**Glenn Springs Holdings, Inc.**
A subsidiary of Occidental Petroleum

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March 17, 2009

Ms. Gloria M. Sosa
United States Environmental Protection Agency
Region II
Site Investigation & Compliance Branch
290 Broadway, 20th Floor
New York, NY 10007-1866

Mr. Will Welling
New York State Department of Conservation
Remedial Bureau D, 12th Floor
625 Broadway
Albany, NY 12233-7013

Dear Ms. Sosa and Mr. Welling:

Re: Abandonment of Long Open-Interval Wells
Hyde Park Remedial Program

## INTRODUCTION

This report documents the completion of a well abandonment effort at the Hyde Park Landfill Site (Site) in the Town of Niagara, New York. The Site is managed by Glenn Springs Holdings, Inc. (GSHI), a subsidiary of Occidental Chemical Company (OxyChem). The Site landfill was active from approximately 1953 until 1975. Environmental investigation of the Site began in the late 1970s. Site investigations up to year 2000 involved the installation of numerous bedrock wells with long open-intervals, some up to 50 feet long. It is these long open-interval bedrock wells that were abandoned in 2008.

Between 2000 and 2004, the conceptual model of the bedrock groundwater was reassessed and changed from three intervals (Upper, Middle, and Lower) to eleven thin, parallel, and discrete groundwater flow zones (FZ-01 through FZ-11). The groundwater monitoring network was also modified from long open-interval Upper, Middle, and Lower bedrock wells to 1-inch diameter flow zone piezometers with 2-foot long screens. Details of these investigations and piezometer construction are documented in the reports listed in the References section of this report.

Most of the long open-interval bedrock wells interconnected two or more of the thin groundwater flow zones. These interconnections influenced groundwater flow and contaminant transport. The interconnections were eliminated at some wells by retrofitting the wells with the 1-inch diameter flow zone piezometers. However, over 100 long open-interval wells were not retrofit with flow zone piezometers.

GSHI proposed to abandon the non-retrofit long open-interval wells in the Site *Performance Monitoring Program* submitted July 31, 2006. A *Well Abandonment Work Plan* (Work Plan) was submitted to the United Stated Environmental Protection Agency (USEPA), the New York State Department of Environmental Conservation (NYSDEC), and the New York State Department of Health (NYSDOH) (collectively, the Agencies) on March 28, 2008. A copy of the Work Plan is attached to this report (Attachment 1). The Work Plan was approved on April 7, 2008. Field abandonment efforts were initiated on June 23, 2008 and completed on September 4, 2008.

The objective of this report is to document the completion of the well abandonments and to provide data collected during the abandonment effort. The additional data collected were not considered to be critical but might be useful in the future. Thus, the Agencies or GSHI required that the data be compiled and submitted, but data analysis/evaluation was not required. A limited description of several clear affects of the abandonments on groundwater levels is provided.

## SCOPE OF WORK

A table of the wells to be abandoned and a plate showing the locations of these wells are included in the attached Work Plan (Table 1 and Plate 1). Two abandonment methodologies were defined in the Work Plan: the NYSDEC Abandonment Procedure and the Miller Springs Remediation Management, Inc. (MSRMI) Modified Procedure. The NYSDEC procedure conforms to the protocol defined in NYSDEC guidance document *Groundwater Monitoring Well Decommissioning Procedures*. The MSRMI procedure is a modification of the NYSDEC procedure and incorporates an extra effort in wells that intersected flow zones of potentially high transmissivity and vertical flow. The Work Plan identified the procedure required at each well. Detailed descriptions of the procedures were presented as a standard field procedure in the Site *Performance Monitoring Program.* Copies of the abandonment procedures are attached to this report (Attachment 2).

During the Site investigations in 2003, it was observed that sealing a long open-interval well could affect groundwater levels in flow zone piezometers several hundred feet from the sealed well. Abandoning 100 additional long open-interval wells had the potential to influence groundwater levels across the Site and the performance of the Lockport Bedrock Non-Aqueous Phase Liquid Plume Containment System (the containment system). Therefore, a groundwater level monitoring program was completed during the abandonment effort. Groundwater levels were monitored by hand in 126 flow zone piezometers on a monthly basis beginning at the start of the abandonment (June 2008) and for 3 months after the abandonments were completed (December 2008). These piezometers are normally monitored on a quarterly basis.

In addition to monitoring water levels in the flow zone piezometers by hand, GSHI agreed to monitor 23 of the flow zone piezometers using electronic water level recorders, Solinst™ Leveloggers. The piezometer water level response may occur within a few hours after a well is abandoned. Thus, the electronic water level recorders were necessary to capture the rapid changes in water levels. Leveloggers were installed in select piezometers in flow zones FZ-06, FZ-07, and FZ-09. These three flow zones exhibit horizontal groundwater flow, which can potentially transport contaminates off Site, and thus are the critical flow zones. Groundwater in the shallower flow zones tend to flow vertically into FZ-06, FZ-07, and FZ-09. The deepest flow zone, FZ-11, is essentially stagnant. Table 2 of the Work Plan lists the piezometers that were monitored with Leveloggers.

## RESULTS

### Abandonments

Table 1 presents the date and time the abandonment of each well was completed. Typically, three wells were abandoned each day, with the actual count varying from one to five. Of the 124 wells scheduled for abandonment, 21 were determined to already have been abandoned, and 1 well was obstructed and was not abandoned; these conditions are identified in Table 1.

Well IFW-3 is obstructed by a bladder pump lodged at approximately 80 feet below grade and could not be abandoned according to the approved procedures. Based on discussions with EPA's oversight contractor (Tamara Raby: AECOM Environment), the well was left open. GSHI will attempt to remove the pump in 2009. If the pump cannot be recovered, GSHI proposes to drive the pump further down into the well and then the borehole would be abandoned according to the NYSDEC procedure.

All abandonments were completed by cutting the casing off below grade and backfilling to grade according to surface conditions (e.g., asphalt, dirt, or gravel), with the following four exceptions:

- PW-3U (RW-3UM);
- E3U (PW-5U);
- F3U (PW-6U); and
- D3U (PW-2U).

For these, the well casings were filled and left in place. The well vaults remain in place and are locked.

There were 25 deviations from the proposed abandonment procedures (identified in Table 1). All deviations in well abandonment methods were approved by AECOM Environment. These deviations are explained below.

At 21 wells where the NYSDEC procedure was proposed, the MSRMI Modified procedure was used instead. Changing from the NYSDEC procedure to the MSRMI Modified procedure occurred when grout was flowing into the formation and not filling the well. The MSRMI Modified procedure uses bentonite chips to fill the open interval. The pellets do not flow into the formation, overcoming the lose of grout.

There were four wells where the MSRMI Modified procedure was proposed and the NYSDEC procedure used instead. These wells had previously been modified by installing 2-inch diameter polyvinyl chloride (PVC) and short well screens. It is difficult to fill the smaller diameter wells with bentonite chips; they easily bridge and block the 2-inch well. Thus, a field decision was made to use the NYSDEC procedure on these wells. The deviations did not adversely impact the quality of the abandonment.

**Data Collection**

The piezometer water level data collected were compiled and are provided in the attached compact disk in a Microsoft Access database format (Attachment 3). Hand water levels were completed for all 126 piezometers. Data from the electronic water level recorders were adjusted to match the hand water level measurements. Only an up-or-down shift in the electronic data was performed, no scaling or trend adjustments were necessary.

Of the 23 piezometers monitored with Leveloggers (Table 2 in the Work Plan), only 19 Leveloggers were recovered. Four of the Leveloggers were lost due to failure of the cable suspending the transducer (at ABP-1-09, D1M-09, F4M-09, and H2M-06). The fifth Levelogger (at J5M-09) experienced electronic instrument failure on July 9, 2008.

In addition to the piezometers proposed for monitoring in the Work Plan, piezometer PMW-1M-09 is monitored using a Levelogger as part of the Site Performance Monitoring Program. The data from this piezometer is included here.

Pumping rates and water levels for the bedrock containment system were also compiled. The data from June 24 2008 through June 30 2008 was lost due to computer system failure.

All data collected are provided in the attached database (Attachment 3). Hydrographs of the data from the water level recorders, hand measurements, and pumping wells were prepared and are attached (Attachment 4). A limited discussion of observations is provided below.

**Observations**

Responses to the well abandonments and other unrelated influences were observed in numerous wells. None of the responses observed altered the conclusion that hydraulic containment is being maintained in the bedrock aquifer. The following discussion reviews obvious changes in water levels that were observed at the G1 and G6 piezometer clusters. This discussion is not intended to be a comprehensive evaluation but a brief description of the only large changes in water levels observed during the well abandonments.

At piezometer clusters G1 and G6, a significant change in water level (considered to be significant relative to normal fluctuations observed between regular monitoring events) was observed during the well abandonments. The G1 and G6 piezometer clusters are south of the groundwater recovery system. The rise in water levels observed tends to direct groundwater towards the containment system, benefiting (versus impairing) containment performance.

**July 22, 2008 Response**

The only significant change in water levels was observed in piezometers G1M-07, G1M-09, G6-07, and G6-09 (significant is subjective and based on comparison with fluctuations typically observed between regular monitoring events). Piezometers G1M-07 and G6-07 (with electronic water level recorders) began rising rapidly on Tuesday, July 22, 2008 around 10:00 a.m. Water level increased by approximately 30 feet in 4 days. Piezometers G6-06 and E6-06 also responded at the same time but with only 3 and 2 feet of change, respectively. G1M-09 and G6-09 (hand water levels only) also rose by 30 to 35 feet in this same timeframe. No other wells exhibited large changes in water levels at this time. Nearby piezometer E6-07, where a similar response might have been expected, has a very low transmissivity and cannot respond quickly to a water level change.

In 2003, when a deep boring was installed to construct the G6 piezometers, water levels in G1M-07 and G1M-09 rose by 20 feet (see the August 2004 *Comprehensive Remedial Characterization Report*). The deep G6 boring interconnected bedrock flow zones from FZ-01 to FZ-11. The water levels in G1M-07 and G1M-09 returned to pre-boring levels as soon as the G6 piezometers were installed, isolating the flow zones. Thus, a large response to interconnection of flow zones is not without precedent.

The response observed on July 22 appears to be related to abandonment of the long open-interval wells F1U, F1M, and F1L, which were all completed on that day. The F1 wells are approximately 1,100; 1,600; and 1,900 feet from piezometer locations G1, G6, and E6, respectively. F2M-09, approximately 450 feet from the abandoned F1 wells, exhibited an apparent drop of about 0.5 feet in water level beginning on July 22.

## G6 Piezometer Cluster Anomalies

Anomalous water level readings have historically been observed in the G6 piezometers. The electronic water level recorder data collected during the abandonment effort show a 5-foot change in the water level at G6-06 and at G6-07 on September 11, 2008. The change occurs in less than 1 hour (the recorder sampling frequency). This type of change is often "apparent" associated with moving the water level recorder. However, there is no record of access to these piezometers on September 11, and the hand water level data confirm the change in level. Similar rapid changes were observed in June 2008; however, there were no hand data to confirm that these changes were real.

The very rapid changes in the G6 piezometer water levels appear to be real and were not related to the abandonments. Abandonments were not being performed when the changes occurred. The cause of this change is unknown. However, these changes in groundwater levels do not alter the interpretation of hydraulic performance of the Site bedrock groundwater containment system.

## SUMMARY

The well abandonments were completed as proposed in the Work Plan. Water level data were compiled and are included in this report. Some changes in piezometer water levels associated with the well abandonments were observed; however, none of the changes were large enough to adversely influence the performance of the Lockport Bedrock Non-Aqueous Phase Liquid Plume Containment System.

## REFERENCES

*1996 NYSDEC: Groundwater Monitoring Well Decommission Procedures (October 1996)*

*2002 Site Characterization Report: Revised Geologic and Hydrogeologic Characterization: Hyde Park Landfill Site (February 2002)*

*2003 Site Characterization Report: Hydrologic Characterization: Hyde Park Landfill Site (February 2003*

*2003 Site Characterization Report: Groundwater Flow Model: Hyde Park Landfill Site (May 2003)*

*2003 Remedial Characterization Report: Hyde Park Landfill Site (May 2003)*

*2003 Major Ions Study: Hyde Park Landfill Site (November 2003)*

*2004 Site Characterization Report: Bedrock Groundwater Quality: Hyde Park Landfill Site (April 2004)*

*2004 Comprehensive Remedial Characterization Report: Hyde Park Landfill Site (August 2004)*

*2006 Performance Monitoring Plan: Hyde Park Landfill Site (July 2006)*

*2008 Well Abandonment Work Plan: Hyde Park Landfill Site (March 2008)*

**TABLES**

Table 1: Wells Abandoned

**ATTACHMENTS**

Attachment 1: *Well Abandonment Work Plan: Hyde Park Landfill Site* (March 2008)

Attachment 2: Field Procedures from the *Performance Monitoring Plan: Hyde Park Landfill Site* (July 2006)

Attachment 3: Compact Disk with Electronic Database

Attachment 4: Hydrographs

Sincerely,

Clinton J. Babcock
Project Manager

CJB/JP/adh/001069-SosaWell-23
Enclosure

M. Anderson, GSHI – 1*
M. Forcucci, NYSDOH – 1*
D. Hoyt, CRA – 1
T. Raby, AECOM Environmental – 1*
J. Pentilchuk, CRA – 1
B. Sadowski, NYSDEC – 1*
G. Sosa, USEPA – 4*
W. Welling, NYSDEC – 2*

*Include one copy on CD

**TABLE 1**

**WELLS ABANDONED**
**ABANDONMENT OF LONG OPEN-INTERVAL WELLS**
**HYDE PARK LANDFILL SITE**

| *Well ID* | *Date Abandon* | *Start* | *Stop* | *Proposed Method* | *Deviation* |
|---|---|---|---|---|---|
| A2U | 8/19/2008 | 8:30 | 9:30 | NYSDEC | |
| AB1L | 7/8/2008 | 7:30 | 8:00 | NYSDEC | |
| AB1M | 7/7/2008 | 12:00 | 13:00 | MSRMI Modified | |
| AB1U | 7/8/2008 | 8:00 | 8:30 | NYSDEC | |
| ABP-2 | 7/14/2008 | 13:00 | 14:30 | MSRMI Modified | NYSDEC |
| ABP-3 | 7/8/2008 | 13:00 | 14:30 | NYSDEC | MSRMI Modified |
| ABP-4 | 7/8/2008 | 10:00 | 11:45 | NYSDEC | MSRMI Modified |
| ABP-5 | 6/26/2008 | 7:30 | 8:15 | NYSDEC | |
| ABP-8 | 7/14/2008 | 10:30 | 11:30 | MSRMI Modified | |
| AGW-2L | 7/7/2008 | 8:30 | 9:30 | NYSDEC | |
| AGW-2M | 7/3/2008 | 10:00 | 15:00 | MSRMI Modified | |
| AGW-3L | 7/11/2008 | 13:30 | 14:30 | NYSDEC | |
| AGW-3M | 7/11/2008 | 9:00 | 11:30 | MSRMI Modified | |
| AGW-3U | 7/14/2008 | 8:00 | 9:45 | NYSDEC | |
| B1L | 6/23/2008 | na | na | NYSDEC | |
| B1M | 6/23/2008 | na | na | MSRMI Modified | |
| B1U | 6/23/2008 | na | na | NYSDEC | |
| BC3L | 6/23/2008 | na | na | NYSDEC | |
| BC3M | 6/23/2008 | na | na | MSRMI Modified | |
| BC3U | 6/23/2008 | na | na | NYSDEC | |
| BH7-95 | 8/12/2008 | 12:30 | 14:00 | NYSDEC | |
| C1L | 6/25/2008 | 12:30 | 13:30 | NYSDEC | |
| C1M | 6/25/2008 | 8:00 | 11:30 | MSRMI Modified | |
| C1U | | 6/25/2008 12:15 | 6/26/2008 7:30 | NYSDEC | |
| C2L | 7/1/2008 | 7:00 | 8:00 | NYSDEC | |
| C2M | 7/1/2008 | 8:30 | 10:30 | MSRMI Modified | |
| C2U (ABP-6) | 7/1/2008 | 11:00 | 12:00 | NYSDEC | |
| CD1L | 7/30/2008 | 7:00 | 9:15 | NYSDEC | MSRMI Modified |
| CD1M | 7/23/2008 | 8:00 | 11:30 | MSRMI Modified | |
| CD1U | 8/6/2008 | | | NYSDEC | |
| CD2M | 6/26/2008 | 12:00 | 13:45 | MSRMI Modified | |
| CD3U | 6/27/2008 | 7:30 | 9:00 | NYSDEC | MSRMI Modified |
| CD4U | 6/30/2008 | 12:00 | 14:30 | NYSDEC | MSRMI Modified |
| CD5U | 6/30/2008 | 7:30 | 10:30 | NYSDEC | MSRMI Modified |
| CD6U | 6/27/2008 | 12:00 | 13:30 | NYSDEC | MSRMI Modified |
| D3U (PW-2U) | 8/8/2008 | 7:00 | 14:00 | NYSDEC | |
| D4L (PMW-2L) | 7/24/2008 | | | NYSDEC | |
| D4M (PMW-2M) | 7/24/2008 | | | MSRMI Modified | NYSDEC |
| D4U (PMW-2U) | 7/24/2008 | | | NYSDEC | |
| D5L | 8/6/2008 | | | NYSDEC | |
| D-6 | | | | Previously Abandoned | |
| D-6-1 | | | | Previously Abandoned | |
| E1L | 7/17/2008 | 12:00 | 14:15 | NYSDEC | |
| E1M | 7/16/2008 | 9:30 | 13:00 | MSRMI Modified | |
| E1U | 7/17/2008 | 9:30 | 10:45 | NYSDEC | MSRMI Modified |
| E2L | 7/15/2008 | 12:30 | 14:30 | NYSDEC | |
| E2M | 7/15/2008 | 8:00 | 11:30 | MSRMI Modified | |
| E2U | | 7/16/2008 | 7/17/2008 | NYSDEC | |

**TABLE 1**

**WELLS ABANDONED**
**ABANDONMENT OF LONG OPEN-INTERVAL WELLS**
**HYDE PARK LANDFILL SITE**

| *Well ID* | *Date Abandon* | *Start* | *Stop* | *Proposed Method* | *Deviation* |
|---|---|---|---|---|---|
| E3L | 7/21/2008 | 8:15 | 9:30 | NYSDEC | |
| E3M | 7/18/2008 | 12:00 | 14:15 | MSRMI Modified | |
| E3U (PW-5U) | 8/29/2008 | 7:30 | 14:30 | NYSDEC | |
| E4L | 8/15/2008 | 12:00 | 13:00 | NYSDEC | |
| E4M | | 8/15/2008 | 8/18/2008 | MSRMI Modified | |
| E4U | 8/15/2008 | 8:00 | 9:15 | NYSDEC | MSRMI Modified |
| E5U | 8/14/2008 | 9:00 | 11:00 | NYSDEC | MSRMI Modified |
| F1L | 7/22/2008 | | | NYSDEC | |
| F1M | 7/22/2008 | | | MSRMI Modified | |
| F1U | 7/22/2008 | | | NYSDEC | |
| F3L | 7/21/2008 | 10:30 | 11:30 | NYSDEC | |
| F3U (PW-6U) | 8/27/2008 | 7:30 | 14:30 | NYSDEC | |
| F-4-1 | | | | Previously Abandoned | |
| F-4-2 | | | | Previously Abandoned | |
| F-4A | | | | Previously Abandoned | |
| F5UR | 8/14/2008 | 12:30 | 13:20 | NYSDEC | MSRMI Modified |
| G2L | | | | Previously Abandoned | |
| G2M | | | | Previously Abandoned | |
| G2U | | | | Previously Abandoned | |
| G3L (BH4-95) | 8/13/2008 | 12:00 | 13:30 | NYSDEC | |
| G3M | | 8/20/2008 | 8/21/2008 | MSRMI Modified | |
| G3U | 8/13/2008 | 10:00 | 11:30 | NYSDEC | MSRMI Modified |
| G4U | 8/12/2008 | 7:30 | 11:30 | NYSDEC | |
| G5L | 8/7/2008 | | | NYSDEC | |
| G5U (T-2) | 8/7/2008 | | | NYSDEC | |
| GH1U | 8/13/2008 | 8:45 | 9:30 | NYSDEC | |
| H1L | 8/5/2008 | 11:00 | 12:00 | NYSDEC | |
| H1M | 8/4/2008 | 12:00 | 14:00 | MSRMI Modified | |
| H1U | 8/5/2008 | 10:00 | 11:00 | NYSDEC | MSRMI Modified |
| H-2 | 8/7/2008 | | | MSRMI Modified | NYSDEC |
| H-3 | 9/4/2008 | 7:30 | 10:30 | MSRMI Modified | NYSDEC |
| H3L | | 8/4/2008 | 8/5/2008 | NYSDEC | |
| H3U | | 8/4/2008 | 8/5/2008 | NYSDEC | |
| H4L | 8/7/2008 | | | NYSDEC | |
| HT-2 (BH2-95) | 7/10/2008 | 8:30 | 9:45 | NYSDEC | |
| IFW-1 | | | | Previously Abandoned | |
| IFW-1R | 7/2/2008 | 7:00 | 9:30 | NYSDEC | |
| IFW-2 | 7/3/2008 | 7:00 | 8:30 | NYSDEC | |
| IFW-3 | * | * | * | NYSDEC | |
| IFW-4 | 8/13/2008 | 7:00 | 8:30 | NYSDEC | |
| IFW-5 | 7/25/2008 | 8:00 | 10:30 | NYSDEC | |
| IFW-6 | 8/14/2008 | 7:00 | 8:40 | NYSDEC | |
| IFW-7 | 6/26/2008 | 10:30 | 11:30 | NYSDEC | |
| I-5A | | | | Previously Abandoned | |
| I-5B | | | | Previously Abandoned | |
| J-1 | | | | Previously Abandoned | |
| J1L | 7/3/2008 | 8:30 | 9:15 | NYSDEC | |
| J1M | 7/2/2008 | 9:30 | 13:30 | NYSDEC | MSRMI Modified |

**TABLE 1**

**WELLS ABANDONED**
**ABANDONMENT OF LONG OPEN-INTERVAL WELLS**
**HYDE PARK LANDFILL SITE**

| *Well ID* | *Date Abandon* | *Start* | *Stop* | *Proposed Method* | *Deviation* |
|---|---|---|---|---|---|
| J1U | 7/2/2008 | 14:00 | 14:30 | NYSDEC | |
| J2L | 7/7/2008 | 9:30 | 10:00 | NYSDEC | |
| J3L | 7/10/2008 | 10:00 | 13:00 | NYSDEC | |
| J3U (BH1-95) | 7/10/2008 | 13:00 | 15:00 | NYSDEC | MSRMI Modified |
| J4L | 7/29/2008 | 13:20 | 14:10 | NYSDEC | |
| JH1L | 7/28/2008 | 7:30 | 10:30 | MSRMI Modified | |
| MW-1-2001 | 8/19/2008 | 12:00 | 13:30 | NYSDEC | MSRMI Modified |
| MW-2-2001 | 8/19/2008 | 10:00 | 10:30 | NYSDEC | |
| MW-3-2001 | 7/9/2008 | 12:30 | 13:30 | NYSDEC | MSRMI Modified |
| MW-4-2001 | 7/9/2008 | 13:30 | 14:30 | NYSDEC | MSRMI Modified |
| MW-5-2001 | 7/9/2008 | 10:15 | 11:00 | NYSDEC | MSRMI Modified |
| MW-6-2001 | 7/9/2008 | 9:30 | 10:15 | NYSDEC | MSRMI Modified |
| MW-7-2001 | 8/20/2008 | 7:30 | 9:00 | NYSDEC | MSRMI Modified |
| OW1-78 | | | | Previously Abandoned | |
| OW4-78 | | | | Previously Abandoned | |
| OW7-78 | 7/28/2008 | 12:00 | 12:45 | NYSDEC | |
| OW11-79 | | | | Previously Abandoned | |
| OW13-79 | | | | Previously Abandoned | |
| OW18-79 | | | | Previously Abandoned | |
| OW20-79 | | | | Previously Abandoned | |
| OW22-80 | | | | Previously Abandoned | |
| OW24-80 | 8/5/2008 | 13:00 | 14:00 | NYSDEC | |
| OW26-80 | | | | Previously Abandoned | |
| OW28-80 | | | | Previously Abandoned | |
| PMW-3L | 8/22/2008 | 12:15 | 14:00 | NYSDEC | |
| PMW-3M | | 8/21/2008 13:00 | 8/22/2008 10:30 | MSRMI Modified | |
| PMW-3U | 8/22/2008 | 10:30 | 11:15 | NYSDEC | |
| PW-3U (RW3UM) | 8/11/2008 | 7:00 | 14:00 | MSRMI Modified | |

Notes:
na - time not recorded
* - IFW-3 blocked; not abandoned with approval of AECOM.

ATTACHMENT 1

Glenn Springs Holdings, Inc.
5005 LBJ Freeway, Suite 1350
Dallas, TX 75244
PHONE: 972-687-7500; FAX: 972-687-7524

March 28, 2008

Ms. Gloria M. Sosa
U.S. EPA, REGION II
Site Investigation &
Compliance Branch
290 Broadway, 20th Floor
New York, NY 10007-1866

Mr. Will Welling
NEW YORK STATE DEC
Division of Environmental Remediation
12th Floor
625 Broadway
Albany, NY 12233-7013

Subject: **Well Abandonment Work Plan - Revised**
Hyde Park Landfill Site
EPA ID: NY000831644
Niagara Falls, NY

Dear Ms. Sosa and Mr. Welling:

Enclosed is a work plan to abandon all remaining long open interval bedrock wells at the Hyde Park Site. It has been revised to address the comments received on January 4, 2008 as discussed below.

***Comments and Responses (responses in bold italic)***

1. Page 2, first paragraph. All wells presented in the PMP should be addressed in Table 1. Wells which will not be addressed during the well abandonment field activities should be addressed in a footnote explaining why the well does not need to be abandoned (i.e., well currently in use as a pumping well or well determined to have been previously abandoned). ***A footnote will be added to the table "Bedrock wells not being abandoned are the site included: the active purge wells, Bloody Run monitoring wells, the Community Monitoring Wells, A1U to be used for NAPL monitoring, and AGW-2U pending agreement by NYPA and NYSDEC DEC Region 9." This has also been discussed in the revised Work Plan. The two wells included in Table 1, CD2U and F5U, are now used as purge wells, PW-7U and PW-5UR, respectively. As they are not being abandoned, these two wells have been removed from Table 1.***

2. Page 2, first and second paragraphs. In an August 8, 2006 email, EPA requested that the Well Abandonment Work Plan present transmissivity values for each well (to aid in determination of which abandonment method to use). In Table 1 of the Work Plan, the majority of wells do not have a value presented. It is acknowledged that the text of the Work Plan provides an explanation why a specific abandonment procedure will be used; however, the following comments apply:

   a. Please indicate using "n/a" or similar where transmissivity data are not available, and

provide data where data are available. ***Table 1 has been updated accordingly.***

b. Please explain why J1M will be abandoned using the MSRM modified abandonment procedure when this well does not include flow zone 9 (no transmissivity value provided). ***J1M will be abandoned by the NYSDEC abandonment procedure. Table 1 has been updated accordingly.***

c. Well JH1L includes flow zone 9, however the table notes that the NYSDEC abandonment procedure will be used. Please provide an explanation. ***JH1L will be abandoned by the NYSDEC abandonment procedure. Table 1 has been updated accordingly.***

d. Please provide an explanation how MSRM will ensure that there are no interconnections between individual flow zones in wells where the NYSDEC abandonment procedure is used and transmissivity data are not given or wells where the flow zones are not known (i.e., flow zone 9 may be in the open interval or the well may have a transmissivity exceeding 100 $ft^2$/day.). ***The abandonments are being performed to decommission inactive wells, preventing potential infiltration of water/contamination from the surface and the need for long-term maintenance. Achieving a perfect seal between flow zones is a desirable outcome but is not required to achieve containment, to prevent migration, understand groundwater flow, or satisfactorily decommission the well. The critical grout seal is from the bottom of the well casing to grade, this seal will be achieved by both the NYSDEC and MRSM modified procedure. Thus, the NYSDEC procedure should be sufficient for every well on site. The MSRM modified procedure was developed as an extra precaution for wells with significant vertical flow within the borehole that could wash out the grout and interconnect flow zones. For the site-wide abandonment effort we decided to apply the MSRM modified procedure where there was a <u>potential</u> for significant vertical flow based on the criteria: T>100 $ft^2$/day, or the open interval intersecting FZ-09 plus one other flow zone. An actual vertical flow problem can only be determined in the field on a case-by-case basis. If a problem associated with vertical flow is encountered during a NYSDEC procedure, the MRSM modified procedure will be used. It should be recognized that no abandonment procedure will guarantee that every flow zone interconnections is eliminated and no level of monitoring will demonstrate that success or failure of isolating flow zones.***

3. <u>Page 3, paragraph 2</u>. In an August 8, 2006 email, EPA requested that water levels be monitored during abandonment work at a greater frequency than the current PMP quarterly frequency (i.e., weekly or monthly) and that select wells nearest the abandonment work be proposed for continuous water level monitoring (i.e., pressure transducers). The Work Plan states that three consecutive months of manual water levels will be collected. EPA requests that select wells nearest the abandonment work be proposed for continuous water level monitoring (i.e., hand levels collected at frequent intervals, such as hourly, is acceptable) to aid in the understanding of the effects on hydraulic containment during the abandonment process. Additionally, if water level changes in the flow zone piezometers are still being observed during the third month of consecutive manual water levels, monthly water levels should continue until static conditions are observed, at which point water level measurements should resume back to

quarterly. ***A monitoring program consisting of transducers and additional rounds of manual water levels has been added to the Work Plan as we agreed on the January 18, 2008 conference call.***

4. The following comments apply to Table 1 and Drawing 1:

   a. Well J3U should be listed as J3U (BH1-95), as shown on Drawing 1. ***Table 1 has been corrected.***

   b. The following wells are listed on the table; however, they are not shown on Drawing 1: OW1-78, OW18-79, and OW20-79. These wells have been added to ***Drawing No. 1. OW18-79 and OW20-79 has been corrected.***

   c. Well PW-3U (RW-3UM) is not shown on Drawing 1 as a well to be abandoned. Please confirm if this well is currently in use. If this well is in use, please edit Table 1 to indicate "in use". If this well is scheduled to be abandoned, please edit Drawing 1 accordingly. ***Well PW-3U was installed in 1991 and later deepened to create a recharge well, RW-3UM. The recharge idea was abandoned and RW-3UM was never used. This well will be abandoned. The well will be added to Drawing 1.***

5. Following the abandonment of the proposed wells, it should be stated within the Work Plan that if a data gap is determined (e.g., hydraulic containment can not be demonstrated), additional flow-zone specific piezometers will be installed. This should be addressed in the proposed Well Abandonment Report. ***The Work Plan has been revised to state "The final Well Abandonment Report will also include, if necessary, recommendations to address any data gaps that may be identified."***

6. Well AGW-2U is being used by NYPA for both quarterly measurements of fuel oil presence and product removal related to DEC Spill #0551698. This information is contained in a letter from Jeff Konsella (DEC Region 9) to William Slade (NYPA) dated March 19, 2007. NYPA has installed wells in this area to investigate the spill, so some coordination of activities between Oxy and NYPA is probably necessary. ***We will not abandon AGW-2U without concurrence of NYPA and DEC Region 9. Well AGW-2U has been so footnoted on Table 1.***

7. Using data from the site characterization reports, are wells CMW-7SH and CMW-8SH really needed? ***The referenced wells, CMW-7SH and CMW-8SH, may be technically unnecessary. However, before abandoning individual community monitoring wells we would propose a reevaluation of the community-monitoring program with input from the Agency.***

8. Well A1U should be kept for NAPL plume definition. ***Agreed - well A1U has been removed from the Work Plan.***

If you have questions on the plan, please contact me at 972-687-7506 or by email at clint_babcock@oxy.com.

Sincerely,

Clint Babcock
Project Manager
Glenn Springs Holdings, Inc.

001069-L-SosaWell-19
Enclosure

Distribution:

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# Well Abandonment Work Plan – Revised 1-18-08

Hyde Park Landfill Site; EPA ID: NY000831644

Niagara Falls, NY

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GSH plans to close the unused, long open interval bedrock wells at the Hyde Park Site, shown on Drawing No. 1 and listed in Table 1. Table 1 includes the following information:

1. A column presenting available transmissivity data (to aid in determination of which abandonment method to use);
2. A column presenting which abandonment method will be used;
3. A column presenting which flow zones are assumed to be found within the open interval at each proposed well to be abandoned; and
4. Intermediate Formation wells to be abandoned.

### *Wells not Abandoned*

Three groups of bedrock wells are not proposed for abandonment at this time. These are:

- Active bedrock purge wells;
- Bloody Run monitoring wells included in the Performance Monitoring Program (PMP); and
- Community Monitoring wells included in the PMP.

In addition, the USEPA requested that well A1U not be abandoned and that it be used for NAPL presence monitoring; and well AGW-2U is currently used by NYPA for monitoring LNAPL and will not be abandoned without the approval of NYPA and the NYSDEC Region 9. The need to abandon any of these wells will be reviewed in the 5-year report described in the PMP.

### *Sequence*

The sequence for abandonment is not critical and will be determined based on site logistics. That is, as convenient to the drillers and as determined by accessibility issues. The exception to this will be wells with NAPL present. A NAPL presence check will be performed at each well prior to the abandonment. Any wells with NAPL will be purged of the NAPL prior to abandonment and will be abandoned last.

### *Monitoring*

During the well abandonment, additional water level monitoring will be performed to evaluate the impact of the closures.

Water levels will be monitored by hand in all of the flow zone piezometers on a monthly basis beginning the week before well abandonment starts, and will continue until three monthly rounds following the abandonments have been collected. In addition, the piezometers listed in Table 2 will be monitored using electronic water level recorders for the duration of the well abandonment. Water levels will be recorded hourly. The electronic water level recorders will be installed on or before this first monthly monitoring event, and will be collected at the time the last round of monthly hand water levels is completed. Data will be downloaded and delivered to the EPA within two weeks of that monitoring event.

### *Procedure*

Two well abandonment procedures were identified in the PMP: a "NYSDEC" procedure and a "MRSM modified" procedure. Both methods will satisfy the objective of well abandonment, that is: sealing the wells to prevent the potential infiltration of surface water or contamination, and eliminating the need for long-term maintenance of the wells. The MSRM modified procedures was developed for wells with a significant vertical flow in the well bore that would prevent the grout seal from isolating individual flow zones intercepted by the open-interval. The MSRM modified procedure is more time-consuming and difficult than the NYSDEC procedure and therefore its use has been limited. Determining a significant vertical flow can only be done for certain during the abandonment. Rather than determining the use of the MSRM procedure on the fly, wells potentially needing the procedure were identified based on reasonable criteria. The selection criteria were: wells with transmissivity exceeding 100 $ft^2$/day, and wells intersecting FZ-09, the most prolific flow zone, and at least one other flow zone. These criteria do not demonstrate that there is a significant vertical flow issue, only that there is a potential for significant vertical flow. All other wells will be abandoned following the NYSDEC procedures. If difficulties associated with vertical flow are encountered during a NYSDEC procedure, the MSRM modified procedure will be implemented.

### *Discussion*

The abandonment of the long-open interval wells will influence groundwater levels in many of the flow zone piezometers, and will influence our interpretation of groundwater flow patterns. It is important to note, however, we historically had difficulty evaluating hydraulic containment based on water level data. Between 2000 and 2004, GSH completed a significant investigation effort, retrofitting many existing wells with flow zone piezometers and recharacterizing the Site hydrogeology. The conclusion of that

effort was that we needed to demonstrate containment based on "weight of evidence" argument. The weight of evidence includes water level data but relies heavily on three other factors: the distribution of Site-related chemistry, the relative age of the groundwater, and groundwater flow model simulations. Abandoning the long open interval wells should have no influence on these three factors in the short-term, i.e., in the timeframe of the abandonment effort. In summary:

- the affects on groundwater quality and relative age will require long-term monitoring consistent with the scope defined in the PMP; and
- the groundwater modeling did not include the influence of interconnections between individual flow zones created by the long open interval wells – it was technically impractical.

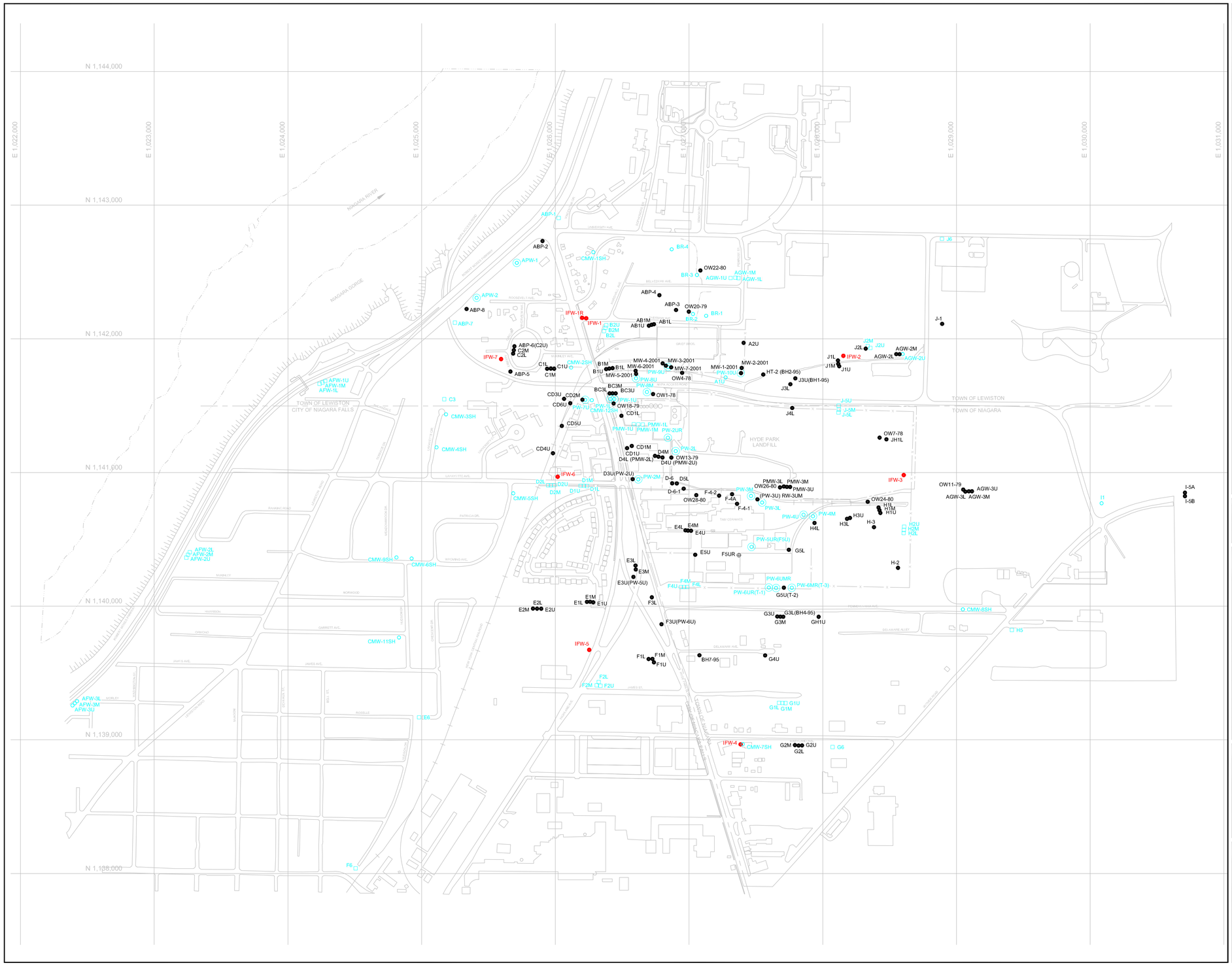
There is no reason to expect that the groundwater flow patterns will change greatly or that containment will be measurably impacted by the well abandonments. The quarterly monitoring of water levels and quality in the flow zone piezometers required in the PMP should be satisfactory to evaluate the influence of the abandonments on groundwater flow. However, the additional water level monitoring described above will be completed during and following the field effort.

### *Evaluation*

Following completion of the abandonment program and monitoring, the hand water level monitoring data will be evaluated by comparing pre-abandonment with post-abandonment conditions. This evaluation will be included in a final Well Abandonment Report. The final Well Abandonment Report will also include, if necessary, recommendations to address any data gaps that may be identified. The data from the electronic water level recorders will be submitted to the Agency in an electronic database format.

### *Schedule*

The well abandonment work will be scheduled immediately following EPA approval of this revised Work Plan. It is anticipated that the field work will begin in the 2$^{nd}$ quarter of 2008, depending on approval, driller availability, and transducer availability. The final Well Abandonment Report will be submitted approximately 90 days after completion of water level monitoring.

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LEGEND

- DITCH
- POWER TOWER
- MUNICIPAL BOUNDARY
- RAILWAY
- FENCE
- EDGE OF NIAGARA GORGE

TO BE MAINTAINED

- □ F4U — LOCATION OF A FLOW ZONE PIEZOMETER CLUSTER MAY CONTAIN MULTIPLE PIEZOMETERS
- ⊙ PW-2L — BEDROCK PURGE WELL
- ○ BR-2 — BEDROCK MONITORING WELL RETAINED FOR PMP

TO BE ABANDONED

- ● OMW-3 — BEDROCK MONITORING WELL - PROPOSED TO BE ABANDONED
- ● IFW-2 — INTERMEDIATE FORMATION MONITORING WELL

NOTE:

1) SITE BENCHMARK IS A P.K. NAIL SET IN THE EAST FACE OF A POWER POLE LOCATED AT THE WEST END OF THE EXISTING HYDE PARK LANDFILL. ELEVATION = 612.77. DATUM NOT VERIFIED.

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

| Status | Date | Initial |
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GLENN SPRINGS HOLDINGS, INC.

HYDE PARK RRT PROGRAM

# PROPOSED LOCATIONS FOR ABANDONMENT

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

COORDINATE SYSTEM : CONVERTED FROM SITE SYSTEM TO STATE PLANE BY GIS NOV 2001
AERIAL PHOTO: ABRAMS - NOVEMBER 25, 1998

| Project Manager: | Reviewed By: | Date: | |
|---|---|---|---|
| JT | BT | DECEMBER 2006 | |
| Scale: | Project N°: | Report N°: | Drawing N°: |
| 1 = 350' | 01069-30 | MISC002 | 1 |

01069-30(MISC002)GN-NF001 MAR 26/2008

TABLE 1
BEDROCK MONITORING WELLS TO BE ABANDON
HYDE PARK LANDFILL SITE

| Well ID | Trans ($ft^2$/day) | Field Procedure | East | North | Grade (ft msl) | Ref Elev (ft msl) | Complete Date | Type | Open Top (fbg) | Open Bottom (fbg) | Open Length (ft) | Flow Zones |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A2U | n/a | NYSDEC | 1,027,408 | 1,141,970 | 593.51 | 593.51 | May 1999 | corehole | 22.0 | 52.1 | 30.1 | 5 6 |
| AB1L | n/a | NYSDEC | 1,026,738 | 1,142,109 | 587.97 | 590.05 | Sep 2001 | corehole | 79.0 | 97.5 | 18.5 | 10 11 |
| AB1M | n/a | MSRM Modified | 1,026,720 | 1,142,105 | 588.00 | 589.44 | Aug 2001 | corehole | 43.5 | 85.5 | 42.0 | 7 8 9 10 |
| AB1U | n/a | NYSDEC | 1,026,699 | 1,142,099 | 587.90 | 589.53 | Sep 2001 | corehole | 30.5 | 45.0 | 14.5 | 6 |
| ABP-2 | n/a | MSRM Modified | 1,025,904 | 1,142,732 | 574.90 | 576.00 | Jun 1994 | corehole | 17.2 | 47.2 | 30.0 | 6 7 8 9 |
| ABP-3 | n/a | NYSDEC | 1,026,903 | 1,142,216 | 591.10 | 592.41 | May 1994 | corehole | 28.5 | 59.9 | 31.4 | 6 |
| ABP-4 | n/a | NYSDEC | 1,026,778 | 1,142,327 | 588.10 | 589.41 | May 1994 | corehole | 27.0 | 59.0 | 32.0 | 6 7 |
| ABP-5 | n/a | NYSDEC | 1,025,664 | 1,141,755 | 589.30 | 590.44 | Jul 1994 | corehole | 28.0 | 56.6 | 28.6 | 6 |
| ABP-8 | n/a | MSRM Modified | 1,025,336 | 1,142,224 | 575.10 | 576.43 | Jul 1994 | corehole | 41.0 | 61.6 | 20.6 | 8 9 |
| AGW-2L | n/a | NYSDEC | 1,028,550 | 1,141,886 | 608.40 | 611.24 | Jun 1991 | corehole | 107.6 | 130.7 | 23.1 | 10 11 |
| AGW-2M | n/a | MSRM Modified | 1,028,575 | 1,141,886 | 608.70 | 610.39 | Aug 1991 | corehole | 65.0 | 107.0 | 42.0 | 7 8 9 |
| AGW-3L | n/a | NYSDEC | 1,029,067 | 1,140,857 | 628.30 | 628.15 | Sep 1991 | corehole | 135.7 | 154.7 | 19.0 | 10 11 |
| AGW-3M | n/a | MSRM Modified | 1,029,093 | 1,140,859 | 627.41 | 627.41 | Aug 1991 | corehole | 77.2 | 132.2 | 55.0 | 6 7 8 9 |
| AGW-3U | n/a | NYSDEC | 1,029,116 | 1,140,860 | 627.10 | 626.64 | Aug 1991 | corehole | 8.7 | 75.4 | 66.7 | 1 2 3 4 5 |
| B1L | n/a | NYSDEC | 1,026,428 | 1,141,781 | 589.70 | 592.24 | Mar 1991 | corehole | 84.0 | 104.0 | 20.0 | 10 11 |
| B1M | n/a | MSRM Modified | 1,026,403 | 1,141,778 | 589.50 | 591.31 | Jun 1991 | corehole | 58.0 | 83.0 | 25.0 | 7 8 9 |
| B1U | n/a | NYSDEC | 1,026,380 | 1,141,774 | 589.80 | 592.40 | Jun 1991 | corehole | 29.3 | 57.0 | 27.7 | 6 |
| BC3L | n/a | NYSDEC | 1,026,406 | 1,141,592 | 595.00 | 594.70 | Oct 1995 | corehole | 86.5 | 106.5 | 20.0 | 10 11 |
| BC3M | n/a | MSRM Modified | 1,026,428 | 1,141,593 | 595.10 | 596.55 | Oct 1995 | corehole | 65.0 | 86.0 | 21.0 | 7 8 9 |
| BC3U | n/a | NYSDEC | 1,026,451 | 1,141,592 | 595.20 | 594.93 | Oct 1995 | corehole | 35.0 | 64.4 | 29.4 | 6 |
| BH7-95 | n/a | NYSDEC | 1,027,078 | 1,139,633 | 610 | | Apr 1995 | corehole | 10.8 | 71.0 | 60.2 | 1 2 3 4 5 |
| C1L | n/a | NYSDEC | 1,025,938 | 1,141,776 | 591.40 | 593.16 | Jan 1991 | corehole | 82.4 | 104.0 | 21.6 | 10 11 |
| C1M | n/a | MSRM Modified | 1,025,967 | 1,141,778 | 591.50 | 594.04 | May 1991 | corehole | 56.5 | 81.5 | 25.0 | 7 8 9 |
| C1U | n/a | NYSDEC | 1,025,991 | 1,141,777 | 591.60 | 593.66 | May 1991 | corehole | 28.5 | 55.5 | 27.0 | 6 |
| C2L | n/a | NYSDEC | 1,025,674 | 1,141,937 | 590.20 | 589.69 | Feb 1991 | corehole | 80.7 | 101.0 | 20.3 | 10 11 |
| C2M | n/a | MSRM Modified | 1,025,670 | 1,141,913 | 590.10 | 589.90 | Jul 1991 | corehole | 56.5 | 80.0 | 23.5 | 7 8 9 |
| C2U (ABP-6) | n/a | NYSDEC | 1,025,694 | 1,141,944 | 590.08 | 590.08 | Jul 1991 | corehole | 30.6 | 55.6 | 25.0 | 6 |
| CD1L | n/a | NYSDEC | 1,026,494 | 1,141,425 | 596.82 | 596.63 | May 1999 | corehole | 87.0 | 109.1 | 22.1 | 10 11 |
| CD1M | n/a | MSRM Modified | 1,026,572 | 1,141,199 | 597.08 | 596.83 | May 1999 | corehole | 63.0 | 88.0 | 25.0 | 7 8 9 |

TABLE 1
BEDROCK MONITORING WELLS TO BE ABANDON
HYDE PARK LANDFILL SITE

| Well ID | Trans ($ft^2$/day) | Field Procedure | East | North | Grade (ft msl) | Ref Elev (ft msl) | Complete Date | Type | Open Top (fbg) | Open Bottom (fbg) | Open Length (ft) | Flow Zones |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CD1U | n/a | NYSDEC | 1,026,537 | 1,141,182 | 597.03 | 596.86 | May 1999 | corehole | 35.4 | 63.6 | 28.2 | 5 6 |
| CD2M | n/a | MSRM Modified | 1,026,203 | 1,141,545 | 596.10 | 598.30 | May 2000 | corehole | 65.2 | 89.8 | 24.6 | 7 8 9 |
| CD3U | n/a | NYSDEC | 1,026,065 | 1,141,551 | 593.40 | 595.41 | Apr 2000 | corehole | 31.5 | 61.7 | 30.2 | 6 |
| CD4U | n/a | NYSDEC | 1,025,982 | 1,141,144 | 588.00 | 588.85 | Nov 2000 | corehole | 13.7 | 44.0 | 30.3 | 4 5 6 |
| CD5U | n/a | NYSDEC | 1,026,049 | 1,141,349 | 588.17 | 588.38 | | corehole | 22.0 | 51.0 | 29.0 | 5 6 |
| CD6U | n/a | NYSDEC | 1,026,111 | 1,141,518 | 588.61 | 588.71 | | corehole | 27.0 | 56.0 | 29.0 | 6 |
| D3U (PW-2U) | n/a | NYSDEC | 1,026,579 | 1,140,950 | 600.00 | 600.02 | May 1991 | | 20 | 52 | 32 | 3 4 5 |
| D4L (PMW-2L) | n/a | NYSDEC | 1,026,741 | 1,141,117 | 598.60 | 600.09 | May 1991 | corehole | 98.1 | 126.6 | 28.5 | 10 11 |
| D4M (PMW-2M) | n/a | MSRM Modified | 1,026,771 | 1,141,119 | 598 | 599 | Jun 1999 | | 60 | 95 | 35 | 7 8 9 |
| D4U (PMW-2U) | n/a | NYSDEC | 1,026,801 | 1,141,105 | 598.40 | 598.09 | May 1991 | corehole | 21.0 | 54.5 | 33.5 | 3 4 5 |
| D5L | n/a | NYSDEC | 1,026,908 | 1,140,919 | 599.10 | 598.81 | Nov 1995 | corehole | 98.0 | 120.0 | 22.0 | 10 11 |
| D-6 | n/a | NYSDEC | 1,026,874 | 1,140,919 | 599.00 | | May 1983 | corehole | 17.8 | 38.0 | 20.2 | 3 4 |
| D-6-1 | n/a | NYSDEC | 1,026,960 | 1,140,879 | 599.00 | | Sep 1983 | corehole | 20.0 | 66.5 | 46.5 | 3 4 5 6 |
| E1L | n/a | NYSDEC | 1,026,236 | 1,140,032 | 594.00 | 596.59 | Apr 1991 | corehole | 95.0 | 118.7 | 23.7 | 10 11 |
| E1M | n/a | MSRM Modified | 1,026,260 | 1,140,033 | 594.30 | 596.25 | May 1991 | corehole | 54.0 | 94.0 | 40.0 | 6 7 8 9 |
| E1U | n/a | NYSDEC | 1,026,283 | 1,140,029 | 594.40 | 596.57 | May 1991 | corehole | 18.9 | 54.0 | 35.1 | 3 4 5 |
| E2L | n/a | NYSDEC | 1,025,869 | 1,140,029 | 591.30 | 592.36 | Jan 1993 | corehole | 89.5 | 116.5 | 27.0 | 10 11 |
| E2M | n/a | MSRM Modified | 1,025,836 | 1,140,030 | 591.20 | 593.70 | Jan 1993 | corehole | 48.2 | 88.5 | 40.3 | 6 7 8 9 |
| E2U | n/a | NYSDEC | 1,025,901 | 1,140,029 | 591.70 | 592.46 | Jan 1993 | corehole | 14.0 | 47.5 | 33.5 | 3 4 5 |
| E3L | n/a | NYSDEC | 1,026,600 | 1,140,304 | 593.10 | 592.90 | Aug 1993 | corehole | 96.0 | 119.0 | 23.0 | 10 11 |
| E3M | n/a | MSRM Modified | 1,026,602 | 1,140,274 | 593.80 | 593.70 | Sep 1995 | corehole | 49.0 | 94.0 | 45.0 | 6 7 8 9 |
| E3U (PW-5U) | n/a | NYSDEC | 1,026,584 | 1,140,219 | 595.00 | 591.61 | Aug 1993 | corehole | 15.3 | 50.0 | 34.7 | 2 3 4 5 |
| E4L | n/a | NYSDEC | 1,026,973 | 1,140,568 | 598.20 | 597.64 | Oct 1995 | corehole | 101.0 | 119.8 | 18.8 | 10 11 |
| E4M | n/a | MSRM Modified | 1,026,992 | 1,140,566 | 598.30 | 597.98 | Mar 1996 | corehole | 61.0 | 99.5 | 38.5 | 7 8 9 |
| E4U | n/a | NYSDEC | 1,027,015 | 1,140,564 | 598.50 | 598.23 | Oct 1995 | corehole | 15.3 | 60.0 | 44.7 | 2 3 4 5 6 |
| E5U | n/a | NYSDEC | 1,027,046 | 1,140,385 | 598.63 | 598.27 | Nov 1999 | corehole | 16.5 | 57.5 | 41.0 | 2 3 4 5 |
| F1L | n/a | NYSDEC | 1,026,681 | 1,139,632 | 602.00 | 604.32 | Oct 1991 | corehole | 111.4 | 131.8 | 20.4 | 10 11 |
| F1M | n/a | MSRM Modified | 1,026,711 | 1,139,633 | 602.60 | 602.38 | Oct 1991 | corehole | 65.5 | 110.5 | 45.0 | 6 7 8 9 |
| F1U | n/a | NYSDEC | 1,026,723 | 1,139,606 | 603.40 | 603.11 | Oct 1991 | corehole | 2.8 | 65.0 | 62.2 | 1 2 3 4 5 |

