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Assessment of Existing Groundwater Conditions Report

Rio Mesa Solar Electric Generating Facility

Riverside County, California

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BRIGHTSOURCE ENERGY, INC.
ASSESSMENT OF GROUNDWATER CONDITIONS REPORT
RIO MESA SOLAR ELECTRIC GENERATING FACILITY, RIVERSIDE COUNTY, CALIFORNIA

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LIST OF ACRONYMS AND ABBREVIATIONS

AMSL	Above mean sea level
Ac	acre
AF	acre-feet
AFC	Application for Certification
AFY	acre-feet per year
bgs	Below ground surface
BLM	Bureau of Land Management
BSE	BrightSource Energy
CEC	California Energy Commission
CFS	cubic feet per second
CO	Colorado
CSP	concentrating solar thermal power plant
CWC	California Water Code
DWR	California Department of Water Resources
ft	foot
ft/ft	feet per foot
ft^2/day	square feet per day
gpm	gallons per minute
IID	Imperial Irrigation District
mgd	million gallons per day
mg/L	milligrams per litre
MW	megawatt
MWD	Metropolitan Water District of Southern California (MWD)
NOAA	National Oceanic and Atmospheric Administration (NOAA)
NWIS	USGS National Water Information System
PVID	Palo Verde Irrigation District

PVMGB	Palo Verde Mesa Groundwater Basin
PVVGB	Palo Verde Valley Groundwater Basin
RMS	Rio Mesa Solar Facility
RWQCB	Regional Water Quality Control Board
SRWQCB	State Water Resources Control Board
TDS	Total Dissolved Solids
USBR	US Bureau of Reclamation
USGS	United States Geological Survey
WAPA	Western Area Power Authority
WRCC	Western Regional Climate Center
WWTF	Wastewater Treatment Facility

1. INTRODUCTION

BrightSource Energy, Inc. (BSE) proposes to construct a solar generating facility consisting of three 250 megawatt (MW) units, located in the eastern Riverside County in California. The Site location is shown on **Figure 1-1** and includes approximately 9,000 acres of land (hereinafter the Site). The proposed project layout is shown on **Figure 1-2**. The project proposes to use groundwater as a water supply during construction and operation. This *Assessment of Existing Groundwater Conditions Report* has been prepared by WorleyParsons on behalf of BSE to provide information regarding groundwater resources that will be incorporated into an Application for Certification (AFC) to the California Energy Commission for the proposed project. The information contained in this report describes the affected environment for an assessment of project impacts which will be the subject a subsequent report. Collectively, these reports are intended to meet the California Energy Commission's (CEC's) Data Adequacy Standards for groundwater resources evaluation as part of an AFC for a facility that uses groundwater as a water supply. Specifically, this report includes the following:

- A description of the project hydrogeologic setting and groundwater resources in the Site vicinity;
- Data on existing groundwater wells including well records, water levels, water quality;
- A water balance;
- Current and projected groundwater demand;
- A description of the regulatory setting including definitive discussion of the proposed Colorado River Accounting Surface; and
- Assessment of groundwater availability and sustainability.

The remaining sections of this report are organized as follows:

- Section 2 presents a description of the project;
- Section 3 assesses the regulatory setting;
- Section 4 describes the project hydrogeologic setting based on a review of available literature, publically available data, and Site specific investigation;
- Section 5 presents information regarding the current and projected groundwater demand in the basin;
- Section 6 discusses the basin water balance;
- Section 7 presents the conclusions of the Report; and
- Section 8 lists the references cited in the report.

2. PROJECT DESCRIPTION

The Rio Mesa Solar Electric Generating Facility (RMS) is proposed to be located in the southern California inland desert on the Palo Verde Mesa in Riverside County, approximately 13 miles southwest of Blythe (**Figure 1-1**). The RMS Project Site covers approximately 7,539 acres, plus additional area for the transmission line and access road connections, south of Interstate Highway 10 (I-10), for a total of approximately 9,000 acres. The RMS is located within Township 8 South, Range 21 East in Sections 2-3, 10-11, 14-16, 20-23, 27-29 and 33-34.

The RMS will consist of three 250 MW concentrating solar thermal power plants (CSPs), each with a central receiver tower surrounded by a tracking heliostat field (**Figure 1-2**). The three plants will be served by a common area that will house water treatment, administration and other operation and maintenance functions. Commercial operation for the first plant is planned to commence in the fourth quarter of 2015 with the two additional plants following in the two subsequent quarters in 2016. This schedule is subject to timing of regulatory approvals and achievement of project equipment procurement and construction milestones.

In the proposed solar power generating process, tracking heliostats will reflect solar energy onto a solar receiver steam generator mounted atop of the central receiver tower. High pressure and temperature steam is generated and expanded through a turbine which is directly connected to a rotating generator that placed electrical power on to the transmission system. BrightSource LLC proposes to use dry cooling technology (air-cooled condensers) for power plant cooling, resulting in a water demand that is approximately 80 to 90 percent less than similar wet cooled plants.

Water will be necessary for both the operation of the project as well as construction of the project. During construction of the facilities, water will be required for soil moisture conditioning during the earthmoving operations, dust control and for equipment reliability and protection. Water use is expected to be approximately up to 400 acre-feet per year (AFY) during the approximately 3-year construction period.

During the 25-year operating life of the plant, raw process water will be supplied from on-Site groundwater wells, and will be treated and used for process operations and heliostat washing. Water will also be stored for fire suppression. The combined water demand of the three solar power plants and common area will be approximately 255 AFY. An additional approximately 5 AFY will be used for potable water applications for a total water demand of 260 AFY. The maximum short term pumping rate for each well is expected to be less than approximately 200 gallons per minute (GPM). Pumping rates for potable water wells will be lower.

The water demand for the project will be met by pumping water from on-Site wells. Three new wells will be installed near the water treatment compound in the Common Area to supply the operating water demand of the RMS (**Figure 1-2**). Operation will be rotated among the wells. The maximum operating water demand will occur during peak daytime generating hours; however, the wells will generally be continuously operated.

The construction water demand will be met by one or more of the new wells installed in the Common Area, plus two or more new wells and one existing well located at the Site. These wells will be used during day time construction hours and will be fitted with temporary pumps capable of supplying groundwater at rates up to approximately 600 gpm.

Other sources of water supply that were considered for this Project include those listed in **Table 2-1**, below:

TABLE 2-1: RMS WATER SUPPLY OPTION COMPARISON*

Water Supply Option	Description	Remarks
Palo Verde Irrigation District (PVID) Canals (1.5 miles)	PVID operates a series of canals in the Palo Verde Valley and on Palo Verde Mesa that deliver Colorado River water. PVID can supply water for municipal and industrial uses including energy generation, but cannot supply water for any use outside its service area.	Not feasible since the Project Site lies outside of the PVID service boundary.
PVID Irrigation Return Water Drains (1 mile)	PVID operates a series of return water and spill water drains. PVID drains carry three types of water: 1) runoff water from agriculture fields, 2) intercepted shallow groundwater, or "groundwater drainage water", and 3) "fresh Colorado water in nearby canals that is not used, or "operational spill water." Operational spill water (i.e., fresh) mixes with and dilutes the saline water from agricultural runoff and groundwater drainage. "Operational spill water" makes up most of the drain water (12-13 cubic feet per second (CFS) of the total 15 CFS) and has been defined as "fresh water" by some.	Use of irrigation return water is generally favored under state policy; however, the CEC's decision in 2005 regarding BEP II, stated that Rannell Drain water was not favored for plant cooling purposes because: (1) Water that is not consumptively used returns to the CO River to be used by growers downstream; (2) water use would be de ducted from the PVID's allocation of CO River water (PVID's loss of the return drain water could come from the Metropolitan Water District's (MWD's) entitlement); (3) Water supply would be insufficient for power plant operations; and (4) Drainwater returns a significant portion of high quality, low total dissolved solids (TDS), fresh Canal B water to the Colorado River. In this case, use of drain water would have a direct effect on return flows to the Colorado River, in comparison to groundwater use that would have negligible effects on surface water.
Blythe Regional Wastewater Reclamation Facility (18 miles**)	Currently treats 1.3 million gallons per day (mgd) using advanced secondary treatment and discharges its effluent to percolation ponds which serve to recharge the groundwater aquifer. It is permitted to treat 2.4 mgd. In January 2007, the City opened a new water production and treatment facility with a capacity that is ultimately expected to be 4.32 mgd.	In 2005, CEC opposed using water from this facility for BEP II for the following reasons: (1) potential supply of water was not sufficient to meet BEP II demands over the course of its life, (2) the City did not have plans to upgrade its facility, and (3) use of reclaimed water would use CO River water because it would not allow water to recharge from the ponds and would reduce PVID's return flows as accounted by the US Bureau of Reclamation (USBR). In this case, use of treated wastewater would have a direct effect on return flows to the Colorado River, in comparison to groundwater use that would have negligible effects on surface water.

TABLE 2-1 (cont.): RMS WATER SUPPLY OPTION COMPARISON*

Water Supply Option	Description	Remarks
Blythe Airport Sewage Treatment Plant (16 miles**)	A wastewater collection, treatment and disposal system provides sewer service to the Blythe Airport. The system discharges approximately 0.11 mgd of treated wastewater into four infiltration/evaporation basins.	The throughput of the airport's sewage treatment plant is insufficient to provide the project needs and requires additional treatment to tertiary standards before it can be reused off site.
City of Blythe Water System (19 miles**)	The City uses 14 groundwater wells, mostly located in the CO River Aquifer and almost entirely accounted for as part of PVID's allocation of CO River water.	The City's water use is almost entirely accounted for as part of PVID's water use, and hence Colorado River water (except, groundwater derived from wells on the Mesa is not directly included in the PVID accounting). Thus, use of City water would have a direct effect on return flows to the Colorado River, in comparison to groundwater use that would likely have negligible effects on surface water.
Chuckwalla Valley State Prison WWTP (33 miles**)	Chuckwalla Valley State Prison operates a wastewater treatment plant with a throughput of approximately 600 AFY, which is treated to secondary standards and discharged to a percolation/evaporation pond system. Approximately 550 AFY of this amount is believed to recharge the local groundwater basin.	Treated effluent from the prison is un-desirable as a source of water supply because (1) the water currently is a source of recharge to the Chuckwalla Valley Groundwater Basin; (2) treatment upgrades and distance make this an uneconomical water source; (3) the future quantity of water available is not certain.

Notes:
* Potential surface and reclaimed water supplies in Arizona were not considered due to interstate water transfer and technical issues.
** Distance was calculated along road alignments as the most likely pipeline path for more distant water sources.

3. REGULATORY SETTING

3.1 Planning

Under the *Water Quality Control Plan* for the Colorado River Basin Regional Water Quality Control Board (RWQCB, 2006), the project site is located in the Colorado Hydrologic Unit of the East Colorado River Basin Planning Area. The East Colorado River Planning Area encompasses the eastern portion of San Bernardino, Riverside, and Imperial Counties along the Colorado River and measures approximately 200 miles long by up to 40 miles wide. The area is characterized by desert valleys and low mountains along the lower Colorado River that are generally less than 4,000 feet above sea level. The Palo Verde and Bard Valleys are within this planning area, and perennial surface water flow is primarily restricted to the Colorado River and associated canals and drains (RWQCB, 2006). The Colorado Hydrologic Unit encompasses the Palo Verde Valley and the Palo Verde Mesa. The *Water Quality Control Plan* identifies groundwater in the Colorado Hydrologic Unit as having a designated beneficial use of municipal supply, industrial supply and agricultural supply. The Colorado Hydrologic Unit is not identified as being in overdraft or subject to special study or restriction requirements.

Under the State Water Plan (DWR, 2005), the project site is located in the Palo Verde Detailed Analysis Unit (DAU345) of the Colorado River Planning Area (PA1004). The Palo Verde Detailed Analysis Unit includes the Palo Verde Mesa and the adjacent irrigated Palo Verde Valley. The area drains to the Colorado River. A DAU is an area for which the California Department of Water Resources (DWR) gathers and maintains data for scheduled updates to the California Water Plan. These data are discussed in subsequent sections of this report.

The Genesis Solar Energy Project is located within the Palo Verde Mesa Groundwater Basin (Basin No. 7-39), which has a surface area of 353 square miles (DWR, 2004). The Palo Verde Mesa Groundwater Basin is not adjudicated or tributary or adjacent to any adjudicated groundwater basins, and does not share overlapping watersheds with any such basins. In addition, it is not within the jurisdiction of any special district with the authority to manage surface or groundwater resources, nor is the Basin covered by any Groundwater Management Plan.

3.2 Water Rights

All types of water rights, diversions, and uses of water in California are governed by principles contained in Article 10, Section 2 of the California Constitution which requires that all water use be beneficial and reasonable, and that waste, unreasonable use, or unreasonable method of use of water be prevented. The right to divert or extract groundwater under an overlying right is obtained by the acquisition of real property that abuts, adjoins, or overlies a natural watercourse or a groundwater basin. The overlying rights are vested property rights which are annexed to the soil

and are "part and parcel" of the overlying land. Groundwater rights are appurtenant to the land and remain with the land unless divested by prescription or severance.

The majority of the property is owned by MWD (**Figure 4-1**), which therefore has overlying rights to groundwater beneath that portion of the Site. The proposed lease agreement with MWD grants BSE the right to pump up to 600 AFY of groundwater for use by the solar power project. The northern portion of the property is owned by the federal government and managed by the Bureau of Land Management (**Figure 4-1**), which has overlying rights to that portion of the Site. Although BLM is a federal agency, it has generally conformed its use of water rights to follow local customs or laws. Providing that the lease and right-of-way grant obtained from BLM for the Site did not place any restrictions or reservations on the underlying groundwater, BSE would also have the right to pump percolating groundwater from beneath the northern portion of the Site for the reasonable and beneficial use of the Project.

According to various compacts, agreements, court decisions, decrees, contracts and regulatory guidelines collectively known as the "Law of the River," consumptive use of Colorado River water can occur through direct diversions of surface water, as well as through withdrawal of water from the river by underground pumping. Users within the lower Colorado River Basin States can divert tributary inflow before it reaches the Colorado River, but once the water reaches the Colorado River, entitlements are required for diversions. In the case of pumping from wells, this distinction may be more subjective to make. To determine the circumstances under which water pumped from underground wells requires a Colorado River surface water entitlement, a method was developed by the United States Geological Survey (USGS) in cooperation with the Bureau of Reclamation to identify groundwater wells outside the flood plain of the lower Colorado River that yield water that is assumed to be replaced by water from the river (the "Accounting Surface" method -- Wilson and Owens-Joyce 1994). The Accounting Surface is defined by groundwater levels that would occur if the Colorado River were the only source and sink for water in an aquifer that is hydraulically connected to the Colorado River floodplain (defined by the USGS as "the Colorado River Aquifer"). The Accounting Surface Method was proposed for adoption in the Federal Register early in 2008, but was withdrawn later that year in response to comments received from multiple parties and states, and has not been acted upon or formally adopted to date by Reclamation.

Wiele and others (2008) presented an updated Accounting Surface based on conditions in 2007–2008, reportedly prior to the issuance of a proposed rule to define the accounting procedure. Under the proposed procedure, wells in the Colorado River flood plain are assumed based on their location to yield water from the Colorado River. The Accounting Surface represents the elevation of the unconfined static water table in the River Aquifer outside the flood plain and the reservoirs of the Colorado River that would exist if the river were the only source of water to the aquifer. Across the RMS Site, the Accounting Surface has been established at elevations ranging from 223 to 231 feet AMSL (**Figure 4-2**). Wells that have static (non-pumping) water levels above the Accounting Surface are presumed to yield water that consists of inflow from tributary sources. Wells that have static water levels equal to or below the proposed Accounting Surface are presumed to yield water

that will be replaced by water from the river, and therefore would be subject to annual accounting requiring an entitlement to divert and use Colorado River water. For the purposes of this method, the static water level is defined by the USGS as the level of water to which water will rise in a tightly cased well under its full pressure head when it is not being affected by groundwater withdrawal. Pumping water levels may drop below the elevation of the Accounting Surface; however, if static water levels remain below the accounting surface following a period of no groundwater withdrawal, under the proposed Accounting Surface method, groundwater withdrawn from the well would be considered Colorado River water. Although USGS is working to construct an inventory of wells in the Colorado River Aquifer that could be subject to the Accounting Surface if it were to become law or policy, there is presently no regulatory requirement for well owners to register their wells with USGS or to report water level or pumping data.

Until a method such as the Accounting Surface Method becomes adopted as policy it is not applicable to present extractions of groundwater and such extractions are instead regulated according to California groundwater law, as they have been for the past century. BSE's lease agreement with MWD stipulates that "if an agency having jurisdiction" (the Bureau of Reclamation is the only such agency) should in the future find that the Project is pumping or diverting Colorado River water, then BSE shall purchase an allotment of Colorado River water from MWD that is equal to the project's water demand. This assures that the project will have the right to pump groundwater for its water use even if the Accounting Surface method or a similar procedure were to become law.

3.3 Regulations and Policies

Section 4999 of the California Water Code (CWC) requires all persons within four counties (*i.e.,* Los Angeles, Riverside, San Bernardino and Ventura), with wells with aggregate extractions of more than 25 acre-feet (or 10 acre-feet or more from a single source) to file an annual report of their extraction, known as a "Notice of Extraction and Diversion of Water" by June 30 each year with the State Water Resources Control Board's Division of Water Rights. Failure to file a notice is deemed the equivalent of non-use of water for that year and could result in the loss of water rights (reference California Water Code section 5004).

State Water Resources Control Board (SWRCB) Resolution 75-58 states the following:

> *"It is the Board's position that from a water quantity and quality standpoint the source of powerplant cooling water should come from the following sources in this order of priority depending on site specifics such as environmental, technical and economic feasibility consideration: (1) wastewater being discharged to the ocean, (2) ocean, (3) brackish water from natural sources or irrigation return flow, (4) inland wastewaters of low TDS, and (5) other inland waters."*

Brackish water for the purposes of both policies is defined as water containing TDS concentrations exceeding 1,000 milligrams per litre (mg/L) or chloride concentrations exceeding 250 mg/L. As discussed in Section 2, the Project proposes to pump groundwater from the Palo Verde Mesa

Groundwater Basin that meets this definition. As such, the Project's proposed use of groundwater is consistent with State water policy.

4. WATER RESOURCES

4.1 Site Location and Land Use

The Site is located on the Palo Verde Mesa, north of the Riverside/Imperial County Line, approximately 13 miles southwest of the City of Blythe, in rural Riverside County, California (**Figure 1-1**). It is located on uninhabited open desert land, most of which is presently owned by the MWD. The northern portion of the Site consists of federal land administered by the U.S. Bureau of Land Management (BLM). The total project area is estimated to be 9,184 acres. The irrigated Palo Verde Valley is located to the east of the Site. Access to the Site is from State Highway 78 via 34th Avenue or Bradshaw Trail (**Figure 4-1**). Several dirt roads traverse the Site and existing transmission lines operated by the Imperial Irrigation District (IID) and the Western Area Power Authority (WAPA) run in a general north-south direction across the western and eastern portions of the Site, respectively. These transmission rights-of-way merge into a single corridor north of the Site. A gas supply pipeline operated by Trans Canada is located parallel to the WAPA line on the eastern part of the Site.

4.2 Physiographic Setting

The Site is located along the lower Colorado River near the southeastern margin of California's Mojave Desert geomorphic province. The lower Colorado River forms the southeastern boundary of the Mojave Desert Geomorphic Province, an area with desert mountain ranges separated by broad expanses of open desert and alluvial plains. Much of the area surrounding the lower Colorado River lies at low elevations, and includes some of the most arid regions in the United States. Along the structural trough that has become the path of the Colorado River are a series of broad alluvial floodplain valleys between low mountain ranges. Near the Site, these include the Parker, Cibola, and Palo Verde Valleys. Surface water is scarce, and the Colorado River and associated canals and drains are the only perennial surface water sources in the area.

The RMS is located approximately 13 miles southwest of the City of Blythe, in the southern portion of the Palo Verde Mesa with the area bounded by the Mule Mountains to the west, Palo Verde Mountains to the south and the Palo Verde Valley to the east (**Figure 1-1**). An alluvial arm of the Palo Verde Mesa extends north of the RMS and across I-10 into the McCoy Wash area, an alluvial valley which extends northward from Blythe and is bounded by the McCoy Mountains to the west, Little Maria and Big Maria Mountains on the north and north-east and Palo Verde Valley and the Colorado River to the east.

The Palo Verde Mesa has a generally low relief until near the surrounding mountains (Mule, McCoy, Big Maria, and Little Maria Mountains). There are two distinct river-cut terraces that form a topographic break westward from the Colorado River. The lowest point in the Palo Verde Mesa is approximately 300 feet above mean sea level (AMSL) extending to approximately 550 feet on the

outer margins and up to approximately 1,175 feet AMSL in the higher mountain ranges. The Palo Verde Mesa is approximately 80 to 130 feet higher than the Palo Verde Valley.

Physiographically, the Site is situated on a low mesa between the Mule Mountains to the west and the Palo Verde Valley to the east. The Palo Verde Valley is a floodplain of the Colorado River, which is now protected from flooding by a series of levees and upstream dams and reservoirs. The Palo Verde Mesa is a fluvial terrace remnant of the former floodplain of the Colorado River. It was formed during a cycle of aggradation (river sediment deposition) followed by downcutting of the Colorado River channel during Pleistocene time (Howard and Bohannon, 2000) and the abandonment and lateral erosion of its former floodplain. The downcutting, abandonment, and lateral erosion of the Palo Verde Mesa was the result of changes in sea level, local and regional tectonic uplift affected by a complex mixture of overall changes in local and regional climate, changes in the amount of sediment being carried by the Colorado River, change in discharge of the Colorado River, and other factors (CEC, 2010).

Regionally, the ground surface slopes gently downward in a southeast direction at a gradient of less than 1%. The general landscape in the vicinity of the RMS Site consists of a gently eastward sloping bajada with a sparse covering of creosote and bursage bush scrub. Dispersed Ironwood, Smoke Trees and Palo Verde occur along several prominent washes that cross the Site from the Mule Mountains eastward to the edge of the mesa. These washes are incised 10 to 40 feet deep and are up to ¼ mile wide. Based on the limited size of the catchments located in the Mule Mountains upslope form the Site, these washes appear to be relict features representative of wetter climatic conditions in the Pleistocene. The modern washes are much smaller features characterized by evidence of recent sediment transport that follow braided paths within the boundaries of the older washes. The upper, western portions of the bajada display a well devised covering of desert pavement and terminate against bedrock of the Mule Mountains.

The RMS is in mid to lower portions of the alluvial fans emanating from the Mule Mountains. The land surface of the Site slopes to the east with an elevation ranging between a maximum of approximately 676 feet AMSL to a minimum of approximately 249 feet AMSL, with an average slope of approximately 1 foot in 72 feet (1.40%) towards the east in the mid portion of the Site. Steeper grades (up to 24%) are present along the western portion of the Site in bedrock areas of Sections 16, 20, 21, and 29 (T08S R21E). Shallower grades (as low as 0.8%) are present along the mid portion of the Site in Sections 15, 22, and 27 (T08S R21E).

4.3 Climate and Precipitation

The climate in the project Site vicinity is characterized by high aridity and low precipitation with hot summers and generally mild winters (CEC, 2010). Average annual precipitation ranges from around 3 inches in the lower elevations to 6 inches in the higher elevations. Table 4-1 provides average historical temperatures and rainfall from the meteorological station at the Blythe Airport weather station. The mean annual precipitation (1948 to 2010) is 3.54 inches per year with the maximum annual precipitation for the period of record of 9.16 inches, and maximum month precipitation of

5.92 inches, recorded in August 1951 (WRCC, 2011). Most of the rainfall occurs during the winter months or in association with summer tropical storms (CEC, 2010). Per the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 for the Southeastern California, between 3.0 and 3.5 inches of rain fall in the 100-year, 24-hour storm event.

Table 4-1: Climate and Precipitation Summary

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max Temp. (°F)	66.8	72.0	78.4	86.4	95.2	104.5	108.4	106.7	101.4	89.7	76.0	66.6	87.7
Average Min. Temp. (°F)	41.6	45.4	50.2	56.5	64.5	72.7	81.1	80.2	73.1	60.8	48.6	41.3	59.7
Average Temperature (°F)	54.2	58.7	64.3	71.4	79.8	88.6	94.8	93.4	87.3	75.3	62.3	54.0	73.7
Published Evaporation (inches)	2.85	4.38	7.15	9.98	12.73	14.85	14.95	13.59	10.8	7.6	3.98	2.49	105.35
Precipitation (inches)	0.49	0.44	0.36	0.15	0.02	0.02	0.23	0.62	0.35	0.26	0.19	0.41	3.54

Sources:

1. Blythe CA Airport for Average Temperatures (from http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca0927 Data from 1948-2010
2. Indio Fire Station, CA for Pan Evaporation – Average 1927-2002. (Note that reference evapotranspiration (ET) data are available from closer locations, but are not referenced herein.)
3. Blythe CA Airport for Precipitation – Average 1948-2010.

4.4 Surface Water Resources

The RMS is within the Colorado River Watershed and all the surface water channels on Site drain towards the Colorado River. In Southern California, nearly all streams that head in the mountains are ephemeral and lose flow to alluvial aquifers within a short distance of where the streams leave the mountains and emerge onto the valley floors (USGS, 1995). Because of the high temperatures, low precipitation, and permeable soils, local drainage is intermittent and occurs in dry washes. In areas where topography is flat, soils are very sandy and there are no adjacent uplands to introduce surface runoff, discrete channels have not formed. The Colorado River and

associated drains and canals are the only perennial surface water sources in the area. There are no perennial streams on the Palo Verde Mesa.

The Big Maria Mountains and the McCoy Mountains north of I-10 are the primary contributing watershed to the Palo Verde Mesa. The McCoy Wash, a tributary of the Colorado River, drains this area to the southeast and flows during major storm events. Surface water drains from the surrounding mountains toward the Colorado River.

Runoff from the Mule Mountains (west of the RMS) predominately flows southwest across the Palo Verde Mesa in dry sandy washes (Thumb Peak USGS, 1983). The Palo Verde Mesa limits the connectivity of ephemeral flow to the Colorado River; however, occasional surface water does penetrate the sand dunes and enters the Hodges Drain (aligned roughly north-south at the toe of the mesa) or the Palo Verde Lagoon, which all ultimately discharge into the Colorado River.

The Colorado River, which is the boundary between Arizona and California, is located about 6 to 8 miles east of the Site. The Colorado River has an average flow of approximately 10,000 CFS (NWIS, 2011). PVID is the senior water rights holder in California on the lower Colorado River and is allocated sufficient Colorado River water to irrigate 104,500 acres of agricultural land in Palo Verde Valley, and additional acreage on the Palo Verde Mesa. Irrigation water diversions to meet this need have historically averaged 950,000 AFY, but in recent years have ranged from approximately 650,000 to 950,000 AFY as a result of implementation of a water transfer program between PVID and MWD (Smith, 2005; PVID, 2011). Water is diverted by PVID at Palo Verde Diversion Dam near the northern end of Palo Verde Valley and distributed by a series of canals totalling over 244 miles in length. The application of large amounts of irrigation water produces annual recharge of an estimated 65,000 to 95,000 acre-feet (10%) to the regional groundwater system, and has created a groundwater mound between the Valley and River. In response to increasing groundwater levels in the valley, PVID installed a series of drains over the past several decades to keep groundwater levels from rising into the root zone of crops. Water collected in these drains is returned to the river near the southern end of the Palo Verde Valley. The total length of drains installed in the valley is over 141 miles. PVID's service territory also includes some irrigated land on Palo Verde Mesa (approximately 4,000 acres). In some cases, water is supplied to mesa growers with water pumped from PVID canals. A few other areas of the Palo Verde Mesa north of Blythe are used for crops (predominately citrus), that are irrigated from deep wells developed by the landowners (PVID, 2011).

