3.8 HYDROLOGY AND WATER QUALITY

This section addresses potential impacts of the Proposed Project on hydrology and water quality. The hydrology and water quality conditions in the area of the Proposed Project have been assessed through review of existing publicly-available data and reports, aerial photographs, and field reconnaissance. Data from the Kern County Water Agency, California Department of Water Resources, U.S. Geological Survey, U.S. Bureau of Reclamation and other publicly-available documents were reviewed and evaluated as part of this assessment. As part of the analysis presented in this section, anticipated changes to existing baseline conditions and trends as a result of the Proposed Project have been identified and, where possible, quantified. Potential impacts to hydrology and water quality are evaluated based on the CEQA thresholds of significance described in Section 3.8.2, below.

3.8.1 Environmental Setting

The Proposed Project is located in the northeast corner of Kern County within the southwest part of the Indian Wells Valley. According to the California Department of Water Resources (2004), Indian Wells Valley is a closed high-desert basin that drains internally. The valley is bounded by mountain ranges consisting of igneous and metamorphic rocks, including the Sierra Nevada range on the west, the Coso Range on the north, the Argus Range on the east, and the El Paso Mountains on the south. China Lake is a perennial saline lake present in the eastern part of Indian Wells Valley. China Lake is the only natural groundwater discharge point in the valley. Within the valley, surface elevations range from 2150 feet above mean sea level (ft msl) at China Lake to over 3,000 ft msl in the southwest corner of the basin. Average annual rainfall in the valley is reported to be between 4 inches and 6 inches per year, with most precipitation occurring between October and March.

3.8.1.1 Hydrology

Numerous studies of the geologic and groundwater conditions in the Indian Wells Valley have been conducted. One of the most detailed and in-depth studies was produced in 1993 as part of a cooperative effort by the U.S. Bureau of Reclamation, Indian Wells Valley Water District, North American Chemical Company (now Searles Valley Minerals), and the Naval Air Weapons Station (NAWS) at China Lake (U.S. Bureau of Reclamation 1993). The 1993 U.S. Bureau of Reclamation report included a detailed review of past studies, an evaluation of past and projected future groundwater pumping in the valley, drilling and testing of 11 deep boreholes extending to depths of several thousand feet, and an evaluation of possible alternative water supply approaches for the Indian Wells Valley.

Drilling data and other information (U.S. Bureau of Reclamation 1993; DWR 2004) indicate that the Indian Wells Valley is filled primarily with coarse material (sands and gravels) deposited in alluvial fans that formed at the base of the mountain ranges surrounding the valley. In the western, southern, and southwestern parts of the basin, coarse materials extend to depths of at least 2,000 feet bgs. Thick organic clays that formed in ancient lake beds are also present beneath the northwestern part of the valley. The clay layer occurs as shallow as 340 ft bgs and is typically over 1,000 feet thick.

3.8.1.2 Groundwater Pumping

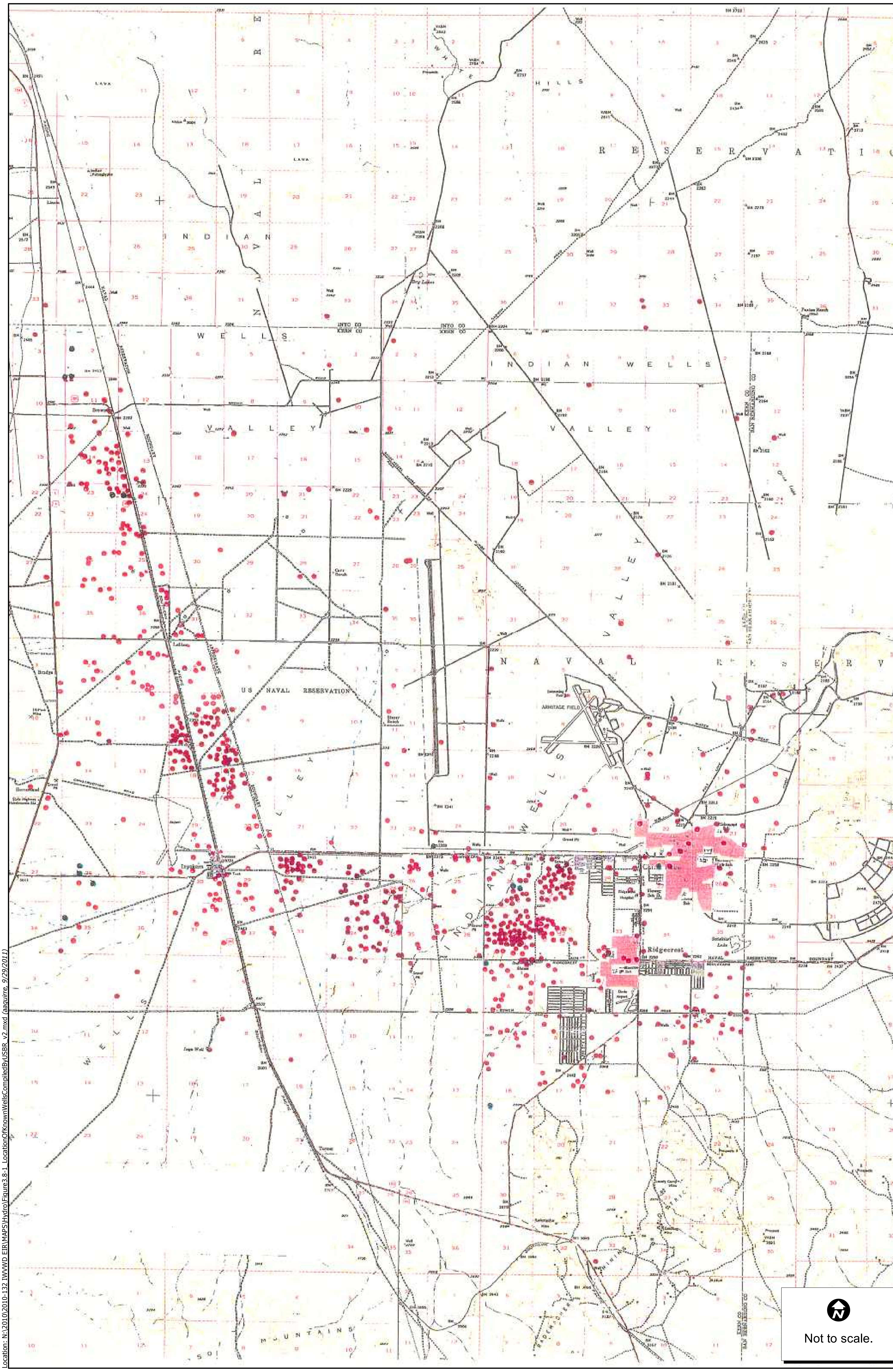
At the time of the 1993 U.S. Bureau of Reclamation study, more than 780 groundwater wells had been installed in the Indian Wells Valley. Figure 3.8-1 shows the locations of known wells compiled by the U.S. Bureau of Reclamation. The majority of the wells are located south of NAWS China Lake, between Ridgecrest and Inyokern, or along the Brown Road/Highway 395 corridor in the northwest part of the valley. The wells are concentrated in more developed areas and areas where agricultural activity is occurring.

Groundwater pumping in the valley began in the early 1900s for agricultural, industrial, and domestic purposes (USGS 1991). Early production was in the range of a few thousand acre-feet per year. An acre-foot is the volume of water that will cover an area of one acre to a depth of one foot. An acre-foot is equivalent to approximately 325,850 gallons. Currently, groundwater is pumped for agricultural, industrial, domestic, and military uses, with approximately 28,500 acre-feet pumped from the valley in 2009 (Indian Wells Valley Cooperative Groundwater Management Working Group 2011). Figure 3.8-2 shows the estimated groundwater production for the major users in the valley from 1979 through 2009. The major users include several agricultural operations (which have been combined for presentation on Figure 3.8-2), NAWS China Lake, Searles Valley Minerals (SVM), IWVWD, private well users, the Inyokern Community Services District (CSD) cooperative, and the City of Ridgecrest. In 1986 and 1988, IWVWD acquired several smaller producers, including China Lake Acres, Neal Ranch, and Ridgecrest Heights. The pre-1988 production volumes from these three systems are included with IWVWD on Figure 3.8-2.

Groundwater production from the Indian Wells Valley has ranged primarily between about 20,000 acre-feet per year to approximately 29,000 acre-feet per year over the past 30 years, with the peak year in 1985. Changes in the production rate over this period are primarily due to large fluctuations in agricultural use, as seen on Figure 3.8-2. Agricultural production currently accounts for over 40 percent of the groundwater pumped from the basin, while IWVWD accounts for less than 30 percent, SVM and private wells account for about 10 percent each, and NAWS China Lake currently accounts for just under seven percent.

