7.1 SURFACE WATER AND GROUNDWATER HYDROLOGY (NEW)

7.1 SURFACE WATER AND GROUNDWATER HYDROLOGY (NEW)

7.1.1 INTRODUCTION

7.1.1.1 Content

The proposed project analyzed in the Monterey Plus EIR was the Monterey Amendment and the Settlement Agreement. The Monterey Plus EIR considered five "elements" of the Monterey Amendment as follows:

- *Changes in the procedures for allocation of Table A water and surplus water among the SWP contractors;*
- *Approval to permanent transfers of 130,000 acre feet and retirement of 45,000 acre-feet of SWP long-term water supply contracts' Table A amounts;*
- *Transfer of property known as the "Kern Fan Element property" in Kern County;*
- *Water supply management practices; and*
- *Restructured water rates.*

This REIR has changed the description of the Kern Fan Element property transfer to be:

- *Transfer of property known as the "Kern Fan Element property" in Kern County and its development and continued use and operation as a locally owned and operated groundwater banking and recovery project.*

There are no revisions to the other elements of the Monterey Amendment or of the Settlement Agreement, and no changes have been made relating to them in this REIR. (See discussion in Introduction/Executive Summary.)

This REIR does not supersede the analysis of the Monterey Plus EIR but supplements the Monterey Plus EIR. The Monterey Plus EIR focused on the transfer of the KFE property, which was fully analyzed in the Monterey Plus EIR. This REIR did not identify any new impacts or changes to impacts caused by the transfer of the KFE property. Therefore, this REIR focuses on the development and continued use and operation of the KWB as a locally owned and operated groundwater banking and recovery project ("KWB activities").

The Monterey Plus DEIR Sections 7.1 and 7.2 identified potential impacts to surface water hydrology, water quality, and water supply, and groundwater hydrology and quality, respectively, as a result of the transfer of the Kern Fan Element. This section describes the potential impacts of KWB activities on surface water and groundwater hydrology. It contains substantial new information developed specifically for this REIR. Consequently, this section replaces those parts of DEIR Sections 7.1 and 7.2 relating to impacts of KWB activities on surface water and groundwater hydrology. In addition to the impacts discussed below, to the extent they apply, indirect impacts as a result of population growth are presented in Chapter 8, Growth-Inducing Impacts, and indirect impacts from potential cropping changes are presented in Section 10.1, Cumulative Environmental Impacts. Impacts of KWB activities on surface water and groundwater water quality are analyzed in Section 7.2, Surface and Groundwater Water Quality.

The impacts analysis consisted of the day-to-day operational decisions of the KWBA for the KWB; no analysis of the decisions of KWB member agencies and/or where they store their water, in the absence of KWB, was conducted. Alternatives to the KWB as part of the proposed project were discussed in Chapter 11 of the Monterey Plus DEIR.

7.1.1.2 Analytical Method

The California Department of Water Resources (Department or DWR) conducted a quantitative assessment of the impacts of KWB activities on groundwater resources in Kern County subbasin No. 5-22.14 (as identified in DWR Bulletin 118) using the DWR Kern Water Bank Model (DWR KWB Model). The DWR KWB Model is a refined version of an existing groundwater model (Kern Water Bank Authority [KWBA] Model) of the KWB area, developed by KWBA with assistance from its consultant, Amec Foster Wheeler.[1]

Groundwater Model Overview

The DWR KWB Model simulated response of the groundwater aquifer to stresses such as groundwater recharge and pumping by predicting groundwater elevations at each of the model cells throughout the model domain. The model domain spans 28 miles (east-west) by 17 miles (north-south) as shown in Figure 7.1-1. The model boundary was originally chosen by KWBA to be far enough from the KWB property boundary to enable analysis and evaluation of impacts of KWB activities on the underlying groundwater aquifer without significant influence from groundwater conditions beyond the model domain. The model domain included several municipal and agricultural entities with some fully included inside the model domain and some partially included, as shown in Figure 7.1-1.

Key features of the DWR KWB Model are summarized in Table 7.1-1. The model grid is shown in Figure 7.1-2.

TABLE 7.1-1

DWR KWB MODEL KEY FEATURES

Model Feature	Description
Model Domain	The model domain spans 28 miles (east-west) by 17 miles (north-south). It covers a total area of 301,000 acres, including the Elk Hills area (48,300 acres), which is included in the model domain but the corresponding model cells in that area are inactive due to thinning out of the aquifer south and west of the California Aqueduct. Approximate distances from the model boundary to the edges of Kern Water Bank are as follows: northern edge: 6 miles; southern edge: 5.2 miles; eastern edge: 10 miles; western edge: 7.7 miles.
Model Grid	The model domain is horizontally discretized into a rectangular mesh, consisting of 39,300 model cells of variable sizes. Model cells are relatively finer inside the KWB area and coarser outside the KWB area.
Model Layering	The model is vertically discretized into five layers with varying thicknesses (from shallow to deep): Layer 1: 22 to 188 feet (average 100 feet); Layer 2: 196 to 235 feet (average 200 feet); Layer 3: uniformly 200 feet; Layer 4: uniformly 200 feet; Layer 5: 130 to 476 feet (average 195 feet).
Boundary Condition	The boundary on all sides except the southwest are leaky; boundary fluxes are governed by time-varying, general-head boundary conditions, developed using observed historical groundwater elevations.
Historical Calibration Period	The historical simulation period is from 1988 through 2014, which includes 20 years of KWB operations (1995–2014); stress periods and time steps are monthly. The model was calibrated by comparing simulated groundwater elevations with historical observed groundwater elevations at monitoring wells. Model calibration is discussed in detail in the DWR KWB Groundwater Model Technical Report (Appendix 7-2).

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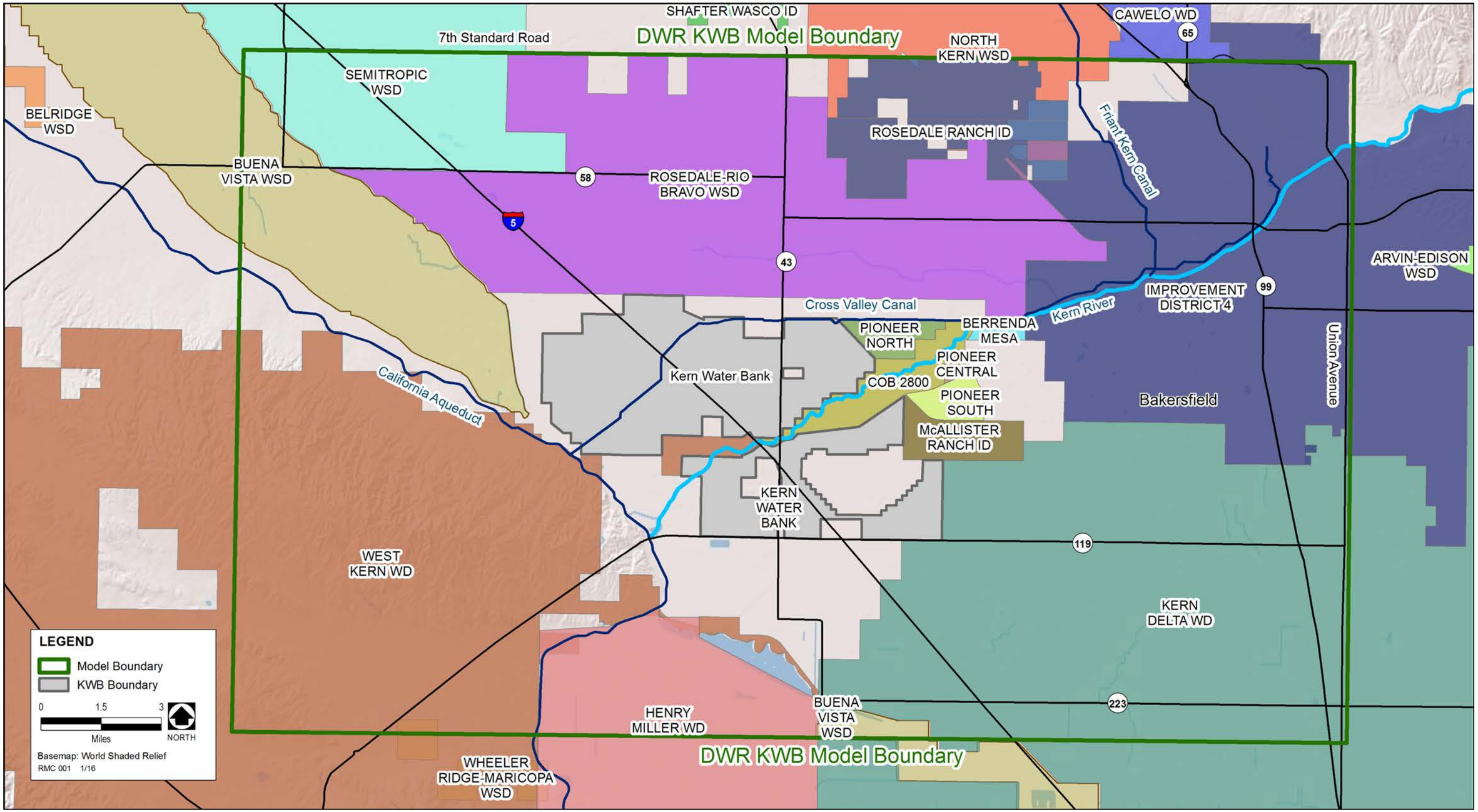


FIGURE 7.1-1. DWR KWB Model Domain and Nearby Municipal and Agricultural Entities

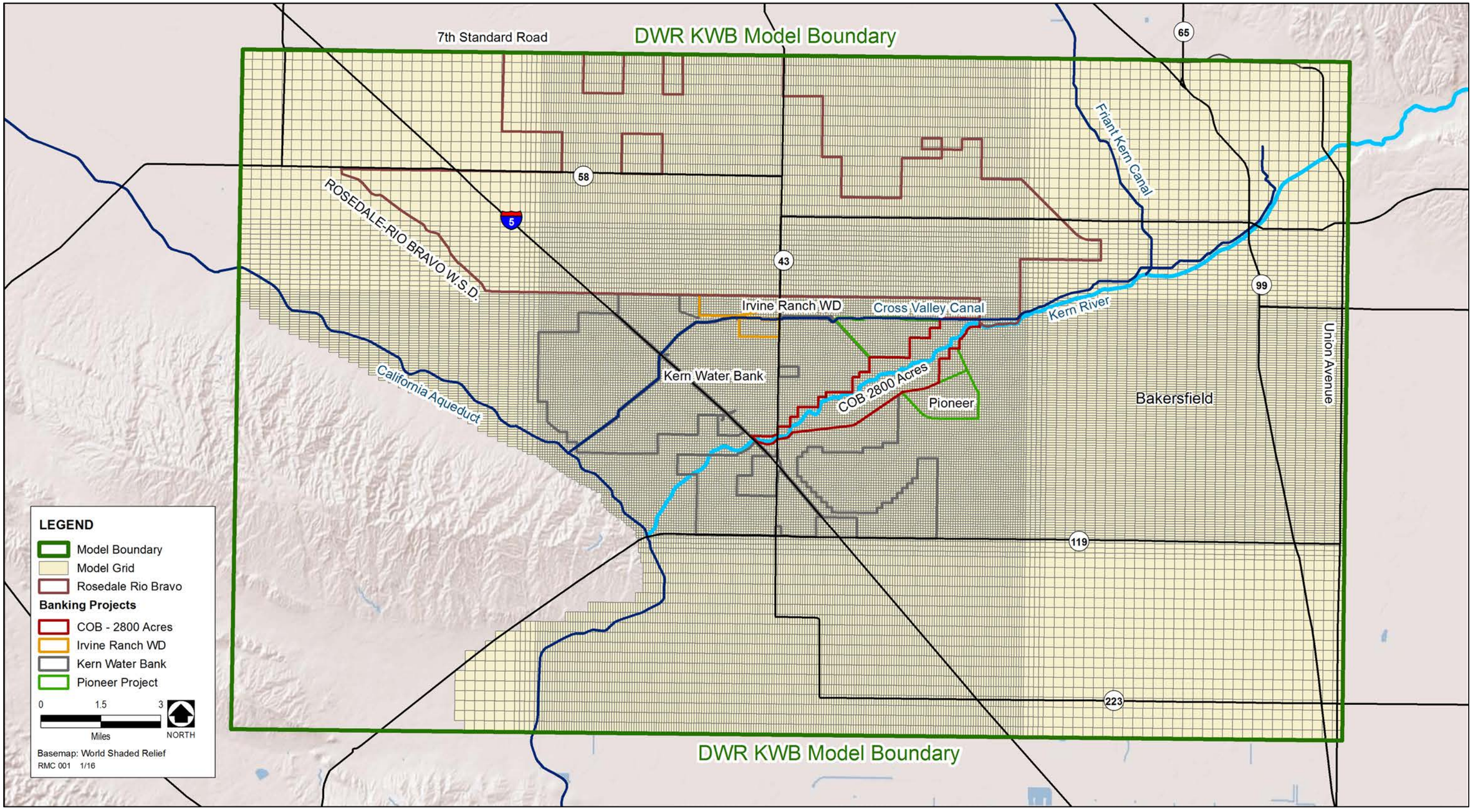


FIGURE 7.1-2. DWR KWB Model Grid

Groundwater Impact Analysis

Potential groundwater impacts resulting from operations of past, existing, and future KWB facilities were evaluated using the DWR KWB Model under different hydrologic conditions and levels of land use development. To isolate the effects of the KWB, potential impacts were evaluated by comparing simulated groundwater elevations from two model runs: (1) "With KWB Operations," which included KWB recharge and recovery under historic and projected future conditions; and (2) "Without KWB Operations," which assumed no recharge or recovery from KWB facilities under the same historic and projected future conditions. All other model parameters were kept the same in the two model runs to isolate the potential impacts of KWB activities.

DWR KWB Model Scenario Development

The following three modeling scenarios were developed to evaluate impacts of KWB activities under different levels of development (i.e., historic, existing conditions, and build-out conditions) within the model domain:

1. Analysis of Past Operations (APO): Simulation of groundwater system response based on past (1995–2014) KWB activities under historic land use conditions.
2. Analysis of Future Operations—Existing Conditions (AFO-EC): Simulation of groundwater system response based on projected future KWB activities under existing (2015) levels of development.
3. Analysis of Future Operations—Build-out Conditions (AFO-BC): Simulation of groundwater system response based on projected future KWB activities under build-out (2030) levels of development.

The model simulation period for the APO scenario is a 20-year past period (1995-2014) using the historical hydrology from 1995 through 2014 The model simulation period for both AFO scenarios is a 21-year future period (2015-2035) using historical 2015 hydrology in simulation year 1 (2015) and repeating the historical 1995-2014 hydrology for simulation years 2 to 21 (2016-2035).

These scenarios are briefly described below. More detailed descriptions of these scenarios are provided in Appendix 7-2.

1. Analysis of Past Operations (APO)

The historical calibration run of the DWR KWB Model was used to evaluate impacts of past KWB operations. It simulated the years 1988 through 2014, but the focus of the APO scenario was the 20-year period of KWB activities from 1995 through 2014. The APO scenario included 1995-2014 urban and agricultural land uses, operation of recharge and recovery facilities, and hydrologic conditions in the entire model domain, which included other groundwater banking projects that were operational within the model domain during the period from 1995 through 2014.

The DWR KWB Model domain encompassed about 470 square miles (including Elk Hills area, an inactive model area of about 70 square miles south and west of the California Aqueduct) with agricultural land use and urban development. For the APO modeling scenario, 1995-2014, land use and crop data were analyzed to determine monthly agricultural and urban water demands. Available 1995-2014 surface water deliveries were incorporated into a model pre-processor to calculate monthly groundwater pumping by land use sections within the model domain.

Historical surface water deliveries for recharge in the KWB came from three sources: Kern River flows, SWP supplies via the California Aqueduct, and Central Valley Project (CVP) supplies via

the Friant-Kern Canal. Recharge ponds within the KWB Lands were used to recharge water from these sources.

The APO "With KWB Operations" scenario is the same as the historical calibration run of the DWR KWB Model. The APO "Without KWB Operations" scenario was constructed by removing 1995-2014 KWB recharge and recovery operations from the historical calibration run. Historical recharge of floodwater in the KWB area also was removed under the "Without KWB Operations" scenario. Both of these changes were made to isolate the potential impacts of day-to-day KWB operations and maintenance activities. Modeling assumptions, including their supporting explanations, are described in Appendix 7-2.

2. Analysis of Future Operations—Existing Conditions (AFO-EC)

The AFO-EC scenario evaluated potential impacts of KWB operations in future under the existing conditions, which correspond to the 2015 level of development in the model area. The 2015 land use conditions and urban water demand data were obtained from the current land use maps and city/county planning data and documents. Agricultural and urban water demand and groundwater pumping were calculated using the same methodology and model pre-processor tool that were used during development of the calibration model run, but with data corresponding to the 2015 levels of land use development.

The DWR KWB Model was run with this fixed level of development for a 21-year future period (2015-2035). Since the future hydrology is unknown, the historical 2015 hydrology is used for the simulation year 1 (2015) and the historical 1995-2014 hydrology was repeated for the simulation years 2 to 21 (2016-2035). The 21-year future simulation period includes a mix of water year types: wet years (1995, 2006, and 2011); average years (1999, 2000, 2010); a dry year (2001); and extended droughts (2007-2009; 2012-2014.

Future surface water deliveries to the KWB under the AFO-EC scenario were assumed to be similar to historical deliveries of surface water from the same three sources. This assumption is consistent with the Department's estimate of future Table A deliveries for existing and future build-out conditions, as specified in the Department's 2013 SWP Delivery Reliability Report.[2]

Although the APO scenarios included the historical (1995-2014) timing of recharge and recovery facilities as they came into operation, the AFO-EC scenario assumed that all existing infrastructure for recharge and recovery was in place at the start of the model simulation period. Due to increased recharge pond area in 2015 relative to 1995-2014 recharge pond area, the KWB would be able to recharge more water during future wet years. Therefore, future recharge volume in KWB ponds was increased, based on available water for recharge from the above-mentioned three KWB recharge water sources under a hydrologic condition similar to the 1995–2014 period.

Recovery from the KWB and other groundwater banking facilities within the model domain for the first year of the AFO-EC simulation was assumed to be the same as 2015 pumping (January to September—measured pumping, and October to December—projected pumping). For the remaining 20 years (years 2 to 21) of the future simulation, historical recharge and recovery in groundwater banks, including the KWB, was assumed to be the same as that during the 1995–2014 period. The AFO-EC general head boundary conditions were assumed to follow similar patterns of fluctuations as the historical hydrologic period, with a starting point of the end of December 2014 simulated groundwater elevations at boundary control points from the historical calibrated model.

The AFO-EC "With KWB Operations" scenario included historical (1995–2015) recharge and recovery operations, while the AFO-EC "Without KWB Operations" scenario entirely removed the historical recharge and recovery operations. Historical recharge of floodwater in the KWB area also was removed under the "Without KWB Operations" scenario. Both of these changes were made to isolate the potential impacts of day-to-day KWB operations and maintenance activities.

AFO-EC assumptions, including supporting explanations, are described in more detail in Appendix 7-2.

3. Analysis of Future Operations—Build-out Conditions (AFO-BC)

The AFO-BC scenario evaluated the potential impacts of KWB operations in the future under the build-out conditions, which correspond to the 2030 level of development in the model area. The 2030 land use conditions and urban water demand data were obtained from city/county general plans and existing urban water management plans. Agricultural and urban water demand and groundwater pumping were calculated using the same methodology and model pre-processor tool that were used during development of the calibration model run, but with data corresponding to the 2030 levels of land use development.

The DWR KWB Model was run with this fixed level of development for a 21-year future period (2015-2035). Since the future hydrology is unknown, the historical 2015 hydrology is used for the simulation year 1 (2015) and the historical 1995-2014 hydrology was repeated for the simulation years 2 to 21 (2016-2035). The 21-year future simulation period includes a mix of water year types: wet years (1995, 2006, and 2011); average years (1999, 2000, 2010); a dry year (2001); and extended droughts (2007-2009; 2012-2014).

Future surface water deliveries to the KWB under the AFO-BC scenario were assumed to be similar to historical deliveries of surface water from the same three sources. This assumption was consistent with the Department's estimate of future Table A deliveries for existing and future build-out conditions as specified in the Department's 2013 SWP Delivery Reliability Report.[3]

Although APO scenarios included the historical timing of recharge and recovery facilities as they came into operation, the AFO-BC scenario assumed that all existing infrastructure for recharge and recovery was in place at the start of the model simulation period. It also included additional reasonably foreseeable future groundwater recharge and recovery operations-related projects that would be likely to come into operation in the model area before 2030. A list of these reasonably foreseeable future projects is provided in Table 7.1-2, and the locations of the projects are shown in Figure 7.1-3.

Due to increased recharge pond area in 2015 relative to 1995-2014 recharge pond area and the addition of new recharge facilities before 2030, the KWB would be able to recharge more water during wet years in the future. Therefore, future recharge volume in the KWB ponds was increased to the maximum capacity, based on available water for recharge from the above-mentioned three KWB recharge water sources under a hydrologic condition similar to the 1995–2014 period.

TABLE 7.1-2

REASONABLY FORESEEABLE FUTURE PROJECTS INCLUDED IN THE AFO-BC MODELING SCENARIO

Project Type	Agency	Project
Groundwater Banking	Kern Water Bank Authority	Kern Water Bank Recharge and Recovery Project
	Buena Vista Water Storage District and Rosedale-Rio Bravo Water Storage District	James Groundwater Storage and Recovery Project (proposed on former McAllister Ranch property)
	Rosedale-Rio Bravo Water Storage District	Drought Relief Project
Urban Development	Regional and Local Development Plans and Programs	City of Bakersfield General Plan
		Kern County General Plan
	City of Bakersfield	West Ming Specific Plan
		Rosedale Ranch (approved residential development)
		Saco Ranch (approved commercial development)
		Strand Ranch (approved residential and commercial development)
		Stockdale Ranch (approved residential development)
		Old River Ranch (approved residential and commercial development)
		Bakersfield Commons (approved commercial development)
		Ashe No. 4 (approved residential development)
		Hosking Commercial Center (proposed commercial development)
	Kern County	Reina Ranch (proposed residential development and drill island for petroleum extraction)
		Rosedale & Renfro Precise Development Plan

Recovery from the KWB and other groundwater banking facilities for the first year of the AFO-BC simulation was assumed to be the same as 2015 pumping (January to September—measured pumping, and October to December—projected pumping). For the remaining 20 years (years 2 to 21) of the future simulation, historical recharge and recovery in the KWB was scaled up to include the additional pumping capacity from the three new wells expected to be operational in the next few years. For all other groundwater banks, recovery was assumed to be the same as during the 1995–2014 period, except that projected pumping because of new projects, such as Stockdale Ranch and the James Groundwater Storage and Recovery Project, were added.

AFO-BC general head boundary conditions were assumed to follow similar patterns of fluctuations as the historical hydrology, with a starting point of the end of December 2014 simulated groundwater elevations at boundary control points from the historical calibration model.

The AFO-BC “With KWB Operations” scenario included the historical (1995–2015) recharge and recovery operations, while the AFO-BC “Without KWB Operations” scenario entirely removed historical recharge and recovery operations. Historical recharge of floodwater in the KWB area was not included in the “Without KWB Operations” scenario. Both of these changes were made to isolate the potential impacts of day-to-day KWB operations and maintenance activities.

Summary of DWR KWB Model Scenarios

A summary of the three model scenarios for both “With KWB Operations” and “Without KWB Operations” is provided in Table 7.1-3.