4.5 Regional Hydrogeologic Setting

The RMS is located near the southeastern margin of the Colorado River Hydrologic Region, which covers approximately 20,000 square miles (13 million acres) in southeast California (DWR, 2003). The Colorado River Hydrologic Region is subdivided into 28 groundwater basins and the Site is located in the Palo Verde Mesa Groundwater Basin (PVMGB; "Mesa Basin") (DWR Basin No. 7-39). The PVMGB covers 353 square miles of river terrace deposits overlooking the current flood plain of the Palo Verde Valley (**Figure 4-1**). It is about 25 miles long and has a maximum width of

about 15 miles; its axis trends north-south. The total groundwater storage capacity of the basin is reported by DWR to be 6,840,000 acre-feet. The PVMGB is bounded by non-water-bearing rocks of the McCoy and Mule Mountains to the west; the Little Maria Mountains, Rice Valley and the Big Maria Mountains to the north; and the Palo Verde Mountains to the south. The Palo Verde Valley Groundwater Basin (PVVGB; "Valley Basin") (DWR Basin No. 7-38) is immediately adjacent to and in hydraulic communication with the Mesa Basin (Owen-Joyce, 1984). Altitudes on the PVMGB floor range from about 300 feet at the Colorado River flood-plain boundary to about 1,000 feet at the base of the mountains in the northwestern part of the basin.

The Valley Basin occupies the flood-plain of the Colorado River to the east of the Mesa Basin. The eastern boundary of the basin is the Colorado River, which also defines the State border. The Palo Verde Dam and the Big Maria Mountains bound the basin on the north. The Palo Verde Mesa abuts the western boundary with subsurface outflow from the Mesa Basin to the Valley Basin estimated to be 9,500 AFY (Owen-Joyce, 1984). As described in a later section of this report, the PVID drains at the foot of Palo Verde Mesa form a discharge boundary, and the groundwater mound that exists between the Colorado River and Mesa Basin as a result of many decades of applied irrigation water forms a groundwater divide. It is not clear whether the outflow estimate of Owen-Joyce accounts for these features, as they would appear to present barriers to the subsurface inflow of groundwater from the Mesa Basin into the Valley Basin. Surface and groundwater from the Palo Verde Valley drain to the Colorado River near the southern margin of the basin (DWR, 2003).

In the Valley and Mesa basins groundwater occurs under unconfined conditions in the alluvium, which is contiguous with the Colorado River gravels. The alluvium in the Palo Verde Valley has been divided into the Younger Alluvium and the Older Alluvium. The Younger Alluvium forms the flood plain of the Colorado River; the Older Alluvium forms the terraces and alluvial slopes that bound the flood plain (Metzger and others, 1973). The Younger Alluvium occurs beneath the flood plain in the Valley Basin and the Older Alluvium forms the mesa above the flood plain and is also encountered below the Younger Alluvium on the flood plain. The Palo Verde Mesa Basin is underlain by the Older Alluvium.

The Colorado River and the underlying and adjacent alluvial aquifer form a complex, hydraulically connected groundwater and surface-water flow system. The USGS has defined this as complex system as the "River Aquifer" (Wilson and Owen-Joyce 1994) in their attempts to define an Accounting Surface for the Bureau of Reclamation. As defined by Wilson and Owen-Joyce (1994), the River Aquifer consists of permeable, partly saturated sediments and sedimentary rocks that are hydraulically connected (in theory) to the Colorado River so that water can move between the river and the aquifer in response to withdrawal of water from the aquifer or differences in water-level elevations between the river and the aquifer. According to this definition, the subsurface limit of the River Aquifer is the nearly impermeable bedrock of the bottom and sides of the basins that underlie the Colorado River valley and adjacent tributary valleys, which is a barrier to groundwater flow.

The proposed definition of the River Aquifer does not consider groundwater flow conditions within the permeable basin fill sediments. As discussed above, groundwater flow in the Mesa and Valley Basins is dominated by the existence of a groundwater mound formed as a result of the annual application of a large volume of irrigation water in the PVID service area between the Mesa and the River. Applied water quantities at present range from approximately 650,000 to 950,000 AFY and produce an estimated annual recharge of 65,000 to 95,000 acre-feet (10%). This groundwater mound forms a groundwater divide that prevents direct hydraulic communication between the Mesa Basin and the Colorado River. In addition, the PVID drains installed to control groundwater levels in the Valley form drainage boundaries.

There are no significant subsurface structural features that restrict horizontal groundwater flow within the PVMGB according to the California DWR (1979, 2004a). The northwest boundary and parts of the western boundary are drainage divides, with the valley drained by the McCoy Wash to the Colorado River (DWR, 2004).

The Chuckwalla Valley Groundwater Basin west of the Site is separated from the Mesa Basin by the McCoy and Mule Mountains. Separating the two mountain ranges is a gap in the McCoy and Mule Mountains through which U.S. Interstate Highway 10 passes (CEC, 2010). Through this gap, underflow occurs from Chuckwalla Valley into the PVMGB at an estimated rate of approximately 980 AFY (WorleyParsons, 2010b).

4.5.1 Hydrostratigraphy

The lower Colorado River is characterized by a depositional trough that formed during an intense period of extensional faulting that affected the Basin and Range Province during middle Miocene time (USGS, 1995; Spencer *et al.,* 2008). Three prominent basins formed between Las Vegas and Yuma that are separated by bedrock canyons. The southernmost of these basins, the Blythe Basin, encompasses the Parker-Blythe-Cibola segment of the lower Colorado River trough. During this period of faulting, uplift increased stream gradients and their transporting power, gulches and canyons were eroded and a thick sequence of alluvial gravels was deposited in the basins of the area. These gravel deposits, referred to as the Miocene Fanglomerate, form the lowest sedimentary basin fill deposits in this region. As the proto-Gulf of California opened in late Miocene and early Pliocene time, the basins of the lower Colorado River trough were occupied by estuaries and lakes. During this time, predominantly fine grained sediments of the Bouse Formation were deposited over the Fanglomerate and surrounding bedrock formations. Finally, from middle to late Pliocene to Recent time, the Bouse Formation was overlain by Colorado River sand and gravel as well as locally-derived alluvial fan deposits.

A more detailed description of the principal hydrostratigraphic units in the area is presented below.

4.5.1.1 Quaternary Alluvium

Alluvial deposits ranging in age from Pliocene to Holocene, comprise the shallow floodplain aquifer, and are the principal source of groundwater in the basin (Owen-Joyce 1984). Alluvial deposits consist of Younger Alluvium, alluvial fan deposit and fluvial sand and gravel of Holocene age deposited in the floodplain of the Colorado River, and Older Alluvium composed of ancestral flood-plain deposits from all but the most recent cycle of erosion and deposition by the Colorado River. The greatest thickness of combined Younger and Older Alluvium occurs in a structural low that approximately coincides with the present day floodplain of the Colorado River, as shown in the structure contour map of the base of alluvial deposits, **Figure 4-3**, and corresponding isopach map of alluvium thickness (**Figure 4-4**). In well 6S/23E-32E1, located approximately ½-mile west of the City of Blythe, the bottom of the Colorado River fluvial deposits, inclusive of the younger and older alluvium reportedly occurs to a depth of about 506 feet bgs (AECOM, 2010).

The Younger Alluvium occurs mainly below the flood plain of the Colorado River and is composed of a basal gravel overlain by sand. The younger alluvium is generally 90 to 125 feet thick above the basal gravel, which is between 5 and 20 feet thick (Metzger and others, 1973). The contact between the older and younger alluvium is generally not distinguishable unless the basal gravel is present. Owens-Joyce (1984) indicated that the younger and older alluvium are hydraulically connected in the Palo Verde Valley. The alluvial fan deposits of the Younger Alluvium consist of lenticular beds of sand, gravel, silt, and clay, except near the mountains where they consist mainly of coarse grained angular rock detritus.

The Older Alluvium comprises all of the groundwater system deposits of the Palo Verde Mesa and extends beneath the Palo Verde Valley, underlying the Younger Alluvium. The Older Alluvium is much thicker than the Younger Alluvium, reaching thickness of 600 feet beneath the central portion of the valley and the mesa and pinching out along the bordering bedrock mountains. The older alluvium is generally comprised of a basal gravel above the Bouse Formation, and is overlain by inter-layered sequences of sand and pebbly sand, with lenses of cobble gravels as well as silt and clay. The older alluvium forms the mesa above the flood plain and is encountered below the younger alluvium under the flood plain. In the mesa area west of the river, the younger alluvium is absent and the older alluvium consists mostly of finer grained materials (very fine to fine grained sands with interbedded silts and clays). At the RMS Site, drilling data from the Sun Desert Project indicates a thickness of older alluvium ranging from 305 to 435 feet (Stone and Webster, 1976).

Municipal wells located on the flood plain within the City of Blythe boundaries, are generally completed between 100 and 350 feet below ground surface (bgs) with a short (< 100 feet) perforated zone in the older alluvium. These wells generally produce between 250 and 750 gpm (Metzger 1973, DWR 1978). One well, City of Blythe Well 11, is completed between 421 and 505 feet bgs in the Older alluvium and produces 2,000 gpm (AECOM 2010). Well yields are reported by DWR to range up to 2,750 gpm and to average 1,650 gpm (DWR, 2004).

Specific capacities reported for four wells in the PVMGB are relatively high, ranging from 13 to 49 gallons per minute per foot of drawdown (gpm/ft) (DWR, 2009). Pumping tests conducted on two

water supply wells completed in the younger and older alluvium at the Blythe Energy Project yielded transmissivities of 52,054 and 59,637 square feet per day (ft^2/day) and hydraulic conductivities of 124 and 130 feet/day (CEC, 2005).

4.5.1.2 Pliocene Bouse Formation

The upper Miocene to Pliocene age Bouse Formation underlies the Quaternary alluvial deposits. Metzger (1968) reported that erosional remnants of the Bouse Formation are present in a belt approximately 20 to 30 miles wide extending along the Lower Colorado River for approximately 190 miles from Lake Mohave to near Yuma, Arizona. The Bouse Formation is reported to include a marine to brackish-water estuarine sequence deposited in an arm of the proto-Gulf of California (Metzger 1968; Wilson and Owen-Joyce, 1994). This formation has alternatively been interpreted as, or may include, lacustrine sediments deposited in a closed, brackish basin (Stone, 2006). It is reported to be composed of a basal limestone (marl) overlain by interbedded clay, silt, sand and tufa. The top of the Bouse Formation is relatively flat lying with a reported dip of approximately 2 degrees south of Cibola (Metzger and others, 1973).

The upper Bouse Formation ranges from 500 to 600 feet below land surface in the PVMGB and consists of interbedded clay, silt, and fine sand. Wilson and Owen-Joyce (1994) reported the Bouse Formation occurs at approximately 125 feet AMSL in the western Palo Verde Mesa. A review of borehole logs for wells completed in the northern PVMGB obtained from DWR indicates that the Bouse Formation occurs at approximately -125 feet AMSL and is characterized by a highly plastic gray clay layer (DWR, 2009).

The upper Bouse Formation is considered an aquifer while the lower formation is considered an aquitard. Well yields can be variable depending on the degree of formation consolidation and stratigraphic location of the perforations (Metzger, 1973). Aquifer test and specific capacity data for the Bouse Formation are not available in the PVMGB. Outside the basin, hydraulic conductivities calculated from pumping tests in the Chuckwalla Valley Groundwater Basin range from 5.2 to 15.4 gpm/foot (WorleyParsons, 2011).

4.5.1.3 Miocene Fanglomerate

According to Metzger and others (1973), the Miocene-age Fanglomerate is made up chiefly of cemented gravel composed of angular to subrounded poorly-sorted pebbles and some fine-grained material with a provenance from a nearby source. The Fanglomerate represents composite alluvial fan deposits that built up from local mountains as the fans prograded toward the valley. Because the Fanglomerate was deposited on an irregular surface having considerable local relief, it varies widely in thickness. Locally, the Fanglomerate may be absent, but at some places (e.g., Milpitas Wash area), it is at least 2,100 feet in thickness. Near Parker, Arizona, wells with specific capacities as much as 15 gpm/ft of drawdown have been reported in the Fanglomerate. A pumping test in the Chuckwalla Valley Groundwater Basin yielded a hydraulic conductivity of 29 feet/day (WorleyParsons, 2011). In contrast, well 11S/21E-5F1, installed by the Southern Pacific Company

located in Milpitas Wash produced only about 0.01 gpm/ft from a well that is an open hole completed in the Fanglomerate from 286 to 752 feet bgs (AECOM, 2010).

4.5.1.4 Bedrock

Bedrock reportedly consists of metamorphic and igneous intrusive rocks of pre-Tertiary age that form the basement complex and some undifferentiated volcanic rocks that may be of Tertiary age and Quaternary age (DWR, 1963). Bedinger and others (1989) reported that the bedrock in the basin consists of metamorphic rocks of Precambrain age consisting of gneiss, schist, metasedimentary and metaplutonic rocks and intrusive plutonic rocks of Mesozoic age consisting of biotite-quartz monzonite and hornblende gabbro, quartz diorite, granodiorite, quartz monzodiorite, and syenogranite. The bedrock in the basin is considered non-water-bearing (DWR, 1963).

A geophysical investigation was performed for AECOM by J R Associates to determine bedrock in the lower Colorado River Valley near Blythe in Riverside County, California. Gravity data was reviewed from a USGS Open File Report and digitized using the program GravMod V3.1 developed at Lancaster University in the UK. From the gravity survey, it was estimated that bedrock at the Site ranges from a minimum depth of 0 ft bgs at the basin edge to an approximate maximum depth of 600 ft bgs (AECOM, 2010).

4.5.2 Groundwater Levels and Flow

Natural groundwater recharge to the PVMGB includes recharge from precipitation and subsurface inflow from the Chuckwalla Valley Groundwater Basin to the west (DWR, 2004) and inflow from the Palo Verde Valley Groundwater Basin (PVVGB) to the east. Other sources of recharge to the basin include agricultural return flow (CEC 2010).

Depths to groundwater on the mesa range from 70 to 300 feet below the surface (City of Blythe, 1989).

The DWR (2004) reports the movement of groundwater in the PVMGB as south-easterly to Palo Verde Valley. **Figure 4-5** presents the water level elevation contours for the PVMGB and PVVGB drawn from average groundwater level data over the period of record from the USGS database and groundwater levels measured from the RMS Project area in 2011 (URS, 2011). As discussed in the next section, groundwater levels have been relatively stable, so contouring of average groundwater levels is appropriate. In the northern part of the PVMGB and PVVGB, groundwater flow is predominantly to the west to southwest. The contours indicate possible groundwater discharge of groundwater to the Colorado River. In the southern part of the basin, in the vicinity of the RMS Site, groundwater flow is more southerly approximately parallel to the Colorado River and locally away from the river, suggesting a losing condition. The contours show that groundwater flow throughout both basins is strongly influenced by the Colorado River, deep percolation from the application of large amounts of irrigation water in the PVID service territory between the river and Palo Verde Mesa, and the PVID drains. The alignment of the resulting groundwater divides and drainage boundaries may be derived from **Figure 4-5** and follows “bulges” and “valleys” in the

groundwater level contours, respectively. These features prevent direct hydraulic communication between groundwater in the Palo Verde Mesa Groundwater Basin and the Colorado River.

4.5.3 Groundwater Level Trends

Groundwater levels in the Palo Verde Mesa north of Blythe declined significantly during the 1970's and 1980's due to groundwater pumping for agricultural irrigation, and recent groundwater level measurements indicate water levels recovered to the levels observed during the 1960's as pumping decreased in the early 1990's (CEC, 2005).

DWR (2004) reported that groundwater levels in the basin as a whole showed no significant increase or decrease from 1980 to 1981. AECOM (2009) reported that hydrographs indicate groundwater levels in the PVMGB have generally remained stable over the recent history (see AECOM, 2009 - Figure 5.17-8). The relatively stable groundwater levels that have been measured over the decades-long period of time suggest that groundwater withdrawal from the underlying aquifer has not significantly changed the water balance within the PVMGB. This is probably in large part due to the influence of the Colorado River (AECOM, 2009), and more particularly from the large volume of annual groundwater recharge in the Palo Verde Valley from applied irrigation water.

In order to further assess groundwater level trends in the basin, hydrographs were constructed for selected wells for which time-series water level data were available from the USGS National Water Information System (NWIS) and compared to precipitation trends. The locations of these wells are illustrated on **Figure 4-5**. The groundwater levels that were graphed are summarized in **Appendix 2**. Precipitation records from the nearest meteorological station for which long term data were available (located near Blythe, California) were examined to help determine if fluctuations in groundwater levels were related to climatic trends or other factors. The period of record for this meteorological station extends from 1948 to present (WRCC, 2011). The data were used to calculate the cumulative departure from average precipitation, which was plotted with the well hydrographs. An upward trend in the cumulative departure curve indicates a wetter than normal period; whereas, a downward trend indicates a drier than normal period.

The hydrographs for two wells located in the northern portion of the PVMGB indicate variable trends. Well 004S021E09B001S (**Figure 4-7-1**) shows a relatively stable trend with a maximum fluctuation of 1.60 feet between July 29, 1971 to April 24, 2000. Well 005S022E31E001S (**Figure 4-7-2**) indicates a downward trend with a maximum fluctuation of 9.20 feet between July 26, 1965 to March 30, 2000. Well 005S022E31E001S is located approximately 4.6 miles north of the Blythe Airport. Historical agricultural pumping may account for the observed groundwater level decline in this well.

The hydrographs for three wells located in the central portion of the PVMGB (**Figure 4-7-3** through **Figure 4-7-5**) and three wells in the mid-western portion of the adjacent PVVGB (**Figure 4-7-6** through **Figure 4-7-8**) indicate variable trends. In the PVMGB, Well 007S021E05C002S (**Figure 4-7-3**) indicates a relatively stable trend with a maximum fluctuation of 1.31 feet between February

10, 1992 to March 30, 2006. Well 006S022E32R001S (**Figure 4-7-4**) indicates a downward trend with a maximum fluctuation of 8.41 feet between April 30, 1995 to March 31, 2006. Since the late 1990s, groundwater levels have recovered somewhat. The influence of local pumping is apparent in groundwater level fluctuations from May 23, 1961 to December 2, 1964. Well 007S021E15A001S (**Figure 4-7-5**) indicates a relatively stable trend with a maximum fluctuation of 2.02 feet between September 23, 1990 to December 8, 2006. A groundwater elevation drop in February 25, 2001 is consistent with local short term pumping influence. In the PVVGB, Well 006S022E24D001S (**Figure 4-7-6**) indicates a relatively stable trend with a maximum fluctuation of 1.22 feet between May 11, 2000 to May 2006. Well 006S022E35R002S (**Figure 4-7-7**) indicates an overall stable trend. The maximum fluctuation of 15.09 feet in this hydrograph appears to be related to short term drawdown associated with local pumping. Non-pumping static water level changes appear limited to about 2 feet between November 18, 1947 and August 2, 1972.

The hydrographs for four wells located in the south portion of the Palo Verde Mesa Groundwater Basin (**Figure 4-7-8** through **Figure 4-7-11**) and three nearby wells located in the southwestern portion of the Palo Verde Valley Groundwater Basin (**Figure 4-7-12** through **Figure 4-7-14**) indicate variable trends. In the PVVGB, Well 008S021E28P001S (**Figure 4-7-8**), which is located within the southern portion of the Site, indicates a relatively stable trend with a maximum fluctuation of 2.15 feet between October 3, 2000 to March 23, 2010. Well 008S021E28R002S (**Figure 4-7-9**), which is also located within the southern portion of the Site, indicates a stable trend with a maximum fluctuation of 0.73 feet between March 20, 1976 to March 23, 2010. Water levels in Well 008S021E28R003S (**Figure 4-7-10**), which is located within the southern portion of the Site, have also remained stable with a maximum fluctuation of 1.67 feet between March 31, 1976 to May 11, 2011. Well 008S021E34R001S (**Figure 4-7-11**), which is located within the southern portion of the Site, indicates a decreasing trend with a maximum fluctuation of 9.63 feet between November 16, 2000 to March 23, 2010. In the PVVGB, Well 008S021E24C001S (**Figure 4-7-12**), indicates a decreasing trend with a maximum fluctuation of 5.19 feet between September 3, 1980 to May 19, 2006. Well 008S021E24H001S (**Figure 4-7-13**), indicates a stable trend with a maximum fluctuation of 0.41 feet between March 20, 1976 to March 23, 2010. Well 008S021E25N001S (**Figure 4-7-14**), indicates a relatively stable trend with a maximum fluctuation of 1.1 feet between January 1, 2006 to May 19, 2006.

Overall, there is no discernable climatic influence on the groundwater elevations observable in the above mentioned hydrographs, due to the apparent absence of any correlation between groundwater level trends and wet or dry periods as indicated by the precipitation departure from the mean. Groundwater levels appear to have remained relatively stable across the basin, with some localized water level declines due to pumping.

4.5.4 Groundwater Quality

Groundwater quality in the basin appears to vary both laterally and vertically. The concentration of TDS in the alluvial aquifer within the basin is reported to range from 730 to more than 3,100 mg/L, with a deep groundwater well reporting a TDS of 4,500 mg/L (DWR, 2004). Concentrations of TDS

are believed to be higher in sediments of the Bouse Formation that underlie the alluvial aquifer (CEC, 2005). This is supported by the reported detection of TDS at a concentration of 4,500 mg/L in a deep well in the southwest portion of the basin. Average TDS concentrations in the alluvial aquifer, based on sampling of 11 public supply wells, are 1,089 mg/L (DWR, 2004). Other constituents reportedly detected at elevated concentrations include arsenic, selenium, fluoride, chloride, boron and sulfate (DWR, 1975). The analytical results for water samples collected near the Site are presented in **Table 4-2** and are discussed in the next section.

4.5.5 Site Hydrogeology

The hydrogeology of the RMS Site has been largely established from drilling and groundwater testing conducted for the Sun Desert Nuclear Plant by San Diego Gas and Electric in the mid-1970s (Stone and Webster, 1976; Nuclear Regulatory Commission, 1978), complemented by recent groundwater level monitoring and groundwater sampling conducted in early 2011 (URS, 2011). At the present time, it not possible to establish an accurate correlation of the wells referenced in the Stone and Webster (1976) study and those measured and sampled by URS (2011), therefore only the URS (2011) wells are used for groundwater elevation mapping, whereas the Stone and Webster well data are used for geologic mapping.

The site is underlain by older alluvial deposits of Quaternary age to depths of 305 to 435 feet, as shown in the simplified hydrogeologic cross-section **Figure 4-6** (Stone and Webster, 1976). The older alluvium consists of alluvial fan deposits consisting predominantly of sand and gravel, and Colorado River fluvial deposits that are predominantly sand with lesser amounts of silt and clay. The fluvial deposits are generally finer with a higher proportion of clay and silt at the base of the section, and with increasing sand and fine gravel higher in the section. The older alluvial deposits are laterally continuous across the Site and as well as regionally.

The Tertiary Bouse Formation underlies the older alluvium to the maximum depth investigated by Stone and Webster (1976), generally to about 500 feet bgs. Stone and Webster report that the Bouse Formation is approximately 500 feet thick in the Site vicinity, with fine sand dominant in the upper part of the formation, and increasing clay and silt in the lower part of the formation. While the upper part of the Bouse Formation is considered an aquifer, the lower part of the formation is an aquitard that acts as a confining bed for the underlying fanglomerate aquifer.

URS measured groundwater levels and collected groundwater samples from 19 on-Site wells in January and May, 2011 (URS, 2011). Some of the wells measured by URS are also included in the NWIS database, and some historical groundwater level measurements were available (**Appendix 2**). Based on these groundwater level measurements, groundwater is present at depths ranging from 140 to 160 feet below ground surface in the older alluvium. Groundwater in the alluvial aquifer beneath the Site occurs under unconfined conditions. Groundwater surface elevation ranges from approximately 232 feet AMSL at the north end of the Site, to approximately 224 feet AMSL at the south end of the Site (**Figure 4-2**). Current groundwater levels are approximately at, or within about 2 feet above, the proposed Colorado River Accounting Surface.

Groundwater elevation contours indicate the local groundwater flow direction in the older alluvium is to the south-southwest, with a horizontal hydraulic gradient of approximately 0.0003 feet per foot (ft/ft). In the southern portion of the Site, groundwater level data indicate a possible groundwater flow component eastward, away from the Mule Mountains. In addition, groundwater level differences between shallow and deeper wells indicate the existence of a vertical downward gradient.

A number of wells were installed on Site as part of the Sun Desert Project (Stone and Webster, 1976). A 12-inch diameter production well (28R003S) screened from approximately 255 to 355 feet bgs, completed mainly in the older alluvium, was installed in the southern portion of the Site. A 97 hour pumping test at a rate of 820 gallons per minute was conducted in April 1976, with three piezometers and four boreholes used as observation wells (Stone and Webster, 1976). Results from the pumping test indicated a transmissivity of approximately 100,000 to 200,000 gallons per day per foot (13,400 to 26,700 ft^2/day), and storage coefficient of 1 x 10^{-3}. The hydraulic conductivity derived from the transmissivity estimate was 60 to 127 ft/day (Stone and Webster, 1976). URS (2011) reported that this pumping test produced approximately 55 feet of drawdown, from which the calculated specific capacity of the well is approximately 15 gpm/foot.

Historical groundwater elevations on the Site range from approximately 226 feet AMSL (141 feet bgs) in well 28R001S to 212 feet AMSL (163 feet bgs) in well 28P001S (refer Appendix 2). These wells are both in the southern portion of the Site. The latter well is completed in the lowermost portion of the alluvial aquifer, likely reflecting that a downward vertical gradient exists.

Table 4-2 presents analytical results for water quality samples collected at the RMS Site and in the vicinity compiled from URS (2011), Stone and Webster (1976) and NWIS (2011). The available analytical data are included in **Appendix 1**. As a general indicator of water quality, on-Site TDS concentrations ranged from 1,570 mg/L in Well #28Q002S) to 1,850 mg/L in Well #28Q0023. The latter well is completed in deeper in the alluvial aquifer than the former well, indicating possible vertical fluctuation in water quality beneath the Site. Concentrations of the following analytes exceed primary or secondary drinking water standards, indicating possible impairment for domestic or agricultural use: arsenic, iron, fluoride, chloride and sulfate.

