Petrotek

MOORE RANCH SUPPLEMENTAL HYDROLOGIC TESTING

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CORPORATION US

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MOORE RANCH PROJECT, CAMPBELL COUNTY, WY

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- Energy Metals Corporation US (EMC) plans to develop and extract uranium from in-situ recovery (ISR) wellfields within the 70 Sand of the Wasatch Formation at the Moore Ranch Project Area. This Supplemental Hydrologic Test Report summarizes aquifer testing conducted within the non-producing hydrostratigraphic units at Moore Ranch to support State and Federal permit applications for this project.

- Pump testing was performed in the 72 Sand (overlying aquifer of the Production Zone 70 Sand), in the directly underlying 68 Sand, and in the lowermost underlying 60 Sand. Testing was conducted within each aquifer at a single location in Wellfields 1 and 2 to evaluate aquifer transmissivity, and overlying and underlying aquifers (relative to the pumped unit) were monitored to demonstrate isolation between units.

- Drawdown during well purging prior to groundwater sampling was monitored at a single location at Wellfield 2 in the uppermost overlying 80 Sand to evaluate aquifer transmissivity within this unit.

- No historical testing data were available for the non-producing units monitored at Moore Ranch, and multiple tests were conducted, if necessary, to obtain meaningful data. Aquifer properties were calculated by conventional type-curve methods for the following units and locations:

    - 72 Sand at Wellfield 1 (Well OMW-3)
    - 68 Sand at Wellfield 2 (Well UMW-2)
    - 60 Sand at Wellfields 1 and 2 (Wells UMW-11 and UMW-10)

  At several monitoring locations with relatively minimal well yields, aquifer properties were estimated by conventional type-curve or analytical solutions, but aquifer tests did not meet some general assumptions for validity (e.g., drawdown primarily reflects removal from casing storage). It is noted that these data represent a semi-quantitative estimate utilizing available data and serve to bracket aquifer properties (transmissivity) at select locations. Aquifer properties were estimated for the following units and locations:

    - 72 Sand at Wellfield 2 (Well OMW-2)
    - 68 Sand at Wellfield 1 (Well UMW-3)
    - 80 Sand at Wellfield 2 (Well OMW-7B)

- Aquifer transmissivity results for the non-producing units were generally at least an order of magnitude lower than the transmissivities reported for the previously evaluated 70 Sand Production Zone, except for the pumping test conducted in the 72 Sand in Wellfield 1 (Well OMW-3). Results are generally variable based on location and sand quality.

1.0 INTRODUCTION

1.1 BACKGROUND

The Moore Ranch project is located in the central Powder River Basin of Wyoming, within Campbell County. Energy Metals Corporation US (EMC) plans to develop and extract uranium from in-situ recovery (ISR) wellfields within the 70 Sand of the Wasatch Formation. This Supplemental Hydrologic Test Report provides a summary of additional testing conducted at Moore Ranch to characterize hydrostratigraphic units that may be potentially affected by the mining process, but are not part of the production zone. This characterization is being conducted to support State and Federal permit applications necessary for the project.

Hydrologic testing has already been performed to evaluate aquifer characteristics of the production zone (70 Sand) including tests by Conoco in 1977, 1978 and 1980, and more recently by EMC and Petrotek in 2007 and 2008. Additional hydrologic testing of the production zone aquifer will be performed and submitted prior to mining as part of the first Moore Ranch Wellfield Data Package.

Moore Ranch is located in all or parts of Sections 25 through 28, and 33 through 36 of T42N, R75W, Sections 1 through 4, 9 and 10 of T41N, R75W, Sections 30 and 31 of T42N, 74W. Figure 1-1 shows Moore Ranch and its relationship to the Powder River Basin. Figure 1-2 presents a proposed permit area outline, general ore trends, and the location of the wells that were tested.

The objectives of the hydrologic tests described in this Plan, are to:

1. Determine the hydrologic characteristics of Non-Producing Hydrostratigraphic Units within the Permit Area, including the following.

    a) 80 Sand: Shallowest occurrence of groundwater within the Permit Area

    b) 72 Sand: The overlying aquifer to the production zone;

    c) 68 Sand: The underlying aquifer throughout most of the Permit Area;

    d) 60 Sand: The underlying aquifer in areas where the production zone (70 Sand) and the underlying 68 sand coalesce; and

2. Demonstrate hydraulic isolation between the pumped units and overlying and underlying hydrostratigraphic units, particularly between the 68 and 60 Sands in the area of where the 68 and 70 Sands coalesce.

There are no operational ISR operations within ten miles of the Moore Ranch property. COGEMA's Christensen Ranch is located approximately fifteen miles to the northwest and PRI's Smith-Highland Ranch uranium project is located over thirty miles to the southeast.

The primary Production Zone at Moore Ranch is the 70 Sand that occurs between depths of 100 and 300 feet, although typically the ore bearing sand is found in the lower portion of that stratigraphic unit at depths of 150 to 300 feet.

Local water use is largely composed of (1) limited livestock and domestic use from the shallow Wasatch/Fort Union wells, and (2) water produced by coal bed methane producers (primarily the Anderson/Big George coal, also called the Roland coal, at an approximate depth of 1,000 to 1,200 feet).

Moore Ranch initially was identified as a significant uranium prospect in the 1970's by Continental Oil Company Minerals Department (Conoco). Conoco had conducted extensive exploratory drilling and prepared a Permit to Mine Application for the Moore Ranch Project (Conoco, 1979). EMC has recently submitted a Permit to Mine Application for Moore Ranch (2007, revised 2008 and 2009). Data from the Conoco and EMC Permit to Mine Applications for the Moore Ranch Project (Appendices D-5-Geology and D-6-Hydrology in each application) were utilized to develop the general hydrogeologic conceptual model for this Project. Ongoing data collection from EMC and analysis by EMC and their subcontractors has been used to refine the site hydrologic conceptual model.

1.2 REPORT ORGANIZATION

The results of the Supplemental Pump Tests conducted at Moore Ranch are included within this report. This report includes nine sections, summarized below:

1.0 Introduction
2.0 Site Characterization
3.0 Monitor Well Locations, Installation, and Completion
4.0 Pump Test Design and Procedures
5.0 Barometric Pressure Correlations and Corrections
6.0 Test Results
7.0 Analytical Methods and Results
8.0 Summary and Conclusions
9.0 References

Field activities for the pump testing were jointly performed by EMC and Petrotek Engineering Corporation (Petrotek) personnel. Geologic interpretations were performed by EMC geologists. Aquifer test analyses were performed by Petrotek, and this summary report was written by Petrotek.

2.0 SITE CHARACTERIZATION

Details regarding site conditions including physiography, geology, and hydrogeology have been provided in the EMC Moore Ranch Permit to Mine Application (2007, revised 2008 and 2009) and are only briefly discussed in this report.

2.1 PHYSIOGRAPHIC SETTING

The topography of the central Powder River Basin (PRB) is dominated by plains, rolling hills, and tablelands. Topographic relief has resulted from structural deformation on the west, east, and south edges of the Basin and historical deposition and erosional cycles within the Basin itself. On a regional basis, the surface of the Basin sediments dips gently (1 to 2 degrees) to the north/northwest.

The Moore Ranch site is located in the central portion of the PRB, approximately 20 miles east of the north-flowing Powder River and approximately 50 miles north of Casper, Wyoming. The site is part of the Great Plains Physiographic Province, which is characterized by broad river plains and low plateaus on stratified sedimentary rocks.

Locally, the elevation in the Moore Ranch area ranges from approximately 5,240 to 5,440 feet above mean sea level (AMSL) within the proposed permit area. The area is characterized by gently rolling hills with deeply dissected drainages.

The climate of the Moore Ranch area is semi-arid, with an average annual precipitation of approximately 13 inches (Western Regional Climate Center; Kaycee and Midwest, Wyoming Stations). The average minimum temperatures range from about 6° F in January to 50° F in July and August. Average maximum temperatures range from 37° F in January to 87° F in mid-summer.

The majority of precipitation (e.g., 60 to 70 percent) is in the form of rain that falls during the summer months. Prevailing winds are from the west and northwest, with an average annual wind velocity of 13 miles per hour.

2.2 GEOLOGIC SETTING

Production at Moore Ranch will be from the Eocene-age Wasatch Formation that unconformably overlies the Fort Union Formation. The Wasatch Formation is present at the surface throughout the Moore Ranch area, and most of the central portion of the PRB. The Wasatch is comprised of claystone, lenticular sandstones, and minor coal deposits of fluvial origin. Approximately 1,000 feet of Wasatch is present in the central portion of the Basin. Due to erosion, progressively thinner Wasatch deposits are found to the south.

Sediments on the edges of the Basin typically are characterized by broad sheet-like sandstones deposited by braided streams that have not been confined within a single channel. These sandstones commonly are coarse-grained, poorly sorted, and contain low concentrations of carbonaceous materials.

Toward the interior of the Basin, channel sand deposits from meandering streams are more common. Between the channels, siltstones and mudstones, containing high carbon content, have been deposited by flood events.

2.3 HYDROLOGIC SETTING

The Moore Ranch permit area lies within the drainage basin of Ninemile Creek, an east flowing tributary of Antelope Creek. Antelope Creek flows generally eastward and eventually joins with the Cheyenne River. The divide between the Cheyenne River and Powder River drainages is approximately one mile north of the permit area. Several small drainages, the largest of which is Simmons Creek, are located within the permit area. Flow within these drainages generally occurs only following a precipitation event or from snowmelt runoff (Conoco 1979). There are no perennial surface water bodies within five miles of the Moore Ranch permit area.

There are commonly multiple water-bearing sands within the Wasatch Formation. Groundwater within the Wasatch aquifers is typically under confined (artesian) conditions, although locally unconfined conditions exist (e.g., 72 and 80 Sands). On a semi-regional scale, groundwater flow occurs to the north-northwest, and the gradient in the 70 Sand is on the order of 0.004 to 0.006 ft/ft (Petrotek, 2007). In the vicinity of Moore Ranch, flow in the shallow groundwater system is north to northwesterly, toward the Powder River.

2.4 SITE GEOLOGY AND HYDROLOGY

Detailed geology and hydrogeology of the Moore Ranch Project area is provided in the EMC Permit to Mine Application (2007, revised 2008 and 2009). The Wasatch occurs at the surface at Moore Ranch and unconformably overlies the Fort Union Formation, which contains several coal sequences. Historic exploration companies assigned a numerical sand sequence to identify the sands in the Wasatch, with increasing numbers from the bottom up. For example, the 10 Sand overlies the Roland coal (or its stratigraphic equivalent) of the Fort Union Formation. A generalized stratigraphic section of the Wasatch formation is shown on Figure 2-1.

Primary uranium reserves identified by historical exploration at Moore Ranch are located in the 70 Sand that occurs between 100 and 330 feet below ground surface (ft bgs). Typical thickness of the 70 Sand ranges from 40 to 120 feet, with 5 to 25 feet of mineralized zone. Within the area of mineralization, the top of the 70 Sand dips generally to the northwest at approximately 40 to 50 feet per mile. The 70 Sand outcrops approximately 1 to 2 miles southeast of the permit area where Ninemile Creek and Pine Tree Draw have eroded the ground surface to elevations lower than 5240 feet AMSL.

The mineralized zone is within the 70 Sand. There are two primary areas of mineralization (ore-bodies) that have been delineated from historic drilling, located within Sections 34 and 35 of T42N and 75W (Figure 1-2). EMC has proposed to develop these ore-bodies as two separate Wellfields. The orebody in Section 34 will be Wellfield 1 and the ore-body in Section 35 will be Wellfield 2. The ore-body in Section 35 was historically divided into two units by Conoco (35S and 35N) but is combined into a single proposed wellfield by EMC.

Groundwater occurs in the 70 Sand under both confined and unconfined conditions. Data indicate that the potentiometric surface in the 70 Sand is close to the top of the sand itself (approximately 100 to 150 feet below ground surface). Groundwater flow direction, based on the potentiometric data, is generally to the north.

Overburden above the 70 Sand consists of a 50- to 330-foot thick sequence of clays, silts, discontinuous sandstones, and alluvial sediments. The alluvial sediments are confined to the low-lying areas of surface drainages. A lignite marker bed, designated the "E" coal, is present across the site above the 70 Sand. The "E" Coal is separated from the 70 Sand by 5 to 10 feet of clay. The overlying sands above the 70 Sand are discontinuous, and when saturated, generally represent perched water conditions.

The uppermost sand unit within the permit area is the 80 Sand. The 80 Sand is present at the surface across portions of the site, reaching a maximum thickness of nearly 100 feet. The 80 Sand pinches out toward the south-southeast. The extent of saturated conditions in the 80 Sand within the permit area appears to be very limited. Three monitor wells (OMW-5, OMW-6 and OMW-7B) were recently installed specifically targeting the 80 Sand interval (Figure 1-2). Only one of these locations, OMW-7B (located in the north central portion of proposed Wellfield 2), contains sufficient water to allow for water quality sampling or pump testing.

Beneath the 80 Sand is the 72 Sand. The top of the 72 Sand occurs at depths ranging from 30 to 200 ft bgs within the permit area and the unit ranges from 5 to 90 feet thick where present. The 72 Sand is discontinuous and unconfined across the permit area, being eroded away to the south and southeast in Nine Mile Draw and its tributary drainages. The 72 Sand is unsaturated in the southern portion of the permit area. In areas where the 72 Sand is saturated, this hydrostratigraphic unit is considered the overlying aquifer to the production zone aquifer. Maximum saturated thickness observed within the permit area is approximately 60 feet. In some areas where the 72 sand is saturated, it is a perched aquifer system.

Beneath the 70 Sand is a sequence of alternating clays, silts, and sandstones. The first sand underlying the 70 Sand is identified as the 68 Sand. This unit is typically 40 to 60 feet thick but can reach over 75 feet in thickness. The 68 Sand appears to be laterally extensive across the permit area but coalesces with the 70 Sand at some locations, most importantly within portions of proposed Wellfield 2. Water levels in the 68 Sand monitor wells indicate this unit is under confining conditions across the site. Hydrologic testing performed in 2007 (Petrotek) indicated some hydraulic communication between the 70 and 68 Sands in the area where the sands coalesce.

The 60 Sand underlies the 68 Sand. The 60 Sand is continuous across the permit area and is typically 100 thick. The top of the 60 Sand is present at depths ranging from 300 to 500 ft bgs. The 60 Sand is under confining conditions across the permit area. In areas where the

68 and 70 Sands coalesce, the 60 Sand is the underlying aquifer to the production zone.

Beneath the 60 Sand are, in descending order, the 58 Sand, the 50 Sand, the 40 Sand, the 30 Sand, the 20 Sand and the 10 Sand. A generalized stratigraphic column is provided in Figure 2-1. Most of the penetrations of these deeper Wasatch sands are from Coal Bed Methane wells. The 10 Sand (overlying the Roland Coal) marks the lowermost identified sand within the Wasatch Formation in the vicinity of the Permit Area. Beneath the 10 Sand is the Roland Coal of the Fort Union Formation

Within and surrounding the permit area, there is active coal bed methane production from the Powder River Basin Coal Bed Field. The producing interval is the Anderson/Big George) coal (locally called the Roland Coal) at depths of between 1,000 and 1,200 feet below ground surface. The Anderson/Big George Coal is within the Fort Union Formation and is separated from the 70 Sand by over 700 feet of interbedded clays, siltstone, and discontinuous sands. As a result, no hydrologic impacts from coalbed methane production are expected on sandstone aquifers and clay aquitards relevant to in-situ mining at Moore Ranch.

Oil and gas production occurs within the area. The Pine Tree Field is located within 1 mile to the west of the Moore Ranch Permit Area. Production in that field is primarily from the Shannon Formation at depths of 10,000 to 11,000 feet. This production is not relevant to the shallow ISR operations due to depth.

3.0 SUMMARY OF PREVIOUS TESTING RESULTS

Previous pump test results were reported in the 2007 Hydrologic Test Report (Petrotek, 2007), the 2008 5-Spot Hydrologic Test Report (Petrotek, 2008) and in the Moore Ranch Permit to Mine Application (EMC 2007, revised 2008 and 2009). A summary of the Conoco and EMC test results at Moore Ranch is presented in Tables 3-1 and 3-2, respectively.

4.0 TEST DESIGN, EQUIPMENT, AND MONITORING

The following section details pump test design and procedures for the Wellfields 1 and 2 pump tests of the non-production zone units conducted during August 11 – 14, 2009. Hydrologic tests were conducted in the 72, 68, and 70 Sand in each wellfield. Water level data collected during recent purging and sampling of an 80 Sand monitor well (OMW-7B) in Wellfield 2 were used to estimate transmissivity for that unit.

4.1 PUMP TEST DESIGN

A series of short-term constant-rate pumping tests were conducted to provide aquifer characterization for the 72, 68 and 60 Sands at locations within Wellfields 1 and 2. Water levels at each pumping well were recorded for the purpose of evaluating aquifer properties in the pumped aquifer, and overlying and underlying aquifers were monitored to demonstrate hydraulic between hydrostratigraphic units.

The pump tests were conducted at monitor well clusters located within proposed Wellfields 1 and 2. Figure 1-2 provides the general location of the proposed pump tests within each wellfield. Each of the well clusters includes individual monitor wells completed in the 72, 70, 68 and 60 Sands. The location of the individual monitor wells within the Wellfield 1 and 2 clusters are provided on Figures 4-1 and 4-2, respectively. The well information for the pumping and monitor wells is provided in Table 4-1. Table 4-2 summarizes which aquifers and wells were pumped and monitored for each individual hydrologic test. Completion reports for all wells monitored during testing are provided in Appendix A.

Initial plans were for a test duration for a period of 2 to 4 hours per well. A pumping rate was selected to allow for collection of sufficient drawdown (and recovery) data for analysis of transmissivity using conventional type curve methods. Step-rate pump tests were not conducted prior to this testing, and therefore the target pumping rates for each well were estimated based on previous groundwater sampling information (if available) and knowledge of the aquifer from geologic logs. In general, the duration of pump tests were shortened due to the minimal well yields observed at these wells.

During each test conducted at a wellfield cluster, water levels in the pumping well and the overlying and underlying hydrostratigraphic units within the well cluster were monitored. Exceptions were for the 60 and 72 Sand tests. The 60 Sand test only monitored the 60 Sand and the overlying unit because there are no wells completed in the underlying unit (58 Sand) at those well clusters. The 72 Sand test only monitored the 72 Sand and the underlying unit (70 Sand) because there are no wells completed in the overlying unit (80 Sand) at those well clusters.

Transmissivity was estimated at a single well completed in the 80 Sand (well OMW-7B) using water level data collected during recent (June 2009) purging and sampling of the one 80 Sand monitor well with sufficient water for sampling. No additional pump tests were conducted in the 80 Sand.

4.2 PUMP TEST SETUP

Prior to testing, background water levels were recorded at all pumping and monitor well locations. Table 4-1 presents the completion details of these wells, and the water levels recorded prior to testing on August 11, 2009. Automated datalogging pressure transducers (InSitu LevelTROLL®) were installed in eight wells on August 6, 2009 (four at each well cluster). The pressure rating of all transducers was 30 psi, and all instruments were programmed to record depth to water level measurements at 5 minute intervals during background monitoring. To ensure adequate data collection, data recording intervals in the pumping wells were significantly shortened (5 to 15 second intervals) immediately prior to pump testing and throughout pumping and most of the aquifer recovery phase of testing.

In addition to the evaluation of aquifer properties of the respective pumping wells, water levels in the overlying and underlying aquifers (if present) were monitored by transducers during all testing, at recording intervals of 5 minutes. Table 4-2 summarizes the pumped aquifers and the respective overlying and underlying aquifers that were monitored in each test.

Barometric pressure was recorded utilizing an InSitu BaroTROLL® instrument, recording data at 5 minute intervals. Barometric pressure data were recorded from the morning of August 11, 2009 through the end of recorvery monitoring. A further discussion of barometric effects is presented in Section 5.

Background monitoring and barometric pressure were not collected during testing at the single 80 Sand well (OMW-7B). Water level data were collected using a manual e-line during purging of the well prior to a collection of a groundwater sample.