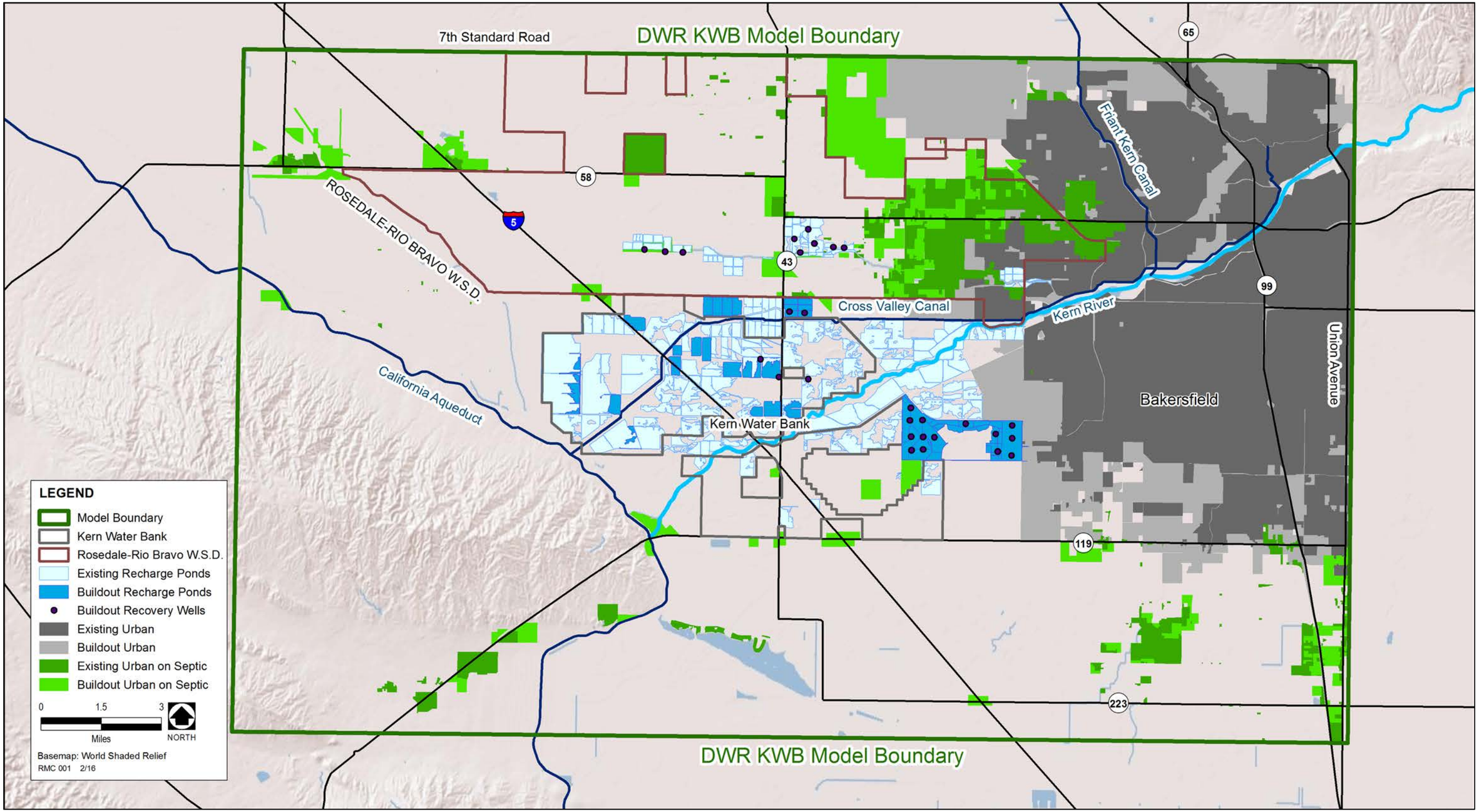


FIGURE 7.1-3. Location of Reasonably Foreseeable Future Projects Included in Build-out (2030) Conditions

TABLE 7.1-3

SUMMARY OF KERN WATER BANK OPERATIONS MODELING SCENARIOS

Model Component	APO		AFO-EC		AFO-BC	
	With KWB Operations	Without KWB Operations	With KWB Operations	Without KWB Operations	With KWB Operations	Without KWB Operations
Hydrologic Simulation Period	20 year simulation period (1995–2014 historic hydrology)	20-year simulation period (1995–2014 historic hydrology)	21-year simulation period from 2015 through 2035 (The hydrology of year 1 is similar to 2015 and years 2 to 21 are similar to 1995–2014 historical hydrology)	21 year simulation period from 2015 through 2035 (The hydrology of year 1 is similar to 2015 and years 2 to 21 used 1995–2014 historical hydrology)	21-year simulation period from 2015 through 2035 (The hydrology of year 1 is similar to 2015 and years 2 to 21 used 1995–2014 historical hydrology)	21-year simulation period from 2015 through 2035 (The hydrology of year 1 is similar to 2015 and years 2 to 21 used 1995–2014 historical hydrology)
Land Use (areas outside of KWB Lands)	1995–2014 Historic Land Use in the DWR KWB Model	1995–2014 historic land use in the DWR KWB Model	2015 level of land use in the model domain held constant for the 21-year future simulation period (2015–2035) Agricultural area ~ 132,000 acres Urban area ~ 56,000 acres	2015 level of land use in the model domain held constant for the 21-year future simulation period (2015–2035) Agricultural area ~ 132,000 acres Urban area ~ 56,000 acres	2015 level of land use in the model domain held constant for the 21-year future simulation period (2015–2035) Agricultural area ~ 110,000 acres Urban area ~ 83,000 acres	2015 level of land use in the model domain held constant for the 21-year future simulation period (2015–2035) Agricultural area ~ 110,000 acres Urban area ~ 83,000 acres
Land Use (on KWB Lands	No agriculture on KWB lands	No agriculture on KWB lands	No agriculture on KWB lands	No agriculture on KWB lands	No agriculture on KWB lands	No agriculture on KWB lands
Agricultural Pumping (areas outside of KWB Lands)	7,935,432 AF (historical total for 1995–2014, a 20 -year period)	7,935,432 AF (historical total for 1995–2014, a 20-year period)	8,436,580 AF (total for 2016–2035, a 20-year period with constant 2015 level of agricultural land use	8,436,580 AF (total for 2016–2035, a 20-year period with constant 2015 level of agricultural land use	7,001,724 AF (total for 2016–2035, a 20-year period with constant 2030 level of agricultural land use	7,001,724 AF (total for 2016–2035, a 20-year period with constant 2030 level of agricultural land use)
Agricultural Pumping (on KWB Lands)	No agricultural pumping	No agricultural pumping	No agricultural pumping	No agricultural pumping	No agricultural pumping	No agricultural pumping
Urban Pumping	Total volume: 700,272 AF	Total volume: 700,272 AF	Total volume: 1,592,424 AF	Total volume: 1,592,424 AF	Total volume: 1,652,826 AF	Total volume: 1,652,826 AF
KWB Recharge	Total volume after 6 percent loss: 2,006,372 AF	0 AF	Total volume after 6 percent loss: 2,112,325 AF (Note: All operational ponds in 2015 would be used for future recharge during 2015–2035)	0 AF	Total volume after 6 percent loss: 2,112,325 AF (Note: All operational ponds in 2015 plus an additional 1,090 acres of recharge ponds would be used for future recharge during 2015–2035)	0 AF
KWB Recharge Distribution	1995–2014 historical recharge distribution in the DWR KWB Model	None	Recharge distribution rearranged to match KWB recharge priority order. More water is recharged in eastern ponds	None	Recharge distribution rearranged to match KWB recharge priority order. More water is recharged in eastern ponds	None
KWB Recovery	Total volume: 1,389,113 AF	0 AF	Total volume: 1,546,368 AF (Note: All operational wells in 2015 would be used for future recovery during 2015–2035)	0 AF	Total volume: 1,614,236 AF (Note: All operational wells in 2015 plus three planned recovery wells would be used for future recovery during 2015–2035)	0 AF
KWB Recovery Distribution	1995–2014 historical recovery distribution in the DWR KWB Model	None	All operational wells in 2015 are used for future recovery during 2015–2035	None	All operational wells in 2015 plus 3 planned recovery wells are used for future recovery during 2015–2035	N/A
Other Water Banks Recharge & Recovery	Historic recharge/recovery in the DWR KWB Model	Historic recharge/recovery in the DWR KWB Model	Historic recharge/recovery in the DWR KWB Model	Historic recharge/recovery in the DWR KWB Model	Historic recharge/recovery in the DWR KWB Model	Historic recharge/recovery in the DWR KWB Model
Kern River Flooding on KWB Lands	Historical 1988–2014 flood water recharge in the KWB	0 AF	Historical 1995-2014 flood water recharge in the KWB plus additional recharge because of increased capacity for operational ponds in 2015	0 AF	Historical 1995–2014 flood water recharge in the KWB plus additional recharge because of increased capacity for operational ponds in 2015	0 AF
Boundary Conditions	1995–2014 historical boundary conditions in the DWR KWB Model	1995–2014 historical boundary conditions in the DWR KWB Model	1995–2014 historical boundary conditions in the DWR KWB Model are adjusted for 2015 conditions to follow similar pattern of fluctuations under historical hydrology, while starting from the December 2014 simulated groundwater elevations at boundary control points of the historical calibrated groundwater model.	1995-2014 historical boundary conditions in the DWR KWB Model are adjusted for 2015 conditions to follow similar pattern of fluctuations under historical hydrology, while starting from the December 2014 simulated groundwater elevations at boundary control points of the historical calibrated groundwater model.	1995–2014 historical boundary conditions in the DWR KWB Model are adjusted for 2015 conditions to follow similar pattern of fluctuations under historical hydrology, while starting from the December 2014 simulated groundwater elevations at boundary control points of the historical calibrated groundwater model.	1995-2014 historical boundary conditions in the DWR KWB Model are adjusted for 2015 conditions to follow similar pattern of fluctuations under historical hydrology, while starting from the December 2014 simulated groundwater elevations at boundary control points of the historical calibrated groundwater model.
Initial Conditions	Simulated December 1994 conditions from the historical calibrated model	Simulated December 1994 conditions from the historical calibrated model	Simulated December 2014 conditions generated by the APO-run "With KWB	Simulated December 2014 conditions generated by the APO-run "Without	Simulated December 2014 conditions generated by the APO-run "With KWB	Simulated December 2014 conditions generated by the APO-run "Without

TABLE 7.1-3

SUMMARY OF KERN WATER BANK OPERATIONS MODELING SCENARIOS

Model Component	APO		AFO-EC		AFO-BC	
	With KWB Operations	Without KWB Operations	With KWB Operations	Without KWB Operations	With KWB Operations	Without KWB Operations
			Operations"	KWB Operations"	Operations"	KWB Operations"
Aquifer Parameters	Aquifer parameters from the historical calibrated model	Aquifer parameters from the historical calibrated model	Aquifer parameters from the historical calibrated model	Aquifer parameters from the historical calibrated model	Aquifer parameters from the historical calibrated groundwater model	Aquifer parameters from the historical calibrated groundwater model
Future Projects on KWB Lands	Historic operation; therefore, no future projects	None	All currently active projects on KWB Lands	None	Groundwater operations related projects. (see Table 7.1-2)	None
Future Projects Outside KWB Lands	Historic operation; therefore, no future projects	None	All currently active projects outside KWB Lands	All currently active projects outside KWB Lands	Groundwater operations related projects. (see Table 7.1-2)	Groundwater operations related projects. (see Table 7.1-2)

7.1.1.3 Standards of Significance

The proposed approach to significance thresholds for surface water and groundwater hydrology includes thresholds from Appendix G of the California Environmental Quality Act (CEQA) Guidelines and the Monterey Plus EIR. For the purposes of this section, substantial changes are generally defined as changes beyond those normally observed in historical records and disproportionate to any documented information on groundwater in the basin.

A significant impact related to surface water and groundwater hydrology would occur if KWB activities would:

1. Substantially deplete groundwater supplies such that there would be a net deficit in aquifer volume.
2. Substantially deplete groundwater supplies such that there would be a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).
3. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on or off site.
4. Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.
5. Place within a 100-year flood hazard area structures which would impede or redirect flood flows.
6. Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam; or cause inundation by seiche, tsunami, or mudflow.
7. Alter water levels in a groundwater basin sufficiently to substantially impact existing infrastructure (e.g., conveyance facilities and residential septic systems).
8. Alter water levels in a groundwater basin sufficiently to substantially interfere with groundwater recharge.

7.1.2 ENVIRONMENTAL SETTING

The environmental setting is divided into two subsections: physical and regulatory settings. The physical subsection describes the physical setting in 1995 and the period between 1996 and 2014; additional data are presented for previous years when available and applicable.

7.1.2.1 Physical Setting in 1995

The physical setting in 1995 for surface and groundwater hydrology is described in Revised Appendix E (Section III, Existing Conditions and Surroundings – 1995).

7.1.2.2 Changes in Physical Setting between 1996 and 2014

This section summarizes the physical setting for surface water and groundwater hydrology during the years when KWB activities occurred (1996 through 2014).

Surface Water Hydrology

The KWB is located in an arid to semiarid region in the southern Central Valley of California. Annual precipitation in the project area averaged approximately 6 inches and varied from 3 to 13 inches in the 1988 to 2014 period (Figure 7.1-4). Most precipitation occurs from December through March (Figure 7.1-5).

Surface water deliveries for recharge in the KWB come from three sources: Kern River flows, the SWP via the California Aqueduct, and the CVP via the Friant-Kern Canal. An extensive conveyance network of lined and unlined canals delivers surface water to KWB recharge ponds.

The Kern River, with a mean annual flow of approximately 720,000 acre-feet (AF), originates at the southern Sierra Nevada and terminates at the Kern River Intertie Basin at the California Aqueduct. The Kern River is fed by annual snowmelt, is used for generation of hydroelectric power, and provides flood control, recreation, and water storage via the Lake Isabella reservoir.

Kern River annual flows are ranked based on April–July runoff rates. April–July runoff rates were compared to the 1894 to 2014 average April–July runoff rate of 461,000 AF and percent of average rankings was calculated. April–July flows in 2011 (wet year) were at 205 percent of average, while 2007 flows were at 27 percent of average. The April–July and August–March annual Kern River flows at the First Point of Measurement, located above Gordon's Ferry in northeast Bakersfield, from 1988 through 2014, are shown in Figure 7.1-6. Average April–July, August–March, and total annual Kern River flows for the 1988–2014 period are approximately 400,000 AF, 240,000 AF, and 640,000 AF, respectively. The maximum and minimum annual Kern River flows of 1,718,000 AF and 175,000 AF occurred in 1998 and 2014, respectively. The 1988–2014 hydrologic record for the Kern River includes a wide range of annual flow conditions, including both individual critically dry and wet years, as well as consecutive years with both types of flow conditions.

The California Aqueduct is the main facility conveying SWP water to agencies with SWP long-term water supply contracts. Recovered water from banking activities is pumped into the California Aqueduct for water banking participants. The KWB Canal and the Cross Valley Canal (CVC) transport water from the California Aqueduct to the KWB and other neighboring water banking projects. The KWB Canal conveys recovered water to be pumped back into the California Aqueduct.

SWP annual deliveries are based on hydrologic conditions, SWP reservoir storage, compliance with State and federal regulatory permits and other requirements, delivery capability, and combined requests from SWP contractors. Table A of the water supply contract lists annual maximum amounts of water that can be requested by each SWP contractors. The cumulative total Table A amount is 4,172,686 AF, which includes 982,730 AF for Kern County Water Agency. Each year, the Department allocates the available SWP water to the contractors as a percentage of Table A amounts based on the above conditions.

The Friant-Kern Canal carries San Joaquin River water south from Millerton Lake to its terminus at the turnout for the Arvin-Edison Canal, which supplies Arvin-Edison Water Storage District with its allocation of CVP water. The CVC and the Kern River channel are used to transport CVP water from the Friant-Kern Canal to water banking projects in the KWB area.

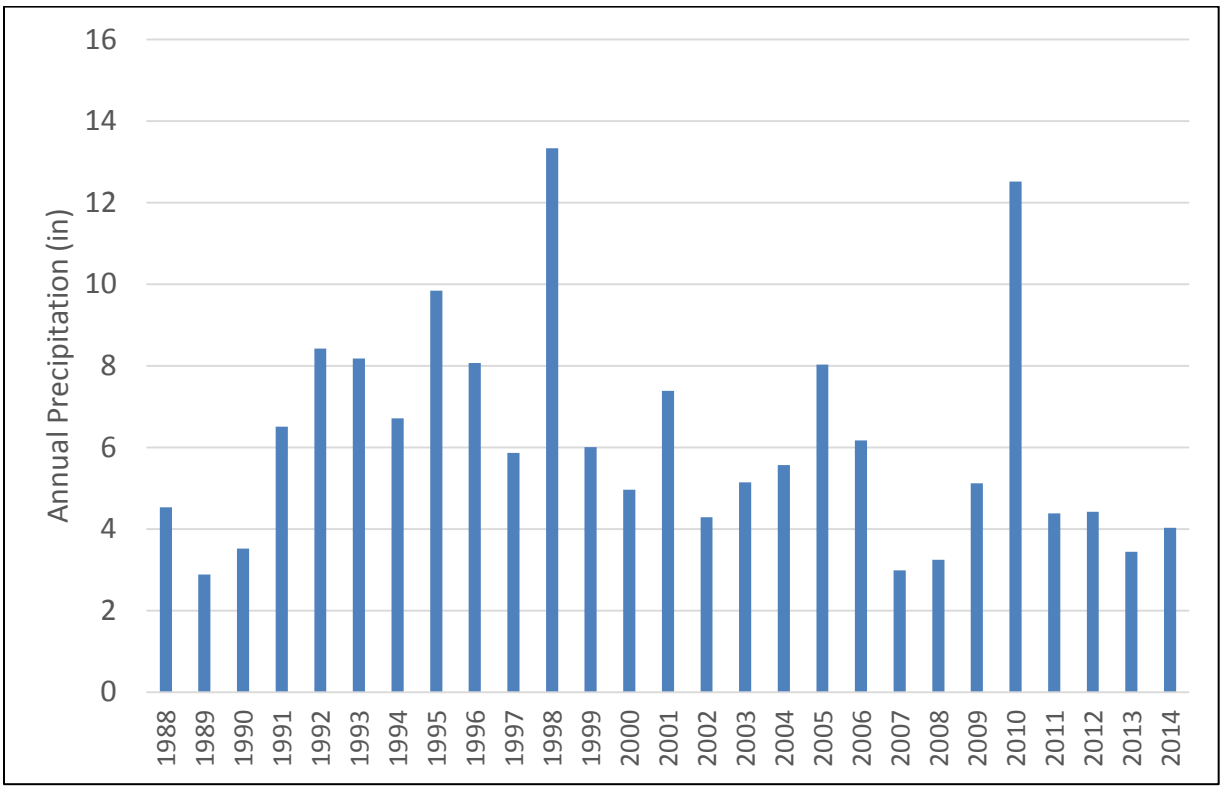


FIGURE 7.1-4. Annual Precipitation in the Vicinity of the Kern Water Bank (Bakersfield Airport), 1988–2014

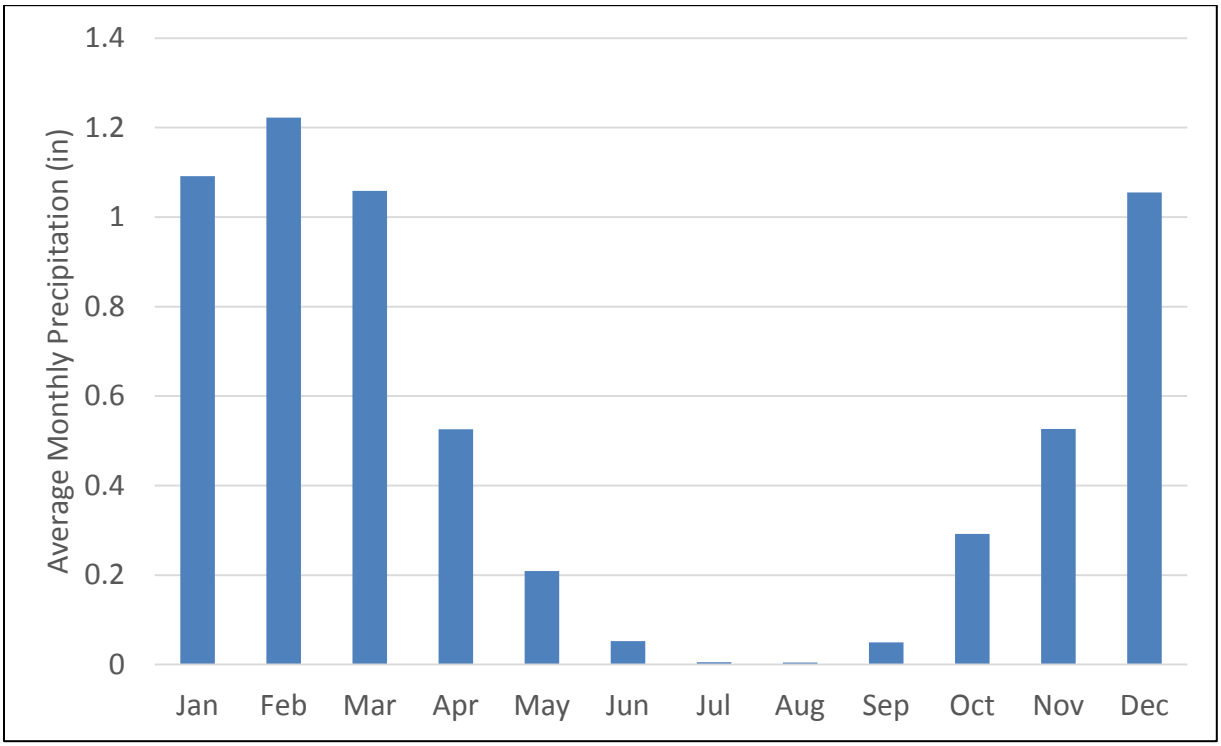


FIGURE 7.1-5. Monthly Average Precipitation in the Vicinity of the Kern Water Bank (Bakersfield Airport), 1988-2014

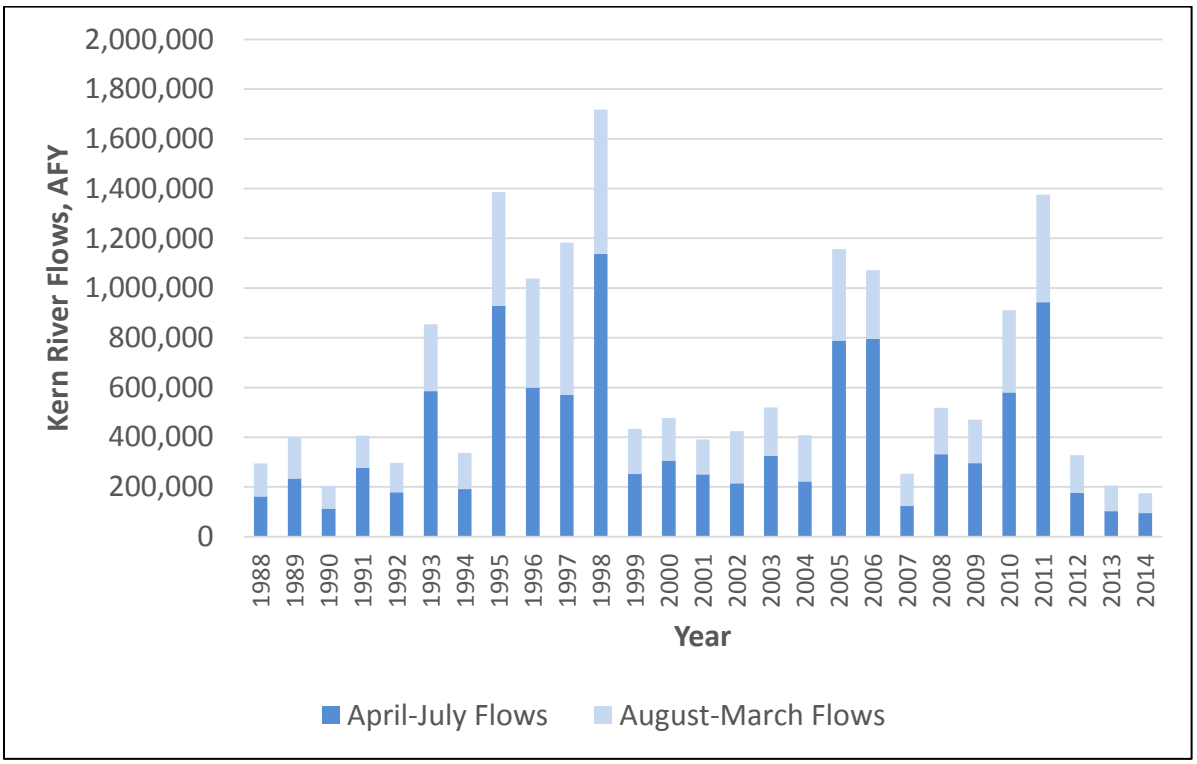


FIGURE 7.1-6. Historical Annual Kern River Flows at First Point of Measurement (above Gordon's Ferry), 1988–2014

Groundwater Hydrology

The aquifer system in the KWB area is part of the Kern County Subbasin, designated as Groundwater Basin Number 5-22.14 in the Department's Bulletin 118, Update 2003.[4] The Kern County Subbasin is located in the portion of the San Joaquin Valley Groundwater Basin in the Tulare Lake Hydrologic Region. The aquifer system is generally thick, with groundwater wells commonly exceeding 1,000 feet in depth. The hydrogeology of the KWB area is dominated by the Kern River alluvial fan. In general, upper portions of the alluvial fan deposits form an unconfined to semi-confined aquifer system that provides a large groundwater recharge capacity. The Corcoran clay, where present, divides the upper aquifer from the confined aquifer. The Corcoran clay is not laterally continuous across the subbasin and is absent in eastern parts of the basin. A more detailed description of the local geology is provided in Section 7.8, Geology, Soils, and Mineral Resources.

Groundwater elevations in the KWB area vary from 100 to 300 feet above mean sea level or approximately 50 to 250 feet below ground surface. Groundwater flow directions vary in the KWB area in response to the artificial recharge and pumping stresses on the aquifer. Figure 7.1-7 shows the groundwater elevation contour map in 2012, following a year of recharge in the KWB area. The contour map shows that higher groundwater elevations in the KWB area resulted from recharge in 2011. Higher groundwater elevations also occur along the Kern River in the eastern parts of the KWB area. Figure 7.1-8 shows the groundwater elevation contour map in 2010, following the 2007-2009 pumping period in the KWB area. The contour map shows lowering of groundwater elevations due to KWB pumping.