3.8.1.3 Groundwater Levels

Long-term data regarding groundwater levels in the Indian Wells Valley are available from the USGS (2011), DWR (2011), and the Kern County Water Agency (KCWA). Much of the data from these three sources are duplicative, with the same wells reported in multiple databases. The most extensive data set is maintained by KCWA, which monitors water levels in numerous wells in the Indian Wells Valley on an approximate semiannual basis. Most of the water-level data extends back to the early 1990s or 1980s, but a few wells have been monitored since the 1940s. To support the analysis conducted for this EIR, data were requested and received from KCWA for wells within the northeast corner of Kern County in the 324-square mile area encompassed by



Location: N:\2010\2010-132 IWVWD EIR\MAPS\Hydro\Figure3.8-1_LocationOfKnownWellsCompiledByUSBR_v2.mxd (aaguirre, 9/29/2011)

Map Date: 9/29/2011

Figure 3.8-1 Locations of Known Wells Compiled by U.S. Bureau of Reclamation

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Source: U.S. Bureau of Reclamation 1993

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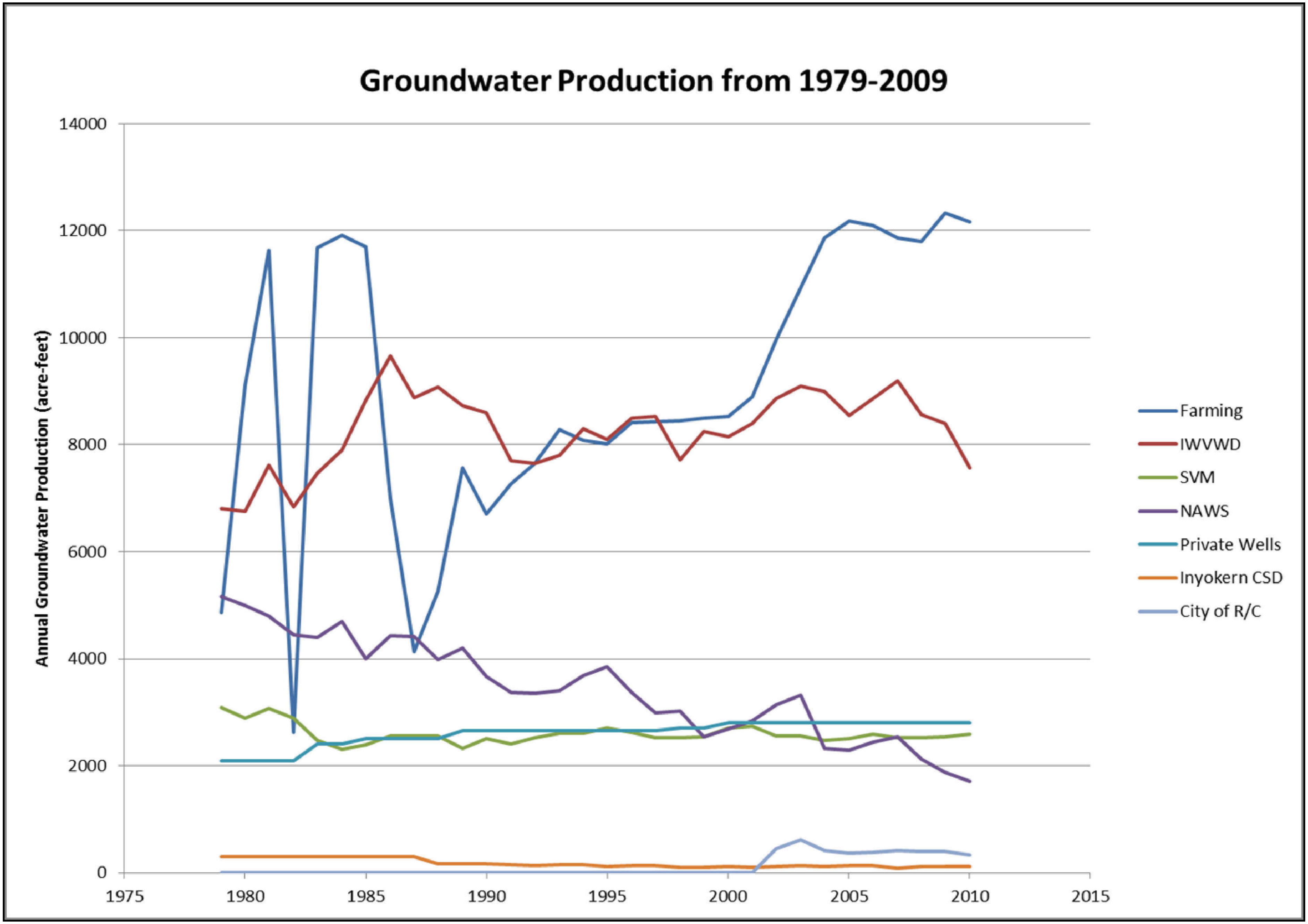

Location: N:\2010\2010-132 IWVWD EIR\MAPS\Hydro\Figure3.8-2_GroundwaterProduction.mxd *(AAguirre, 9/22/2011)*

Date: 9/22/2011

Figure 3.8-2 Groundwater Production from 1979-2009

2010-132 Indian Wells Valley Water District EIR

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Townships 25 South through 27 South and Ranges 38 East through 40 East. This area is shown on Figure 3.8-3. KCWA provided 5,042 individual water level records from approximately 200 wells. The water-level data provided by KCWA are included as Appendix F of this EIR.

For many of the wells, data has only been recorded for a few years. Approximately 135 wells, however, have records that cover at least 10 years. A detailed analysis of the wells with a 10-year record or longer was conducted as part of the evaluation of existing, or baseline conditions, for this EIR.

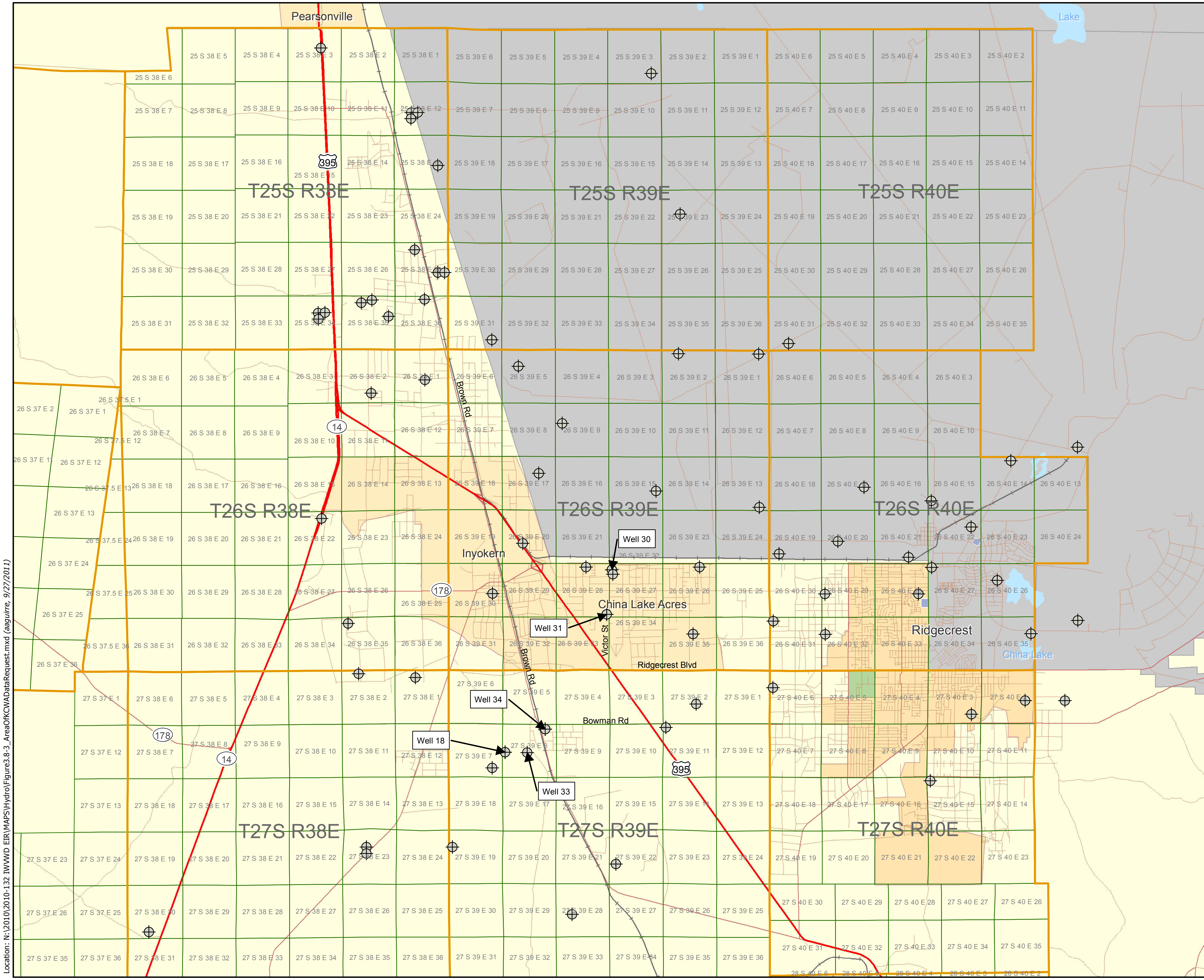
Current depth to groundwater varies throughout the basin. In the northeast, east, and southeast parts of the Indian Wells Valley, groundwater is less than 100 feet bgs. As discussed above, in the vicinity of China Lake, the groundwater is close to or at the surface. In the northwestern and central part of the basin, including most of the western half of NAWS China Lake, the depth to groundwater varies from approximately 100 to 200 feet bgs. In the area south of NAWS China Lake, including Ridgecrest and Inyokern, the intermediate area (generally including the area south of NAWS China Lake, east of Victor Street, and north of Ridgecrest Boulevard), and the southwest area, the depth to groundwater generally ranges from 200 to 400 feet bgs.

Figures 3.8-4, 3.8-5, and 3.8-6 present hydrographs showing the changes in water levels over time for wells 25S/38E-35B01, 27S/39E-07R01, and 27S/40E-15D01, respectively. These wells were selected because they have the longest period of recorded water levels and are representative of conditions in different parts of the basin. (The wells names are reported in the format of township/range-section. Thus, well 25S/38E-35B01 is in Township 25 South, Range 38 East, Section 35. The B01 designation is part of the California Department of Water Resources well naming convention to designate in what part of the section the well is located.) These well locations are shown on Figure 3.8-7.

