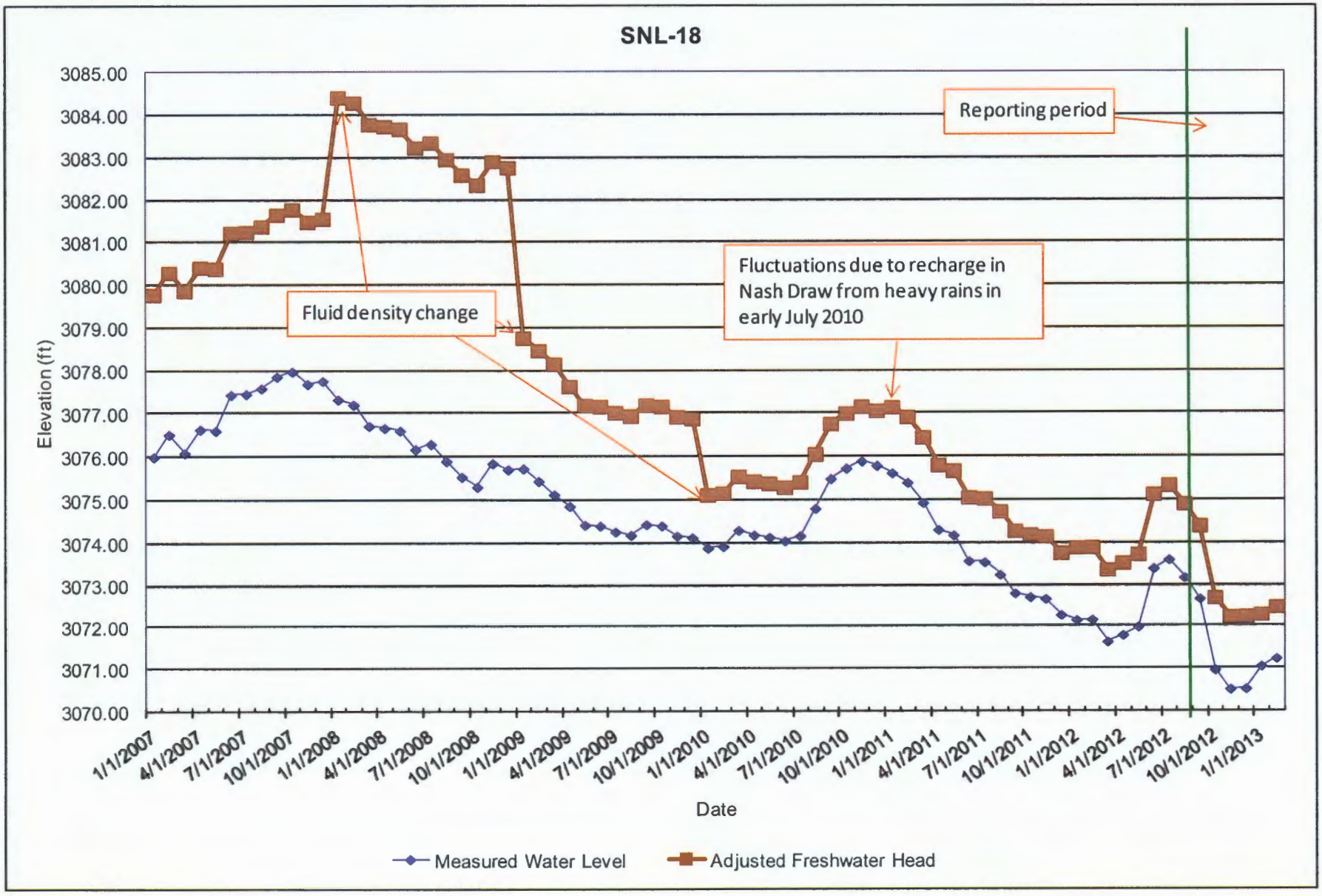

SNL-13
Elevation (ft)
3029.00
3028.00
3027.00
3026.00
3025.00
3024.00
3023.00
3022.00
3021.00
3020.00
3019.00
3018.00
3017.00
3016.00
3015.00
3014.00
3013.00
3012.00
3011.00
3010.00
3009.00
3008.00
3007.00
3006.00
3005.00
Fluctuations due to drilling of near by oil/gas well
Fluid density change
Reporting period
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head

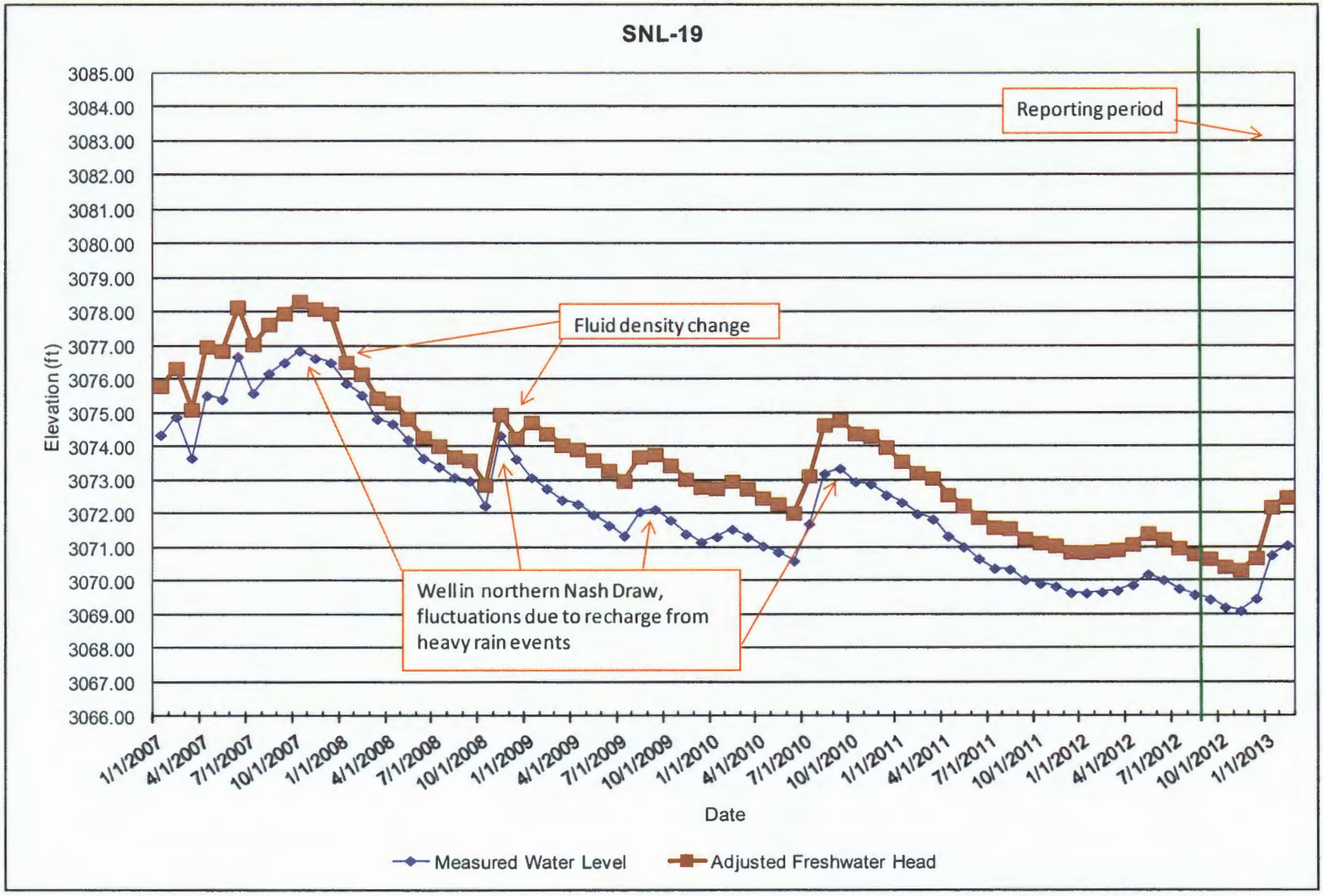

SNL-14
3009.00
3006.00
3003.00
3000.00
2997.00
2994.00
2991.00
2988.00
2985.00
Elevation (ft)
Reporting period
SNL testing prior to Nov. 2007
Drawdown from H-11b4R testing in June 2012
Drawdown from H-9bR testing in Aug 2012
11/1/2007
2/1/2008
5/1/2008
8/1/2008
11/1/2008
2/1/2009
5/1/2009
8/1/2009
11/1/2009
2/1/2010
5/1/2010
8/1/2010
11/1/2010
2/1/2011
5/1/2011
8/1/2011
11/1/2011
2/1/2012
5/1/2012
8/1/2012
11/1/2012
2/1/2013
Date
Measured Water Level
Adjusted Freshwater Head

