

**HAY RANCH PROJECT CONDITIONAL USE PERMIT  
HYDROLOGIC MONITORING AND REPORTING  
FOURTH QUARTER 2010  
INYO COUNTY, CALIFORNIA**



PREPARED FOR



PREPARED BY

**TEAM**

---

ENGINEERING & MANAGEMENT, INC.  
Bishop and Mammoth Lakes, California

JANUARY 13, 2011

Dr. Bob Harrington  
Inyo County Water Department  
135 South Jackson Street  
Independence, CA 93526

January 13, 2011

**RE: Hay Ranch Project Conditional Use Permit  
Hydrologic Monitoring and Reporting  
Fourth Quarter Report 2010  
Inyo County, California**

Dear Dr. Harrington:

TEAM Engineering & Management, Inc. (TEAM), is pleased to present the results of hydrologic monitoring activities in Rose Valley relating to the Hay Ranch Project Conditional Use Permit (#2007-003) conducted from October through December 2010.

*This Hay Ranch Project Conditional Use Permit Hydrologic Monitoring and Reporting, Fourth Quarter Report 2010, Inyo County, California* was produced per the guidelines of the Inyo County Water Department and the Coso Operating Company Hay Ranch Water Extraction and Delivery System Final Environmental Impact Report's Hydrologic Monitoring and Mitigation Plan.

Information provided in this report includes a summary of Rose Valley monitoring activities conducted during Phase 1 of the Hay Ranch Project in 2009. Information provided in this report also includes hydrologic monitoring data collected during Phase 2 of the Hay Ranch Project from Phase 2 initiation in December 2009 through the Fourth Quarter 2010. This report presents groundwater elevation, surface flow, water quality and Hay Ranch North and South Production Well pumping data in graphical form.

\* \* \* \* \*

If you have any questions or require additional information, please contact TEAM at your convenience.

Sincerely,

TEAM Engineering & Management, Inc.

Keith Rainville  
Staff Geologist

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**HAY RANCH PROJECT CONDITIONAL USE PERMIT  
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**1.0 EXECUTIVE SUMMARY**

The following summarizes hydrologic monitoring activities during Fourth Quarter 2010 related to the Coso Operating Company's Hay Ranch Project Conditional Use Permit (CUP):

- Hay Ranch Project CUP pumping was initiated on December 25, 2009. A total of approximately 970 million gallons of groundwater (2976 acre feet) were pumped from the Hay Ranch North and South Production wells through December 23, 2010.
- During Fourth Quarter 2010, monthly groundwater and surface water data were collected from 30 monitoring points throughout Rose Valley as per the schedule set forth in the Hay Ranch Project CUP's Hydrologic Monitoring and Mitigation Plan (HMMP).
- The HMMP set one-year groundwater elevation Trigger Levels for specific monitoring wells. Based on data collected by TEAM Engineering & Management, Inc. (TEAM) during the December monitoring event, the one-year Trigger Level for the Dunmovin Well was exceeded. Inyo County Water Department (ICWD) was notified in writing of this event in a timely manner. No other Trigger Levels were exceeded at specified wells and no "Maximum Acceptable Drawdowns" were exceeded in the fourth quarter.
- Quarterly groundwater samples were collected from the Hay Ranch South, Coso Junction Store #2, and Little Lake Ranch North wells. These samples were analyzed for Total Dissolved Solids (TDS). None of these samples exceeded "Threshold Requiring Action" levels.
- Monthly data transmittal, including groundwater and surface water hydrographs, occurred between TEAM and ICWD. Monthly update letters and groundwater and surface water hydrographs have been posted on the ICWD's public website: [www.inyowater.org](http://www.inyowater.org).
- Quarterly hydrographs, which compare Rose Valley groundwater elevations, surface flow amounts, and Total Dissolved Solid data to Hay Ranch Project CUP pumping amounts over time, are included in this report.
- A Dunmovin Well Assessment field event was held in October 2010. This event recorded Dunmovin Well production amounts, groundwater dynamic drawdown levels and recovery times, and pump pressure amounts. Additionally a groundwater sample from the Dunmovin Well was collected and analyzed for TDS.
- ICWD set a process and timeline (December 2010 to March 2011) for completion of the Phase 3 model recalibration work which included setting interim pumping rates and water trigger levels, and described the process for finalizing the revised pumping rates, pumping duration and water level triggers developed by the Phase 3 model recalibration.

## **2.0 INTRODUCTION**

The Coso Operating Company, LLC (COC) operates a geothermal electric generating plant located to the east of Rose Valley in the Coso Mountains in Inyo County, California. COC proposed a project to pump water into the Coso geothermal field from groundwater wells located on the COC Hay Ranch Property in the Rose Valley Basin. Inyo County, as lead agency, approved the Final Environmental Impact Report (FEIR) associated with this project in 2009, issuing a Conditional Use Permit (CUP) for the project: Hay Ranch Water Extraction Project and CUP #2007-03 (Hay Ranch Project). The FEIR includes a Hydrologic Monitoring and Mitigation Plan (HMMP) which stipulates monitoring and mitigation requirements associated with the project. The primary objective of the HMMP is to protect the groundwater and surface water quality and availability in Rose Valley. In May 2009, Inyo County Water Department (ICWD) approved TEAM Engineering & Management, Inc. (TEAM) as the objective, third-party groundwater monitor with respect to the monitoring requirements stipulated in the HMMP.

### **2.1 BACKGROUND**

The Rose Valley hydrologic system has been the subject of sporadic research since the early 1900s. Recent, more intensive study includes work by C. M. Bauer in 1996, and numerous studies from 2000 to the present related to the proposed Hay Ranch Project. COC has conducted groundwater monitoring since 2002 at a number of the monitoring wells specified in the HMMP. In addition to being used as an irrigation water supply well in the 1980s, the Hay Ranch South Well, the primary production well for the Hay Ranch Project, underwent two recent pump tests. In 2003, a 24-hour pump test was conducted, and groundwater elevation data was collected during this test. Then, from November to December 2007, a 14-day constant discharge aquifer test was conducted to evaluate potential impacts of the Hay Ranch Project. Groundwater elevation data was collected during this test both by data-logging pressure transducers and manual measurements taken with a depth-to-water (DTW) sounder in various Rose Valley wells.

As part of the California Environmental Quality Act (CEQA) process for the Hay Ranch Project, a Draft Environmental Impact Report (DEIR) and FEIR were produced from 2004 to 2009 with the creation of a numerical groundwater model for Rose Valley and a proposed HMMP for the project. The HMMP specifies which sites are to be included in the monitoring plan for the Hay Ranch Project, how often those sites will be monitored, the types of data to be collected, and the procedures for presenting the monitoring data to Inyo County.

The goal of the HMMP is to prevent potential off-site impacts of the Hay Ranch Project on groundwater and surface water users in Rose Valley. The HMMP is designed to monitor changes in groundwater levels throughout Rose Valley and compare the observed changes to groundwater-model predicted changes in order to predict and prevent potential impacts related to project pumping. The HMMP is broken into four phases: Phase 1 is Monitoring System Setup and Supplemental Data Collection; Phase 2 is Startup Monitoring and Reporting; Phase 3 is Model Recalibration and Redefinition of Pumping Rates and Durations; and Phase 4 is Ongoing Monitoring, Mitigation and Reporting.

In 2009, Phase 1 work was conducted by COC, TEAM and ICWD. On December 25, 2009 Phase 2 began with initiation of project pumping from the Hay Ranch South Well. In April 2010, Daniel B. Stephens & Associates (DBS&A) was retained by ICWD to conduct Phase 3 work.

### **3.0 PHASE 1 MONITORING AND REPORTING**

The purpose of the Phase 1 Monitoring and Reporting period was to install the hydrologic monitoring system in Rose Valley and collect background data to establish prevailing hydrologic conditions prior to any potential impacts caused by Phase 2 project implementation. From May to December 2009, 30 monitoring points were completed in Rose Valley from the Enchanted Village area in the north to the Little Lake Gap area in the south (Figure 1). These monitoring points include 25 wells and five surface water measuring points. Data logging pressure transducers were installed in 18 wells and five surface water measuring points to record hourly changes in water levels.

During Phase 1, two clusters of monitoring wells were completed on the Hay Ranch Property near the Hay Ranch South Well (the Hay Ranch Cluster 1 and 2 Wells). An additional monitoring well was completed north of the Red Hill Cinder Cone. Surface flow measuring devices (flumes) were installed at Davis Ranch and Little Lake Ranch. The Stilling Well was installed in the north end of Little Lake to measure lake level (stage).

Access agreements were finalized between COC and Rose Valley land owners to collect hydrologic data at numerous points in Rose Valley. Security systems were installed at Rose Valley monitoring points where necessary. Monitoring points were surveyed for northing, easting and elevation data.

Also during Phase 1, monthly field events were conducted to collect DTW and surface flow data from Rose Valley monitoring points. Background hydrologic data was collected from May to December 2009, and a data processing and transfer system was established between TEAM and ICWD. Monthly data packages, update letters and groundwater and surface flow hydrographs were produced. At least six months of groundwater elevation data was collected from wells specified by the HMMP to be used as “trigger wells” in the monitoring system.

#### **3.1 ROSE VALLEY MONITORING POINTS**

The hydrologic monitoring points throughout Rose Valley vary from active supply wells, to newly constructed monitoring wells, to inactive/former supply wells, to a hand-pumped campground well. Monitoring point locations range from the Enchanted Village area in the north to the Little Lake Hotel Well in the south, and from the Lego Well in the east to the Davis Ranch Wells in the west. Monitoring locations are on private and/or gated property as well as open, remote areas in Rose Valley. Some wells are locked in structures or behind gates, some have locked construction job boxes installed over the casings, and others have security installed on or around the well casing itself. Well owners include private individuals, the U.S. Navy, the Bureau of Land Management (BLM), the Los Angeles Department of Water and Power (LADWP), and Coso Operating Company. A summary table is included in this report (Table 1) which standardizes the names of the Rose Valley monitoring points and provides a reference to the names used in the HMMP for each monitoring point.

Important features of Rose Valley Monitoring Wells are as follows:

The Hay Ranch Cluster Wells feature shallow (1A and 2A), intermediate (1C and 2C) and deep (1B and 2B) screened intervals at each location to provide enhanced groundwater and upper aquifer data. These cluster wells provide data on groundwater drawdown on the Hay Ranch property itself. With their specific screened intervals, each cluster grouping also has the potential

to provide additional information on groundwater drawdown at specific depths. This data can be assessed to deduce upper aquifer parameters such as hydraulic conductivity and specific yield.

The Enchanted Village and Dunmovin Wells are active domestic supply wells. The Coso Junction Store #1 Well is located 20 yards north of an active business supply well: Coso Junction Store #2 Well. The Fossil Falls Well is a hand-operated well that supplies water for campers. At these locations, data collection procedures are in place to recognize and minimize the effects of in-well pumping. However, DTW readings from these wells can potentially be affected by significant, recent pumping of these wells.

The Cal Pumice, Coso Junction Ranch, Lego, G-36, Red Hill, 18-28 and Cinder Road Wells are not actively pumped wells, and are currently used for groundwater elevation monitoring only.

### **3.2 PORTUGUESE BENCH MONITORING POINTS**

On Portuguese Bench to the west of US 395, there are three monitoring points located at the Davis Ranch. Two of the monitoring points are supply wells for the property: Davis Ranch North and South Wells, respectively. A third monitoring point, Davis Ranch South Flow, captures outflow from the Davis Ranch South Well.

Davis Ranch North and South Wells are located just below ground surface and are artesian at the top of each well casing. Groundwater from these two wells flows into PVC supply pipes for use at Davis Ranch. At the Davis Ranch North Well, water from the PVC pipe flows downhill into a complicated, gravity-powered water-delivery system. Water from this North Well is used for consumption and irrigation. At the Davis Ranch South Well, water from the PVC pipe flows into a pond.

At the Davis Ranch North and South Wells, pressure transducers have been installed to record well head levels. A small change in head in these wells (e.g. hundredths of a foot) will result in increased or decreased flow.

Outflow from the North Well cannot be directly measured without interrupting the sensitive Davis Ranch water-delivery system. However, due to the simplicity of the water delivery system at the South Well, outflow can be directly measured without disruption. A flow metering system consisting of a trapezoidal flume and stilling well with a data-logging pressure transducer has been installed (Davis Ranch South Flow) in the PVC outflow pipe. Hourly flow measurements are being recorded by the Davis Ranch South Flow flume.

### **3.3 LITTLE LAKE RANCH MONITORING POINTS**

The Little Lake Ranch (LLR) area of Rose Valley (Figure 2) extends northwards to the mouth of the Fossil Falls Canyon, east along the volcanic scarp, west to US 395 with some property on the west side of the highway, and south through Little Lake Gap into the lower Little Lake area. As currently understood, Little Lake is fed by groundwater springs; there is no surface water flow into the lake. The surface elevation of Little Lake is controlled by a pair of weirs located in the lake's southwest corner. From these weirs a system of trenches moves surface water from Little Lake south to Pond 1 and Pond 2. Surface water exiting the Little Lake Weirs flows southeast via a trench system toward Pond 1. Coso Springs, located to the northeast of Pond 1, provides surface water to Pond 1. The Siphon Well, located between the Little Lake Weirs and Pond 1, is a siphon well which provides additional surface flow via an outlet pipe to Pond 2. Trenches



connect surface flow between Little Lake Weir, Coso Springs, Pond 1 and Pond 2. These trenches ultimately converge, and all surface water exiting the property flows through the North Culvert, located south of Pond 2, and through the Little Lake Gap area where it can be diverted by LLR staff to various ponds and irrigation trenches in the lower Little Lake area for growth of avian forage.

At the northeast end of the property is the LLR North Well. The LLR North Well is approximately 0.75 miles north of Little Lake and has no pumping infrastructure installed. Located to the southwest of LLR North Well is the LLR 395 Well. This is the primary groundwater supply well for the property. To the southeast is the LLR Ranch House Well. This is a reserve groundwater supply well that is also pumped for irrigation purposes. The LLR Dock Well is located approximately 100 feet northwest of Little Lake itself north of the Boat House, and has a gasoline-engine powered pumping system in place that is rarely pumped. The LLR Stilling Well is located southeast of the Boat House in the north end of Little Lake, and measures the water level (stage) of the lake.

The Little Lake surface level can be manually controlled by two weirs located at the southwest corner of the lake. These concrete weirs have a slat system in place and a pair of three-inch diameter holes which can be plugged or opened to release water. Surface water flowing from the Little Lake weir trench system flows through the LLR Lake Outflow flume and then is diverted into the northwest corner of Pond 1. Water from Coso Springs flows through the LLR Coso Springs Flow flume and then enters the northeast corner of Pond 1. Water leaves Pond 1 at a concrete weir in the southwest corner, and the pond's surface level can be controlled by a slat system at this weir. Water from Pond 1 flows by trench to the northwest corner of Pond 2. The LLR Siphon Well draws groundwater to the surface via a siphon pipe that discharges into Pond 2. Pond 2 has a concrete weir in the west corner and the pond's surface level can be controlled by a slat system. Water flows from Pond 2 into a trench system that runs south through the LLR North Culvert Flow flume. LLR North Culvert Flow captures surface flow from Little Lake, Coso Springs, Ponds 1 and 2, and the Siphon Well.

The LLR Hotel Well is located west of US 395 and south of Little Lake. It is a seasonally artesian well, which is not directly connected to the LLR surface water transport system.

The LLR surface water system is managed by LLR staff to place water in parts of the property as needed for wildlife and vegetation management.

A typical water management practice by LLR staff can have the following effects, for example:

In order to supply water to the lower Little Lake area, boards may be removed from the weirs at Little Lake, Pond 1 and Pond 2. Water will flow from Little Lake to the south. The resulting surface water level decline in Little Lake can be measured at the LLR Stilling Well. The LLR Lake Outflow flume will register an increase in flow. Outflow from Little Lake, Pond 1 and Pond 2, will register as increased flow at LLR North Culvert Flow. When the boards are replaced at Little Lake, at Pond 1 and at Pond 2, lake and pond levels will slowly rise. Flows will decrease at LLR Lake Outflow and LLR North Culvert Flow. Throughout this water movement event, flow from Coso Springs and the Siphon Well (if actively producing groundwater) will continue to supply water to the Ponds and, once the water levels in the Ponds have recovered, flow through North Culvert Flow.

In addition to active water management by LLR staff, wind and weather events can cause wave action that produces flow over the Little Lake Weirs. Also, if groundwater flow into Little Lake exceeds losses due to percolation and evapotranspiration, Little Lake surface level will rise, causing overflow at the lake weirs.

A spike in the LLR Lake Outflow hydrograph is typically indicative of water movement (removal of boards at the Little Lake Weirs) by LLR staff. After a time lag, increased outflow from Little Lake will also cause a spike in the LLR North Culvert Flow. A spike in the LLR North Culvert may also be caused by removal of boards at Pond 1 or 2; when only Pond boards are removed, the LLR Lake Outflow flume will not record increased flow, but the LLR North Culvert Flow will record a flow spike. Wind or weather events will cause a less dramatic increase in Lake Outflow and North Culvert Flow readings.

### **3.4 SUPPLEMENTAL DATA COLLECTION**

In addition to setting up the monitoring system and conducting monthly DTW and surface flow measurements, supplemental data was collected during the Phase 1 period.

In September 2009, a field event was conducted to evaluate groundwater levels beneath Little Lake. Temporary drive-point piezometers were installed and then removed at four locations around Little Lake to depths of four or more feet beneath the lake bottom. At all four locations, the measurements indicated a downward hydraulic gradient from Little Lake to groundwater beneath Little Lake.

A bathymetric survey was conducted in August 2009 at 21 points across Little Lake. Depth to bottom was measured and location was recorded using a hand held GPS unit. The maximum depth measured was 4.8 feet in the central section of the lake, with average depths between 3.0-4.5 feet throughout most of the lake. The lake level was approximately one foot below the top of the east weir when this bathymetry survey was conducted.

In October and December of 2009, groundwater samples were collected from three wells: Hay Ranch South, Coso Junction Store #2, and LLR North wells. These groundwater samples were lab-analyzed for Total Dissolved Solids (TDS) to establish background water quality conditions. During sample collection, a hand-held field instrument recorded specific conductivity and computed TDS data. In addition to groundwater sample collection, pressure transducers in the Hay Ranch Cluster (1A-1C and 2A-2C), Red Hill, LLR North, LLR Dock and LLR Stilling wells recorded specific conductivity and computed TDS values hourly.

Data gaps regarding various details of monitoring points were closed where possible. In active supply wells which also serve as monitoring wells, total depth and pump depths were collected from owners. Precipitation gauges were identified in Rose Valley and in the Sierra to the north and southwest of Rose Valley to provide additional information for future groundwater modeling.

### **3.5 BASELINE GROUNDWATER LEVELS**

At the conclusion of Phase 1, data from 2002 through 2009 was used to establish preliminary baseline groundwater elevations. Steve Brooks, Professional Geologist and Principal Hydrogeologist/Senior Project Manager of Schlumberger Water Services, conducted a Rose Valley Baseline Water Level Analysis. ICWD accepted these preliminary baseline levels in January, 2010, and the baseline groundwater elevations are summarized in Table 3.

## **4.0 PHASE 2 MONITORING AND REPORTING**

With the initiation of Hay Ranch South Production Well groundwater pumping by COC on December 25, 2009, the Hay Ranch Project entered into the Phase 2 Startup Monitoring and Reporting period as outlined in the HMMP. The objective of Phase 2 is to document the response of the Rose Valley aquifer to pumping at the Hay Ranch. In addition to monthly groundwater and surface water data collection from the 30 monitoring points in Rose Valley, during the initial three months of Phase 2 monitoring weekly data was collected from specific areas of Rose Valley. This hydrologic data will be used to improve initial estimates of aquifer specific yield, storage coefficients, hydraulic conductivity and groundwater recharge rates to validate or revise the numeric groundwater model.

### **4.1 MONITORING AND REPORTING**

During Fourth Quarter 2010, monthly data collection occurred at the 30 monitoring points in Rose Valley. In addition, quarterly groundwater samples were collected in December from three wells in Rose Valley to gather TDS data.

As part of Phase 2 Start-Up Monitoring and Reporting, groundwater elevation (GWE) drawdown Trigger Levels have been established for certain Rose Valley monitoring wells. Table 3.1 of the HMMP for the Hay Ranch Project establishes the Trigger Level drawdown amounts compared to pre-pumping baseline GWEs for specific monitoring wells. Trigger Levels have been set for the one-year time period. Based on data collected by TEAM during the December 2010 monthly monitoring event, the one-year Trigger Level for the Dunmovin Well has been exceeded. Table 3 compares December GWEs, pre-pumping baseline GWEs and the one-year trigger levels for Hay Ranch Project monitoring points.

Groundwater elevations were above one-year Trigger Levels at all other Hay Ranch Project monitoring wells which have baseline and trigger levels established during the fourth quarter. Also, no Maximum Acceptable Drawdowns were exceeded in Hay Ranch Project trigger wells.

For the Dunmovin Well, the baseline groundwater elevation (GWE) for Dunmovin, set by Inyo County Water Department (ICWD) in January 2010, is 3252.73 feet. The GWE at Dunmovin as measured at 10:00 on December 15, 2010 was 3250.37 feet. The one-year Trigger Level for Dunmovin is 1.1 feet. The Dunmovin GWE has decreased by 2.36 feet compared to its baseline, exceeding its one-year Trigger Level drawdown by 1.26 feet. The Dunmovin GWE was 0.44 feet above its Maximum Acceptable Drawdown level as of December 15. The maximum GWE recorded at Dunmovin Well was 3253.60 and occurred on January 21, 2010. The minimum GWE recorded at the Dunmovin Well was 3250.37 and occurred on December 15, 2010. Previously, during Second and Third Quarters 2010, the Dunmovin Well GWE had exceeded the 0.5-year and 0.75-year Trigger Levels. In both instances, Inyo County Water Department and Coso Operating Company were notified by TEAM in a timely manner regarding the Trigger Level events at Dunmovin Well.

A Dunmovin Well assessment field event was conducted on October 20, 2010. This well assessment event recorded Dunmovin Well production amounts, groundwater dynamic drawdown levels and recovery times, and pump pressure amounts. In addition physical parameters of the groundwater produced during the assessment were measured by a Horiba U52 MPS hand-held unit and a groundwater sample was collected and analyzed by a California-

Certified Analytic Laboratory for TDS. The “Dunmovin Well Assessment” letter report, summarizing the results of the October 20 field event, was submitted to ICWD on November 3, 2010. Data from the Dunmovin Well Assessment will be used to develop a mitigation plan for potential impacts from Hay Ranch Project groundwater pumping on the Dunmovin Well.

Hydrographs from the monthly field events were submitted to ICWD. These monthly hydrographs featuring the full suite of Rose Valley monitoring points were uploaded to the ICWD website: [www.inyowater.org](http://www.inyowater.org). These hydrographs along with monthly letter reports can be viewed on-line at [www.inyowater.org/coso/default/htm](http://www.inyowater.org/coso/default/htm). The December 2010 monthly hydrographs are included in this report as Appendix A.

Monthly reads from the Hay Ranch North and South Production Well totalizers documenting groundwater extraction amounts are included in this report as Table 2. The combined groundwater extraction amounts from these two production wells represent the total groundwater extracted by the Hay Ranch Project.

Hydrographs which present various Rose Valley monitoring points comparing GWEs to Hay Ranch Project pumping amounts over time are included in this report as Figures 3 through 10. Groundwater elevations, in feet above mean sea level, are listed on the left axis. Hay Ranch Project average daily pumping amounts, in acre feet per day, are listed on the right axis in inverse order. In these figures, Rose Valley monitoring points have been grouped along similar GWE contours.

A hydrograph which compares groundwater and surface water elevations in the Little Lake area to Hay Ranch Project pumping amounts over time is included in this report as Figure 11. Groundwater and surface water elevations at the LLR Dock, LRR Stilling Well (lake surface level) and LLR Hotel Well are listed, in feet above mean sea level, on the left axis. Hay Ranch Project average daily pumping amounts, in acre feet per day, are listed on the right axis in inverse order.

A hydrograph which compares groundwater and surface water elevations in the immediate vicinity of Little Lake to LLR Lake Outflow amounts over time is included in this report as Figure 12. Groundwater and surface water elevations at the LLR Dock and LLR Stilling Well (Little Lake surface level) are listed, in feet above mean sea level, on the left axis. Surface water outflow from Little Lake, captured by the LLR Lake Outflow flume in cubic feet per second, is listed on the right axis in inverse order.

A hydrograph which compares surface water flows in the Little Lake Ranch area to Hay Ranch Project pumping rates over time is also included in this report as Figure 13. Surface water flows from Lake Outflow, Coso Springs Flow and North Culvert Flow are listed on the left axis, in cubic feet per second. Hay Ranch Project average daily pumping amounts, in acre feet per day, are listed on the right axis in inverse order. As noted in Section 3.3, surface flow captured by the North Culvert Flow flume represents an accumulation of surface flows from Little Lake, Coso Springs and the Siphon Well flow.

Groundwater quality graphs are presented in Figures 14 through 16, comparing TDS levels in Rose Valley monitoring wells with Hay Ranch Project pumping amounts over time. This data is being collected by the in-well, data-logging transducers. The transducers are converting hourly specific conductivity measurements to computed TDS values. TDS values, in parts per million

(equivalent to mg/L) are listed on the left axis. Hay Ranch Project average daily pumping rates are listed on the right axis, in average acre feet per day.

A hydrograph which compares the amount of groundwater pumped from the Hay Ranch Project in acre feet (AF) with a hypothetical pumping amount is included in this report as Figure 17. The hypothetical pumping amount assumes a linear pumping rate (approximately 8.2 AF/day) which starts on December 25, 2009 and reaches 3000 AF on December 25, 2010. The Hay Ranch Project CUP sets 3000 AF as the maximum amount of groundwater extraction allowed in the first year of project pumping. As of December 23, 2010, approximately 2976 AF of groundwater had been extracted at the Hay Ranch property.

Tabular data, in digital format, of groundwater elevations and flow amounts from Rose Valley monitoring points can be obtained by contacting ICWD in writing at PO Box 337, 135 South Jackson St., Independence, CA, 93526 or by phone at (760) 878-0001.

## **4.2 GROUNDWATER QUALITY**

On December 13, 2010 groundwater samples were collected from the Hay Ranch South, Coso Junction Store #2, and Little Lake Ranch North Well as part of the quarterly monitoring activities specified in the HMMP. These groundwater samples were analyzed for TDS by TestAmerica, Inc. a California-Certified Analytical Laboratory. Prior to sample collection, groundwater was purged from each well until groundwater physical parameters stabilized, as monitored by a Horiba U52 MPS hand-held unit.

At the Hay Ranch South Well (HRS), approximately 11,000 gallons of groundwater were purged from the well preceding sample collection. The groundwater sample, HR Production, was collected from the Hay Ranch South production outflow pipe at 16:35 hours. The laboratory analytical result from HR Production was TDS 730 mg/L. The physical parameters of the groundwater from HRS outflow pipe immediately prior to sampling (16:34 hours) were as follows: temperature 22.6 C; specific conductivity 1130 uS/cm; TDS 726 mg/L.

At the Coso Junction Store #2 Well (CJS#2), the groundwater sample, CJS#2, was collected from the groundwater holding tank located 20 yards north of this active supply well. Water was purged from the holding tank's sample port until groundwater physical parameters stabilized; approximately 10 gallons of water was purged. The CJS#2 groundwater sample was collected from the holding tank's sample port at 16:12 hours. The laboratory analytical result from CJS#2 was TDS 430 mg/L. The physical parameters of the groundwater from CJS#2 holding tank immediately prior to sampling (16:10 hours) were as follows: temperature 22.7 C; specific conductivity 676 uS/cm; TDS 433 mg/L.

At the Little Lake Ranch North Well (LLR North), approximately 12 gallons of groundwater were purged from the well preceding sample collection. The groundwater sample, LLR North, was collected 11:28 hours. The laboratory analytical result from LLR North was TDS 520 mg/L. The physical parameters of the groundwater from LLR North immediately prior to sampling (11:26 hours) were as follows: temperature 23.3° C; specific conductivity 882 uS/cm; TDS 565 mg/L.

At the three wells, the TDS values from the December 13, 2010 groundwater sampling event were below “Threshold Requiring Action” values as specified in Table 3-2 of the HMMP (1500 mg/L for Coso Junction Store #2 and Little Lake Ranch North, and 2000 mg/L for Hay Ranch South Well).

#### **4.3 DATA COLLECTION AND PROCESSING**

A protocol for measuring and sampling the Rose Valley monitoring sites has been defined and instituted by TEAM with the oversight of ICWD. Transducer hanging points, flow and DTW measuring points have been marked, surveyed and standardized (where feasible). Groundwater levels are measured by lowering a sounding probe into a well and obtaining two successive readings that agree to within 0.01 feet. These measurements are referenced to a mark at the top of the casing. The results of the measurements are then recorded on field sheets.

Field sheets are copied and archived at TEAM. Data from these sheets is input into the project database program “Coso.dbf” and checked against the field sheets. Data from the Coso database is then graphed in flow and groundwater hydrographs. TEAM performs internal quality control and quality assurance checks on this data and then transmits the draft hydrographs to ICWD. After review and/or discussion with ICWD, the draft hydrographs are finalized and uploaded to the ICWD server for public posting on [www.inyowater.org](http://www.inyowater.org).

#### **4.4 OPERATIONAL NOTES**

During Fourth Quarter 2010, there was one operational issue of note:

The pressure transducer installed in HR 2A (RV080) experienced technical difficulties with power supply; as a result, the November 17 to December 23 data was lost. This transducer was replaced with a temporary unit on December 23, and a permanent replacement will be installed during the January 2011 field event.

#### **4.5 ADDITIONAL OBSERVATIONS**

During the week of December 16-23, 2010 a large storm brought significant amounts of snow to the Sierra Nevada mountains and rain to the Owens Valley floor. Preliminary data from the LADWP weather station at South Haiwee Reservoir, located approximately 5 miles north of the Hay Ranch property, reported approximately 4.5 inches of precipitation during the December 16-23 period. During the same date range, preliminary data from the BLM’s Remote Automated Weather Station (RAWS) at Five Mile Canyon road (station FMRC1), located approximately 5 miles south-southwest of Little Lake at an elevation of 4,150 feet, reported approximately 3.5 inches of precipitation. Preliminary data from the California Department of Water Resources’ Cottonwood Lakes weather station, located approximately 30 miles north of the Hay Ranch property in the Sierra at an elevation of 10,150 feet, reported approximately 10 inches of water content in the form of snow during the same date range.

The December 2010 monthly monitoring event occurred before the week of significant precipitation. During the January 2011 monthly monitoring event, Rose Valley hydrologic data will be examined in light of this precipitation event and any data variations will be noted in both the January 2011 monthly letter report and also the First Quarter 2011 quarterly report. Also, any additional physical observations at Rose Valley monitoring points relating to the precipitation event will be noted.

#### **4.6 PHASE 3: MODEL RECALIBRATION**

Work on Phase 3: Model Recalibration and Redefinition of Pumping Rates and Duration was initiated with ICWD retaining DBS&A as the groundwater modeler for Phase 3 of the Hay Ranch Project in April 2010. An initial field visit to Rose Valley with TEAM, DBS&A, and ICWD staff was conducted on April 30, 2010. The purpose of this field event was to introduce DBS&A staff to the Hay Ranch Project's location and monitoring network. Phase 2 Hay Ranch Project hydrologic data, including groundwater monitoring data through September 2010, was transmitted from ICWD and TEAM to DBS&A in September 2010. This monitoring data was used by DBS&A for Phase 3 groundwater flow model recalibration. DBS&A submitted a letter report to ICWD on December 22, 2010 which outlined preliminary predictive simulation results obtained using the updated and recalibrated Rose Valley groundwater flow model. In a December 22, 2010 memo titled "Coso/Hay Ranch Project Phase 3 Wrap-up," ICWD described the timeline and process for the completion of Phase 3 work. The timeline for completion of Phase 3 work runs from December, 2010 to March 2011. The process includes setting interim pumping rates for the December to March time period, review and circulation of the final Phase 3 report, a 30-day public review period for the final Phase 3 report, ICWD consideration of public comments, and the finalization of Hay Ranch Project pumping rates, durations, and trigger levels.

During the December 2010 to March 2011 interim time period, the Hay Ranch Project pumping rate was set at 3000 AF/yr and the water level triggers were set at the maximum acceptable drawdowns given in Table 3-1 of the HMMP.

## **5.0 GENERAL CONDITIONS**

Geology, hydrogeology and geochemistry are inexact sciences, and investigative data commonly contain large uncertainties. The behavior of groundwater can be complex. Our judgments and conclusions are based upon the analytical data obtained from groundwater measurements collected by TEAM, data supplied to TEAM by COC, Inyo County and other sources, as well as our experience on similar projects. Services performed for this project by TEAM Engineering & Management, Inc. are in accordance with professional standards for groundwater and hydrologic assessment investigations; no guarantees are either expressed or implied.



## **TABLES**

**TABLE 1**  
**HAY RANCH PROJECT MONITORING POINT SUMMARY**

Well ID	Well Name	Hay Ranch Project FEIR HMMP reference names from HMMP Tables 3-1 and 3-2	Monitoring Role	Current Well Use	Transducer Installed	Data Logging Frequency
RV-10	Enchanted Village	Wells located west of Haiwee Reservoir	Observation	Active Supply	No	NA
RV-20	LADWP V816	Same	Observation	Inactive	No	NA
RV-30	Cal Pumice	Pumice Mine Well	Trigger	Inactive	Yes	Hourly
RV-40	Dunmovin	Same or Dunmovin Area well	Trigger	Active Supply	No	NA
RV-50	Hay Ranch North	Same	Production/GWQ	Production	Flow Meter	NA
RV-60	HR 1A	Six New Hay Ranch Observation wells	Undecided	Inactive	Yes	Hourly
RV-61	HR 1B	Six New Hay Ranch Observation wells	Undecided	Inactive	Yes	Hourly
RV-62	HR 1C	Six New Hay Ranch Observation wells	Undecided	Inactive	Yes	Hourly
RV-70	Hay Ranch South	Same	Production/GWQ	Production	Flow Meter	NA
RV-80	HR 2A	Six New Hay Ranch Observation wells	Undecided	Inactive	Yes	Hourly
RV-81	HR 2B	Six New Hay Ranch Observation wells	Undecided	Inactive	Yes	Hourly
RV-82	HR 2C	Six New Hay Ranch Observation wells	Undecided	Inactive	Yes	Hourly
RV-90	Coso Jct Ranch	Coso Ranch North	Trigger	Inactive	Yes	Hourly
RV-100	Coso Jct Store #1	Coso Junction #1	Trigger/GWQ (#2)	Inactive/Active Supply*	Yes	Hourly
RV-110	Davis Ranch North	Not Mentioned	Observation	Artesian	Yes	Hourly
RV-111	Davis Ranch South	Not Mentioned	Observation	Artesian	Yes	Hourly
RV-112	Davis Ranch South Flow	Not Mentioned	Observation	Flume	Yes	Hourly
RV-120	Red Hill (BLM)	New well to be located between Coso Jnc and Cinder Road Red Hill	Trigger**	Inactive	Yes	Hourly
RV-130	Well G36	Well G-36 or Navy G-36 Well	Trigger	Inactive	No	NA
RV-140	Lego	Same or Navy Lego Well	Trigger	Inactive	Yes	Hourly
RV-150	Cinder Road	Cinder Road, Red Hill	Trigger	Inactive	Yes	Hourly
RV-160	Well 18-28 GTH	Well 18-28 or Navy 18-28 Well	Trigger	Inactive	Yes	Hourly
RV-170	Fossil Falls Campground	Same	Observation	Active Supply	No	NA
RV-180	LLR North	Little Lake Ranch North Well	Trigger/GWQ	Inactive	Yes	Hourly
RV-190	LLR 395	Little Lake Major Operational Changes	Observation	Active Supply	No	NA
RV-200	LLR Ranch	Little Lake Major Operational Changes	Observation	Active Supply	No	NA
RV-210	LLR Dock	Little Lake North Dock Well	Observation	Inactive	Yes	Hourly
RV-220	LLR Lake Stilling	Little Lake	Observation	Actively Managed	Yes	Hourly
RV-230	LLR Lake Outflow	Little Lake Weir	Observation	Actively Managed Flume	Yes	Hourly
RV-240	LLR Coso Springs	Coso Springs	Observation	Flume	Yes	Hourly
RV-245	LLR North Culvert	Little Lake North Culvert Weir	Observation	Actively Managed Flume	Yes	Hourly
RV-250	LLR Siphon	Pond P1 Siphon Well***	Observation	Active Siphon	No	NA
RV-260	LLR Hotel	Little Lake Hotel Well	Observation	Inactive	Yes****	Hourly

GWQ- Groundwater Quality monitoring well

\* RV-100 Coso Jct Store #1 Well is an inactive well located approximately 20 yards north of Coso Jct Store #2 well which is an active supply well where groundwater quality is being recorded.

\*\* Trigger Levels for RV-120 were not set in HMMP Table 3-1. However, a preliminary baseline level was set in January, 2010.

\*\*\* RV-250 LLR Siphon Well supplies water directly to LLR Pond 2, not LLR Pond 1 as erroneously stated in the HMMP.

\*\*\*\* RV-260 LLR Hotel Well is a seasonally artesian well. Hourly pressure transducer reads are occurring during periods of non-artesian groundwater elevations.

