TABLE OF CONTENTS

5. **Environmental Information** 5.14-1
5.14 Water Resources 5.14-1
5.14.1 Affected Environment 5.14-3
5.14.1.1 Physiographic Setting 5.14-3
5.14.1.2 Climate 5.14-4
5.14.1.3 Flooding 5.14-4
5.14.1.4 Groundwater Conditions 5.14-4
5.14.1.5 Water Supply History and Future Projections 5.14-14
5.14.1.6 Project Water Use 5.14-16
5.14.1.7 Project Wastewater 5.14-23
5.14.1.8 Storm Water Runoff 5.14-24
5.14.2 Environmental Consequences 5.14-28
5.14.2.1 Effect on Subbasin Water Balance 5.14-28
5.14.2.2 Water Level Drawdown Effects 5.14-29
5.14.2.3 Water Quality Effects—Groundwater 5.14-32
5.14.2.4 Water Quality Effects—Surface Water 5.14-33
5.14.2.5 Flooding 5.14-37
5.14.2.6 OEHI Project 5.14-38
5.14.3 Cumulative Impacts Analyses 5.14-38
5.14.4 Mitigation Measures 5.14-40
5.14.4.1 Groundwater 5.14-40
5.14.4.2 Surface Water 5.14-41
5.14.5 Laws, Ordinances, Regulations, and Standards 5.14-42
5.14.5.1 Federal Authorities and Administering Agencies 5.14-42
5.14.5.2 State Authorities and Administering Agencies 5.14-42
5.14.5.3 Local Authorities and Administering Agencies 5.14-44
5.14.5.4 Industry Codes and Standards 5.14-45
5.14.5.5 Involved Agencies and Agency Contacts 5.14-45
5.14.6 Permits Required and Permit Schedule 5.14-45
5.14.7 References 5.14-46

Tables

Table 5.14-1 Monthly Temperature Data for Bakersfield, California (°F)
Table 5.14-2 Average Monthly Precipitation Bakersfield, California (Inches)
Table 5.14-3 Aquifer Parameters
Table 5.14-4 Ackerman Well Groundwater Quality
Table 5.14-5 Daily and Annual Water Flows
Table 5.14-6 BVWSD Supply Water Quality
Table 5.14-7 WKWD Supply Water Quality
Table 5.14-8 Estimated Construction Water Use
Table 5.14-9 Summary of LORS—Water Resources
Table 5.14-10 Agency Contacts

TABLE OF CONTENTS

Figures

Figure 5.14-1 Site Location (1:24,000)
Figure 5.14-2 Water Supply Well Field Location
Figure 5.14-3 Groundwater Subbasins in Kern County
Figure 5.14-4 Generalized Hydrogeologic Cross Section
Figure 5.14-5 Example Geophysical Log
Figure 5.14-6 2008 Depth to Groundwater
Figure 5.14-7 2008 Groundwater Elevations
Figure 5.14-8 Well Location Map
Figure 5.14-9 BVWSD and Private Water Well Location Map
Figure 5.14-10 Total Dissolved Solids – Summer 2001
Figure 5.14-11 Water Districts in Vicinity of Project
Figure 5.14-12 TDS Concentration vs. Mass Removal Rate
Figure 5.14-13 Mass Water Balance

Appendices

Appendix N-1 Water Resources Information
- November 2009 BVWSD-HECA Water Contract
- February 14, 2012 Will Serve Letter from WKWD for construction water and potable water during operations

Appendix N-2 Groundwater Modeling Documentation

Appendix N-3 BVWSD's Groundwater Monitoring Plan and Memorandum of Understanding Regarding Operation and Monitoring of the Buena Vista Water Storage District Groundwater Banking Program (MOU)

5.14 WATER RESOURCES

Hydrogen Energy California LLC (HECA LLC) is proposing an Integrated Gasification Combined Cycle (IGCC) polygeneration project (HECA or Project). The Project will gasify a fuel blend of 75 percent coal and 25 percent petroleum coke (petcoke) to produce synthesis gas (syngas). Syngas produced via gasification will be purified to hydrogen-rich fuel, and used to generate a nominal 300 megawatts (MW) of low-carbon baseload electricity in a Combined Cycle Power Block, low-carbon nitrogen-based products in an integrated Manufacturing Complex, and carbon dioxide (CO_2) for use in enhanced oil recovery (EOR). CO_2 from HECA will be transported by pipeline for use in EOR in the adjacent Elk Hills Oil Field (EHOF), which is owned and operated by Occidental of Elk Hills, Inc. (OEHI). The EOR process results in sequestration (storage) of the CO_2.

Terms used throughout this section are defined as follows:

- **Project or HECA.** The HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes, including its linear facilities.

- **Project Site or HECA Project Site.** The 453-acre parcel of land on which the HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes (excluding off-site portions of linear facilities), will be located.

- **OEHI Project.** The use of CO_2 for EOR at the EHOF and resulting sequestration, including the CO_2 pipeline, EOR processing facility, and associated equipment.

- **OEHI Project Site.** The portion of land within the EHOF on which the OEHI Project will be located and where the CO_2 produced by HECA will be used for EOR and resulting sequestration**.**

- **Controlled Area.** The 653 acres of land adjacent to the Project Site over which HECA will control access and future land uses.

This introduction provides brief descriptions of both the Project and the OEHI Project. Additional HECA Project description details are provided in Section 2.0. Additional OEHI Project description details are provided in Appendix A of this Application for Certification (AFC) Amendment.

HECA Project Linear Facilities

The HECA Project includes the following linear facilities, which extend off the Project Site (see Figure 2-7, Project Location Map):

- **Electrical transmission line.** An approximately 2-mile-long electrical transmission line will interconnect the Project to a future Pacific Gas and Electric Company (PG&E) switching station east of the Project Site.

- **Natural gas supply pipeline.** An approximately 13-mile-long natural gas interconnection will be made with PG&E natural gas pipelines located north of the Project Site.

- **Water supply pipelines and wells.** An approximately 15-mile-long process water supply line and up to five new groundwater wells will be installed by the Buena Vista Water Storage District (BVWSD) to supply brackish groundwater from northwest of the Project Site. An approximately 1-mile-long water supply line from the West Kern Water District (WKWD) east of the Project Site will provide potable water.

- **Coal transportation.** HECA is considering two alternatives for transporting coal to the Project Site:

  - **Alternative 1, rail transportation.** An approximately 5-mile-long new industrial railroad spur that will connect the Project Site to the existing San Joaquin Valley Railroad (SJVRR) Buttonwillow railroad line, north of the Project Site. This railroad spur will also be used to transport some HECA products to market.

  - **Alternative 2, truck transportation.** An approximately 27-mile-long truck transport route via existing roads from an existing coal transloading facility northeast of the Project Site. This alternative was presented in the 2009 Revised AFC.

OEHI Project

OEHI will be installing the CO_2 pipeline from the Project Site to the EHOF, as well as installing the EOR Processing Facility, including any associated wells and pipelines needed in the EHOF for CO_2 EOR and sequestration. The following is a brief description of the OEHI Project, which is described in more detail in Appendix A of this AFC Amendment:

- **CO_2 EOR Processing Facility.** The CO_2 EOR Processing Facility and 13 satellites are expected to occupy approximately 136 acres within the EHOF. The facility will use 720 producing and injection wells: 570 existing wells and 150 new well installations. Approximately 652 miles of new pipeline will also be installed in the EHOF.

- **CO_2 pipeline.** An approximately 3-mile-long CO_2 pipeline will transfer the CO_2 from the HECA Project Site south to the OEHI CO_2 EOR Processing Facility.

This section evaluates impacts to water resources. The analysis included in this section focuses on the HECA Project as well as the CO_2 pipeline associated with the OEHI Project. The analysis of the CO_2 EOR Processing Facility associated with the OEHI Project is included in Appendix A-1, Section 4.8, Hydrology and Water Quality, of this AFC Amendment. No construction impacts to water resources related to coal transportation Alternative 2 (existing coal transloading facility) are expected because the coal transloading facility is an existing use and trucks would use existing roads. Therefore, operation of coal transportation Alternative 2 (existing coal transloading facility) and construction and operation of coal transportation Alternative 1 (new railroad spur) are evaluated in section.

In its water resources formulation and evaluation of water resource options, the HECA Project considered the benefits and potential impacts on subjects ranging from environmental to commercial. Each subject was considered on a local, regional, state, and federal basis, where appropriate. The Project's water source evaluation criteria included the following:

- Project objectives
- Existing water-related conditions and water demands in the surrounding Project area
- Projected future needs of the county, including regional coordination with irrigation and other districts on water matters
- Applicable laws, ordinances, regulations, standards, and policies
- Project source water and wastewater demands (at maximum annual load), and their inter-dependency
- Mitigation needs and plans, where appropriate

The HECA Project's evaluation and preferred raw water source and wastewater disposal option are presented in this section. The water resources data and information for the area, and the water demand data, were used to identify and evaluate the potential effects of the Project on local water resources, and to identify mitigation measures that will reduce potential significant impacts (if any) to a level of insignificance.

5.14.1 Affected Environment

5.14.1.1 Physiographic Setting

The Project Site is located in the Central Valley as shown on Figure 2-1, Project Vicinity. Figure 5.14-1 shows the Project Site on USGS topographic mapping (i.e., at a scale of 1:24,000). The Project is located in the southern end of the Central Valley region of California. The topography at the Project Site is characterized by relatively flat, low-lying terrain that slopes very gently from southeast to northwest.

Several regional irrigation and water supply canals are located in the vicinity of the Project Site (see Figure 5.14-1). The West Side Canal (and the Outlet Canal) and the Kern River Flood Control Channel (KRFCC) are approximately 500 and 700 feet south of the Project Site, respectively. The East Side Canal is located approximately 0.25 mile east of the Project Site boundary. The California Aqueduct, which was constructed in the 1970s and supplies agricultural and municipal areas in Southern California, is located parallel to, and west of the West Side and Outlet Canals, approximately 1,900 feet south of the Project Site. The California Aqueduct generally runs north-south and is the major conveyance feature for the California State Water Project that brings water from Northern to Southern California. The aqueduct is 444 miles long and is mostly an open concrete-lined canal. The canal width and depth vary along the length of the aqueduct, but it is generally approximately 50 feet wide and approximately 30 feet deep.

An irrigation canal extends generally from the east to the west from Tupman Road along the southern border of the Project Site. This irrigation canal connects the East Side Canal with the West Side and Outlet Canals.

An irrigation ditch crosses the Project Site from south to north and ends just south of Adohr Road. This ditch is approximately 7 feet deep and feeds the smaller irrigation ditches that traverse the Project Site from north to south and east to west around the crop fields. These irrigation ditches are fed by the West Side Canal and the East Side Canal.

5.14.1.2 Climate

The climate of the Central Valley in the vicinity of the Project can be characterized as semi-arid. The valley experiences long, hot, dry summers and relatively mild winters. Monthly average, maximum, and minimum temperature data based on a 69-year record for the Bakersfield World Service Office (WSO) Airport, Station No. 040442, are presented in Table 5.14-1, Monthly Temperature Data for Bakersfield, California. Based on 69 years of record, the average annual temperature for Bakersfield is 65.4 degrees Fahrenheit (°F).

Precipitation in the area is characterized by long, dry summers and intermittent wet periods. Based on the 69-year record of precipitation, the average annual precipitation is 6.23 inches. See Table 5.14-2, Average Monthly Precipitation Bakersfield, California.

5.14.1.3 Flooding

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), the Project Site is not located in an area identified as having flood hazards or shallow groundwater (FEMA, 2008).

The Kern River Flood Control Channel is located approximately 0.5 mile south of the Project Site. This channel conveys overflows from the Kern River during flood events. The floodplain associated with this channel does not extend onto the Project Site.

5.14.1.4 Groundwater Conditions

Geology

Project Site

The Project Site is situated in the asymmetrical San Joaquin Valley basin, a structural trough that comprises the southern portion of the Great Central Valley of California. It is defined by the Coast Ranges to the west, the San Emigdio and Tehachapi Mountains to the south, the Sierra Nevada to the east, and the delta of the San Joaquin and Sacramento rivers to the north. The axis of the valley is closer to the Coast Ranges than to the Sierra Nevada (Belitz and Heimes, 1990). The oldest rocks in the valley comprise a mass of plutonic and metamorphic rocks commonly referred to as the Sierra Nevada batholith of pre-Tertiary age. The valley is filled with up to 32,000 feet of marine sedimentary rock eroded from the Diablo coastal range and granitic, sedimentary, and metamorphic rock eroded from the western Sierra Nevada. Sierran sands do

not generally extend very far west of the axis of the valley trough; as such, in the Project vicinity, the geology is dominated by Coast Range alluvium. The continental sediments form an alluvial wedge that thickens toward the valley axis (DWR, 2006).

The Project Site is located approximately 2 miles north of the Elk Hills, an east-trending anticlinal uplift consisting of a series of low hills, also known as the EHOF. The Elk Hills form the surface expression of an anticline composed of gravel and mudstone derived from the Coast Ranges to the west. The Elk Hills are being dissected by numerous streams that redeposit the material on an apron of small coalescing fans along the northeast flank of the hills which abut the much larger Kern River fan to the north. The Elk Hills are composed of Tertiary to Quaternary rocks, of which the Tulare Formation is the shallowest unit. An unconformity separates the Elk Hills from the flatter portion of the valley on which the Project Site is located.

The surficial deposits in the vicinity of the Project Site are Quaternary alluvial gravel and sand. Bedrock underlying alluvium at the Project Site is the Pliocene- to Pleistocene-age Tulare Formation, which consists of alternating beds of sand and mudstone. According to Dibblee (2005), these deposits are stream-laid, weakly indurated, light gray pebble gravels, sands, and clays; pebbles are primary composed of Monterey siliceous shale and debris from bedrock in the adjacent Temblor Range (URS, 2009).

The soils at the Project Site consist of Lokern clay and Buttonwillow clay (NRCS, 1988). These soils are very deep and somewhat poorly drained. Both soil types formed in alluvium weathered mainly from granitic rock, but a variety of rock sources are included. Typically, in units, the surface layer is dark gray clay about 21 to 28 inches thick. The underlying material is light yellowish brown sandy loam to a depth of 60 inches or more. In some areas, the surface layer is loamy sand.

Permeability of the Buttonwillow clay is moderately rapid between depths of 28 and 55 inches and slow below a depth of 55 inches, while the permeability of the Lokern clay is slow. Available water capacity is moderate or high for both soil types. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight.

A preliminary geotechnical investigation was conducted at the Project Site in January 2009. The field exploration program included drilling and sampling of five borings and eight cone penetration test (CPT) probes, as well as conducting percolation tests at two locations. Results indicate that the upper 10 feet of soils materials are generally fine-grained materials (e.g., sandy clays or silty sands). The underlying sandy soils consist of interbedded layers of sands, silty sands and sandy silts with varying degrees of consistencies from medium dense to very dense. Below 30 feet below grade, the sandy soils become dense, grading denser to the maximum depth explored in the borings (100 feet below grade) (URS, 2009).

Proposed Well Field

The BVWSD well field is located approximately 15 miles northwest of the Project Site, as shown on Figure 5.14-2, Water Supply Well Field Locations. The geology for the proposed well field area is similar to that described for the Project Site above. The approximate location of the well field is located 6 miles north of the Elk Hills and approximately 8 to 10 miles northeast of

the Temblor Range, a northwest-trending, Miocene to Plio-Pleistocene assemblage of marine sedimentary rocks. Temblor Range and Sierra Nevada derived sediments, interbed under and east of the well field area, predominantly consist of sands and gravels with some silt and clay layers of minor thickness and extent. They are vertically and laterally discontinuous as evidenced in local geophysical logs described below.

A 1991 study prepared by Kern County Water Agency (KCWA) (referred to as the "Clay Study") characterized the area geology within 2,000 feet below grade as alluvial, fluvial, and lacustrine clastic sediments dominated by sands and silts, with clays being less common and typically associated with oxbow lake depositional settings or, alternatively, small lacustrine settings within basin lows (KCWA, 1991).

Due to a paucity of geologic logs, spontaneous potential (SP) and resistivity geophysical logs for wells located in and around the proposed well field were reviewed to evaluate the geology of the proposed well field area. The logs available generally are not deeper than 500 to 600 feet below grade. The logs reveal that the sediments below the well field and in the vicinity are dominated by coarser-grained material (sand or gravel). The proportion of coarse-grained material generally decreases with depth. However, the sediments are consistently coarse-grained at depth. Fine-grained layers were observed in some of the logs, possibly correlative with the Corcoran Clay (see "Hydrogeology"), although the distance between logs (i.e., typically from 0.5 to 3 miles) precluded the correlation of these layers over large distances.

Hydrogeology

Project Site

The Project Site is located in the Kern County subbasin (DWR Subbasin No. 5-22.14) of the San Joaquin Valley groundwater basin. The subbasin is bounded by the Kern County line and the Tule groundwater subbasin on the north, by granitic bedrock of the Sierra Nevada foothills and Tehachapi Mountains on the east and southeast, and by the marine deposits of the San Emigdio Mountains and Coast Ranges on the southwest and west (DWR, 2006).

The southern San Joaquin Valley, of which the Kern County subbasin is part, has been further divided into additional hydrogeological subbasins that are bounded by distinct structural highs due to folding or faulting. These subbasins may contain isolated hydrogeological systems (KCWA, 1991). The Project Site is located in what is termed as the Buttonwillow Subbasin which is separated from the Jerry Slough Subbasin to the east and the Tulare Subbasin to the north and west as shown on Figure 5.14-3, Groundwater Subbasins in Kern County.

Shallow-to intermediate-depth water-bearing sediments in the Kern County subbasin are dominated by Tertiary and Quaternary continental deposits (KWBA, 2009). In the Project vicinity, the two main water-bearing units consist of the Plio-Pleistocene Tulare Formation and the overlying Pleistocene "older" alluvium/steam deposits (DWR, 2006).

The Tulare Formation, primarily derived from the Coast Range, is moderately to highly permeable and consists of up to 2,200 feet of interbedded sands, gypsiferous clays, and gravels (DWR, 2006). In the Project vicinity, the Tulare gently dips to the northeast beneath the valley

(Page, 1986).The Tulare Formation is included in undifferentiated non-marine strata approximately 2,580 feet thick encountered in the upper portion of nearby gas wells (DOGGR, 1998). Much of the San Joaquin Valley north of the Project Site includes the Corcoran Clay, which is an extensive lacustrine deposit of low permeability that divides the groundwater flow system into a lower confined zone and an upper semi-confined zone. While the Corcoran Clay has been encountered in the San Joaquin Valley north of the Project Site, it does not appear to be present in the Project area (Williamson, et al., 1985; KCWA, 1991).

Above the Tulare Formation, older alluvium/stream deposits are up to 250 feet thick and are dominated by loosely consolidated to cemented clay, silt, sand, and gravel. These are mainly exposed at the subbasin margins and are moderately to highly permeable (DWR, 2006). Together with the Tulare Formation, the older alluvium/stream deposits constitute the main water-bearing body of the subbasin.

Based on information available from the KWBA (KWBA, 2009), the upper 200 feet of the aquifer within the Kern Water Bank area east of the Project Site consists of discontinuous, thick sand intervals interbedded with gravel and silt, characterized as an unconfined aquifer. Below 200 feet, strata are dominated by interbedded sand, gravel, silt, and clay of limited lateral continuity. There are no widespread confining beds in the area. However, based on pumping response and the occurrence of downward leakage within the Kern Water Bank area, the deeper portion of the water-bearing zone is consistent with a semiconfined aquifer. As such, the aquifer below the Project area is characterized as a combination of an unconfined and a semiconfined system.

Proposed Well Field

In the well field vicinity, the two main water-bearing units consist of the Plio-Pleistocene Tulare Formation and the Pleistocene “older” alluvium/stream deposits (DWR, 2006). The Clay Study proposed further subdivision of the Kern County Subbasin, whereby the Project Site and proposed well field are located within a northwest-trending subbasin (“Buttonwillow Subbasin”) within the Kern County Subbasin bounded by subsurface structural highs (anticlines) mapped from borehole and seismic data (KCWA, 1991).

The regional hydrogeology for the well field is similar to that described for the Project Site. However, unconsolidated sediments underlying the approximate well field area include Temblor Range marine sediments from the west interbedding with alluvial sediments from the Sierra Nevada (Kern Fan) from the east. These sediments predominantly consist of sands and gravels with some silt and clay layers of minor thickness and extent (vertically and laterally discontinuous as evidenced in local geophysical logs described in the well field geology section). Figure 5.14-4, Generalized Hydrogeologic Cross Section, is a generalized cross section of the hydrogeologic system (tending southwest to northeast) from the Temblor Range to the well field area. Figure 5.14-5, Example Geophysical Log, is a geophysical log from a representative boring/well nearby the proposed well field that depicts the predominance of sands and gravels with minor interbeds of silts and clay. The dominance of coarse-grained alluvium and stream deposits, in combination with the presence of discontinuous lacustrine clay lens(es), suggest that the aquifer below the proposed well field is a combination of an unconfined and a semiconfined system.

The dominant recharge source in the subbasin is applied irrigation water (DWR, 2006). Although water levels in different parts of the subbasin have varied over the last several decades (e.g., 25-foot decrease in the Bakersfield area and 30-foot increase in the Lost Hills/ Buttonwillow areas), average groundwater levels in the subbasin have been relatively stable since 1970 (DWR, 2006). Data provided by the BVWSD for 2008 indicate that depth to groundwater in the proposed well field area is approximately 30 feet below grade, which corresponds to a groundwater elevation of approximately 220 feet msl. Information provided by the BVWSD indicates that in 2008 depths to water ranged from 20 feet below grade in the north to 130 feet below grade in the south near the Project Site (see Figure 5.14-6, 2008 Depth to Groundwater). BVWSD also reports perched groundwater zones in the northern-most portions of the Buttonwillow Service Area with depths to water ranging from less than 5 feet below grade to 10 feet below grade.

Aquifer Characteristics

DWR estimates of specific yield (Sy) for Kern County range from 8 to 19.5 percent, with the highest specific yield values for the subbasin associated with the Kern River alluvial fan west of Bakersfield and east of the Project Site (DWR, 2006). Information provided by the BVWSD indicates that the local aquifer system is prolific, of high permeability and yields high volumes of water to wells (typical pumping rates are 1,500 to 2,000 gpm in most of BVWSD's service area agricultural wells). Personal communications with Dr. Robert Crewdson of Sierra Scientific Services (BVWSD's Hydrogeologic Consultant), indicate there has been very little pumping impact (i.e., minimal drawdown) in local agricultural wells and that the local aquifer system responds similarly to and most likely exhibits similar hydraulic characteristics to nearby Kern County areas already studied in detail (Sierra Scientific Services, 2003; 2004; 2007a; and 2007b). Sy values reportedly range from 10 to 20 percent and hydraulic conductivity (K) values is estimated to be in the range of 57 feet/day (426 gpd/ft^2) for the sandy zones which appear to predominate the well field area. The aquifer is characterized as unconfined (shallow-water table portion) to semi-confined (due to apparent lack of thick or laterally continuous clay or aquitard-like deposits). The aquifer is also anisotropic with high anisotropic ratios—i.e., horizontal K to vertical K Kh/Kv) on the order of 30 to 50 or more. This means that water flows quicker in the horizontal rather than vertical direction because the unconsolidated alluvial sediments comprising the aquifer system were deposited in horizontal layers. The aquifer thickness in the well field area is as deep as 2,000 feet thick.

Assumptions for the aquifer parameters included in the groundwater model used to evaluate aquifer response to Project-specific pumping are summarized in Table 5.14-3, Aquifer Parameters. Sensitivity analyses for various parameters were also performed to account for uncertainties associated with a lack of site-specific hydraulic data in the well field area and to evaluate model response to the parameters. See Appendix N-2, Groundwater Model Documentation for additional information.

In late 2009, URS in cooperation with the BVWSD, implemented a Hydrogeologic Data Acquisition Program to evaluate hydrogeologic conditions in the vicinity of the proposed process water well field. Prior to the Hydrogeologic Data Acquisition Program, there was no known pumping test information in the proposed well field area. The results of this field program were provided to the CEC in the Draft – Hydrogeologic Data Acquisition Report (Draft HDAR),

Groundwater Monitoring and Process Water Well Field Development Project (URS, 2010a) and the Draft Data Acquisition Report Addendum (URS, 2010b). The primary goals of the field program and the Draft HDAR were:

- To gather initial field data to verify that the assumptions used in the May 2009 Revised AFC Water Resources Section (with supporting Groundwater Model Appendix N-2) were reasonable
- To use the data to support anticipated data requests from the CEC
- To evaluate whether the BVWSD's brackish groundwater remediation project (BGRP) area identified for the BVWSD well field was reasonable with respect to HECA process water demand—7,500 acre feet per year (afy) and water quality criteria (average total dissolved solids (TDS) of 2,000 milligrams per liter (mg/L).