4.3 PUMP TEST EQUIPMENT

Two pumps were utilized for testing, including a Grundfos Redi-Flo2 2-inch variable speed submersible pump and a 4-inch Grundfos 10S15-21 submersible pump (1.5 horsepower, 10 gallons per minute [gpm], 460V 3-phase motor) The smaller 2-inch pump was utilized in wells where the water level was expected to fall below the J-collar above the screen (i.e., wells OMW-3 and OMW-2) and in wells where pumping rates were expected to be low (i.e., wells UMW-3 and UMW-2). Pumping rates with the 4-inch submersible pump were adjusted at the surface using a choke valve on the discharge line.

Pumps were installed (and dataloggers were withdrawn) prior to pump testing at a well, and water levels allowed to equilibrate to within approximately 0.1 ft or less of the initial static water level. Following completion of the pumping phase of the test, the pumps were withdrawn after a sufficient amount of recovery was observed for the purposes of analysis.

All pump tests were conducted at a constant discharge rate, or as close as practical. Due to the relatively low discharge rates (generally less than 3 gpm), discharge was measured periodically utilizing either a 5-gallon bucket or a 1-gallon bucket. A time-averaged calculation of pumping rates throughout each pump test was utilized as the average pumping rate during these constant-discharge tests.

5.0 BAROMETRIC PRESSURE MONITORING AND CORRECTIONS

5.1 MONITORING EQUIPMENT

All of the In-Situ Level TROLLS® used during testing were vented (gauged). In-Situ has stated that if vented transducers are used, the vent eliminates the impact of barometric pressure (BP) on the sensor. However, a change in water levels due to barometric changes will occur whether a vented sensor is used or not. Hence, the use of vented equipment eliminates the barometric impact of the sensor, but does not correct the water level measurements for barometric effects on the aquifer. In this regard, the vented transducers are barometrically *compensated*, but not corrected. If significant variations in water levels are observed, the data may require correction for fluctuations in water levels associated with changes in BP. As part of the testing protocol, an In-Situ BaroTROLL® was utilized to measure BP at the site.

5.2 BAROMETRIC CORRECTIONS

Due to the short duration of the testing conducted at Wellfields 1 and 2, and minimal changes in BP observed over the course of pumping and recovery, barometric corrections were not applied to the water level data. Table 5-1 summarizes observed variations in BP during the testing periods (including pumping and recovery). A summary of testing at both Wellfields is included in Table 6-1 and water level graphs of pumping wells versus BP are presented and discussed in Section 6. Barometric pressure data are provided in Appendix B-1.

As seen Table 5-1, variations in BP during the testing periods were minimal, less than 0.03 in Hg (0.034 ft H_20) for all tests except OMW-2 (0.068 ft Hg, or 0.077 ft H_2O), which included a longer recovery interval due to the slow recharge of the well. Assuming 100% aquifer barometric efficiency (BE = 1.0) in response to barometric pressure changes (i.e., the change in water level in the well equals the corresponding change in barometric pressure), this range of BP variations corresponds to fluctuations between 0.034 and 0.077 ft in a well. Maximum drawdown from these tests (presented in Table 6-1) is approximately 1-3 orders of magnitude greater than the scale of fluctuations observed from BP changes. Generally, BE for a confined aquifer ranges from 0.20 to 0.75 (Kruseman and deRidder, 1990).

Published specifications of the In-Situ BaroTROLL® indicate that accuracy readings of this instrument are approximately 0.1% of the full scale of pressure readings (16.5 psi, or 33.6 in Hg). This accuracy is equivalent to 0.03 in Hg, which is on the order of observed variations between maximum and minimum measured barometric pressure during water level monitoring activities.

Previous aquifer testing conducted in the 70 Sand at Moore Ranch by Petrotek (2007, 2008) indicated that atmospheric pressure changes could have an effect on observed water levels. These tests were conducted over much longer time intervals (9.9, 1.0, and 3.8 days), where larger differences in atmospheric pressure exist due to the longer period of observation. As part of this investigation, corrections due to barometric changes were not necessary for the following reasons: minimal variation in barometric pressure occurred during the pump tests; potential fluctuations due to atmospheric pressure were minimal compared to the overall drawdown from pumping; and the observed differences in barometric pressure over the course of testing was on the order of the accuracy level of the pressure transducer.

6.0 TEST RESULTS

Results of the supplemental pumping tests conducted in the 72 Sand, 68 Sand, and 60 Sand, including background trends, pump duration and rate, pumped aquifer response, and overlying and underlying aquifer response (if present) are presented below. Data collected during groundwater sampling of the 80 Sand (at well OMW-7B) are also presented.

6.1 72 SAND

6.1.1 WELL OMW-3, 72 SAND, WELLFIELD 1

Background Trend

Water level stability data were collected prior to the start of testing at well OMW-3, completed in the 72 Sand. Figure 6-1 presents the water level data at this monitoring location along with measured barometric pressure at the site prior to, during, and after pump testing. The figure shows that water levels were relatively stable throughout background monitoring, with only a slight increasing trend prior to testing.

Pump Duration and Rate

Testing was conducted on August 13, 2009, and included three short-term tests lasting 15 to 30 minutes with a pumping rate of 0.91 to 0.94 gallons per minute. Table 6-1 summarizes the details of the 72 Sand Hydrologic Test conducted at Wellfield 1. The 2-inch Redi-Flo2 pump was utilized for testing this well due to the minimal water column above the J-collar above the screen (approximately 7 feet). The 4-inch pump was too large to fit through the J collar. The 2-inch pump was operated at maximum power.

Pumped Aquifer Response

Figure 6-2 presents a plot of water level at OMW-3 during the three pump tests. The pump was shut-in for each test once drawdown in the pumping well had stabilized, which occurred around 0.6 feet. Recovery in the aquifer was rapid with water levels returning to near static levels within minutes of pump shut-in. The abrupt rise in water level that occurred at pump shut-in was the result of pump backflow into the well.

Figure 6-2 also shows the corresponding barometric pressure data over the course of testing. Barometric pressure changes were minimal over the duration of each test, on the order of 0.01 inches of mercury (in Hg). No corrections were applied to water levels to adjust for atmospheric changes due to the short duration of testing and minimal variation in barometric pressure observed at this well, as described in Section 5. Water level data at well OMW-3 are presented in Appendix B-2.

Confining Unit Response

Well MW-3, completed in the directly underlying 70 Sand, was monitored during testing at OMW-3. Because OMW-3 is located in the uppermost continuous aquifer (72 Sand), no overlying aquifer response is reported for this test. Figure 6-3 presents the water levels of the pumping well versus well MW-3, and shows no response to pumping, and water level data for MW-3 are presented in Appendix B-3. While the aquifer was only minimally stressed during testing (due to short testing durations and low pumping rates), the lack of response in the underlying aquifer indicates isolation in the near-wellbore vicinity.

6.1.2 WELL OMW-2, 72 SAND, WELLFIELD 2

Background Trend

Water level stability data were collected for approximately six days prior to pump testing at well OMW-2, completed in the 72 Sand. Figure 6-4 presents the water level data at this monitoring location versus barometric pressure prior to, during, and after pump testing. Water levels in the well were relatively stable prior to testing.

Pump Duration and Rate

A pump test was conducted on August 12, 2009. Pumping was conducted for 33 minutes at a constant rate of 0.84 gpm, utilizing the 2-inch submersible pump. A summary of the 72 Sand Hydrologic Test conducted in Wellfield 2 is provided in Table 6-1.

Pumped Aquifer Response

Figure 6-5 shows the water level response in well OMW-2 during the pumping test. Total drawdown at the end of the test was 7.2 feet. The linear slope of drawdown shown in Figure 6-5, indicates that the well response was dominated by casing storage. The saturated thickness in the well was approximately 11 feet at the start of the test. The test was stopped prior to the water level falling below the level of the pump. As seen in Figures 6-4 and 6-5, there is an abrupt rise in water level immediately following pump shut-in, resulting from pump backflow. After that initial rise of 0.2 feet in water level there was only 1.3 feet of recovery over the next five days of monitoring. The abrupt water level rise and subsequent fall early on August 16 may be related to transducer error, as the magnitude of change is much larger than that observed due to barometric effects. Water level data at well OMW-2 are presented in Appendix B-6.

Figure 6-5 also shows the corresponding barometric pressure over the course of testing. Barometric pressure change was minimal over the duration of the test, on the order of 0.01 inches of mercury (in Hg). No corrections were applied to water levels to adjust for atmospheric changes due to the short duration of testing and minimal variation in barometric pressure observed at this well, as described in Section 5.

Confining Unit Response

As summarized in Table 4-2, no overlying well was monitored during testing, and the directly underlying well (MW-2) is completed in the 70 Sand. Figure 6-6 presents the water level of well MW-2 versus the pumping well, and water level data are provided in Appendix

B-7. The water level in MW-2 is slightly increasing, with no observed response from pumping.

6.2 70 SAND

No testing was conducted in the 70 Sand, but two wells were monitored during testing to evaluate communication between aquifers. Background water level data and water level data were continuously recorded in wells MW-3 (Wellfield 1) and MW-2 (Wellfield 2), as presented in Figures 6-7 and 6-8. Water level data from wells MW-3 and MW-2 are presented in Appendices B-3 and B-7, respectively.

6.3 68 SAND

6.3.1 WELL UMW-3, 68 SAND, WELLFIELD 1

Background Trend

Water level stability data were collected prior to the start of testing at well UMW-3, completed in the 68 Sand. Figure 6-9 presents the water level data at UMW-3 and barometric pressure at the site prior to, during, and after pump testing. A significant downward trend is observed in the 8 days prior to testing, as the water level drops a total of 14 feet over this time period. No other wells in either wellfield exhibited a similar decreasing trend. Major increasing and decreasing water level trends have been observed at this well in the past (during monitoring and testing from 2006 through 2008), with no definitive explanation. It is possible that windmill-driven stock wells in the area may be pumping from this interval, but that has not been confirmed.

Pump Duration and Rate

Testing was conducted on August 14, 2009, and included a single short-term test lasting 20 minutes, with a pumping rate of 0.8 gpm. Table 6-1 summarizes the details of the 68 Sand Hydrologic Test conducted at Wellfield 1. The 2-inch Redi-Flo2 pump was utilized for testing due to the anticipated low yield of the well. The pump was operated at maximum power. The pump was shut-in as the water level approached the level of the pressure transducer installed in the well.

Pumped Aquifer Response

Figure 6-10 presents the water level of the pumping well during testing. Drawdown at UMW-3 at the end of pumping was 21.3 feet. The steep linear slope observed in Figure 6-10 indicates that the test was dominated by casing storage, with minimum flux from the aquifer. The water level in the well did not recover in the three days of recovery monitoring as shown on Figure 6-9, and resumed the declining trend observed prior to pumping. Water level data at well UMW-3 are presented in Appendix B-4.

Figure 6-10 also shows the corresponding barometric pressure during the pump test. Barometric pressure change was minimal over the duration of the test, on the order of 0.01

inches of mercury (in Hg). No corrections were applied to water levels to adjust for atmospheric changes due to the short duration of testing and minimal variation in barometric pressure observed at this well, as described in Section 5.

Confining Unit Response

As summarized in Table 4-2, the directly overlying (MW-3) and underlying wells (UMW-10) in the 70 and 60 Sands, respectively, were monitored during testing of UMW-3. Figure 6-11 presents the overlying and underlying responses versus the pumping well, and water level data are provided in Appendices B-3 and B-9, respectively. Water levels in well MW-3 in the overlying 70 Sand were slightly increasing during and after pumping, and levels in the underlying well (UMW-10) showed a similar increasing trend, with no apparent response to pumping.

6.3.2 WELL UMW-2, 68 SAND, WELLFIELD 2

Background Trend

Water level stability data were collected for approximately five days prior to pump testing of well UMW-2, completed in the 68 Sand. Figure 6-12 presents the water level data at this monitoring location versus barometric pressure prior to, during, and after pump testing. Water levels in the well were relatively stable prior to testing.

Pump Duration and Rate

Two pump tests were conducted at UMW-2. The first test was run on August 11 for approximately 10 minutes at 1.2 gpm, but was stopped due to a malfunction with the pump. Water levels were allowed to recover, and a second test was conducted on August 12 for 113 minutes at a constant-rate of 1.1 gpm, utilizing the 2-inch submersible pump. A summary of the 68 Sand Hydrologic Test conducted at Wellfield 2 is provided in Table 6-1.

Pumped Aquifer Response

Figure 6-13 shows the water level response in well UMW-2 during the pump test. The first pump test is not presented nor analyzed due to the short duration caused by equipment malfunction. Total drawdown from the second pump test was 63.5 feet. Near the end of the test, the pumping rate was decreasing, and the test was stopped. Water level data at well UMW-2 are presented in Appendix B-8.

Figure 6-13 also shows the corresponding barometric pressure during the pump test. Barometric pressure change was minimal over the duration of the tests, on the order of 0.01 inches of mercury (in Hg). No corrections were applied to water levels to adjust for atmospheric changes due to the short duration of testing and minimal variation in barometric pressure observed at this well, as described in Section 5.

Confining Units Response

Table 4-2 summarizes the overlying and underlying units monitored during the test. Figures 6-14 and 6-15 show the water level of the overlying 70 Sand well (MW-2) and underlying 60 Sand well (UMW-10) versus the pumping well, respectively. Water level data for these wells are provided in Appendices B-7 and B-9, respectively. The water level in the overlying well (MW-2) appears to drop slightly and recover and then gently increase after the test, but the level of change is extremely small, on the order of 0.05 ft. The slight fluctuation in water level may indicate minimal leakage from the overlying aquifer. Previous testing has indicated that some hydraulic communication exists between the 68 and 70 Sands in this area. The 68 and 70 Sands coalesce in this portion of Wellfield 2. A similar response is observed in the underlying well, but the magnitude of water level change (less than 0.05 feet during testing) is on the order of barometric pressure fluctuations or fluctuations between transducer readings, and therefore is not considered indicative of hydraulic communication between aquifers.

6.4 60 SAND

6.4.1 UMW-11, 60 SAND, WELLFIELD 1

Background Trend

Water level stability data were collected prior to the start of testing at well UMW-11, completed in the 60 Sand. Figure 6-16 presents the water level data at this monitoring location as well as barometric pressure at the site prior to, during, and after pump testing. Water levels in the well were relatively stable prior to testing.

Pump Duration and Rate

Two tests were conducted at well UMW-11. The 4-inch submersible pump was utilized during both tests. On August 12, a short-term test was conducted lasting 16 minutes at a pumping rate of 2.6 gpm. Initial pumping rates for the test conducted on August 12 were erratic as the pump was choked back from approximately 6 gpm in the first minute. On August 13, a test lasting 141 minutes was conducted at a pumping rate of 2.12 gpm. A more constant discharge rate was maintained during the August 13th test. A summary of the 60 Sand Hydrologic Test conducted at Wellfield 1 is provided in Table 6-1.

Pumped Aquifer Response

Due to the erratic pumping rate of the first test, and the longer duration of the second test, the first test is not presented and was not analyzed. Figure 6-17 presents the water level of the pumping well during the second test (August 13). Drawdown at UMW-11 during the pump test was measured at 76.6 feet. Water level measurements were supplemented with manual e-line measurements at one-minute intervals late in the test, as the water level in the well fell below the level of the transducer during the test. A complete summary of water level data are presented in Appendix B-5.

Figure 6-17 also shows the corresponding barometric pressure during the pump tests.

Barometric pressure change was minimal over the duration of the tests, on the order of 0.02 inches of mercury (in Hg). No corrections were applied to water levels to adjust for atmospheric changes due to the short duration of testing and minimal variation in barometric pressure observed at this well, as described in Section 5.

Confining Unit Response

As summarized in Table 4-2, the directly overlying well (UMW-3) completed in the 68 Sand was monitored during testing. No underlying aquifer was monitored during the UMW-11 test as that well is the deepest completion in the well cluster. Figure 6-18 presents the overlying aquifer water levels (well UMW-3) versus the pumping well (UMW-11). Water level data for well UMW-3 are presented in Appendix B-4. Water levels in well UMW-3 are decreasing during the pump test. However, as shown in Figure 6-9, a background downward trend was already observed at this well, with a decrease in water level of approximately 14 feet during background monitoring. No change in this trend is observed during the hydrologic testing of UMW-11, and no abrupt change is observed. Because of the magnitude of the background trend, hydraulic communication between the 60 and 68 Sands cannot be assessed at this time for the Wellfield 1 well cluster.

6.4.2 UMW-10, 60 SAND, WELLFIELD 2

Background Trend

Water level stability data were collected for approximately seven days prior to pump testing of well UMW-10, completed in the 60 Sand. Figure 6-19 presents the water level data at this monitoring location versus barometric pressure prior to, during, and after pump testing. Water levels in the well were relatively stable prior to testing.

Pump Duration and Rate

Table 6-1 summarizes the 60 Sand Hydrologic Test conducted at Wellfield 2 in well UMW-10. On August 13, 2009 a pump test was conducted for 11 minutes at a rate of 11.5 gpm. The pumping rate resulted in a rapid water level drop to below the depth of the transducer; therefore this test is not presented nor analyzed. On August 14, three pump tests were attempted. The first test ran for less than three minutes, and was aborted due to high pressure buildup in the pump. The second test was conducted for 27 minutes at a pumping rate of 5.4 gpm. This test is presented below and was analyzed for aquifer properties. A third test was conducted for less than 7 minutes at 9.5 gpm, but is not presented nor analyzed as the rate was too high and much of the drawdown response was dominated by casing storage.

Pumped Aquifer Response

Figure 6-20 shows the water level response in well UMW-10 from pumping for the second test conducted on August 14, 2009. Drawdown at the pumping well was 85.2 feet at the end of the test. Recovery to near initial static conditions occurred in less than two hours after pump shut-in. Complete water level data are presented in Appendix B-9.

Figure 6-20 also shows the corresponding barometric pressure over the course of testing. Barometric pressure change was minimal over the duration of the tests, on the order of 0.01 inches of mercury (in Hg). No corrections were applied to water levels to adjust for atmospheric changes due to the short duration of testing and minimal variation in barometric pressure observed at this well, as described in Section 5.

Confining Unit Response

As summarized in Table 4-2, the directly overlying well (UMW-2) completed in the 68 Sand was monitored during testing. No underlying aquifer was monitored during the UMW-10 test as the pumping well is the deepest completion in the well cluster. Figure 6-21 presents the overlying aquifer water levels versus the pumping well, and water level data are presented in Appendix B-8. The lack of response in the overlying aquifer suggests that there are no artificial pathways due to improper well completion in the immediate area of the test.

6.5 80 SAND, WELL OMW-7B, WELLFIELD 2

Aquifer characteristics of the 80 Sand were estimated from the water level response of well OMW-7B during purging prior to water quality sampling. Monitor well OMW-7B is located in Wellfield 2 and completed in the 80 Sand (well location is presented on Figure 1-2 and completion details provided in Table 4-2). No background monitoring was performed on this well prior to purging/sampling. No monitoring was conducted on other aquifers during the purging/sampling event because of the absence of an overlying aquifer (the 80 Sand is the shallowest known aquifer within the Permit Area) and the distance of this well from any underlying aquifer monitor wells (well OMW-7B is approximately 1000 ft northwest of the Wellfield 2 well cluster shown in Figure 4-2).

Well OMW-7B was purged on June 1, 2, and 3, 2009. Following the first purging, the well was allowed to return to near static levels before beginning the second round of purging. For the second round of purging, OMW-7B was pumped at a rate of 1.6 gpm for 30 minutes. Drawdown at the end of 30 minutes was 13.4 feet. The pumping test data are summarized in Table 6-1. Water level measurements were made during the second round of purging at one-minute intervals using an e-line. Measurements were continued at one-minute intervals through the first 30 minutes of recovery following shut-in of the well. The measurement frequency was then gradually increased to 5-, 10- and 30-minute intervals. Recovery was measured for 6 hours after the end of pumping. Figure 6-22 shows the water level response in well OMW-7B during the pumping and recovery conducted on June 2, 2009. Note that 6 hours after pumping was terminated, the water level in OMW-7B was still 4.5 feet below the pre-pumping level. Water level data from this well are presented in Appendix B-10.

7.0 TEST ANALYSIS

The following section details the analytical methods and results of evaluation of aquifer properties conducted within the non-production zone aquifer units at Moore Ranch.