**TABLE 2**  
**HAY RANCH PROJECT GROUNDWATER PUMPING TO DATE**  
**DECEMBER 2010**

**HAY RANCH PRODUCTION WELLS**

Date: 12/25/2009      HRS A Totalizer Initial Read (gallons):      741,800,000  
 Date: 05/14/2010      HRS A Totalizer Final Read (gallons):      987,094,000

Date: 05/12/2010      HRS B Totalizer Initial Read (gallons):      0  
 Date: 12/23/2010      HRS B Totalizer Recent Read (gallons)      459,455,000

Date: 05/12/2010      HRN C Totalizer Initial Read (gallons):      0  
 Date: 12/23/2010      HRN C Totalizer Recent Read (gallons)      264,959,000

Date Numeric	Date Short	Total Days Elapsed	Total Gallons Pumped Since 12/25/2009	Total Acre Feet Pumped Since 12/25/2009	Days in Period	Total Gallons Pumped for period	Acre Feet Pumped for period	Average Daily Acre Feet Pumped for period
40172	12/25/09	0	-	0.0	0.0	0	0.0	0.0
40175	12/28/09	3.5	2,902,000	8.9	3.5	2,902,000	8.9	2.5
40182	1/4/10	10.5	9,469,000	29.1	7.0	6,567,000	20.2	2.9
40189	1/11/10	17.5	18,101,000	55.5	7.0	8,632,000	26.5	3.8
40196	1/18/10	24.5	24,009,000	73.7	7.0	5,908,000	18.1	2.6
40199	1/21/10	27.5	28,463,000	87.3	3.0	4,454,000	13.7	4.6
40203	1/25/10	31.5	33,589,000	103.1	4.0	5,126,000	15.7	3.9
40210	2/1/10	38.5	40,633,000	124.7	7.0	7,044,000	21.6	3.1
40217	2/8/10	45.5	46,049,000	141.3	7.0	5,416,000	16.6	2.4
40224	2/15/10	52.5	55,035,000	168.9	7.0	8,986,000	27.6	3.9
40227	2/18/10	55.5	59,004,000	181.1	3.0	3,969,000	12.2	4.1
40231	2/22/10	59.5	67,248,000	206.4	4.0	8,244,000	25.3	6.3
40238	3/1/10	66.5	81,177,000	249.1	7.0	13,929,000	42.7	6.1
40245	3/8/10	73.5	96,304,000	295.5	7.0	15,127,000	46.4	6.6
40252	3/15/10	80.5	114,238,000	350.6	7.0	17,934,000	55.0	7.9
40254	3/17/10	82.5	120,024,000	368.3	2.0	5,786,000	17.8	8.9
40259	3/22/10	87.5	132,704,000	407.3	5.0	12,680,000	38.9	7.8
40266	3/29/10	96.5	151,531,000	465.0	7.0	18,827,000	57.8	8.3
40281	4/13/10	109.5	190,826,000	585.6	15.0	39,295,000	120.6	8.0
40312	5/14/10	140.5	248,524,000	762.7	31.0	57,698,000	177.1	5.7
40347	6/18/10	175.5	325,519,000	999.0	35.0	76,995,000	236.3	6.8
40380	7/21/10	208.5	384,977,000	1181.5	33.0	59,458,000	182.5	5.5
40408	8/18/10	236.5	461,484,000	1416.2	28.0	76,507,000	234.8	8.4
40436	9/15/10	264.5	569,767,000	1748.6	28.0	108,283,000	332.3	11.9
40471	10/20/10	299.5	719,918,000	2209.3	35.0	150,151,000	460.8	13.2
40499	11/17/10	327.5	843,610,000	2588.9	28.0	123,692,000	379.6	13.6
40527	12/15/10	355.5	942,496,000	2892.4	28.0	98,886,000	303.5	10.8
40535	12/23/10	363.5	969,708,000	2975.9	8.0	27,212,000	83.5	10.4

**Notes:**

Data based on manual reads by TEAM of the Hay Ranch North and South Well Totalizers.

Hay Ranch Project groundwater pumping was initiated on 12/25/09.

The HRS A Totalizer, measuring groundwater pumped from Hay Ranch South Well, was discontinued on May 12, 2010 and subsequently uninstalled.

After May 12, 2010 groundwater pumped from Hay Ranch South Well flows into the permanent Hay Ranch Water Tank and is measured by the HRS B Totalizer.

The Hay Ranch North Well is the reserve production well and groundwater pumped from this well is measured at the HRN C Totalizer.

**TABLE 3**  
**HAY RANCH PROJECT GROUNDWATER BASELINES AND TRIGGER LEVELS**  
December 2010

Well ID	Monitoring Point	Baseline GWE <sup>1</sup>	Recent Date of Measurement	Recent GWE	Recent GWE Compared to Baseline	Recent GWE Above Max DD <sup>2</sup>	Trigger Level At 1 year elapsed	Recent GWE Compared to Trigger Level
RV-30	Cal Pumice	TBD <sup>3</sup>	12/15/10	3252.86	NA	NA	5.3	NA
RV-40	Dunmovin	3252.73	12/15/10	3250.37	-2.36	0.44	1.1	-1.26
RV-90	Coso Jct Ranch	3230.65	12/15/10	3231.68	1.03	3.53	1.4	2.43
RV-100	Coso Jct Store #1	3227.59	12/15/10	3227.96	0.37	2.67	1.2	1.57
RV-120	Red Hill Well	3200.66	12/15/10	3201.00	0.34	TBD <sup>4</sup>	TBD <sup>4</sup>	NA
RV-130	G-36	3198.35	12/15/10	3199.97	1.62	2.72	0.2	1.82
RV-140	Lego	3199.21	12/15/10	3200.84	1.63	2.73	0.2	1.83
RV-150	Cinder Road	3186.92	12/15/10	3187.03	0.11	0.81	0.2	0.31
RV-160	18-28 GTH	3187.67	12/15/10	3188.66	0.99	1.99	0.2	1.19
RV-180	LLR North Well	3158.88	12/13/10	3159.02	0.14	0.54	0.2	0.34

1) GWE: Groundwater elevation measured in feet above mean sea level. Baseline GWEs set 1/25/10 and approved by Inyo County Water Department

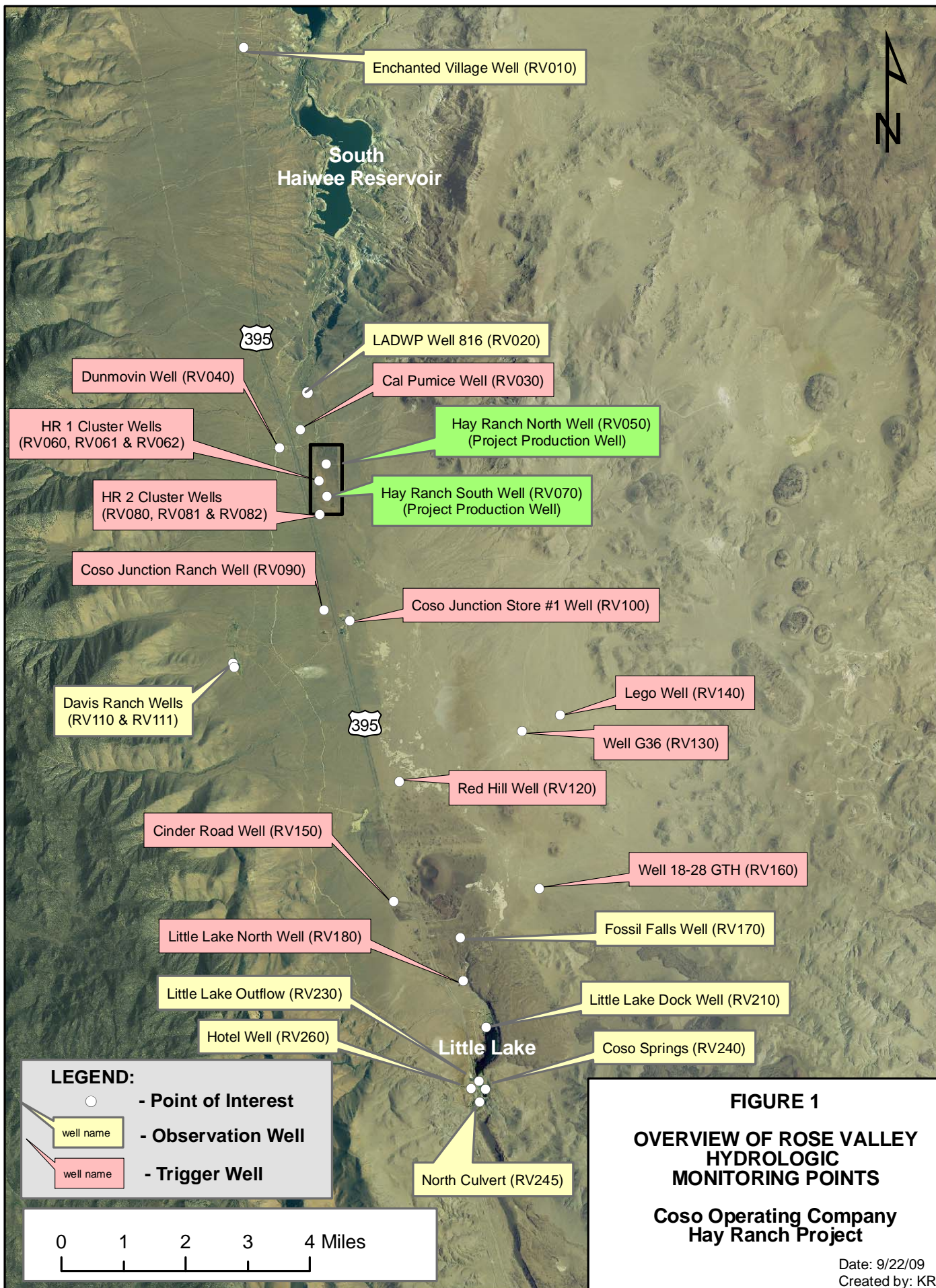
2) Max DD: Maximum Acceptable Drawdown from HMMP Table 3-1

3) Cal Pumice Well baseline groundwater elevation has not been set

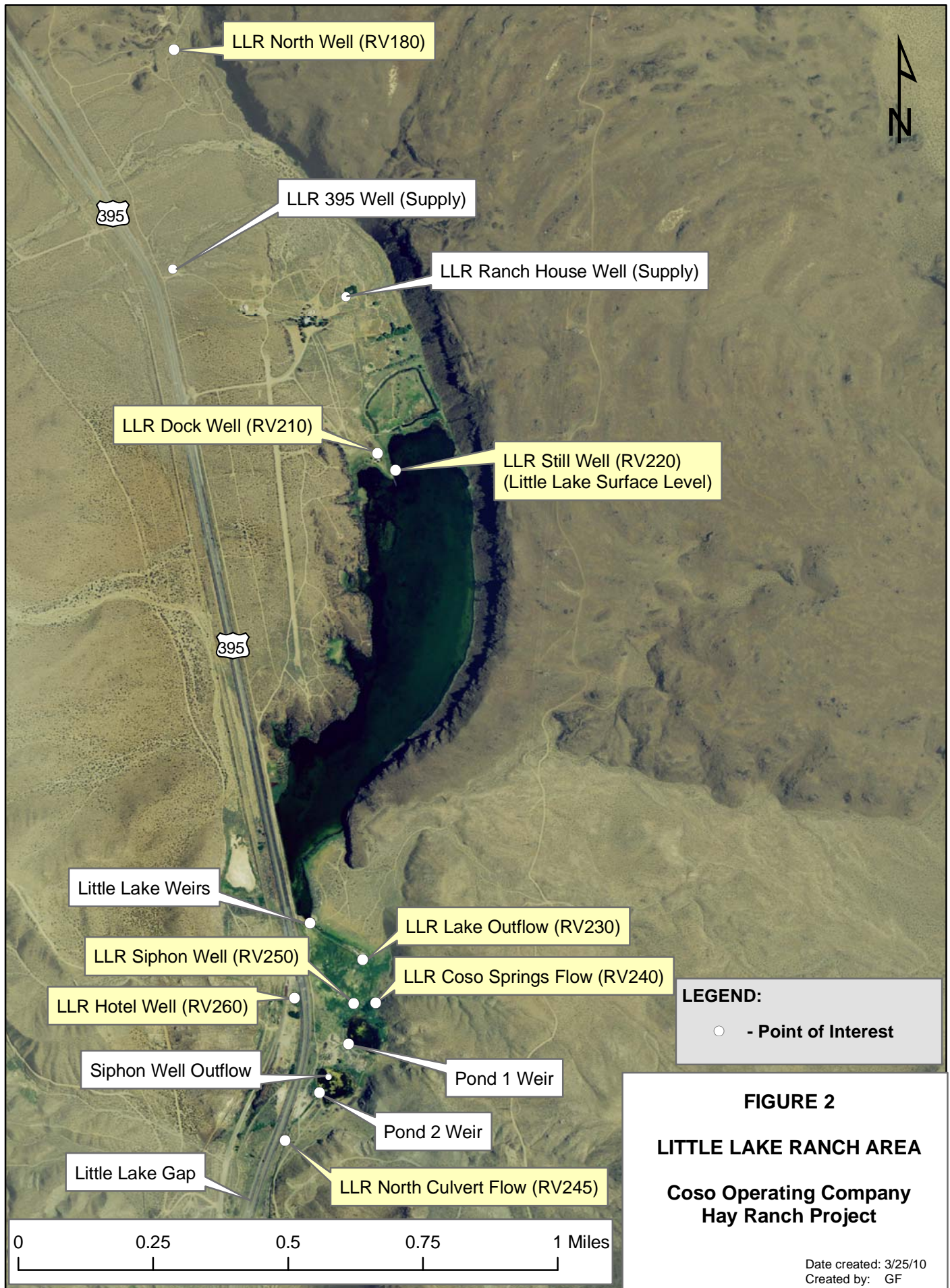
4) Trigger Levels and Maximum Acceptable Drawdown levels for Red Hill Well have not been set

## **FIGURES**



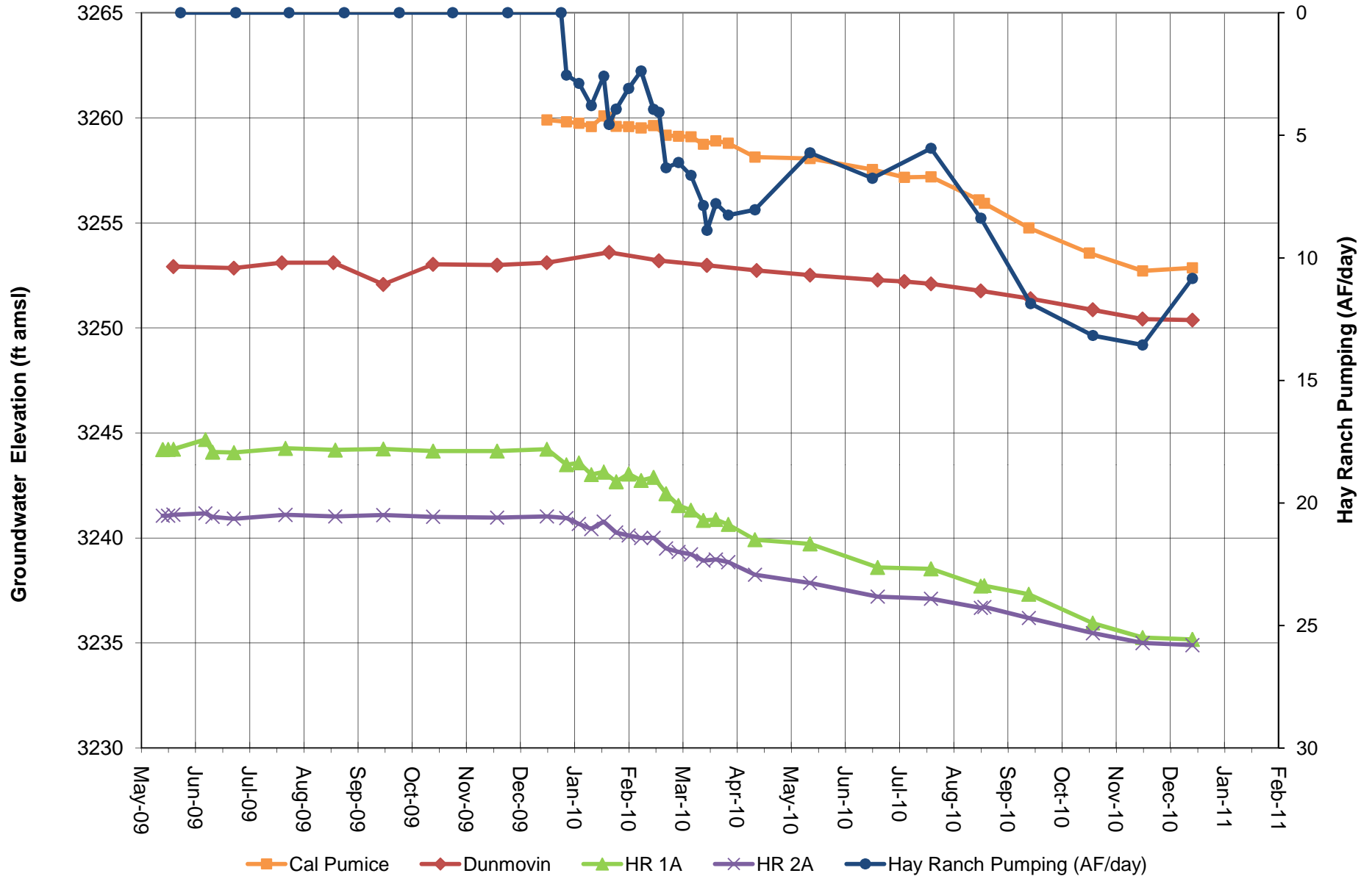






**FIGURE 3**

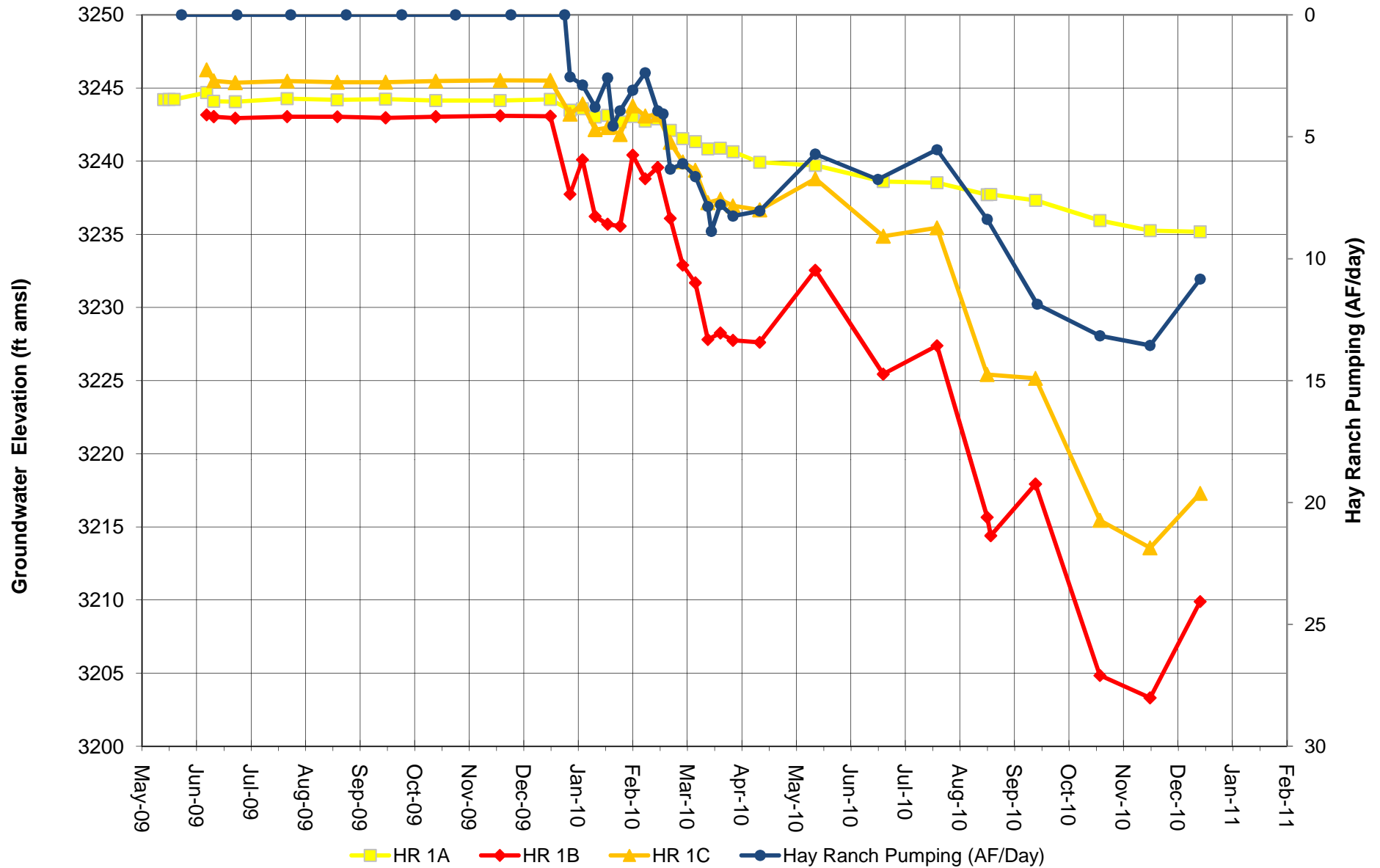
GROUNDWATER ELEVATION and HAY RANCH PUMPING  
Cal Pumice, Dunmovin, HR 1A and HR 2A



Note: Groundwater elevation data based on manual depth-to-water measurements.  
Hay Ranch pumping is average acre feet per day.  
Coso Operating initiated Hay Ranch Project pumping on 12/25/09.

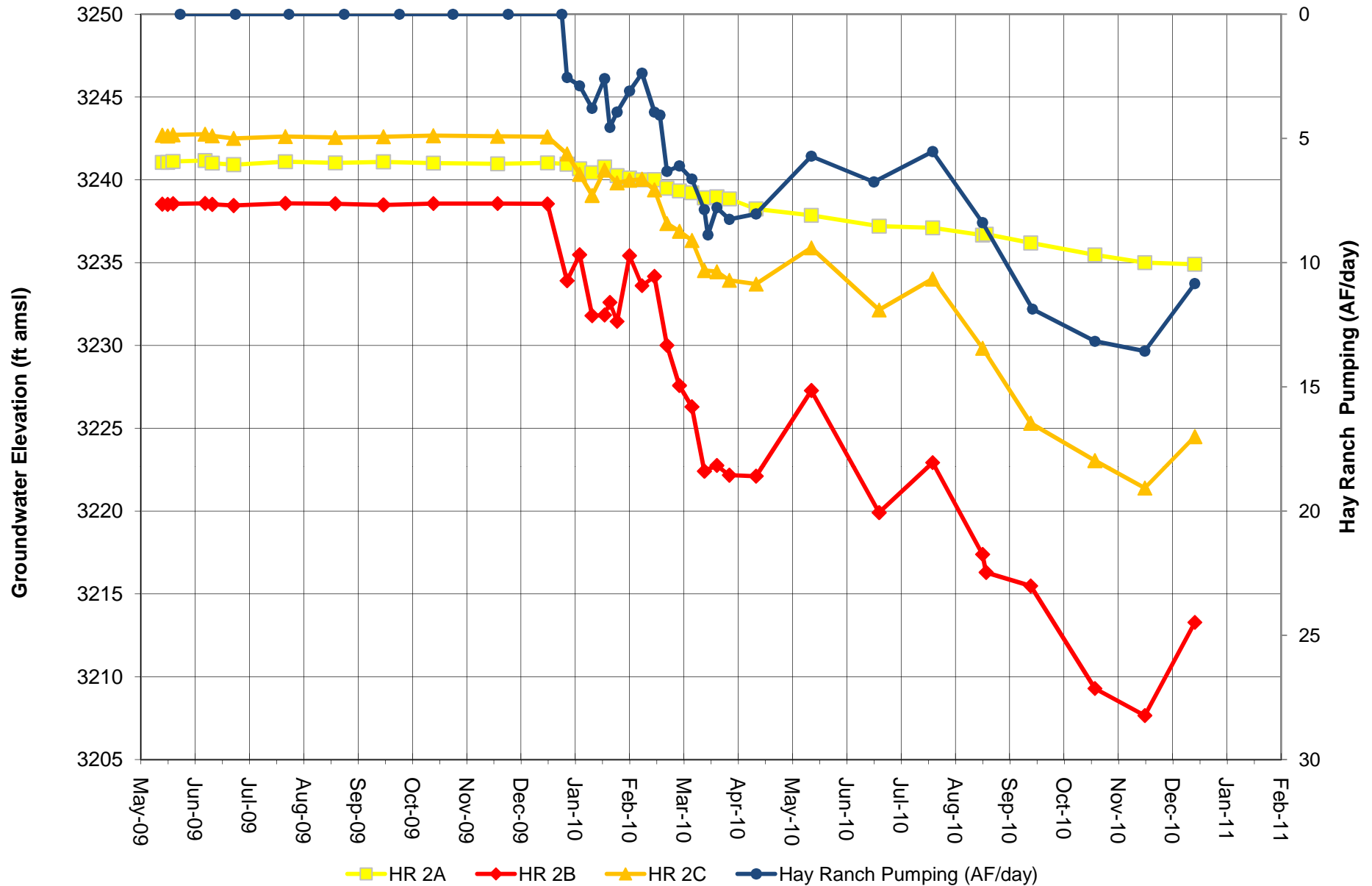


**FIGURE 4**  
GROUNDWATER ELEVATION and HAY RANCH PUMPING  
HR 1A, HR 1B and HR 1C



Note: GWE data based on manual DTW measurements. Hay Ranch pumping is average acre feet per day.  
Screened intervals: HR 1A 170-260 feet; HR 1B 490-540 feet; HR 1C 340-405 feet.  
Coso Operating initiated Hay Ranch Project pumping on 12/25/09.

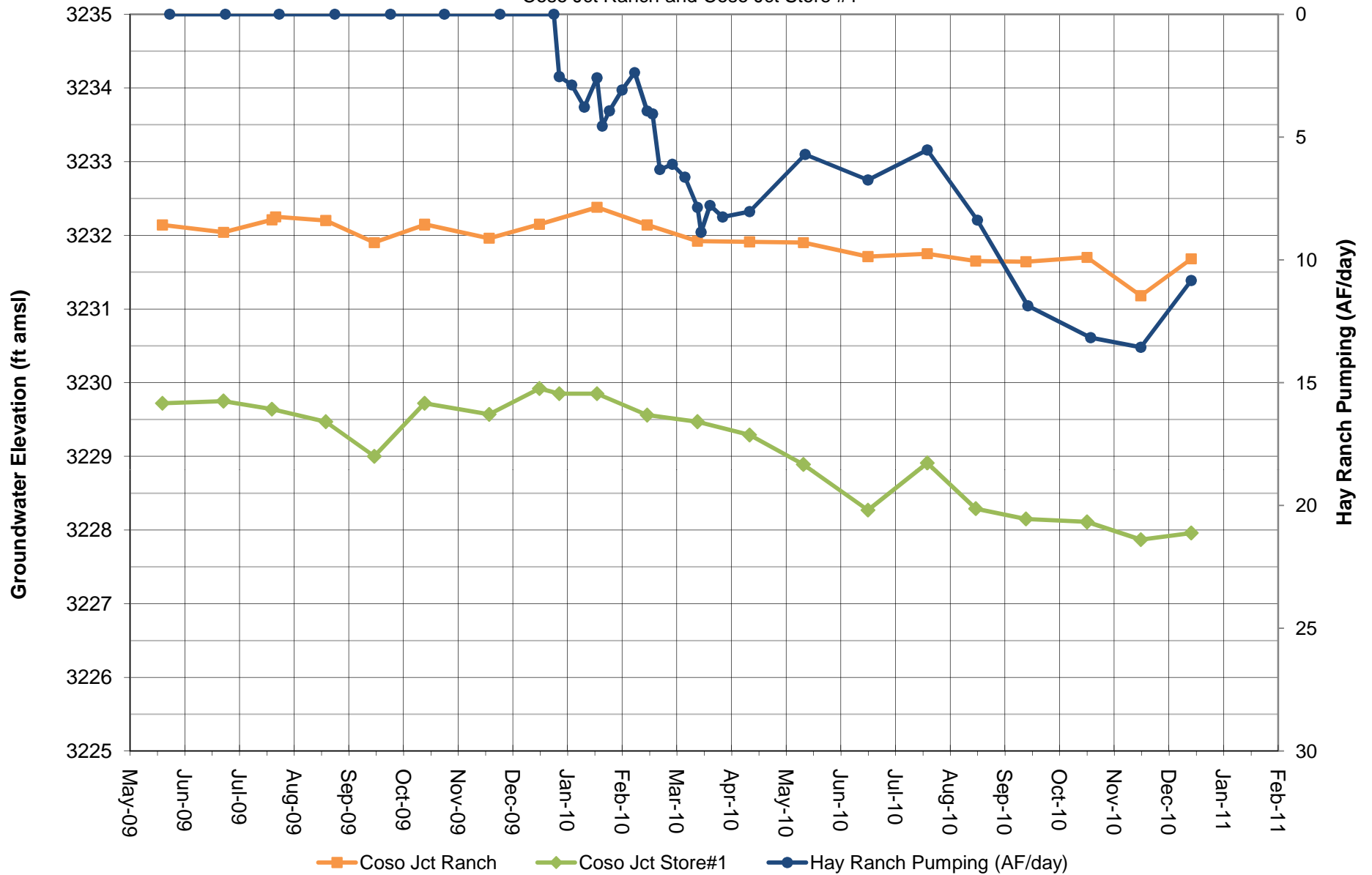
**FIGURE 5**  
GROUNDWATER ELEVATION and HAY RANCH PUMPING  
HR 2A, HR 2B and HR 2C



Note: GWE data based on manual DTW measurements. Hay Ranch pumping is average acre feet per day.  
Screened intervals: HR 2A 180-300 feet; HR 2B 519-584 feet; HR 2C 370-420 feet.  
Coso Operating initiated Hay Ranch Project pumping on 12/25/09.

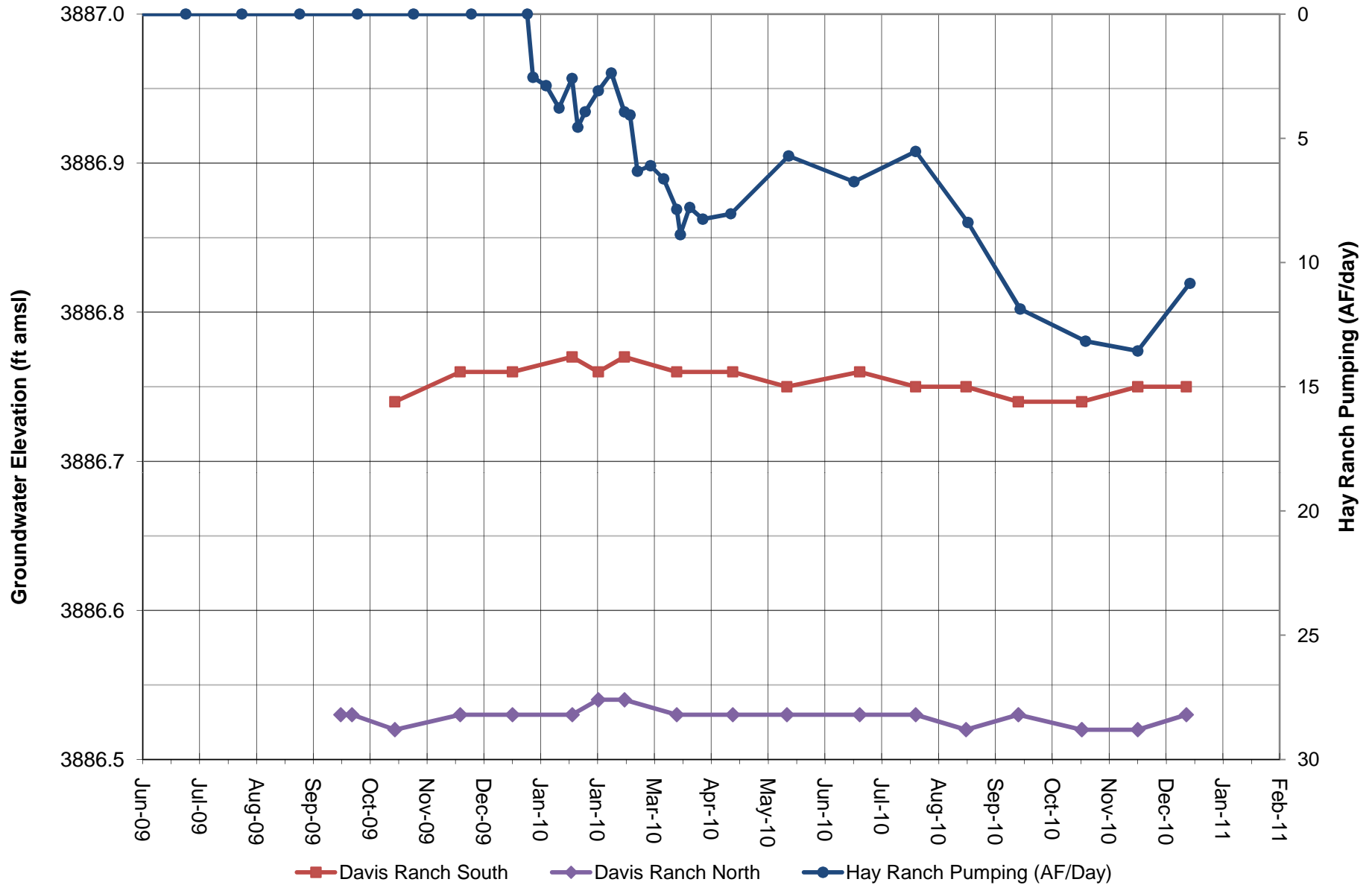
**FIGURE 6**

GROUNDWATER ELEVATION and HAY RANCH PUMPING  
Coso Jct Ranch and Coso Jct Store #1



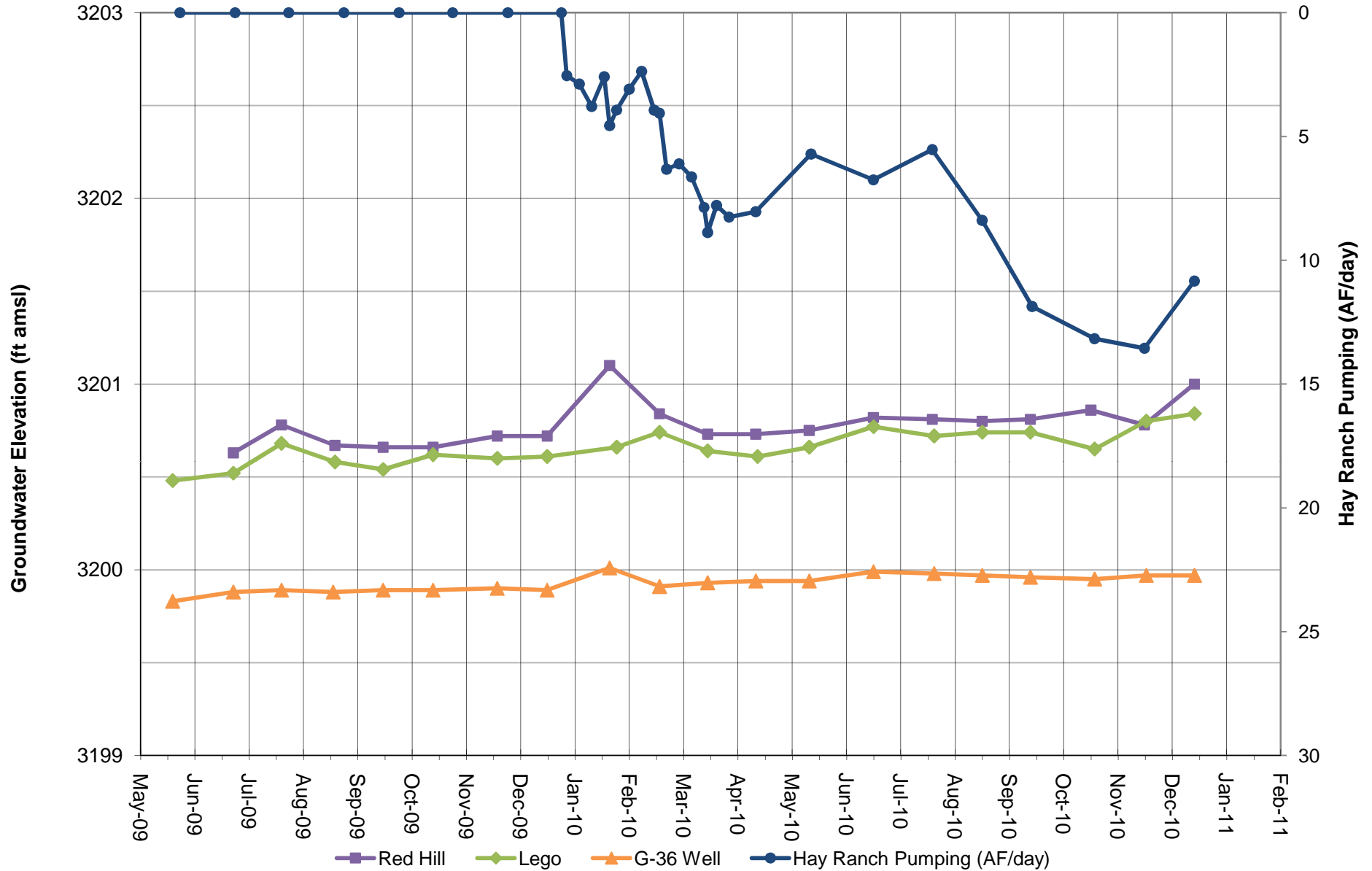
Note: Groundwater elevation data based on manual depth-to-water measurements.  
Hay Ranch pumping is average acre feet per day.  
Coso Operating initiated Hay Ranch Project pumping on 12/25/09.