TABLE 1
BEDROCK MONITORING WELLS TO BE ABANDON
HYDE PARK LANDFILL SITE

| Well ID | Trans ($ft^2$/day) | Field Procedure | East | North | Grade (ft msl) | Ref Elev (ft msl) | Complete Date | Type | Open Top (fbg) | Open Bottom (fbg) | Open Length (ft) | Flow Zones |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F3L | n/a | NYSDEC | 1,026,722 | 1,140,067 | 597.59 | 597.41 | Aug 1993 | corehole | 105.5 | 120.4 | 14.9 | 11 |
| F3U (PW-6U) | n/a | NYSDEC | 1,026,794 | 1,139,865 | 603.30 | 609.76 | | corehole | 4.7 | 60.0 | 55.3 | 1 2 3 4 5 |
| F-4-1 | n/a | NYSDEC | 1,027,359 | 1,140,766 | 600.80 | | Oct 1983 | corehole | 18.0 | 32.0 | 14.0 | 2 3 |
| F-4-2 | n/a | MSRM Modified | 1,027,225 | 1,140,827 | 600.50 | | Oct 1993 | corehole | 79.2 | 95.0 | 15.8 | 7 8 9 |
| F-4A | n/a | NYSDEC | 1,027,322 | 1,140,838 | 601.20 | | Aug 1983 | corehole | 12.6 | 28.0 | 15.4 | 2 |
| F5UR | n/a | NYSDEC | 1,027,373 | 1,140,382 | 604.85 | 604.63 | Apr 1996 | corehole | 9.0 | 58.7 | 49.7 | 2 3 4 5 |
| G2L | n/a | NYSDEC | 1,027,777 | 1,139,009 | 609.80 | 609.55 | Mar 1991 | corehole | 124.0 | 141.1 | 17.1 | 10 11 |
| G2M | n/a | MSRM Modified | 1,027,749 | 1,139,012 | 610.10 | 609.87 | Aug 1991 | corehole | 70.0 | 123.0 | 53.0 | 6 7 8 9 |
| G2U | n/a | NYSDEC | 1,027,805 | 1,139,010 | 609.10 | 608.87 | Aug 1991 | corehole | 11.8 | 69.0 | 57.2 | 1 2 3 4 5 |
| G3L (BH4-95) | n/a | NYSDEC | 1,027,697 | 1,139,949 | 617.70 | 620.67 | Apr 1995 | corehole | 128.0 | 147.0 | 19.0 | 10 11 |
| G3M | n/a | MSRM Modified | 1,027,675 | 1,139,949 | 617.00 | 618.76 | Sep 1995 | corehole | 63.5 | 126.0 | 62.5 | 5 6 7 8 9 |
| G3U | n/a | NYSDEC | 1,027,651 | 1,139,950 | 616.70 | 619.23 | Sep 1995 | corehole | 13.0 | 63.0 | 50.0 | 1 2 3 4 |
| G4U | n/a | NYSDEC | 1,027,569 | 1,139,632 | 610.60 | 620.31 | May 1998 | corehole | 13.3 | 71.5 | 58.2 | 1 2 3 4 5 |
| G5L | n/a | NYSDEC | 1,027,746 | 1,140,422 | 605.46 | 605.46 | Nov 1999 | corehole | 115.0 | 133.5 | 18.5 | 11 |
| G5U (T-2) | n/a | NYSDEC | 1,027,709 | 1,140,138 | 610.60 | 613.10 | Apr 1995 | corehole | 13.3 | 71.5 | 58.2 | 1 2 3 4 5 |
| GH1U | n/a | NYSDEC | 1,027,969 | 1,139,921 | 619.50 | 620.51 | May 1996 | corehole | 8.2 | 58.5 | 50.3 | 1 2 3 |
| H1L | n/a | NYSDEC | 1,028,456 | 1,140,652 | 618.90 | 620.84 | Feb 1991 | corehole | 128.0 | 143.0 | 15.0 | 11 |
| H1M | n/a | MSRM Modified | 1,028,464 | 1,140,631 | 619.40 | 621.74 | May 1991 | corehole | 58.0 | 127.0 | 69.0 | 5 6 7 8 9 |
| H1U | n/a | NYSDEC | 1,028,472 | 1,140,610 | 619.80 | 621.53 | May 1991 | corehole | 13.0 | 57.0 | 44.0 | 1 2 3 |
| H-2 | n/a | MSRM Modified | 1,028,563 | 1,140,287 | 619.40 | | Feb 1983 | corehole | 98.4 | 162.0 | 63.6 | 7 8 9 10 11 |
| H-3 | n/a | MSRM Modified | 1,028,383 | 1,140,591 | 616.10 | | May 1983 | corehole | 96.4 | 145.0 | 48.6 | 7 8 9 10 11 |
| H3L | n/a | NYSDEC | 1,028,182 | 1,140,654 | 612.90 | 614.95 | Nov 1995 | corehole | 118.0 | 138.0 | 20.0 | 10 11 |
| H3U | n/a | NYSDEC | 1,028,204 | 1,140,660 | 613.70 | 615.05 | Nov 1995 | corehole | 11.8 | 72.0 | 60.2 | 1 2 3 4 5 |
| H4L | n/a | NYSDEC | 1,027,938 | 1,140,622 | 611.20 | 613.82 | Jul 1996 | corehole | 113.0 | 133.2 | 20.2 | 10 11 |
| HT-2 (BH2-95) | n/a | NYSDEC | 1,027,555 | 1,141,733 | 600.20 | | Feb 1995 | corehole | 20.5 | 37.5 | 17.0 | 3 4 |
| IFW-1 | 0.008 | NYSDEC | 1,026,262 | 1,142,162 | 585.56 | 585.27 | Aug 1989 | corehole | 151.7 | 178.8 | 27.1 | na |
| IFW-1R | n/a | NYSDEC | 1,026,240 | 1,142,162 | 584.85 | | | corehole | 151.7 | 178.8 | 27.1 | na |
| IFW-2 | 0.001 | NYSDEC | 1,028,170 | 1,141,843 | 606.67 | 610.56 | Oct 1989 | corehole | 179.9 | 205.2 | 25.3 | na |
| IFW-3 | 0.002 | NYSDEC | 1,028,630 | 1,140,907 | 618.70 | 622.14 | Jul 1989 | corehole | 199.5 | 226.8 | 27.3 | na |

TABLE 1
BEDROCK MONITORING WELLS TO BE ABANDON
HYDE PARK LANDFILL SITE

| Well ID | Trans ($ft^2$/day) | Field Procedure | East | North | Grade (ft msl) | Ref Elev (ft msl) | Complete Date | Type | Open Top (fbg) | Open Bottom (fbg) | Open Length (ft) | Flow Zones |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IFW-4 | 0.009 | NYSDEC | 1,027,323 | 1,139,013 | 611.57 | 611.78 | Aug 1989 | corehole | 205.3 | 229.7 | 24.4 | na |
| IFW-5 | 0.033 | NYSDEC | 1,026,247 | 1,139,710 | 595.85 | 596.43 | Sep 1989 | corehole | 177.4 | 206.4 | 29.0 | na |
| IFW-6 | 0.004 | NYSDEC | 1,026,017 | 1,140,968 | 592.30 | 592.05 | Aug 1989 | corehole | 164.2 | 191.3 | 27.1 | na |
| IFW-7 | 0.003 | NYSDEC | 1,025,605 | 1,141,858 | 589.74 | 592.27 | Oct 1988 | corehole | 155.9 | 180.2 | 24.3 | na |
| I-5A | n/a | MSRM Modified | 1,030,709 | 1,140,849 | 617 | Info for boring I-5 | | | 5 | 144 | | na |
| I-5B | n/a | MSRM Modified | 1,030,709 | 1,140,849 | 617 | Info for boring I-5 | | | 5 | 144 | | na |
| J-1 | n/a | NYSDEC | 1,028,893 | 1,142,112 | 610.10 | | Dec 1982 | | 7 | 27 | 20 | 2 |
| J1L | n/a | NYSDEC | 1,028,128 | 1,141,806 | 606.80 | 609.78 | Mar 1991 | corehole | 102.5 | 122.5 | 20.0 | 10 11 |
| J1M | n/a | NYSDEC | 1,028,131 | 1,141,779 | 606.90 | 609.09 | Apr 1991 | corehole | 46.4 | 88.0 | 41.6 | 6 7 8 |
| J1U | n/a | NYSDEC | 1,028,138 | 1,141,761 | 606.90 | 608.86 | Apr 1991 | corehole | 16.1 | 45.4 | 29.3 | 2 3 4 |
| J2L | n/a | NYSDEC | 1,028,321 | 1,141,927 | 608.00 | 610.53 | Apr 1991 | corehole | 101.8 | 124.7 | 22.9 | 10 11 |
| J3L | n/a | NYSDEC | 1,027,758 | 1,141,661 | 600.20 | 602.71 | Oct 1995 | corehole | 100.5 | 120.5 | 20.0 | 11 |
| J3U (BH1-95) | n/a | NYSDEC | 1,027,795 | 1,141,705 | 600.30 | 603.10 | Feb 1995 | corehole | 15.2 | 45.0 | 29.8 | 2 3 4 5 |
| J4L | n/a | NYSDEC | 1,027,772 | 1,141,483 | 599.90 | 600.69 | Nov 1995 | corehole | 102.5 | 122.0 | 19.5 | 11 |
| JH1L | n/a | MSRM Modified | 1,028,476 | 1,141,249 | 624.40 | 626.43 | | corehole | 111.0 | 147.3 | 36.3 | 9 10 11 |
| MW-1-2001 | n/a | NYSDEC | 1,027,389 | 1,141,744 | 595.41 | 597.16 | Jul 2001 | corehole | 17.0 | 37.5 | 20.5 | 3 4 5 |
| MW-2-2001 | n/a | NYSDEC | 1,027,394 | 1,141,783 | 594.42 | 596.04 | Jul 2001 | corehole | 22.5 | 34.9 | 12.4 | 5 |
| MW-3-2001 | n/a | NYSDEC | 1,026,827 | 1,141,799 | 589.76 | 591.26 | Jul 2001 | corehole | 32.0 | 49.6 | 17.6 | 6 |
| MW-4-2001 | n/a | NYSDEC | 1,026,803 | 1,141,817 | 588.82 | 590.90 | Jul 2001 | corehole | 32.0 | 50.3 | 18.3 | 6 |
| MW-5-2001 | n/a | NYSDEC | 1,026,604 | 1,141,738 | 591.69 | 593.11 | Jul 2001 | corehole | 34.5 | 50.0 | 15.5 | 6 |
| MW-6-2001 | n/a | NYSDEC | 1,026,600 | 1,141,761 | 591.16 | 592.66 | Jul 2001 | corehole | 34.5 | 50.0 | 15.5 | 6 |
| MW-7-2001 | n/a | NYSDEC | 1,026,867 | 1,141,787 | 590.28 | 591.86 | | corehole | 29.0 | 56.0 | 27.0 | 6 |
| OW1-78 | n/a | NYSDEC | 1,026,731 | 1,141,587 | 593.35 | | Sep 1978 | corehole | 45.9 | 50.2 | 4.3 | 6 |
| OW4-78 | n/a | NYSDEC | 1,026,948 | 1,141,746 | 591.66 | | Sep 1978 | | 38 | 45.0 | 7.0 | 6 |
| OW7-78 | n/a | NYSDEC | 1,028,425 | 1,141,261 | 609.66 | 610 | Sep 1979 | corehole | 17.3 | 20.8 | 3.5 | -1/2- |
| OW11-79 | n/a | NYSDEC | 1,029,051 | 1,140,872 | 622.20 | | Sep 1979 | | | 42.1 | 42.1 | 1 |
| OW13-79 | n/a | NYSDEC | 1,026,868 | 1,141,112 | 598.40 | | Sep 1979 | screen | 28.9 | 33.9 | 5.0 | 4 |
| OW18-79 | n/a | NYSDEC | 1,026,436 | 1,141,517 | 596.70 | | Oct 1979 | corehole | 78 | 85.5 | 7.5 | 9 |
| OW20-79 | n/a | NYSDEC | 1,026,998 | 1,142,204 | 587.80 | | Oct 1979 | | 38 | 45.4 | 7.4 | 6 |

TABLE 1
BEDROCK MONITORING WELLS TO BE ABANDON
HYDE PARK LANDFILL SITE

| Well ID | Trans ($ft^2$/day) | Field Procedure | East | North | Grade (ft msl) | Ref Elev (ft msl) | Complete Date | Type | Open Top (fbg) | Open Bottom (fbg) | Open Length (ft) | Flow Zones |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OW22-80 | n/a | NYSDEC | 1,027,085 | 1,142,512 | 588.50 | | Jan 1980 | | 36 | 43.3 | 7.3 | 6 |
| OW24-80 | n/a | NYSDEC | 1,028,336 | 1,140,781 | 613.70 | | Jul 1980 | screen | 16.5 | 21.5 | 5.0 | 1 |
| OW26-80 | n/a | NYSDEC | 1,027,680 | 1,140,889 | 603.80 | | Jul 1980 | screen | 20.5 | 25.5 | 5.0 | 2 |
| OW28-80 | n/a | NYSDEC | 1,027,054 | 1,140,831 | 598.30 | | Jul 1980 | screen | 24.5 | 29.5 | 5.0 | 3 |
| PMW-3L | n/a | NYSDEC | 1,027,709 | 1,140,896 | 604.60 | 606.51 | Apr 1991 | corehole | 108.4 | 126.1 | 17.7 | 10 11 |
| PMW-3M | n/a | MSRM Modified | 1,027,732 | 1,140,893 | 605.10 | 607.47 | May 1991 | corehole | 48.8 | 106.5 | 57.7 | 5 6 7 8 9 |
| PMW-3U | n/a | NYSDEC | 1,027,756 | 1,140,892 | 604.90 | 607.30 | Apr 1991 | corehole | 9.9 | 47.8 | 37.9 | 2 3 4 |
| PW-3U (RW3UM) | n/a | MSRM Modified | 1,027,496 | 1,140,804 | 601.28 | 593.93 | May 1991 | corehole | 15.4 | 104.0 | 88.6 | 2 3 4 .. 9 |

**Location is unknown** - The location of this well is currently unknown and is still under investigation.
**n/a** - indicates that the well has not been tested for transmissivity.
**na** - flow zone is unknown or well is an intermediate formation well.
**-1/2-** - indicates the monitored interval is between the two flow zones.

**Notes:**

Bedrock wells not being abandoned are the site include: the active purge wells, Bloody Run monitoring wells, Community Monitoring Wells, well A1U to be used for NAPL monitoring, and AGW-2U pending agreement by NYPA and NYSDEC DEC Region 9.
All locations well be inspected following the standard inspection field procedures before abandonment is initiated.
If problems associated with vertical flow are encountered during a NYSDEC procedure, the MSRM modified procedure will be implemented.

TABLE 2
PIEZOMETERS TO MONITOR DURING
WELL ABANDONMENT
HYDE PARK LANDFILL SITE

| **Piezometer** | **FZ** | **Transmissivity ($ft^2$/day)** |
|---|---|---|
| AGW-1U-06 | 6 | 6.7 |
| E6-06 | 6 | 218 |
| F6-06 | 6 | 134 |
| G1M-06 | 6 | 58 |
| G6-06 | 6 | 79 |
| H2M-06 | 6 | 16 |
| J2M-06 | 6 | 280 |
| C3-07 | 7 | 13 |
| G1M-07 | 7 | 0.004 |
| G6-07 | 7 | 1 |
| J5M-07 | 7 | 220 |
| ABP-1-09 | 9 | 3 |
| ABP-7-09 | 9 | 67 |
| AGW-1M-09 | 9 | 150 |
| B2M-09 | 9 | 38 |
| C3-09 | 9 | 117 |
| D1M-09 | 9 | 184 |
| E6-09 | 9 | 5 |
| F2M-09 | 9 | 110 |
| F4M-09 | 9 | 30 |
| H2M-09 | 9 | 16 |
| J2M-09 | 9 | 2 |
| J5M-09 | 9 | 150 |

ATTACHMENT 2

# FP-07: Monitoring Well Decommissioning Procedure

The draft document, *Groundwater Monitoring Well Decommissioning Procedures,* (NYDEC Guidance) provides guidelines for decommissioning (abandoning, plugging) environmental monitoring wells when they are no longer needed or when their integrity is suspect or compromised. The following procedure summarizes these guidelines as they apply to the Hyde Park Site.

## Preparation

Well information including: current conditions, well logs, and laboratory analytical data collected from soil and/or groundwater will be reviewed. This information will provide the planning health and safety protocol, an appropriate abandonment technique, and for real-time decisions that may be made during the decommissioning process.

Two weeks prior to site mobilization, the property owner and all other interested parties including governing regulatory agencies will be notified of well decommissioning project.

## Selection of Well Decommissioning Method

The primary rationale for well decommissioning is to prevent contaminant migration along the disturbed construction zone created by the original well boring. This requires selection of a procedure that considers such factors as:

- Hydrogeological conditions at the well site
- Presence/absence of contamination in the groundwater
- Original well construction details

The four primary decommissioning procedures are:

1. Grouting the casing in-place
2. Perforating the casing followed by grouting in-place
3. Casing pulling
4. Overdrilling

Detailed discussion of the decommissioning selection processes and methods are presented in the NYSDEC Guidance. Based on a review of the NYSDEC Guidance, grouting-in-place

appears to the most appropriate technology for bedrock monitoring wells and piezometers at the Site.

Grouting In-Place: Bedrock Monitoring Wells

Grouting in-place is the simplest decommissioning procedure. This method is preferred for bedrock wells with casings 2 inches or greater in diameter. The method involves filling the casing and open interval with a cement-bentonite grout. Unless special conditions exist such as grout flowing into fractures and not filling the borehole, or grout entry into the filter pack of a screened well is desired, the flowing grout mixture will be used:

One 94-pound bag of Type I Portland Cement
3.9 pounds powdered Bentonite
7.8 gallons of water

Based on past experience at the Site, where there is significant vertical flow in the open interval of a well, the flow may create "piping" conditions, an erosion of the cement-bentonite grout described. The piping may result in an interconnection of flow zones within the abandoned well. Therefore, in wells with significant vertical flow, MSRM will modify the NYSDEC procedure as described below. The MSRM procedure is satisfactory for all wells, however, it is more time consuming than NYSDEC procedure. In wells with no apparent vertical flow, the NYSDEC Groundwater Monitoring Well Decommissioning Procedures may be followed.

NYSDEC Procedure

The grout mixture will be placed using a tremie pipe at least one-inch in diameter lowered to within 5 feet of the bottom of the borehole. The borehole will be filled with the grout mixture to the top of bedrock or five feet below grade, whichever is closer to grade. Any groundwater displaced during the placement of grout should be containerized and properly disposed of.

The grout should be allowed to set for 24 hours. The casing is then cut off at five feet below grade or at the top of bedrock. If the grout level has settled from the target 5 feet below grade or top of bedrock, then additional grout should be added. To allow future location of the abandoned well, an iron marker detectable with a metal detector must be left in place. If steel casing (carbon or stainless) is left in the ground, this is a sufficient marker. Otherwise, a marker such as a large bolt should be placed on top of the grout. After adding the grout and iron marker, the unfilled portion of the borehole will be filled to ground surface with material appropriate to the intended land use. For example, concrete or asphalt will be patched with

concrete or asphalt of the same type and thickness; grassed areas will be seeded; and topsoil – similar to native soil – will be used to restore the site.

MSRM Modification for Wells with Significant Vertical Flow

The MSRM modification replaces the cement-bentonite grout in the well open interval with bentonite chips. The well open interval will be filled with bentonite chip at least 2 feet into the well casing. The chips will be introduced in 5-foot lifts. A predetermined volume of bentonite chips will be added to the well to create a 5-foot thickness of bentonite. Following the addition of each lift, a heavy cylindrical "tamp" will be lowered on a cable to the top of the bentonite chips and allowed to rest on the bentonite chips. The purpose of the tamp is to ensure that the bentonite chips are fully in place. A tape measure attached to the top of the tamp will be used to check that the actual thickness of bentonite is consistent with the expected thickness for the volume of chips added. The addition of bentonite chips will continue until the seal extends at least 2 feet into the well casing.

Grouting In-Place: 1-inch diameter Bedrock Piezometers

Abandonment of the 1-inch diameter bedrock piezometers will conform to the procedures identified above for a bedrock monitoring well, with the following exceptions.

Because a 1-inch diameter tremie pipe will not fit down the borehole, a smaller diameter tremie pipe will be used. Also, a thinner grout will be used to flow in the smaller diameter tremie pipe as well as to enter the screened interval:

One 94-pound bag of Type III Portland Cement
3.9 pounds powdered Bentonite
7.8 gallons of water

All other abandonment procedures will conform to the above defined procedures for a bedrock monitoring well. Because the screened interval in the 1-inch diameter piezometers is only 2 feet long, there is no concern for interconnection of flow zones and no need to use the MSRM modification to the NYSDEC decommissioning procedures.

## Field Oversight and Documentation

The on-site inspector will document all well decommissioning activities according to procedures outlined in Appendix B-3. Additionally, records and forms will be maintained for the duration of the well decommissioning project, including the Monitoring Well Field Inspection Log and the Well Decommissioning Record. Additional well decommissioning

forms available via NYSDEC include the Inspector's Daily Report, Problem Identification Report, and the Corrective Measures Report. Samples of these forms are presented at the end of this appendix.

All solid waste materials generated during the well decommissioning process will be disposed of properly.

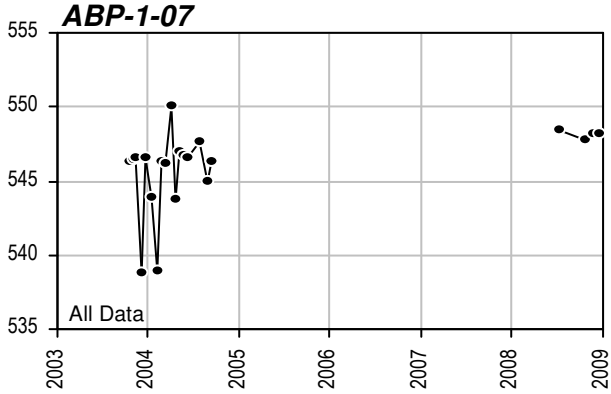
ATTACHMENT 3

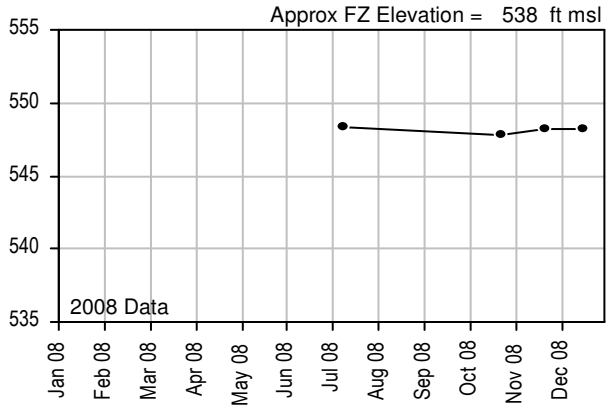
ATTACHMENT 4

## *Hydrographs Piezometer Cluster: ABP-1*

3/10/2009

### *ABP-1-07*

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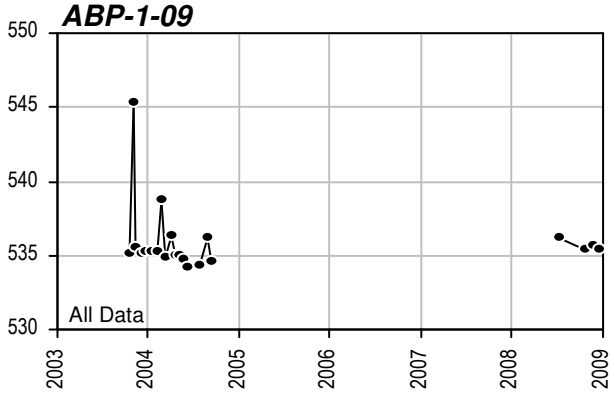
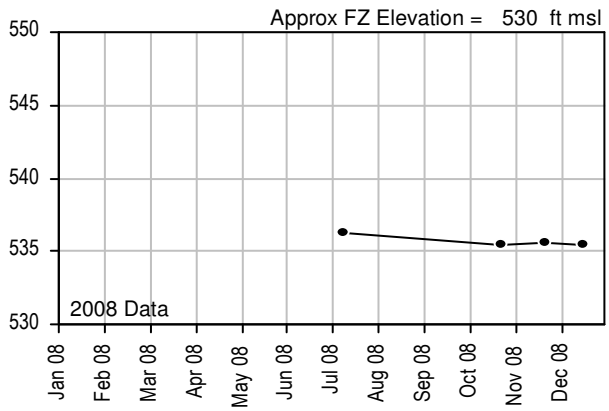
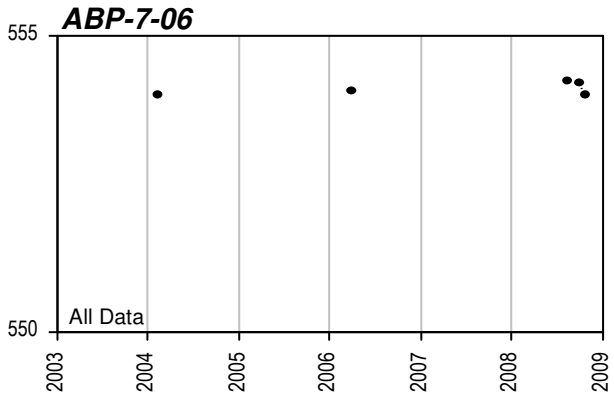
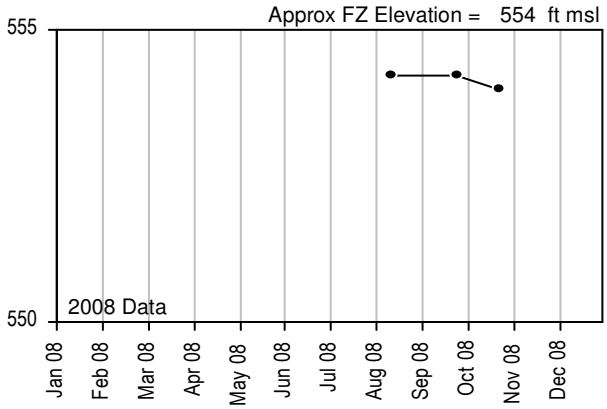
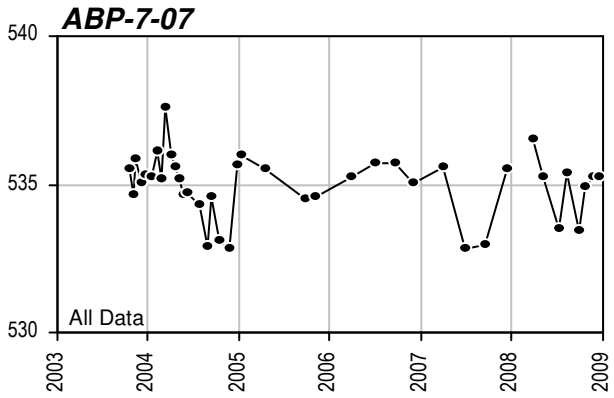


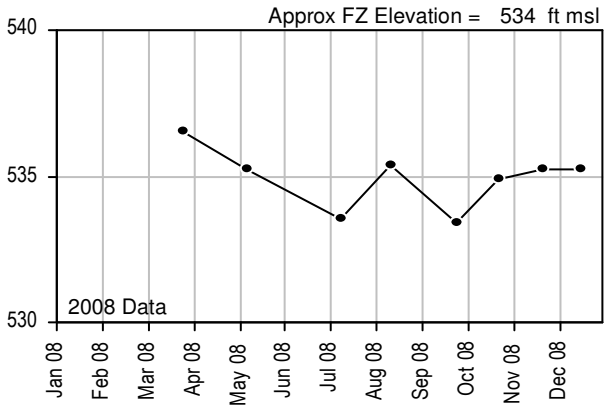



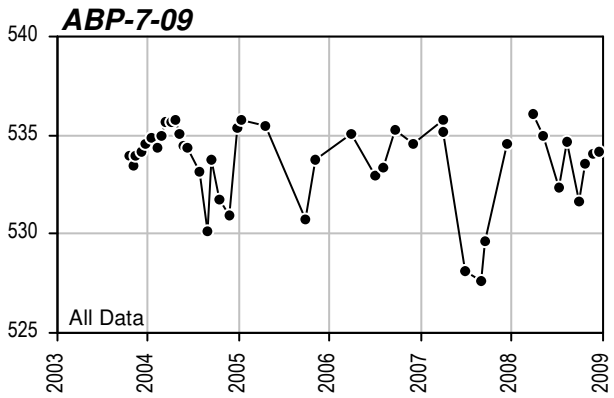

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

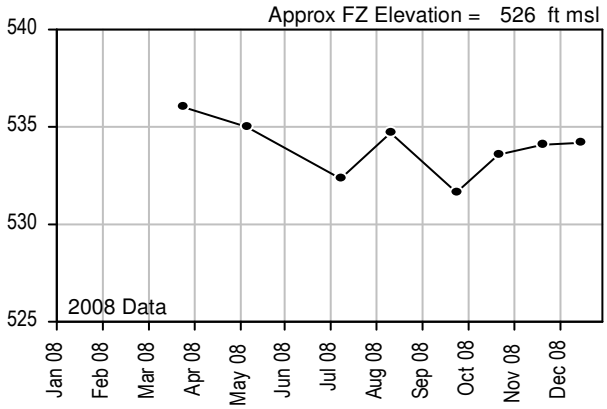


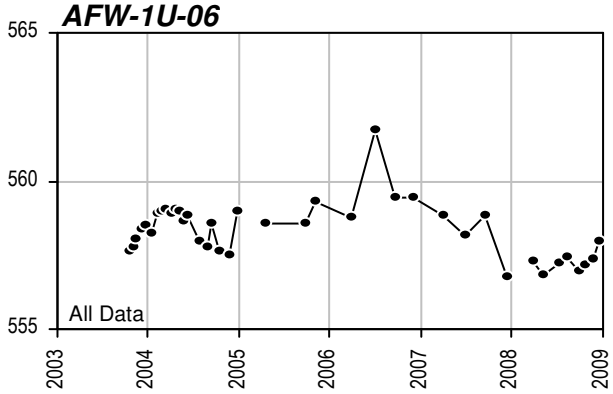



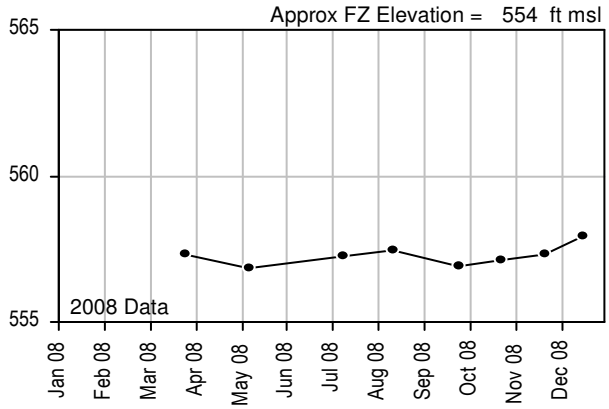




Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

***AFW-1U-06***

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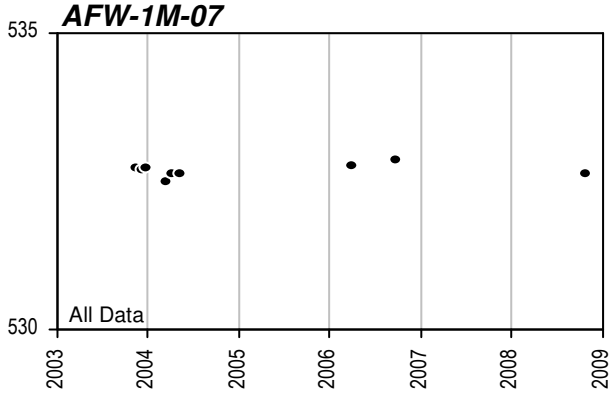


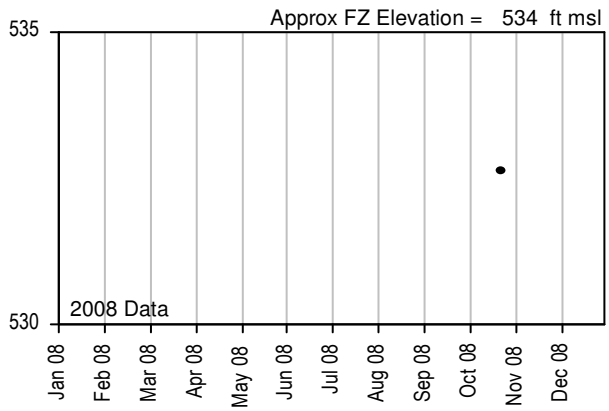


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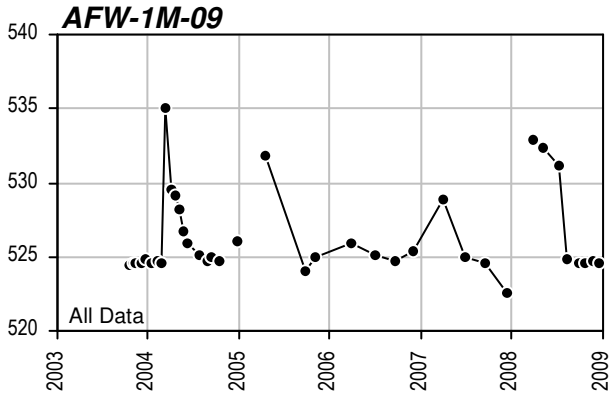


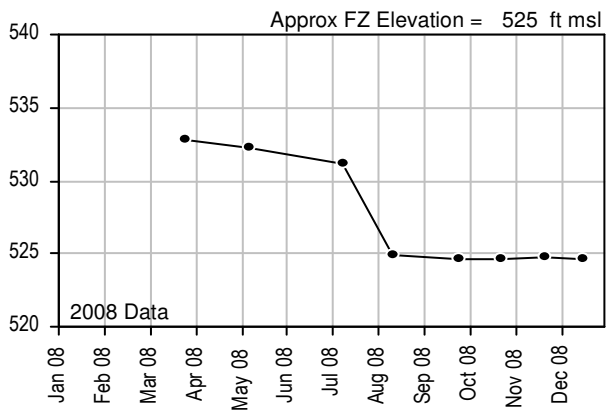


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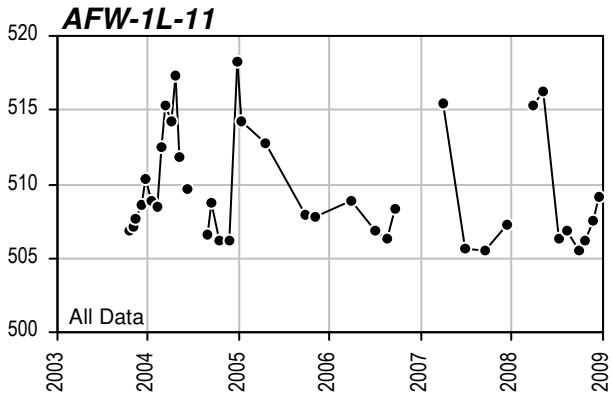
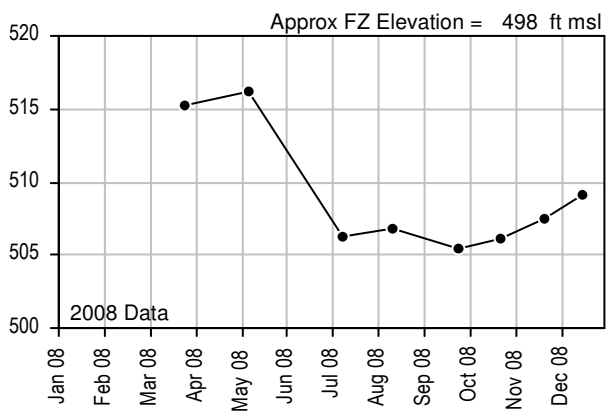
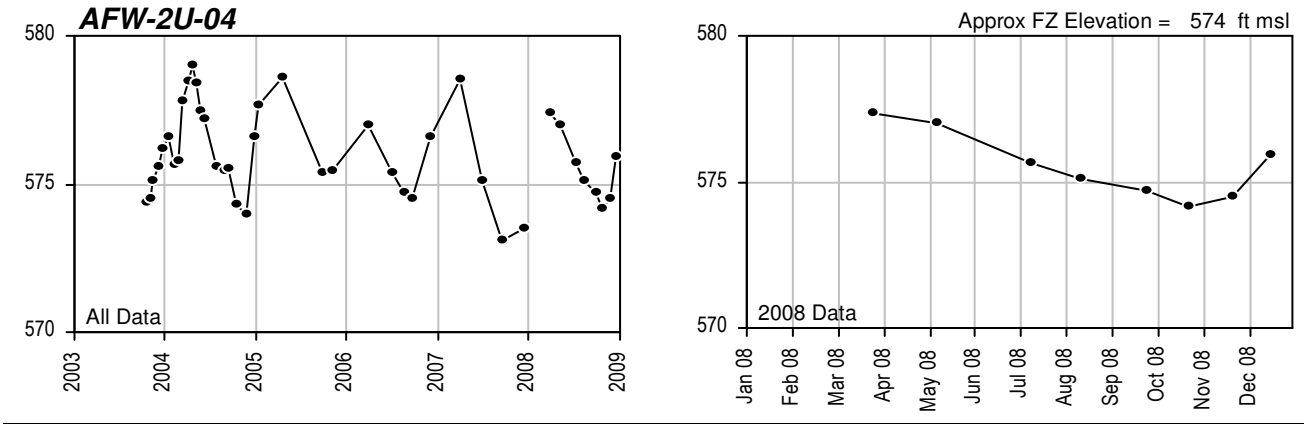
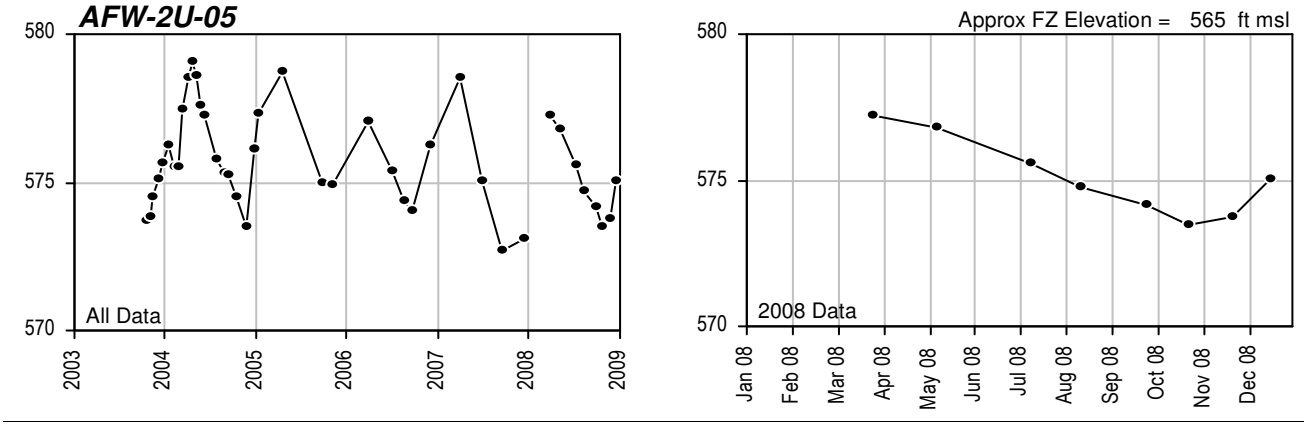
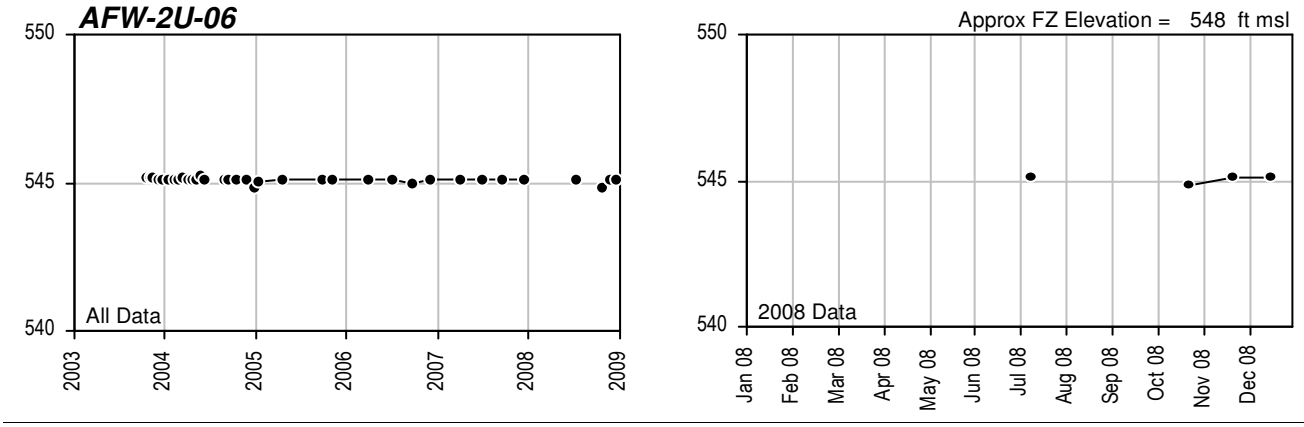


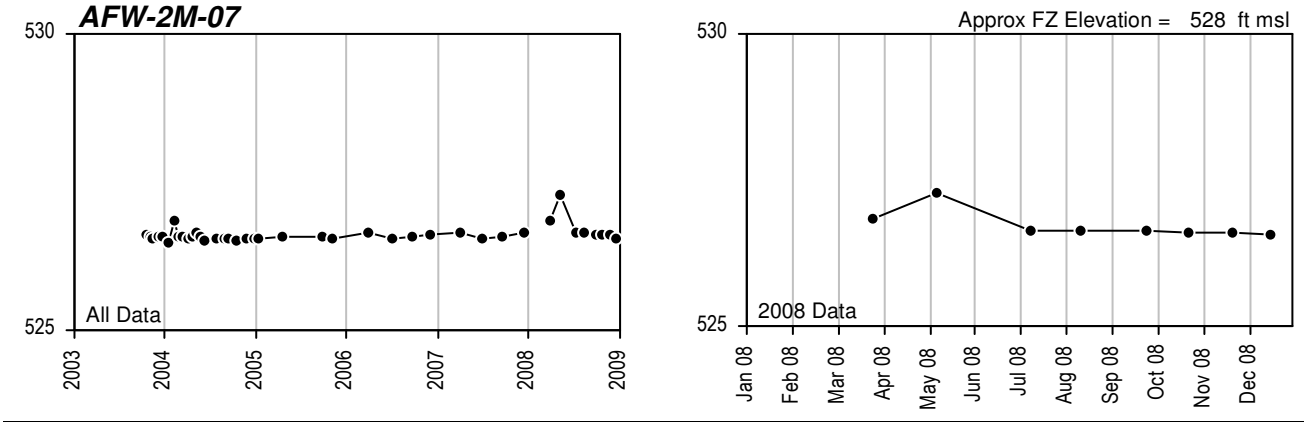




Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

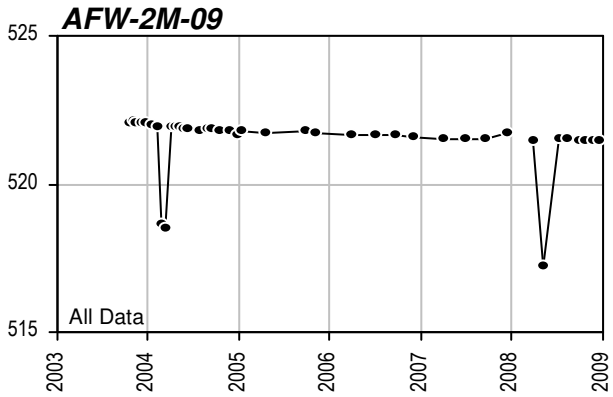


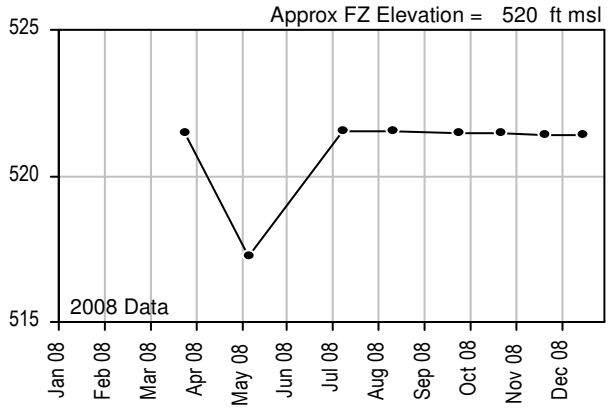



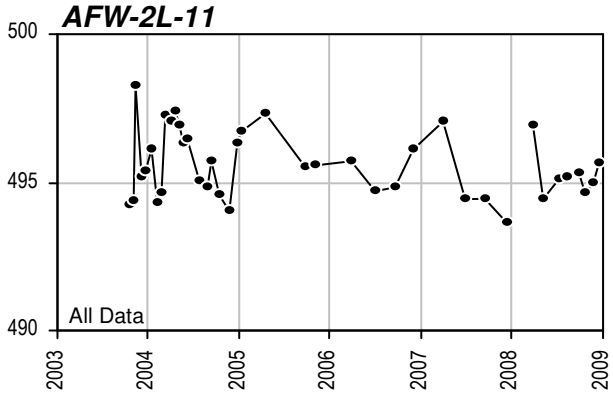



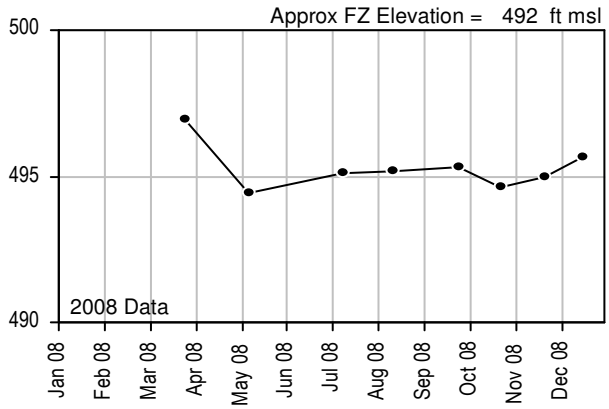




Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.