The hydrographs, along with the analysis of the data from other wells in the KCWA database, indicate that groundwater levels have been declining in the Indian Wells Valley for many decades. Prior to approximately 1950, groundwater levels were stable. Between 1950 and approximately 1980, groundwater levels were decreasing at a rate of approximately one-half foot per year or less throughout the basin. In the 1980s, population growth and resulting water demand in the basin increased. As a result, the rate of decline in the groundwater level accelerated. Figure 3.8-8 shows the average rate of decline at various well locations throughout the Indian Wells Valley over the past 10 to 20 years. The information presented on Figure 3.8-8 shows that water levels have been stable or even slightly increasing in the northeast part of the basin, and the extreme southeast and southwest corners of the basin. Between these areas, however, groundwater levels have been persistently declining for many years. The total decline in groundwater elevations is as much as 70 to 80 feet in the main pumping areas of the basin.

Historically, groundwater levels have shown the greatest decline in the areas with the greatest density of wells, as shown on Figure 3.8-1. However, due to the shifting of major production from the intermediate area to the southwest area by the IWVWD, the greatest rates of decline now occur in the southwest area.

Figure 3.8-3
Area of KCWA Data Request



Wells
Kern County Townships
Kern County Sections

Miles
0 1 2
1 " = 16 miles

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Location: N:\2010\2010-132 IWVWD EIR\MAPS\Hydro\Figure3.8-3_AreaofKCWADataRequest.mxd (aaguirre, 9/27/2011)

Map Date: 9/27/2011

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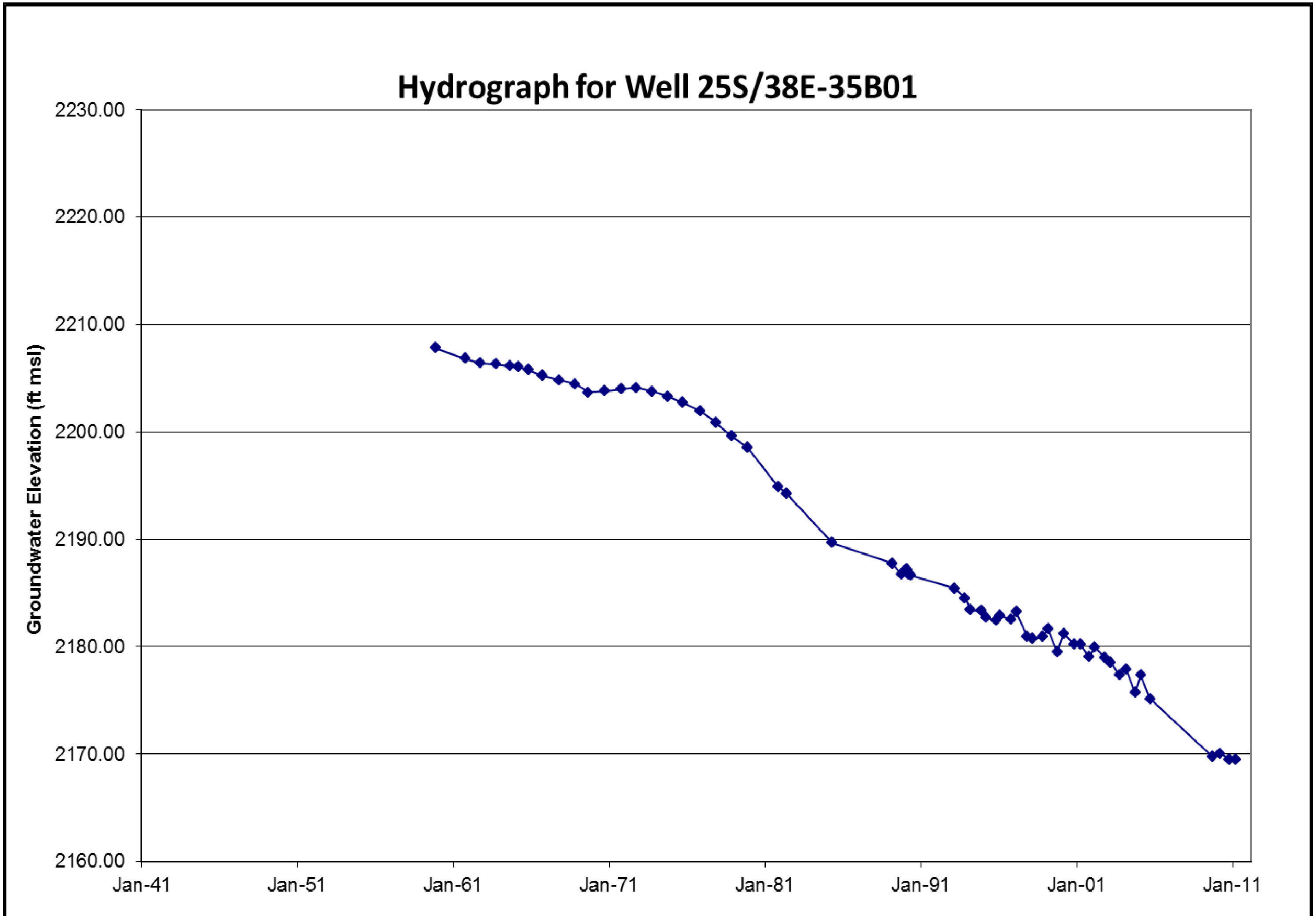

Location: N:\2010\2010-132 IWVWD EIR\MAPS\Hydro\Figure3.8-4_WellHydrograph.mxd *(AAguirre, 9/22/2011)*

Date: 9/22/2011

Figure 3.8-4 Hydrograph for Well 25S/38E-35B01

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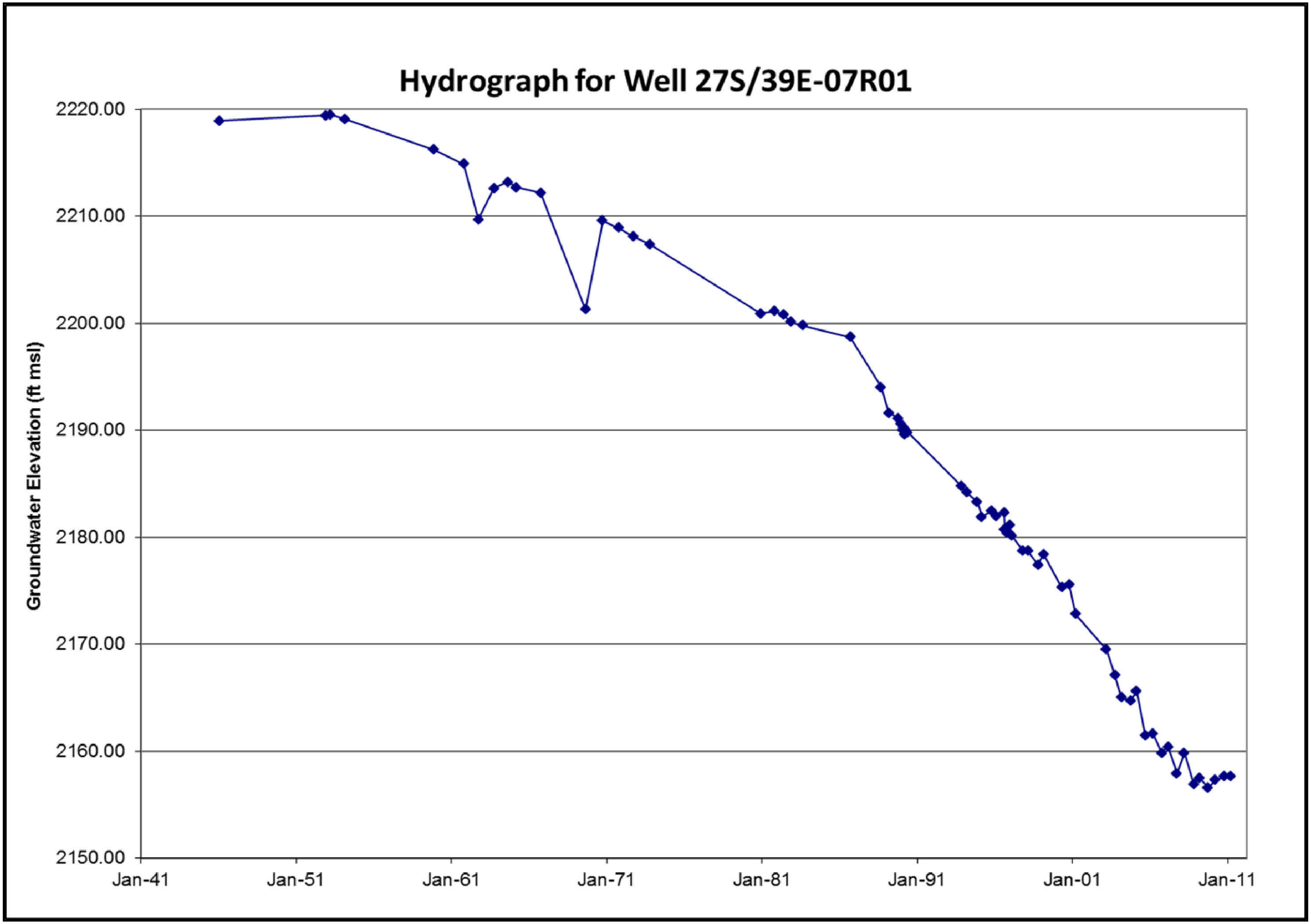

Location: N:\2010\2010-132 IWVWD EIR\MAPS\Hydro\Figure3.8-5_HydrographForWell27S-39E-07R01.mxd *(AAguirre, 9/22/2011)*