Five groundwater samples were collected at daily intervals in 1976 as part of the aquifer test undertaken at the Site for the Sun Desert Project (URS, 2011). The TDS concentrations measured during the aquifer test remained relatively constant and ranged from 1,805 to 1,850 mg/L. The major ion chemistry indicates that the general water character is sodium chloride-sulfate. URS compared the composition of the water samples collected from the pumping well in 1976 and 2011 and plotted the data on a Piper Diagram. This is a standard method to compare water chemistry and origin between samples. Based on the Piper Diagram, the composition of the groundwater samples collected in 1976 and 2011 is essentially unchanged.

5. GROUNDWATER DEMAND

5.1 Historical Demand

Historically, groundwater pumping for agricultural irrigation in the Mesa Basin was higher than at present. Groundwater levels in the Palo Verde Mesa declined significantly during the 1970's and 1980's due to groundwater pumping for agricultural irrigation, and subsequently water levels recovered to the levels observed during the 1960's as pumping decreased the early 1990's (CEC, 2005).

5.2 Current Demand

Groundwater in the Palo Verde Mesa and Valley basins is used for local water supply by the City of Blythe, the Mesa Verde Community, and by individual property owners, particularly in the Palo Verde Mesa Groundwater Basin where the surface water delivery infrastructure is limited. Blythe derives most of its groundwater supply from the Palo Verde Valley (Colorado River Floodplain) and this pumping is accounted for as part of PVID's allocation of Colorado River Water. Blythe pumps a lesser amount of water from the Palo Verde Mesa Groundwater Basin. BEP Phase I is the second largest consumer of groundwater in the basin at 3,300 AFY (CEC, 2005).

There are 724 acres of agricultural (predominantly citrus) and municipal land on the mesa that rely on groundwater from private wells for irrigation. To estimate agricultural pumping on the Mesa the DWR Water Use Estimates (2001) of 4.5 to 5.85 acre-feet/acre (median value 5.175 AF/Ac) was multiplied by 724 acres to arrive at a total of 1,030 AFY, based on the median water use value.

AECOM (2010) estimated municipal groundwater pumping in the Palo Verde Mesa and Valley basins , which is summarized as follows. According to the City of Blythe Department of Public Works Department, the City of Blythe pumps the Mesa Ranch Well #3 for municipal use (230 AFY) and PVC Well #2 for municipal use at the Palo Verde College (260 AFY), Main System (3,700 AFY) and Mesa Well #2 for the Golf Course (560 AFY). The County of Riverside operates one well (Airport Well #7) at the Blythe Airport that serves the Mesa Verde Community (47 AFY). This estimate also includes pumping for the Blythe Energy Plant I, a 520 mega watt natural gas fired power plant located on the Palo Verde Mesa near the airport (3,300 AFY). It does not include pumping for BEP II as this project is not yet in operation. This gives a total of 8,100 AFY of municipal pumping.

The total groundwater pumping for irrigation on the mesa and for municipal pumping on the mesa and in the valley (mainly City of Blythe) thus represents a total outflow of about 9,100 AFY.

5.3 Projected Future Demand

Future groundwater demand will increase primarily in support of energy developments in the Palo Verde Basin. Projected water demand for future developments are summarized below (AECOM 2010):

- **Blythe Energy Project II** (Combined Cycle (520MW)). AFC (2004) indicates an operational usage of 3,300 AFY starting in 2013. No construction pumping rate or volume are specified; however, the construction water demand is expected to be limited for development of this relatively small (76 acre) site.
- **McCoy Soleil Project** (Photo Tower (136MW)). POD assumes 30-month construction period with facility start-up at end of 2013. Estimated water use of 1,225 AF over construction period and 600 AFY during operational period thereafter beginning in 2014.
- **Blythe Solar Power Project** (Parabolic Trough (484MW)). POD assumes 69 month (5.75years) construction period starting in 2011with total water usage during construction of 3,100 AF and 600 AFY usage during full-scale operation starting in 2015.

Note that there are several solar photovoltaic projects planned in addition to the above, however their groundwater use is negligible (<0.5 AFY) compared to overall groundwater demand.

6. GROUNDWATER BUDGET FOR THE PALO VERDE MESA AND VALLEY BASINS

The groundwater budget for the Palo Verde Mesa and Valley Basins discussed below was derived from information in previous USGS investigations (Metzger and others 1973, Owen-Joyce 1984, Owen-Joyce and Kimsey 1987), plus a groundwater balance by AECOM (2010) as part of a groundwater flow model development for the basins. The AECOM study represents the mose recent and comprehensive groundwater budget available. It utilized stream flow data for the Colorado River, recent PVID diversion and return flow data, and a recent estimate of discharge from groundwater pumping for municipal, industrial and agricultural supply.

The groundwater budget discussed herein was developed for both the Mesa Basin and the Valley Basin combined since they appear to be hydraulically connected and are comprised of a single hydrostratigraphic unit consisting of younger and older alluvial deposits. The dominant components of the water balance in the Palo Verde Valley are the diversion of Colorado River water for irrigation in PVID's service territory and the resulting deep percolation of irrigation water, and the return flow of water in PVID drains to the river near the downstream end of the valley. These water volumes are several orders of magnitude more than other components of the groundwater balance, including precipitation recharge, underflow from adjacent basins, or groundwater pumping. Groundwater levels in the Palo Verde Valley have been relatively stable since at least the 1980s, suggesting steady state conditions and therefore a balance between groundwater inflows and outflows in a system that is dominated by the above water budget components.

The components of recharge and discharge for the groundwater budget in the Palo Verde Mesa and Valley basins are as follows:

Recharge (Inflows)

- Recharge from Precipitation
- Subsurface inflow from the Parker Valley and Chuckwalla Valley
- Agricultural Irrigation Infiltration (Deep Percolation)
- Irrigation Canal Seepage
- Recharge to groundwater from Colorado River seepage (Losing Condition)

Discharge (Outflows)

- Groundwater Pumping (Agriculture and Municipal)
- Consumptive Use – Native Vegetation
- Groundwater Discharge to the PVID Drains
- Groundwater Discharge to the Colorado River (Gaining Condition)

The water budget components of the groundwater system for the combined the Palo Verde Mesa and Valley Groundwater Basins are illustrated schematically in **Figure 6-1** and the corresponding water budget is summarized in **Table 6-1**. A water balance of 424,600 AFY (**Table 6-1**) is estimated from a balance of the recharge and discharge elements discussed below. As noted above, the key recharge elements of the groundwater balance are infiltration and deep percolation of agricultural irrigation water, canal seepage and recharge to groundwater from the Colorado River. These components comprise 98% of the total recharge to the PVMGB and PVVGB. Deep percolation from irrigation and canal seepage represent 44% of total recharge (**Table 6-1**) [1]. The discharge or outflow of groundwater is largely comprised of the measured discharge from PVID drains (84% of total discharge).

6.1 Groundwater Inflow to the Palo Verde Mesa and Valley Basins

Groundwater inflow components of the water balance for the PVMGB and PVVGB include underflow from adjacent groundwater basins (Chuckwalla and Parker Valley basins), infiltration and deep percolation of irrigation water (infiltration of irrigation water that becomes groundwater recharge) and seepage losses from the Colorado River to groundwater[2]. Groundwater recharge from precipitation is mainly in the form of mountain front recharge, Groundwater recharge from direct precipitation onto the valley floor or mesa is considered negligible, which is consistent with the approach of Metzger et al. (1973) who considered recharge from precipitation to be negligible in areas with mean annual precipitation less than eight inches..

6.1.1 Recharge from Precipitation

Recharge from precipitation was estimated by applying the runoff-recharge method of Hely and Peck (1964) in the same manner as applied by AECOM (2010) and CEC (2010). AECOM (2010) divided the Palo Verde Mesa Groundwater Basin into localities that approximated the localities as described by Hely and Peck (i.e. mountains, hills, alluvium-steep slope or alluvium-shallow slope) and then calculated the area for each locality. WorleyParsons verified the areas used by AECOM

[1] Note that outflow/inflow to/from the Colorado River was treated as a residual component in the most recent available water balance (AECOM, 2010), as discussed in Section 6.1.5 of this report. The groundwater elevation contours shown on **Figure 4-5** suggest the river is gaining in the northern half of Palo Verde Valley and losing in the southern half. Further, underflow out of the Valley through the gap above Cibola is assumed to be negligible since most of this water should discharge into the river in the Cibola Valley above the narrows, as previously assumed by Metzger et al. (1973) and Owen-Joyce (1984). These factors suggest that basin-wide, there may be closer balance between groundwater inflow and outflow to/from the river, and recharge derived from deep percolation of irrigation water may be more significant and recharge from infiltration of river water less significant than suggested by the groundwater budget.

[2] As noted above, this component may be overestimated.

(2010) and in some cases, particularly for the runoff areas of the Mule and Palo Verde Mountains, expanded the areal analysis used by AECOM (2010). The revised mapping and areas are shown in **Figure 6-2** and given in **Table 6-2**. Figure 10 of Hely and Peck (1964) was used to select an average runoff curve number for each locality assuming an average of all soil types which roughly corresponded to a median of the soil type "B" as defined by the US Bureau of Reclamation. For example, an average runoff number of 74 was selected for alluvium-steep slope. Hely and Peck (1964) developed a relationship between the runoff curve number and the runoff as a percentage of the precipitation (see Hely and Peck, 1964 Figure 9). Using this relationship, the annual volume of runoff from each locality was calculated by multiplying the area of each locality times the mean annual precipitation times the percentage of runoff estimated for the runoff curve number. The mean annual precipitation was approximated for each locality by overlaying the mean annual precipitation isohyetals from Plate 3 of Hely & Peck (1964).

The results of this analysis by AECOM, as adjusted by WorleyParsons, are presented in **Table 6-2**. A total of 9,810 AFY of runoff is calculated for the PVMGB by this method, with the majority (7,569 AFY) comprised of mountain front recharge. CEC (2010) used an alternative analysis of simply using 3 to 5% of precipitation to estimate recharge from precipitation. For the Palo Verde Mesa Basin with 302,000 acres and an average annual precipitation of 4.3 inches, these percentages yield 3,159 AFY (3%) and 5,265 AFY (5%). Based on the CEC calculation, we assumed a value of 5,300 AFY for recharge from precipitation. According to AECOM (2010), the majority of this recharge is expected to occur as mountain front recharge. Metzger et al. (1973) and Owens-Joyce (1984) estimated that recharge from surface water through the McCoy Wash was 800 AFY and from the Palo Verde Mountains was 1,200 AFY, for a combined total of about 2,000 AFY.

6.1.2 Groundwater Underflow from the Parker Valley and Chuckwalla Valley

Groundwater underflow occurs from two adjacent groundwater basins, the Chuckwalla Basin to the west, and the Parker Basin to the north along the Colorado River. Underflow of 1,200 AFY from the Parker Basin was calculated using transmissivity of 26,000 ft^2/day (from Leake, 2008), a gradient of 0.0003 ft/ft, and a 19,000-foot cross-sectional width (from AECOM 2010). This is less than the 3,000 AFY estimated by Metzger et al. (1973) for groundwater flow through the river valley narrows adjacent to the Palo Verde Diversion Dam, however those authors did not specify the basis for their calculation.

Underflow from the Chuckwalla Valley has been estimated at 1,000 AFY based on a three-dimensional groundwater flow model for the Chuckwalla Basin developed by Worley Parsons (2010) as part of the Genesis Solar Project application. This value represents an increase from the 400 AFY previously estimated by Metzger et al. (1973). The difference represents more recent information provided by more up-to-date hydrogeologic data on aquifer characteristics and geophysical surveys conducted to determine the geometry of the bedrock "high", and subsequently

the saturated thickness of the aquifer in the gap between the Chuckwalla and Palo Verde Mesa areas (AECOM, 2010).

6.1.3 Infiltration and Deep Percolation of Irrigation Water

One of the largest sources of groundwater recharge in the Palo Verde Valley Basin (including the Mesa Basin) is the deep percolation from water diverted for irrigation by PVID, referred to as agriculture return. From 1993 and 2009, an average of 731,743 AFY was diverted for irrigation in the Valley Basin and an average of 10,616 AFY was diverted to the Mesa Basin, for a total average diversion of 742,359 AFY (AECOM, 2010, Appendix E). Irrigation canals are distributed throughout the flood plain, including both lined and unlined canals generally less than 10 feet deep, and therefore above the water table. Flood irrigation of individual fields is carried out, and the irrigation is either consumptively used by agricultural crops, evaporated, or infiltrates into the subsurface where it recharges groundwater as deep percolation. The PVID drains, at depths between 15 and 20 feet bgs, intercept a portion of the percolated irrigation water and return it back to the Colorado River.

RECHARGE FROM IRRIGATION DEEP PERCOLATION – VALLEY BASIN

An estimate of the groundwater recharge from irrigation return was made by AECOM (2010) using the average of water diverted for irrigation on the floodplain less total spill return to the river less consumption, canal seepage and evaporation. As noted above, the average diversion of water to the flood plain for irrigation from 1993 to 2009 was 743,000 AFY. The USBR measured spill return and estimated consumptive fraction (1993-2009) were 136,000 AFY and 420,000 AFY, respectively. Owen-Joyce 1984 estimated canal seepage at 125,000 AFY, and evaporation from the canal surface at 5,000 AFY. The remainder attributed to net groundwater recharge from irrigation deep percolation is 57,000 AFY.

RECHARGE FROM IRRIGATION DEEP PERCOLATION – MESA BASIN

There are 2,683 acres of irrigated agricultural land on the Mesa (PVID February 2010, as reported in AECOM (2010), of which 1,862 acres are irrigated with surface water from PVID. The other 724 acres are irrigated with groundwater, including 97 acres at the Blythe Municipal Golf Course. Agricultural return on the Mesa was calculated for the 2,683 acres using the DWR Water Use Estimates (2001) of 4.5 to 5.85 acre-feet/acre (median value 5.175 AF/Ac) and crop efficiency of 70% to 75% (median value 72.5%). The quantity of irrigation deep percolation that recharges groundwater (3,800 AFY) was calculated using the above median values as the difference between the total applied water (13,884 AFY) less the consumptive use derived from the crop efficiency estimate (10,066 AFY).

RECHARGE FROM THE BLYTHE PUBLICLY OWNED TREATMENT WORKS (POTW)

AECOM 2010 estimated the infiltration recharge from the Blythe POTW to be 750 AFY, based on information provided on the daily flow to evaporation/percolation ponds (City of Blythe website), and assuming a total pond area of 120 acres (estimated from aerial photo review) and the annual evaporation rate of 71 inches.

6.1.4 Recharge from Canal Seepage

Owen-Joyce (1984) and Bookman-Edmonston (1976) estimated seepage from irrigation canals in the Palo Verde Valley flood plain as 125,000 AFY as part of an evaluation of irrigation return flows to the Colorado River.

6.1.5 Colorado River Recharge to Groundwater

According to AECOM (2010) the Colorado River loses water to the alluvial aquifer (losing conditions) particularly in the southern part of the Palo Verde Valley and under high river stage conditions. However, this seepage loss from the river cannot be measured directly but is based on the assumption of steady state groundwater conditions. Under the assumption of steady state conditions, the loss of river water that recharges groundwater in the alluvial aquifer can be estimated by difference, knowing the other major components of the groundwater balance. As given in **Table 6-2,** estimates or measurements are available for all major recharge and discharge components of the groundwater budget except river recharge to groundwater, therefore this component was estimated by zeroing the difference between total outflow components and the sum of the remaining groundwater inflow components. AECOM 2010 estimated this component at 225,850 AFY, and Metzger et al (1973) estimated an average loss along this reach of the Colorado River of 361,000 AFY for the period between 1955 and 1961. Using this method for the current water budget yields an estimate of Colorado River Recharge to groundwater of 230,550 AFY.

The relatively stable groundwater levels in the Palo Verde Valley Basin over time do in fact suggest steady state groundwater conditions; however, as discussed previously, this condition is currently maintained largely by a balance between the deep percolation of irrigation water and a series of drains installed by PVID. The groundwater elevation contours shown on **Figure 4-5** suggest the river is gaining in the northern half of Palo Verde Valley and losing in the southern half. Further, underflow out of the Valley through the gap above Cibola is assumed to be negligible since most of this water should discharge into the river in the Cibola Valley above the narrows, as previously assumed by Metzger et al. (1973) and Owen-Joyce (1984). These factors suggest that basin-wide, there may be closer balance between groundwater inflow and outflow to/from the river, or a net inflow of groundwater to the river when the unmeasured return of diverted irrigation water (as groundwater) and the discharge of groundwater upstream of the Cibola Valley are considered.

6.2 Groundwater Outflow from the Palo Verde Mesa and Valley Basins

In the Palo Verde Valley by far the largest component of groundwater outflow to surface water is discharge into the PVID drains, which then discharge into the Colorado River. Direct, but unmeasured, groundwater discharge to the Colorado River (i.e., gaining conditions) is also expected to be significant (see USBOR, 2011). Underflow out of the Valley through the gap above Cibola is assumed to be negligible since most of this water should discharge into the river in the Cibola Valley above the narrows, as previously assumed by Metzger et al. (1973) and Owen-Joyce (1984).

6.2.1 Groundwater Pumping

AGRICULTURAL IRRIGATION, MESA

As previously noted, there are 724 acres of agricultural (predominantly citrus) and municipal land on the Mesa that rely on groundwater from private wells for irrigation. To determine agricultural pumping on the Mesa the DWR Water Use Estimates (2001) of 4.5 to 5.85 acre-feet/acre (median value 5.175 AF/Ac) was multiplied by 724 acres to arrive at a total of 1,030 AFY (rounds to 1,000 AFY), based on the median water use value.

MUNICIPAL GROUNDWATER SUPPLY

As previously discussed, AECOM (2010) estimated municipal groundwater pumping in the Palo Verde Valley, including the City of Blythe Mesa Ranch Well #3 for municipal use (230 AFY), PVC Well #2 for municipal use at the Palo Verde College (260 AFY), Main System (3700 AFY) and Mesa Well #2 for the Golf Course (560 AFY). Other municipal pumping includes the County of Riverside Airport Well #7 (47 AFY). In addition, the Blythe Energy Plant I, a 520 mega watt natural gas fired power plant located on the Palo Verde Mesa pumps 3,300 AFY. This estimate does not include pumping for BEP II as this project is not yet in operation. This gives a total of 8,100 AFY of municipal pumping.

6.2.2 Consumptive Use – Native Vegetation

The USBR estimates consumptive use of groundwater by native vegetation annually as part of their accounting of Colorado River water usage. The native vegetation is mainly phreatophytes—notably saltcedar, arrowweed, and mesquite (Owen-Joyce, 1984). The USBR evapotranspiration estimates for native vegetation includes a larger area than just the Palo Verde Valley. AECOM (2010) used the average estimates for areas within the Palo Verde Valley from 2003 to 2009 to give estimate of ET loss from native vegetation of about 8,500 AFY. This volume is presumed to be a component of the larger estimate of consumptive use by phreatophytes of 23,500 AFY for the year 1981 by Owen-Joyce, 1984.

6.2.3 Discharge to PVID Drains

The return of water, previously applied as irrigation, from the PVID drains to the Colorado River is measured daily by PVID. According to PVID, the average return from the drains to the river since 1993 is 357,000 AFY, with individual years ranging from 267,000 AFY to 406,000 AFY (AECOM, 2010).

6.2.4 Discharge to Colorado River (Gaining Condition)

Groundwater discharge to the Colorado River is estimated annually by the USBR as part of their accounting of Colorado River water. For the period of 2003 to 2009, the average unmeasured groundwater discharge to the Colorado River was estimated to be approximately 50,000 AFY (AECOM, 2010). This compares to the estimated loss of river water to groundwater recharge of approximately 231,000 AFY. Previously reported unmeasured discharge values are generally comparable, for example, as estimated by Owen-Joyce and Kimsey (1987) with values between 2,500 to 31,700 AFY.

As noted previously, the groundwater elevation contours shown on **Figure 4-5** suggest the river is gaining in the northern half of Palo Verde Valley and losing in the southern half. Underflow out of the Valley through the gap above Cibola is assumed to be negligible since most of this water should discharge into the river in the Cibola Valley above the narrows, as previously assumed by Metzger et al. (1973) and Owen-Joyce (1984). These factors suggest that basin-wide, there may be closer balance between groundwater inflow and outflow to/from the river, or a net inflow of groundwater to the river when the unmeasured return of diverted irrigation water (as groundwater) and the discharge of groundwater upstream of the Cibola Valley are considered.

7. CONCLUSIONS

The RMS Site is located atop the southern arm of the PVMGB between the Mule Mountains to the west and the PVVGB to the east. The Site is underlain by the Older Alluvium which is part of the primary alluvial aquifer system of the mesa. Wells in the Older Alluvium are generally relatively productive, and pump testing of a well at the Site as part of investigations for the Desert Sunlight project indicates the aquifer should be easily capable of providing the quantities of water needed for the RMS project. Groundwater quality analysis of samples collected from on-Site wells indicates that groundwater is slightly brackish in quality and of sodium chloride-sulfate character. Detected concentrations exceed primary and/or secondary standards for arsenic, iron, fluoride, chloride and sulphate. These characteristics should be considered when developing plans for groundwater pre-treatment.

The Site is located in the area of the proposed Colorado River Accounting Surface, and existing water levels are generally within approximately 2 feet above the water table level below which the contemplated policy would classify groundwater withdrawals as Colorado River surface water. It is likely that static water levels will fall below the proposed Accounting Surface as a result of project pumping. It should be understood, however, that at this time, the proposed Accounting Surface does not have force of law and has been found by the CEC not to be an applicable Law, Ordinance, Regulation or Standard (LORS) for other power projects licensed in this area. As such, the project may pump groundwater for beneficial use under California Water Law. Should the Accounting Surface methodology or a similar regulation be adopted in the future and the Bureau of Reclamation concludes as a matter of formal policy that the project's groundwater use must be accounted for as e Colorado River water, the project is required under its lease from MWD to purchase an allotment of Colorado River water equivalent to its pumping.

Groundwater levels in the PVMGB are generally stable and display limited historical decline (generally less than 10 feet) due to localized pumping influence. Deep percolation of applied irrigation water in the Palo Verde Valley exert a strong stabilizing influence on groundwater levels in the basin.

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TABLES

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Table 4-2
GROUNDWATER QUALITY IN THE PALO VERDE MESA GROUNDWATER BASIN
Rio Mesa Solar Facility, Riverside, California

Analyte	Primary / Secondary	Well #28R003S			Well #28Q002S
Site & Sample Information					
On Site / Off Site	-		On Site		On Site
Source	-	URS, Stone & Webster	URS	URS	URS
Date	-	1976	1/26/2011	5/11/2011	1/26/2011
Sample Depth	-		Pump at 250 ft bgs	Pump at 300 ft bgs	Pump at 250 ft bgs
General Parameters					
Total Dissolved Solids (TDS)	500	1815	1850	1840	1570
Specific Conductance (SC) (umhos	900	2900	2900	2600	2300
pH (unitless)	NE	7.7	8.6	8.12	7.27
Turbidity (NTU)	NE	0	14	4.8	5.6
Total Suspended Solids (TSS)	NE	5	5.4	5.9	8.9
Phosphorus	NE	NA	0.27	0.12	0.35
Carbon Dioxide	NE	NA	<0.10	1.5	12
Total Organic Carbon (TOC)	NE	NA	NA	0.12	NA
Title 22 Metals					
Antimony	0.006	NA	<0.000380	<0.000380	<0.000380
Arsenic	0.01	NA	0.00919	**0.0129**	<0.000589
Barium	1	NA	0.0184	0.0269	0.0845
Beryllium	0.004	NA	<0.000131	<0.000131	<0.000131
Cadmium	0.005	NA	<0.000266	<0.000266	<0.000266
Chromium	0.05	NA	0.00151	0.00138	0.00351
Title 22 Metals					
Cobolt	NE	NA	<0.000618	<0.000140	0.00027**
Copper	1.0*	NA	0.00054**	0.00121	0.0438
Lead	0.015	NA	<0.000170	<0.000170	0.00033**
Mercury	0.002	NA	<0.0000348	<0.0000348	<0.0000348
Molybdenum	NE	NA	0.0438	0.0589	0.0249
Nickel	0.1	NA	0.00067**	0.00164	0.0117
Selenium	0.05	NA	<0.000554	0.00461	0.00173
Silver	0.1*	NA	<0.000120	<0.000120	<0.000120
Thallium	0.002	NA	<0.000498	<0.000498	<0.000498
Vanadium	NE	NA	<0.000790	<0.000790	<0.000790
Zinc	5	NA	0.00635	0.0101	0.35

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Table 4-2
GROUNDWATER QUALITY IN THE PALO VERDE MESA GROUNDWATER BASIN
Rio Mesa Solar Facility, Riverside, California

Analyte	Primary / Secondary MCL	Well #28R003S			Well #28Q002S
Base Cations					
Calcium	NE	56	18.3	36.2	89.8
Magnesium	NE	5	2.27	3.7	19.1
Sodium	NE	580	511	615	363
Potassium	NE	11	5.02	6.18	5.28
Other Metals					
Aluminum	0.2*	NA	<0.0105	<0.0105	<0.0105
Iron	0.3*	0.08	**0.321**	0.25	0.0618
Manganese	0.05*	NA	0.00782	0.0188	0.00991
Anions					
Fluoride	2	**3.8**	**4.2**	**4.2**	0.41
Chloride	250*	**604**	**740**	**730**	**470**
Nitrate (as N)	10	2	<0.017	0.0045	0.07**
Total Alkalinity (as CaCO3)	NE	160	74	95	124
Sulfate	250*	**450**	**390**	**420**	**410**
o-Phosphate (as P)	NE	NA	<0.014	<0.047	<0.014
Bicarbonate (as CaCO3)	NE	140	74	95	124
Hydroxide (as CaCO3)	NE	NA	<0.85	<0.85	<0.85
Silica					
Total	NE	32	19	36.6	15
Dissolved	NE	NA	17	34.7	14
Collodial (Reactive)	NE	NA	19	30	15
Other Priority Pollutants					
Cyanide	NE	NA	<0.050	<0.0070	<0.050
SVOCs: Bis (2-Ethylhexyl) Phthalate (ug/l)	NE	NA	<10	ND	2.3**
OCPs	NE	NA	ND	ND	ND
PCBs	NE	NA	ND	ND	ND
VOCs: Toluene (ug/L)	NE	NA	ND	1.4	ND

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Table 4-2
GROUNDWATER QUALITY IN THE PALO VERDE MESA GROUNDWATER BASIN
Rio Mesa Solar Facility, Riverside, California

Notes:

ft = feet

bgs = below ground surface

.- = not available / not applicable

NA = Not Analyzed

NE = No Limit Established

SVOCs = Semi Volatile Organic Compounds

OCPs = Organochlorine pesticides

PCBs = Polychlorinated biphenyls

VOCs = Volatile Organic Compounds

MCL = Maximum Contaminant Level. Reported as Primary Level unless has an asterisk (*) indicated secondary MCL

< = consituent was not detected above the analytical detection limit

** = Constituent was detected at a concentration below reporting limit but above the laboratory detection limit.

Shaded Bold Cell indicates level above the MCL

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Table 6-1

Groundwater Budget for the Palo Verde Mesa and Valley Basins
Palo Verde Mesa Groundwater Basin