This work was preliminary in nature, using existing agricultural wells for pumping tests and water quality sampling. The Draft HDAR concluded that the assumptions used in the analysis of Project pumping from the BVWSD well field were reasonable, and the BGRP area appears feasible from both a water demand and quality standpoint. This preliminary work was to be followed by more robust exploratory drilling and well installation programs directed towards designing and constructing the well field. It is our understanding that the BVWSD is now planning those follow-on drilling and testing programs.

Groundwater Occurrence and Flow

Regional

On a regional scale, the development of irrigated agriculture in the western San Joaquin Valley has significantly altered the groundwater flow system. Percolation of irrigation water past crop roots has caused a rise in the elevation of the water table. Pumpage of groundwater from wells has caused a lowering of the potentiometric surface of the confined zone over much of the western valley. Percolation of irrigation water from agricultural fields, drainage ditches and canals has replaced infiltration of intermittent streamflow as the primary mechanism of recharge. Pumpage of groundwater from wells and crop evapotranspiration have replaced natural evapotranspiration and seepage to streams in the valley trough as the primary mechanisms of discharge. Decreases in groundwater pumping following delivery of surface water have allowed consequent recovery in hydraulic head throughout the groundwater flow system. The present-day groundwater flow system is in a transient state and is adjusting to the stresses placed upon it in both the past and present (Belitz and Heimes, 1990).

The dominant recharge source in the subbasin is applied irrigation water (DWR, 2006). Although water levels in different parts of the subbasin have varied over the last several decades, the average groundwater level in the subbasin has been relatively stable since 1970 (DWR, 2006). A groundwater divide is approximately located at the Kern River (Dale et al., 1966). The Elk Hills, together with the nearby Buena Vista Hills, restrict groundwater movement from the Buena Vista Valley (Page, 1986).

The average subbasin water level is essentially unchanged from 1970 to 2000, after experiencing cumulative changes of approximately a 15-foot decrease through 1978, a 15-foot increase through 1988, and an 8-foot decrease through 1997. However, net water level changes in different portions of the subbasin were quite variable through the period 1970 to 2000. These changes ranged from increases of more than 30 feet at the southeast valley margin and in the Lost Hills/Buttonwillow areas to decreases of more than 25 and 50 feet in the Bakersfield area and McFarland/Shafter areas, respectively.

The Kern Water Bank Authority recharges, stores, and recovers groundwater in the Bakersfield area. The western boundary of the approximately 20,000-acre water bank property is located 1 mile east of the Project Site. The Kern Water Bank, which receives water from the California Aqueduct, the Kern River, and the Friant–Kern Canal, can store more than 1 million acre-feet of water and can recover up to 240,000 acre-feet of water per year (KWBA, 2009). Banking facilities, including recharge basins, occupy approximately 7,000 acres of water bank property. Eighty recovery wells, with total depths ranging from 700 to 1,000 feet below grade, are located throughout the water bank, and are capable of being pumped at rates ranging from 2,500 to 5,000 gpm (KWBA, 2009).

Project Site

The Project Site is in an area of relatively deep groundwater conditions. A BVWSD 2008 Depth to Groundwater Map indicates that first groundwater at the Project Site should be encountered at between 120 and 130 feet below grade (Figure 5.14-6). The groundwater surface was not encountered within 60 to 100 feet of the ground surface based on the geotechnical borings and CPT probes (URS, 2009). During the on-site geotechnical investigation conducted in late January 2009, one boring was drilled to approximately 100 feet below grade, four borings were drilled to approximately 60 feet below grade and eight CPT probes were advanced to approximately 60 to 80 feet below grade. No groundwater was observed in the borings or CPTs at the time of the investigation. Anecdotal information provided by the property owner during the geotechnical investigation suggests that groundwater could be expected to be encountered at approximately 50 to 100 feet below grade. In the vicinity of the Project Site, spring-time groundwater elevations based on regional data from the DWR have ranged from approximately elevation 180 to 250 above msl in recent years, which corresponds to approximately 40 to 110 feet below grade (DWR, 2000 through 2006).

Proposed Well Field

Groundwater in the proposed BVWSD water supply well field area occurs under unconfined to semi-confined conditions depending on the depth of the water bearing zones. As stated previously, the well field is located in the Buttonwillow Subbasin (KCWA, 1991). Geophysical logs suggest that the aquifer system at and adjacent to the well field is interconnected laterally and vertically with a dominance of coarse-grained sediments and a lack of aquitard-like sediments. The depth to water in the well field area is approximately 20 to 30 feet below grade with general groundwater flow direction to the east and northeast (Figures 5.14-6, 2008 Depth to Groundwater, and 5.14-7, 2008 Groundwater Elevations).

Groundwater in Storage

Kern County Water Agency estimates that the total volume of groundwater in storage in the Kern River subbasin is approximately 40,000,000 acre-feet. The dewatered aquifer storage is estimated to be approximately 10,000,000 acre-feet. These estimates consider areas of the subbasin which are known to overlay useable groundwater, which is estimated to be about 1,000,000 acres (DWR, 2006).

From 1962 to 2000, BVWSD's operations in the Buttonwillow Service Area have resulted in a positive groundwater balance of approximately 46,000 acre-feet per year (afy). Based on future projections by BVWSD for the Buttonwillow Service Area, a positive groundwater balance of approximately 25,000 afy is estimated (BVWSD and Sierra Scientific Services, 2009). Therefore, even though the southern San Joaquin Valley has been classified by the DWR as an overdrafted groundwater basin, the BVWSD has historically been able to achieve a positive groundwater balance. As stated previously, water levels in the BVWSD Buttonwillow Service Area (which includes the proposed Project well field area) have and are expected to continue to rise in response to BVWSD's positive water balance operations. This may be attributed to the BVWSD's Buttonwillow Service Area location within the Buttonwillow subbasin (KCWA, 1991), which may be partially isolated from adjacent hydrogeological subbasins by structural highs due to folding or faulting (see Figure 5.14-3).

Aquifer storage in the Buttonwillow Service Area is approximately 7,000,000 acre-feet (af) (Sierra Scientific Services, 2009).

Groundwater Wells

Project Site

According to the Environmental Data Resources, Inc. (EDR) report that was compiled for the 2012 Phase I Environmental Site Assessment (see Appendix L), there are two water wells on the Project Site: W1 (USGS3174524) and W3 (CADW40000021752). Another well, W2 (USGS3175401), is located in the Controlled Area. There is also another water well (known as the Ackerman Well) located adjacent and northwest of the Project Site in the parcel that was acquired subsequent to the 2009 Revised AFC and that is now in the Controlled Area; this well was not identified in the EDR report. No information on well depth or water table elevation was available, per the EDR report; however, based on a discussion with a representative of the property owner, the Ackerman Well is completed to a depth of 680 feet below ground surface (bgs), with a perforated interval from 600 to 680 feet. It is constructed of 6-inch-diameter steel casing and has a cement annular seal from the ground surface to 500 feet bgs. The pump is set at 468 feet, and pumps 50 to 55 gallons per minute (gpm) at 70 pounds per square inch, gauge. The pump is an electric 5-horsepower "Grundfos" model 40s50-15 installed on October 17, 2007. There is a 1,000-gallon holding tank adjacent to the well.

The March 2012 EDR report indicated that there are two off-site water wells (Well C and Well D) and one on-site well (Well W1) that are approximately 0.5 mile or less from the Ackerman Well.

In addition to the water wells, the March 2012 EDR Report also listed one state oil and gas well located on the Project Site, identified as CAOG80000105543. The EDR report indicates that the oil and gas well was operated by the Quintana Production Company and was abandoned in November 1950.

Proposed Well Field

An EDR well search for the BVWSD water supply well field area and a 0.5-mile buffer around the well field was conducted (EDR, April 3, 2009). The locations of wells within the boundaries of the search area are presented on Figure 5.14-8, Well Location Map. The BVWSD reports that the Buttonwillow Service Area has more than 200 agricultural supply wells as shown on Figure 5.14-9, BVWSD and Private Water Well Location Map. According to BVWSD, typical agricultural wells are of large diameter, are completed to depths up to 450 feet below grade and are typically capable of pumping between 1,500 and 2,000 gpm of groundwater.

According to BVWSD, there are ten private landowner water supply wells at nine locations and no BVWSD supply wells located within 0.5 mile of the proposed well field. Four of the wells are located within the proposed well field area and the other six are located within the buffer zone. The EDR well search report provided information on wells located within 0.5 mile of the proposed well field culled from two databases: the USGS National Water Inventory System and the DWR Water Well Database. Eleven wells were listed in the USGS database and eight wells were listed in the DWR database. Based on latitude and longitude information provided in the EDR report, it is likely that the eight DWR database wells correspond to eight of the USGS wells, indicating that the well listings are duplicative, although it is not possible to determine this definitively.

Comparison of well location information provided by BVWSD to the EDR database reveals that six of the EDR well locations correspond to BVWSD well locations. At one of the EDR well locations with a BVWSD equivalent, two wells are listed as being present. Three of the nine BVWSD well locations do not have equivalent listings in the EDR report; at one of these locations, two wells are listed as being present, according to BVWSD. Therefore, accounting for duplicative listings in the BVWSD database and the EDR report, there are at least 15 private landowner water supply wells at 13 locations located within 0.5 mile of the proposed well field.

Groundwater Quality

Groundwater within the Coast Range alluvium is generally considered to be of relatively low quality due to the presence of water-soluble deleterious minerals within the parent rocks (Gilliom et al., 1989).

Groundwater in the Project area is primarily sodium sulfate to calcium-sodium sulfate type. The average total dissolved solids (TDS) of groundwater is 400 to 450 milligrams per liter (mg/L) with a range of 150 to 5,000 mg/L. Shallow groundwater presents problems for agriculture in the vicinity of the Project with high concentrations of TDS, sodium chloride, and sulfate. Analytical results for a water sample collected from the Ackerman Well on March 10, 2010 show that the total dissolved solids are 960 milligrams per liter (mg/L). The water quality data are summarized on Table 5.14-4 (URS, 2010c).

In the vicinity of the proposed BVWSD water supply well field, groundwater quality exhibits elevated TDS. As shown on Figure 5.14-10, Total Dissolved Solids—Summer 2001, TDS concentrations in summer 2001 were about 3,000 mg/L. According to BVWSD, TDS concentrations in groundwater in this area are expected to range from approximately 1,000 to 4,000 mg/L. BVWSD water quality information indicates that within the Buttonwillow Service Area, sulfate (SO_4) can range up to 1,200 mg/L and chloride (Cl) can range up to 900 mg/L. Water of this quality is consistent with the California State Water Resources Control Board Resolution No. 75-58 Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Power Plant Cooling (CWRCB Res. No. 75-58) definition of brackish water which includes all waters with a salinity (i.e., TDS) range of 1,000 to 30,000 mg/L and a chloride concentration of 250 to 12,000 mg/L. According to BVWSD, the only use for groundwater in the well field area is agricultural but the impaired groundwater is considered objectionable by local users because it is unsuitable for good crop yields and crop diversification.

In addition to the above, additional water quality data were provided in the Draft Hydrogeologic Data Acquisition Report (URS, 2010a) and the Draft Hydrogeologic Data Acquisition Report Addendum (URS, 2010b).

TDS data from BVWSD's water chemistry database, collected from January 2000 to October 2007, and TDS data collected during URS' Hydrogeologic Data Acquisition Field Program (HDAR field program) between September 2009 and January 2010 indicate that there is an axial interface east of the BVWSD well field between good-chemistry (i.e., low TDS) groundwater (<2,000 milligrams per liter [mg/L] TDS) and poor-chemistry (i.e., high TDS) groundwater (>2,000 mg/L TDS). The poor-chemistry groundwater area to the west of the axial interface was defined by TDS concentrations ranging from 2,900 mg/L (Well 96, east of the southern portion of the proposed HECA Well Field) to 4,300 mg/L (Well 70A, northeast of the proposed HECA Well Field). The good-chemistry groundwater area east of the axial interface is defined by TDS concentrations ranging from 530 mg/L to 1,510 mg/L (URS, 2010e).

The TDS data were collected within the last 10 years from 15 wells within or near the eastern boundary of the BVWSD service area, and in some cases included data from multiple sampling events. Therefore, these data were considered reliable, reflective of current conditions, constitute the appropriate basis for well-field analysis, and demonstrate that the axial interface lies east of the proposed BVWSD Well Field.

Groundwater chemistry data west of the BVWSD service area were not available, but that part of the Belridge Water Storage District is not under active agricultural production and, because of poor groundwater chemistry, continues to be unusable for agriculture. An EDR Geocheck® report in October 2010 identified wells within a 3-mile radius from a central point located 3 miles west of the proposed well field. The EDR report identified mostly oil and gas wells, with some state and USGS wells within the 3-mile radius search. However, TDS data were not provided for any of the wells.

Despite the lack of TDS data west of BVWSD, it is widely accepted that groundwater west of BVWSD is of poor chemistry due to high TDS concentrations. A report published by the California Department of Water Resources (DWR), "Report on Proposed Bellridge Water Storage District" (DWR, 1961) notes that TDS from the five wells within the Belridge Water

Storage District range in concentration from 2,848 mg/L to 13,800 mg/L. An October 2010 discussion with the Kern County Water Agency (KCWA) indicated that the KCWA lacks data for the area west of BVWSD, because TDS is so high and groundwater is not used for either agricultural or domestic purposes.

5.14.1.5 Water Supply History and Future Projections

Water Supply History

Water supply within Kern County is provided by groundwater, the Kern River and other surface water imports, which include deliveries by the California State Water Project via the Friant-Kern Canal and the federally operated Central Valley Project via the California Aqueduct. In Kern County, about 60 percent of the water used for domestic and agricultural use is pumped from groundwater and agricultural uses comprise almost 90 percent of the total amount of water used in the region (Kern County Planning Department, 2004). Several water agencies in Kern County manage groundwater and surface-water supply resources for both domestic and agricultural uses. Water agencies with service areas in the vicinity of the Project are shown on Figure 5.14-11, Water Districts in Vicinity of Project, and include Buena Vista Water Storage District, West Kern Water District and the Kern Water Bank Authority (KWBA). Also numerous private water supply wells are located within the region.

Buena Vista Water Storage District

The BVWSD is located northwest of the Project Site, as shown on Figure 5.14-11, Water Districts in Vicinity of Project. The area served by the BVWSD consists primarily of irrigated farmland. The BVWSD Buttonwillow Service Area covers approximately 50,000 acres and the underlying aquifer has a storage capacity of approximately 7,000,000 acre-feet.

Early farmers in the BVWSD made use of surface and groundwater for irrigation. Water supplies for the BVWSD include a 2nd Point Kern River entitlement of 150,000 afy average. In 1973, the BVWSD contracted with the State Department of Water Resources via the Kern County Water Agency for an additional surface water supply. The contract provided for an annual firm entitlement of 21,300 acre-feet and surplus entitlement of 3,750 acre-feet. The BVWSD currently has access to five turnouts from the California State Water Project, that provide the system with about 850 cubic feet per second of added gravity inflow capacity directly into the District's distribution system.

BVWSD consumptive use demand is about 100,000 afy which is met by a combination of canals and groundwater pumping. As stated previously, with its water allocations, the BVWSD has been able to maintain a historic positive groundwater balance amounting to approximately 47,000 afy above groundwater withdrawals. This balance is projected to be approximately 30,000 afy in the future.

A local issue in the BVWSD's Buttonwillow Service Area is the movement of poor quality, high TDS, groundwater from the west to the east entering the shallow aquifer system. The TDS is derived from dissolution of salts from the marine sediments as groundwater flows eastward entering the western part of the BVWSD's service area. Figure 5.14-10 is a contour map of TDS

concentrations in groundwater for summer 2001. Elevated TDS in groundwater presents crop yield and diversification issues that have prompted the BVWSD to develop a BGRP, which includes extraction of groundwater in the elevated TDS area of BVWSD's service area. BVWSD began developing the BGRP long before this Project was proposed. The BGRP is Component 4 of the BVWSD Groundwater Management Plan (GMP) for which an EIR was prepared and certified in December 2009 (Krieger and Stewart, Incorporated, 2009). The BVWSD GMP states that the problem areas will require "...new and innovative solutions and corresponding management practices to enable the area to continue as a viable farming area over the long term."

After decades of irrigation pumping, the BVWSD determined that it is not possible to just remove the higher-TDS water from the aquifer simply by extraction because lateral recharge from the west brings in the brackish groundwater faster than it can be removed. The BGRP is designed to remediate brackish groundwater by recovering the brackish groundwater and brackish shallow perched groundwater from strategic locations within the aquifer to reduce the lateral recharge from the west. The recovered brackish groundwater is then transported to users, such as the Project. Implementation of the BGRP increases available water supplies and improves areas in BVWSD's service area for agricultural use.

West Kern Water District

The West Kern Water District (WKWD) service area covers approximately 250 square miles of western Kern County south of the Project Site (see Figure 5.14-11). This water district serves a population of approximately 25,000 people, residing in the communities of Taft and Maricopa, and other unincorporated communities (WKWD, 1997). The district also serves industrial users. WKWD obtains its potable water supply from local groundwater. The district has eight groundwater wells located within the Kern River groundwater basin on the western edge of the Kern River Alluvial Fan (WKWD, 2007). This well field is located in the Tupman area. In water year 1995-1996 the total water demand from the district was approximately 13,000 acre-feet (WKWD, 1997). Water demands have been steadily increasing and currently are estimated to be on the order of approximately 28,500 afy of which approximately 24,000 afy is delivered from WKWD's well field and the remainder delivered directly from the California Aqueduct (ESA, 2010).

In order to enhance reliability and operational flexibility, WKWD has acquired 480 acres northeast of the Project Site between Interstate 5 and the California Aqueduct. WKWD has initiated a groundwater banking project at this location that includes recharge basins and groundwater production wells. The groundwater production wells at this well field are designed to deliver up to 24,000 afy, i.e., the same pumping capacity as provided by the well field in the Tupman area. The purpose is to improve access to banked water and not increase WKWD water supplies or entitlements. WKWD prepared an EIR for the groundwater banking project, which was certified in March 2010 (ESA, 2010).

Other sources of WKWD's water supply include State Water Project water deliveries and agreements with various Kern County water agencies.

Kern Water Bank Authority

Kern Water Bank Authority (KWBA) owns approximately 20,500 acres of land along the Kern River in Kern County southwest of Bakersfield and east of the Project Site. This land is used for groundwater recharge and banking operations. The water bank receives water from the Kern River, the California Aqueduct and Friant–Kern Canal. This water is recharged into the underlying water supply aquifer and then later extracted and distributed for beneficial use by the member agencies via a system of wells, pipelines and canals. The KWBA has appropriated water rights to store 500,000 afy of which most is allocated for irrigation use (490,000 afy) and the remainder for municipal and industrial uses (5,000 afy each). Of the total area owned by the KWBA, only approximately 5,900 acres are used for recharge basins and approximately 481 acres are used for water bank facilities. The remainder is used for habitat preservation, farming, conservation banking, and other uses (KWBA, 2007). The nearest recharge area to the Project Site is located approximately 1 mile east of the site's eastern boundary (see Figures 5.14-1 and 5.14-11).

5.14.1.6 Project Water Use

Process Water Needs

The Project proposes to construct and operate a facility producing approximately 300 MW of low-carbon baseload power, low-carbon nitrogen-based products, and CO_2 for EOR . The HECA Combined Cycle Power Block will include one single-shaft nominal 405 MW MHI 501GAC® "G" class, air-cooled advanced combustion turbine (CT)/steam turbine (ST)/ generator configured to use hydrogen-rich fuel, one heat recovery steam generator (HRSG), and a water-cooled surface condenser. The CT, HRSG, and ST will convert chemical energy contained in the syngas fuel to electricity through the shaft power developed by the CT and ST generator and through the thermal energy recovered from the CT exhaust. This exhaust gas is converted to high-energy steam in the HRSG and combined with the high-energy steam recovered in the gasification process to generate additional electricity in the ST. The G-class machine is arranged in a single shaft configuration where the CT and ST share a common shaft/ generator.

Mechanical draft cooling towers are provided for the plant for indirect heat rejection where low process outlet temperatures are critical to overall plant efficiency. Mechanical draft cooling towers serve multiple heat loads in more than one process unit.

The Project will have three mechanical draft cooling towers (one for the Combined Cycle Power Block, the second for the Gasification Block/Process Units and the third dedicated for the Air Separation Unit).

The water balance diagram (Figure 5.14-13, Mass Water Balance) shows the potable and process water flow streams. Table 5.14-5, Daily and Annual Water Flows, shows the maximum daily, average daily, and average annual water supply and demand flows. These correspond to the Heat and Mass Balance Diagram (Table 2-10 in Section 2, Project Description), which provides further information for various ambient temperatures.

The Project's average annual water use of brackish groundwater provided by BVWSD is projected at approximately 7,430 afy. HECA signed an agreement with BVWSD for up to 7,500 afy (see Appendix N-1). The water contract between HECA and the BVWSD was negotiated in 2008, when deep well injection was the proposed method of water disposal for the Project. Deep well injection increases overall Project water demand significantly, and the water contract was negotiated on that basis. Subsequent to contract enactment, HECA reanalyzed water processing for the Project and changed the method of wastewater treatment to zero liquid discharge (ZLD).

The Project's water use per unit of net power output is reflective of large internal parasitic demand of the CO_2 separation and compression equipment. This large internal demand decreases net output and artificially increases water consumption per net MW exported. In light of this and to reduce water usage, the HECA Project has undertaken significant effort to reduce water demand. The most significant output of this activity was the selection of a ZLD design, which eliminated liquid water discharge from the Project and dramatically improved the water efficiency of the facility. The HECA Project productively uses all water consumed, either by vaporization for cooling needs or via chemical consumption for fuel generation, without losses from liquid-phase water discharge.

In addition to the brackish groundwater provided by BVWSD, the Project will recycle water from various process streams, as shown on Table 5.14-5 and Figure 5.14-13. Approximately 568 acre-feet per year (or approximately 7 percent) of the Project's total water usage will come from these other streams, which include boiler blowdown, gasification wastewater and sour water blowdown. In addition, wastewater from the Acid Gas Removal Unit and storm water runoff collected in the Project's detention basins will be used when available to offset the amount of water delivered by BVWSD.

The raw water requirement rates are greater than those presented in the 2009 Revised AFC because of the following two main factors:

- Project design improvements resulted in an approximately 150 percent increase in syngas production. Increased syngas production drives a need for more water, which is consumed in the shift reaction to produce more hydrogen.

- Project design addition of the Manufacturing Complex, which increased the process cooling tower duty, thereby increasing its water evaporation rate.

Project Water Supply Plan

Brackish groundwater provided by the BVWSD will be used at the Project for raw water supply. A copy of the will-serve letter from BVWSD is provided in Appendix N-1, Water Resources Information.

The primary uses of the raw water supply will be for cooling tower makeup, evaporative cooling, fire water, gasification, service water, and steam generation. The BVWSD supply was selected as the process water supply as it was determined to be most optimal in terms of environmental impact, capital cost, technical risk, and volume availability/reliability. (See Section 6.0,

Alternatives, of this AFC Amendment.) The BVWSD is a local water district with impaired groundwater sources not suitable for agricultural or drinking use without extensive treatment. These impaired groundwater sources are found in various locations within BVWSD's Buttonwillow Service Area. According to the BVWSD, the impaired groundwater is considered objectionable by local agricultural users because it is unsuitable for good crop yield or crop diversification. As such this water currently poses a negative impact on agriculture. Elevated TDS in groundwater has prompted the BVWSD to develop the BGRP. This program includes extraction of groundwater in elevated TDS areas.

With the desire to use poor quality groundwater for the Project's process water needs, HECA LLC entered into an agreement with the BVWSD to purchase as much as 7,500 afy of groundwater. Accordingly, this water would come from a BVWSD well field located in the elevated TDS area as shown on Figure 5.14-10. Extraction of water from the line of wells (i.e., picket fence well field) is directed toward impeding eastward flow of high TDS groundwater from the shallow aquifer system (first water up to 400 feet below grade) with the possibility of shifting the water quality divide in the eastern part towards the western part of BVWSD's service area. This Project-specific pumping would also remove considerable volumes of TDS from the local groundwater system during the lifetime of Project operation.

The effects of Project pumping and the potential benefits to the BVWSD are summarized below (URS, 2010d):

- Based on well-water quality data, the expected zone of influence of the well field, and a quantitative estimate of the long-term quality produced by the well field, there is an estimated axial interface location between east and westward flowing water (URS, 2010e).

- There will be a net benefit of in terms of salt removal (i.e., TDS removal in terms of rate and mass) as a result of Project pumping.