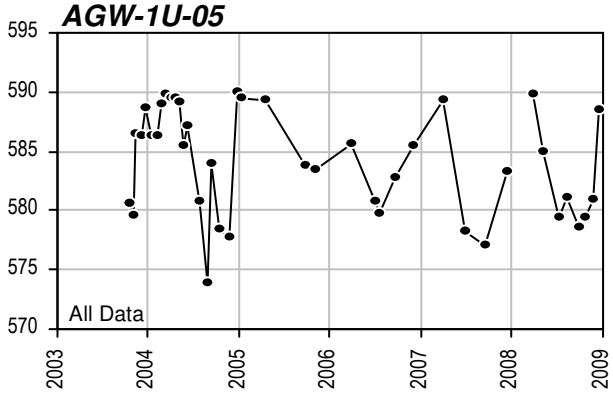



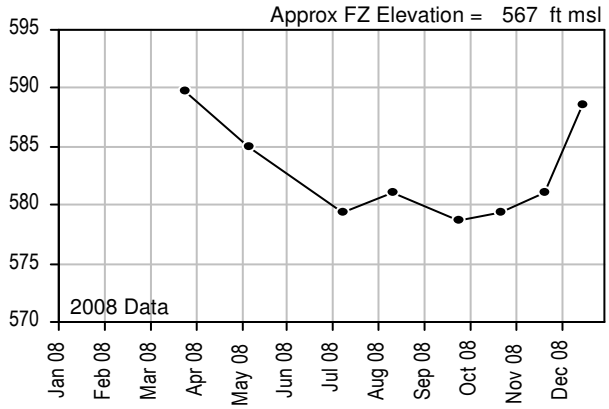




Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

***AGW-1U-05***

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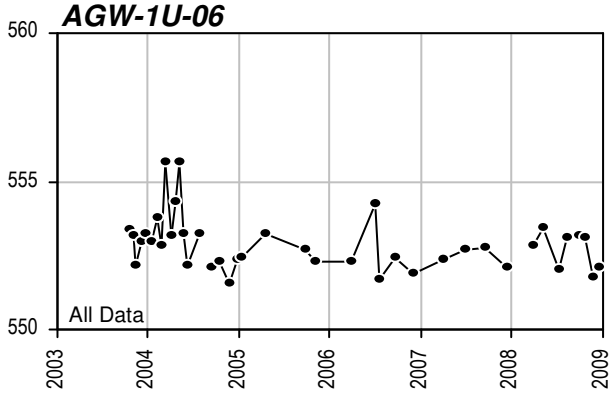
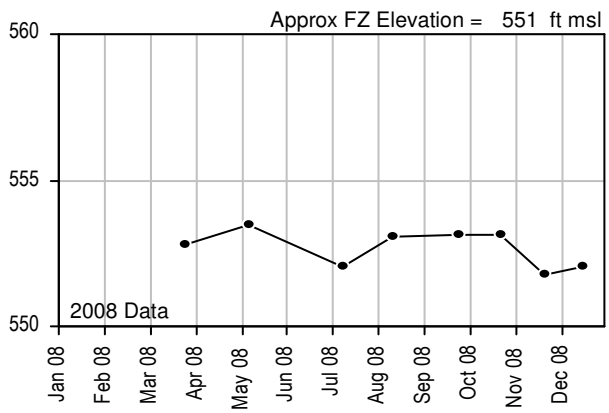
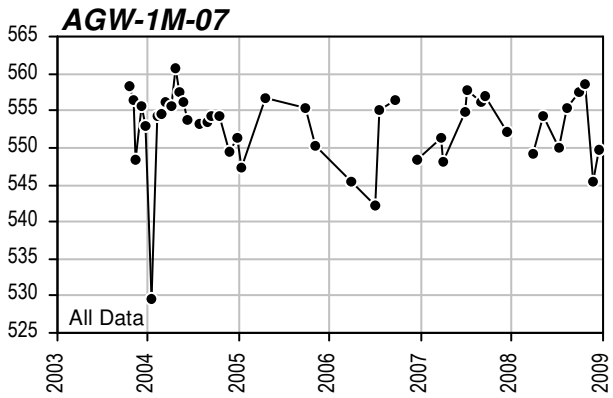
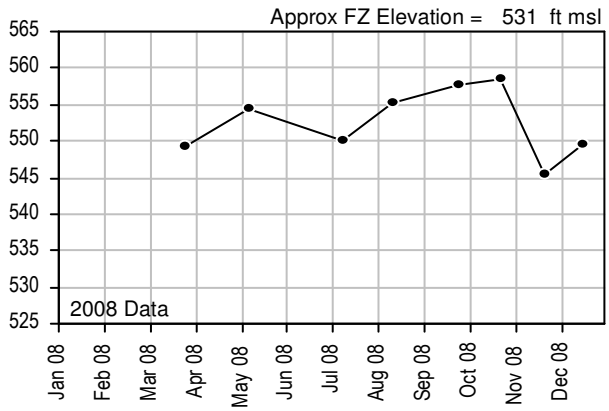


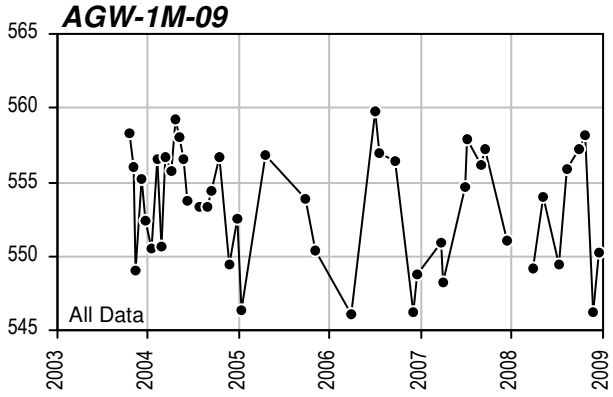



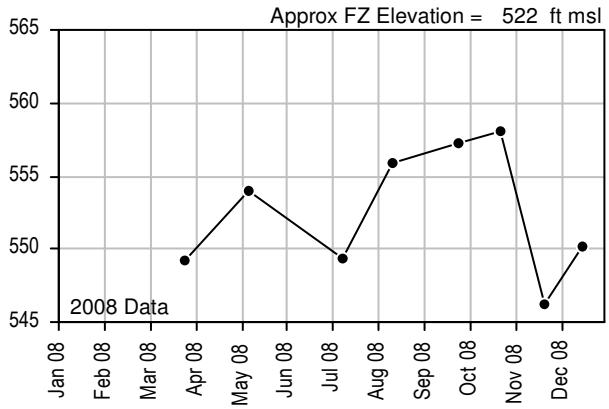

***AGW-1M-07***



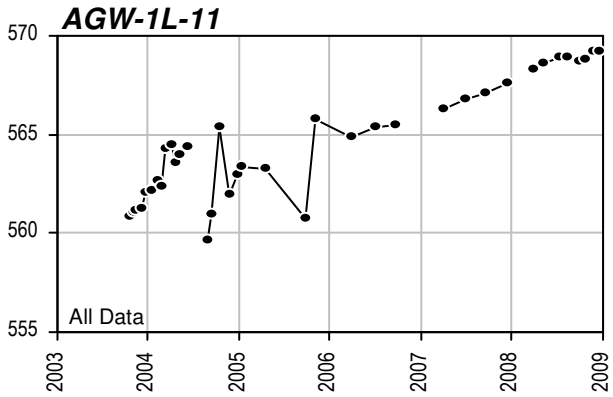



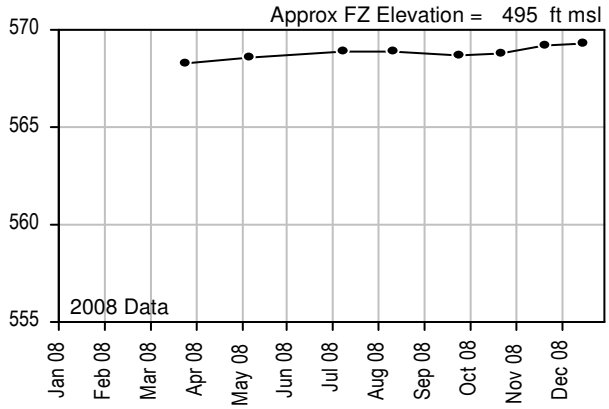

***AGW-1M-09***



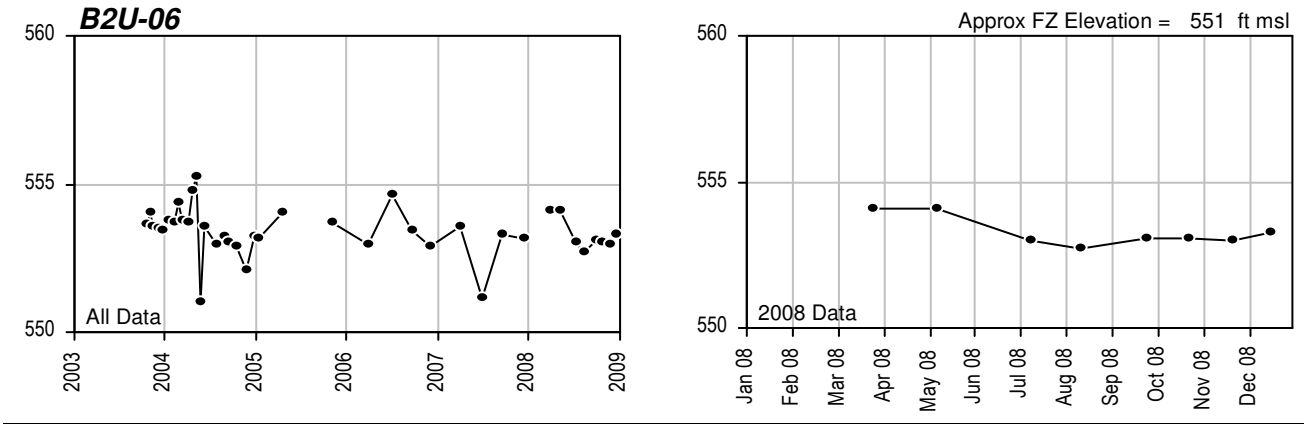



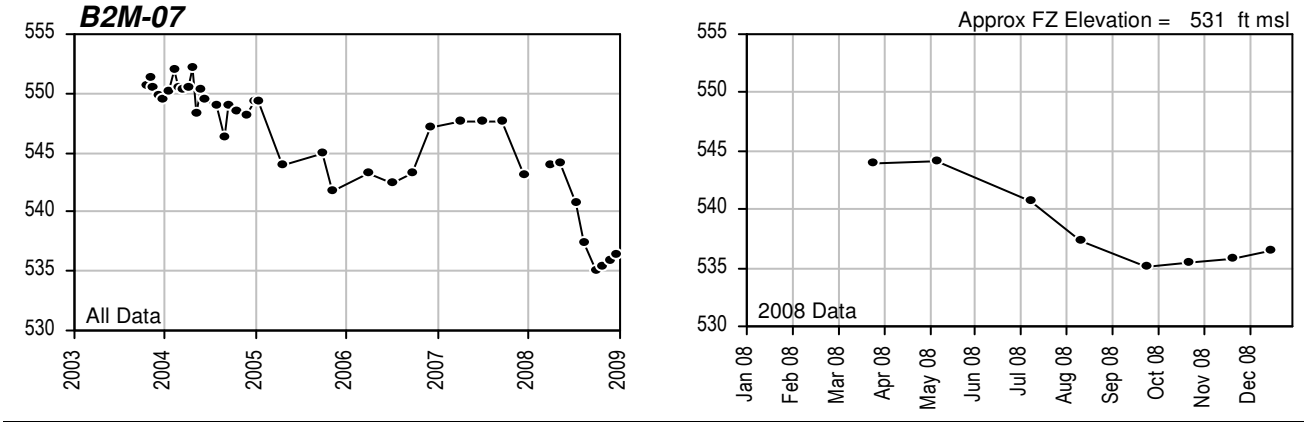

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

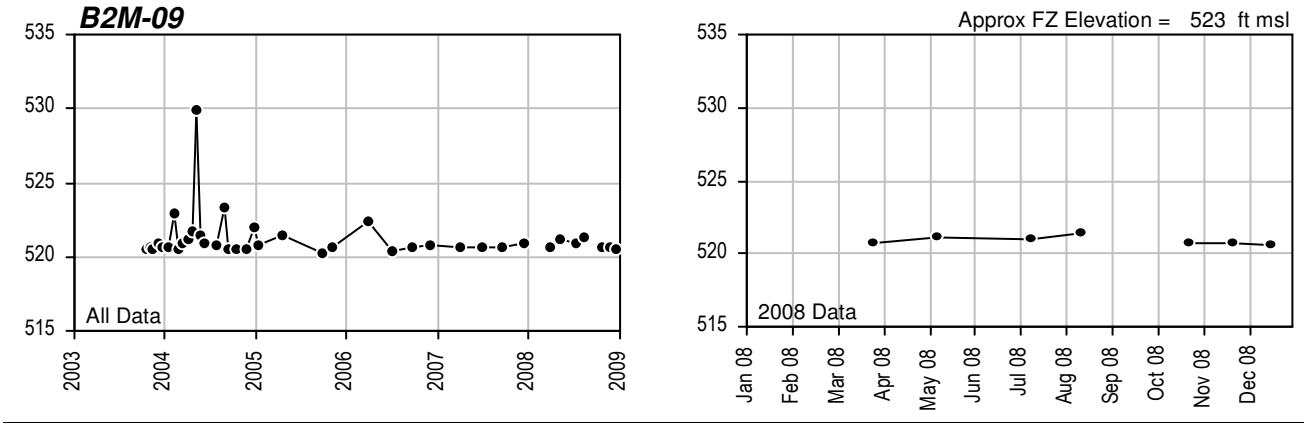


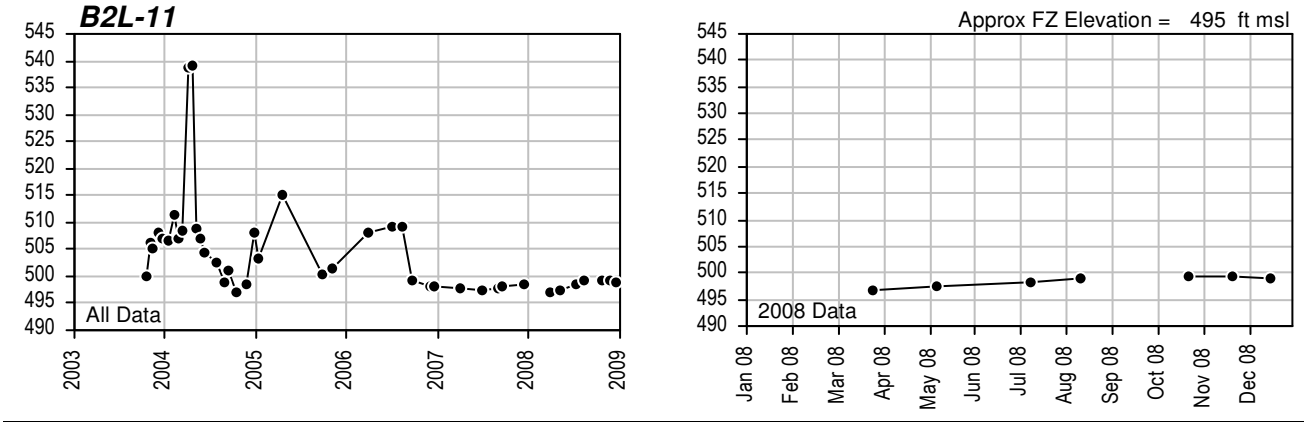




Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

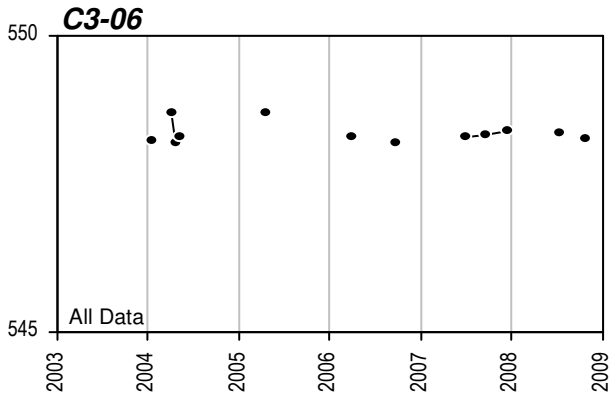


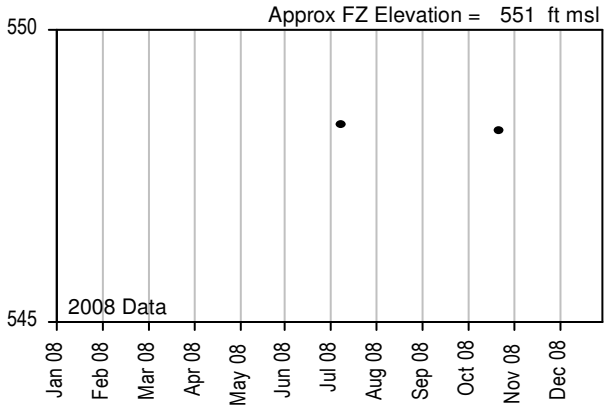



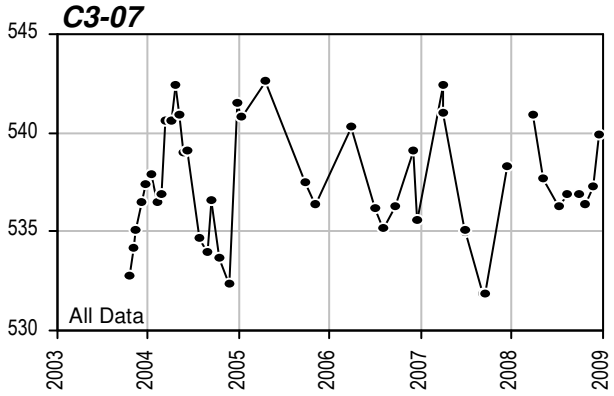



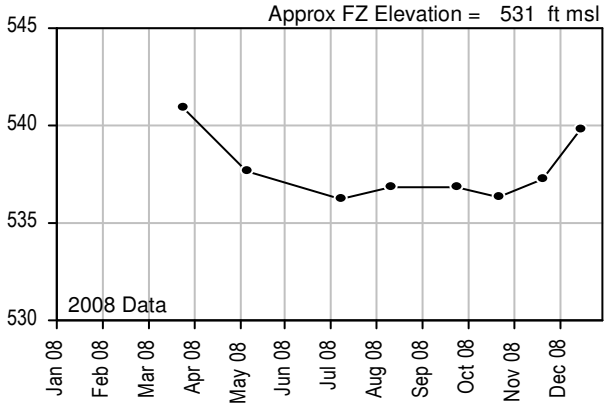



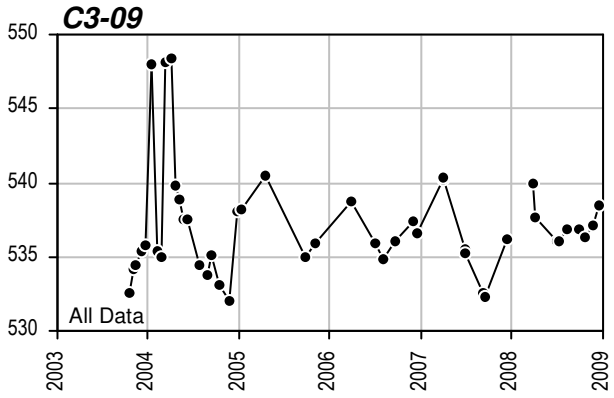

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

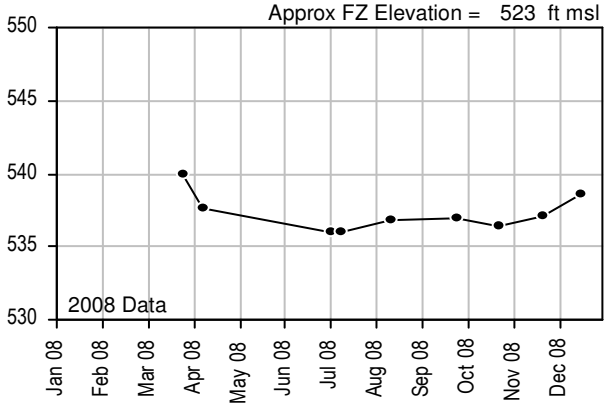


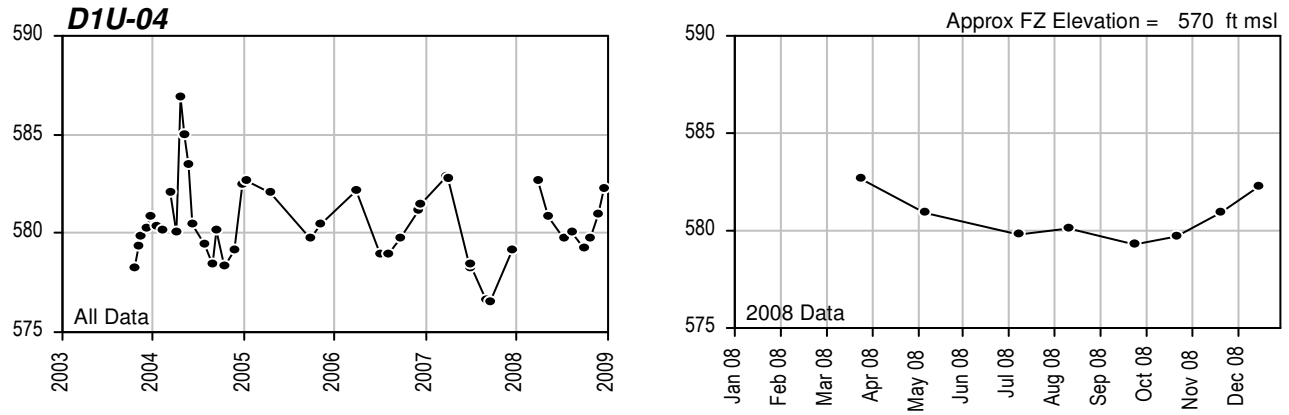



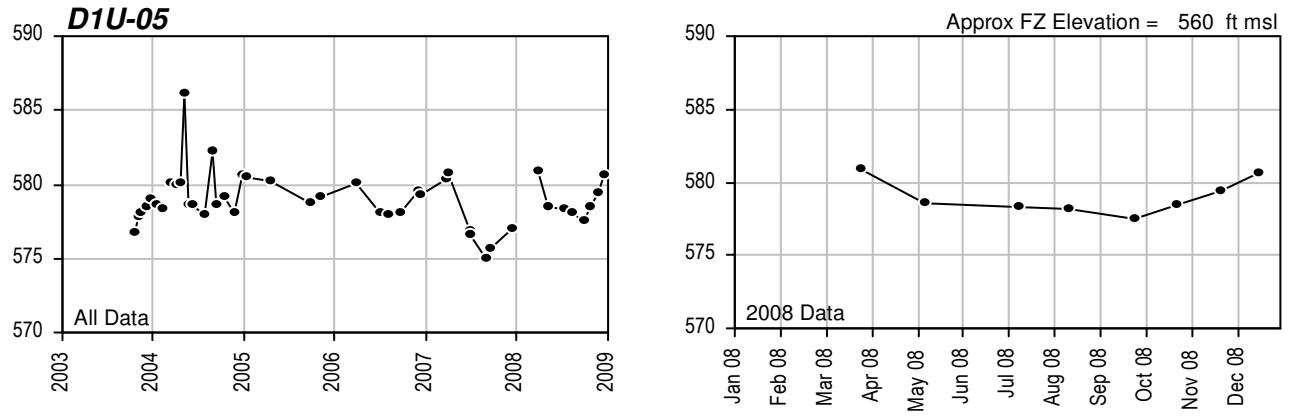



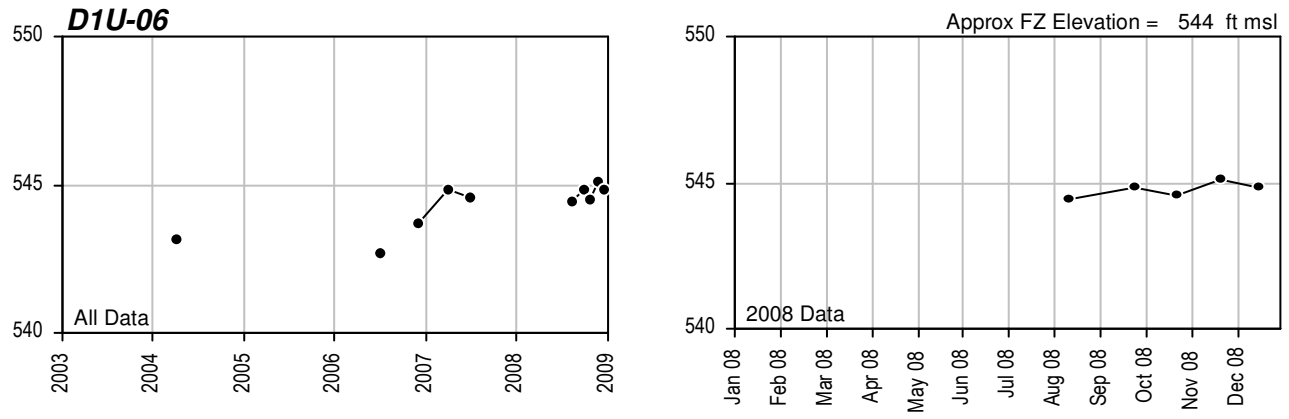



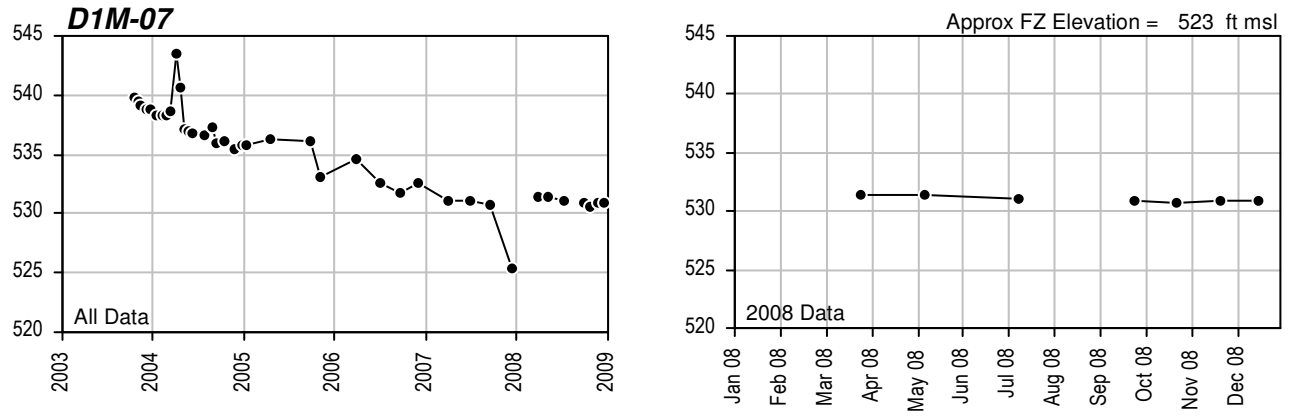




Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

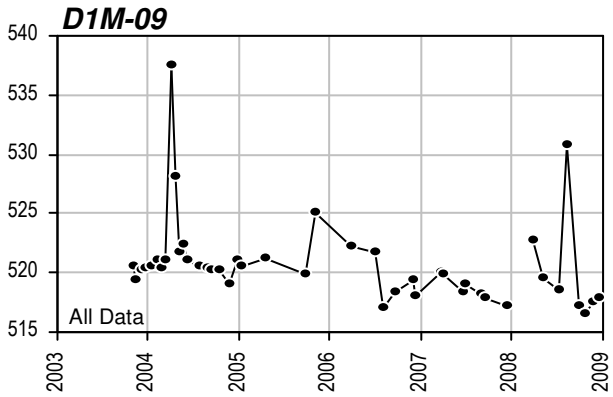


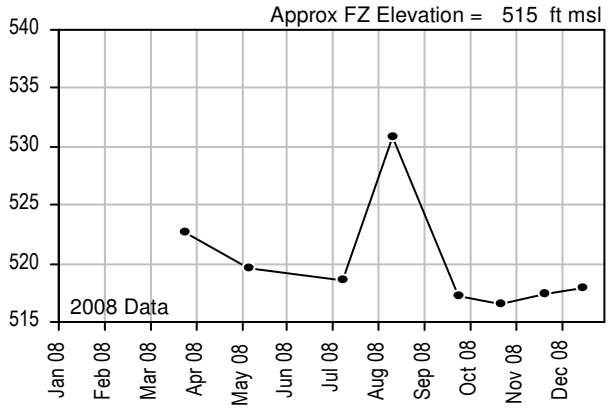



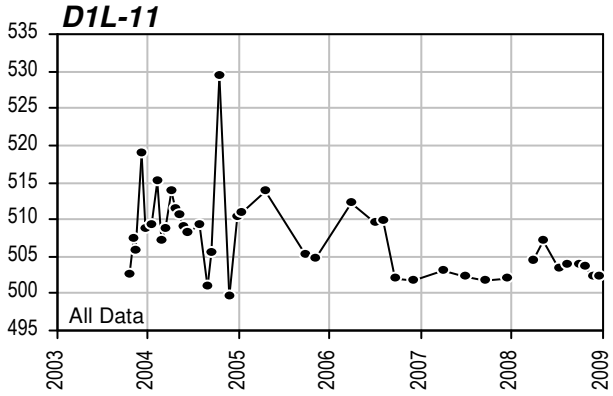



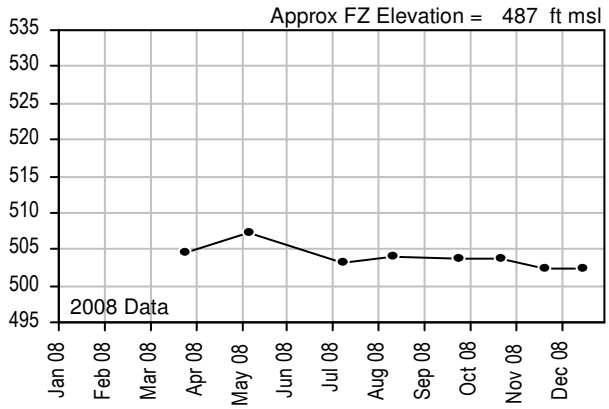




Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.



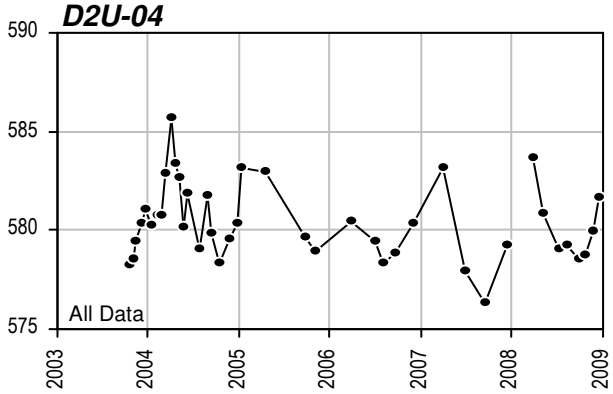



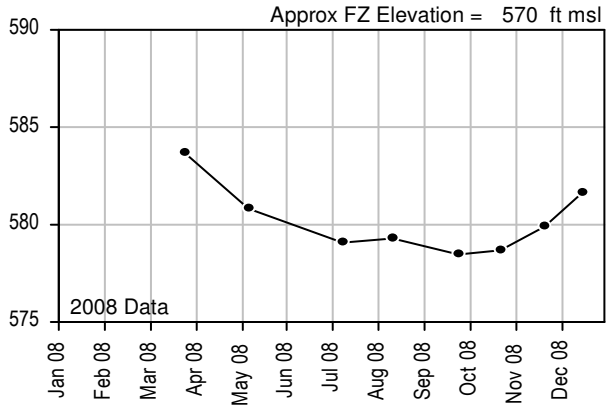



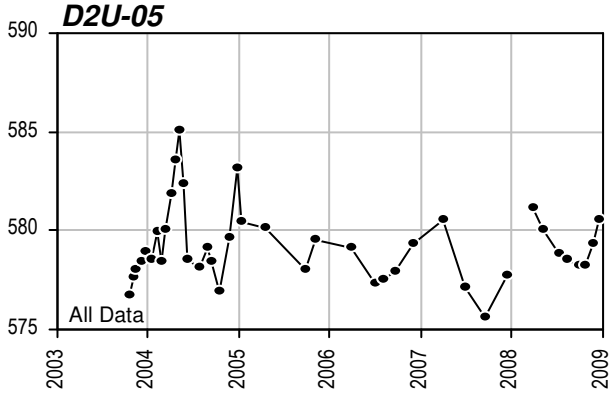

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

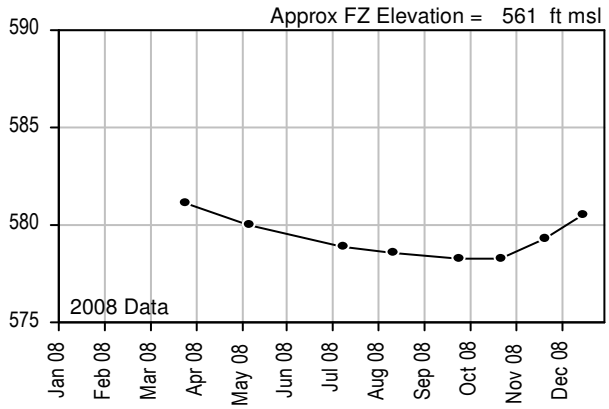
***D2U-04***



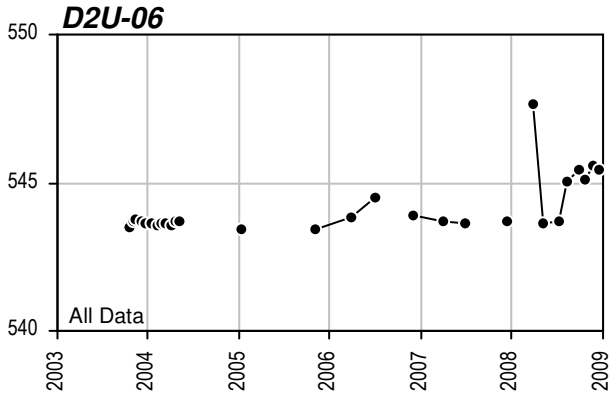



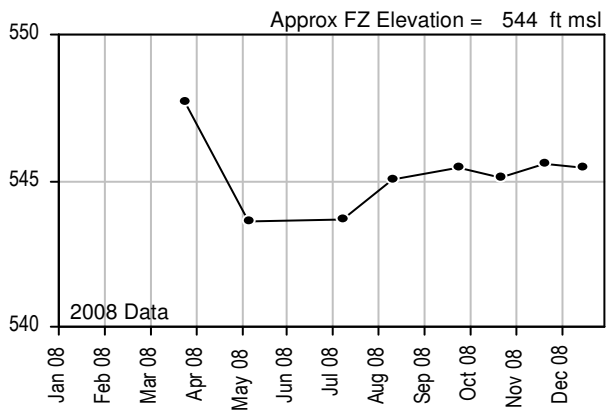

***D2U-05***




***D2U-06***

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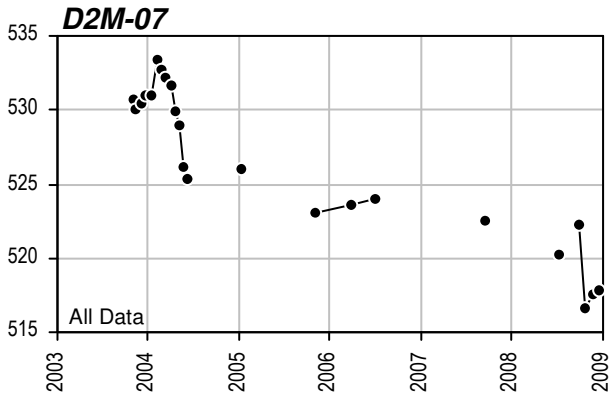
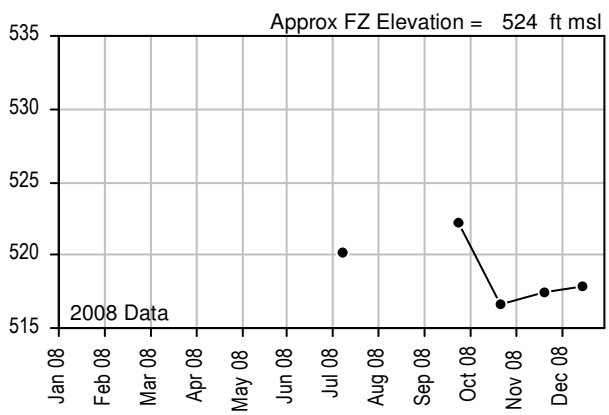
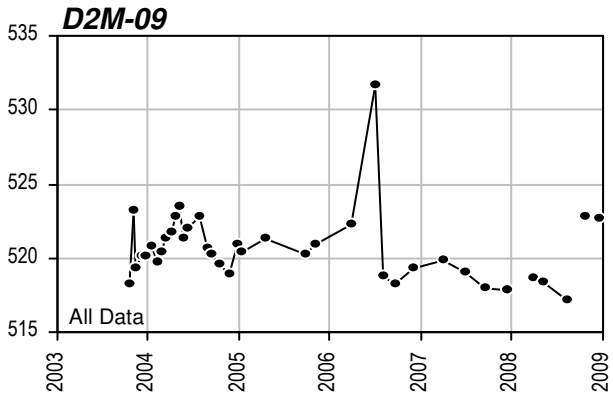
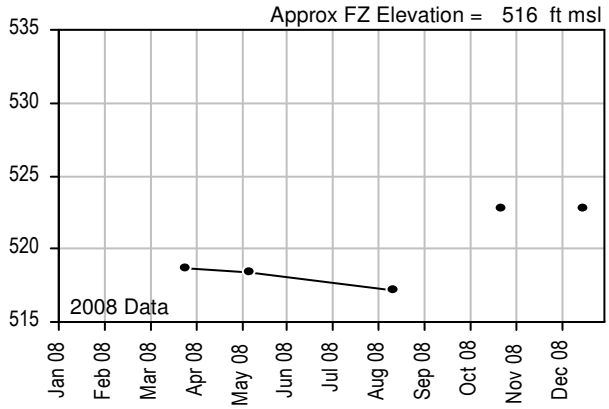
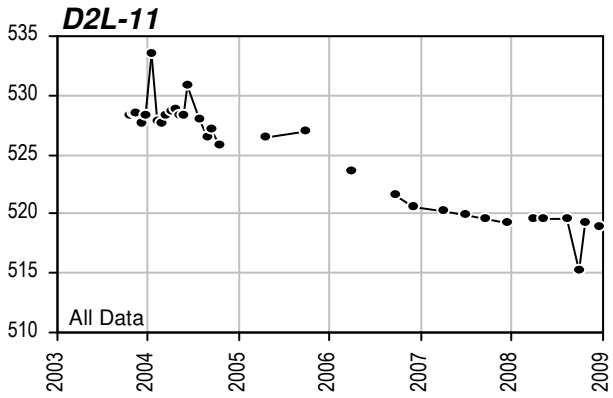


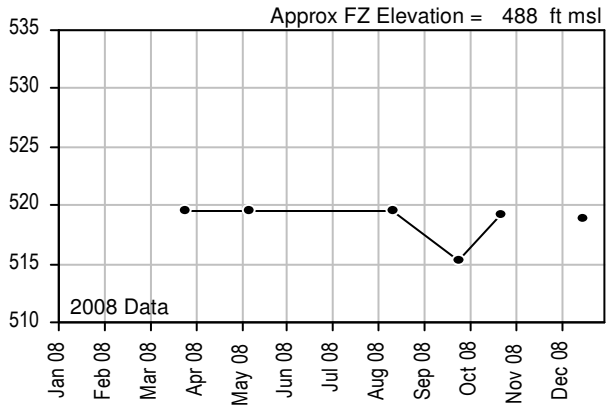




Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

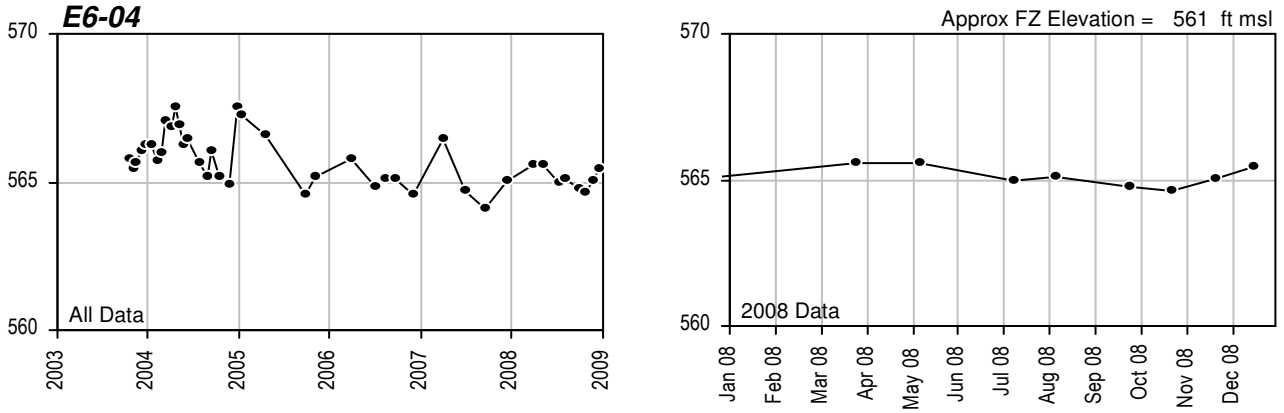


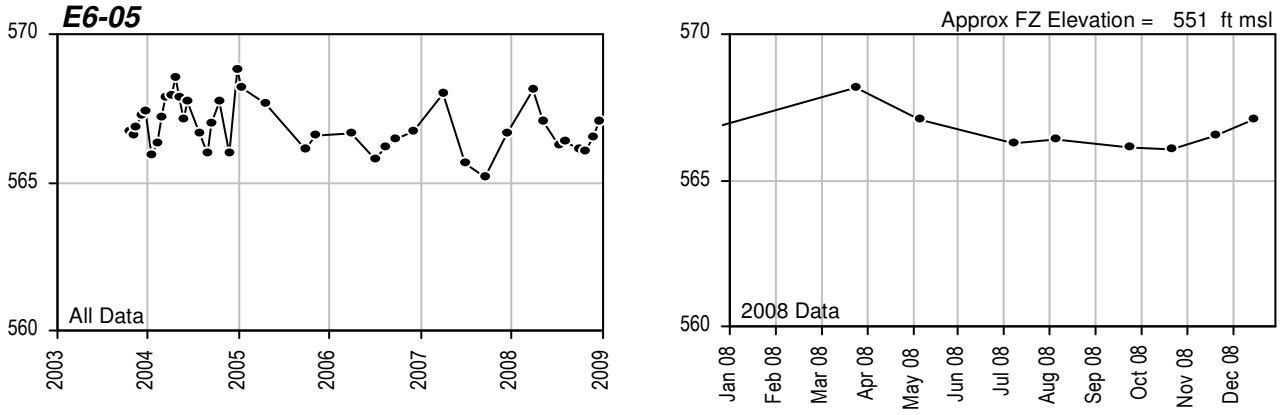



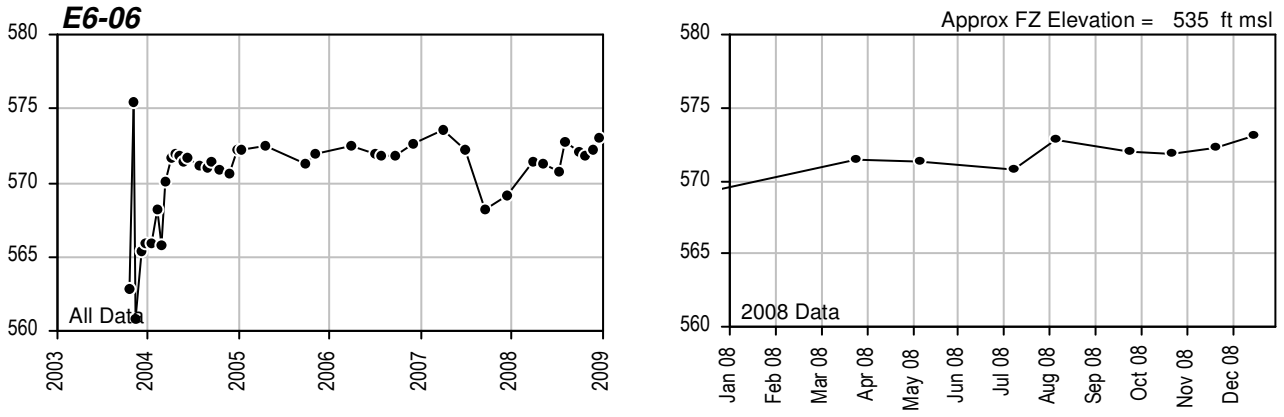



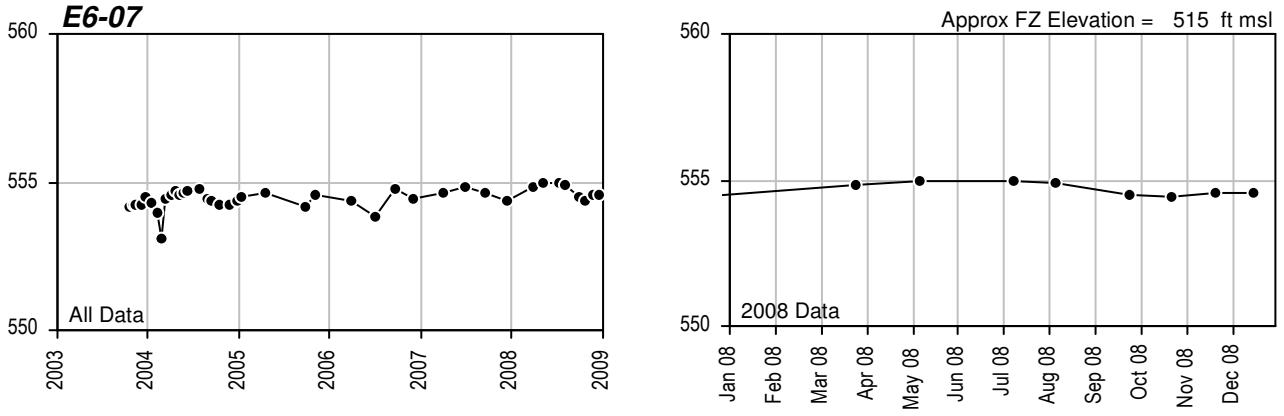




Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.