**FIGURE 7**  
GROUNDWATER ELEVATION and HAY RANCH PUMPING  
Davis Ranch North and South



Note: Groundwater elevation data based on manual depth-to-water measurements.  
Hay Ranch pumping is average acre feet per day.  
Coso Operating initiated Hay Ranch Project pumping on 12/25/09.

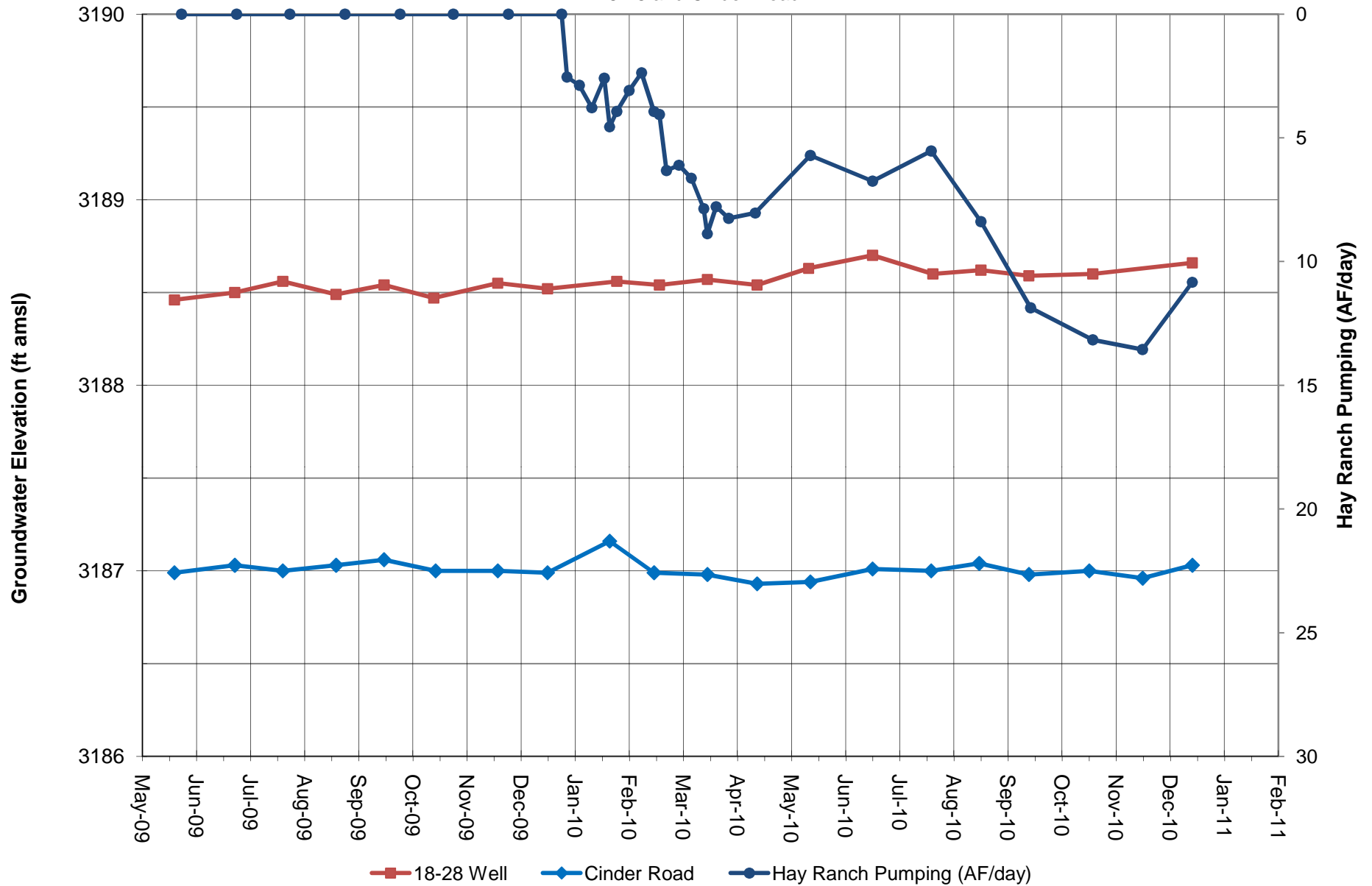
**FIGURE 8**  
GROUNDWATER ELEVATION and HAY RANCH PUMPING  
Red Hill, Lego and G-36



Note: Groundwater elevation data based on manual depth-to-water measurements.  
Hay Ranch pumping is average acre feet per day.  
Coso Operating initiated Hay Ranch Project pumping on 12/25/09.

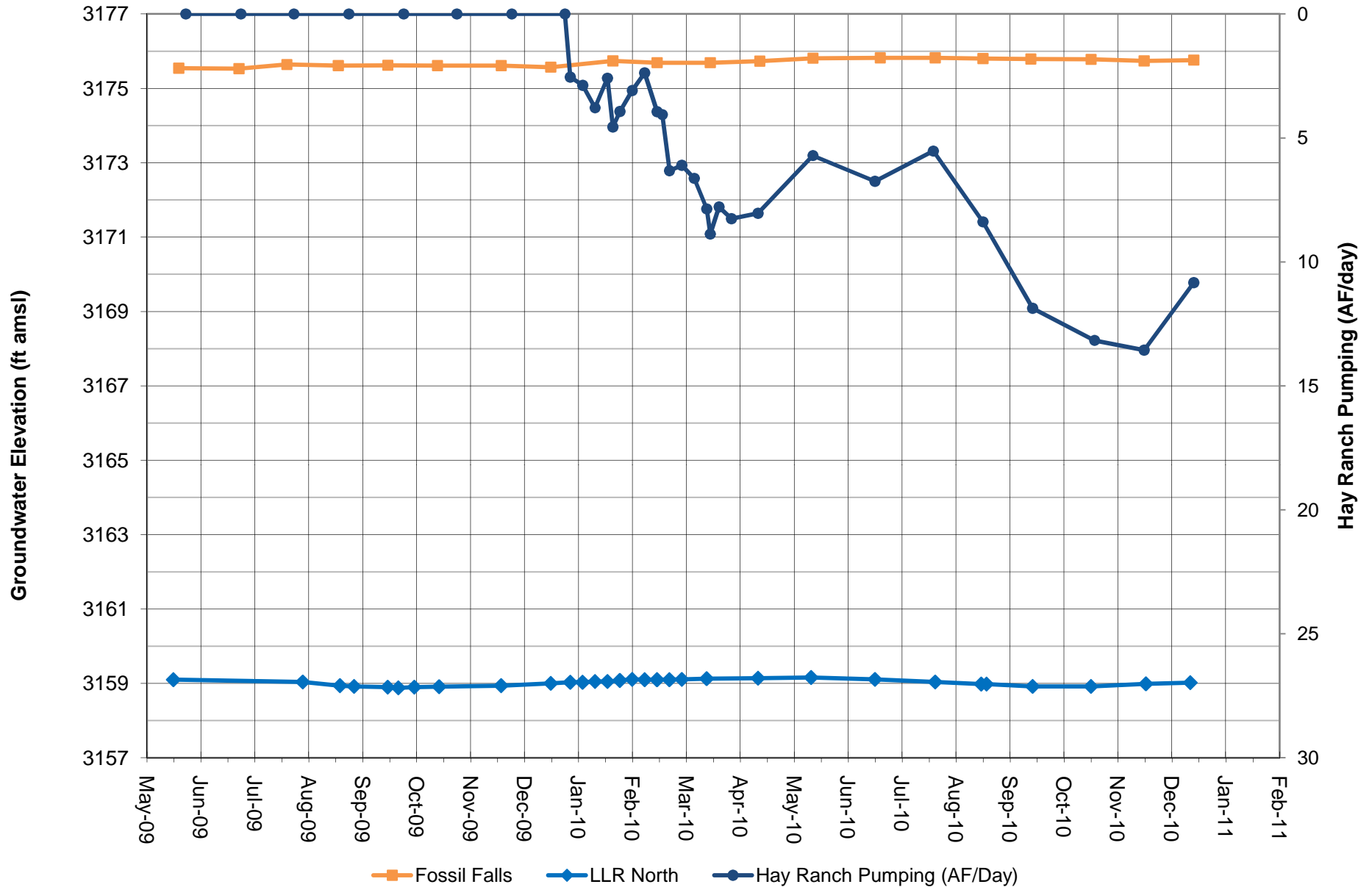
**FIGURE 9**

GROUNDWATER ELEVATION and HAY RANCH PUMPING  
18-28 and Cinder Road



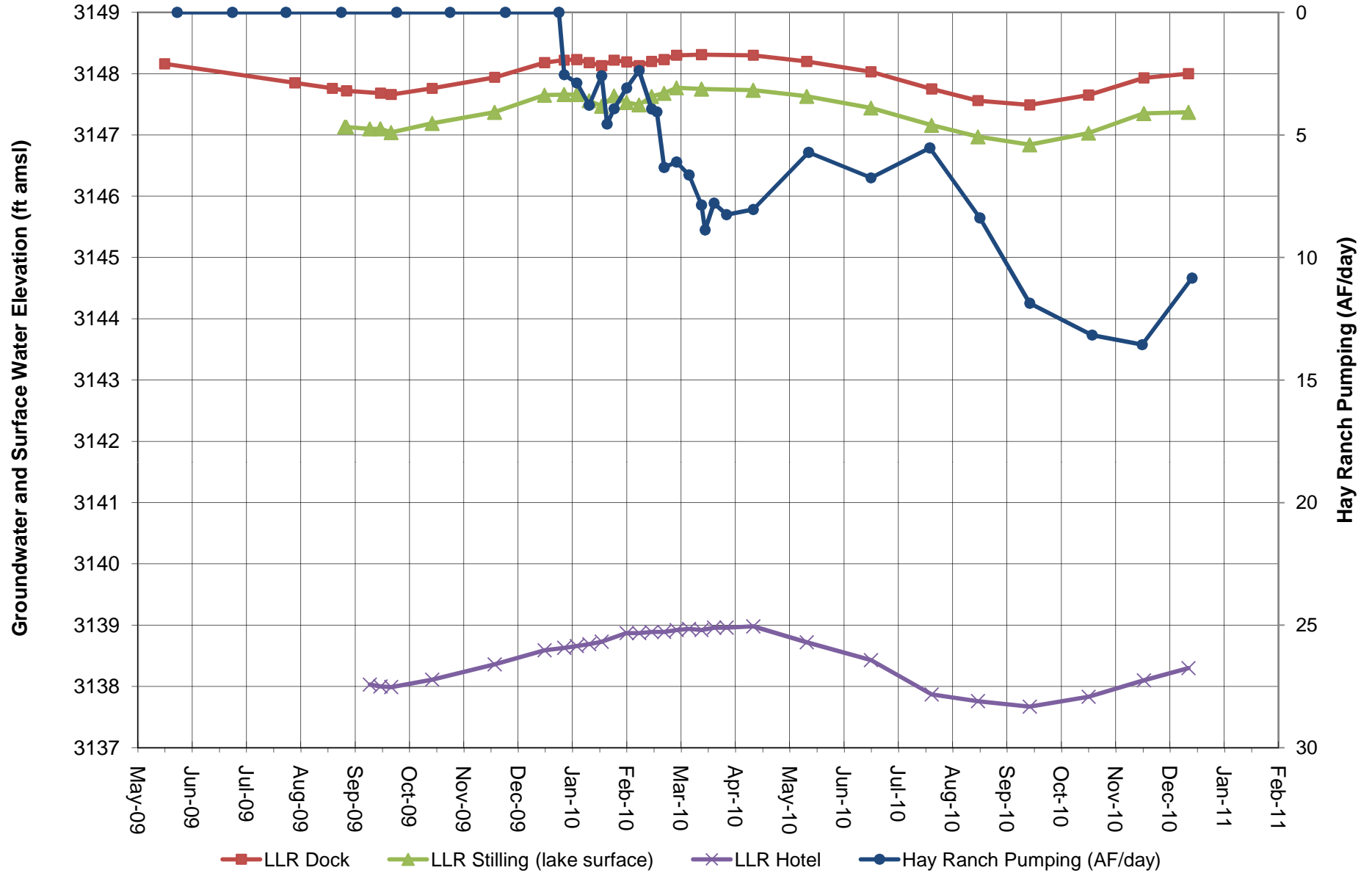
Note: Groundwater elevation data based on manual depth-to-water measurements.  
Hay Ranch pumping is average acre feet per day.  
Coso Operating initiated Hay Ranch Project pumping on 12/25/09.

**FIGURE 10**  
**GROUNDWATER ELEVATION and HAY RANCH PUMPING**  
 Fossil Falls and LLR North



Note: Groundwater elevation data based on manual depth-to-water measurements.  
 Hay Ranch pumping is average acre feet per day.  
 Coso Operating initiated Hay Ranch Project pumping on 12/25/09.

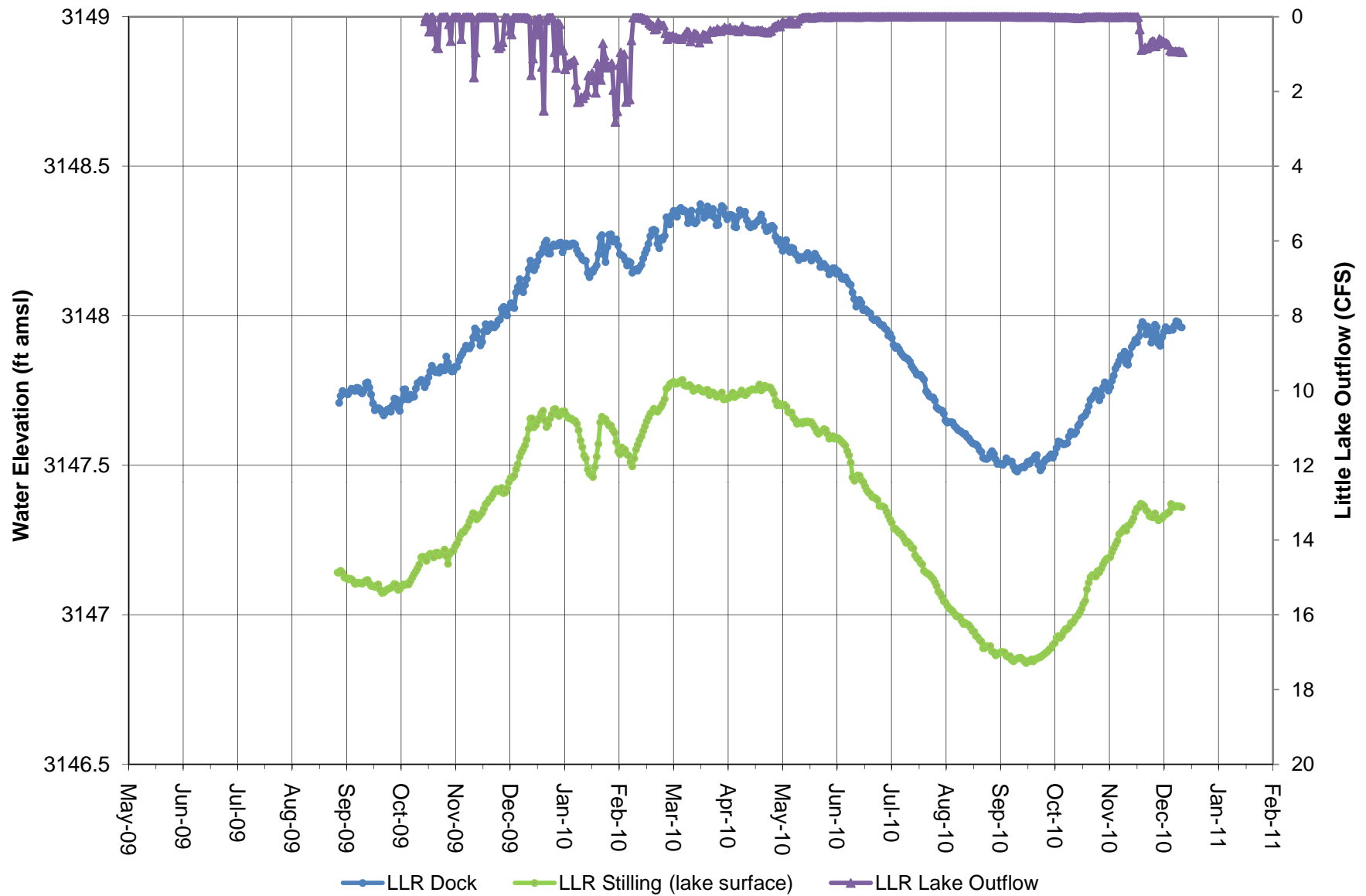
**FIGURE 11**  
**WATER ELEVATION and HAY RANCH PUMPING**  
 LLR Dock, LLR Stilling and LLR Hotel



Note: Groundwater and surface water elevation data based on manual depth-to-water measurements.  
 Hay Ranch pumping is average acre feet per day.  
 Coso Operating initiated Hay Ranch Project pumping on 12/25/09.

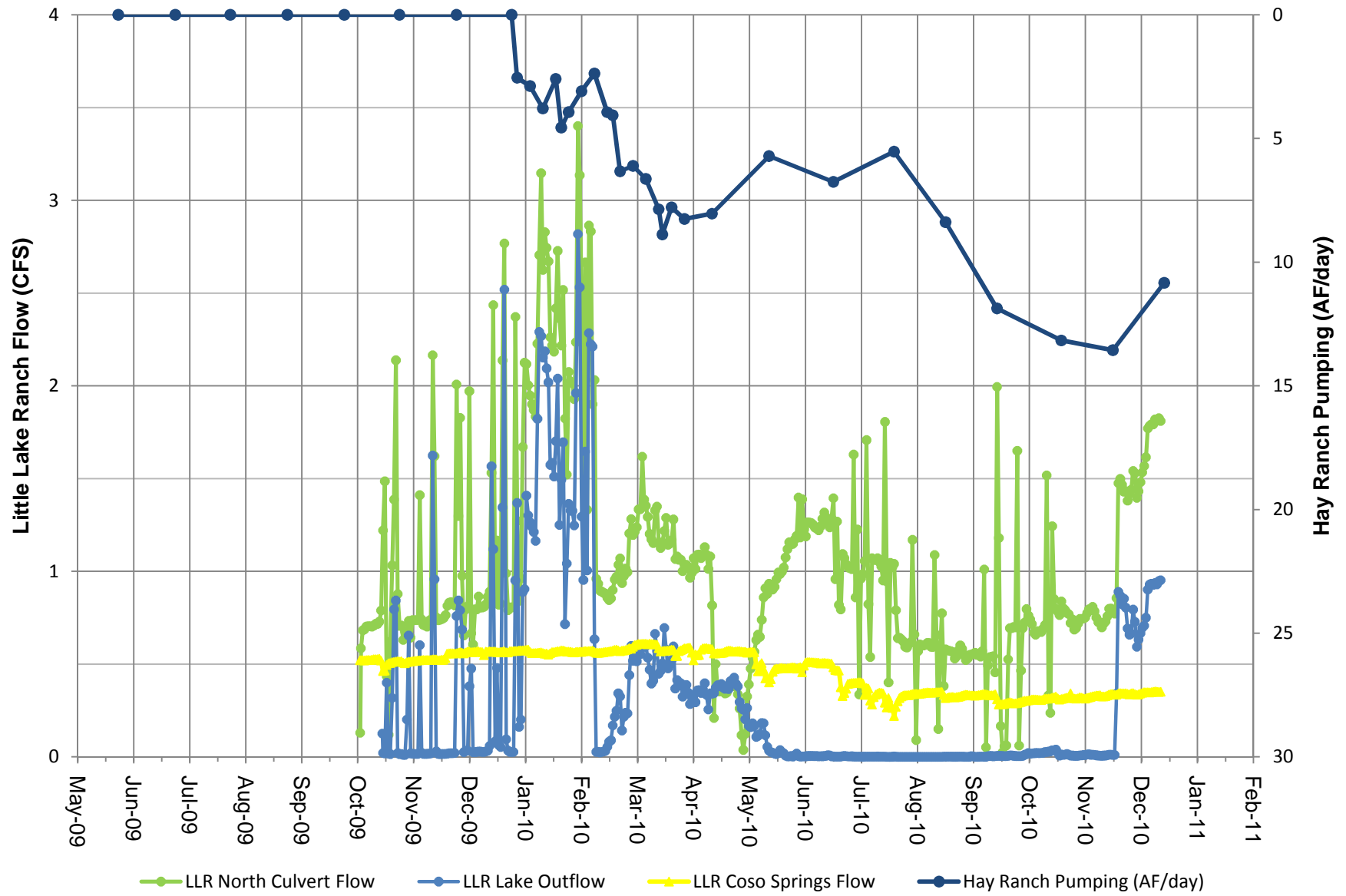


**FIGURE 12**  
**WATER ELEVATION and LITTLE LAKE OUTFLOW**  
**LLR Dock and LLR Stilling**



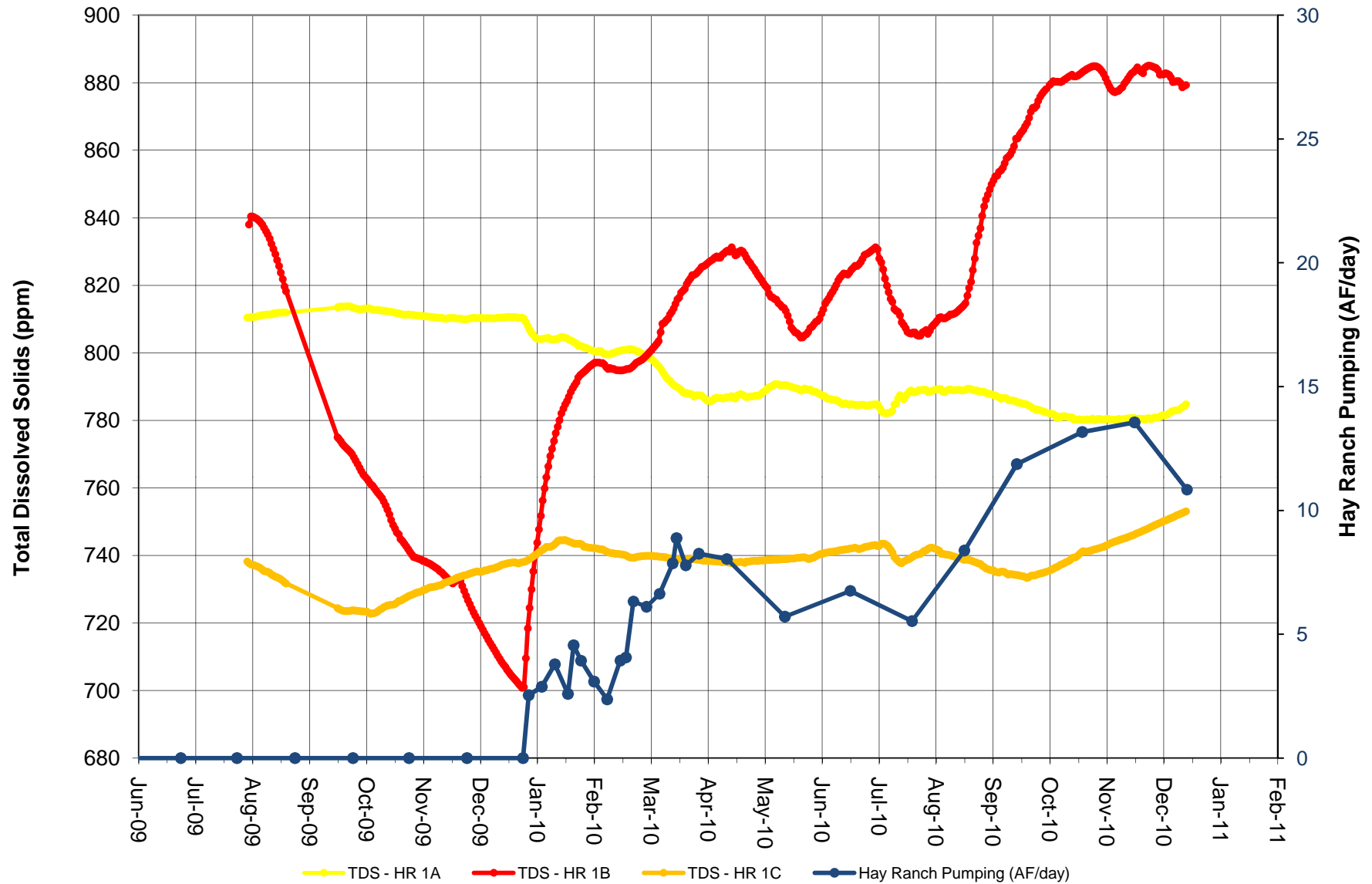
Note: Groundwater and surface water elevations based on pressure transducer data.  
 Little Lake Outflow based on pressure transducer data; flow is cubic feet per second.  
 Coso Operating initiated Hay Ranch Project pumping on 12/25/09.

**FIGURE 13**  
**LLR FLOW and HAY RANCH PUMPING**  
**North Culvert, Coso Springs and Little Lake Outflow**



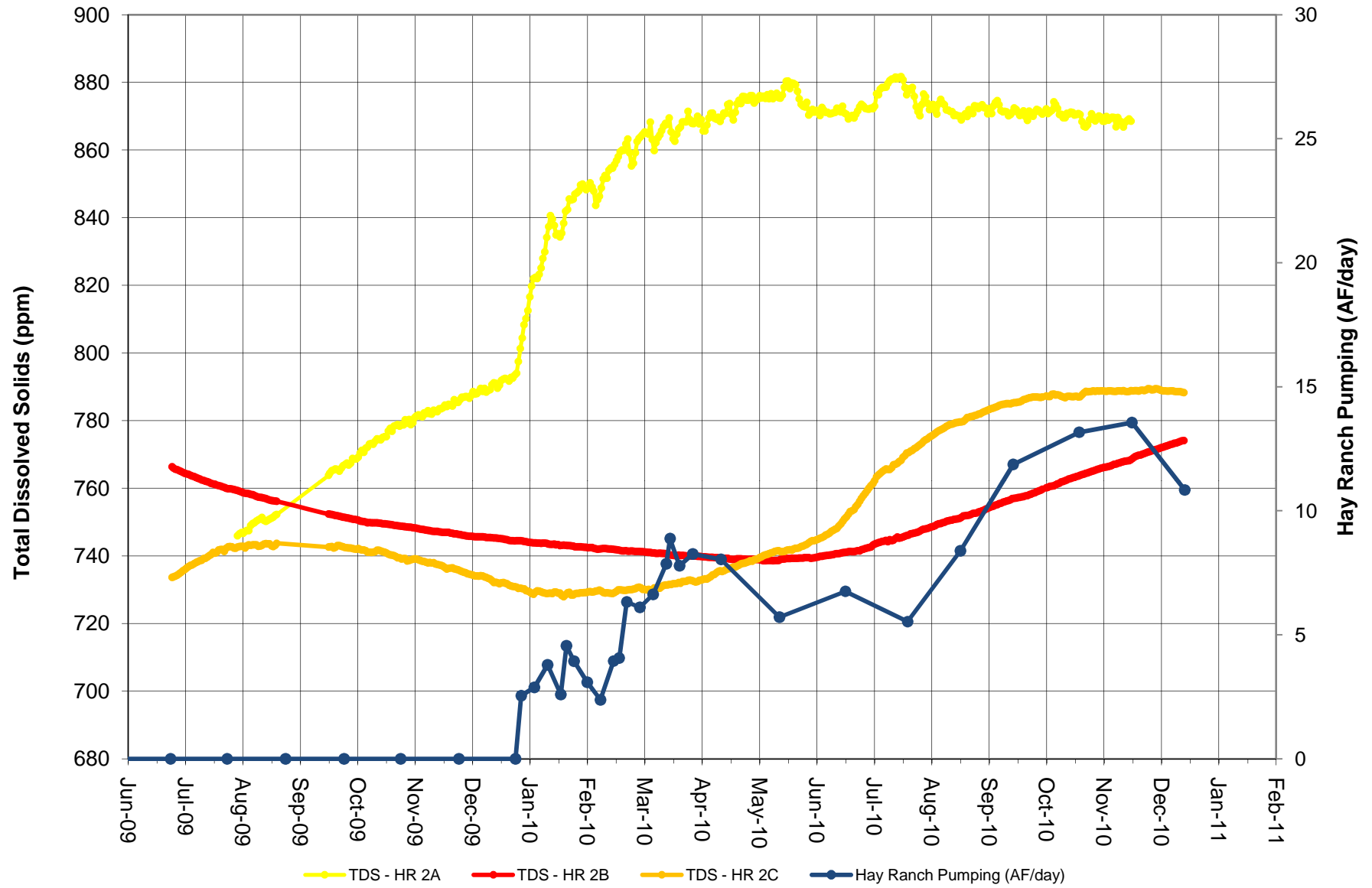
Note: Little Lake Ranch Flows are cubic feet per second.  
 Hay Ranch pumping is average acre feet per day.  
 Flows at Little Lake Outflow and North Culvert are influenced both by natural and water management processes at LLR.

**FIGURE 14**  
TOTAL DISSOLVED SOLIDS (TDS) and HAY RANCH PUMPING  
HR 1A, HR 1B and HR 1C



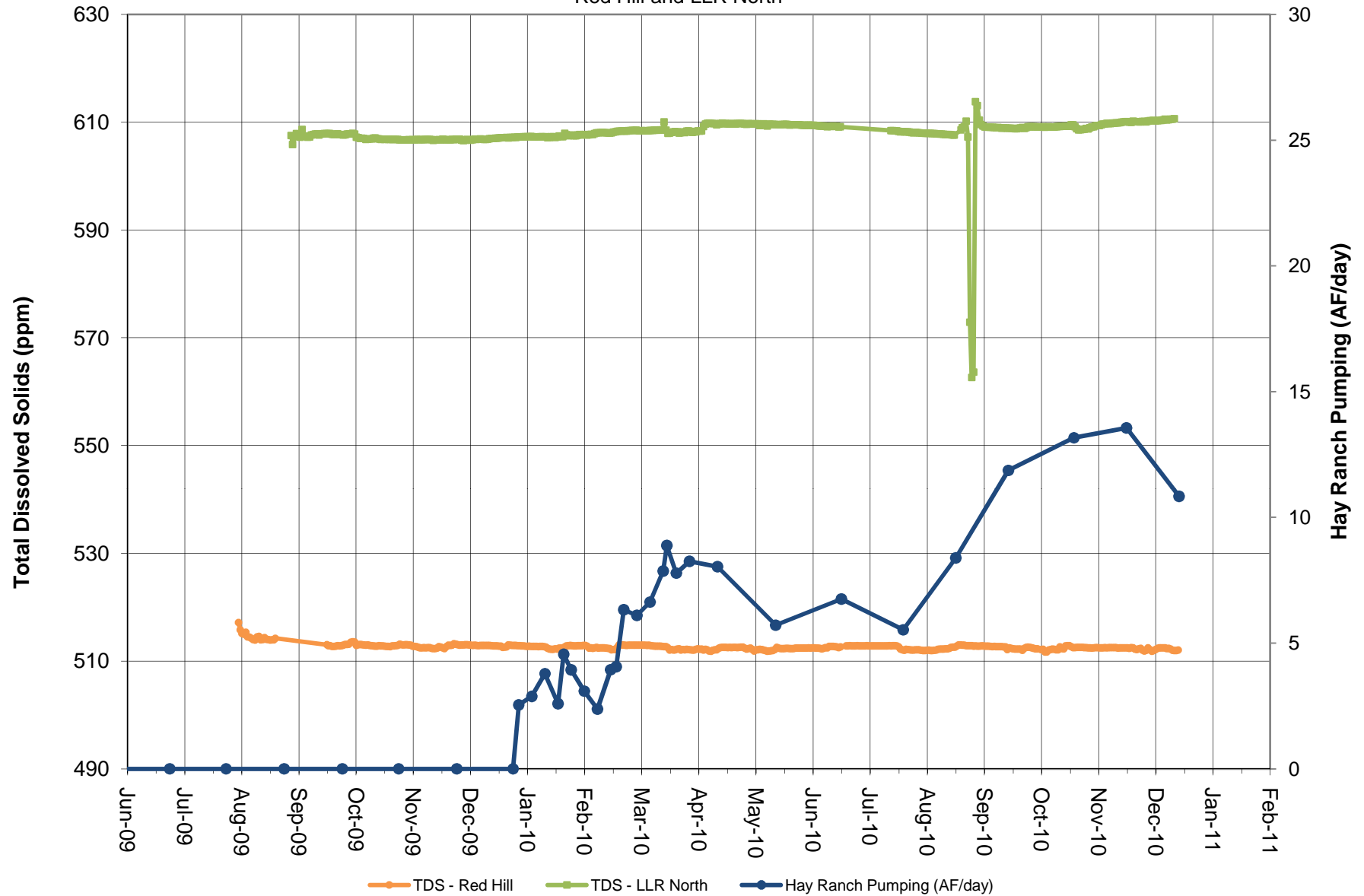
Note: TDS data from in-well transducers. Hay Ranch pumping is average acre feet per day.  
Screened intervals: HR 1A 170-260 feet; HR 1B 490-540 feet; HR 1C 340-405 feet.  
Coso Operating initiated Hay Ranch Project pumping on 12/25/09.

**FIGURE 15**  
TOTAL DISSOLVED SOLIDS (TDS) and HAY RANCH PUMPING  
HR 2A, HR 2B and HR 2C



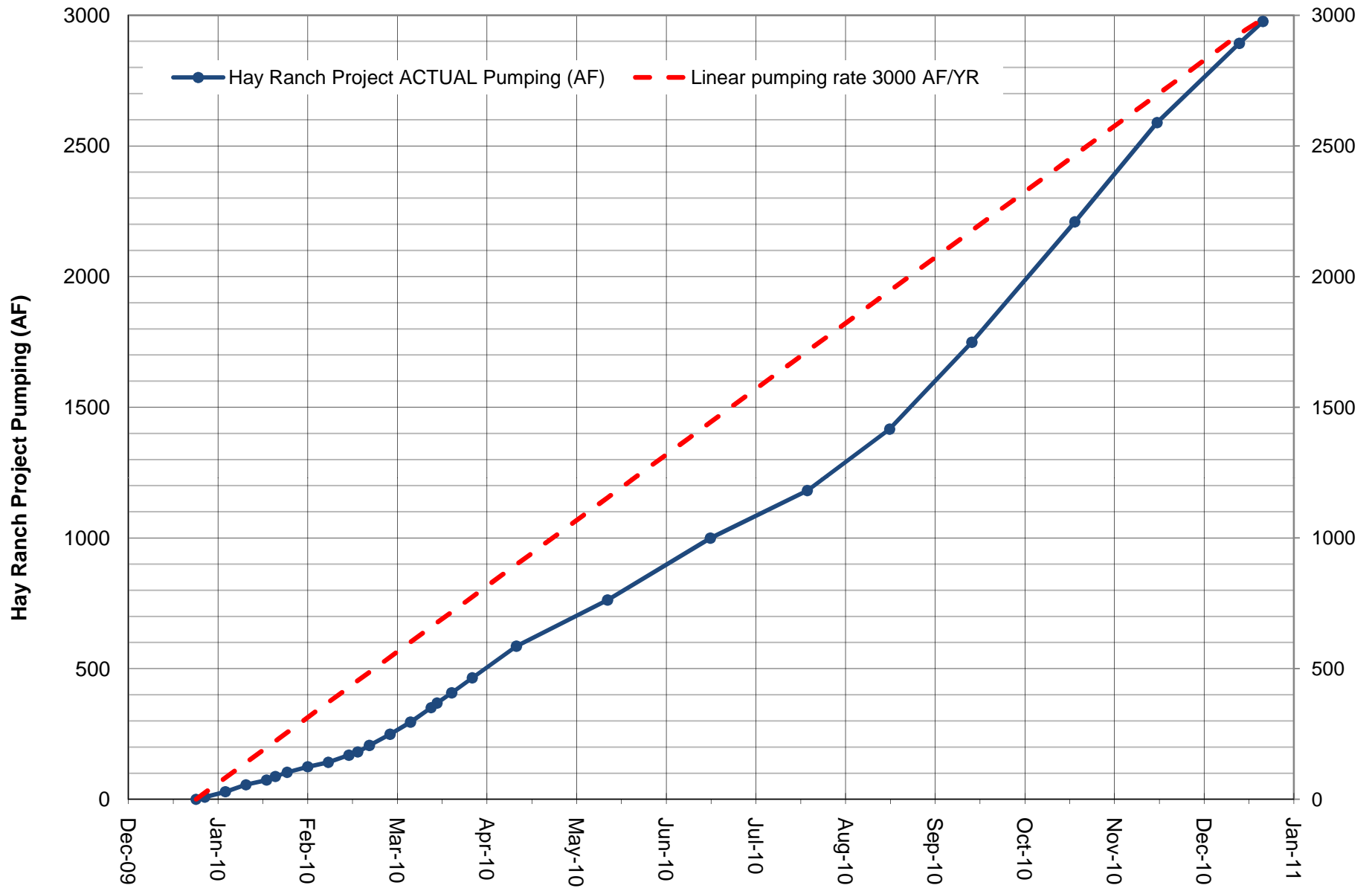
Note: TDS data from in-well transducers. Hay Ranch pumping is average acre feet per day.  
Screened intervals: HR 2A 180-300 feet; HR 2B 519-584 feet; HR 2C 370-420 feet.  
HR 2A missing Nov-Dec 2010 data due to transducer malfunction.

**FIGURE 16**  
TOTAL DISSOLVED SOLIDS (TDS) and HAY RANCH PUMPING  
Red Hill and LLR North



Note: TDS data from in-well transducers. Hay Ranch pumping is average acre feet per day.  
Coso Operating initiated Hay Ranch Project pumping on 12/25/09.

**FIGURE 17**  
HYPOTHETICAL AND ACTUAL HAY RANCH PROJECT PUMPING



Note: Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.  
The "linear pumping rate" shown above is a hypothetical pumping rate that reaches 3000 Acre Feet (AF) in one year with pumping evenly distributed at 8.2 AF/day.