- BVWSD's BGRP Area B picket fence well field design (the proposed BVWSD Well Field) is specifically intended to improve local groundwater chemistry (URS, 2010e). The two benefit areas are:

  - **Area 1.** Salt Shadow zone, which represents the zone of net TDS mass movement induced by Project pumping which includes the net capture zone, and the area between the capture zone and the simulated net axial interface after 25 years of pumping.

  - **Area 2.** Zone of Maximum Benefit (the area between the current estimated axial interface and the simulated net axial interface) representing the westward shift of the axial interface during the 25 years of Project pumping.

- The BVWSD well field will not pump good-chemistry groundwater because the axial interface between good and poor groundwater chemistry is east of the well field and, as such, Project pumping would pull the axial interface to the west, thereby increasing the volume of good-chemistry groundwater within the BVWSD service area. Ultimately this would help to increase crop diversity and crop yield within BVWSD.

- Analysis performed to date supports that the proposed production water supply will be in conformity with state water policy. The BVWSD-HECA water contract (see Appendix N-1) states that average TDS in the groundwater supply from BVWSD will be about 2,000 mg/L TDS and range will be between about 1,000 and 4,000 mg/L TDS. California State Water Resources Control Board Resolution 75-58, entitled "Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Powerplant Cooling" (Resolution 75-58), defines "brackish waters" as ". . . all waters with a salinity range of 1,000 to 30,000 mg/L and a chloride concentration range of 250 to 12,000 mg/L." The water proposed for use by HECA meets this definition of brackish waters, and is therefore consistent with relevant policy regarding the use of inland waters for power plant cooling. Furthermore the BVWSD groundwater monitoring and operating plans would ensure that conditions would be in place to ensure that waters of described quality for the Project would be provided to and used by the Project.

- A groundwater monitoring/operating plan will be followed by BVWSD during the 25-year duration of HECA Project pumping to ensure that high quality groundwater that did not meet the water transfer terms would not be used by the Project. BVWSD proposes an operating plan that considers the following good-chemistry groundwater breakthrough mitigations: 1) isolating and plugging back aquifer zones to eliminate recovery of good-chemistry groundwater; 2) isolating or shutting down wells to eliminate recovery of good chemistry groundwater; 3) using an existing well that is 0.25 to 0.5 mile away from the proposed BGRP well field and has acceptable TDS concentrations; and/or 4) drilling replacement wells, as necessary, in adjacent areas of elevated TDS. BVWSD has also affirmed that there is more than enough groundwater of poor quality along the western boundary of the BVWSD immediately adjacent to the proposed well field to ensure that the proposed well field could be expanded to the north and south into broader areas (as much as 500 percent larger), if necessary, to replace or augment the primary source area.

- The currently proposed well configuration at Target Area B is optimal for the intended purpose of the BGRP Well Field process water supply.

- A perceived TDS concentration "divide" at Seventh Standard Road, that suggests that the BVWSD well field may have better-chemistry groundwater, is not supported by data (URS, 2010d).

- BVWSD does not have a tile drainage system and the shallow perched aquifer in the northern area of the BVWSD (Target Area A) is not available to HECA due to other planned BVWSD projects.

Recharge of the aquifer supplying the brackish groundwater will be provided by ongoing irrigation and replenishment activities in BVWSD's service area. There is sufficient brackish groundwater available to meet the needs of the Project. The use of brackish groundwater is consistent with California State Water Resources Control Board Resolution No. 75-58 Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Power Plant Cooling (CWRCB Res. No. 75-58).

As shown on Table 5.14-5, the average process water requirement to be supplied by BVWSD's brackish groundwater will be approximately 6.6 mgd, and the maximum water consumption will be approximately 7.4 mgd. BVWSD has stated that it will be able to provide brackish groundwater with an average TDS concentration of approximately 2,000 mg/L, with an acceptable range from about 1,000 to 4,000 mg/L, to the Project for the estimated life of the Project. Table 5.14-6, BVWSD Supply Water Quality, provides a summary of recent water quality analytical data from the currently-available brackish groundwater supply.

The water quality data shown on Table 5.14-6 was substantiated by groundwater sample results presented in Table 6 of the Draft Hydrogeologic Data Acquisition Report (URS, 2010a). Sample results from wells 70A, 96, and 98, which are located closest to the proposed BGRP Area B HECA production well field, had TDS values of 4,300, 2,900, and 2,400 mg/L, respectively, resulting in an average TDS value of 3,200 mg/L. The BVWSD will design, construct and operate the water supply system.

Process Water Uses

The raw water supply from BVWSD to the Project will be used for the Power Block cooling tower, process cooling tower, HRSG stack, ASU cooling tower, gasification solids, and low-carbon nitrogen-based products.

Project Water Supply Facilities

Water from BVWSD will be conveyed to the Project by a pipeline that will be installed in the District's unpaved service road along the east bank of the West Side Canal.

The brackish water supply will be treated on site prior to use. Storage tanks will be used to maintain a backup supply of raw water, treated water, purified water, demineralized water, and fire water. Water storage tanks include: 0.6 million gallons (MGAL) demineralized water storage tank, 2.8 MGAL raw water storage tank, 2.1 MGAL treated water storage tank, 1.6 MGAL purified water storage tank, and a 0.5 MGAL utility water storage tank. The on-site water storage that can be used if the raw water supply is interrupted is equivalent to about one day of operation at full capacity on coal/petcoke feedstock. The on-site water storage is equivalent to about two days of operation on natural gas feedstock. The raw water storage tank has been sized to cover the expected time for maintenance and repair of the raw water pipeline. The raw water supply is provided by multiple wells that operate independently to supply the raw water pipeline. For this reason outages or maintenance of individual wells is not expected to have a significant impact on the raw water supply.

Project Water Treatment

Preliminary engineering indicates that BVWSD brackish water requires pre-filtration, nano filtration and some degree of ion removal prior to cooling tower and other utility use. Purified water is produced in the Wastewater Zero Liquid Discharge Unit. Additional treatment to the purified water consisting of mixed bed polishing of the ZLD unit distillate will be required to produce demineralized water for gasifier and HRSG make-up use.

Water for non-potable use (service water and fire protection) will be provided by treating the industrial supply water to appropriate quality levels by blending purified water and treated water to appropriate quality levels.

Demineralized Water

High quality water for use as boiler feedwater makeup will be produced by further treatment of ZLD distillate with mixed bed deionization.

Potable Water Supply

Potable water consumption for personnel, typically 120 persons on site at any one time, is estimated to be 1,800 gallons per day (gpd). The peak potable water demand is not expected to exceed 2,700 gallons per day (gpd). Estimated average annual consumption is approximately 2 afy.

Potable water will be supplied by WKWD. The point of connection will be located 1.2 miles east of the northeast corner of the Project Site. The pipeline will be constructed and owned by HECA LLC. The pipeline will be placed within the electrical transmission corridor ROW (see Figure 2-7, Project Location Map). The 4-inch pipeline will be installed at least 5 feet below grade for most of the route and will cross the East Side Canal. Installation of the water supply pipeline will involve industry standard construction activities for pipelines, including trenching; hauling and stringing of pipe along the routes; welding; radiographic inspection and coating of pipe welds; lowering welded pipe into the trench; hydrostatic testing; and backfilling and restoring the approximate surface grade. Construction of the water pipeline is expected to take approximately 3 months to complete. Hydrotest water will be supplied by WKWD.

WKWD recently acquired 480 acres of land northeast of the Project Site for implementation of a groundwater banking project to aid in the management of WKWD's existing water supplies. This groundwater banking project includes recharge basins, groundwater monitoring wells, groundwater production wells and conveyance facilities. Currently there are two existing irrigation water supply wells on the 480-acre property. The pumping rates for Well #1 and Well #2 have ranged from approximately 1,800 to 2,500 gpm and from 1,900 to 2,900 gpm, respectively. WKWD's main water supply well field is located approximately 7 miles south of the Project Site. This well field has eight wells that provide approximately 24,000 afy of WKWD's current customer demand of 28,500 afy. Ultimately, WKWD will replace the existing two wells with five new wells on the 480-acre property that will be designed to have the capacity to recover up to 24,000 afy to increase water supply reliability and operational flexibility for WKWD's customers. (ESA, 2010).

A will-serve letter from WKWD stating that the district will provide potable water during construction and operation of the HECA Project is provided in Appendix N.

Table 5.14-7, WKWD Supply Water Quality, provides a summary of recent water quality analytical data from WKWD's groundwater supply wells.

Construction Water Supply

During Project construction, drinking water for personnel will be delivered by truck.

Water for construction uses (e.g., compaction, dust control, and hydrotesting) will be provided by existing on-site irrigation wells or supplied by WKWD. No new wells will be installed for construction water supply. Water supplied by WKWD for construction at the Project Site will be provided by 1) WKWD's wells east of the Project Site via the proposed potable water pipeline, once constructed, and 2) WKWD water transported via truck. Water will be transported to the linear construction sites via truck. A will-serve letter from WKWD stating that the district will provide water during construction of the HECA Project is provided in Appendix N-1.

Average daily water usage during construction (e.g., compaction, dust control, and hydrotesting) is summarized in Table 5.14-8. This table provides details for the estimated construction water use for the activities associated with construction of the Project Site and the linears (URS, 2009b).

The average daily water use over the construction period is estimated as follows:

- Project Site:
  - Water use is estimated to be 24,000 gpd during the first 2 months of construction, reducing to 14,000 gpd for the following 5 months. Construction activities during this phase include site grading, underground work, and dust control.
  - During the next 26 months, water use is estimated to be 12,000 gpd. Construction activities during this phase include day-to-day construction, foundations, backfill, compaction, dust control, and road cleaning.
  - Over the following 5 months, water use for the hydrostatic testing of the equipment and plant piping is estimated to be approximately 5,600 gpd.
  - In the final 4 months of construction, water use for final grading, construction cleanup, and ongoing dust control is estimated to be approximately 8,000 gpd.
- Linears:
  - An average construction water use of 900 gpd is estimated over a 6-month period for the construction of linear systems; this includes backfill/compaction of the trenches and dust control.
  - An additional 2,300 gpd of water is estimated to be required for the HDD. The average water use for hydrotesting the linear systems is estimated to be 2,000 gpd over a period of 6 months. This estimate is based on reuse of the water where possible. For example, water used to hydrotest portions of a pipeline would be re-circulated back to a holding water truck to be used on subsequent portions of the pipeline.

Construction of the linear systems is expected to take place within the overall Project construction schedule.

The Project also considered other options for construction water supply; however all of these options were determined to be unavailable or infeasible (URS, 2009b).The Project Site is approximately 17 miles northeast of the City of Bakersfield Wastewater Treatment Plant #3. This plant treats a portion of the municipal effluent generated from the City of Bakersfield. The current design capacity of this plant is 16 million gallons per day (mgd). The existing facility provides primary and secondary treatment of incoming wastewater. The secondary treated effluent is used for irrigation on 400 acres of City-owned land adjacent to the treatment plant facility and is provided by contract to the City of Los Angeles for crop irrigation on 4,700 acres of land alongside Interstate 5 (I-5). The I-5 site uses 14 mgd, with the remaining 2 mgd used near the plant.

The City is in the process of expanding and upgrading Wastewater Treatment Plant #3. Upon completion of the expansion project, the design treatment capacity of the plant will be increased to 32 mgd to accommodate potential future growth. The project also includes improvements to the primary and secondary treatment systems, as well as a 2 mgd tertiary treatment facility to produce recycled water for use on nearby landscaping and at the wastewater treatment plant. In August 2009, the Central Valley Regional Water Quality Control Board issued Waste Discharge Requirements (WDR) Order No. R5-2009-0087 for Wastewater Treatment Plant #3 to cover discharges from the existing and expanded plant.

WDR No. R5-2009-0087 specifies that the use of secondary treated wastewater effluent is limited to flood irrigation of crops that are not intended for human consumption or for grazing of non-milking cattle. Public contact with secondary treated wastewater is prohibited.

While the City of Bakersfield may have secondary treated municipal wastewater available in the future, the City cannot guarantee availability and the Applicant is concerned with the personnel exposure hazard associated with using the wastewater for construction purposes. It is expected that personnel will come into occasional contact with construction water and City of Bakersfield municipal effluent is not appropriate for human contact. As stipulated in WDR No. R5-2009-0087, direct contact with the effluent from the City's plant is prohibited. Other municipal wastewater treatment plants in Kern County are much smaller than Bakersfield's Wastewater Treatment Plant #3 and are not able to provide the necessary quantity of water to the HECA Project.

5.14.1.7 Project Wastewater

Wastewater Treatment and Recovery

The Project will recycle water to the maximum extent practical and will incorporate Zero Liquid Discharge (ZLD) technology; therefore there will be no wastewater discharge. Because the Project is a ZLD facility, the wastewater is, by definition, completely recycled. The primary sources of wastewater at the Project treated and recovered in the process wastewater ZLD will be from raw water supply treatment and cooling tower blowdown. Table 5.14-5, Daily and Annual Water Flows, shows the major wastewater streams and how they will be treated and recycled.

The cooling tower circulation water will be concentrated to the maximum practical extent. Cooling tower blowdown that cannot be recycled is sent to a plant ZLD unit where it is treated and recovered as high purity water and ZLD solids. The ZLD solids will be disposed of at an approved off-site facility.

Domestic/Sanitary Wastewater

No municipal sanitary sewer is available in the vicinity to serve the Project. The sanitary sewer system will consist of a septic collection and forwarding lift station system and holding tank designed to handle the sanitary sewer flow from the administration and control building and other restrooms, if any, located on the Project Site. The sanitary waste from the facility will be disposed of in an on-site leachfield.

For purposes of designing the septic system, it is assumed that sanitary wastewater discharge rates will be based on a maximum plant population of 120 persons at 35 gpd per person in accordance with Table K-3 of the Uniform Plumbing Code for estimating sanitary wastewater flowrates.

5.14.1.8 Storm Water Runoff

Details of the Project's storm water management features are provided in Section 2.0 (Project Description) of this AFC Amendment. The Project Site is relatively flat. All existing irrigation ditches within the Project Site will be abandoned and filled in to meet grade. The irrigation ditches only serve the current agricultural uses on the property and will no longer be needed once the Project Site is developed. The smaller irrigation ditches on the Project Site that serve the individual crop fields will also be abandoned and filled where not required for crop irrigation.

As shown on Figure 5.14-1, the topography in the vicinity of the Project Site is relatively flat, with a very gentle slope from the southeast to the northwest. In general, the roads in the vicinity of the site are slightly raised above the agricultural fields. Tupman Road, along the eastern boundary of the site, and the levee associated with the irrigation canal south of the site create barriers that limit runoff from upstream (i.e., from the east and south) areas flowing onto the site. Similarly, the roads at the downstream edges of the site (e.g., Dairy Road along the western boundary and Adohr Road along the northern boundary) limit the amount of runoff that leaves the Project Site.

An irrigation ditch crosses approximately three-quarters of the Project Site from south to north and ends just south of Adohr Road. This ditch feeds the smaller irrigation ditches that traverse the Project Site from north to south and east to west around the crop fields. These irrigation ditches are fed with water pumped from the canal south of the Project Site, which is supplied by the West Side Canal and the East Side Canal. The canal no longer connects to the property north of the Project Site. The canal crossing the Project Site is used only for irrigation and drainage within the Controlled Area of the Project; therefore, filling in the canal will not impact any off-site drainage paths of adjacent properties.

The storm water management for the Project is described in Section 2.5.16 in Section 2, Project Description and shown on Figure 2-45, Preliminary Storm Water Drainage System. In response

to Data Requests (specifically Data Request 95 and Data Request 202), HECA prepared a Draft Drainage, Erosion, and Sediment Control Plan (DESCP). While some Project details may have been modified, the overall approach to storm water management and erosion control remains the same as described in the previous Draft DESCP that was filed in November 2010 (URS, 2010e).

Storm water management for the Project is designed to avoid direct discharge to surface waters. The site drainage system will be separated in two distinct systems: 1) potentially contaminated storm water from the process, power block and administration building areas, and 2) noncontact storm water runoff from the undeveloped open areas.

Storm water from inside the process plant area will be routed to lined retention basins before it is reused. Water will be tested to determine an appropriate destination for reuse. Depending on the water quality, it may be used for cooling tower makeup or processed in the ZLD system at the wastewater treatment plant.

Storm water from outside the process plant area but within the Project Site should be relatively clean. Storm water from these areas will be separately collected in unlined retention basins located throughout the Project Site. Low permeability soil under these retention basins will be replaced with well graded permeable soil to allow percolation of the storm water into the sandy layer found to be approximately 6 to 12 feet bgs. Retention basins and storm water collection/ conveyance systems will be designed in accordance with the Kern County Development Standards. There are two types of retention basins, one for collection of clean storm water and the other for potentially contaminated storm water. The retention basin locations and types are shown on Figure 2-45, Preliminary Storm Water Drainage Plan.

Preliminary Drainage Calculations were prepared and included as Revised Appendix B in the 2009 Revised AFC and the Draft DESCP prepared in response to Data Request 202. While some Project details may have been modified, the overall approach for the drainage system remains the same as described in the previous calculations. These calculations demonstrate that the retention basins, both lined and unlined basins, have been sized to meet or exceed the Kern County standards. Storm water will be managed such that there will be no off-site surface water discharge from the Project Site.

Storm water generated at the Project Site will be managed as follows:

- Storm water runoff from inside the process plant areas will be routed to lined retention basins. After solids have settled and water is determined to be suitable for reuse, storm water will be pumped to the water treatment plant for further treatment and reuse. If this collected storm water is determined to be unsuitable for reuse, then it will be transferred and processed in the ZLD system at the wastewater treatment plant.

- Storm water that may be contaminated with oil will be separately collected and routed to an oil/water separator. Recovered waste oil from the separator will be disposed off site. The separated water will be transferred and processed at the wastewater treatment plant.

- Storm water from chemical and oil storage areas will be held within the associated secondary containment. Storm water held in these areas will first be tested. If it is acceptable for

cooling water makeup, then it will be routed to the lined retention basin. Oily storm water will be routed through an oil/water separator at the wastewater treatment plant.

- Storm water within the process plant area where solids are present (e.g., coal, petcoke, or gasification solids) will be collected and conveyed to the solids handling water collection facility. The collection facility will be constructed of concrete, and will provide for mobile equipment access to remove accumulated solids. Water that accumulates within the solids handling collection facility will be processed in the ZLD system at the wastewater treatment plant.

- All hazardous materials will be properly stored, and spill prevention measures will be implemented to prevent storm water contact with these materials. The preliminary DESCP included a summary of hazardous materials that would be used and stored on site for plant operations (see Tables 4 and 5 in the DESCP filed under confidential cover in response to DR 202 [URS, 2010e)]). Storm water from process areas where potential contaminants will be stored will be routed to lined on-site storm water retention basins as described below.

  - **Process Area.** The process area of the Project Site has a drainage area of approximately 104 acres. Potential contaminants that would be present in the process area of the Project Site were summarized in the November 2010 Draft DESCP. All hazardous materials would be properly stored, and spill prevention measures would be implemented to prevent storm water contact with these materials. Storm water runoff from the process areas will be directed to a retention basin. The retention basin would be lined with high-density polyethylene (HDPE) because this material is chemically inert with the materials that would be present on site. Storm water runoff from the process area would be conveyed to the retention basin via an underground network of pipes made of cast iron or carbon steel and HDPE. A monitoring system will be installed to detect potential leaks.

  - **AGR Process Area.** A separate HDPE-lined retention basin is proposed for the AGR unit as an additional protection measure to segregate and contain storm water in the unlikely event of a methanol spill.

  - **Gasification Area.** Storm water and washdown water within the gasifier area will be intercepted by a network of underground piping made of cast iron, carbon steel, or HDPE piping, draining to a concrete sump. Potential contaminants consist of off specification feedstock and solid waste material from the gasifier process. The gasification solids are currently anticipated to be a product that will be sold for reuse, not classified as a waste. If the gasification solids are not sold or reused, they are anticipated to be characterized as nonhazardous waste. Regarding the chemical analytical characterization of the gasification solids, the anticipated compositional range of constituents are summarized in in Table 2-9 in Section 2 (Project Description). More precise chemical composition data will not become available until the gasification solids are generated during operation. The gasification solids are dewatered and the solids are accumulated for off-site disposal. Upon exiting the gasifier, the liquids are recovered for reuse. The remaining dried gasification solids will be retained on site until sufficient quantities are accumulated to facilitate their economical transportation to the designated off-site location. No wastes would be generated during the temporary storage of the gasification solids.

- **Admin/Control Room/Warehouse Building Complex.** Potential pollutants include those commonly associated with vehicles and storage of chemical reagents, paint, thinners, solvents, and adhesives. Storm water will be conveyed to a lined retention basin to contain any contaminants associated with the warehouse operations.

- **Feedstock Unloading / Product Loading Area.** Contact storm water will be conveyed to a lined retention basin to contain contaminants associated with the feedstock unloading and operations.

- **Urea and UAN Production, Storage, and Transfer Area.** The urea pastille handling system consists of the urea collection/transfer area, urea storage domes, urea reclaim system, and urea loadout system. All conveyors are fully enclosed in uninsulated tubular galleries for weather protection and for control of fugitive dust. All urea handling buildings are fully enclosed with uninsulated roofing and siding. Dust collection systems, and/or transfer system design, are used to control dusting and fugitive dust emissions. The UAN solution is stored in tanks, and then loaded into railcars or tank trucks for shipment.

Existing drainage patterns outside the Project Site will be maintained, such that storm water runoff will be conveyed around the Project Site and not commingled with on-site storm water. The existing drainage ditches located along the site property will be improved where necessary.

The storm water management system will be designed in accordance with the U.S. Environment Protection Agency's (USEPA's) guidance document entitled "Storm Water Management for Construction Activities – Developing Pollution Prevention Plans and Best Management Practices" (USEPA, 1992), the California Storm Water Best Management Practices Handbook, the National Pollution Discharge Elimination System (NPDES) Industrial General Permit Requirements, and the NPDES Construction General Permit requirements.

The DESCP prepared and submitted in response to Data Request 202, provided information on inspection and maintenance procedures for the storm water management system and erosion and sedimentation control system. Prior to every rainy season (October 15 to April 15), all drainage facilities will be inspected, maintained, and properly repaired. An inspection and monitoring program will be developed to ensure that the systems are maintained in good operating condition and in good working order throughout the rainy season.

The Applicant will provide separate DESCP and SWPPP documents. A draft DESCP has been submitted in response to Data Request 95 and revised in response to Data Request 202. A Construction SWPPP will be provided as a post-certification submittal to allow for finalization of the Project Site and construction facilities design during detailed engineering. The Operations SWPPP will be prepared and submitted at least 60 days before commencement of commercial operations of the facility.

5.14.2 Environmental Consequences

Project effects on water resources can be evaluated relative to significance criteria derived from the California Environmental Quality Act (CEQA) Appendix G checklist. Under CEQA, the project is considered to have a potentially significant effect on water resources if it would:

- Substantially alter the existing drainage pattern of the site or area, including the alteration of the course of a stream or river, in a manner which will result in substantial erosion or siltation on or off site, or in flooding on or off site.
- Create or contribute runoff water which will exceed the capacity of existing or planned storm water drainage systems, or provide substantial additional sources of polluted runoff.
- Violate any water quality standards or waste discharge requirements, or otherwise substantially degrade water quality.
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there will 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 will drop to a level which will not support existing land uses or planned uses for which permits have been granted).
- Place within a 100-year flood hazard area structures that will impede or redirect flood flows.

5.14.2.1 Effect on Subbasin Water Balance

Construction Water Supply

The estimated average annual groundwater consumption (if not supplemented by WKWD) during construction period is estimated to be approximately 13 acre-feet per year (afy). The estimated total consumption of groundwater would be approximately 40 acre-feet (af). The aquifer storage in the Buena Vista Water Storage District is estimated to be approximately 7,000,000 af. Therefore, the amount of groundwater extracted by the Project during construction would have a negligible effect on subbasin water balance.

Process Water Supply

Even though the southern San Joaquin Valley has been classified by the DWR as an overdrafted groundwater basin, the BVWSD has historically been able to achieve a positive groundwater balance. Water levels in the BVWSD Buttonwillow Service Area aquifer (which includes the proposed water supply well field) have and are expected to continue to rise in response to BVWSD recharge and replenishment operations due to the partially-isolated nature of the Buttonwillow subbasin in which BVWSD is located.