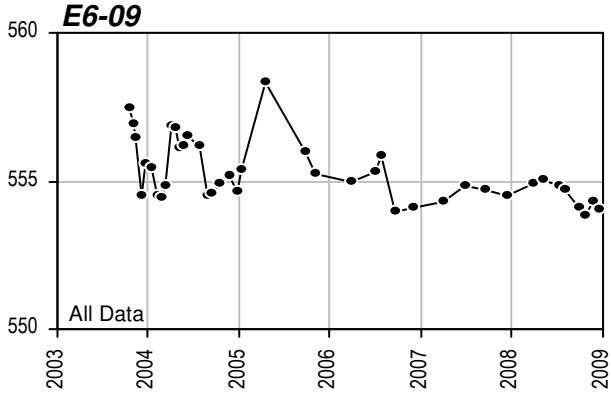



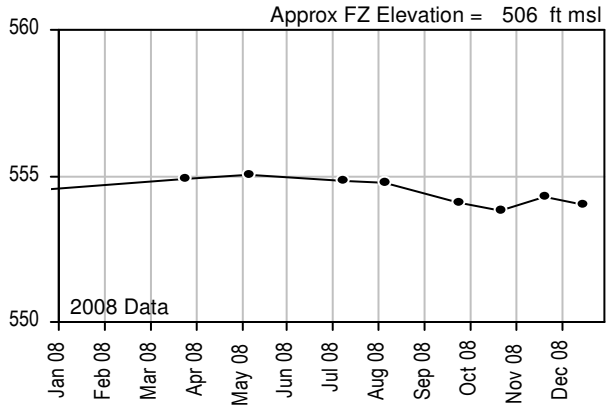



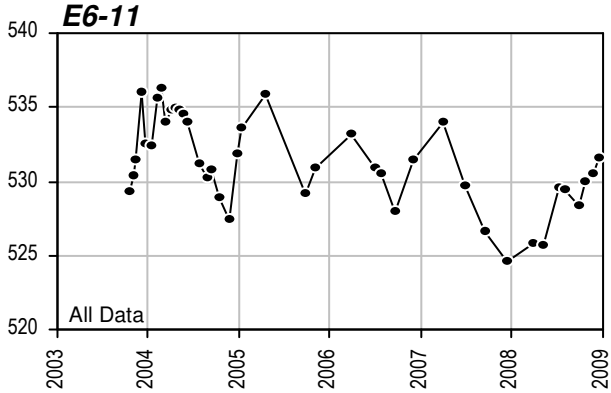

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

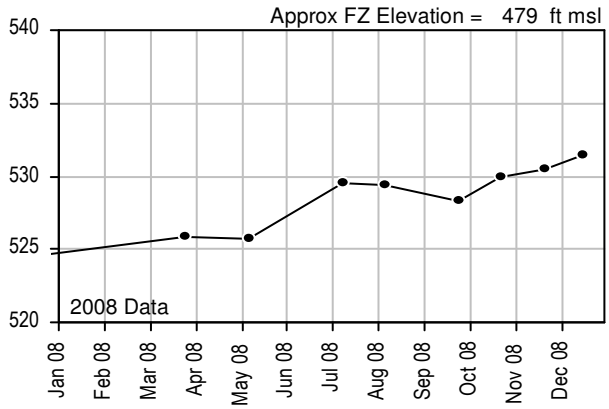
***E6-09***



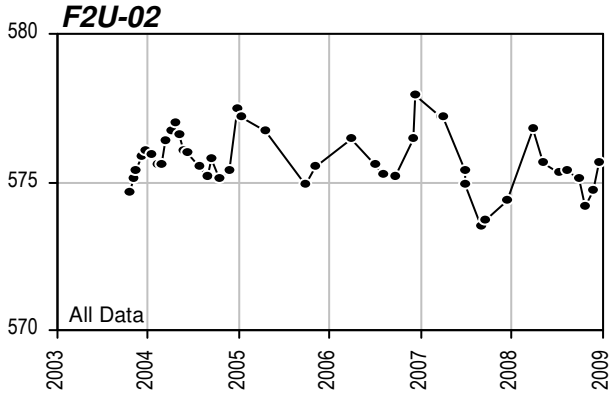

***E6-11***

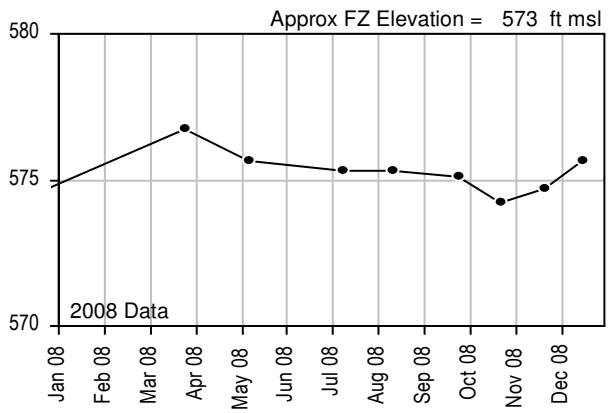


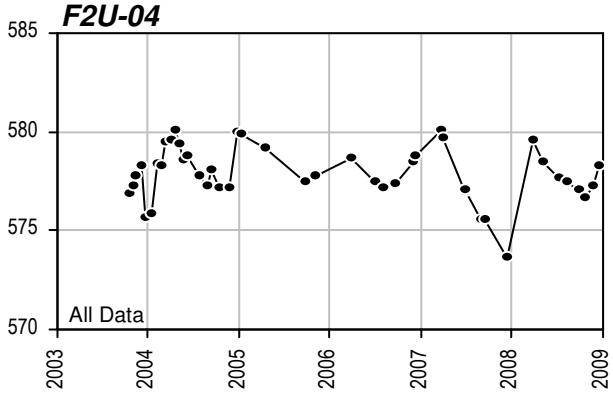

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

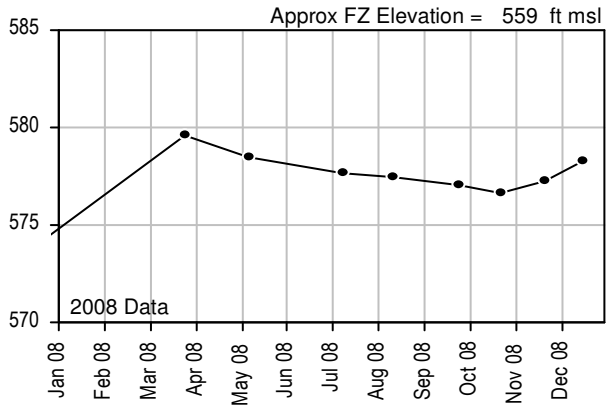
### F2U-02



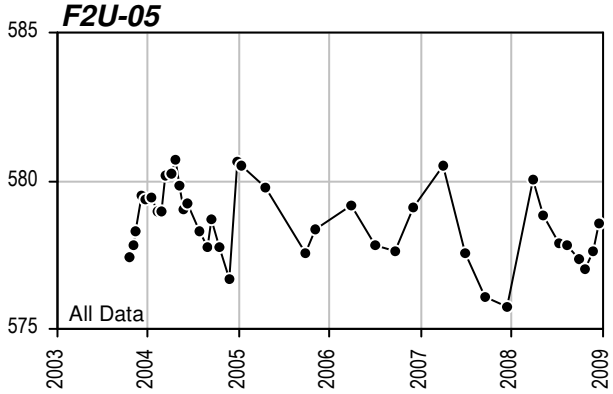



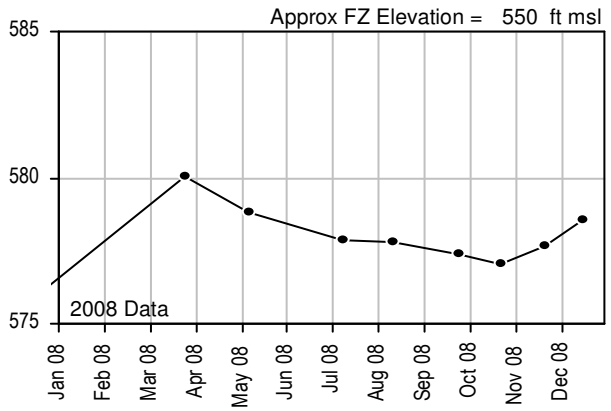

### F2U-04



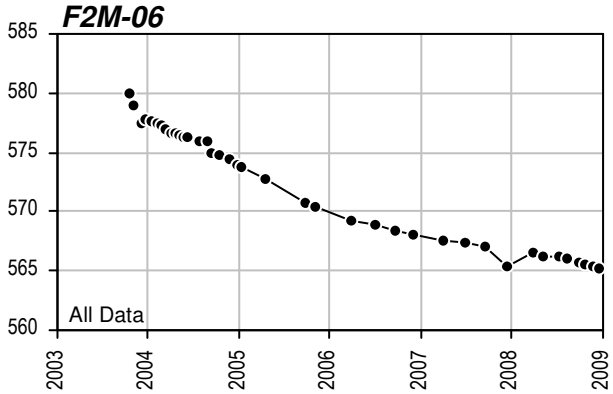



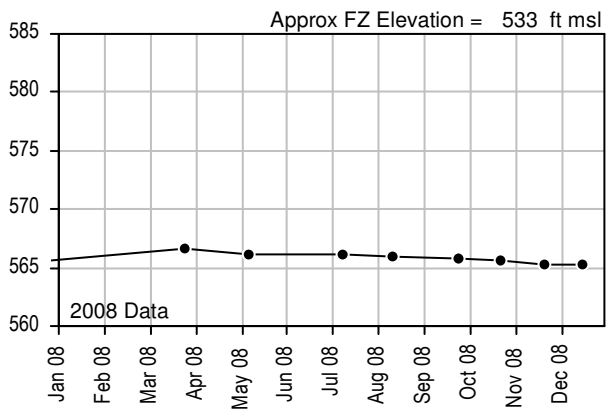

### F2U-05



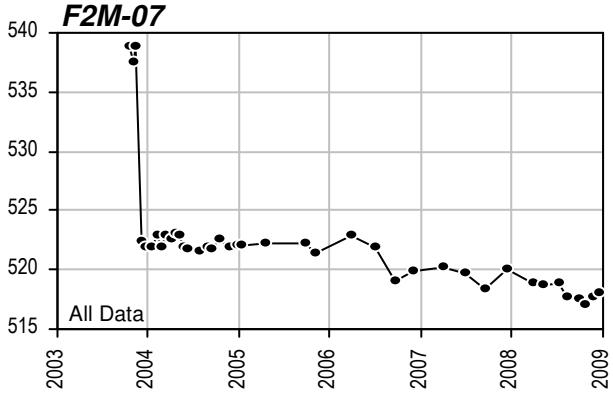

### F2M-06

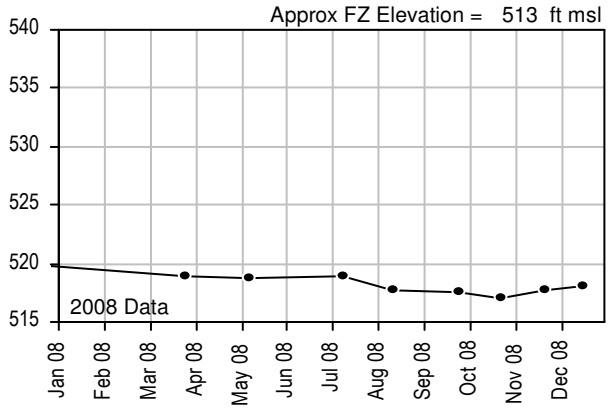


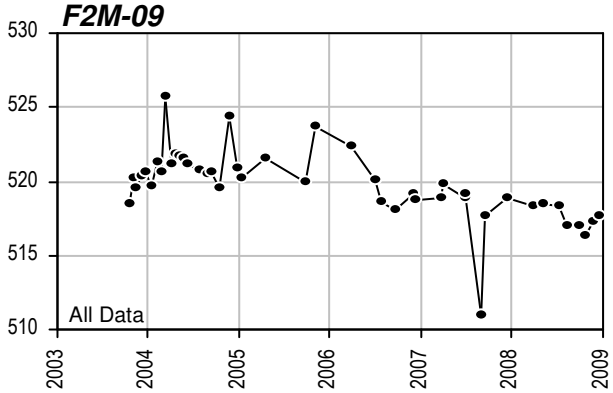

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

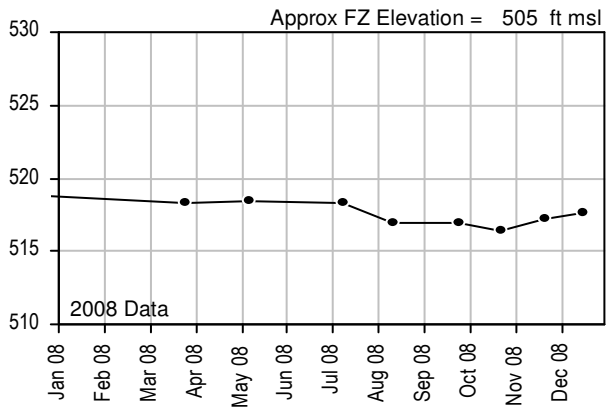
***F2M-07***



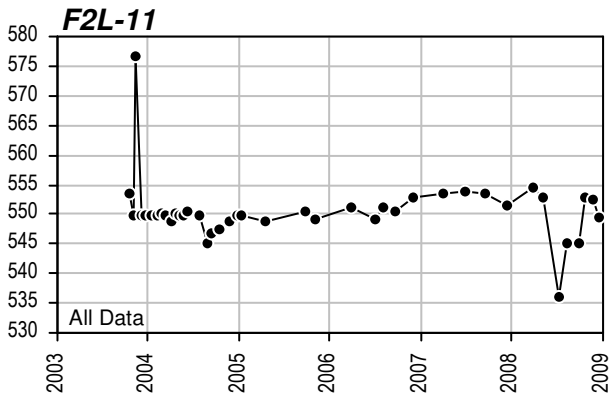



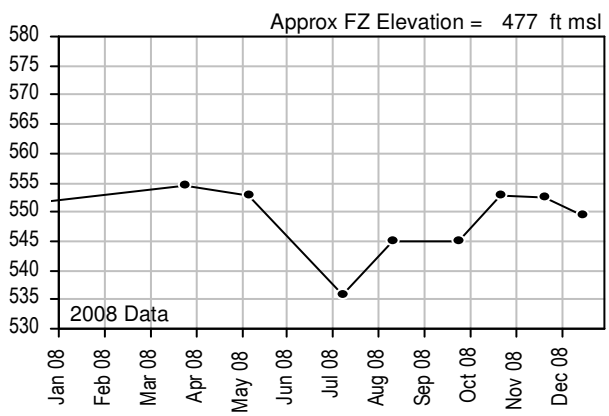

***F2M-09***



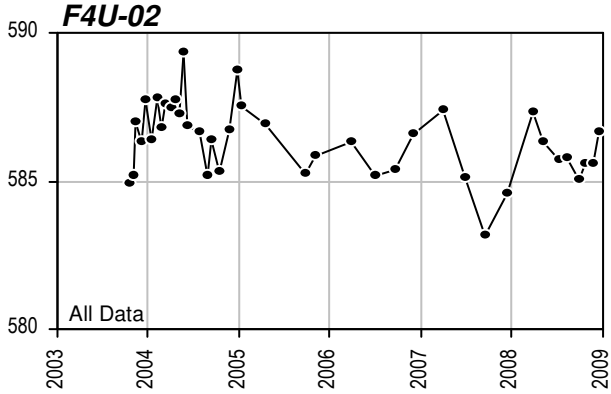

***F2L-11***

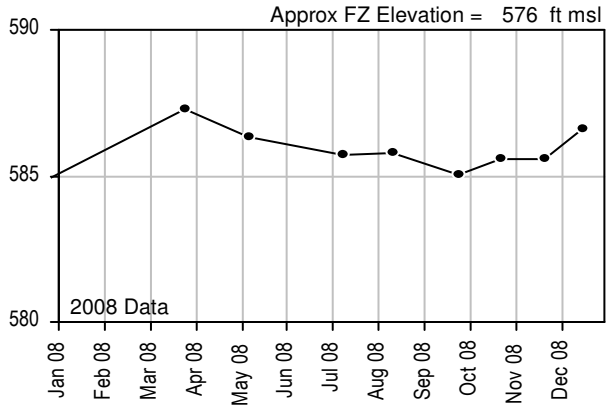


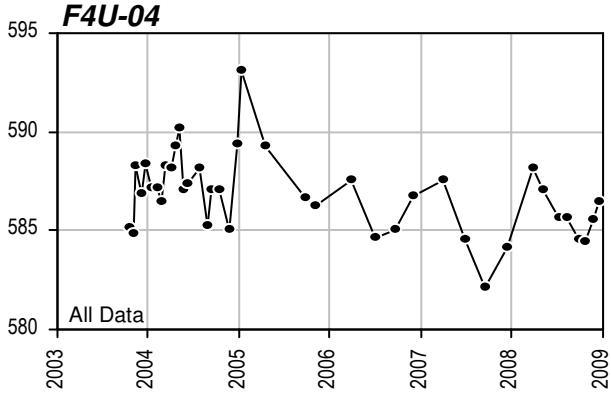

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

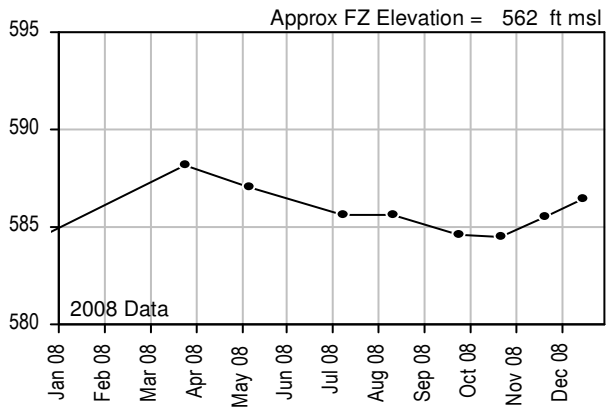
***F4U-02***



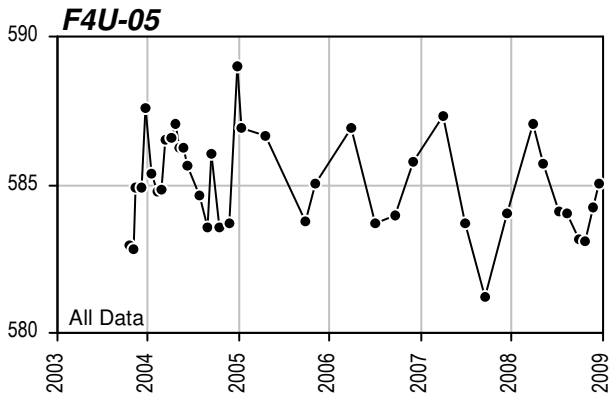



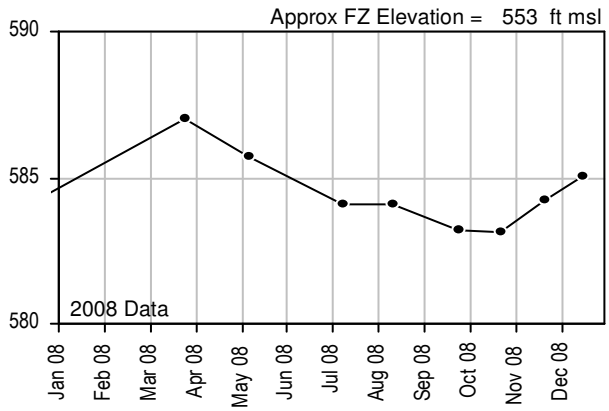

***F4U-04***



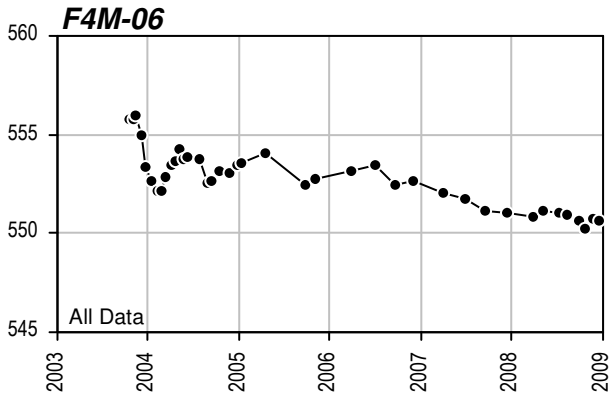



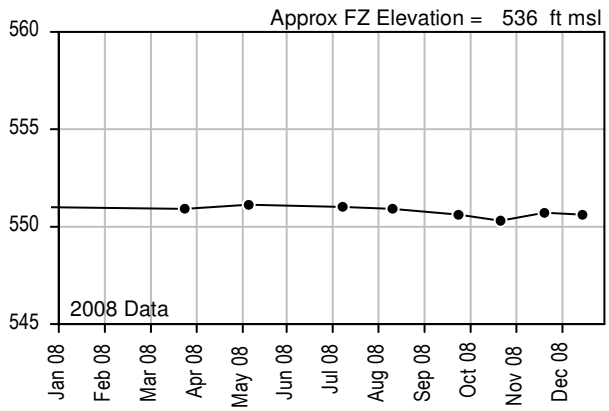

***F4U-05***



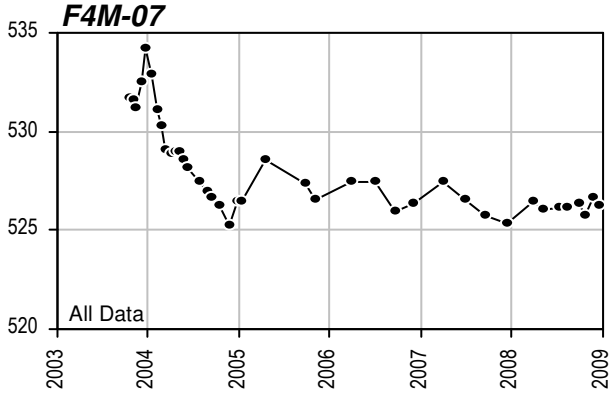

***F4M-06***

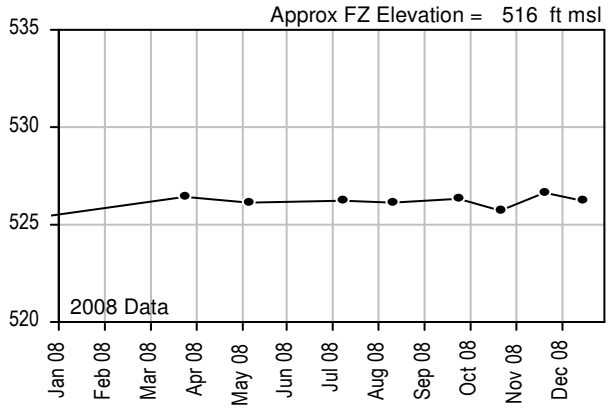


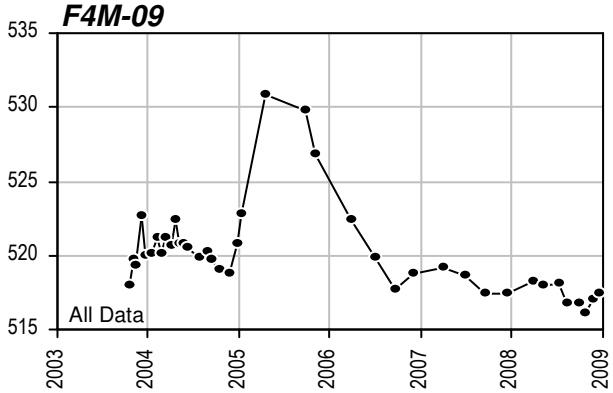

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

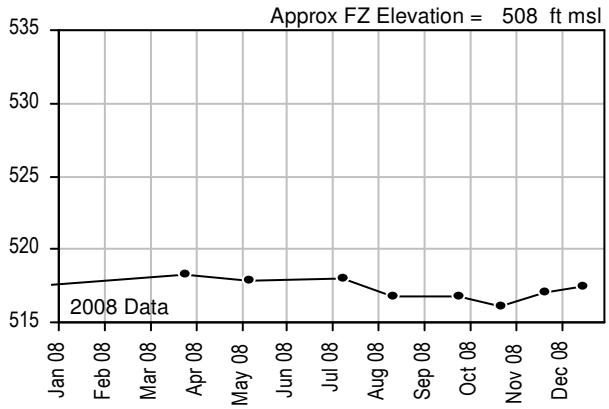
***F4M-07***



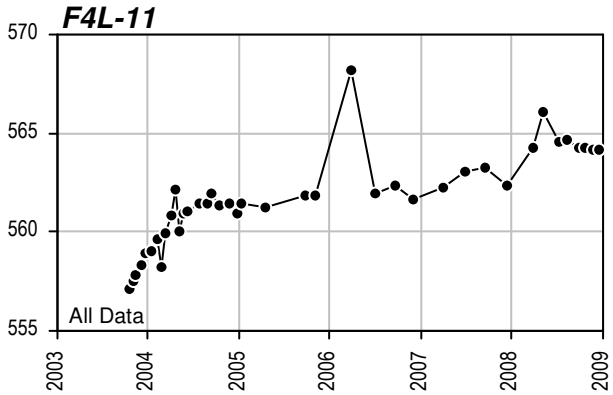



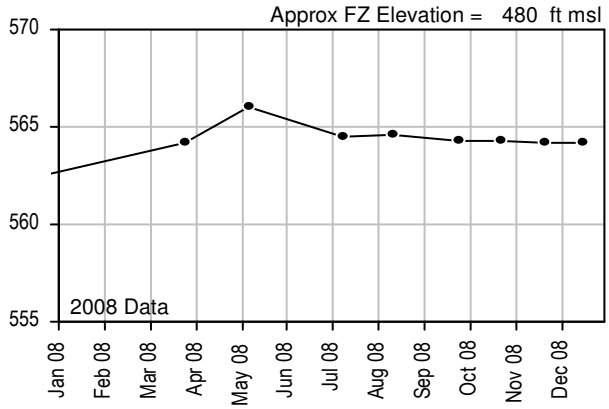

***F4M-09***



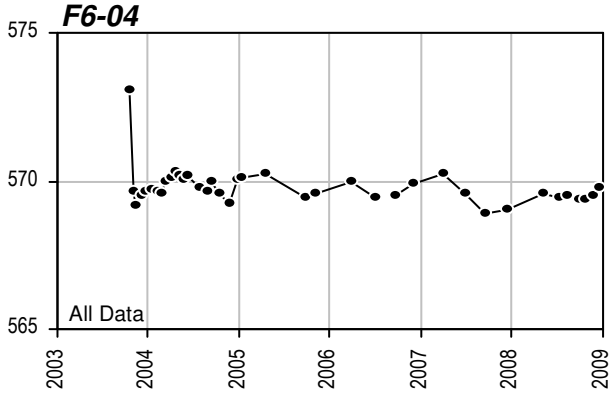

***F4L-11***

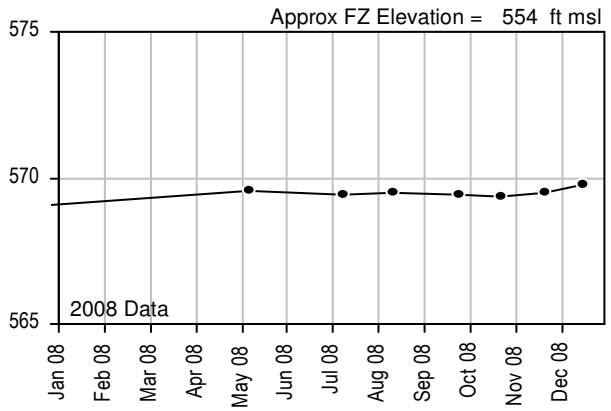


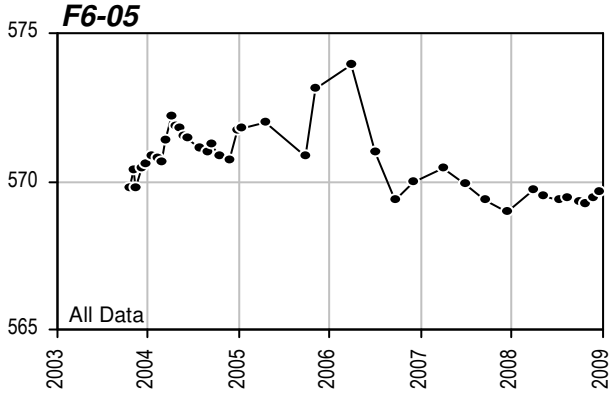

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

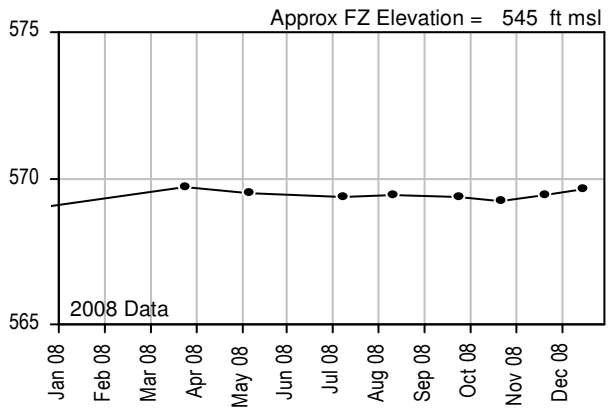
***F6-04***



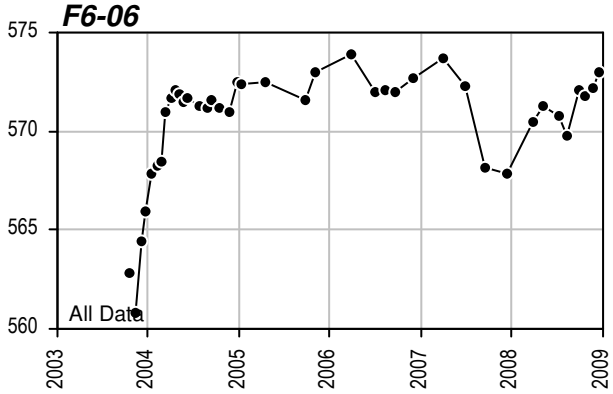



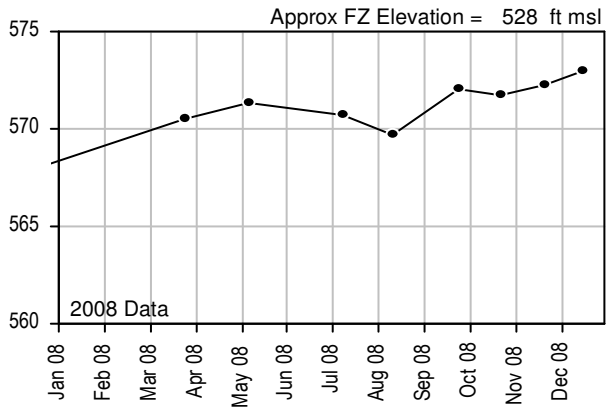

***F6-05***



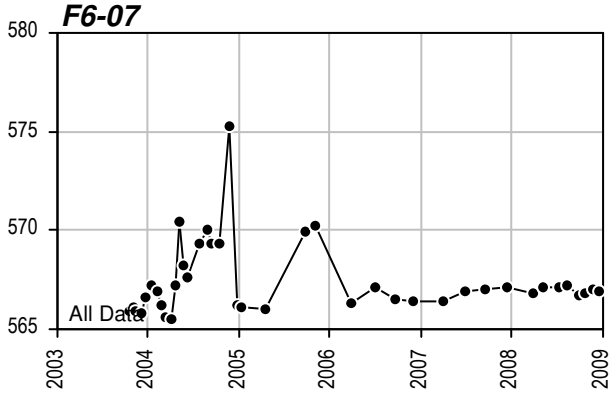



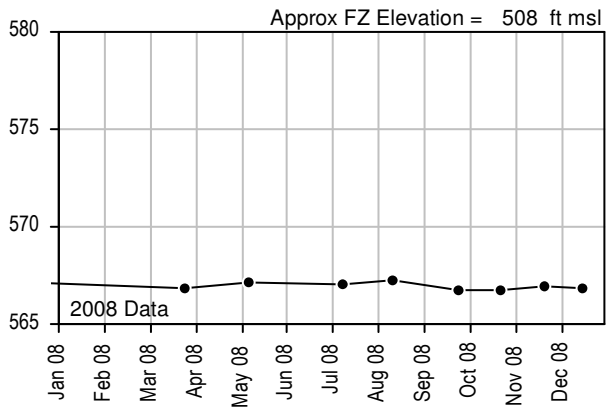

***F6-06***



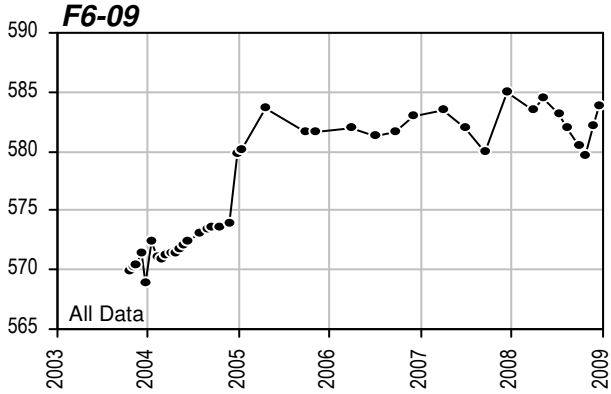

***F6-07***

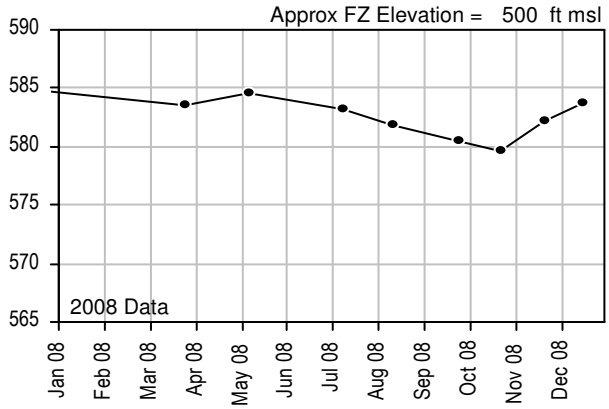


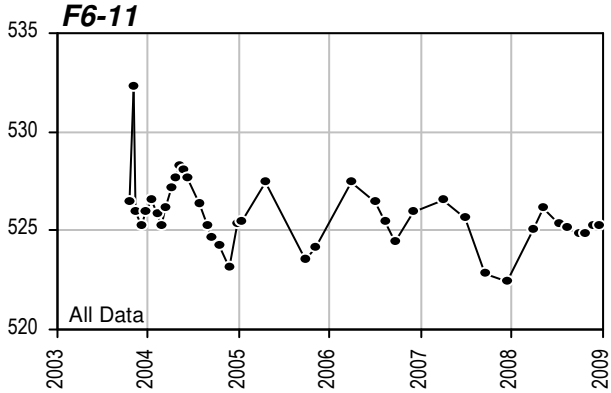

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

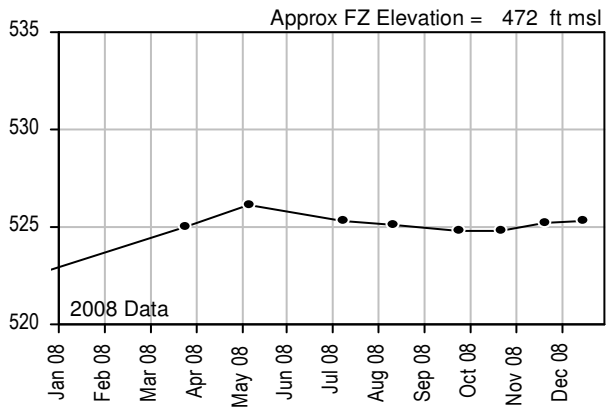
***F6-09***



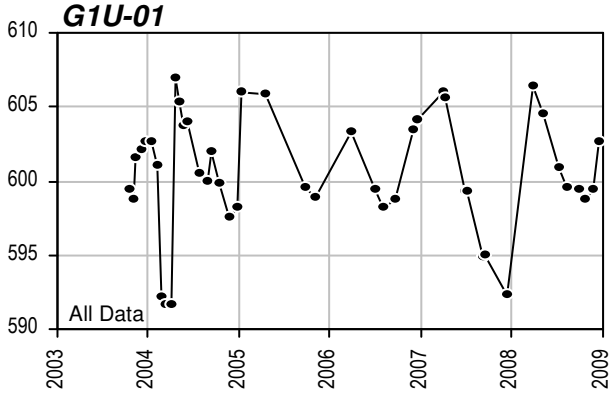

***F6-11***

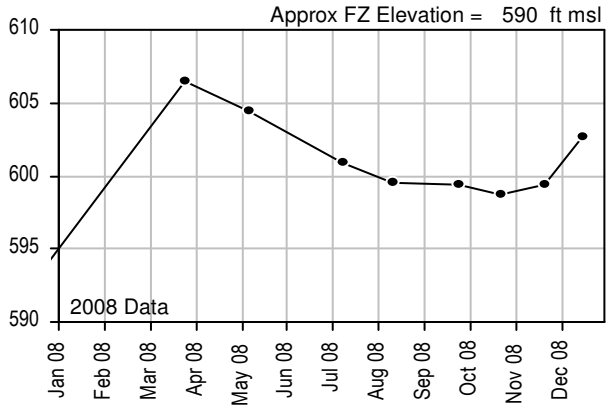


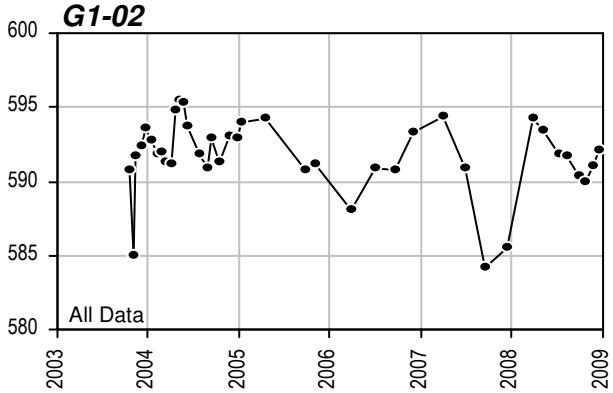

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

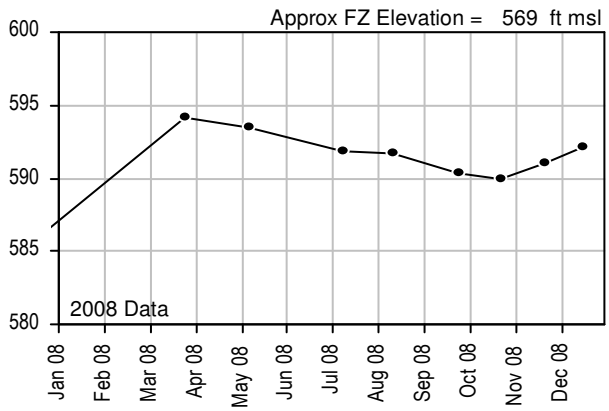
***G1U-01***



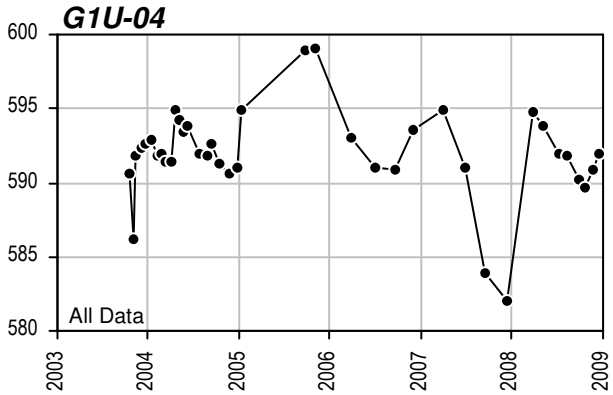



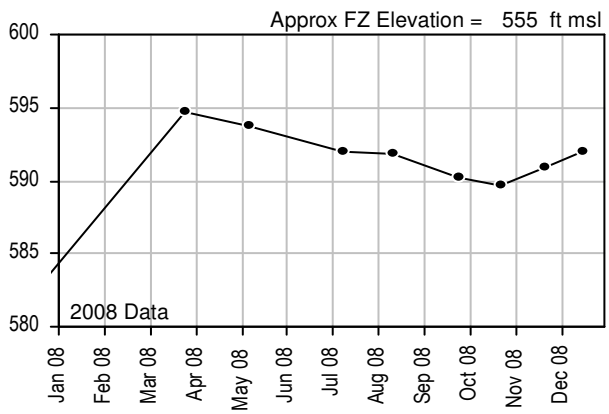

***G1-02***



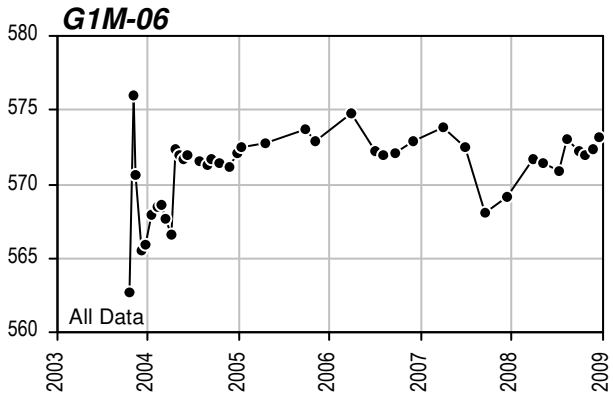



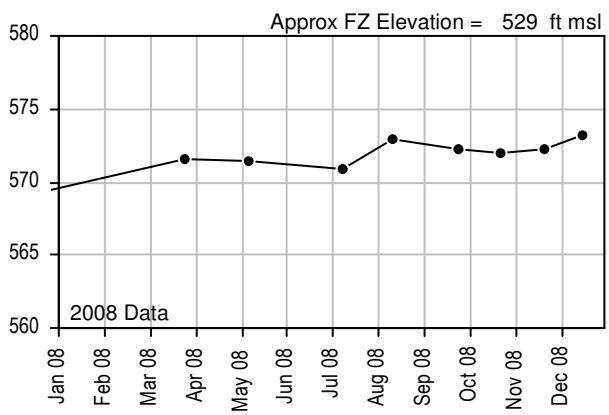

***G1U-04***



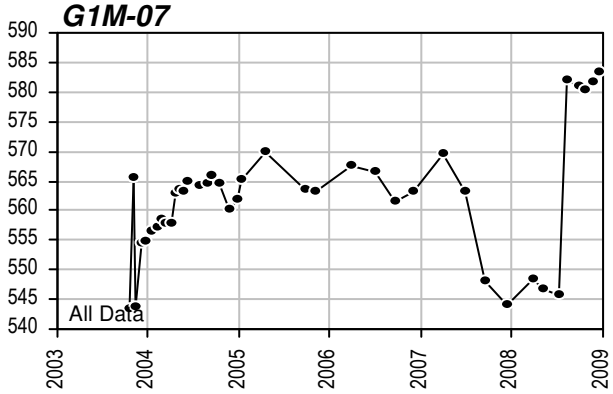

***G1M-06***

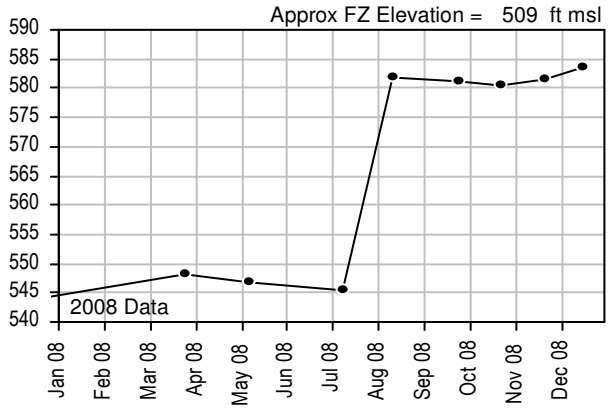


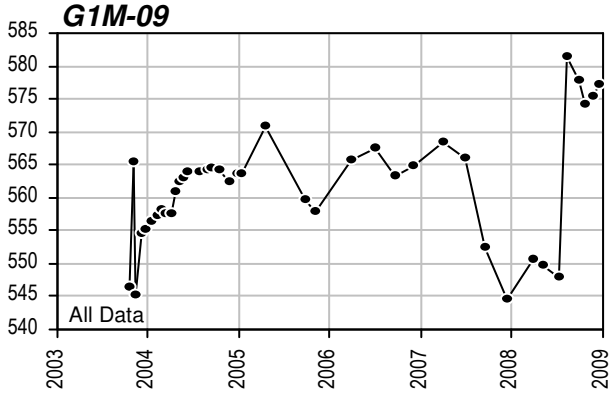

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

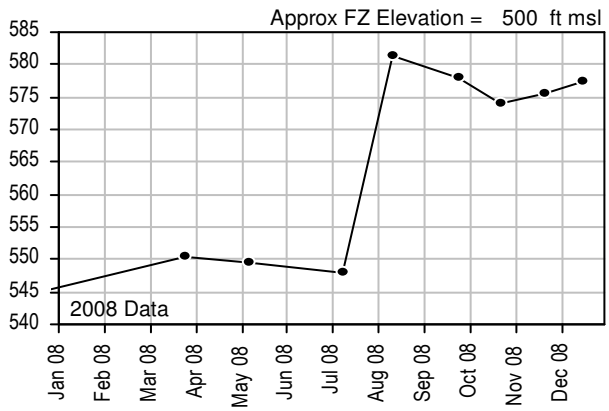
***G1M-07***



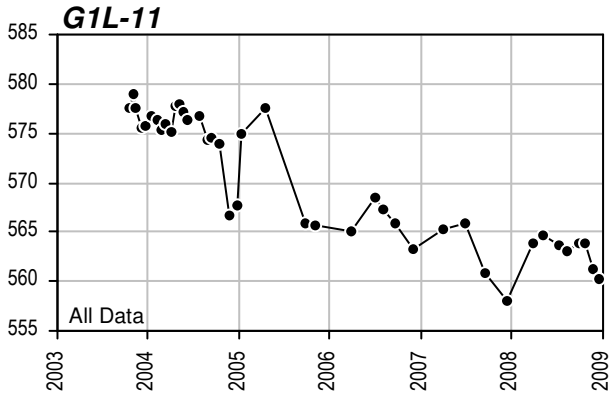



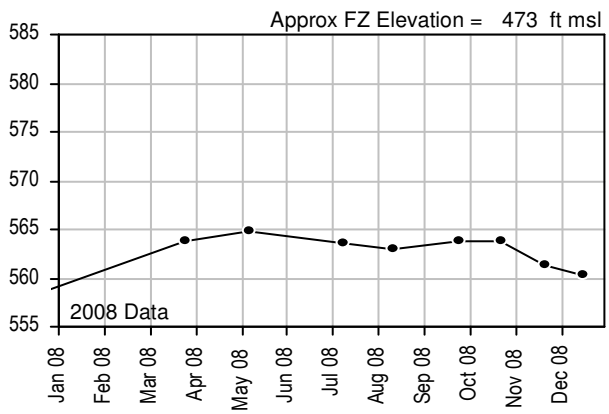

***G1M-09***



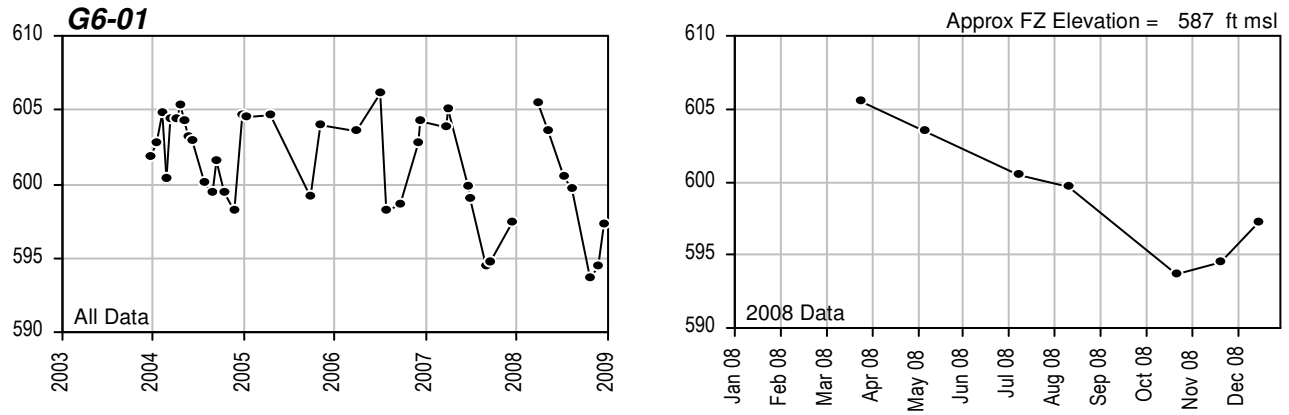



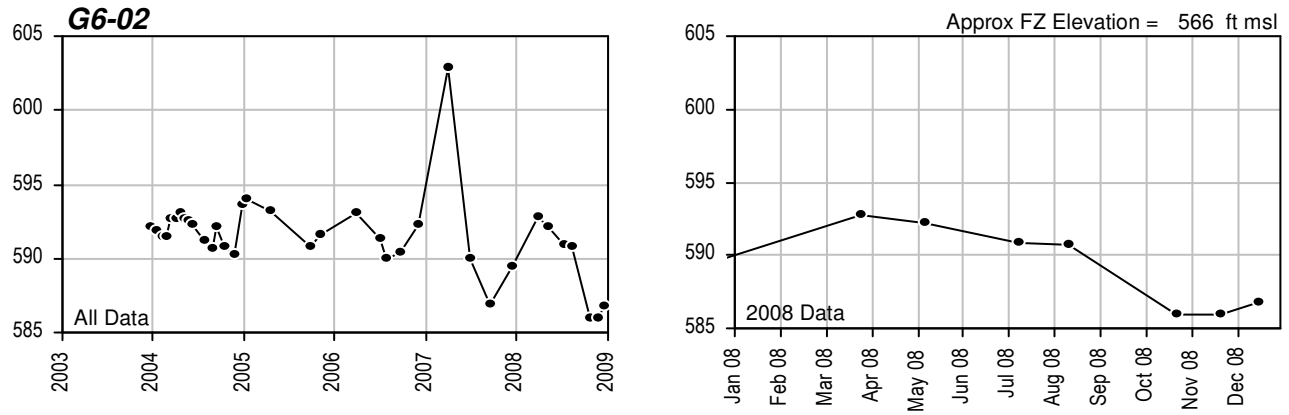

***G1L-11***

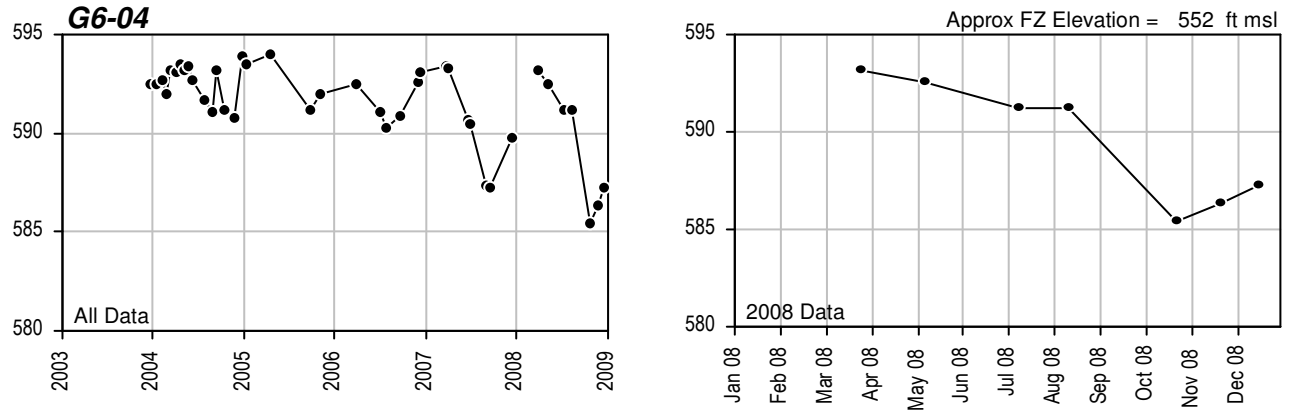


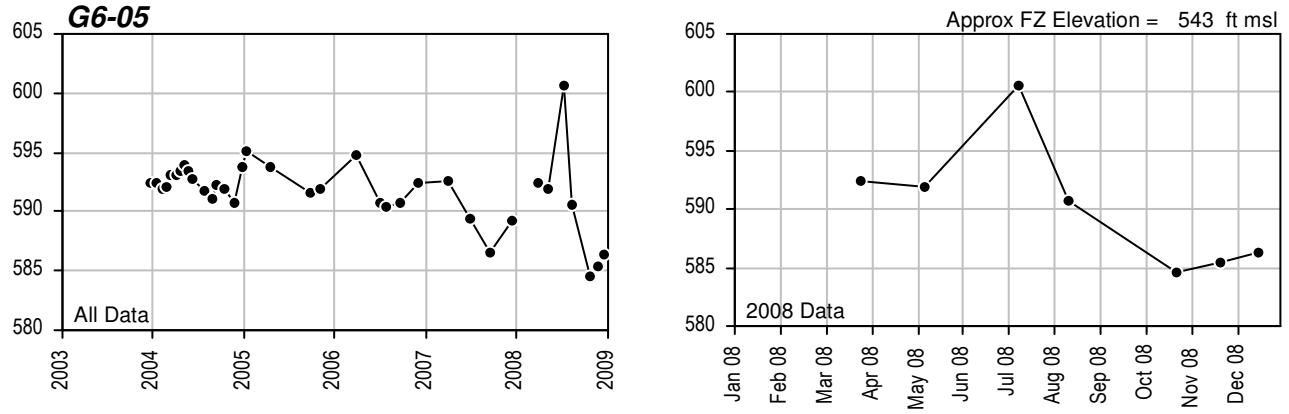




Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.



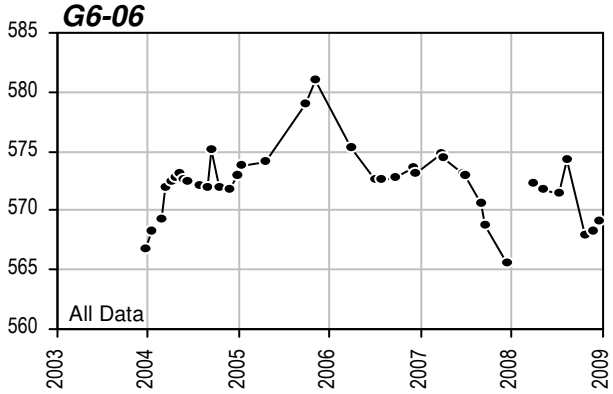



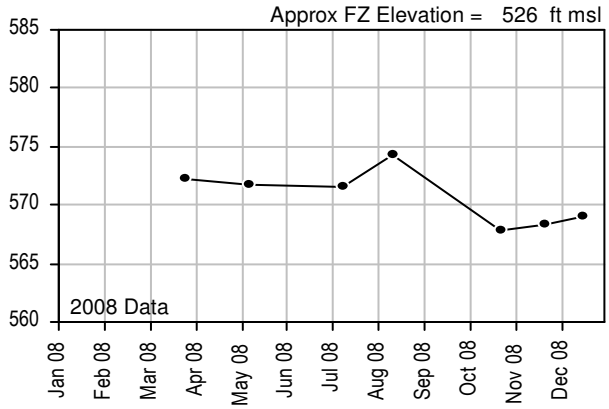



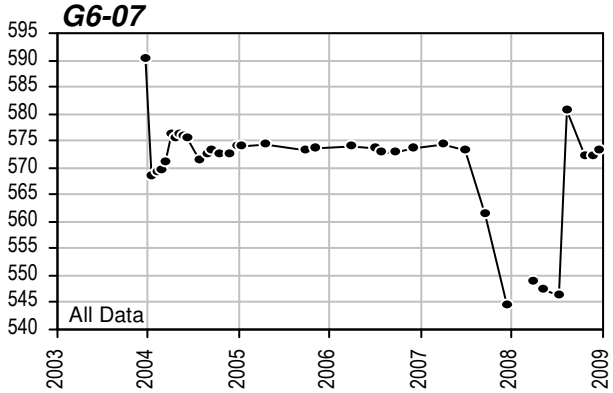

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

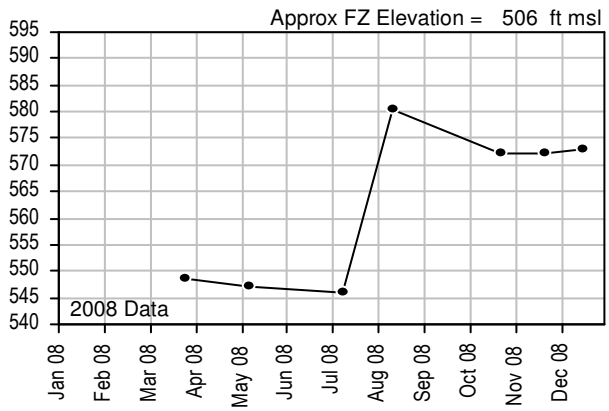
***G6-06***



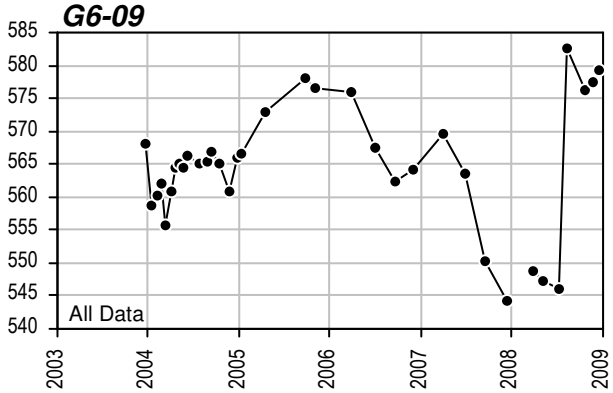



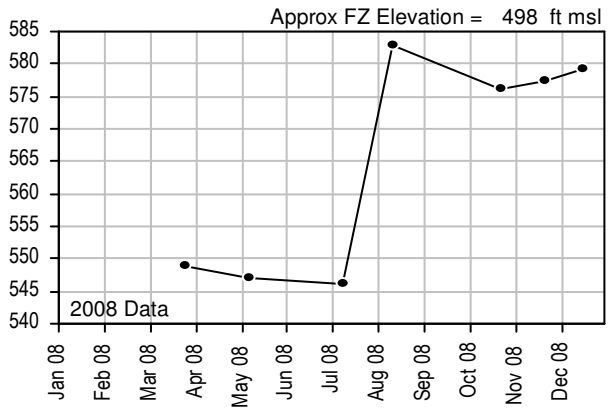

***G6-07***



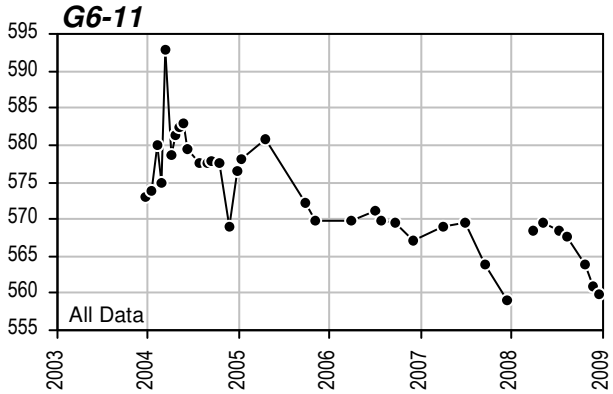



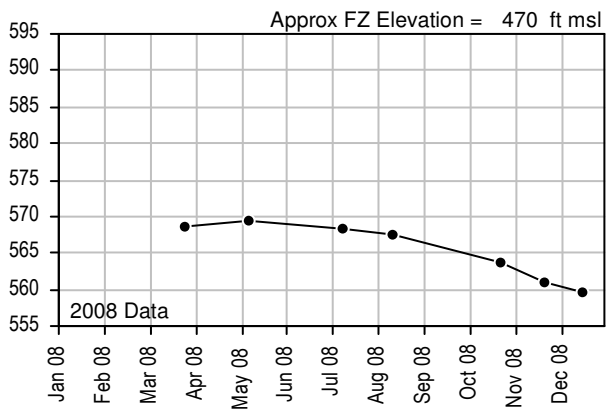

***G6-09***



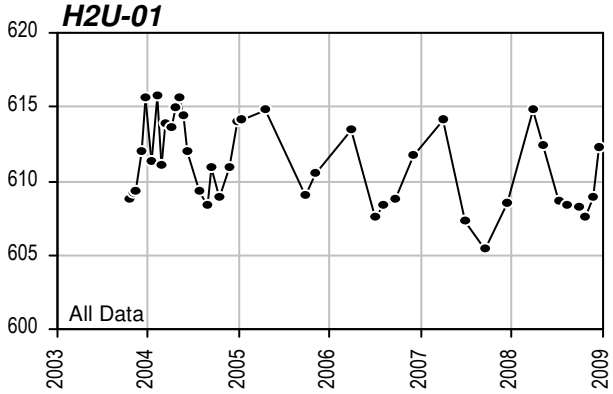

***G6-11***

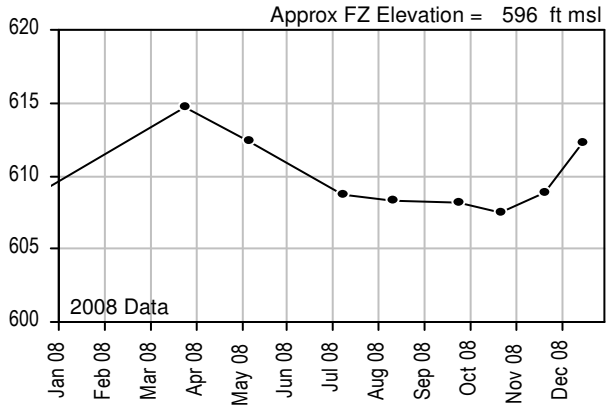


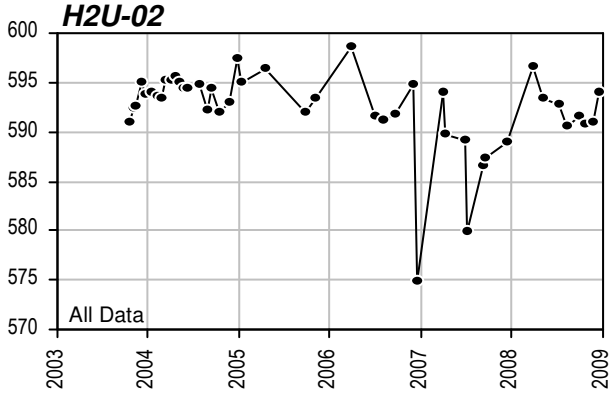

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

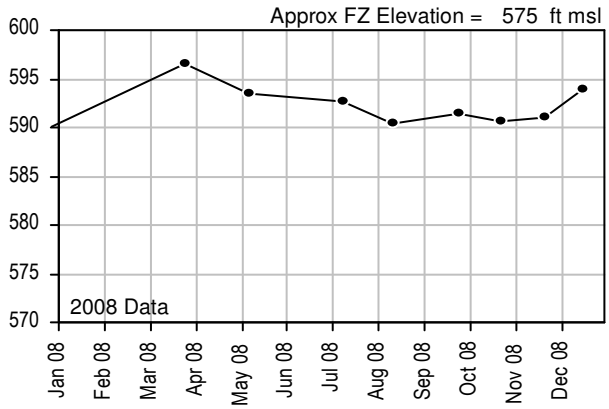
***H2U-01***



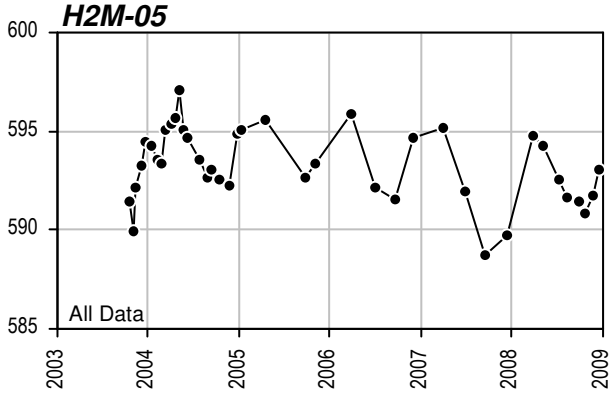



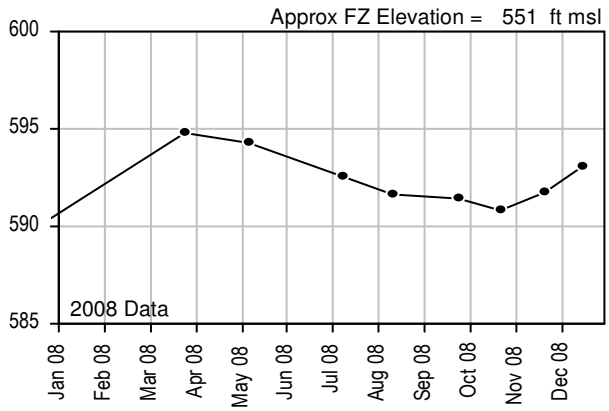

***H2U-02***



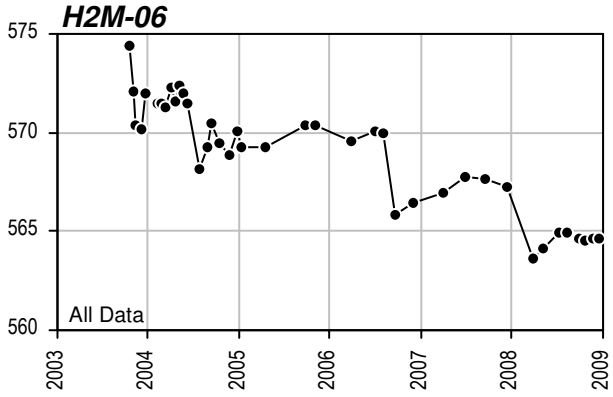



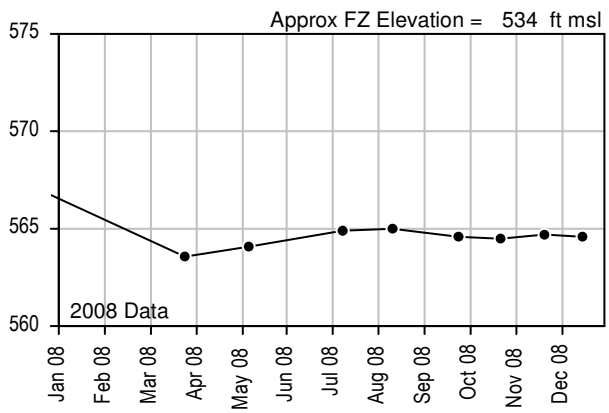

***H2M-05***



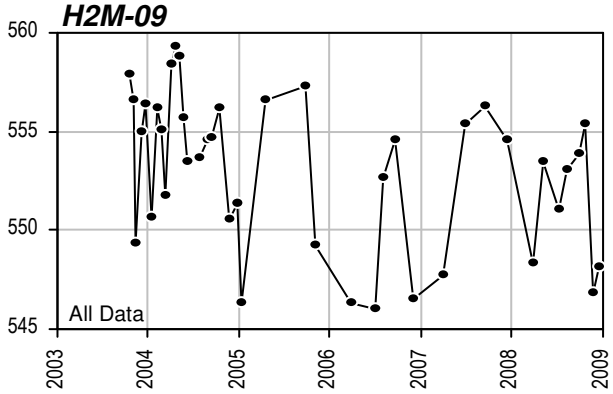

***H2M-06***

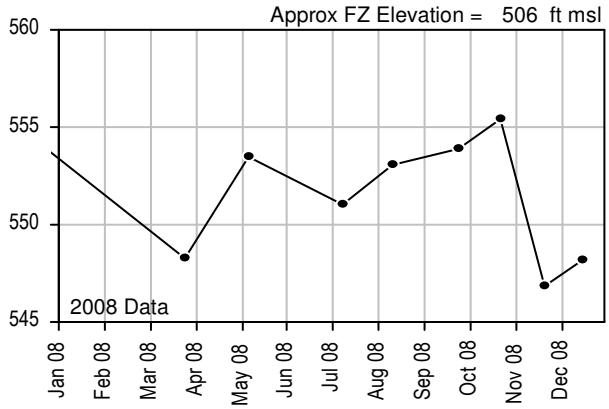


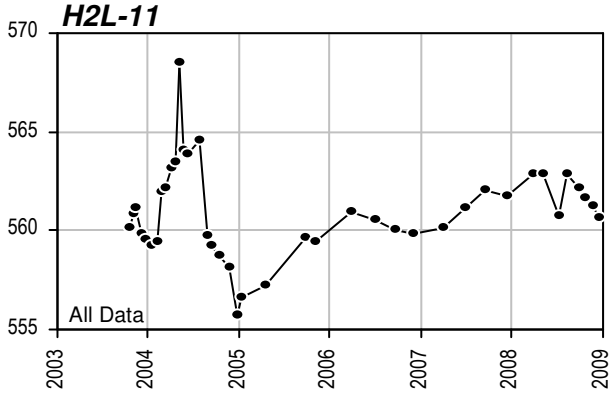

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

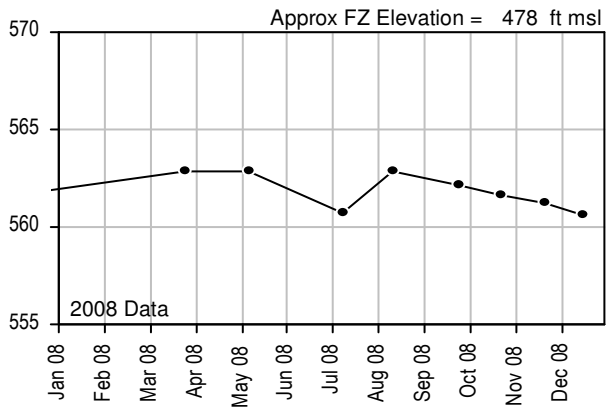
***H2M-09***



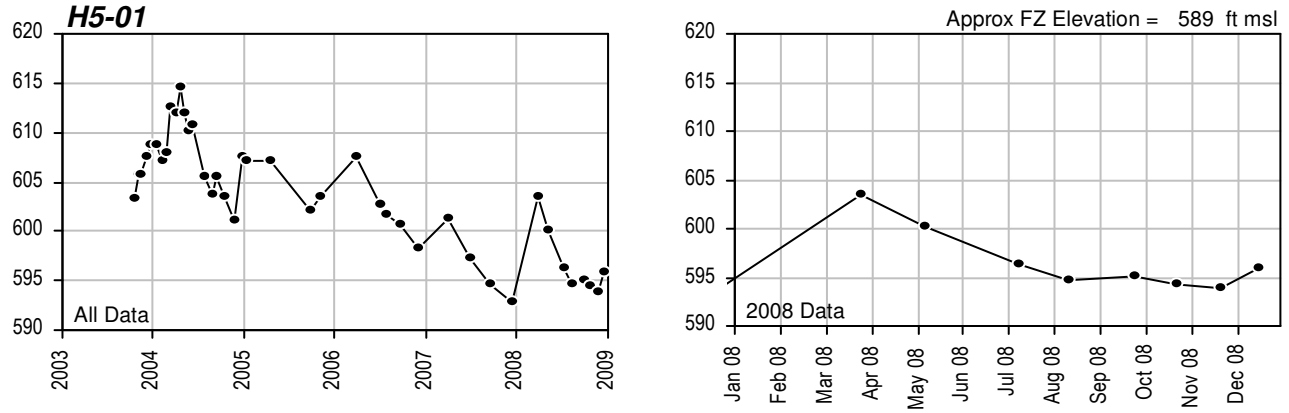



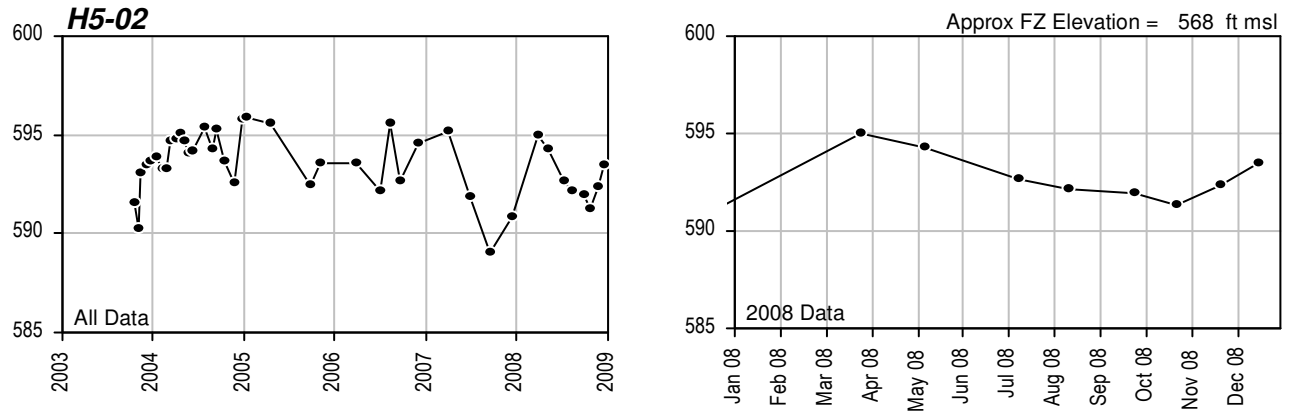

***H2L-11***

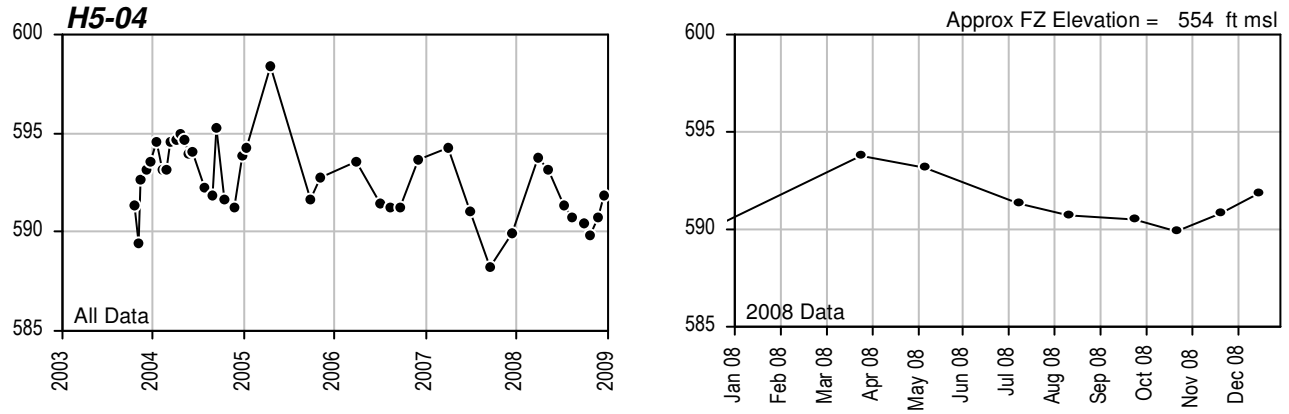


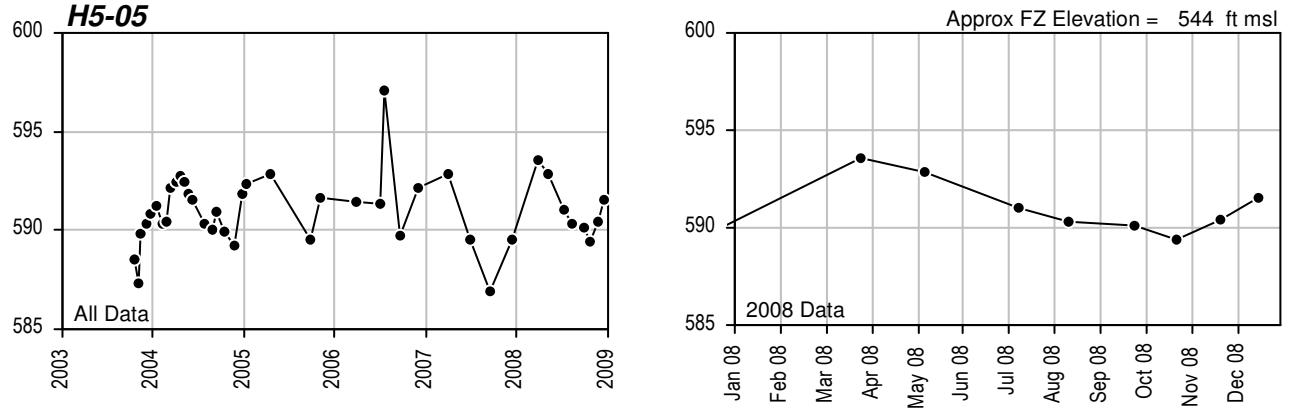




Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.