Date: 9/22/2011

Figure 3.8-5 Hydrograph for Well 27S/39E-07R01

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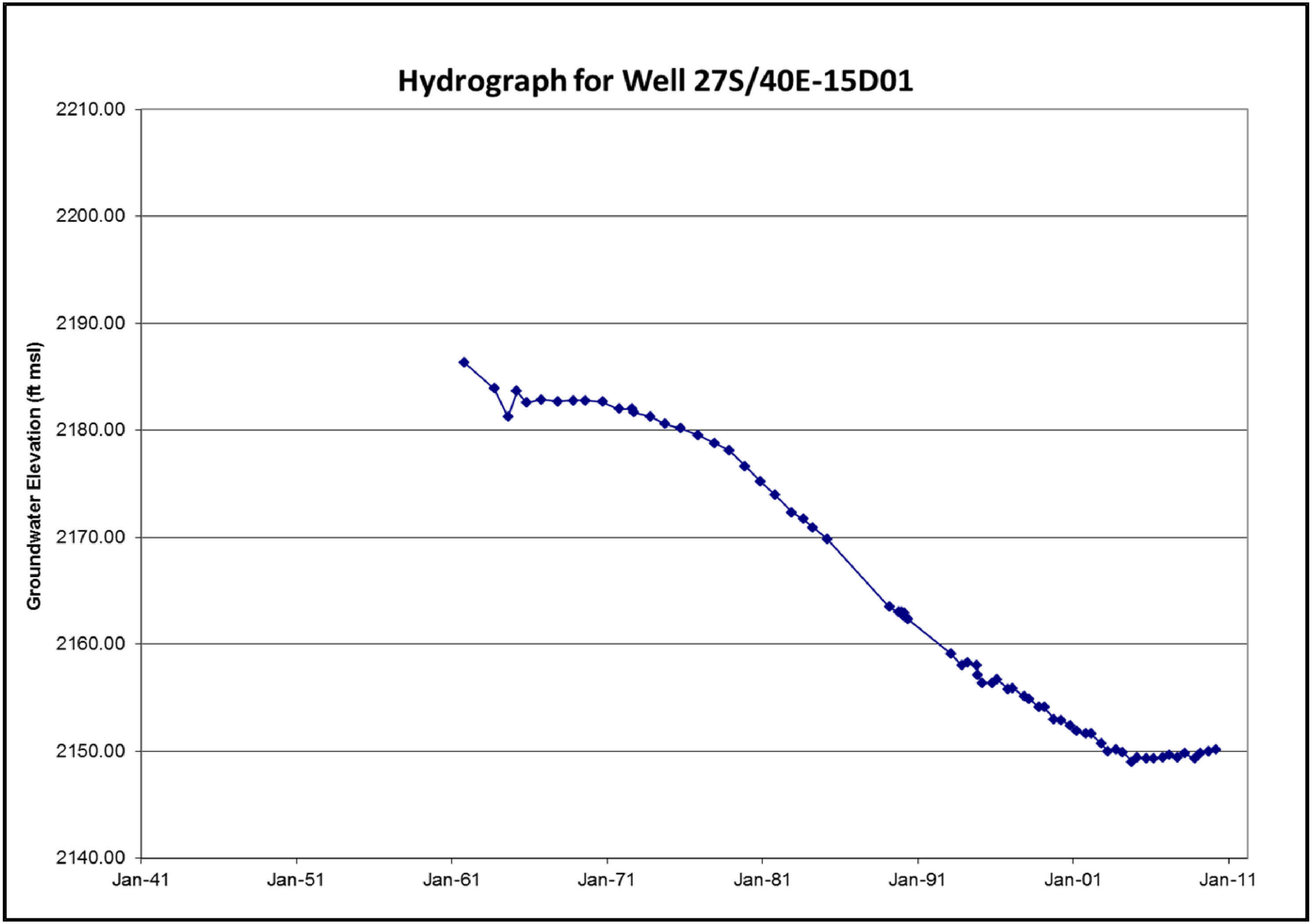

Location: N:\2010\2010-132 IWVWD EIR\MAPS\Hydro\Figure3.8-6_HydrographForWell27S-40E-15D01.mxd *(AAguirre, 9/22/2011)*

Date: 9/22/2011

Figure 3.8-6 Hydrograph for Well 27S/40E-15D01

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Figure 3.8-9 is a contour map of the groundwater surface elevation in the Indian Wells Valley based on the most recent data in the KCWA database. A groundwater depression has formed along a northwest trend from Ridgecrest across the southwest corner of NAWS, where groundwater elevations are less than 2,150 feet msl. The groundwater elevations within this depression are lower than the groundwater levels in any other part of the basin, including China Lake to the northeast, which has historically been the area of natural groundwater discharge.

The groundwater contours shown on Figure 3.8-9 also indicate that a small groundwater depression is developing in the southwest area in the vicinity of Brown Road and Bowman Road (T27S/R39E-Section 8). Toward the southwest of this depression, the groundwater elevations increase rapidly.

3.8.1.4 Groundwater Quality

Water-quality data are available from multiple sources, including the USGS (2011), IWVWD, and U.S. Bureau of Reclamation (1993). As part of its scope, the group funding the U.S. Bureau of Reclamation study drilled 11 deep boreholes and installed nested piezometers in the boreholes. Figure 3.8-7 shows the locations of the deep boreholes. Table 3.8-1 summarizes the data obtained from the boreholes. The deep boreholes assist in identifying the depth of the Indian Wells Valley groundwater basin and the extent of high-quality groundwater.

The water quality varies appreciably across the basin. Figure 3.8-10 shows the TDS levels across the basin. Water quality data from the northwest area of the basin indicate elevated levels of TDS, in the range of 500 milligrams per liter (mg/L) to 1,000 mg/L, along with elevated levels of specific constituents such as arsenic, chloride, and nitrate, in shallow and deeper aquifer intervals. A TDS of less than 500 mg/L is generally targeted for potable water use. The elevated TDS and occurrence of arsenic and other constituents in the northwest area appears to be associated with the thick organic clay layer that is present at depths ranging from as shallow as 340 feet bgs to as deep as 1,820 feet bgs. The presence of methane gas in the groundwater has also been associated with the thick organic clay layer.

In the northeastern and eastern part of the basin, TDS levels can be very high – several thousand milligrams per liter - due to evaporation and concentration of salts in the area of China Lake.

The central, western, and southern parts of the basin generally contain the best quality groundwater. TDS levels are below 500 mg/L and most other constituents meet drinking water standards. In the area beneath the City of Ridgecrest, arsenic levels may exceed the MCL. The best quality groundwater occurs in the intermediate and southwest areas of the groundwater basin. The testing program conducted by the U.S. Bureau of Reclamation (1993) indicated that high-quality groundwater exists to depths of at least 2,000 ft bgs in the southwest area, where Well 35 is proposed.

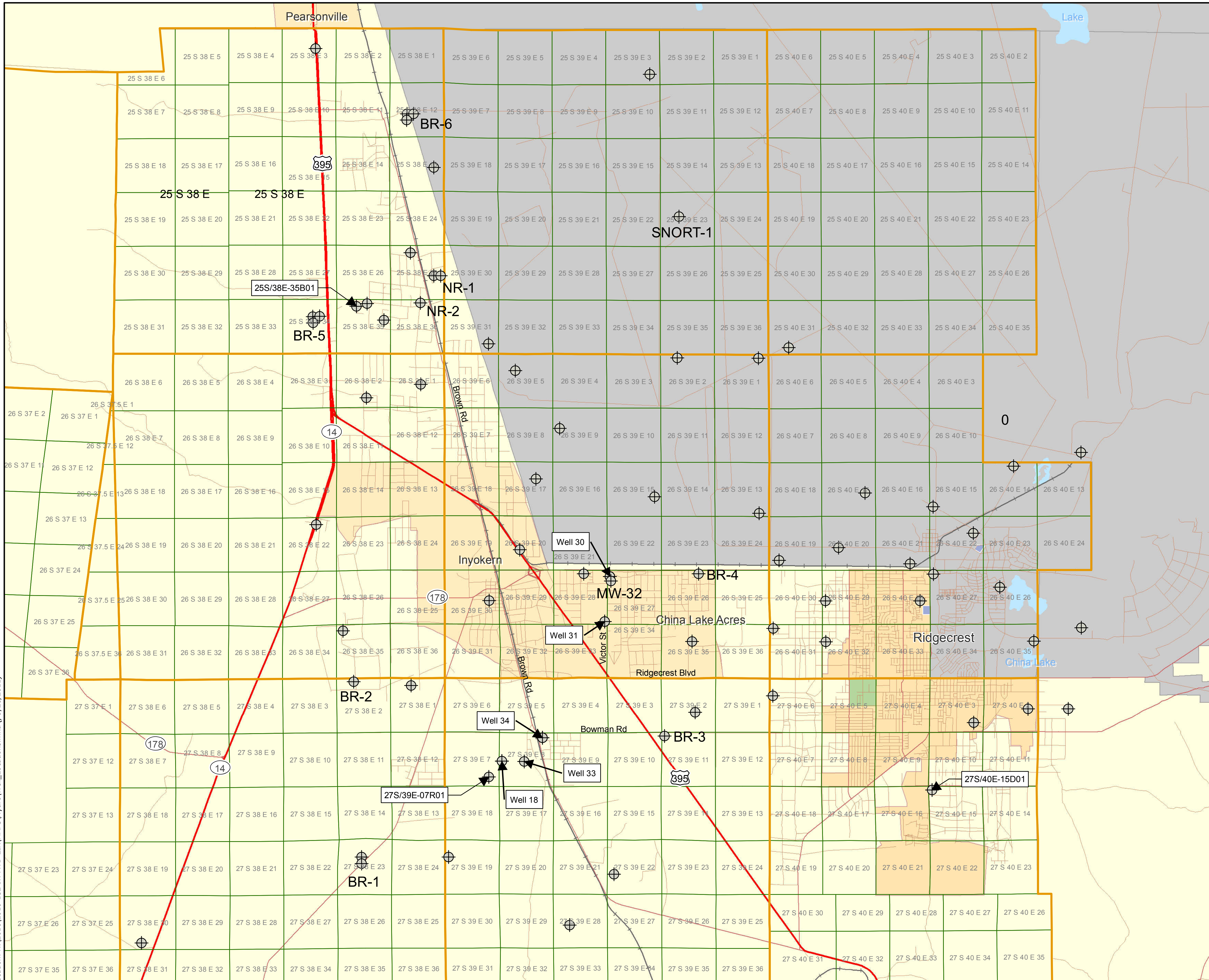

Figure 3.8-7
Hydrograph Well Locations and U.S. Bureau of Reclamation Deep Well Locations