7.1 ANALYTICAL METHODS

Drawdown data from pumping wells were graphically analyzed to determine aquifer transmissivity (T). The primary method of analysis for the drawdown data was Cooper and Jacob (1946), and the recovery data were analyzed by the Theis (1935) recovery analysis method. Assumptions inherent in these methods include:

- The aquifer is confined and has apparent infinite extent;
- The aquifer is homogeneous and isotropic, and of uniform effective thickness over the area influenced by pumping;
- The piezometric surface is horizontal prior to pumping;
- Well is pumped at a constant rate;
- The pumping well is fully penetrating; and
- Well diameter is small, so well storage is negligible.

The Cooper – Jacob method utilizes a simplification of the Theis (1935) solution for time-drawdown analysis, with the condition that μ (dimensionless constant) is sufficiently small (<0.05, from Fetter [2001])), where μ equals:

$$\mu = r^2S / 4Tt$$

Where:

r = Distance from center of well to point of drawdown measurement (ft)
S = Storativity (dimensionless)
T = Transmissivity (gallons per day per foot [gpd/ft])
t = Time (days)

The Cooper-Jacob validity condition is met when *t* is sufficiently large and r is sufficiently small. If μ has been determined to be sufficiently small, the solution for T (S cannot be determined from a single-well test) equals (Driscoll,1986, p. 221):

$$T = 264Q / \Delta s$$

Where:

Q = Pumping rate (gpm)
Δs = Slope of time-drawdown; change in drawdown per log cycle of time (ft)

Aquifer tests conducted as single-well pumping tests without observation wells can only be evaluated for transmissivity, and no storativity (S) values are reported. It is noted that subsequent figures referenced in this section analyzed by the Cooper-Jacob method have a reported S value. This is an error with the analytical software program and these numbers should be ignored.

Water level recovery data can be analyzed utilizing the Theis (1935) solution, which has the same assumptions for validity as discussed above. The equation for T equals (Driscoll, 1986, p. 255):

$$T = 264Q / \Delta(s - s')$$

Where:

$\Delta(s - s')$ = Water level recovery per log cycle of time, where s = drawdown and s' = residual drawdown (ft)

For wells OMW-2 and UMW-3 where pumping did not proceed past casing storage due to very low well yields, alternative analysis methods were employed. With the Cooper and Jacob (1946) method, a relationship between specific discharge (ratio of pumping rate to drawdown) and transmissivity (T), with underlying assumptions, can be used to solve for T. This method assumes that the measured drawdown observed in the well is a result of flow from the aquifer, which is not the case for both of these tests, as the majority of water removed is displaced from the casing with minimal inflow from the aquifer. Therefore, this specific capacity analysis represents an upper-bound on aquifer conductivity. The Cooper and Jacob equation that relates specific discharge to T and S (and time) from Driscoll (1986, p. 1021) is presented below:

$$Q/s = T / (264 * \log [0.3Tt / r^2S]) \qquad \text{(Equation 1)}$$

Where:

Q = Pumping rate (gpm)
s = Drawdown at end of pumping (ft)
T = Transmissivity (gallons per day per foot [gpd/ft])
t = Time (days)
r = radius of the well (ft)
S = Storativity (dimensionless)

Utilizing the data collected during testing (Q, s, *t*), assuming an estimated value of S, a value of T can be estimated by equating both sides of Equation 1. Transmissivity is presented in this report as ft^2/day (1 ft^2/day equals 7.48 gpd/ft). Radius of the well (r) is estimated at some small distance into the formation (0.5 ft for these analyses). It is noted that results from this analysis represent an upper-bound limit for aquifer transmissivity, and true transmissivity is likely lower by an order of magnitude or greater.

For well OMW-2, the recovery data after pumping was evaluated as a slug-test type analysis by the Bouwer and Rice (1976) method. The drawdown response for well UMW-3 was similar to well OMW-2, but the recovery trend after pumping was obscured by a strong decreasing trend in water level at this well (water levels dropped 14 feet during background monitoring). Therefore, no analysis of the recovery data for the OMW-3 test was attempted. Hydraulic conductivity (K) using the Bouwer and Rice method is evaluated by the following equation from Fetter (2001):

$$K = (r^2 \ln (R_e / R) / 2Lt) * \ln (h_o / h_t)$$

Where:

K = Hydraulic conductivity (ft/day)
r = Radius of well casing (ft)
R_e = Effective radial distance over which head is dissipated in aquifer (ft)
R = Borehole diameter (ft)
L = Length of screen (ft)
t = Time (days)
h_0 = Drawdown at $t = 0$ (ft)
h_t = Drawdown at time t (ft)

At well OMW-2, where the Bouwer and Rice method was utilized to evaluate K, the water level during testing is entirely changing within the screened interval. Therefore, the parameter r must be evaluated as effective radius (r_{eff}) utilizing the following equation (Waterloo Hydrogeologic):

$$r_{eff} = [r^2(1-n) + nR^2)]^{1/2}$$

Where:

r = Screen radius (ft)
n = Porosity of gravel pack (dimensionless, assumed to be 0.30)
R = Borehole radius (ft)

The software used to graphically analyze the data was AquiferTest Pro (Version 4.2, Schlumberger Water Services, 2008). The specific capacity analyses conducted on wells OMW-2 and UMW-3 were derived analytically.

7.2 ANALYTICAL RESULTS

7.2.1 72 SAND

A summary of analytical results of the supplemental hydrologic testing is provided in Table 7-1. Four tests were conducted in the 72 Sand, including three tests at well OMW-3 in Wellfield 1 and a single test at OMW-2 in Wellfield 2.

Three separate tests were conducted at well OMW-3, with calculated transmissivity values ranging between 306 and 318 ft^2/day, utilizing the Cooper and Jacob (1946) method. Based on an aquifer thickness of 71 feet, hydraulic conductivity ranges from 4.3 to 4.5 ft/day. Due to the rapid recovery after the end of pumping and lack of a pump check valve (see Figure 6-2), recovery analysis was not attempted. Curve matches for the analyses of Tests #1, #2, and #3 at OMW-3 are presented in Figures 7-1 to 7-3, respectively.

The single test conducted at OMW-2 resulted in rapid dewatering of the 72 Sand. The water level response in that test was dominated by casing storage. An upper limit of T was estimated utilizing the specific capacity analysis (Equation 1) described previously. Using the drawdown and time of pumping (presented in Table 6-1), and estimating an S value of 0.05 (72 Sand at OMW-2 is an unconfined aquifer and storativity equals specific yield), T was estimated at 0.3 ft^2/day. Storativity (S) was estimated based on historical testing conducted under unconfined conditions at Moore Ranch during testing for the 35S-Orebody and 5-Spot Test, summarized in Tables 3-1 and 3-2, respectively. Utilizing the initial saturated thickness of the aquifer (11 feet at the start of the test), conductivity is approximately 0.03 ft/day.

An alternative analysis of the data from OMW-2 was estimated using the Bouwer and Rice (1976) method typically used to evaluate slug tests in unconfined aquifers. The recovery data were analyzed assuming that a slug of water was removed from the well. Though the removal of the slug was not instantaneous (as is assumed in analysis), this type of analysis provides an estimate of hydraulic conductivity that would not have been possible from the drawdown data. Utilizing the Bouwer and Rice method, hydraulic conductivity (K) was calculated as 8.8×10^{-4} ft/day. Multiplying the calculated hydraulic conductivity by the saturated thickness of 11 ft, T is calculated to be 0.01 ft^2/day. A presentation of the data analysis is included in Figure 7-5. Further discussion of the Bouwer and Rice (1976) method is included in Kruseman and deRidder (2000). In applying the Bouwer and Rice method when the water column is entirely within the screened interval, an effective radius accounting for screen radius, borehole radius, and gravel pack porosity, as discussed in Section 7.1, is utilized.

7.2.2 68 SAND

Table 7-1, summarizes the analytical results for wells UMW-3 and UMW-2, in Wellfields 1 and 2, respectively. The test that was conducted at UMW-3 was dominated by casing storage; therefore, the drawdown data were not analyzed. Recovery data were also unsuitable for analysis. The decreasing water level trend observed since the start of background monitoring at well UMW-3, coupled with the slow recovery of the well after pumping, did not allow for assessment of the recovery data. A specific capacity analysis (Equation 1) was used to provide an upper limit estimate of transmissivity of the 68 Sand aquifer at UMW-3. Utilizing drawdown and time of pumping data (presented in Table 6-1), and an estimated S value of 0.001 (approximate results of previous testing by EMC in the 70 Sand, as presented in Section 3) the transmissivity was estimated as 3.5 ft^2/day. Hydraulic conductivity estimated from a saturated thickness of 50 feet was 0.07 ft/day. As previously discussed, the specific capacity analysis represents an upper limit of T at this well location.

Drawdown data from the test conducted at UMW-2 on August 12, 2009, were analyzed by the Cooper and Jacob (1946) method. Recovery data were evaluated using the method of Theis (1935). Transmissivity was estimated as 0.7 ft^2/day from the drawdown data, and 0.5 ft^2/day from recovery data. Curve matches for these analyses are presented in Figures 7-5 and 7-6, respectively. Hydraulic conductivity estimated from a saturated thickness of 61 feet was approximately 0.01 ft/day for both analyses.

7.2.3 60 SAND

Table 7-1 summarizes the analytical results of testing in wells UMW-11 and UMW-10, in Wellfields 1 and 2, respectively. Drawdown and recovery data from testing at both locations were analyzed using the methods of Cooper and Jacob (1946) and Theis (1935), respectively.

Drawdown and recovery data from the test conducted on August 13, 2009 were analyzed for well UMW-11. Calculated transmissivities were 1.4 ft^2/day from the drawdown data and 1.4 ft^2/day from the recovery data. Hydraulic conductivity utilizing a saturated thickness of 30 feet was 0.05 ft/day for both analyses.

Drawdown and recovery data from the test conducted on August 14, 2009 were analyzed for well UMW-10. Calculated transmissivities were 2.4 ft^2/day from the drawdown data and 2.2 ft^2/day from the recovery data, and hydraulic conductivities using a saturated aquifer thickness of 32 feet were 0.08 and 0.07 ft/day, respectively.

7.2.4 80 SAND

The water level response in OMW-7B during the June 2, 2009 purging/sampling event was estimated using the Cooper and Jacob method (1946). The drawdown data were corrected for unconfined conditions. Results of the analysis indicate a transmissivity of 13.3 ft^2/d for the 80 Sand (Table 7-1 and Figure 7-11). Based on a 15 foot saturated thickness at the start of the test, the hydraulic conductivity of the 80 Sand is calculated as 0.89 ft//d. It is noted that this is an upper limit on transmissivity, as the analytical method assumes flux from the aquifer, and the linear slope of water level through time indicates that much of the groundwater appears to be removed from casing storage.

8.0 SUMMARY AND CONCLUSIONS

- As required for the completion of State and Federal permitting requirements, Energy Metals Corporation US (EMC) conducted supplemental hydrologic investigations to evaluate aquifer properties (i.e., transmissivity) within the non-producing hydrostratigraphic units relative to the 70 Sand Production Zone.

- Pump testing was conducted in the overlying 72 Sand, underlying 68 Sand, and in the lowermost underlying 60 Sand at locations within Wellfields 1 and 2. Drawdown data collected during groundwater purging activities prior to sampling were utilized to estimate aquifer properties in the single well completed in the uppermost 80 Sand (unconfined and perched aquifer unit) with sufficient water for sampling.

- Within the overlying (relative to the 70 Sand Production Zone) 72 Sand, transmissivity was calculated between 306 to 318 ft^2/day in Wellfield 1 at OMW-3. In Wellfield 2 at OMW-2, a semi-quantitative estimate of transmissivity was evaluated from drawdown data (dominated by casing storage removal) indicates a T values less than 0.3 ft^2day. A slug-test type estimate of T from recovery data indicates a T value of approximately 0.01 ft^2day.

- Within the underlying (relative to the 70 Sand) 68 Sand, transmissivity was calculated between 0.5 to 0.7 ft^2/day in Wellfield 2 at UMW-2. A semi-quantitative analysis of drawdown data (dominated by casing storage removal) indicates a T value less than 3.5 ft^2/day at UMW-3 in Wellfield 1, and true T is likely at least an order of magnitude lower than this estimate.

- Within the lowermost 60 Sand (underlies the 68 Sand, and represents the underlying aquifer where the 68 and 70 Sands coalesce), T values were calculated at 1.4 ft^2/day in Wellfield 1 at UMW-11, and between 2.2 to 2.4 ft^2/day in Wellfield 2 at UMW-10.

- Within the uppermost 80 Sand (unconfined and perched aquifer unit of limited extent), a semi-quantitative analysis of drawdown data from well purging prior to groundwater sampling was used to estimate T within this aquifer. Results of analysis indicate a T value less than approximately 13 ft^2/day at this location.

- Calculated and estimated transmissivity results for the non-producing units were generally at least an order of magnitude lower than the reported T values from historical testing within the 70 Sand Production Zone, except for the 72 Sand Test at Wellfield 1 (Well OMW-3).

9.0 REFERENCES

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TABLES

Table 3-1. Summary of Previous Aquifer Test Results, 70 Sand, Conoco, Moore Ranch Project

Pump Test	Aquifer Property	Range of Values	Representative Value
34-Orebody	Transmissivity (T; ft^2/d)	23 to 240	110
	Hydraulic Conductivity (k; ft/day)	0.38 to 4.0	1.9
	Net Sand Thickness (h; ft)	60	60
	Storativity (S)	5.3×10^{-6} to 2.9×10^{-3}	9.8×10^{-4}
35N-Orebody	Transmissivity (T; ft^2/d)	112 to 297	165
	Hydraulic Conductivity (k; ft/day)	0.95 to 1.52	1.4 ft/d
	Net Sand Thickness (h; ft)	80	80
	Storativity (S)	8.0×10^{-5} to 5.2×10^{-4}	2.5×10^{-4}
35S-Orebody	Transmissivity (T; ft^2/d)	374 to 735	555
	Hydraulic Conductivity (k; ft/day)	9.35 to 18.3	13.8
	Net Sand Thickness (h; ft)	40	40
	Storativity (S)	3.2×10^{-4} to 4.3×10^{-3}	1.4×10^{-3}
	Specific Yield	0.01 to 0.058	0.032

Table 3-2. Summary of Previous Aquifer Test Results, 70 Sand, EMC, Moore Ranch Project

Pump Test	Aquifer Property	Representative Value
Between Wellfields 1 and 2 (PW-1 Test)	Transmissivity (T; ft^2/d)	657
	Hydraulic Conductivity (k; ft/day)	8.9
	Net Sand Thickness (h; ft)	77
	Storativity (S)	4.4×10^{-3}
Wellfield 1 Test (MW-3)	Transmissivity (T; ft^2/d)	321
	Hydraulic Conductivity (k; ft/day)	4.5
	Net Sand Thickness (h; ft)	72
	Storativity (S)	NA
Wellfield 2 Test (MW-2)	Transmissivity (T; ft^2/d)	711
	Hydraulic Conductivity (k; ft/day)	7.3
	Net Sand Thickness (h; ft)	97
	Storativity (S)	NA
5-Spot Test (Wellfield 2)	Transmissivity (T; ft^2/d)	405
	Hydraulic Conductivity (k; ft/day)	5.6
	Net Sand Thickness (h; ft)	94
	Storativity (S)	0.02

Table 4-1. Monitor and Pumping Well Information, Moore Ranch Supplemental Hydrologic Testing

Well	Easting	Northing	T / R Section	TOC Elevation (ft amsl)	Hole Depth (ft bgs)	Casing Depth (ft bgs)	Top Screen (ft bgs)	Bottom Screen (ft bgs)	Screen Length (ft bgs)	Aquifer	Aquifer Thickness (ft)	Casing I.D. (inches)	DTW 8/11/09 (ft from TOC)	GW Elev. 8/11/09 (ft amsl)	Ft of Water in Well (ft)
Wellfield 1 Well Cluster															
OMW-3	317,939	1,060,553	T42N R75W 34	5429.86	250	203	205	245	40	72 Sand	71	4.5	189.18	5240.68	56
MW-3	317,949	1,060,552	T42N R75W 34	5430.26	320	267	269	317	48	70 Sand	76	4.5	249.39	5180.87	68
UMW-3	317,960	1,060,551	T42N R75W 34	5429.00	380	351	353	378	25	68 Sand	50	4.5	204.60	5224.40	173
UMW-11	317,948	1,060,542	T42N R75W 34	5430 (Est)	500	448	450	480	30	60 Sand	30	4.5	256.44	5173.6 (Est)	224
Wellfield 2 Well Cluster															
OMW-2	322,626	1,057,719	T42N R75W 35	5314.59	100	59	60	78	18	72 Sand	25	4.5	66.58	5248.01	11
MW-2	322,636	1,057,719	T42N R75W 35	5314.65	200	128	130	195	65	70 Sand	100	4.5	123.66	5190.99	71
UMW-2	322,646	1,057,720	T42N R75W 35	5315.30	280	228	230	250	20	68 Sand	61	4.5	124.94	5190.36	125
UMW-10	322,635	1,057,728	T42N R75W 35	5315 (Est)	420	333	335	365	30	60 Sand	32	4.5	139.82	5175.2 (Est)	225
80 Sand Well													**DTW 6/2/2009**	**GW Elev. 6/2/2009**	
OMW-7B	321,924	1,058,292	T42N R75W 35	5310 (Est)	58	31	33	42	9	80 Sand	15	4.5	31.28	5178.7 (Est)	11

GS - ground surface
TOC - top of casing
DTW - Depth to water
ft amsl - feet above mean sea level
ft bgs - feet below ground level
Est - Estimated value, UMW-11 and UMW-10 have not been surveyed

Table 4-2. Tested Aquifer Units and Overlying and Underlying Aquifer Monitoring

Tested Unit	Pumping Well	Monitored Overlying Wells	Monitored Underlying Wells
Wellfield 1 Tests			
72 Sand	OMW-3	None	**MW-3 (70 Sand)** UMW-3 (68 Sand) UMW-11 (60 Sand)
68 Sand	UMW-3	OMW-3 (72 Sand) **MW-3 (70 Sand)**	**UMW-11 (60 Sand)**
60 Sand	UMW-11	OMW-3 (72 Sand) MW-3 (70 Sand) **UMW-3 (68 Sand)**	None
Wellfield 2 Tests			
72 Sand	OMW-2	None	**MW-2 (70 Sand)** UMW-2 (68 Sand) UMW-10 (60 Sand)
68 Sand	UMW-2	OMW-2 (72 Sand) **MW-2 (70 Sand)**	**UMW-10 (60 Sand)**
60 Sand	UMW-10	OMW-2 (72 Sand) MW-2 (70 Sand) **UMW-2 (68 Sand)**	None
80 Sand	OMW-7B	None	None

Notes:

Wells in bold are completed in the immediately adjacent overlying and underlying aquifers.