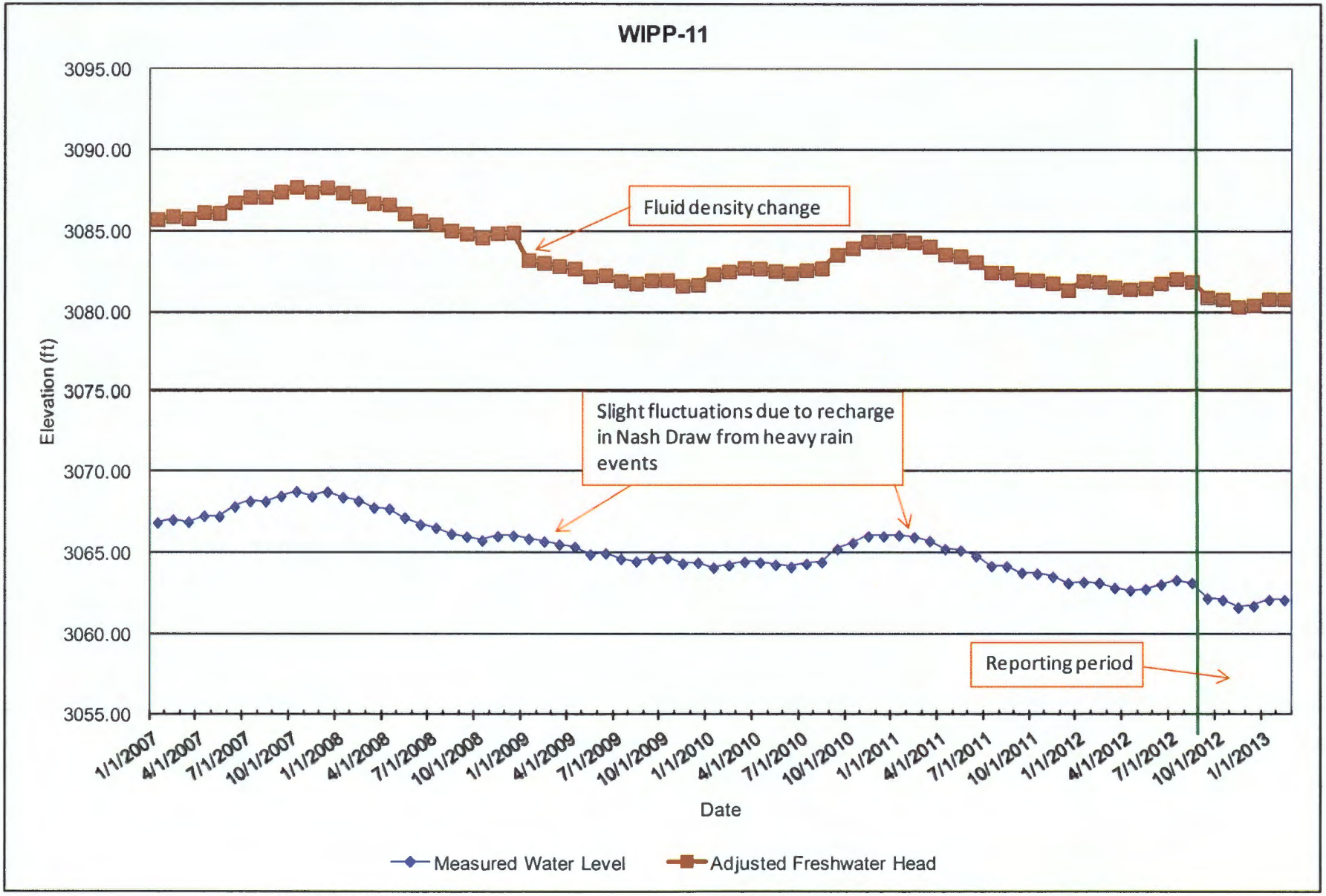

SNL-15
Elevation (ft)
3038.00
3028.00
3018.00
3008.00
2998.00
2988.00
2978.00
2968.00
2958.00
2948.00
2938.00
2928.00
2918.00
2908.00
2898.00
2888.00
2878.00
2868.00
2858.00
2848.00
2838.00
2828.00
2818.00
2808.00
2798.00
2788.00
2778.00
Recovering to expected equilibrium from drilling
Reporting period
1/16/2007
4/16/2007
7/16/2007
10/16/2007
1/16/2008
4/16/2008
7/16/2008
10/16/2008
1/16/2009
4/16/2009
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
1/16/2012
4/16/2012
7/16/2012
10/16/2012
1/16/2013
Date
Measured Water Level
Adjusted Freshwater Head

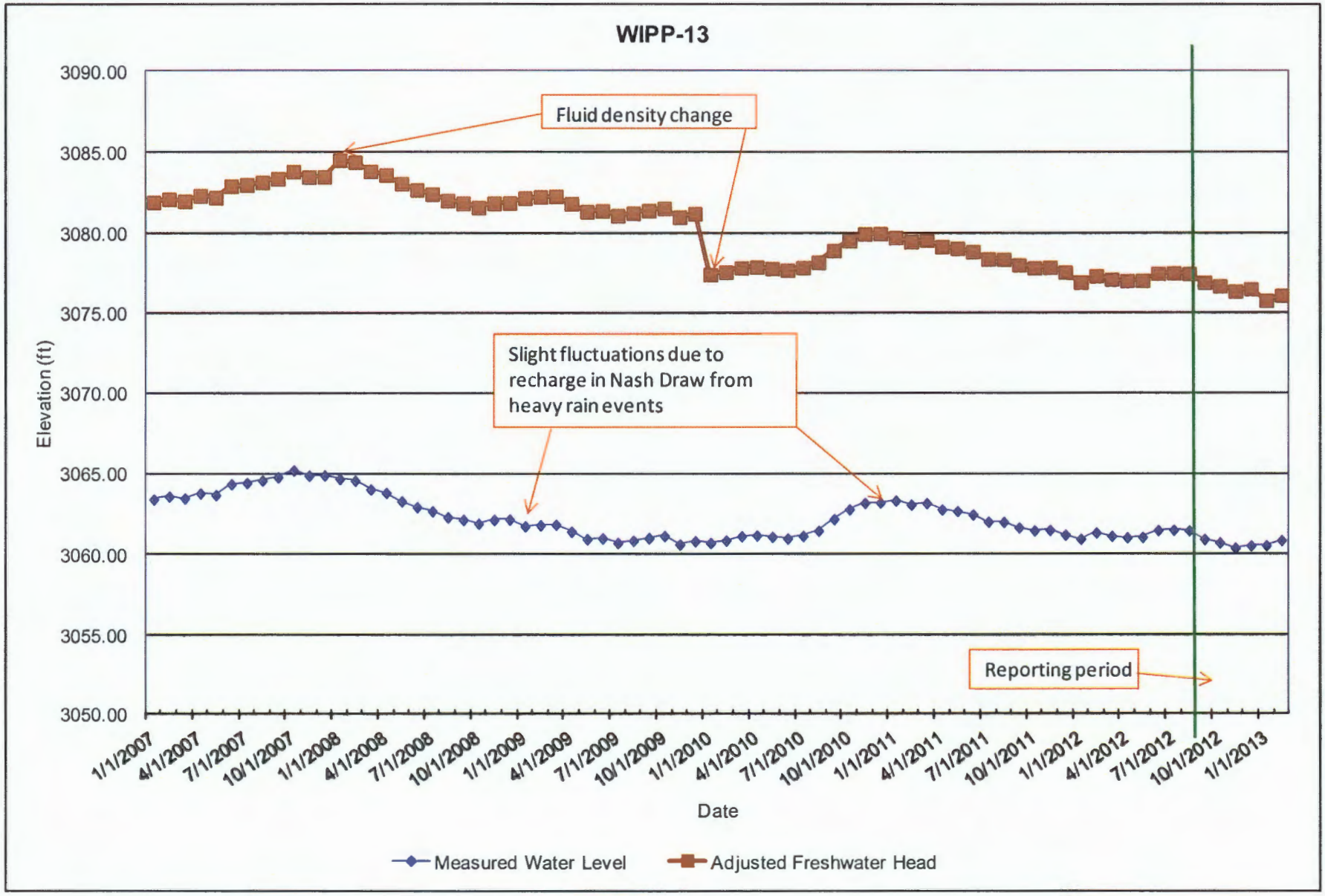

SNL-16
Elevation (ft)
3020.00
3019.00
3018.00
3017.00
3016.00
3015.00
3014.00
3013.00
3012.00
3011.00
3010.00
3009.00
3008.00
3007.00
3006.00
3005.00
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Fluid density change
Change due to nearby potash mine roof collapse
Well located in Nash Draw, fluctuations due to recharge from rainfall events
Reporting period
Measured Water Level
Adjusted Freshwater Head