Wells

Kern County Townships

Kern County Sections

Miles

0 1 2

1 " = 16 miles

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Location: N:\2010\2010-132 IWVWD EIR\MAPS\Hydro\Well_Locations.mxd (, 9/28/2011)

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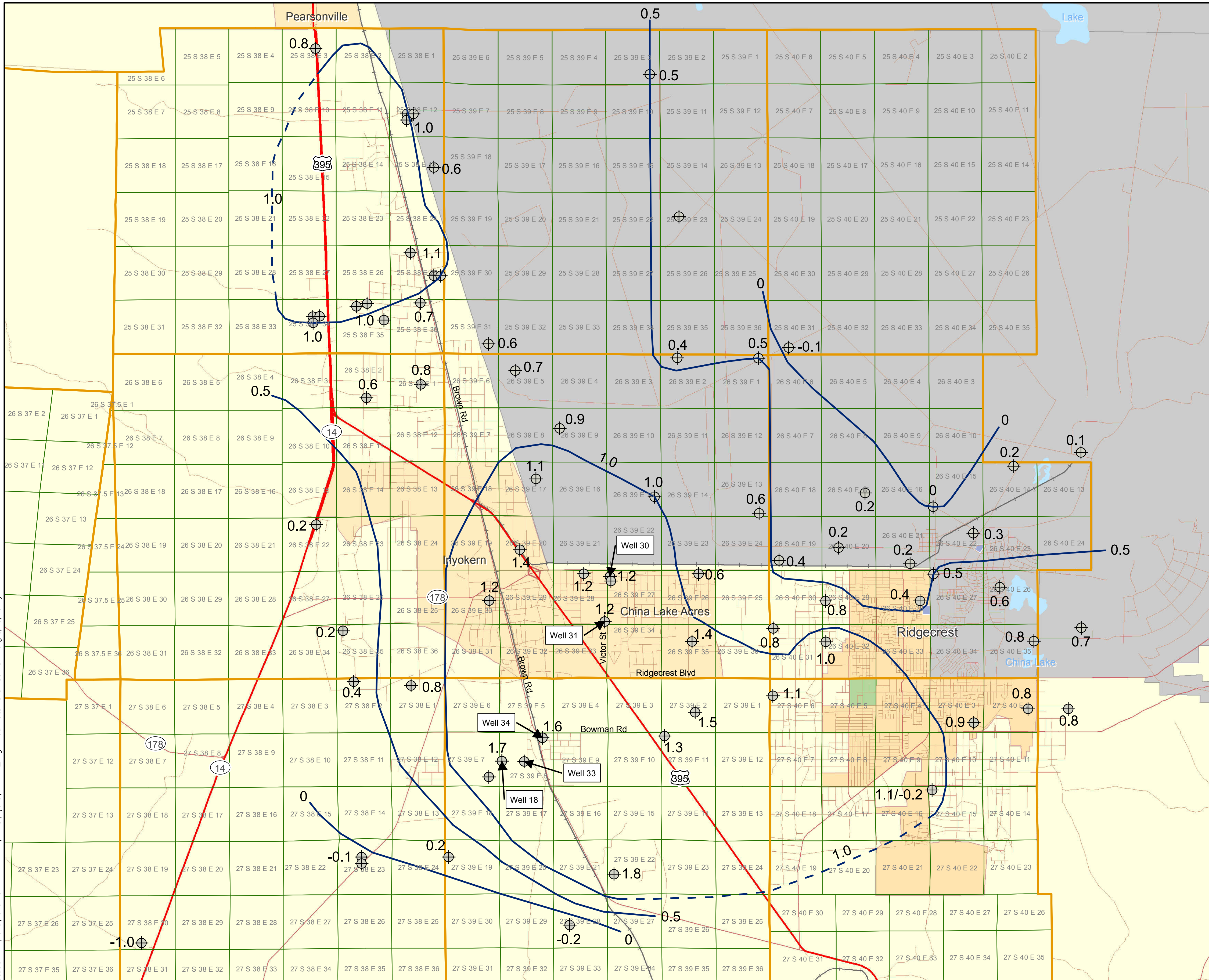

Figure 3.8-8
Average Annual Water Level Decline (ft/yr)

Location: N:\2010\2010-132 IWVWD EIR\MAPS\Hydro\IWVWD_AvgAnnualWaterLevelDecline.mxd (, 8/25/2011)

Map Date: 8/25/2011

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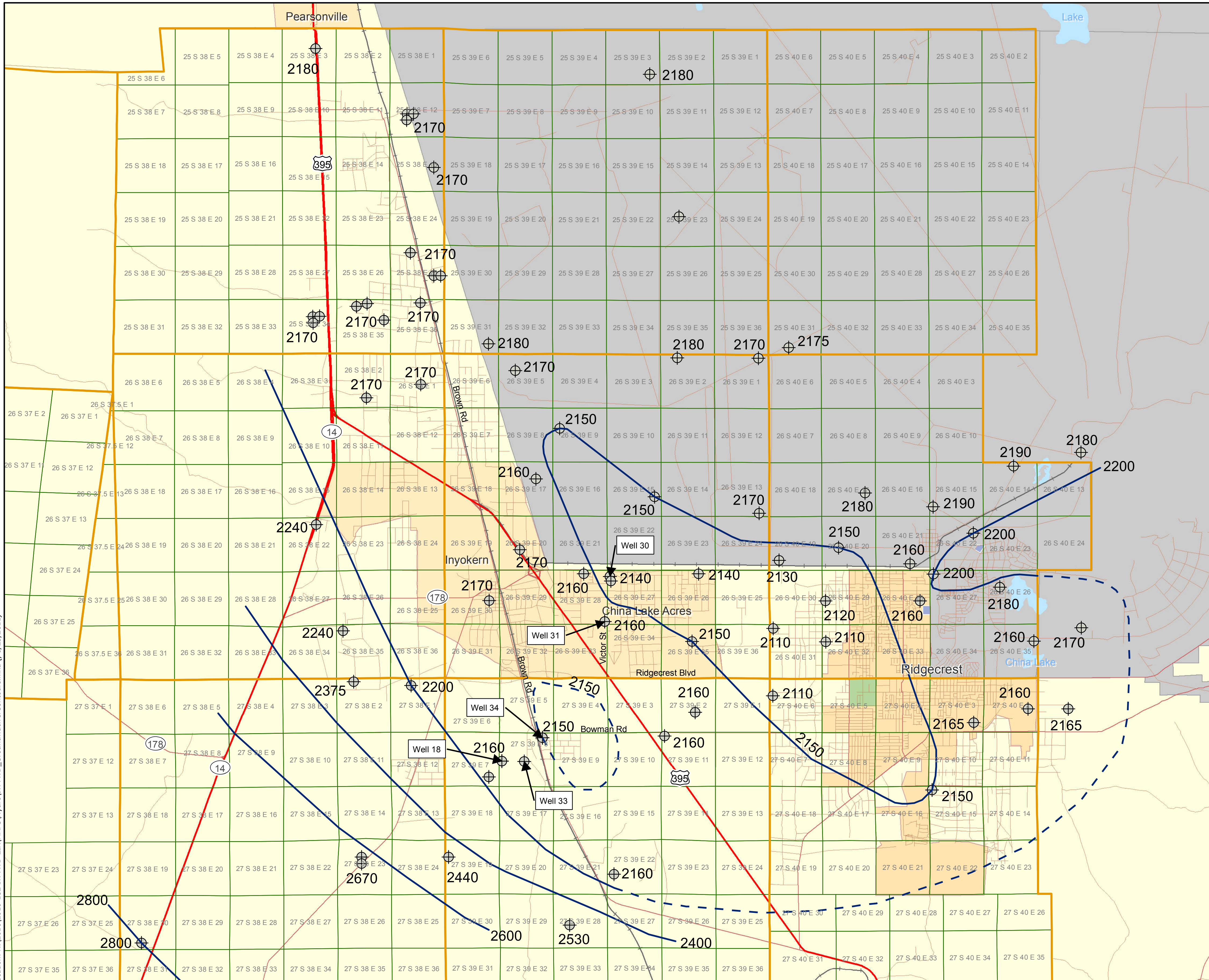
Figure 3.8-9
Approximate Groundwater Contours



Wells

Approximate Groundwater Contours (ft msl)

Kern County Townships

Kern County Sections

Miles

0 1 2

1 " = 2 miles

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Location: N:\2010\2010-132 IWWD EIR\MAPS\Hydro\IWWD_GroundwatverContours.mxd (, 8/25/2011)