RECHARGE (INFLOW)	**acre-feet per year**
UNDERFLOW from the CHUCKWALLA BASIN	1,000
UNDERFLOW from PARKER VALLEY	1,200
AGRICULTURE RETURN - MESA	3,800
AGRICULTURE RETURN - VALLEY	57,000
POTW RETURN	750
MOUNTAIN FRONT	5,300
IRRIGATION CANAL LEAKAGE	125,000
RIVER DISCHARGE TO GROUNDWATER (LOSING CONDITION)	230,550
BEDROCK	0
TOTAL (INFLOW)	**424,600**
DISCHARGE (OUTFLOW)	**acre-feet per year**
UNDERFLOW OUT of the PALO VERDE and CIBOLA VALLEY	0
GROUNDWATER PUMPING AGRICULTURE - MESA	1,000
GROUNDWATER PUMPING MUNICIPAL and DOMESTIC	8,100
GROUNDWATER DISCHARGE TO COLORADO RIVER (GAINING	50,000
CONSUMPTIVE USE - NATIVE VEGETATION	8,500
GROUNDWATER DISCHARGE THROUGH PVID DRAINS	357,000
TOTAL (OUTFLOW)	**424,600**
WATER BALANCE	**0**

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Table 6-2

Runoff and Infiltration Estimates
Palo Verde Mesa Groundwater Basin

Layer (1)	Area (acres)	Mean Annual Precipitation (inches) (2)	Total Volume of Rainwater from Mean Annual Precipitation (af)	Runoff Curve Classification (2)	Runoff Curve Number (2)	Runoff (percent of Precipitation)	Total Annual Volume of Runoff (Infiltration) Hely & Peck (AF)	Total Annual Volume of Infiltration AFf) based on 3 percent (3)	Total Annual Volume of Infiltration (AF) based on 5 percent (3)
unit1-pvm	23,731	4	7,910	Alluvium, Steep Slope	74	3.50%	277	237	396
bedrock1-pvm	7,807	4	2,602	Hills	83	10%	260	78	130
bedrock2-pvm	3,664	3.5	1,069	Mountains	93	29.10%	311	32	53
bedrock3-pvm	12,661	4	4,220	Mountains	93	29.10%	1,228	127	211
bedrock4-pvm	20,073	6	10,037	Mountains	93	29.10%	2,921	183	305
bedrock5-pvm	33,564	3.5	9,790	Mountains	93	29.10%	2,849	294	489
unit1-pvm	78,714	5	32,798	Alluvium, Steep Slope	74	3.50%	1,148	984	1640
unit2-pvm	122,451	4	40,817	Alluvium ,Flat Slope	69	2%	816	1225	2041
Totals	**302,665**	**---**	**109,242**	**---**	**---**	**---**	**9,810**	**3,159**	**5,265**

Notes:

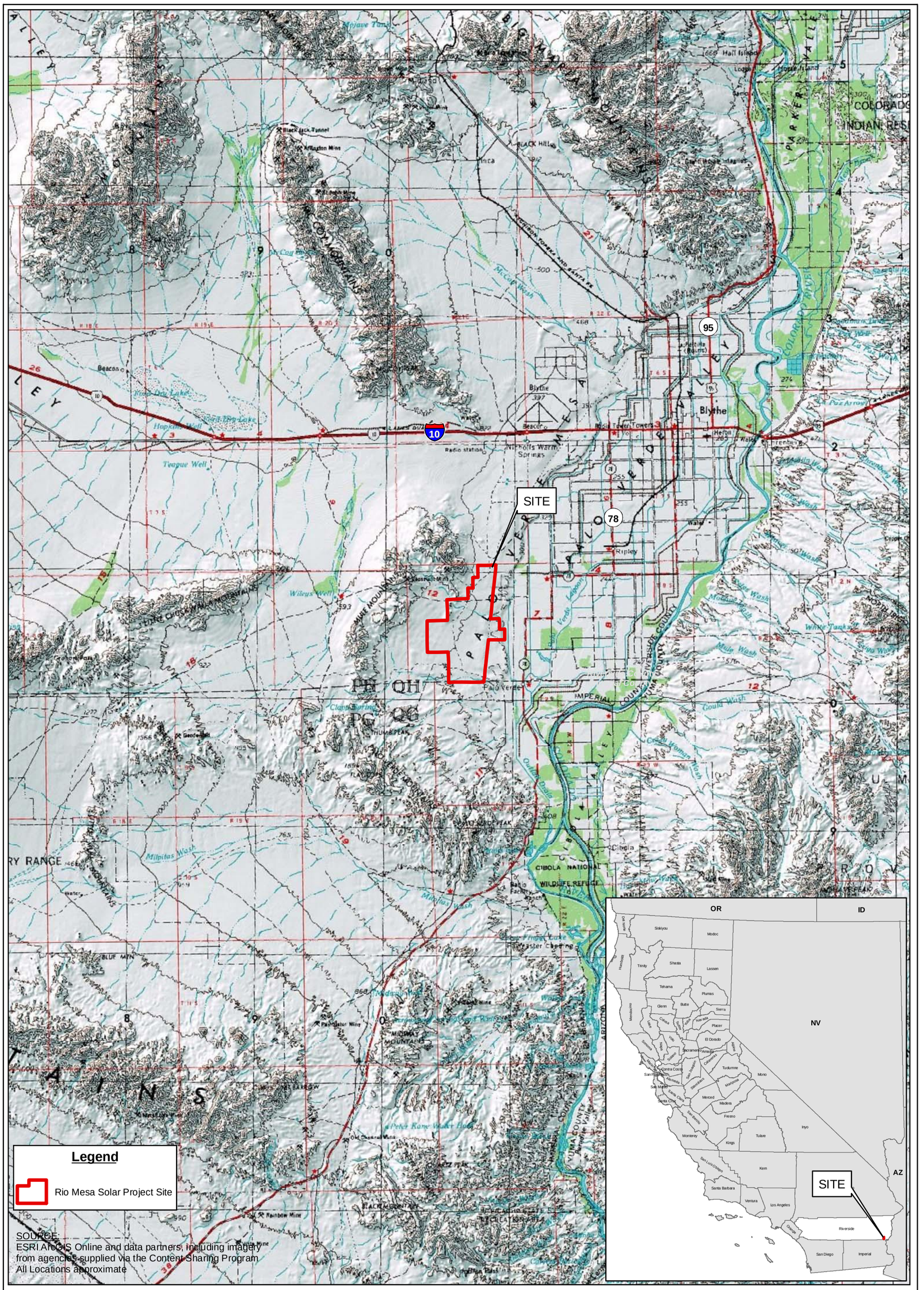
1) See Figure 6-1

2) From Hely & Peck, 1964.

3) Based on a percent of Total Volume of Rainwater from Mean Annual Precipitation (Column 4).

Source: Layer mapping from AECOM, 2010. Areas dervied by WorleyParsons

FIGURES



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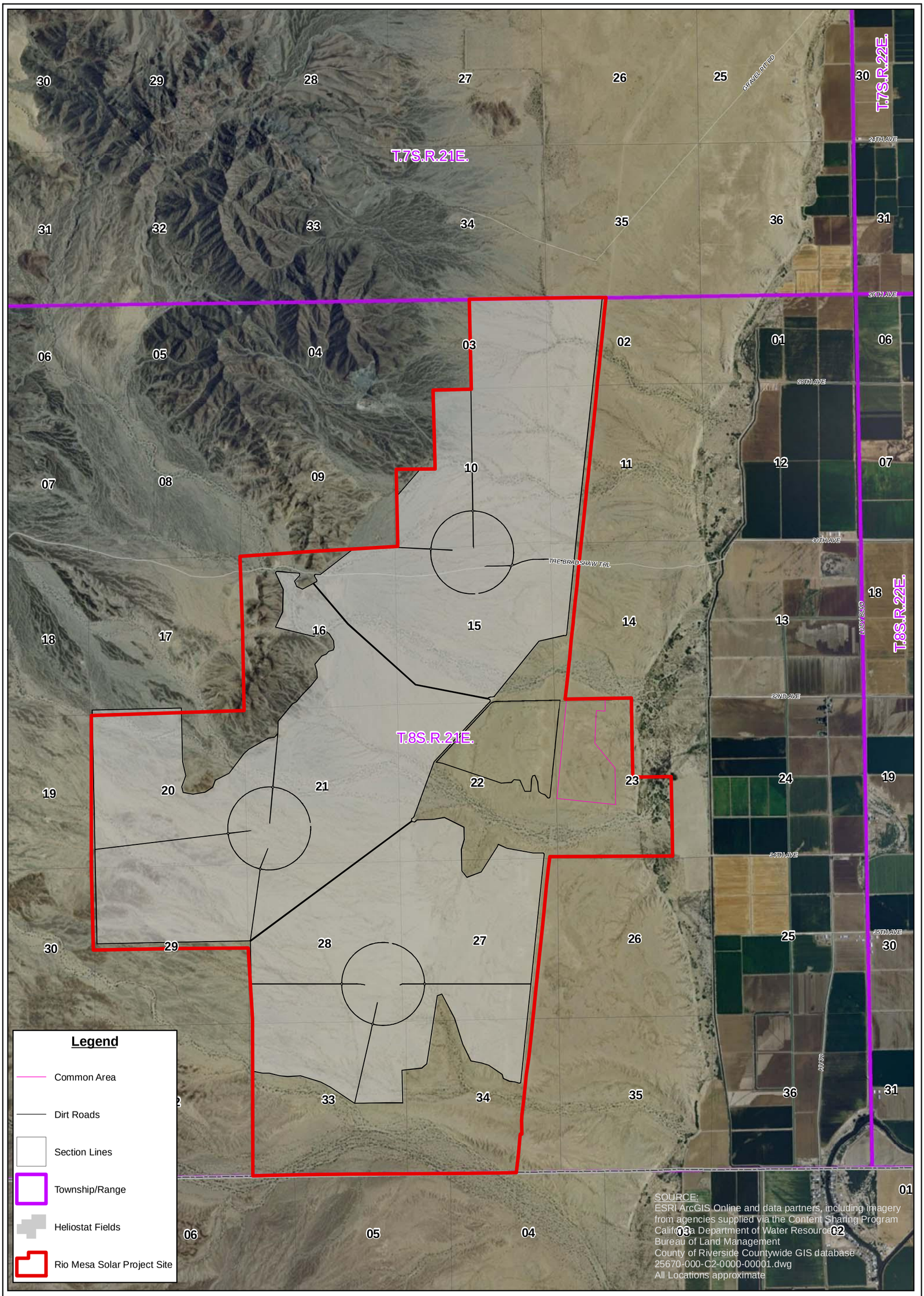
RIO MESA SOLAR
PROJECT LOCATION

SWL	MT	9/2011
308038-03598	**1-1**	



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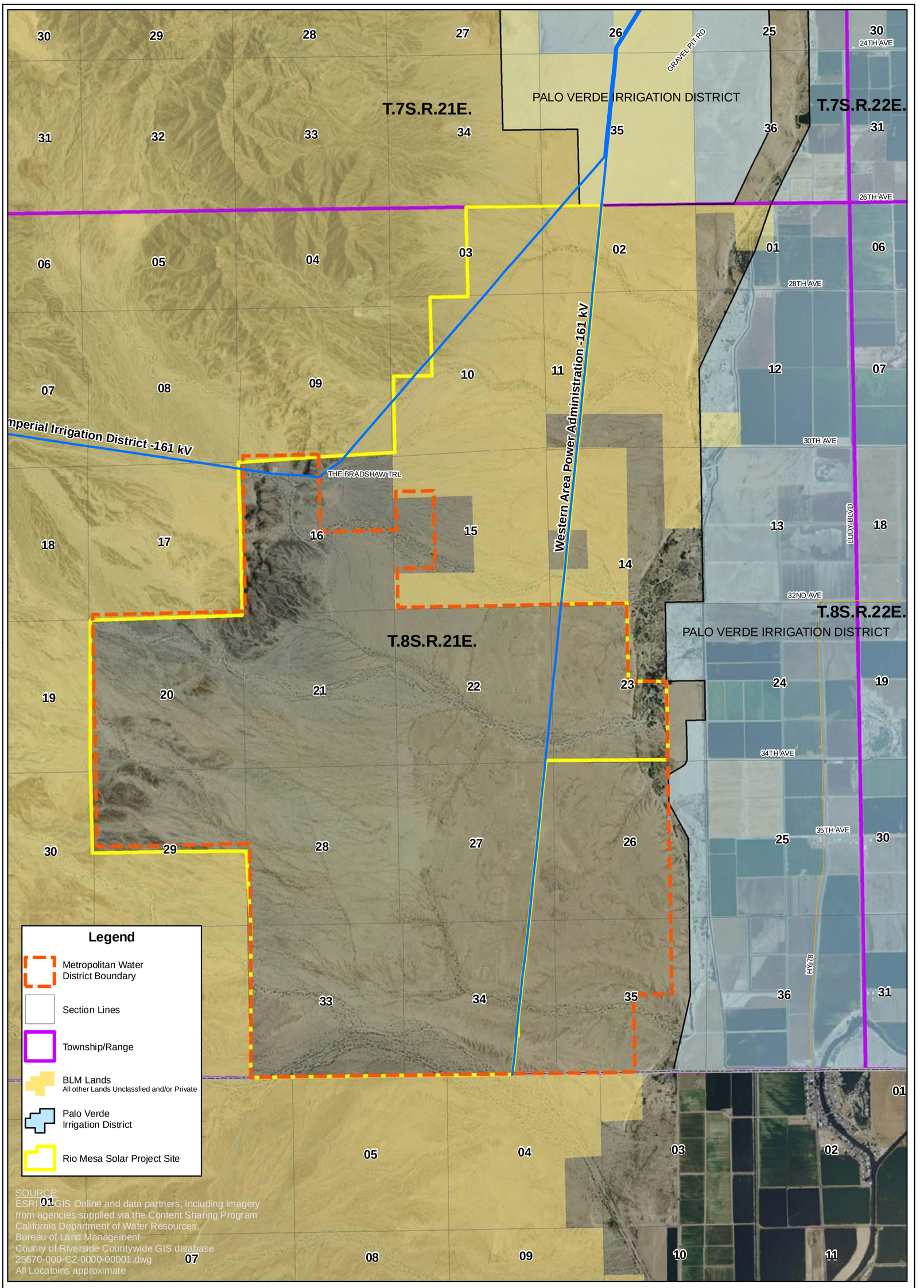
RIO MESA SOLAR PROJECT
SITE PLAN

SWL	MT	9/2011
308038-03598	**1-2**	



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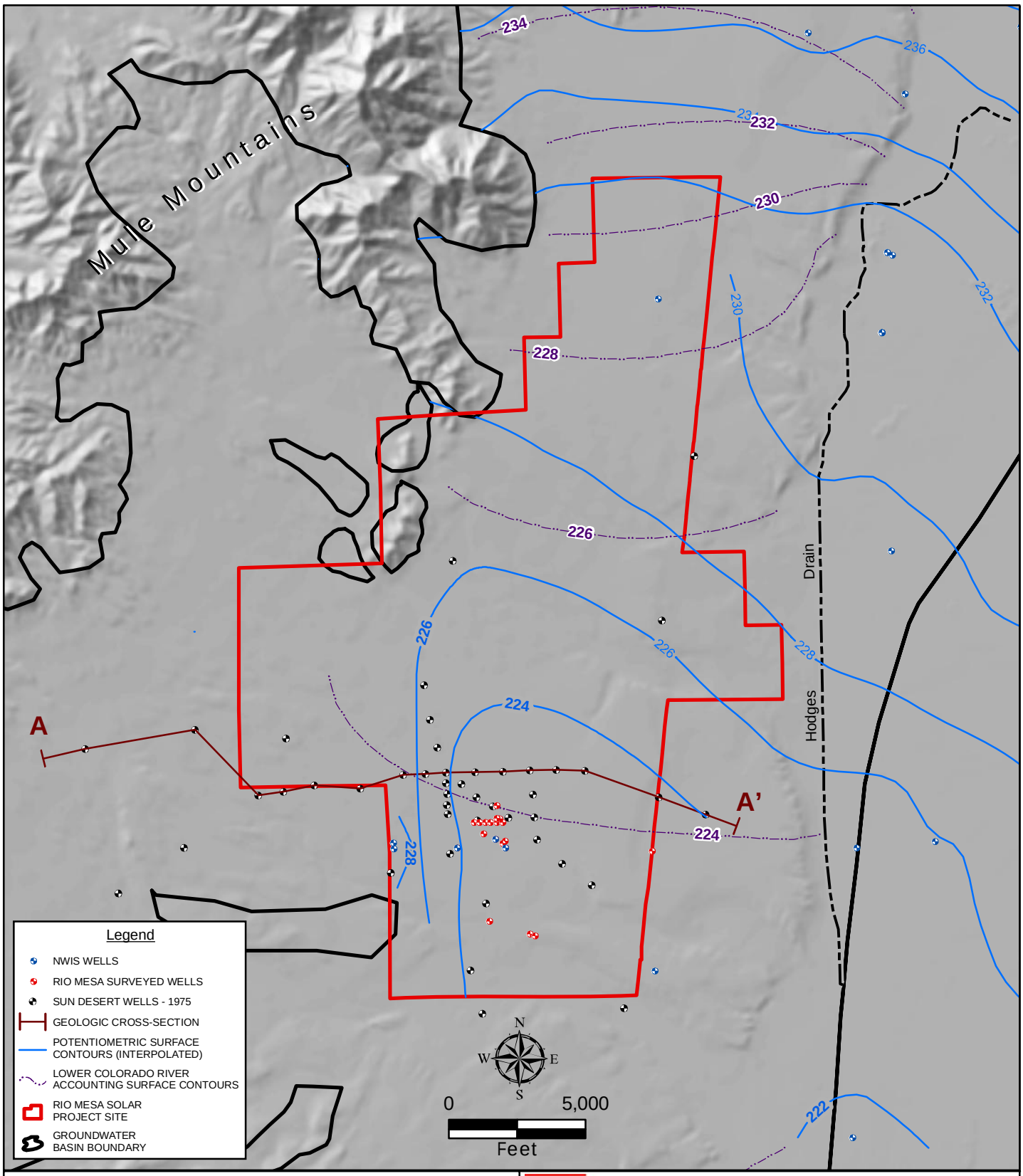
REGIONAL SETTING

SWL	MT	9/2011
308038-03598		**4-1**



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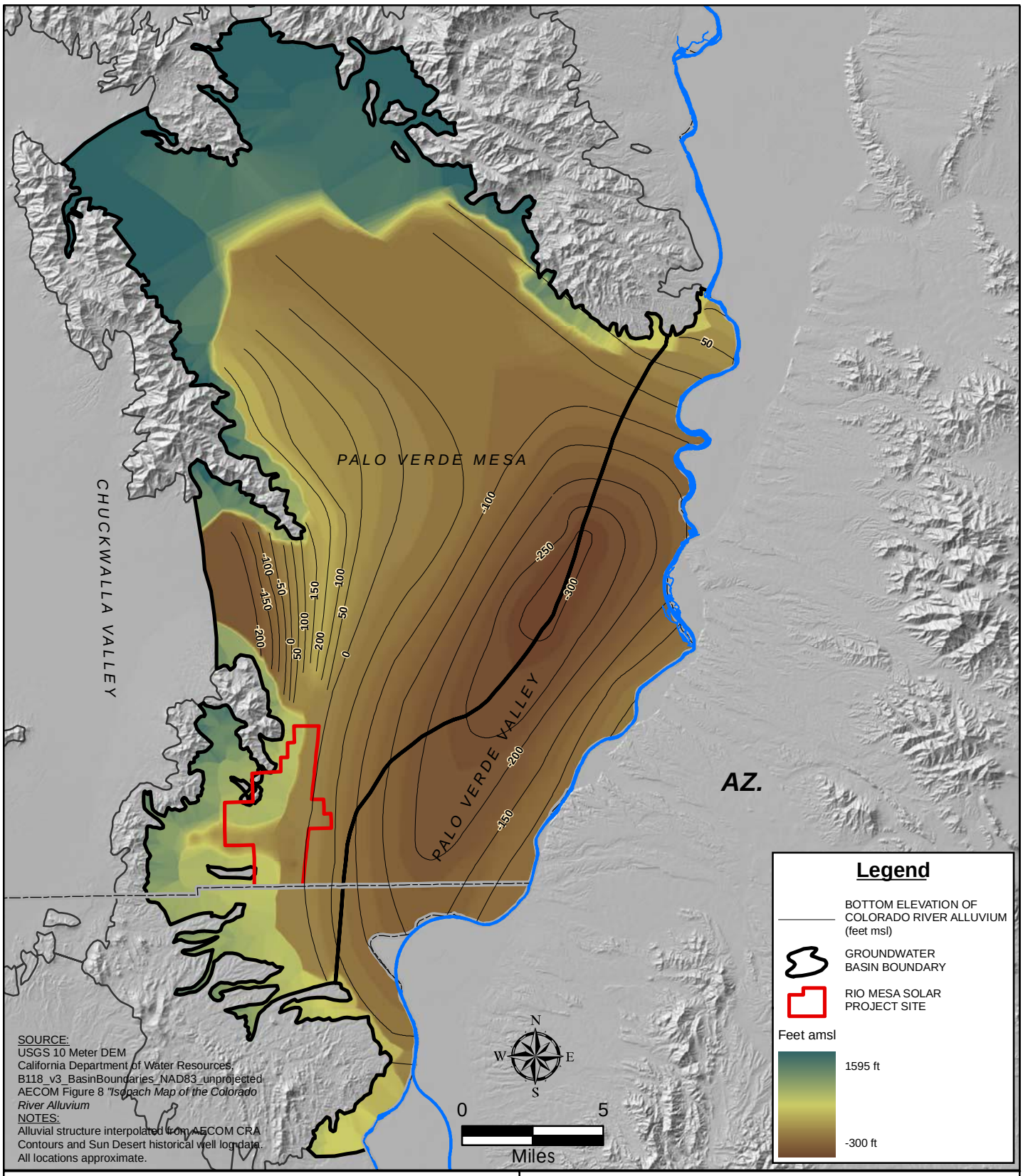
SOURCE:
USGS 10 Meter DEM. USGS Arizona Water Science Center
California Department of Water Resources,
B118_v3_BasinBoundaries_NAD83_unprojected
California Hydrography-Hodges Drain,
NOTES:
Potentiometric surface lines interpolated using historical well log data from NWIS and Rio Mesa Well log data from URS

GROUNDWATER ELEVATIONS AND ACCOUNTING SURFACE SITE VICINITY

SWL	MT	9/2011
308038-03598		4-2



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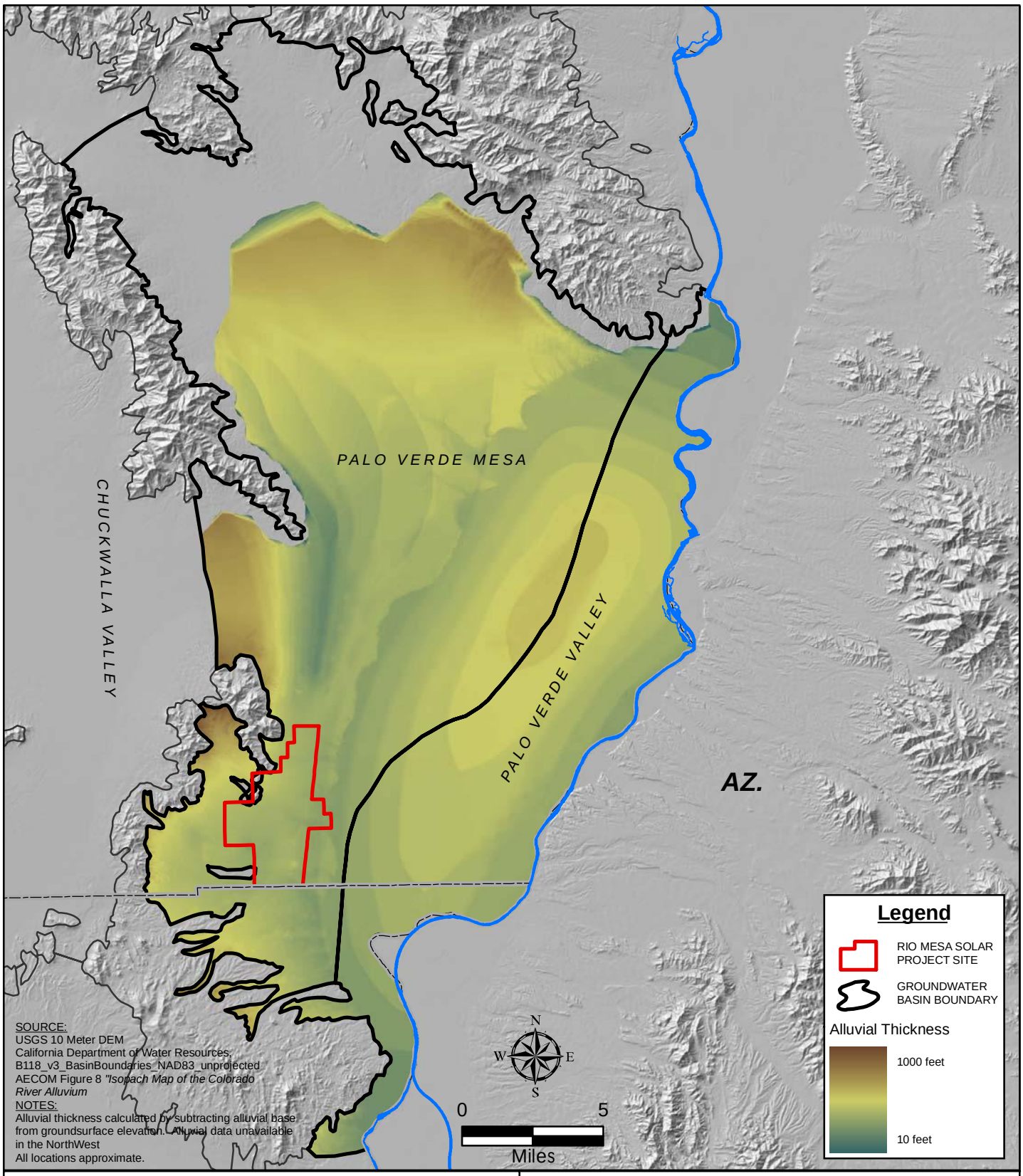
STRUCTURE CONTOUR MAP OF THE BASE OF ALLUVIAL DEPOSITS	SWL	MT	9/2011
	308038-03598	4-3	