Table 5-1. Barometric Pressure Changes During Testing, Moore Ranch Supplemental Hydrologic Testing

Pumping Well	Sand	Date	Max BP (in Hg)	Min BP (in Hg)	ΔBP (in Hg)	ΔBP (ft H_2O)
OMW-3, Test #1	72 Sand	8/13/2009	24.668	24.661	0.007	0.008
OMW-3, Test #2	72 Sand	8/13/2009	24.659	24.653	0.006	0.007
OMW-3, Test #3	72 Sand	8/13/2009	24.652	24.645	0.007	0.008
OMW-2	72 Sand	8/12/2009	24.713	24.645	0.068	0.077
UMW-2	68 Sand	8/12/2009	24.761	24.741	0.02	0.022
UMW-11	60 Sand	8/13/2009	24.673	24.645	0.028	0.031
UMW-10	60 Sand	8/14/2009	24.638	24.626	0.012	0.014

Notes:

ft H_20 = feet of water (1 in Hg = 1.125 ft H_20)

BP = Barometric pressure

Table 6-1. Summary of Pump Testing, Moore Ranch Supplemental Hydrologic Testing

Wellfield 1

Well Location	Sand	Date	Duration (min)	Pumping Rate (gpm)	Pump	Maximum Drawdown (ft)	Notes	Analysis Conducted?
OMW-3	72 Sand	8/13/09	30	0.91	2-in	0.6	Drawdown reached near equilibrium for all 3 tests.	Yes
		8/13/09	15	0.94	2-in	0.6		Yes
		8/13/09	17	0.93	2-in	0.6		Yes
UMW-3	68 Sand	8/14/09	20	0.8	2-in	21.3	Pumping did not get pass casing storage; continuous downward trend of water levels did not allow analysis of very slow recovery after pumping.	No
UMW-11	60 Sand	8/12/09	16	2.6	4-in	49.0	Pumping rate was ~6 gpm over first minute of testing; data not analyzed due to erratic data.	No
		8/13/09	141	2.12	4-in	76.6	Transducer water levels supplemented by manual e-lines after logger was exposed. Pumping rate slowed near the end of test, possibly due to pump exposure.	Yes

Wellfield 2

Well Location	Sand	Date	Duration (min)	Pumping Rate (gpm)		Maximum Drawdown (ft)	Notes	Analysis?
OMW-2	72 Sand	8/12/09	33	0.84	2-in	7.2	Pumping did not get past casing storage; shallow TD and minimal saturated thickness did not allow greater drawdown. Recovery data analyzed as slug-test type analysis.	Yes
UMW-2	68 Sand	8/11/09	~10	1.2	2-in	11.4	Test was aborted; pump stalled/shut off.	No
		8/12/09	113	1.12	2-in	63.5		Yes
UMW-10	60 Sand	8/13/09	11	11.5	4-in	> 62.4	Transducer exposed and max drawdown reached after ~ 6 minutes; rate was too high for well.	No
		8/14/09	<3	Not measured	4-in	15.2	Aborted test; in attempting to choke back the pump to get lower rate, pressure buildup became too high and test was stopped.	No
		8/14/09	27	5.4	4-in	85.2	Utilized manual e-lines once transducer was exposed; stopped test due to e-line getting tangled.	Yes
		8/14/09	6.8	9.5	4-in	67.4	Pumping rate too high; response dominated by casing storage and test was not analyzed.	
OMW-7B	80 Sand	6/2/09	30	1.6	2-in	13.4	Water levels measured with e-lines during purging of well prior to sampling.	Yes

Table 7-1. Analytical Results, Moore Ranch Supplemental Hydrologic Testing

Sand	Pumping Well	Analytical Method	Transmissivity (ft^2/day)	Hydraulic Conductivity (ft/day)
72 Sand	OMW-3 - Test 1	Cooper-Jacob	306	4.3
	OMW-3 - Test 2	Cooper-Jacob	312	4.4
	OMW-3 - Test 3	Cooper-Jacob	318	4.5
	OMW-2	Bouwer & Rice (Slug-test)	9.6×10^{-3}	8.8×10^{-4}
	OMW-2	Specific Capacity*	0.3*	0.03*
68 Sand	UMW-3	Specific Capacity*	3.5*	0.07*
	UMW-2	Cooper-Jacob	0.7	0.01
	UMW-2	Theis Recovery	0.5	0.01
60 Sand	UMW-11	Cooper-Jacob	1.4	0.05
	UMW-11	Theis Recovery	1.4	0.05
	UMW-10	Cooper-Jacob	2.4	0.08
	UMW-10	Theis Recovery	2.2	0.07
80 Sand	OMW-7B	Cooper-Jacob	13.3	0.89

Notes:

[shaded] Denotes analysis conducted to estimate aquifer properties (semi-quantitative) from available data.

* - The specific capacity analysis represents an upper-bound limit on transmissivity. Water level data indicates that the tests were dominated by casing storage with minimal influx from the aquifer. Specific capacity analysis assumes flux to the well is from the aquifer, therefore results from this analysis are estimated to be at least an order of magnitude higher than actual aquifer conditions.

FIGURES

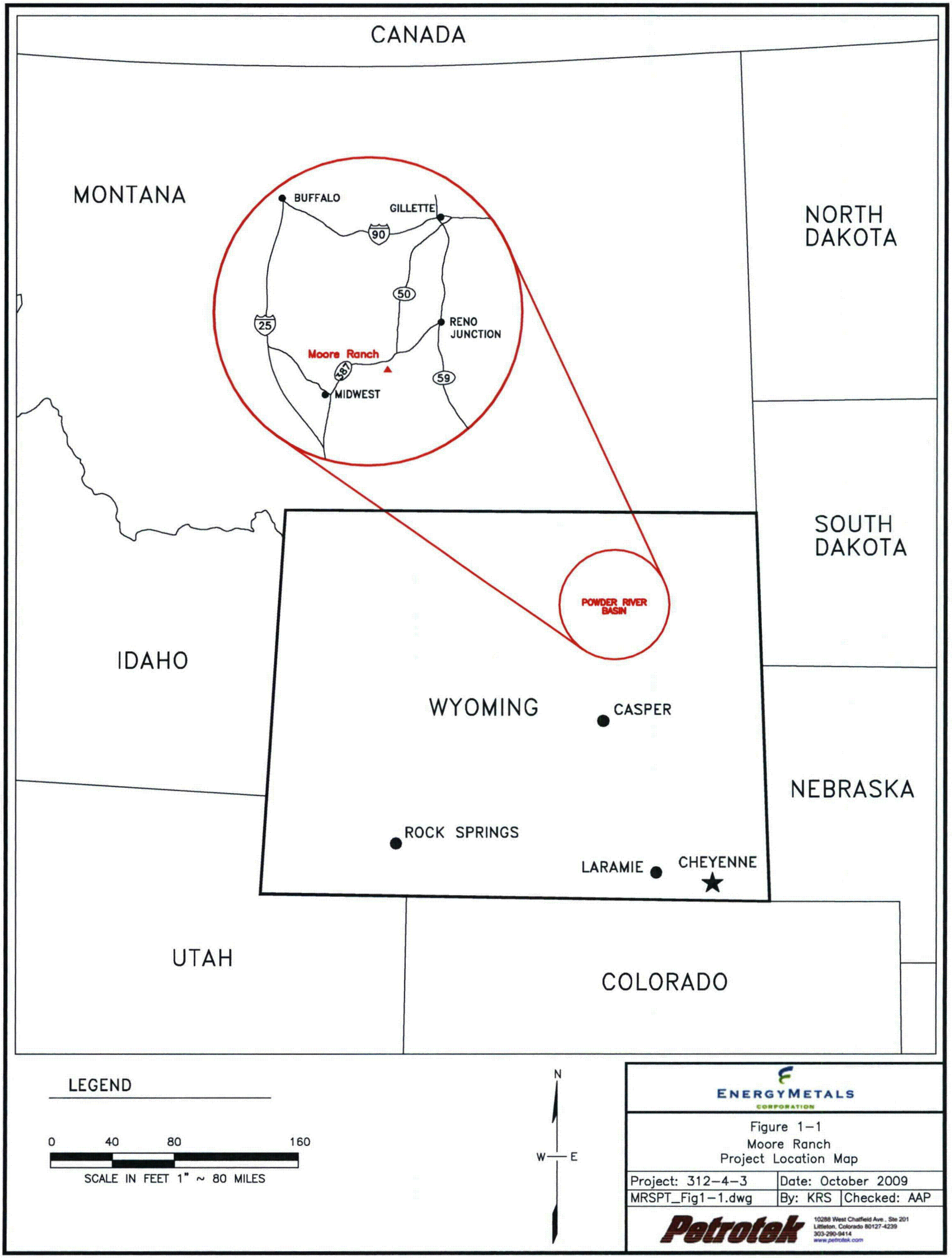
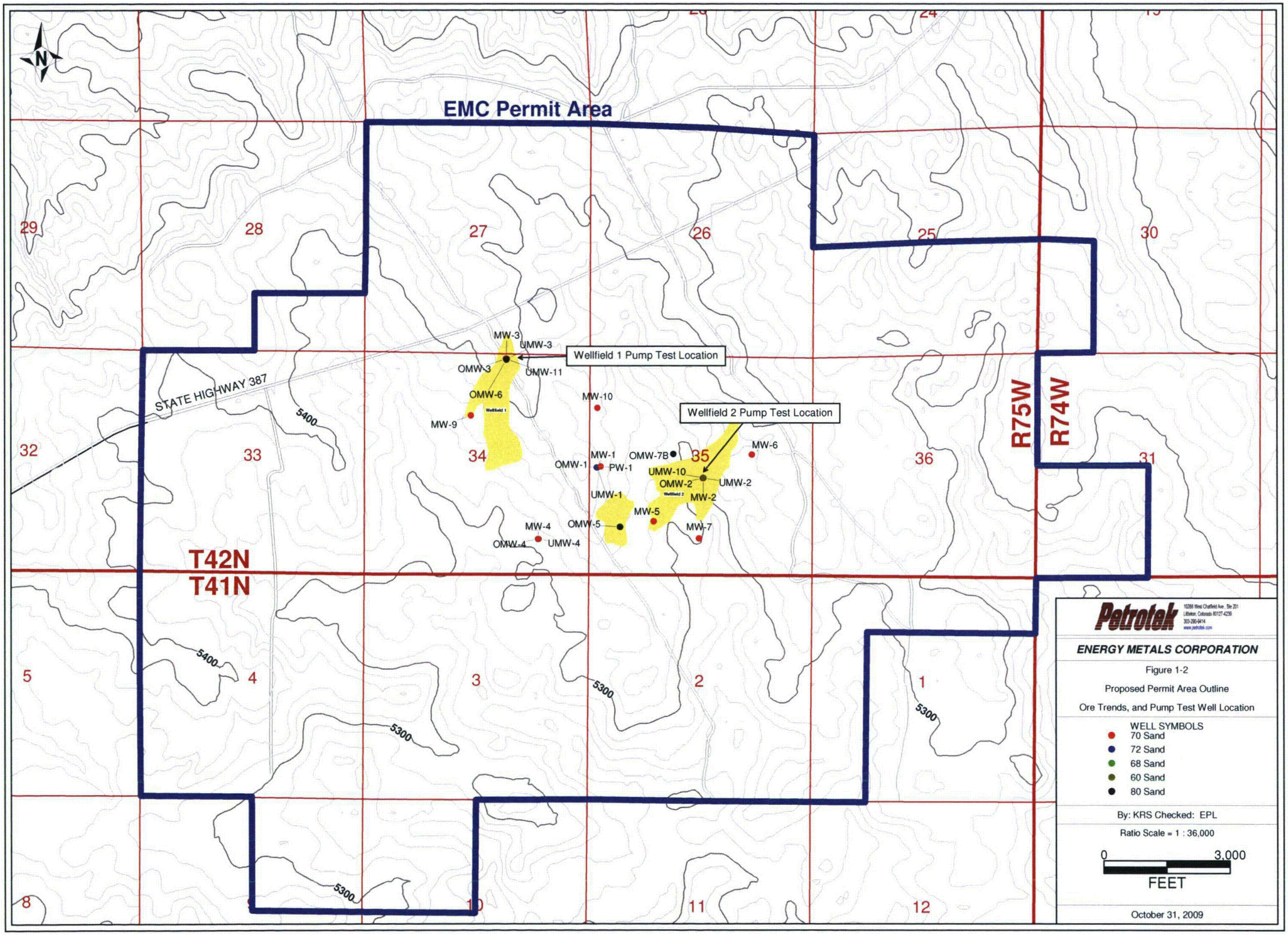
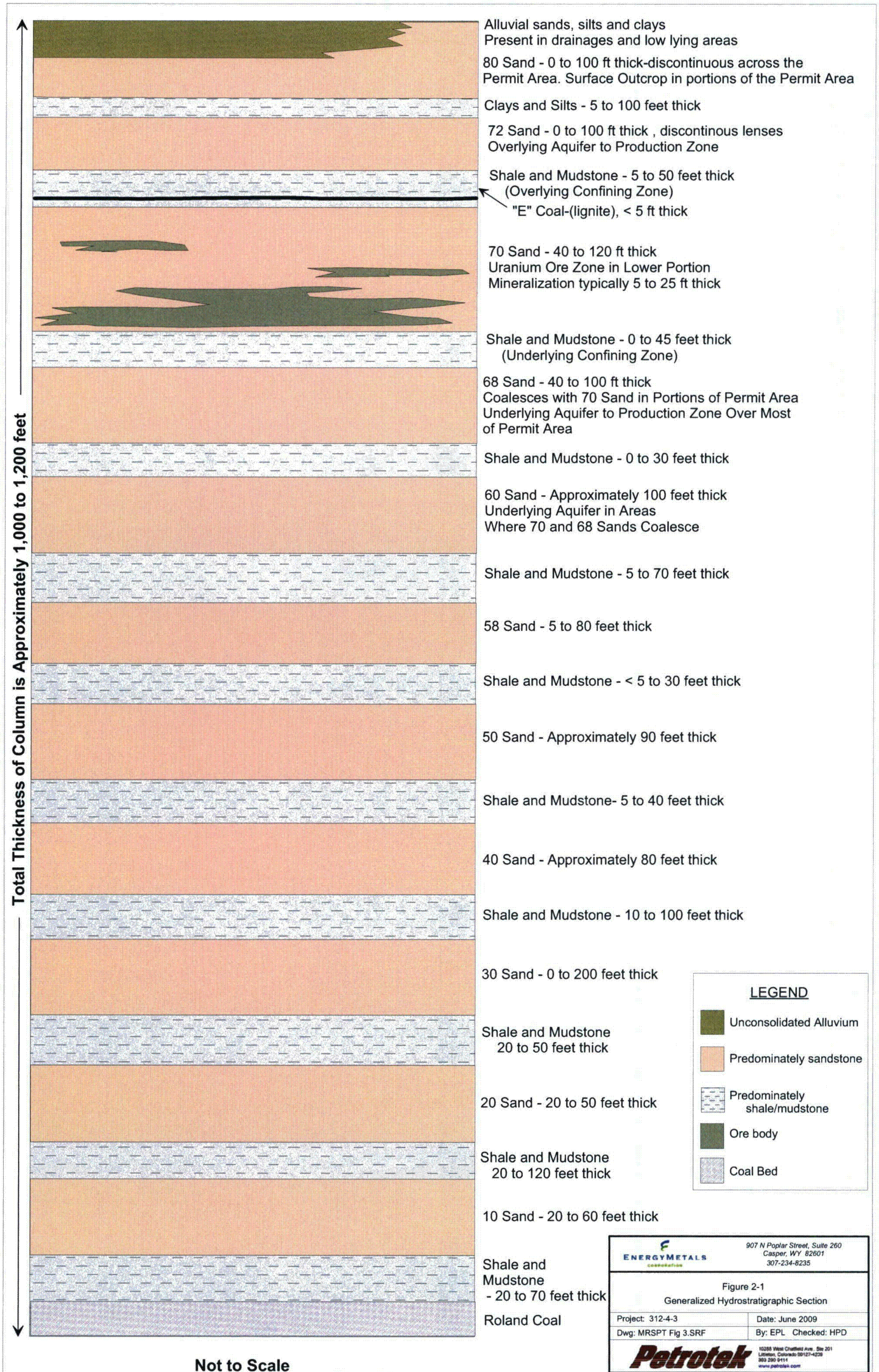
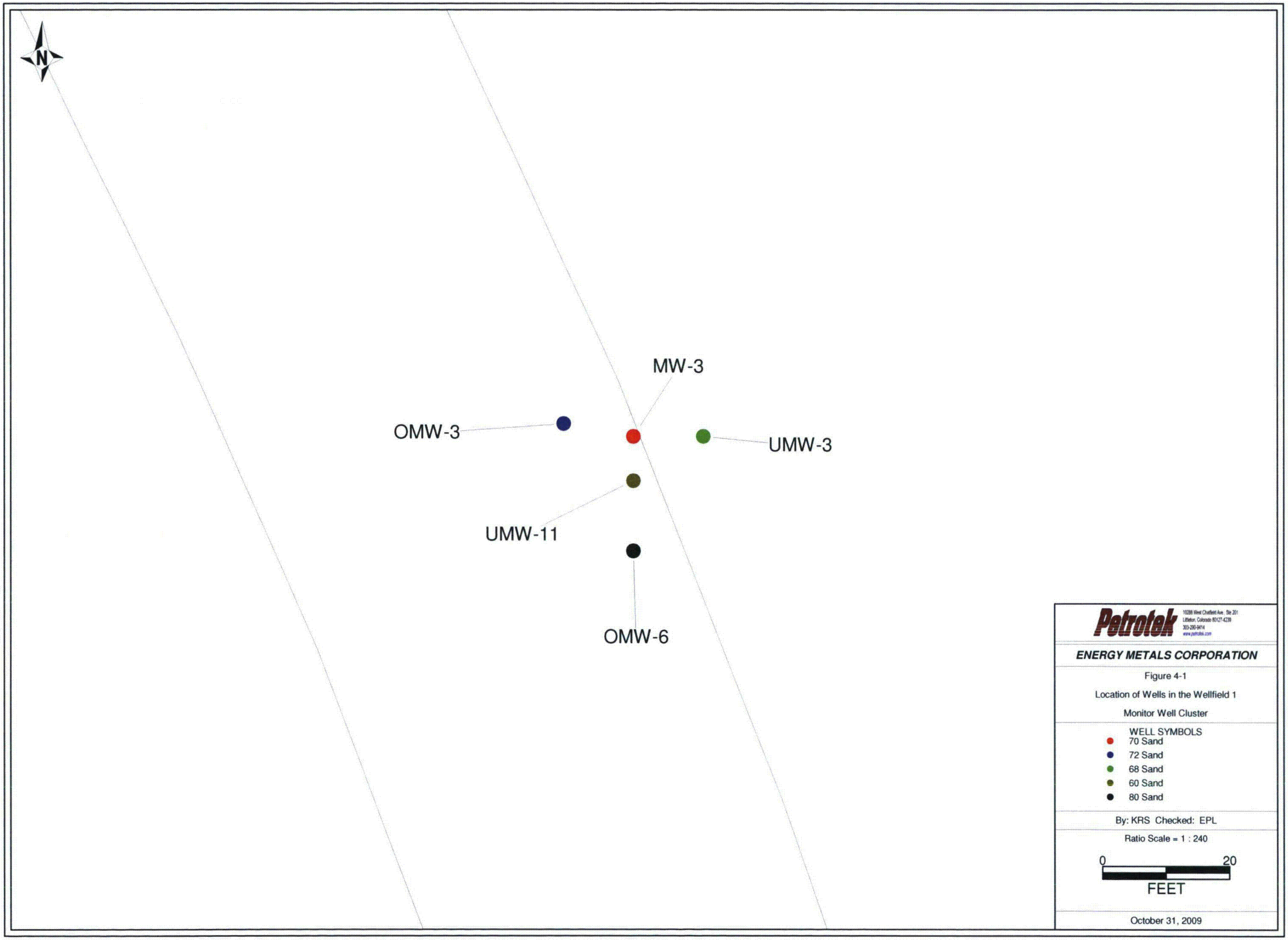


Figure 1-1
Moore Ranch
Project Location Map


EMC Permit Area
Wellfield 1 Pump Test Location
Wellfield 2 Pump Test Location
STATE HIGHWAY 387
MW-3
UMW-3
OMW-3
UMW-11
OMW-6
MW-9
MW-10
MW-1
OMW-7B
OMW-1
PW-1
UMW-10
OMW-2
UMW-2
MW-2
MW-6
UMW-1
MW-5
OMW-5
MW-4
OMW-4
UMW-4
MW-7
T42N
T41N
R75W
R74W
5400
5300
29
28
27
26
25
30
32
33
34
35
36
31
5
4
3
2
1
8
10
11
12
ENERGY METALS CORPORATION
Figure 1-2
Proposed Permit Area Outline
Ore Trends, and Pump Test Well Location
WELL SYMBOLS
70 Sand
72 Sand
68 Sand
60 Sand
80 Sand
By: KRS Checked: EPL
Ratio Scale = 1 : 36,000
0
3,000
FEET
October 31, 2009