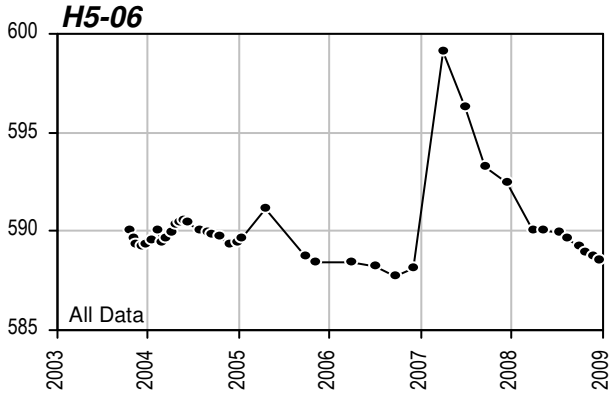



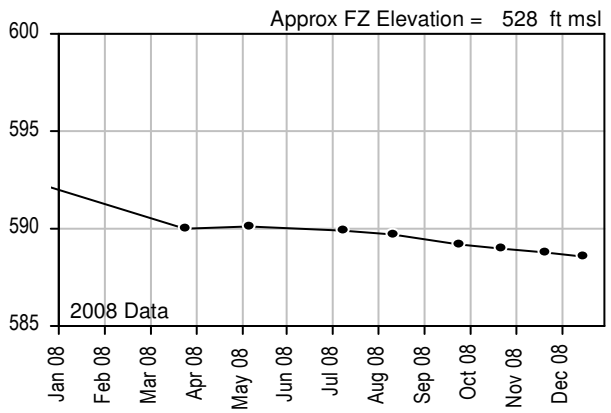



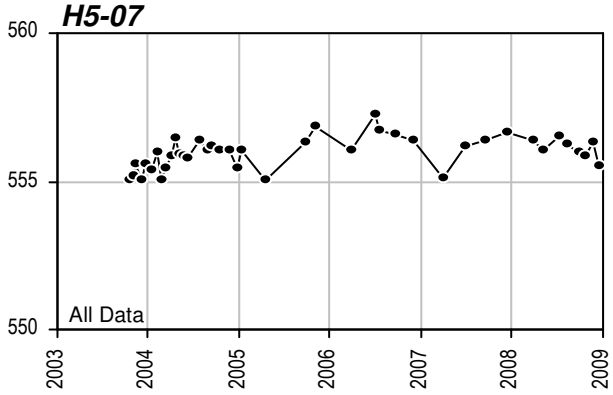

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

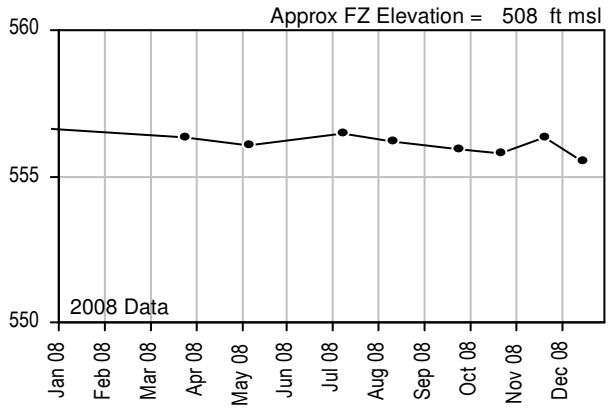
***H5-06***



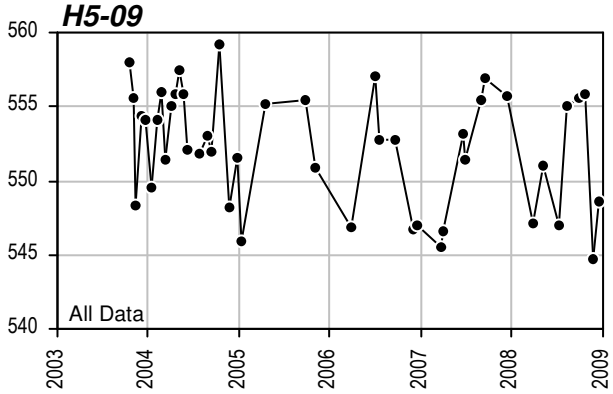



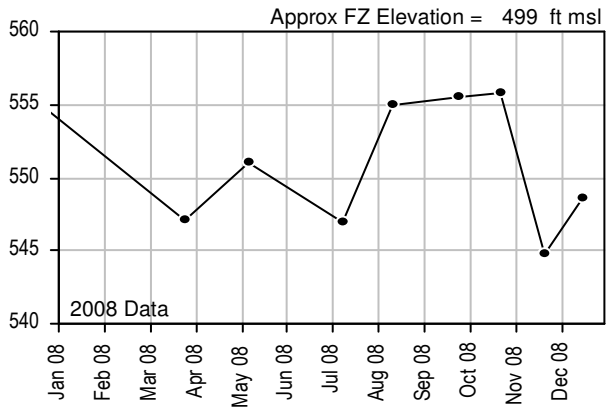

***H5-07***



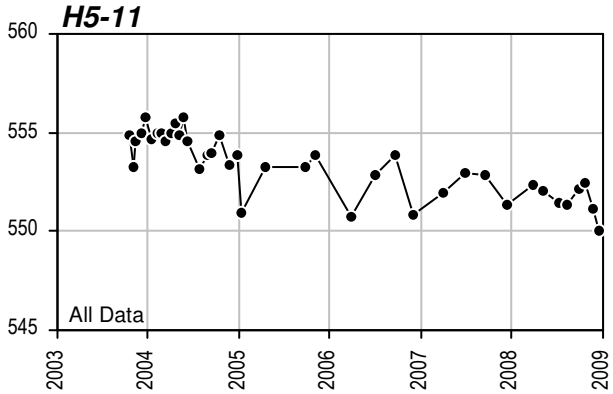



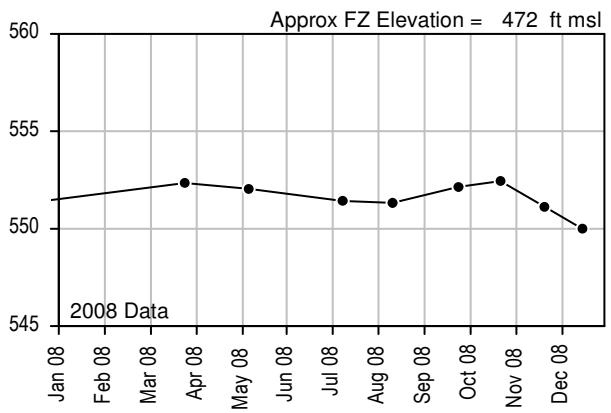

***H5-09***



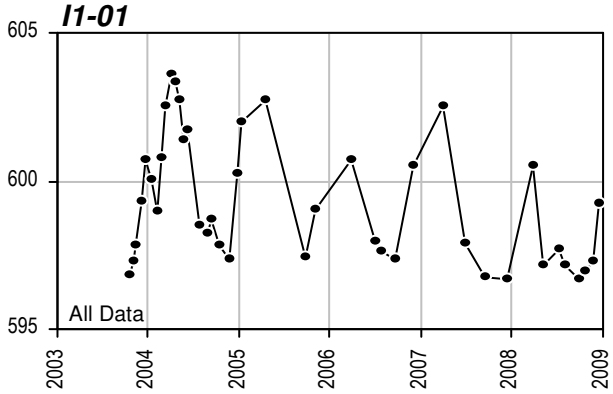

***H5-11***

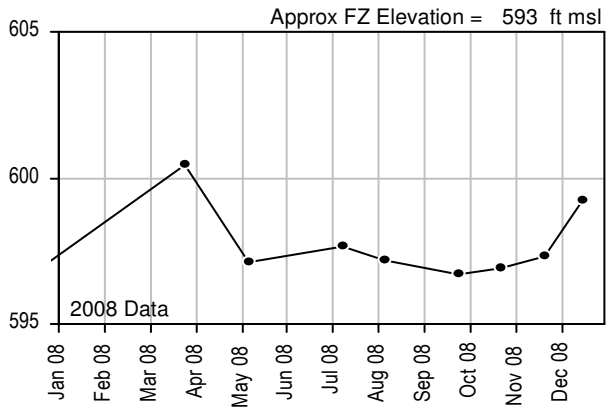


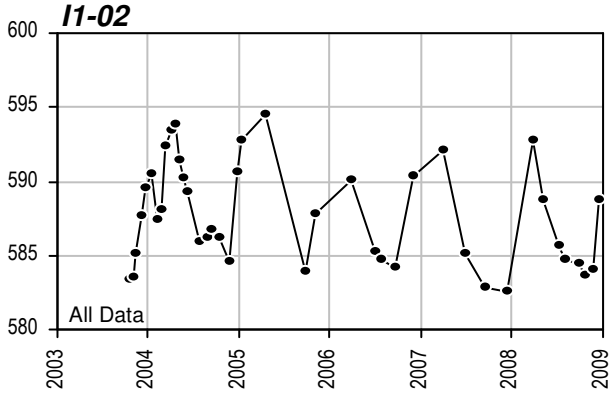

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

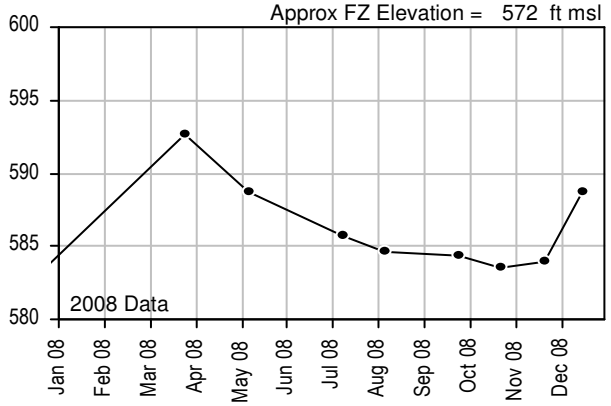
***I1-01***



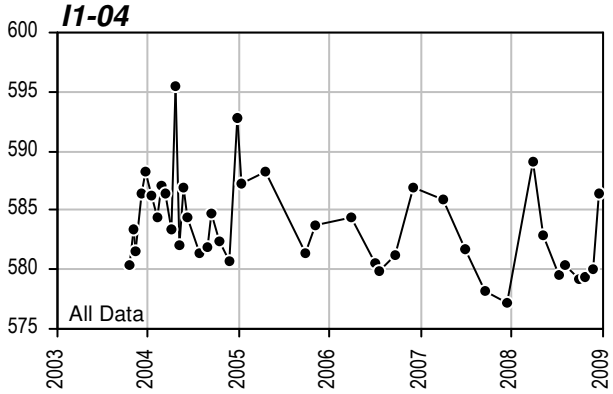



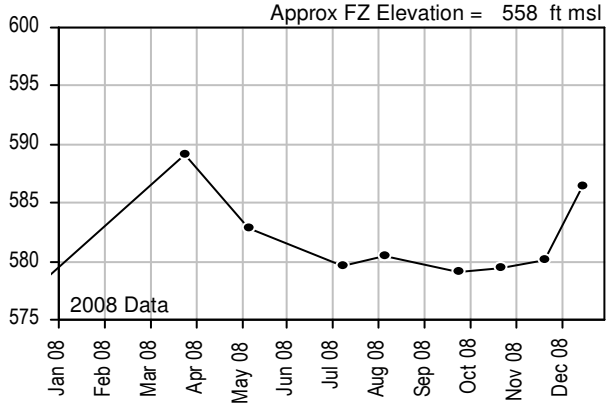

***I1-02***



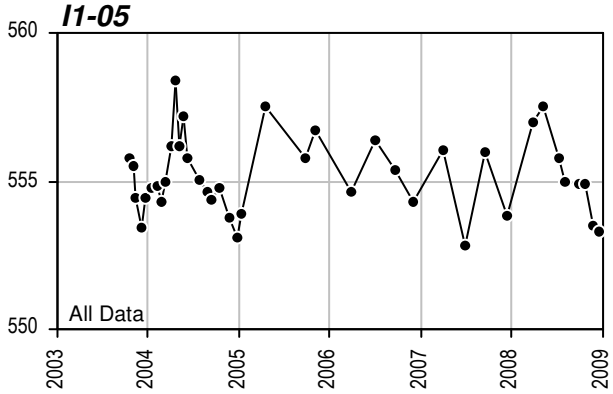



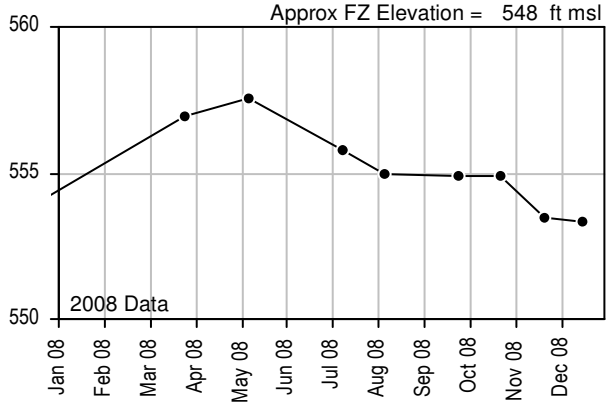

***I1-04***



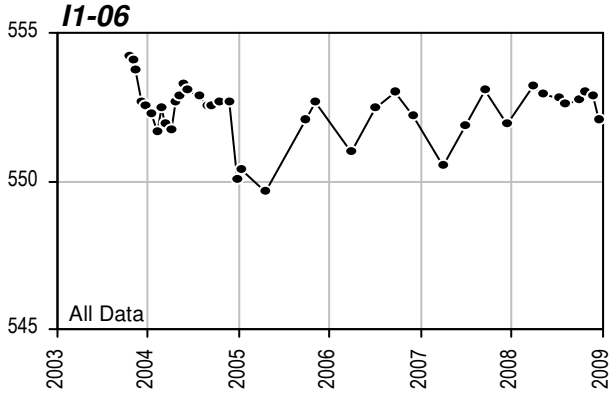

***I1-05***

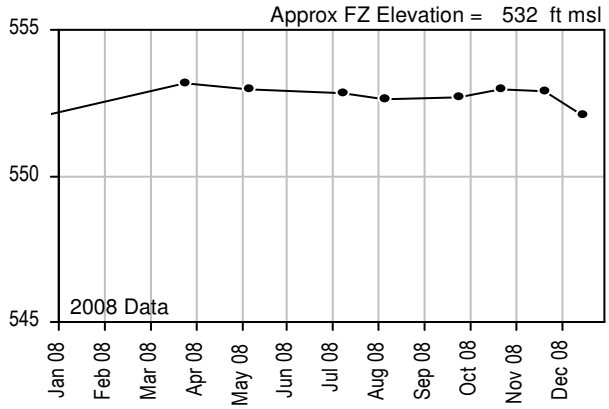


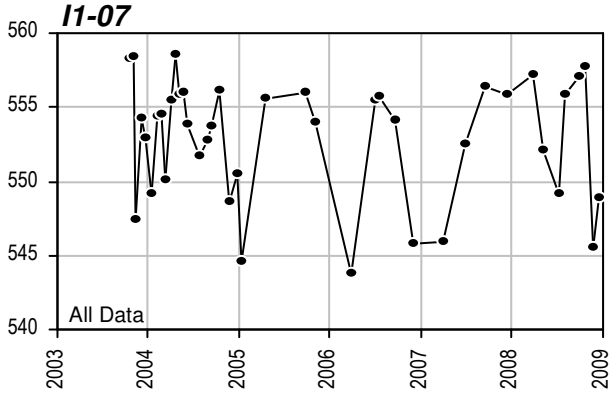

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

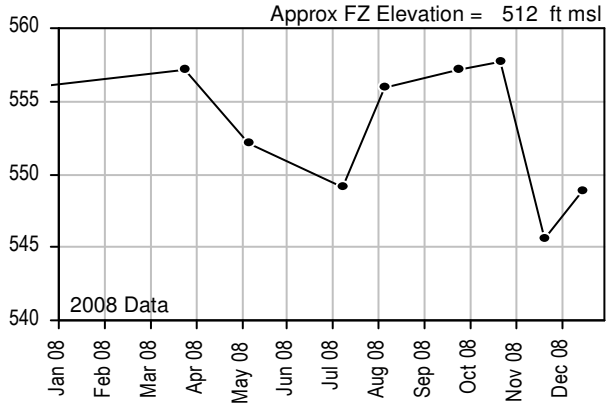
***I1-06***



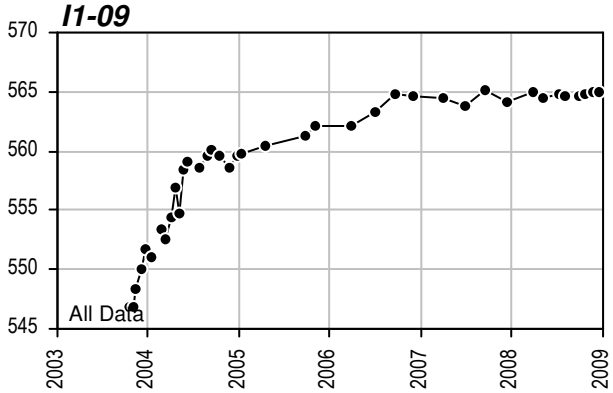



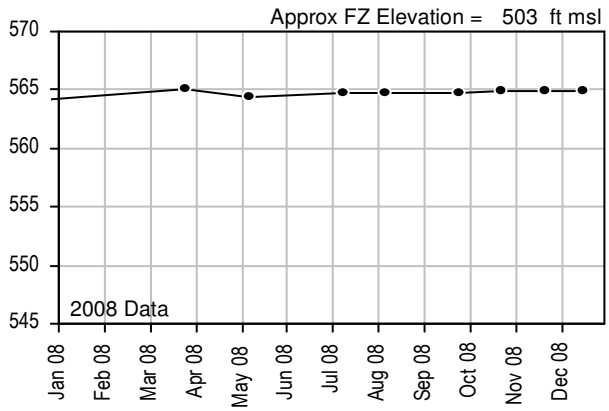

***I1-07***



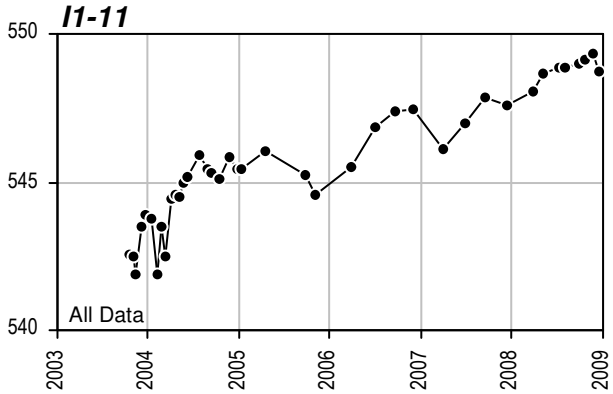



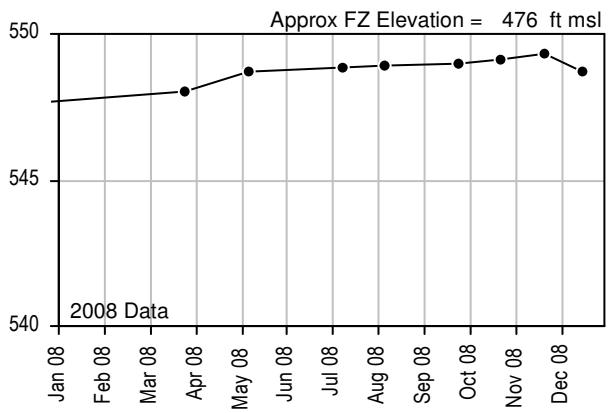

***I1-09***



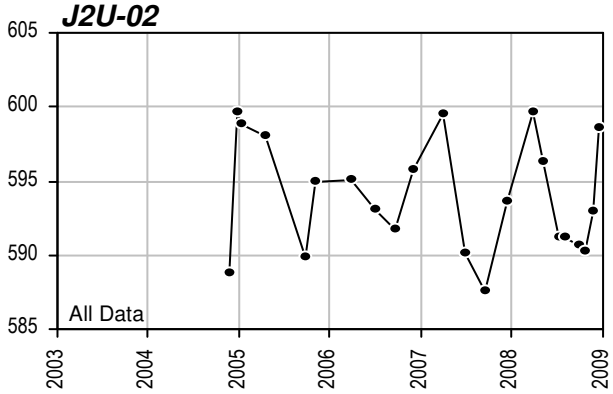

***I1-11***

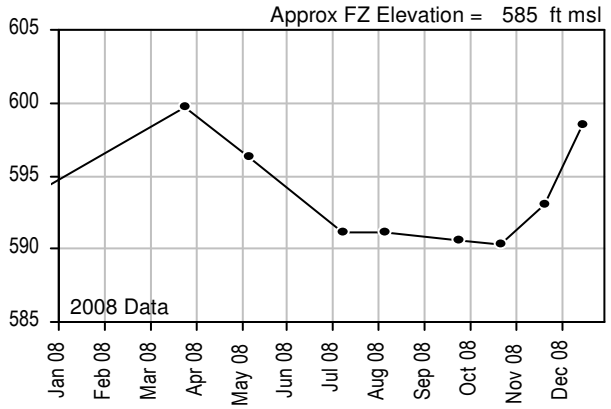


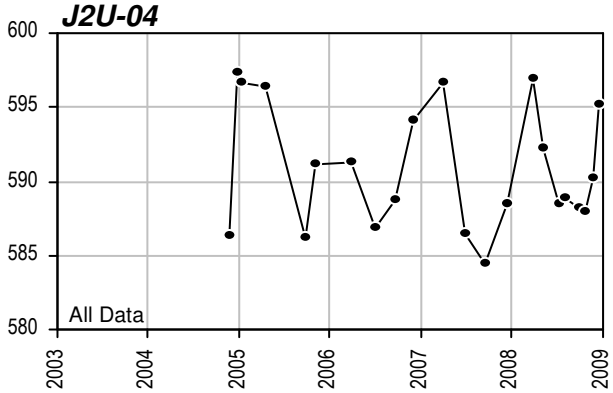

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

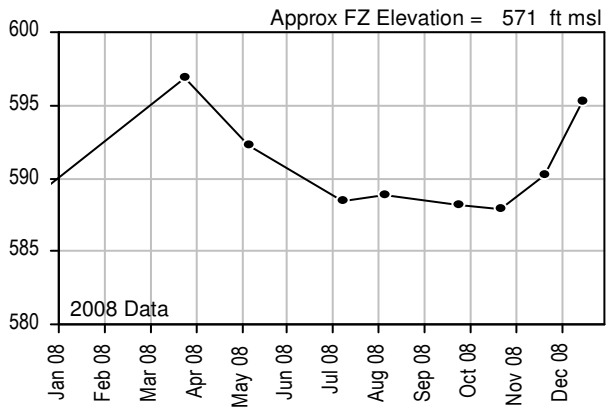
***J2U-02***



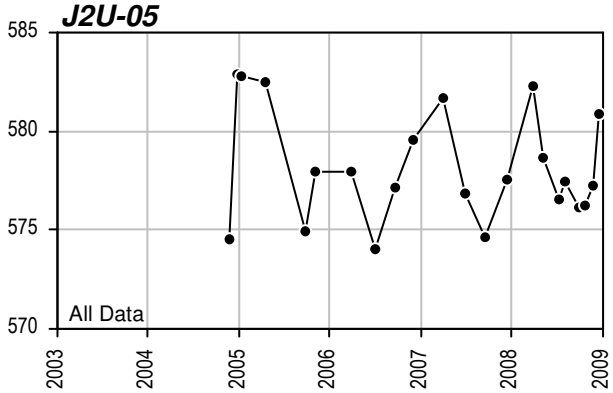



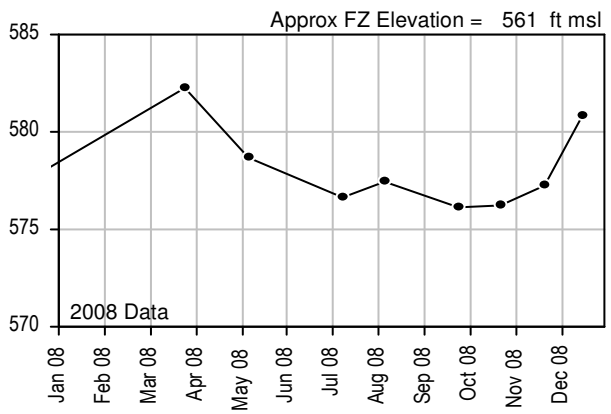

***J2U-04***



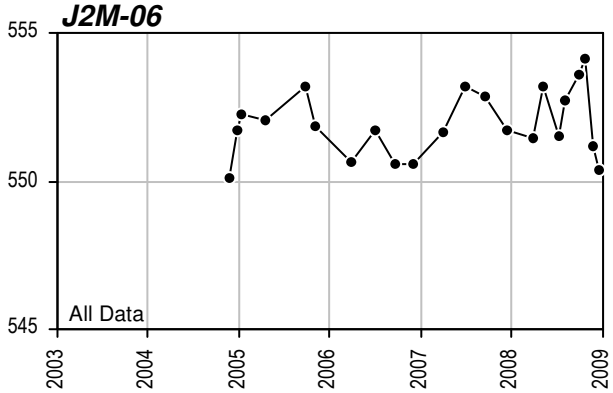



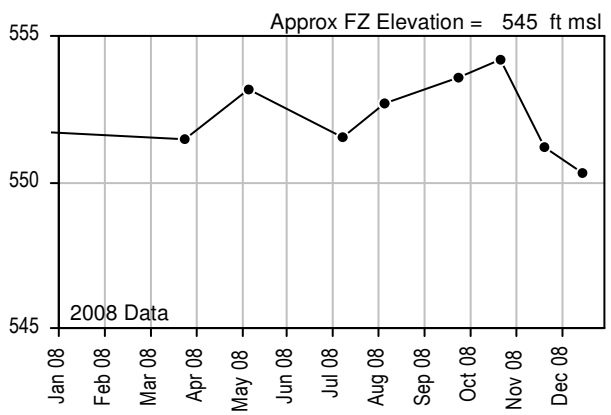

***J2U-05***



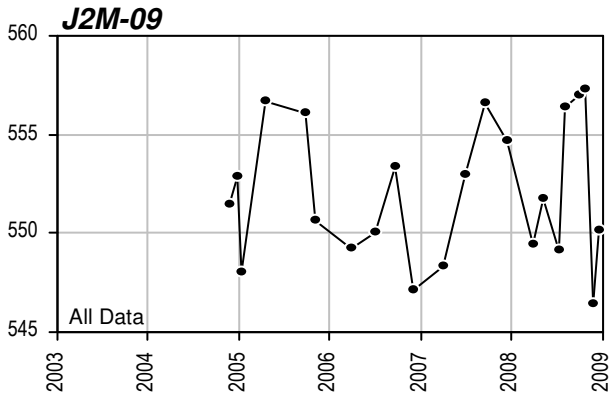



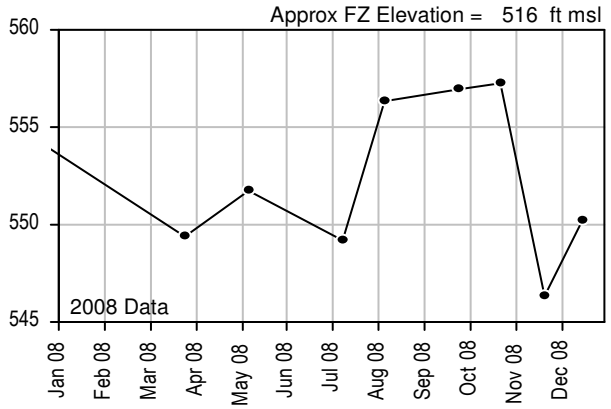

***J2M-06***



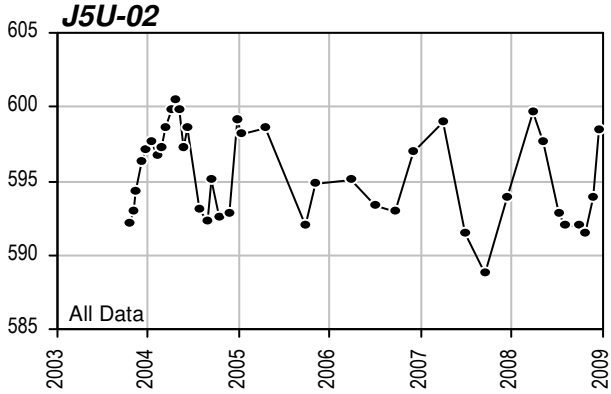

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

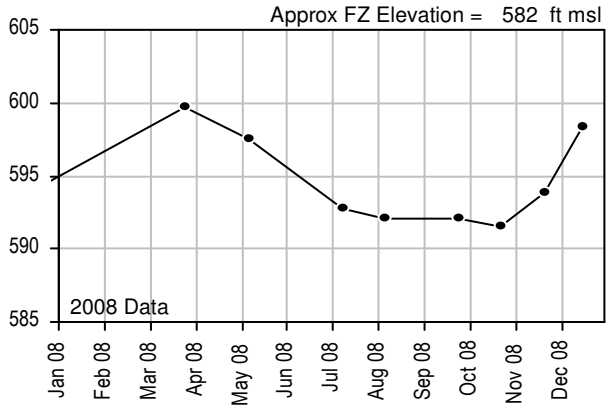


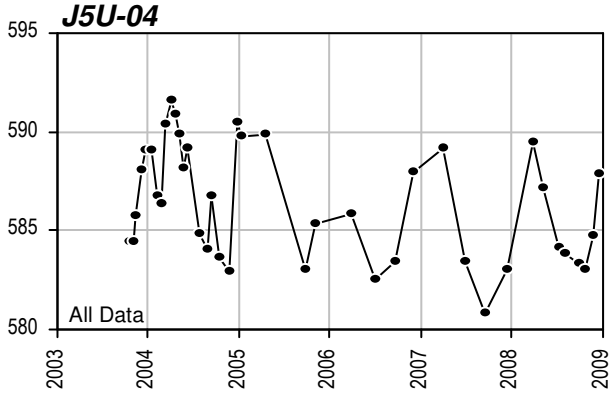

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

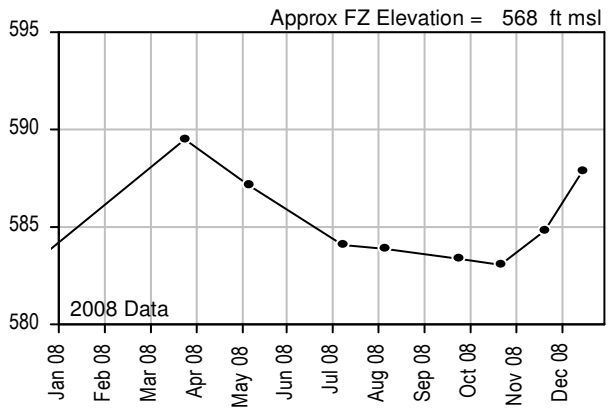
***J5U-02***



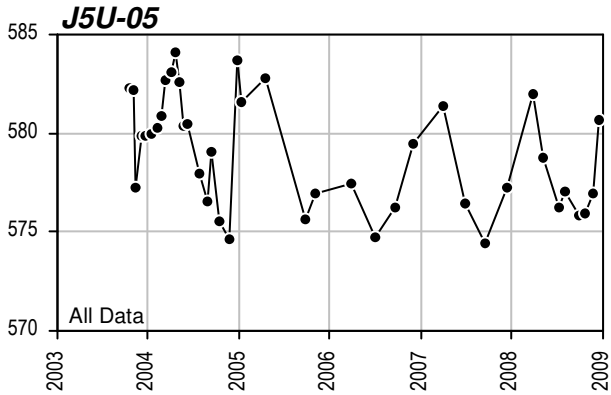



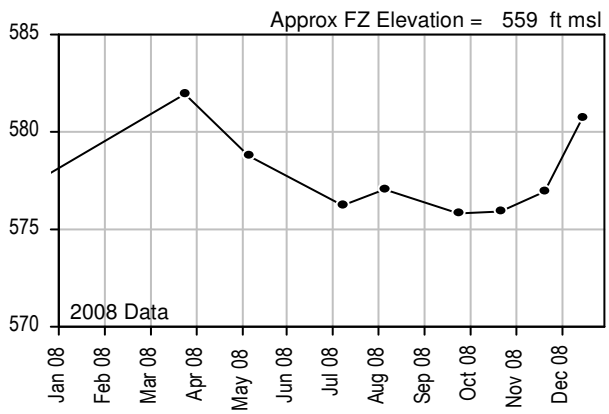

***J5U-04***



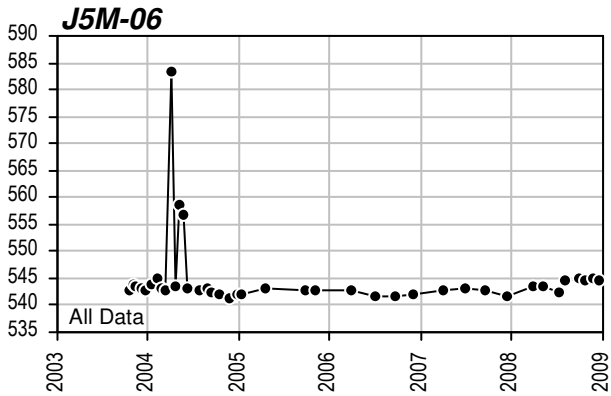



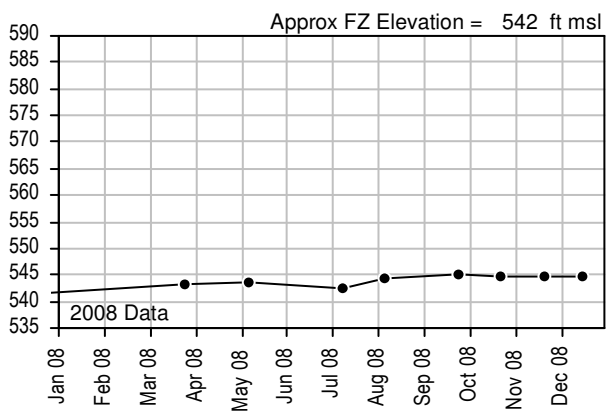

***J5U-05***



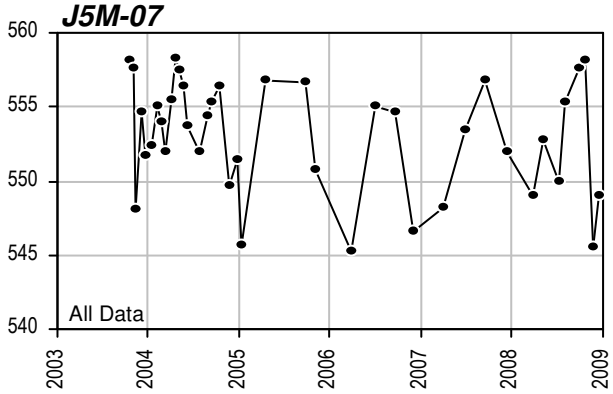

***J5M-06***

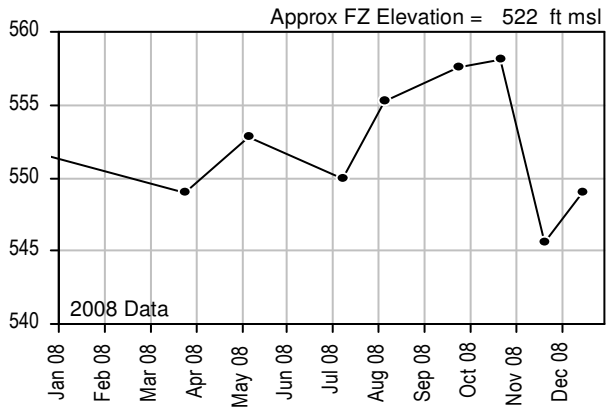


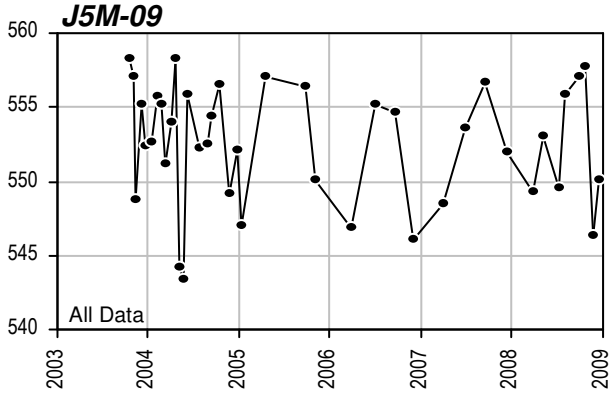

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

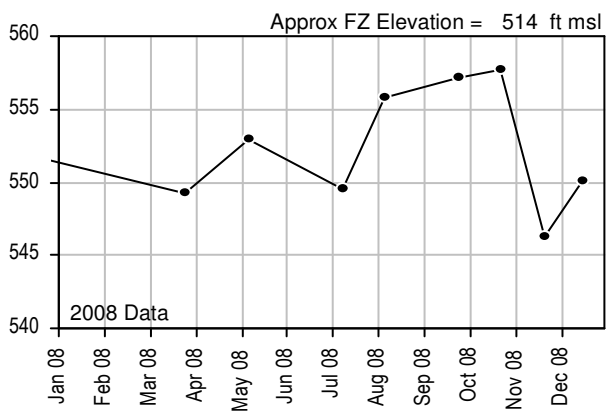
***J5M-07***



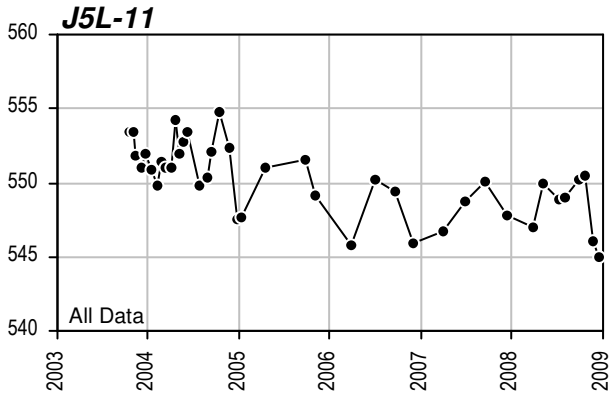



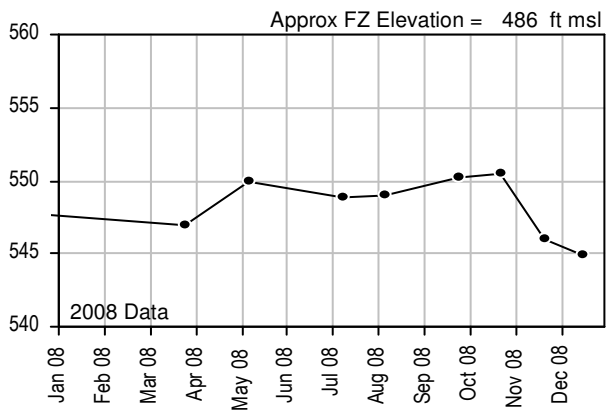

***J5M-09***



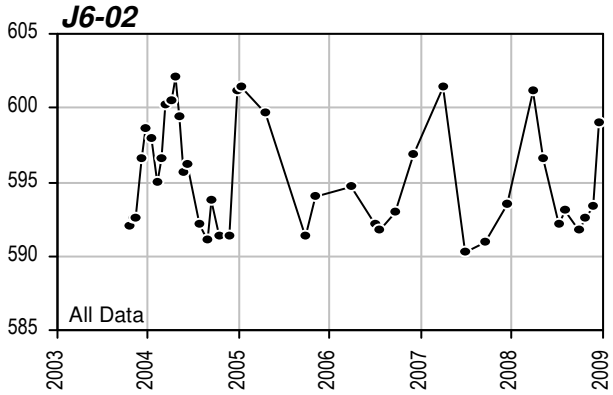

***J5L-11***

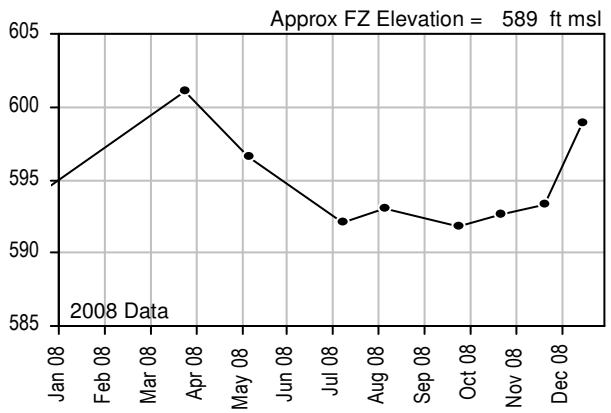


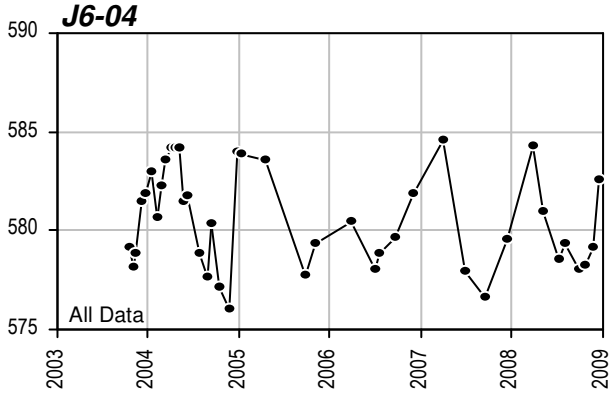