Aquifer storage is approximately 7,000,000 af (Sierra Scientific Services, 2009). Annual pumping for the Project is expected to average 7,430 afy with a maximum at 7,500 afy per the HECA/BVWSD agreement. This amounts to 0.1 percent of total aquifer storage on an annual

basis. The Project's annual extraction of up to 7,500 afy is part of the BVWSD's BGRP which is currently planned to handle up to 12,000 afy (Krieger and Stewart, 2009). The Project's pumping volume would be offset by recharge from BVWSD's normal recharge and replenishment operations that maintain or increase overall aquifer storage. BVWSD has historically maintained a positive water balance and expects to maintain a positive balance of approximately 25,000 afy in the future. Overall Project-specific pumping is seen as a benefit to BVWSD in that it impedes eastward flow of poor quality groundwater and enhances westward flow of good quality groundwater.

As such, the use of impaired quality groundwater proposed by the Project will result in a less than significant impact to the subbasin water balance.

Potable Water Supply

The Project will use a small amount of potable water (approximately 2 afy). This water will be supplied by WKWD. This is a very small amount of water compared to the overall water usage within the district's service area. The estimated average annual water usage within WKWD's service area is on the order of approximately 28,500 afy. The personnel associated with the operation of the Project will not create significant additional demands on the potable water supply. Therefore the Project impact to potable water supplies in the area will be less than significant.

5.14.2.2 Water Level Drawdown Effects

Process Water Supply

Groundwater modeling was conducted to evaluate the potential effects of Project-specific pumping on drawdown of groundwater levels. The groundwater model documentation and results are included in Appendix N-2, Groundwater Model Documentation. The groundwater model simulates probable drawdown effects associated with pumping from three of five wells located in the proposed water supply well field area (two additional wells are redundant and serve as backup wells for well maintenance and repairs). Simulated pumping rates total 4,650 gpm (i.e., 1,550 gpm per well with continuous pumping for 365 days per year for 25 years) to correspond to the maximum amount of impaired groundwater to be provided to the Project by BVWSD (i.e., 7,500 afy). The model results include simulated drawdowns in the pumping wells and at various distances from the well field. Normal BVWSD recharge activities that would offset Project-specific pumping were included in the model to simulate what would be expected during the Project lifetime. Sensitivity analyses were also performed to account for aquifer parameter uncertainties due to a lack of site-specific hydraulic data in the well field area.

The base case groundwater model results indicate that the net effect of Project-specific pumping is a cone of depression that extends approximately 1.4 miles to the north, south, and east of the well field and approximately 2.5 miles to the west of the well field. Beyond those distances drawdown is negligible, and to the north, south, and east water levels rise slightly due to BVWSD's positive water balance recharge. Maximum drawdown 0.5 mile from the pumping wells was simulated to be 5.2 feet to the east, 5.6 feet to the west, 3.9 feet to the north, and 3.9 feet to the south. Accordingly, wells within 0.5 mile of the pumping wells would be subject

to greater drawdown. The model estimates the maximum drawdown at the central pumping well to be approximately 37 feet. As would be expected, drawdown decreases outward from the pumping wells, for example drawdown 200 feet east is estimated to be approximately 5.2 feet. As noted in Section 5.14.1.4 under Groundwater Wells, there are at least 11 and as many as 20 wells located within 0.5 mile of the proposed Project water supply well field. All of these wells were located within the BVWSD's service area. Depending on location, drawdowns between 3.9 and 37 feet would be expected, but are not considered significant as this would be an acceptable operating condition for the BVWSD BGRP. In fact some of the wells identified may be used as Project-specific pumping wells under the BGRP.

Simulation results also indicate that maximum drawdown occurs within the first 9 years of the Project, after which overall water levels stabilize, with annual fluctuations of approximately 2 feet in response to the continued pumping cycle and 75-day annual recharge cycle. Approximately 90 percent of the drawdown would occur during the first 3 years of pumping, after which drawdown gradually continues to increase until maximum drawdown is reached at approximately year nine. Once Project-specific pumping stops in year 25, water levels would recover to pre-project conditions as an inverse to the above, with 90 percent recovery expected within the first 3 years and probably sooner as BVWSD's recharge program would be ongoing as part of their operations.

These groundwater modeling results are consistent with what the BVWSD has observed for high yield agricultural wells in the Buttonwillow Service area. Information provided by the BVWSD indicates that the local aquifer system is prolific, of high permeability, and yields high volumes of water to wells (typical pumping rates are 1,500 to 2,000 gpm in most of the service area agricultural wells). Personal communications with Sierra Scientific Services, indicate there has been very little pumping impact (i.e., minimal drawdown) in local agricultural wells in the vicinity of the proposed well field area. This response is similar to nearby Kern County areas already studied in detail (Sierra Scientific Services personal communications January through April 2009). Local hydrogeologic information supplied by the BVWSD based on more than 40 years of observations indicates that there have been no impacts to wells in their Buttonwillow Service Area (which includes more than 200 agricultural supply wells).

As described in Section 5.15, Geological Hazards and Resources, the Project area is not located within an area mapped as having more than 1 foot of land subsidence in about 50 years (Poland, et al, 1975; Galloway and Riley, 1999); and therefore, it is considered unlikely that subsidence will occur. The California Aqueduct is located approximately 1.5 to 2 miles west of the BVWSD well field. Groundwater modeling as outlined above and in Appendix N-2 indicates that the net effect of Project-specific pumping is a cone of depression that extends approximately 2.5 miles to the southwest of the well field beyond which drawdown is almost non-existent. That cone of depression is radial and only a portion of the California Aqueduct lies at the distal end of that cone of depression where the maximum pumping effect from the well field would be on the order of approximately 1 to 2 feet. The proposed production wells will be completed to expected depths of 300 to 400 feet bgs. According to the BVWSD, the well field area is underlain by a single, thick sequence of interbedded sands and silty sands from ground surface to depths exceeding 700 feet (Sierra Scientific Services, 2009). As such, fine grained clay and silt beds are not considered thick or laterally extensive enough for conditions to exist in which subsidence would be expected to occur from Project-specific pumping. This is particularly the case in distal

locations such as that at the California Aqueduct where drawdown is only expected in the 1- to 2-foot range. Once Project-specific pumping stops (i.e., at the end of the Project life) water levels would recover quickly to pre-Project conditions, with 90 percent recovery expected within the first 3 years and probably sooner, as BVWSD's recharge program would be ongoing as part of their operations.

Based on the modeling analysis described above, the Project's impact to water level drawdown will be less than significant.

Construction Water Supply

The existing Ackerman Well may be used to supply water during construction. Groundwater modeling was conducted to evaluate the potential effects of on-site irrigation well pumping for construction water supply on groundwater levels (i.e., drawdown) (URS, 2010c). This evaluation assumed that all construction water would be supplied by an on-site irrigation well, even though it is expected that construction water would be supplied by the WKWD. The groundwater model for the process water well field pumping presented in Appendix N-2 was used as the base model. This evaluation consisted of simulating pumping groundwater from one well at a flow rate of approximately 17 gpm during the first 2 months of Project construction (the highest expected construction related pumping rate), followed by pumping at a flow rate of approximately 8 gpm during the remaining pumping period (equating to the projected average use of 11,800 gpd over the whole construction period). These pumping rates are simulated as being continuous for 24 hours per day, 365 days per year, for the construction period. The pumping well perforated interval assumed in the model is from 600 to 680 feet bgs; similar to the Ackerman Well. No recharge was simulated. The aquifer parameters are the same as the model for the BVWSD well field presented in Appendix N-2.

Simulation results show that the maximum drawdown after construction is 0.009 foot 0.5 mile from the pumping well. The simulated cone of depression after construction is roughly 0.41 foot near the pumping well, decreasing to 0.062 foot one-quarter mile from the pumping well and to 0.009 foot at a distance of one-half mile. This drawdown is significantly less than the drawdown simulated by the process water well field model. Maximum drawdown simulated for the well field was 5.6 feet at a distance of one-half mile from the pumping wells after 25 years of Project operation. The pumping flow rate in the process water well field model was 4,650 gpm—several orders of magnitude greater than the approximately 17 gpm pumping rate (first 2 months) and approximately 8 gpm pumping rate (remaining months). For comparative purposes, typical agricultural wells in the area produce water rates greater than 1,500 to 2,000 gpm during irrigation periods. As such, construction-related groundwater pumping effects would be less than significant in such a prolific aquifer system.

Drawdown Effects on Nearby Wells (one-half mile radius)—Construction Period Pumping

The March 2012 EDR report indicated that well (W1 or USGS3175424) is located approximately 0.5 mile south-southeast of the Ackerman Well and is on the Project Site. Other wells (W3 or CADW40000021752, W2 or USGS3175401, and W10 or USGS3175257) are located approximately 1 mile to the southeast, 1 mile to the south-southeast, and 1 mile to the east of the Ackerman Well, respectively. Well W3 is located on the Project Site, well W2 is

located in the Controlled Area, and well W10 is located off site. The simulated drawdown of 0.009 foot 0.5 mile from the pumping well establishes that there would be no drawdown effects to wells even if they were present within 0.5 mile of the pumping well.

5.14.2.3 Water Quality Effects—Groundwater

Process Water Supply

The use of impaired quality groundwater proposed by the Project will result in a less than significant impact on local groundwater quality and, in fact, will serve to improve local water quality during the Project lifetime.

BVWSD will provide impaired quality groundwater from existing and/or new wells (that comprise a well field) located in the elevated TDS area as shown on Figure 5.14-10. Extraction of water from the line of wells (i.e., picket fence well field) is directed toward impeding eastward flow of high TDS groundwater from the shallow aquifer system (first water up to 400 feet below grade) while locally shifting the water quality divide in the eastern part towards the western part of the BVWSD's service area. Groundwater modeling (Appendix N-2, Groundwater Model Documentation) indicates that the net movement of groundwater is about 0.8 mile towards the well field for the 25-year lifetime of the Project.

The positive effects on local groundwater quality were further documented based on information obtained during the 2009/2010 Hydrogeologic Data Acquisition Program (URS, 2010a and 2010b). This Project-specific pumping would remove considerable volumes of TDS from the local groundwater system. Figure 5.14-14, TDS Concentration vs. Mass Removal Data, illustrates TDS mass removal in US tons per year for a range of TDS concentrations and pumping rates. For example, if the average TDS concentration is 2,000 mg/L, the estimated amount of TDS that would be removed from the aquifer would be approximately 20,177 tons/year at a the average annual pumping rate of 7,427 afy.

Use of the brackish groundwater for the Project would remove salts from the aquifer, thereby improving the aquifer's water quality. As a result, the Project will facilitate efforts by the BVWSD to improve local groundwater quality and agriculture. Therefore, the proposed use of the brackish groundwater will beneficially affect local groundwater quality and the Project's impacts to water quality will be less than significant.

Construction Water Supply

A particle tracking simulation was applied to the groundwater modeling simulation, as described above under Water Level Drawdown Effects – Construction Period Pumping, as a means of evaluating groundwater flow paths and the capture zone around the existing irrigation well that may be used for construction water supply. For purposes of the analysis, it was assumed that all construction water would be supplied by the irrigation well (URS, 2010c). The particle tracking results indicate that the maximum net movement of groundwater induced by pumping the construction water supply well is approximately 210 feet (i.e., radial movement toward the pumping well) over the construction period. This is a very small net movement of groundwater and would not be expected to result in a change to local groundwater quality. Accordingly, no

significant impact to local groundwater quality is expected from the use of on-site irrigation wells during the Project construction period.

Project Construction

Construction or maintenance of the facility could potentially affect groundwater quality through inadvertent spills or discharge that could then infiltrate and percolate down to groundwater. The Project Site is underlain by approximately 10 feet of clay, which would impede migration of any inadvertent spills to groundwater. Estimated depth of site excavation for the proposed Project is up to 40 feet. Excavation dewatering during construction is not anticipated since the depth to groundwater at the site is approximately 40 to 100 feet below grade. Due to the depth to groundwater, the Project is not expected to degrade groundwater during construction and the impact to groundwater quality is less than significant.

Project Operation

Operation and maintenance of the facility could potentially affect groundwater quality through inadvertent spills or discharge that could then infiltrate and percolate down to groundwater. As described above, the Project Site is underlain by approximately 10 feet of clay, which would impede migration of any inadvertent spills or releases of contaminated storm water from retention basins to groundwater.

Storm water runoff from the Project Site will be directed to on-site retention basins. The retention basins that will be used to collect and store storm water from areas where hazardous materials will be stored will be lined with HDPE to prevent infiltration to underlying groundwater. Potentially contaminated storm water collected in the retention basins will be tested to determine an appropriate destination for reuse. Depending on the water quality, it may be used for cooling tower makeup or disposed in the ZLD system.

Since no municipal system is available in the immediate area to serve the Project, sanitary waste water from the Project restrooms, showers, and kitchens will be conveyed by an underground gravity collection system and discharged to a private on-site sewage disposal system consisting of a conventional septic tank and leach field. The septic system will be designed and constructed in accordance with Kern County and the Central Valley Water Quality Control Board (CVWQCB) requirements, which will require the system to be protective of groundwater supplies. Current standards are provided in “Standards and Rules and Regulations for Land Development, Sewage Disposal, Water Supply and Preservation of Environmental Health” (KCEHSD 2008). No impacts to groundwater are anticipated.

For all of these reasons, there will be no discharge of wastes or potentially contaminated storm water from the Project’s operations to groundwater. Therefore, impacts to groundwater will be less than significant.

5.14.2.4 Water Quality Effects—Surface Water

Construction, operation, or maintenance of the Project could affect surface water quality of nearby canals through inadvertent spills or discharges. Construction activities could also

increase the potential for erosion and uncontrolled runoff of storm water contaminated with sediments or other pollutants that could impact surface water quality and sedimentation. The existing topography at the Project Site and vicinity is shown on Figure 2-7, Project Location Map and Figure 5.14-1. The preliminary site drainage and grading plans of the proposed facility after construction are shown on Figures 2-36, Preliminary Storm Water Drainage Plan and 2-41, Preliminary Grading Plan. Best management practices (BMPs) as described in the Draft DESCP submitted in response to previous data requests will be used during construction to minimize the potential for erosion (see Responses to Data Request 95 and Data Request 202). A construction SWPPP will be prepared and implemented in accordance with the General Permit for Construction Activities. With implementation of Project design elements, and mitigation measures proposed in Section 5.14.4.2, the impacts to surface water quality will be less than significant.

The CO_2 pipeline will leave the southwestern portion of the Project Site, and HDD will be used to pass under the Outlet Canal, the KRFCC, and the California Aqueduct. BMPs for HDD would include silt fencing around the drill sites, energy dissipation devices for discharging water from hydrostatic testing of the pipeline, selecting drilling fluids for environmental compatibility, and removing spent fluids from the areas immediately adjacent to the aqueduct and canals for safe disposal and to prevent potential discharge of pollutants into the waterways. In addition, soil erosion control measures to prevent runoff and impacts to water quality would be implemented. The depth of HDD under water bodies will comply with all applicable state and federal regulations (including CDFG). The clay soils expected to be present in the areas where HDD will be used have a low likelihood of causing frac-outs. If a frac-out occurred, the area would be restored and monitored. A draft HDD frac-out plan, based on plans that have been used for major directional drills with the Southern California Gas Company and consistent with the level of detail to satisfy CDFG requirements was previously submitted in response to Data Request 106. A more comprehensive HDD Plan that addressed additional risks associated with HDD activities, such as soil heaving/settlement from drilling, water disposal from dewatering, erosion from work at entrance/exit pits, and damage/injury from inadvertently boring through existing utilities was prepared and submitted in response to Data Request 209. In addition, the Project will comply with and obtain encroachment permits from appropriate federal, state, and local agencies, which include the Department of Water Resources, Caltrans, Buena Vista Water Storage District, and any other appropriate agencies. Therefore, the Project's impacts to surface waters will be less than significant.

Portions of the potable water pipeline and the natural gas pipeline will cross the East Side Canal and other small irrigation canals. The Project proposes to perform an assessment of the site conditions where the pipeline routes cross the canals. The assessment will consider the canal-specific hydrologic conditions at the time of crossing, along with the landscape terrain features. When feasible, crossing of the canals will be performed when the canal is dry, using dry-ditch techniques. If water is present at the time of crossing a canal, sites will be evaluated on a case-by-case basis to determine if conventional open cut, flume variation of open-cut, or dam and pump variation of open-cut will be used. BMPs to be implemented with conventional open- cut waterbody crossings include, but are not limited to the following: material excavated from the trench will be stockpiled above the canal banks; excavated trench material will generally be used as backfill; and the canal will be returned to its pre-construction contours to the extent practicable.

Where the pipeline alignment crosses sensitive areas underground pipeline installation methods such as pipe ramming, auger boring or microtunnelling, could be used to avoid direct impacts to the bed, channel, and banks of the drainage channel and minimize disruption to irrigation operations. These construction methods allow the pipeline to be constructed beneath the irrigation canal, roads, railway tracks, and other obstacles without causing surface disturbance. As the method requires the excavation of an entrance and exit pit at each end of the boring area, these will be located at least 10 feet from the ditch or canal to avoid disturbance to the bed or banks. Spoils will be reused as fill wherever possible.

Construction of the transmission line will require installing approximately 26 (15 off-site and 11 on-site) tubular-steel transmission structures and the supporting foundations. Construction will also involve stringing the conductor and the optical ground wires. Temporary access roads will need to be constructed within the transmission line ROW, except where the line runs parallel to existing roads. A small area around each structure site will need to be disturbed temporarily during the construction period. The approximate area that may be temporarily disturbed is quantified in Section 4.8.3. Roadway matting may be used on the road and around the area of each structure to minimize the effects of the construction vehicles and the construction activity. The time to construct the entire transmission line is estimated to be approximately 3 months. Construction of the above-ground electrical transmission line will result in minor, mostly temporary soils impacts. Project construction-related soil erosion will be minimized through implementation of BMPs and erosion control measures described in Section 5.9.4 and Section 5.14.5. The transmission line will cross the East Side Canal. The poles will be placed outside of the canal and the transmission line will span the canal. Construction activities for the new transmission line poles and footings will not occur in the canal. BMPs similar to those used during the gas line construction will be implemented to minimize erosion and discharge of pollutants. New foundations will not substantially increase impervious surfaces. Therefore, impacts to water quality due to construction and operation of the transmission line will be less than significant.

Alternative 1 for the transportation of coal to the Project Site is an approximately 5 mile new railroad spur. Construction of the railroad spur will use earthwork and track construction equipment typically used on similar rail projects throughout California and the United States. Since the majority of the alignment is traversing previously disturbed agricultural areas, minimal clearing and grubbing of the proposed right-of-way will be required to remove vegetation. Once the right-of-way is cleared, rough grading work will begin. Earth moving equipment will create a track embankment and drainage ditches using standard equipment consisting of bulldozers, scrapers, dump trucks, roadway graders, and vibratory compactors. Utility relocation work will also be performed as part of this initial grading work. Existing local service power lines and underground irrigation piping will be relocated or protected in place. The proposed route crosses the East Side Canal managed by BVWSD. HECA will work with BVWSD and secure the appropriate approvals. In addition, BMPS will be implemented during construction of the railroad spur to prevent discharge of construction materials or pollutants into the canal. Project construction-related soil erosion will be minimized through implementation of erosion control measures described in Section 5.9.4 and 5.14.5. Because the spur alignment will be covered in ballast material to support the tracks, soil erosion during operation of the spur will be reduced. The rail and truck unloading systems, feedstock reclaiming and blending system, and pre-crushing system will have dust collection systems to minimize particulate emissions. The

transfer conveyor will be fully enclosed for weather protection and to control fugitive dust. Therefore, impacts to water resources are expected to be less than significant.

Alternative 2 for the transportation of coal to the Project Site is truck transport via existing roads from an existing coal transloading facility located in Wasco northeast of the Project Site. Therefore, there are no construction activities associated with this alternative that would impact water resources. During operations, feedstock will be delivered to the Project Site via trucks. At the Project Site, feedstock will be unloaded at the truck dump unloading station. The truck dump has a single hopper located below each unloading station. Feedstock from these hoppers is sent to the storage barn via belt feeders, unloading conveyor, and transfer conveyors. The concrete floor under the truck unloading system slopes to a sump. This sump is equipped with an installed sump pump to recycle water back to the wash down system or to forward it to the IGCC water reclaim system. Once trucks have unloaded the feedstock, each vehicle exits and passes through a truck wash system. This truck wash system sprays the entire truck with wash-down water (no soap added) and a specific spray system cleans the wheels. This is done to minimize or eliminate any dust and debris from being deposited on the roads both inside the Project Site and on the public highway system. The wastewater collected under the truck wash is routed to a sump that sends the wastewater back to the IGCC water reclaim system. Therefore, impacts to water resources are expected to be less than significant.

Hydrotest water will be reused to test various Project equipment and piping features to the extent practicable. The source of the water to be used for hydrostatic testing of the pipelines will be water from WKWD. WKWD obtains its potable water from groundwater wells located within the Kern River groundwater basin, and supplements it with water from State Water Project water deliveries and agreements with various Kern County water agencies. The expected characteristics of the water to be supplied through the on-site irrigation supply well are summarized in Table 5.14-4. The expected characteristics of the water to be supplied by WKWD are summarized in Table 5.14-7. The hydrostatic testing will be performed on new pipelines and no chemicals will be added to the test water. As such, the expected quality of the test water will be similar to the quality of the source water. After all testing has been complete; the test water will be discharged to upland areas, to canals, or returned back to the source from which it was obtained. The water would be sampled prior to discharge and dispersed by an energy dissipation device to minimize erosion. Water discharged over land will be directed through containment structures such as hay bale structures and filter bags. The discharge rate will be regulated using valves and energy dissipation devices to prevent erosion, and the discharge will be monitored for residual materials being flushed from the tested pipe. Tie-in locations will be cleaned and restored after hydrostatic testing. The hydrotest water will not be stored in the pipes or tanks for an extended period of time. As such, no chemicals will be added to the test water during hydrostatic testing; therefore, it is expected that the quality of the test water will be similar to the quality of the source water. Therefore, impacts to surface waters will be less than significant.

The Central Valley Regional Water Quality Control Board Resolution No. R5-2008-0182 waives WDRs and Reports of Waste Discharge (RWDs) for specific types of discharges that pose a low threat to the quality of waters of the state. The waiver covers discharge to land of hydrostatic test water when the discharges occur for no more than a few weeks. The waiver is only applicable when the source water for the hydrostatic test is local (i.e., the same or better quality

than the underlying groundwater), and the only expected waste constituents in the test water discharge are picked up from the structure being tested (i.e., no chemicals are introduced). If the duration of the discharge of the hydrostatic test water is more than a few weeks, then the HECA Project will comply with the State Water Resources Control Board's General Order No. 2003-0003-DWQ, which includes low threat discharges to land from hydrostatic testing. Alternatively, the hydrostatic test water could be discharged to one of the local canals in accordance with the Central Valley Regional Water Quality Control Board's General Order No. R5-2008-081, which includes low threat discharges to surface water from hydrostatic testing. This general permit allows discharges of up to 4 months in duration or up to 0.25 mgd. In response to Data Request 108, HECA prepared and submitted a draft Notice of Intent (NOI) to comply with General Order No. 2003-0003-DWQ (to land) and Attachment 108-2 for the draft NOI to comply with General Order No. R5-2008-0081 (to surface water). Once the design and construction details have been developed and the quantity, duration, and method of discharge have been determined, the appropriate NOI will be prepared and submitted to the Central Valley Regional Water Quality Control Board, along with the appropriate fees, prior to the start of construction.

The Regional Water Quality Control Board's requirements (i.e., Reports of Waste Discharge [ROWDs] or Engineering Reports) are specifically for discharges of waste that could affect the quality of the waters of the state, other than into a community sewer system (see California Water Code Section 13260). The HECA Project has been designed as a project that will have zero liquid discharge (ZLD) off site. No wastes of any type will be disposed to waters of the state. As such, a ROWD would not be required for the on-site material storage or "disposal systems" of the HECA Project.

As described in Section 2.5.16 and Section 5.14.1.8, storm water management for the Project is designed to avoid direct discharge to surface waters. Clean storm water runoff from process areas will be routed to on-site storm water retention basins before it is used as makeup water to the cooling towers. Potentially contaminated storm water will be routed to lined retention basins and then tested to determine an appropriate destination for reuse. Depending on the water quality, it may be used for cooling tower makeup or disposed in the ZLD system. All hazardous materials will be properly stored to prevent contact with storm water. Feedstock will be stored in an on-site holding barn with a concrete divider separating the storage piles. Gasification solids will be retained in on-site storage bins or containers. All urea handling buildings are fully enclosed.

The Project will be constructed such that storm water runoff will be contained in retention basins and reused at the Project Site. As there will not be any storm water discharges from industrial activities to waters of the United States, the Project will not be required to obtain coverage under the General Industrial Activity Storm Water Permit. Wastewaters will be discharged to the ZLD unit. Therefore, there will be no discharges to surface waters and no impacts to surface water quality.