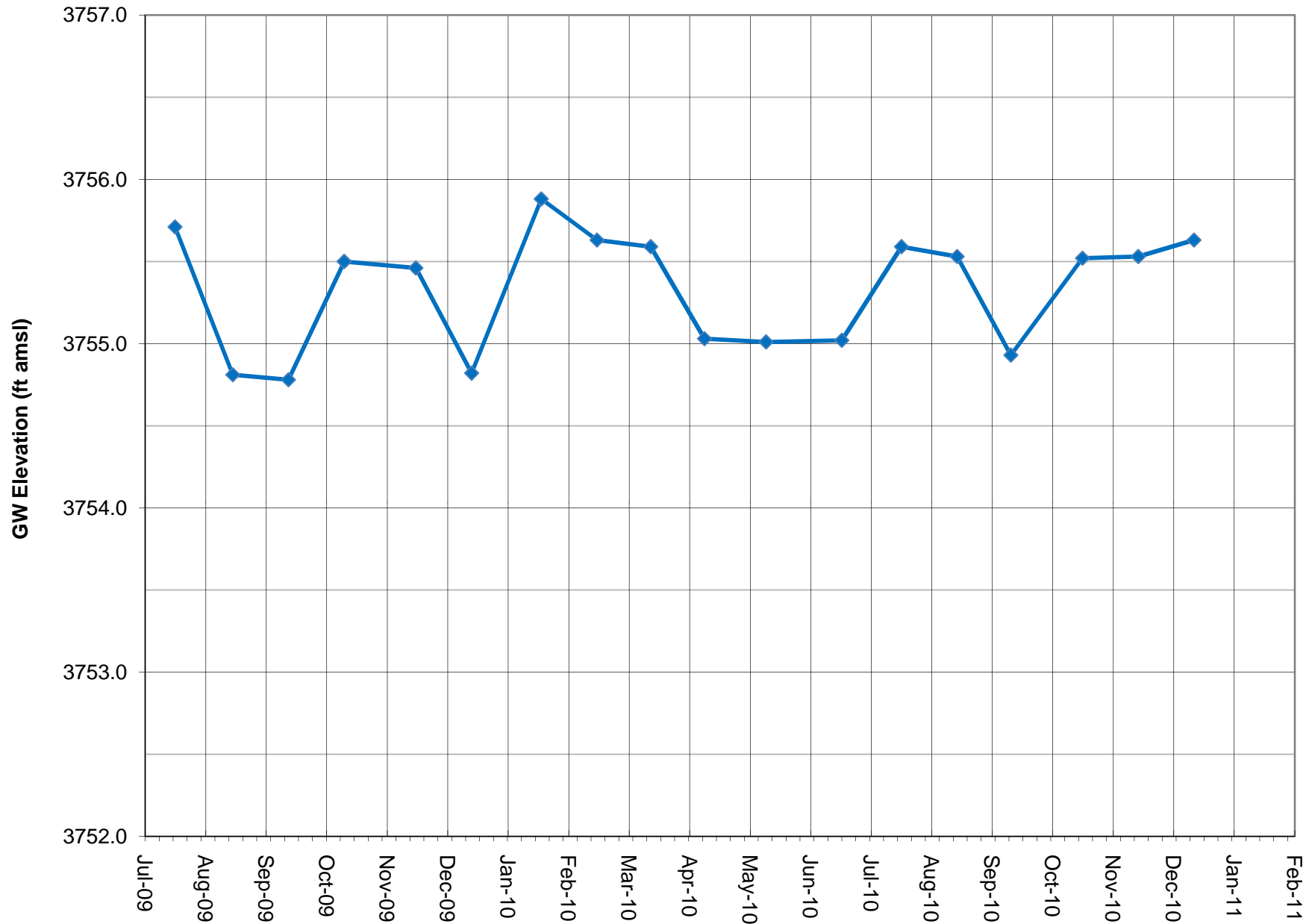
## **APPENDIX A**

**HAY RANCH PROJECT CUP  
MONTHLY HYDROGRAPHS  
DECEMBER 13 and 15, 2010**

**GROUNDWATER ELEVATION DATA  
LONG-TERM (MANUAL READS)**

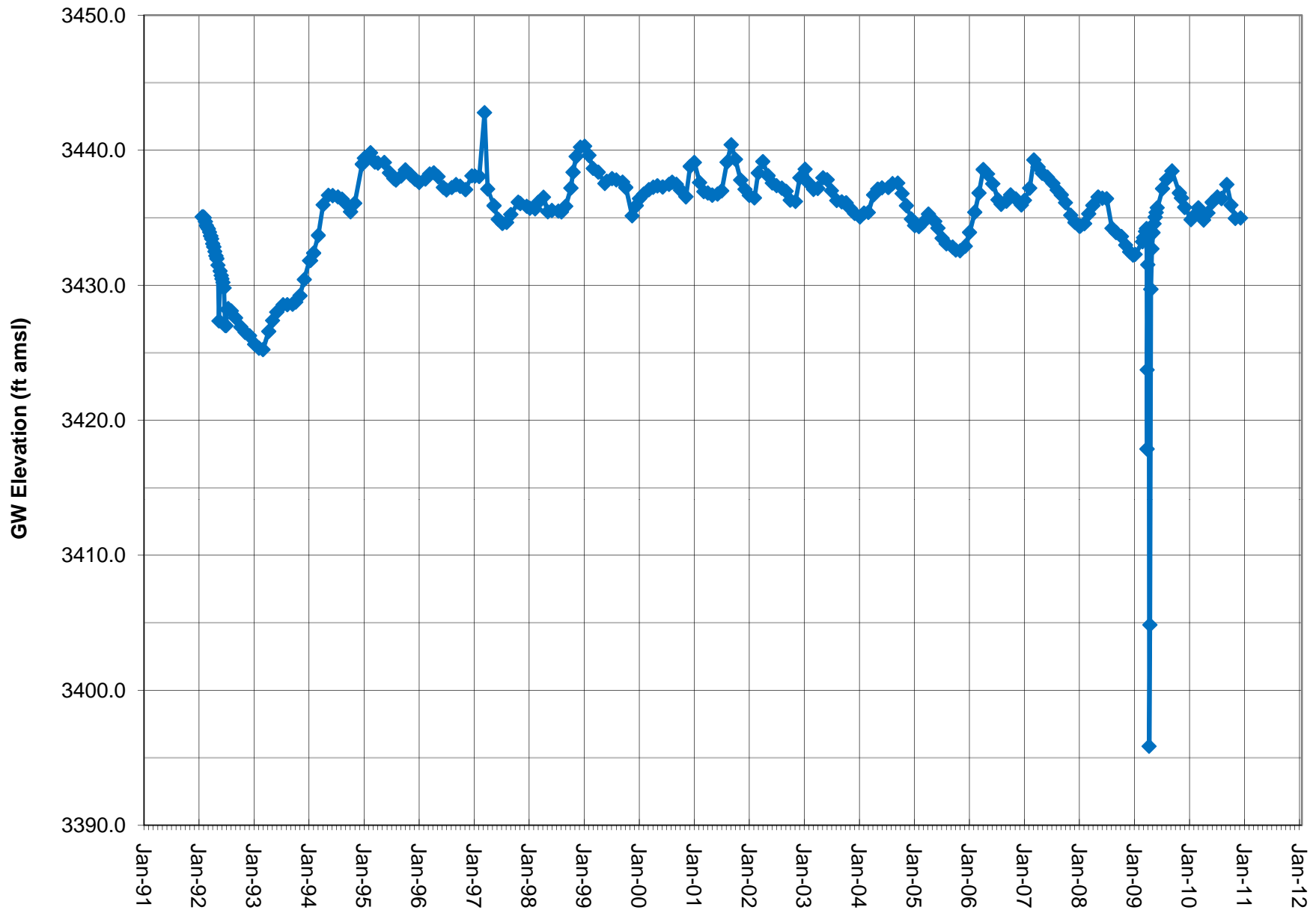


# GROUNDWATER ELEVATION DATA - Long-Term (Manual) RV010 - Enchanted Village Well



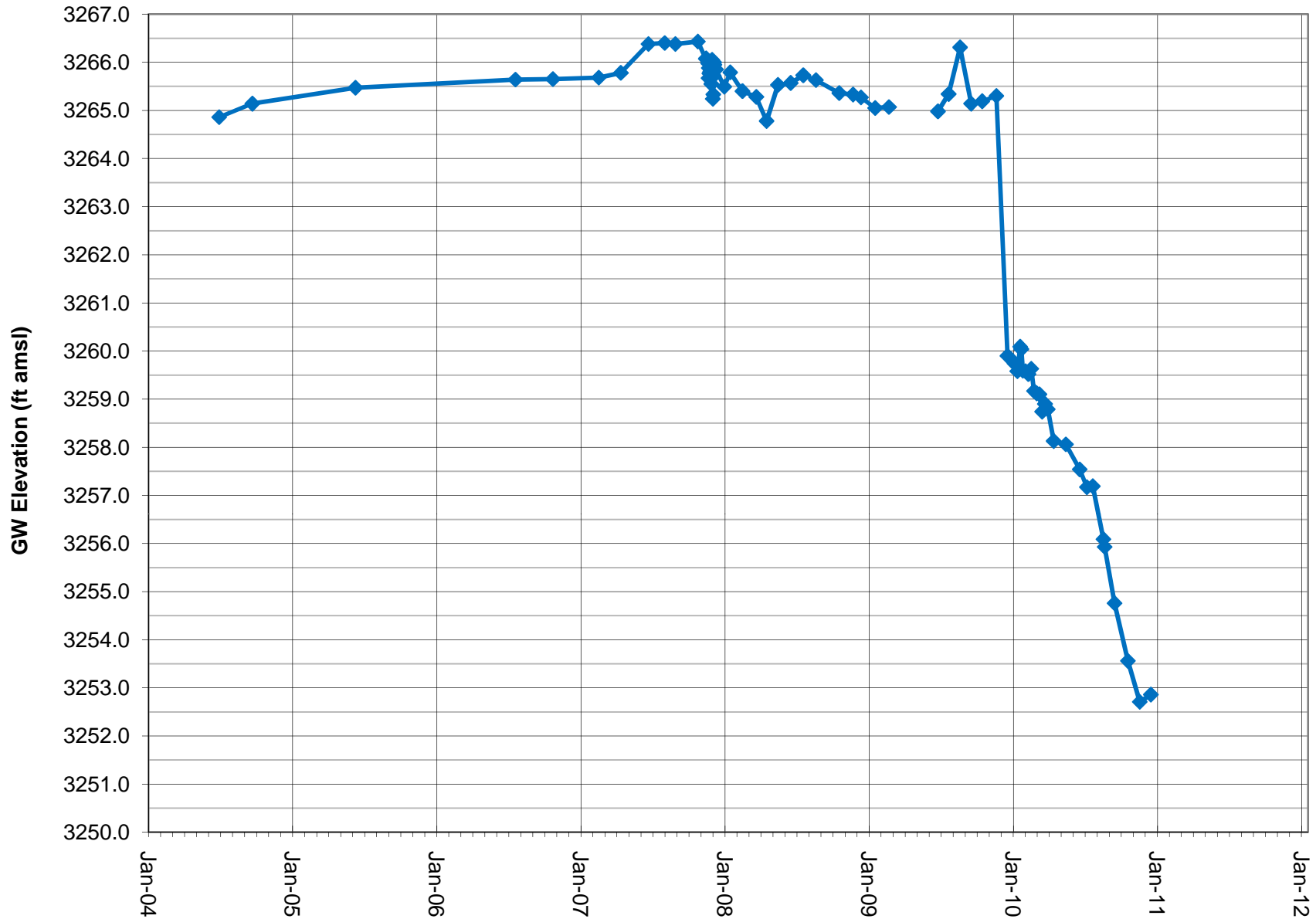
Note: Groundwater elevation data based on manual depth-to-water measurements.  
DTW measured to .01 foot; GWE calculated using approximate surface elevation.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# GROUNDWATER ELEVATION DATA - Long-Term (Manual) RV020 - LADWP 816 Well



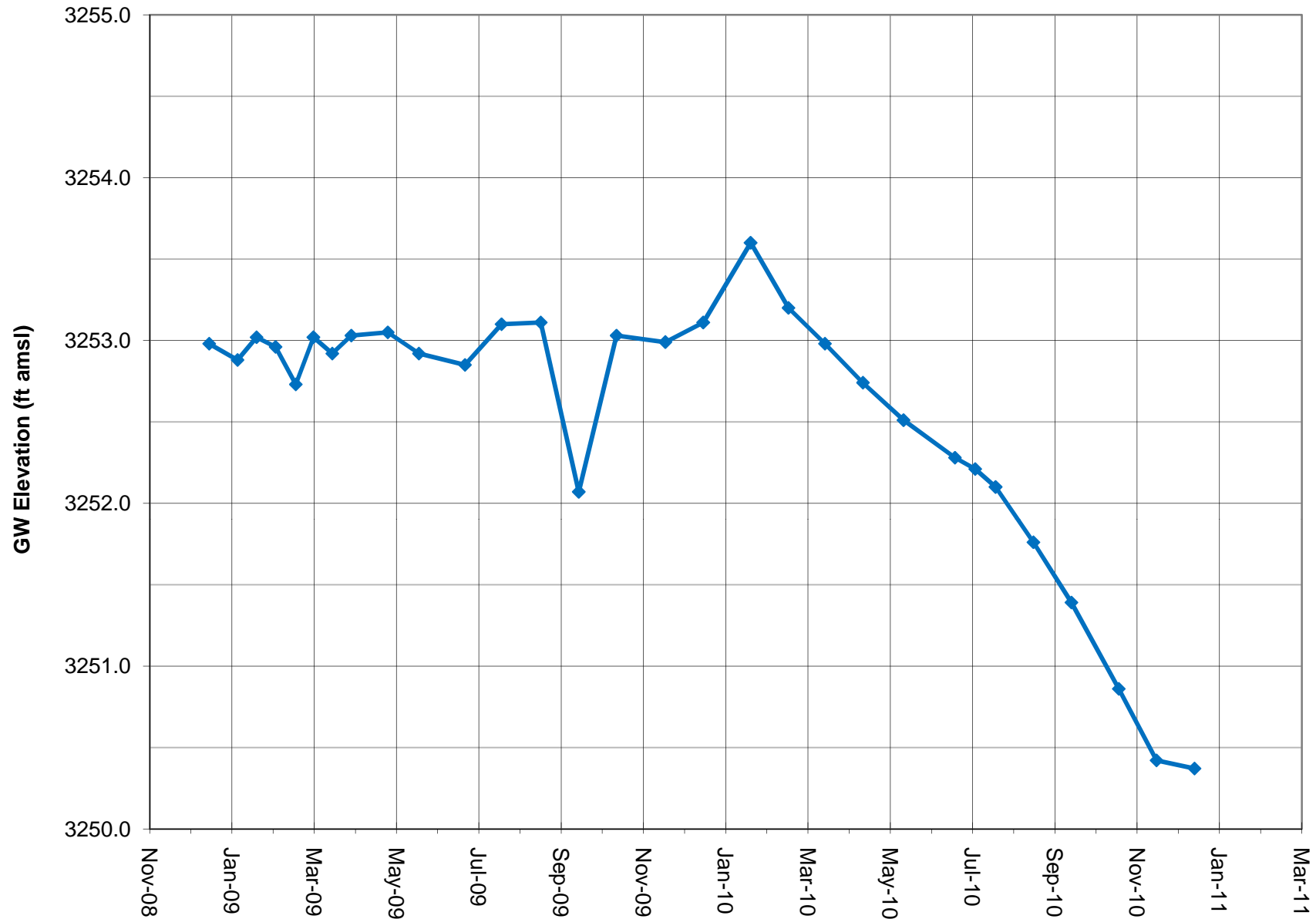
Note: Groundwater elevation data based on manual depth-to-water measurements.  
LADWP conducted a groundwater pump test on a nearby well in the first quarter 2009.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# **GROUNDWATER ELEVATION DATA - Long-Term (Manual)** **RV030 - Cal Pumice Well**



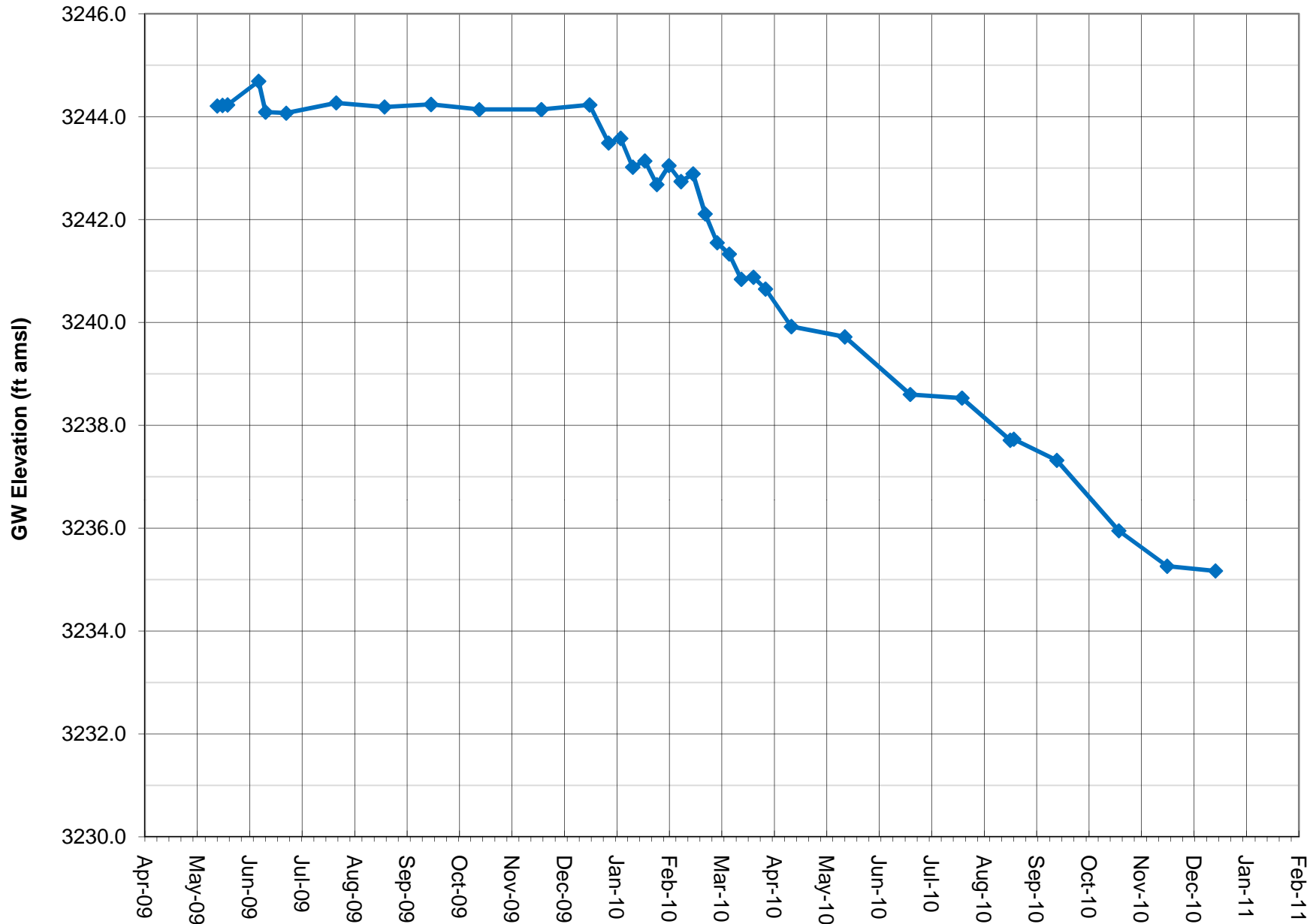
Note: A data gap exists in 2009 during a LADWP pump test on a nearby well.  
 The notable DTW change from 11/19/09 to 12/17/09 was confirmed by in-well PT.  
 Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# GROUNDWATER ELEVATION DATA - Long-Term (Manual) RV040 - Dunmovin Well



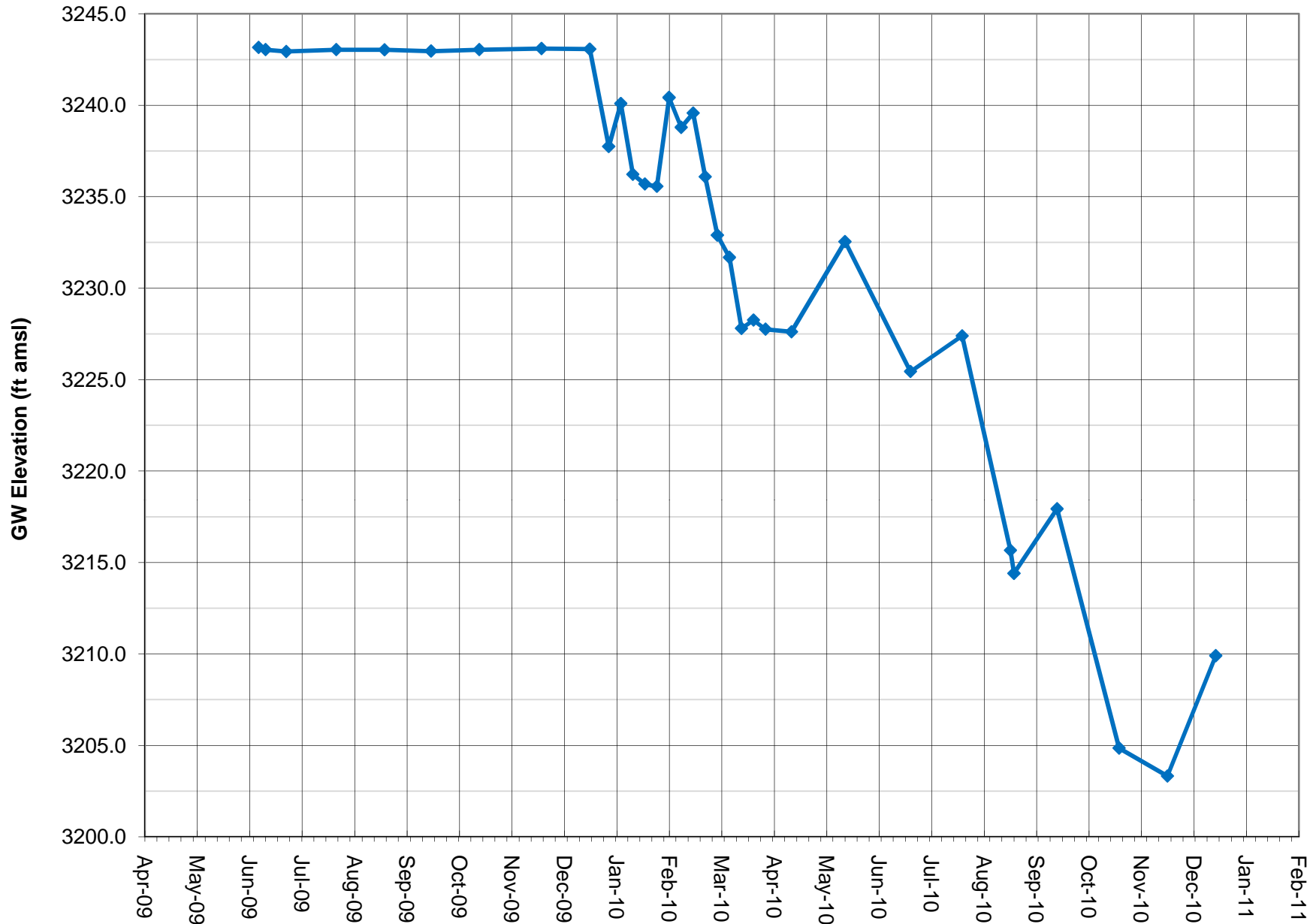
Note: Groundwater elevation data based on manual depth-to-water measurements. Lines between data points are approximations.  
Dunmovin Well is an active domestic supply well.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# **GROUNDWATER ELEVATION DATA - Long-Term (Manual)** **RV060 - Hay Ranch 1A Well**



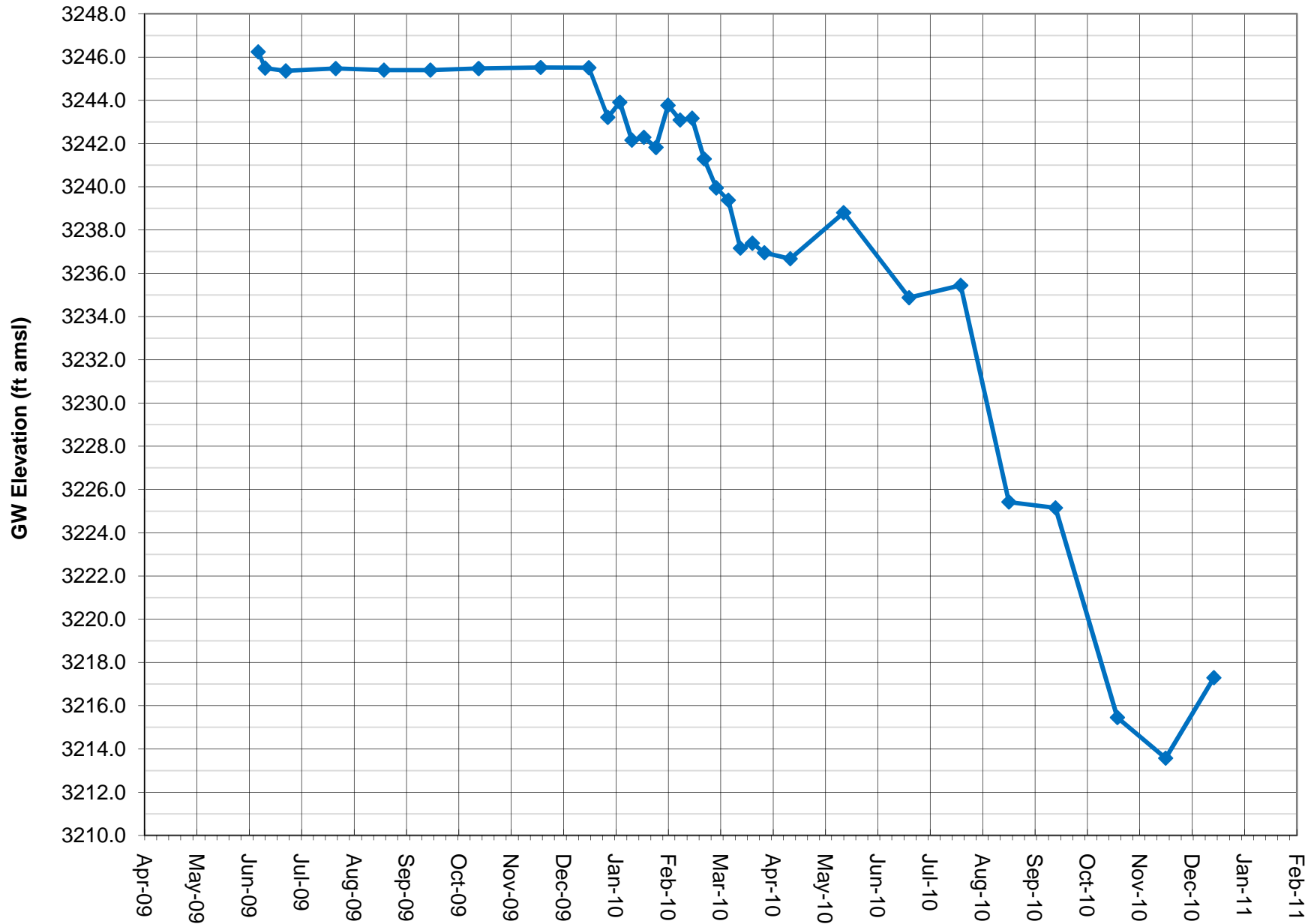
Note: Groundwater elevation data based on manual depth-to-water measurements. Lines between data points are approximations.  
 Screened interval is 170-260 feet.  
 Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# GROUNDWATER ELEVATION DATA - Long-Term (Manual) RV061 - Hay Ranch 1B Well



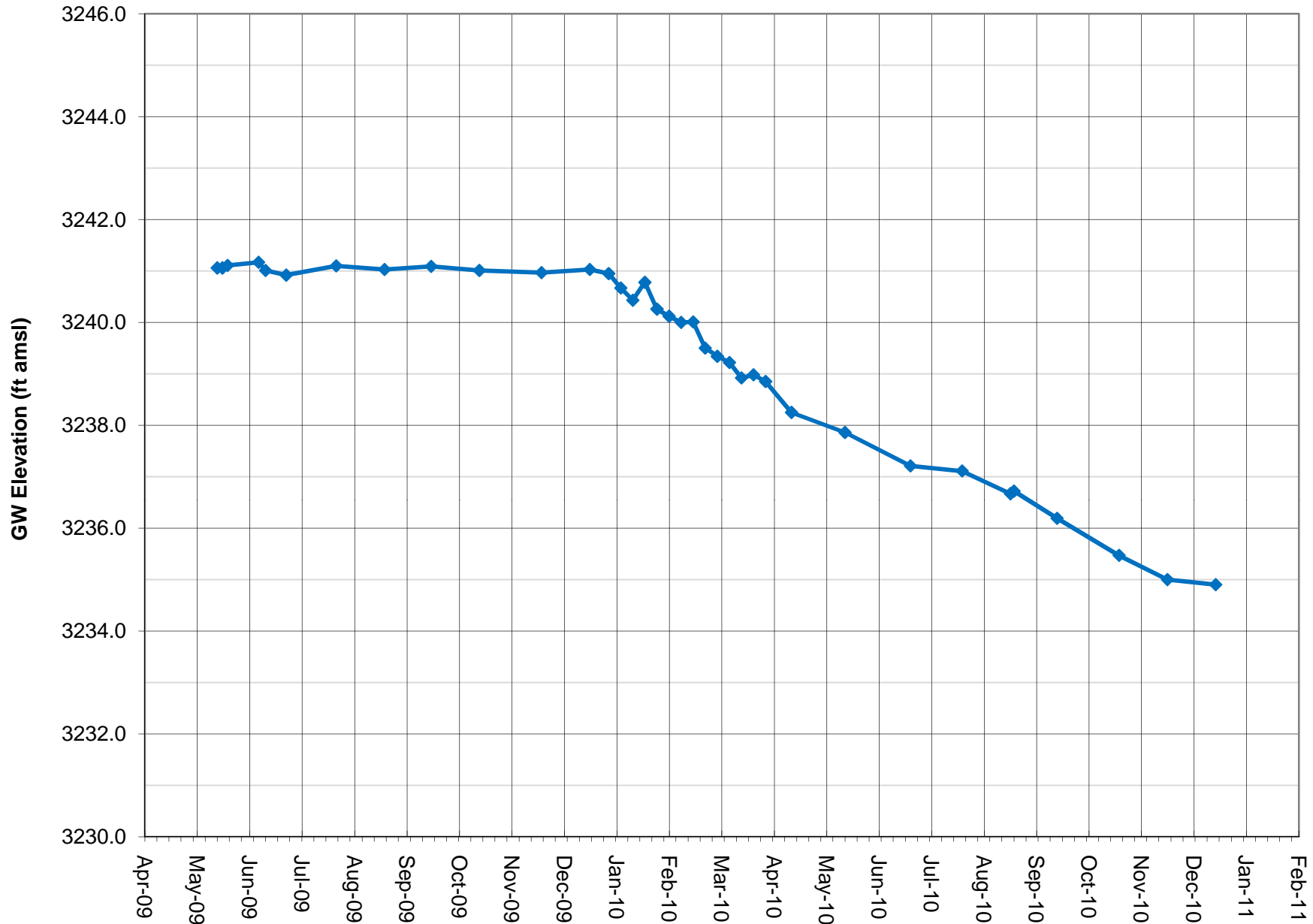
Note: Groundwater elevation data based on manual depth-to-water measurements. Lines between data points are approximations.  
Screened interval is 490-540 feet.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

**GROUNDWATER ELEVATION DATA - Long-Term (Manual)**  
**RV062 - Hay Ranch 1C Well**



Note: Groundwater elevation data based on manual depth-to-water measurements. Lines between data points are approximations.  
Screened interval is 340-405 feet.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

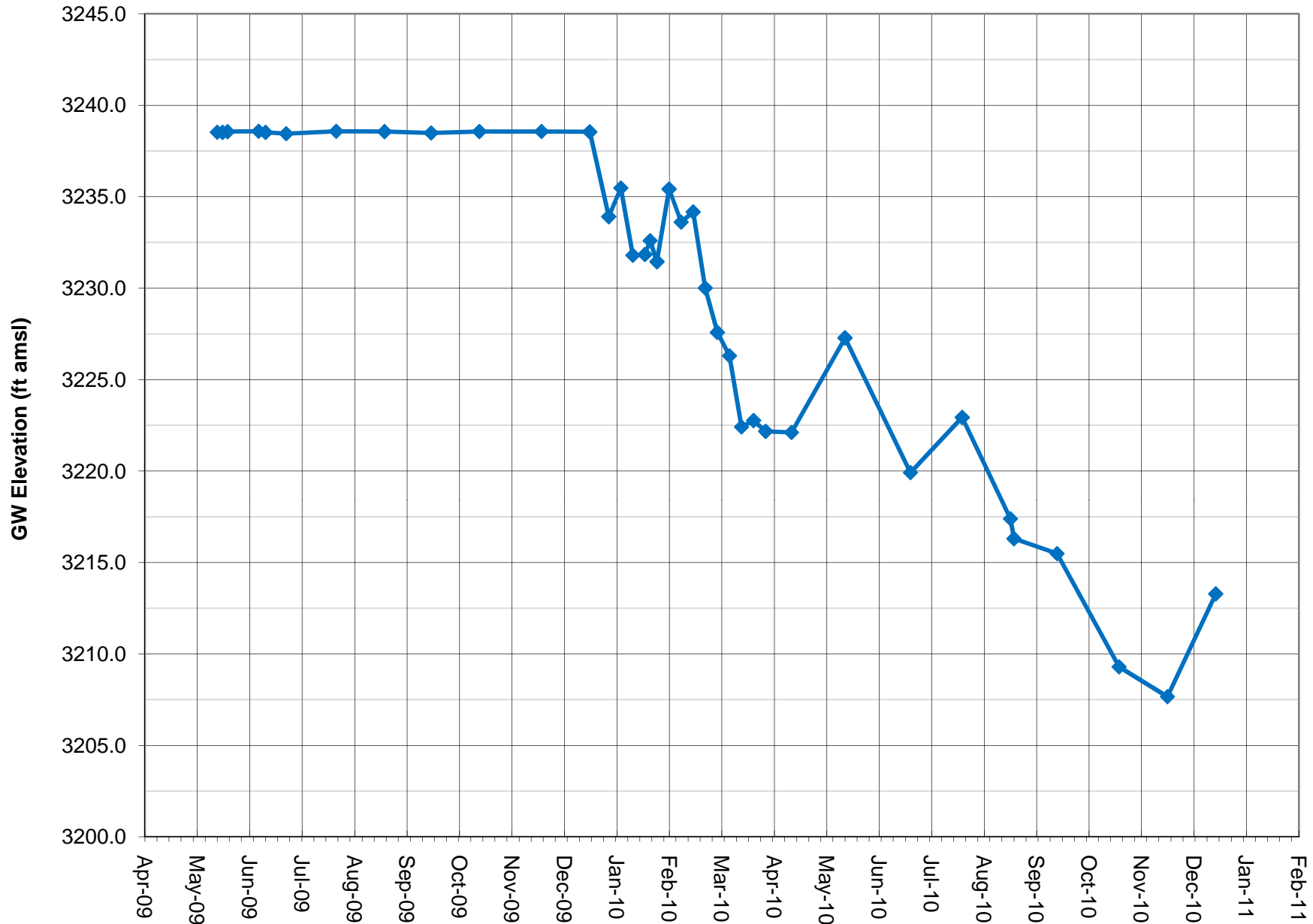
# GROUNDWATER ELEVATION DATA - Long-Term (Manual) RV080- Hay Ranch 2A Well



Note: Groundwater elevation data based on manual depth-to-water measurements. Lines between data points are approximations.  
Screened interval is 180-300 feet.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