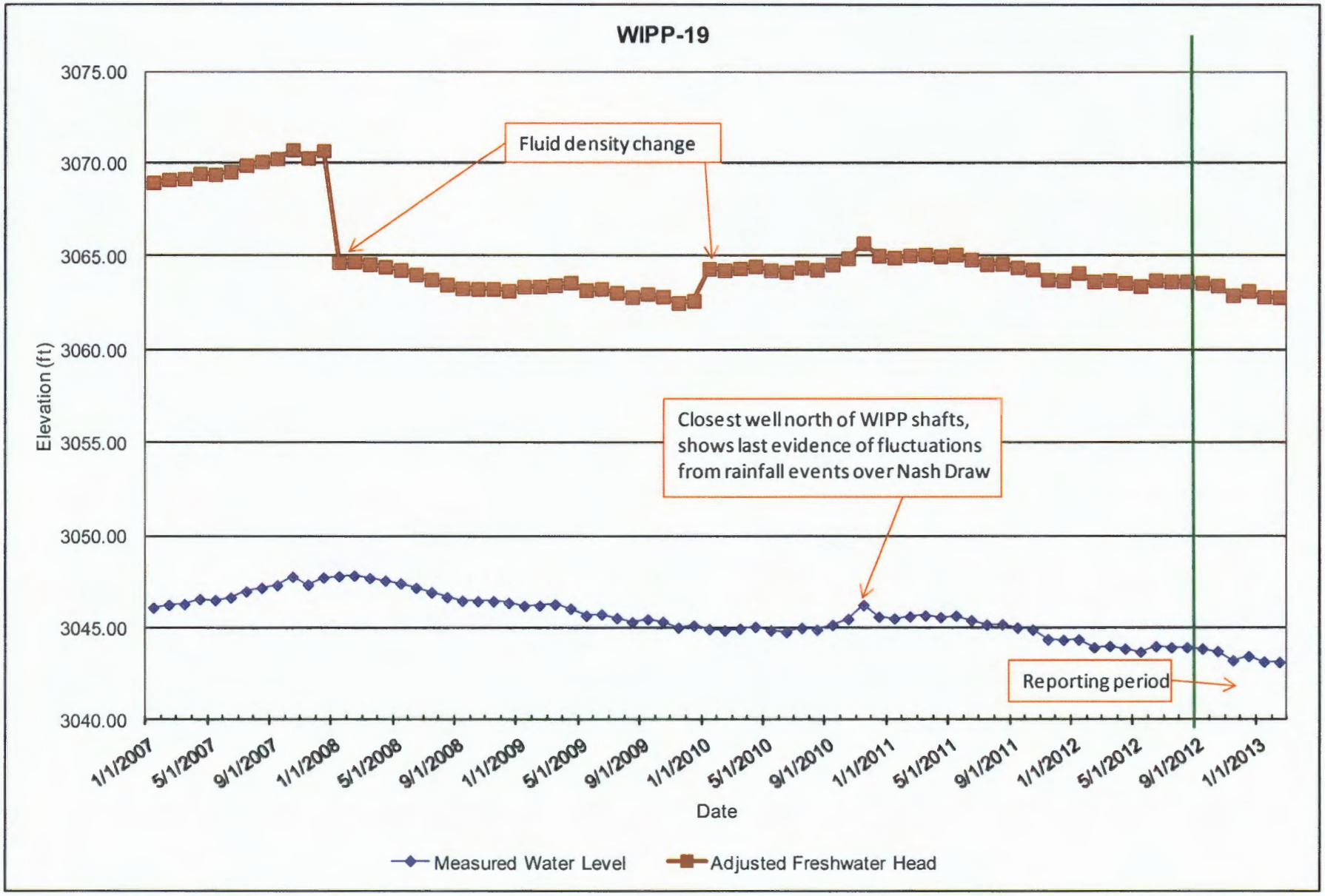

SNL-17
Reporting period
Fluid density change
Possible effect of oil/gas activities
Elevation (ft)
3010.00
3009.00
3008.00
3007.00
3006.00
3005.00
3004.00
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head

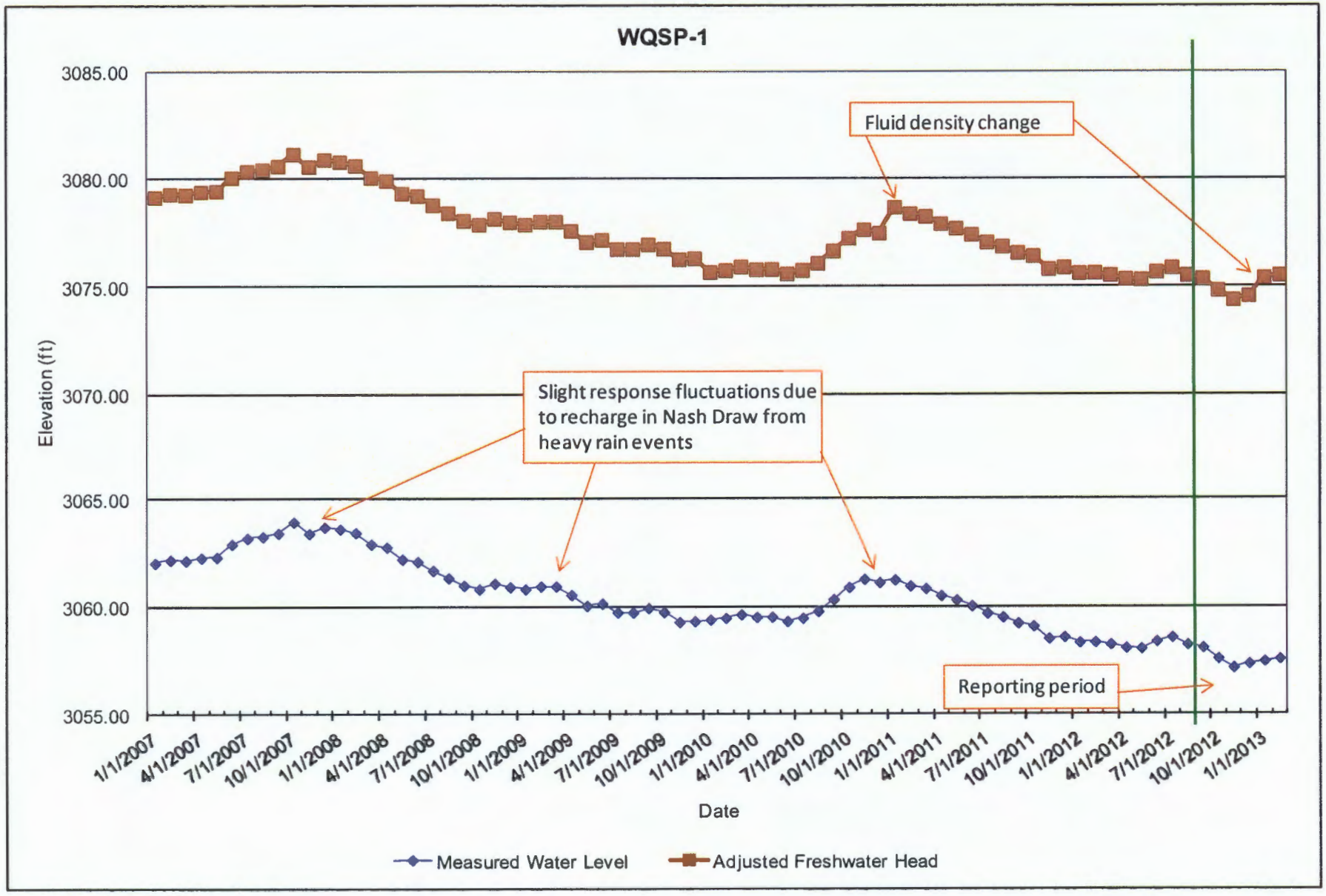

SNL-18
Reporting period
Fluid density change
Fluctuations due to recharge in Nash Draw from heavy rains in early July 2010
Elevation (ft)
3085.00
3084.00
3083.00
3082.00
3081.00
3080.00
3079.00
3078.00
3077.00
3076.00
3075.00
3074.00
3073.00
3072.00
3071.00
3070.00
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head