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

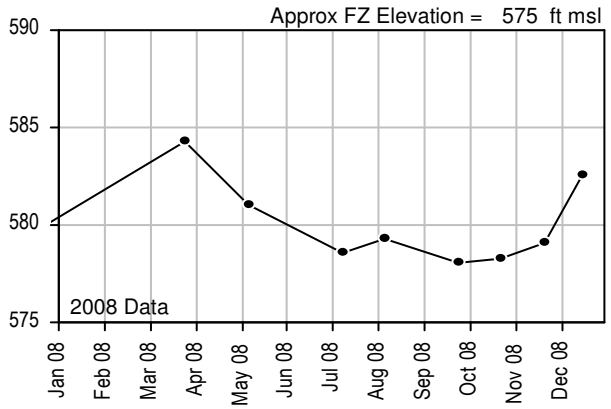
### J6-02



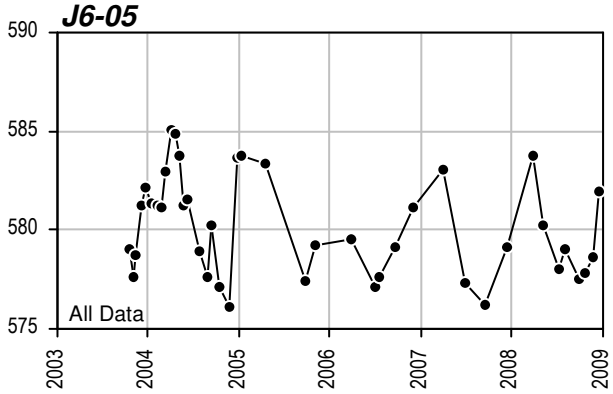



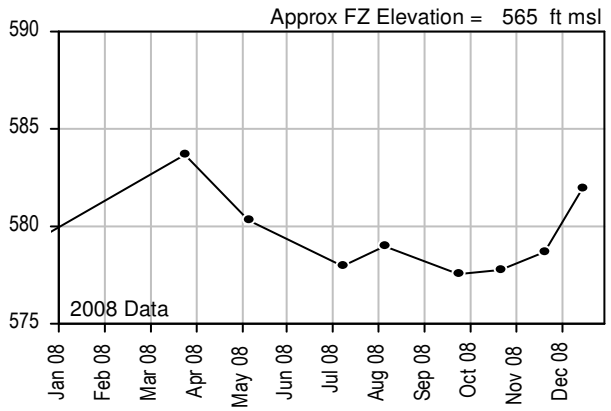

### J6-04



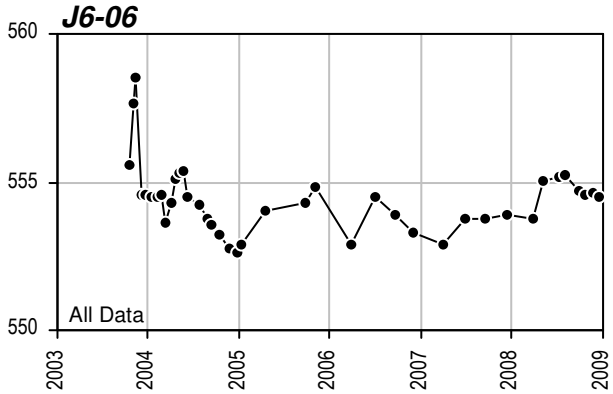



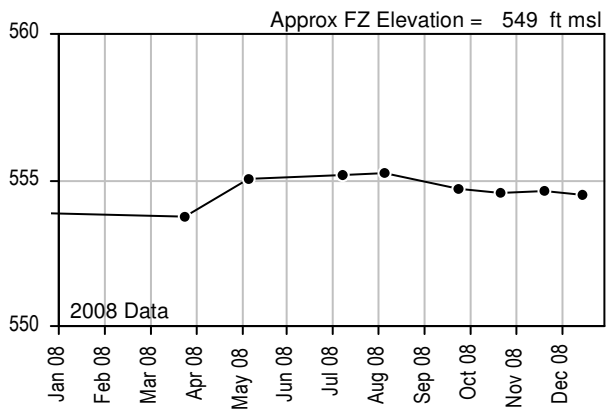

### J6-05



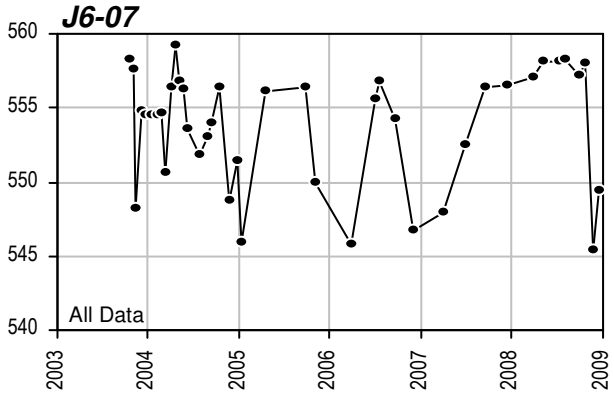



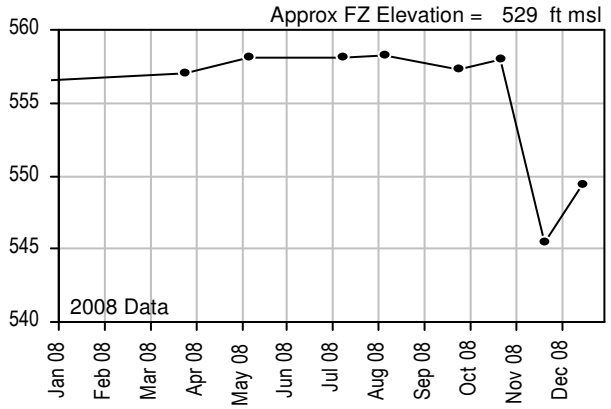

### J6-06

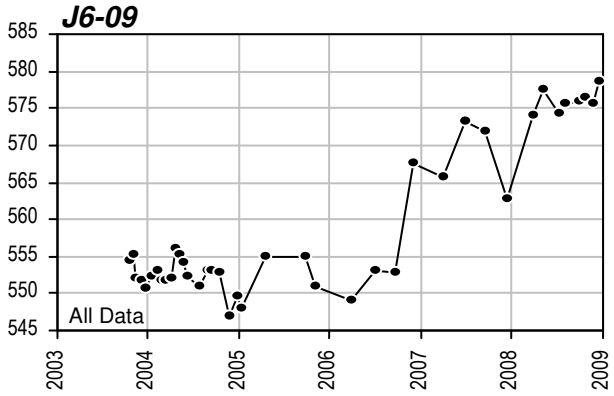


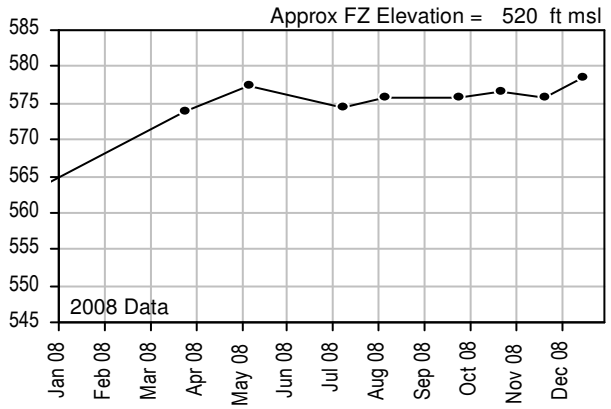



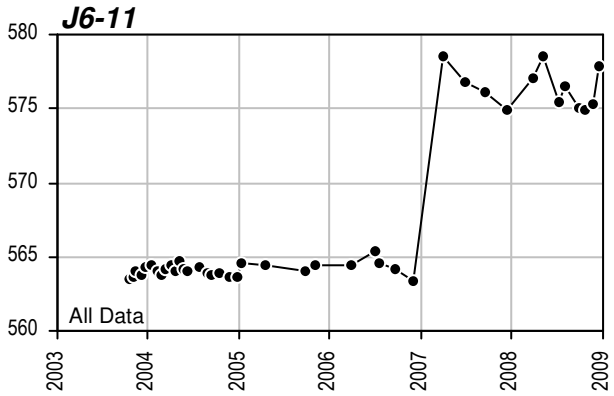

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

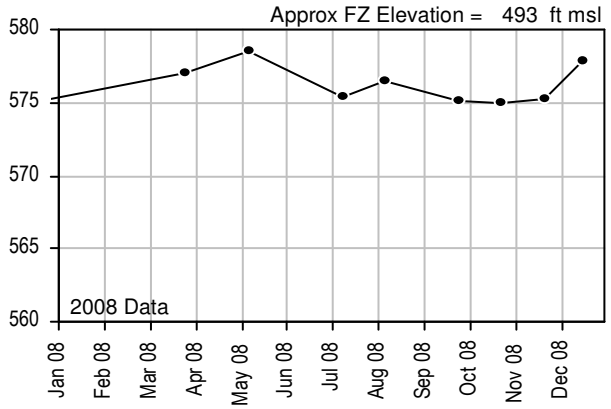


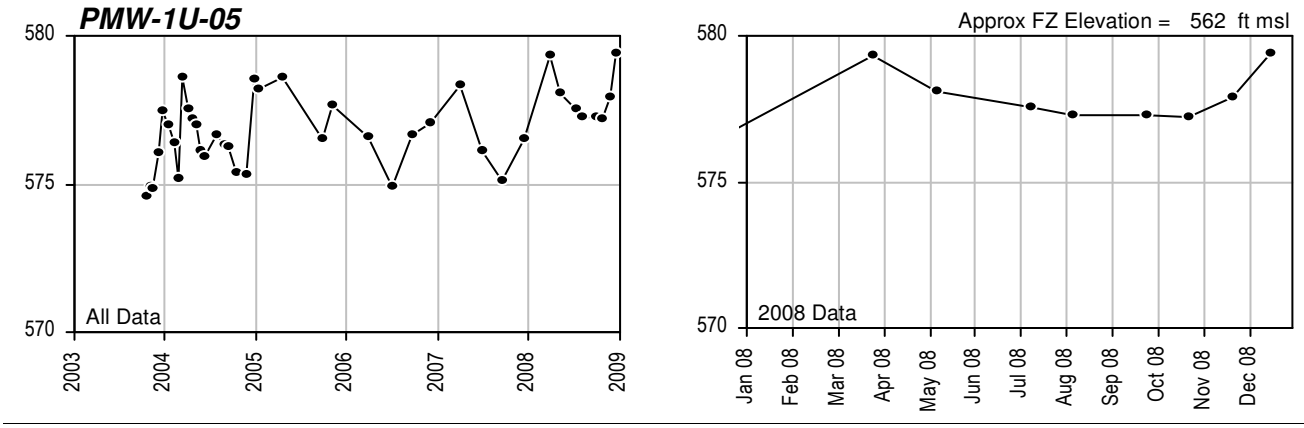



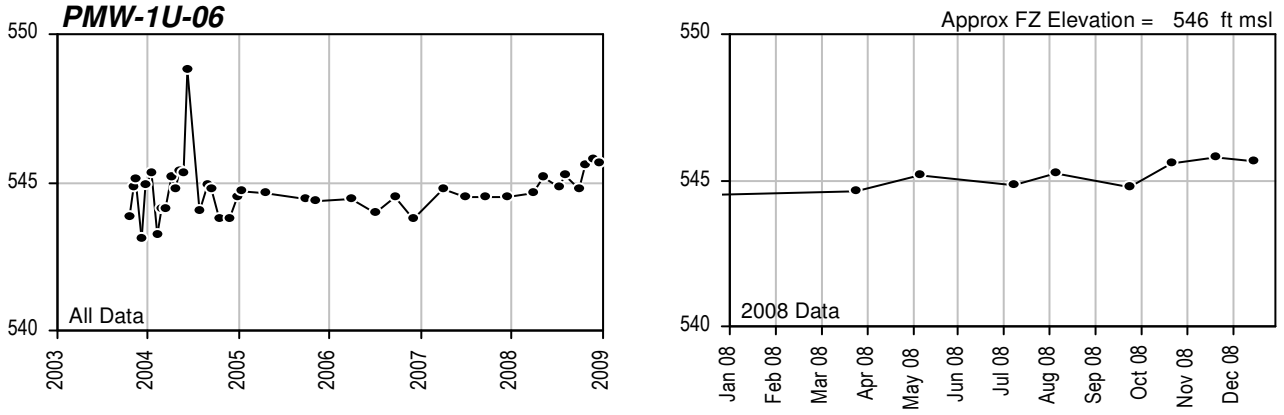



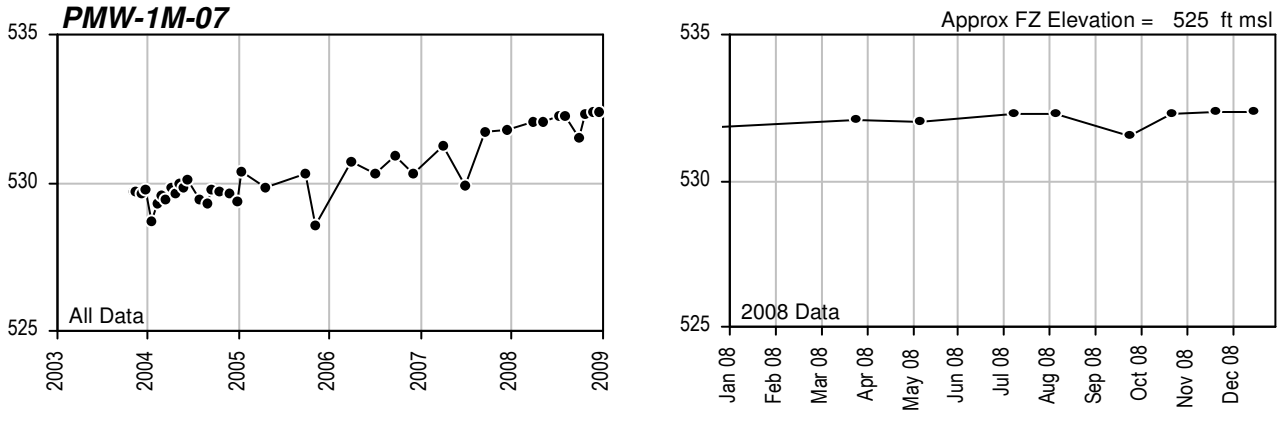



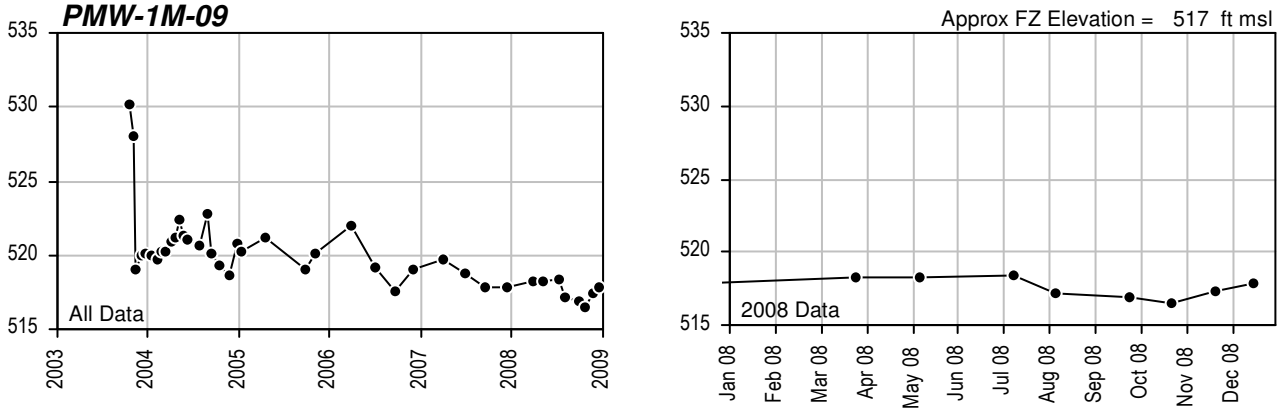




Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.

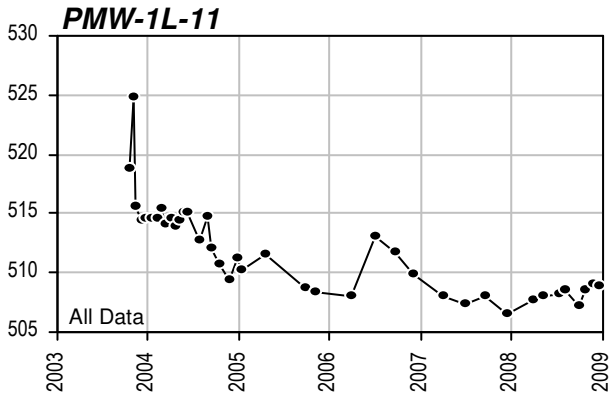


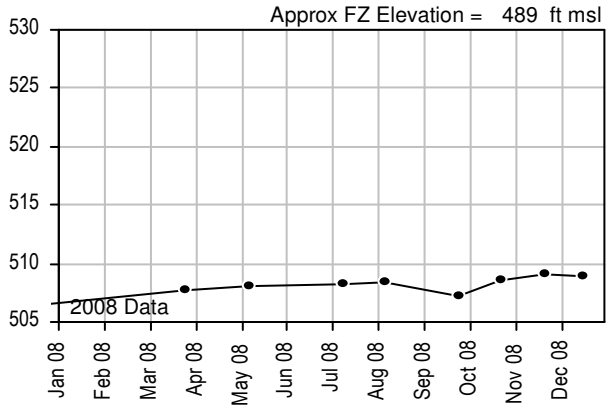



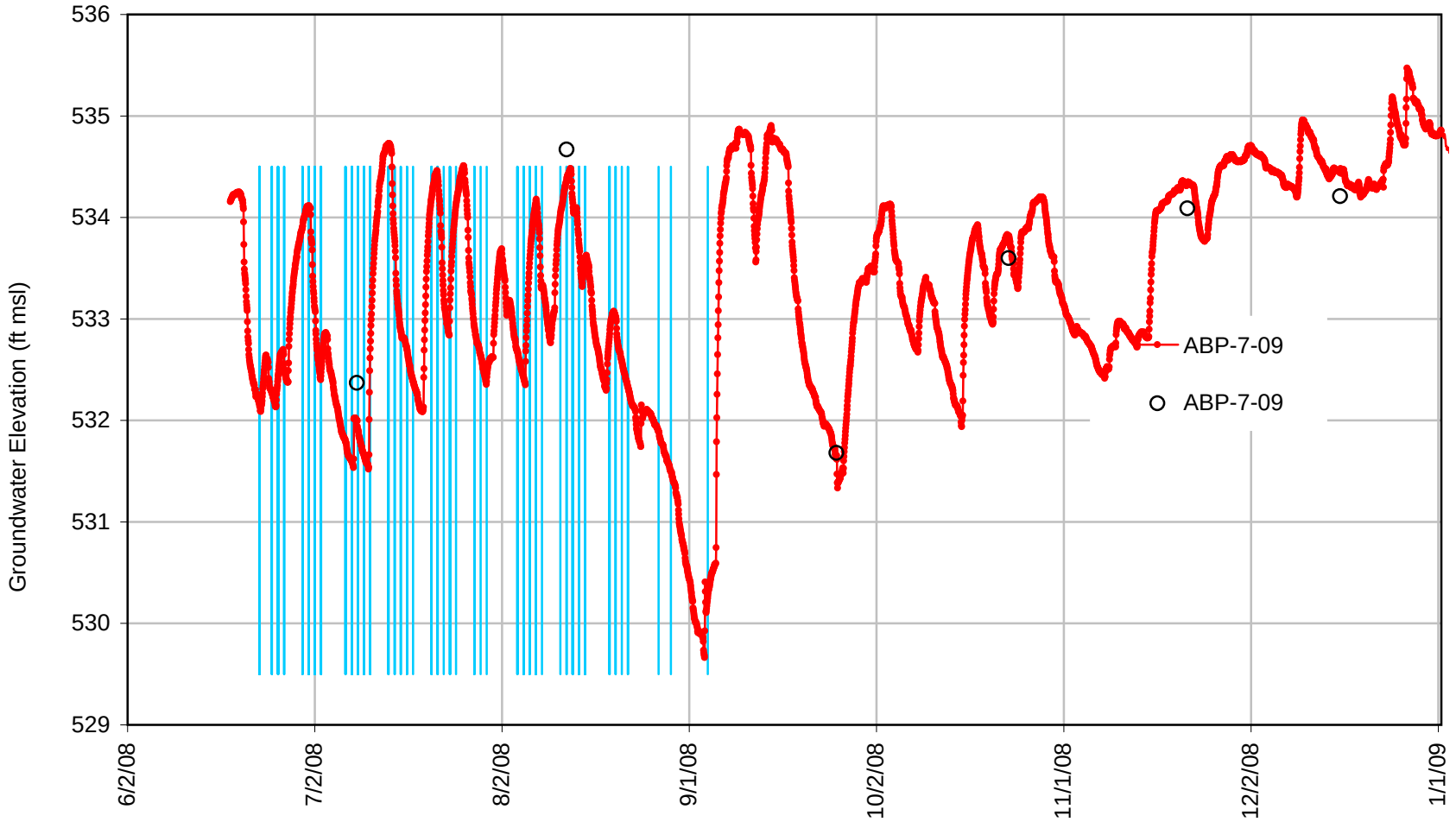



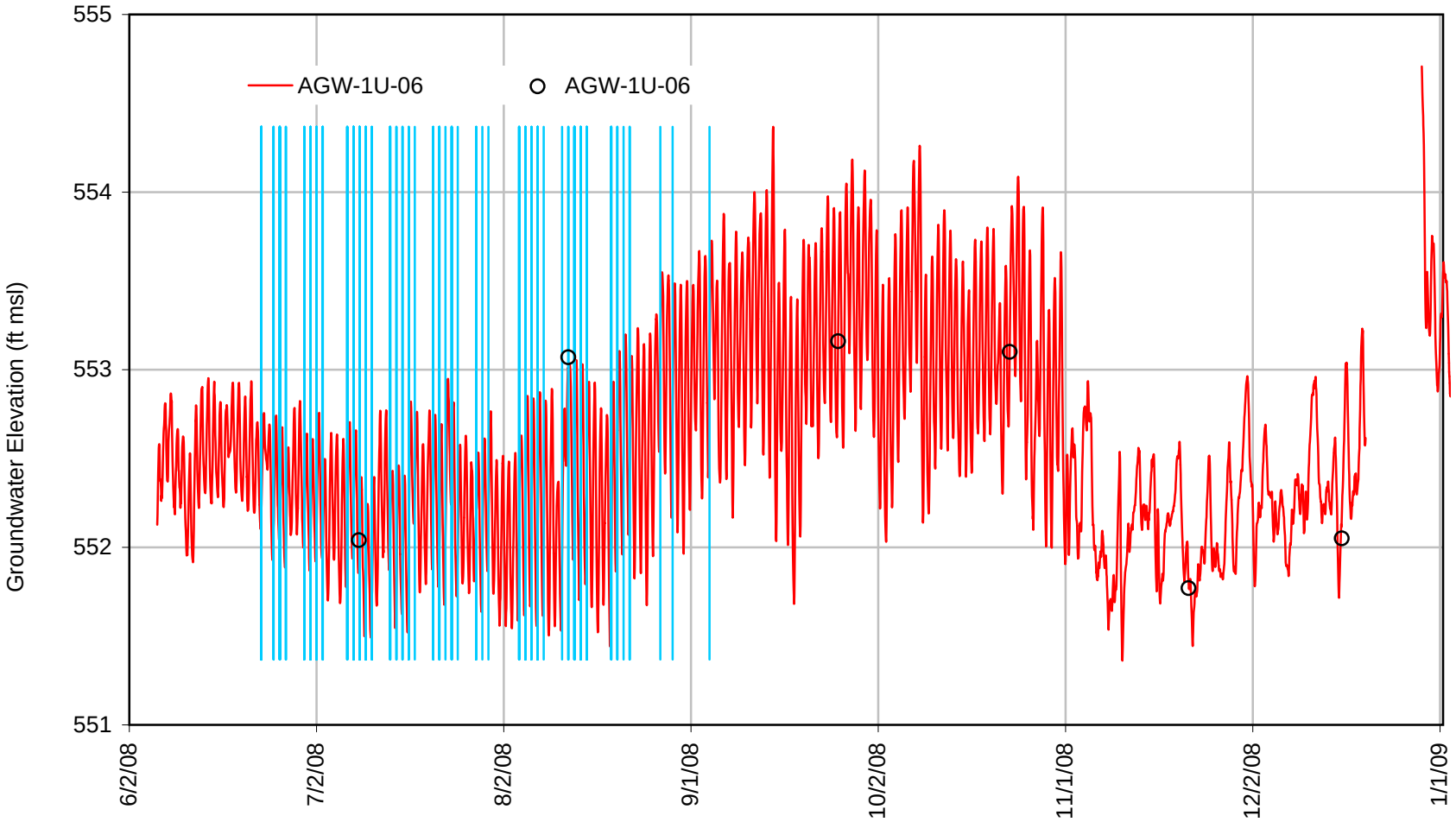

Groundwater Elevations in ft msl
Side-by-side graphs are identical data with different x-axes.


PMW-1L-11
530
525
520
515
510
505
All Data
2003
2004
2005
2006
2007
2008
2009


Approx FZ Elevation = 489 ft msl
530
525
520
515
510
505
2008 Data
Jan 08
Feb 08
Mar 08
Apr 08
May 08
Jun 08
Jul 08
Aug 08
Sep 08
Oct 08
Nov 08
Dec 08




Red line is the electronic water level recorder data
Black open dots are hand water levels
Vertical blue lines are dates that wells were abandoned.




Red line is the electronic water level recorder data
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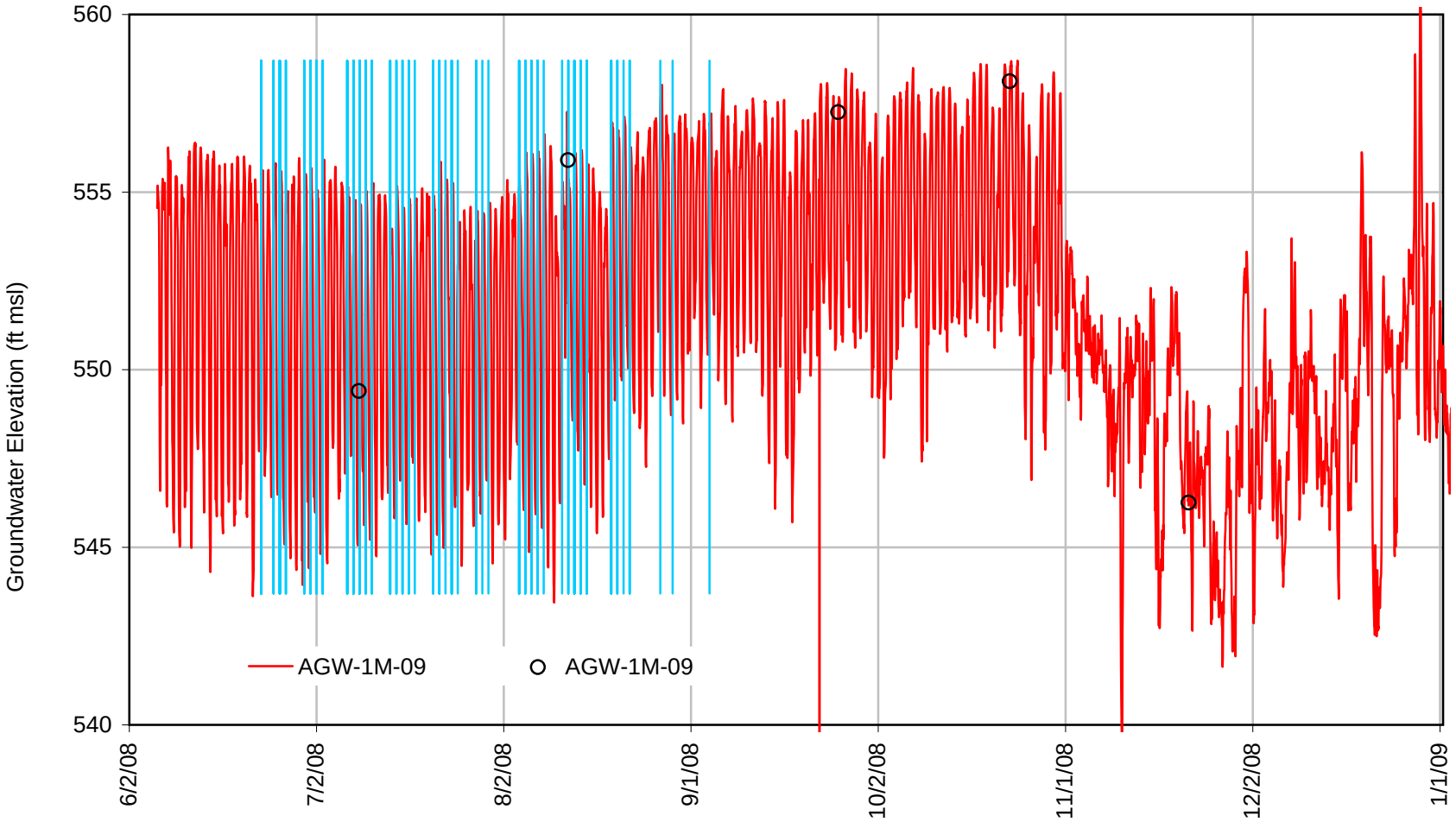


Red line is the electronic water level recorder data
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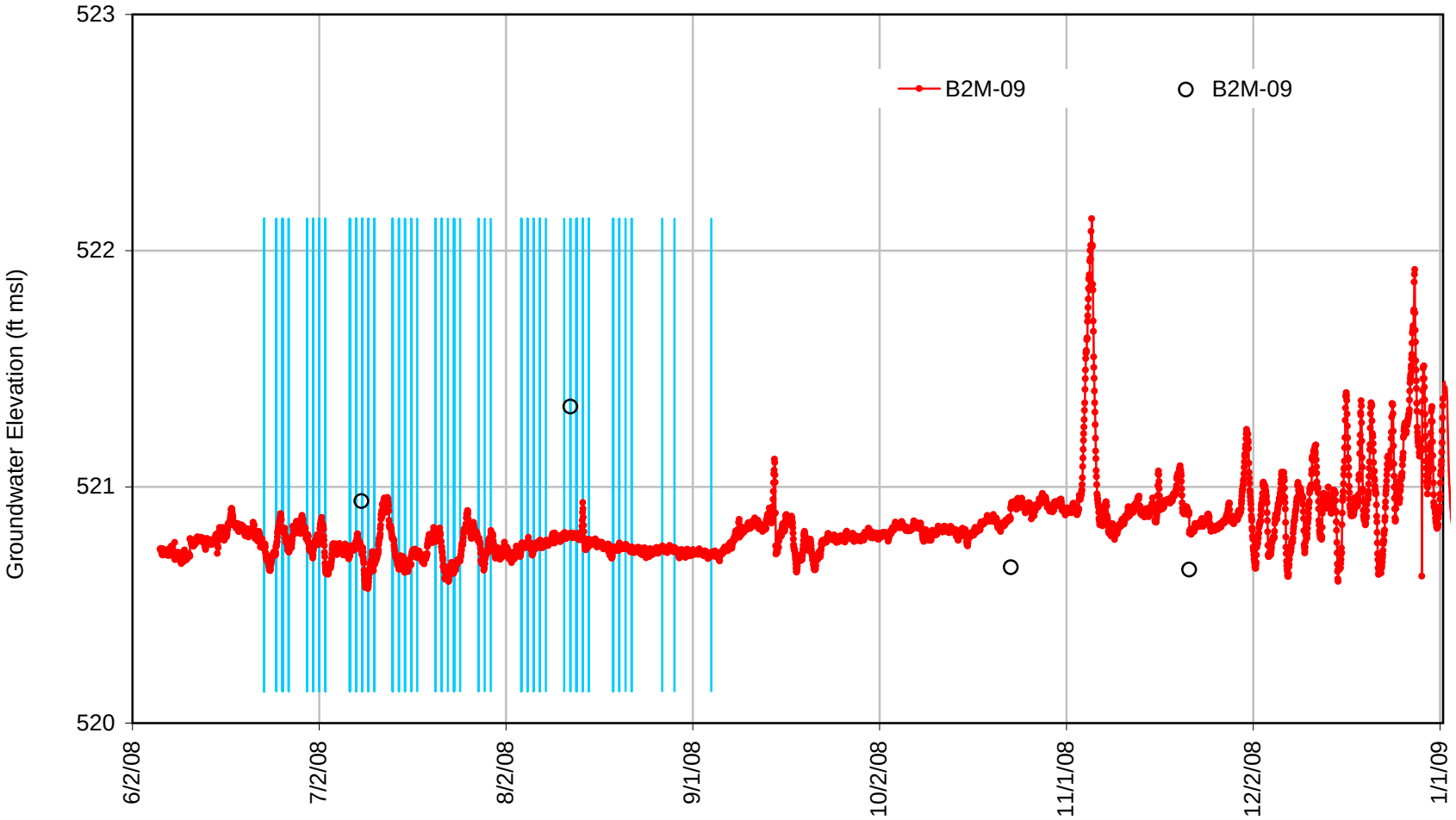


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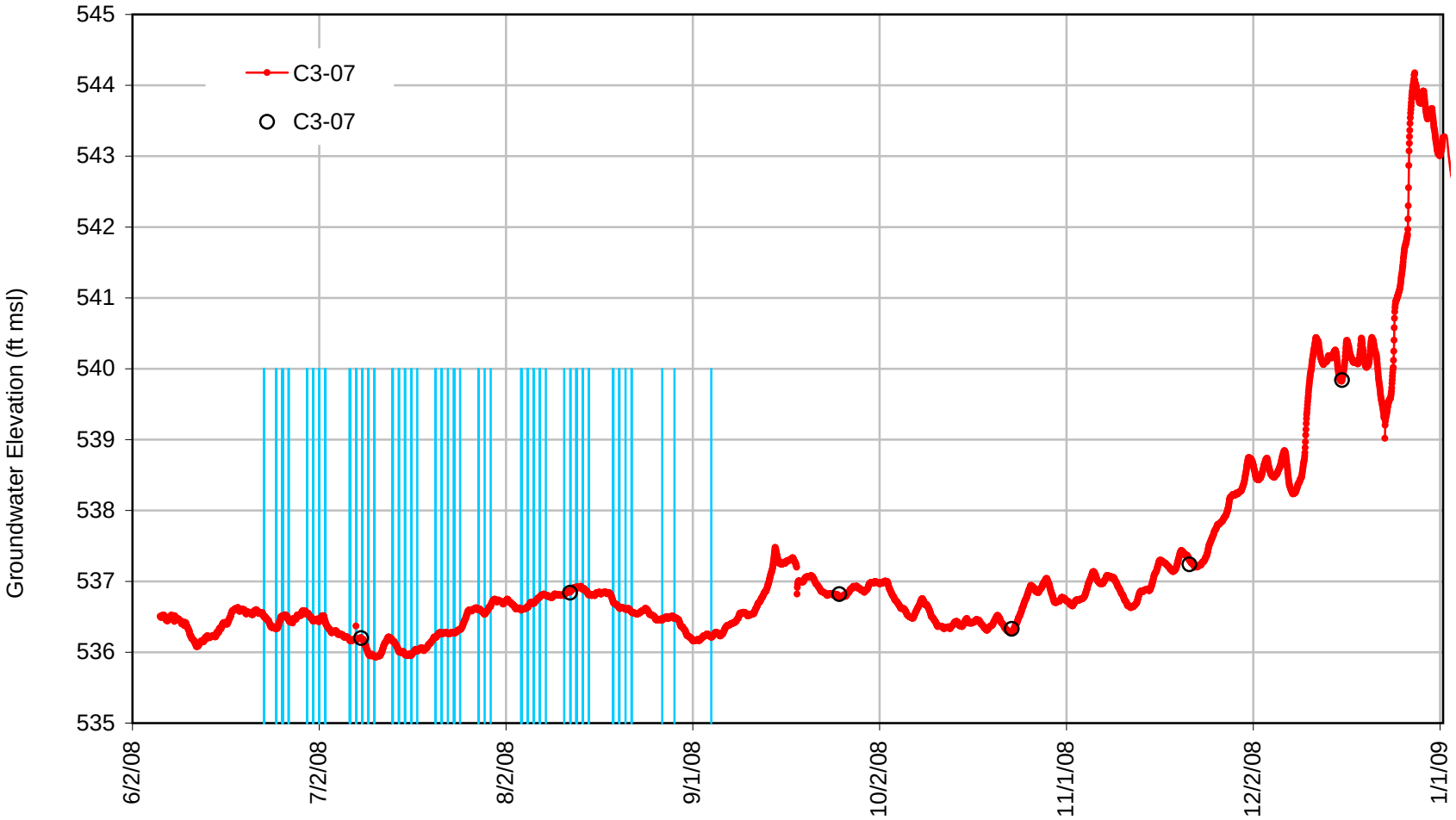


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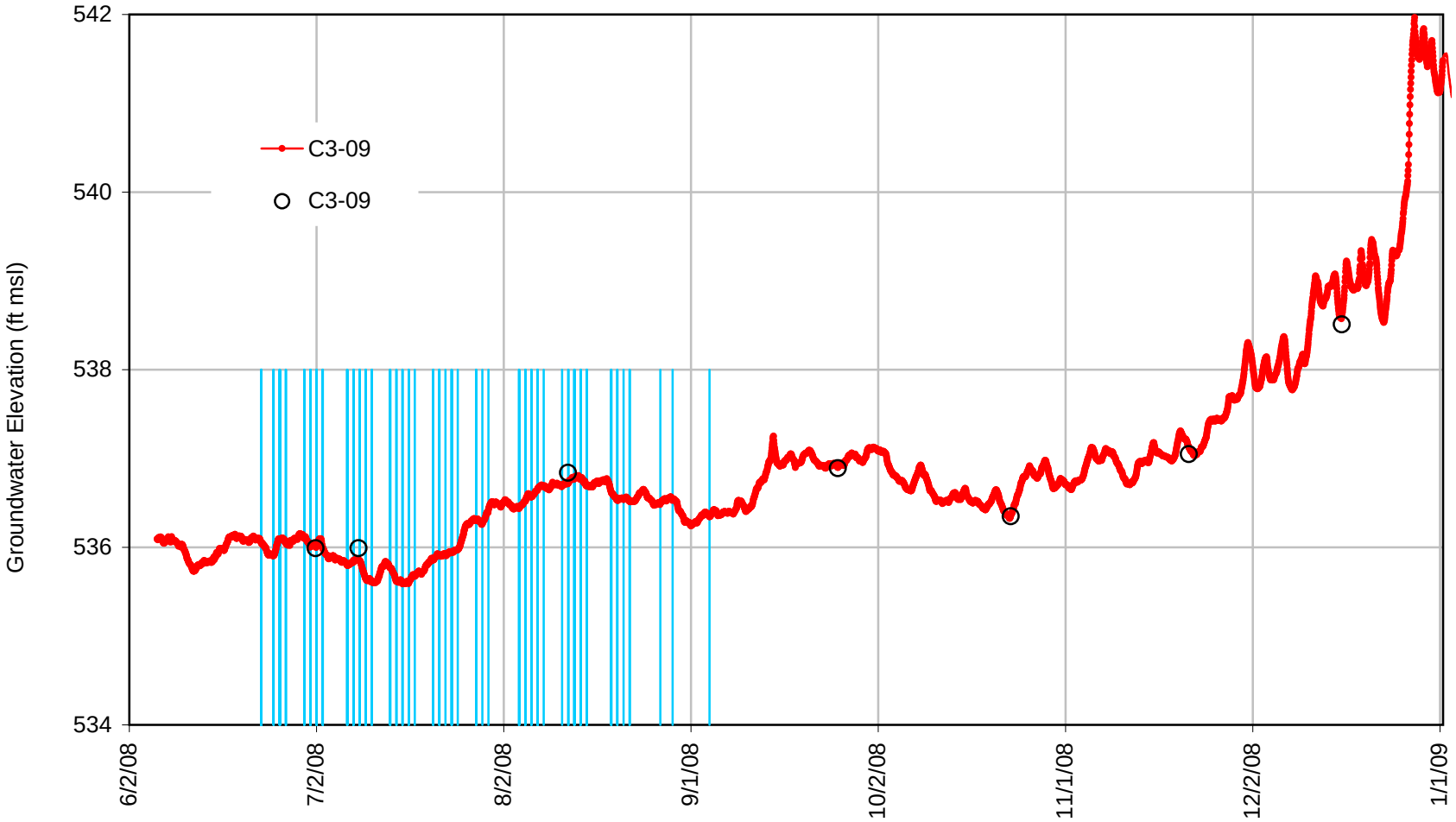


Red line is the electronic water level recorder data
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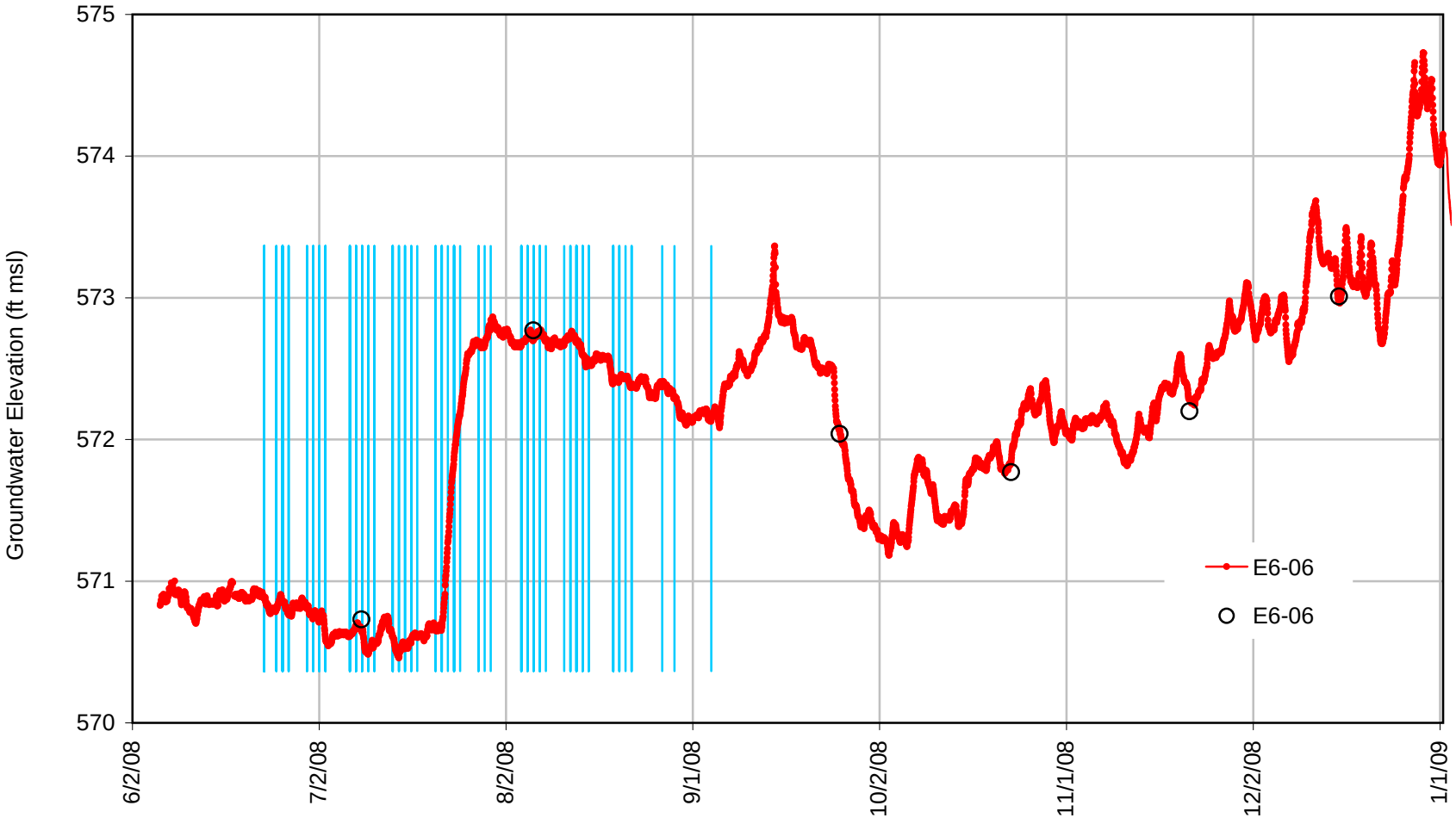


Red line is the electronic water level recorder data
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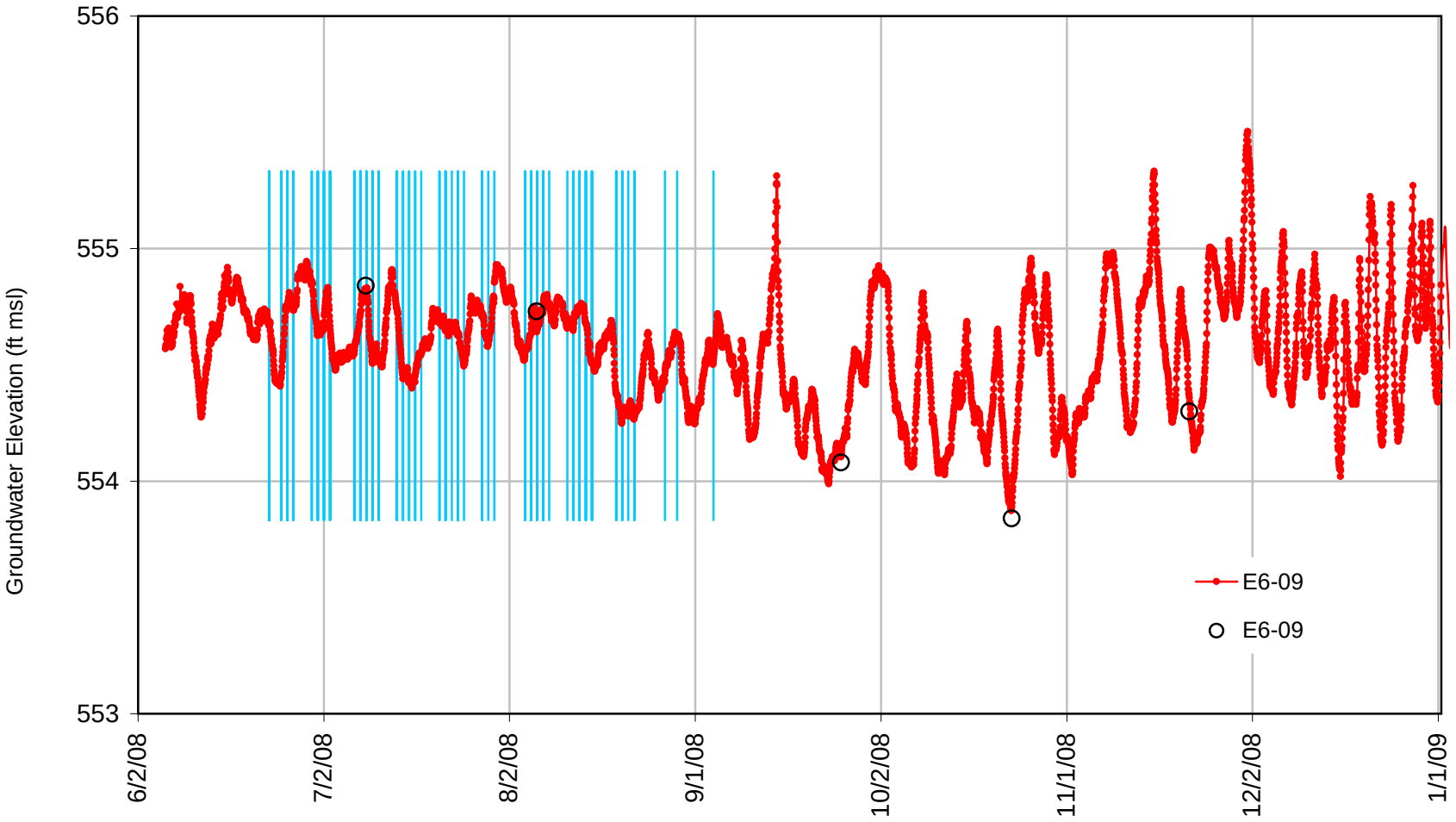


Red line is the electronic water level recorder data
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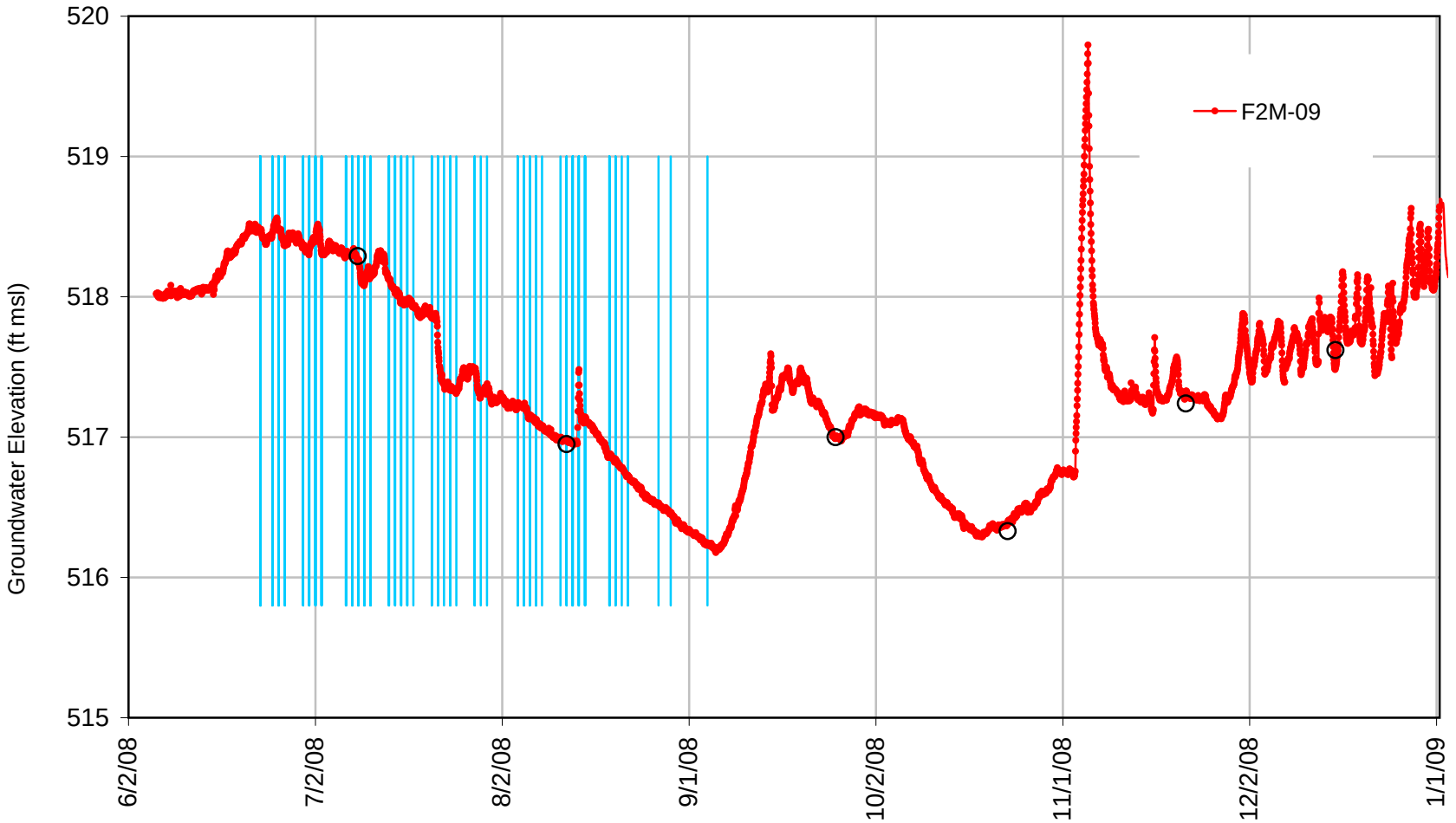
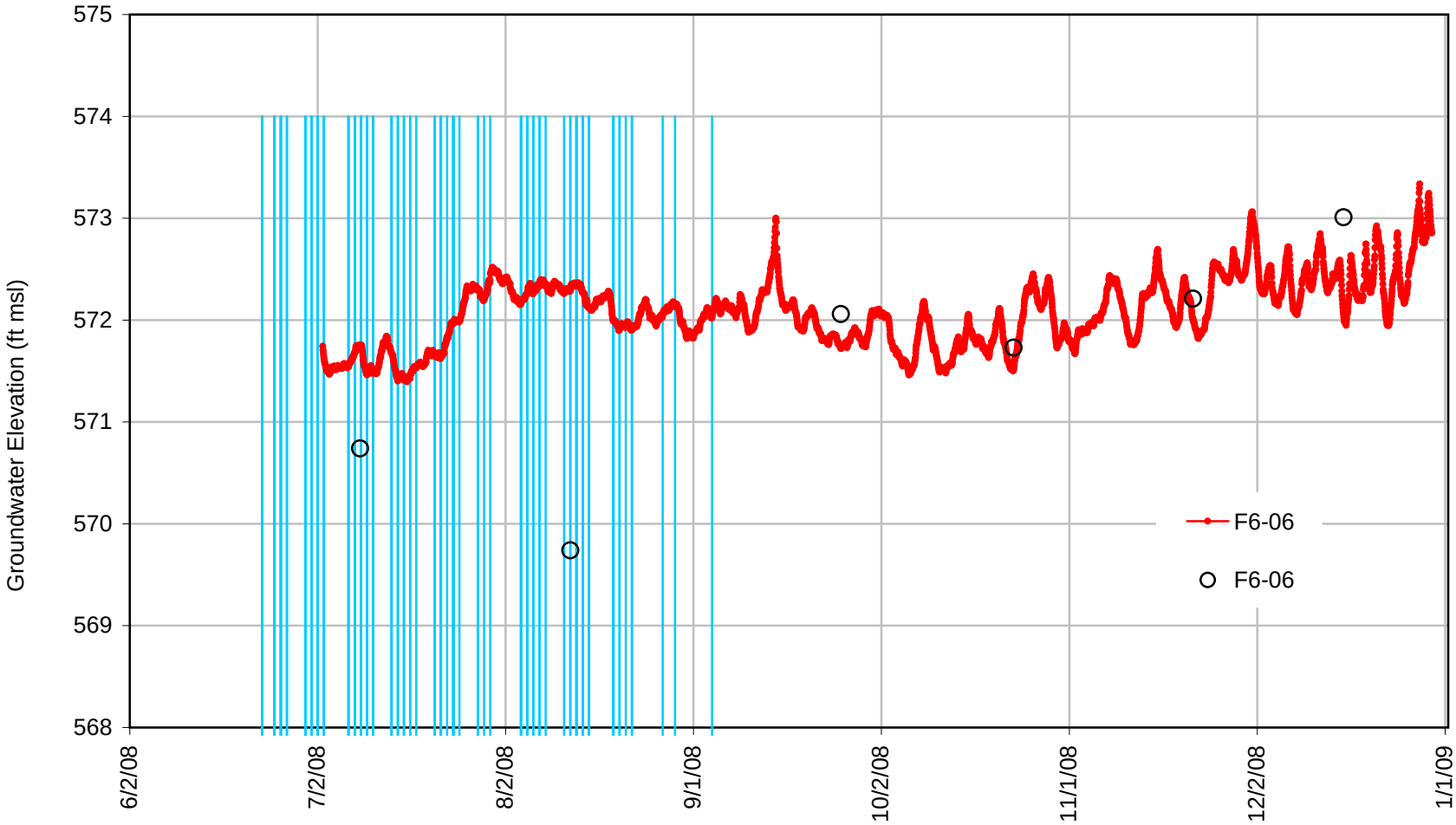



Red line is the electronic water level recorder data
Black open dots are hand water levels
Vertical blue lines are dates that wells were abandoned.




Red line is the electronic water level recorder data
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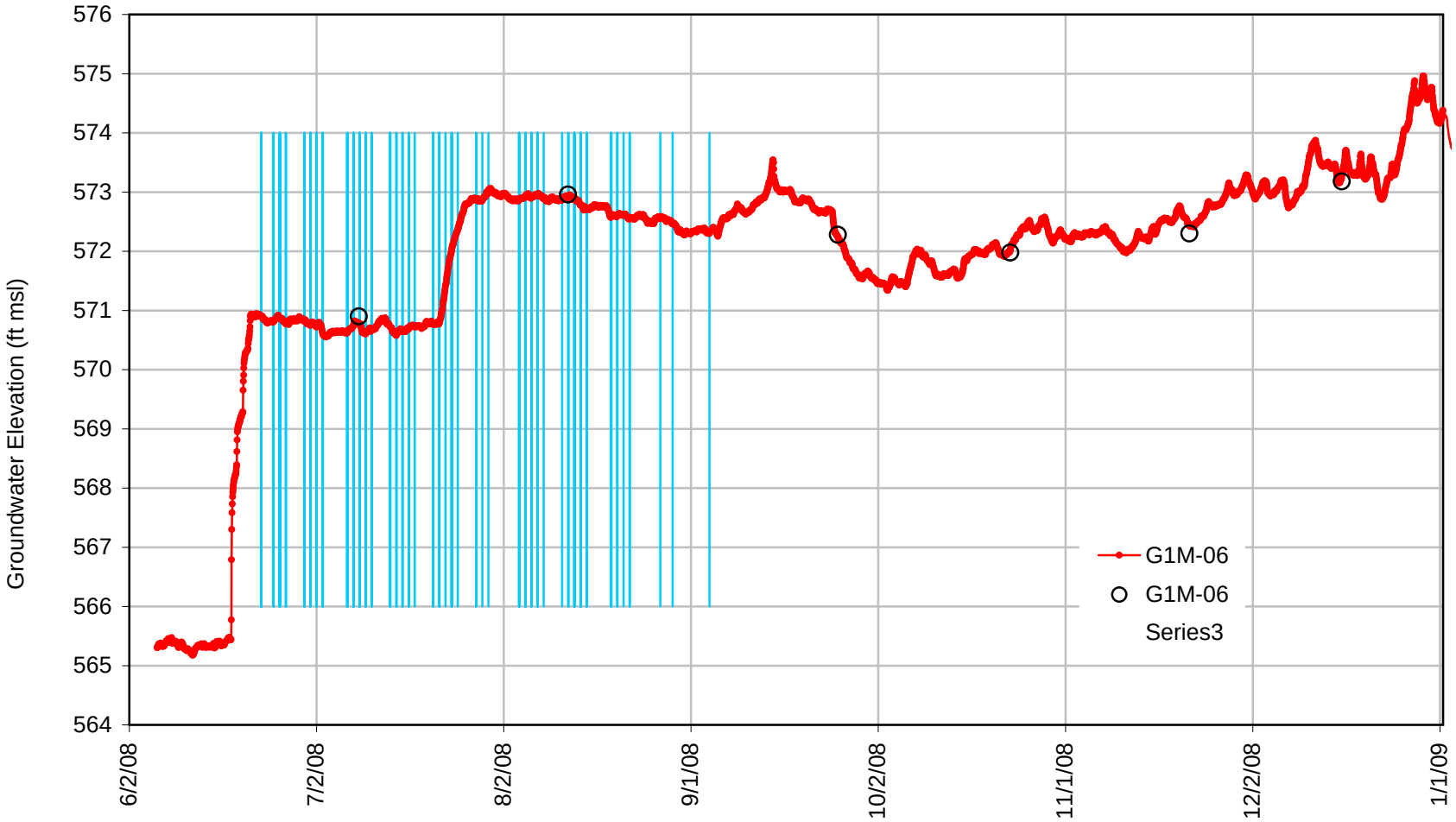
Vertical blue lines are dates that wells were abandoned.