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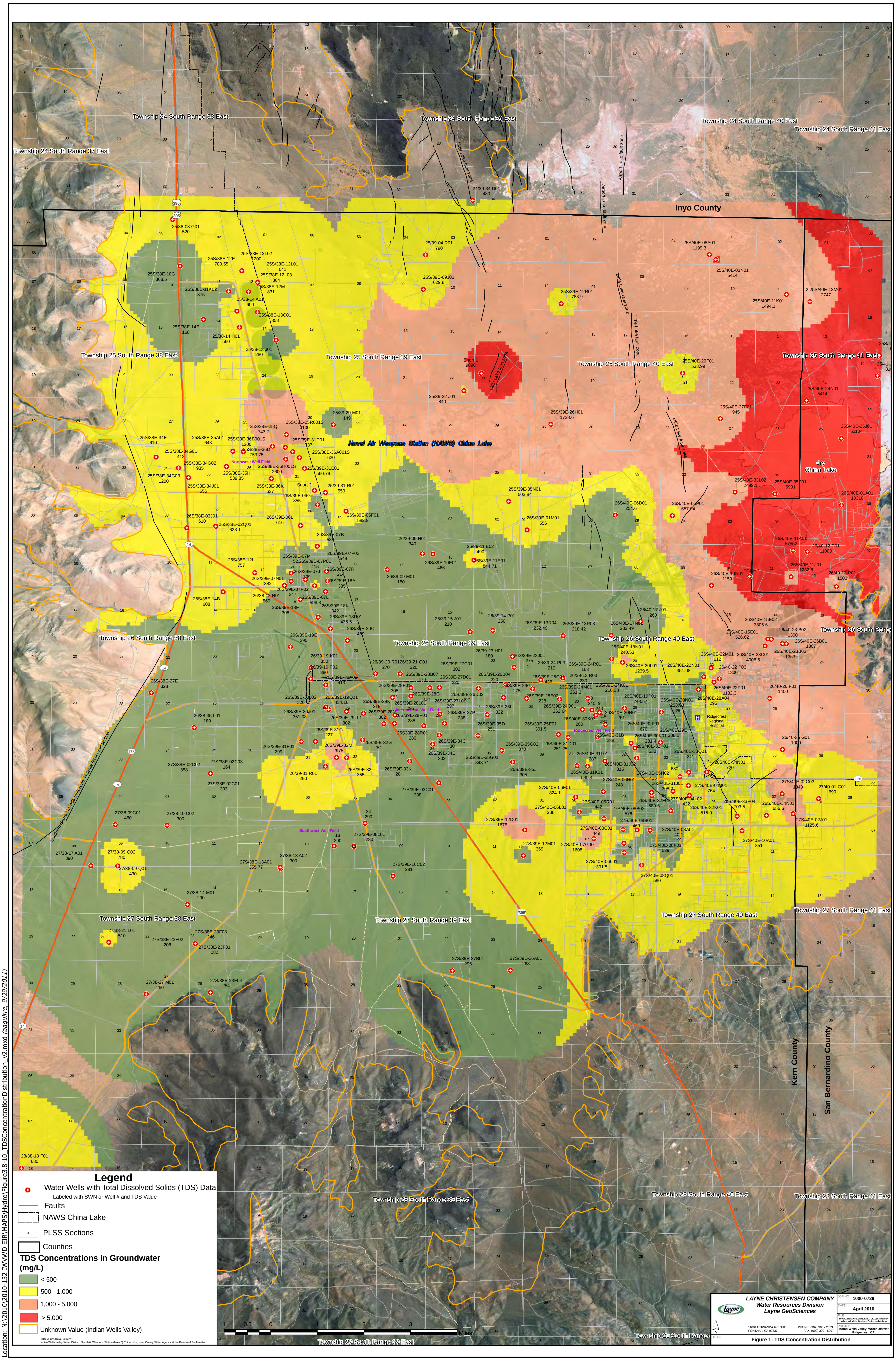

Location: N:\2010\2010-132 IWVWD EIR\MAPS\Hydro\Figure3.8-10_TDSConcentrationDistribution_v2.mxd (aaguirre, 9/29/2011)

Map Date: 9/29/2011

Figure 3.8-10 TDS Concentration Distribution

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Source: Layne Christensen Company 2010

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Table 3.8-1
Borehole Test Data U.S. Bureau of Reclamation 1993 Study[1]

Borehole	Location	Total Depth (ft bgs)	Screened Intervals	TDS (mg/L)	Water Quality[2]	Stratigraphy
BR-1	27S/38E-23	1910	615-635	212		Sand with some clay
			1040-1060	243		
			1500-1520	353		
			1680-1700	285		
BR-2	27S/38E-2	2020	620-640	NA		Sand
			1460-1480	240	Fe, Mn>MCL	
			1940-1960	354	Fe, Mn>MCL	
BR-3	27S/39E-11	2024	650-670	360		Sand and fine gravel to 1380, clay 1380-1740, sand and fine gravel below 1740
			1320-1340	955		
			1850-1870	6,634		
BR-4	26S/39E-26	2020	1190-1200	183	Fe>MCL	Fine to coarse sand
BR-5	26S/38E-34	2013	850-870	534	Fe, Mn>MCL	Medium to coarse sand
			1590-1610	837	Fe, Mn>MCL	
			1960-1980	891	Fe, Mn>MCL	
BR-6	25S/38E-10	2012	330-350	596	As, Fe, Mn, Al>MCL	Medium to coarse sand to 370, clay 370-1700, layey to silty medium sand below 1700
			1190-1210	481	As, Fe, Mn, Al>MCL	
			1640-1660	540	As, Fe, Mn, Al>MCL	
BR-10	24S/38E-21	2005	640-660	1000		Medium to coarse sand to 680, clay 680-1440, medium to coarse sand below 1440
			1180-1200	580		
			1560-1580	1220	Fe, Mn>MCL	
			1930-1950	1330	Fe, Mn>MCL	
NR-1	27S/38E-25	2012	250-270	2406	NO_3>MCL	Medium to coarse sand to 340, clay 340-1820, medium sand below 1820
			1170-1190	3660	Methane gas	
			1960-1980	3251		
NR-2	27S/38E-36	1994	330-350	808	As>MCL	Fine to coarse sand to 440, clay 440-1480, interbedded sand and clay below 1480
			1540-1560	1367	As>MCL	
			1930-1910	3305	As>MCL	
SNORT-1	27S/39E-23	7394	840-880	9890		
			1430-1470	NA		No flow in deeper zone
MW-32	26S/39E-27	1968	340-360	252		Fine to medium sand
			880-900	169		
			1240-1260	176		
			1900-1920	526		

Notes:
[1]ft bgs = feet below ground surface, TDS = Total Dissolved Solids, mg/L = milligrams per liter, MCL = drinking water maximum contaminant level, Fe= iron, Mn = manganese, As = arsenic, Al = aluminum

[2]High concentrations of iron and manganese in Wells BR-1 through BR-10 may have been due to residual drilling fluid that could not be purged from the wells due to their small diameter (2 inches in diameter)

3.8.1.5 Recharge

There have been numerous assessments of the potential recharge to the Indian Wells Valley groundwater basin (see discussion in USGS 1991 beginning on page 9). Estimates range from as little as 3,000 acre-feet per year to as high as 30,000 acre-feet per year. Most recent studies have identified recharge rates in the range of 8,000 acre-feet per year to 11,000 acre-feet per year.

For this assessment, an estimate of recharge was made based on a comparison of the aquifer volume dewatered each year due to declining water levels with the volume of groundwater extracted. As discussed above, groundwater levels have been declining across a large area of the valley for many decades. As indicated on Figure 3.8-8, during the last 10 to 20 years, the rate of decline has averaged approximately one foot per year over an area of approximately 175 square miles, or 112,000 acres. Using an aquifer storage coefficient of 0.15 (U.S. Bureau of Reclamation 1993), the net volume of aquifer storage dewatered each year may be in the range of approximately 16,800 acre-feet.

Over the last 30 years, groundwater pumping from the valley has averaged about 26,000 acre-feet per year. The difference between the average annual volume of aquifer dewatered with the average annual pumping rate is equivalent to the volume of recharge each year. Based on the parameters described above, the average annual recharge in the Indian Wells Valley is in the range of 9,200 acre-feet per year. This value is consistent with the prior estimates of 8,000 acre-feet per year to 11,000 acre-feet per year.

Previous studies, as summarized by the USGS (1991), suggest that most of the recharge (approximately 65 percent) comes from the Sierra Nevada range to the west, with approximately 30 percent coming from the Argus and Coso Ranges to the east and north, and less than five percent coming from the El Paso Mountains to the south. Due to the very small amount of annual precipitation, little to no recharge is believed to occur from rainfall on the valley floor.

Water quality and hydrogeologic data can also provide some insight into the potential areas of recharge. The water that recharges the aquifer from the mountain ranges should be of very high quality, with very low TDS and few trace elements. The northwest area of the basin has elevated TDS levels and contains arsenic, chloride, and other constituents. The elevated TDS indicates that there is minimal recharge of runoff from the Sierra Nevada occurring in the northwest area. If substantial recharge was occurring, much higher water quality would be expected. The presence of the thick organic clay layer, however, may be affecting the water quality and masking the effects of recharge.

The highest quality groundwater occurs in the southwest area of the valley, suggesting that there may be appreciable recharge occurring in the southwest area. The southwest area, however, is also experiencing the greatest rate of groundwater level decline in the valley, even though there are fewer wells in this area than in other parts of the basin. As shown on Figure 3.8-9, there is also a relatively steep hydraulic gradient, or slope of the groundwater surface, that flows toward the northeast. The steep hydraulic gradient may be indicative of a geologic discontinuity, such as a fault or a change in the aquifer permeability. The relatively steep hydraulic gradient in the southwest area, combined with the relatively rapid development of a groundwater depression in this same area, suggests that there is not substantial recharge entering the basin from the southwest and that a major hydrologic boundary may occur in this area.

3.8.2 Thresholds of Significance

According to Appendix G of the CEQA Guidelines, a project would have a significant effect on the hydrology and water quality if it would:

- Violate any water quality standards or waste discharge requirements;
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site;
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial sources of polluted runoff;
- Otherwise substantially degrade water quality;
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows;
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam; or
- Inundation by seiche, tsunami, or mudflow.