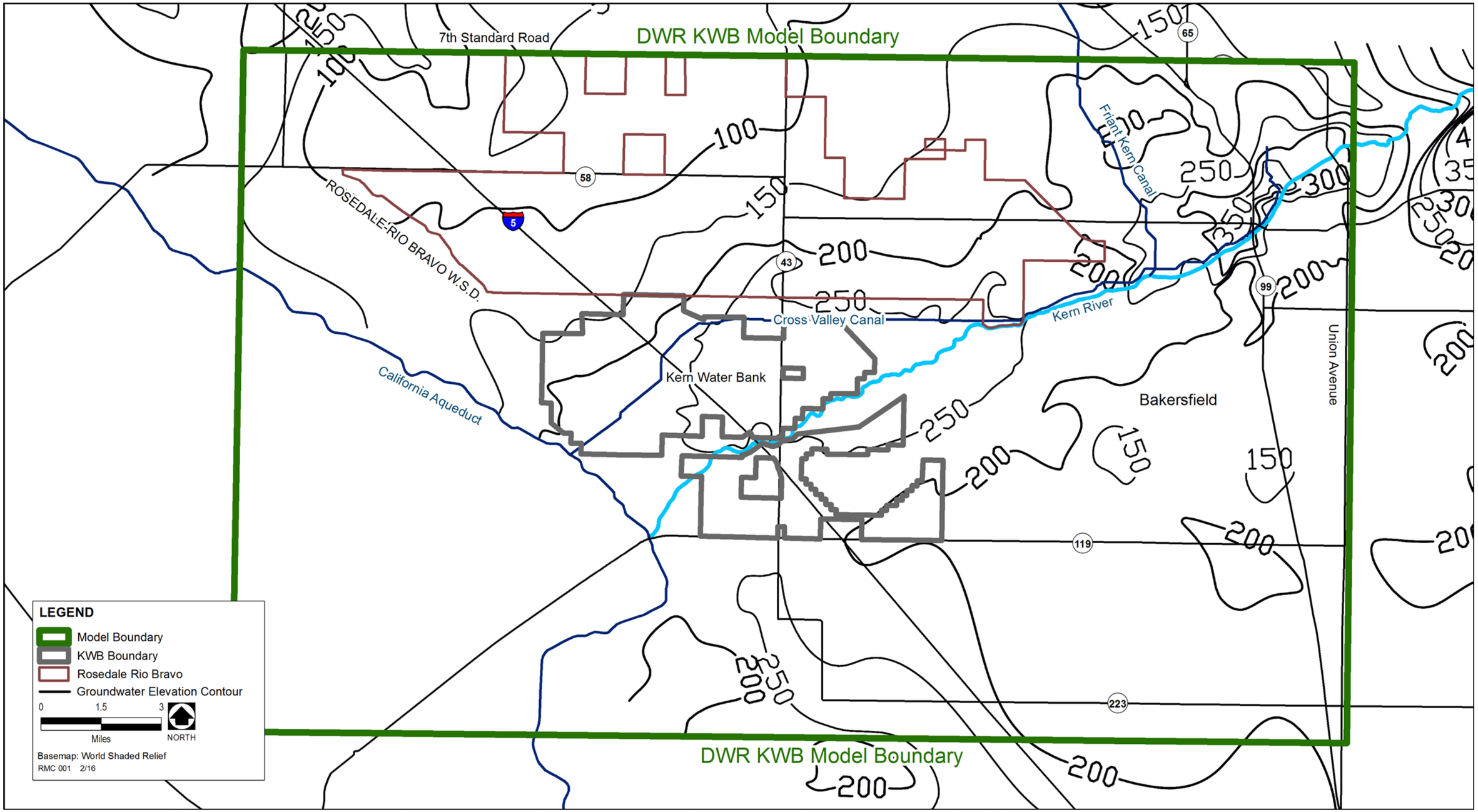


FIGURE 7.1-7. Groundwater Elevation Contour Map in 2012

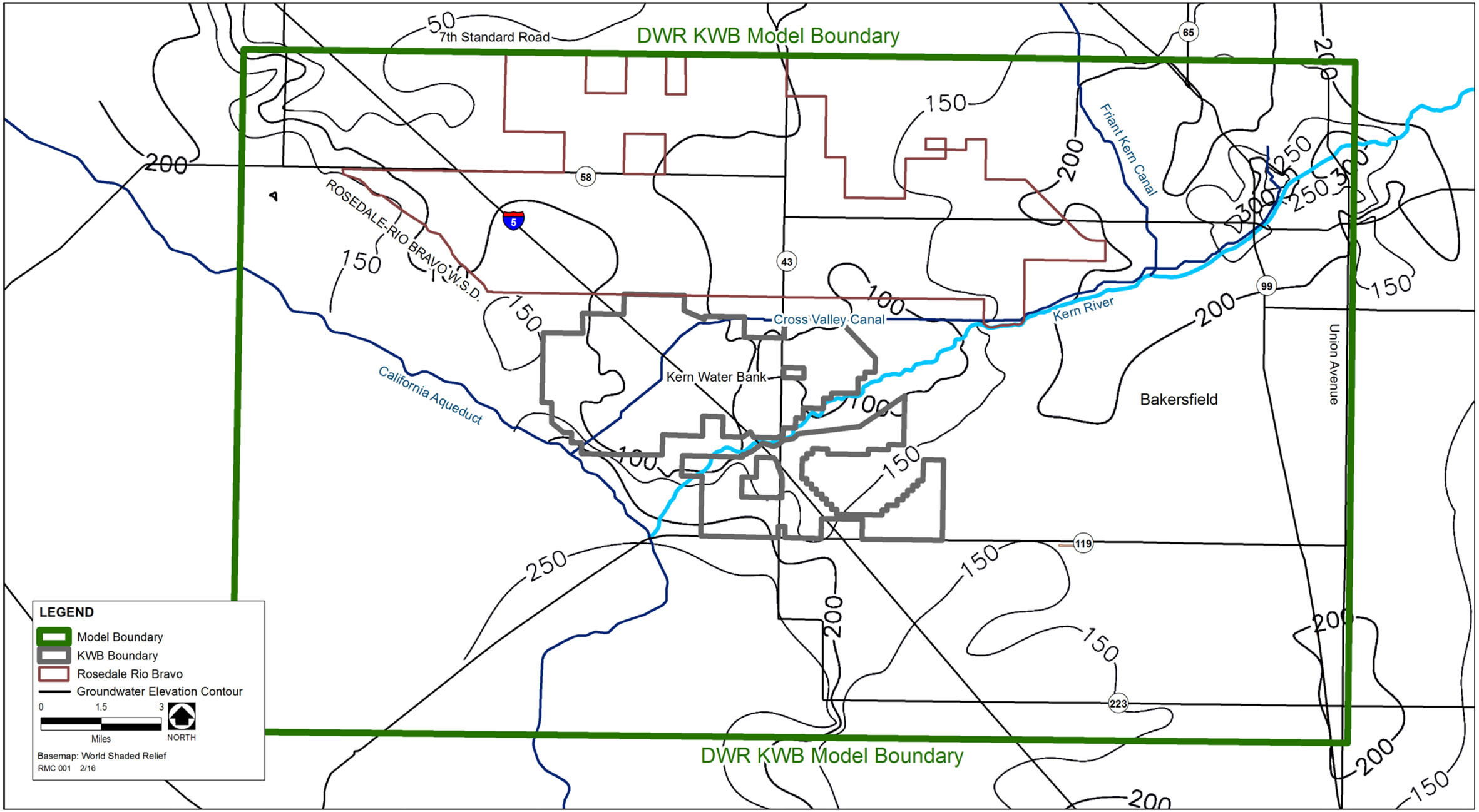


FIGURE 7.1-8. Groundwater Elevation Contour Map in 2010

TABLE 7.1-4

ANNUAL WATER DELIVERY TO THE KERN WATER BANK BY SOURCE, 1995–2014

(Volume in acre-feet)

Year	SWP	CVP	Kern River	Total
1995	70,329	47,035	104,896	222,260
1996	87,492	49,893	36,490	173,875
1997	40,049	28,806	43,407	112,262
1998	51,155	55,248	196,683	303,086
1999	26,011	10,563	179	36,753
2000	19,455	8,124	-	27,579
2001	10,030	-	-	10,030
2002	13,439	-	-	13,439
2003	40,374	-	-	40,374
2004	18,065	-	-	18,065
2005	327,418	59,239	900	387,557
2006	178,065	40,244	64,924	283,233
2007	16,728	-	-	16,728
2008	-	-	-	-
2009	-	-	-	-
2010	33,131	-	-	33,131
2011	352,297	68,230	26,621	447,148
2012	8,918	-	-	8,918
2013	-	-	-	-
2014	-	-	-	-
Total	**1,292,956**	**367,382**	**474,100**	**2,134,438**
Total by Percent	**61%**	**17%**	**22%**	**100%**

Kern Water Bank Water Supply

Water recharged into the KWB comes from the SWP via the California Aqueduct, the CVP via the Friant-Kern Canal, and Kern River flood flows. Descriptions of these surface water supplies, as well as the associated conveyance network, are provided in the Revised Appendix E.

During the 1995–2014 period, 2,134,438 AF of water was delivered to KWB for recharge. The distribution of the delivered volume during the 20-year period by source is as follows: SWP (Table A and Article 21): 1,292,956 AF; CVP (Friant-Kern section 215 of Reclamation Reform Act of 1982 water): 367,382 AF; and Kern River flood flows: 474,100 AF. Annual deliveries to KWB by source are shown in Table 7.1-4.

Kern Water Bank Facilities

The KWB area includes portions of several KCWA water district service areas and associated banking projects, including the KWB. Figure 7.1-9 shows KWB area facilities.

The KWB facilities include approximately 7,200 acres of recharge ponds, 85 recovery wells, an extensive network of monitoring wells, 36 miles of pipeline, and the 6-mile-long KWB Canal. The ponds consist of low earthen berms that pond water to depths of a few feet. The ponded water infiltrates into the alluvial fan for recharge into the aquifer. Water flows between the ponds in small channels; KWBA operators control the flow with small weir boxes. The recovery wells average about 750 feet deep and produce as much as 5,000 gallons per minute of water. They are distributed throughout the KWB Lands and are spaced approximately one-third mile apart. The 16- to 20-inch-diameter wells are powered with electric motors. Small diameter (15- to 36-inch-diameter) PVC pipelines transport water recovered from wells to existing canals or, in some cases, to large diameter pipelines. Approximately 28 miles of small-diameter and 5 miles of large-diameter (> 36-inch-diameter) pipeline have been constructed.

The KWB Canal was constructed to convey water both to the water bank ponds for recharge purposes and from the water bank wells for recovery purposes. The canal extends 6 miles from the Kern River on the east to the California Aqueduct on the west. Associated structures include headworks at the Kern River, a 100 cubic feet per second (cfs) pump station serving the Kern River area, a crossing under Enos Lane, a check structure, a 545 cfs pump station serving the eastern portions of the KWB, and diversion facilities at the California Aqueduct (see Figure 7.1-9).

Between 1996 and 2014, maintenance and operational activities included the replacement of recovery wells and the servicing and maintenance of all wells involved in groundwater recovery. Periodic berm repair and mowing of the KWB Canal banks to control excessive vegetation growth were ongoing maintenance activities. Existing fencing was maintained and additional fencing installed as needed. Other management activities included trash cleanup and removal of illegally dumped materials, environmental cleanup, and monitoring of third-party operations and cleanup activities.[5,6,7,8,9,10,11]

Major groundwater recharge and recovery operations at water banking facilities in Kern County have affected groundwater elevations and flow directions in the KWB area. During the 1995–2014 period, 2,006,372 AF of surface water was recharged and 1,389,113 AF of groundwater was recovered at KWB. Figure 7.1-10 shows monthly recharge and recovery at the KWB from 1995 through 2014. Higher groundwater levels correspond to years with recharge activities, and lower water levels indicate recovery periods. During recovery periods, pumping depressions developed near KWB and other recharge/recovery projects in the area, causing changes in groundwater elevations and flow directions.

Figure 7.1-11 shows the locations of the Kern Fan Monitoring Committee wells in the DWR KWB Model domain. Groundwater elevation hydrographs from three multi-completion monitoring wells are presented in Figures 7.1-12 to 7.1-14. These wells are selected from areas within three local groundwater banks to provide a general idea of fluctuations in observed groundwater elevations caused by KWB recharge and recovery operations, as well as the neighboring Rosedale and 2800 Acres groundwater banking projects. Figure 7.1-12 shows groundwater level fluctuations from two different well perforation intervals (210 feet to 310 feet and 610 feet to 700 feet as shown in the color legend at the bottom of the graph) at a monitoring well inside Rosedale. Figure 7.1-13 shows groundwater level fluctuations from four different well perforation intervals (45 feet to 65 feet; 100 feet to 150 feet; 223 feet to 375 feet; and 560 feet to 650 feet) at a monitoring well in 2800 Acres groundwater banking project. The data symbols that are “unfilled” on the graph indicate that the water level has fallen below the bottom of the corresponding well perforation interval, resulting in the dry well condition at that well depth interval. Figure 7.1-14 shows groundwater level fluctuations from four different well perforation intervals (110 feet to 130 feet; 285 feet to 345 feet; 515 feet to 555 feet; and 645 feet to 690 feet) at a monitoring well inside KWB boundary. This well becomes dry at the topmost perforation interval as shown by the “unfilled” green square symbols on the graph. The fluctuations of groundwater elevations in these three wells range from 160 feet to 330 feet. All three wells show similar trends of increasing and decreasing groundwater elevations, with the least amount of groundwater decline during 2007-2010 occurring in the Rosedale well.

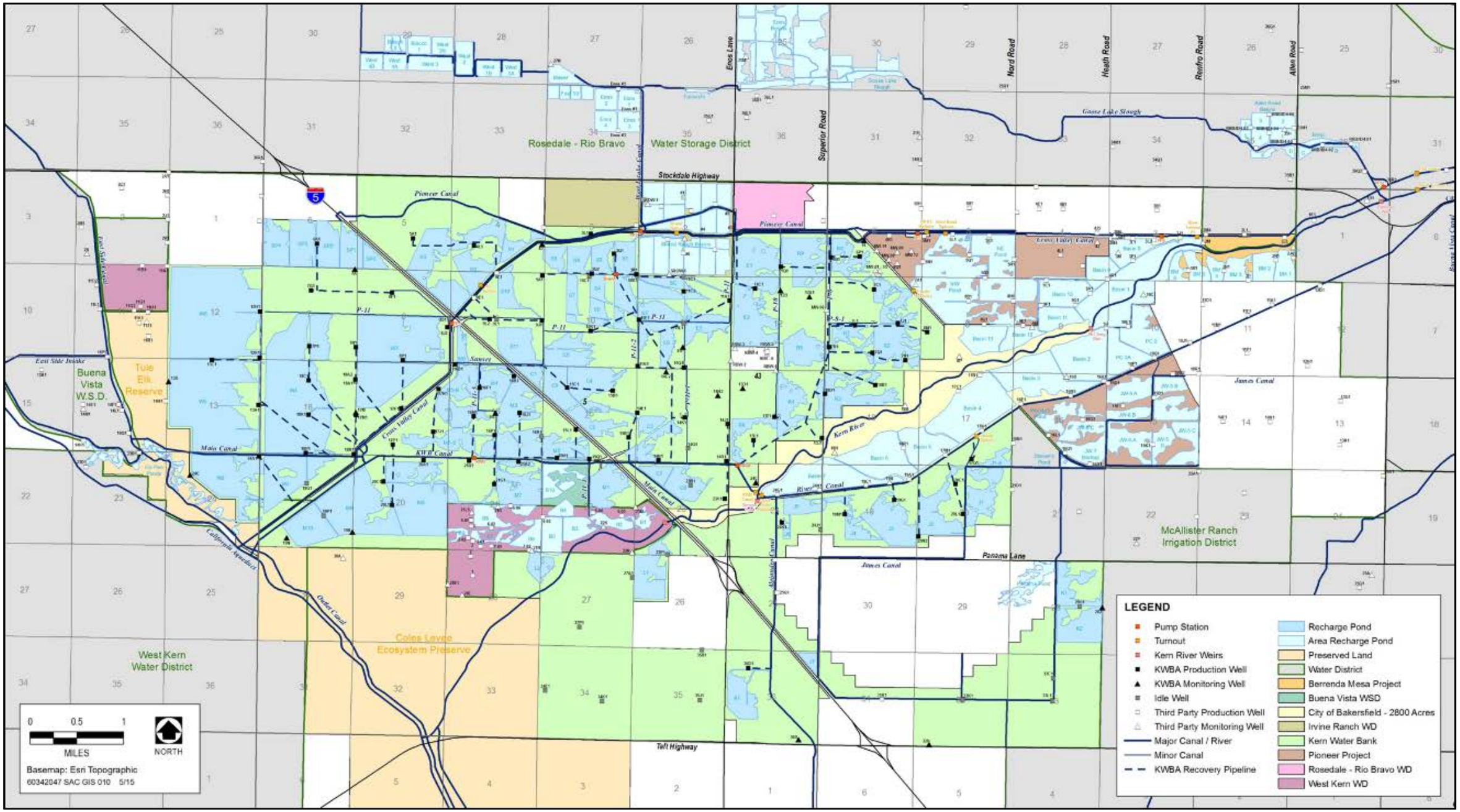


FIGURE 7.1-9. Kern Water Bank Area Facilities

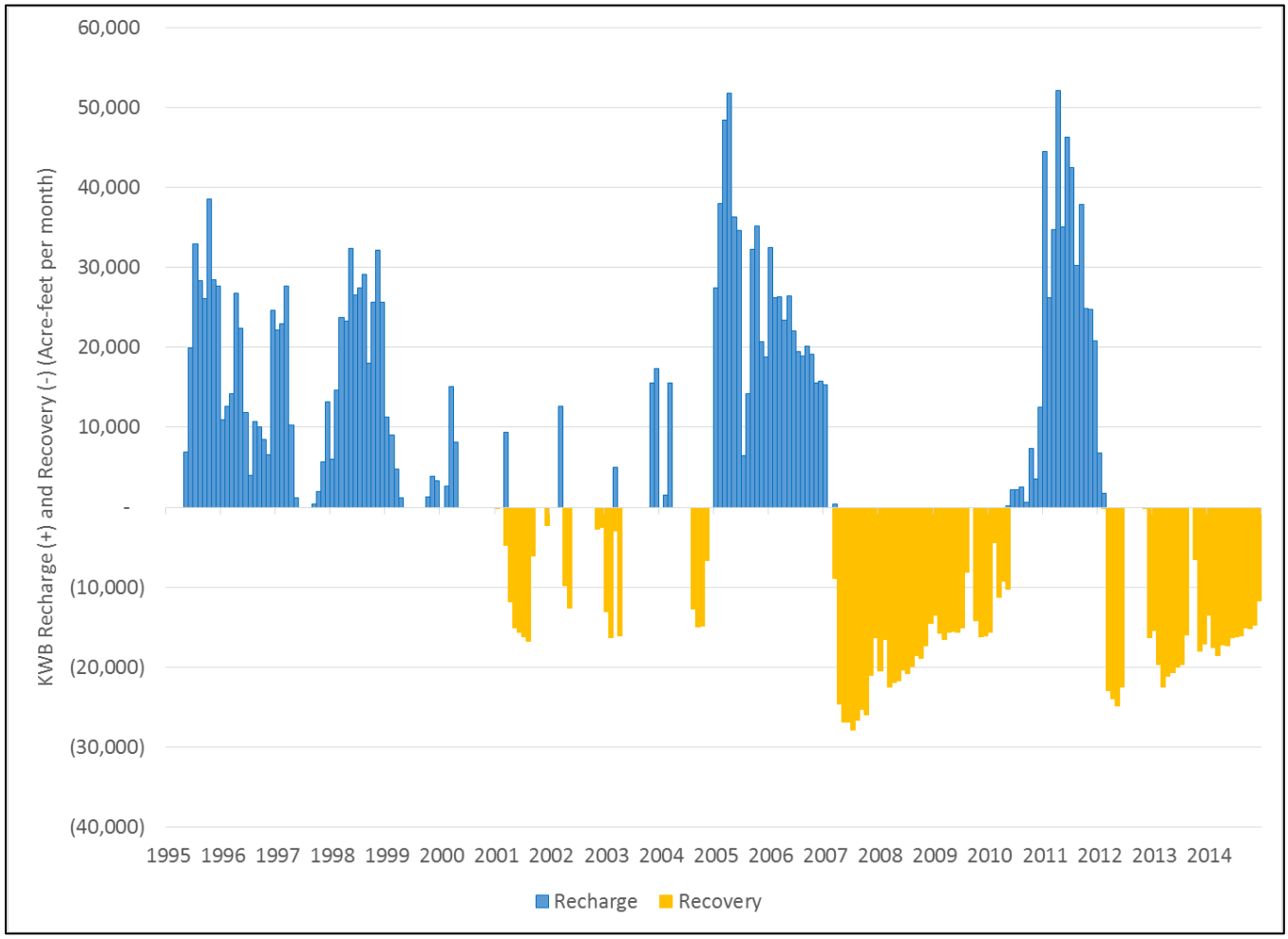


FIGURE 7.1-10. Monthly Recharge and Recovery at the Kern Water Bank, 1995–2014

7.1.2.3 Regulatory Setting in 1995

The regulatory setting in 1995 for KWB activities is generally unchanged from Section 7.1.2.3, Regulatory Setting in 1995, presented in the Monterey DEIR. Key regulations are described below.

Clean Water Act

Growing public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act Amendments of 1972. As amended in 1977, this law became known as the Clean Water Act (CWA). The CWA established the basic structure for regulating discharges of pollutants into the waters of the U.S. It gave the U.S Environmental Protection Agency (EPA) the authority to set ambient water quality standards for surface waters and set standards for municipal and industrial wastewater discharges. The CWA made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained.

Section 303(d) of the CWA requires states, territories and authorized tribes to develop a list of water quality-impaired segments of waterways. The list includes waters that do not meet water quality standards for the beneficial uses of that waterway, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for water segments on the lists and develop action plans, called Total

Maximum Daily Loads (TMDLs), to improve water quality. Many water bodies in the Monterey Plus EIR area of analysis are listed as water quality limited (impaired) for one or more of the constituents of concern. The lists of impaired water bodies are prepared every two years.

Safe Drinking Water Act

The federal Safe Drinking Water Act (SDWA), enacted in 1974, and significantly amended in 1986, was established to protect the public health and quality of drinking water in the United States. The law addresses all waters actually or potentially designated for drinking use, whether from above ground or underground sources. The SDWA directed the EPA to set national standards for drinking water quality.

It required the EPA to set maximum contaminant levels (MCLs) for a wide variety of potential drinking water pollutants. The owners or operators of public water systems are required to comply with primary (health-related) MCLs and encouraged to comply with secondary (nuisance- or aesthetics-related) MCLs. The 1986 amendments to the SDWA directed the EPA to expand its list of MCLs.

SDWA drinking water standards apply to treated water as it is served to consumers. All surface waters require some form of treatment in order to meet drinking water standards. The degree of treatment needed depends on the quality of the raw water. The highest quality raw surface waters need only to be disinfected before being served to consumers. More typically, raw water is treated in a conventional water treatment plant that includes sedimentation, filtration and disinfection processes. Although it is technically possible to treat virtually any raw water so that it will meet drinking water standards, it is usually not practical to do so. Municipal water suppliers prefer raw water sources of high quality because their use minimizes risk to public health and the cost and complexity of treatment needed to meet SDWA drinking water standards.

Elevated total dissolved solids or chloride concentrations in drinking water can adversely affect its taste. Secondary MCLs for total dissolved solids and chloride are 500 mg/L and 250 mg/L respectively.[12] Bromide and total organic carbon concentrations are of concern because bromides and organic compounds react with disinfecting agents to form various chemical compounds that can harm human health at low concentrations. These compounds are referred to as disinfection byproducts and include trihalomethanes (chloroform, bromodichloromethane, dibromochloromethane, and bromoform), haloacetic acids (mono-, di-, and trichloroacetic acid, mono- and dibromoacetic acid), chlorite and bromate. The primary MCLs for total trihalomethanes, total haloacetic acids, chlorite and bromate are 0.08, 0.06, 1 and 0.01 mg/L, respectively.[13] Elevated total organic carbon concentrations can also affect the taste and odor of treated water.

Porter-Cologne Act

Responding to public concern in California, state legislators enacted a law designed to curb water pollution several years before passage of the Federal Water Pollution Control Act Amendments. The Porter-Cologne Act of 1969 established regional water quality control boards and gave them defined responsibilities for water quality management.

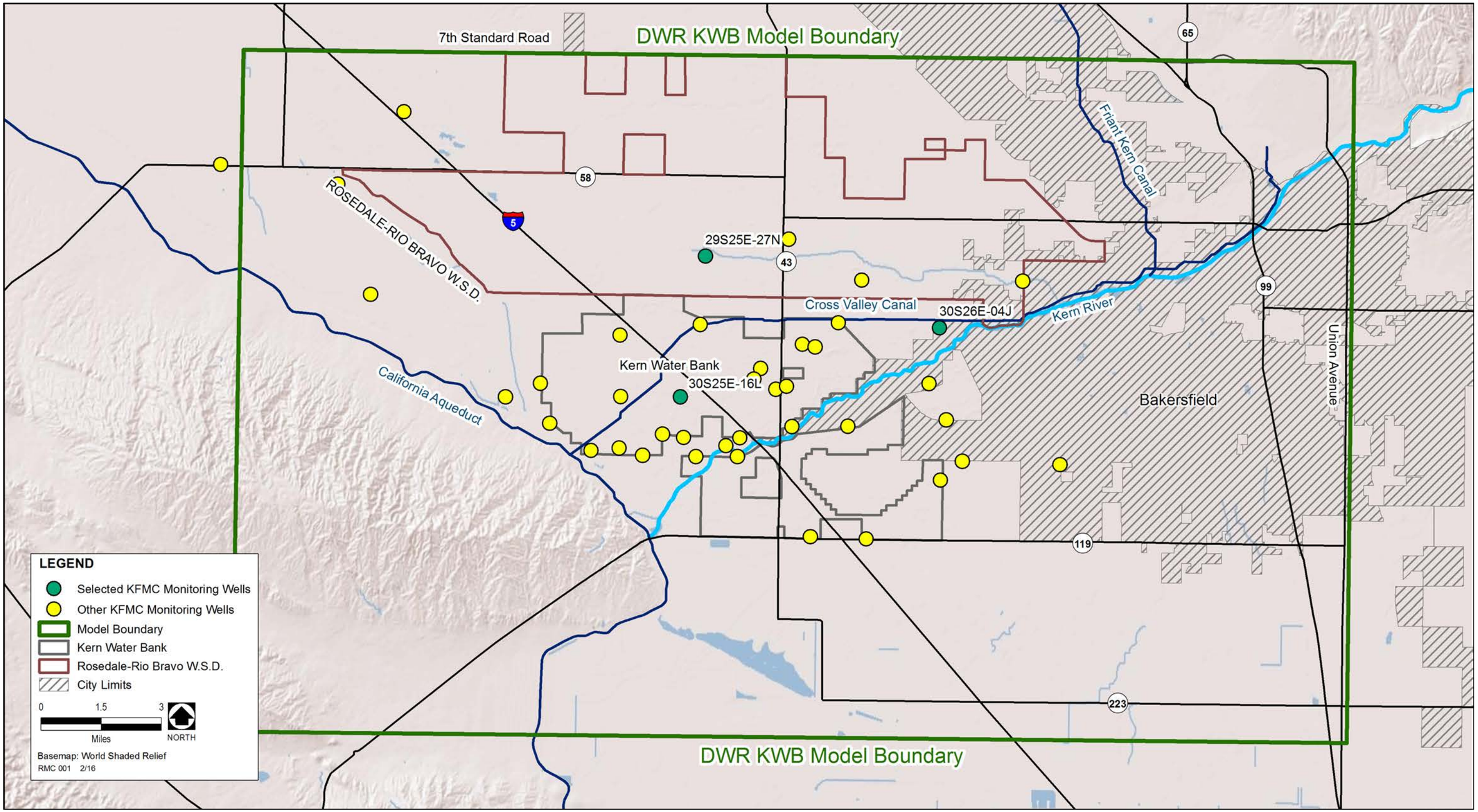


FIGURE 7.1-11. Location of Selected Kern Fan Monitoring Committee Monitoring Wells