Red line is the electronic water level recorder data
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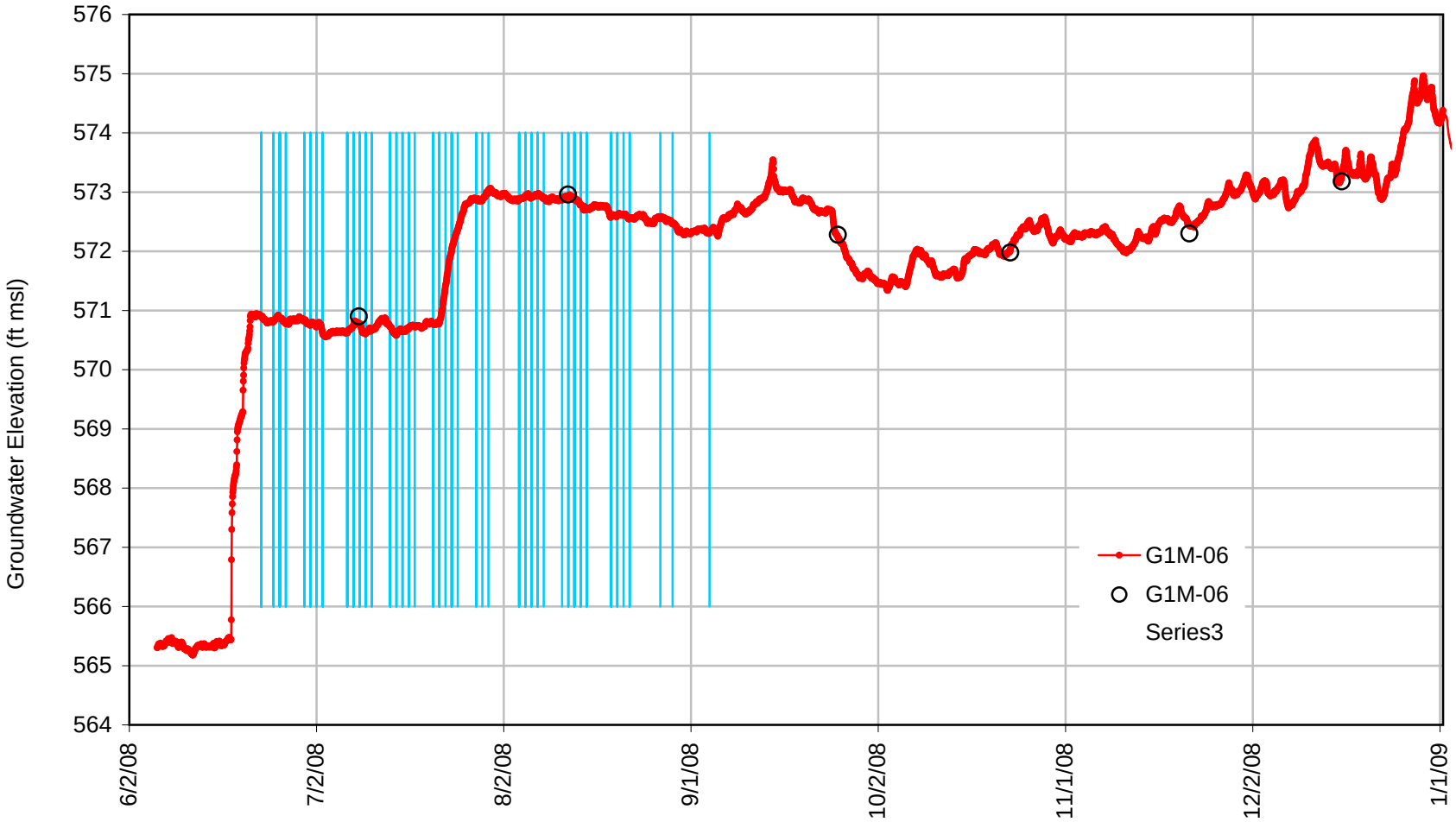


Red line is the electronic water level recorder data
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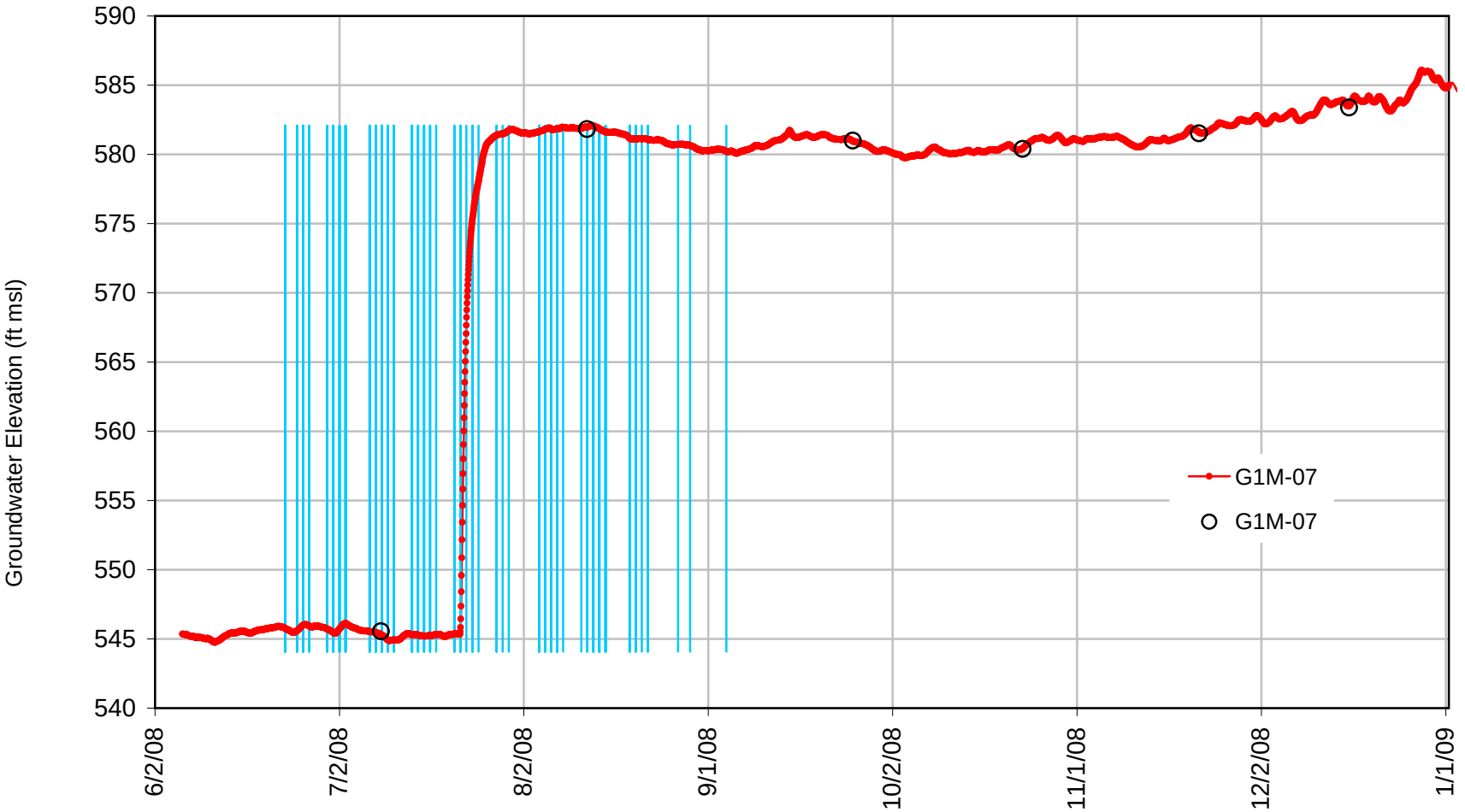


Red line is the electronic water level recorder data
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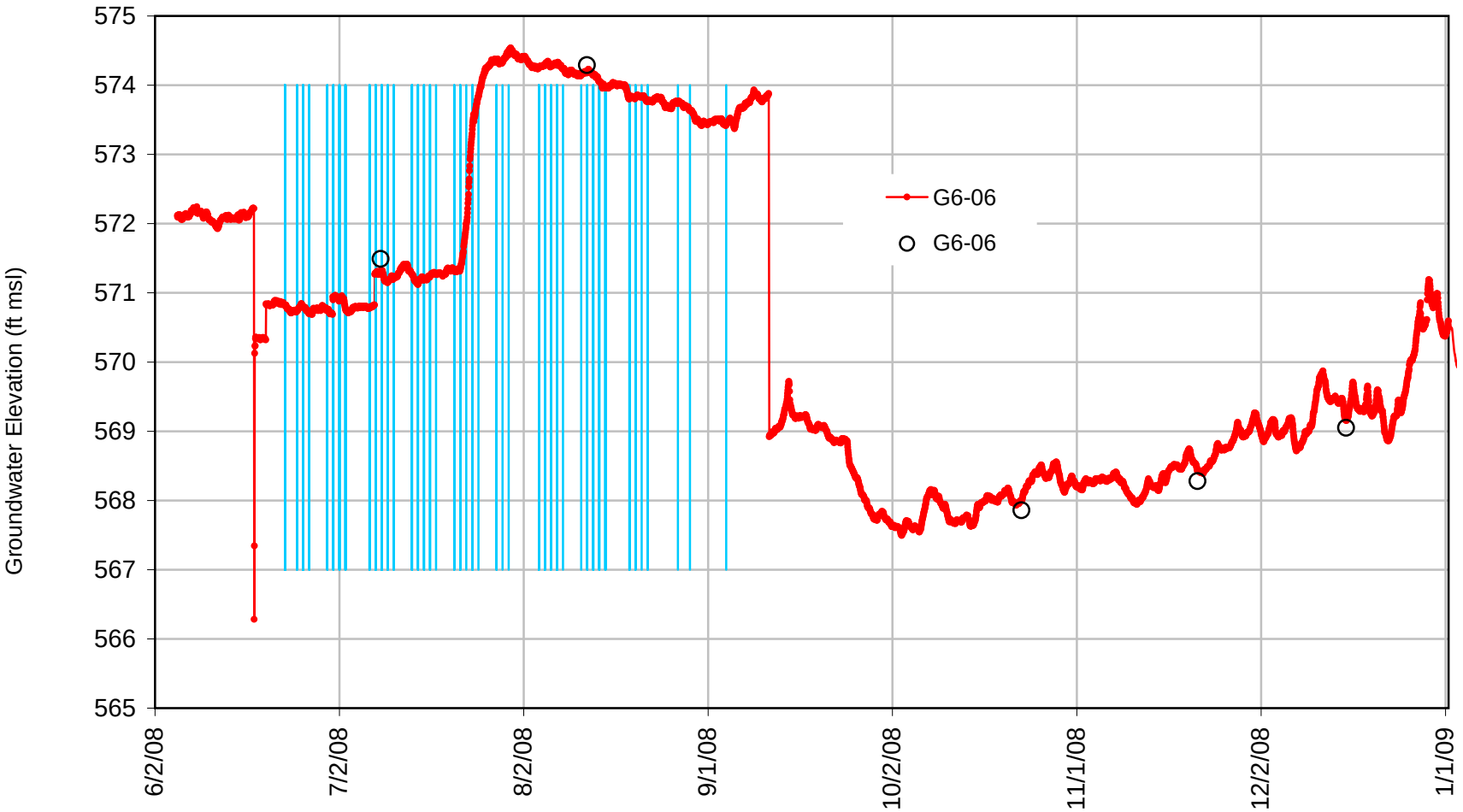
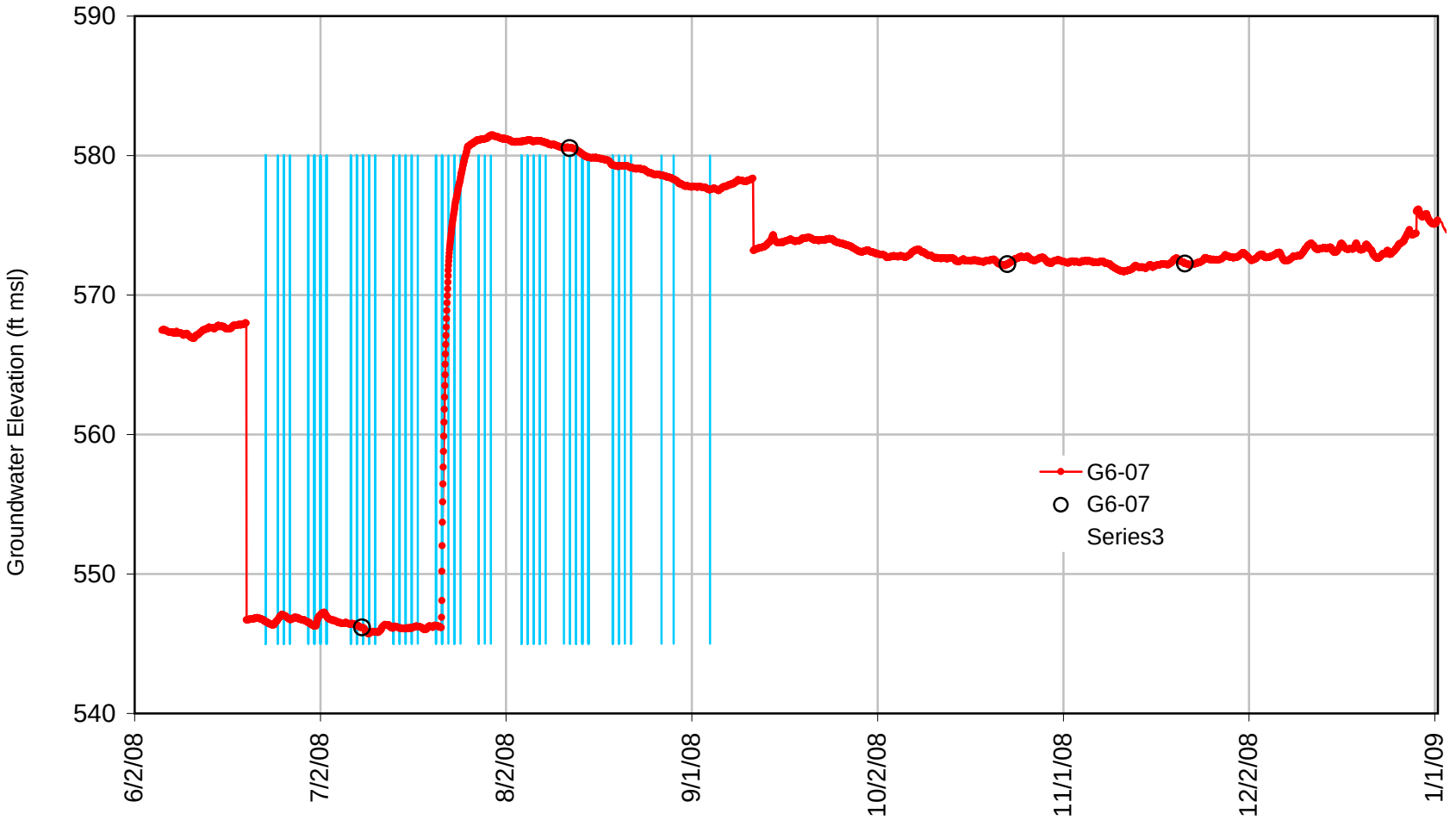
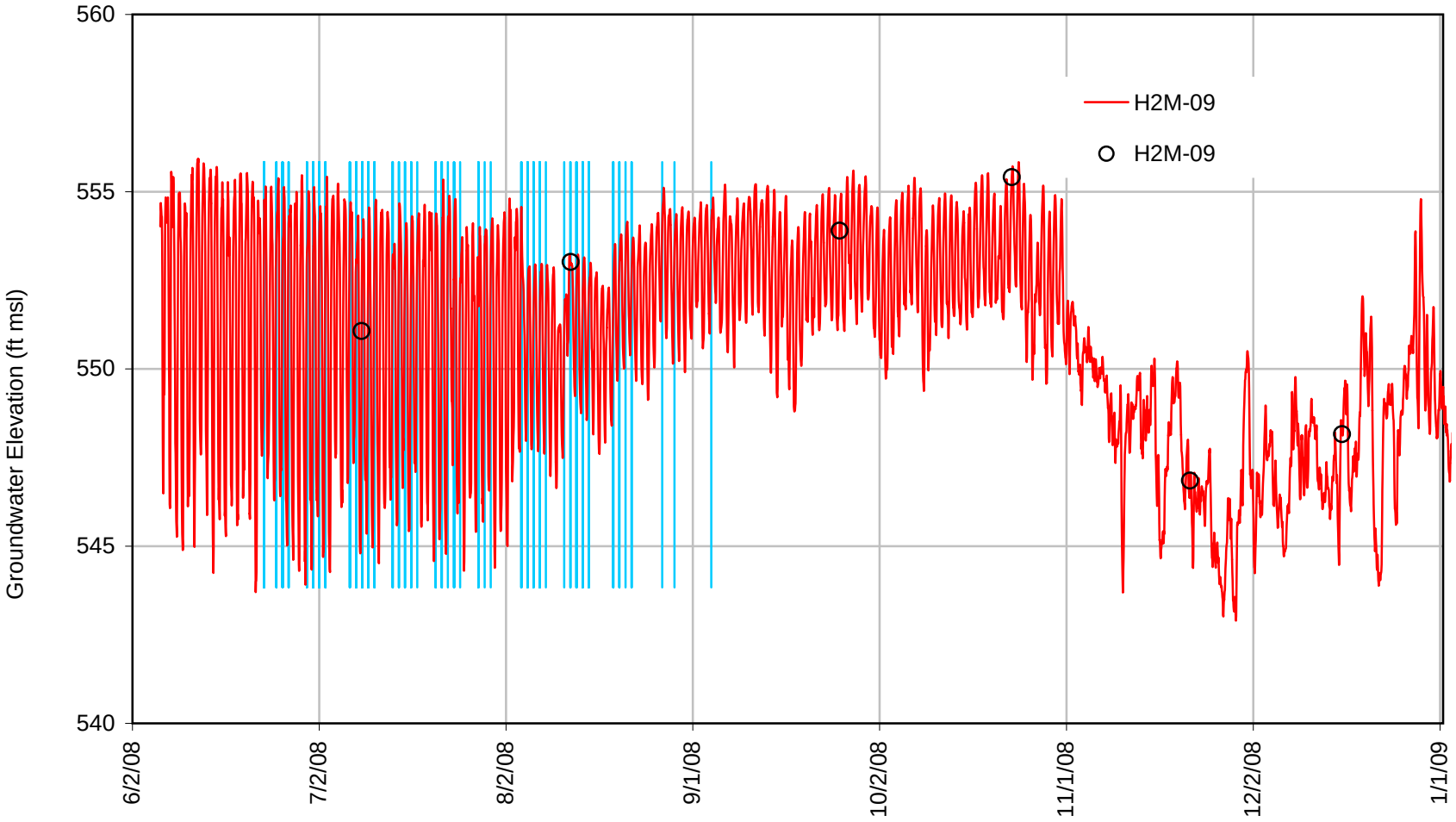



Red line is the electronic water level recorder data
Black open dots are hand water levels
Vertical blue lines are dates that wells were abandoned.




Red line is the electronic water level recorder data
Black open dots are hand water levels
Vertical blue lines are dates that wells were abandoned.




Red line is the electronic water level recorder data
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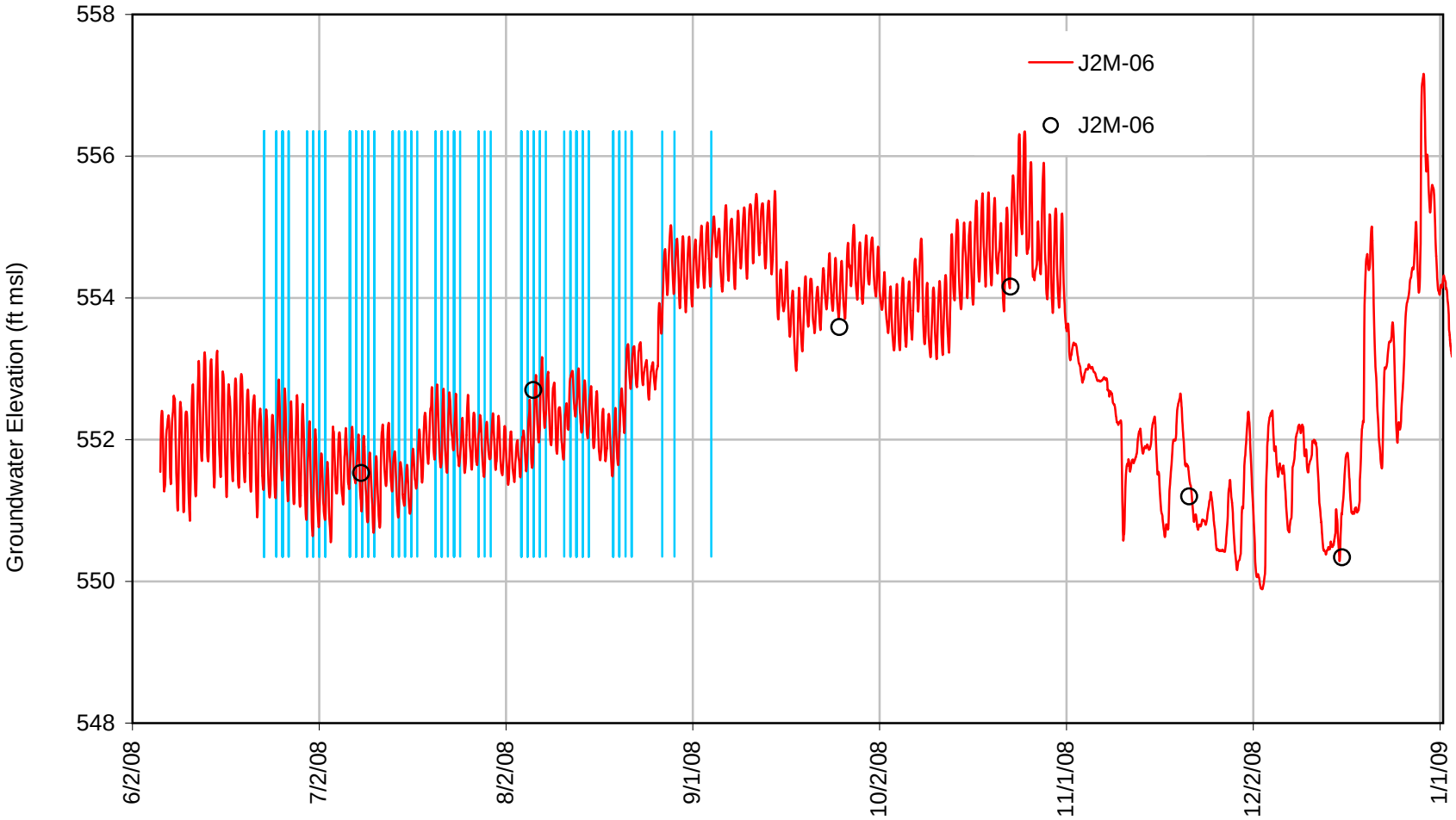


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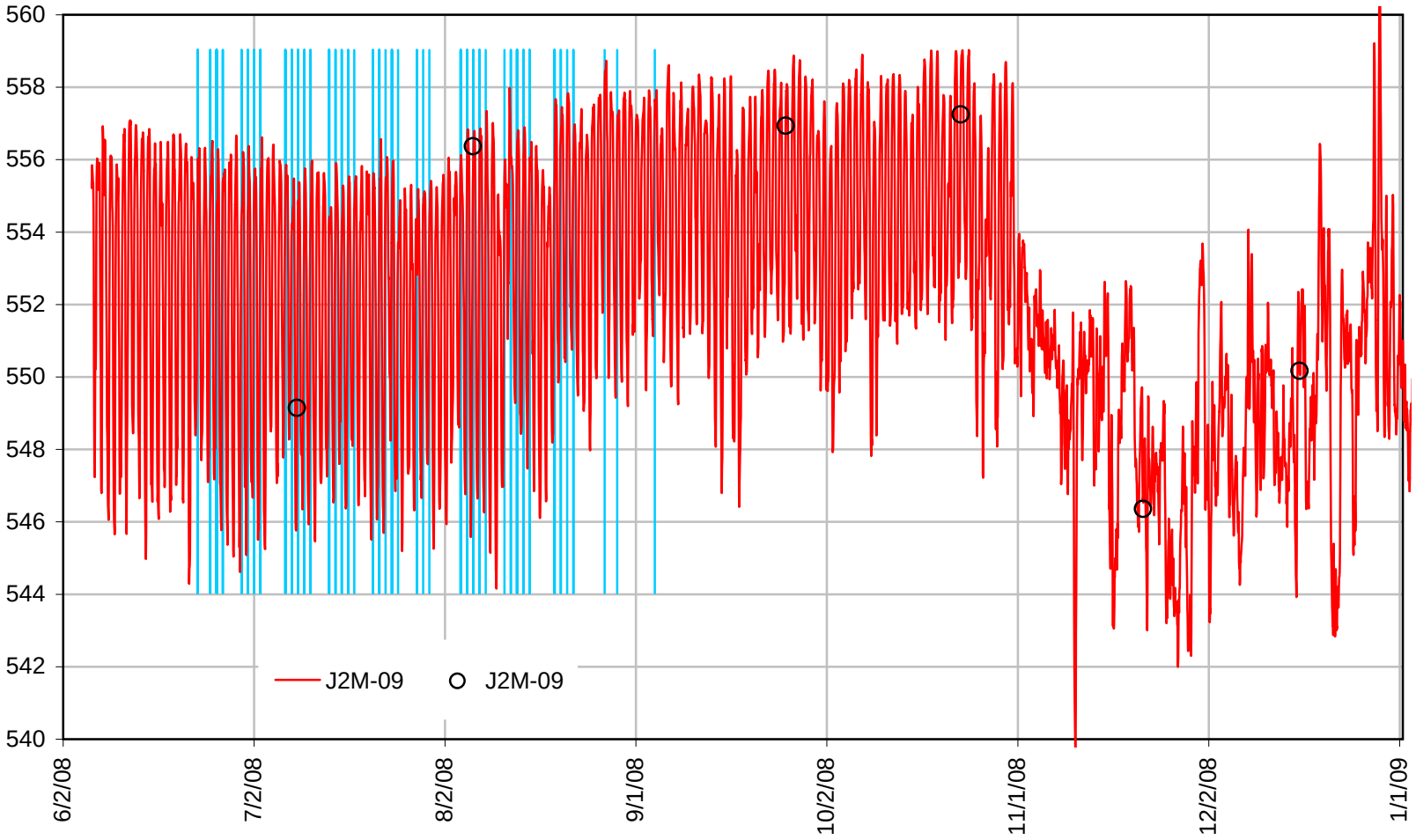
560
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9/1/08
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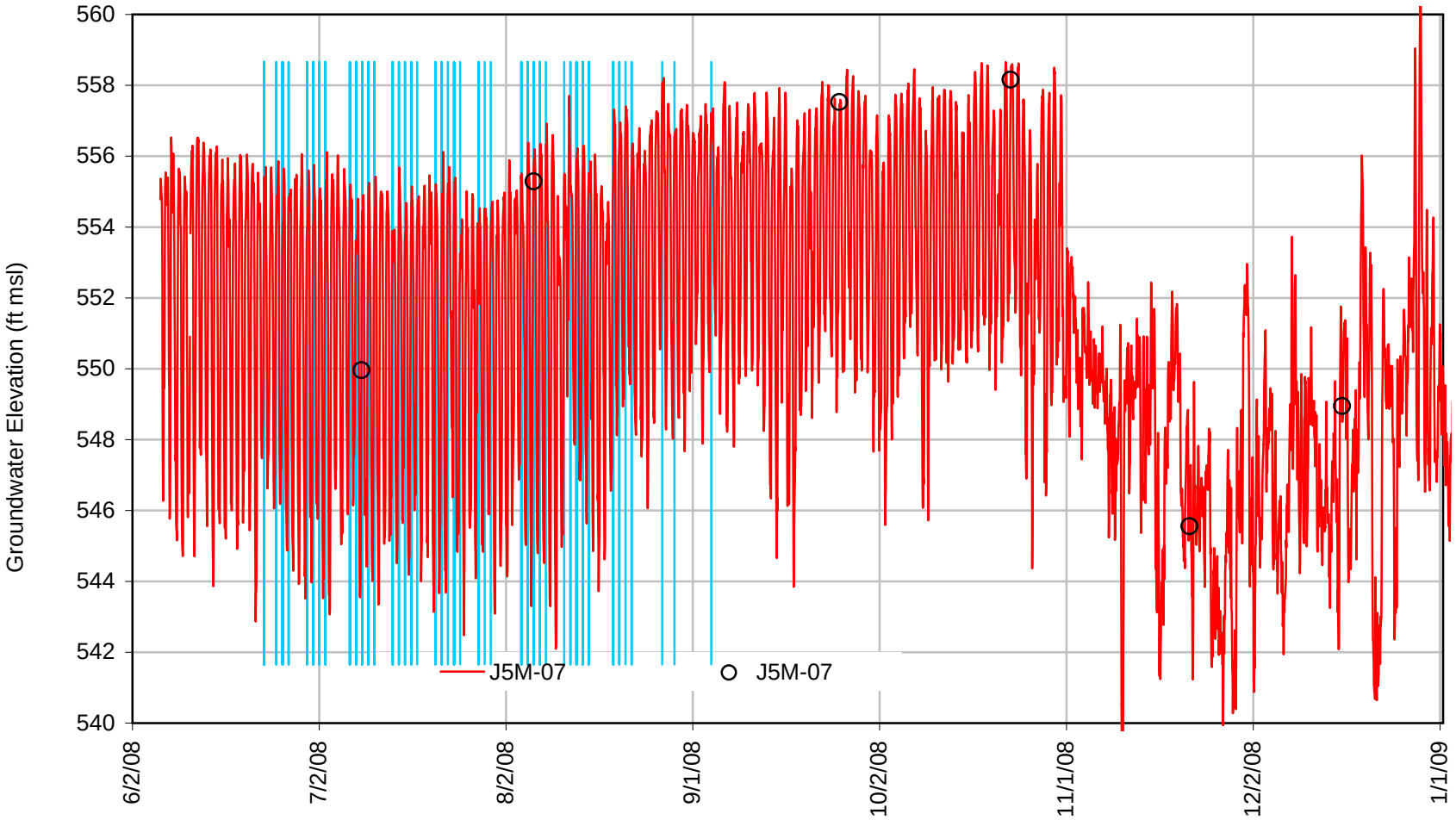
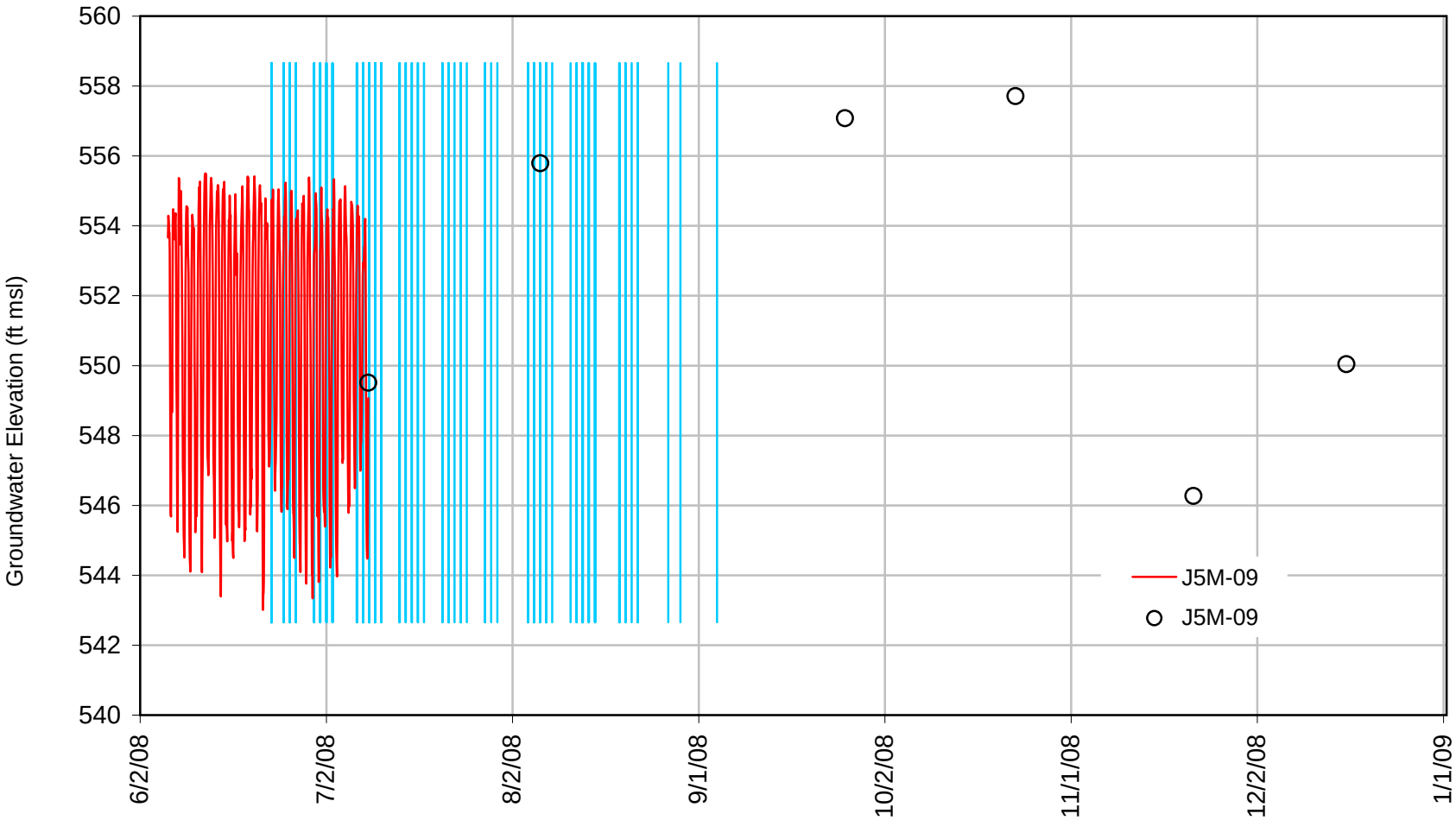
11/1/08
12/2/08
1/1/09
J2M-09
J2M-09




Red line is the electronic water level recorder data
Black open dots are hand water levels
Vertical blue lines are dates that wells were abandoned.




Red line is the electronic water level recorder data
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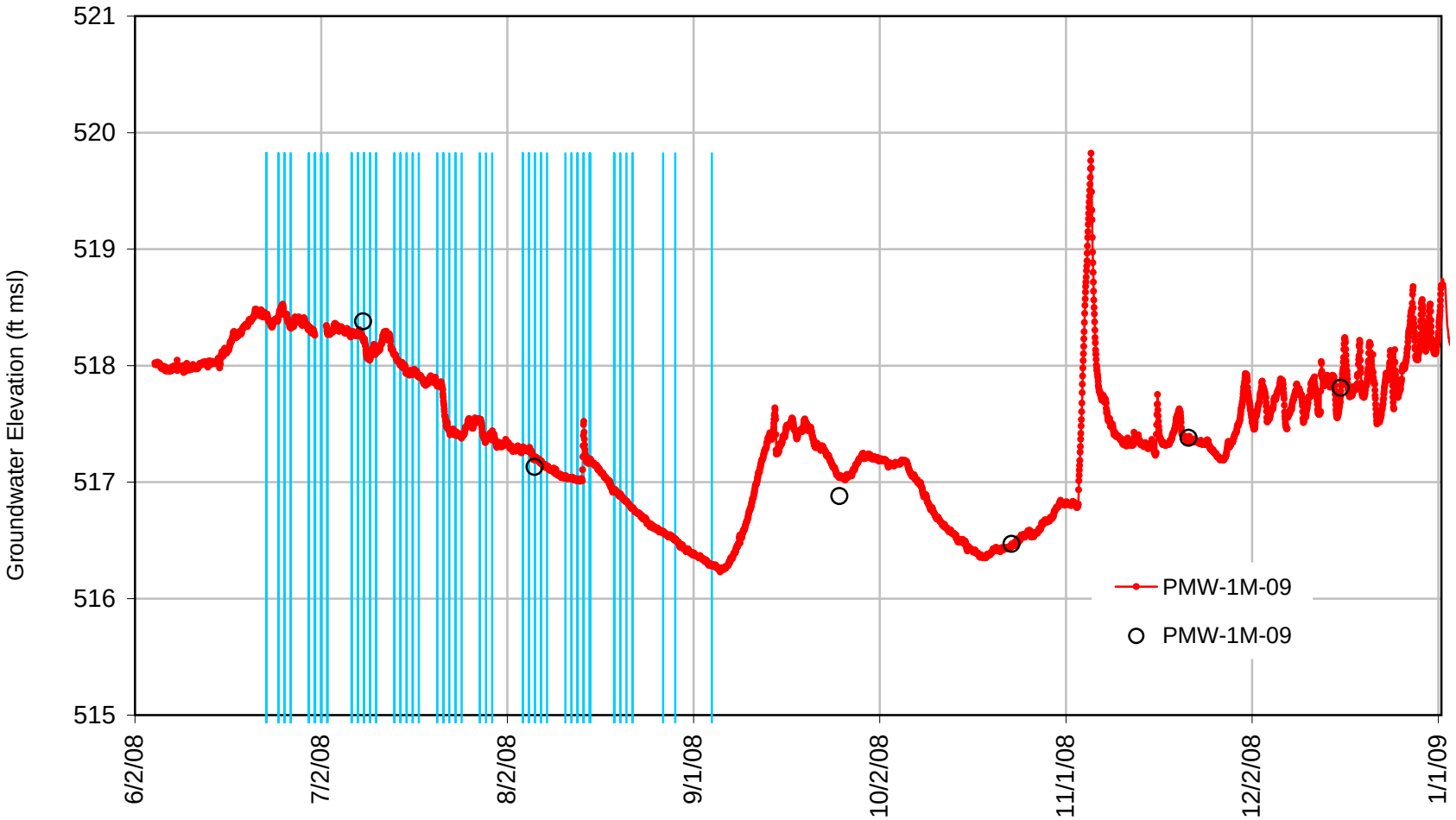
Vertical blue lines are dates that wells were abandoned.




Red line is the electronic water level recorder data
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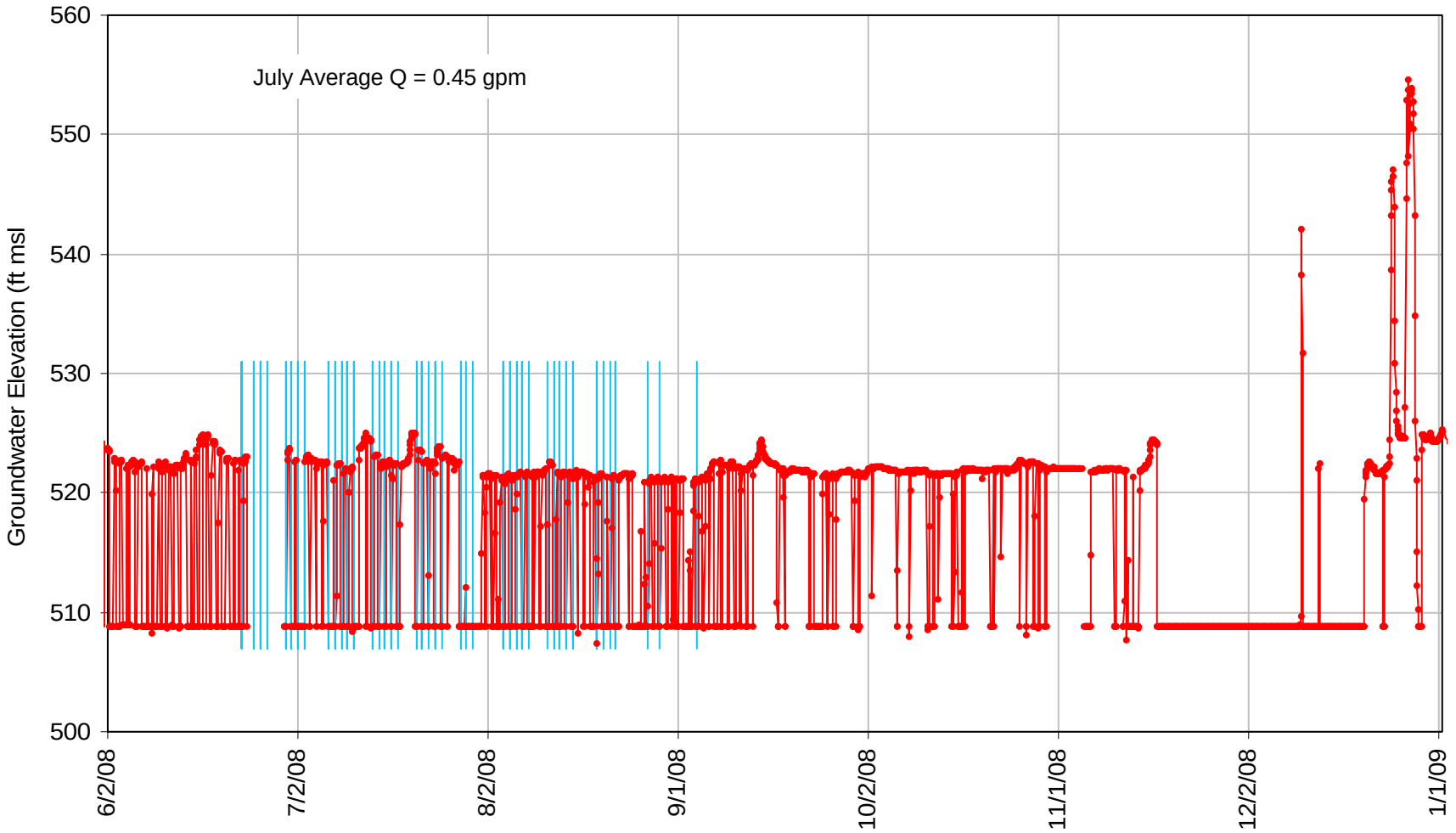
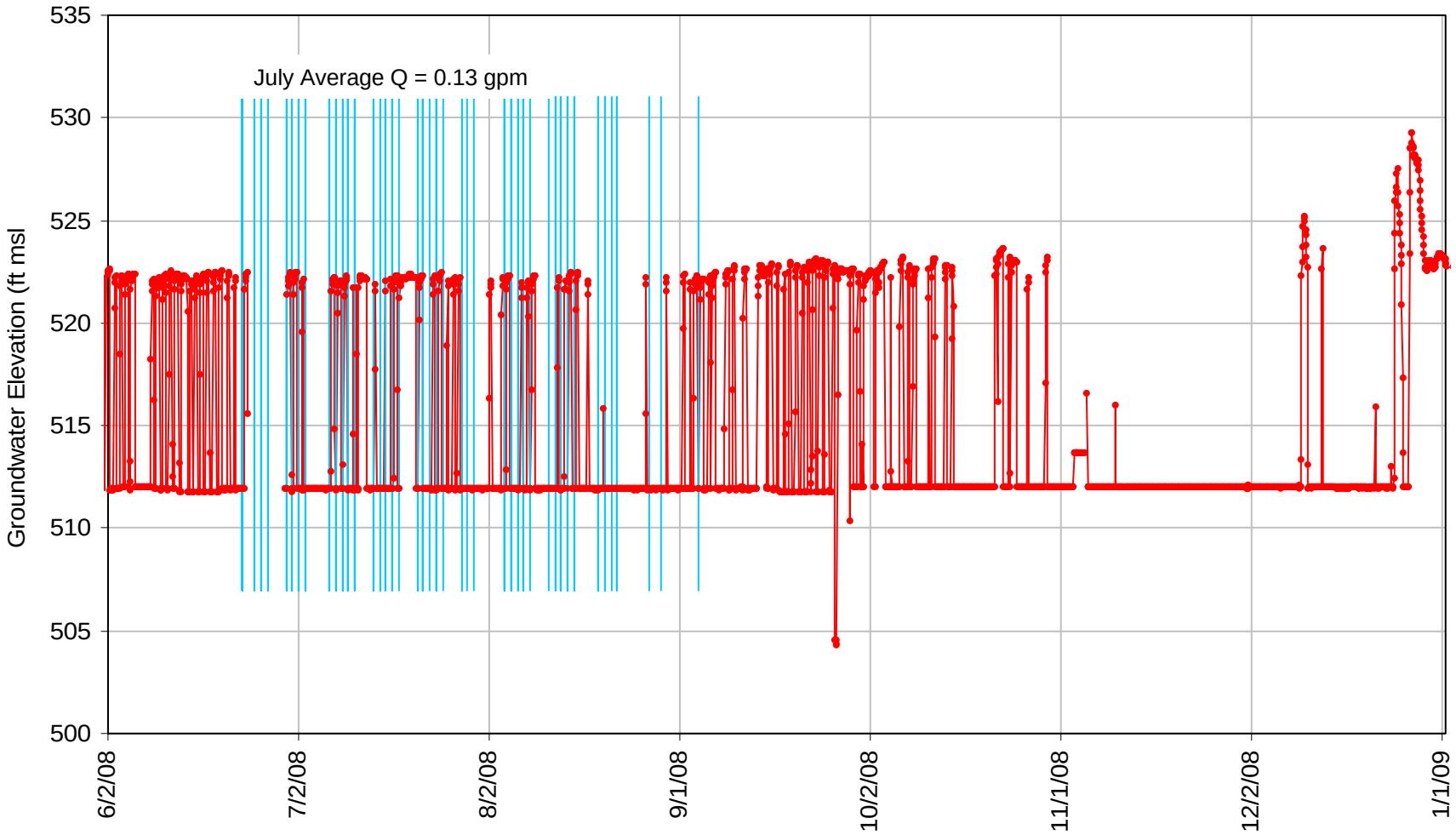
Vertical blue lines are dates that wells were abandoned.