3.8.3 Environmental Impacts

3.8.3.1 Criteria Determined to Have No Impact

The following were determined to have No Impact in the Initial Study (Appendix A) and were not evaluated further in this EIR:

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site;
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial sources of polluted runoff;
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows;
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam; or
- Inundation by seiche, tsunami, or mudflow.

3.8.3.2 Criteria Determined to Have a Less Than Significant Impact

The following was determined to have a Less Than Significant Impact in the Initial Study but is discussed further here based on comments received from the RWQCB:

- Violate any water quality standards or waste discharge requirements.

The primary goal of the Proposed Project, and of IWVWD, is to provide safe water that meets all applicable drinking water standards. The District owns and operates many wells and treatment units that meet applicable standards for sanitary seals and water quality objectives. For example, the wells include a 50-foot sanitary seal to protect water quality. Water delivered by the District to customers meets state and federal drinking water standards. The retrofit of existing Wells 18 and 34 during Phase 1 and the installation of new Well 35 during Phase 2 would be completed in the same manner as existing District facilities. As such, the Proposed Project would not violate any water quality standards.

During drilling and well testing, groundwater produced from new Well 35 would be discharged to the ground surface to allow it to percolate back into the subsurface. The new well would be developed and subsequently tested for approximately two weeks. The water discharged from the development and testing of the wells would be percolated into the ground locally, either by discharge to an on-site percolation pond or by sprinklers. Based on existing water-quality data, the groundwater meets applicable water quality standards such as MCLs and thus the discharge would comply with the *Water Quality Control Plan for the Lahontan Region, North and South Basins*, commonly referred to as the Basin Plan (RWQCB 2005).

The new well would require chlorination facilities with secondary containment and such additional treatment facilities that may be indicated by water quality testing performed at the time of drilling. Facilities for the removal of arsenic are not anticipated at this time. Prior to operation, the wells would be disinfected in accordance with the District's standard specifications. Disinfection water would be dechlorinated prior to being discharged on the site in the same manner as the development and testing water. The discharged water would not contain any residual chlorine and, thus, would be in compliance with the Basin Plan (RWQCB 2005).

These actions described above would not result in any violations of water quality standards or waste discharge requirements. This is a less than significant impact.

3.8.3.3 Criteria Determined to Have a Potentially Significant Impact

The following were determined to have a Potentially Significant Impact in the Initial Study and are evaluated in detail below.

- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)

As part of Phase 1 of the Proposed Project, the nominal pumping capacity of Wells 18 and 34 would be increased from 1,200 gpm to up to 2,200 gpm. The pumping capacity would be increased to provide a 20 percent system redundancy for the existing maximum day demand plus a 20 percent safety factor. As such, Phase 1 provides additional backup capacity in case of equipment failure, maintenance, or emergency situations at other well locations, but does not result in an additional net annual volume of groundwater pumping. In other words, the existing system is capable of meeting the existing maximum day demand, but does not have adequate redundancy or reserve capacity to meet the District's specifications and standard operating procedures for a 20 percent safety factor.

Phase 1 would not result in an increase in annual pumping by the District. It may, however, result in some variations in the amount of water pumped from different wells and different areas of the valley. For example, due to the increased pumping rate in Wells 18 and 34, when these wells are operated, more groundwater would be pumped from the southwest well field area of the valley over a given time period than can currently be pumped from the same wells. Thus, the amount of drawdown in the water table in the vicinity of Wells 18 and 34 would be greater than currently occurs when these wells are pumped. At the same time, pumping from other IWVWD wells in other areas, such as the intermediate well field or under the City of Ridgecrest, would decrease when Wells 18 and 34 are operating, resulting in less drawdown in these areas of the valley. These variations, though, are short-term in nature and would only occur when Wells 18 and 34 are operating. As described in Section 2.4, individual wells are operated approximately 70 to 90 percent of the time during high-demand summer months and 20 to 40 percent of the time during winter months.

In 2010, Layne Christensen Company prepared an evaluation of the existing water supply wells, the water quality in existing wells, and modeled the effects of increasing the water supply through additional pumping at various combinations of existing and new wells (Layne Christensen Company, 2010). The 2010 modeling effort was developed to address pumping scenarios consistent with the 2007 WSIP, as discussed further in Section 2.1.2 and Section 4.0. To better evaluate the effects of the Proposed Project, additional modeling was conducted by Layne Hydro (successor firm to Layne Christensen) in August 2011 (Layne Hydro 2011, Appendix G). The 2011 model assumes that when the Phase 1 wells (Wells 18 and 34) are pumped, they are pumped at their full capacity (2,200 gpm) as part of the normal well rotation for IWVWD. Thus, in the model, Phase 1 results in more pumping occurring in the southwest well field area and less pumping occurring under the City of Ridgecrest than might occur under actual operational conditions because the different well field areas are in different pressure zones for water delivery within the District. In addition, the 2011 model assumes that new Well 35 (labeled the SWWF well in the model) would be installed and operated beginning in the first year of the Proposed Project, as opposed to 2015. These assumptions make the 2011 model conservative in that it would tend to over-predict the drawdown that may occur in the southwest area. The 2011 modeling report is included as Appendix G.

The 2011 model results indicate that, over 10 years, the Proposed Project may result in an additional eight to 10 feet of drawdown occurring in the immediate area of Wells 34 and 35. The area of increased drawdown may extend up to two miles from the southwest well field area with additional drawdowns of up to two feet occurring at the perimeter of this area (Appendix G). Overall, however, Phase 1 would not result in additional net groundwater pumping by IWVWD. Therefore, Phase 1 would not alter the long-term trends in groundwater levels that are shown on Figures 3.8-4, 3.8-5, and 3.8-6.

Phase 2 includes the installation of new Well 35 in the southwest well field area in approximately 2015, based on an anticipated increase in demand of approximately one percent per year. The additional pumping from Well 35 for Phase 2 would result in an increased rate of drawdown locally. Based on the 2011 modeling results (Layne Hydro, 2011), the average rate of water level decline within one-half mile of Well 35 is anticipated to increase by up to 0.5 foot per year, from a rate of approximately 1.6 feet per year to a rate of approximately 2.1 feet per year. The average rate of water level decline within 1.5 miles of Well 35 is anticipated to increase by 0.2 foot per year, from a rate of approximately 1.6 feet per year to a rate of approximately 1.8 feet per year. The difference between these two rates of decline and the current baseline rate of decline is projected on the hydrograph for nearby well 27S/39E-07R01 as shown on Figure 3.8-11.

The existing water level declines in the vicinity of the Proposed Project already have the potential to affect the production rate of pre-existing wells, such that these wells may not support existing land uses in the future. This effect, however, is primarily a function of the total depth of the wells. Based on the drilling data from the 1993 U.S. Bureau of Reclamation Report, as summarized in Table 3.8-1, high-quality groundwater exists to depths of at least 2,000 ft bgs in the area of the Proposed Project. This is a potentially significant impact that can be mitigated.

- Otherwise substantially degrade water quality

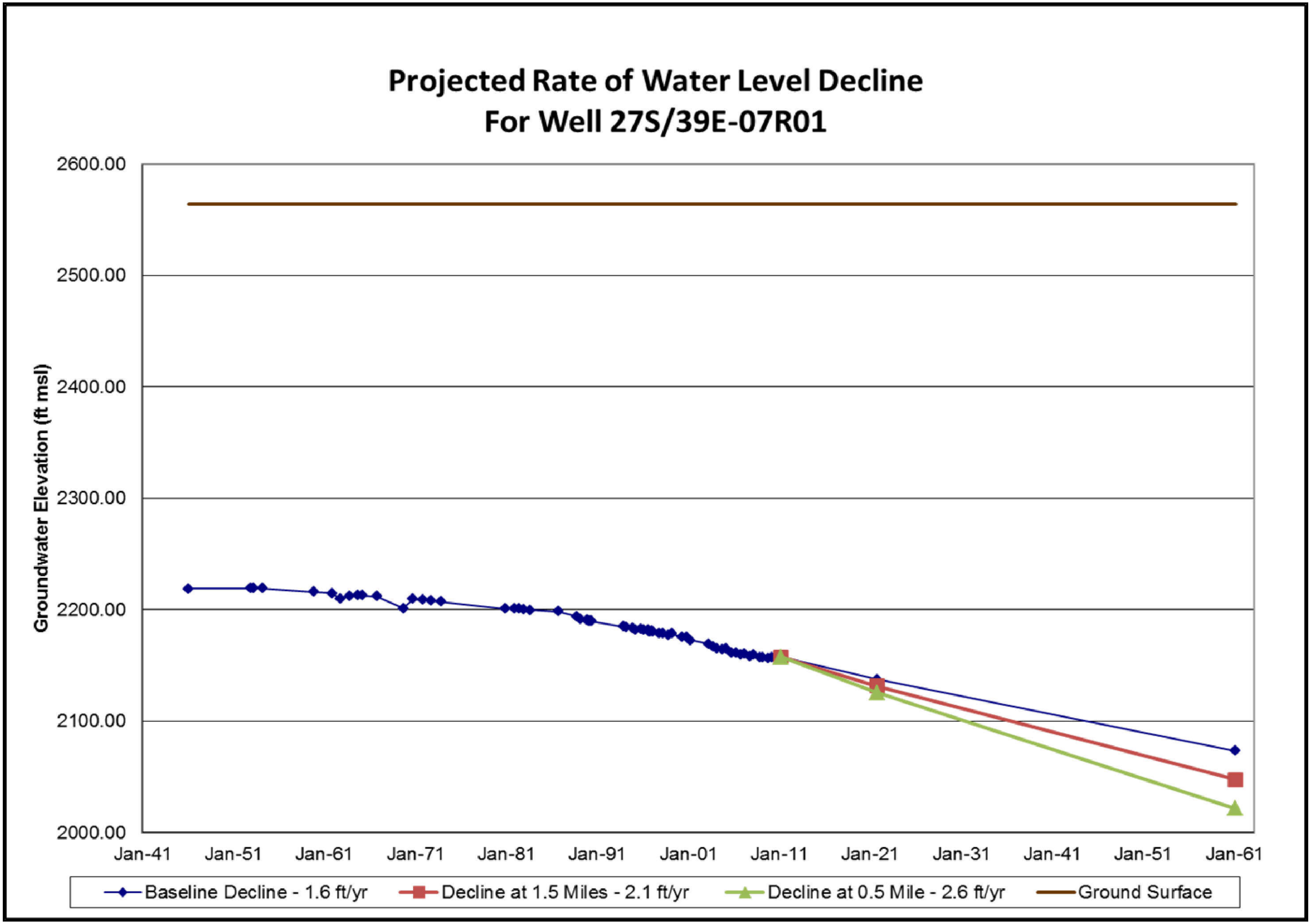
The Proposed Project would not involve the discharge of water offsite or into any other water bodies. As discussed above, the wells would be constructed in accordance with applicable standards and would produce groundwater that meets all drinking water standards. Water discharged to the ground surface would percolate back into the ground. Water used to disinfect the wells would be dechlorinated before being discharged to the ground surface and would not violate applicable water quality standards or waste discharge requirements.