Total Thickness of Column is Approximately 1,000 to 1,200 feet
Alluvial sands, silts and clays
Present in drainages and low lying areas
80 Sand - 0 to 100 ft thick-discontinuous across the Permit Area. Surface Outcrop in portions of the Permit Area
Clays and Silts - 5 to 100 feet thick
72 Sand - 0 to 100 ft thick , discontinous lenses
Overlying Aquifer to Production Zone
Shale and Mudstone - 5 to 50 feet thick
(Overlying Confining Zone)
"E" Coal-(lignite), < 5 ft thick
70 Sand - 40 to 120 ft thick
Uranium Ore Zone in Lower Portion
Mineralization typically 5 to 25 ft thick
Shale and Mudstone - 0 to 45 feet thick
(Underlying Confining Zone)
68 Sand - 40 to 100 ft thick
Coalesces with 70 Sand in Portions of Permit Area
Underlying Aquifer to Production Zone Over Most of Permit Area
Shale and Mudstone - 0 to 30 feet thick
60 Sand - Approximately 100 feet thick
Underlying Aquifer in Areas
Where 70 and 68 Sands Coalesce
Shale and Mudstone - 5 to 70 feet thick
58 Sand - 5 to 80 feet thick
Shale and Mudstone - < 5 to 30 feet thick
50 Sand - Approximately 90 feet thick
Shale and Mudstone- 5 to 40 feet thick
40 Sand - Approximately 80 feet thick
Shale and Mudstone - 10 to 100 feet thick
30 Sand - 0 to 200 feet thick
Shale and Mudstone
20 to 50 feet thick
20 Sand - 20 to 50 feet thick
Shale and Mudstone
20 to 120 feet thick
10 Sand - 20 to 60 feet thick
Shale and Mudstone - 20 to 70 feet thick
Roland Coal
Not to Scale
LEGEND
Unconsolidated Alluvium
Predominately sandstone
Predominately shale/mudstone
Ore body
Coal Bed
ENERGYMETALS CORPORATION
907 N Poplar Street, Suite 260
Casper, WY 82601
307-234-8235
Figure 2-1
Generalized Hydrostratigraphic Section
Project: 312-4-3
Date: June 2009
Dwg: MRSPT Fig 3.SRF
By: EPL Checked: HPD
Petrotek


N
MW-3
OMW-3
UMW-3
UMW-11
OMW-6
Petrotek
ENERGY METALS CORPORATION
Figure 4-1
Location of Wells in the Wellfield 1
Monitor Well Cluster
WELL SYMBOLS
70 Sand
72 Sand
68 Sand
60 Sand
80 Sand
By: KRS Checked: EPL
Ratio Scale = 1 : 240
0
20
FEET
October 31, 2009

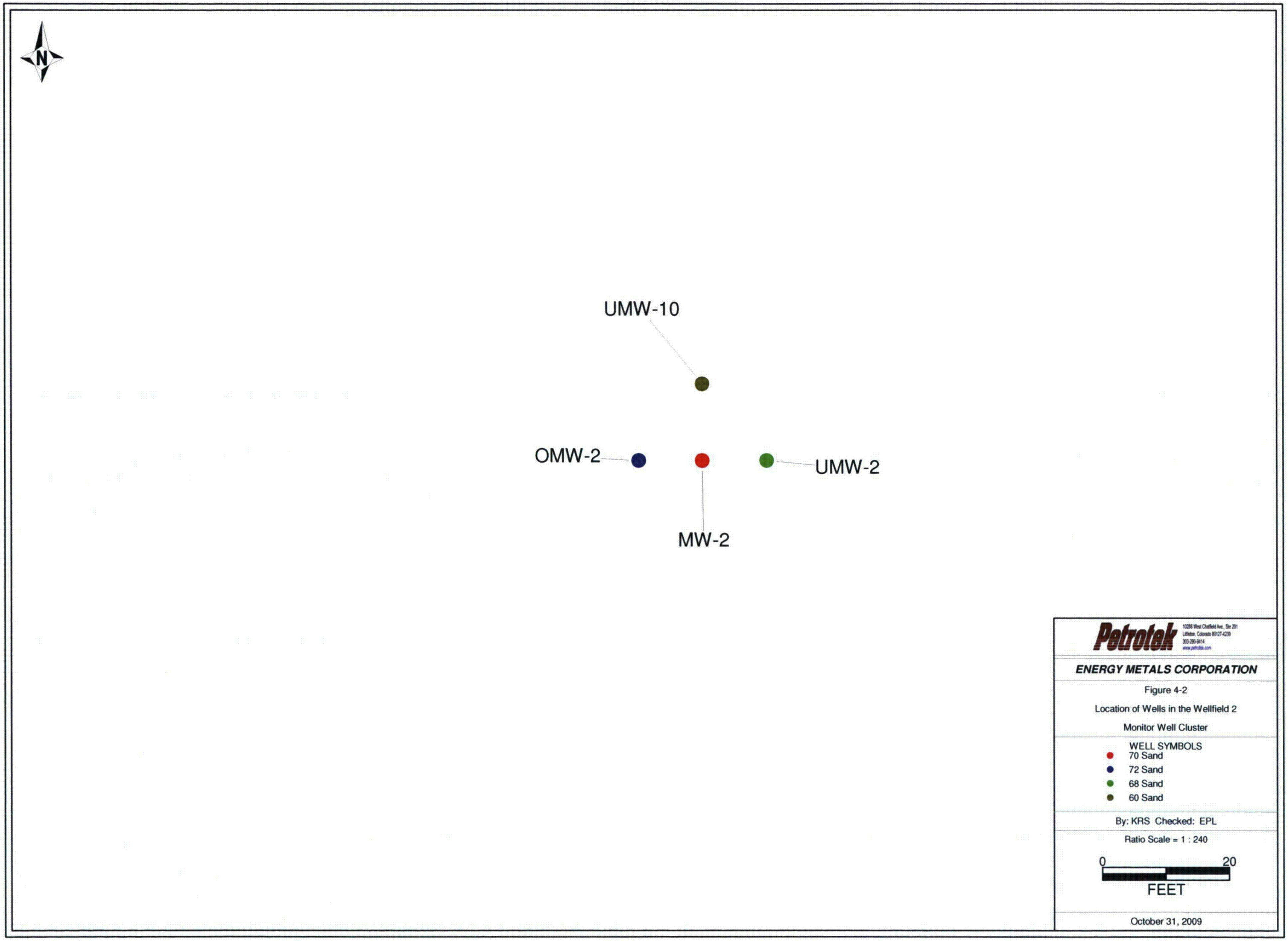

N
UMW-10
OMW-2
UMW-2
MW-2
Petrotek
ENERGY METALS CORPORATION
Figure 4-2
Location of Wells in the Wellfield 2
Monitor Well Cluster
WELL SYMBOLS
70 Sand
72 Sand
68 Sand
60 Sand
By: KRS Checked: EPL
Ratio Scale = 1 : 240
0
20
FEET
October 31, 2009

Figure 6-1. OMW-3 Water Level vs Barometric Pressure, 72 Sand

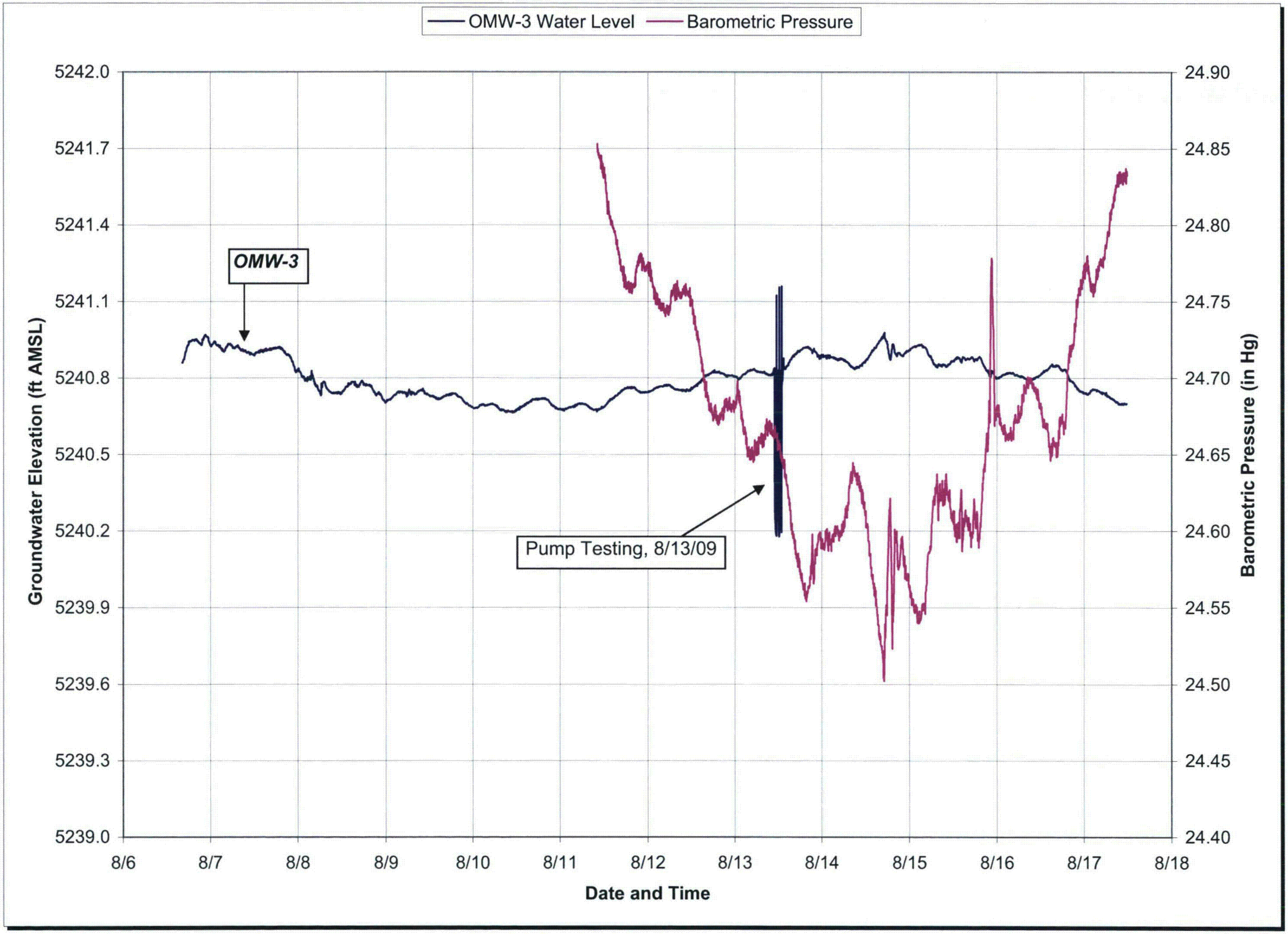


Figure 6-2. OMW-3 Pump Test Hydrograph vs Barometric Pressure, 72 Sand

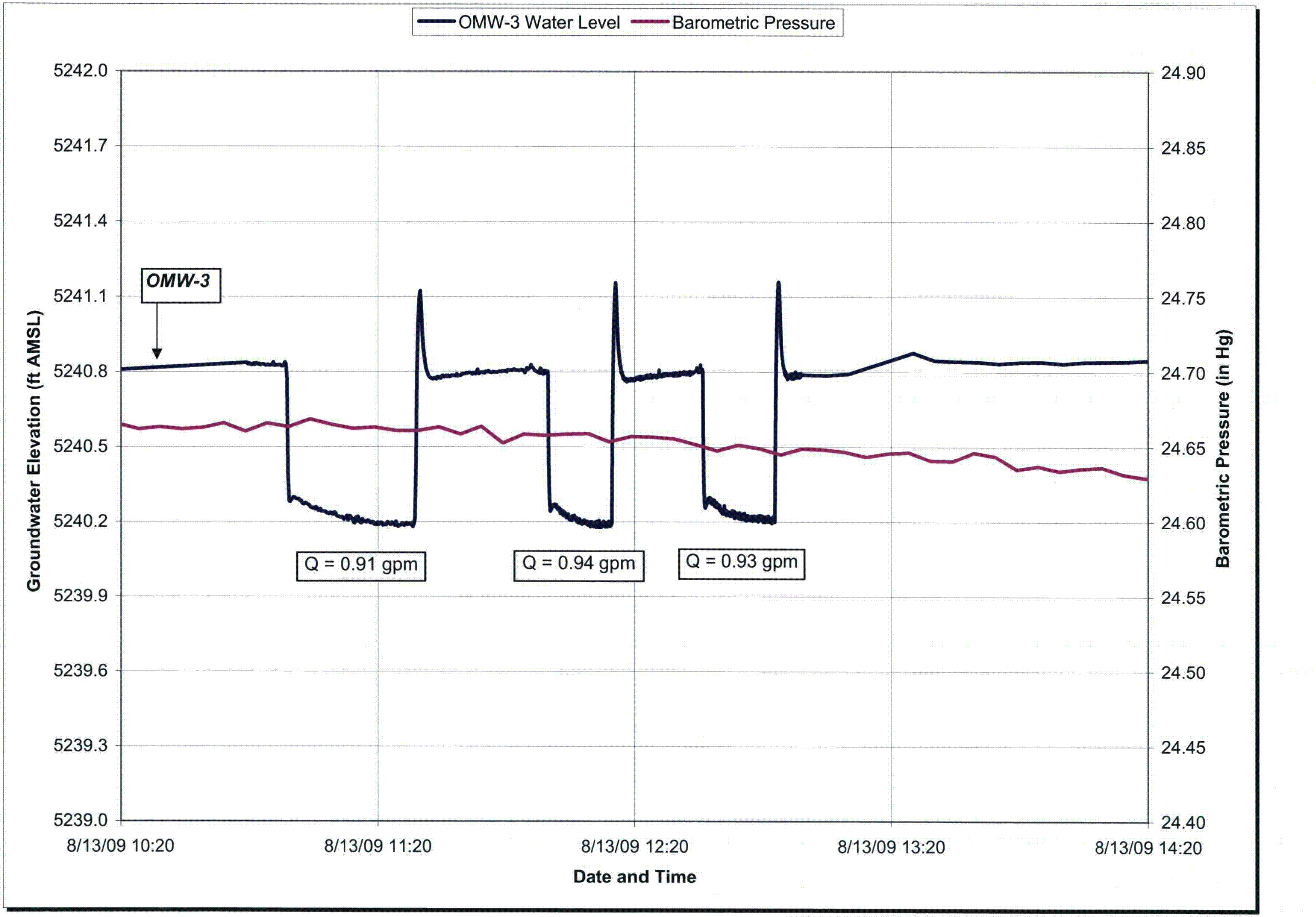


Figure 6-3. OMW-3 Pump Test Hydrograph vs Underlying Aquifer (70 Sand, Well MW-3)