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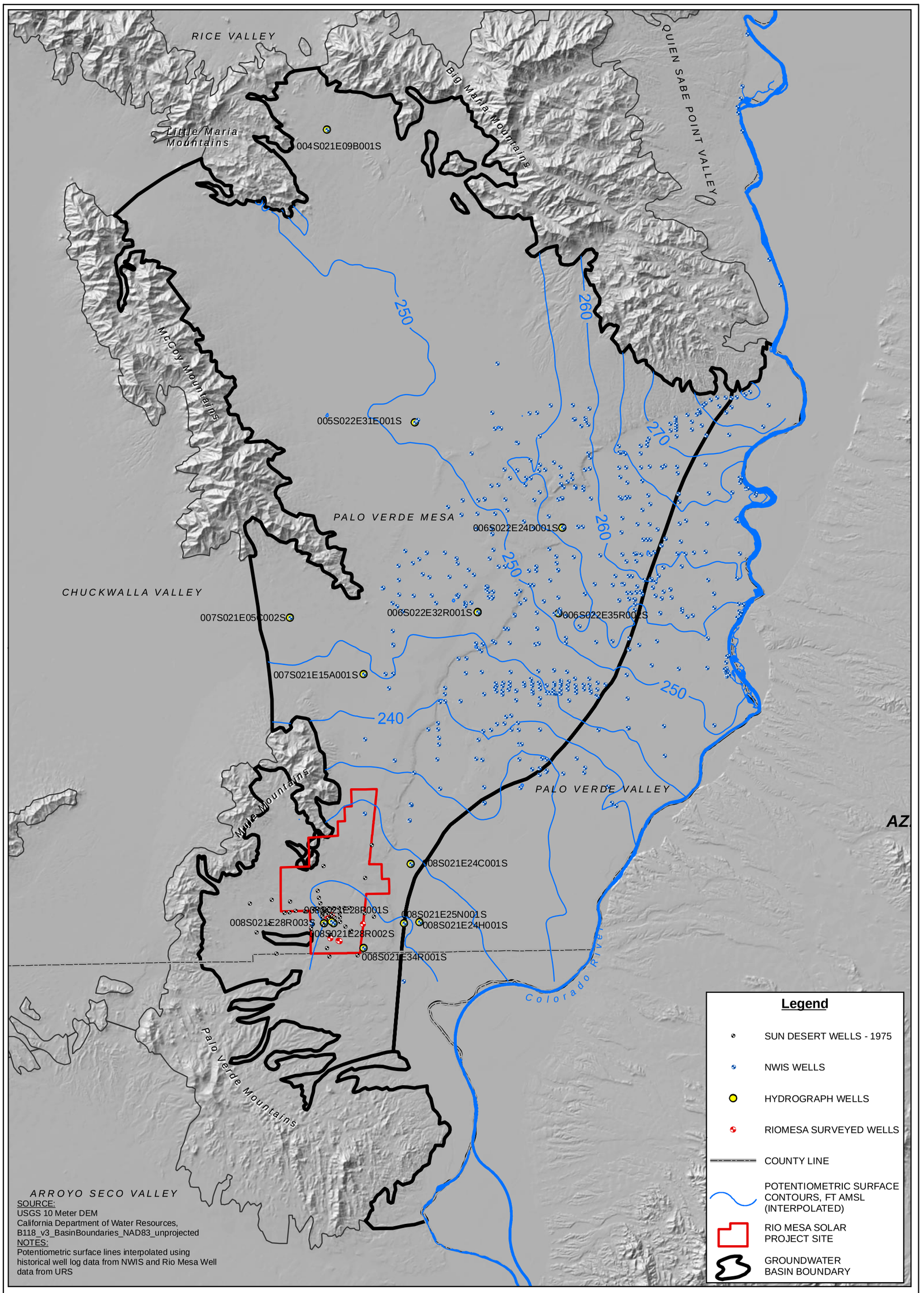
ISOPACH MAP THICKNESS
OF ALLUVIAL DEPOSITS

SWL	MT	9/2011
308038-03598	4-4	



SOURCE:
USGS 10 Meter DEM
California Department of Water Resources, B118_v3_BasinBoundaries_NAD83_unprojected
NOTES:
Potentiometric surface lines interpolated using historical well log data from NWIS and Rio Mesa Well data from URS

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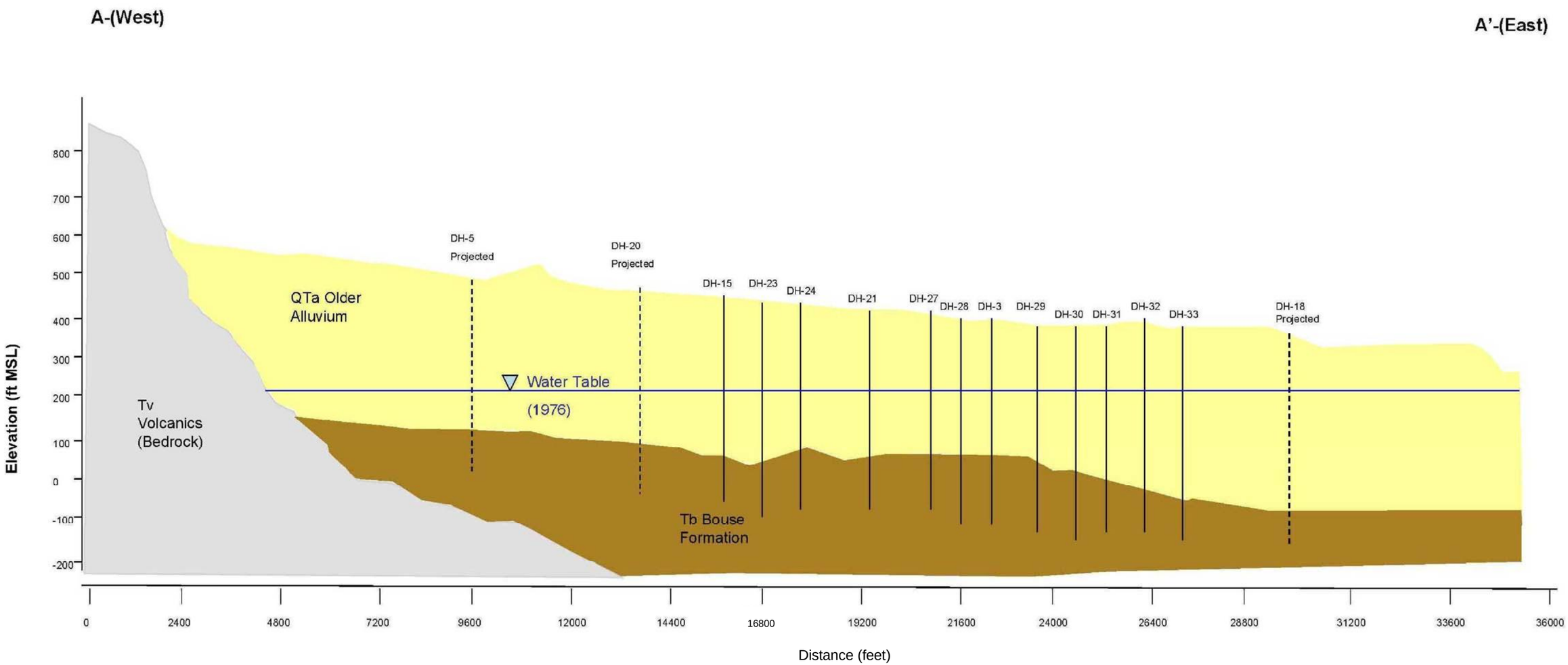
GROUNDWATER SURFACE ELEVATIONS
PALO VERDE MESA AND VALLEY GROUNDWATER BASINS

SWL	MT	9/2011
308038-03598		**4-5**



Vertical Exaggeration 10x

Modified from Stone and Webster, 1976

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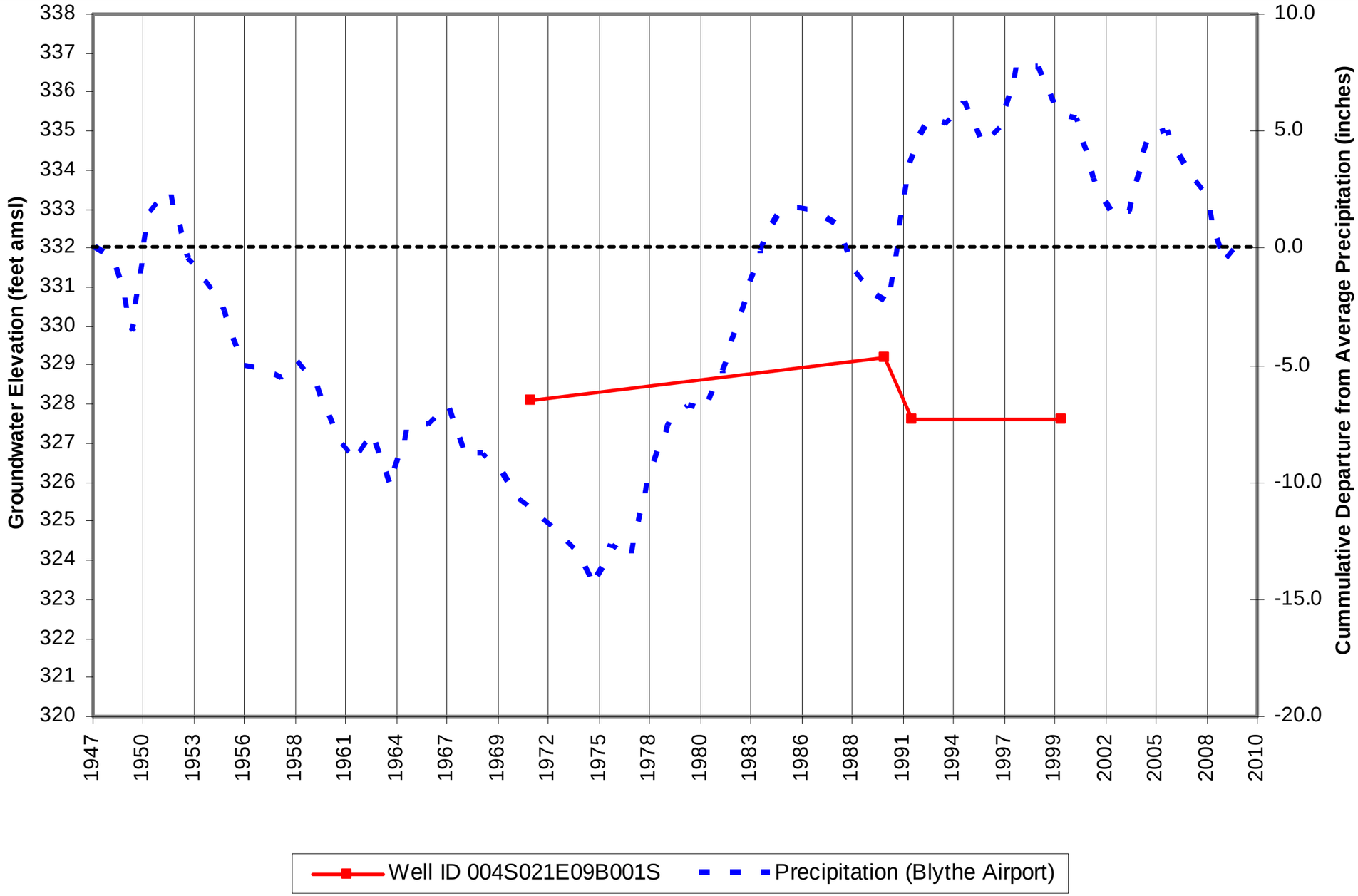
SIMPLIFIED GEOLOGIC CROSS-SECTION A - A', RMS SITE

SWL	MT	9/2011
308038-03598		**4-6**



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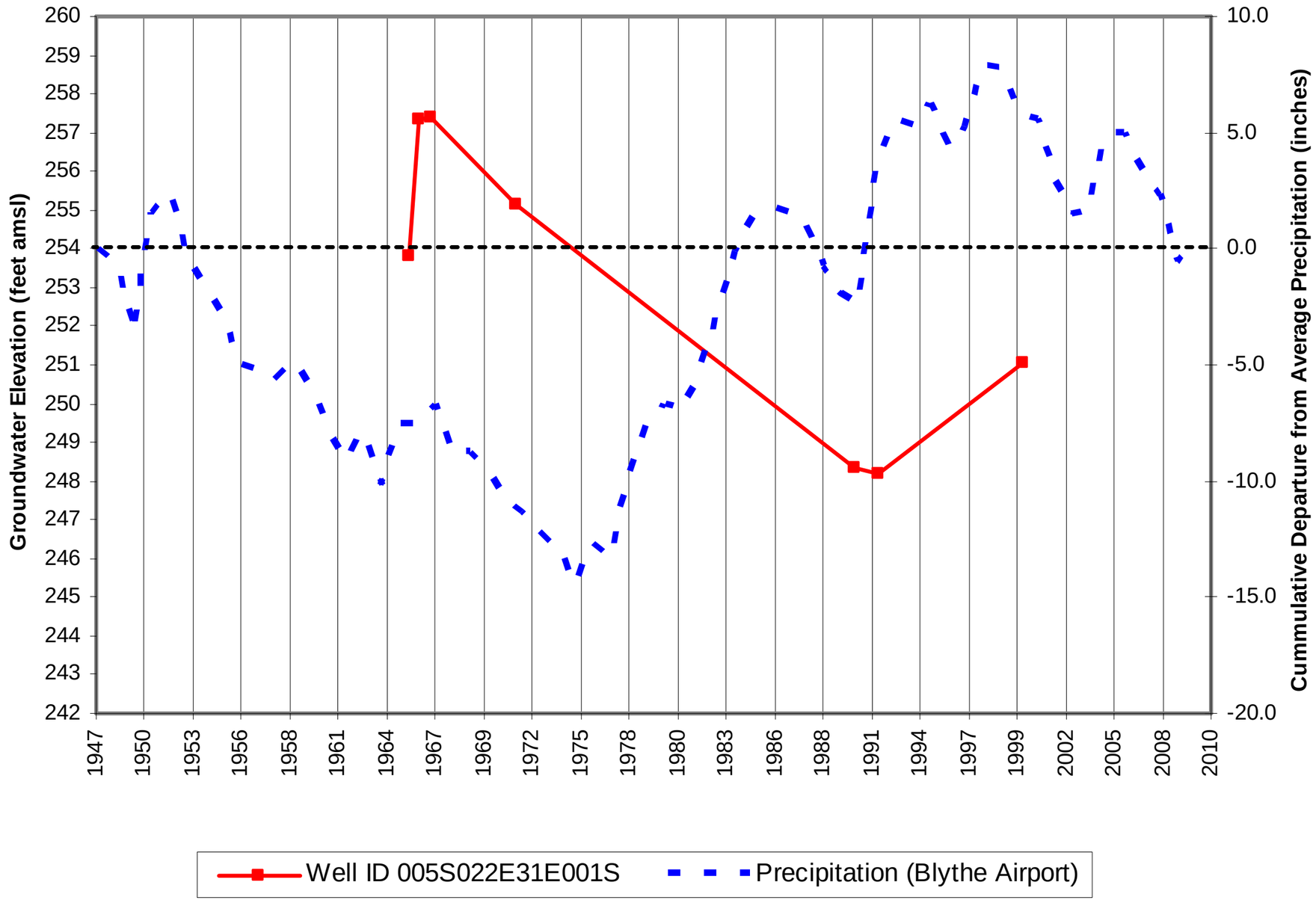
WELL ID 004S021E09B001S
GROUNDWATER LEVELS VS. PRECIPITATION TREND

SWL	MT	9/2011
308038-03598		**4-7-1**



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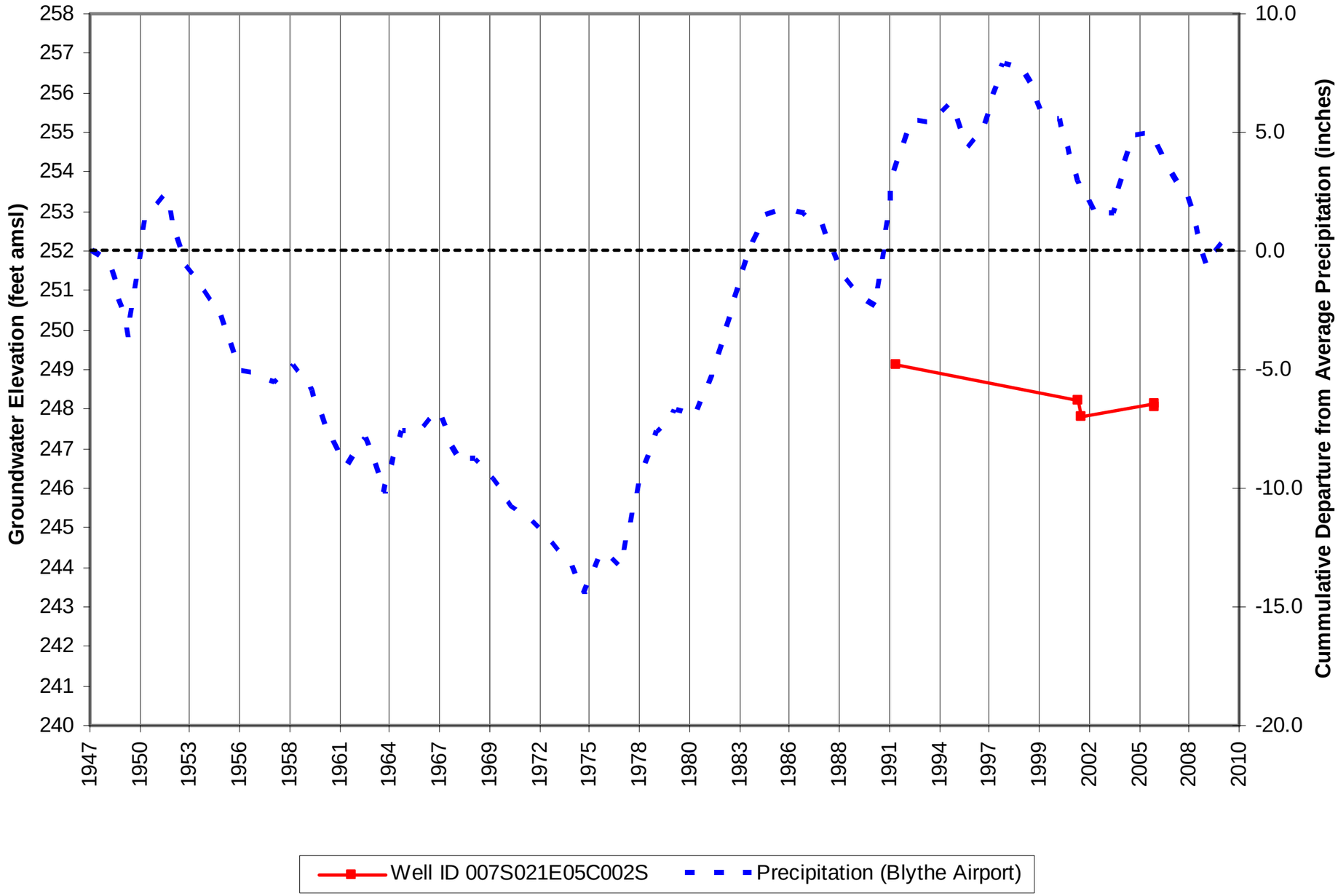
GROUNDWATER LEVELS VS. PRECIPITATION TRENDS

SWL	MT	9/2011
308038-03598		**4-7-2**



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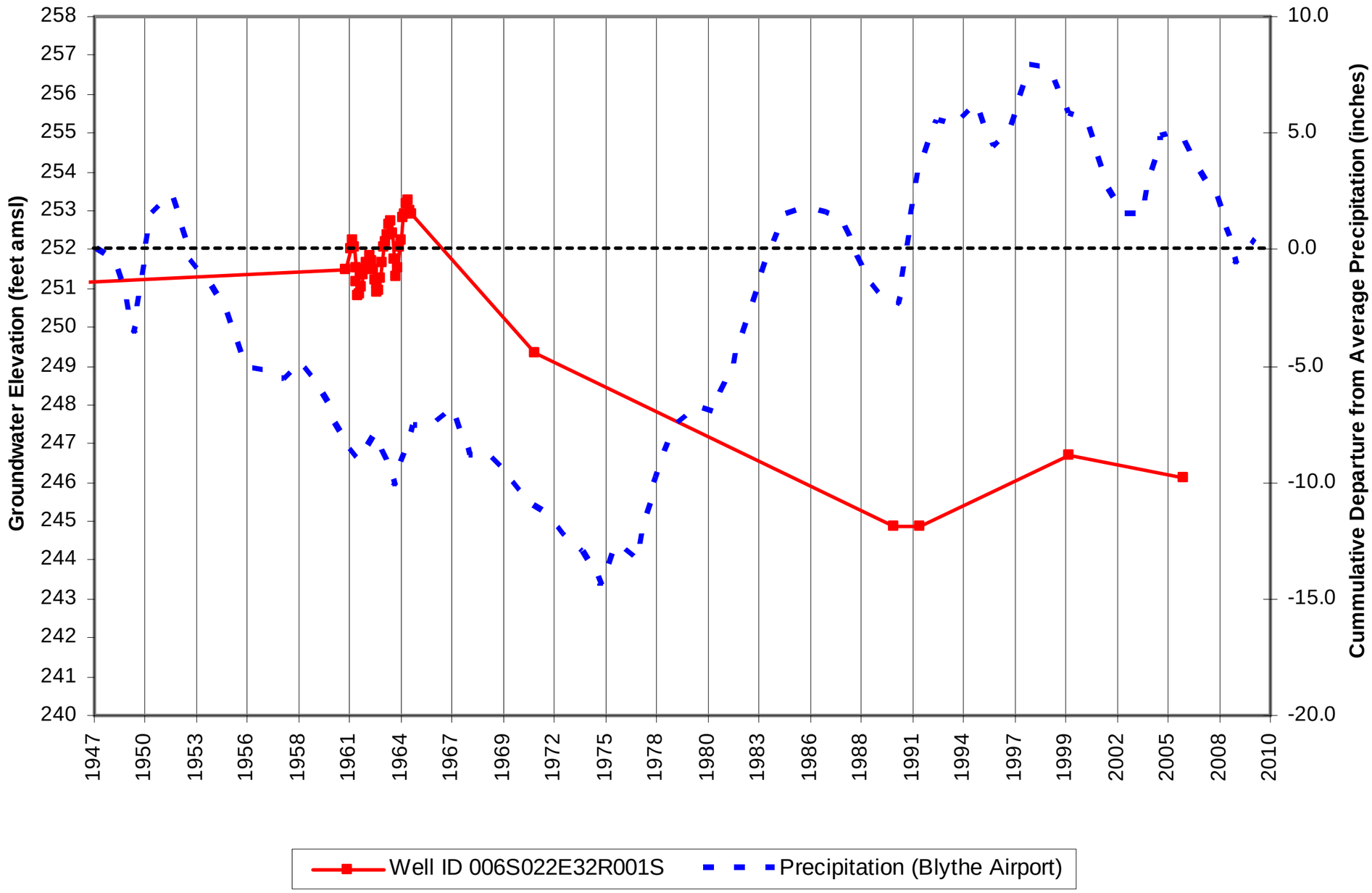
GROUNDWATER LEVELS VS. PRECIPITATION TRENDS

SWL	MT	9/2011
308038-03598		**4-7-3**



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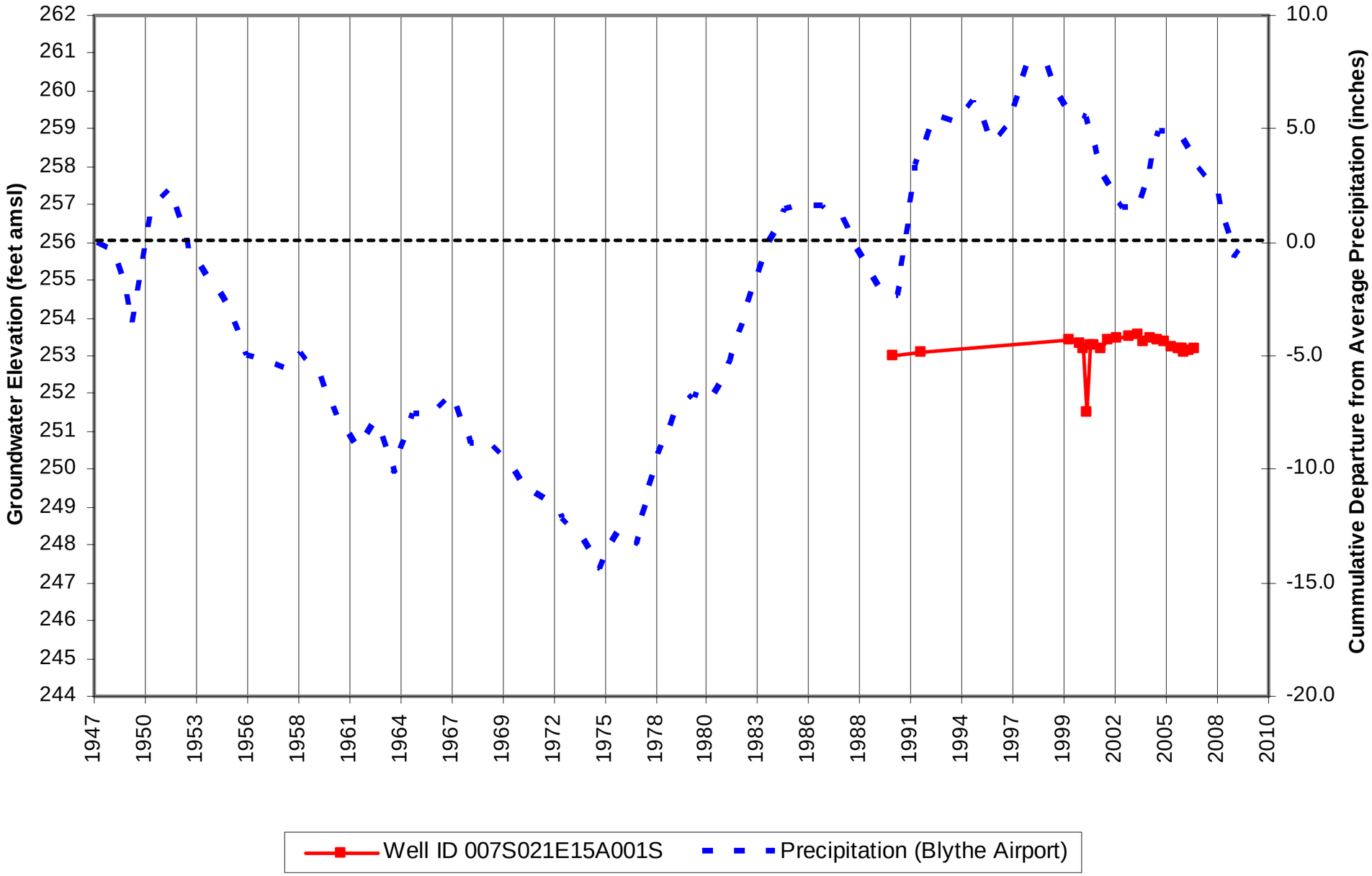
GROUNDWATER LEVELS VS. PRECIPITATION TRENDS