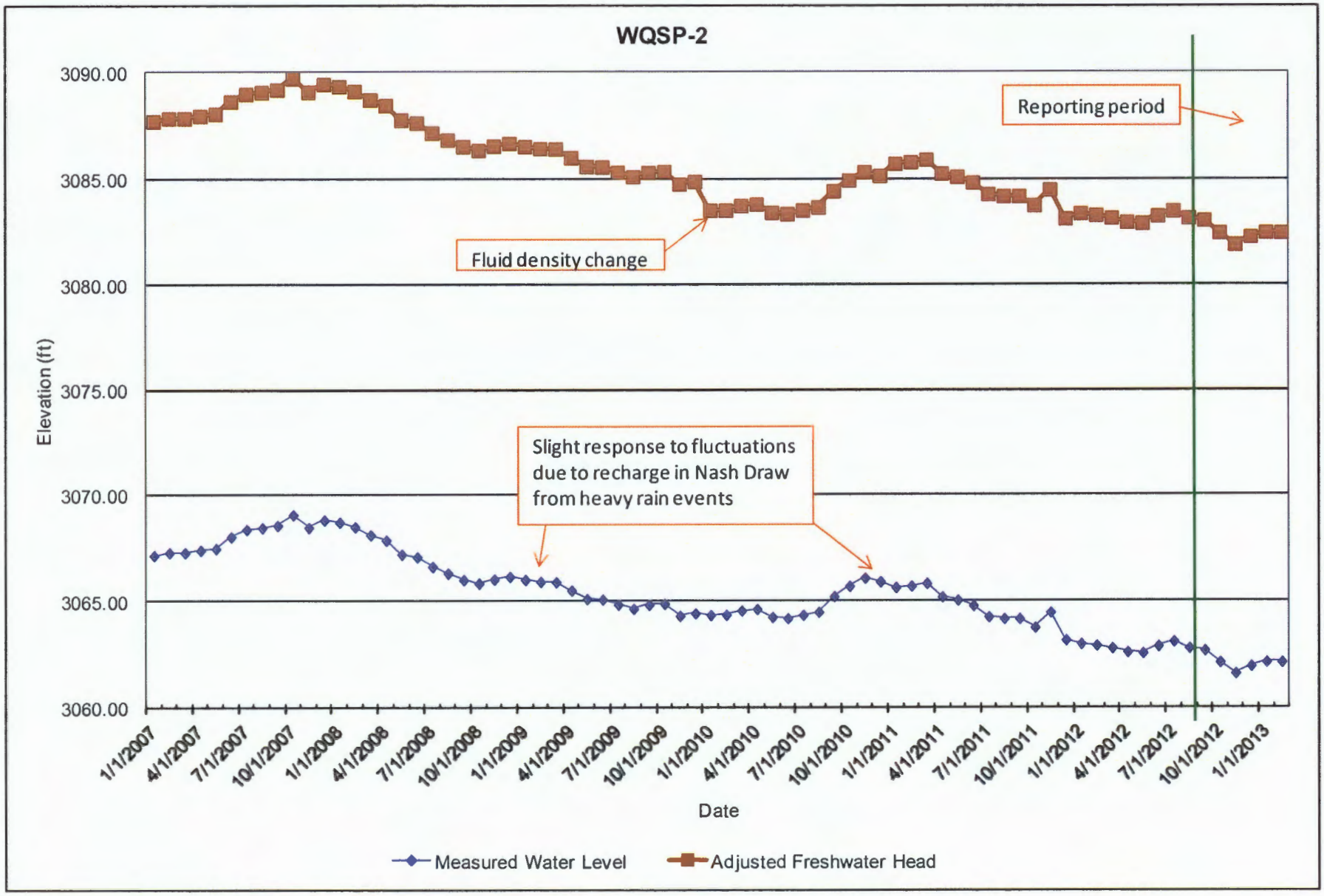

SNL-19
Reporting period
Fluid density change
Well in northern Nash Draw, fluctuations due to recharge from heavy rain events
Elevation (ft)
3085.00
3084.00
3083.00
3082.00
3081.00
3080.00
3079.00
3078.00
3077.00
3076.00
3075.00
3074.00
3073.00
3072.00
3071.00
3070.00
3069.00
3068.00
3067.00
3066.00
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head

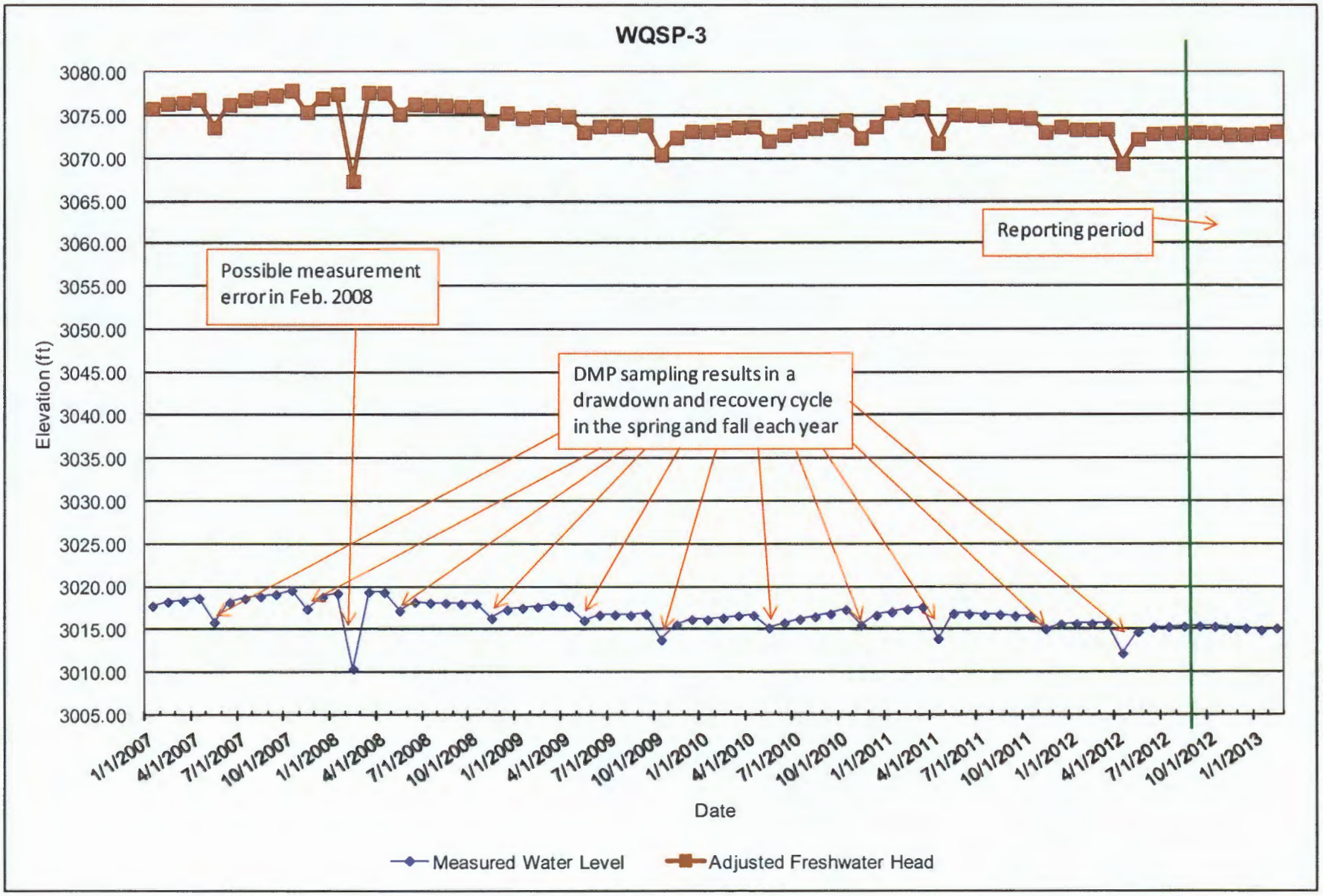

WIPP-11
3095.00
3090.00
3085.00
3080.00
3075.00
3070.00
3065.00
3060.00
3055.00
Elevation (ft)
Fluid density change
Slight fluctuations due to recharge in Nash Draw from heavy rain events
Reporting period
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head


WIPP-13
Fluid density change
Slight fluctuations due to recharge in Nash Draw from heavy rain events
Reporting period
Elevation (ft)
3090.00
3085.00
3080.00
3075.00
3070.00
3065.00
3060.00
3055.00
3050.00
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head


WIPP-19
3075.00
3070.00
3065.00
3060.00
3055.00
3050.00
3045.00
3040.00
Elevation (ft)
Fluid density change
Closest well north of WIPP shafts, shows last evidence of fluctuations from rainfall events over Nash Draw
Reporting period
1/1/2007
5/1/2007
9/1/2007
1/1/2008
5/1/2008
9/1/2008
1/1/2009
5/1/2009
9/1/2009
1/1/2010
5/1/2010
9/1/2010
1/1/2011
5/1/2011
9/1/2011
1/1/2012
5/1/2012
9/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head


WQSP-1
3085.00
3080.00
3075.00
3070.00
3065.00
3060.00
3055.00
Elevation (ft)
Fluid density change
Slight response fluctuations due to recharge in Nash Draw from heavy rain events
Reporting period
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head