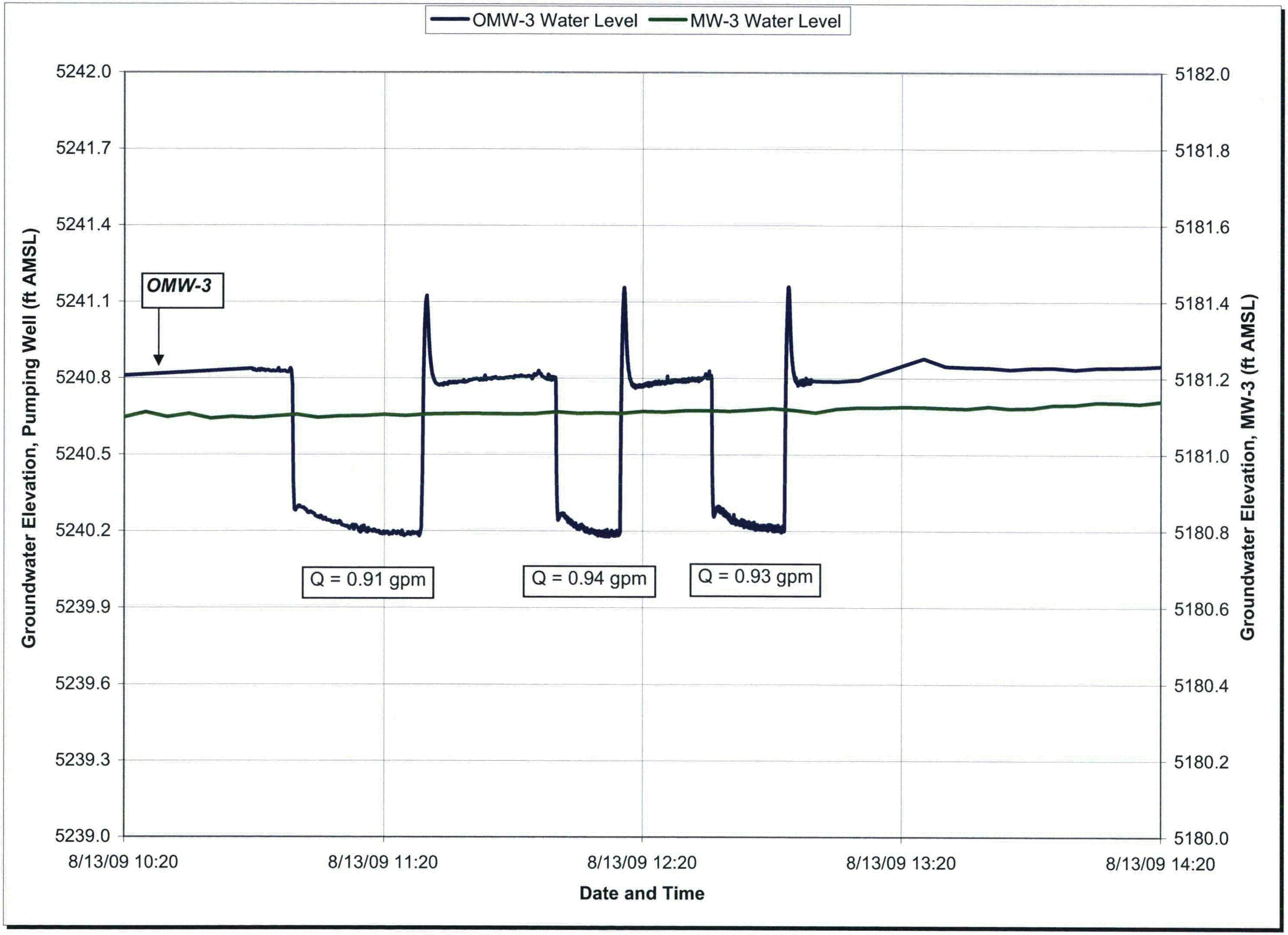


Figure 6-4. OMW-2 Water Level vs Barometric Pressure, 72 Sand

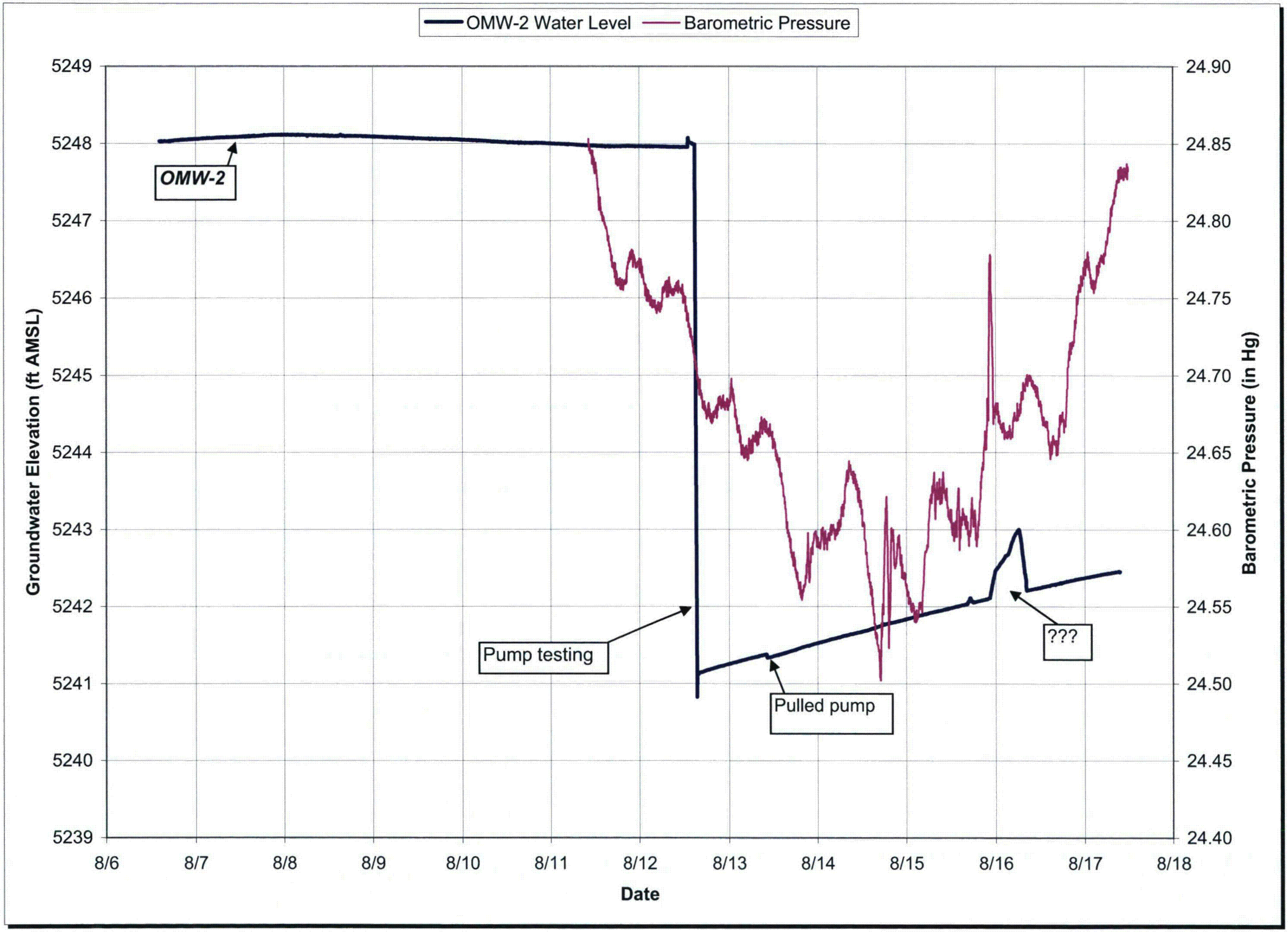


Figure 6-5. OMW-2 Pump Test Hydrograph vs Barometric Pressure, 72 Sand

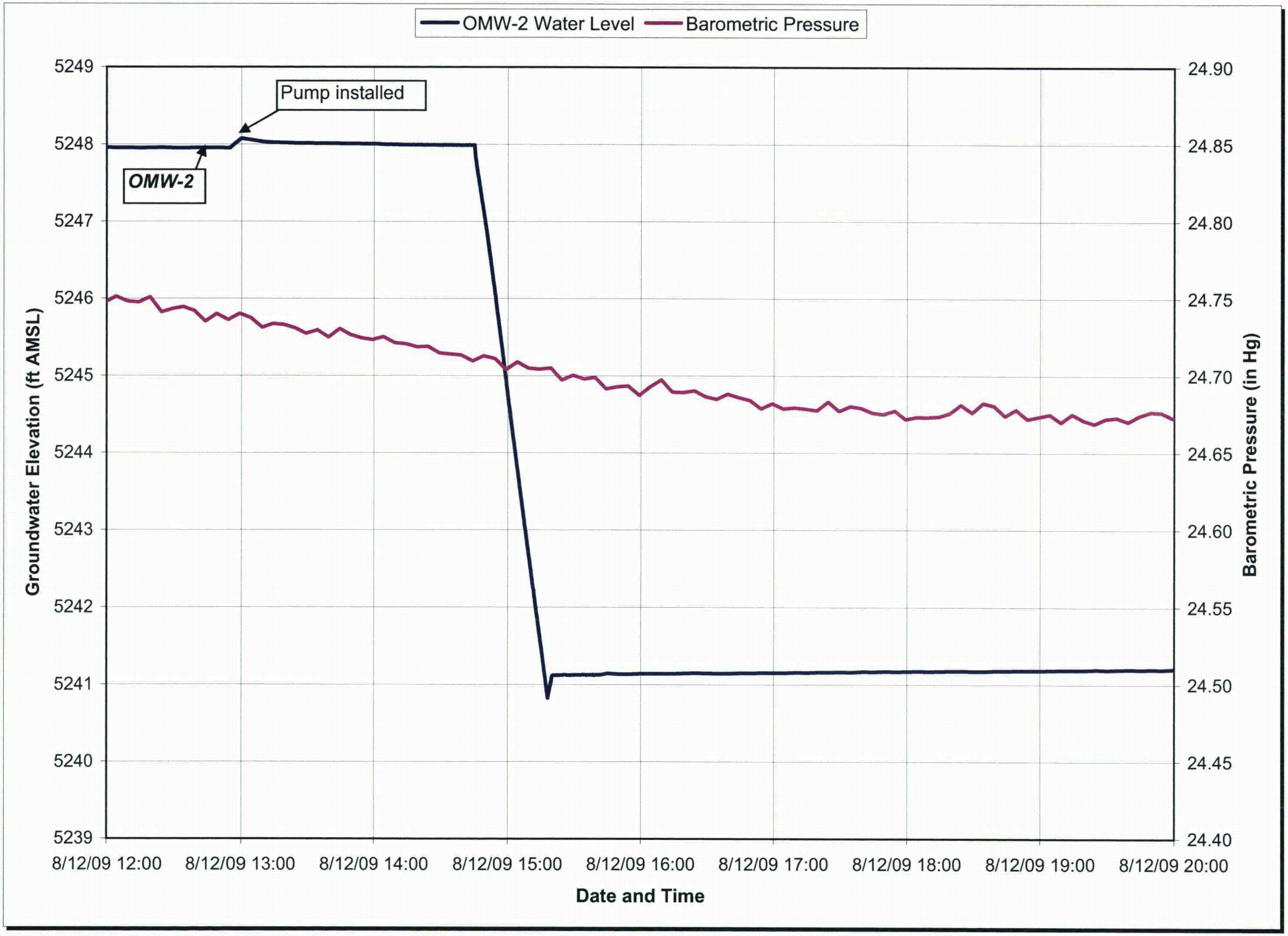


Figure 6-6. OMW-2 Pump Test Hydrograph vs Underlying Aquifer (70 Sand, MW-2)