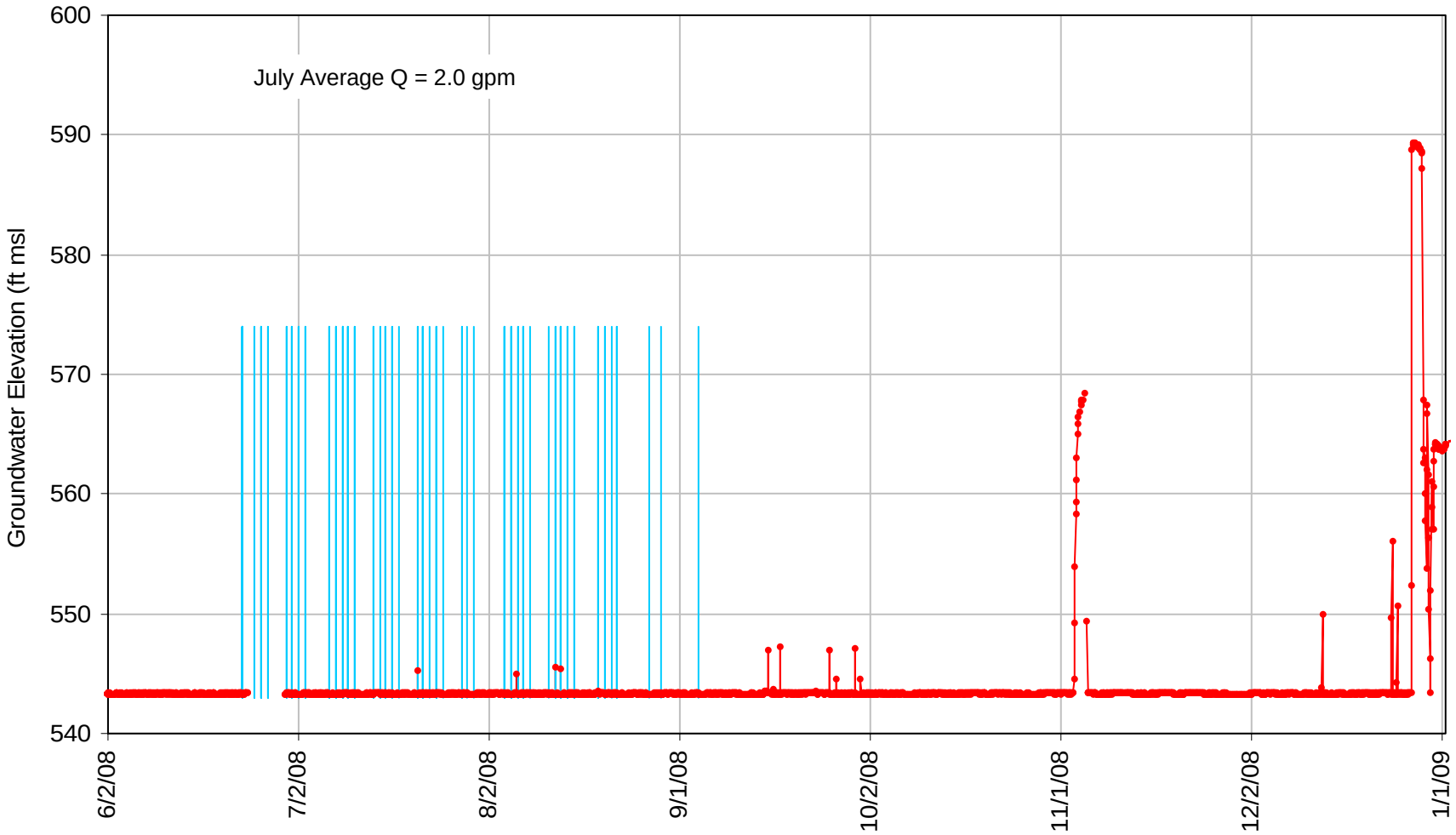

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

APW-1



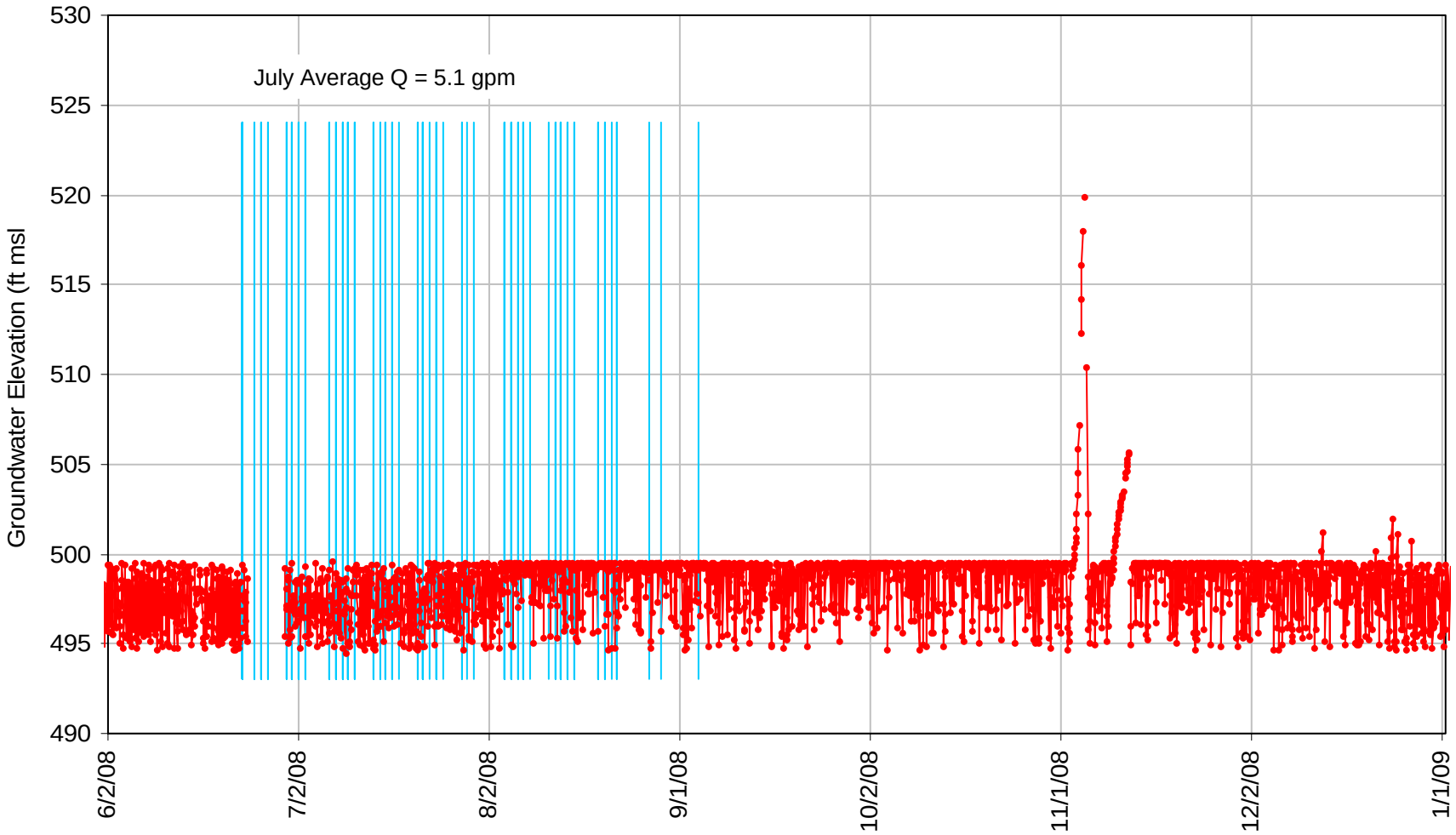

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

APW-2



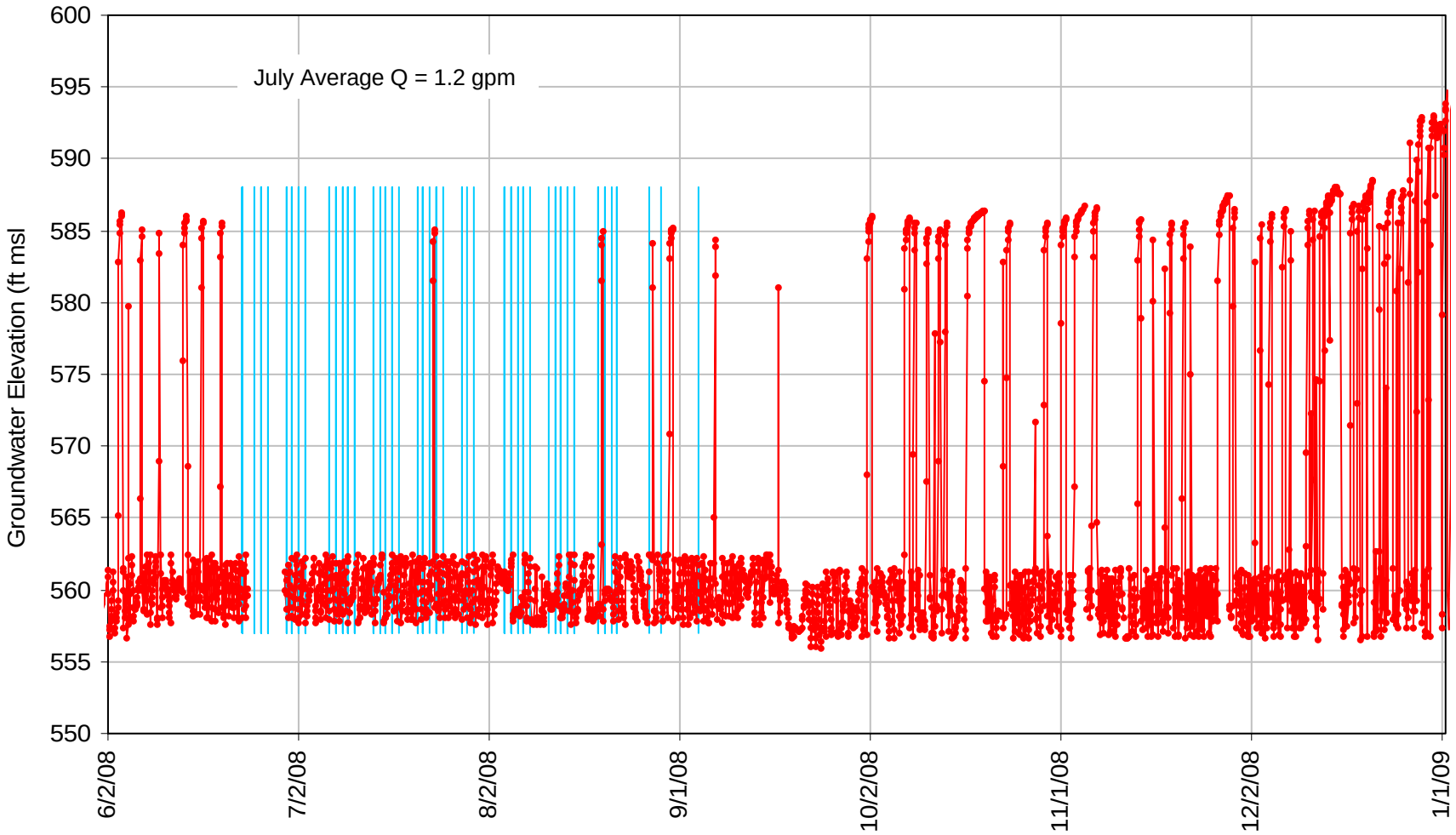

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-1U



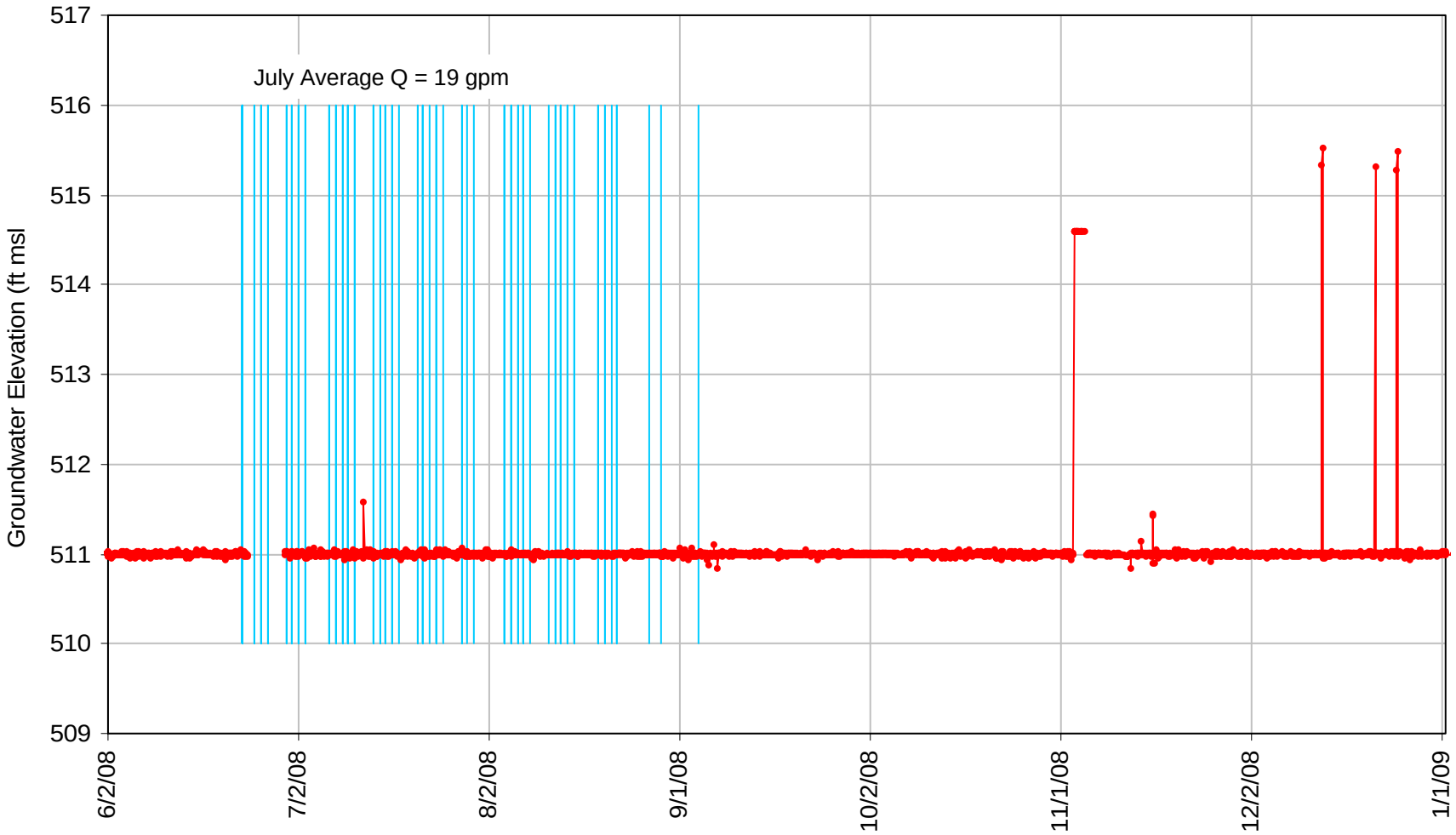

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-1L



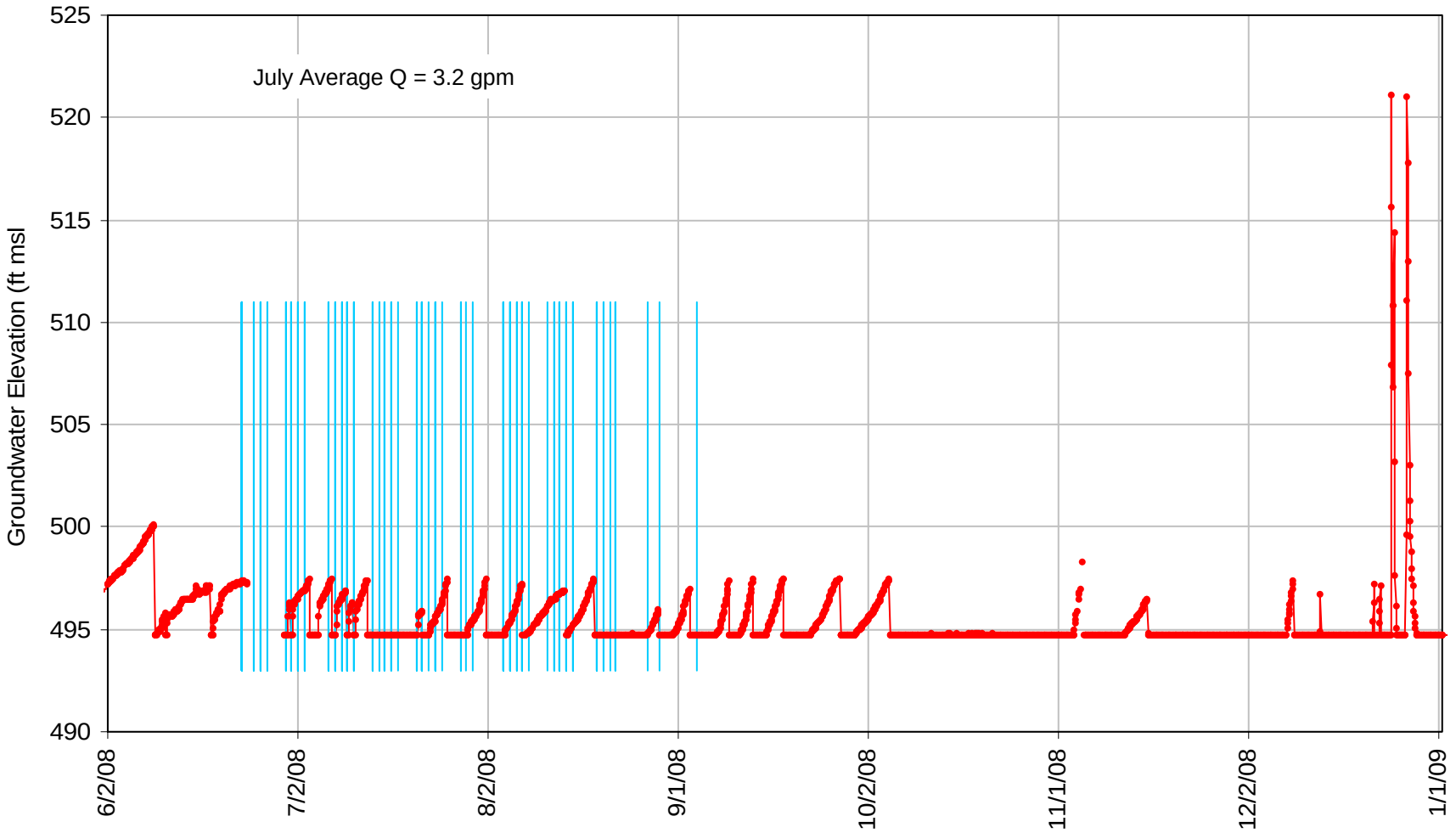

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-2UR



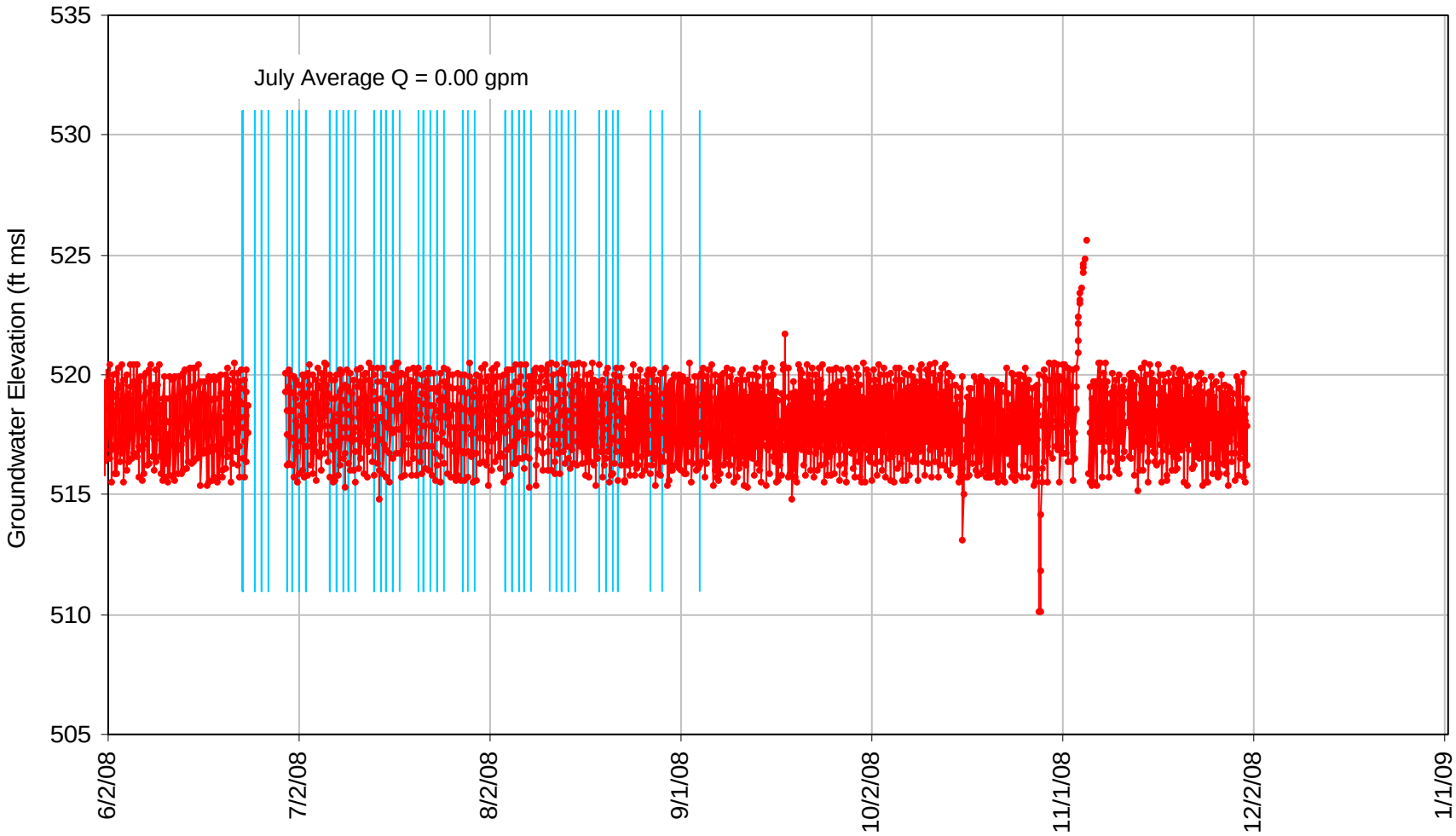

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-2M



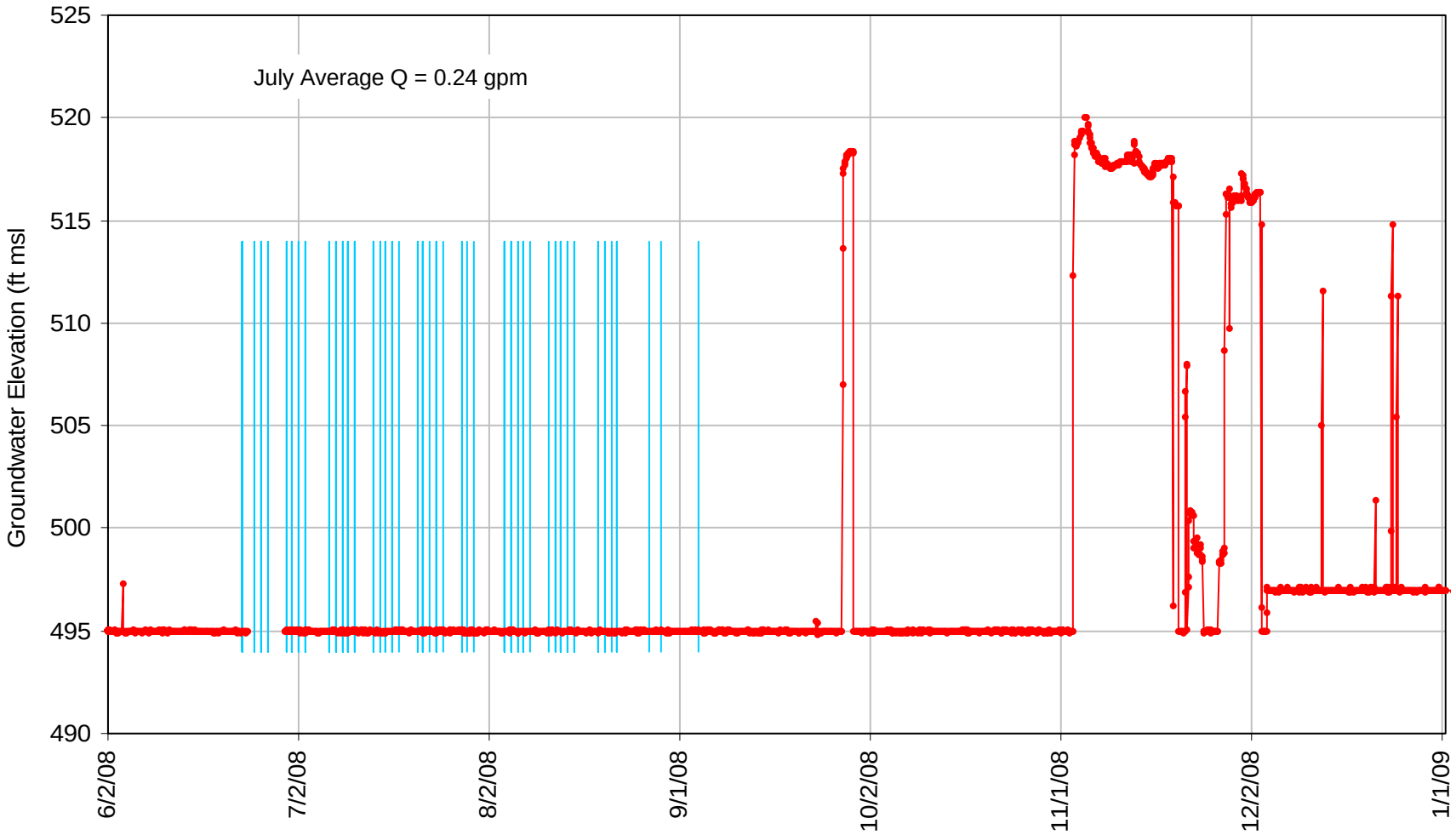

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-2L



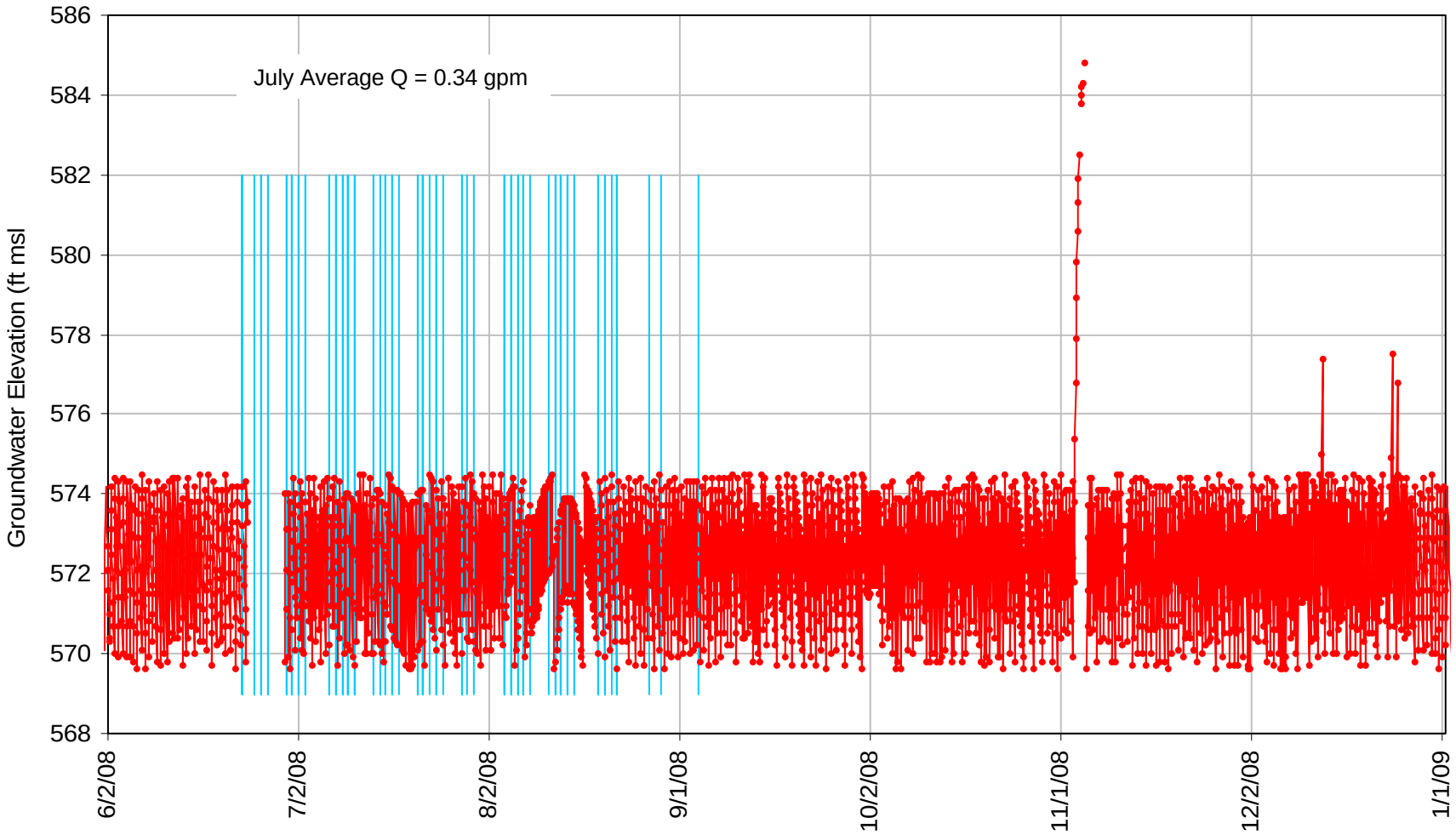

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-3M



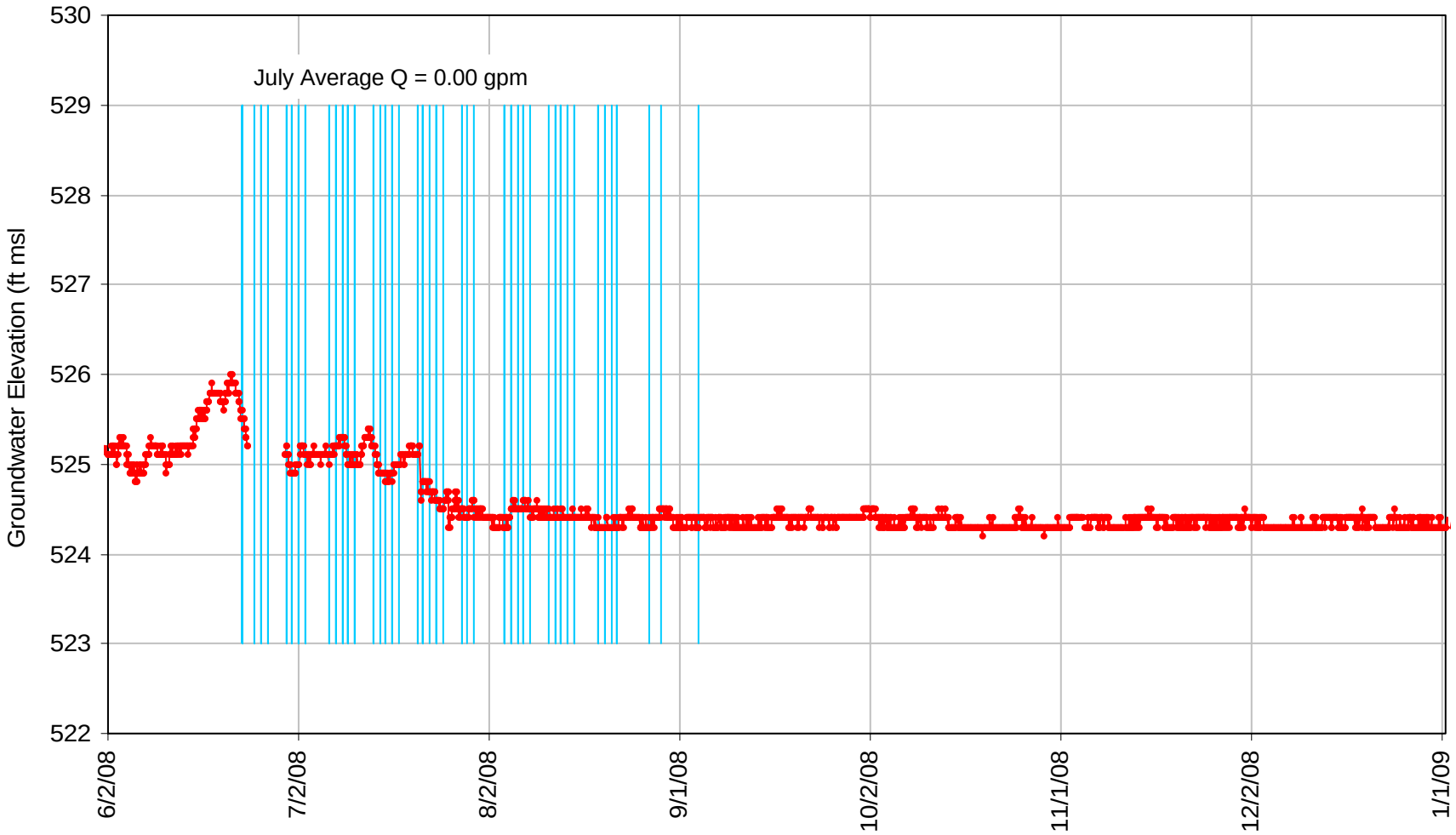

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-3L



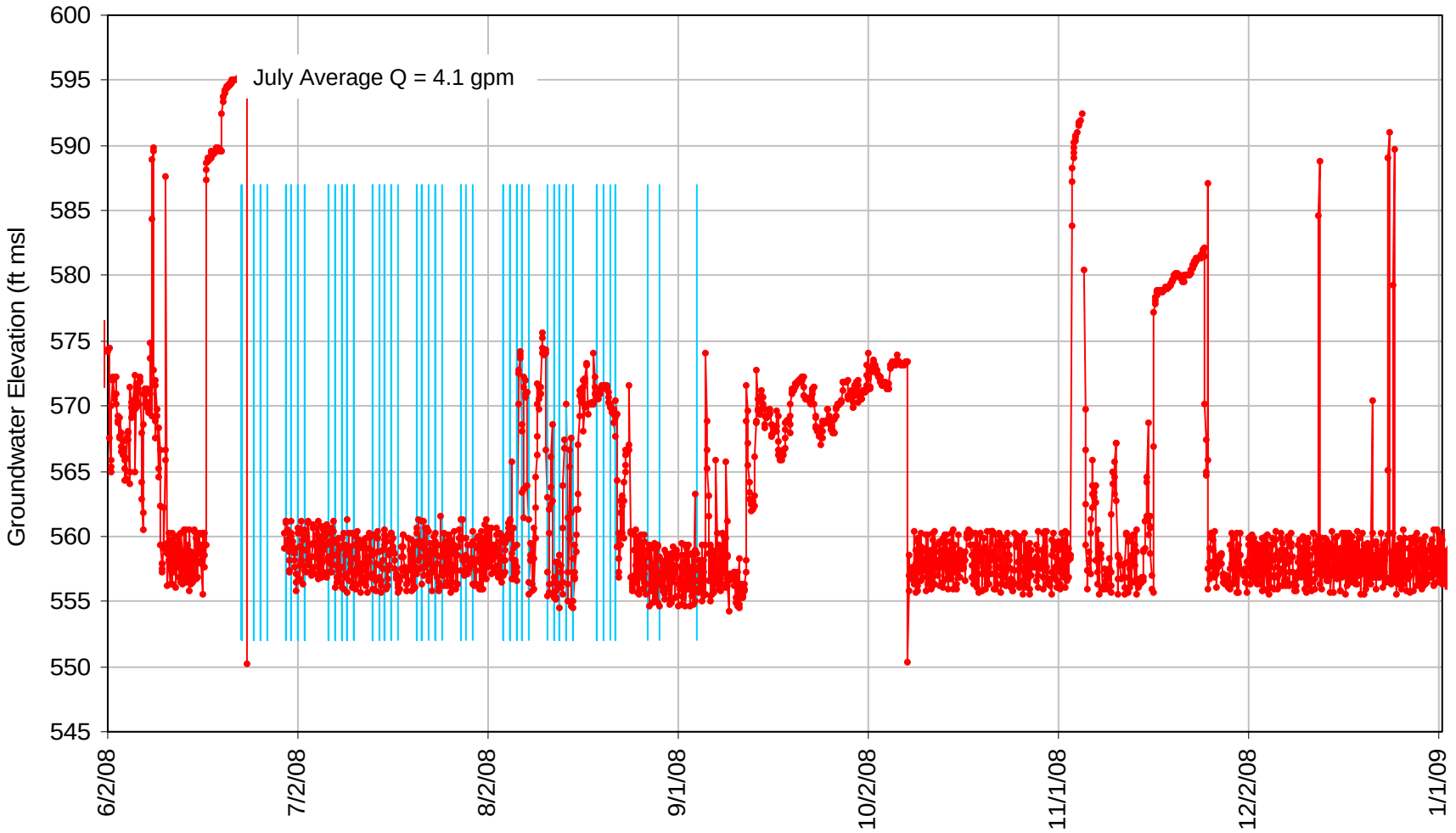

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-4U



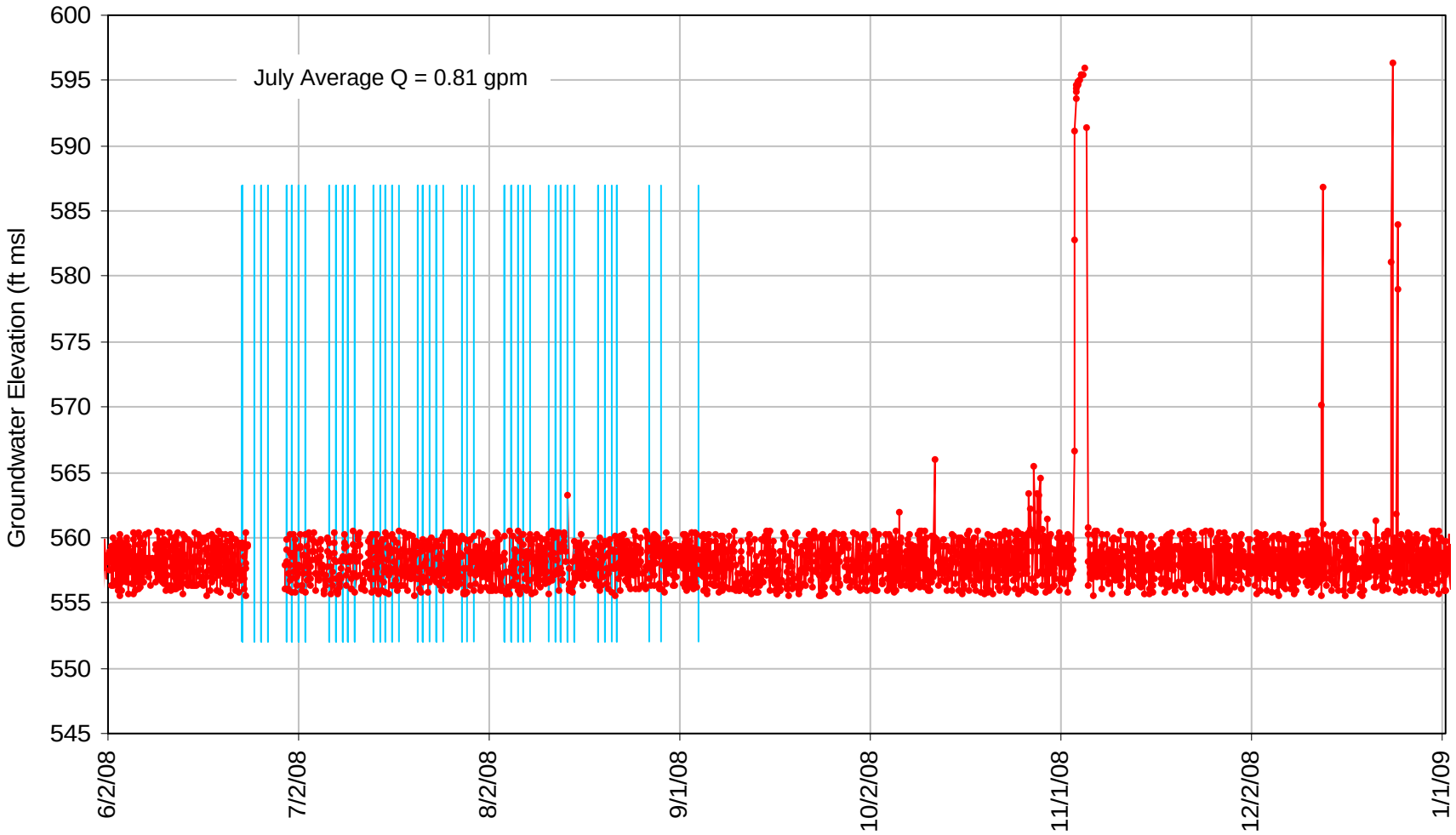

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-4M



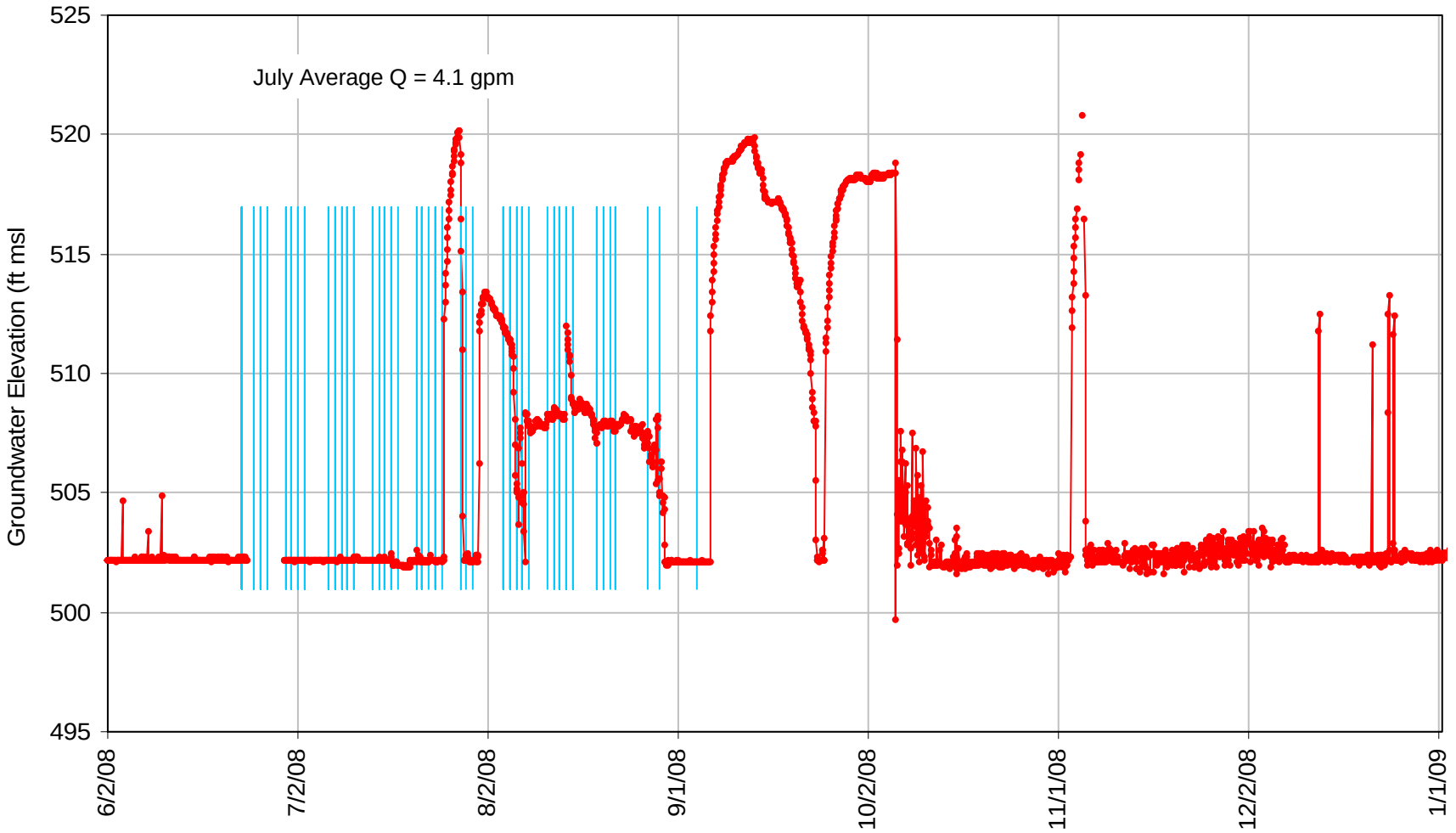

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-5UR



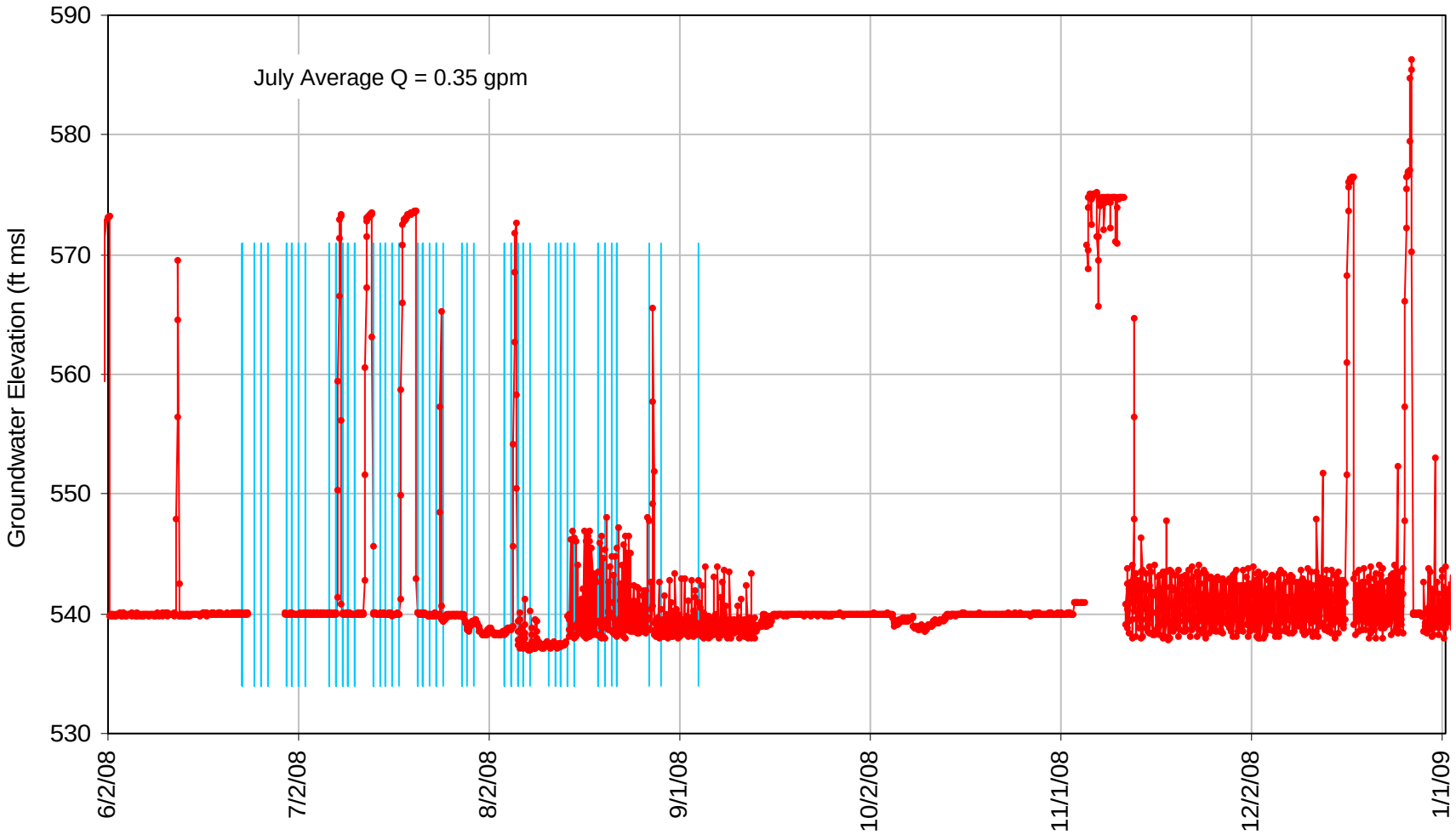

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-6UR



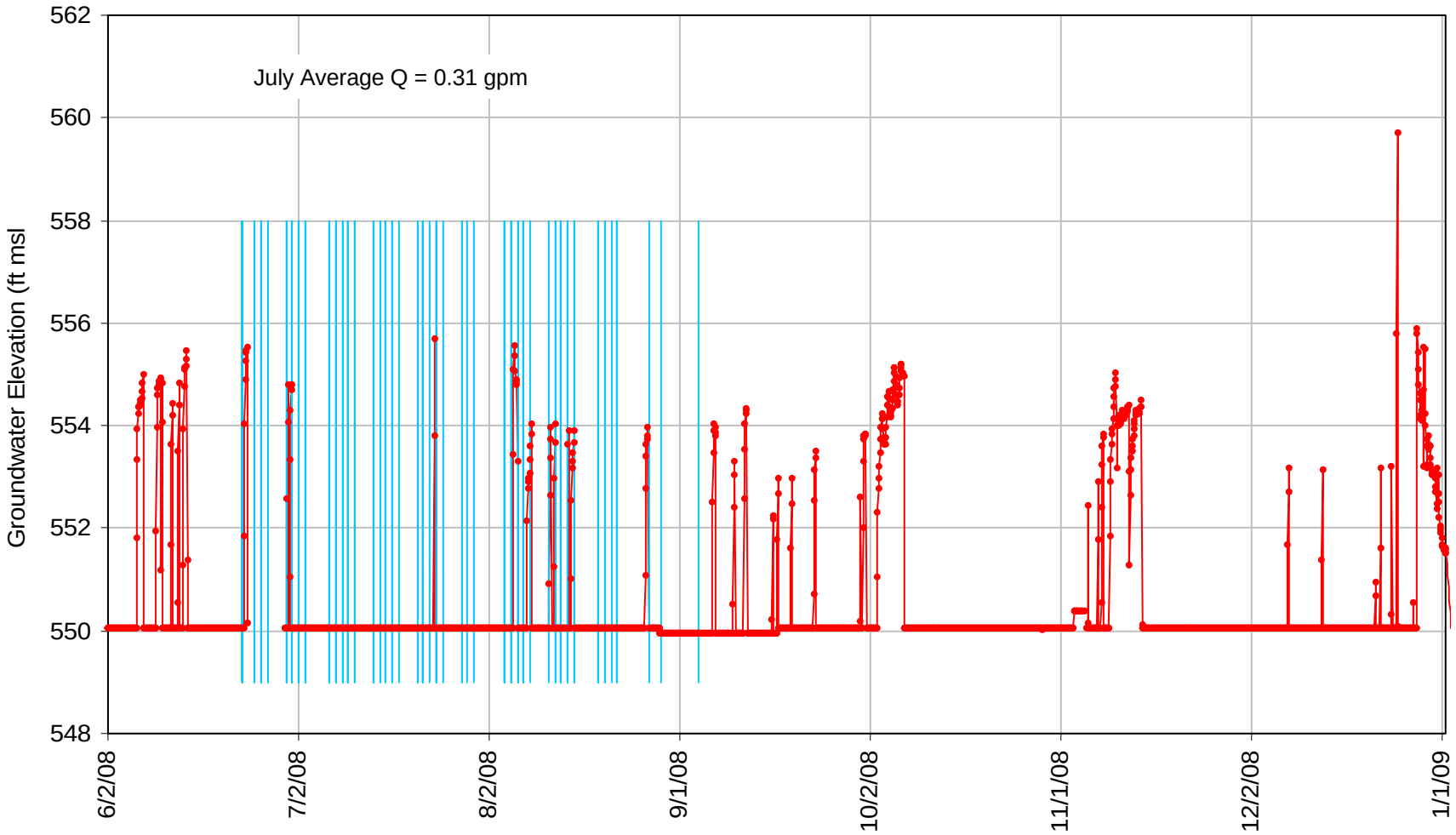

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-6MR



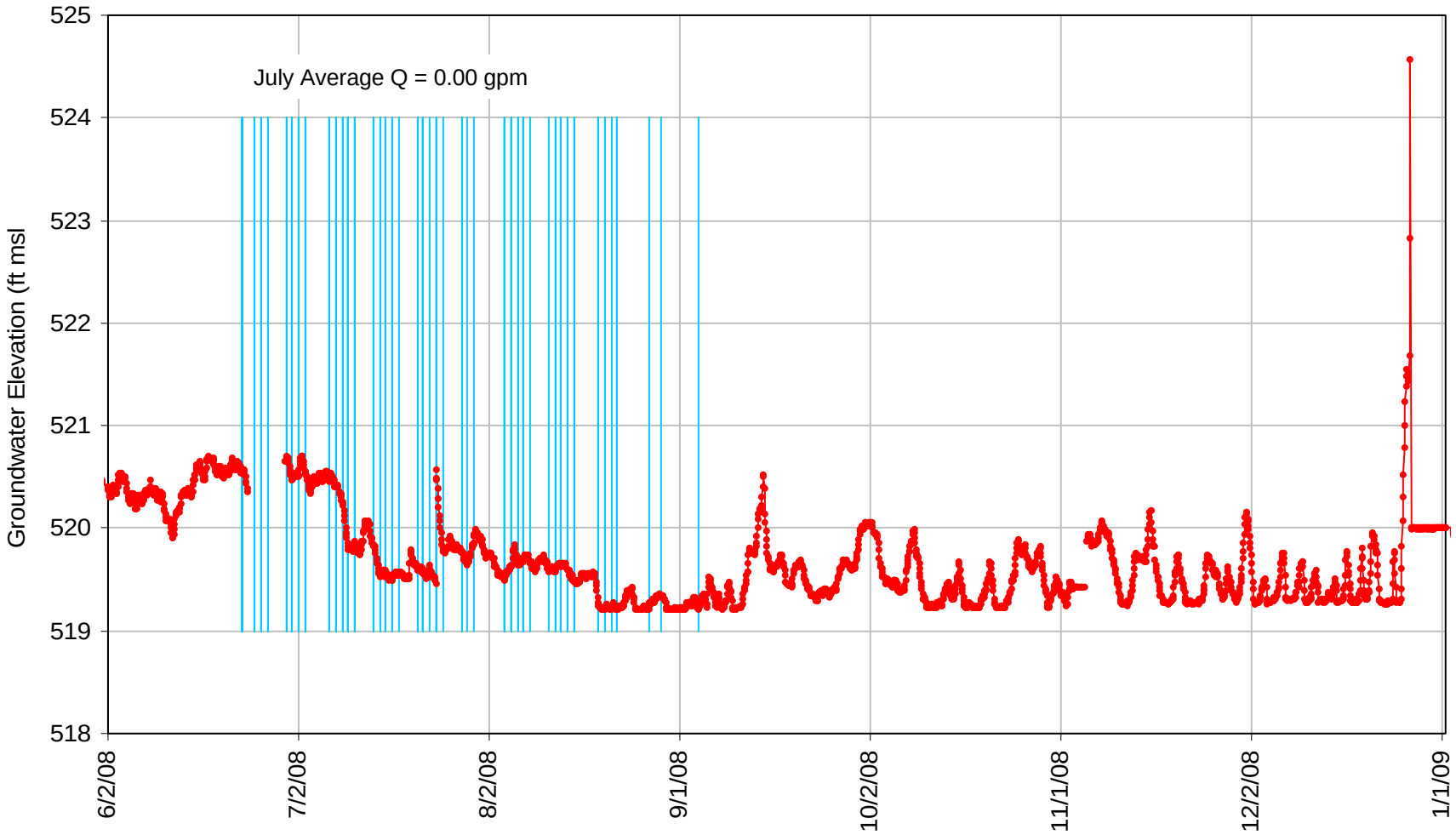

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-7U



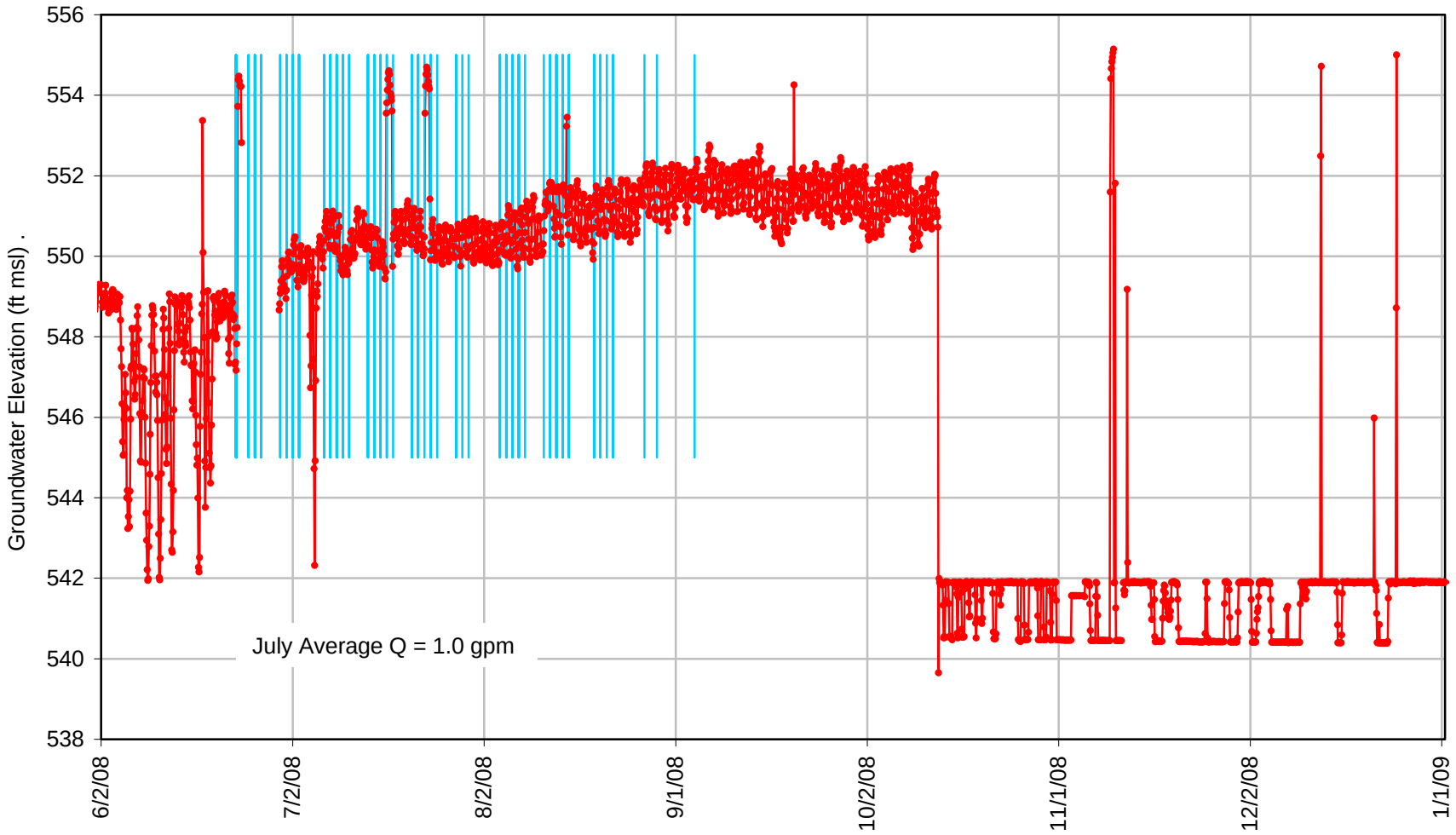

Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-8U

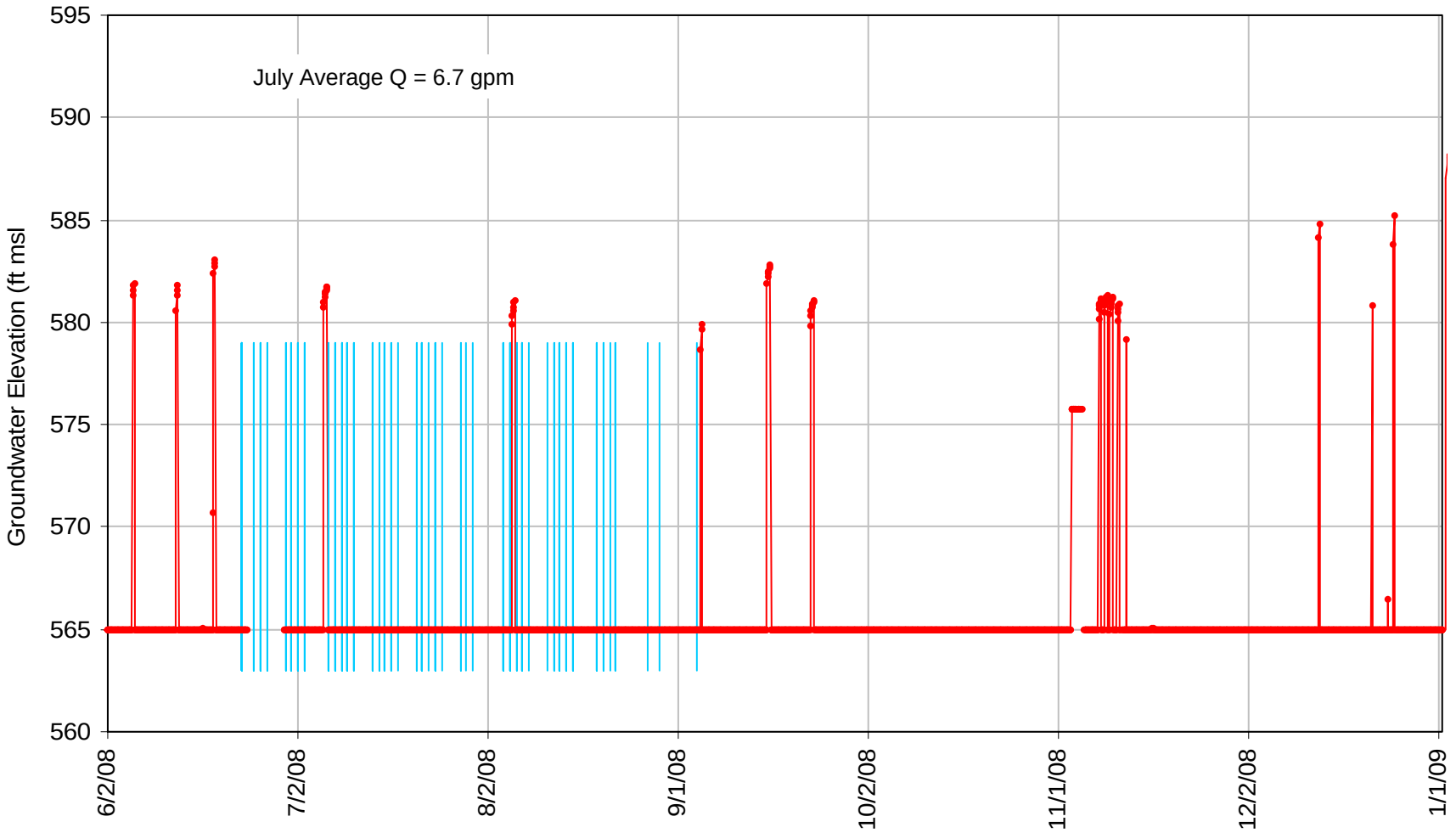



Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-8M


Groundwater Elevation (ft msl) .
556
554
552
550
548
546
544
542
540
538
6/2/08
7/2/08
8/2/08
9/1/08
10/2/08
11/1/08
12/2/08
1/1/09
July Average Q = 1.0 gpm

PW-9U




Red line shows water level data.
Vertical blue lines show that dates that wells were abandoned.

PW-10U