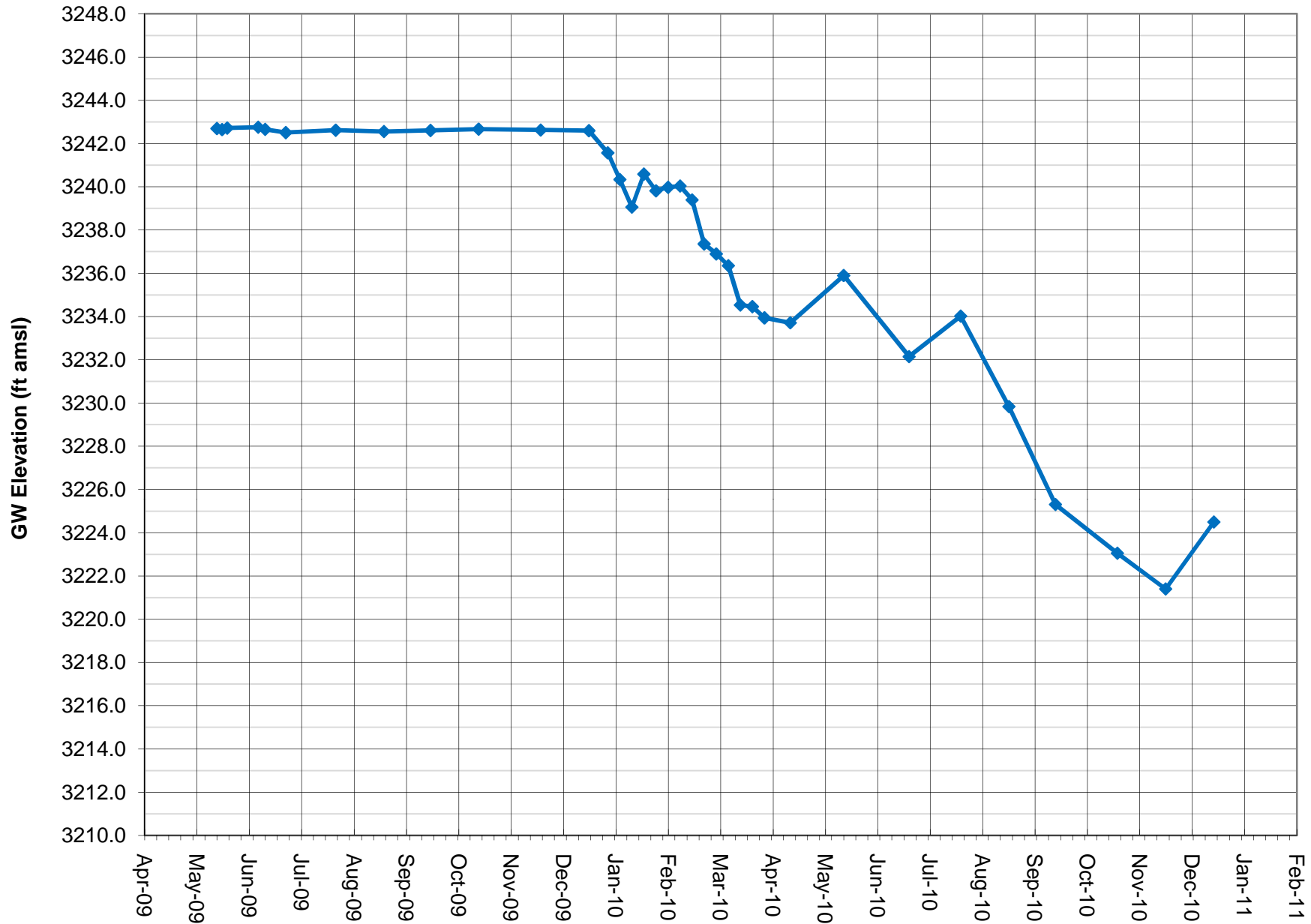


# **GROUNDWATER ELEVATION DATA - Long-Term (Manual)** **RV081 - Hay Ranch 2B Well**



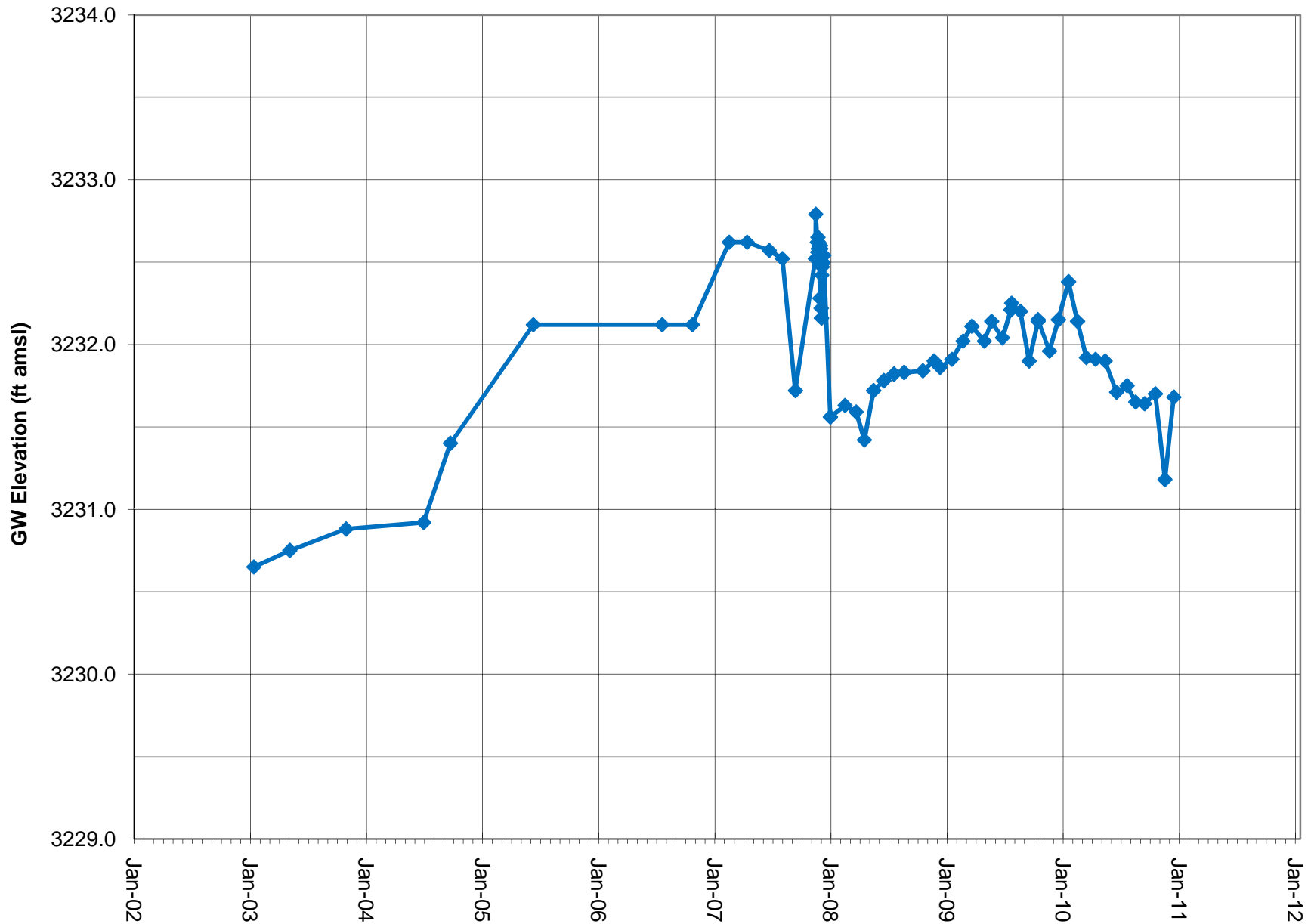
Note: Groundwater elevation data based on manual depth-to-water measurements. Lines between data points are approximations.  
 Screened interval is 519-584 feet.  
 Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

**GROUNDWATER ELEVATION DATA - Long-Term (Manual)**  
**RV082 - Hay Ranch 2C Well**



Note: Groundwater elevation data based on manual depth-to-water measurements. Lines between data points are approximations.  
Screened interval is 370-420 feet.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# **GROUNDWATER ELEVATION DATA - Long-Term (Manual)** **RV090 - Coso Junction Ranch Well**



Note: Groundwater elevation data based on manual depth-to-water measurements.  
 Coso Operating Co. conducted a pump test on the Hay Ranch South Well in fourth quarter 2007.  
 Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

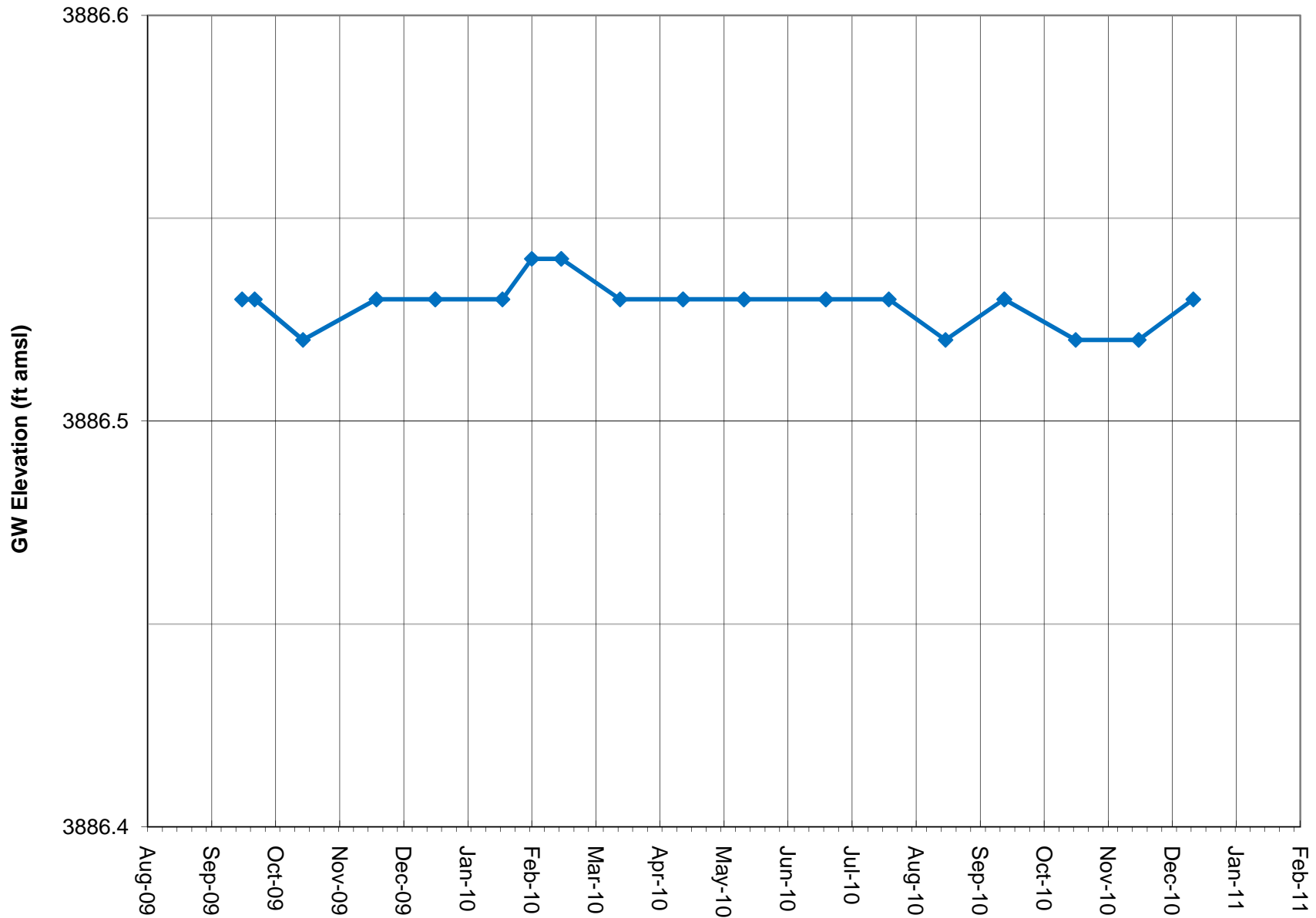
The graph displays groundwater elevation data over a ten-year period. The y-axis represents elevation in feet above mean sea level (ft amsl), ranging from 3226.0 to 3231.0. The x-axis shows time from January 2002 to January 2012. The data points are connected by a blue line, showing a general upward trend until mid-2007, followed by a period of high variability with peaks and troughs, and finally a downward trend starting in late 2009.

Date	GW Elevation (ft amsl)
Jan-03	3227.8
Mar-03	3227.2
Apr-03	3227.6
Jun-03	3227.6
Sep-03	3227.9
Nov-03	3227.9
Feb-04	3228.2
May-04	3228.6
Aug-04	3228.9
Nov-04	3229.1
Feb-05	3229.4
May-05	3229.6
Aug-05	3229.8
Nov-05	3229.9
Feb-06	3229.7
May-06	3229.2
Aug-06	3229.8
Nov-06	3229.9
Feb-07	3229.6
May-07	3229.2
Aug-07	3229.8
Nov-07	3229.1
Feb-08	3229.2
May-08	3229.2
Aug-08	3229.0
Nov-08	3229.4
Feb-09	3229.5
May-09	3229.6
Aug-09	3229.8
Nov-09	3229.9
Feb-10	3229.7
May-10	3229.0
Aug-10	3229.7
Nov-10	3229.9
Feb-11	3229.5
May-11	3229.3
Aug-11	3228.9
Nov-11	3228.3
Feb-12	3228.1
May-12	3227.9
Aug-12	3228.0

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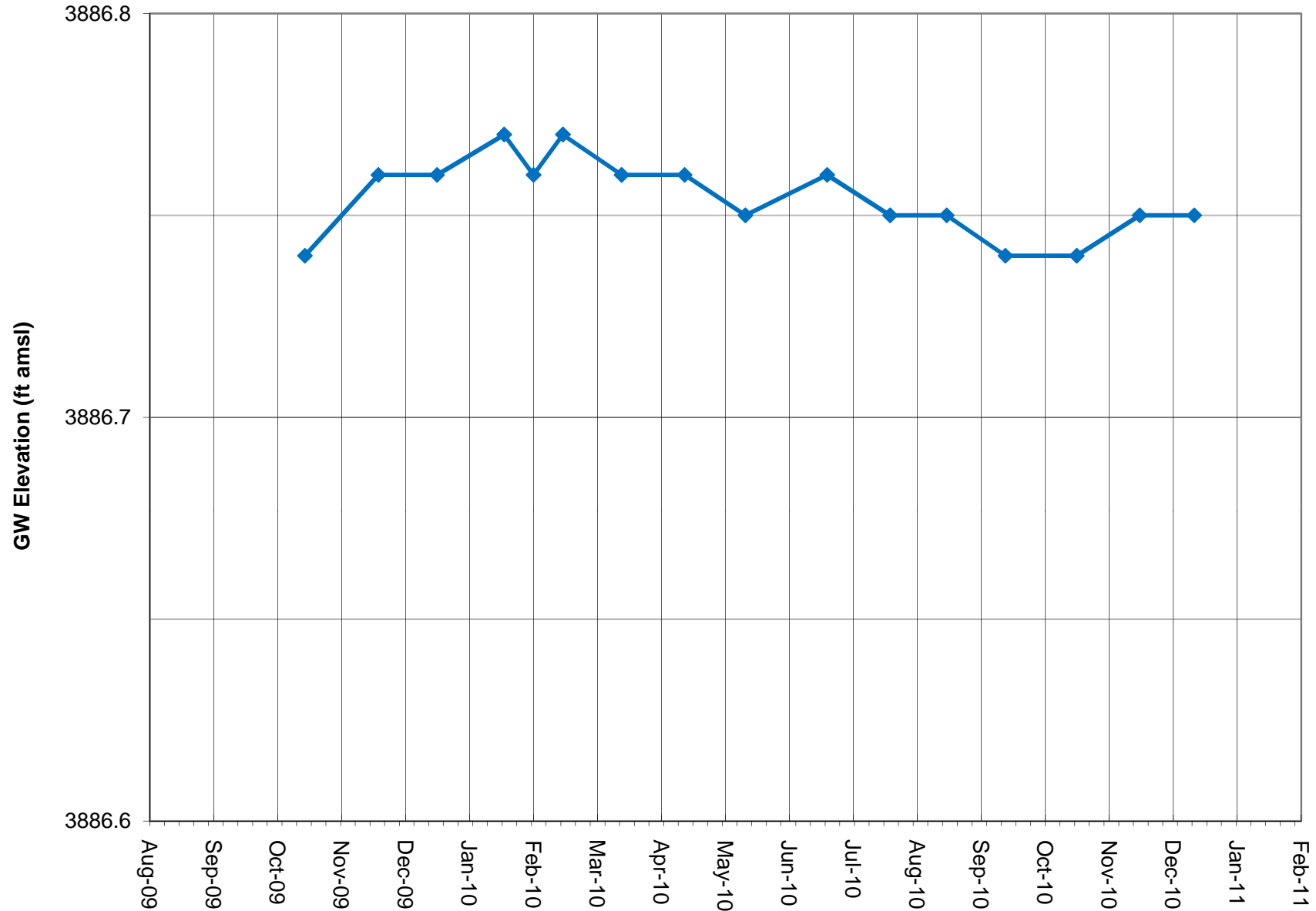
12/20/2010

# GROUNDWATER ELEVATION DATA - Long-Term (Manual) RV110 - Davis Ranch North Well



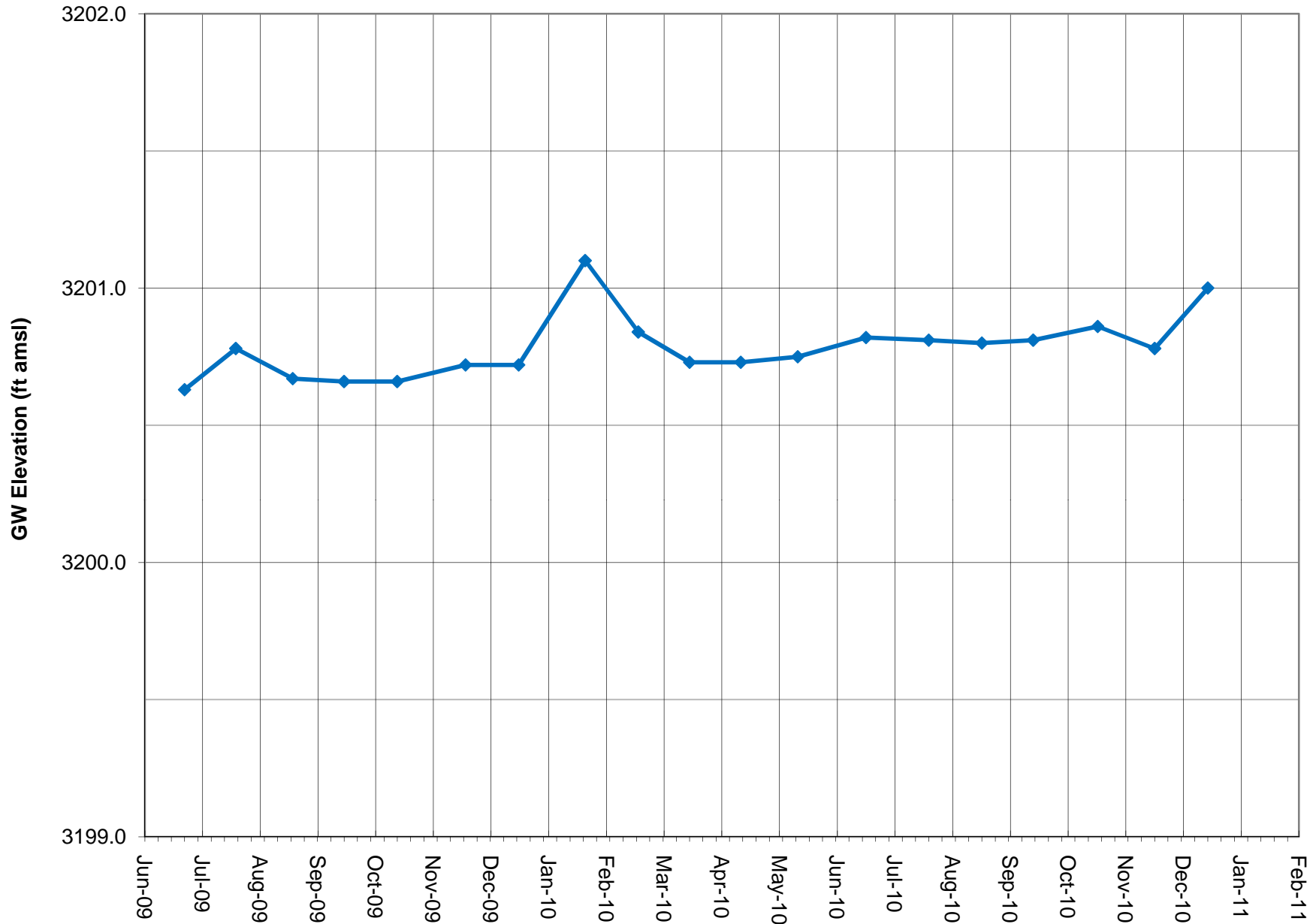
Note: Groundwater elevation data based on manual depth-to-water measurements.  
DTW measured to .01 foot; GWE calculated using approximate surface elevation.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

**GROUNDWATER ELEVATION DATA - Long-Term (Manual)**  
**RV111 - Davis Ranch South Well**



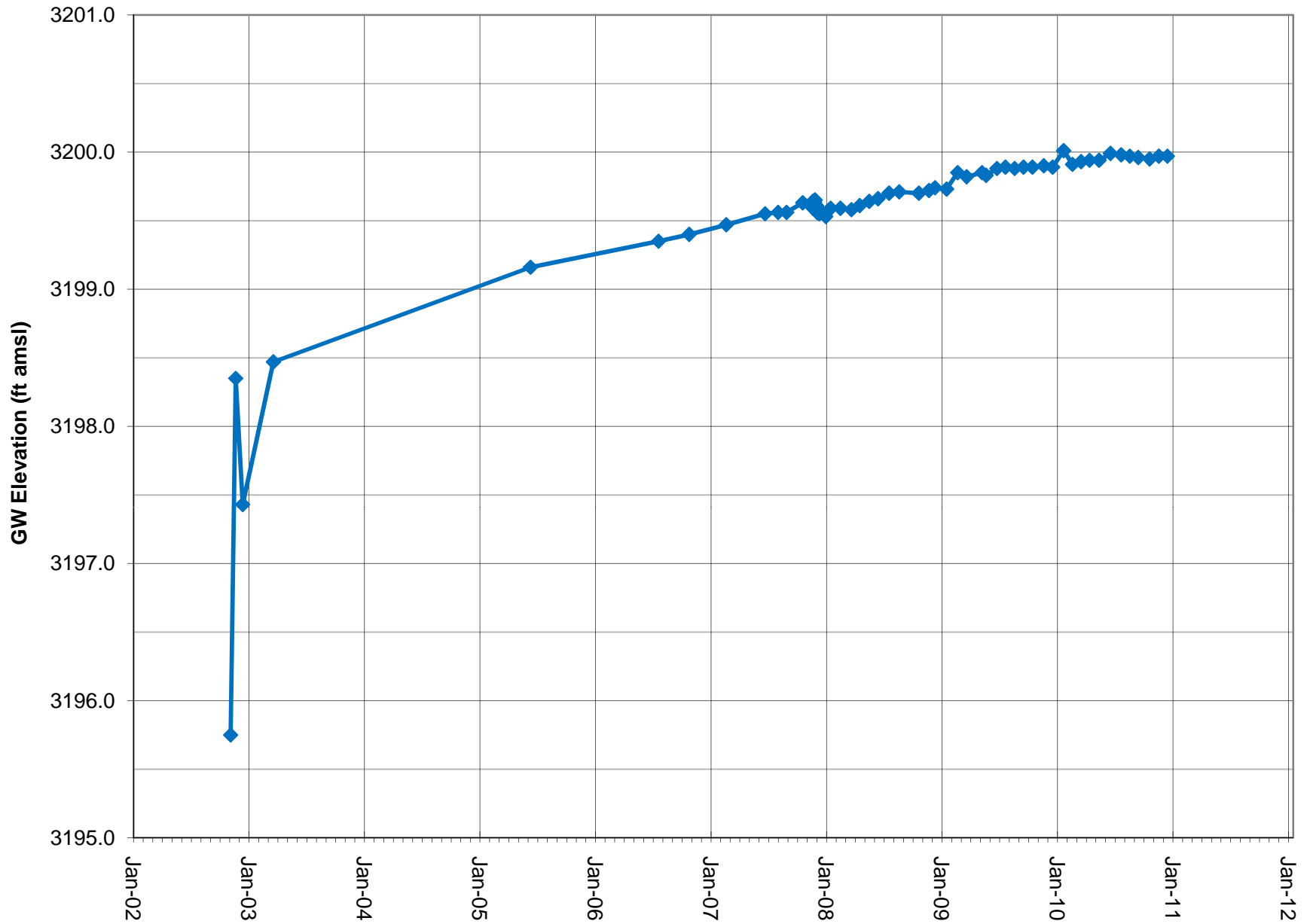
Note: Groundwater elevation data based on manual depth-to-water measurements.  
DTW measured to .01 foot; GWE calculated using approximate surface elevation.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# GROUNDWATER ELEVATION DATA - Long-Term (Manual) RV120 - Red Hill Well



Note: Groundwater elevation data based on manual depth-to-water measurements. Lines between data points are approximations.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

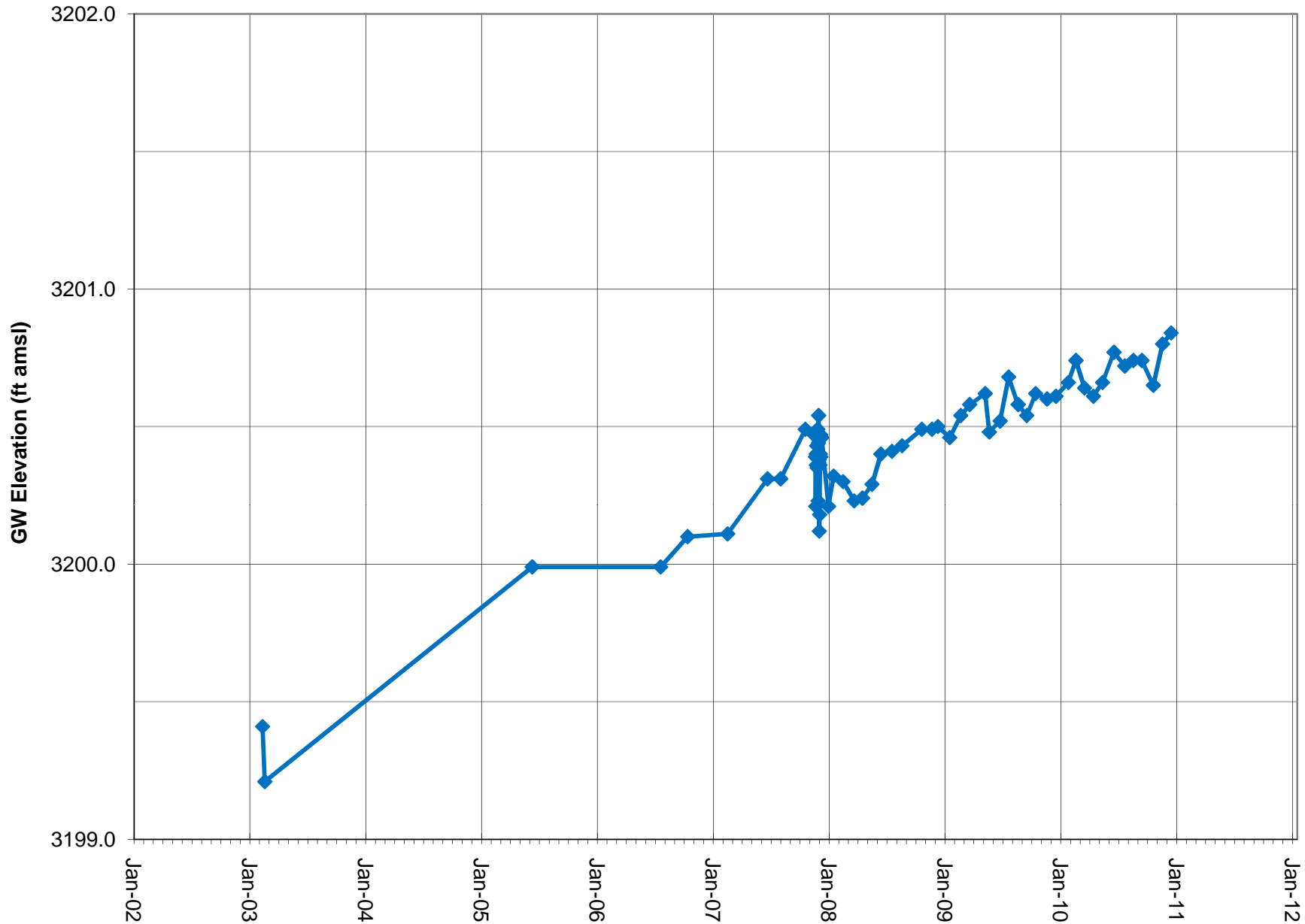
# GROUNDWATER ELEVATION DATA - Long-Term (Manual) RV130 - G-36 Well



Note: Groundwater elevation data based on manual depth-to-water measurements.  
Coso Operating Co. conducted a pump test on the Hay Ranch South Well in fourth quarter 2007.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

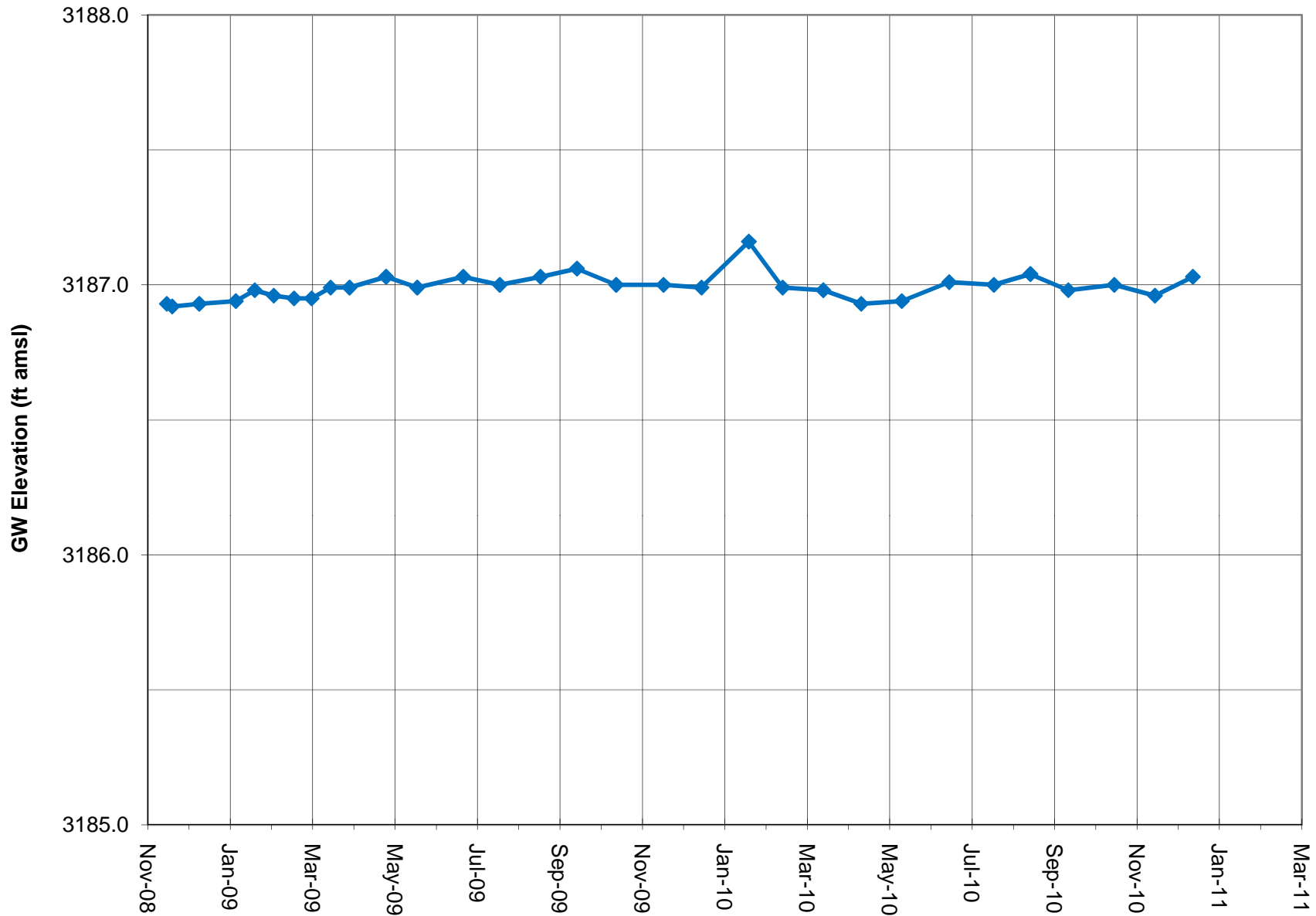


# GROUNDWATER ELEVATION DATA - Long-Term (Manual) RV140 - Lego Well



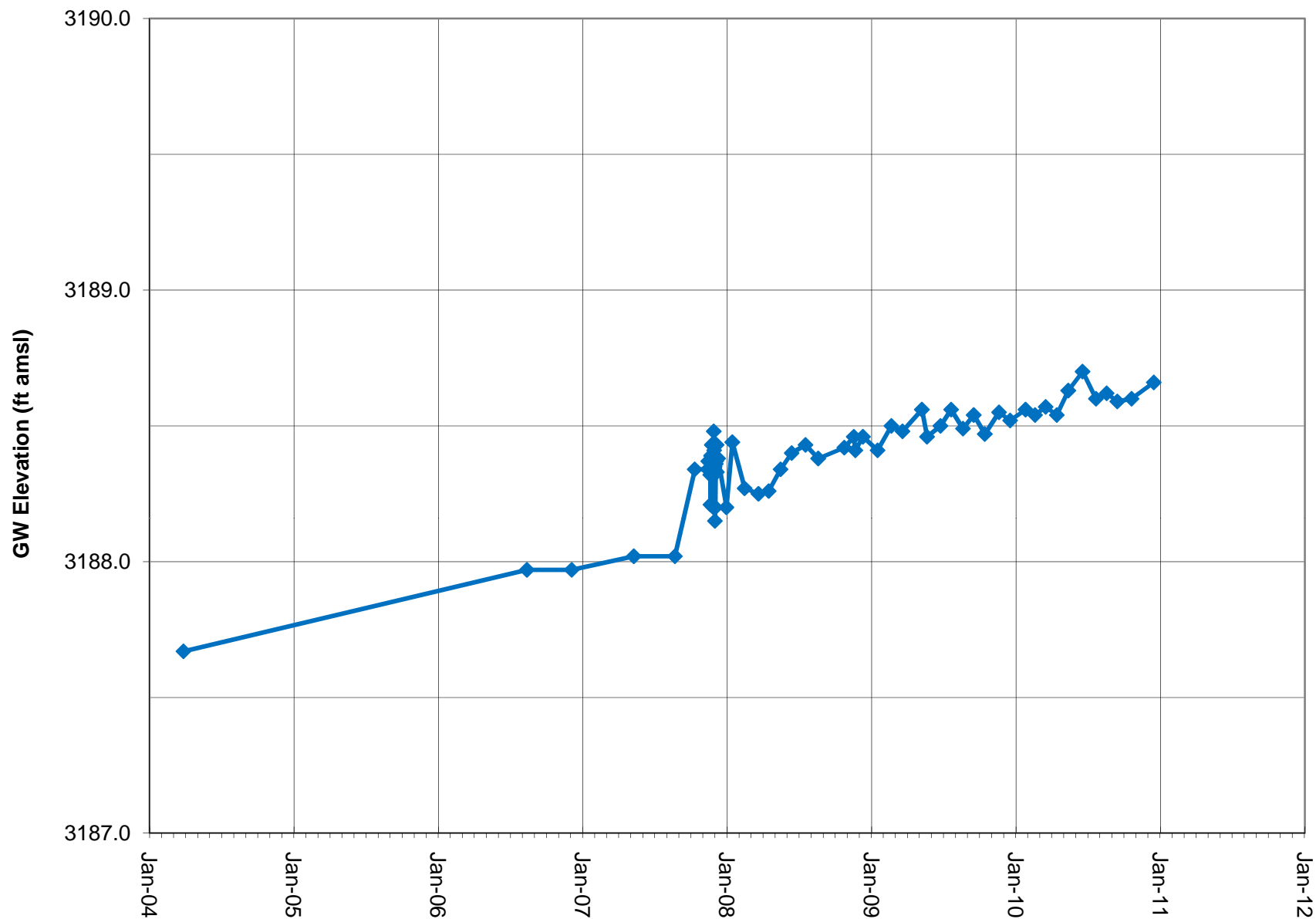
Note: Groundwater elevation data based on manual depth-to-water measurements.  
Coso Operating Co. conducted a pump test on the Hay Ranch South Well in fourth quarter 2007.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

**GROUNDWATER ELEVATION DATA - Long-Term (Manual)**  
**RV150 - Cinder Road Well**



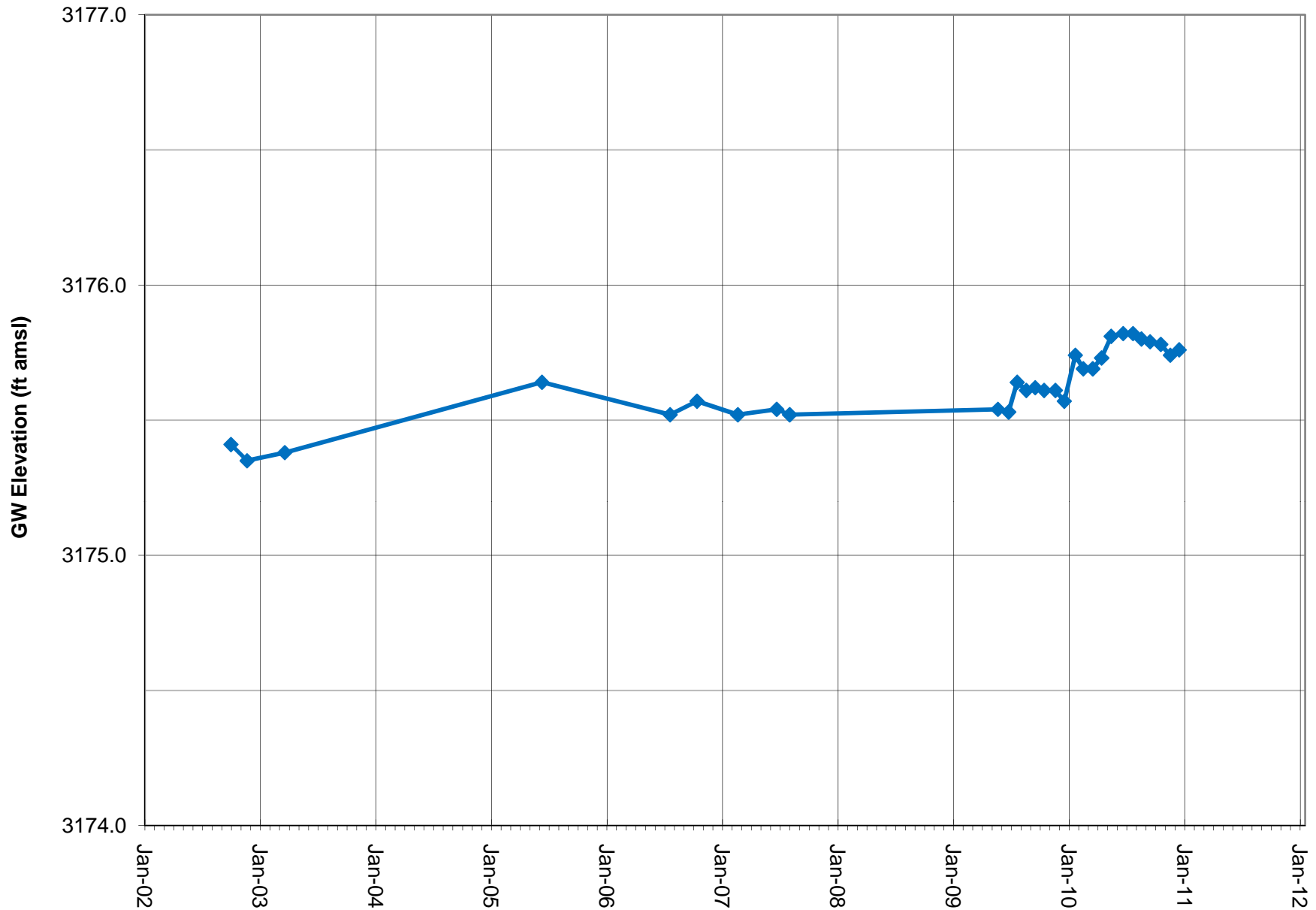
Note: Groundwater elevation data based on manual depth-to-water measurements. Lines between data points are approximations.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# GROUNDWATER ELEVATION DATA - Long-Term (Manual) RV160 - 18-28 GTH Well