WQSP-2
Reporting period
Fluid density change
Slight response to fluctuations due to recharge in Nash Draw from heavy rain events
Elevation (ft)
3090.00
3085.00
3080.00
3075.00
3070.00
3065.00
3060.00
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head


WQSP-3
Elevation (ft)
3080.00
3075.00
3070.00
3065.00
3060.00
3055.00
3050.00
3045.00
3040.00
3035.00
3030.00
3025.00
3020.00
3015.00
3010.00
3005.00
Possible measurement error in Feb. 2008
DMP sampling results in a drawdown and recovery cycle in the spring and fall each year
Reporting period
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
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4/1/2011
7/1/2011
10/1/2011
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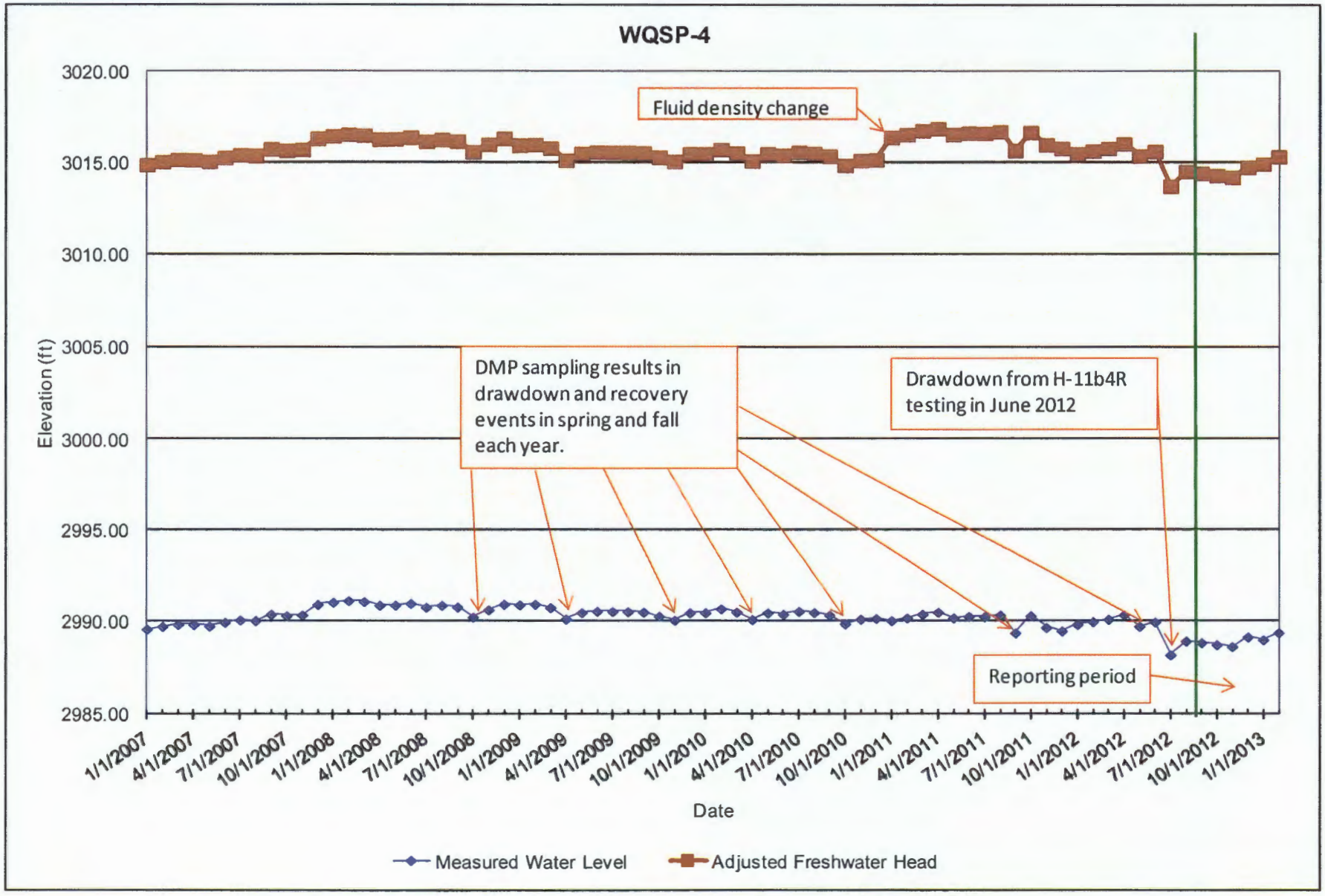
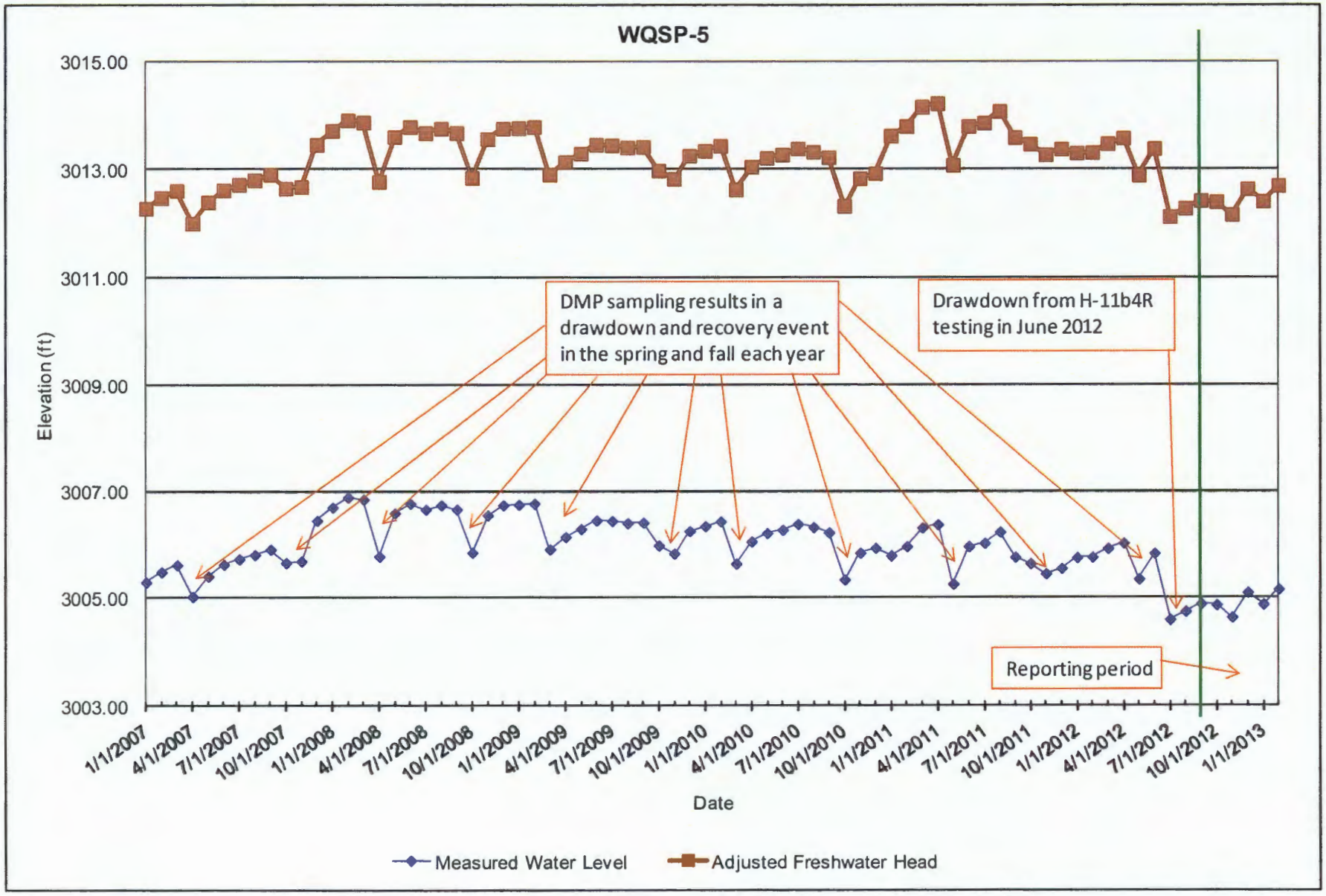
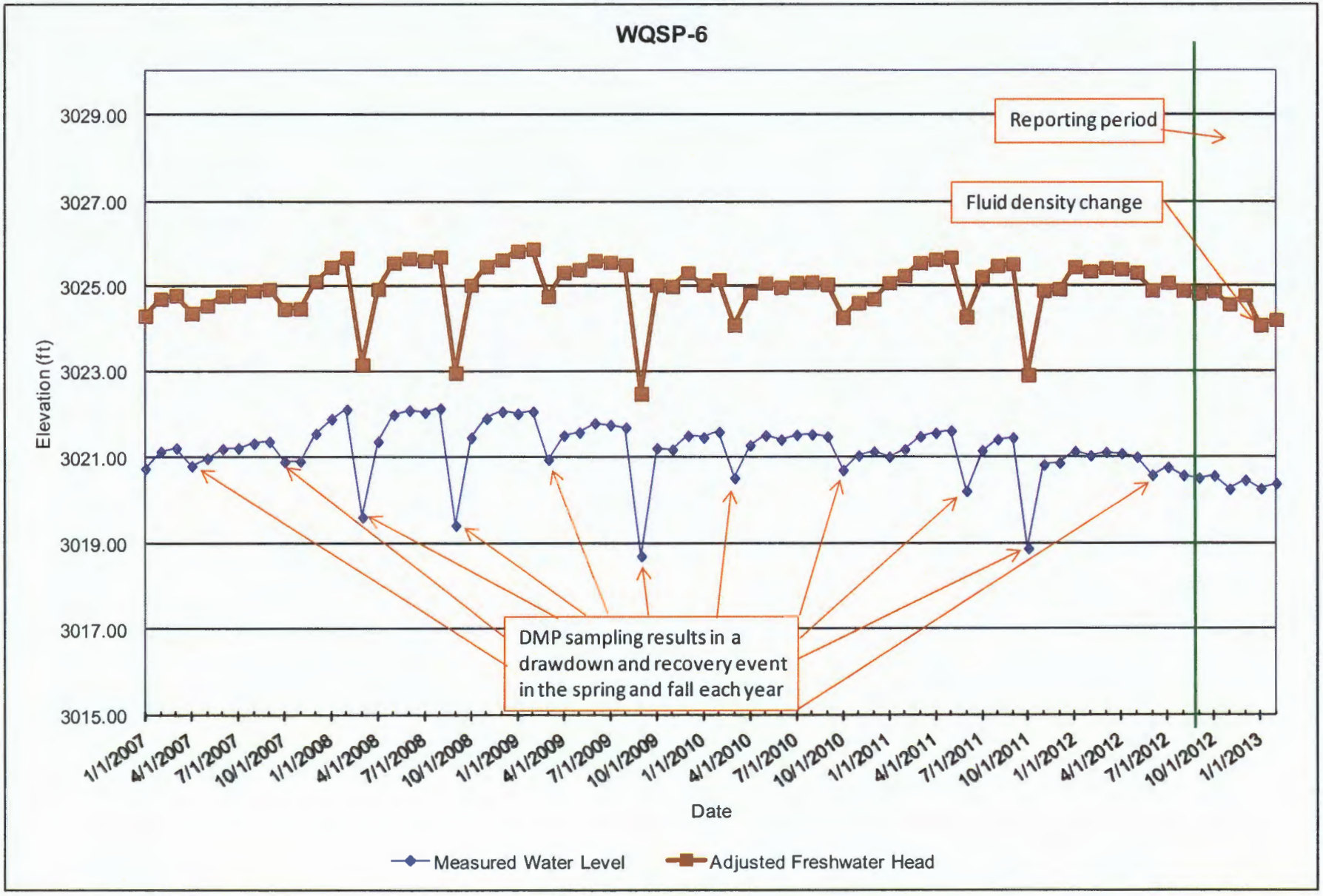
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head