5.14.2.5 Flooding

The Project Site is not located in a designated floodplain. The Project Site will be graded, as shown on Figure 2-50, Preliminary Grading Plan, to promote drainage to prevent on-site

flooding. Storm water runoff from on-site areas will be retained and reused; therefore, the volume of runoff leaving the site will be less than for existing conditions. No significant impacts related to flooding are expected as a result of the Project.

The CO_2 pipeline, will cross through a FEMA-designated floodplain area. This pipeline will be buried and installed at the canal crossings using the HDD method. Therefore, there will be no impacts to floodplains.

Portions of the Project Site will be graded and pads will be constructed a few feet above existing grade.

5.14.2.6 *OEHI Project*

According to the analysis contained in Appendix A-1, Section 4.8, Hydrology and Water Quality, construction and operation of the OEHI Project will not result in significant adverse impacts to groundwater or surface water supplies or quality. Nor will the OEHI Project expose people or structures to a significant risk of loss, injury, or death involving flooding, or inundation by seiche, tsunami, or mudflow.

5.14.3 Cumulative Impacts Analyses

Under certain circumstances, CEQA requires consideration of a project's cumulative impacts (CEQA Guidelines Section 15130). A "cumulative impact" consists of an impact which is created as a result of the combination of the project under review together with other projects causing related impacts (CEQA Guidelines Section 15355). CEQA requires a discussion of the cumulative impacts of a project when the project's incremental effect is cumulatively considerable (CEQA Guidelines Section 15130[a]). "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (CEQA Guidelines Section 15065 [a][3]).

When the combined cumulative impact associated with a project's incremental effect and the effects of other projects is not significant, further discussion of the cumulative impact is not necessary (CEQA Guidelines Section 15130[a]). It is also possible that a project's contribution to a significant cumulative impact is less than cumulatively considerable and thus not significant (CEQA Guidelines Section 15130[a]).

The discussion of cumulative impacts should reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great a level of detail as is provided for the effects attributable to the project under consideration (CEQA Guidelines Section 15130[b]). The discussion should be guided by standards of practicality and reasonableness (CEQA Guidelines Section 15130[b]).

A cumulative impact analysis may be conducted by analyzing the impacts of the project under consideration with those of past, present, and probable future projects within a defined geographical scope with the potential to produce related or cumulative impacts (CEQA Guidelines Section 15130[b]). Alternatively, the impacts of the project under consideration can

be evaluated in the context of projections contained in an adopted general plan or related planning document, or in a prior environmental document which has been adopted or certified, which described or evaluated regional or areawide conditions contributing to the cumulative impact (CEQA Guidelines Section 15130[b]).

Groundwater

The proposed water supply is consistent with the industrial beneficial use established for groundwater in the Kern River Valley in the Basin Plan adopted by the Central Valley Regional Water Quality Control Board (CVRWQCB, 2004). Withdrawal of impaired quality groundwater to alleviate impacts on agriculture is consistent with the Drainage Control and Irrigation Conservation Programs described in the BVWSD Groundwater Management Plan (Boyle Engineering 2002) and is part of BVWSD's BGRP, which provides benefits for BVWSD's Buttonwillow Service Area. BVWSD's BGRP was analyzed in the Final Environmental Impact Report for the Buena Vista Water Storage District Buena Vista Water Management Program, dated December 2009 (Krieger and Stewart, Incorporated, 2009).

The process water supply for the Project will consist of groundwater of impaired quality. Drawdown (lowered water levels) in response to pumping at the proposed water supply well field area will be localized around the well field itself and normal BVWSD recharge activities would offset Project-specific pumping.

Overall Project-specific pumping is seen as a benefit to BVWSD in that it impedes eastward flow of poor quality groundwater, enhances westward flow of good quality groundwater, and removes a significant volume of TDS/salts from the local aquifer system. The Project also would use groundwater that other users do not want and find objectionable for their needs. As such there is no cumulative impact expected, but rather a regional benefit.

Groundwater used for construction water supply from an on-site irrigation well would not affect water balance, would have minimal drawdown, would not affect water levels in any nearby wells (simulated drawdown estimated at 0.002 foot at a distance of one-half mile, and would have no effect on water quality, with expected maximum net movement of groundwater induced by pumping to be approximately 210 feet (i.e., radial movement towards the well) over the construction period.

Surface Water

Other reasonably foreseeable development projects could also result in temporary and permanent impacts to water quality and potentially exceed applicable water quality standards. Temporary impacts may result from land clearing, site disturbance, and grading associated with construction activities. Typical construction impacts include increased erosion, sediment transport, siltation, and on-site storage and use of lubricants and fuels. Temporary construction impacts could be minimized through use of Project-specific BMPs and applicable federal, state, and local construction mitigation guidelines. Permanent water quality impacts could result from storm water runoff from newly constructed impervious surfaces associated with agricultural, commercial and residential developments. Each development project would be expected to

comply with applicable state regulations that require on-site attenuation and treatment of storm water.

In summary, the cumulative development projects have potential to generate water quality impacts. However, it is expected that existing programs, policies, and regulatory requirements would prevent and/or minimize the potential water quality impacts to a level below a substantial impact. The limited water quality impacts associated with construction activities for the Project, when compared to potential impacts of other development projects, are not expected to lead to substantial cumulative water quality impacts.

OEHI Project

According to the analysis contained in Appendix A-1, Section 4.8, Hydrology and Water Quality, construction and operation of the OEHI Project would not result in significant cumulative adverse impacts to water resources.

5.14.4 Mitigation Measures

This section discusses mitigation measures proposed by the Applicant that will be implemented to ensure that Project-related impacts to water resources are less than significant.

5.14.4.1 Groundwater

As discussed above, the evaluation of water resources impacts considered both the occurrence and the quality of water in the area. For the occurrence of groundwater in the Project Site area and the proposed water supply well field area, the Project will have no significant impact on the depth to water in the aquifer, or water resources as a result of the drawdown caused by pumping of the aquifer system. Furthermore, the Project will not have any negative effect on the quality of groundwater in the area. In fact, the Project will have a net positive effect on groundwater quality and agricultural activity. The process water supply to the Project will consist of brackish groundwater. The BVWSD is a local water district with shallow brackish groundwater sources that are less than ideal for agricultural or drinking use without treatment. The brackish groundwater is found in the local aquifer and causes negative impacts on agriculture. Project consumption of the brackish groundwater will beneficially affect local groundwater quality and agriculture consistent with the BVWSD Groundwater Management Plan.

Thus, no mitigation is required for groundwater resources other than monitoring and operating plans that BVWSD will require to ensure that groundwater of low quality would be used for the HECA process water supply.

WR-1: Annual Groundwater Use Report

The Applicant will prepare an annual summary of the amount of water pumped from the BVWSD well field and used for process water needs.

Verification

As part of the Annual Compliance Report, the Applicant will submit to the CPM the annual summary of water pumped from the BVWSD well field.

5.14.4.2 Surface Water

As discussed above in Section 5.14.2.4, no impacts to surface waters are anticipated due to the Project. However, the Project will implement the following best management practices to ensure that impacts to surface water are less than significant.

WR-2: Soil and Water 2: General Construction Activity Storm Water Permit

Prior to beginning any clearing, grading, or excavating activities associated with Project construction, and as required by the General Construction Activity Storm Water Permit, the Project will develop and implement an SWPPP prepared under the requirements of the General Construction Activity Storm Water Permit.

Verification

At least 30 days prior to the start of construction, the Applicant will submit a draft Construction Phase SWPPP to the Compliance Project Manager (CPM) for review and comment. Two weeks prior to the start of construction, the Applicant will submit to the CPM a copy of the final Construction Phase SWPPP for review and approval. The final SWPPP shall contain all the elements of the draft plan with changes made to address staff comments and the final design of the Project. Approval of the plan by the CPM must be received prior to the initiation of any clearing, grading, or excavation activities associated with Project construction.

WR-3: Erosion Control and Revegetation Plan

Prior to beginning clearing, grading, or excavation activities associated with Project construction, the Applicant shall submit an Erosion Control and Revegetation Plan to the CPM for approval. The final plan shall contain all the elements of the draft plan with changes made to address the final design of the Project.

Verification

One month prior to the initiation of any clearing, grading, or excavation activities associated with Project construction, the Applicant will submit the final Erosion Control and Revegetation Plan to the CPM for review and approval. Approval of the plan by the CPM must be received prior to the initiation of any clearing, grading, or excavation activities associated with Project construction.

5.14.5 Laws, Ordinances, Regulations, and Standards

The construction and operation of the Project will be in accordance with all applicable LORS relating to water resources. Applicable LORS are discussed in this section and are summarized in the following Table 5.14-7, Summary of LORS – Water Resources.

5.14.5.1 Federal Authorities and Administering Agencies

Clean Water Act of 1977 (including 1987 amendments) §402; 33 United States Code §1342; 40 Code of Federal Regulations Parts 122 – 136

The Clean Water Act (CWA) requires a National Pollutant Discharge Elimination System (NPDES) permit for any discharge of pollutants from a point source to Waters of the United States. This law and its regulations apply to storm water and other discharges into Waters of the United States. The CWA requires compliance with a general construction activities permit for the discharge of storm water from construction sites disturbing 1 acre or more. This federal permit requirement is administered by the State Water Resources Control Board (SWRCB), but designated to the Regional Water Quality Control Board (RWQCB).

Construction activities at the Project Site will be performed in accordance with a Construction Phase SWPPP and associated monitoring plan that is required in accordance with the NPDES General Permit for Storm Water Discharges Associated with Construction Activities issued by the SWRCB. The SWPPP will include control measures including BMPs to reduce erosion and sedimentation as well as other pollutants associated with vehicle maintenance, material storage and handling, and other activities occurring at the Project Site.

Clean Water Act §311; 33 United States Code §1342; 40 Code of Federal Regulations Parts 122–136

This portion of the CWA requires reporting of any prohibited discharge of oil or hazardous substance. The Project will conform by proper management of oils and hazardous materials both during construction and operation. The administering agency is the Central Valley RWQCB and the California Department of Toxic Substances Control (DTSC).

5.14.5.2 State Authorities and Administering Agencies

Water Code Section 13552.6

This portion of the California Water Code (CWC) relates to the use of potable domestic water for cooling towers. Use of potable domestic water for cooling towers is unreasonable if a suitable non-potable source, including recycled water or brackish groundwater, is available. The Project will use a brackish groundwater supply in compliance with this requirement. SWRCB Resolution No. 75-58 addresses this issue; the administering agency is the Central Valley RWQCB (see Table 5.14-9, Summary of LORS—Water Resources). State Water Resources Control Board, Resolution No. 75-58 (18 June 1975).

SWRCB prescribes state water policy on the use and disposal of inland water used for power plant cooling. A discussion of this resolution as it applies to the Project is presented in the Chapter 6 Alternatives of this AFC Amendment. The administering agencies for this resolution are the SWRCB and the Central Valley RWQCB.

California Porter-Cologne Water Quality Control Act 1998; California Water Code § 13000–14957; Division 7, Water Quality

The Porter-Cologne Water Quality Control Act authorizes the state to develop and implement a statewide program for the control of the quality of all waters of the state. The Act establishes the SWRCB and nine RWQCBs as the principal state agencies with primary responsibility for the coordination and control of water quality. Under §13172, siting, operation, and closure of waste disposal sites are regulated. The SWRCB requires classification of the waste and the disposal site. Discharges of waste must comply with the groundwater protection and monitoring requirements of RCRA of 1976, as amended (42 United States Code [USC] Section 6901 *et seq.*), and any federal acts which amend or supplement RCRA, together with any more stringent requirements necessary to implement this revision or Article 9.5 (commencing with Section 25208) of Chapter 6.5 of Division 20 of the Health and Safety Code. The Project will comply with the regulations set forth in this Act.

The administering agencies for the above authority are CEC, SWRCB, and the Central Valley RWQCB.

Title 22, California Code of Regulations Division 4, Chapter 3.

This regulation requires maximum use of reclaimed water in the satisfaction of requirements for beneficial uses of water. The Project satisfies this requirement in that it complies with the Central Valley Region Basin Plan's designated beneficial uses for local groundwater. It also meets this requirement as it relates to SWRCB Resolution No. 75-58. The administering agency is the Central Valley RWQCB.

California Public Resources Code §25523(a); 20 California Code of Regulations §§1752, 1752.5, 2300 –2309 and Chapter 2 Subchapter 5 Article 1, Appendix B, Part (1)

The code provides for the inclusion of requirements in the CEC's decision on an AFC to assure protection of environmental quality and requires submission of information to the CEC concerning proposed water resources and water quality protection. The administering agency for the above authority is the CEC.

California Water Code §§13271 – 13272; 23 CCR §§2250 – 2260

These code sections require reporting of releases of specified reportable quantities of hazardous substances or sewage (§13272), when the release is into, or where it will likely discharge into, waters of the state. For releases into or threatening surface waters, a "hazardous substance" and its reportable quantities are those specified at 40 Code of Federal Regulations (CFR) §116.5, pursuant to §311(b)(2) of the CWA, 33 USC §1321(b)(2). For releases into or threatening groundwater, a "hazardous substance" and its reportable quantities are those specified at 40 CFR

§116.5, pursuant to §311(b)(2) of the CWA, 33 USC §1321(b)(2). For releases into or threatening groundwater, a "hazardous substance" is any material listed as hazardous pursuant to the California Hazardous Waste Control Act, Health and Safety Code §§25100 – 2520.24, and the reportable quantities are those specified at 40 CFR Part 302. Although such releases are not anticipated, the Project will comply with the reporting requirements.

The administering agencies for the above authority are the Central Valley RWQCB and the California Office of Emergency Services.

California Water Code §13260 –13269; 23 California Code of Regulations Chapter 9

The code requires the filing of a Report of Waste Discharge (ROWD) and provides for the issuance of WDRs with respect to the discharge of any waste that can affect the quality of the waters of the state. The WDRs will serve to enforce the relevant water quality protection objectives of the Central Valley Region Basin Plan and federal technology-based effluent standards applicable to the Project. With respect to potential water pollution from construction activities, the WDRs may incorporate requirements based on the CWA §402(p) and implementing regulations at 40 CFR Parts 122 *et seq*., as administered by the Central Valley RWQCB. The administering agency for the above authority is the Central Valley RWQCB.

California Environmental Quality Act, Public Resources Code §21000 et seq.; CEQA Guidelines, 14 California Code of Regulations §15000 et seq.*; Appendix G*

The California Environmental Quality Act (CEQA) Guidelines (Appendix G) contain definitions of projects that can be considered to cause significant unmitigated impacts to water resources. The Project is not expected to cause significant impacts to water resources, as described in Section 5.14.2, Environmental Consequences. The administering agency of the above authority is the CEC.

5.14.5.3 Local Authorities and Administering Agencies

The primary source of water supply will be provided by the BVWSD. This supply will be provided in accordance with the terms and conditions of the water supply agreement provided in Appendix N-1, Water Resources Information.

Kern County General Plan

The Kern County General Plan provides guidance on the types of development activity and allowable uses within the county limits. In particular the Land Use element pertains to the protection and management of groundwater and surface water resources within the county (Kern County Planning Department 2007). The administering agency for the above authority is Kern County.

Kern County Zoning Ordinance Title 14 Utilities, Chapter 14.08 Water Supply Wells

Provides standards and requirements for the design, construction, reconstruction, abandonment, and destruction of wells. The administering agency for the above authority is Kern County.

Kern County Zoning Ordinance Title 17 Building and Construction, Chapter 17.28 Grading Code

Sets forth rules and regulations to control excavation, grading and earthwork construction, including fills and embankments; establishes the administrative procedure for issuance of permits; and provides for approval of plans and inspection of grading construction. The administering agency for the above authority is Kern County.

Kern County Zoning Ordinance Title 17 Building and Construction, Chapter 17.48 Floodplain Management

Restricts or prohibits uses which are dangerous to health, safety, and property loss due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities; requires that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction; controls the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters; controls filling, grading, dredging, and other development which may increase flood damage; and prevents or regulates the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas. The administering agency for the above authority is Kern County.

5.14.5.4 Industry Codes and Standards

With regards to water resources and the related Project facilities, including pipelines, sewers, and other facilities, all construction will be in compliance with LORS mentioned in this report section or state and local building codes.

5.14.5.5 Involved Agencies and Agency Contacts

See the following Table 5.14-10, Agency Contacts, for agency contacts.

5.14.6 Permits Required and Permit Schedule

The water-related permits that are required for the Project are identified in Table 5.14-9, Agency Contacts, Summary of LORS—Water Resources. The timing for the preparation of each permit is noted in Table 5.14-9. These permits include:

- General Construction Activity Storm Water Permit. Notice of Intent (NOI) to comply with this general permit to be prepared and submitted to the SWRCB at least 2 weeks prior to the start of Project construction.

- Draft of Construction Activity SWPPP to be prepared and submitted to CPM at least 30 days prior to the start of construction for review and comment. A final plan to be submitted to the CPM no later than 2 weeks prior to the start of construction.

5.14.7 References

Belitz, K. and F.J. Heimes, 1990. Character and Evolution of the Ground-Water Flow System in the Central Part of the Western San Joaquin Valley, California. U.S. Geological Survey Water-Supply Paper 2348.

Bertoldi, G. L., R. H. Johnston, and K. D. Evenson, 1991. Ground Water in the Central Valley, California – A Summary Report. U.S. Geological Survey Professional Paper 1401-A.

Boyle Engineering Corporation, 2002. Groundwater Status and Management Plan for Buena Vista Water Storage District.

Buena Vista Water Storage District, 2009. Personal communication with URS. May.

California Department of Water Resources, 1961, Report on Proposed Bellridge Water Storage District.

California Department of Water Resources, 2000-2006. Kern Groundwater Basin Spring 2000-2006, Lines of Equal Elevation of Water in Wells, Unconfined Aquifer [available at http://www.sjd.water.ca.gov/groundwater/basin_maps/index.cfm].

California Department of Water Resources, 2003. California's Groundwater. Department of Water Resources Bulletin 118-203.

California Department of Water Resources, 2006. Supplemental Information to Bulletin 118-2003 – Individual Basin Descriptions. www.groundwater.water.ca.gov/bulletin118.

California Regional Water Quality Control Board, Central Valley Region, 2004. Water Quality Control Plan for the Tulare Lake Basin, Second Edition. January 2004.

California State Water Resources Control Board, 1975, State Water Resources Control Board Resolution No. 75-58, Water Quality Control Policy on the Use and Disposal of Inland Waters for Power Plant Cooling. June 19, 1975

California State Water Resources Control Board, 2002. Update to Resolution 75-58: Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Power Plant Cooling. May.

California Storm Water Quality Association, 2003. California Storm Water Best Management Practice Handbook – Industrial and Commercial, January.

CIMIS (California Irrigation Management Information System), 2010. Reference Evapotranspiration Zones, Zone 15 [available at EvapZones.pdf].

Croft, M.G., 1972. Subsurface Geology of the Late Tertiary and Quaternary Water-Bearing Deposits of the Southern Part of the San Joaquin Valley, California. U.S. Geological Survey Water-Supply Paper 1999-H.

Davis, G. H., J.H. Green, F.H. Olmsted, and D.W. Brown, 1959. Ground-Water Conditions and Storage Capacity in the San Joaquin Valley, California. U.S. Geological Survey Water-Supply Paper 1469.

Dibblee, T.W., Jr., 2005. Geologic Map of the East Elk Hills And Tupman Quadrangles, Kern County, California. 1:24,000. Dibblee Geology Center Map #DF-103. August.

DOGGR (California Department of Conservation, Division of Oil, Gas, and Geothermal Resources), 1998. California Oil and Gas Fields.

Environmental Data Resources, Inc. (EDR), 2009. Data Map Well Search Report, April 3, 2009.

ESA, 2010. Groundwater Banking Project Environmental Impact Report. Prepared for West Kern Water District. March.

FEMA (Federal Emergency Management Agency), 2008. Flood Insurance Rate Map, Kern County, California and Incorporated Areas, Community Panel Numbers 06029C2225E and 06029C2250E, Effective Date September 26, 2008 Website accessed on February 24, 2009: http://msc.fema.gov

Fetter, C.W., 1994. Applied Hydrogeology. Macmillan. New York. 691 p.

Galloway, D.R., and F.S. Riley, 1999. Subsidence in the San Joaquin Valley, California, USGS Circular 1182.

Gilliom, R.J., et al., 1989. Preliminary Assessment of Sources, Distribution, and Mobility of Selenium in the San Joaquin Valley, California. U.S. Geological Survey Water Resources Investigation 88-4186.

Kern County Environmental Health Services Department, 2008. Standards and Rules and Regulations for Land Development, Sewage Disposal, Water Supply and Preservation of Environmental Health. November 17. [Document available at www.co.kern.ca.us/eh]

Kern County Planning Department, 2007. Kern County General Plan. March 13.

Kern County Planning Department, 2004. Recirculated Draft Program Environmental Impact Report, Volume I, SCH# 2002071027. January.

KCWA (Kern County Water Agency), 1991. Study of the Regional Geologic Structure Related to Groundwater Aquifers in the Southern San Joaquin Valley Groundwater Basin, Kern County, California. September 20.

KWBA (Kern Water Bank Authority), 2009. http://kwb.org/main.htm. website accessed March 2009.

KWBA (Kern Water Bank Authority), 2007. Petition to Revise Declaration of Fully Appropriated Stream Systems for the Kern River and Application to Appropriate Water. September 26.

Krieger and Stewart, Incorporated, 2009. Final Environmental Impact Report for the Buena Vista Water Storage District Buena Vista Water Management Program. December.

NRCS (Natural Resources Conservation Service), 1988. Soil Survey of Kern County, California, Northwestern Part. Website accessed on February 19, 2009: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Page, R.W., 1973. Base of Fresh Ground Water (Approximately 3,000 Micromhos) in the San Joaquin Valley, California. U.S. Geological Survey Hydrologic Investigations Atlas HA-459.

Page, R.W., 1986. Geology of the Fresh Ground-Water Basin of the Central Valley, California, with Texture Maps and Sections. U.S. Geological Survey Professional Paper 1401-C.

Poland, J.F., Lofgren, B.E., Ireland, R.L., and Pugh, R.G., 1975. Land Subsidence in the San Joaquin Valley, California, as of 1972, USGS Professional Paper 437-H.

Ranger, M.J., S.G. Pemberton, and R.J. Sharpe, 1988. Lower Cretaceous example of a shoreface-attached marine bar complex: the Wabiskaw "C" sand of northeastern Alberta. In "Sequences, Stratigraphy, Sedimentology: Surface and Subsurface." Edited by D. P. James and D. Leckie. Canadian Society of Petroleum Geologists Memoir.

Sawyer, E., 1991. Log Correlation Techniques: Southern Louisiana and Gulf of Mexico shelf. Houston: Exxon Company.

Sierra Scientific Services, 2003. Determination of Aquifer Storage Capacity for the Rosedale - Rio Bravo Water Storage District, Bakersfield, California. January 20.

Sierra Scientific Services, 2004. An Evaluation of Well Placements and Potential Impacts of the ID4/Kern Tulare/Rosedale—Rio Bravo Aquifer Storage and Recovery Project. July 20.

Sierra Scientific Services, 2007a. A Water Quality Evaluation of the Strand Ranch Aquifer Storage and Recovery Project, Kern County, CA., *in:* Rosedale—Rio Bravo Water Storage District Strand Ranch Integrated Banking Project Environmental Impact Report, January, 2008, prepared by ESA, Los Angeles, California. December 19.

Sierra Scientific Services, 2007b. An Evaluation of Well Placements and Potential Impacts of the proposed Strand Ranch Well Field, Kern County, California. In "Rosedale—Rio Bravo Water Storage District Strand Ranch Integrated Banking Project Environmental Impact Report," January 2008, prepared by ESA, Los Angeles, California. December 20.

Sierra Scientific Services, 2009. An Evaluation of the Geology, Hydrology, Well Placements and Potential Impacts of the Buena Vista Water Storage District's proposed Brackish Groundwater Remediation Project. In prep.

URS, 2009a. Preliminary Geotechnical Investigation for Proposed Hydrogen Energy California Project (HECA), Kern County, California.

URS 2009b. Responses to CEC Data Requests Set One: Nos. 1 through 132, Revised Application for Certification (08-AFC-8) for Hydrogen Energy California, Kern County, California. November 2009.

URS, 2010a. Draft Hydrogeologic Data Acquisition Report—Groundwater Monitoring and Process Water Well Field Development Project for Proposed Hydrogen Energy California Project (HECA), Kern County, California. March 2010.

URS 2010b. Draft Addendum to the Draft Hydrogeologic Data Acquisition Report for Proposed Hydrogen Energy California Project (HECA), Kern County, California. April 2010.