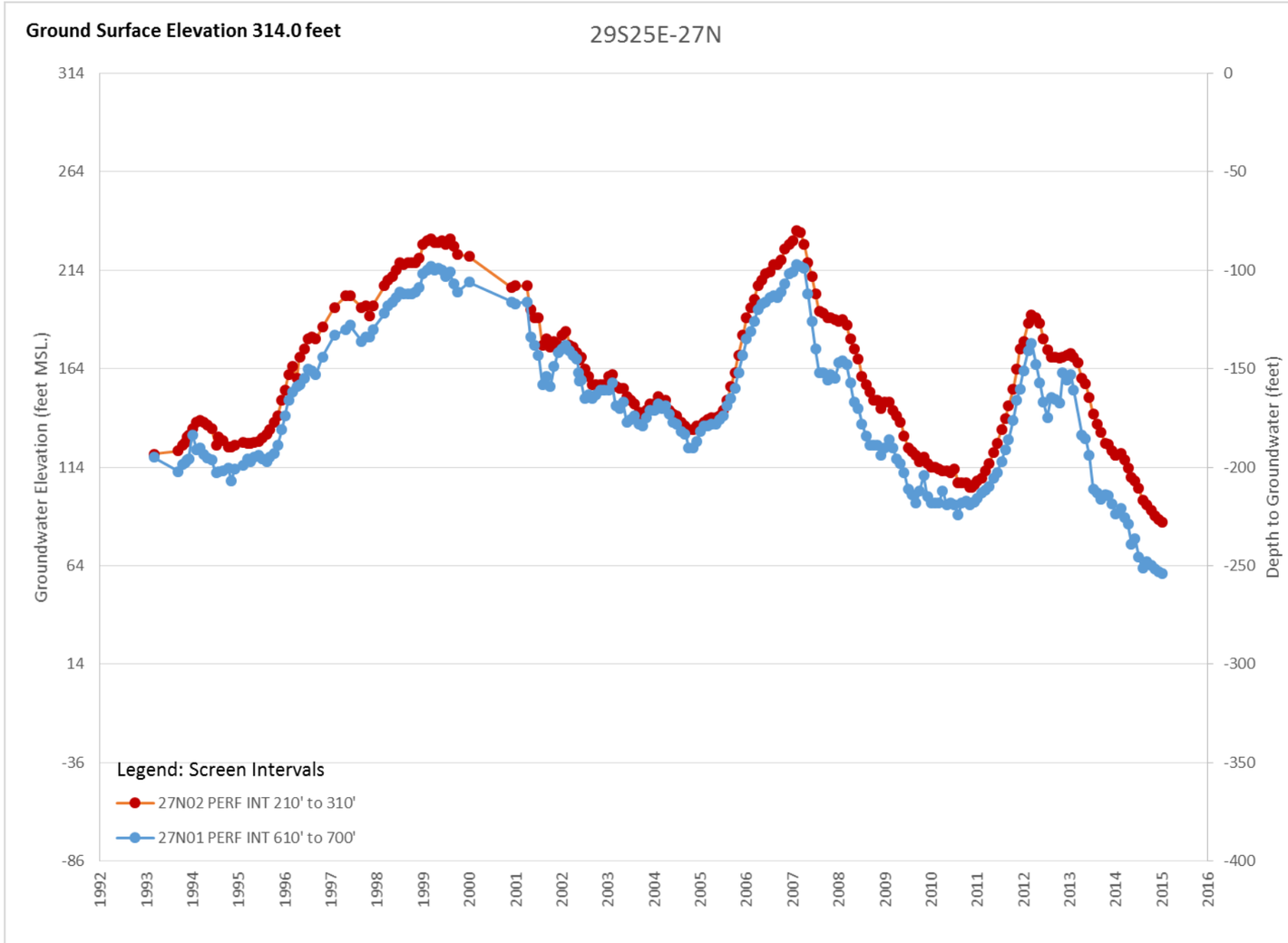


FIGURE 7.1-12. Groundwater Elevation Hydrograph at Multi-Completion Monitoring Well 27N North of the Kern Water Bank in Rosedale-Rio Bravo Water Storage District, 1993–2015

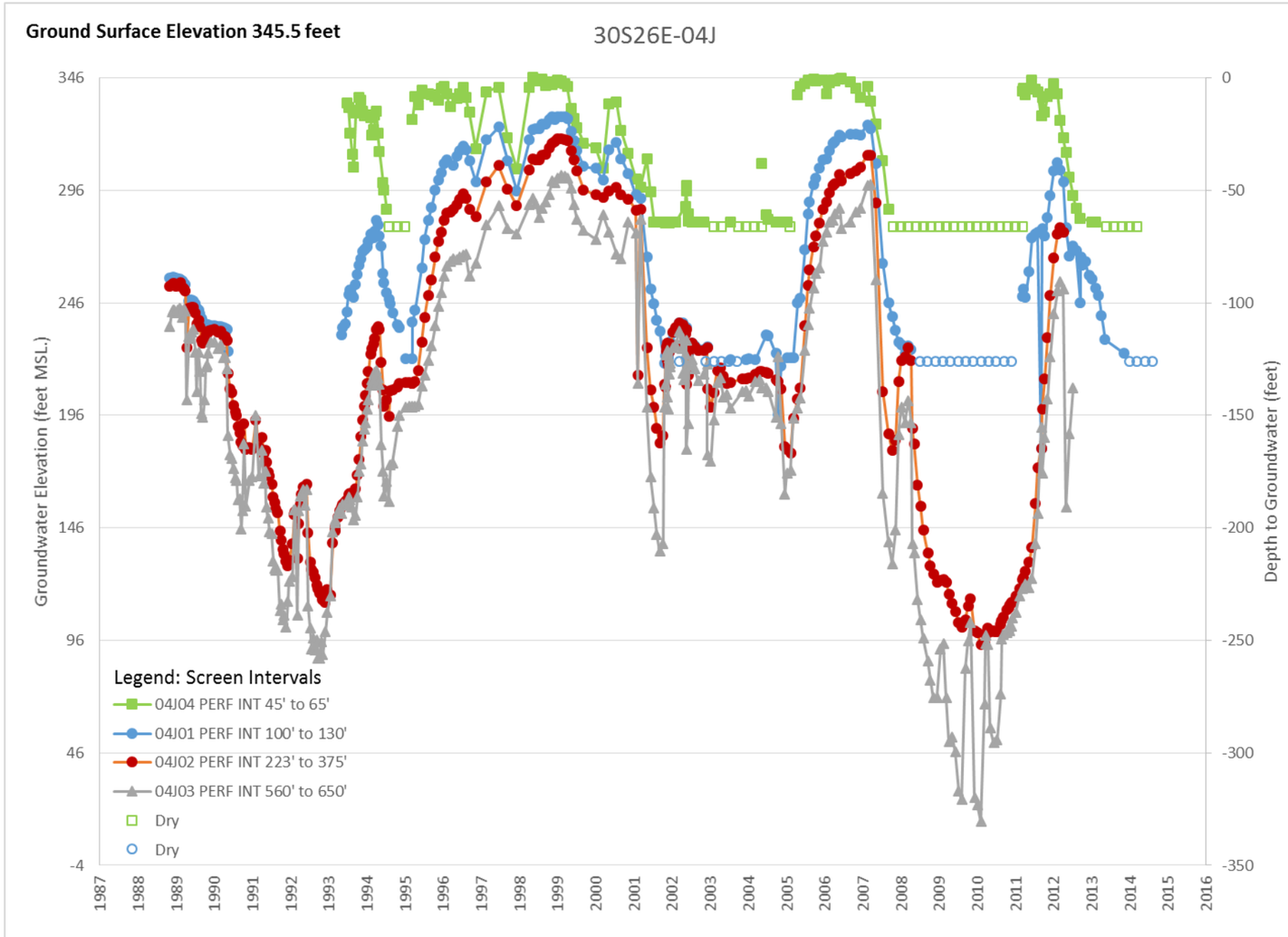


FIGURE 7.1-13. Groundwater Elevation Hydrograph at Multi-Completion Monitoring Well 04J Northeast of the Kern Water Bank in 2800 Acres, 1988–2015

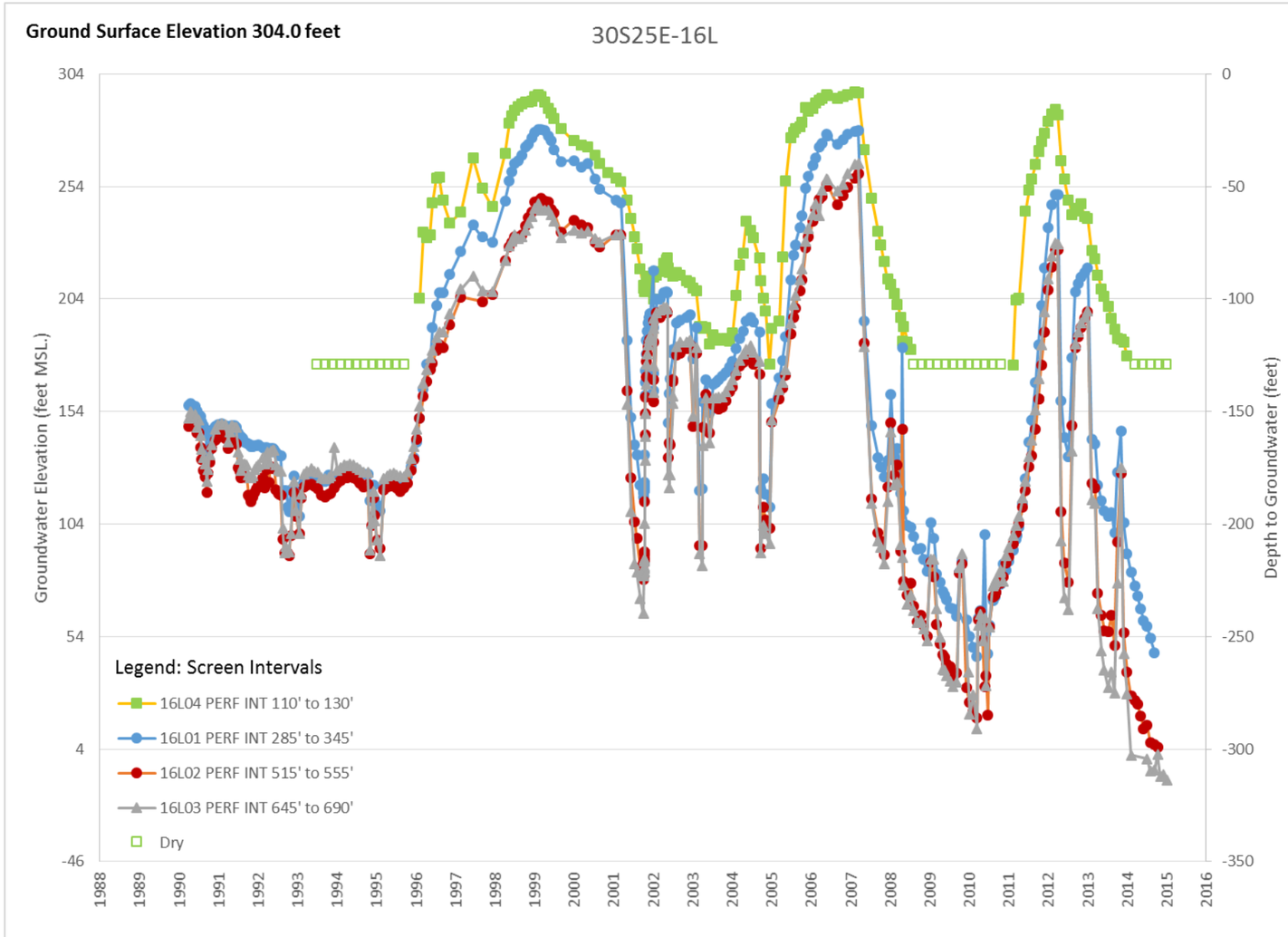


FIGURE 7.1-14. Groundwater Elevation Hydrograph at Multi-Completion Monitoring Well 16L within the Kern Water Bank, 1990–2015

The Porter-Cologne Act requires the regional water quality control boards to prepare regional water quality control plans (WQCPs), often referred to as basin plans. The WQCPs must identify present and future beneficial uses of California's waters and establish water quality objectives that will protect those uses. California's beneficial use designations and water quality objectives are the functional equivalent of the federal ambient water quality standards. After passage of the Federal Water Pollution Control Act Amendments, California's water quality objectives served as federal water quality standards, upon review and approval by the EPA.

WQCPs are adopted and amended by the regional water quality control boards but do not become effective until adopted by the State Water Resources Control Board (SWRCB). All WQCPs are subject to CEQA review. Adoption or revision of surface water objective/standards is subject to the approval of the EPA. The regional WQCPs complement statewide WQCPs adopted by the SWRCB.

Several WQCPs govern management of surface and ground waters that could be affected by KWB activities. The Tulare Lake WQCP covers the watershed in the southern San Joaquin Valley that drains to the Tulare Lake bed, including the Kings, Kaweah, Tule and Kern rivers. Each WQCP identifies existing and potential beneficial uses of surface waters and establishes water quality objectives within its part of California. Surface waters in the Tulare Lake WQCP area are in compliance with objectives.

7.1.2.4 Changes in Regulatory Setting between 1996 and 2014

California Statewide Groundwater Elevation Monitoring - 2009

California Statewide Groundwater Elevation Monitoring (CASGEM) was authorized by SBX7 6 and was enacted in November 2009. CASGEM mandates a statewide groundwater elevation monitoring program to track seasonal and long-term trends in groundwater elevations in California's groundwater basins. This requires collaboration between local monitoring entities and the Department to collect groundwater elevation data. As part of the CASGEM program, monitoring entities are designated to conduct or coordinate the monitoring of groundwater elevations for a basin or subbasin. The monitoring entities that monitor parts of Kern County subbasin 5-22.14 in Kern County are the KCWA Improvement District No. 4, the Kern River Fan Group, and the Semitropic Water Storage District.

Sustainable Groundwater Management Act - 2014

The 2014 Sustainable Groundwater Management Act (SGMA) went into effect on January 1, 2015. It established a new structure for managing groundwater in California. SGMA requires development of projects and programs to achieve long-term basin sustainability and includes: a) formation of groundwater sustainability agencies (GSAs) for all basins designated as high or medium priority by the Department; b) development of a groundwater sustainability plan (GSP); and c) implementation of the GSP to avoid "undesirable result" (California Water Code Section 10721(x)).

The Kern County subbasin (No. 5-22.14) has been designated a high priority basin by the Department. This means local agencies in this subbasin are required to form GSAs by June 2017, and to develop and adopt their GSPs by January 2020. Each GSP needs to include measurable goals and objectives, and implementation actions to achieve/maintain basin sustainability. The subbasin needs to be under sustainable management by 2040, by implementing monitoring, project implementation, and administrative actions.

7.1.3 IMPACTS AND MITIGATION MEASURES

As discussed in Section 7.1.1.2, three modeling scenarios (APO, AFO-EC, and AFO-BC) were used to evaluate potential impacts of KWB activities by comparing the results of DWR KWB Model runs both

"With KWB Operations" and "Without KWB Operations." For this impact analysis, KWB operations include recharge, recovery, and conveyance of water to KWB participants, and are a subset of KWB activities, which includes the development and continued use and operations of the KFE property, including facility construction and maintenance.

7.1-1 KWB Operations could potentially deplete groundwater supplies so that a net deficit in aquifer volume of stored groundwater would occur.

1995 – 2014 (Analysis of Past Operations)

During the 1995–2014 operation period, KWB recharged surface water into the underlying aquifer in relatively wet years and recovered stored groundwater in relatively dry years.

The volume of water recharged into the aquifer during 1995–2014 at the KWB facilities was 2,006,372 AF. In comparison, the volume of water recovered from KWB during the same period was 1,389,113 AF. This resulted in 617,258 AF of water stored in the aquifer through KWB operations during 1995–2014. The annual recharge, recovery, and cumulative net recharge for the APO scenario are shown in Figure 7.1-15.

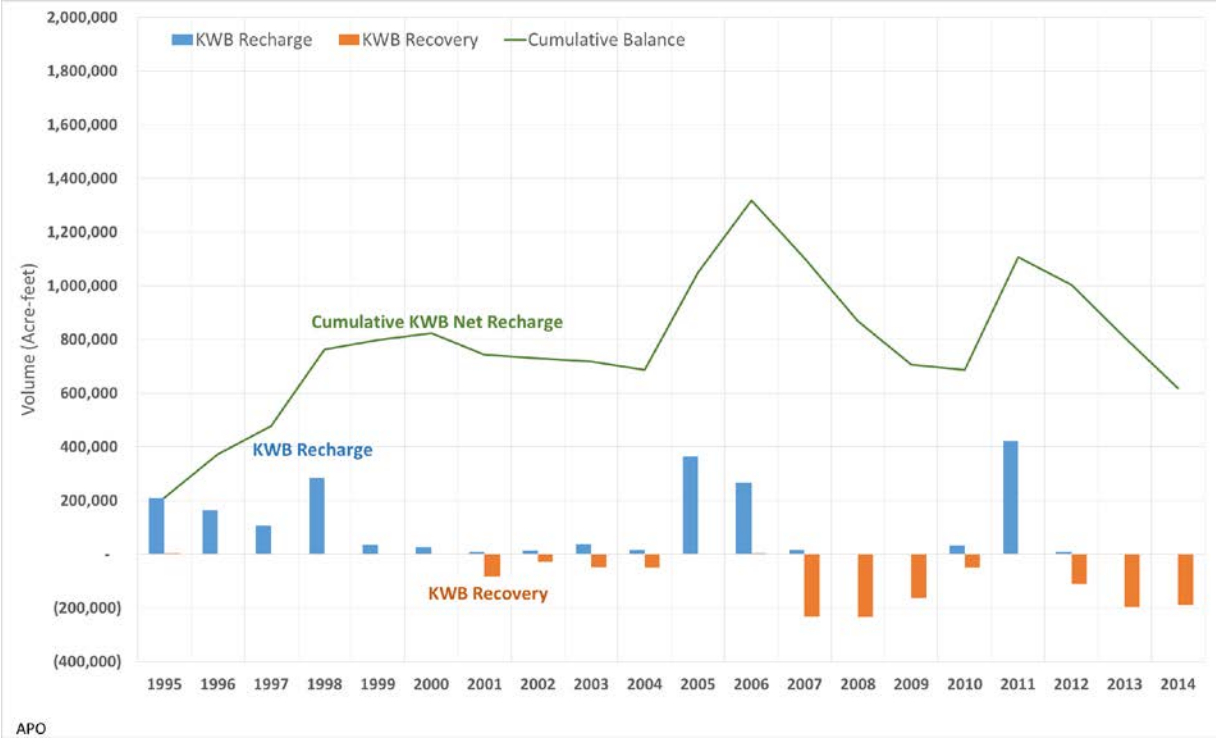


FIGURE 7.1-15. APO: Historical (1995–2014) Kern Water Bank Modeled Recharge, Recovery, and Cumulative Net Recharge

The information provided above shows that the historical use and operation of the KWB did not deplete groundwater supplies to cause a net deficit in aquifer volume of stored water; rather, KWB use and operation resulted in about 617,000 AF of stored water into the aquifer at the end of the 1995–2014 KWB operations.

Therefore, the impact of KWB operations from 1996 to 2014 on groundwater supplies, such that a net deficit in aquifer volume of stored groundwater would occur, was ***less than significant***.

Mitigation Measures

None required.

2015 – 2035 (Analysis of Future Operations—Existing Conditions)

During the 21 years (2015–2035) of future modeled operations under the existing (2015) level of land use development, the total volume of water recharged at the KWB facilities would be 2,112,325 AF. This amount is slightly higher than the total recharge volume during the historical 1995–2014 period because increased recharge pond areas would allow KWB to recharge an additional amount of water compared to that available under a hydrologic condition similar to the 1995–2014 period. In comparison, the total volume of water that would be recovered from KWB during the same 2015–2035 period would be 1,546,368 AF, which also would be higher than the 1995-2014 amount because of an additional year of pumping in 2015. The net impact of KWB activities under AFO-EC would be the introduction of an additional 565,957 AF of stored water into the aquifer during 2015–2035. The annual recharge, recovery, and cumulative net recharge for AFO-EC scenario are shown in Figure 7.1-16.

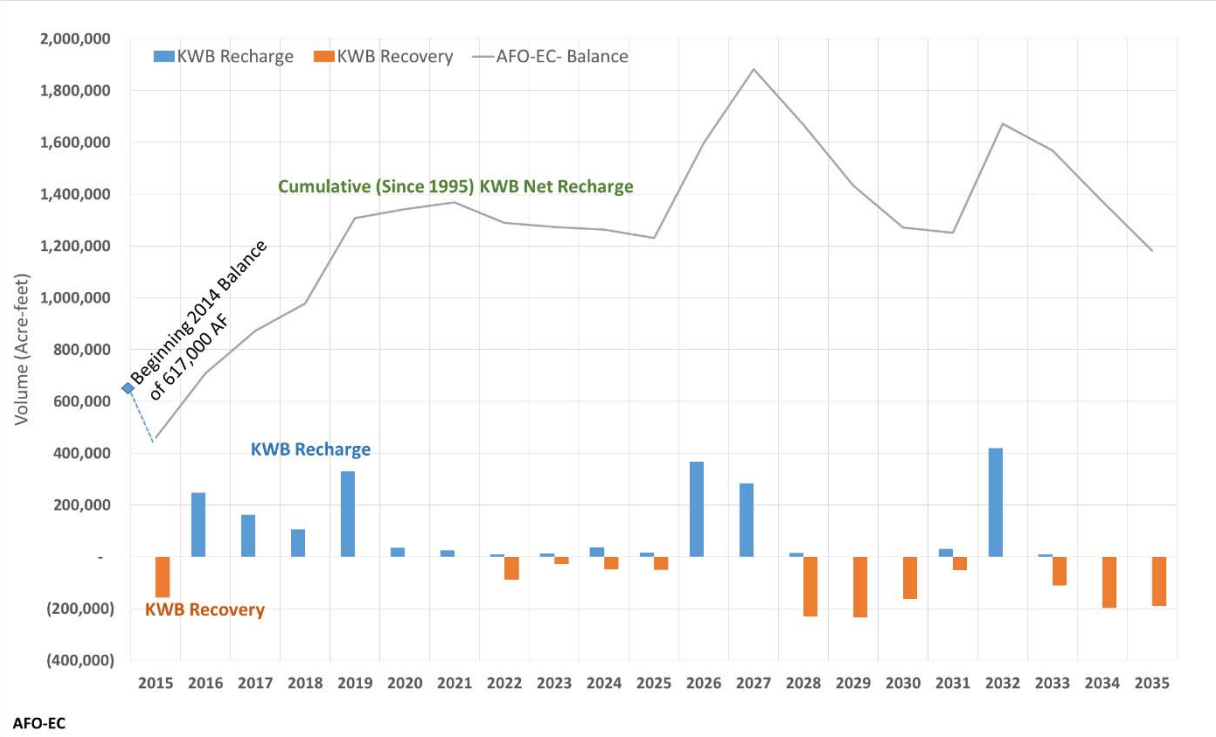


FIGURE 7.1-16. AFO-EC: Kern Water Bank Modeled Recharge, Recovery, and Cumulative Net Recharge, 2015-2035

At the end of 1995–2014 historical KWB operations, an accumulated balance of 617,258 AF of stored water existed from past KWB activities. When this prior balance is added to the additional water stored during the 2015–2035 period, there is a balance of 1,183,215 AF of stored water at the end of 2035 under the AFO-EC scenario, assuming a repeat of hydrology similar to the 1995-2014 period.

The information provided above shows that future KWB activities under existing conditions would not deplete groundwater supplies to cause a net deficit in aquifer volume of stored water; rather, KWB activities would add about 566,000 AF of water into storage during future operations from 2015 through 2035, under the existing level of development.

Therefore, the impact of KWB future operations under existing conditions from 2015 to 2035 on groundwater supplies, such that a net deficit in aquifer volume of stored groundwater would occur, would be ***less than significant***.

Mitigation Measures

None required.

2015 – 2035 (Analysis of Future Operations—Build-out Conditions)

During the 21 years (2015–2035) of future modeled operations under the build-out (2030) level of land use development, the total volume of water recharged at the KWB would be 2,112,325 AF. This amount is higher than the total recharge volume during the APO but is equal to the total recharge volume of the AFO-EC scenario. Although there is an increase in recharge pond areas under build-out conditions compared to existing conditions, the total recharge volume remained the same because of availability of recharge water and the capacity of aquifer to store the water without causing surface flooding. In comparison, the total volume of water recovered from KWB during the same 2015–2035 period would be 1,614,236 AF. This would be higher than the APO scenario because of one additional year of pumping in 2015 and increased pumping capacity made available from new recovery wells and recharge ponds. The net impact of KWB activities under AFO-BC would be the introduction of an additional 498,090 AF of stored water into the aquifer during 2015–2035. Annual recharge, recovery, and cumulative net recharge for the AFO-BC scenario are shown in Figure 7.1-17.

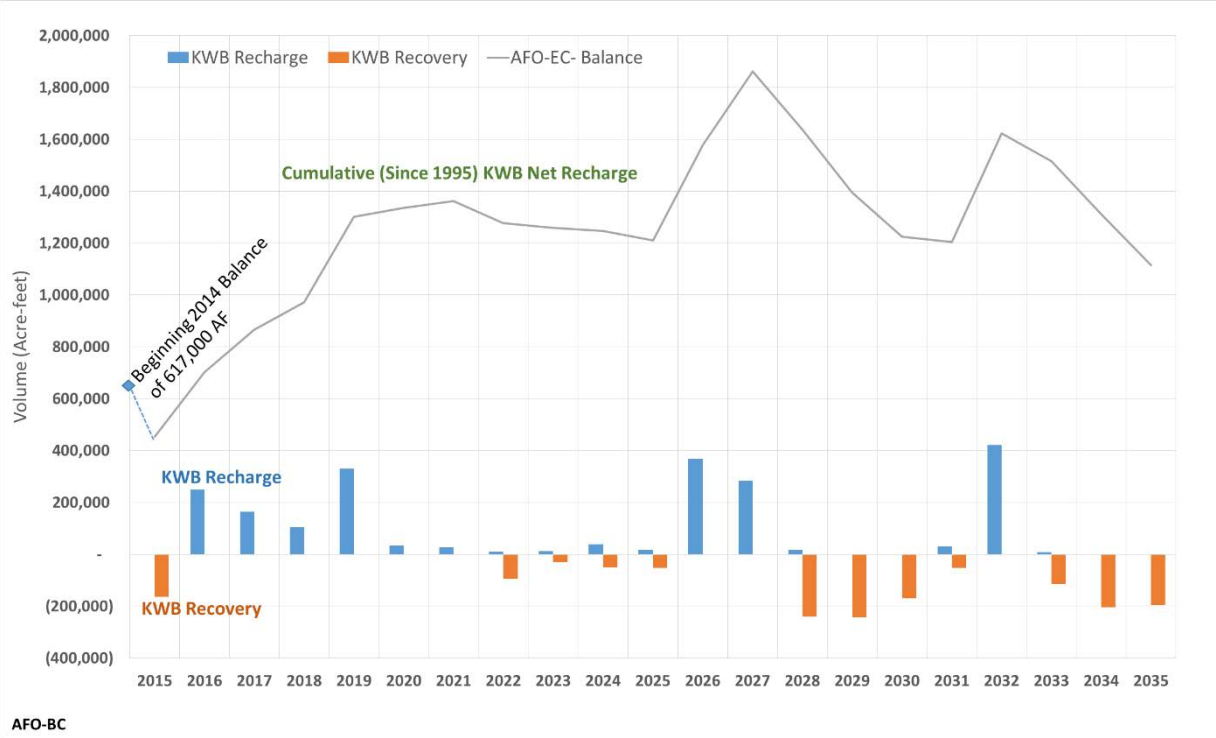


FIGURE 7.1-17. AFO-BC: Kern Water Bank Modeled Recharge, Recovery, and Cumulative Net Recharge, 2015-2035

At the end of the 1995–2014 historical KWB modeled operations, an accumulated balance of about 617,000 AF of stored water existed from past KWB activities. When this prior balance is added to the additional water stored during the 2015–2035 period, there is a balance of 1,115,348 AF of stored

water at the end of 2035 under the AFO-BC scenario, assuming a repeat of hydrology similar to the 1995-2014 period.