SWL	MT	9/2011
308038-03598		**4-7-4**



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GROUNDWATER LEVELS VS. PRECIPITATION TRENDS

SWL	MT	9/2011
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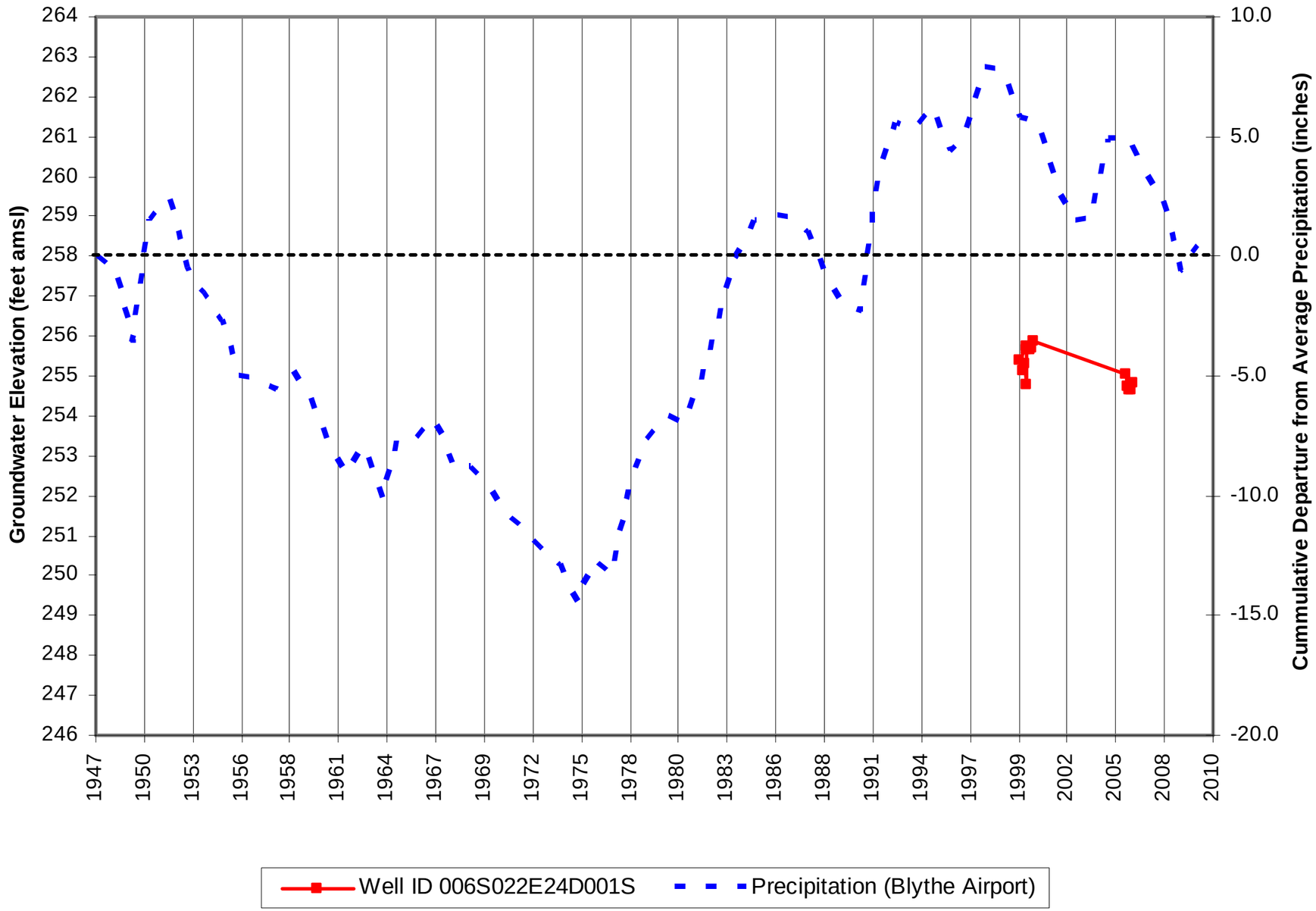

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GROUNDWATER LEVELS VS. PRECIPITATION TRENDS

SWL	MT	9/2011
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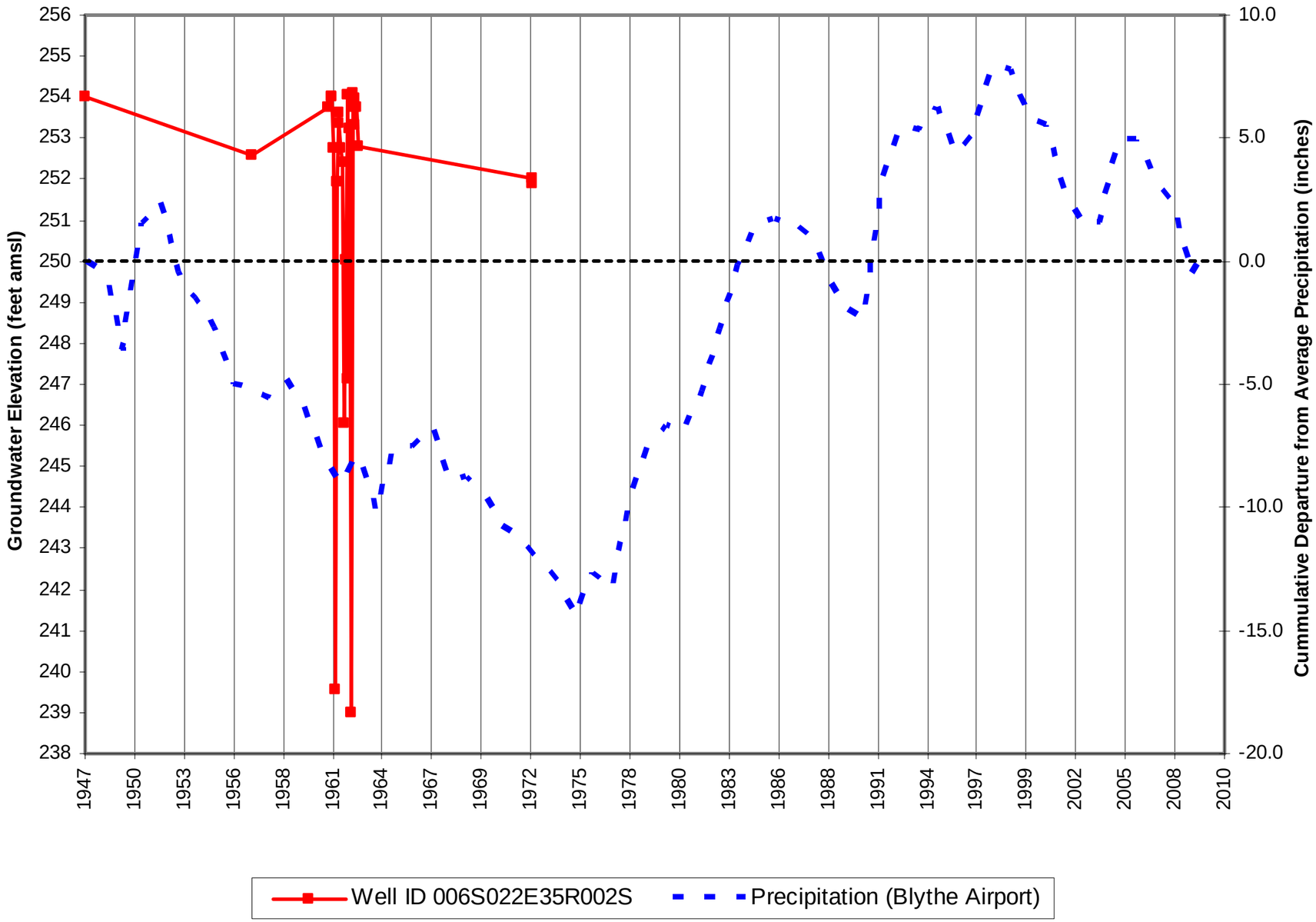

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GROUNDWATER LEVELS VS. PRECIPITATION TRENDS

SWL	MT	9/2011
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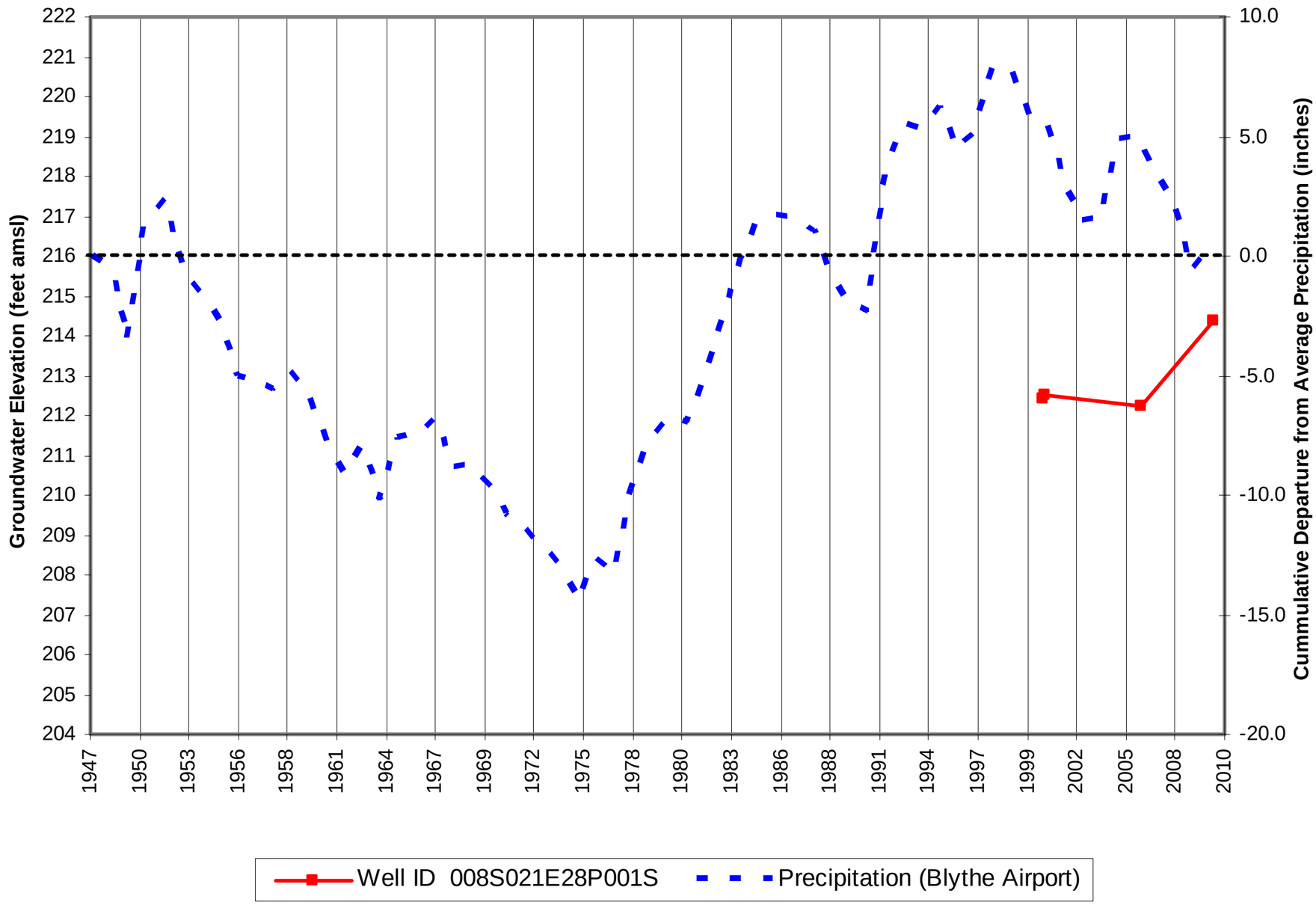

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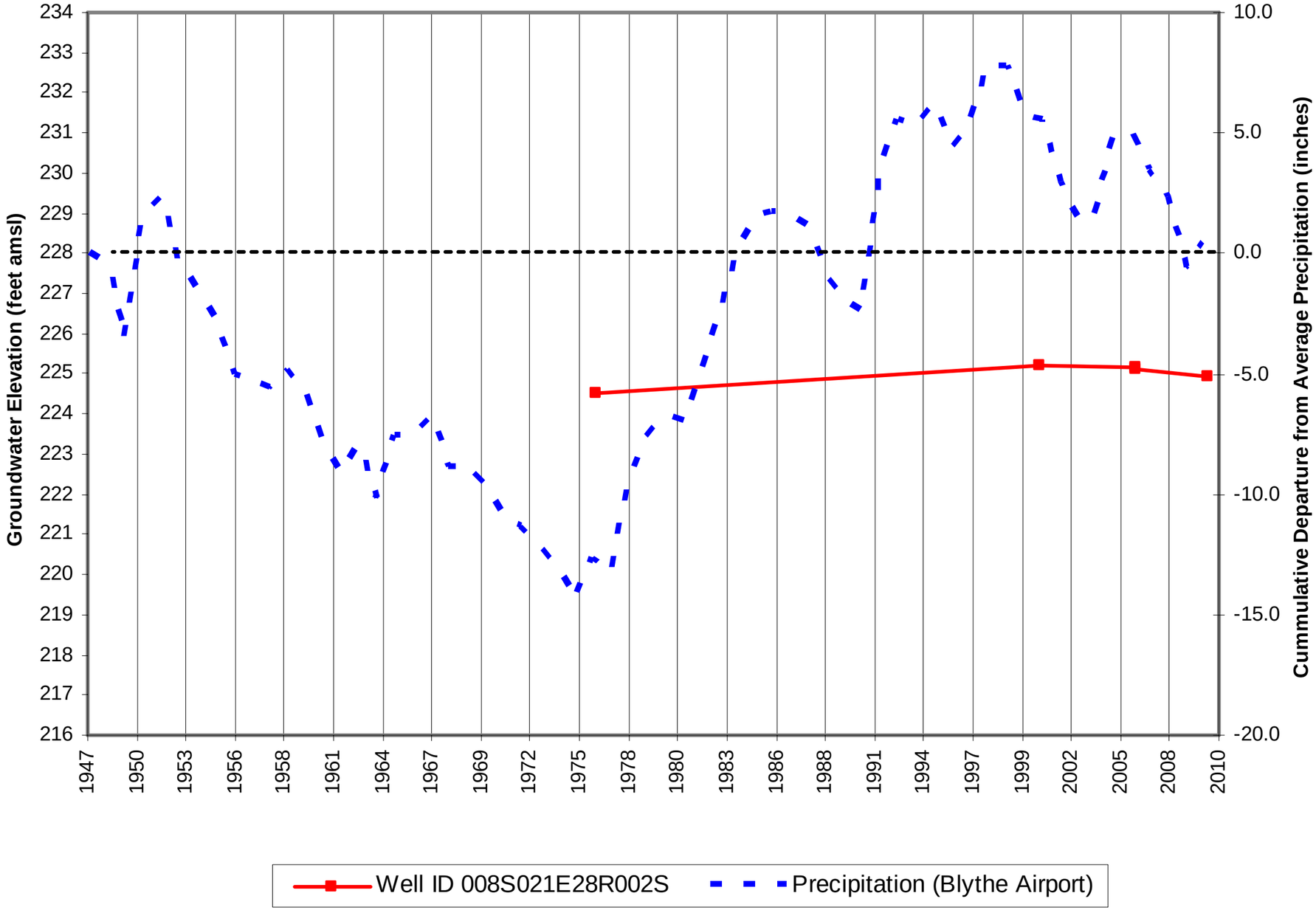
WELL ID 008S021E28P001S
GROUNDWATER LEVELS VS. PRECIPITATION TRENDS

SWL	MT	9/2011
308038-03598		**4-7-8**



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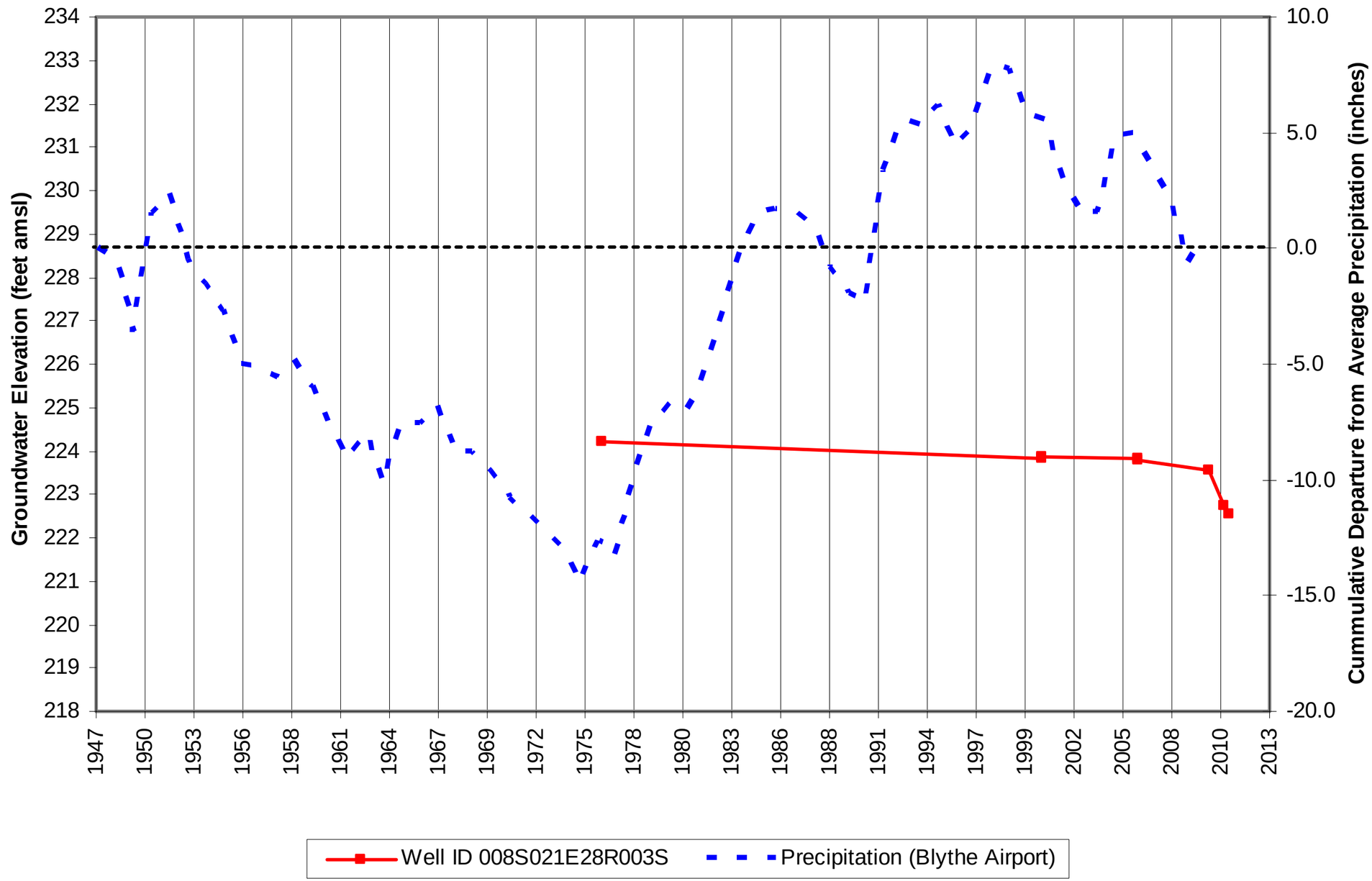
WELL ID 008S021E28R002S
GROUNDWATER LEVELS VS. PRECIPITATION TRENDS

SWL	MT	9/2011
308038-03598		**4-7-9**



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WELL ID 008S021E28R003S
GROUNDWATER LEVELS VS. PRECIPITATION TRENDS

SWL	MT	9/2011
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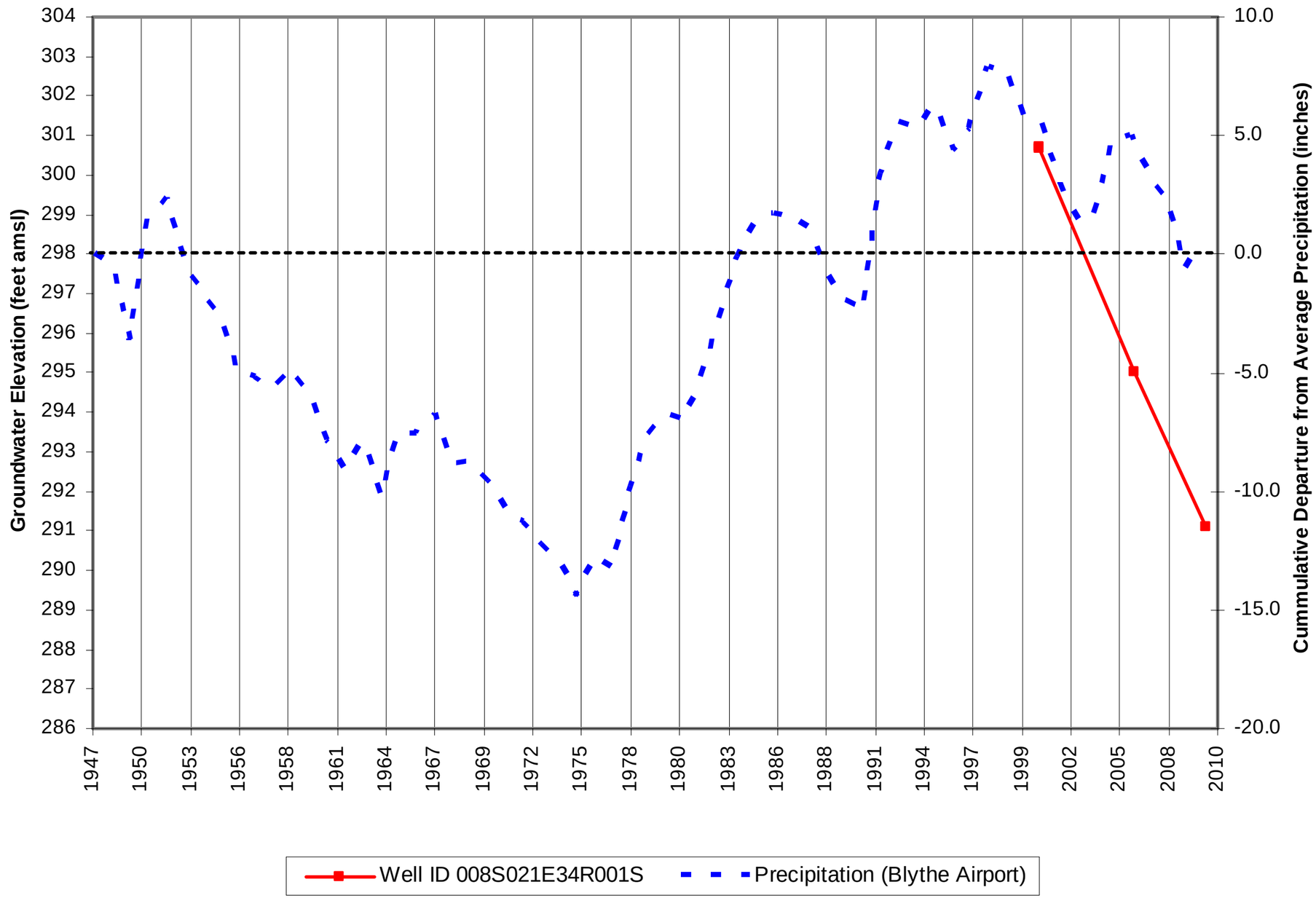

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GROUNDWATER LEVELS VS. PRECIPITATION TRENDS

SWL	MT	9/2011
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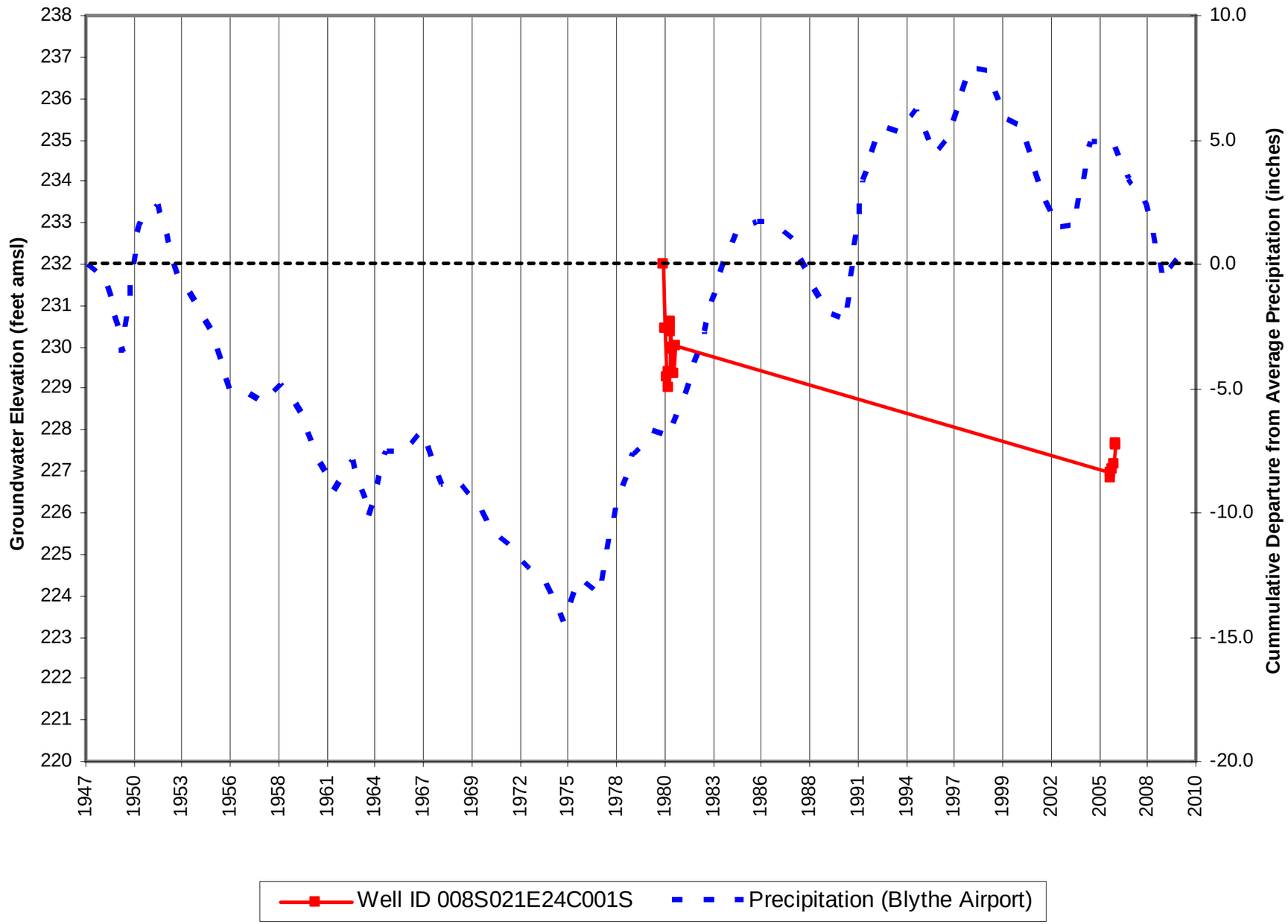