URS 2010c. Linear Modifications to the Revised Application for Certification for Hydrogen Energy California, Kern County, California. August 2010.

URS 2010d. Responses to CEC Data Requests Set Three: Nos. 153 through 218, Revised Application for Certification (08-AFC-8) for Hydrogen Energy California, Kern County, California. November 2010.

URS 2010e. Responses to CEC Data Requests Set Three: Nos. 153–157, 160–167, 182–185, and 187–190, Revised Application for Certification (08-AFC-8) for Hydrogen Energy California, Kern County, California, Confidential. November 2010.

West Kern Water District, 2007. West Kern Water District Consumer Confidence Report 2007. Available at http://www.wkwd.org

West Kern Water District, 1997. Groundwater Management Plan. February (as cited in CEC's April 7 1999 FSA for the La Paloma Project).

Williamson, A. K., D.E. Prudic, and L.A. Swain, 1989. Ground-Water Flow in the Central Valley, California. U.S. Geological Survey Professional Paper 1401-D.

Williamson, A. K., D.E. Prudic, and L.A. Swain, 1985. Ground-Water Flow in the Central Valley, California. U.S. Geological Survey Open-File Report 85-345.

Table 5.14-1
Monthly Temperature Data for Bakersfield, California (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum	82	87	92	101	107	114	115	112	112	103	91	83
Mean	47.8	53.3	57.4	63.0	71.0	78.2	84.1	82.6	76.8	67.8	55.8	47.5
Minimum	20	25	31	34	37	45	52	52	45	29	28	19

Source: Western Regional Climatic Center; Bakersfield WSO Airport, Station Number 040442, Period of Record October 1, 1937 to December 31, 2006.

Notes:

ºF = degrees Fahrenheit

WSO = Weather Service Office

Table 5.14-2
Average Monthly Precipitation
Bakersfield, California (Inches)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.08	1.17	1.16	0.68	0.22	0.07	0.01	0.04	0.11	0.30	0.60	0.79

Source: Western Regional Climatic Center; Bakersfield WSO Airport, Station Number 040442, Period of Record October 1, 1937 to December 31, 2006.

Notes:

WSO = Weather Service Office

Table 5.14-3
Aquifer Parameters

Aquifer Parameter	Assumed Value for Model[1]
Hydraulic Conductivity, K	57 feet/day
Specific Yield, Sy	0.18 for unconfined zone
Specific Storage, (Ss)	0.000055 for semi-confined zone
Anisotropic Ratio	30
Aquifer Thickness	2,000 feet
Sand Percentage	75 percent

Notes:

1 See Groundwater Model Documentation in Appendix N-2, Groundwater Model Documentation for additional information on the aquifer parameter assumptions used in the groundwater model.

Table 5.14-4
Ackerman Well Groundwater Quality

General	Units	Value	Maximum Contaminant Level (MCL)
Conductivity	µS/cm	1,200	No standard
pH		7.8	No standard
Total Suspended Solids	Ppm	N/A	Not listed
TDS	Ppm	960	No standard
Total Alkalinity	mg/L	73	No standard
Hardness (as $CaCO_3$)	mg/L	360	No standard
Calcium	mg/L	140	No standard
Magnesium	mg/L	0.42	No standard
Sodium	mg/L	130	No standard
Potassium	mg/L	1.1	Not listed
Bicarbonate	mg/L	73	No standard
Sulfate	mg/L	420	No standard
Chloride	mg/L	94	No standard
Nitrate-Nitrite	mg/L	<1	10 (sum as Nitrogen)
Arsenic	mg/L	<0.002	0.010
Boron	mg/L	N/A	Not listed
Fluoride	mg/L	<0.1	2.0
Silica	mg/L	N/A	Not listed

Source: Zalco Laboratories, Inc., 2010, California Department of Public Health, 2007.

Notes:
This table is not a complete list of all of the analytes tested.
µS/cm = microSiemens per centimeter
< = less than
$CaCO_3$ = calcium carbonate
mg/L = milligrams per liter
N/A = not available
pH = value indicating acidity or alkalinity of a liquid
ppm = parts per million
TDS = total dissolved solids

Table 5.14-5
Daily and Annual Water Flows

	Maximum Daily[2] (1000 gal/day)	Average Daily[3] (1000 gal/day)	Average Annual (acre-ft/year)[5]
Available Water Supply			
Plant Water	8,800[1]	6,700	7,500
Water Requirements			
Inflows			
BVWSD Brackish Groundwater	7,392	6,630	7,427
Recycled Water:[4]			
• Boiler blowdown	36	48	53
• Gasification wastewater	11	11	13
• Sour Water Blowdown	180	180	202
• Wastewater from Acid Gas Removal Unit	7	7	8
• Wastewater from SO_2 Scrubber Unit	3	3	3
• Wastewater from Urea Plant	258	258	289
• Storm water	0	0	0
Subtotal Recycled Water	495	507	568
Total Inflow	7,887	7,137	7,995
Consumptive Uses			
• Power Block Cooling Tower (evaporation)	2,721	2,391	2,679
• Process Block Cooling Tower (evaporation)	2,721	2,391	2,678
• ASU Cooling Tower (evaporation)	819	724	812
• Evaporative Cooler (evaporation)	75	0	0
• Demineralized Water (to Users)	1,535	1,616	1,810
• Softener Filter Cake (solid waste removal)	4	3	3
• ZLD Filter Cake (solid waste removal)	12	12	13
Total Consumptive Use	**7,887**	**7,137**	**7,995**

Source: HECA Project, 2012.

Notes:

1 Current will serve letter as provided in Appendix N-1, Water Resources Information, provides documentation for the supply of 6,700,000 gpd on an annual basis with capacity to peak to 8,800,000 gpd.

2 The maximum daily use is based on 24 hours of full load operation during the design hottest day (115ºF day/ 80ºF night, 97 ºF average).

3 The average daily use is 24 hours of the average of the full load use at the average monthly temperatures for every month (65 ºF average).

4 Reject water volumes listed are captured and recycled by the Project. Storm water from the site will be used when available and are thus shown as zero values on this table.

5 The average annual use is based on 8,760 hours/year at the average daily rate, corresponding to the maximum plant capacity factor of 100 percent.

ASU = Air Separation Unit
ºF = degrees Fahrenheit
ft = feet
gal = gallon(s)
ZLD = Zero Liquid Discharge

Table 5.14-6
BVWSD Supply Water Quality

General	Units	Projected Average	Projected Maximum
pH	N/A	7.25	7.25
TDS	Ppm	2000	4000
Total Alkalinity	mg/L	238	328
Hardness	mg/L	897	1,561
Calcium	mg/L	300	500
Magnesium	mg/L	35	75
Sodium	mg/L	278	726
Potassium	mg/L	2	3
Bicarbonate	mg/L	250	400
Sulfate	mg/L	700	1,000
Chloride	mg/L	381	1,237
Nitrate-Nitrite	mg/L	0.2	0.2
Arsenic	mg/L	0.025	0.025
Boron	mg/L	2.5	5
Fluoride	mg/L	0.4	1
Silica	mg/L	30	35

Source: Values for the BVWSD source water represent a composite of historical laboratory test results on elevated TDS wells provided by BVWSD (BVWSD, 2009).
Notes:
Average of the water sample data provided by BVWSD
mg/L = milligrams per liter
N/A = not applicable
pH = value indicating acidity or alkalinity of a liquid
TDS = total dissolved solids

Table 5.14-7
WKWD Supply Water Quality

General	Units	WKWD Well Field South of Project Site[1] Value	WKWD Well #1 East of Project Site[2] Value	WKWD Well #2 East of Project Site[3] Value
Conductivity	µS/cm	444	N/A	N/A
pH		7.98	8.4	8.1
Total Suspended Solids	ppm	N/A	N/A	N/A
TDS	ppm	294	380	459
Total Alkalinity	mg/L	N/A	N/A	N/A
Hardness	mg/L	90	86	154
Calcium	mg/L	33	N/A	N/A
Magnesium	mg/L	1.9	N/A	N/A
Sodium	mg/L	48	N/A	N/A
Potassium	mg/L	N/A	N/A	N/A
Bicarbonate	mg/L	135	N/A	N/A
Sulfate	mg/L	39	155	185
Chloride	mg/L	35	41	55
Nitrate–Nitrite	mg/L	1.59	13.4	18.2
Arsenic	mg/L	0.00121	0.002	0.002
Boron	mg/L	0.00014	N/A	N/A
Fluoride	mg/L	0.15	N/A	N/A
Silica	mg/L	N/A	N/A	N/A

Notes:
1 Represents average water quality from WKWD's eight groundwater wells located south of the Project Site (WKWD, 2007).
2 Represents average water quality from existing Well #1 (ESA, 2010).
3 Represents average water quality from existing Well #2 (ESA, 2010).
µS/cm = microSiemens per centimeter
< = less than
$CaCO_3$ = calcium carbonate
mg/L = milligrams per liter
N/A = not available
ppm = parts per million
pH = value indicating acidity or alkalinity of a liquid
TDS = total dissolved solids

Table 5.14-8
Estimated Construction Water Use

Activity	Estimated Daily Average Use by Construction Phase (gpd)	Estimated Construction Phase Duration (months)	Daily Average Over Construction Period (gpd)	Estimated Water Use (acre-feet)	
				12-Month Period Maximum Use	Monthly Average Over Construction Period
Project Site (453 acres)					
Early Works • Initial Grading of Entire Site • Dust Control	24,000	2	11,800[1]	12	10
Site Preparation • Underground • Excavation/Backfill/Compaction • Dust Control	14,000	5			
Ongoing Day-to-Day Construction • Foundations • Backfill • Compaction • Dust Control • Road Cleaning	12,000	26			
Finishing Stage • Finish Grading and Paving • Landscaping • Construction Cleanup • Demobilization Dust Control	8,000	4			
Hydrotest—Plant Equipment and Piping	5,600	5			
Linear Construction					
Trenching	900	6	2,000	1.5	N/A
Horizontal Directional Drilling	2,300	3			
Hydrotest – Linears	2,000	6			

Source: HECA Project, 2012.
Notes:
[1] Daily average use after the first 12 months of construction, including construction of linears, is estimated at 10,000 gpd.
gpd = gallons per day
N/A = not applicable

Table 5.14-9
Summary of LORS—Water Resources

LORS	Applicability	Conformance and Timing
Federal		
CWA §402; 33 USC §1342; 40 CFR Parts 110, 112, 116	Requires NPDES permits for construction and industrial storm water discharges. Requires preparation of an SWPPP and Monitoring Program.	Project proposes to retain and re-use industrial storm water discharge. As such, the Project would comply with the zero discharge exemption under the NPDES industrial storm water permit. NOI for coverage under NPDES construction storm water permit will be filed prior to construction and Project operation. An SWPPP will also be prepared for construction activity.
CWA §311; 33 USC §1342; 40 CFR Parts 122–136	Requires reporting of any prohibited discharge of oil or hazardous substance.	The Project will conform by proper management of oils and hazardous substances both during construction and operation.
State		
CWC §13552.6	Use of potable domestic water for cooling towers is unreasonable use if suitable recycled water is available.	Project has determined that brackish groundwater is feasibly available in the vicinity of the Project Site at this time and will be used for cooling tower make-up.
California Constitution Article 10 §2	Avoid the waste or unreasonable uses of water. Regulates methods of use and diversion of water.	Project includes appropriate water conservation measures, both during construction and operation (e.g., ZLD). The Project will comply with this requirement as well as SWRCB Resolution No. 75-58.
SWRCB, Resolution No. 75-58	Addresses sources and use of cooling water supplies for power plants which depend on inland waters for cooling and in areas subject to general water shortages.	Project has determined that brackish water is feasibly available at the site at this time and will be used for cooling water supply.
Porter-Cologne Water Quality Act of 1972; CWC §13000–14957, Division 7, Water Quality	Requires state and RWQCBs to adopt water quality initiatives to protect state waters. Those criteria include identification of beneficial uses, and narrative and numerical water quality standards.	Project will conform to applicable state water standards, both qualitative and quantitative, prior to Project operation. Use of brackish groundwater for industrial supply is consistent with designated beneficial use.

Table 5.14-9
Summary of LORS—Water Resources (Continued)

LORS	Applicability	Conformance and Timing
Title 22, CCR	Addresses the use of recycled water for cooling equipment.	Project proposes to use treated brackish groundwater for cooling tower make-up. Sufficient quantities of recycled water supply are not available. Project proposes to recycle cooling tower circulation water and process condensate from gasification to the maximum extent practicable. The Project uses ZLD technology to recycle plant wastewater to the maximum extent possible.
The Safe Drinking Water and Toxic Enforcement Act of 1986 (proposition 65), Health and Safety Code 25241.5 *et seq.*	Prohibits the discharge or release of chemicals known to cause cancer or reproductive toxicity into drinking water sources.	Project will conform to all state water quality standards, both qualitative and quantitative.
CWC Section 461	Encourages the conservation of water resources and the maximum reuse of wastewater, particularly in areas where water is in short supply.	Project proposes to use treated brackish groundwater for cooling tower make-up. The Project uses ZLD technology to recycle plant wastewater to the maximum extent possible. Project proposes to recycle cooling tower circulation water and process condensate from gasification to the maximum extent practicable.
California Public Resources Code §25523(a); 20 CCR §§1752, 1752.5, 2300–2309, and Chapter 2 Subchapter 5, Article 1, Appendix B, Part (1)	The code provides for the inclusion of requirements in the CEC's decision on an AFC to assure protection of environmental quality and requires submission of information to the CEC concerning proposed water resources and water quality protection.	The Project will comply with the requirements of the CEC to assure protection of water resources.
CWC §§13271–13272; 23 CCR §§2250–2260	Reporting of releases of reportable quantities of hazardous substances or sewage and releases of specified quantities of oil or petroleum products.	Project will conform to all state water quality standards, both qualitative and quantitative.
CWC § 13260–13269; 23 CCR Chapter 9	Requires the filing of a Report of Waste Discharge (ROWD) and provides for the issuance of WDRs with respect to the discharge of any waste that can affect the quality of the waters of the state.	An NOI will be filed for coverage under the NPDES General Construction Permit. Otherwise, there will be no discharges to waters of the state.
CEQA, Public Resources Code §21000 *et seq.*; CEQA Guidelines, 14 CCR §15000 *et seq.*; Appendix G	The CEQA Guidelines (Appendix G) contain definitions of projects which can be considered to cause significant impacts to water resources.	The Project will comply with the requirements of the CEC to assure protection of water resources.

Table 5.14-9
Summary of LORS—Water Resources (Continued)

LORS	Applicability	Conformance and Timing
Local		
Kern County General Plan—Land Use Element: Resource Goals, Objectives, and Policies Policy LU 1.9.11	Minimize the alteration of natural drainage areas. Require development plans to include necessary mitigation to stabilize runoff and silt deposition through use of grading and flood protection ordinances.	The Project will implement BMPs, including erosion control measures and will comply with the Kern County Grading Ordinance 17.28.
Kern County General Plan—Land Use Element: Resource Goals, Objectives, and Policies Policy LU 1.9.20	Areas along rivers and streams will be conserved where feasible to enhance drainage, flood control, recreation, and other beneficial uses while acknowledging existing land use patterns.	The Project will not impact canal levees and will not discharge into the canals. The Project Site is not located in a floodplain. The Project will not increase storm water runoff off site and therefore will not contribute to off-site flooding.
Kern County General Plan—Land Use Element: Resource Goals, Objectives, and Policies Policy LU 1.10.6.34	Ensure that adequate water storage, treatment, and transmission facilities are constructed concurrently with Plan.	The Project includes water supply pipelines, storage tanks and water treatment facilities.
Kern County General Plan—Land Use Element: Resource Goals, Objectives, and Policies Policy Public Facilities and Services-Policy 1.4.5	Ensure that adequate supplies of quality (appropriate for intended use) water are available to industrial users.	BVWSD will provide the Project with brackish water for process uses.
Kern County General Plan—Land Use Element: Resource Goals, Objectives, and Policies Policy Public Facilities and Services-Policy 1.4.6	Provide a healthful and sanitary means of collecting, treating, and disposing of sewage and refuse.	The Project will have an on-site septic system constructed, designed and operated in accordance with Kern County and RWQCB requirements.
Kern County Zoning Ordinance 14.08	Provides standards and requirements for the design, construction, reconstruction, abandonment, and destruction of wells. The administering agency for the above authority is Kern County.	Any existing on-site wells will be abandoned or destroyed in accordance with Kern County requirements.

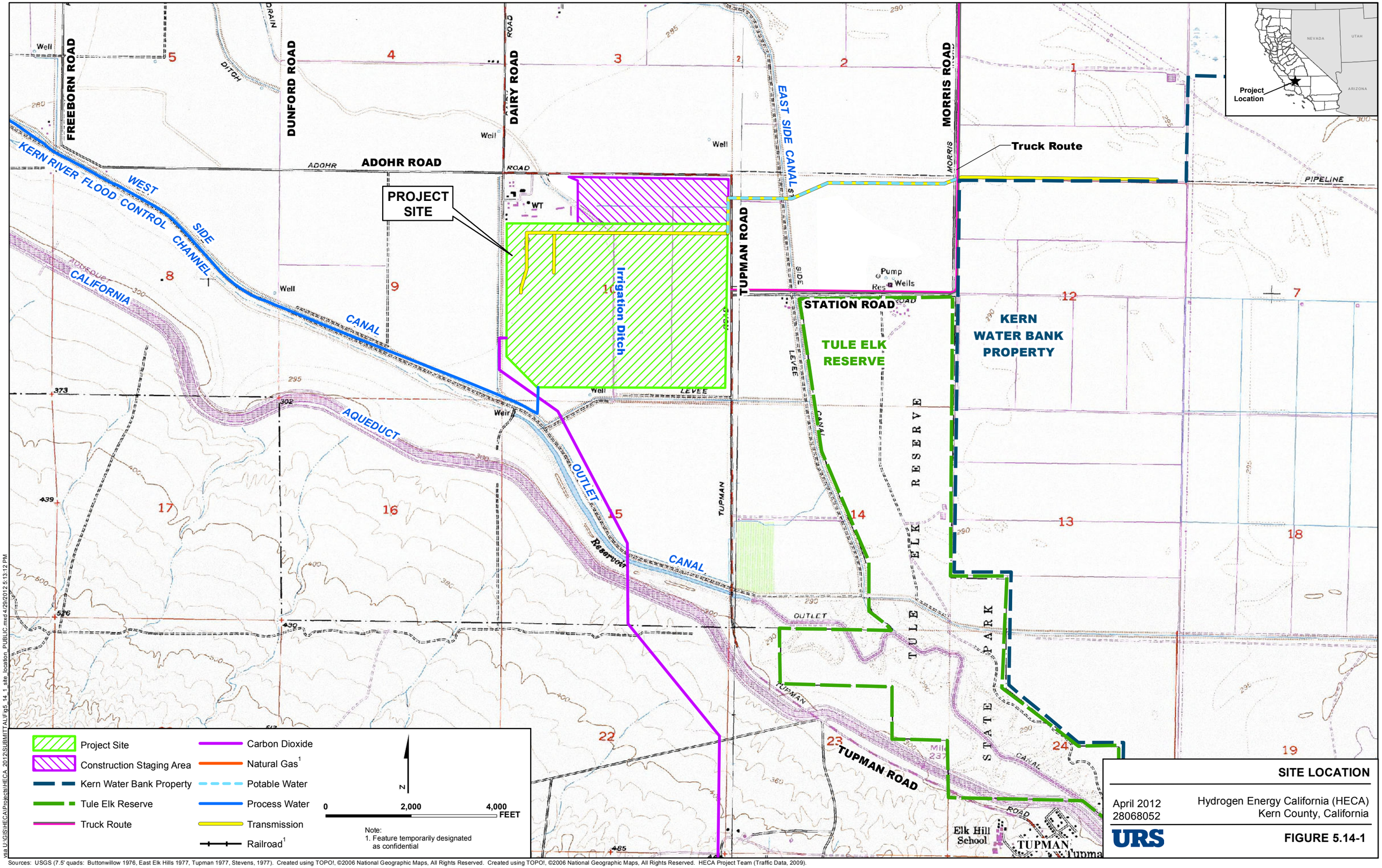
Table 5.14-9
Summary of LORS—Water Resources (Continued)

LORS	Applicability	Conformance and Timing
Kern County Zoning Ordinance 17.28	Sets forth rules and regulations to control excavation, grading and earthwork construction, including fills and embankments; establishes the administrative procedure for issuance of permits; and provides for approval of plans and inspection of grading construction.	The Project will obtain a grading permit.
Kern County Zoning Ordinance 17.48	Restricts or prohibits uses which are dangerous to health, safety, and property loss due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities; requires that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction; controls the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters; controls filling, grading, dredging, and other development which may increase flood damage; and prevents or regulates the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas.	The Project is not in a floodplain and will not increase storm water discharges off site. The CO_2 pipeline crossing at the Kern River Flood Channel will be constructed using the HDD method and will not impede flood flows or impact floodplains.

Notes:
CCR = California Code of Regulations
CEC = California Energy Commission
CEQA = California Environmental Quality Act of 1970
CFR = Code of Federal Regulations
CO_2 = carbon dioxide
CWA = Clean Water Act
CWC = California Water Code
HECA = Hydrogen Energy California
LORS = laws, ordinances, regulations, and standards
N/A = not applicable
NOI = Notice of Intent
NPDES = National Pollutant Discharge Elimination System
RWQCB = Regional Water Quality Control Board
SWPPP = storm water pollution prevention plan
SWRCB = State Water Resources Control Board
USC = United States Code

Table 5.14-10
Agency Contacts

Agency	Contact	Title	Telephone
California Regional Water Quality Control Board, Central Valley Region 1685 E Street Fresno, CA 93706	Doug Patteson	Senior Water Resource Control Engineer	(559) 445-5146
West Kern Water District 800 Kern Street PB Box 1105 Taft, CA 93268	J.D. Bramlet	Director of Operations	(661) 763-3151
Buena Vista Water Storage District 525 North Main Street PO Box 756 Buttonwillow, CA 93206	Dan Bartel	District Manager	(661) 324-1101



SITE LOCATION

April 2012
28068052

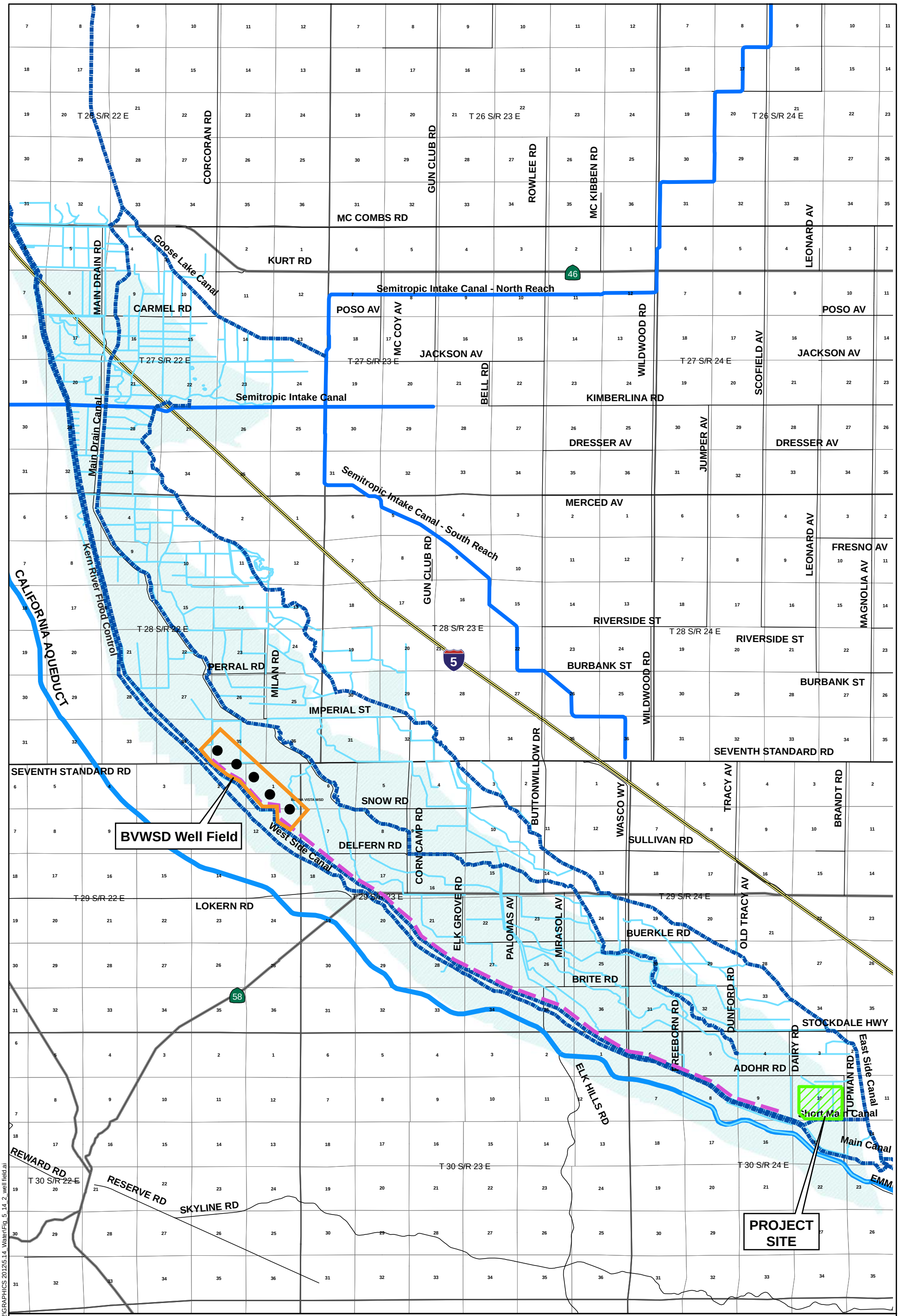
Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 5.14-1