The information provided above shows that future KWB activities under build-out conditions would not deplete groundwater supplies to cause a net deficit in aquifer volume of stored water; rather, KWB activities would add about 498,000 AF of water into storage during future operations from 2015 through 2035, under build-out conditions.

Therefore, the impact of KWB future operations under build-out conditions from 2015 to 2035 on groundwater supplies, such that a net deficit in aquifer volume of stored groundwater would occur, would be ***less than significant***.

Mitigation Measures

None required.

7.1-2 KWB operations could potentially deplete groundwater supplies so that a lowering of the local groundwater table level would occur (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted).

Evaluation Method

Impacts of KWB activities on the local groundwater table within the DWR KWB Model domain were evaluated by comparing simulated groundwater elevations of the “With KWB Operations” model run with those from the “Without KWB Operations” model run.

At each monthly interval in the model simulation, the simulated groundwater elevation at every model cell for the “Without KWB Operations” model run was subtracted from the simulated groundwater elevation at the corresponding cell for the “With KWB Operations” model run. For the purpose of the current evaluation, all differences within ±5 feet were ignored because they were likely within the range of uncertainty in model results. Uncertainty exists for all models and, in the case of the DWR KWB Model, it arises due to many factors including a simplified representation of aquifer complexity and assumptions about stresses (e.g., calculated agricultural pumping).

KWBA and Rosedale agreed, pending the completion of the REIR, to an Interim Project Operations Plan (Interim Operations Plan) for the KWB and Rosedale water banks (see Appendix 7-5b) which establishes triggers and actions for mitigation using the following two-tier approach:

- The average water level at seven index wells, measured on March 31 of each year, must be more than 140 feet from the surface (i.e., average depth to water at these wells must exceed 140 feet on March 31).
- After the above condition is met, a negative project impact (NPI) would be said to occur when the model simulated groundwater elevation (i.e., projected groundwater elevation) at an operative well for “with project” (with both KWB and Rosedale projects) conditions is 45 feet lower than that of the “without project” (without both KWB and Rosedale projects) conditions.

As of early 2016, KWBA has been working on a Long-Term Operations Plan that uses the same two-tier approach but proposes to lower the mitigation threshold to 30 feet, because the 45-foot NPI defined above includes impacts from both the KWB and the Rosedale groundwater banking projects, rather than the KWB in isolation.

Based on the above information and in consideration of local agreements regarding mitigation thresholds, the model-generated groundwater elevation differences of more than -30 feet ("with KWB activities" minus "without KWB activities") at any time during the DWR KWB Model simulation period were analyzed to evaluate whether the impacts on the local groundwater table would be potentially significant.

1995 – 2014 (Analysis of Past Operations)

Impacts of past (1995–2014) KWB operations on the local groundwater table were evaluated by comparing simulated groundwater elevations from the "With KWB Operations" model run with those from the "Without KWB Operations" model run.

Figure 7.1-18 shows lines of groundwater differences that indicate the extent of the lowering of the local water table due to KWB activities. The line labeled as "-30" feet shows the outermost edge of model cells where water levels were lowered by more than 30 feet due to KWB activities at least in one time step (month) during the 1995–2014 model simulation period. Figure 7.1-18 shows that lowering of the water table of more than 30 feet has occurred between KWB's northern boundary and Rosedale's southern boundary.

KWB operations under the APO scenario result in lowering the water table up to 55 feet outside of KWB Lands. Figure 7.1-19 shows the location of wells that lie in areas outside of KWB Lands, where lowering of the water table exceeds 30 feet. Table 7.1-5 lists the range of maximum drawdowns at these wells located outside of KWB Lands.

TABLE 7.1-5

APO RESULTS: MAXIMUM DRAWDOWN IN EXISTING WELLS OUTSIDE KWB BOUNDARY

Well Locations	Range of Maximum Drawdown* Simulated in Existing Wells
North of KWB Boundary	30 feet to 43 feet
East of KWB Boundary	30 feet to 32 feet
Southeast of KWB Boundary (2800 Acres and Improvement District No. 4 area)	32 feet to 40 feet
Southwest of KWB Boundary (West Kern Water District)	33 feet to 46 feet

**These drawdowns reflect maximum drawdown simulated in existing wells. Maximum drawdown anywhere outside KWB is 55 feet, which occurs in a location where there are no existing wells. See Figure 7.1-19.*

Impacts of past KWB activities on the local groundwater table were also evaluated by comparing modeled groundwater elevations with historical data and well characteristics. Modeled depth to water at well (30S25E-02L02 SREX-06) nearest to the KWB boundary on the north is shown in Figure 7.1-20 for both "With KWB Operations" and "Without KWB Operations" model runs under the APO scenario. The modeled groundwater elevation of this well decreases by 220 feet from 2007 through 2009. Historical groundwater fluctuations in the KWB area have been measured of up to 246 feet. Therefore, the model-predicted drawdowns associated with KWB activities are within these recorded fluctuations. During KWB recovery periods, an additional drawdown between 30 to 46 feet may have no adverse effects on pre-existing nearby wells and their ability to produce water to support existing or planned land uses.

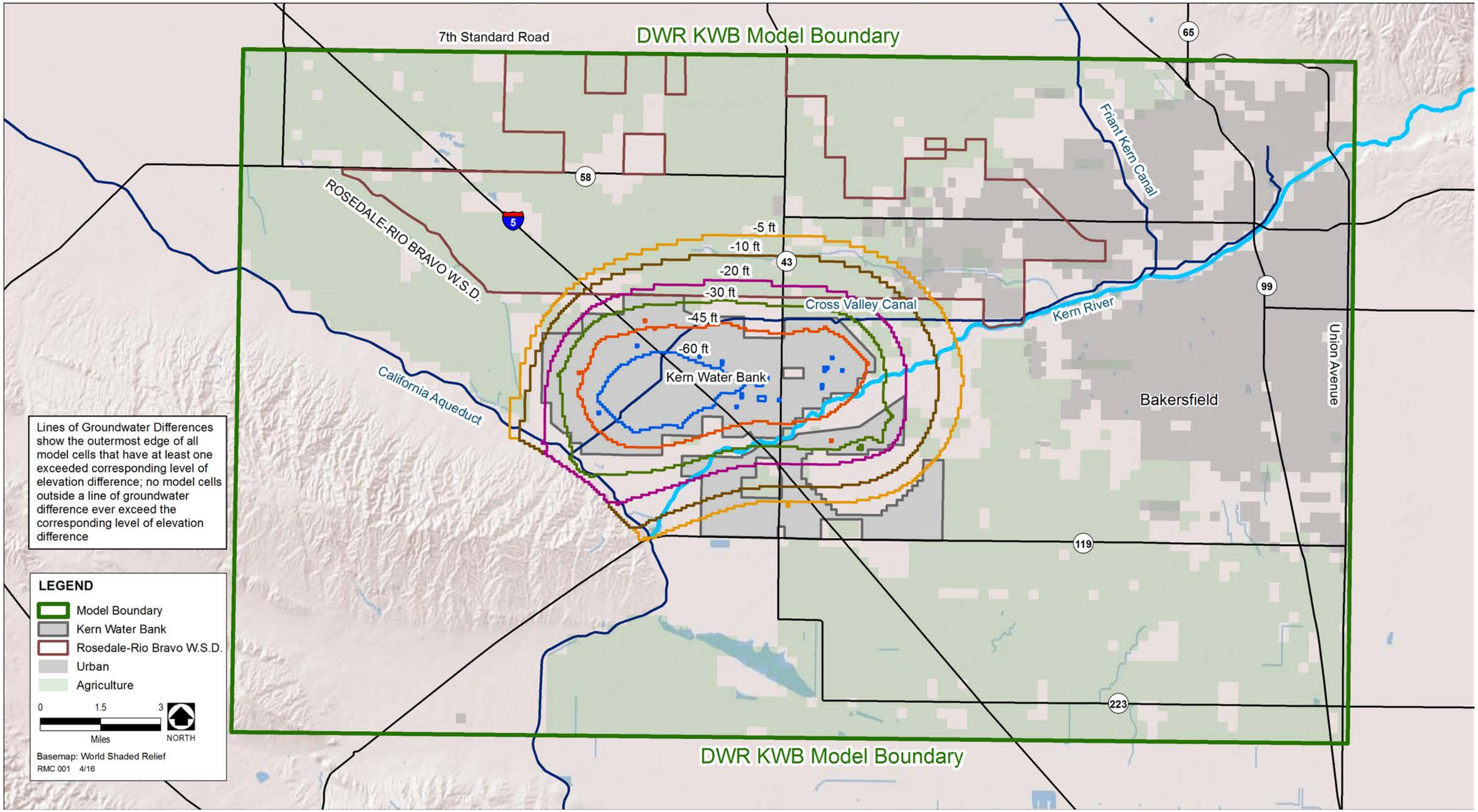


FIGURE 7.1-18. APO: Contours of Maximum Extent of Negative Differences ("With" minus "Without" KWB Operations), 1995–2014

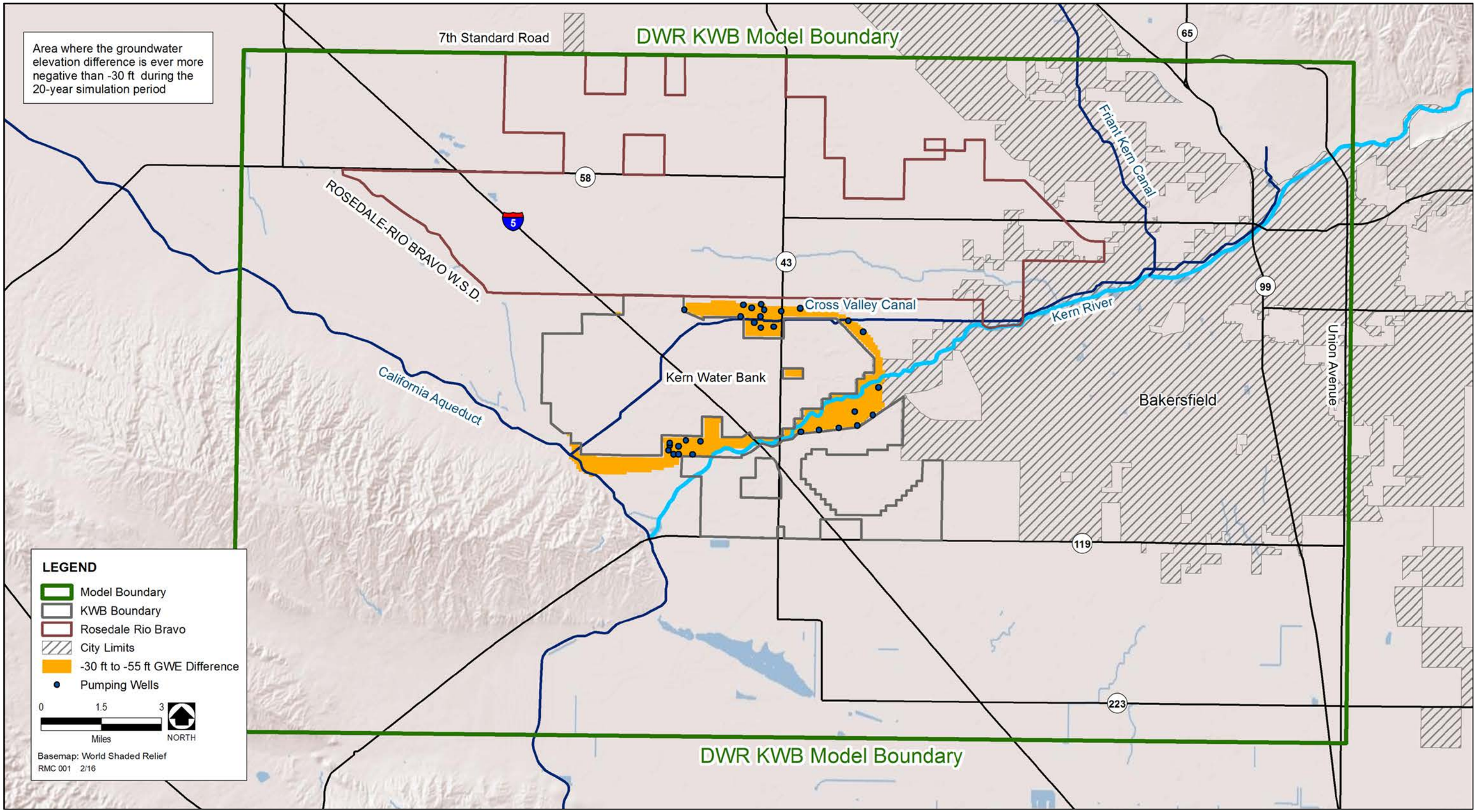


FIGURE 7.1-19. APO: Location of DWR KWB Model Wells in Areas with Groundwater Elevation Difference between -30 feet and -55 feet ("With KWB Operations" minus "Without KWB Operations"), 1995–2014 *(These drawdowns reflect maximum drawdown simulated anywhere outside KWB. Maximum drawdown at any well is 46 feet. See Table 7.1-5.)*

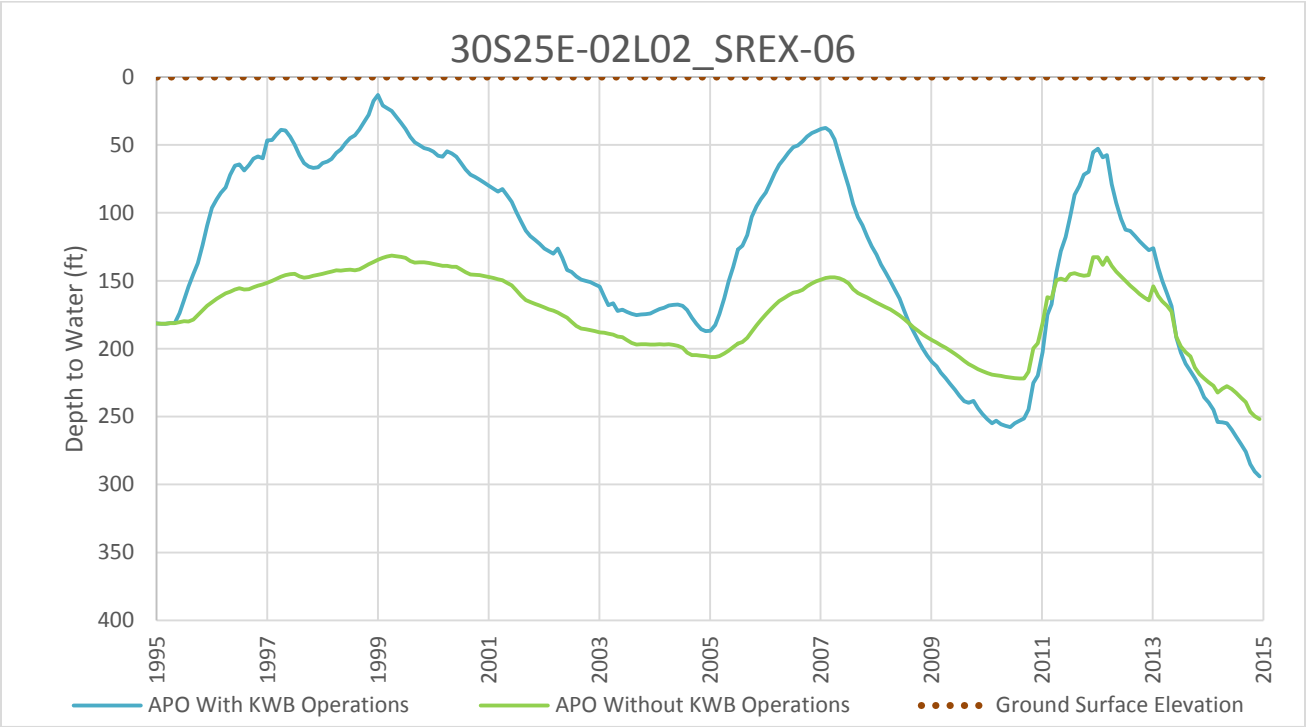


FIGURE 7.1-20. APO: Model Simulated Depth to Water at Production Well 30S25E-02L02 SREX-06

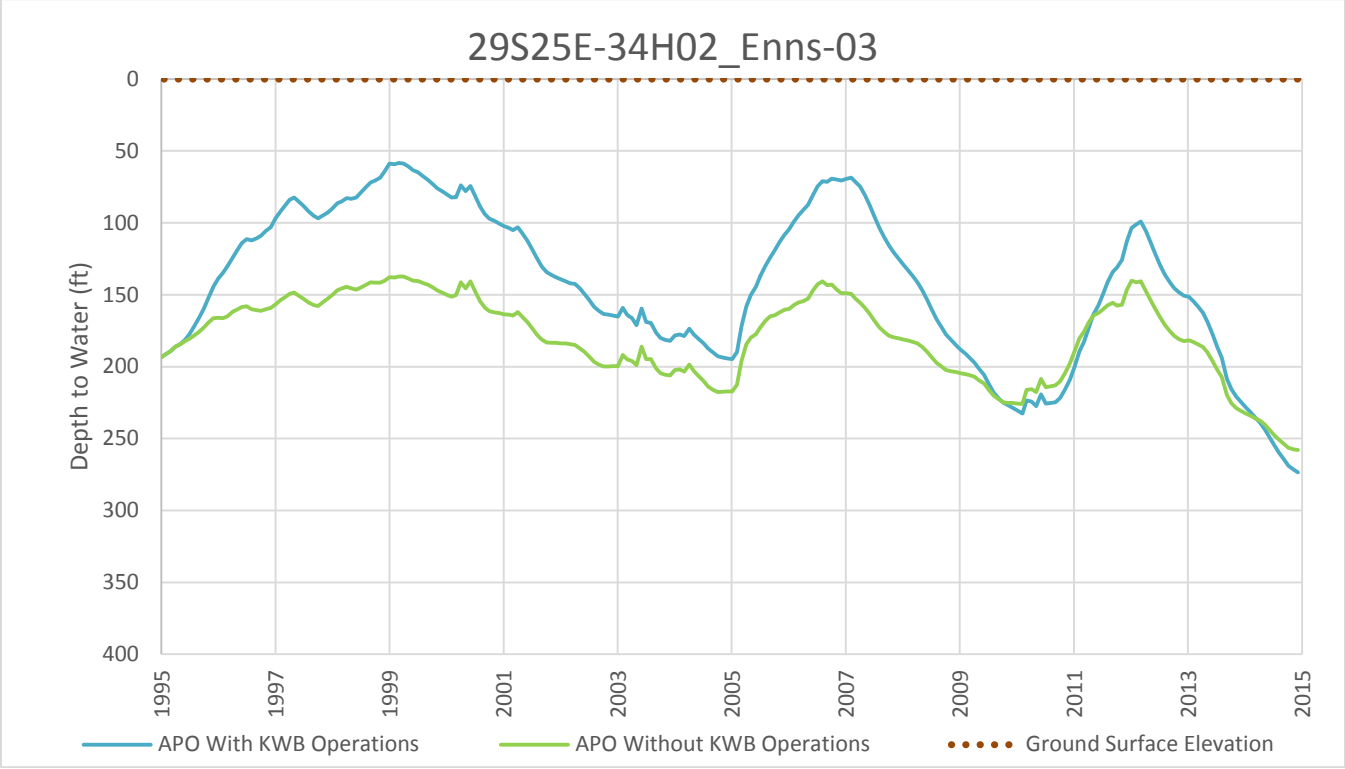


FIGURE 7.1-21. APO: Model Simulated Depth to Water at Production Well 29S25E-34H02 Enns-03

Most private wells are perforated up to approximately 400 feet below ground surface (bgs) and produce water at rates that meet domestic water use requirements. KWB activities lower groundwater levels to approximately 260 feet bgs at the end of the 2007-2009 recovery period and to approximately 300 feet bgs at the end of the 2012-2014 recovery period. This would leave approximately 100 feet of screened well below water, which would provide adequate flow to support operation at sufficient production rates for private wells. Therefore KWB operations are not expected to have a significant effect on operation of neighboring private landowner wells under historical low groundwater conditions except on those wells that are perforated to a depth less than 300 feet bgs.

Most production wells operated by neighboring water districts have screens that are perforated in the deep aquifer up to approximately 700 feet bgs. For example, two Rosedale productions wells that are in the immediate vicinity of the northern KWB boundary have the following screen intervals: 177 to 417 feet bgs (29S25E-34H02 Enns-03) and 457 to 737 feet bgs (29S25E-34H01 Enns-02). The DWR KWB Model predicted that at the shallower Rosedale production well, low water table conditions during 1995-2014 without KWB activities was about 258 feet bgs and with KWB activities was about 274 feet bgs (Figure 7.1-21). This groundwater level is higher than the production well depths of both deeper and shallower Rosedale wells.

Whether KWBA's operations caused an impact that actually was significant at a specific agricultural or domestic well would depend on several factors, such as location of the well, depth of the well and operational depth of the pump, pump efficiency, and pumping rate. Because all of this information for each well is not known, the specific potential impacts of KWB activities with respect to lowering of the local groundwater table at specific wells could not be determined through modeling alone.

However, as described in Revised Appendix E, KWBA and Rosedale developed and implemented an Interim Operations Plan in 2014 (see Appendix 7-5b). The Interim Operations Plan designates measures to be employed to "... prevent, eliminate or mitigate significant adverse impacts" resulting from KWB and Rosedale project operations. Pioneer Project participants and Rosedale subsequently developed and have implemented a similar plan which employs similar measures to prevent, eliminate, or mitigate significant adverse impacts resulting from Pioneer Project and Rosedale project operations.

Each plan requires the formation of a Joint Operations Committee (JOC) that oversees the implementation of the plan, including the establishment of a process to respond to and evaluate landowner claims associated with project operations including claims made prior to the Interim Plan The two separate JOCs have established a process whereby landowner claims are responded to and evaluated at joint meetings and in an otherwise coordinated manner (hereinafter referred to, collectively, as the "JOC").

At the onset of implementation of the plans, the JOC sent letters to those who in 2010 made claims of groundwater impacts to various local groundwater banks and landowners in areas of concern. The letters alerted them to the potential for groundwater level declines to affect their wells and that the groundwater bank participants may be able to provide funds to help alleviate those impacts. As of December 31, 2015, the JOC has evaluated and responded to claims filed before the Interim Plan and has received about 21 new claims from 2015. Of the pre-Interim Plan claims, 8 were processed for payment and 8 were rejected. Of the 2015 claims filed after the Interim Plan, 13 have been processed for payment, 6 have been rejected, and 3 are pending.

To date, the JOC has authorized payments totaling approximately $447,800 as mitigation for the processed claims. These payments have been pro-rated based on the relative contribution of each of the projects toward an impact. The KWB share of these payments has been about 15%; the other projects' collective share (Rosedale and Pioneer) has been about 85%.

The payments have been used for the following improvements: providing a permanent connection to a municipal water supply, lowering pumps in existing wells, and drilling deeper wells. These improvements provide for a more reliable water supply during the current and future droughts, such that future impacts are less likely to occur because wells particularly vulnerable to declining groundwater levels have already been permanently mitigated. The JOC has also paid for and provided emergency water for domestic uses while evaluating claims, where needed.

Therefore, the impact of KWB operations from 1995 to 2014 depleted groundwater supplies and lowered the local groundwater table level (e.g., the production rate of pre-existing nearby wells would dropped to a level that would not support existing land uses or planned uses for which permits have been granted). KWBA, however, implemented measures and impacts were ***less than significant.***

Mitigation Measures

None required.

2015 – 2035 (Analysis of Future Operations—Existing Conditions)

Potential impacts of future (2015–2035) KWB activities under existing conditions (2015 level of development) on the local groundwater table were evaluated by comparing simulated groundwater elevations from the “With KWB Operations” model run with those from the “Without KWB Operations” model run under AFO-EC scenario.

Figure 7.1-22 shows line of groundwater differences that indicate the extent of the lowering of local water table due to KWB activities. The line labeled as “-30 feet” show the outermost edge of model cells where water levels were lowered by more than 30 feet due to KWB activities at least in one time step (month) during the 2015-2035 model simulation period under existing conditions (2015 level of development). Figure 7.1-22 shows that lowering of the water table of more than 30 feet has occurred to agricultural land inside Rosedale’s southern boundary.

Figure 7.1-23 shows location of the wells that lie in areas outside of KWB Lands, where lowering of the water table is between 30 feet and 75 feet, due to KWB activities under the AFO-EC scenario. Table 7.1-6 lists the range of maximum drawdowns at those wells located outside of KWB Lands. Since no wells are located at the point of maximum drawdown outside KWB Lands, the greatest drawdown seen in an individual well is 66 feet.

Modeled depth to water (DWR KWB Model) at well (30S25E-02L02 SREX-06) nearest to the KWB boundary on the north is shown in Figure 7.1-24 for both “With KWB Operations” and “Without KWB Operations” model runs under AFO-EC scenario. Historical fluctuations in groundwater levels in the DWR KWB Model area have been measured up to 246 feet; therefore, these model-predicted drawdowns associated with KWB activities are well within normal fluctuations. During KWB recovery period, additional drawdown between 30 to 75 feet may have no adverse effects on pre-existing nearby wells and their ability to produce water to support existing or planned land uses.