WQSP-4
Fluid density change
DMP sampling results in drawdown and recovery events in spring and fall each year.
Drawdown from H-11b4R testing in June 2012
Reporting period
Elevation (ft)
3020.00
3015.00
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head


WQSP-5
3015.00
3013.00
3011.00
3009.00
3007.00
3005.00
3003.00
Elevation (ft)
DMP sampling results in a drawdown and recovery event in the spring and fall each year
Drawdown from H-11b4R testing in June 2012
Reporting period
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head


WQSP-6
Reporting period
Fluid density change
DMP sampling results in a drawdown and recovery event in the spring and fall each year
Elevation (ft)
3029.00
3027.00
3025.00
3023.00
3021.00
3019.00
3017.00
3015.00
1/1/2007
4/1/2007
7/1/2007
10/1/2007
1/1/2008
4/1/2008
7/1/2008
10/1/2008
1/1/2009
4/1/2009
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
Date
Measured Water Level
Adjusted Freshwater Head

Appendix 2

Culebra Water Levels

Sept. 2012 – Feb. 2013

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC ft	WATER LEVEL ELEVATION ft amsl[1]	ADJUSTED FRESHWATER HEAD ft amsl
AEC-7	CUL	09/11/12	612.84	3044.22	3062.65
AEC-7	CUL	10/09/12	612.95	3044.11	3062.54
AEC-7	CUL	11/08/12	612.85	3044.21	3062.64
AEC-7	CUL	12/04/12	613.04	3044.02	3062.44
AEC-7	CUL	01/08/13	612.99	3044.07	3061.45
AEC-7	CUL	02/08/13	612.21	3044.85	3062.29
C-2737 (PIP)	CUL	09/17/12	387.68	3013.08	3021.27
C-2737 (PIP)	CUL	10/11/12	387.86	3012.90	3021.09
C-2737 (PIP)	CUL	11/16/12	388.00	3012.76	3020.94
C-2737 (PIP)	CUL	12/06/12	387.67	3013.09	3021.28
C-2737 (PIP)	CUL	01/09/13	387.94	3012.82	3019.79
C-2737 (PIP)	CUL	02/12/13	387.89	3012.87	3019.84
ERDA-9	CUL	09/17/12	399.46	3010.71	3033.90
ERDA-9	CUL	10/10/12	399.55	3010.62	3033.81
ERDA-9	CUL	11/07/12	399.74	3010.43	3033.60
ERDA-9	CUL	12/03/12	399.82	3010.35	3033.52
ERDA-9	CUL	01/09/13	400.03	3010.14	3033.29
ERDA-9	CUL	02/12/13	400.05	3010.12	3033.27
H-02b2	CUL	09/17/12	336.78	3041.58	3045.17
H-02b2	CUL	10/11/12	336.91	3041.45	3045.03
H-02b2	CUL	11/12/12	337.24	3041.12	3044.70
H-02b2	CUL	12/06/12	336.98	3041.38	3044.96
H-02b2	CUL	01/09/13	337.29	3041.07	3044.65
H-02b2	CUL	02/12/13	337.15	3041.21	3044.79
H-03b2	CUL	09/10/12	389.24	3000.67	3012.91
H-03b2	CUL	10/11/12	389.26	3000.65	3012.89
H-03b2	CUL	11/12/12	389.40	3000.51	3012.74
H-03b2	CUL	12/06/12	388.96	3000.95	3013.20
H-03b2	CUL	01/09/13	388.58	3001.33	3012.10
H-03b2	CUL	02/12/13	388.82	3001.09	3011.85
H-04bR	CUL	09/10/12	332.93	3001.71	3004.68
H-04bR	CUL	10/09/12	332.19	3002.45	3005.44
H-04bR	CUL	11/12/12	332.11	3002.53	3005.52
H-04bR	CUL	12/03/12	331.56	3003.08	3006.08
H-04bR	CUL	01/09/13	331.50	3003.14	3006.14
H-04bR	CUL	02/11/13	331.16	3003.48	3006.48
H-05b	CUL	09/11/12	465.78	3041.00	3084.12
H-05b	CUL	10/09/12	465.85	3040.93	3084.04
H-05b	CUL	11/08/12	465.95	3040.83	3083.93
H-05b	CUL	12/04/12	466.05	3040.73	3083.82
H-05b	CUL	01/07/13	466.11	3040.67	3082.87
H-05b	CUL	02/08/13	466.13	3040.65	3082.84
H-06bR	CUL	09/10/12	291.31	3057.91	3070.30
H-06bR	CUL	10/10/12	291.75	3057.47	3069.84
H-06bR	CUL	11/13/12	291.85	3057.37	3069.74
H-06bR	CUL	12/05/12	291.72	3057.50	3069.87
H-06bR	CUL	01/07/13	291.25	3057.97	3070.36
H-06bR	CUL	02/11/13	290.87	3058.35	3070.76
H-07b1	CUL	09/12/12	165.55	2998.17	2998.80