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POWER PROJECT

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GROUNDWATER LEVELS VS. PRECIPITATION TRENDS

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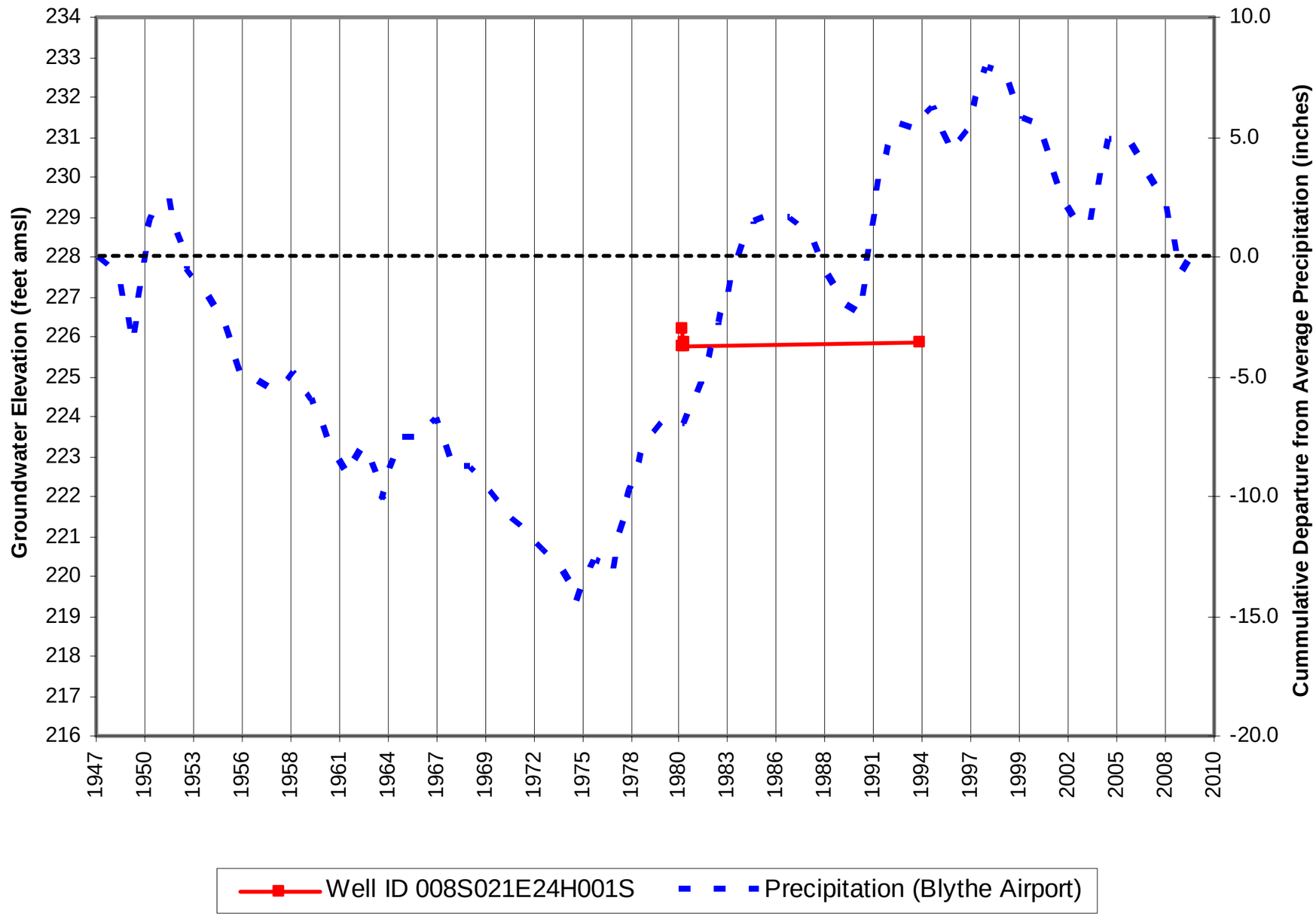

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POWER PROJECT

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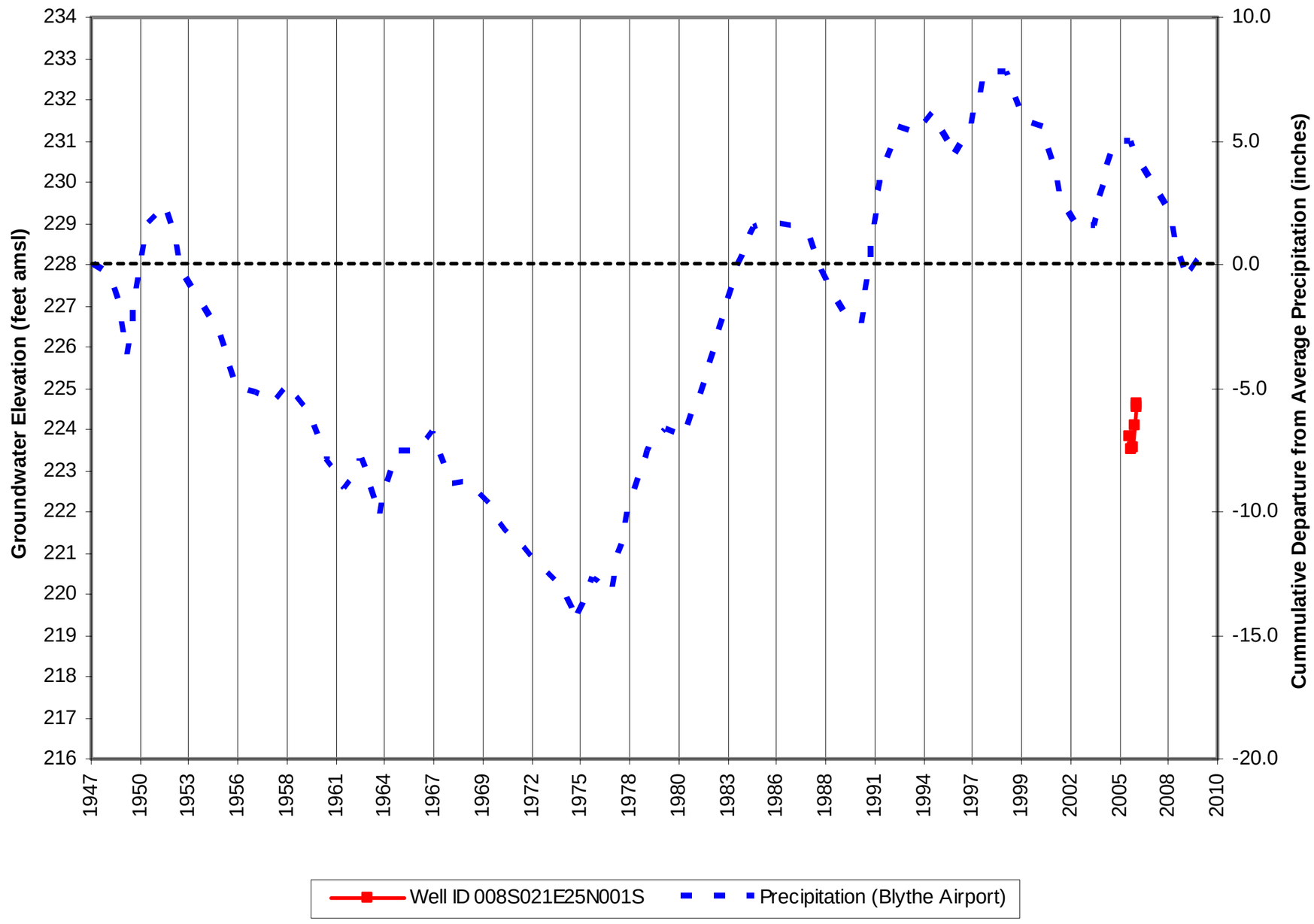
WELL ID 008S021E24H001S
GROUNDWATER LEVELS VS. PRECIPITATION TRENDS

SWL	MT	9/2011
308038-03598	**4-7-13**	

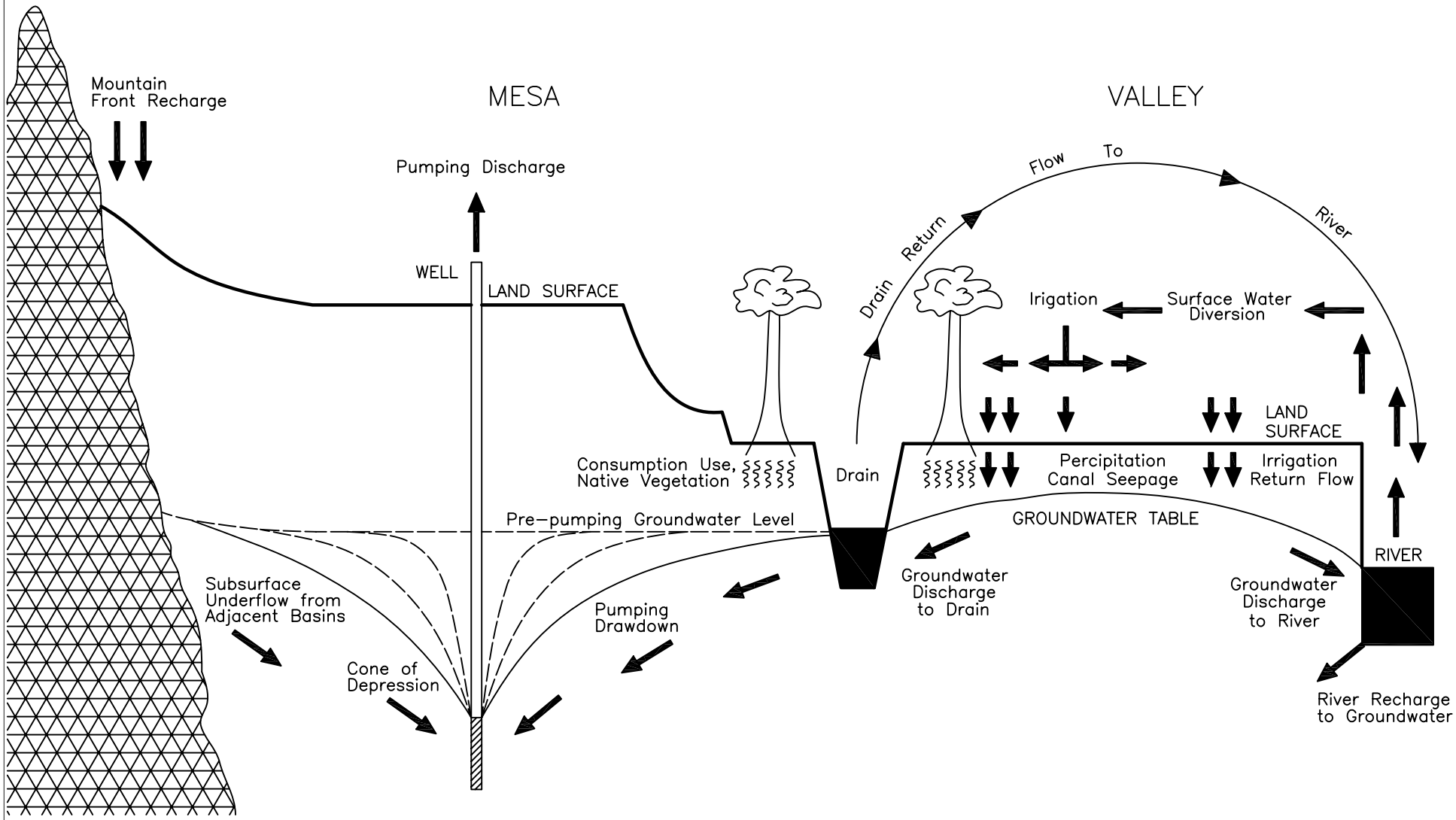


RIO MESA SOLAR
POWER PROJECT

WorleyParsons
resources & energy

WELL ID 008S021E25N001S
GROUNDWATER LEVELS VS. PRECIPITATION TRENDS

SWL	MT	9/2011
308038-03598	**4-7-14**	



RIO MESA SOLAR POWER PROJECT
BRIGHTSOURCE ENERGY, INC.

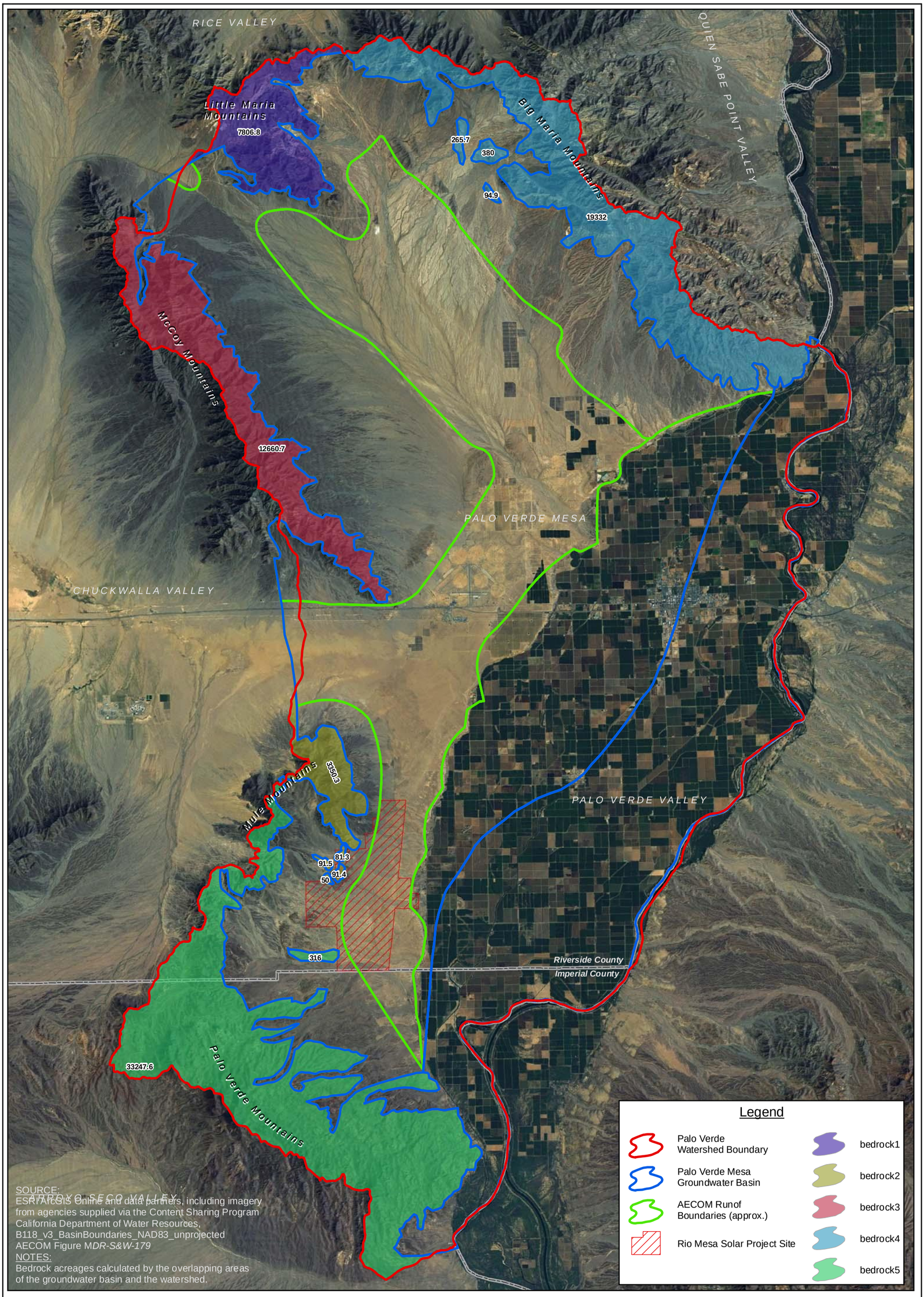
WorleyParsons
resources & energy

SCHEMATIC ILLUSTRATION OF MAIN WATER BUDGET COMPONENTS

DRAWN BY:	APPROVED:	DATE:
MH	MT	9/2011

308038–03598

6-1



SOURCE:
ESRI ArcGIS Online and data partners, including imagery from agencies supplied via the Content Sharing Program
California Department of Water Resources,
B118_v3_BasinBoundaries_NAD83_unprojected
AECOM Figure MDR-S&W-179
NOTES:
Bedrock acreages calculated by the overlapping areas of the groundwater basin and the watershed.

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RIO MESA SOLAR
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DISTRIBUTION OF RUNOFF TYPES AND AREAS

SWL	MT	9/2011
308038-03598		**6-2**

APPENDICES

APPENDIX 1. GROUNDWATER QUALITY DATA

APPENDIX 1A. GROUNDWATER QUALITY DATA, URS 2011

Table 1
Groundwater Analytical Results
BrightSource – Rio Mesa Solar

Analyte	Well #28R003S			Well #28Q002S 1/26/11	Primary/ Secondary MCL
Date Sampled	1976[a]	1/26/11	5/11/11		
Title 22 Metals:					
Antimony	NA	<0.000380	<0.000380	<0.000380	0.006
Arsenic	NA	0.00919	0.0129	<0.000589	0.01
Barium	NA	0.0184	0.0269	0.0845	1.0
Beryllium	NA	<0.000131	<0.000131	<0.000131	0.004
Cadmium	NA	<0.000266	<0.000266	<0.000266	0.005
Chromium	NA	0.00151	0.00138	0.00351	0.05
Cobalt	NA	<0.000618	<0.000140	0.00027J	NE
Copper	NA	0.00054 J	0.00121	0.0483	1.0*
Lead	NA	<0.000170	<0.000170	0.00033J	0.015
Mercury	NA	<0.0000348	<0.0000348	<0.0000348	0.002
Molybdenum	NA	0.0438	0.0589	0.0249	NE
Nickel	NA	0.00067J	0.00164	0.0117	0.1
Selenium	NA	<0.000554	0.00461	0.00173	0.05
Silver	NA	<0.000120	<0.000120	<0.000120	0.1*
Thallium	NA	<0.000498	<0.000498	<0.000498	0.002
Vanadium	NA	<0.000790	<0.000790	<0.000790	NE
Zinc	NA	0.00635	0.0101	0.350	5.0
Base Cations:					
Calcium	56	18.3	36.2	89.8	NE
Magnesium	5	2.27	3.70	19.1	NE
Sodium	580	511	615	363	NE
Potassium	11	5.02	6.81	5.28	NE
Other Metals:					
Aluminum	NA	<0.0105	<0.0105	<0.0105	0.2*
Iron	0.08	0.321	0.250	0.0618	0.3*
Manganese	NA	0.00782	0.0188	0.00991	0.05*
Anions:					
Fluoride	3.8	4.2	4.2	0.41	2.0
Chloride	604	740	730	470	250*
Nitrate (as N)	2	<0.017	0.0045	0.070J	10
Total Alkalinity (as CaCO3)	160[b]	74.0	95.0	124	NE
Sulfate	450	390	420	410	250*
o-Phosphate (as P)	NA	<0.014	<0.047	<0.014	NE
Bicarbonate (as CaCO3)	140	74.0	95.0	124	NE
Hydroxide (as CaCO3)	NA	<0.85	<0.85	<0.85	NE

Table 1
Groundwater Analytical Results
BrightSource – Rio Mesa Solar
(Continued)

Analyte	Well #28R003S			Well #28Q002S 1/26/11	Primary/ Secondary MCL
Date Sampled	1976[a]	1/26/11	5/11/11		
Silica:					
Total	32	19.000	36.6	15.000	NE
Dissolved	NA	17.000	34.7	14.000	NE
Colloidal (Reactive)	NA	19	30	15	NE
General Water Quality Parameters:					
SC (umhos/cm)	2900	2900	2600	2300	900*
TDS	1815	1850	1840	1570	500*
pH (unitless)	7.7	8.60	8.12	7.27	NE
Turbidity (NTU)	0	14	4.8	5.6	NE
TSS	5	5.4	5.9	8.9	NE
Phosphorus	NA	0.27	0.12	0.35	NE
Carbon Dioxide	NA	<1.0	1.5	12	NE
Total Organic Carbon (TOC)	NA	NA	0.12	NA	NE
Other Priority Pollutants:					
Cyanide	NA	<0.050	<0.0070	<0.050	NE
SVOCs: Bis(2-Ethylhexyl) Phthalate (ug/l)	NA	<10	ND	2.3J	NE
OCPs	NA	ND	ND	ND	NE
PCBs	NA	ND	ND	ND	NE
VOCs: Toluene (ug/l)	NA	ND	1.4	ND	NE

Notes:

[a] From Stone & Webster, 1976. Represents average concentrations for five samples collected during aquifer testing.
[b] Reported as total hardness (as CaCO3)
J: Analyte was detected at a concentration below the reporting limit and above the laboratory method detection limit. Reported value is estimated.
NA: Not Analyzed
NE: None Established
ND: None detected; see lab report for detection limits for specific compounds.
SVOCs: Semivolatile organic compounds
OCPs: Organochlorine pesticides
PCBs: Polychlorinated biphenyls
VOCs: Volatile organic compounds
MCL: Maximum Containment Level.
MCL is primary, unless indicated with an asterisk (*) that indicates secondary.
BOLD indicates concentration is above MCL.
The symbol "<" (less than) indicates the constituent was not detected above the analytical detection limit specified.

APPENDIX 1B. GROUNDWATER QUALITY DATA, STONE AND WEBSTER 1976

TABLE 3-2 (CONT'D)

CHEMICAL ANALYSIS OF GROUNDWATER IN PALO VERDE AND CIBOLA VALLEYS *

WELL LOCATION	DATE SAMPLED	TEMPERATURE (°C)	GEOLOGIC SOURCE	SILICA (SiO_2) (mg/l)	CALCIUM (Ca) (mg/l)	MAGNESIUM (Mg) (mg/l)	SODIUM AND POTASSIUM (Na + K) (mg/l)	BICARBONATE (HCO_3) (mg/l)	SULFATE (SO_4) (mg/l)	CHLORIDE (Cl) (g/l)	FLUORIDE (F) (mg/l)	NITRATE (NO_3) (mg/l)	DISSOLVED SOLIDS (Sum) (mg/l)	HARDNESS AS $CaCO_3$: CALCIUM, MAGNESIUM (mg/l)	HARDNESS AS $CaCO_3$: NON-CARBONATE (mg/l)	SPECIFIC CONDUCTANCE (Micromhos at 25°C)	pH	PERCENT SODIUM	REMARKS
(B-1-23)				37	318	65	572	240	725	950	1.0		2800	1060	863	4380	7.2	54	Y
28bdc	12-21-64		CA	1	320	154	1920	23	1350	2960			6720	1480	1410	10700	8.2	74	Y
31cdc	12-13-62		CA	17	88	25	162	304	170	175			789	322	72	1330	7.5	52	
(B-2-22)				21	254	54	735	598	1180	525			3060	855	364	4240	7.6	65	
9cba	2-9-62		CA	21	170	70	329	548	675	194			1730	710	260	2650	7.1	50	
(B-3-22)				19	153	42	163	352	417	132	.5		1100	556	268		7.7	39	Y
22bbb	4-24-62		CA	37	91	10	343	202	190	462			1230	268	102	2250	8.1	74	
27bbb	4-24-62		CA	36	40	4	195	267	130	133			672	118		1110	8.0	78	
(B-4-22)				28	353	821	134	372	952	1360			3830	1430	1120	5940	7.3	56	A, Boron-.42
2bca	6-18-64	22	CA	38	414	101	829	300	1020	1380			3930	1450	1200	6220	7.7	55	Y
(C-1-23)				36	149	70	299	556	462	265			1560	660	204	2390	8.1	50	
19caa	12-14-61		CA	11	255	12	457	22	1020	425			2190	685	667	3160	7.7	59	Y
30aca	12-14-61		CA																
(C-1-24)																			
36bbb	6-14-63	22	CA																
(C-2-23)																			
19adc																			
19dcd	11-19-62		CA																
SS/22E-																			
28C1	2-8-62	32	CA																

NOTE:

Metzger, et al. Geohydrology of the Parker-Blythe-Cibola Area, Arizona and California. U.S. Geol. Survey, Prof. Paper 486G, 130 pp., 1973.

TABLE 3-2 (CONT'D)

CHEMICAL ANALYSIS OF GROUNDWATER IN PALO VERDE AND CIBOLA VALLEYS *

WELL LOCATION	DATE SAMPLED	TEMPERATURE (°C)	GEOLOGIC SOURCE	SILICA (SiO_2) (mg/l)	CALCIUM (Ca) (mg/l)	MAGNESIUM (Mg) (mg/l)	SODIUM AND POTASSIUM (Na + K) (mg/l)	BICARBONATE (HCO_3) (mg/l)	SULFATE (SO_4) (mg/l)	CHLORIDE (Cl) (mg/l)	FLUORIDE (F) (mg/l)	NITRATE (NO_3) (mg/l)	DISSOLVED SOLIDS (Sum) (mg/l)	HARDNESS AS $CaCO_3$: CALCIUM, MAGNESIUM (mg/l)	HARDNESS AS $CaCO_3$: NON-CARBONATE (mg/l)	SPECIFIC CONDUCTANCE (Micromhos at 25°C)	pH	PERCENT SODIUM	REMARKS
28C1	10-25-62	32	CA	116	268	9	439	38	972	435		3.8	2160	705	674	3090		68	A, Boron-1.2
33J1	3-16-62	31	CA	29	128	2.1	316	58	380	395	2.2	9.7	1290	328	280	2090	7.2	66	A, Boron-.48 Y
	10-26-62		CA	24	122	7.4	302	50	375	395	1.7		1250	315	294	2200	7.35	82	T, boron-1.2 Y
35A1	2-10-66	31	CA	18	68	5	376	122	330	405	1.8		1300	190	90	2160	7.4	76	T, boron-1.3
35M1	1-27-64	31	CA	19	84	2.1	315	82	338	340	1.9		1140	218	151	1940	7.6	79	
	2-10-66	31	CA	20	110	1.8	376	80	365	415	1.7		1300	282	217	2150	7.6		USSAL
68/21E-																		85	
36M1	7-15-54		CA		108	24	927	104	1060	845	4.0		3020	368	283	4700	7.6		A
36R2	5-23-61	24	CA	33	35	8	451	120	404	396	2.4	7.9	1400	120	22	2310	7.7	88	
68/22E-																			
1M1	2-9-66		CA	16	20	8.8	230	244	150	161	1.2		709	86		1210	7.7	85	A, boron-.29
2P1	5-14-64		CA	15	21	6	214	201	120	178	1.7	.6	640	76		1150	8.2	85	P, Boron-.34 Y
9P2	6-13-67	32	CA	16	154	9.4	422	34	475	578			1670	430	392	2920	7.5	69	Y
11M1	6-19-64	27	CA	22	108	39	253	224	312	332	1.0		1180	428	244	2060	7.2	56	Y
12Z1	10-22-64		CA		106	37	334	238	404	373			1370	415	220	2300		64	USSAL
12F1	1-5-61		CA		100	35	313	255	404	324	.8		1300	395	184		8.0	63	CALIF.
11R1	3-27-67	24	CA	21	138	56	295	288	450	369	.9		1470	575	339	2420	7.7	53	Y
11R2	3-21-67	24	CA	39	124	84	270	436	575	202	.9		1510	655	293	2400	7.5	47	
13Q1	3-23-67	22	CA	22	108	39	138	324	262	135	.5		867	430	164	1450	7.5	41	Y
13Q2	3-23-67	21	CA	20	126	69	358	304	800	208	1.3		1730	600	350	2630	7.7	56	
14L1	3-31-67	24	CA	24	135	59	315	300	500	352	1.0		1540	580	334	2600	7.7	54	Y

NOTE:

Metzger, et al. Geohydrology of the Parker-Blythe-Cibola Area, Arizona and California. U.S. Geol. Survey, Prof. Paper 486G, 130 pp., 1973.