Most private wells are perforated up to approximately 400 feet bgs and produce water at rates that meet domestic water use requirements. KWB activities lower groundwater levels to approximately 340 feet bgs at the end of the 2015 recovery period and to approximately 310 feet bgs at the end of the 2033-2035 recovery period. This would leave approximately 60 feet of screened well below the water level, which would provide adequate flow to support operation at sufficient production rates for private wells.

However, whether KWBA's operations would cause an impact that would be potentially significant at a specific agricultural or domestic well would depend on several factors, such as location of the well, depth of the well and operational depth of the pump, pump efficiency, and pumping rate. Because all of this information for each well is not known, the specific potential impacts of KWB activities with respect to lowering of the local groundwater table at specific wells could not be determined through modeling alone. Consequently, lowering of the local water table at sites in the vicinity of KWB could have adverse effects at individual wells.

Therefore, the impact of KWB future operations under existing conditions from 2015 to 2035 could potentially deplete groundwater supplies so that a lowering of the local groundwater table level would occur (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted). This impact would be ***potentially significant***.

2015 – 2035 (Analysis of Future Operations—Build-out Conditions)

Potential impacts of future (2015–2035) KWB activities under build-out conditions (2030 level of development) on local groundwater table were evaluated by comparing simulated groundwater elevations of the "With KWB Operations" and "Without KWB Operations" model runs under AFO-BC scenario.

Figure 7.1-26 shows lines of groundwater differences that indicate extent of the lowering of local water table due to KWB activities. The line labeled as "-30 feet" show the outermost edge of model cells where water levels were lowered by more than 30 feet due to KWB activities at least in one time step (month) during the 2015-2035 model simulation period under build-out conditions (2030 level of development). Figure 7.1-26 shows that lowering of the water table of more than 30 feet has occurred in agricultural land inside Rosedale's southern boundary.

Figure 7.1-27 shows location of the wells that lie in areas outside of the KWB Lands, where lowering of the water table is between approximately 30 and 80 feet, due to KWB activities under AFO-BC scenario. Table 7.1-7 lists the range of maximum drawdowns at these wells located outside of the KWB Lands. Since no wells are located at the point of maximum drawdown outside KWB, the greatest drawdown seen in an individual well is 66 feet.

Modeled depth to water (DWR KWB Model) at well (30S25E-02L02 SREX-06) nearest to the KWB boundary on the north is shown in Figure 7.1-28 for both "With KWB Operations" and "Without KWB Operations" model runs under the AFO-BC scenario. The modeled groundwater elevation of this well decreases by 260 feet from 2028 through 2030. Historical groundwater fluctuations in the KWB area have been measured of up to 246 feet. Therefore, the model-predicted drawdowns associated with KWB activities are within these recorded fluctuations. During the KWB recovery period, an additional drawdown between approximately 30 to 80 feet may have no adverse effects on pre-existing nearby wells and their ability to produce water to support existing or planned land uses.

Most private wells are perforated up to approximately 400 feet bgs and produce water at rates that meet domestic water use requirements. KWB activities lower groundwater levels to approximately 360 feet bgs at the end of the 2015 recovery period and to approximately 340 feet bgs at the end of the 2033-2035 recovery period. This would leave approximately 40 feet of screened well below water, which would provide adequate flow to support operation at sufficient production rates for private wells.

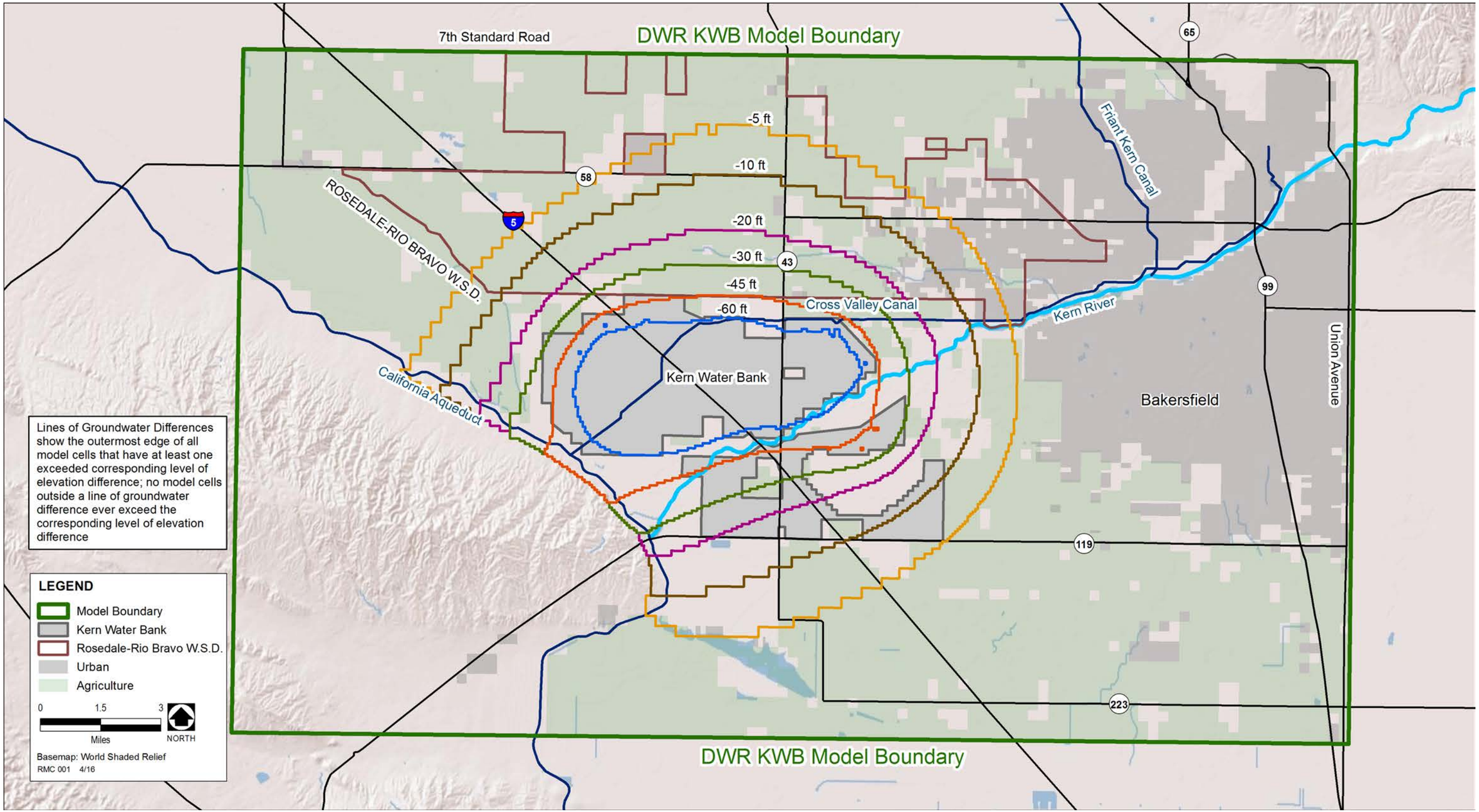


FIGURE 7.1-22. AFO-EC: Contours of Maximum Extent of Negative Differences ("With" minus "Without" KWB Operations), 2015–2035

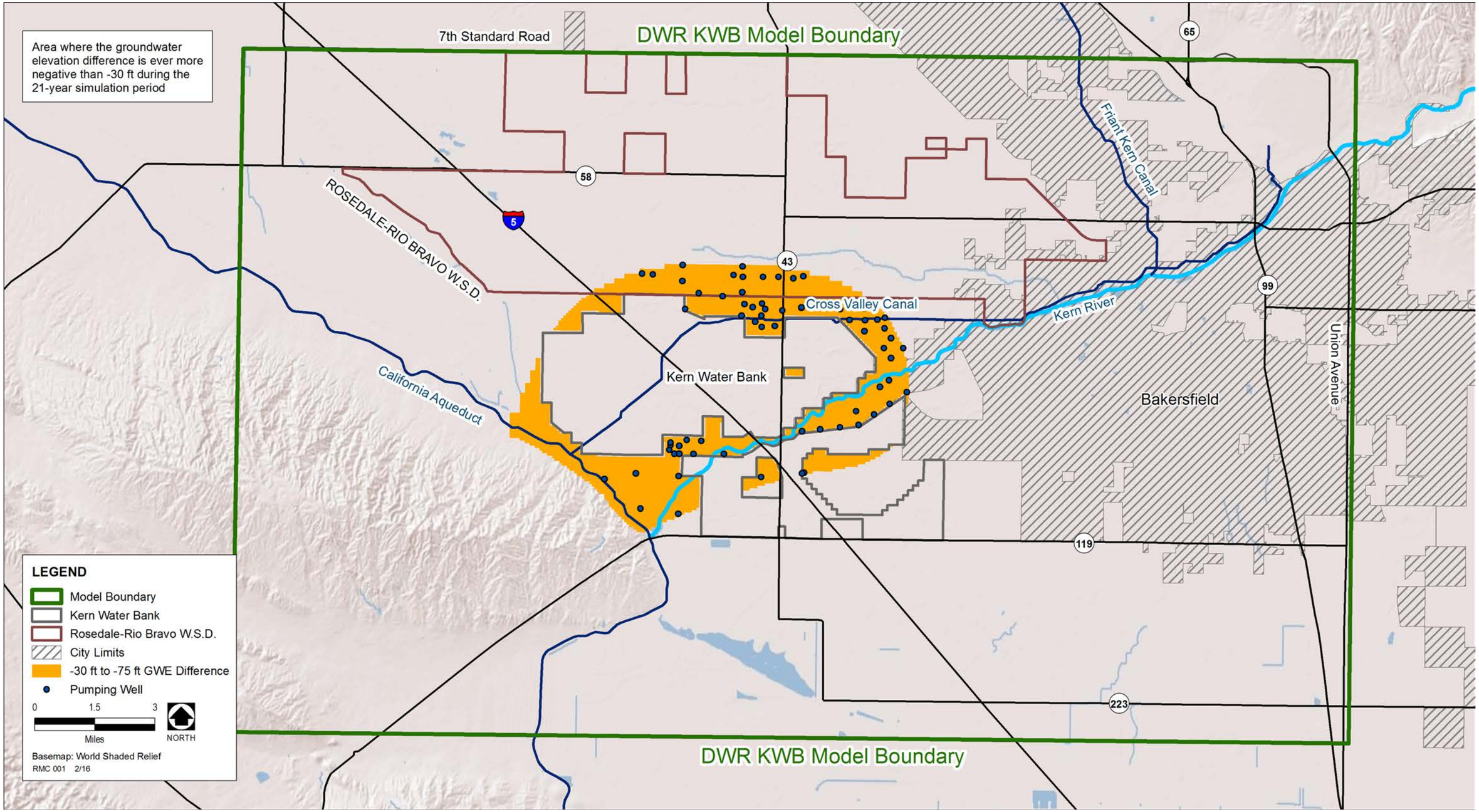


FIGURE 7.1-23. AFO-EC: Location of DWR KWB Model Wells in Areas with Groundwater Elevation Difference Between -30 feet and -75 feet ("With KWB Operations" minus "Without KWB Operations"), 2015–2035 *(These drawdowns reflect maximum drawdown simulated anywhere outside KWB. Maximum drawdown at any well is 66 feet. See Table 7.1-6.)*

TABLE 7.1-6

AFO-EC RESULTS: MAXIMUM DRAWDOWN IN EXISTING WELLS OUTSIDE KWB BOUNDARY

Well Locations	Range of Maximum Drawdown* Simulated in Existing Wells
North of KWB Boundary	30 feet to 63 feet
East of KWB Boundary	30 feet to 45 feet
Southeast of KWB Boundary (2800 Acres and Improvement District No. 4 area)	30 feet to 54 feet
Southwest of KWB Boundary (West Kern Water District)	33 feet to 66 feet

*These drawdowns reflect maximum drawdown simulated in existing wells. Maximum drawdown anywhere outside KWB is 75 feet, which occurs in a location where there are no existing wells. See Figure 7.1-23.

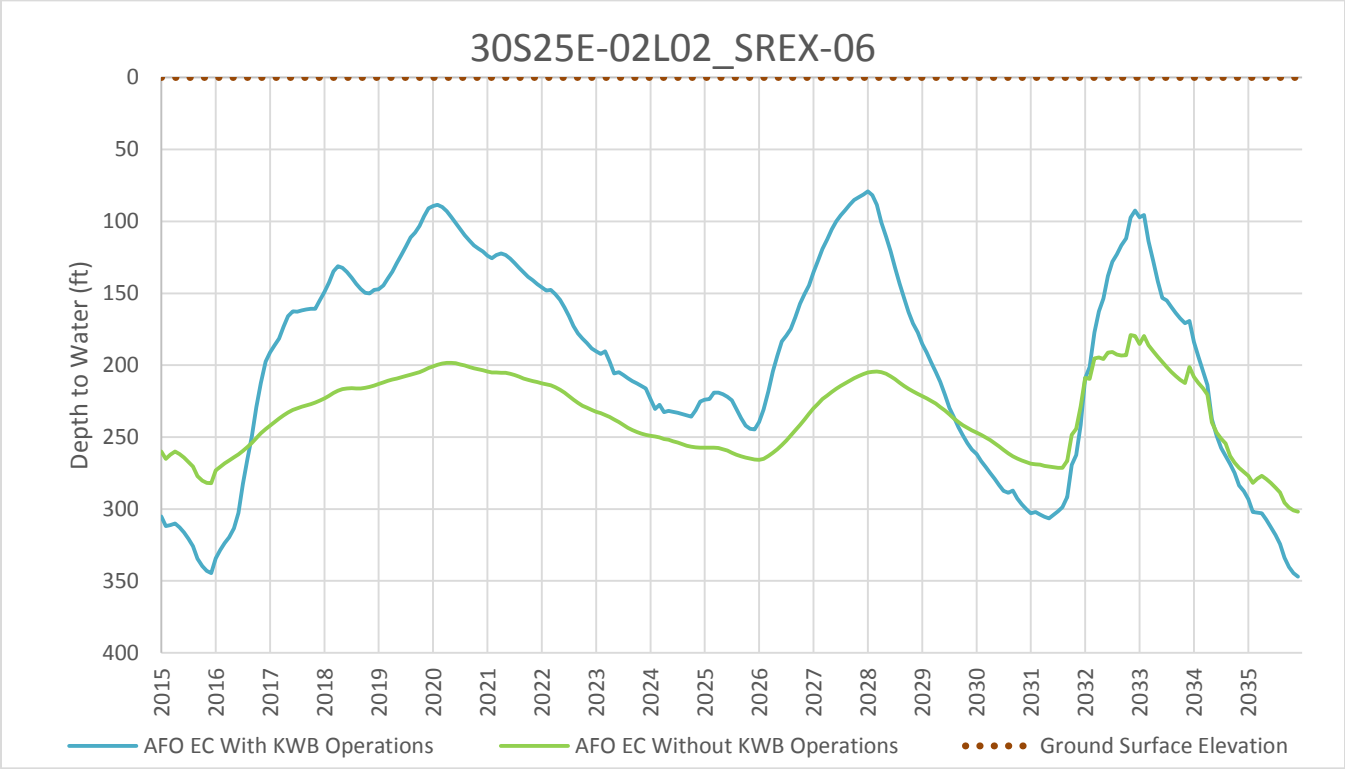


FIGURE 7.1-24. AFO EC: Model Simulated Depth to Water at Production Well 30S25E-02L02 SREX-06

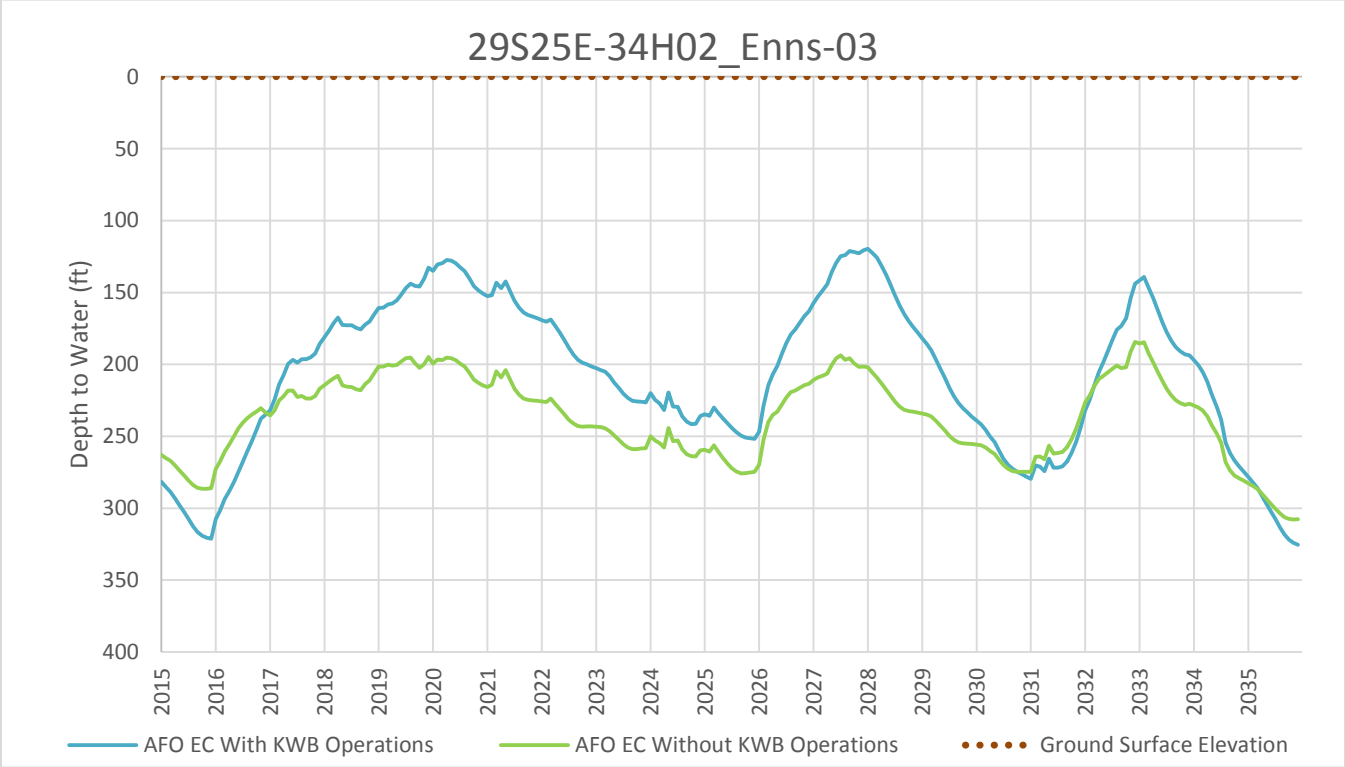


FIGURE 7.1-25. AFO EC: Model Simulated Depth to Water at Production Well 29S25E-34H02 Enns-03

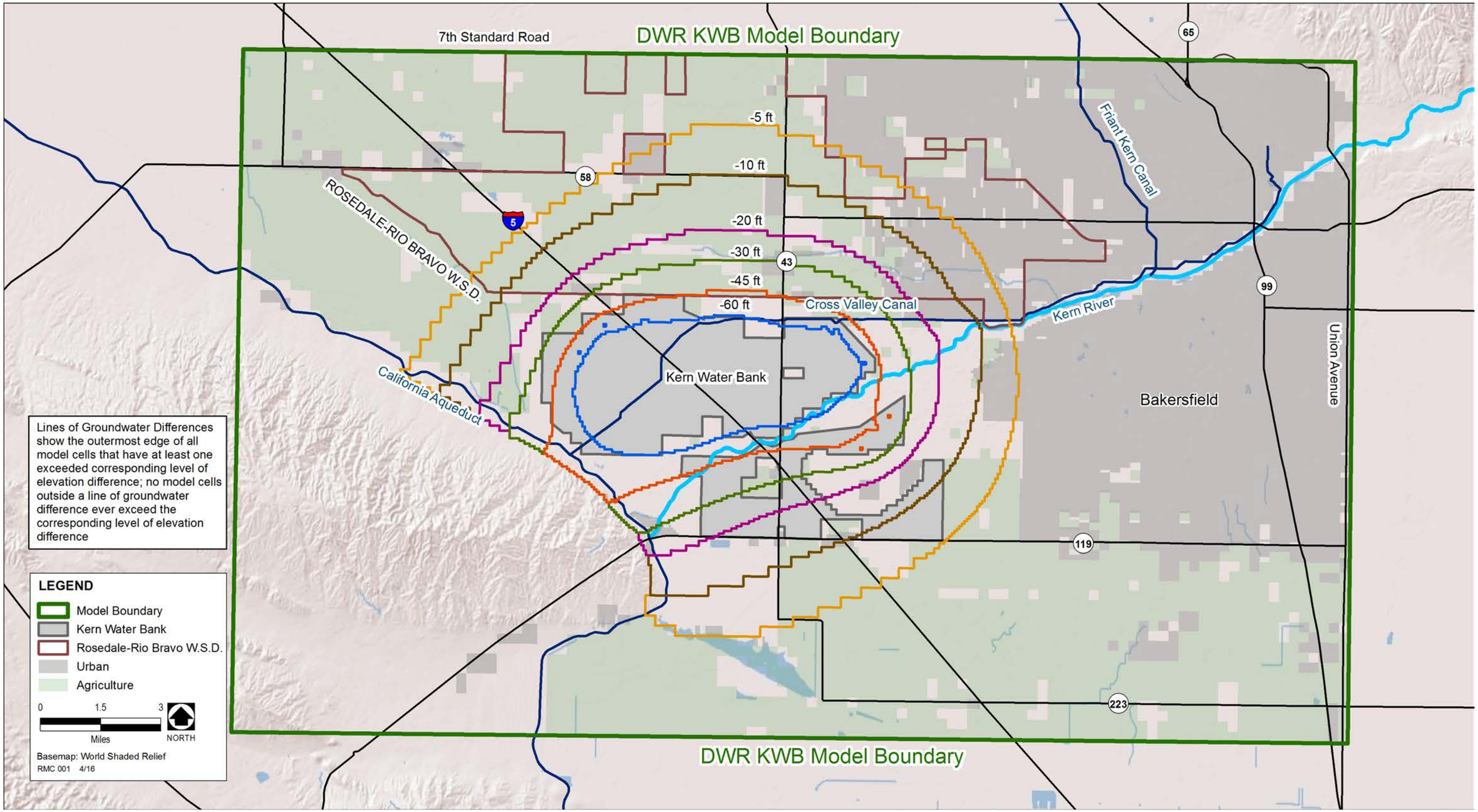


FIGURE 7.1-26. AFO-BC: Contours of Maximum Extent of Negative Differences ("With" minus "Without" KWB Operations), 2015–2035

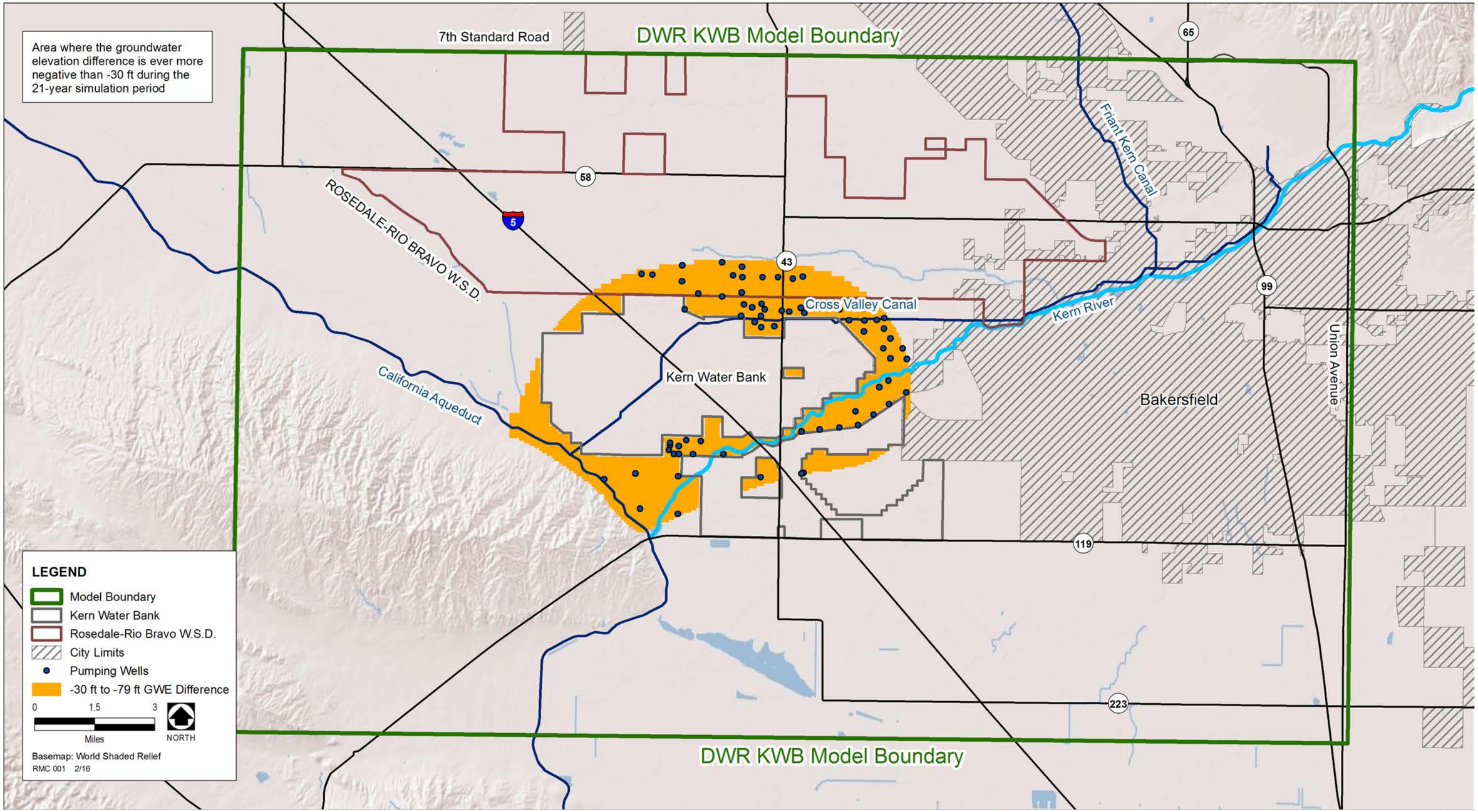


FIGURE 7.1-27. AFO-BC: Location of DWR KWB Model Wells in Areas with Groundwater Elevation Difference Between -30 Feet and -79 feet ("With KWB Operations" minus "Without KWB Operations"), 2015–2035 *(These drawdowns reflect maximum drawdown simulated anywhere outside KWB. Maximum drawdown at any well is 66 feet. See Table 7.1-7.)*