Sources: USGS (7.5' quads: Buttonwillow 1976, East Elk Hills 1977, Tupman 1977, Stevens, 1977). Created using TOPO!, ©2006 National Geographic Maps, All Rights Reserved. Created using TOPO!, ©2006 National Geographic Maps, All Rights Reserved. HECA Project Team (Traffic Data, 2009).

usa U:\GIS\HECA\Projects\HECA_2012\SUBMITTAL\Fig5_14_1_site_location_PUBLIC.mxd 4/29/2012 5:13:12 PM



Project Site

BVWSD Buttonwillow Service Area

Production Wells (3 pumping, 2 redundant)

BVWSD Water Ways

Water Supply Pipeline

BVWSD Well Field

N

0 1 2 MILE

PROCESS WATER SUPPLY WELL FIELD LOCATION

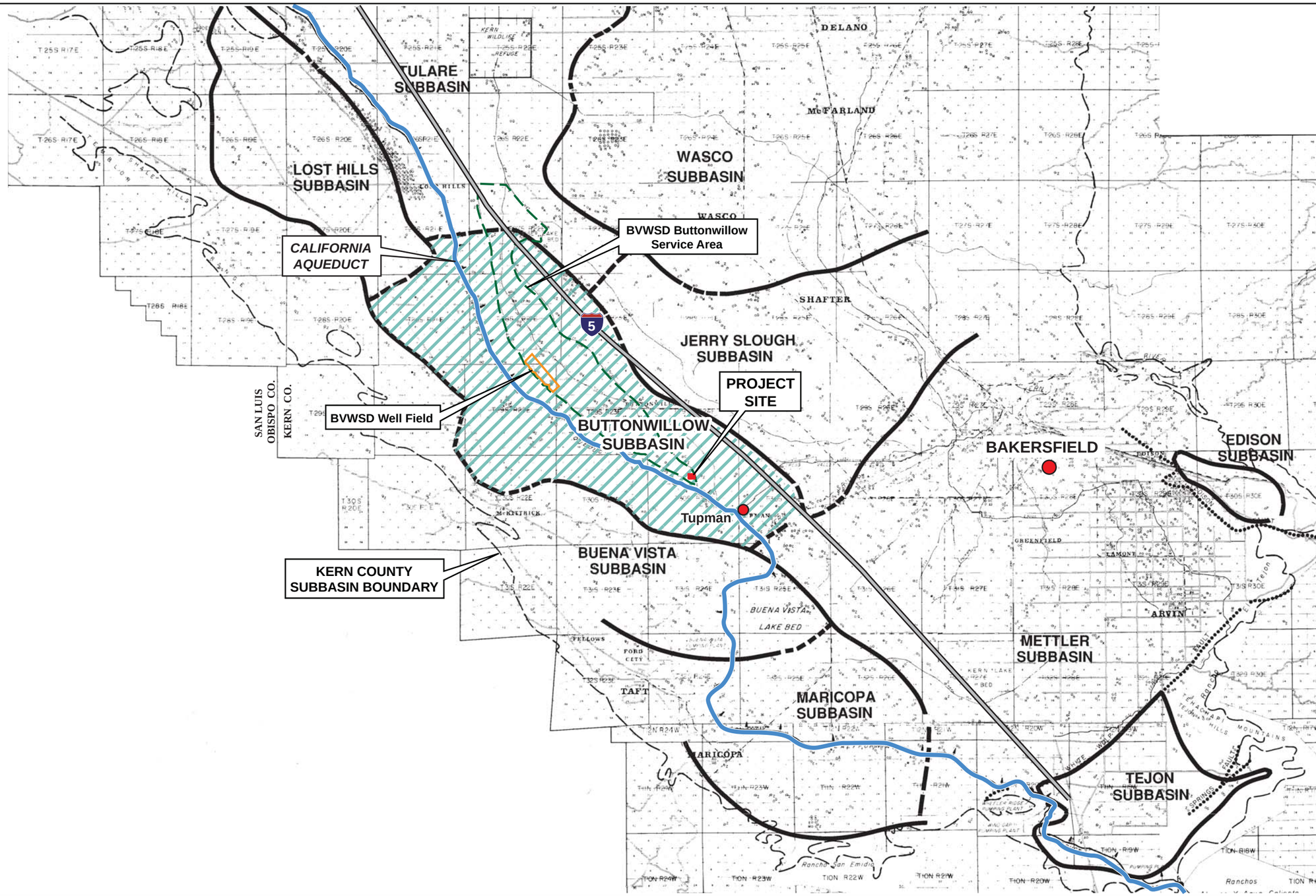
April 2012
28068052

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 5.14-2

4/29/12 vsa/hk..T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_2_well field.ai



Note:
The subbasins shown are bounded by distinct structural highs due to folding and faulting as developed by KCWA (1991). These subbasins may contain isolated or partially isolated hydrologeologic systems.

BVWSD Buttonwillow Service Area

Kern County Subbasin Boundary

Subbasin Boundaries:

Prominent, continuous structural highs

Low areas, along boundaries (where communication between subbasins is more likely)

N

0 7 MILE (APPROX.)

Source: Kern County Water Agency, 1991

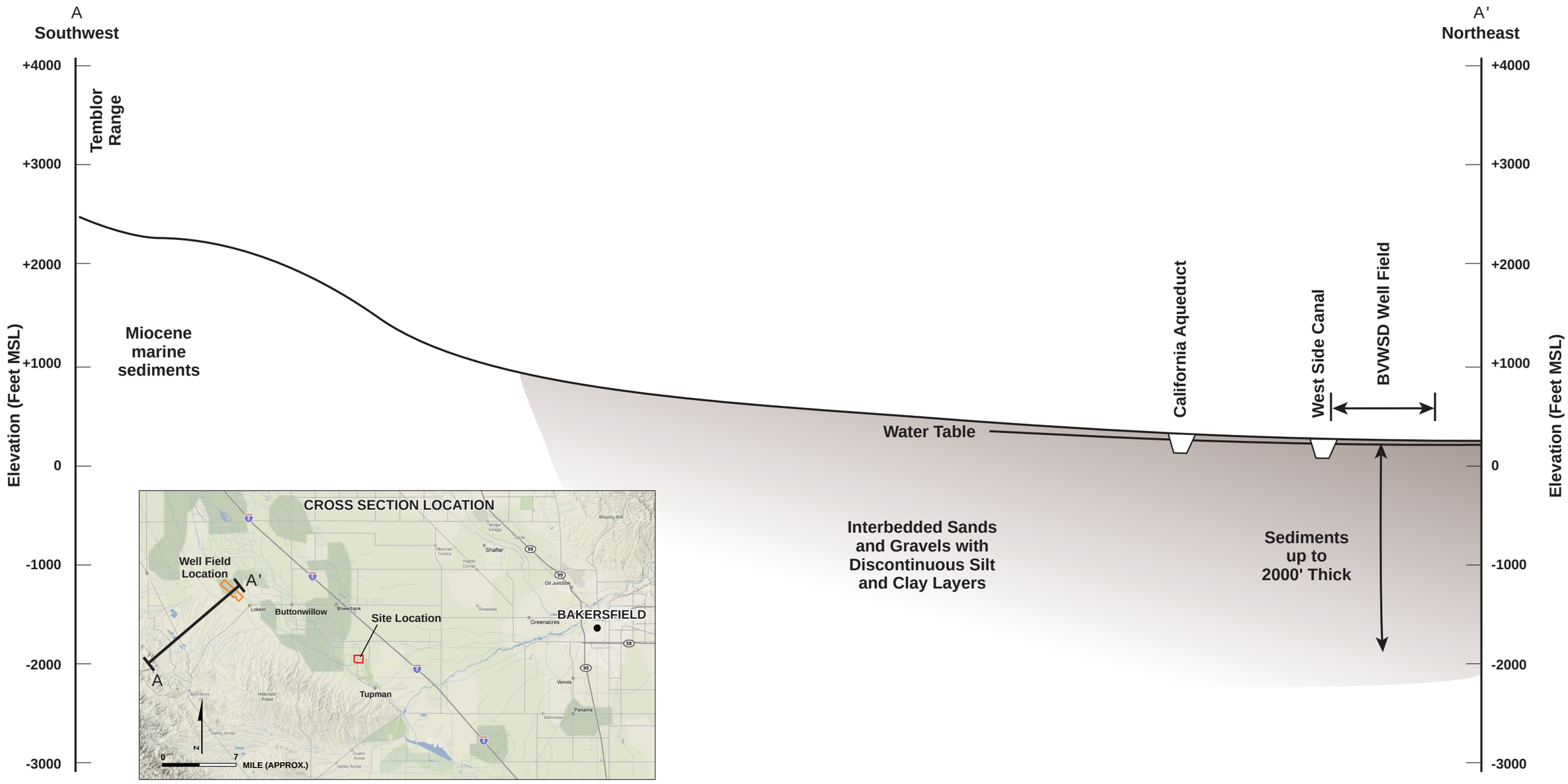
GROUNDWATER SUBBASINS IN KERN COUNTY

April 2012 Hydrogen Energy California (HECA)
28068052 Kern County, California

URS

FIGURE 5.14-3

4/25/12 vesa. T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_3_subbasins_Kern_Co.ai



Note:
High TDS, high SO_4, lateral recharge water from west blends with low TDS, mixed anion, lateral recharge water from east, under BVWSD

0 2
APPROXIMATE HORIZONTAL SCALE, MILES

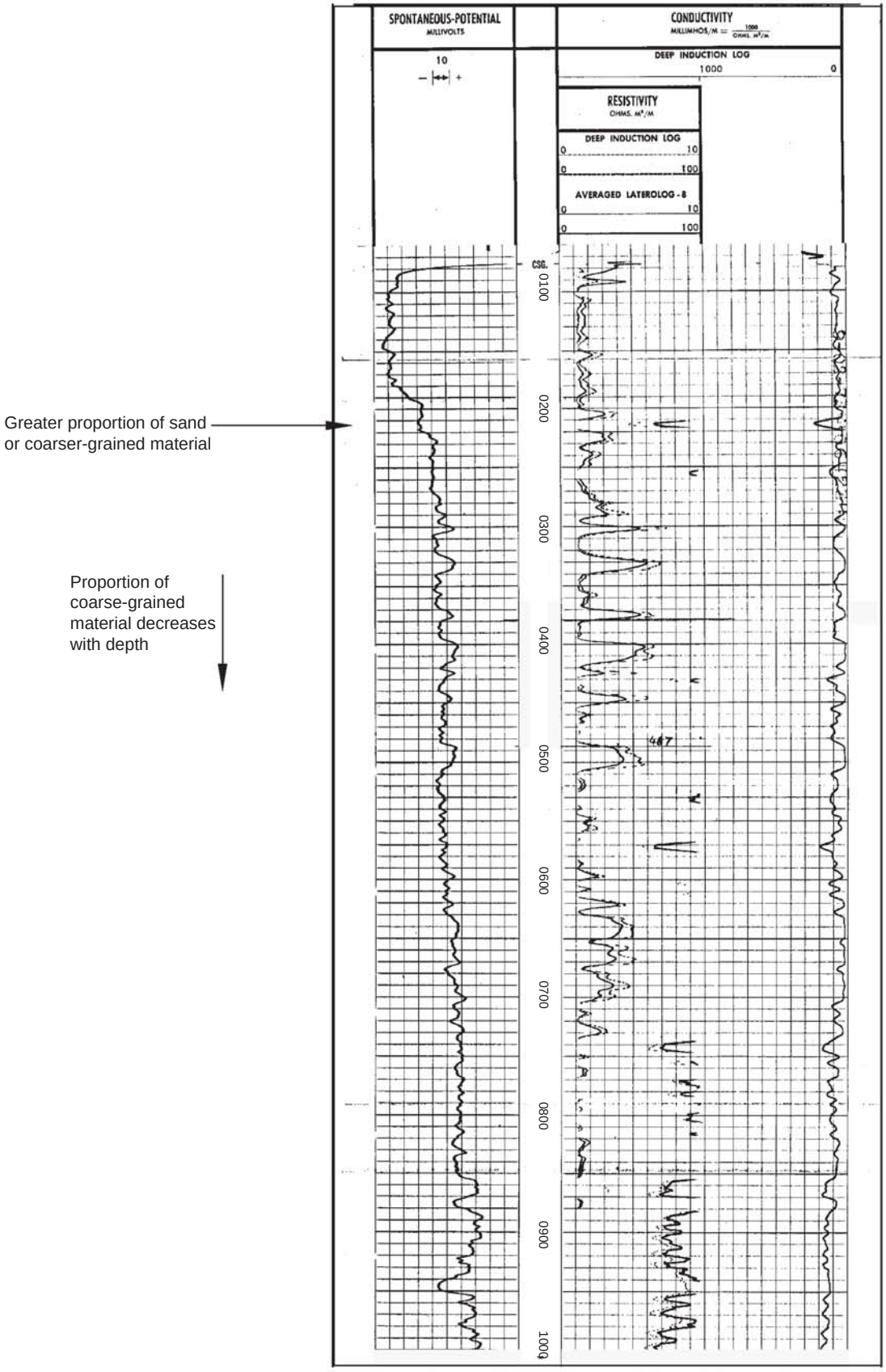
GENERALIZED HYDROGEOLOGIC CROSS SECTION

April 2012 Hydrogen Energy California (HECA)
28068052 Kern County, California

URS

FIGURE 5.14-4

4/25/12 vsa..T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_4_gen_crosssectoin_AA.ai



Notes:
1. Well log is for Mobil-Gulf-Tupman-USL #1-10 located in T28S-R23E-10N.
2. Depths are in feet below ground surface.

EXAMPLE GEOPHYSICAL LOG

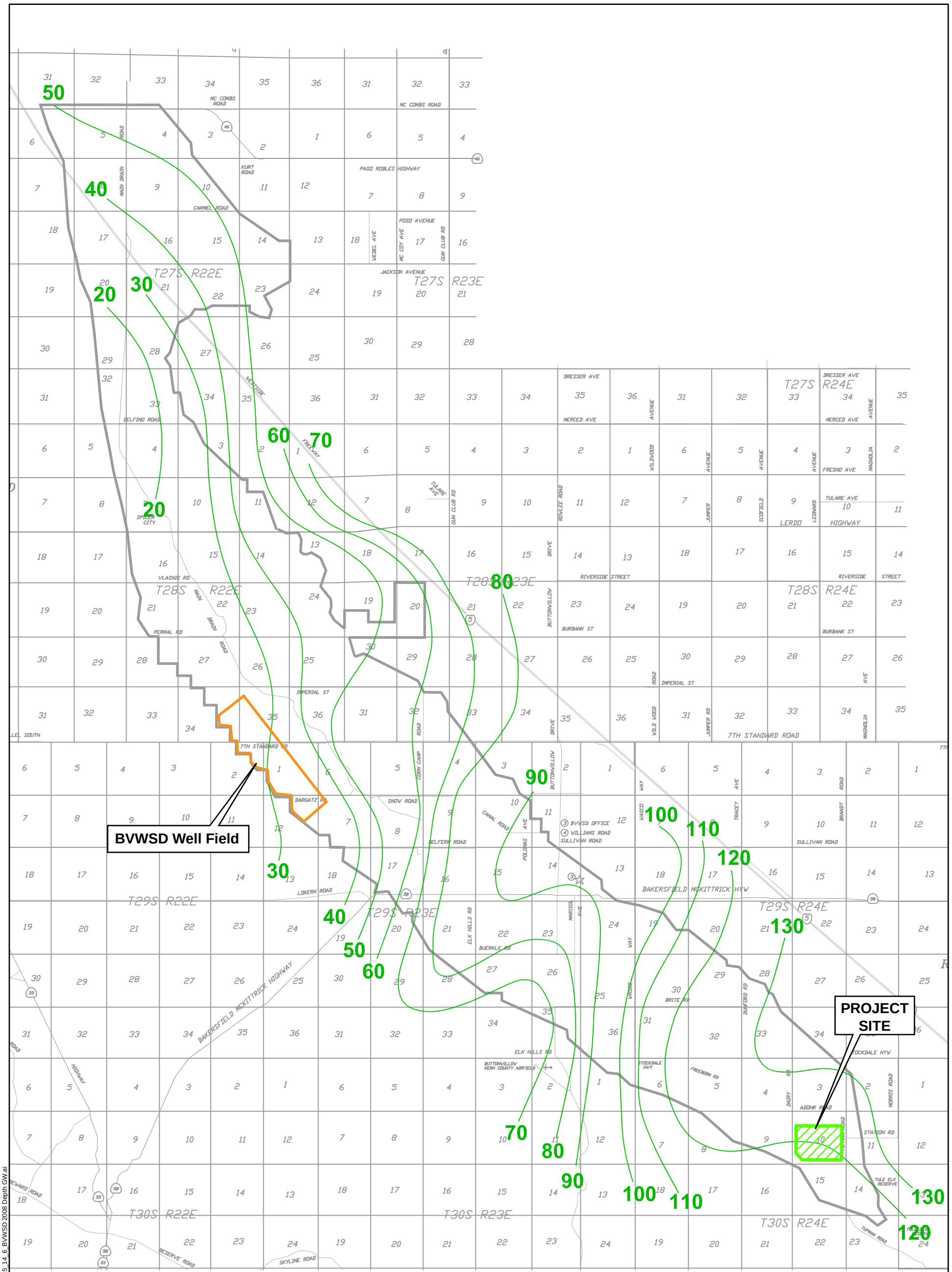
April 2012
28068052

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 5.14-5

4/25/12 vsa.. T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_5_example log.ai



Project Site

BVWSD Buttonwillow Service Area

40 2008 Depth to Groundwater, feet

N

0 1 2 MILE

2008 DEPTH TO GROUNDWATER

April 2012
28068052

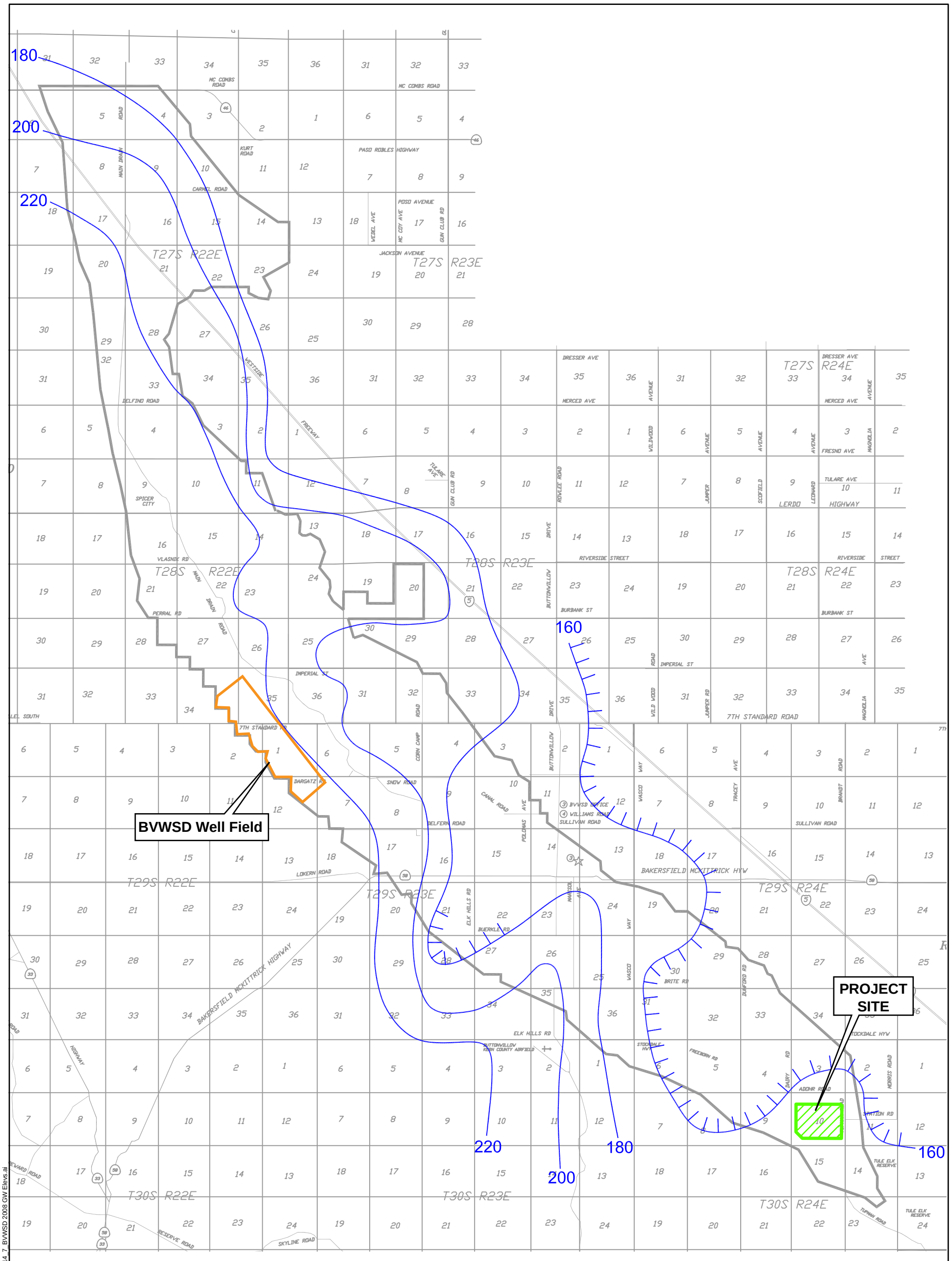
Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 5.14-6

4/29/12 vsa/hk. T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_6_BVWSD 2008 Depth GW.ai