TABLE 3-2 (CONT'D)

CHEMICAL ANALYSIS OF GROUNDWATER IN PALO VERDE AND CIBOLA VALLEYS*

WELL LOCATION	DATE SAMPLED	TEMPERATURE (°C)	GEOLOGIC SOURCE	SILICA (SiO_2) (mg/l)	CALCIUM (Ca) (mg/l)	MAGNESIUM (Mg) (mg/l)	SODIUM AND POTASSIUM (Na + K) (mg/l)	BICARBONATE (HCO_3) (mg/l)	SULFATE (SO_4) (mg/l)	CHLORIDE (Cl) (mg/l)	FLUORIDE (F) (mg/l)	NITRATE (NO_3) (mg/l)	DISSOLVED SOLIDS (Sum) (mg/l)	HARDNESS AS $CaCO_3$: CALCIUM, MAGNESIUM (mg/l)	HARDNESS AS $CaCO_3$: NON-CARBONATE (mg/l)	SPECIFIC CONDUCTANCE (Micromhos at 25°C)	pH	PERCENT SODIUM	REMARKS
14L2	3-31-67	24	CA	22	134	60	319	300	500	358	.9		1540	580	334	2590	7.7	54	
15M1	6-12-63	27	CA	19	35	8.9	251	196	189	222	3.8	.2	822	124		1400	8.1	81	A, Boron-.45
15Q1	9-16-63	33	CA	17	23	.1	257	240	150	183	2.3		752	58		1320	7.9	91	Y
20A1	6-15-67	31	CA	30	55	10	223	76	212	268	1.8		838	180	118	1510	8.0	73	Y
26E1	3-28-67	23	CA	16	135	59	127	240	350	208	.8		1020	580	383	1740	7.8	32	Y
26E2																			
26G1	3-28-67	22	CA	20	159	60	193	332	500	191	.8		1290	645	373	2080	7.7	39	Y
26G2	3-28-67	22	CA	22	146	74	140	248	500	175	1.3		1180	670	466	1930	7.5	31	
28G1	2-9-66	31	CA	18	38	8.5	268	217	220	245	2.9		930	130		1550	7.7	64	T, Boron-.63
31Z1	10-17-17		CA	39	38	64	365	111	324	343		.7	1170	121	30			87	W
32F1	5-23-61		CA	32	24	11	248	116	220	207	2.5	11	813	104	9	1340		83	A
32K1	1954		CA				283	101		296				174	92	1670			USSAL
	5-23-61		CA	24	62	17	324	86	374	330			1180	224	154	1960		76	N, Boron-1.2
32N1	6-11-63	31	CA	22	67	24	427	204	575	301	1.7		1520	266	98	2310	7.6	78	Y
33R1	1960		CA		86	17	341	127	366	391	1.7	1.0	1270	284	180	2150	7.7	72	USSAL
34L1	5-25-61		CA	16	81	26	376	270	354	368	.6	.3	1350	310	88	2220	7.8	72	A
35M1	2-7-62		CA	8	57	20	207	250	181	199			797	224	19	1490	8.0	67	Y
35R1	1960		CA	24	76	28	157	268	170	177	.1		770	306	86	1200	8.0	53	?
35R2	10-23-62		CA	19	79	28	150	259	170	175	.5		752	310	100	1320	7.4	51	Y
6S/23E-29R1	2-7-61	25	CA	20	133	28	117	269	302	114	.4	.5	847	448	228	1290	7.6	35	A

NOTE:

Metzger, et al. Geohydrology of the Parker-Blythe-Cibola Area, Arizona and California. U.S. Geol. Survey, Prof. Paper 486G, 130 pp., 1973.

TABLE 3-2 (CONT'D)

CHEMICAL ANALYSIS OF GROUNDWATER IN PALO VERDE AND CIBOLA VALLEYS*

WELL LOCATION	DATE SAMPLED	TEMPERATURE (°C)	GEOLOGIC SOURCE	SILICA (SiO_2) (mg/l)	CALCIUM (Ca) (mg/l)	MAGNESIUM (Mg) (mg/l)	SODIUM AND POTASSIUM (Na + K) (mg/l)	BICARBONATE (HCO_3) (mg/l)	SULFATE (SO_4) (mg/l)	CHLORIDE (Cl) (mg/l)	FLUORIDE (F) (mg/l)	NITRATE (NO_3) (mg/l)	DISSOLVED SOLIDS (Sum) (mg/l)	HARDNESS AS $CaCO_3$: CALCIUM, MAGNESIUM (mg/l)	HARDNESS AS $CaCO_3$: NON-CARBONATE (mg/l)	SPECIFIC CONDUCTANCE (Micromhos at 25°C)	pH	PERCENT SODIUM	REMARKS
1L1	2-6-62		CA	7	40	11	129	218	100	102			498	146		852	7.9	66	Y
2D1	10-23-62	24	CA	21	143	38	163	338	375	141	.3	.6	1050	514	237	1610	7.5	41	Y, Boron-.14
2J1	9-14-60		CA		46	11	121	223	90	110	.2		491	161		817	7.8	62	Calif.
2M1	1960		CA		44	10	123	218	92	110	1.1		489	151			8.2	63	Calif.
2P1	10-23-62	26	CA	18	104	27	136	264	192	177	.5		787	372	156	1370	7.4	44	Y
2Z1	10-16-17		CA	23	69	22	92	297	81	95			530	263	19			43	W
2Z2	10-16-17		CA	29	76	20	87	297	79	96			535	272	28			41	W
2Z3	10-16-17		CA	29	51	23	108	295	81	92			532	222				52	W
3G1	2-7-62		CA	12	80	17	118	248	155	115			621	271	68	997	7.7	48	Y
3K1	2-7-62		CA	11	63	17	87	230	92	93			478	226	38	874	8.0	46	Y
3M1	2-7-62		CA	11	78	19	122	249	165	115			634	272	68	1010	7.7	49	Y
3N1	2-6-62		CA	13	124	34	128	308	317	102			872	448	196	1320	7.2	38	Y
7S/21E-1R1	2-8-66			24	85	29	893	59	460	150	6.4		2650	224	176	4490	7.9	90	T
1H1	3-1-66		F	45	150	14	1510	65	800	990	5.2		4550	430	376	7680	7.5	88	Y
7S/22E-3D1	3-29-67	22	CA	19	47	17	312	236	400	177		2.0	1090	186		1810	7.7	79	Y
3D2	3-30-67	25	CA	22	56	35	461	320	525	335	1.8		1600	284	22	2650	7.7	78	
3H1	3-10-67	23	CA	23	175	91	541	400	700	658	.9		2190	810	482	3900	7.4	59	Y
3H2	3-30-67	23	CA	20	98	55	148	216	400	139	.9		969	470	293	1570	7.4	41	
4P1	10-22-62	28	CA	25	124	46	559	168	700	602			2140	500	362	3790	7.3	71	Y

NOTE:

Metzger, et al. Geohydrology of the Parker-Blythe-Cibola Area, Arizona and California. U.S. Geol. Survey, Prof. Paper 486G, 130 pp., 1973.

TABLE 3-2 (CONT'D)

CHEMICAL ANALYSIS OF GROUNDWATER IN PALO VERDE AND CIBOLA VALLEYS*

WELL LOCATION	DATE SAMPLED	TEMPERATURE (°C)	GEOLOGIC SOURCE	SILICA (SiO_2) (mg/l)	CALCIUM (Ca) (mg/l)	MAGNESIUM (Mg) (mg/l)	SODIUM AND POTASSIUM (Na + K) (mg/l)	BICARBONATE (HCO_3) (mg/l)	SULFATE (SO_4) (mg/l)	CHLORIDE (Cl) (mg/l)	FLUORIDE (F) (mg/l)	NITRATE (NO_3) (mg/l)	DISSOLVED SOLIDS (Sum) (mg/l)	HARDNESS AS $CaCO_3$: CALCIUM, MAGNESIUM (mg/l)	HARDNESS AS $CaCO_3$: NON-CARBONATE (mg/l)	SPECIFIC CONDUCTANCE (Micromhos at 25°C)	pH	PERCENT SODIUM	REMARKS
8S/21E -																			
5D1	2-7-62		CA	14	108	26	140	293	225	147			806	378	138	1290	7.8	45	Y
11Q1	2-14-62			12	44	12	167	239	135	133			623	161		1080	7.9	69	Y
34Z1					80	29	183	258	134	250		1.0	856	319	106	1290	7.9	54	Calif.
7S/23E -																			
5E1	2-15-62			16	23	17	125	228	133	124			592	228	41	997	7.8	54	Y
17D1	2-14-62		CA	17	129	36	239	302	375	249			1200	468	220	1880	7.7	53	Y
17E1	2-14-62			13	172	54	321	322	575	345			1640	650	386	2410	7.5	52	Y
18A1	2-14-62		CA	12	120	34	179	218	231	291			976	440	261	1700	7.7	47	Y
21W1	2-15-62			11	36	9	174	242	140	113			604	125		1020	8.1	75	Y
29D1				19	156	37	285	277	342	398	.2	3.0	1380	540	313	2250	7.5	53	A
32W1	2-14-62			15	68	19	88	241	100	97			507	246	98	897	7.8	44	Y
8S/21E -																			
13A1	8-28-63	24	CA	30	29	12	743	271	730	517	8.0	.3	2200	123		3420	8.6	92	A,Boron-1.0
13A1	8-14-63	28	CA	28	256	43	2430	184	1600	3040			7490	815	664	11,700	7.6	87	Y,Zone (395-400)
24A1	2-13-63		CA	23	182	55	223	346	600	181	1.1		1440	680	396	2160	7.6	42	
8S/22E -																			
8D1	2-15-63		CA	22	191	59	172	340	538	180	.9		1330	720	441	1960	7.5	34	
17Z1	11-6-17		CA	20	63	20	146	281	175	101		1.5	665	240	8			57	W
19A1	3-63		CA	24	151	73	120	390	412	130	1.4		110	675	355	1770	7.3	28	
8S/23E -																			
6P1	2-8-62		CA	10	71	18	95	224	129	99			534	250	66	887	7.8	45	Y

NOTE:

TABLE 3-2 (CONT'D)

CHEMICAL ANALYSIS OF GROUNDWATER IN PALO VERDE AND CIBOLA VALLEYS*

WELL LOCATION	DATE SAMPLED	TEMPERATURE (°C)	GEOLOGIC SOURCE	SILICA (SiO_2) (mg/l)	CALCIUM (Ca) (mg/l)	MAGNESIUM (Mg) (mg/l)	SODIUM AND POTASSIUM (Na + K) (mg/l)	BICARBONATE (HCO_3) (mg/l)	SULFATE (SO_4) (mg/l)	CHLORIDE (Cl) (mg/l)	FLUORIDE (F) (mg/l)	NITRATE (NO_3) (mg/l)	DISSOLVED SOLIDS (Sum) (mg/l)	HARDNESS AS $CaCO_3$: CALCIUM, MAGNESIUM (mg/l)	HARDNESS AS $CaCO_3$: NON-CARBONATE (mg/l)	SPECIFIC CONDUCTANCE (Micromhos at 25°C)	pH	PERCENT SODIUM	REMARKS
7D1	2-14-62		CA	11	89	26	96	217	190	115			635	328	150	1040	7.6	39	Y
9S/21E -																			
1W1	2-7-63		CA	19	158	63	1640	572	1250	1740			5160	655	186	8170	7.9	84	
2J1	3-27-62	24	CA	20	510	153	4640	426	4150	5190			14,900	1900	1550	21,100	8.2	84	Y
2J3	3-27-62	24	CA	25	57	24	1540	608	1150	1340			4400	242		6950	7.9	93	Y
2J4	2-15-62		CA	8	98	79	892	571	1080	655			3100	570	102	4820	8.0	77	Y
2P1	5-7-63	24	CA	23	470	165	4560	600	3440	5450			14,400	1850	1360	21,100	7.4	84	Y
2Z1	11-6-17		CA	21	64	27	153	289	214	102			726	271	34			55	W
2Z2	5-11-50		CA		99	29	221	305	355	163			1020	366	116	1540		57	
2Z3	3-9-54		CA		76	24	238	325	338	134	2.8		975	288	22			63	Calif.
2Z4	3-9-54		CA		202	63	1456	471	1200	1460	1.8		4620	765	377		7.9	80	Calif.
2Z5	3-9-54		CA		178	60	520	395	652	570	1.1		2180	692	366		7.8	61	Calif.
2Z6	10-14-58		CA		164	60	424	432	570	412			1850	655	300			57	Calif.
2Z7	8-2-59		CA		164	33	559	270	860	480	5.0		2240	545	323		8.3	68	Calif.
2Z8	4-6-61		CA		169	54	548	483	508	655			2180	644	248		8.1	64	Calif.
2Z9	3-15-63		CA		138	44	413	359	517	410	1.2		1700	525	231		8.1	62	Calif.
3W1	3-15-63	26	CA	25	190	62	1190	121	850	1660			4040	730	631	6830	7.6	78	Y
3Z1	5-11-50				178	73	3800	180	1740	5010			11,000	744	596	16,800		92	Calif.
11A1	3-27-63	22	CA	21	310	123	3250	504	2550	3750			10,300	1280	856	15,600	7.6	85	Y
11A2	5-8-63	23	CA	21	41	13	1080	524	850	840			3100	156		5060	8.0	94	Y
11K1	3-26-63	21	CA	24	110	43	144	328	317	117			920	452	183	1470	7.7	41	Y

NOTE:

TABLE 3-2 (CONT'D)

CHEMICAL ANALYSIS OF GROUNDWATER IN PALO VERDE AND CIBOLA VALLEYS *

WELL LOCATION	DATE SAMPLED	TEMPERATURE (°C)	GEOLOGIC SOURCE	SILICA (SiO_2) (mg/l)	CALCIUM (Ca) (mg/l)	MAGNESIUM (Mg) (mg/l)	SODIUM AND POTASSIUM (Na + K) (mg/l)	BICARBONATE (HCO_3) (mg/l)	SULFATE (SO_4) (mg/l)	CHLORIDE (Cl) (mg/l)	FLUORIDE (F) (mg/l)	NITRATE (NO_3) (mg/l)	DISSOLVED SOLIDS (Sum) (mg/l)	HARDNESS AS $CaCO_3$: CALCIUM, MAGNESIUM (mg/l)	HARDNESS AS $CaCO_3$: NON-CARBONATE (mg/l)	SPECIFIC CONDUCTANCE (micromhos at 25°C)	pH	PERCENT SODIUM	REMARKS
23C1	7-29-63			26	780	378	6300	852	4600	8300	.7		20,800	3500	2800	29,500	7.2	80	A
24D1	5-9-63	22	CA	20	7.8	2.3	370	364	325	135	2.4		1040	29		1670	8.1	96	A

NOTE:

Metzger, et al. Geohydrology of the Parker-Blythe-Cibola Area, Arizona and California. U.S. Geol. Survey, Prof. Paper 486G, 130 pp., 1973.

TABLE 3-3

GROUNDWATER QUALITY BENEATH SUNDESERT NUCLEAR PLANT SITE

Constituent		mg/l
Calcium	(Ca)	56
Magnesium	(Mg)	5
Sodium	(Na)	580
Potassium	(K)	11
Ammonium	(NH4)	0
Bicarbonate	(HCO3)	140
Sulfate	(SO4)	450
Chloride	(Cl)	604
Nitrate	(NO3)	2
Phosphate	(PO4)	0
Silica		32
Total Hardness	(as CaCO3)	160
Fluoride	(F)	3.8
Boron	(B)	1.4
Iron	(FE)	0.08
Total Dissolved Solids	(TDS)	1,815
Suspended Solids		5
Turbidity	0 JTU	
Color	0 JTU	
pH	7.7	
Conductivity @ 25°C	2900 mhos/cm	

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Appendix 2

Groundwater Levels from Selected Wells in the Palo Verde Mesa and Valley Groundwater Basins
Genesis Solar, LLC

Well ID	Latitude	Longitude	Groundwater Basin	Measurement Date	Approximate Ground Surface Elevation (feet amsl)	Water Surface Elevation (feet amsl)	Depth to Water (feet bgs)	Max GW Elevation Difference (ft)	Well Depth (feet bgs)
008S021E34R001S	33.436222	-114.764397	Palo Verde Mesa	11/16/2000	340.1	300.72	39.38	9.63	91.64
				11/28/2000	340.1	300.67	39.43		
				3/28/2006	340.1	295.03	45.07		
				3/23/2010	340.1	291.09	49.01		
008S021E28R003S	33.449206	-114.781575	Palo Verde Mesa	3/31/1976	365.2	224.2	141	1.67	
				11/16/2000	365.2	223.84	141.36		
				11/28/2000	365.2	223.88	141.32		
				3/28/2006	365.2	223.83	141.37		
				3/29/2006	365.2	223.78	141.42		
				3/23/2010	365.2	223.56	141.64		
				1/26/2011	365.2	222.73	142.47		
				5/11/2011	365.2	222.53	142.67		
008S021E25N001S	33.448269	-114.739958	Palo Verde Valley	1/1/2006	233.8	223.82	9.98	1.1	13.17
				2/1/2006	233.8	223.50	10.30		
				3/1/2006	233.8	223.55	10.25		
				4/1/2006	233.8	224.09	9.71		
				5/17/2006	233.8	224.60	9.20		
				5/18/2006	233.8	224.52	9.28		
				5/19/2006	233.8	224.59	9.21		
008S021E28R002S	33.448744	-114.781269	Palo Verde Mesa	3/20/1976	365.5	224.50	141.00	0.73	365.5
				11/28/2000	365.5	225.23	140.27		
				3/28/2006	365.5	225.15	140.35		
				3/29/2006	365.5	225.1	140.40		
				3/23/2010	365.5	224.94	140.56		
008S021E28P001S	33.448831	-114.787081	Palo Verde Mesa	10/3/2000	375.7	212.41	163.29	2.15	
				11/28/2000	375.7	212.5	163.2		
				3/28/2006	375.7	212.22	163.48		
				3/23/2010	375.7	214.37	161.33		
008S021E24H001S	33.470556	-114.730556	Palo Verde Valley	11/25/1980	237.04	226.19	10.85	0.41	15
				12/19/1980	237.04	225.78	11.26		
				1/5/1981	237.04	225.84	11.2		
				1/13/1981	237.04	225.78	11.26		
				4/20/1994	237.04	225.84	11.2		

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Genesis Solar, LLC

Well ID	Latitude	Longitude	Groundwater Basin	Measurement Date	Approximate Ground Surface Elevation (feet amsl)	Water Surface Elevation (feet amsl)	Depth to Water (feet bgs)	Max GW Elevation Difference (ft)	Well Depth (feet bgs)
008S021E24C001S	33.478069	-114.735294	Palo Verde Valley	9/3/1980	238.60	232.02	6.58	5.19	
				10/20/1980	238.60	230.44	8.16		
				11/24/1980	238.60	229.26	9.34		
				12/18/1980	238.60	229.02	9.58		
				1/5/1981	238.60	229.40	9.2		
				1/12/1981	238.60	229.37	9.23		
				2/2/1981	238.60	230.60	8		
				2/4/1981	238.60	230.56	8.04		
				2/11/1981	238.60	230.40	8.2		
				2/13/1981	238.60	230.35	8.25		
				2/18/1981	238.60	229.95	8.65		
				2/25/1981	238.60	229.97	8.63		
				3/31/1981	238.60	229.37	9.23		
				5/21/1981	238.60	230.01	8.59		
				1/1/2006	238.60	226.98	11.62		
				2/1/2006	238.60	226.83	11.77		
				3/1/2006	238.60	227.03	11.57		
				4/1/2006	238.60	227.19	11.41		
				5/17/2006	238.60	227.64	10.96		
				5/18/2006	238.60	227.64	10.96		
				5/19/2006	238.60	227.66	10.94		
006S022E24D001S	33.645987	-114.641261	Palo Verde Valley	5/11/2000	277.6	255.76	- -	1.22	25.31
				1/1/2000	277.6	255.40	- -		
				3/1/2000	277.6	255.12	- -		
				4/1/2000	277.6	255.32	- -		
				5/1/2000	277.6	254.78	- -		
				6/1/2000	277.6	255.67	- -		
				8/1/2000	277.6	255.65	- -		
				9/1/2000	277.6	255.7	- -		
				10/1/2000	277.6	255.87	- -		
				1/1/2006	277.6	255.05	- -		
				2/1/2006	277.6	254.74	- -		
				3/1/2006	277.6	254.65	- -		
				4/1/2006	277.6	254.67	- -		
				5/1/2006	277.6	254.83	- -		

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Genesis Solar, LLC

Well ID	Latitude	Longitude	Groundwater Basin	Measurement Date	Approximate Ground Surface Elevation (feet amsl)	Water Surface Elevation (feet amsl)	Depth to Water (feet bgs)	Max GW Elevation Difference (ft)	Well Depth (feet bgs)
006S022E35R002S	33.60294	-114.64426	Palo Verde Valley	11/18/1947	260	254	- -	15.09	328
				2/8/1957	260	252.58	- -		
				5/25/1961	260	253.75	- -		
				7/6/1961	260	254.02	- -		
				7/28/1961	260	254	- -		
				8/24/1961	260	252.76	- -		
				9/25/1961	260	239.54	- -		
				10/18/1961	260	251.93	- -		
				11/21/1961	260	253.62	- -		
				12/20/1961	260	253.35	- -		
				1/22/1962	260	252.75	- -		
				2/19/1962	260	252.4	- -		
				3/26/1962	260	246.06	- -		
				4/23/1962	260	250.02	- -		
				5/25/1962	260	254.06	- -		
				6/21/1962	260	247.11	- -		
				7/19/1962	260	253.24	- -		
				8/16/1962	260	239	- -		
				9/20/1962	260	254.09	- -		
				10/11/1962	260	253.98	- -		
				10/23/1962	260	253.3	- -		
				11/8/1962	260	253.74	- -		
				12/13/1962	260	253.77	- -		
				1/11/1963	260	252.8	- -		
				8/1/1972	260	252	- -		
				8/2/1972	260	251.9	- -		
004S021E09B001S	33.847832	-114.779446	Palo Verde Mesa	7/29/1971	874.7	328.1	546.6	1.60	1088
				9/25/1990	874.7	329.2	545.5		
				3/10/1992	874.7	327.6	547.1		
				4/24/2000	874.7	327.63	547.07		
005S022E31E001S	33.700025	-114.729109	Palo Verde Mesa	7/26/1965	475.83	253.83	- -	9.20	484
				2/8/1966	475.83	257.33	- -		
				10/19/1966	475.83	257.41	- -		
				8/4/1971	475.83	255.14	- -		
				9/26/1990	475.83	248.33	- -		
				2/14/1992	475.83	248.21	- -		
				3/30/2000	475.83	251.05	- -		

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Groundwater Levels from Selected Wells in the Palo Verde Mesa and Valley Groundwater Basins
Genesis Solar, LLC

Well ID	Latitude	Longitude	Groundwater Basin	Measurement Date	Approximate Ground Surface Elevation (feet amsl)	Water Surface Elevation (feet amsl)	Depth to Water (feet bgs)	Max GW Elevation Difference (ft)	Well Depth (feet bgs)
006S022E32R001S	33.604236	-114.692959	Palo Verde Mesa	4/30/1905	334.20	250.20	- -	8.41	560
				5/23/1961	- -	251.50	- -		
				8/24/1961	- -	252.03	- -		
				9/21/1961	- -	252.24	- -		
				10/18/1961	- -	252.04	- -		
				11/21/1961	- -	251.53	- -		
				12/20/1961	- -	251.16	- -		
				1/22/1962	- -	250.80	- -		
				2/19/1962	- -	250.85	- -		
				3/26/1962	- -	251.05	- -		
				4/24/1962	- -	251.35	- -		
				5/24/1962	- -	251.47	- -		
				6/20/1962	- -	251.64	- -		
				7/19/1962	- -	251.63	- -		
				8/16/1962	- -	251.58	- -		
				9/17/1962	- -	251.85	- -		
				10/11/1962	- -	251.68	- -		
				11/8/1962	- -	251.49	- -		
				12/13/1962	- -	251.20	- -		
				1/10/1963	- -	251.14	- -		
				2/4/1963	- -	250.91	- -		
				3/4/1963	- -	250.96	- -		
				4/1/1963	- -	251.26	- -		
				5/6/1963	- -	251.66	- -		
				6/3/1963	- -	252.05	- -		
				7/11/1963	- -	252.20	- -		
				8/6/1963	- -	252.35	- -		
				9/9/1963	- -	252.62	- -		
				10/29/1963	- -	252.74	- -		
				11/27/1963	- -	252.42	- -		
				12/31/1963	- -	251.73	- -		
				2/7/1964	- -	251.29	- -		
				3/10/1964	- -	251.54	- -		
				4/15/1964	- -	252.05	- -		
				5/12/1964	- -	252.23	- -		
				6/18/1964	- -	252.84	- -		
				7/21/1964	- -	252.90	- -		
				8/19/1964	- -	253.16	- -		
				9/17/1964	- -	253.27	- -		
				10/21/1964	- -	252.99	- -		
				12/2/1964	- -	252.91	- -		
				7/15/1971	- -	249.35	- -		
				9/22/1990	- -	244.88	- -		
				2/15/1992	- -	244.86	- -		
				2/15/2000	- -	246.69	- -		
				3/31/2006	- -	246.12	- -		

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Groundwater Levels from Selected Wells in the Palo Verde Mesa and Valley Groundwater Basins
Genesis Solar, LLC

Well ID	Latitude	Longitude	Groundwater Basin	Measurement Date	Approximate Ground Surface Elevation (feet amsl)	Water Surface Elevation (feet amsl)	Depth to Water (feet bgs)	Max GW Elevation Difference (ft)	Well Depth (feet bgs)
007S021E15A001S	33.573864	-114.761956	Palo Verde Mesa	9/23/1990	390.8	252.99	- -	2.02	
				3/23/1992	390.8	253.07	- -		
				3/29/2000	390.8	253.4	- -		
				10/4/2000	390.8	253.34	- -		
				12/14/2000	390.8	253.2	- -		
				2/25/2001	390.8	251.53	- -		
				4/17/2001	390.8	253.3	- -		
				7/11/2001	390.8	253.27	- -		
				11/7/2001	390.8	253.17	- -		
				4/3/2002	390.8	253.41	- -		
				10/2/2002	390.8	253.47	- -		
				6/3/2003	390.8	253.52	- -		
				11/5/2003	390.8	253.55	- -		
				3/2/2004	390.8	253.39	- -		
				8/4/2004	390.8	253.48	- -		
				12/8/2004	390.8	253.44	- -		
				4/15/2005	390.8	253.38	- -		
				8/31/2005	390.8	253.23	- -		
				1/27/2006	390.8	253.19	- -		
				3/30/2006	390.8	253.17	- -		
				3/31/2006	390.8	253.17	- -		
				5/5/2006	390.8	253.11	- -		
				8/10/2006	390.8	253.16	- -		
				12/8/2006	390.8	253.19	- -		
007S021E05C002S	33.602827	-114.805707	Palo Verde Mesa	2/10/1992	504.40	249.12	- -	1.31	
				2/5/2002	504.40	248.22	- -		
				3/19/2002	504.40	247.81	- -		
				3/29/2006	504.40	248.12	- -		
				3/30/2006	504.40	248.06	- -		

Notes
1. - - = not availible
2. bgs = below ground surface
3. Water level data is from the United States Geological Survey - National Water Information System (USGS-NWIS) website at http://nwis.waterdata.usgs.gov/ca/nwis/gwlevels
4. amsl = above mean sea level