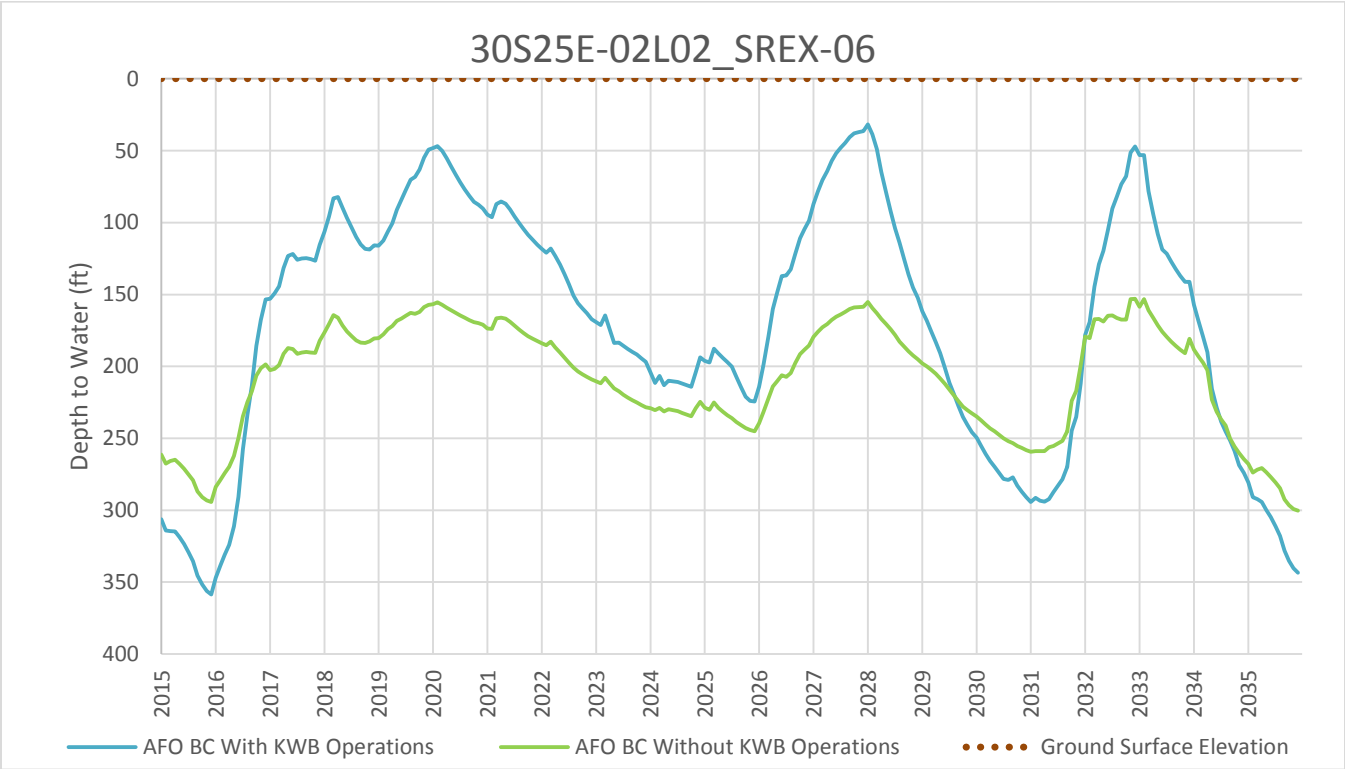


FIGURE 7.1-28. AFO BC: Model Simulated Depth to Water at Production Well 30S25E-02L02 SREX-06

TABLE 7.1-7

AFO-BC RESULTS: MAXIMUM DRAWDOWN IN EXISTING WELLS OUTSIDE KWB BOUNDARY

Well Locations	Range of Maximum Drawdown* Simulated in Existing Wells
North of KWB Boundary	30 feet to 63 feet
East of KWB Boundary	30 feet to 46 feet
Southeast of KWB Boundary (2800 Acres and Improvement District No. 4 area)	30 feet to 54 feet
Southwest of KWB Boundary (West Kern Water District)	33 feet to 66 feet

**These drawdowns reflect maximum drawdown simulated in existing wells. Maximum drawdown anywhere outside KWB is 79 feet, which occurs in a location where there are no existing wells. See Figure 7.1-27.*

Therefore KWB activities are not expected to have a significant effect on operation of neighboring private landowner wells under historical low groundwater conditions except on those wells that are perforated to a depth less than 380 feet bgs, which would result in less than 20 feet of screened well below water for usage.

Most production wells operated by neighboring water districts have screens that are perforated in the deep aquifer up to approximately 700 feet bgs. For example, two Rosedale productions wells that are in the immediate vicinity of the northern KWB boundary have screen intervals: 177 to 417 feet bgs (29S25E-34H02 Enns-03) and 457 to 737 feet bgs (29S25E-34H01 Enns-02), respectively. The DWR KWB Model predicted that at the shallower Rosedale production well, low water table conditions during

2015-2035 without KWB activities was about 305 feet bgs and with KWB activities was about 334 feet bgs (Figure 7.1-29). This groundwater level is higher than the production well depths of both deeper and shallower Rosedale wells. Since typical production wells are perforated up to 700 feet bgs, KWB activities are not expected to have a significant effect on operation of neighboring production wells under historical low groundwater conditions.

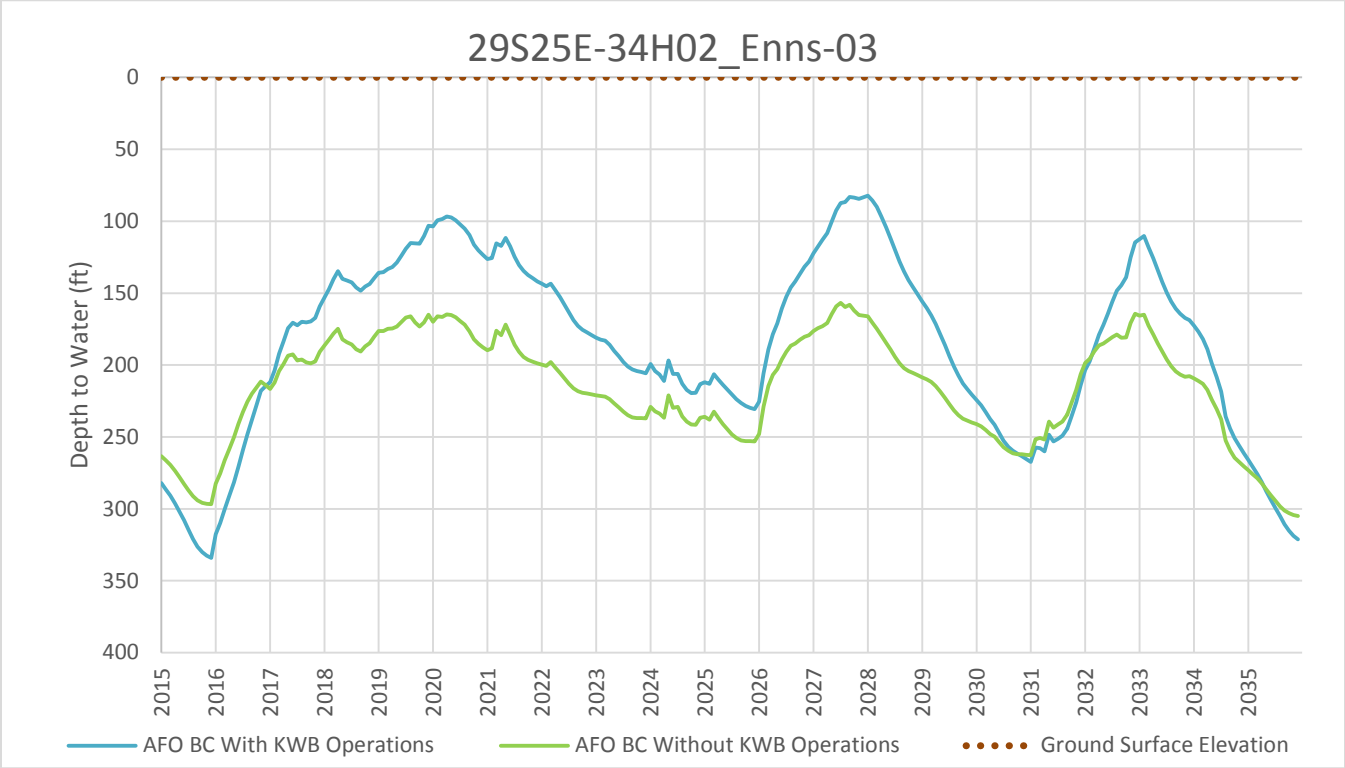


FIGURE 7.1-29. AFO BC: Model Simulated Depth to Water at Production Well 29S25E-34H02 Enns-03

However, whether KWBA's operations would cause an impact that would be potentially significant at a specific agricultural or domestic well would depend on several factors, such as location of the well, depth of the well and operational depth of the pump, pump efficiency, and pumping rate. Because all of this information for each well is not known, the specific potential impacts of KWB activities with respect to lowering of the local groundwater table at specific wells could not be determined through modeling alone. Consequently, lowering of the local water table at sites in the vicinity of KWB could have adverse effects at individual wells.

Therefore, the impact of KWB future operations under build-out conditions from 2015 to 2035 could potentially deplete groundwater supplies so that a lowering of the local groundwater table level would occur (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted). This impact would be ***potentially significant.***

<u>Mitigation Measures (for Future Existing and Build-out Conditions)</u>

KWB activities could result in a potentially significant impact to groundwater elevations near KWB during major recovery periods. Continued well monitoring and implementation of existing agreements regarding KWB operations offer the most feasible and pragmatic approach (i.e., the 1995 KWB MOU,

see Appendix 7-5a; and the 2014 Interim Operations Plan, see Appendix 7-5b). Rosedale has also adopted a long-term operations plan to prevent, eliminate, or mitigate potential impacts from its projects. Rosedale's plan is part of its Stockdale Integrated Banking Project Final EIR dated November 2015. KWBA has adopted the 2016 KWB Long-Term Project Recovery Operations Plan (see Appendix 7-5c) that prevents, eliminates, or mitigates potential impacts from the KWB. It is possible that a joint long-term agreement will be developed in the near future between KWBA, Rosedale, and the Pioneer Project for the coordinated implementation of a long-term banking operations plan that includes standards that address potential cumulative impacts of the participating banks. Mitigation Measure 7.1-2 therefore builds on these existing and proposed agreements.

Implementation of Mitigation Measure 7.1-2 would reduce this impact to less than significant. KWBA is obligated to carry out the measures in Mitigation Measure 7.1-2 (see Section 7.0.4.3.2, 2016 KWBA Resolution). Therefore, impacts from KWB activities with regard to groundwater elevations near the KWB during major recovery periods are ***less than significant, with mitigation.***

7.1-2 *KWBA will establish a program that meets the following requirements in accordance with the Long-Term Project Recovery Operations Plan regarding the Kern Water Bank Project (2016 KWB Long-Term Operations Plan, Appendix 7-5c):*

A. ***Monitor and Report Groundwater Conditions to KWBA's Board of Directors and the Public***

1) *KWBA will monitor groundwater levels monthly, except during periods of no recovery when monitoring will occur at least quarterly. KWBA may rely on monitoring conducted by the Kern Fan Monitoring Committee to meet these requirements.*

2) *KWBA will report current groundwater levels to its Board of Directors at each monthly regular meeting, and will make the reports available to the public on its website (http://www.kwb.org/).*

3) *KWBA will regularly update its Groundwater Model (Model) to actual conditions and use the Model to project future groundwater conditions. KWBA will endeavor to use the best practicable science and latest information available in all modeling and technical matters. KWBA will report the results of its modeling to its Board of Directors and will make the results available to the public on its website (http://www.kwb.org/). Recovery of banked groundwater in any calendar year beyond March 15 of that year shall not commence (or continue) until the Model has been run for projected KWB operations and the results have been reported to KWBA's Board of Directors and made available to the public. Because model data for a preceding year becomes available at different times in the following year, modeling at the beginning of any given year will necessitate estimating certain model input data for the preceding year (e.g., Kern River losses). These estimates will be replaced with actual data at regular intervals when the model is updated.*

B. ***Implement Proactive Measures (in addition to A above)***

1) *KWBA will use its Model as a tool to evaluate potential groundwater impacts resulting from its project operations. The Model will be periodically run and updated as projected recovery plans become known or changed and the Model will assume such conditions as described in A.3.*

2) *The Model will be used to:*

   a) *Forecast groundwater levels.*

   b) *Forecast and predict the contribution of KWB Operations to groundwater level declines in the area.*

   c) *Determine water level conditions with "Without KWB Operations" for purposes of evaluating the potential impact of "With KWB Operations". The "Without KWB Operations" is the water level that would have been at any particular well location absent "KWB Operations."*

   d) *Identify, based upon an analysis of "Without KWB Operations" versus "With KWB Operations," if a* ***negative potential impact ("NPI")*** *has or is likely to occur for which the measures described at D, E, and F may be operative.* ***NPI*** *is determined according to C.1 below.*

   e) *Forecast any localized areas for special attention and/or additional monitoring where groundwater levels will decline 30 or more feet below the "Without KWB Operations" groundwater level.*

   f) *Identify wells at risk of potential impacts during recovery operations.*

3) *KWBA will provide notification on its website if the Model shows that an* ***NPI*** *has or is likely to occur, including steps that potentially affected landowners must follow if the landowner desires to make a claim to KWBA regarding potential well impacts due to KWBA's recovery operations.*

C. ***Implement Triggers and Actions***

The actions described in sections D, E, and F will be implemented in consultation with affected landowners/well owners that make a claim to KWBA regarding well impacts relating to KWBA's recovery operations and groundwater level declines, subject to the following:

1) *The trigger for mitigation shall be based upon an analysis and comparison of Model generated "Without KWB Operations" versus "With KWB Operations." When "With KWB Operations" are 30 feet deeper than the "Without KWB Operations" at an operative well, and the well has (or is expected to) experience mechanical failure or other operational problems due to declining water levels, a* ***negative potential impact ("NPI")*** *is triggered. If KWBA enters into a joint operations agreement with other water*

*banks in the area, the depth at which a **NPI** is triggered shall provide an equivalent measure of potential impact as described in the 2016 KWB Long-Term Operations Plan (Appendix 7-5c).*

2) *For a well owner to be eligible for mitigation as provided below, the affected landowner shall submit a claim to KWBA, in accordance with the Government Claims Act, which shall, at a minimum, provide information concerning the condition of the well and casing and pumping equipment of the well, and other information that is relevant to the landowner's claim. Upon receipt of a claim, KWBA shall use the Model (or the results of modeling as reported to the Board and the public) to determine whether an **NPI** exists at the landowner's well and respond with the appropriate action described below.*

3) *KWBA will provide mitigation and/or compensation for the KWB Operations' contribution to the adverse impact. Mitigation and/or compensation is not required for a well owner's lack of well maintenance, normal wear and tear, depreciation, failure of well equipment, well casing degradation, etc., or other reasons not relating to KWB Operations.*

D. *Implement Action for Agricultural Wells When Well Adjustment Is Needed and Available*

1) *Trigger: When the Model predicts **NPI** for an operational agricultural well outside the current operating range of the pump but within the potential operating range of the well.*

2) *KWBA actions will be completed within 60 days (provided that the land/well owner cooperates) from receipt of a claim as follows:*

   a) *Field verify (with the affected landowner if requested) static depth to groundwater levels within the well and compare to Model values to determine if flow stoppage is due to groundwater level decline due to KWB operations. If needed:*

      - *Obtain right-of-entry permit and well data release from well owner.*
      - *Collect pump manufacturer data, the in-situ pump setting, and casing depth information.*

   b) *Compare pump setting information with Model projected pumping water levels throughout the year to determine pump submergence levels and evaluate the necessity and feasibility of lowering the well pump to meet the landowner's needs to provide the least-cost short and long-term solution.*

   c) *Develop a cost estimate to complete the necessary work.*

d) Develop and submit a report to the landowner informing the landowner of the findings and proposed actions, including denying the claim because groundwater declines are not due to KWB operations.

3) *At KWBA's option, it may reduce or adjust pumping of its wells as necessary to prevent, avoid, or eliminate the **NPI**, using the Model to identify the well or wells that may require reduction or adjustment in pumping.*

4) *If groundwater declines are due to KWB operations, unless D.3 occurs, once agreement is reached between KWBA and the landowner pursuant to D.2.b and all cost estimates have been completed, pay costs associated with the landowner claim (considering C.3 above), including the cost to complete the necessary work.*

E. *Implement Action for Agricultural Wells When Well Adjustment Is Unavailable*

1) *Trigger: When the Model predicts **NPI** for an operational agricultural well outside the current and potential operating range of the well.*

2) *KCWA actions will be completed within 60 days (provided that the land/well owner cooperates) from receipt of a claim as follows:*

a) Field verify (with the affected landowner if requested) static depth to groundwater levels within the well and compare to Model values to determine if flow stoppage is due to groundwater level decline due to KWB operations. If needed:

- *Obtain right-of-entry permit and well data release from well owner.*
- *Collect pump manufacturer data, the in-situ pump setting, and casing depth information.*

b) Identify water of an equivalent water quantity and quality suitable for agricultural uses for the affected landowner from an alternate source at no greater cost to the affected landowner or, with the consent of the affected landowner, identify acceptable mitigation (for example, drill and equip a new well) to provide the least-cost short- and long-term solution, including an estimate to complete the necessary work.

Develop and submit a report to the landowner informing the landowner of the findings and resulting proposed actions, including denying the claim because groundwater declines are not due to KWB operations.

3) *At KWBA's option, it may reduce or adjust pumping of its wells as necessary to prevent, avoid, or eliminate the **NPI** using the Model to identify the well or wells that may require reduction or adjustment in pumping.*

4) *If groundwater declines are due to KWB operations, unless E.3 occurs, once an agreement is reached between KWBA and the landowner to provide mitigation pursuant to E.2.b and all cost estimates have been completed, pay costs associated with the landowner claim (considering C.3 above), including the cost to complete the necessary work.*

F. *Implement Action for Domestic Wells*

1) *Trigger: When the Model predicts **NPI** for a domestic well that is outside the current operating range of the pump but within the potential operating range of the well production.*

2) *KWBA's actions will be completed within 60 days (provided that the land/well owner cooperates) from receipt of a claim as follows:*

   a) *Field verify (with the affected landowner if requested) static depth to groundwater levels within the well and compare to Model values to determine if flow stoppage is due to groundwater level decline. If needed:*

      - *Obtain right-of-entry permit and well data release from well owner.*
      - *Collect pump manufacturer data, the in-situ pump setting, and casing depth information.*

   b) *Identify availability and cost of a permanent connection to the nearest water service provider.*

   c) *Identify acceptable mitigation (for example, lower the domestic submersible pump bowl setting sufficient to restore and maintain service or drill and equip a new well that complies with applicable county well standards) to provide the least-cost short- and long-term solution, including an estimate to complete the necessary work.*

   d) *Develop and submit a report to the landowner informing the landowner of the findings and resulting proposed actions, including denying the claim because groundwater declines are not due to KWB operations.*

   e) *If necessary for emergency health and safety concerns, provide interim in-home water supplies within 14 days after receipt of the claim until a permanent mitigation action is implemented or the claim has been denied because groundwater declines are not due to KWB operations.*

3) *At KWBA's option, it may reduce or adjust pumping of its wells as necessary to prevent, avoid, or eliminate the **NPI** using the Model to identify the well or wells that may require reduction or adjustment in pumping.*

4) *If groundwater declines are due to KWB operations, unless F.3 occurs, once an agreement is reached for KWBA to provide mitigation pursuant to F.2.c*

above and all cost estimates have been completed, pay costs associated with the landowner claim (considering C.3 above), including the cost to complete the necessary work.

7.1-3 Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on or off site.

1995 – 2014

The KWB has a self-contained system of recharge and recovery facilities (i.e., recharge ponds and pumping wells), entirely within KWB Lands. Existing conveyance facilities and stream courses (i.e., canals, aqueducts, and streams) in the area were used to receive recharge water and deliver recovered water. The recharge ponds were constructed on flat KWB Lands that were fallowed; construction or operations of these ponds did not alter the existing drainage pattern of the KWB or the neighboring area. The KWB facilities were built alongside the existing Kern River stream channel, but no modifications were made to any portion of the stream channel. KWB activities have had negligible impacts on the rate and amount of surface runoff, and have not contributed to flooding on or off site.

Therefore, the impact of KWB activities from 1995 to 2014 on the existing drainage patterns or on the rate or amount of surface runoff that would result in flooding on or off site was ***less than significant.***

<u>Mitigation Measures</u>

None required.

2015 – 2035

Near-term future KWB activities include construction of approximately 190 acres of recharge ponds and three wells under the ongoing Integrated Regional Water Management (IRWM) program (Kern Water Recharge and Recovery Project). Longer-term future construction of approximately 862 acres of additional recharge ponds and associated facilities is anticipated as part of full build-out. KWBA has also issued a Notice of Preparation in 2012 for the proposed Kern Water Bank Conservation and Storage Project, which would use existing facilities to divert water from the Kern River to increase reliability and enhance the dry-year water supply of KWBA's participating members through storage in the KWB. No new water conveyance facilities to convey KWB-recovered water are anticipated to be constructed by KWB participants; KWB participants already have facilities in place to convey and exchange recovered water.

The KWB has a self-contained system of recharge and recovery facilities (i.e., recharge ponds and pumping wells), entirely within KWB Lands. Existing conveyance facilities and stream courses (i.e., canals, aqueducts, and streams) in the area are used to receive recharge water and deliver recovered water. Future recharge ponds would be constructed on flat KWB Lands; construction or operations of these ponds and related facilities would not alter the existing drainage pattern of the KWB or the neighboring area. The proposed KWB facilities would not require modifications to any stream channels. KWB activities would have negligible impacts on the rate and amount of surface runoff, and would not contribute to flooding on or off site.

Therefore, the impact of existing and future KWB facilities and activities from 2015 to 2035 on the existing drainage patterns or on the rate or amount of surface runoff that would result in flooding on or off site would be ***less than significant.***

Mitigation Measures

None required.

7.1-4 Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.

1995 – 2014

The KWB is a groundwater bank with recharge and recovery facilities that serves water primarily for agricultural uses. It does not include any housing construction or place housing within a 100-year flood hazard area.

Therefore, KWB activities during 1995 to 2014 did not place housing within a 100-year flood hazard area and there was ***no impact***.

Mitigation Measures

None required.

2015 – 2035

The KWB is a groundwater bank with recharge and recovery facilities that serves water for primarily agricultural uses. It does not include any onsite housing construction. In the future, the KWB would continue to be a groundwater bank with recharge and recovery facilities that would operate in a similar fashion The KWB would not include any future onsite housing construction or place housing within a 100-year flood hazard area.

Therefore, KWB activities during 2015 to 2035 would not place housing within a 100-year flood hazard area and there would be ***no impact***.

Mitigation Measures

None required.

7.1-5 Place within a 100-year flood hazard area structures that would impede or redirect flood flows.

1995 – 2014

The Kern River passes through the KWB area. The KWB is a groundwater bank with limited physical facilities such as recharge ponds, canals, recharge and pumping stations, access roads, and underground recovery wells. No aboveground structures related to the KWB impeded or redirected Kern River flood flows.

Therefore, impacts from KWB activities from 1995 to 2014 did not place any structures that would impede or redirect flood flows. The impact was ***less than significant***.

Mitigation Measures

None required.

2015 – 2035

The Kern River passes through the KWB area. The KWB is a groundwater bank with limited physical facilities such as recharge ponds, canals, recharge and pumping stations, access roads, and underground recovery wells. Construction and operations of new recharge ponds and related facilities would not place structures that would impede or redirect flood flows or alter the existing drainage pattern of the KWB or the neighboring area. No above ground structures related to the KWB would impede or redirect Kern River flood flows.

Therefore, impacts from KWB activities from 2015 to 2035 would not place any structures that would impede or redirect flood flows. The impact would be ***less than significant***.

Mitigation Measures

None required.

7.1-6 Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam; or cause inundation by seiche, tsunami, or mudflow.

1995 – 2014

The KWB is located on a generally flat, relatively barren land area with little infrastructure including recharge ponds, canals, recharge and pumping stations, access roads, and underground recovery wells. There are no levees or dams as part of the KWB, nor do KWB activities affect risk of failure of any levee or dam. The inland and level location of the KWB and its nature ensured that it did not cause inundation by seiche, tsunami, or mudflow.

Therefore, KWB activities during 1995 to 2014 would not expose people or structures to any risk of loss, injury, or death involving flooding. There was ***no impact****.*

Mitigation Measures

None required.

2015–2035

As of 2035, the KWB would continue to be located on a flat, relatively barren land area with little infrastructure including recharge ponds, canals, recharge and pumping stations, access roads, and underground recovery wells. Some additional recharge ponds and related facilities would be constructed and in operation under build-out conditions. There are no levees or dams as part of the KWB, nor would KWB activities affect risk of failure of any levee or dam. The inland and level location of the KWB and its nature ensures that it would not cause inundation by seiche, tsunami, or mudflow.

Therefore, KWB activities during 2015 to 2035 would not expose people or structures to any risk of loss, injury, or death involving flooding. There would be ***no impact****.*

Mitigation Measures

None required.

7.1-7 Raise groundwater levels sufficiently to substantially impact existing infrastructure (e.g., Cross Valley Canal).

Historic recharge operations at the KWB during the past recharge periods of 1995-1998, 2005-2006, and 2011, together with similar recharge operations at other neighboring groundwater banks, resulted in high groundwater elevations within KWB Lands and surrounding areas. Approximately 7 miles of the CVC are located within KWB Lands, and past high groundwater elevations may have contributed to damages to the CVC lining in the mid-1990s. Results of APO, AFO-EC, and AFO-BC model scenarios were evaluated to determine the potential impact of KWB recharge operation during high groundwater elevations on the CVC.