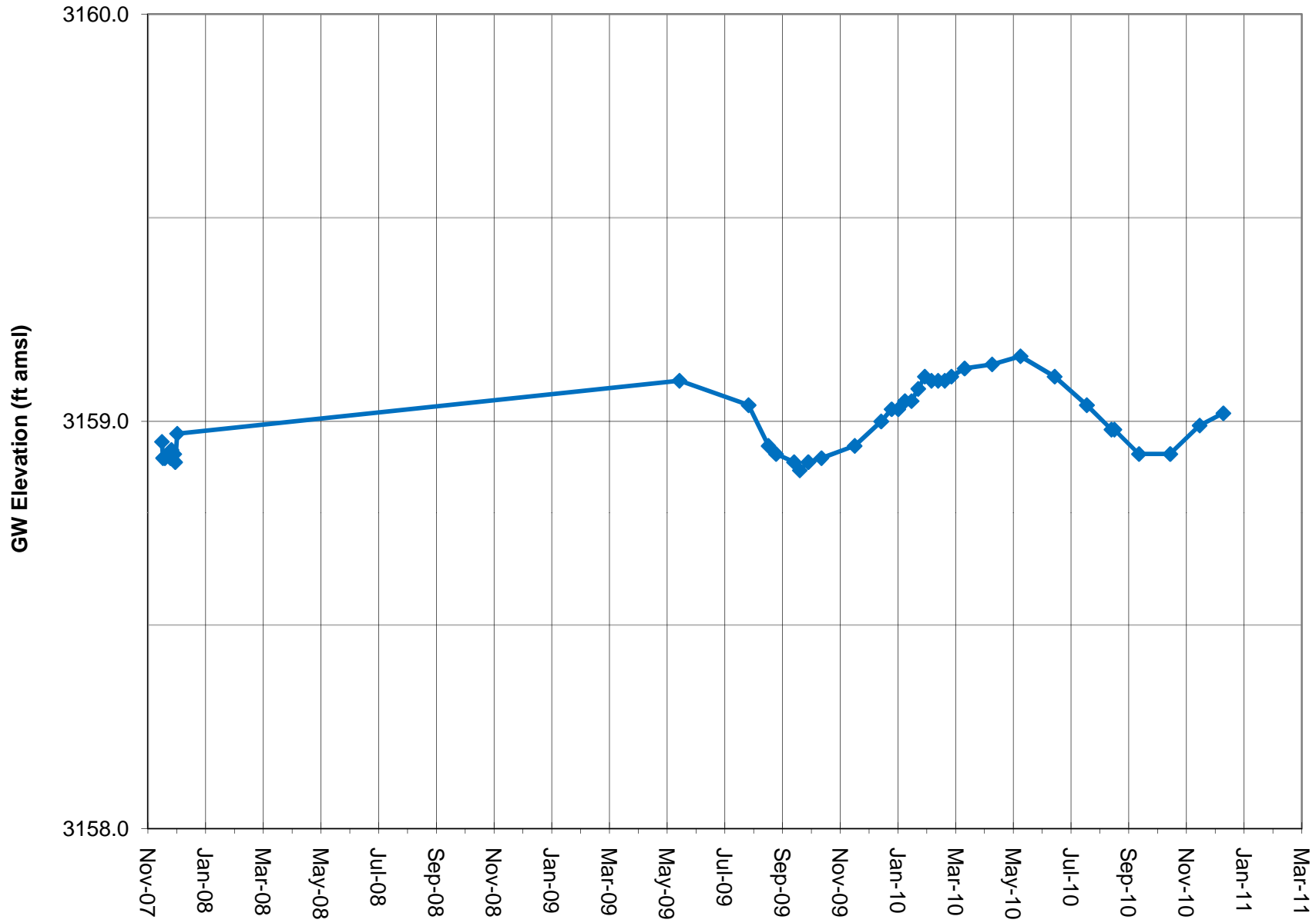
Note: Groundwater elevation data based on manual depth-to-water measurements.  
Coso Operating Co. conducted a pump test on the Hay Ranch South Well in fourth quarter 2007.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# GROUNDWATER ELEVATION DATA - Long-Term (Manual) RV170 - Fossil Falls Well



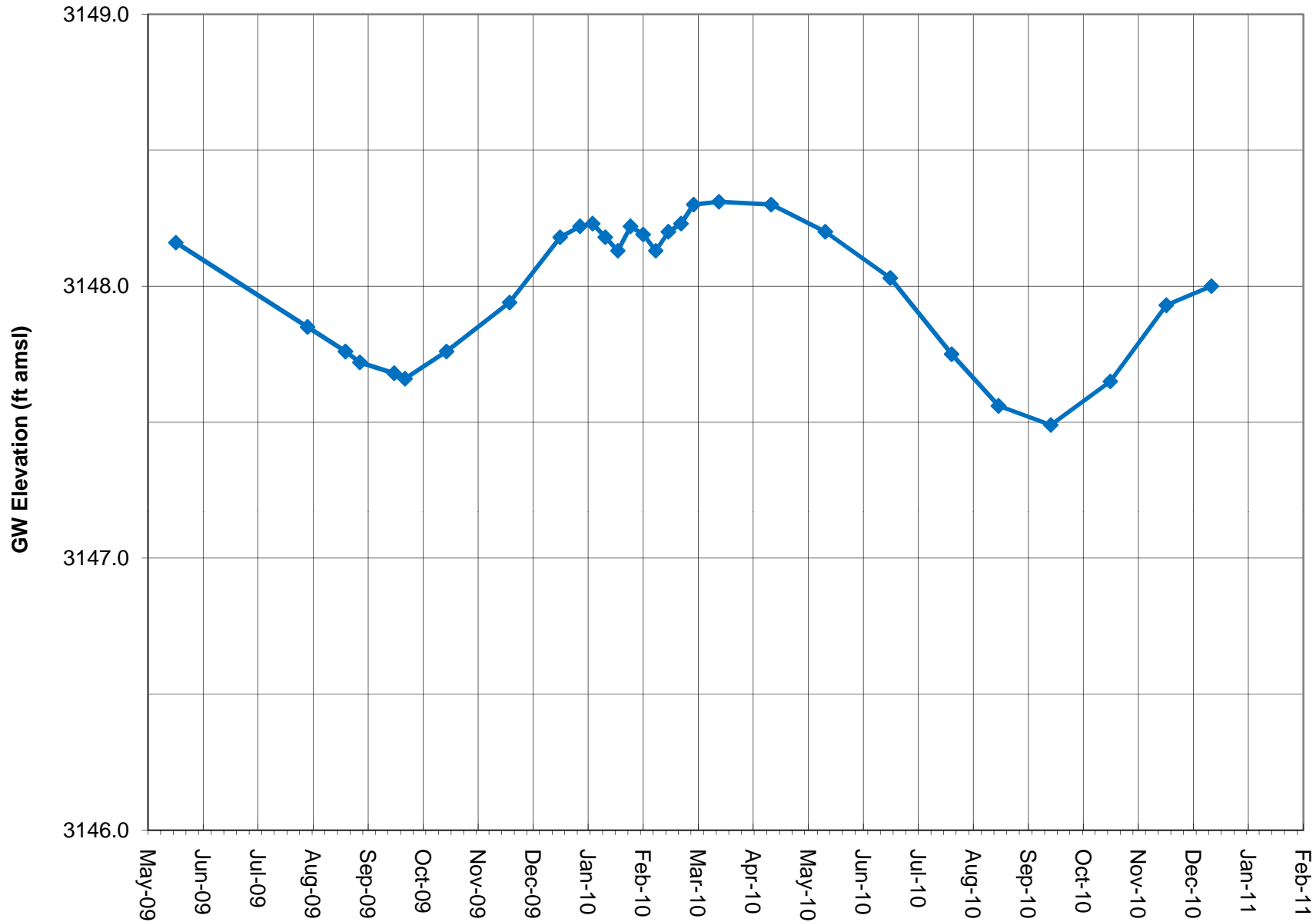
Note: Groundwater elevation data based on manual depth-to-water measurements.  
Coso Operating Co. conducted a pump test on the Hay Ranch South Well in fourth quarter 2007.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# **GROUNDWATER ELEVATION DATA - Long-Term (Manual)** **RV180 - Little Lake Ranch North Well**



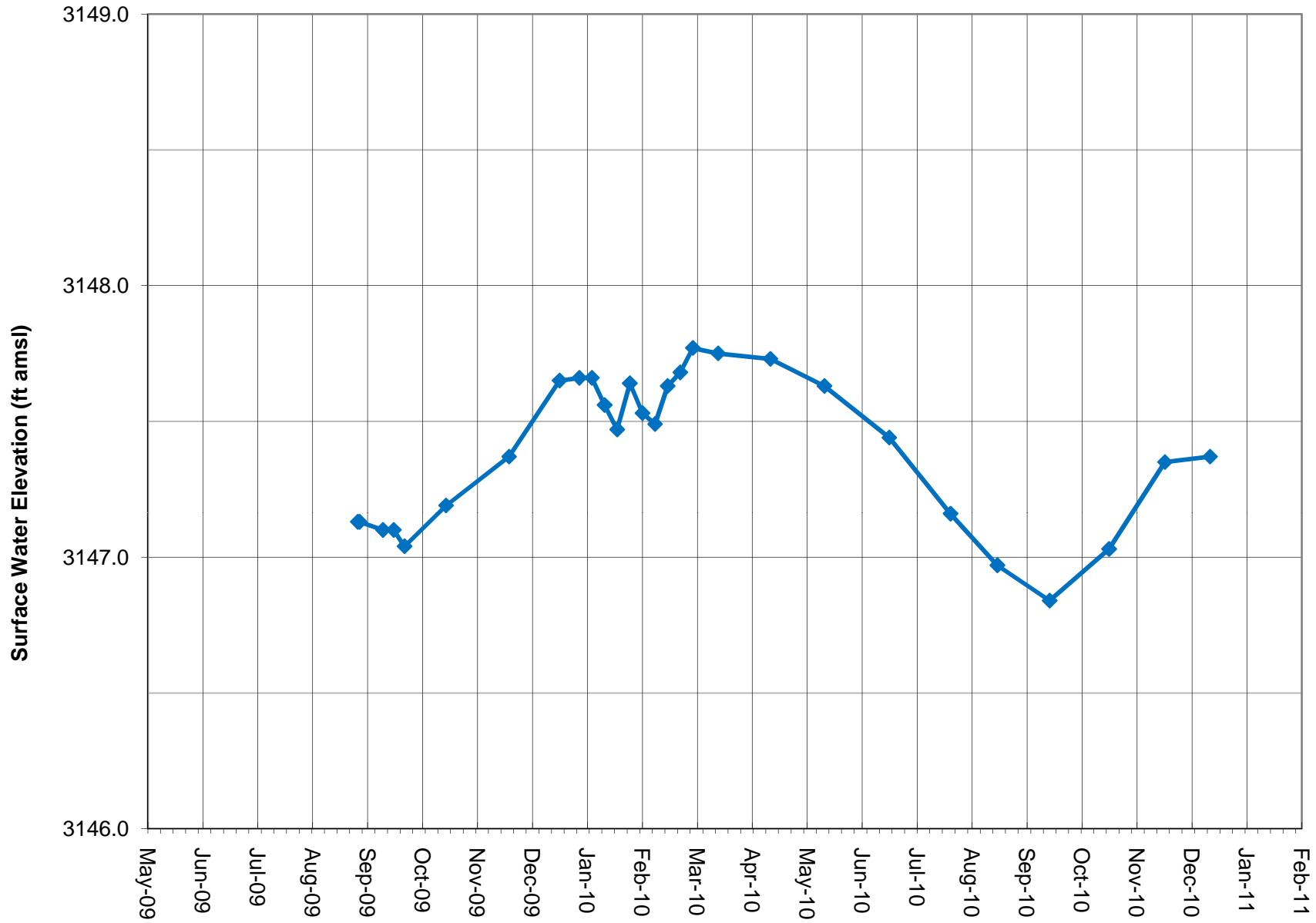
Note: Groundwater elevation data based on manual depth-to-water measurements.  
 Coso Operating Co. conducted a pump test on the Hay Ranch South Well in fourth quarter 2007.  
 Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

**GROUNDWATER ELEVATION DATA - Long-Term (Manual)**  
**RV210 - Little Lake Ranch Dock Well**



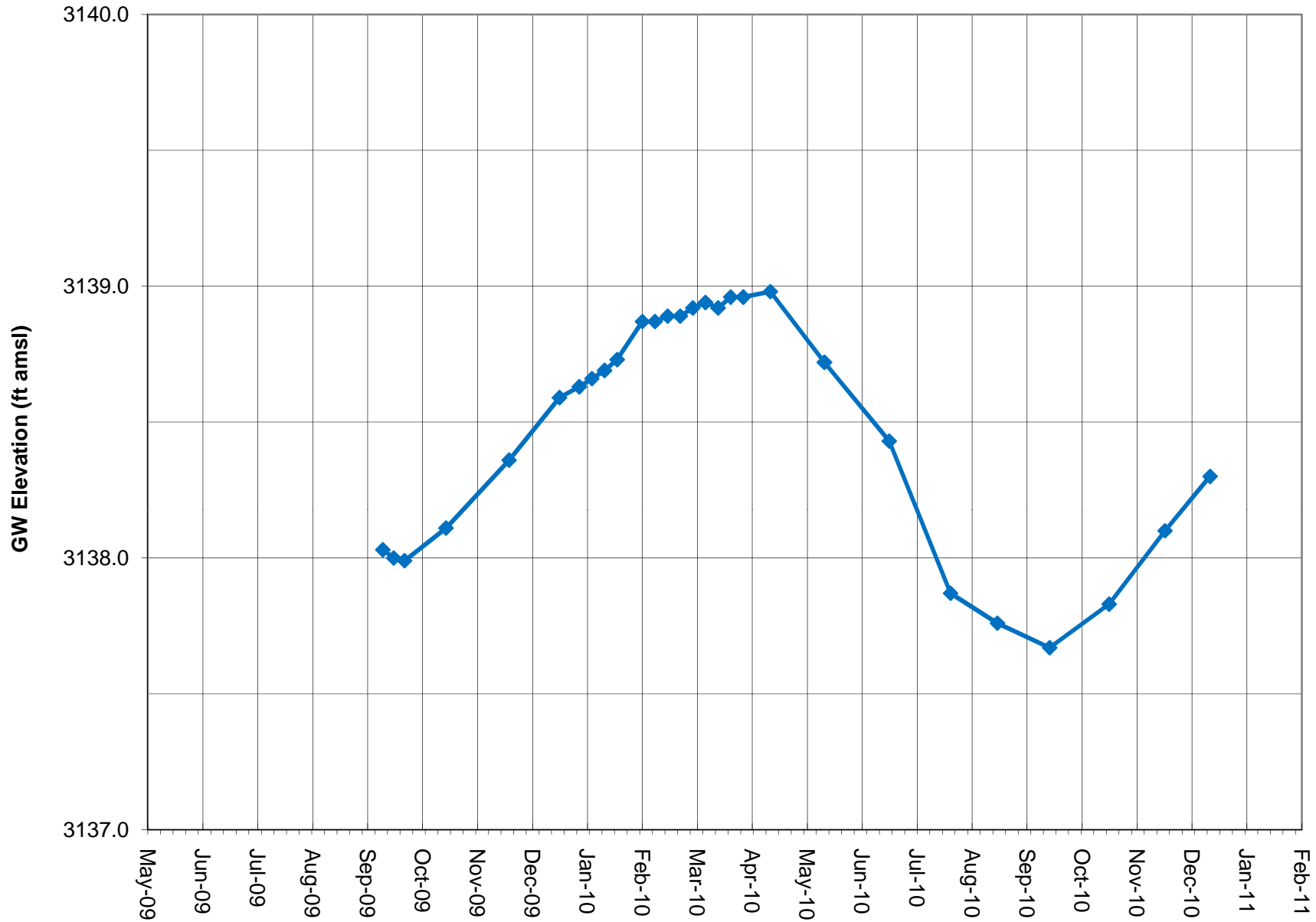
Note: Groundwater elevation data based on manual depth-to-water measurements. Lines between data points are approximations.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

**GROUNDWATER ELEVATION DATA - Long-Term (Manual)**  
**RV220 - LLR Stilling Well (lake surface)**



Note: Surface water elevation data based on manual depth-to-water measurements. Lines between data points are approximations.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

**GROUNDWATER ELEVATION DATA - Long-Term (Manual)**  
**RV260 - Little Lake Ranch Hotel Well**

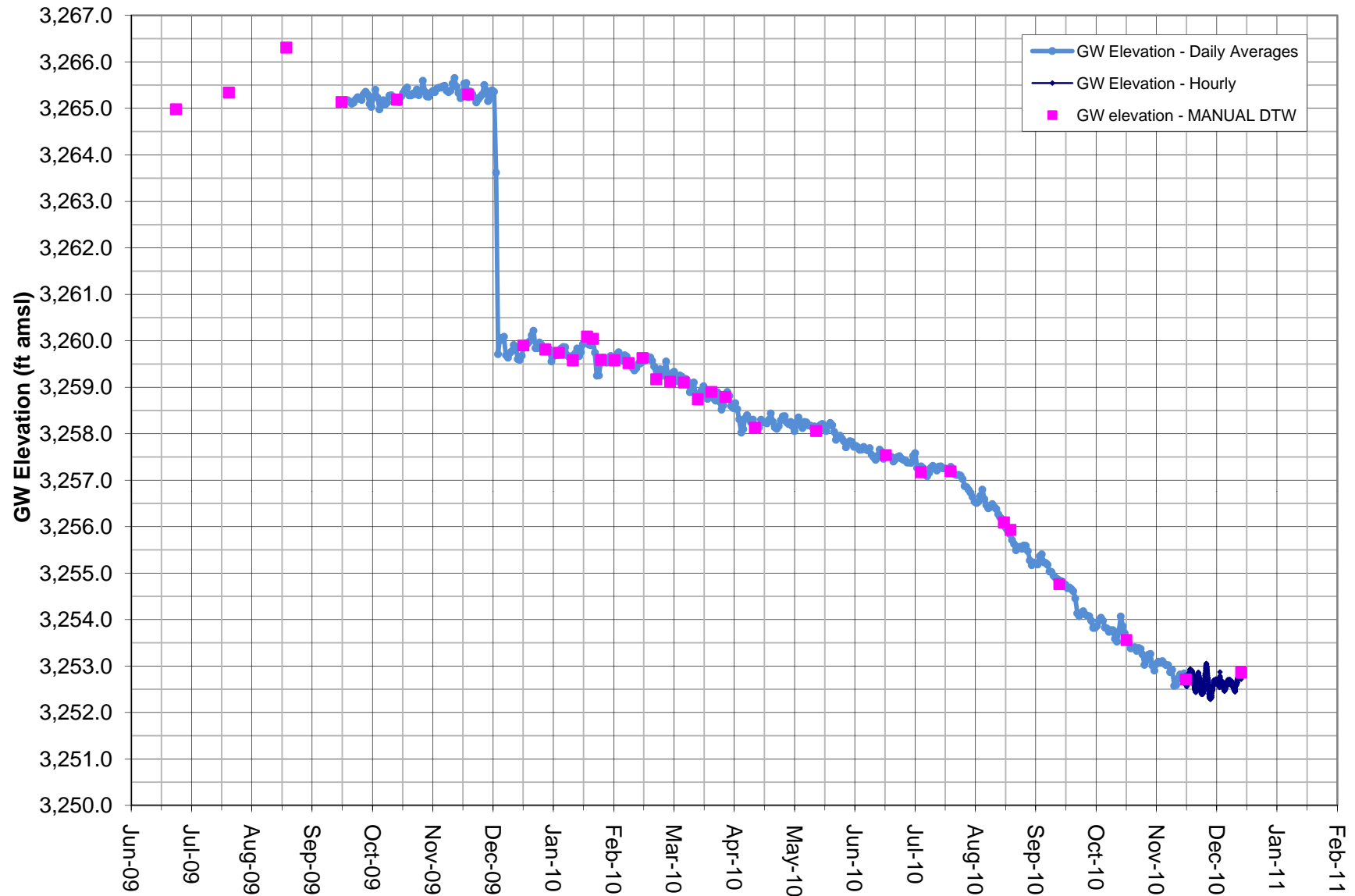


Note: Groundwater elevation data based on manual depth-to-water measurements. Lines between data points are approximations.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.



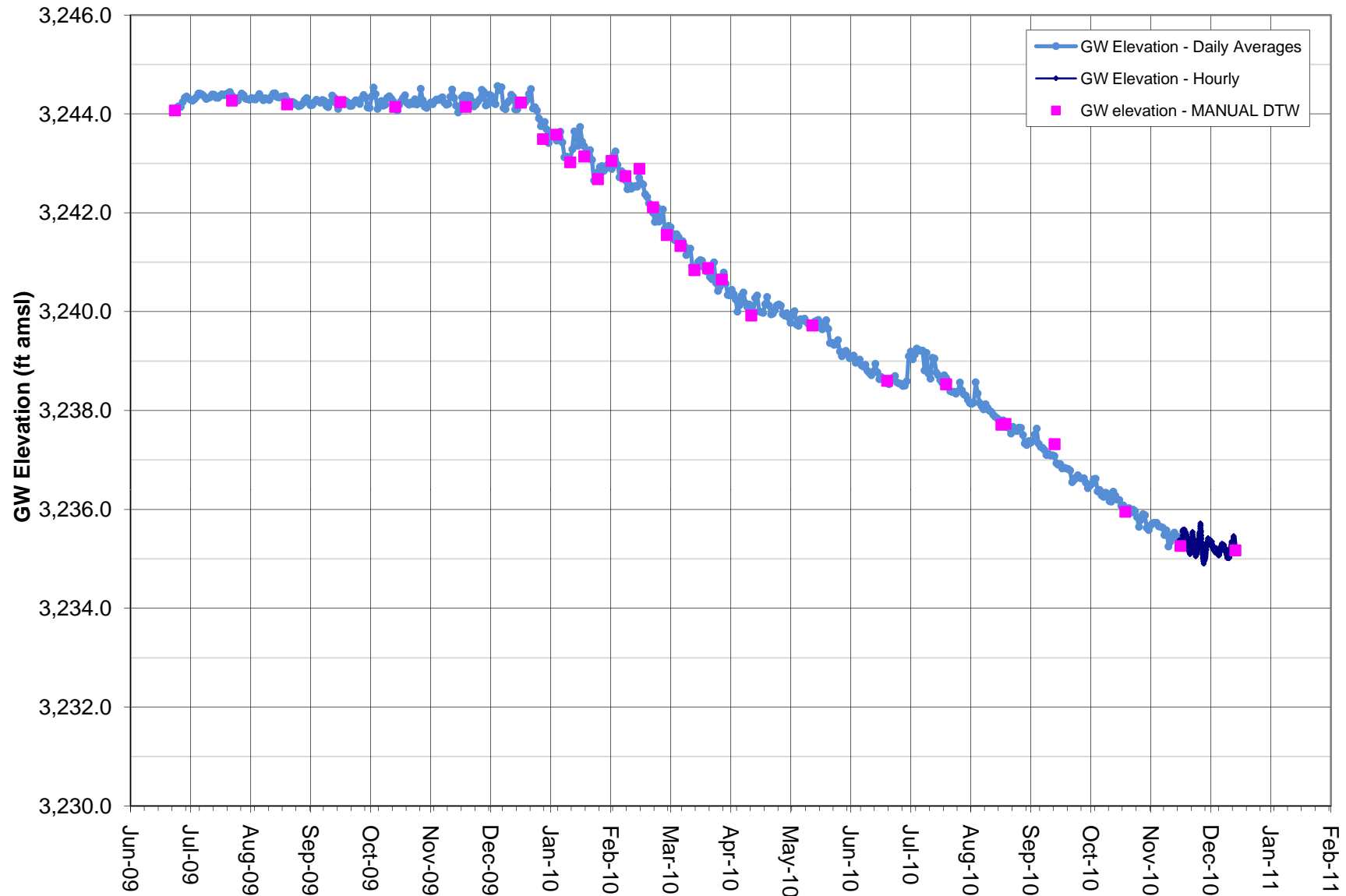
**GROUNDWATER ELEVATION DATA  
TRANSDUCER**

## GROUNDWATER ELEVATION DATA - Transducer RV030 - Cal Pumice Well



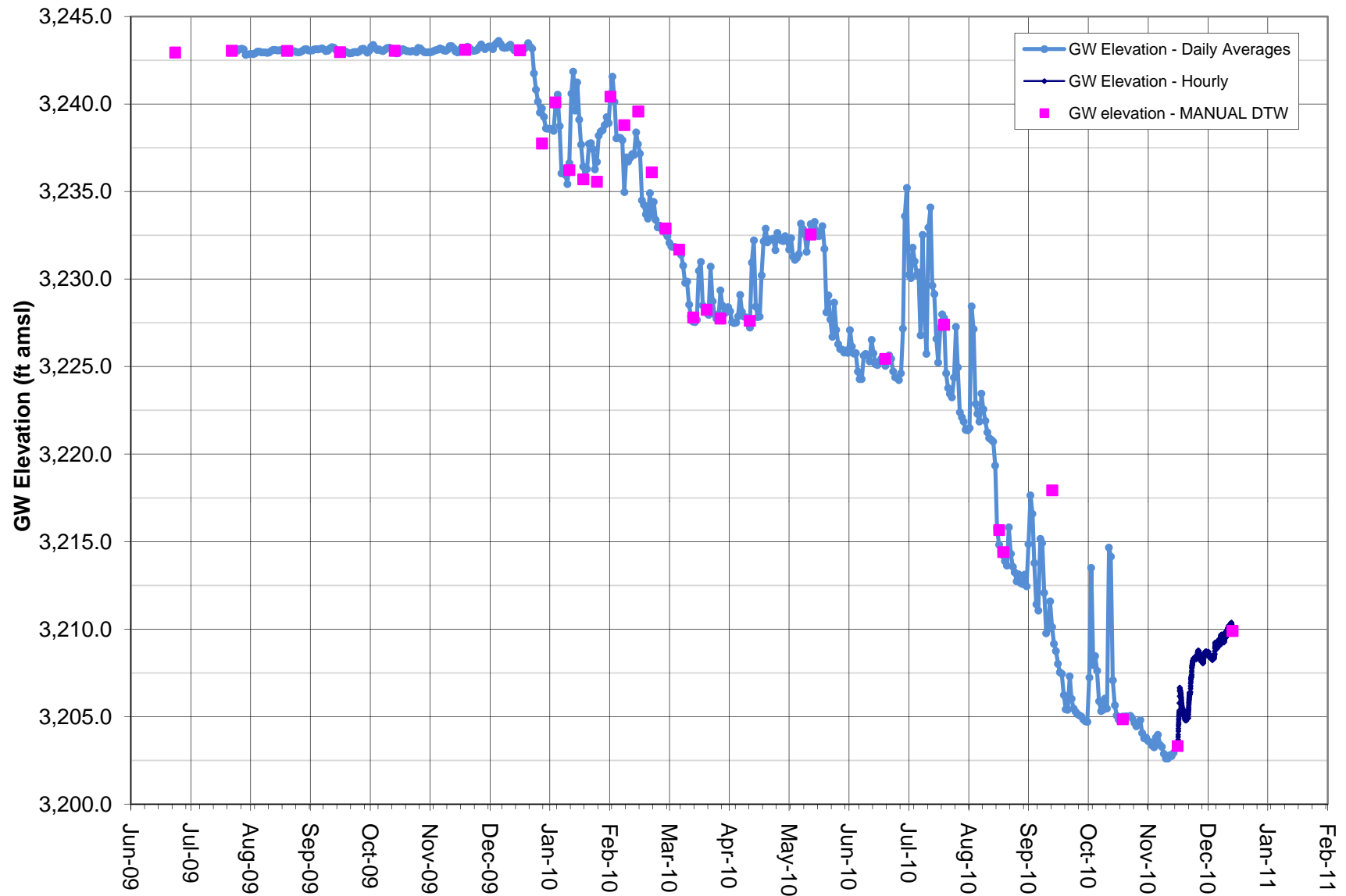
Note: Transducer data adjusted by BaroTroll and correlated to Manual DTW.  
 The 12/3/09 GWE decrease was confirmed by in-well PT and manual DTW.  
 Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# **GROUNDWATER ELEVATION DATA - Transducer RV060 - HR 1A Well**



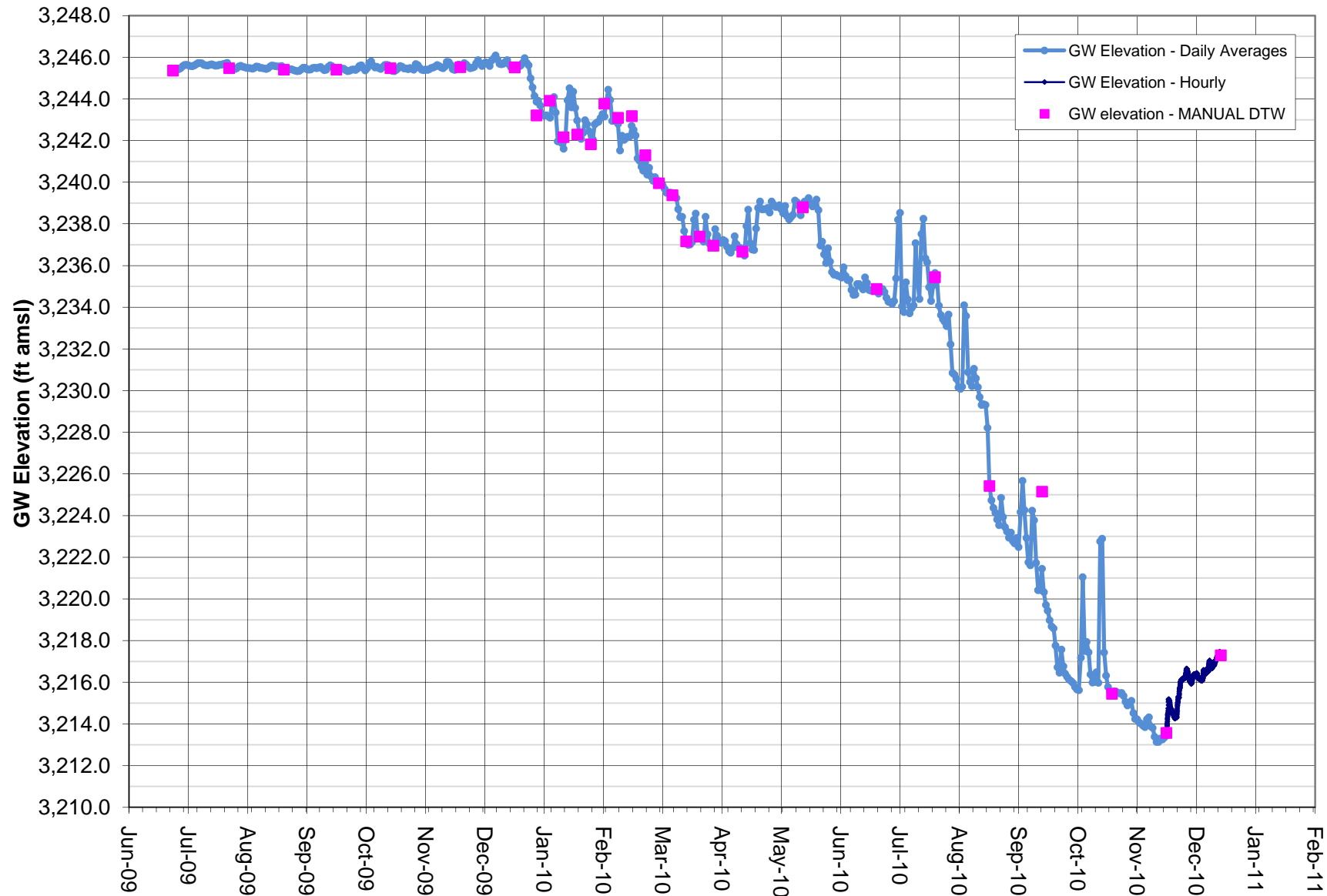
Note: Transducer data (absolute pressure) adjusted by data logged from BaroTroll and correlated to Manual DTW measurements.  
 Screened interval 170-260 feet.  
 Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# **GROUNDWATER ELEVATION DATA - Transducer RV061 - HR 1B Well**



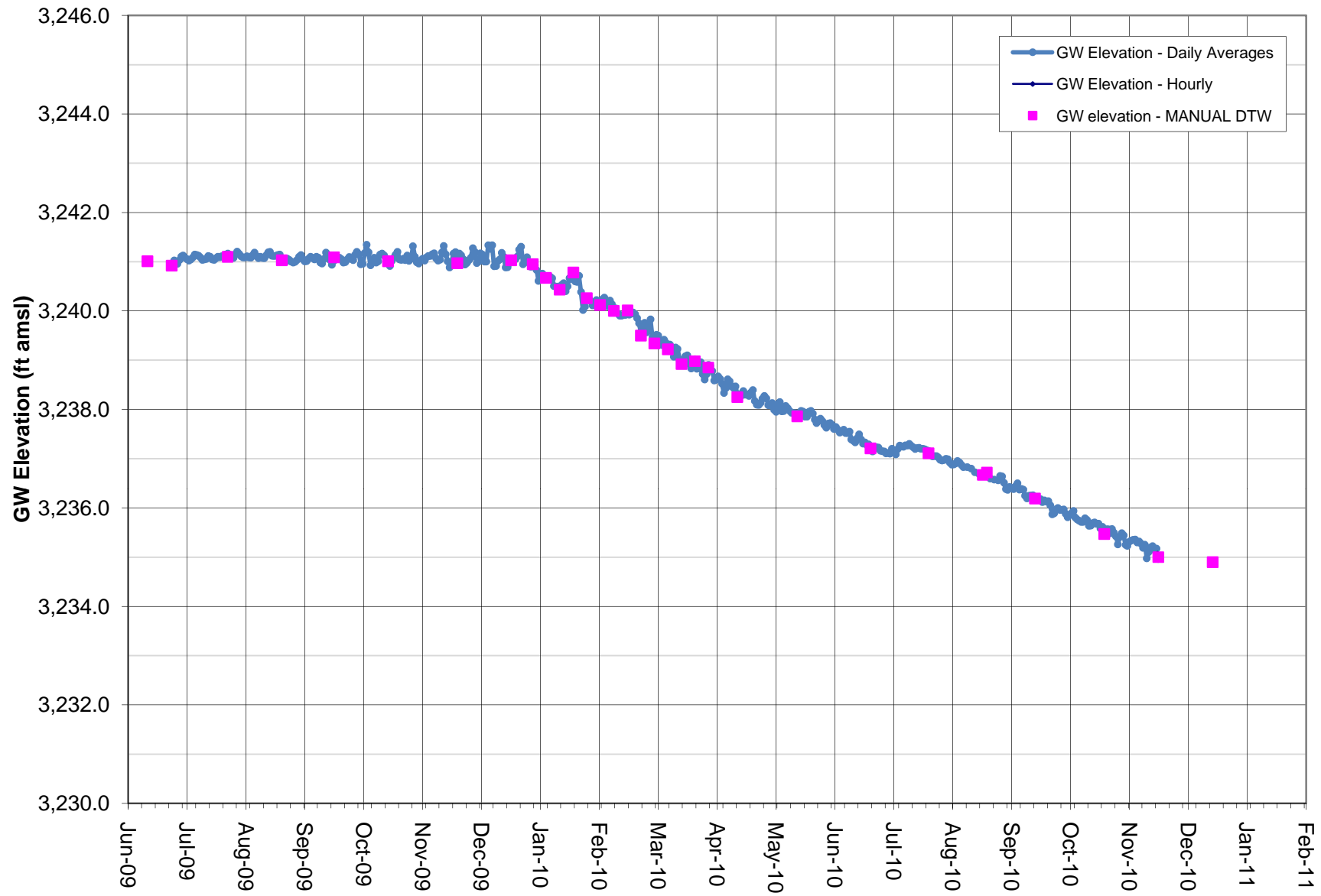
Note: Transducer data (absolute pressure) adjusted by data logged from BaroTroll and correlated to Manual DTW measurements.  
 Screened interval 490-540 feet.  
 Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# **GROUNDWATER ELEVATION DATA - Transducer RV062 - HR 1C Well**