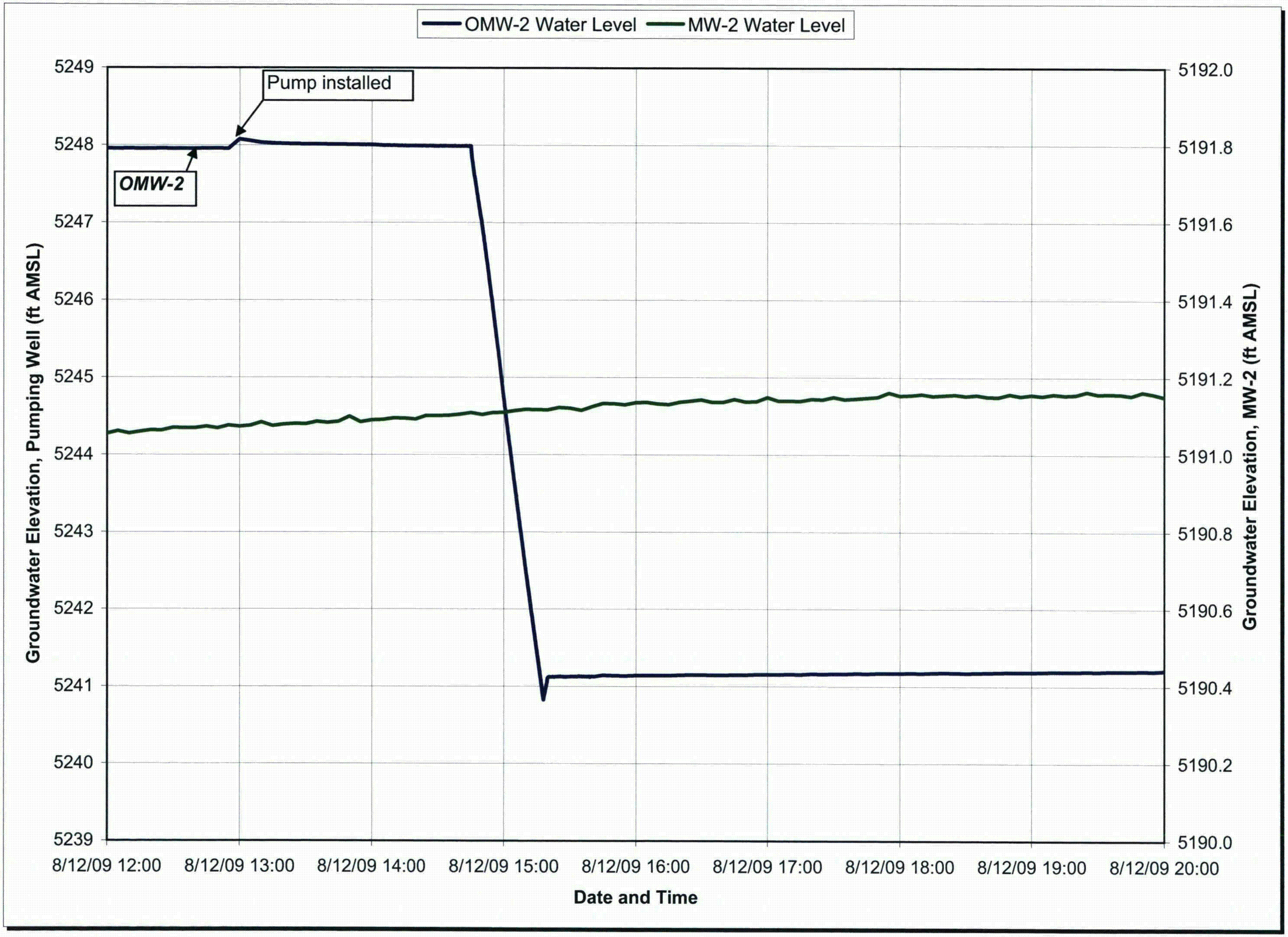


Figure 6-7. MW-3 Water Level vs Barometric Pressure, 70 Sand

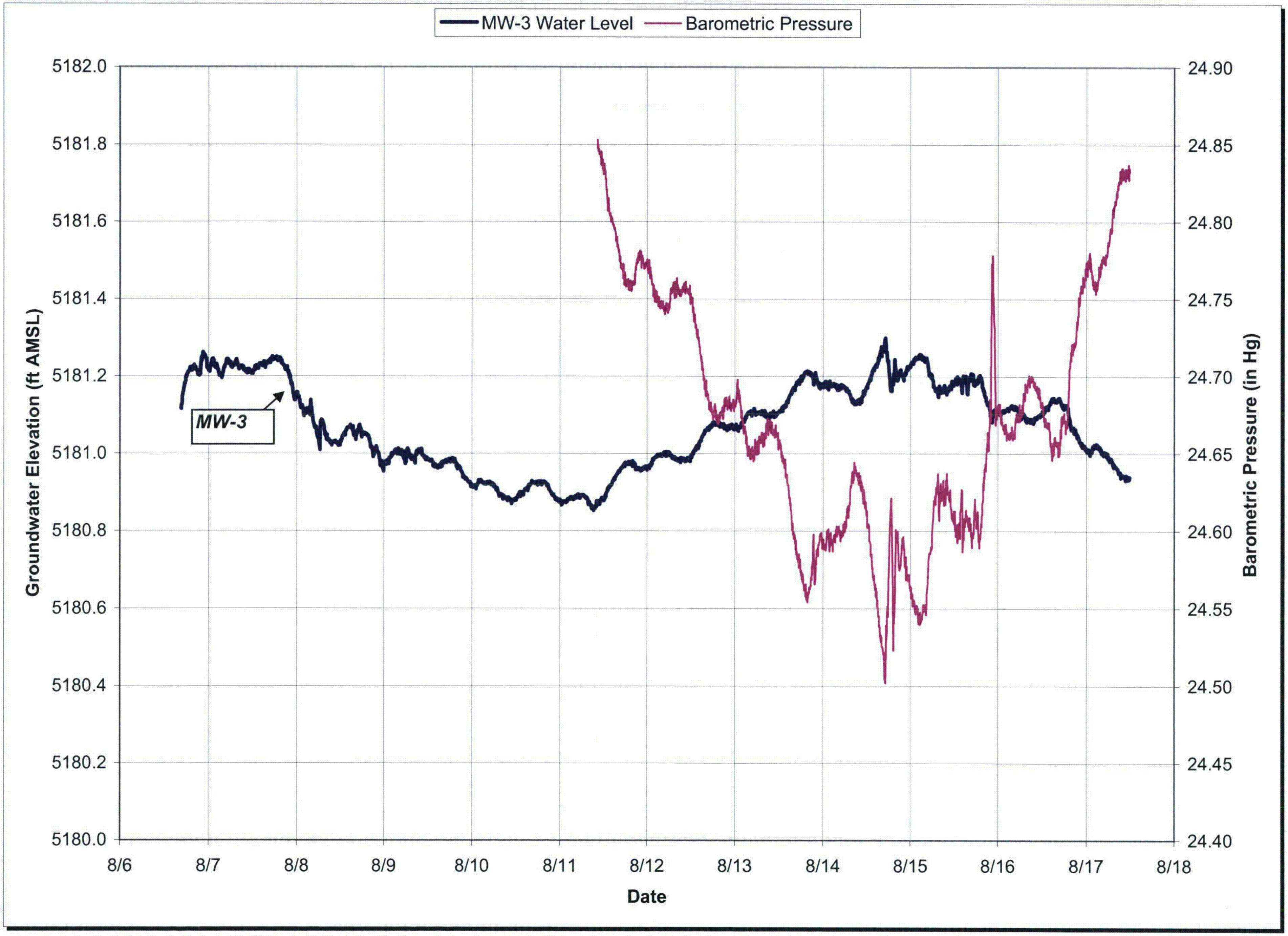


Figure 6-8. MW-2 Water Level vs. Barometric Pressure, 70 Sand

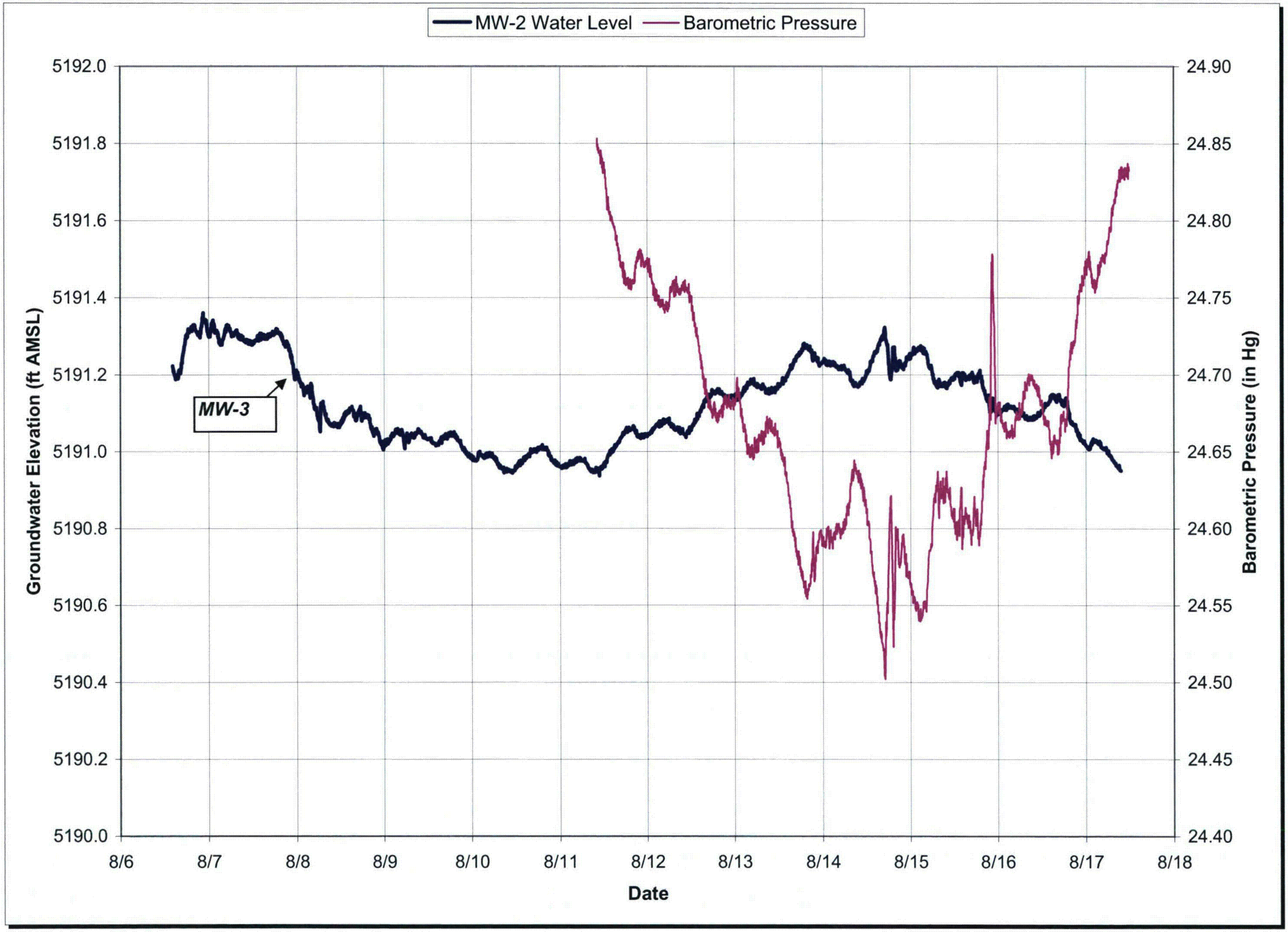


Figure 6-9. UMW-3 Water Level vs. Barometric Pressure, 68 Sand

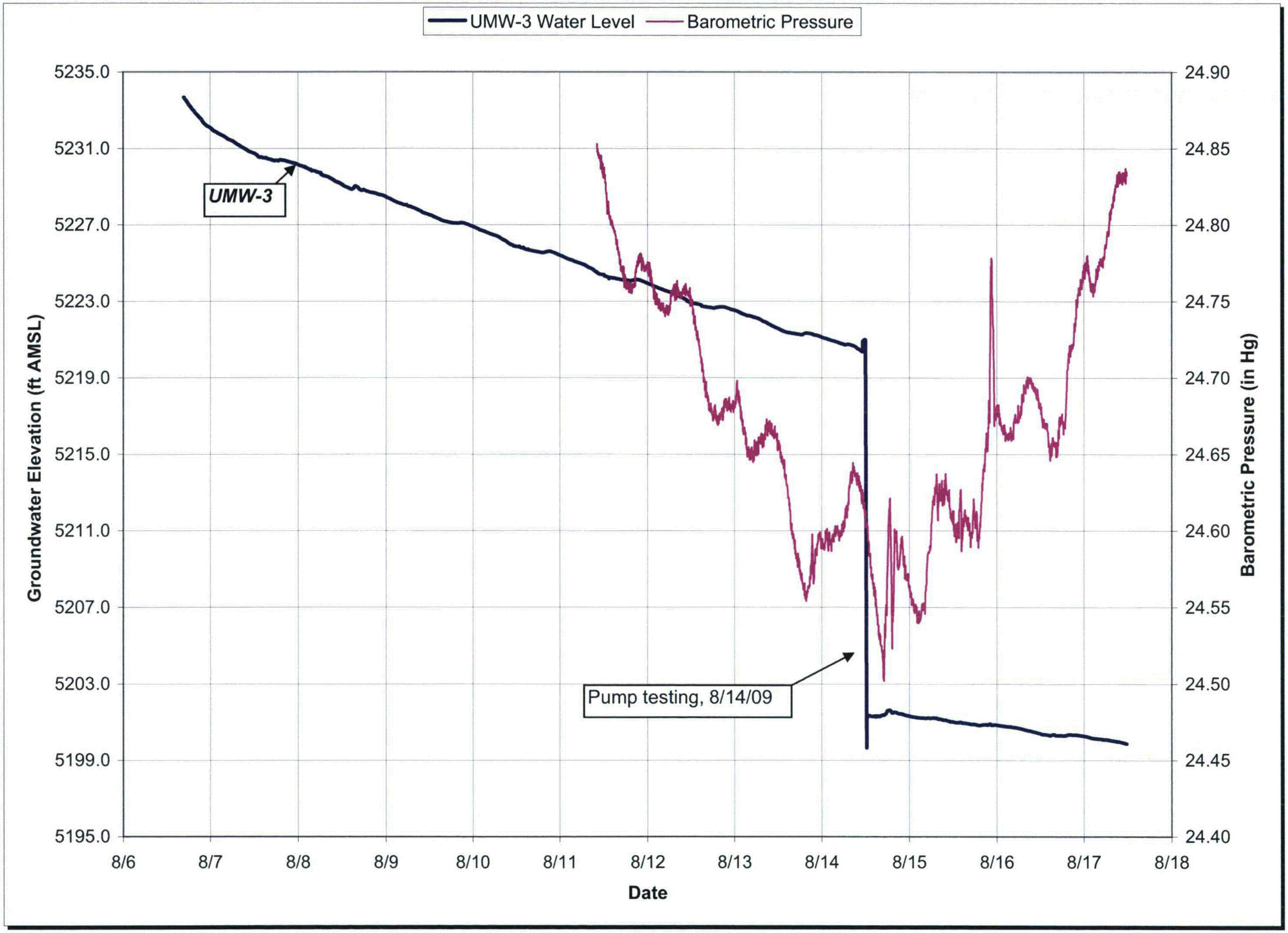


Figure 6-10. UMW-3 Pump Test Hydrograph vs. Barometric Pressure, 68 Sand

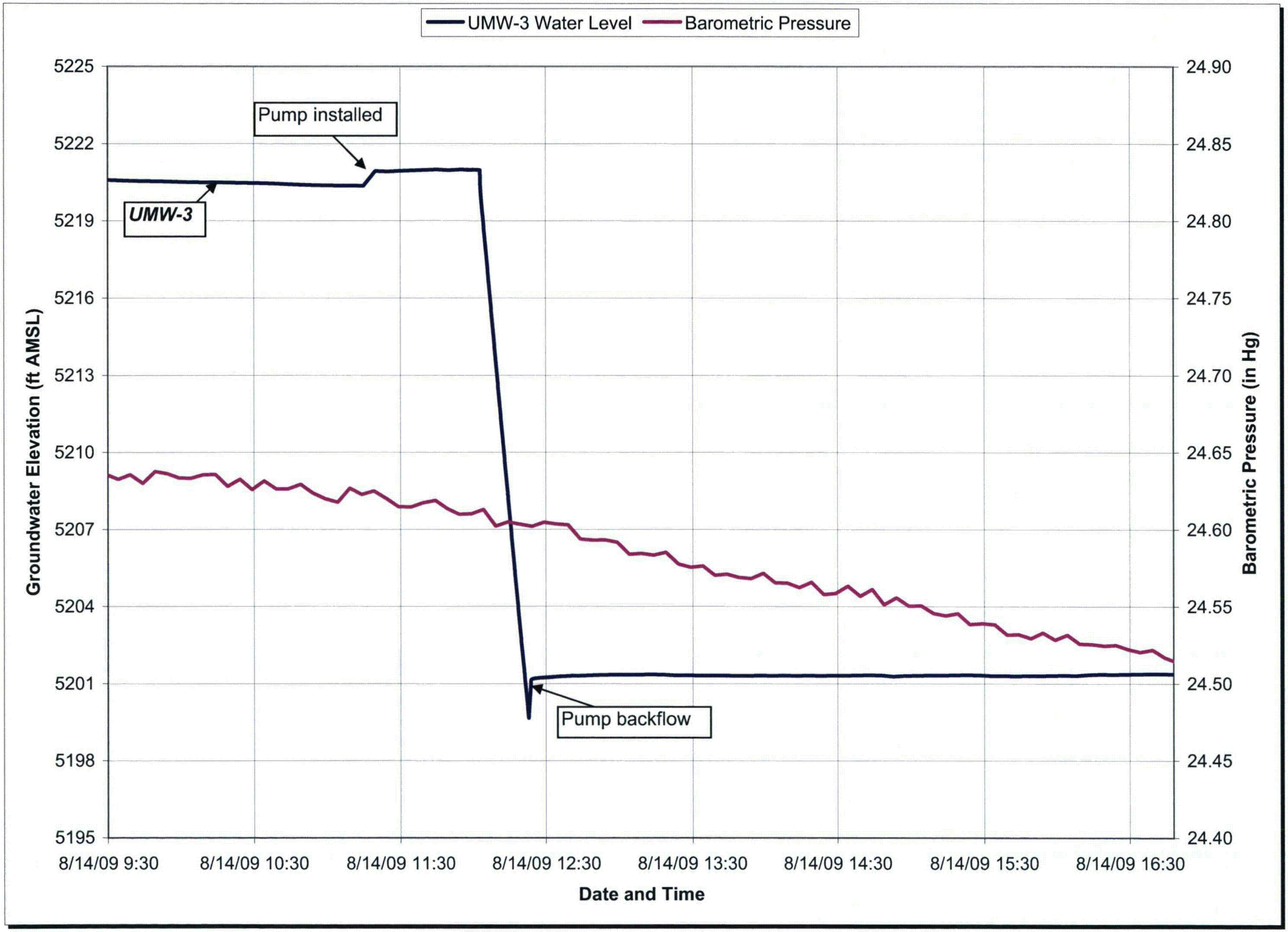


Figure 6-11. UMW-3 Pump Test Hydrograph vs Overlying Aquifer (70 Sand, MW-3) and Underlying Aquifer (60 Sand, UMW-11)

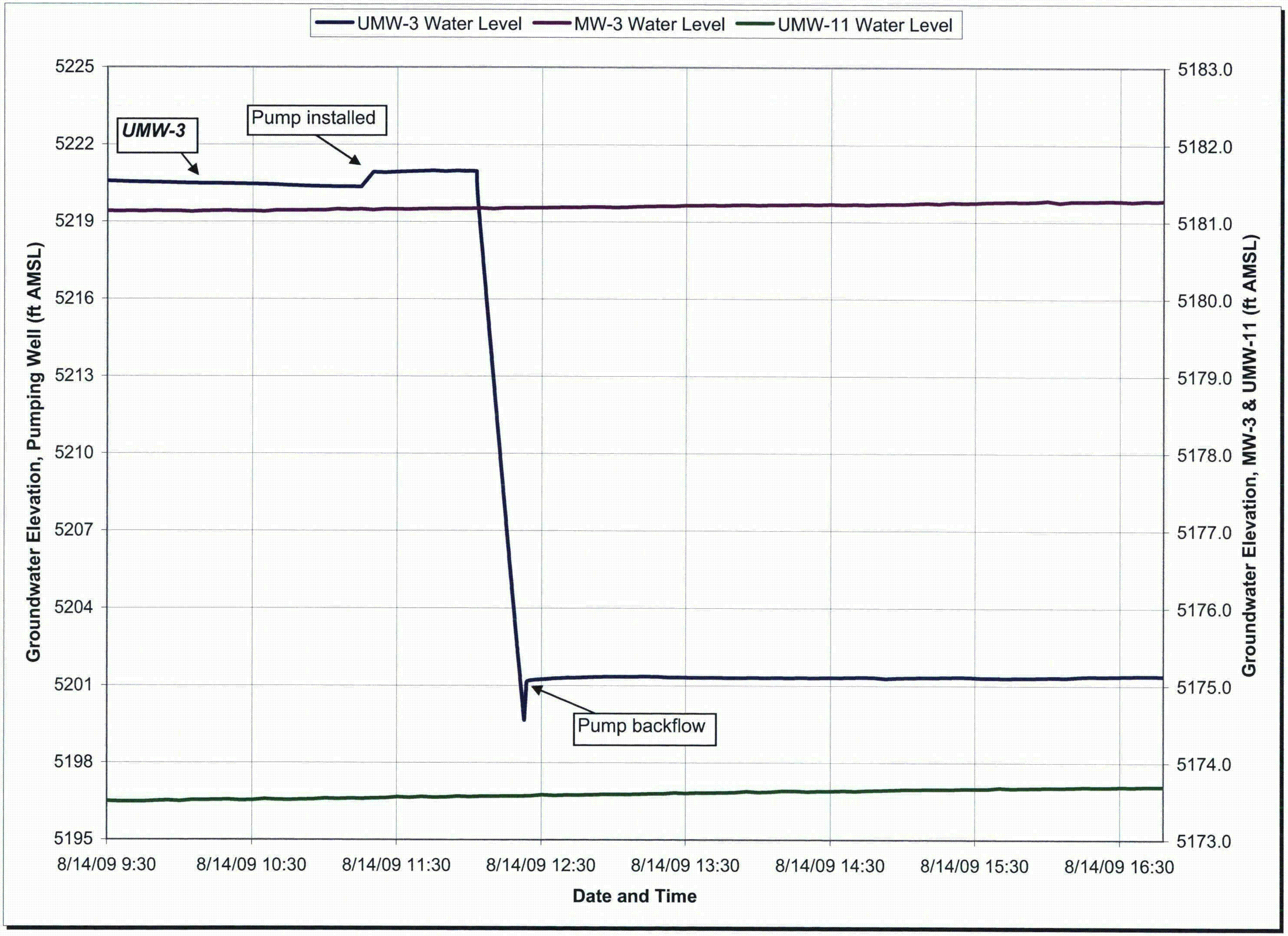


Figure 6-12. UMW-2 Water Level vs. Barometric Pressure, 68 Sand

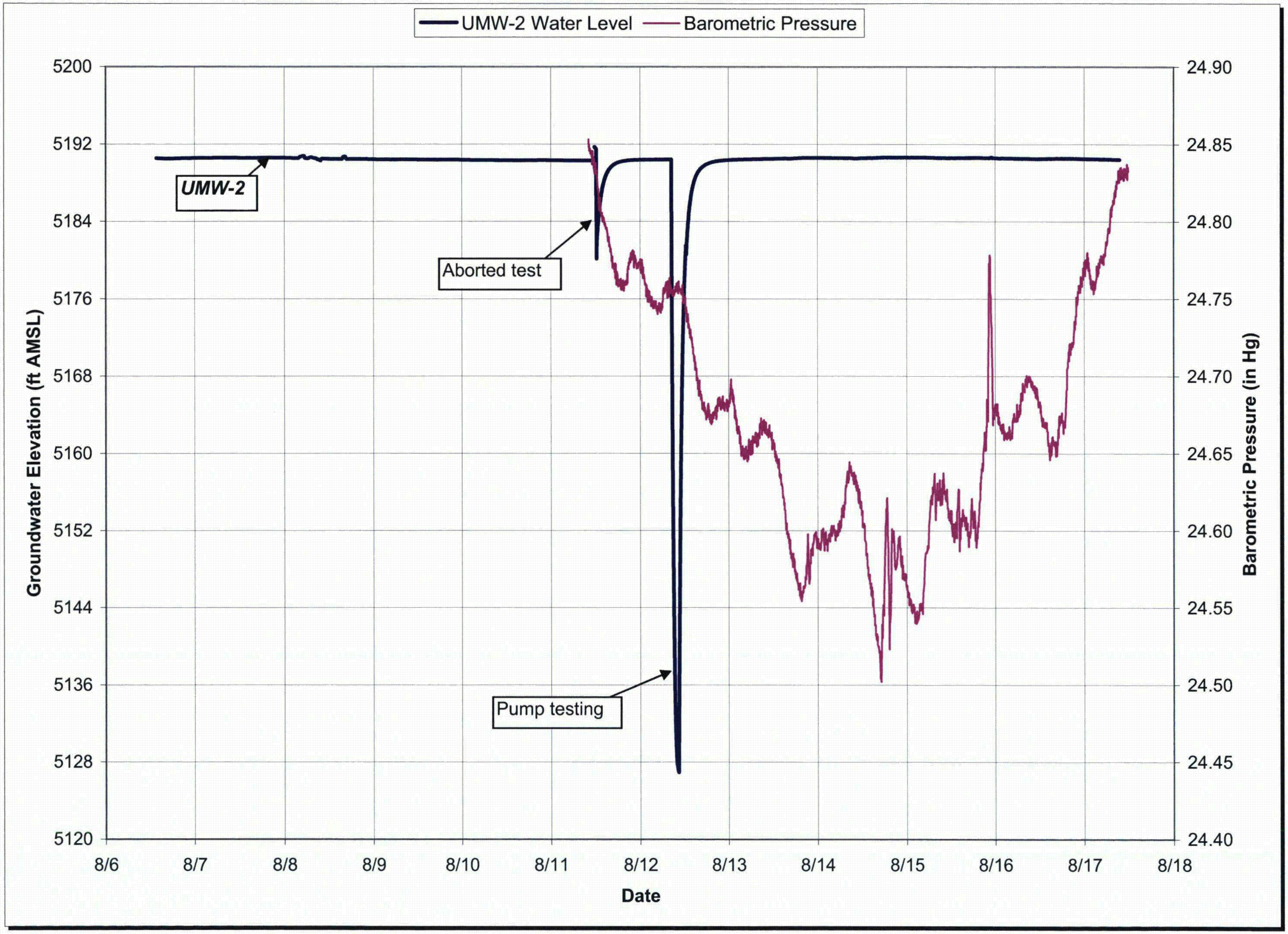


Figure 6-13. UMW-2 Pump Test Hydrograph vs Barometric Pressure, 68 Sand

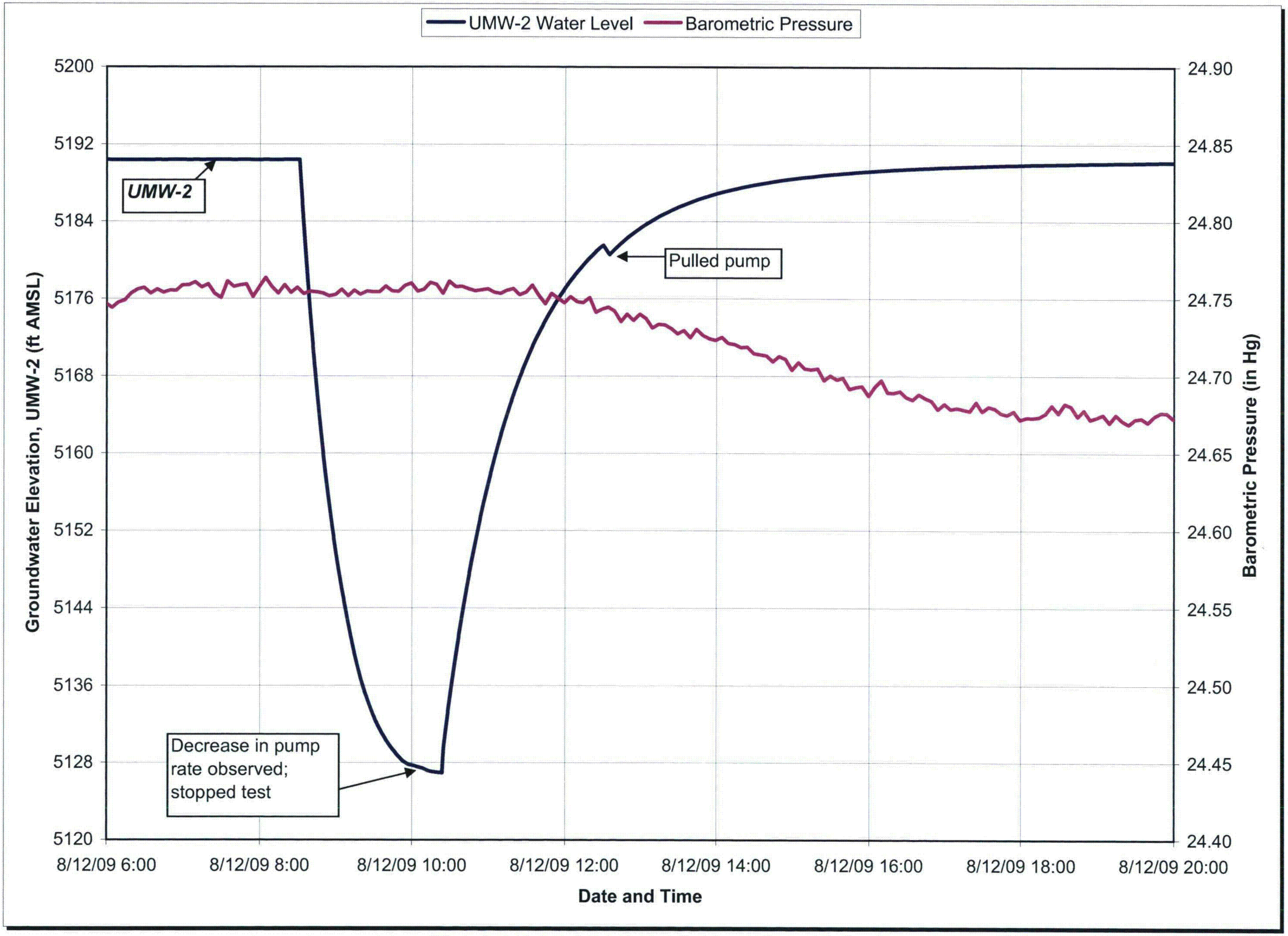


Figure 6-14. UMW-2 Pump Test Hydrograph vs Overlying Aquifer (70 Sand, MW-2)

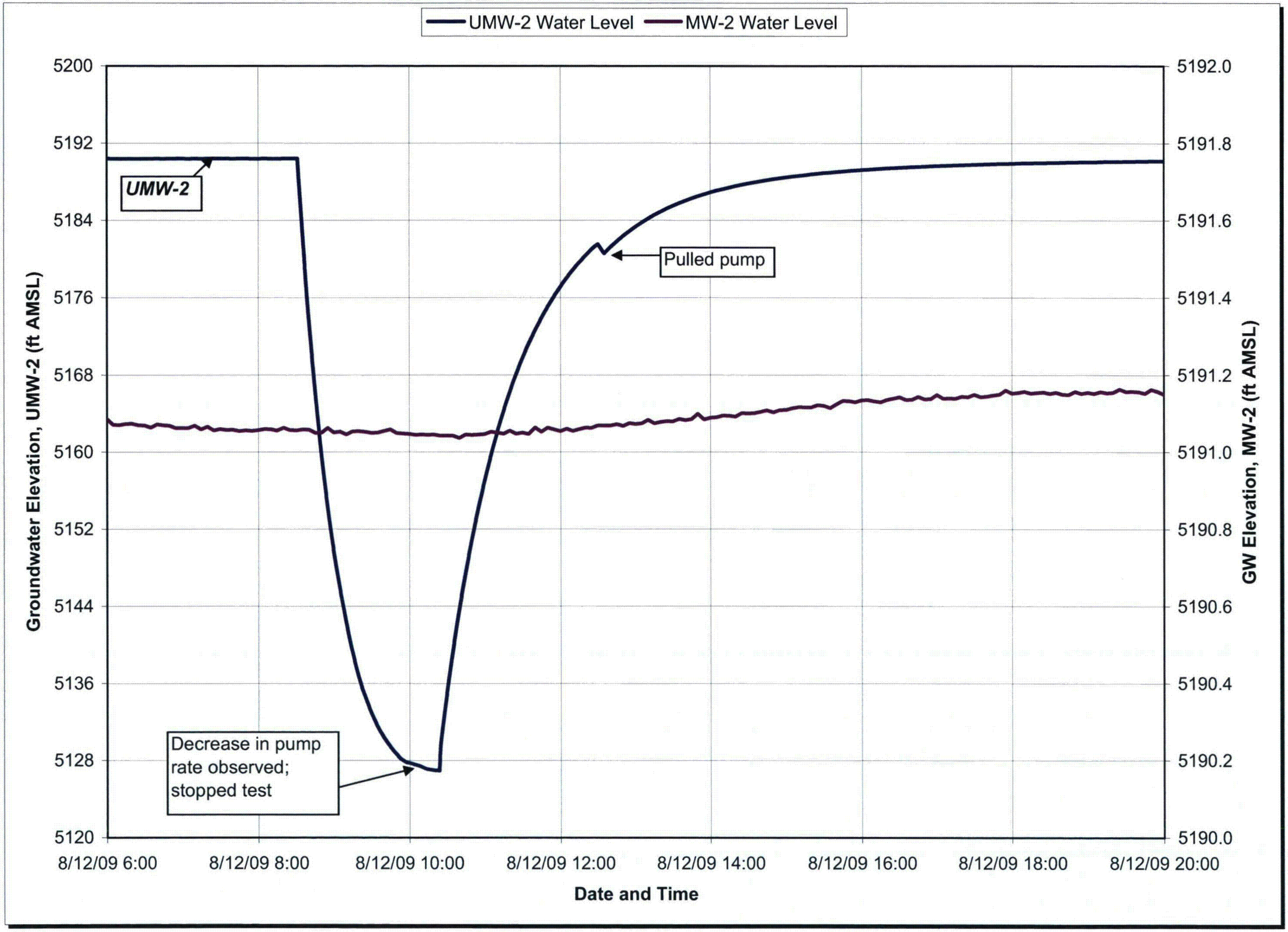


Figure 6-15. UMW-2 Pump Test Hydrograph vs. Underlying Aquifer (60 Sand, UMW-10)