The U.S. Bureau of Reclamation (1993) and the Layne Christensen Company (2010) studies evaluated water quality variations within the groundwater basin. One of the major findings of the U.S. Bureau of Reclamation (1993) is that a greater quantity of high-quality groundwater is in storage at depth in both the intermediate and southwest areas of the valley than previously known. This same study (U.S. Bureau of Reclamation 1993) concludes that one of the main approaches for extending the time period over which high-quality groundwater can be extracted from the Indian Wells Valley is to expand pumping in the southwest part of the basin. The Layne Christensen Company (2010) expanded on the prior findings and recommendations and based selection of appropriate pumping locations for the Proposed Project on areas with lower chloride and TDS concentrations, and areas with higher transmissivity (i.e., higher capability of the aquifer to transmit water to a well). The locations of existing Wells 18 and 34, and new Well 35, are in the southwest part of the basin in areas with lower chloride and TDS concentrations. Therefore, these wells are expected to produce high-quality groundwater for the foreseeable future in accordance with the findings and recommendations of the U.S. Bureau of Reclamation (1993) study.

Figure 3.8-10 shows the TDS concentrations in groundwater throughout the valley. Elevated TDS levels, often associated with elevated concentrations of other constituents such as arsenic, iron, and manganese, occur across the northern and eastern parts of the basin. Based on very limited data, there may be an area with elevated TDS concentrations located south of Inyokern and at least 0.5 to one mile of Wells 18 and 34 and proposed Well 35. There may also be a larger area of elevated TDS located two miles or more to the east of proposed Well 35.

Existing groundwater pumping in the intermediate and southwest areas, unrelated to the Proposed Project, has created groundwater depressions, as depicted on Figure 3.8-9, such that groundwater elevations in these areas are lower than those in surrounding areas. It is assumed, therefore, that water levels dropping throughout the basin has caused the co-mingling of good quality and lesser quality water. The Proposed Project would contribute to the pumping that has created the groundwater depression and thus would contribute to the migration of groundwater with elevated levels of TDS and/or other constituents toward the pumping well locations. The increased pumping from the Proposed Project, however, is a very small fraction of the total pumping from the basin that has created the groundwater depressions. Thus, the contribution of the Proposed Project to the change in groundwater quality is miniscule and cannot be quantified, measured, or monitored.

While it may be possible to mitigate for this impact at individual wells by adjusting the depth of the well screen or using wellhead treatment, it is not possible to mitigate for this impact in the aquifer. It is important to note that this impact on the aquifer would occur whether or not the Proposed Project is implemented. In fact, even if all of the pumping by IWVWD was to cease, more groundwater would still be pumped from the basin than is being recharged. Groundwater depressions would still persist and lower-quality groundwater would continue to mingle with higher-quality groundwater. As discussed above, the average groundwater pumping from the basin over the last 30 years has been about 26,000 acre-feet per year. Over the same time period, the average pumping by IWVWD (including the entities acquired in the 1980s) has been about 8,000 acre-feet per year. Thus, non-IWVWD pumping has averaged 18,000 acre-feet per year, while the annual recharge is between 8,000 acre-feet and 11,000 acre-feet. Therefore, the non-IWVWD pumping exceeds the recharge rate by 7,000 acre-feet per year to 10,000 acre-feet per year. The minor incremental increase in pumping that may occur as part of Phase 2 of the Proposed Project is nominal in comparison to the non-IWVWD pumping. On a Project-specific basis, this impact is less than significant. On a cumulative basis, this impact is significant, unavoidable, and unmitigatable. Discussion of cumulative impacts is presented in Section 5.1.



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Date: 9/22/2011

Figure 3.8-11 Projected Rate of Water Level Decline for Well 27S/39E-07R01

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ENVIRONMENTAL CONSULTANTS

3.8.4 Mitigation Measures

The technical assessments and modeling conducted for this EIR establish the existing baseline rates of water level decline in the vicinity of the Proposed Project. They also establish the radius of influence of the potential increase in pumping. Potentially measurable effects of the proposed increased pumping for Phase 2 would occur within no more than a two-mile radius of new Well 35.

As discussed in Section 3.8-1 and Section 3.8-3, water levels are already declining in the area of the Proposed Project at the rate of approximately 1.6 feet per year. As a result of the Proposed Project, the average rate of water level decline within one-half mile of Well 35 is anticipated to increase by one foot per year, to approximately 2.6 feet per year. The average rate of water level decline within 1.5 miles of Well 35 is anticipated to increase by one-half foot per year, from a rate of approximately 1.6 feet per year to a rate of approximately 2.1 feet per year. The difference between these two rates of decline is projected on the hydrograph for nearby well 27S/39E-07R01 as shown on Figure 3.8-11.

Existing baseline conditions will, over time, potentially reduce the production rate of pre-existing wells, such that these wells may not support existing land uses in the future. Under the requirements of CEQA, Mitigation Measure H-1 addresses the incremental increase in the rate of drawdown and potentially shorter timeframe before the impact to an individual well may occur.

H-1: To evaluate whether the Proposed Project will have an incremental impact on individual wells, a mitigation monitoring program will be established. This mitigation monitoring program shall be in place for the life of Well 35. The mitigation monitoring program must be prepared by a California-licensed Certified Hydrogeologist or California-licensed Professional Engineer experienced with groundwater monitoring programs and procedures. A detailed monitoring plan will be prepared that specifies field measurement procedures, the well locations to be included in the program, data collection and documentation procedures, and data analysis methods. The monitoring program will include a number of perimeter control wells, outside the area of influence of the Proposed Project, to document the baseline rate of water level decline over time. The monitoring program will also include any wells within two miles of new Well 35 for which the owners agree to participate in the program. It should be noted that non-participation in the monitoring program would make it extremely difficult if not impossible to evaluate whether or not the Proposed Project will have an effect on a specific individual well.

Water levels will be measured semiannually in each well that is part of the program. The monitoring frequency and timing may be coordinated with monitoring that is currently conducted by KCWA to enhance the overall public knowledge of groundwater conditions in the valley. The monitoring data will also be provided to KCWA for inclusion in its public database of water levels in Indian

Wells Valley. To help establish pre-Project conditions, the monitoring program should begin in 2012.

Water level data from individual wells will be analyzed semiannually and compared with the data from the perimeter control wells. The data will be evaluated to determine whether the rate of water level decline in a well within two miles of new Well 35 starts to increase after Phase 2 of the Proposed Project is implemented relative to the baseline rate in the perimeter control wells. If a rate of decline greater than the baseline rate develops in any well in the monitoring program as a result of District activities, then a mitigation program will be developed for that well by IWVWD in cooperation with the well owner. The rate of decline must also be clearly correlated with activity related to the Proposed Project. For example, if increased drawdown is occurring but new Well 35 has not been installed yet, or it is not pumped at a rate, in combination with other southwest well field wells (i.e. Wells 18, 33, and 34), that exceeds current pumping from those areas, then the increased drawdown cannot be attributed to the Proposed Project.

The mitigation program will include an assessment of the time at which the water level decline may reduce the production rate of the well, such that the wells will not support land uses that existed at the time this EIR was certified. The mitigation must then be implemented prior to this determined water level decline, so that the well owner does not experience a loss of pre-Project land use. Potential mitigation options that may be considered include:

- Deepening an existing well;
- Installing a different pump in an existing well;
- Drilling a deeper well; or
- Providing a hookup to IWVWD or another cooperative water system in the area.

The monitoring will be conducted by IWVWD. The mitigation options, if needed, may be installed by IWVWD or they may be funded by IWVWD and installed by the owner.

Current depth to groundwater in the area of the Proposed Project is approximately 400 ft bgs. Drilling data from the 1993 U.S. Bureau of Reclamation study demonstrates that good quality groundwater is present to depths of at least 2,000 ft bgs in the Project vicinity. Even at a rate of decline of 2.6 feet per year, this mitigation approach will be effective for over 600 years. Thus, this mitigation measure will reduce potential impacts to groundwater levels to less than significant.

3.8.5 Residual Impacts After Mitigation

No residual project-level impacts would occur with mitigation.

Significant and unavoidable cumulative impacts to groundwater quality would occur. These impacts would occur in the absence of the Proposed Project and it is not possible to quantify, measure, or monitor the potential nominal contribution from the Proposed Project. Therefore, this potential impact is unmitigatable and would persist with or without the Proposed Project. Additional discussion of this cumulative impact is in Sections 5.1.