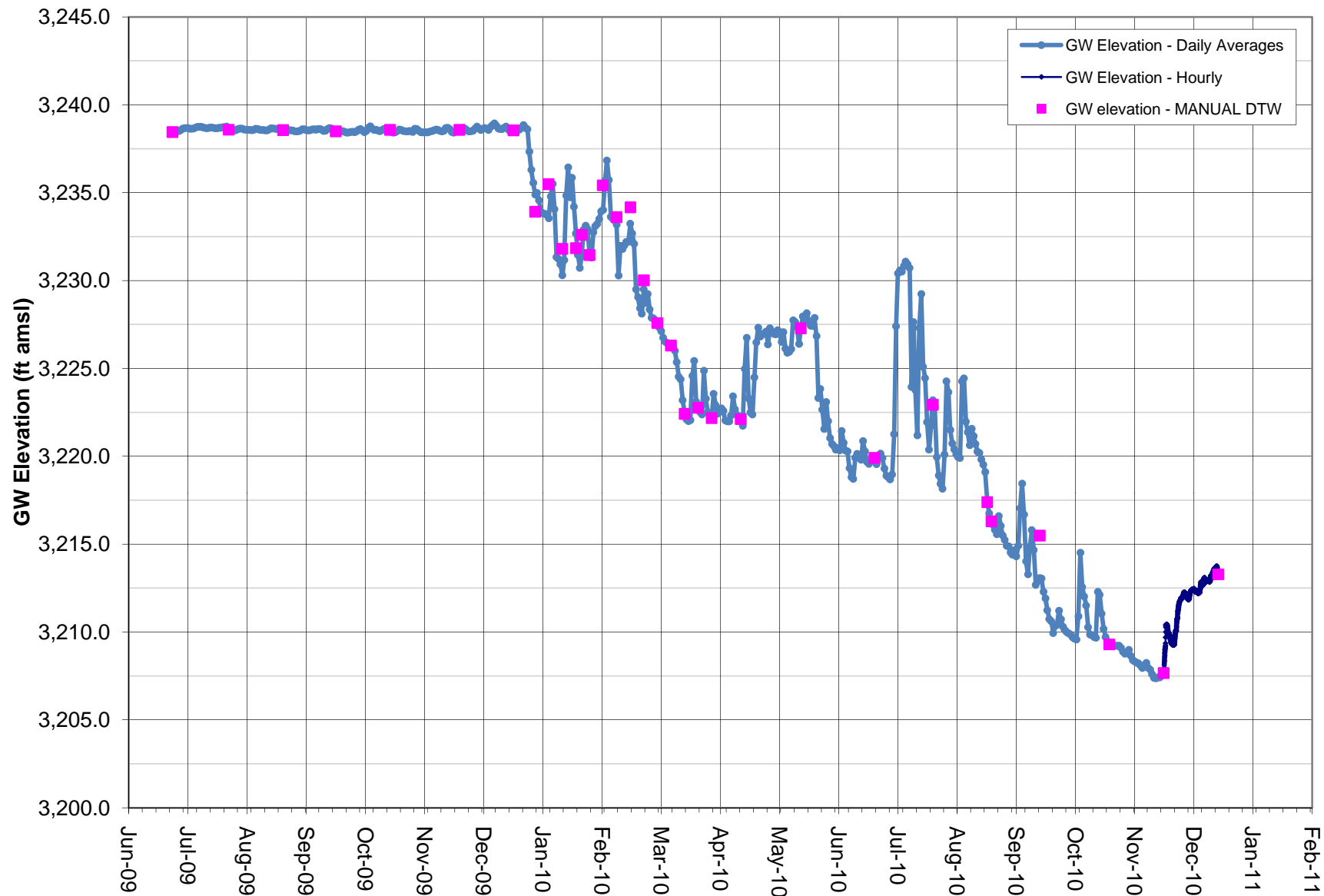
Note: Transducer data (absolute pressure) adjusted by data logged from BaroTroll and correlated to Manual DTW measurements.  
 Screened interval 340-405 feet.  
 Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# **GROUNDWATER ELEVATION DATA - Transducer RV080 - HR 2A Well**



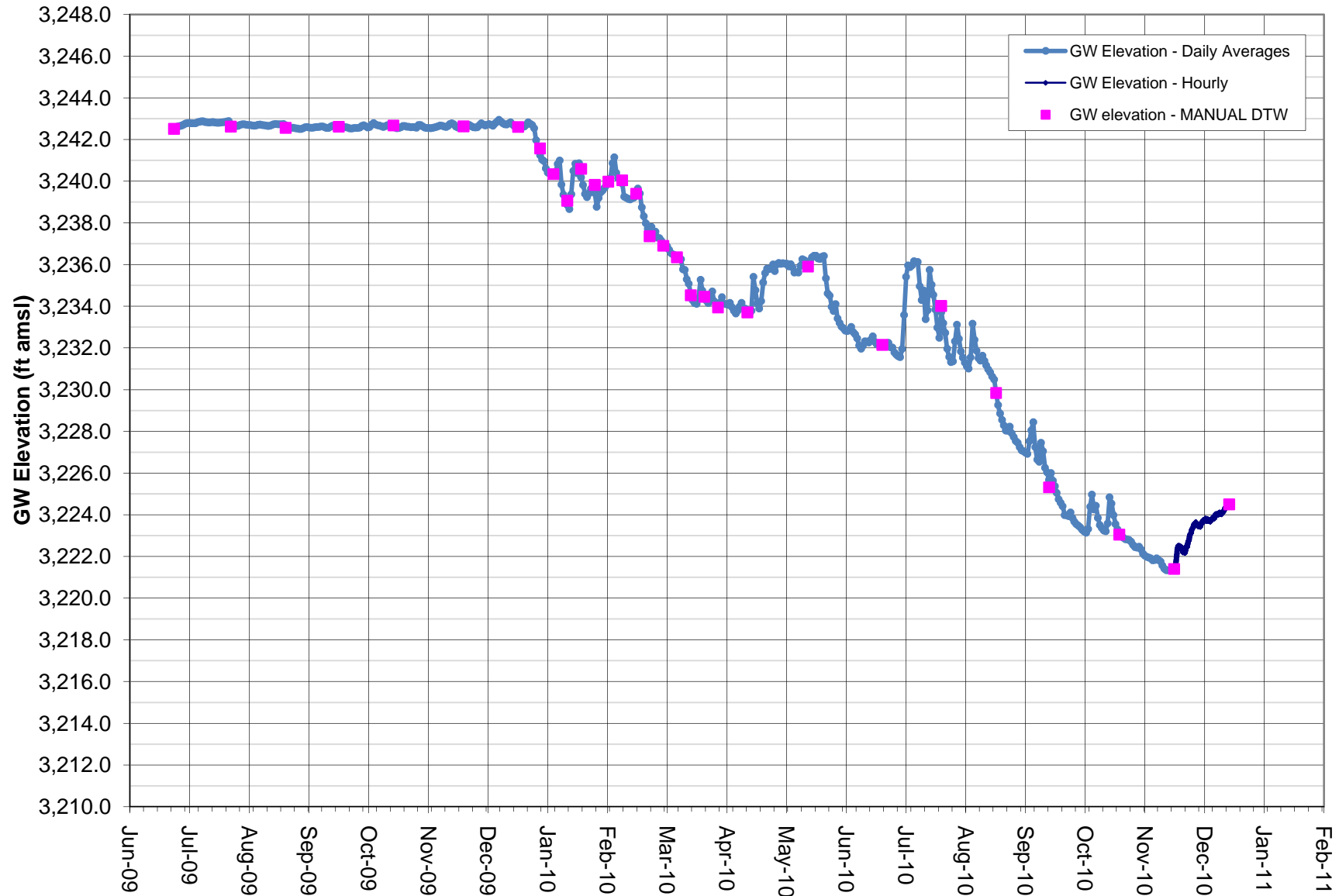
Note: Screened interval 180-300 feet.  
 Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.  
 HR 2A missing Nov-Dec 2010 data due to transducer malfunction.

# **GROUNDWATER ELEVATION DATA - Transducer RV081 - HR 2B Well**



Note: Transducer data (absolute pressure) adjusted by data logged from BaroTroll and correlated to Manual DTW measurements.  
 Screened interval 519-584 feet.  
 Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

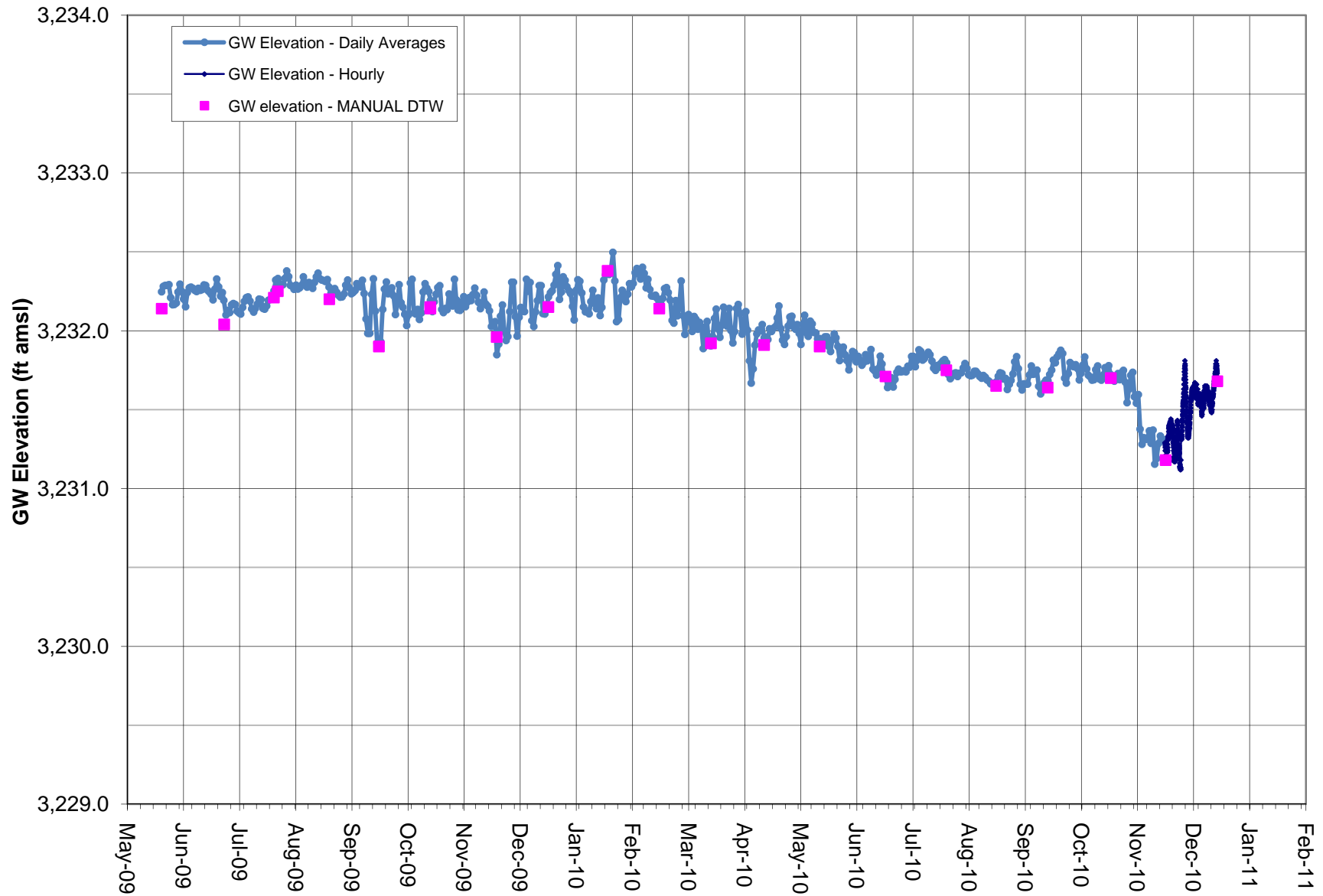
# **GROUNDWATER ELEVATION DATA - Transducer RV082 - HR 2C Well**



Note: Transducer data (absolute pressure) adjusted by data logged from BaroTroll and correlated to Manual DTW measurements.  
 Screened interval 370-420 feet.  
 Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

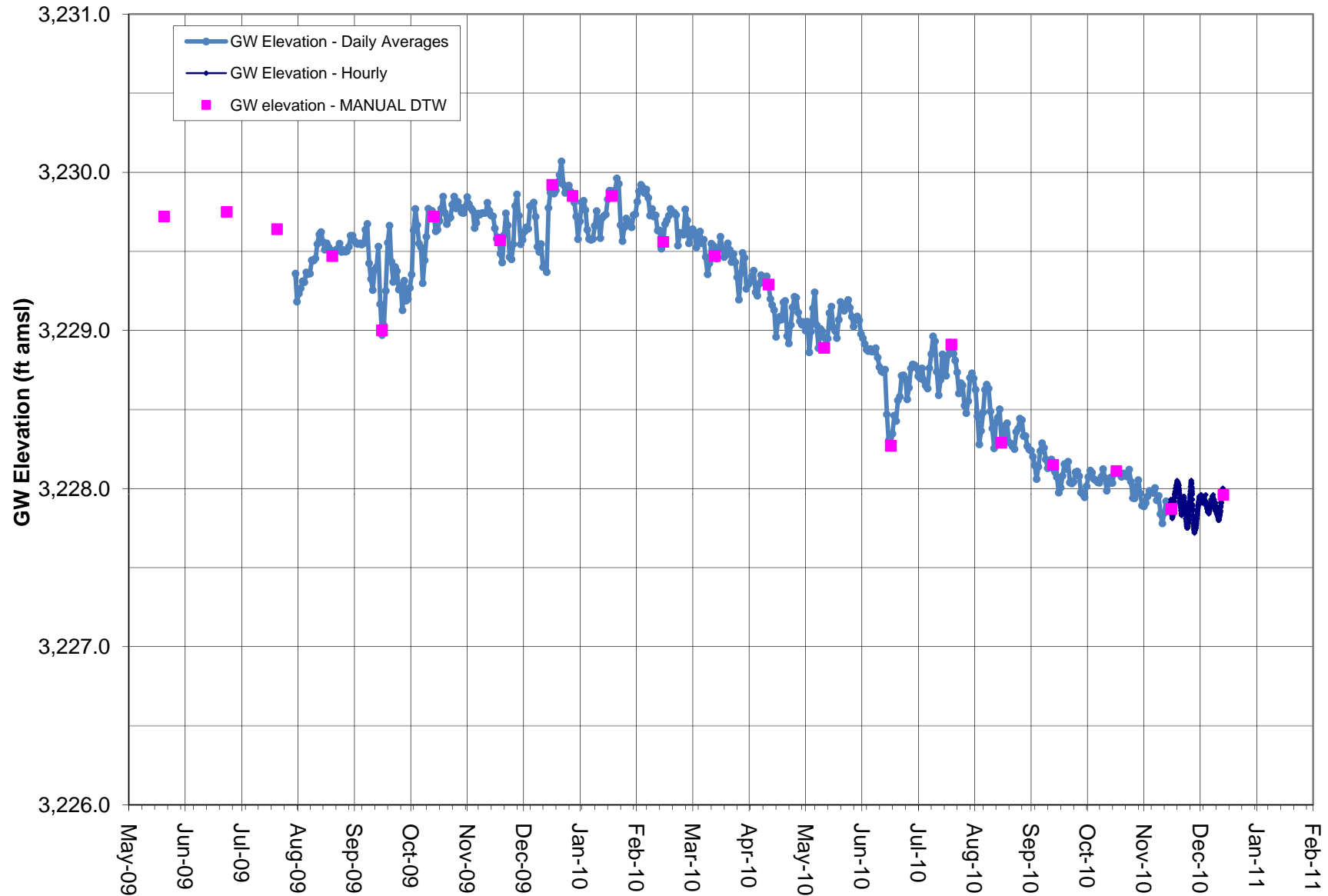


# **GROUNDWATER ELEVATION DATA - Transducer RV090 - Coso Junction Ranch Well**



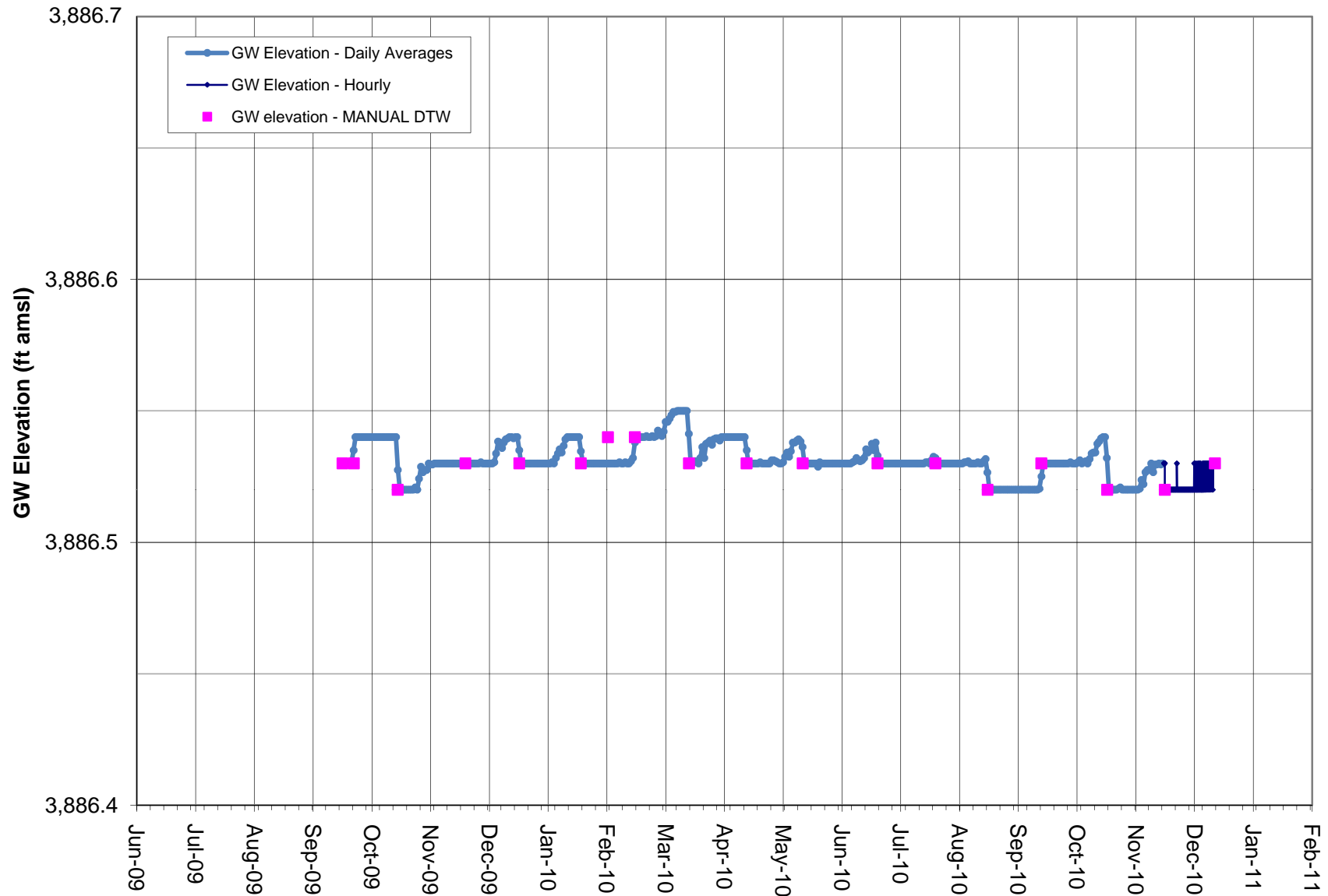
Note: Transducer data (absolute pressure) adjusted by data logged from BaroTroll and correlated to Manual DTW measurements.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# **GROUNDWATER ELEVATION DATA - Transducer RV100- Coso Junction Store#1 Well**



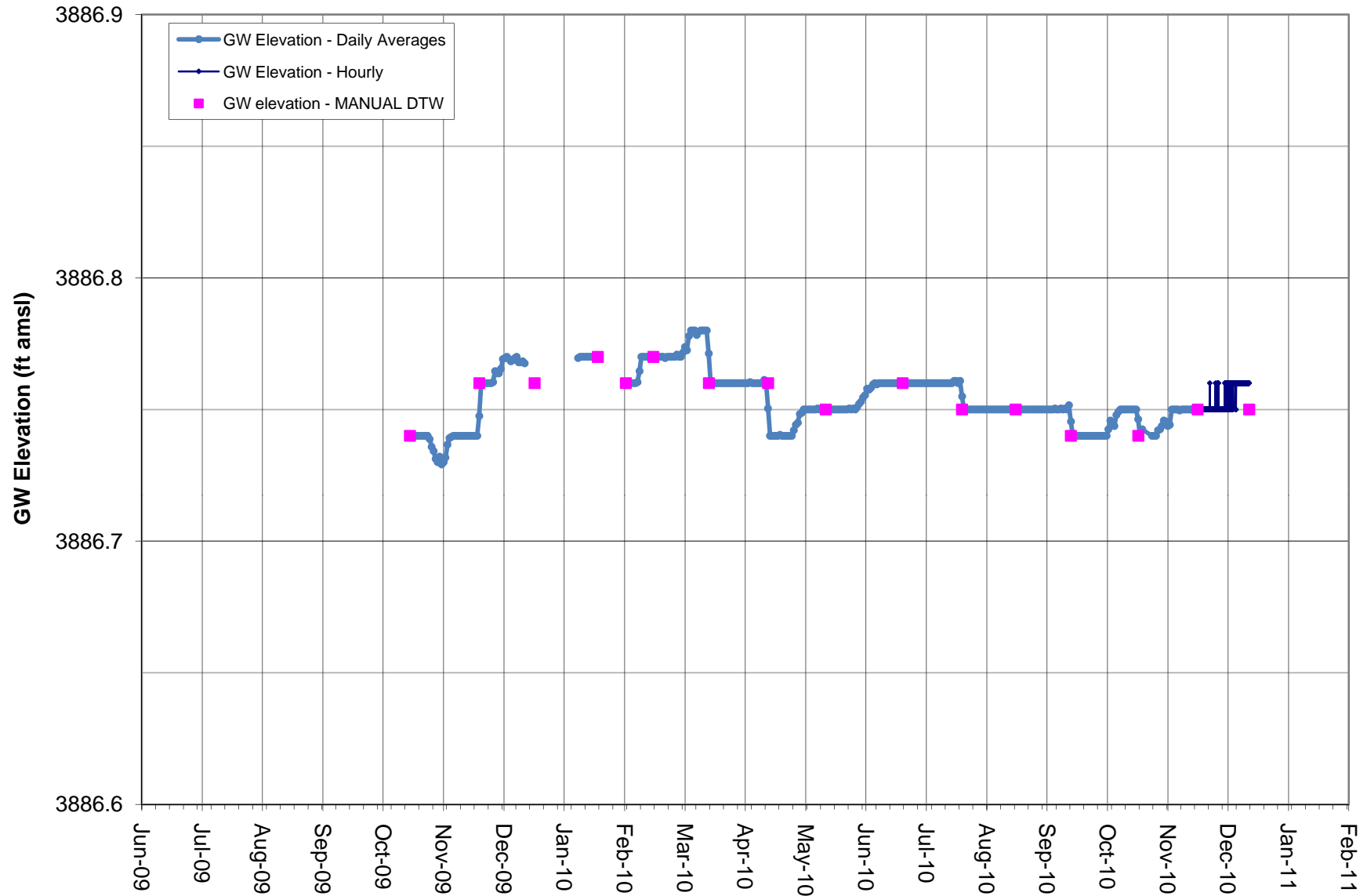
Note: Transducer data (absolute pressure) adjusted by data logged from BaroTroll and correlated to Manual DTW measurements.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# **GROUNDWATER ELEVATION DATA - Transducer RV110 - Davis Ranch North Well**



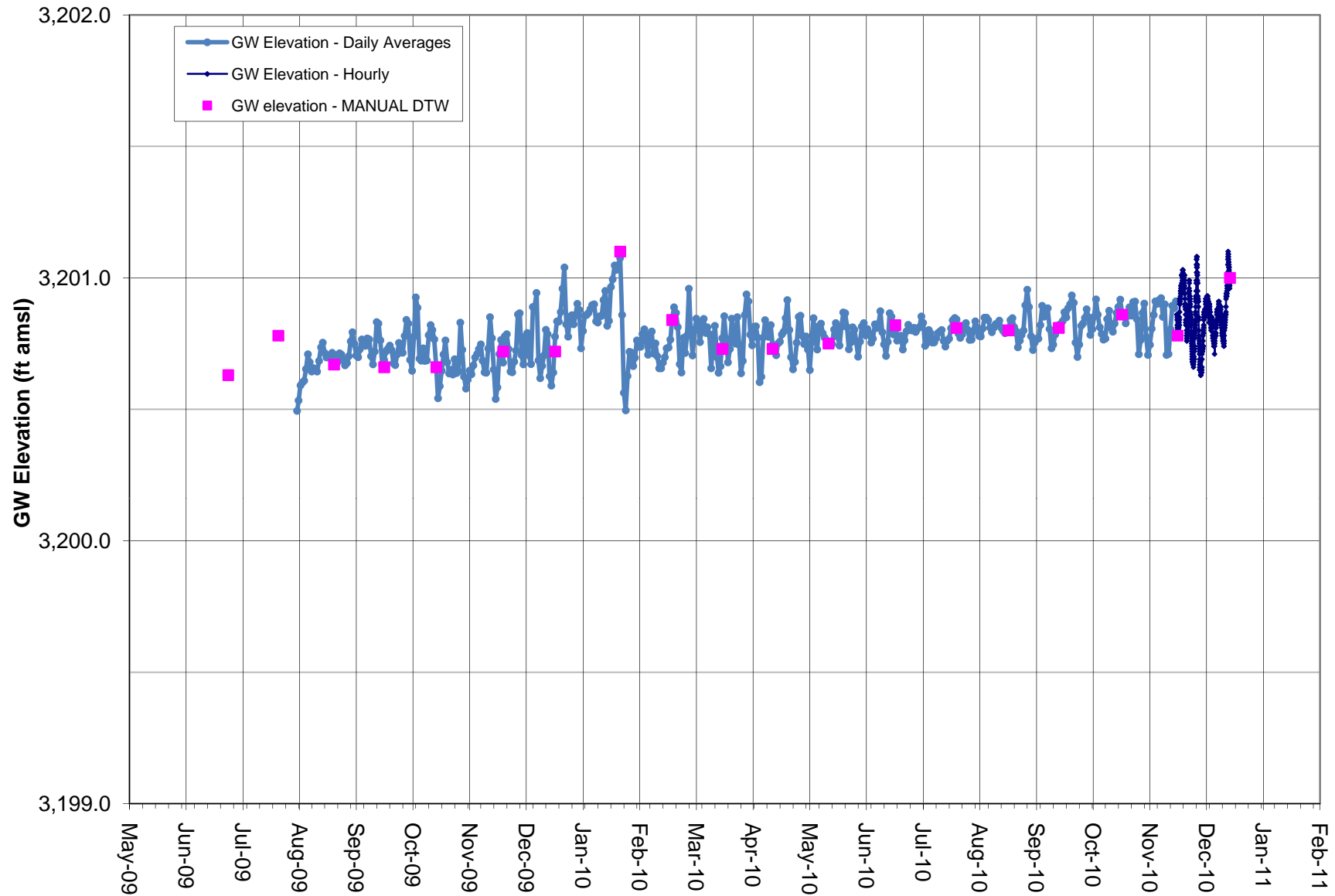
Note: Vented transducer data correlated to Manual DTW measurements.  
 DTW measured to .01 foot; GWE calculated using approximate surface elevation.  
 Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# **GROUNDWATER ELEVATION DATA - Transducer RV111 - Davis Ranch South Well**



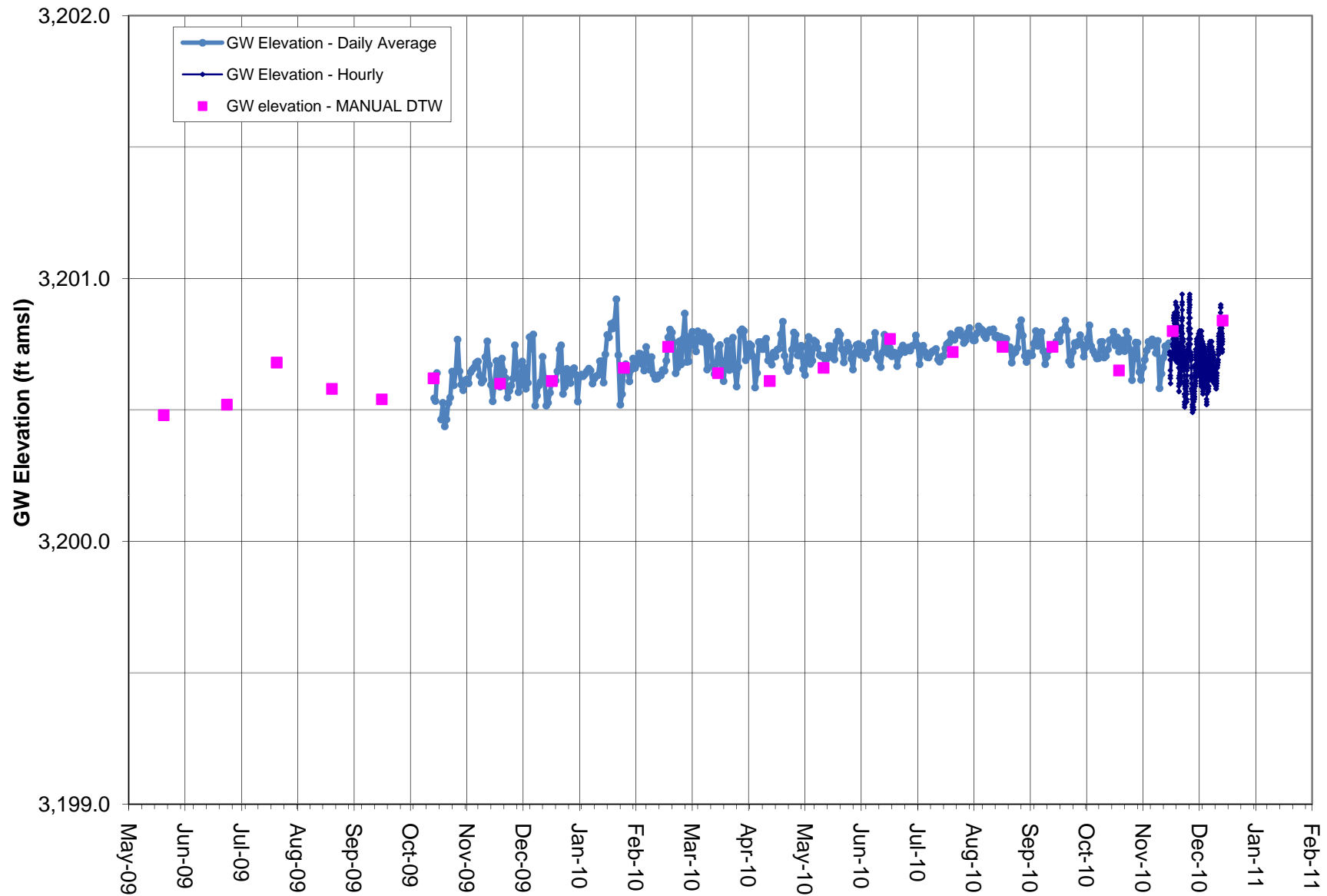
Note: Vented transducer data correlated to Manual DTW measurements.  
PT experienced technical difficulties from 12/09 to 1/10 and was replaced in 2/10.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# GROUNDWATER ELEVATION DATA - Transducer RV120 - Red Hill Well



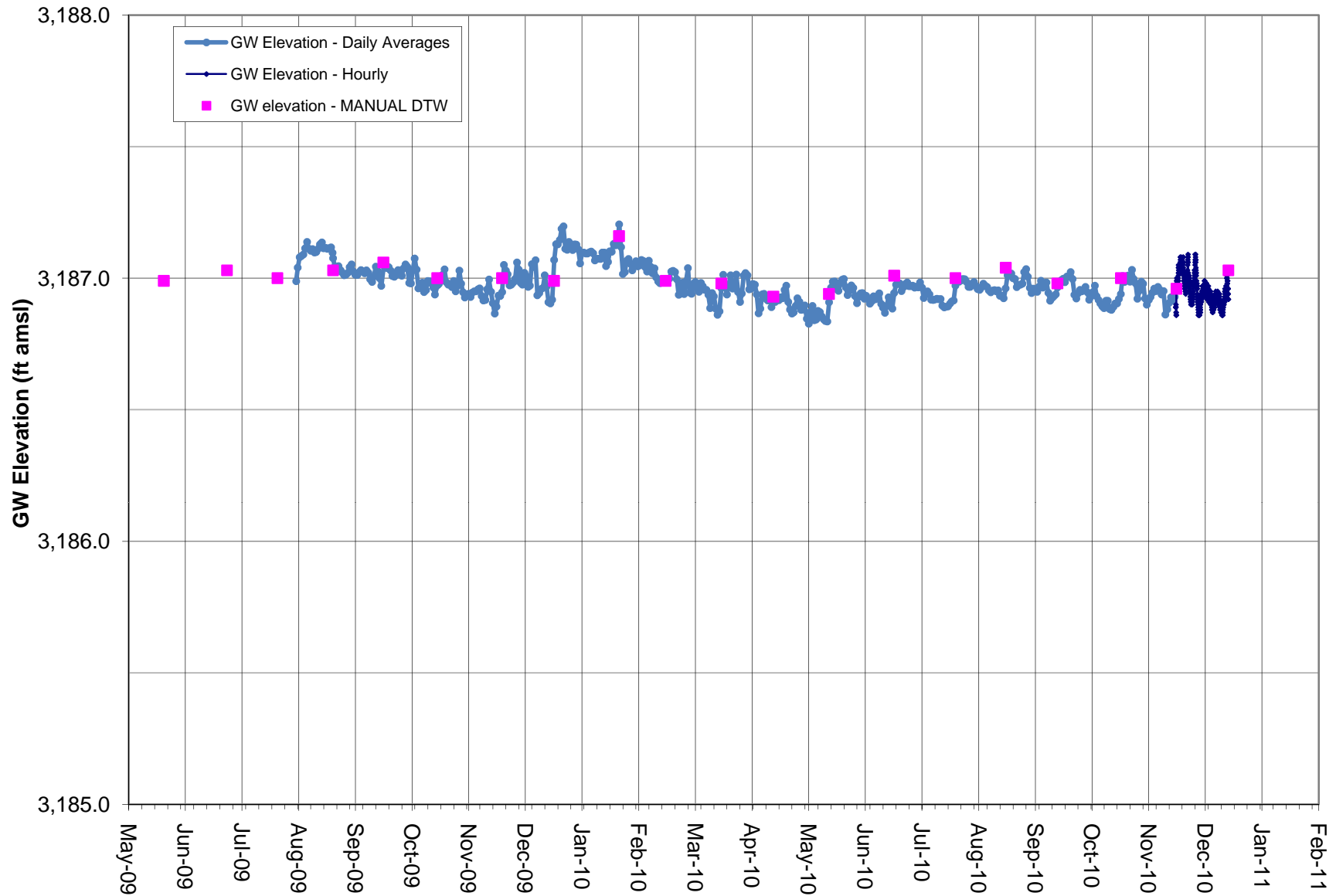
Note: Transducer data (absolute pressure) adjusted by data logged from BaroTroll and correlated to Manual DTW measurements.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# GROUNDWATER ELEVATION DATA - Transducer RV140 - Lego Well



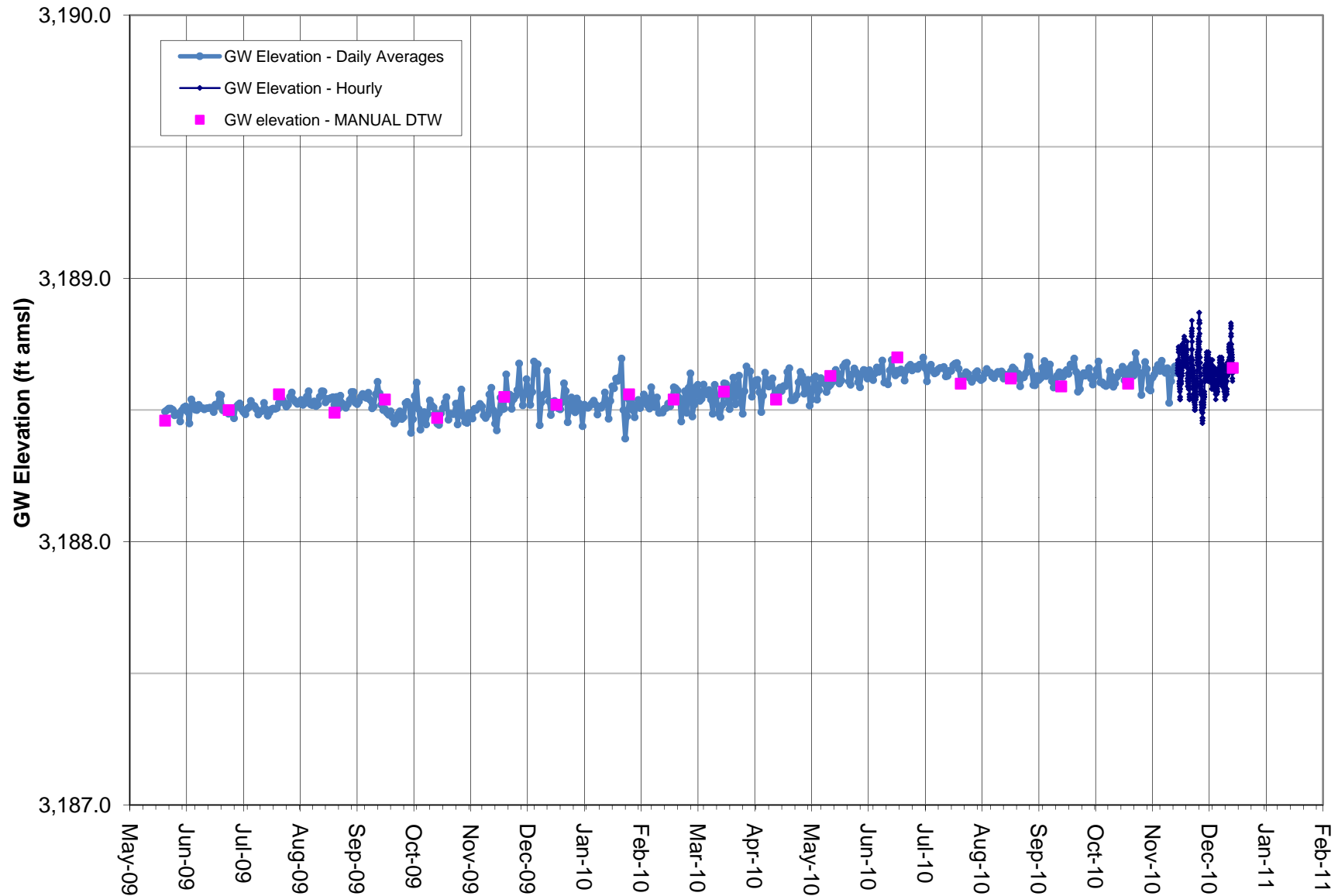
Note: Transducer data adjusted by BaroTroll and correlated to Manual DTW .  
Data from 10/17/09 is omitted as PT slipped less than 1 foot.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