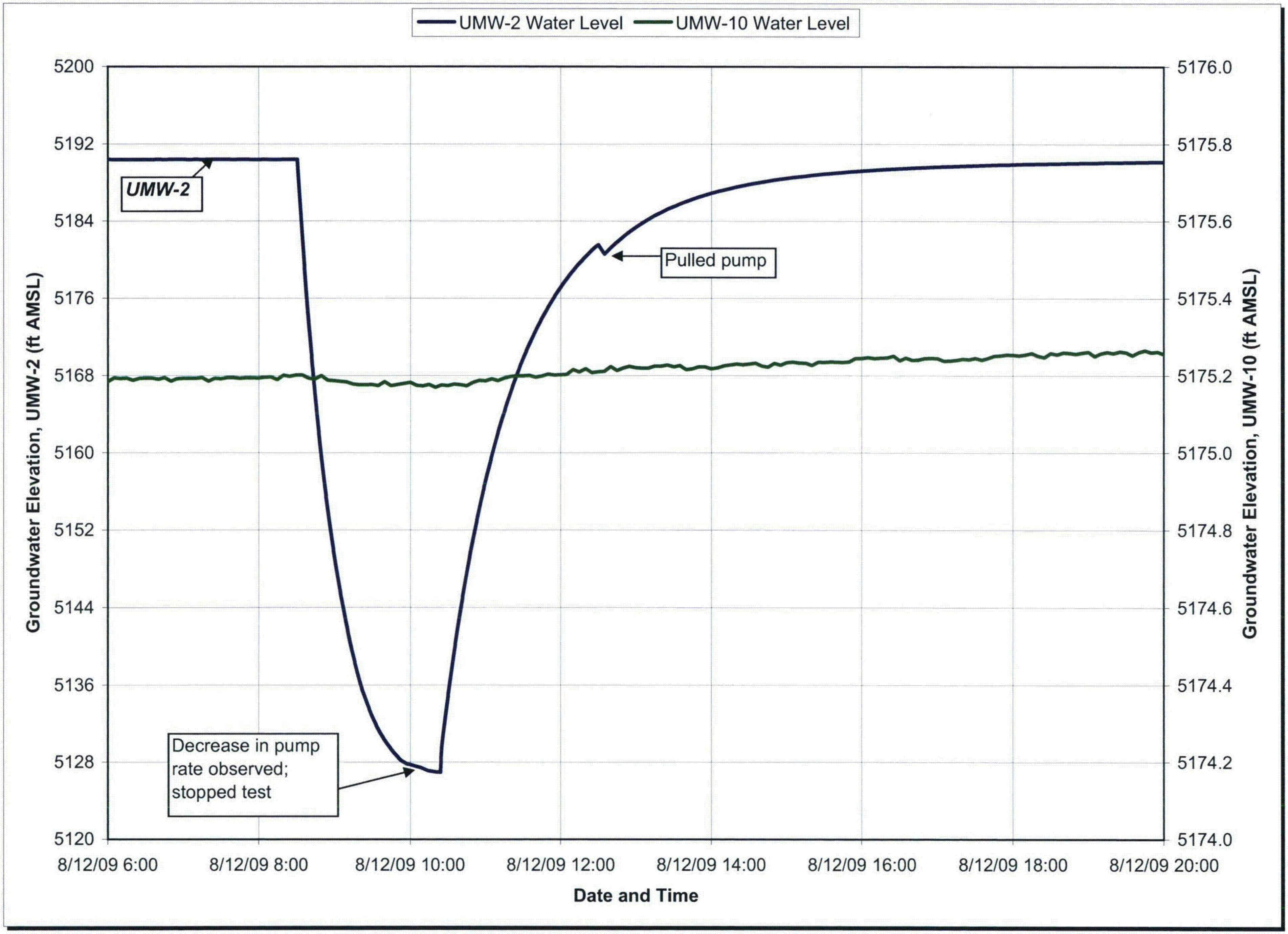


Figure 6-16. UMW-11 Water Level vs. Barometric Pressure, 60 Sand

Figure 6-17. UMW-11 Pump Test vs. Barometric Pressure, 60 Sand

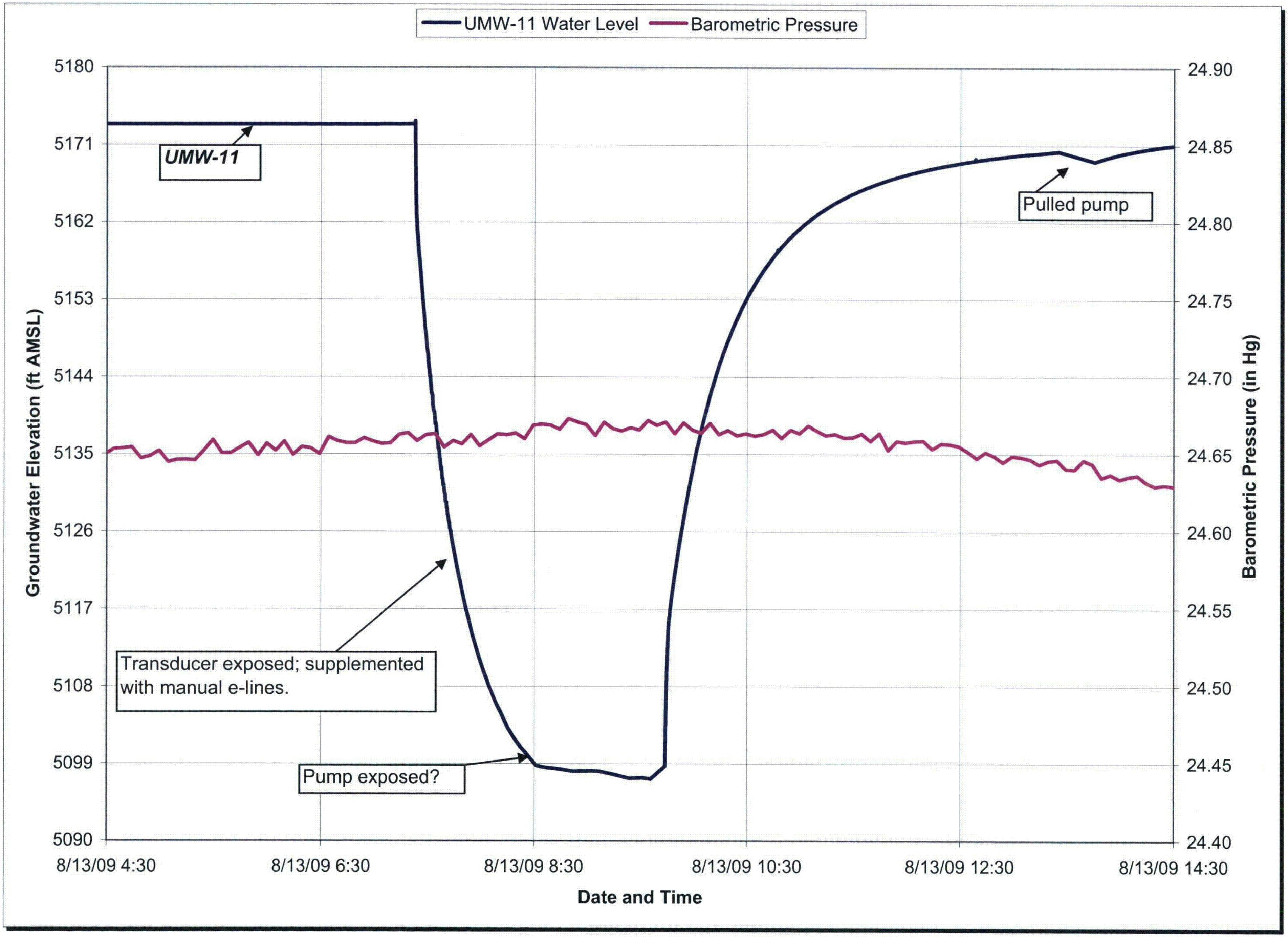


Figure 6-18. UMW-11 Pump Test Hydrograph vs Overlying Aquifer (68 Sand, UMW-3)

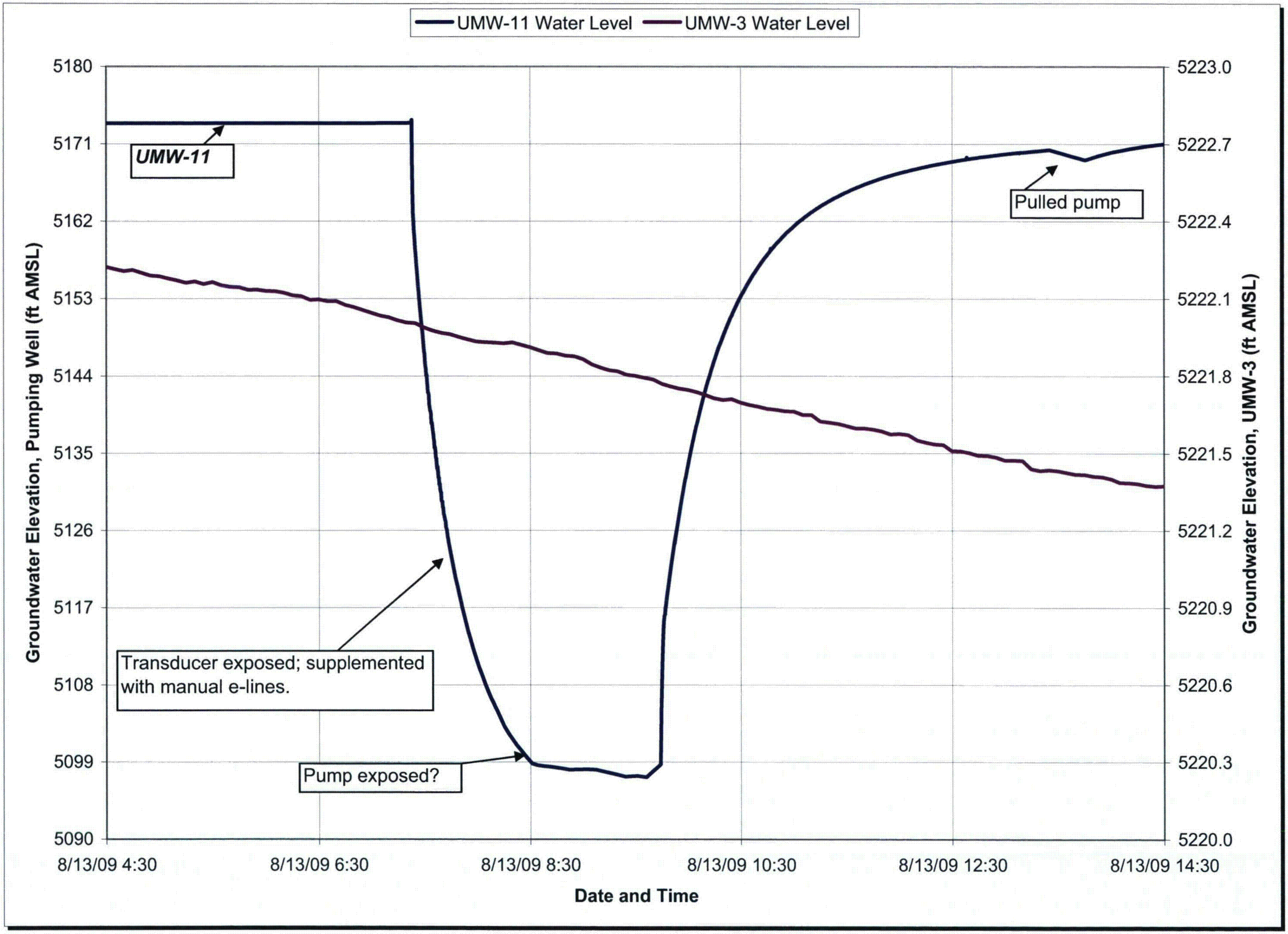


Figure 6-19. UMW-10 Water Level vs. Barometric Pressure, 60 Sand

Figure 6-20. UMW-10 Pump Test Hydrograph vs Barometric Pressure, 60 Sand

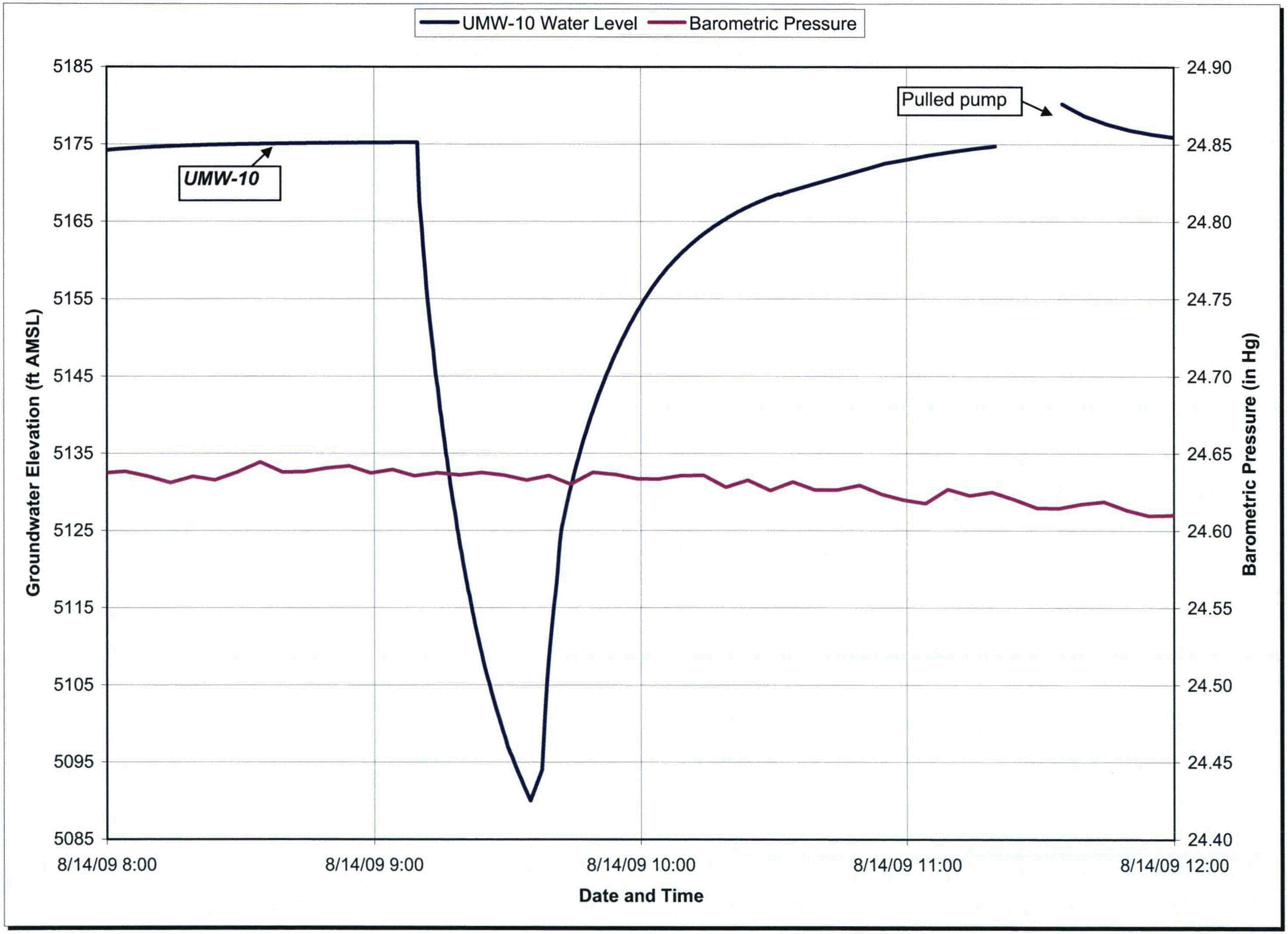


Figure 6-21. UMW-10 Pump Test Hydrograph vs. Overlying Aquifer (68 Sand, UMW-2)

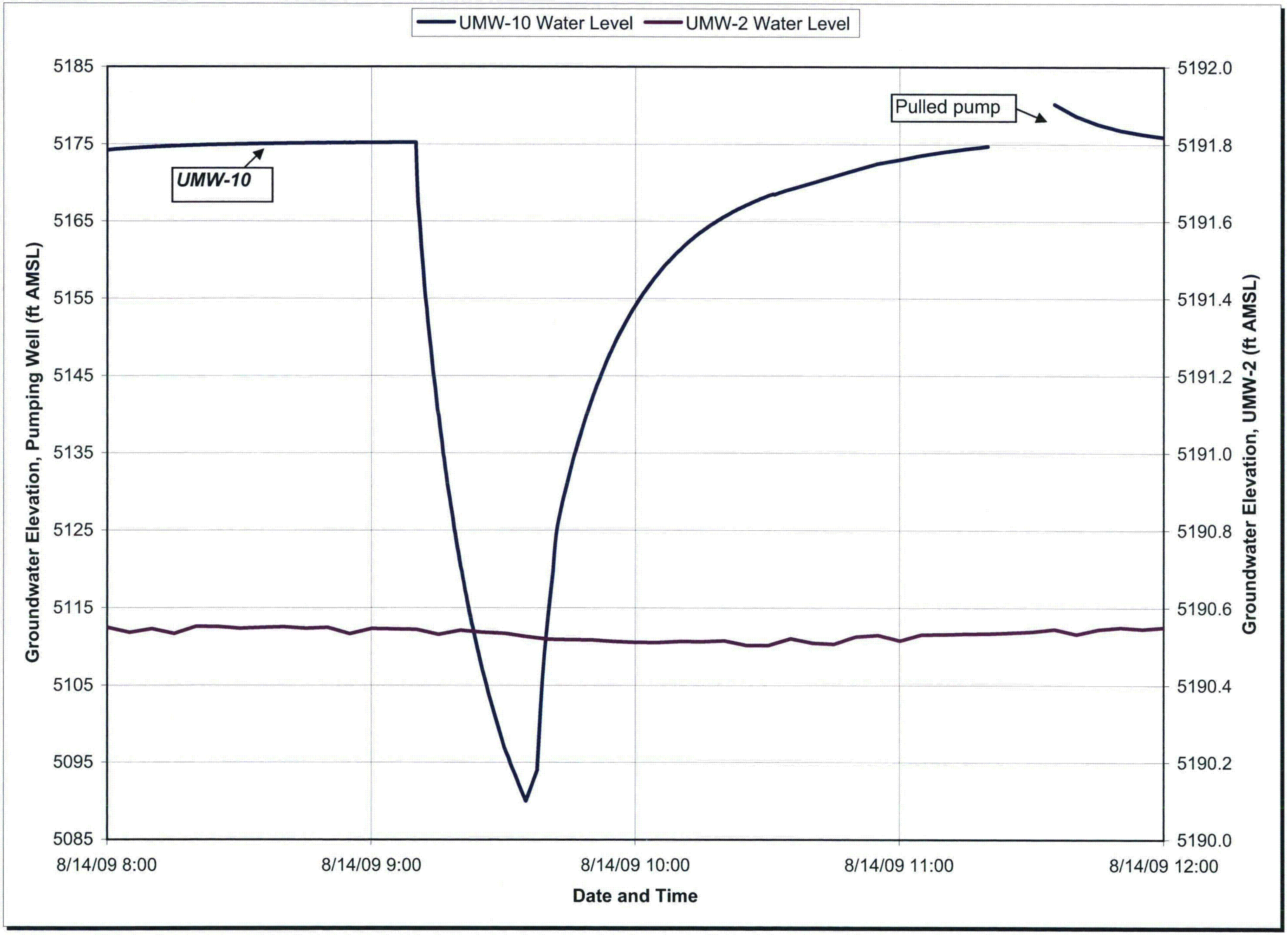


Figure 6-22. OMW-7B Drawdown Response to Pumping, 80 Sand