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC ft	WATER LEVEL ELEVATION ft amsl[1]	ADJUSTED FRESHWATER HEAD ft amsl
H-07b1	CUL	10/08/12	166.08	2997.64	2998.26
H-07b1	CUL	11/05/12	166.15	2997.57	2998.19
H-07b1	CUL	12/04/12	166.29	2997.43	2998.05
H-07b1	CUL	01/07/13	166.03	2997.69	2998.42
H-07b1	CUL	02/07/13	166.03	2997.69	2998.42
H-09bR	CUL	Sept. '12	SNL Testing[3]		
H-09bR	CUL	Oct. '12	SNL Testing		
H-09bR	CUL	Nov. '12	SNL Testing		
H-09bR	CUL	12/05/12	413.68	2994.66	2994.66
H-09bR	CUL	01/07/13	412.96	2995.38	2995.38
H-09bR	CUL	02/08/13	413.00	2995.34	2995.34
H-10c	CUL	09/12/12	719.38	2969.02	3030.38
H-10c	CUL	10/09/12	719.29	2969.11	3030.47
H-10c	CUL	11/07/12	719.32	2969.08	3030.44
H-10c	CUL	12/05/12	719.30	2969.10	3030.46
H-10c	CUL	01/07/13	719.08	2969.32	3030.70
H-10c	CUL	02/08/13	718.80	2969.60	3031.01
H-11b4R	CUL	12/05/11[2]	428.98	2982.89	3006.21
H-11b4R	CUL	01/09/12[2]	427.85	2984.02	3007.43
H-11b4R	CUL	02/06/12[2]	427.63	2984.24	3007.66
H-11b4R	CUL	03/12/12[2]	427.48	2984.39	3007.83
H-11b4R	CUL	04/09/12[2]	427.52	2984.35	3007.78
H-11b4R	CUL	May '12[2]	SNL Testing		
H-11b4R	CUL	June '12[2]	SNL Testing		
H-11b4R	CUL	07/11/12[2]	429.15	2982.72	3006.03
H-11b4R	CUL	08/09/12[2]	428.35	2983.52	3006.89
H-11b4R	CUL	09/13/12	430.08	2981.79	3005.03
H-11b4R	CUL	10/10/12	429.43	2982.44	3005.73
H-11b4R	CUL	11/12/12	429.09	2982.78	3006.09
H-11b4R	CUL	12/04/12	428.67	2983.20	3006.55
H-11b4R	CUL	01/08/13	428.16	2983.71	3007.09
H-11b4R	CUL	02/11/13	428.02	2983.85	3007.25
H-12	CUL	09/12/12	457.08	2970.25	3011.05
H-12	CUL	10/09/12	457.37	2969.96	3010.73
H-12	CUL	11/07/12	457.31	2970.02	3010.80
H-12	CUL	12/05/12	457.37	2969.96	3010.73
H-12	CUL	01/07/13	457.38	2969.95	3013.01
H-12	CUL	02/11/13	457.11	2970.22	3013.31
H-15R	CUL	09/17/12	508.49	2973.53	3016.87
H-15R	CUL	10/11/12	508.54	2973.48	3016.82
H-15R	CUL	11/07/12	508.46	2973.56	3016.91
H-15R	CUL	12/03/12	508.21	2973.81	3017.19
H-15R	CUL	01/09/13	508.10	2973.92	3016.95
H-15R	CUL	02/12/13	507.83	2974.19	3017.25
H-16	CUL	09/17/12	374.78	3035.28	3047.85
H-16	CUL	10/11/12	374.88	3035.18	3047.74
H-16	CUL	11/13/12	375.44	3034.62	3047.16
H-16	CUL	12/11/12	375.58	3034.48	3047.02
H-16	CUL	01/09/13	377.01	3033.05	3045.53

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC ft	WATER LEVEL ELEVATION ft amsl[1]	ADJUSTED FRESHWATER HEAD ft amsl
H-16	CUL	02/12/13	376.55	3033.51	3046.01
H-17	CUL	09/13/12	419.50	2965.74	3006.67
H-17	CUL	10/10/12	419.36	2965.88	3006.83
H-17	CUL	11/08/12	419.12	2966.12	3007.10
H-17	CUL	12/04/12	418.89	2966.35	3007.36
H-17	CUL	01/08/13	418.53	2966.71	3006.86
H-17	CUL	02/08/13	418.35	2966.89	3007.07
H-19b0	CUL	09/17/12	426.95	2991.38	3012.96
H-19b0	CUL	10/10/12	427.14	2991.19	3012.76
H-19b0	CUL	11/12/12	427.15	2991.18	3012.75
H-19b0	CUL	12/06/12	426.68	2991.65	3013.25
H-19b0	CUL	01/09/13	426.75	2991.58	3013.17
H-19b0	CUL	02/11/13	426.46	2991.87	3013.48
H-19b2	CUL	09/17/12	428.37	2990.56	3010.55
H-19b2	CUL	12/06/12	428.06	2990.87	3010.88
H-19b3	CUL	09/17/12	428.59	2990.43	3008.04
H-19b3	CUL	12/06/12	428.29	2990.73	3008.35
H-19b4	CUL	09/17/12	427.80	2991.18	3009.48
H-19b4	CUL	12/06/12	427.52	2991.46	3009.78
H-19b5	CUL	09/17/12	427.81	2990.77	3011.66
H-19b5	CUL	12/06/12	427.53	2991.05	3011.96
H-19b6	CUL	09/17/12	428.48	2990.54	3011.09
H-19b6	CUL	12/06/12	428.20	2990.82	3011.38
H-19b7	CUL	09/17/12	428.51	2990.43	3011.30
H-19b7	CUL	Dec. '12	SNL Testing		
I-461	CUL	09/12/12	243.24	3040.37	3040.37
I-461	CUL	10/08/12	243.00	3040.61	3040.61
I-461	CUL	11/05/12	243.11	3040.50	3040.50
I-461	CUL	12/04/12	243.23	3040.38	3040.38
I-461	CUL	01/07/13	242.70	3040.91	3040.91
I-461	CUL	02/07/13	242.37	3041.24	3041.24
SNL-01	CUL	09/11/12	436.31	3076.53	3082.00
SNL-01	CUL	10/08/12	436.81	3076.03	3081.49
SNL-01	CUL	11/05/12	437.15	3075.69	3081.14
SNL-01	CUL	12/04/12	437.50	3075.34	3080.78
SNL-01	CUL	01/08/13	437.46	3075.38	3080.47
SNL-01	CUL	02/07/13	437.70	3075.14	3080.22
SNL-02	CUL	09/12/12	254.62	3068.44	3070.39
SNL-02	CUL	10/08/12	254.69	3068.37	3070.31
SNL-02	CUL	11/05/12	254.88	3068.18	3070.12
SNL-02	CUL	12/04/12	254.57	3068.49	3070.44
SNL-02	CUL	01/08/13	252.90	3070.16	3072.12
SNL-02	CUL	02/07/13	252.58	3070.48	3072.44
SNL-03	CUL	09/11/12	420.29	3070.06	3079.76
SNL-03	CUL	10/08/12	420.67	3069.68	3079.36
SNL-03	CUL	11/13/12	421.34	3069.01	3078.68
SNL-03	CUL	12/05/12	421.30	3069.05	3078.72
SNL-03	CUL	01/08/13	421.20	3069.15	3078.82
SNL-03	CUL	02/07/13	421.23	3069.12	3078.79