## GROUNDWATER ELEVATION DATA - Transducer RV150 - Cinder Road Well



Note: Transducer data (absolute pressure) adjusted by data logged from BaroTroll and correlated to Manual DTW measurements.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

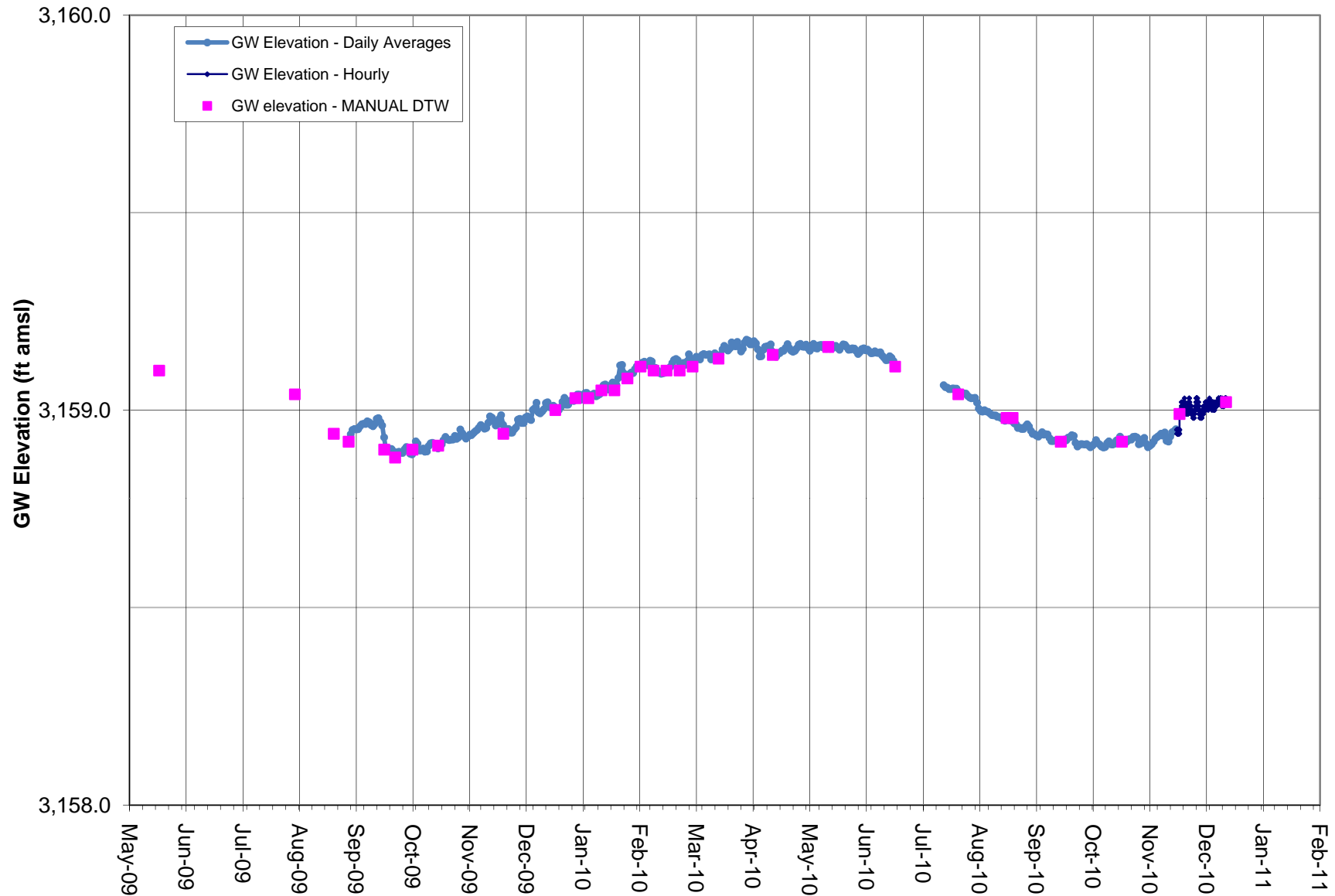
# **GROUNDWATER ELEVATION DATA - Transducer RV160 - 18-28 GTH Well**



Note: Transducer data (absolute pressure) adjusted by data logged from BaroTroll and correlated to Manual DTW measurements.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

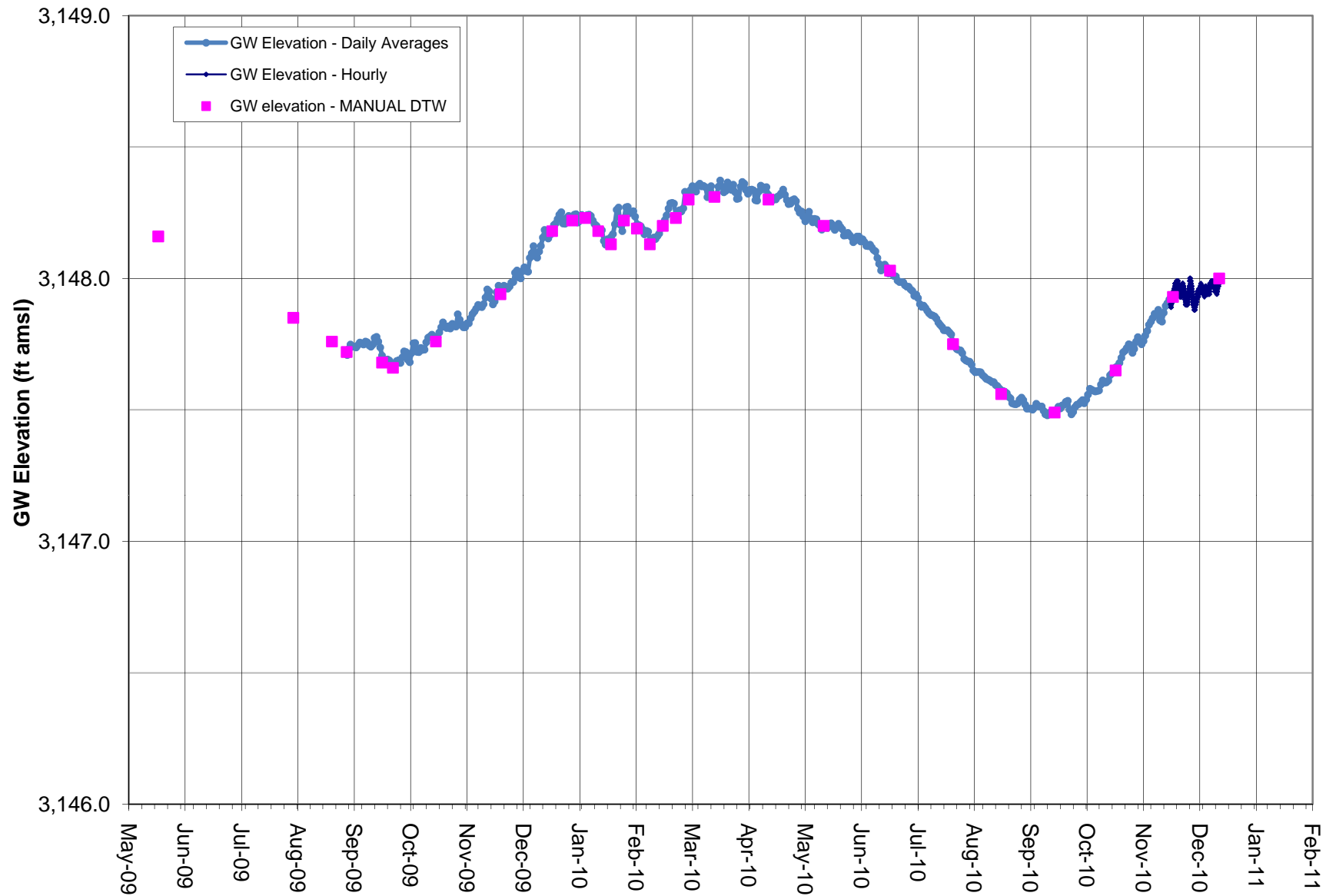


## GROUNDWATER ELEVATION DATA - Transducer RV180 - Little Lake Ranch North Well



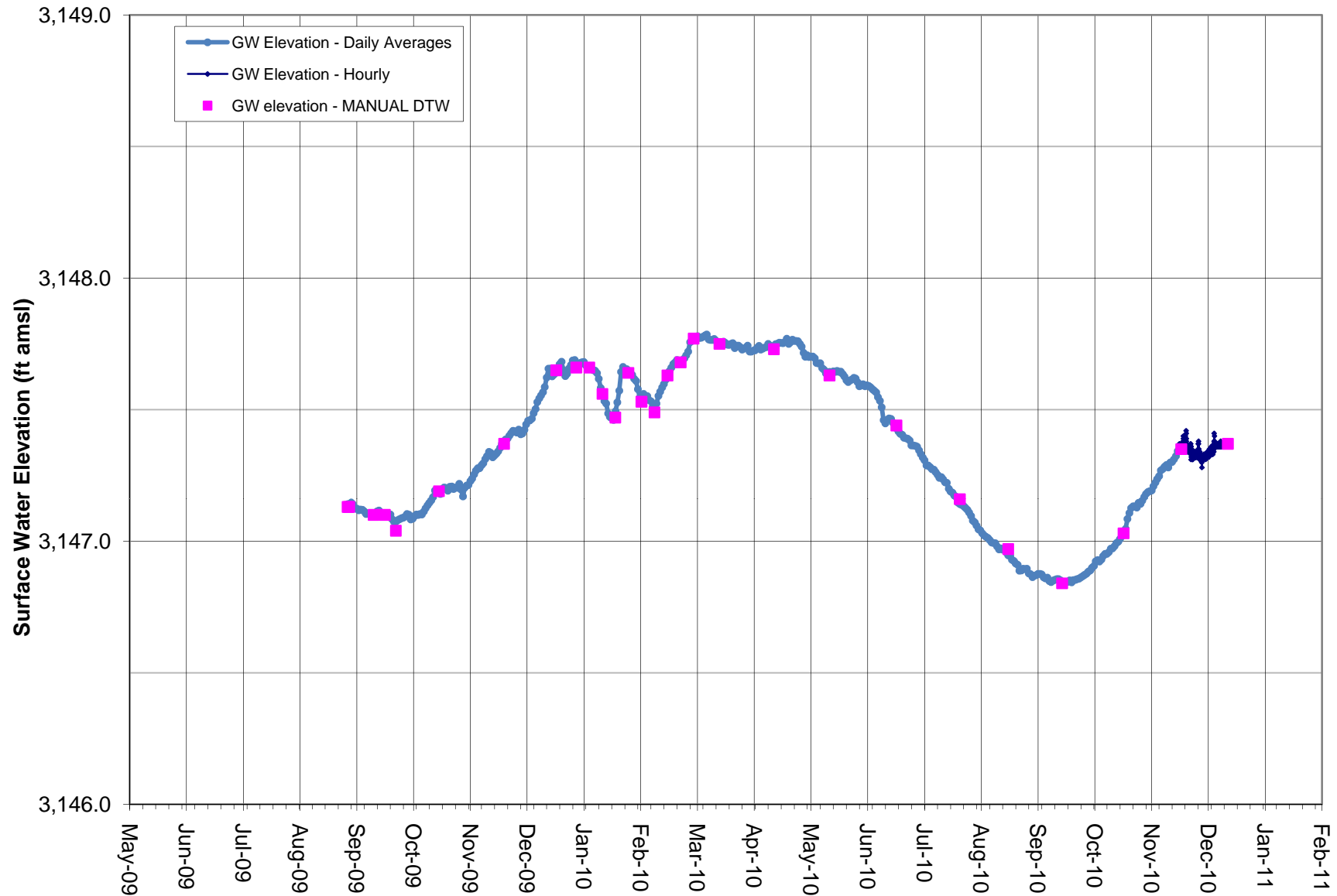
Note: Vented transducer data correlated to Manual DTW measurements.  
 Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.  
 Transducer data for June-July 2010 is suspect (faulty sensor).

# GROUNDWATER ELEVATION DATA - Transducer RV210 - Little Lake Ranch Dock Well



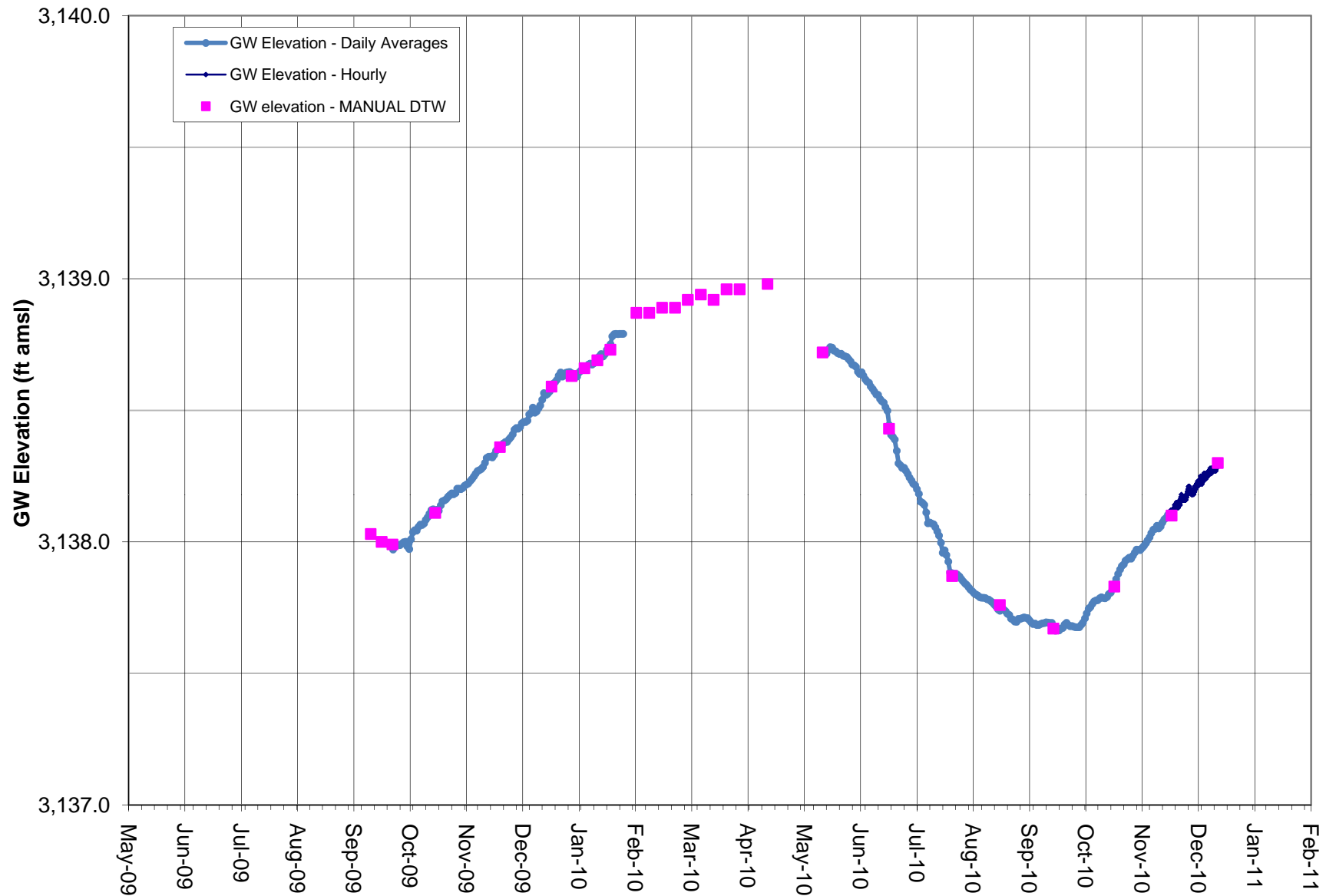
Note: Vented transducer data correlated to Manual DTW measurements.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# **GROUNDWATER ELEVATION DATA - Transducer RV220 - Little Lake Ranch Stilling Well (lake surface)**



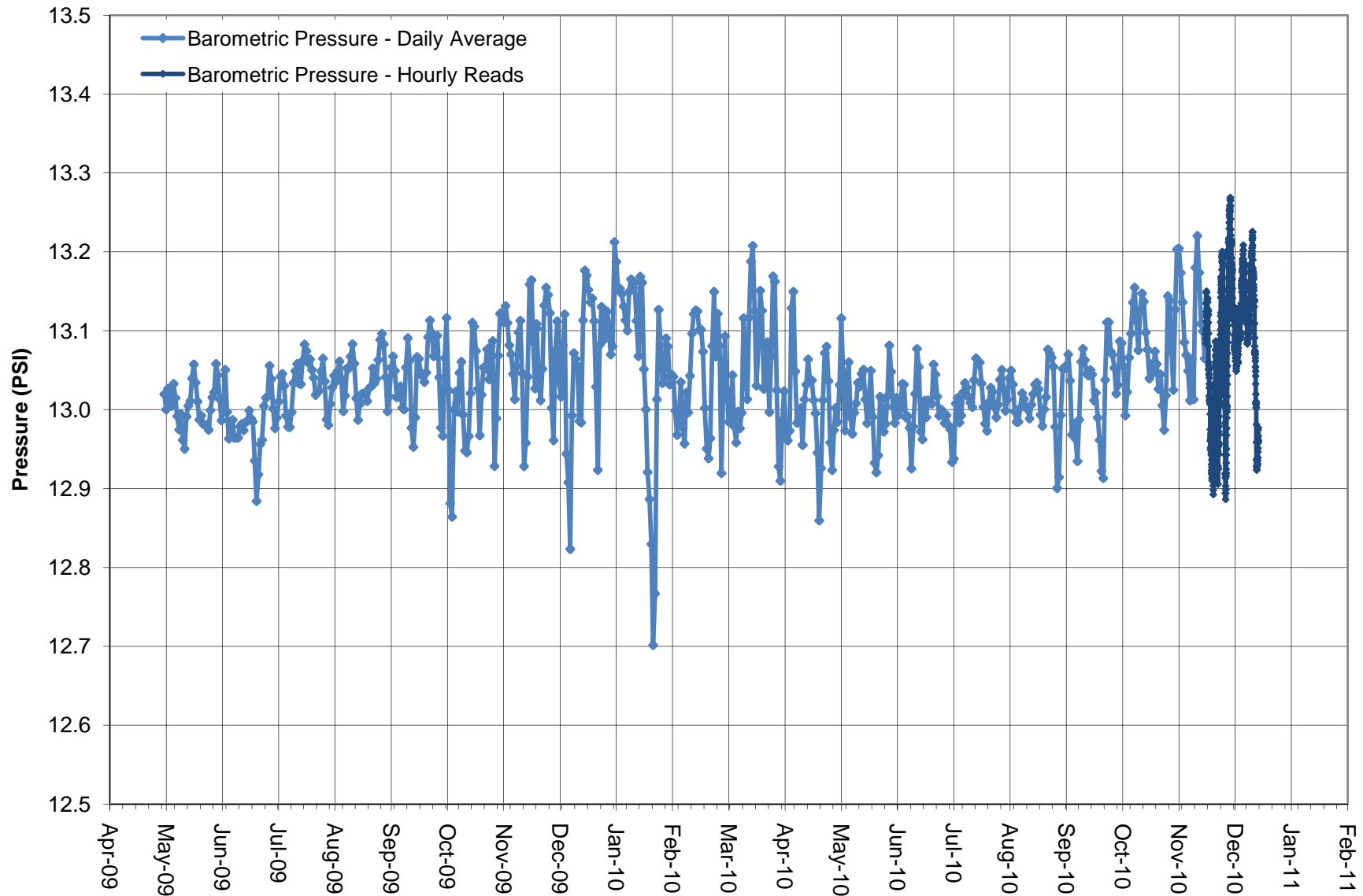
Note: Vented transducer data correlated to Manual DTW measurements. Represents surface water elevation of Little Lake.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# **GROUNDWATER ELEVATION DATA - Transducer RV260 - Little Lake Ranch Hotel Well**



Note: Vented transducer data correlated to Manual DTW measurements.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

## BAROMETRIC PRESSURE as Logged by BaroTroll



Note: BaroTroll located in well casing of well HR-2B. Records atmospheric pressure.  
Significant pressure dip in January 2010 caused by large storm.

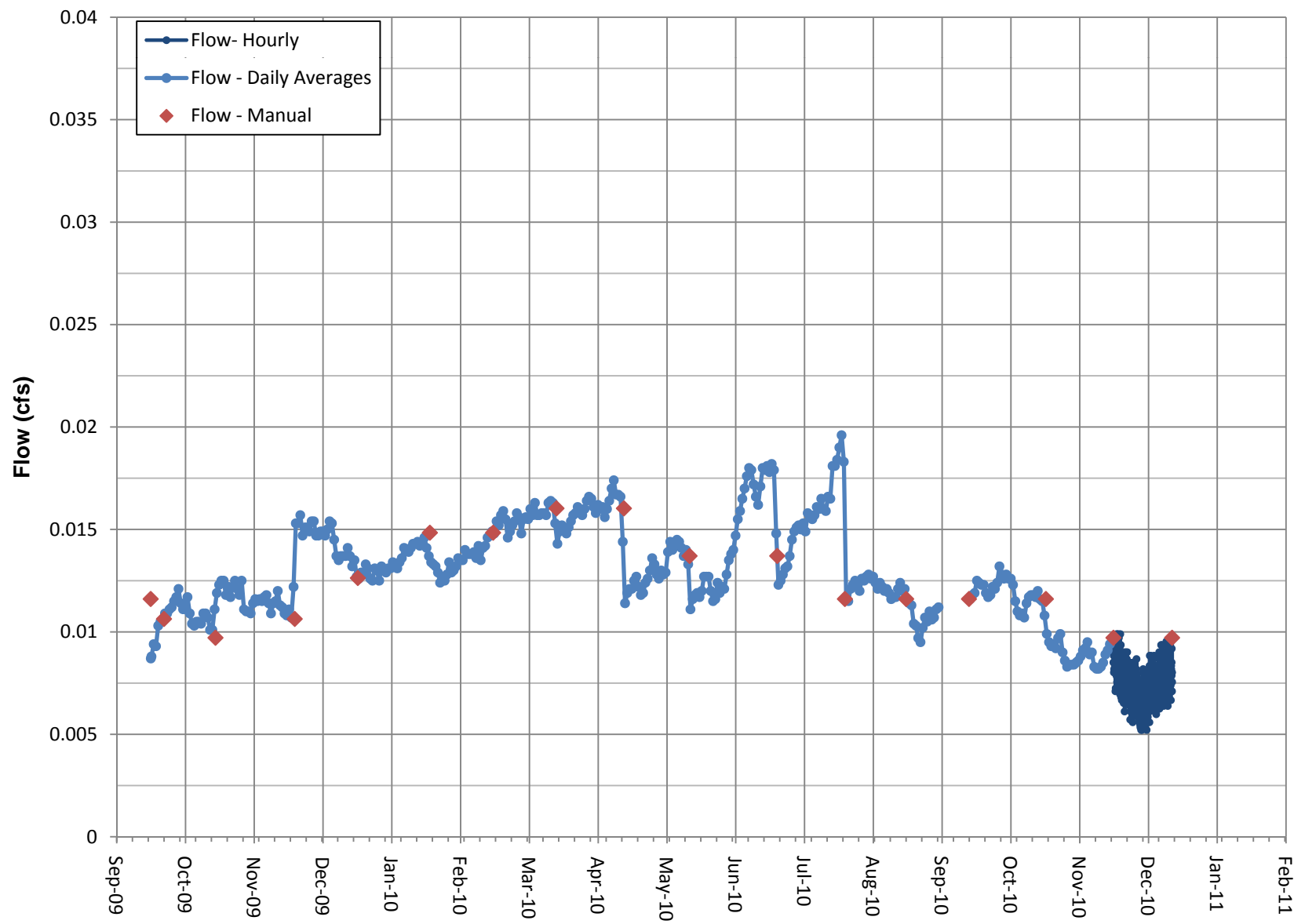
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Bishop and Mammoth Lakes, California

12/20/2010

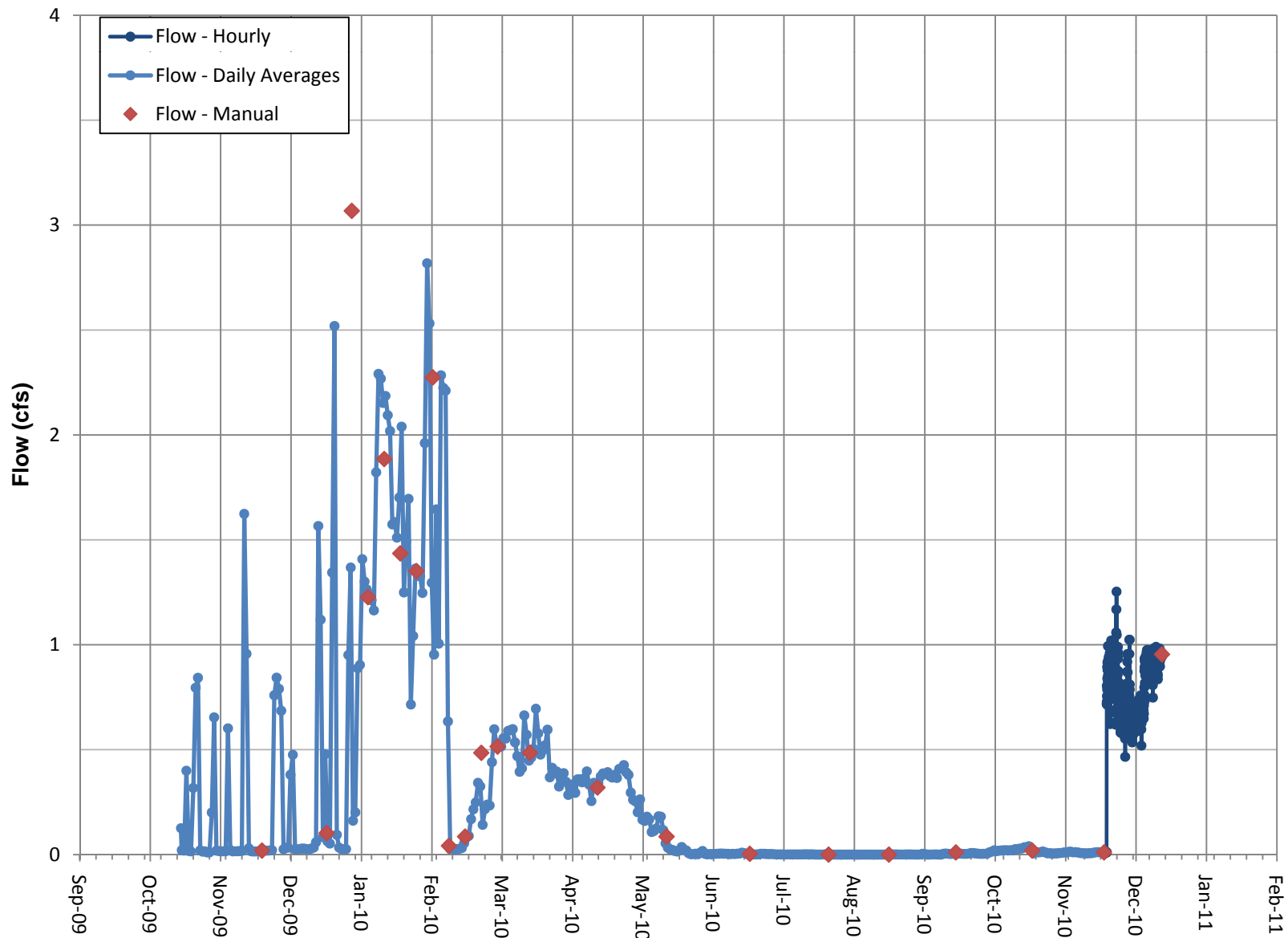
# **SURFACE FLOW TRANSDUCER**

# **Surface Flow- Transducer RV 112- Davis Ranch South Flow**



Note: Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.  
Transducer reads drifted upwards from April-July and September 2010 due to biological activity in flume.

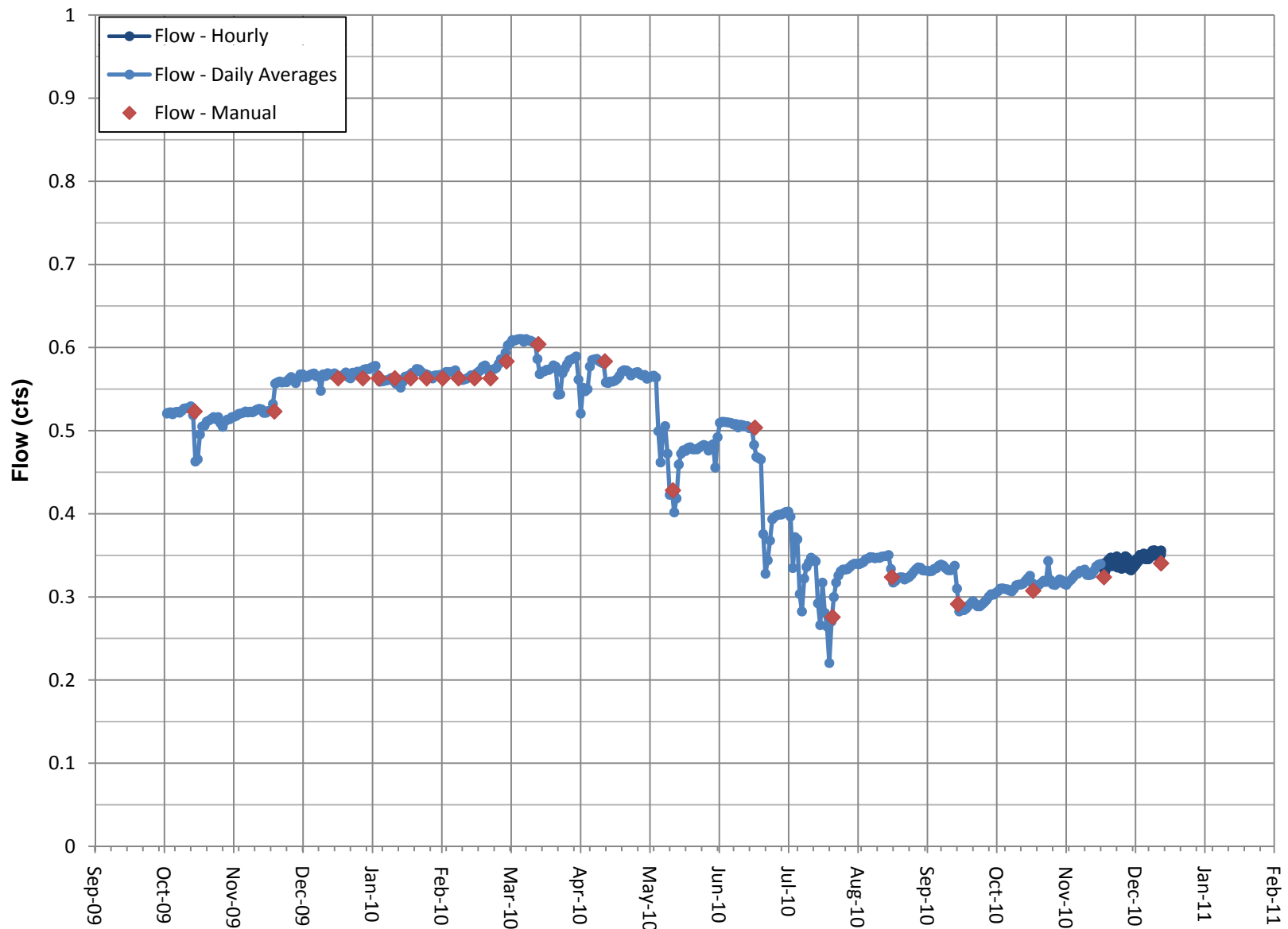
# Surface Flow- Transducer RV 230- Little Lake Outflow



Note: Flows through Little Lake Outflow are influenced by natural and water management processes at Little Lakes Ranch. Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

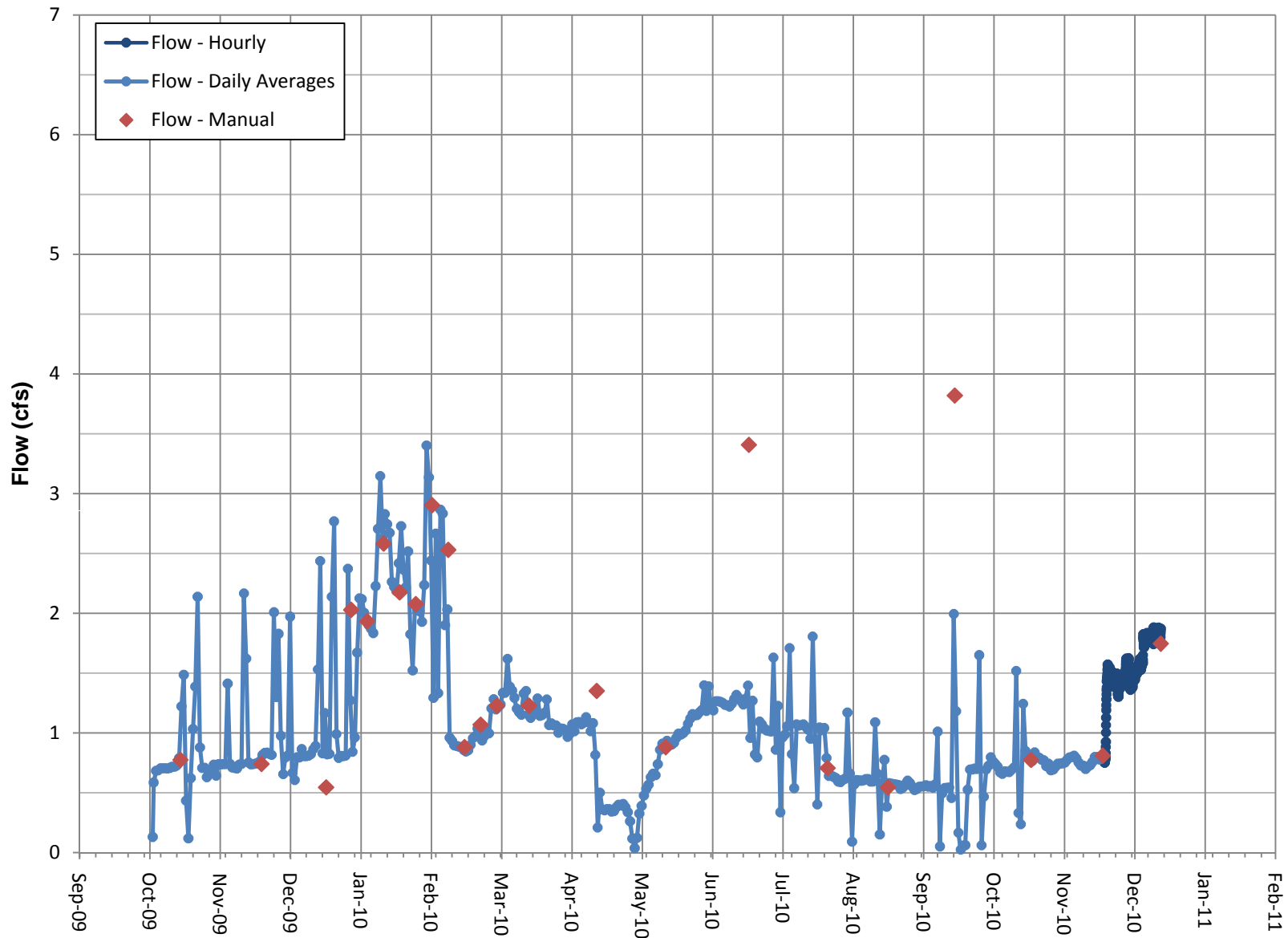


# Surface Flow- Transducer RV 240- Coso Springs



Note: Coso Springs is an artesian spring.  
Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.

# Surface Flow- Transducer RV 245- North Culvert



Note: Flows through North Culvert are influenced by natural and water management processes at Little Lakes Ranch. Coso Operating Co. initiated Hay Ranch Project pumping on 12/25/09.