Source: Buena Vista Water Storage District



Project Site

BVWSD Buttonwillow Service Area

200 2008 Groundwater Elevation, feet, msl

N

0 1 2 MILE

2008 GROUNDWATER ELEVATIONS

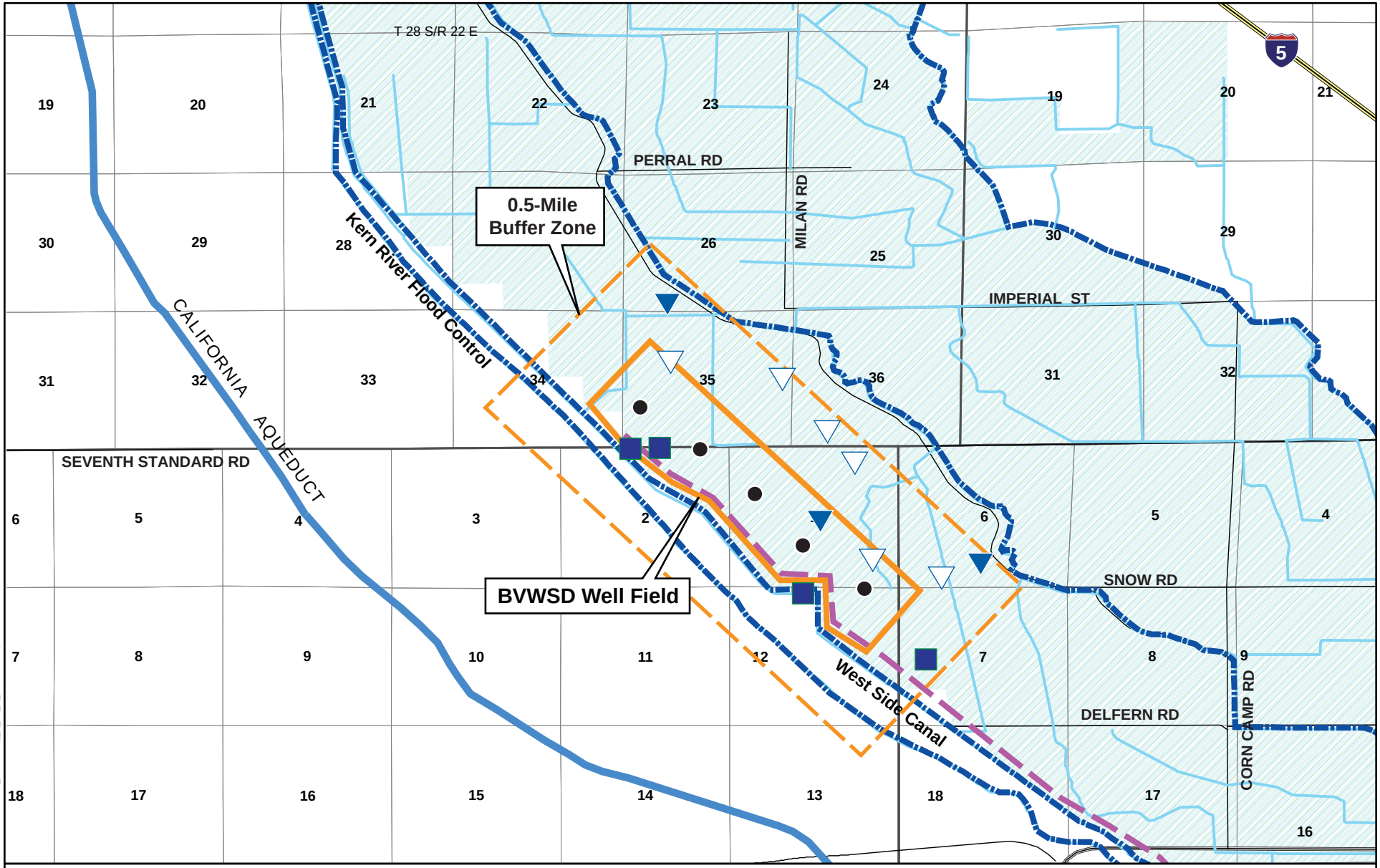
April 2012 Hydrogen Energy California (HECA)
28068052 Kern County, California

URS

FIGURE 5.14-7

4/29/12 vsa/hk.. T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_7_BVWSD 2008 GW Elevs.ai

Source: Buena Vista Water Storage District



BVWSD Buttonwillow Service Area
BVWSD Water Ways
Process Water Supply Pipeline
BVWSD Well Field
0.5-Mile Buffer Zone
Production Wells (3 pumping, 2 redundant)
Private Water Well (Source: BVWSD)
Private Water Well (Source: BVWSD and EDR)
Private Water Well (Source: EDR)

N

0 1 MILE

WELL LOCATION MAP

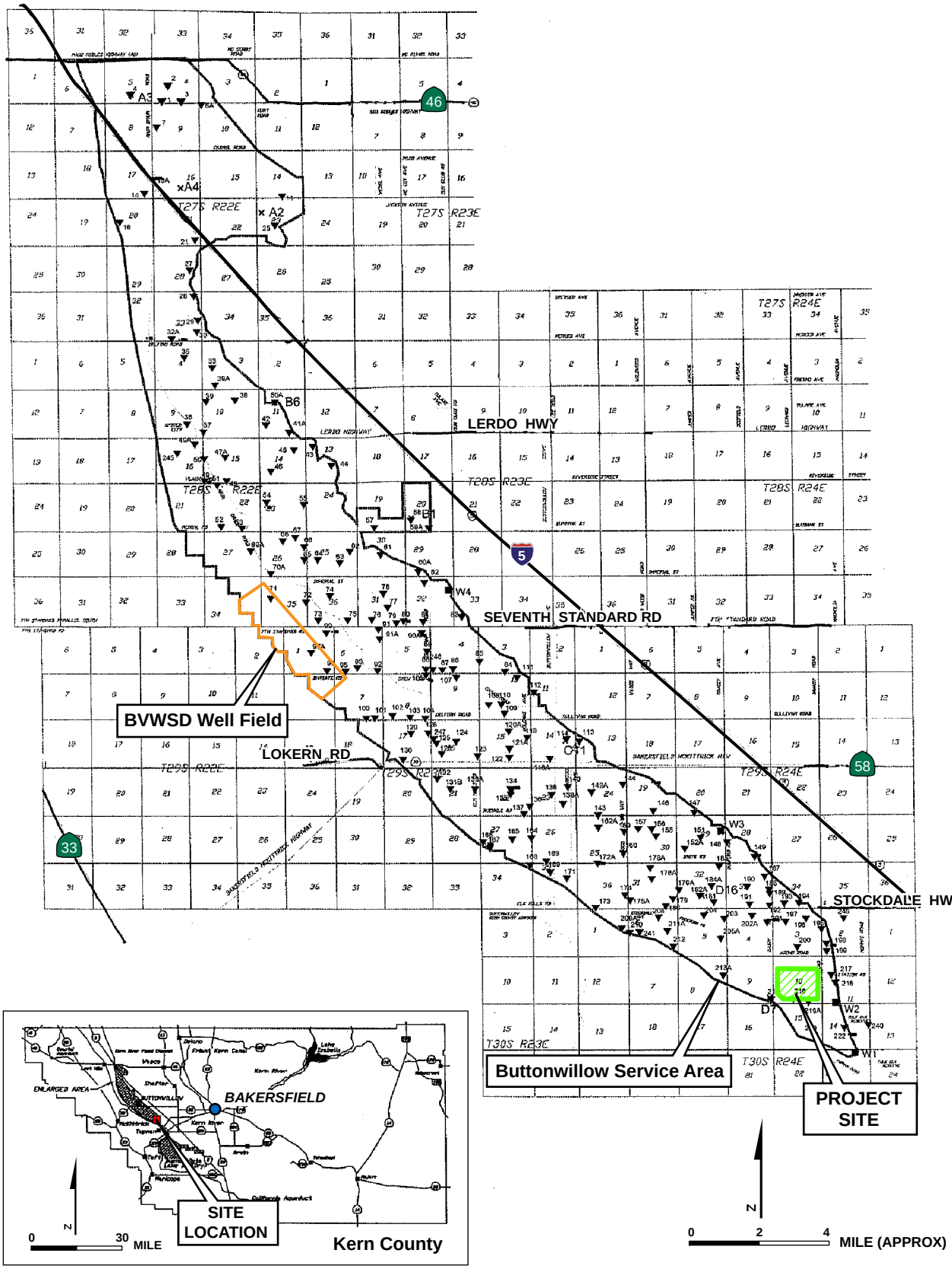
April 2012
28068052

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 5.14-8

4/25/12 vsa. T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_8_well loc map.ai



Project Site

BVWSD Buttonwillow Service Area

BVWSD Well Field

Landowner Supply Well

District Supply Well

BVWSD AND PRIVATE WATER WELL LOCATION MAP

April 2012
28068052

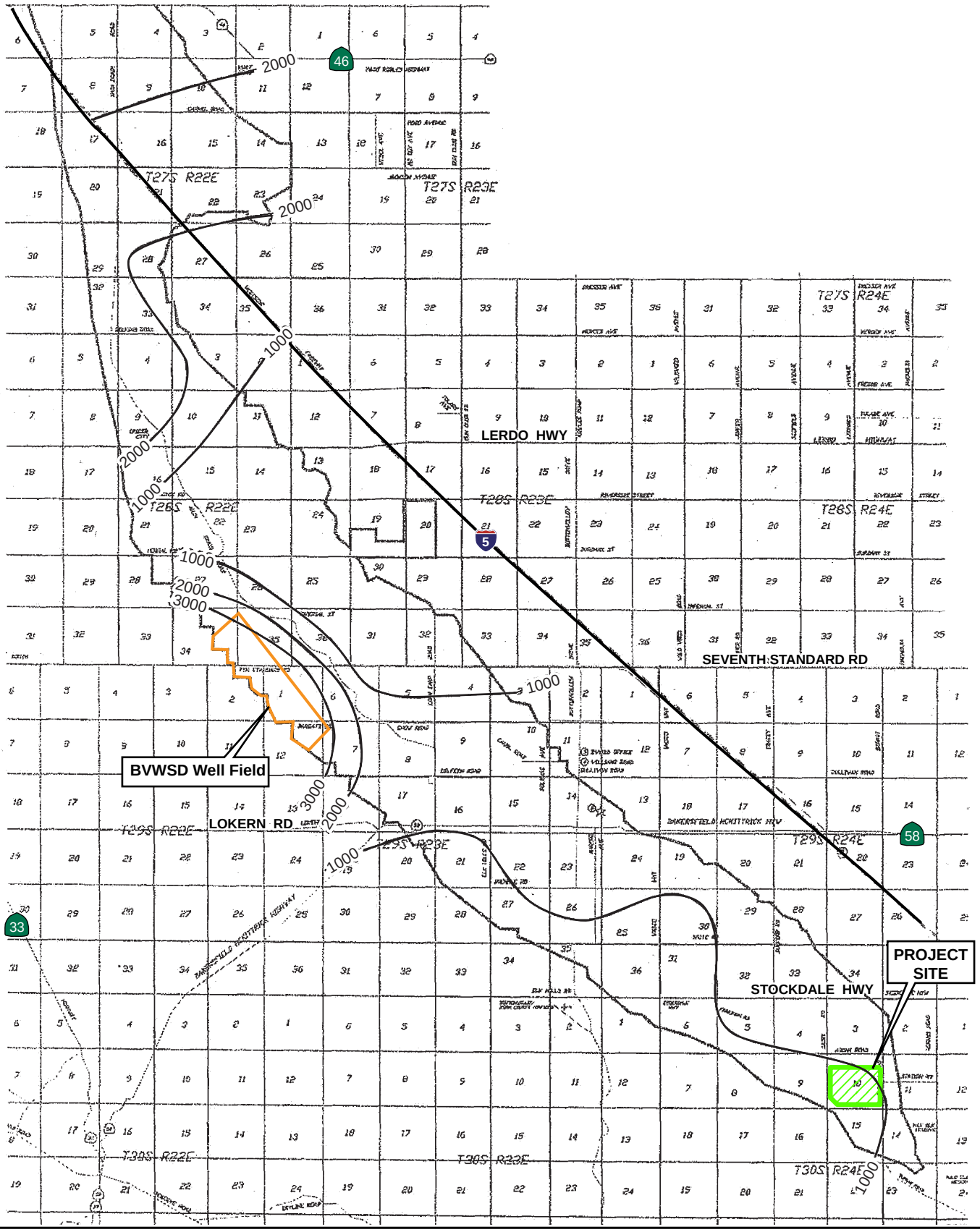
Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 5.14-9

Source: Buena Vista Water Storage District

4/29/12 vsa/hk. T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_9_BVWSD+Private Water Well Locs.ai



Project Site

BVWSD Buttonwillow Service Area

BVWSD Well Field

1000 TDS (mg/L) Summer 2001

N

0 1 2 MILE (APPROX)

TOTAL DISSOLVED SOLIDS – SUMMER 2001

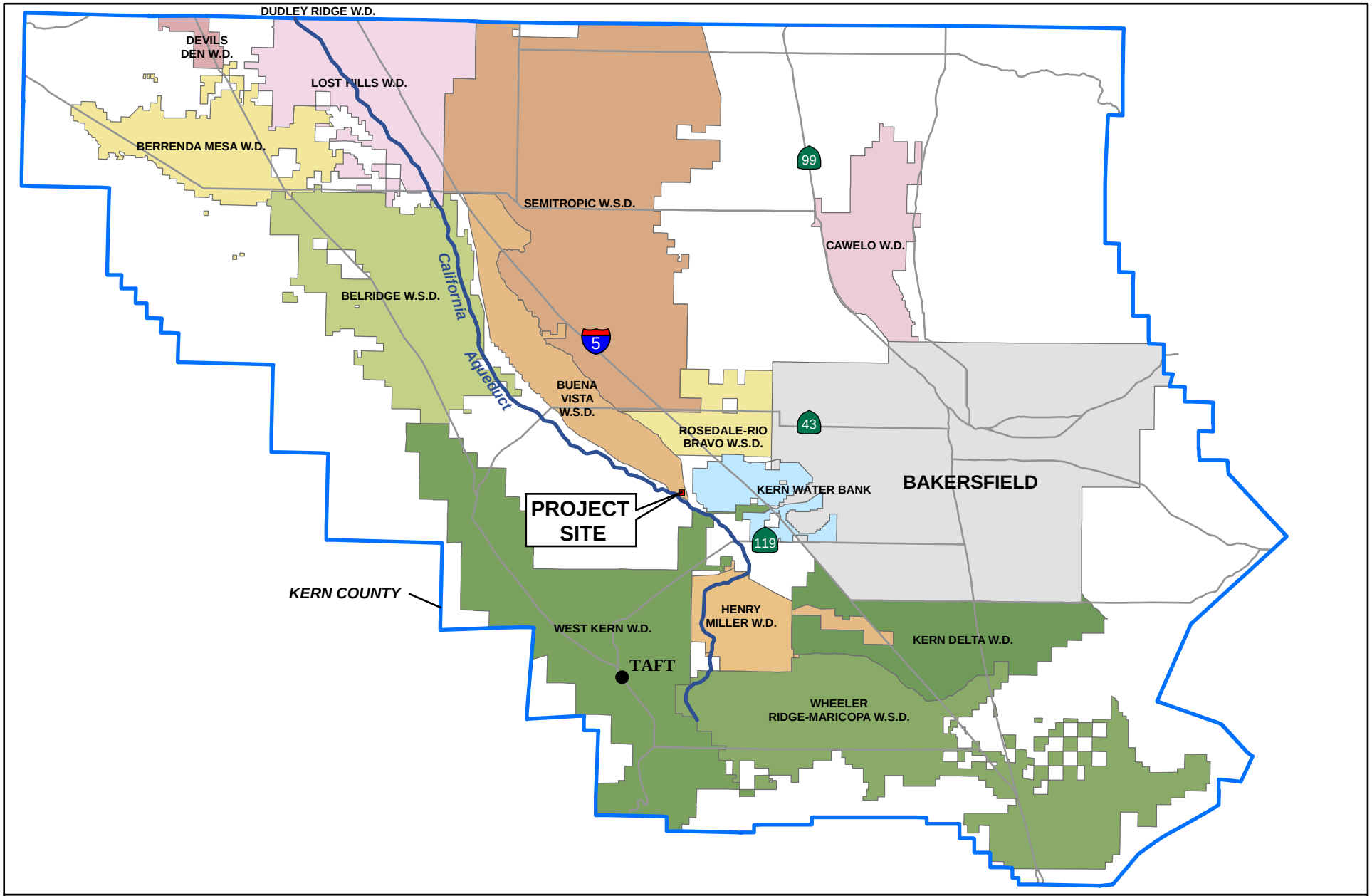
April 2012 Hydrogen Energy California (HECA)
28068052 Kern County, California

URS

FIGURE 5.14-10

Source: Buena Vista Water Storage District

4/29/12 vsa/hk. T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_10_TDS_summer_2001.ai



W.D. Water District

W.S.D Water Storage District

Kern County

California Aqueduct

N

0 1 MILE

WATER DISTRICTS IN VICINITY OF PROJECT

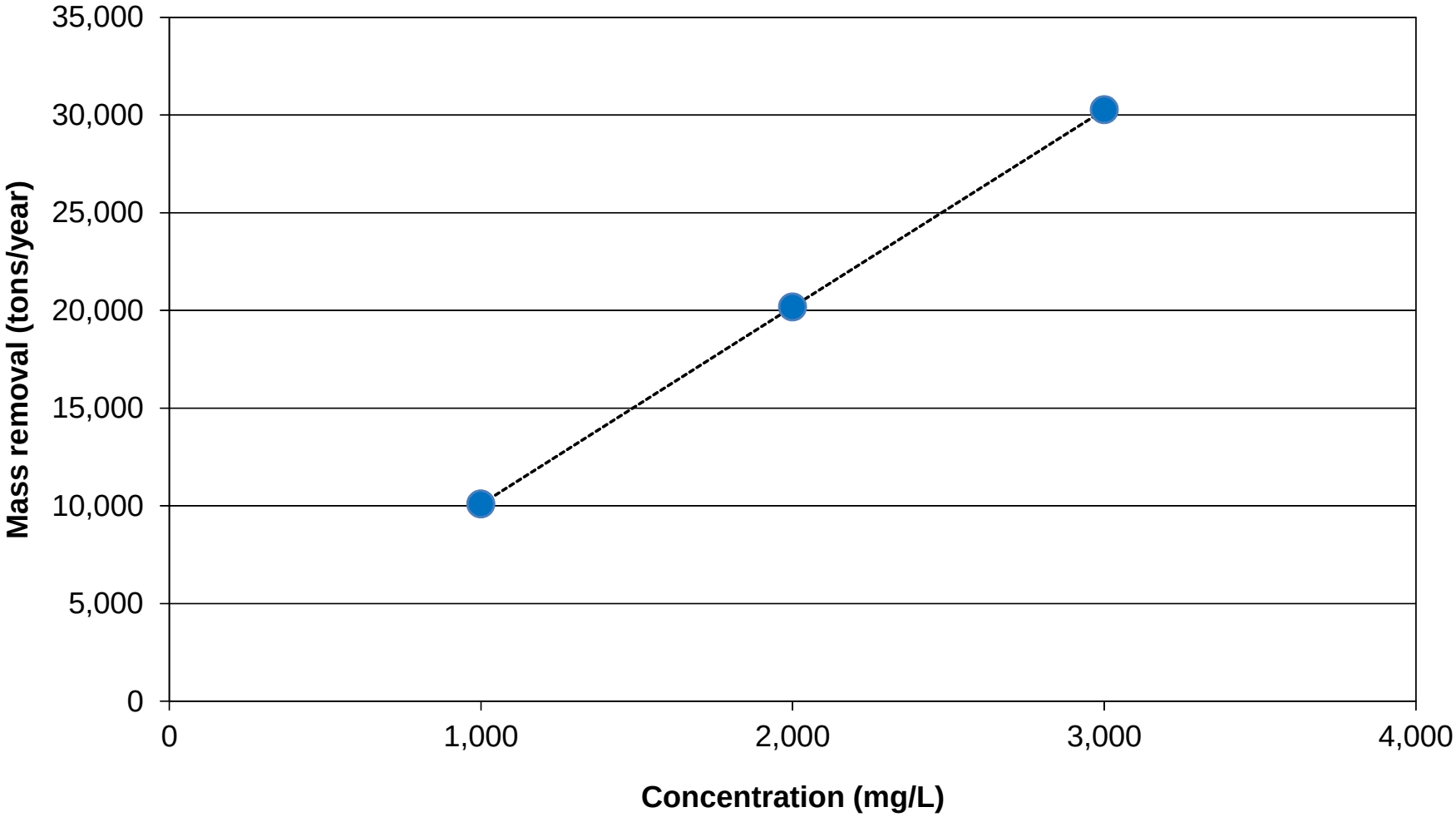
April 2012 Hydrogen Energy California (HECA)

28068052 Kern County, California

URS

FIGURE 5.14-11

4/25/12 vsa. T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_11_water districts.ai



7,427 afy

TDS CONCENTRATION VS MASS REMOVAL RATE

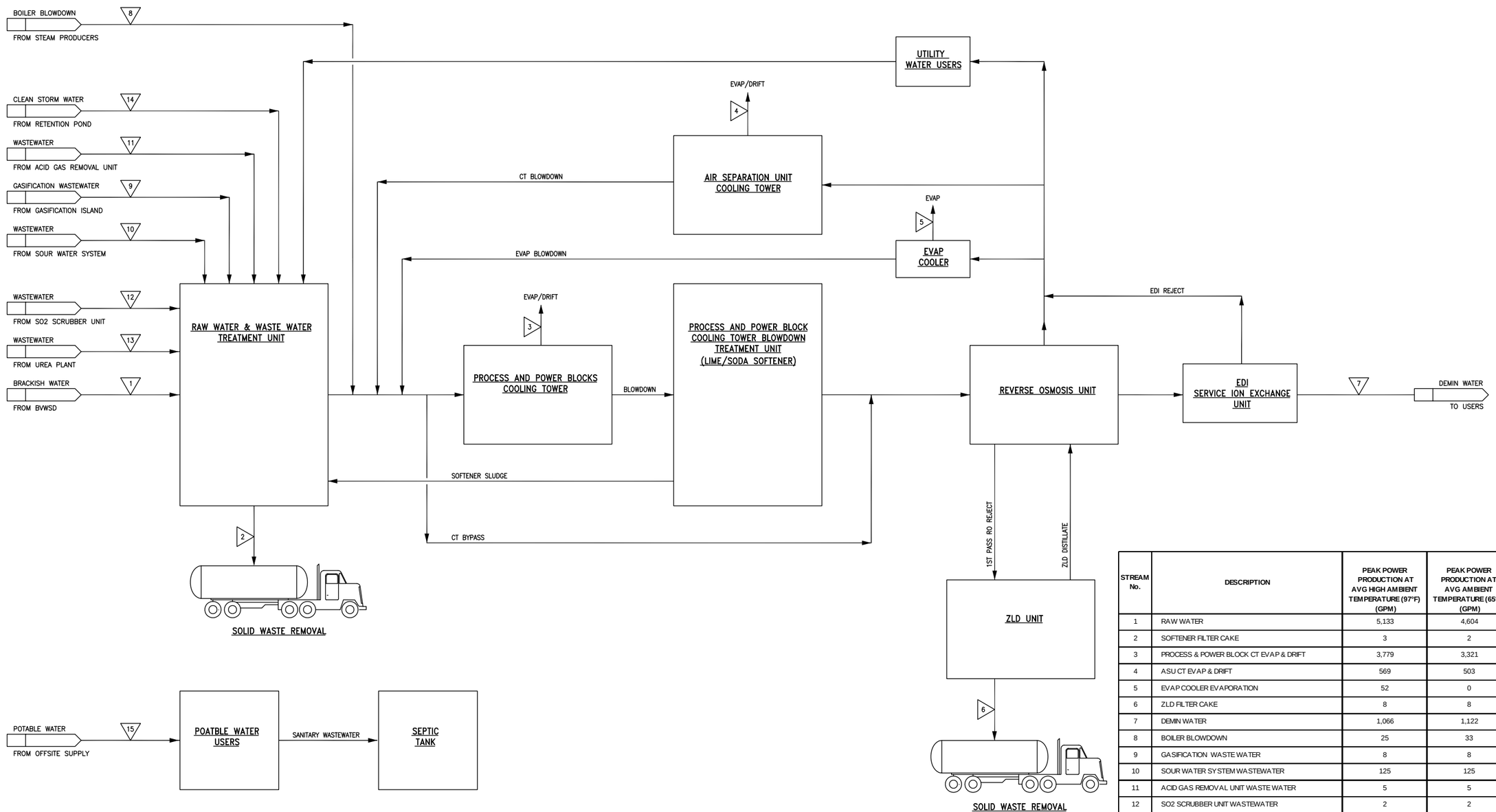
April 2012
28068052

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 5.14-12

4/25/12 vsa..T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_12-TDS_conc_vs_mass.ai



STREAM No.	DESCRIPTION	PEAK POWER PRODUCTION AT AVG HIGH AMBIENT TEMPERATURE (97°F) (GPM)	PEAK POWER PRODUCTION AT AVG AMBIENT TEMPERATURE (65°F) (GPM)
1	RAW WATER	5,133	4,604
2	SOFTENER FILTER CAKE	3	2
3	PROCESS & POWER BLOCK CT EVAP & DRIFT	3,779	3,321
4	ASU CT EVAP & DRIFT	569	503
5	EVAP COOLER EVAPORATION	52	0
6	ZLD FILTER CAKE	8	8
7	DEMIN WATER	1,066	1,122
8	BOILER BLOWDOWN	25	33
9	GASIFICATION WASTE WATER	8	8
10	SOUR WATER SYSTEM WASTEWATER	125	125
11	ACID GAS REMOVAL UNIT WASTE WATER	5	5
12	SO2 SCRUBBER UNIT WASTEWATER	2	2
13	UREA UNIT WASTEWATER	179	179
14	CLEAN STORM WATER	NNF	NNF
15	POTABLE WATER	75	75

Source:
Fluor; HECA-SCS, 2012 AFC Update; Mass Water Balance Peak Flows for Avg High Temperature and Avg Ambient Temperature;
Drawing No: A4UV-090-25-SK-0002, Rev. 1 (4/12/12)

MASS WATER BALANCE
PEAK FLOWS FOR AVERAGE HIGH TEMPERATURE AND AVERAGE AMBIENT TEMPERATURE

April 2012 — Hydrogen Energy California (HECA)
28068052 — Kern County, California

URS

FIGURE 5.14-13

4/25/12 vsa..T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_13_MWB_peak_flows.ai