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC ft	WATER LEVEL ELEVATION ft amsl[1]	ADJUSTED FRESHWATER HEAD ft amsl
SNL-05	CUL	09/12/12	309.69	3070.29	3073.34
SNL-05	CUL	10/08/12	310.31	3069.67	3072.72
SNL-05	CUL	11/05/12	310.91	3069.07	3072.11
SNL-05	CUL	12/04/12	310.99	3068.99	3072.03
SNL-05	CUL	01/08/13	310.38	3069.60	3072.65
SNL-05	CUL	02/07/13	310.29	3069.69	3072.74
SNL-06	CUL	09/11/12	620.50	3025.61	3198.58
SNL-06	CUL	10/09/12	617.79	3028.32	3201.94
SNL-06	CUL	11/08/12	613.89	3032.22	3206.78
SNL-06	CUL	12/04/12	610.99	3035.12	3210.38
SNL-06	CUL	01/08/13	607.04	3039.07	3216.74
SNL-06	CUL	02/08/13	603.68	3042.43	3220.92
SNL-08	CUL	09/11/12	542.51	3013.22	3053.38
SNL-08	CUL	10/09/12	542.41	3013.32	3053.49
SNL-08	CUL	11/07/12	542.49	3013.24	3053.40
SNL-08	CUL	12/04/12	542.41	3013.32	3053.49
SNL-08	CUL	01/08/13	542.12	3013.61	3053.81
SNL-08	CUL	02/08/13	542.26	3013.47	3053.65
SNL-09	CUL	09/13/12	312.74	3048.22	3052.80
SNL-09	CUL	10/08/12	312.49	3048.47	3053.05
SNL-09	CUL	11/13/12	312.66	3048.30	3052.88
SNL-09	CUL	12/05/12	312.42	3048.54	3053.13
SNL-09	CUL	01/07/13	312.04	3048.92	3053.51
SNL-09	CUL	02/07/13	311.69	3049.27	3053.87
SNL-10	CUL	09/13/12	327.50	3050.09	3052.66
SNL-10	CUL	10/09/12	327.30	3050.29	3052.87
SNL-10	CUL	11/13/12	327.61	3049.98	3052.55
SNL-10	CUL	12/05/12	327.55	3050.04	3052.61
SNL-10	CUL	01/08/13	327.30	3050.29	3052.87
SNL-10	CUL	02/07/13	327.02	3050.57	3053.15
SNL-12	CUL	09/12/12	341.11	2998.35	2999.50
SNL-12	CUL	10/09/12	340.00	2999.46	3000.61
SNL-12	CUL	11/05/12	339.54	2999.92	3001.08
SNL-12	CUL	12/05/12	339.28	3000.18	3001.34
SNL-12	CUL	01/07/13	338.78	3000.68	3002.07
SNL-12	CUL	02/08/13	338.82	3000.64	3002.03
SNL-13	CUL	09/13/12	282.17	3011.94	3014.91
SNL-13	CUL	10/08/12	282.49	3011.62	3014.58
SNL-13	CUL	11/13/12	282.92	3011.19	3014.14
SNL-13	CUL	12/03/12	282.41	3011.70	3014.67
SNL-13	CUL	01/07/13	282.35	3011.76	3013.90
SNL-13	CUL	02/07/13	282.40	3011.71	3013.84
SNL-14	CUL	09/13/12	380.13	2988.28	3001.88
SNL-14	CUL	10/10/12	379.23	2989.18	3002.82
SNL-14	CUL	11/08/12	378.43	2989.98	3003.66
SNL-14	CUL	12/04/12	378.38	2990.03	3003.71
SNL-14	CUL	01/08/13	377.86	2990.55	3003.97
SNL-14	CUL	02/08/13	377.74	2990.67	3004.09
SNL-15	CUL	09/13/12	550.94	2928.99	3015.27

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC ft	WATER LEVEL ELEVATION ft amsl[1]	ADJUSTED FRESHWATER HEAD ft amsl
SNL-15	CUL	10/10/12	549.84	2930.09	3016.62
SNL-15	CUL	11/12/12	548.65	2931.28	3018.09
SNL-15	CUL	12/05/12	547.68	2932.25	3019.28
SNL-15	CUL	01/08/13	546.41	2933.52	3019.72
SNL-15	CUL	02/08/13	546.26	2933.67	3019.90
SNL-16	CUL	09/12/12	123.59	3009.41	3010.07
SNL-16	CUL	10/08/12	123.48	3009.52	3010.18
SNL-16	CUL	11/05/12	123.53	3009.47	3010.13
SNL-16	CUL	12/04/12	123.79	3009.21	3009.87
SNL-16	CUL	01/07/13	123.54	3009.46	3010.20
SNL-16	CUL	02/07/13	123.44	3009.56	3010.31
SNL-17	CUL	09/12/12	233.67	3004.39	3005.09
SNL-17	CUL	10/08/12	233.67	3004.39	3005.09
SNL-17	CUL	11/05/12	233.55	3004.51	3005.21
SNL-17	CUL	12/03/12	233.67	3004.39	3005.09
SNL-17	CUL	01/08/13	233.24	3004.82	3005.40
SNL-17	CUL	02/08/13	233.34	3004.72	3005.30
SNL-18	CUL	09/11/12	302.78	3072.66	3074.40
SNL-18	CUL	10/08/12	304.48	3070.96	3072.69
SNL-18	CUL	11/05/12	304.93	3070.51	3072.23
SNL-18	CUL	12/04/12	304.92	3070.52	3072.24
SNL-18	CUL	01/08/13	304.39	3071.05	3072.28
SNL-18	CUL	02/07/13	304.21	3071.23	3072.47
SNL-19	CUL	09/12/12	153.20	3069.45	3070.66
SNL-19	CUL	10/08/12	153.44	3069.21	3070.42
SNL-19	CUL	11/05/12	153.54	3069.11	3070.32
SNL-19	CUL	12/04/12	153.18	3069.47	3070.68
SNL-19	CUL	01/08/13	151.88	3070.77	3072.19
SNL-19	CUL	02/07/13	151.59	3071.06	3072.48
WIPP-11	CUL	09/13/12	365.57	3062.21	3080.91
WIPP-11	CUL	10/10/12	365.68	3062.10	3080.80
WIPP-11	CUL	11/13/12	366.13	3061.65	3080.33
WIPP-11	CUL	12/05/12	366.04	3061.74	3080.43
WIPP-11	CUL	01/08/13	365.66	3062.12	3080.82
WIPP-11	CUL	02/12/13	365.67	3062.11	3080.81
WIPP-13	CUL	09/13/12	344.73	3060.94	3076.88
WIPP-13	CUL	10/10/12	344.94	3060.73	3076.66
WIPP-13	CUL	11/13/12	345.26	3060.41	3076.32
WIPP-13	CUL	12/05/12	345.12	3060.55	3076.47
WIPP-13	CUL	01/09/13	345.11	3060.56	3075.74
WIPP-13	CUL	02/12/13	344.80	3060.87	3076.06
WIPP-19	CUL	09/10/12	391.26	3043.85	3063.55
WIPP-19	CUL	10/11/12	391.40	3043.71	3063.40
WIPP-19	CUL	11/13/12	391.89	3043.22	3062.89
WIPP-19	CUL	12/06/12	391.67	3043.44	3063.12
WIPP-19	CUL	01/07/13	391.96	3043.15	3062.81
WIPP-19	CUL	02/12/13	391.99	3043.12	3062.78
WQSP-1	CUL	09/17/12	361.15	3058.10	3075.37
WQSP-1	CUL	10/11/12	361.66	3057.59	3074.84

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC ft	WATER LEVEL ELEVATION ft amsl[1]	ADJUSTED FRESHWATER HEAD ft amsl
WQSP-1	CUL	11/13/12	362.08	3057.17	3074.40
WQSP-1	CUL	12/06/12	361.90	3057.35	3074.59
WQSP-1	CUL	01/10/13	361.79	3057.46	3075.40
WQSP-1	CUL	02/12/13	361.68	3057.57	3075.52
WQSP-2	CUL	09/10/12	401.17	3062.70	3083.05
WQSP-2	CUL	10/11/12	401.73	3062.14	3082.46
WQSP-2	CUL	11/13/12	402.25	3061.62	3081.92
WQSP-2	CUL	12/06/12	401.91	3061.96	3082.27
WQSP-2	CUL	01/08/13	401.72	3062.15	3082.47
WQSP-2	CUL	02/12/13	401.73	3062.14	3082.46
WQSP-3	CUL	09/10/12	464.76	3015.38	3073.06
WQSP-3	CUL	10/11/12	464.83	3015.31	3072.98
WQSP-3	CUL	11/07/12	464.99	3015.15	3072.80
WQSP-3	CUL	12/06/12	465.00	3015.14	3072.79
WQSP-3	CUL	01/07/13	465.22	3014.92	3072.93
WQSP-3	CUL	02/12/13	465.02	3015.12	3073.16
WQSP-4	CUL	09/17/12	444.27	2988.82	3014.40
WQSP-4	CUL	10/11/12	444.38	2988.71	3014.28
WQSP-4	CUL	11/12/12	444.48	2988.61	3014.18
WQSP-4	CUL	12/06/12	443.96	2989.13	3014.74
WQSP-4	CUL	01/09/13	444.11	2988.98	3014.91
WQSP-4	CUL	02/11/13	443.73	2989.36	3015.32
WQSP-5	CUL	09/10/12	379.50	3004.88	3012.42
WQSP-5	CUL	10/11/12	379.52	3004.86	3012.40
WQSP-5	CUL	11/12/12	379.75	3004.63	3012.16
WQSP-5	CUL	12/06/12	379.29	3005.09	3012.63
WQSP-5	CUL	01/09/13	379.51	3004.87	3012.41
WQSP-5	CUL	02/12/13	379.23	3005.15	3012.70
WQSP-6	CUL	09/10/12	344.20	3020.52	3024.82
WQSP-6	CUL	10/11/12	344.15	3020.57	3024.87
WQSP-6	CUL	11/12/12	344.46	3020.26	3024.56
WQSP-6	CUL	12/03/12	344.25	3020.47	3024.77
WQSP-6	CUL	01/09/13	344.45	3020.27	3024.06
WQSP-6	CUL	02/12/13	344.33	3020.39	3024.18

Notes:
1: amsl = Above Mean Sea Level
2: New well in Nov. 2011, fluid density not available until 2012 to calculate Adjusted Freshwater Head
3: SNL Testing = testing equipment in well so not accessible for water level measurements