1995 – 2014 (Analysis of Past Operations)

Impacts of KWB recharge operations during high groundwater elevations for APO on the CVC were evaluated by analyzing water levels at locations along the CVC.

Figure 7.1-30 shows the locations of the two selected water level hydrographs along the CVC. The hydrograph locations were selected based on locations of the piezometers jointly owned by KCWA and KWBA and pumping stations of the CVC to provide known points of reference while analyzing water levels at two distinct locations along the CVC within KWB; these hydrographs are used to demonstrate the impacts on the CVC.

Figure 7.1-32 shows the groundwater level hydrographs at two selected locations along the CVC. The hydrographs show the water levels at the selected locations for the APO With and Without KWB operations, ground surface elevation, and the CVC invert elevation. The modeled potential and actual impacts of the KWB recharge operations on the CVC are discussed below.

<u>Modeled Potential Impacts on the CVC</u>

Modeled potential impacts on the CVC are as follows:

- 1995-1998 Recharge Operations – Water levels rose to within 5 feet from ground surface as shown in the hydrograph in the western part of KWB Lands while the water levels were lower in the hydrograph north of KWB Lands.
- 2005-2006 Recharge Operations – Water levels rose to within 5 feet from ground surface as shown in the hydrograph in the western part of KWB Lands while the water levels were lower in the hydrograph north of KWB Lands.
- 2011 Recharge Operations – Water levels were lower than 50 feet from surface as shown in the two hydrographs along the CVC in the KWB area. Water levels in 2011 were generally lower than that after 1995-1998 and 2005-2006 recharge operations. This is partly due to 2011 being a single-year recharge period while the other two recharge periods are four- and two-year recharge periods, respectively.

<u>Actual Impacts on the CVC</u>

During 1998, damage occurred to the CVC. High groundwater resulting from natural conditions, offsite recharging, or recharging on the KWB Lands could impact the integrity of CVC structures or cause cracks in sub-surface concrete panels. Discussions between KWBA and KCWA (which operates the CVC) resulted in repairs to the CVC in the early 2000s. As part of the discussions, KWBA and KCWA agreed to the following water level monitoring and recharge operations management (Appendix 7-5e):

a). Several measures had already been undertaken by KWBA including installing a shallow groundwater monitoring network, conducting regular monitoring and evaluation of shallow groundwater conditions, and reducing recharge activities in the vicinity of the CVC.

b). KCWA and KWBA are monitoring water levels frequency, evaluating groundwater conditions on a weekly/monthly basis, and coordinating water operations.

c). KWBA will manage recharge operations to help ensure that groundwater gradient is away from the CVC during shallow groundwater conditions. Should groundwater conditions develop that might induce piping behind the CVC's liner, KWBA will minimize recharge adjacent to the CVC either by reducing inflow to adjacent ponds or increasing the setbacks of adjacent ponds. The goal of these actions will be to prevent flow into the CVC.

d). During periods where shallow groundwater conditions exist, the CVC will be operated in such a manner as to maintain higher-than-normal pool levels**,** unless prohibited by delivery demands. Also, additional low-level cut-off float switches, adjustment of low-level alarms, and improved monitoring of CVC forebay levels have been incorporated into CVC operations during periods where shallow groundwater conditions exist. In addition to the above, regular inspections of the CVC's concrete liner will continue to be conducted, and any observed voids will be repaired promptly.

With implementation of the above measures, impacts from KWB operations from 1995 to 2014 to the CVC during major recharge periods were ***less than significant.***

<u>Mitigation Measures</u>

None required.

2015 – 2035 (Analysis of Future Operations—Existing Conditions)

Impacts of KWB recharge operations during future recharge operations under AFO-EC conditions on the CVC were evaluated by analyzing water levels at locations along the CVC under the future recharge scenarios based on the operating assumptions in the KWBA-KCWA agreement discussed above (Appendix 7-5e).

Figure 7.1-30 shows the locations of the two selected water level hydrographs along the CVC. The hydrograph locations were selected based on locations of the piezometers and pumping stations of the CVC; these hydrographs are used to demonstrate the impacts on CVC.

Figure 7.1-34 shows the groundwater level hydrographs at two selected locations along the CVC. The hydrographs show the water levels at the selected locations for the AFO-EC With and Without KWB operations, ground surface elevation, and the CVC invert elevation. It is assumed that the CVC invert is 10 feet below ground surface. The impact of KWB recharge operations on the CVC is discussed below:

- 2016-2019 Recharge Operations – Depth to groundwater is greater than 50 feet at the hydrographs along the CVC in the KWB area and no potential impact to the CVC is expected because of low groundwater elevations.
- 2026-2027 Recharge Operations – No potential impacts to the CVC are expected as groundwater elevations are similar to 2016-2019 conditions.
- 2032 Recharge Operations – No potential impacts to the CVC are expected as groundwater elevations are lower than 2016-2019 conditions.

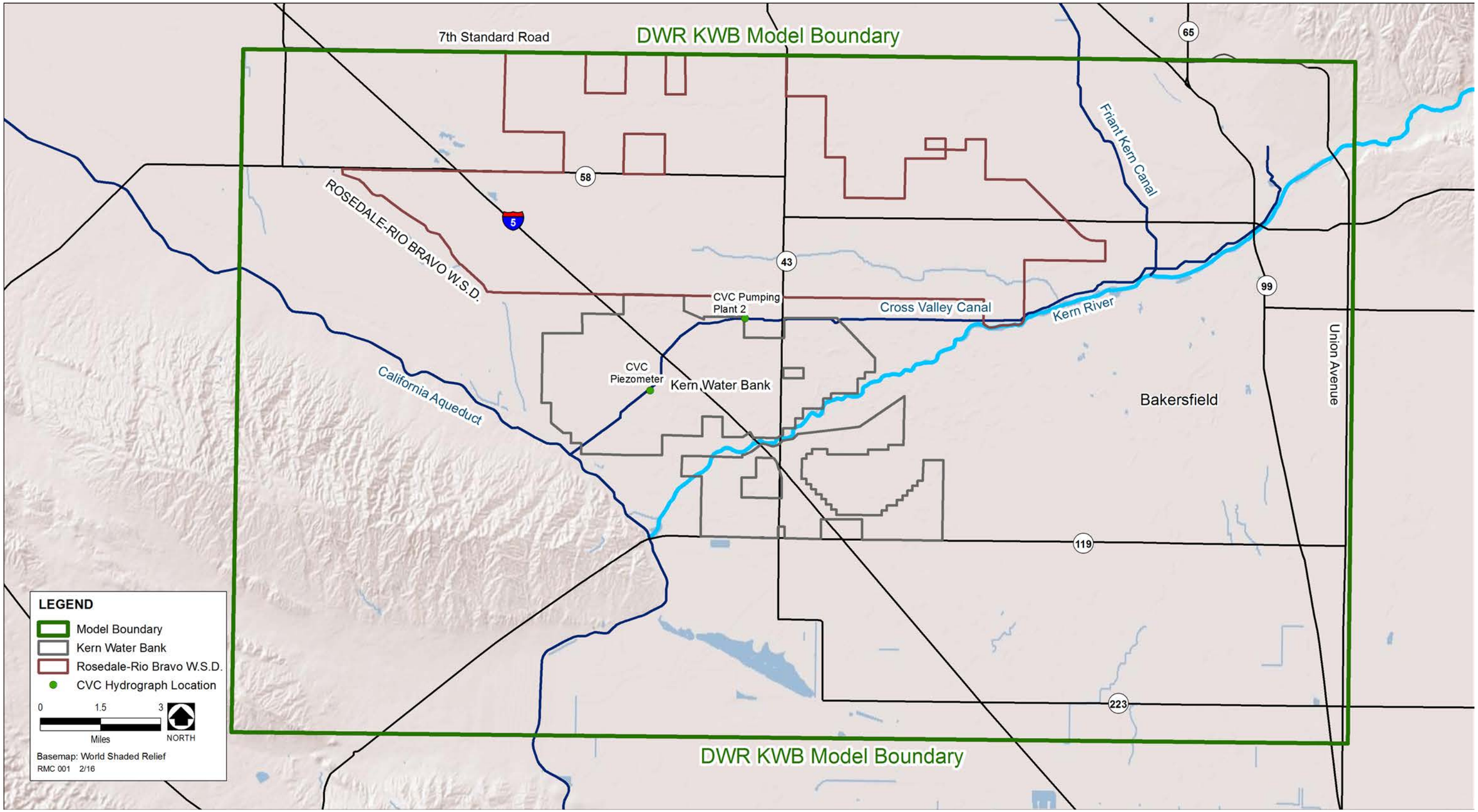


FIGURE 7.1-30. Selected Hydrograph Locations along the Cross Valley Canal

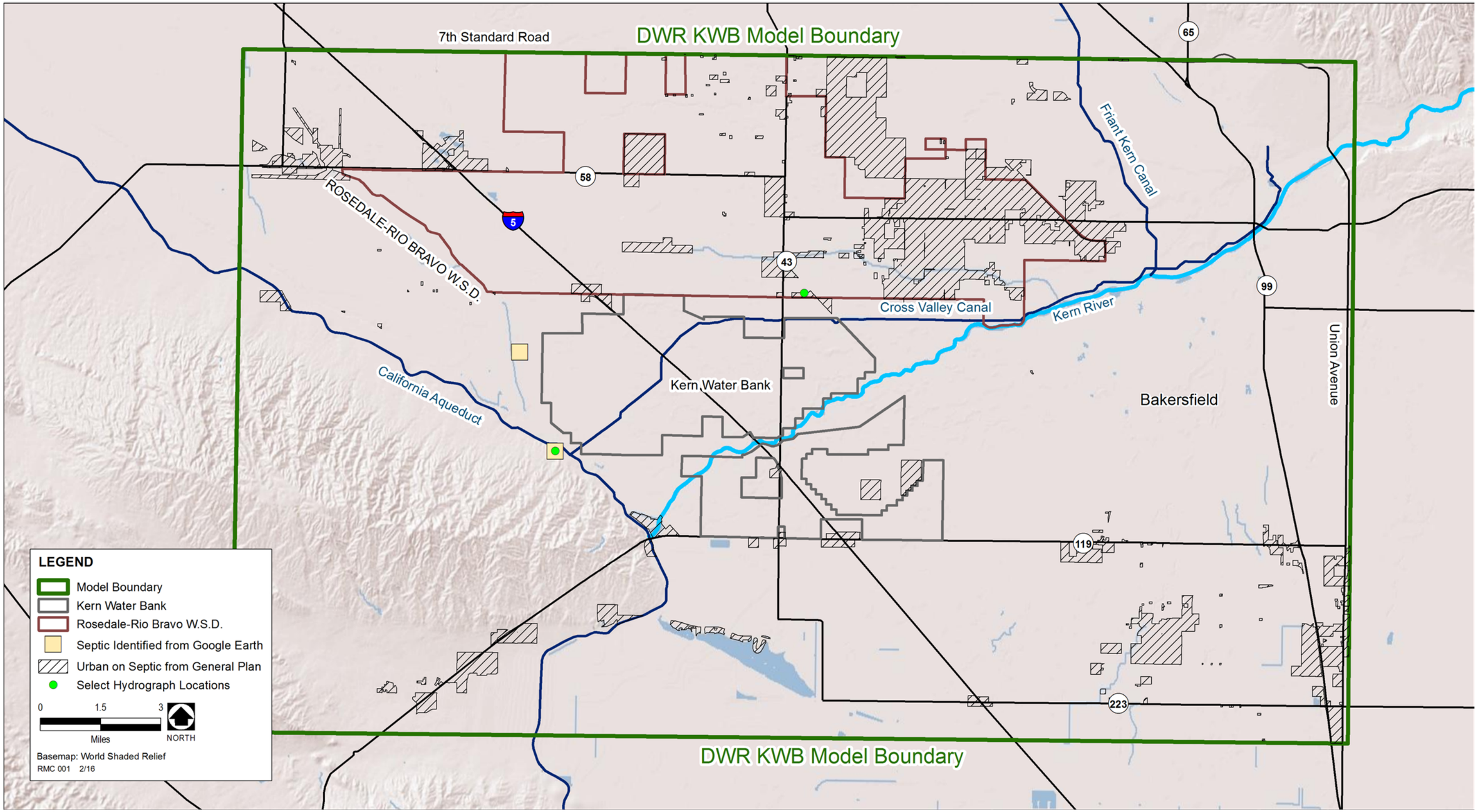


FIGURE 7.1-31. Potential Urban Areas on Septic Systems near KWB Lands

As summarized in the analysis above, KWB operations under AFO-EC scenario conditions during periods of KWB recharge could cause groundwater levels to increase. High groundwater resulting from natural conditions, offsite recharging, or recharging on the KWB Lands could impact the integrity of CVC structures or cause cracks in sub-surface concrete panels. Therefore this impact is potentially significant. KCWA and KWBA have agreed to certain water level monitoring and recharge operations management and these measures have helped assure that KWBA operations would not harm the CVC (Appendix 7-5e).

Therefore, the impact of KWB activities from 2015 to 2035 under AFO-EC scenario conditions with regard to the effect of high groundwater levels during recharge on the CVC would be ***potentially significant***.

2015 – 2035 (Analysis of Future Operations—Build-out Conditions)

Impact of KWB recharge operations during future recharge operations at the KWB under AFO-BC conditions on the CVC were evaluated by analyzing water levels at locations along the CVC.

Figure 7.1-30 shows the locations of the two selected water level hydrographs along the CVC. The hydrograph locations were selected based on locations of the piezometers and pumping stations of the CVC; these hydrographs are used to demonstrate the impact on the CVC.

Figure 7.1-36 shows the groundwater level hydrographs at two selected locations along the CVC. The hydrographs show the water levels at the selected locations for the AFO-BC With and Without KWB operations, ground surface elevation, and the CVC invert elevation. It is assumed that the CVC invert is 10 feet below ground surface. The impact of the KWB recharge operations on the CVC is discussed below:

- 2016-2019 Recharge Operations – Depth to groundwater is greater than 40 feet at the hydrographs along the CVC in the KWB area and no potential impact to the CVC is expected.
- 2026-2027 Recharge Operations – No potential impacts to the CVC are expected as groundwater elevations are similar to 2016-2019 conditions.
- 2032 Recharge Operations – No potential impacts to the CVC are expected as groundwater elevations are lower than 2016-2019 and 2026-2027 water levels.

As summarized in the analysis above, KWB operations under AFO-BC scenario conditions during periods of KWB recharge could cause groundwater levels to increase. High groundwater resulting from natural conditions, offsite recharging, or recharging on the KWB Lands could impact the integrity of CVC structures or cause cracks in sub-surface concrete panels. Therefore this impact is potentially significant. KCWA and KBWA have agreed to certain water level monitoring and recharge operations management and these measures have helped assure that KWBA operations would not harm the CVC (Appendix 7-5e).

Therefore, the impact of KWB activities from 2015 to 2035 under the AFO-BC scenario with regard to the effect of high groundwater levels during recharge on the CVC would be ***potentially significant***.

<u>Mitigation Measures (for Future Existing and Build-out Conditions)</u>

Mitigation Measure 7.1-7 would reduce impacts of KWB activities with regard to impacts on existing infrastructure to less than significant. KWBA is obligated to carry out the measures relating to its actions in subsections a) and b) below (Section 7.0.4.3.2, 2016 KWBA Resolution). Therefore, the impact of KWB activities from 2015 to 2035 with regard to impacts on the CVC would be ***less than significant, with mitigation***.

7.1-7 *KWBA will implement the following measures in accordance with the KCWA and KWBA CVC Agreement* (Appendix 7-5e)*:*

a). KWBA will monitor water levels frequency, evaluating groundwater conditions on a weekly/monthly basis.

b). KWBA will coordinate water operations with KCWA.

c). KWBA will manage recharge operations to help ensure that groundwater gradient is away from the CVC during shallow groundwater conditions. Should groundwater conditions develop that might induce piping behind the CVC's liner, KWBA will minimize recharge adjacent to the CVC either by reducing inflow to adjacent ponds or increasing the setbacks of adjacent ponds.

7.1-8 Raise groundwater levels sufficiently to substantially impact existing infrastructure (e.g., septic systems).

Historic recharge operations at the KWB during the past recharge periods of 1995-1998, 2005-2006, and 2011, together with similar recharge operations at other neighboring groundwater banks, resulted in high groundwater elevations within KWB Lands and surrounding areas. Urban areas to the east and northeast of KWB Lands use septic systems. Additionally, there are small residential areas in the vicinity of KWB Lands that are on septic systems or dry wells. High groundwater elevations in these areas could potentially impact the septic systems and dry wells.

Results of APO, AFO-EC, and AFO-BC model scenarios were evaluated to determine the potential impact of KWB recharge operation during high groundwater elevations on nearby areas on septic systems.

1995 – 2014 (Analysis of Past Operations)

Figure 7.1-31 shows the areas near KWB Lands that are on septic systems or dry wells as obtained from the Kern County General Plan and Google Earth; it also shows the locations of two selected water level hydrographs used to demonstrate the impacts on septic areas. Figure 7.1-33 shows water level hydrographs at two locations near KWB Lands with groundwater levels that have the potential to impact septic systems. The hydrographs show the water levels for the APO With and Without KWB Operations and the ground surface elevation and facilitate the following conclusions:

- 1995-1998 Recharge Operations – Depth to groundwater in areas in the vicinity of KWB Lands with septic systems or dry wells was more than 35 feet west of KWB Lands and more than 40 feet north of KWB Lands. Groundwater elevations are not high enough to impact the septic systems of these areas.
- 2005-2006 Recharge Operations – Similar to 1995-1998 conditions, depth to groundwater in areas in the vicinity of KWB Lands with septic systems or dry wells were more than 50 feet west of KWB Lands and more than 65 feet north of KWB Lands. No impact to septic systems is expected.
- 2011 Recharge Operations – Depth to groundwater as a result of 2011 recharge operations were more than the previous two recharge periods. Depth to groundwater was more than 125 feet west of KWB Lands and more than 90 feet north of KWB Lands. Groundwater elevations were not high enough to impact septic systems.

As summarized in the analysis above, KWB operation under APO scenario conditions did not cause groundwater levels to rise such that the septic systems in the vicinity of KWB Lands were significantly impacted.

Therefore, impacts from KWB operations during 1995 to 2014 did not raise groundwater levels sufficiently to substantially impact septic systems and the impact was ***less than significant***.

Mitigation Measures

None required.

2015 – 2035 (Analysis of Future Operations—Existing Conditions)

Impacts of KWB recharge operations during future recharge operations under AFO-EC conditions on septic systems were evaluated by analyzing water levels at locations at nearby areas with septic systems under the future recharge scenarios.

Figure 7.1-31 shows the areas near the KWB that are on septic systems or dry wells as obtained from the Kern County General Plan and Google Earth; it also shows the locations of two selected water level hydrographs used to demonstrate the impacts on septic areas.

As summarized in the analysis above, KWB operations under AFO-EC scenario conditions during periods of KWB recharge could cause groundwater levels to increase but not to significantly impact the septic systems.

Therefore, impacts from KWB operations during 2015 to 2035 would not raise groundwater levels sufficiently to substantially impact septic systems and the impact would be ***less than significant***.

Mitigation Measures

None Required.

2015 – 2035 (Analysis of Future Operations—Build-out Conditions)

Impact of KWB recharge operations during future recharge operations at the KWB under AFO-BC conditions on septic systems or dry wells were evaluated by analyzing water levels at locations at nearby areas with septic systems.

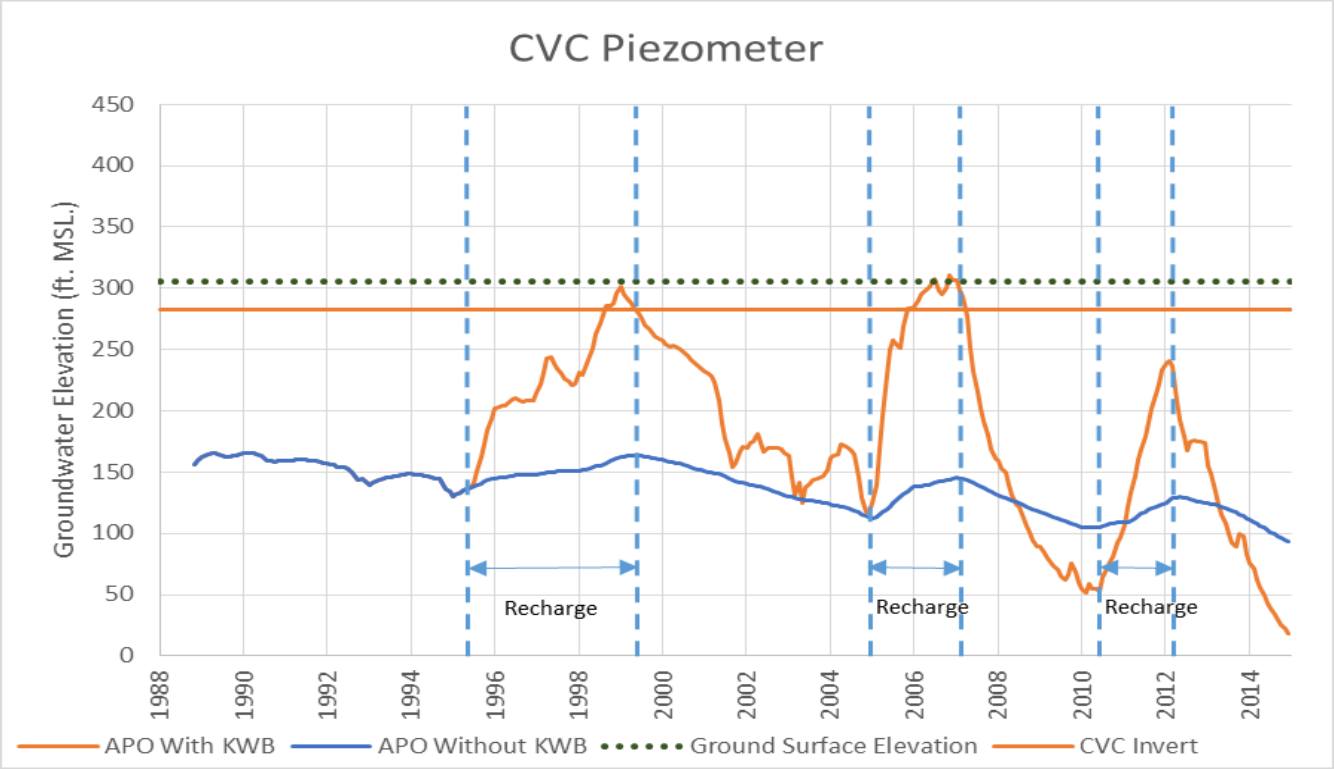
Figure 7.1-31 shows the areas near the KWB that are on septic systems or dry wells as obtained from the Kern County General Plan and Google Earth; it also shows the locations of two selected water level hydrographs used to demonstrate the impacts on septic areas.

As summarized in the analysis above, KWB operations under AFO-BC scenario conditions during periods of KWB recharge could would not cause groundwater levels to increase but not to levels that would cause significant impacts such that damage would occur to significantly impact septic systems.

Therefore, the impact of KWB activities from 2015 to 2035 with regard to the effect of high groundwater levels during recharge on existing septic systems would be ***less than significant.***

Mitigation Measures

None required.



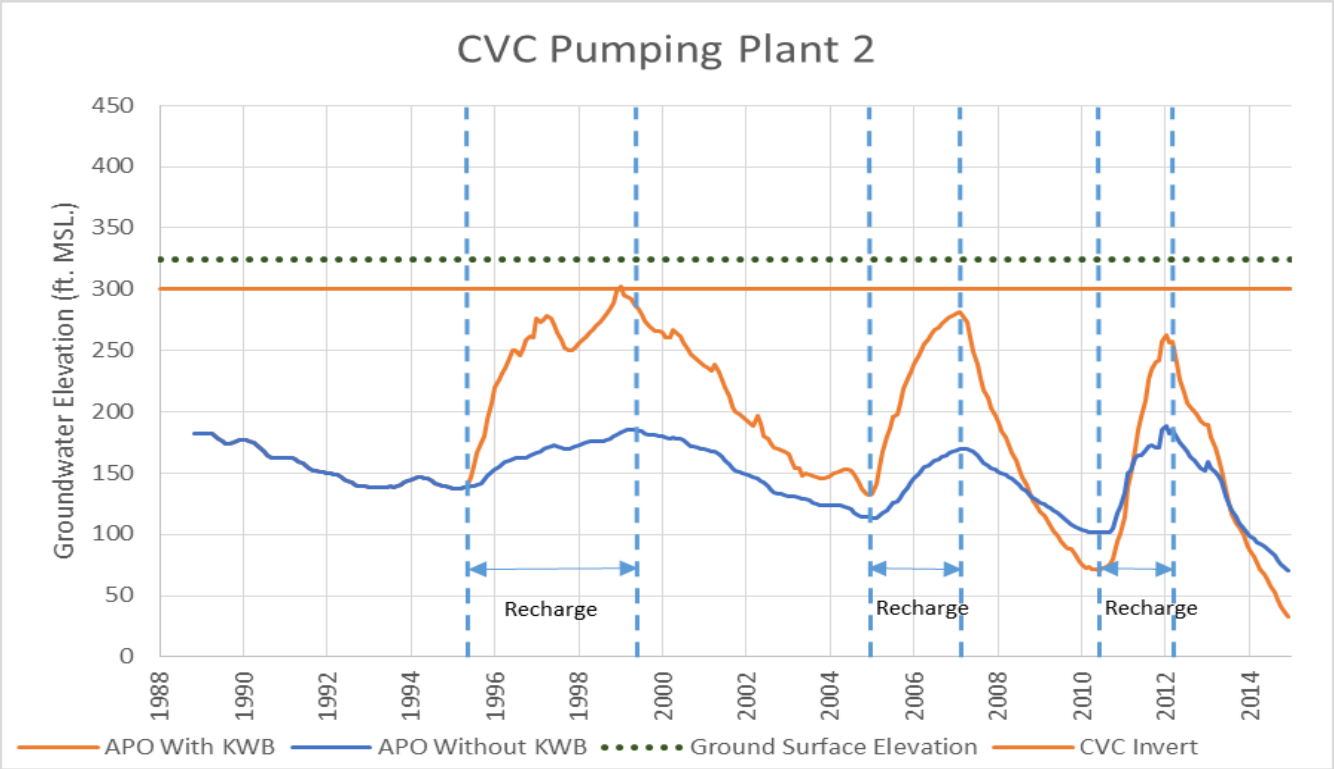
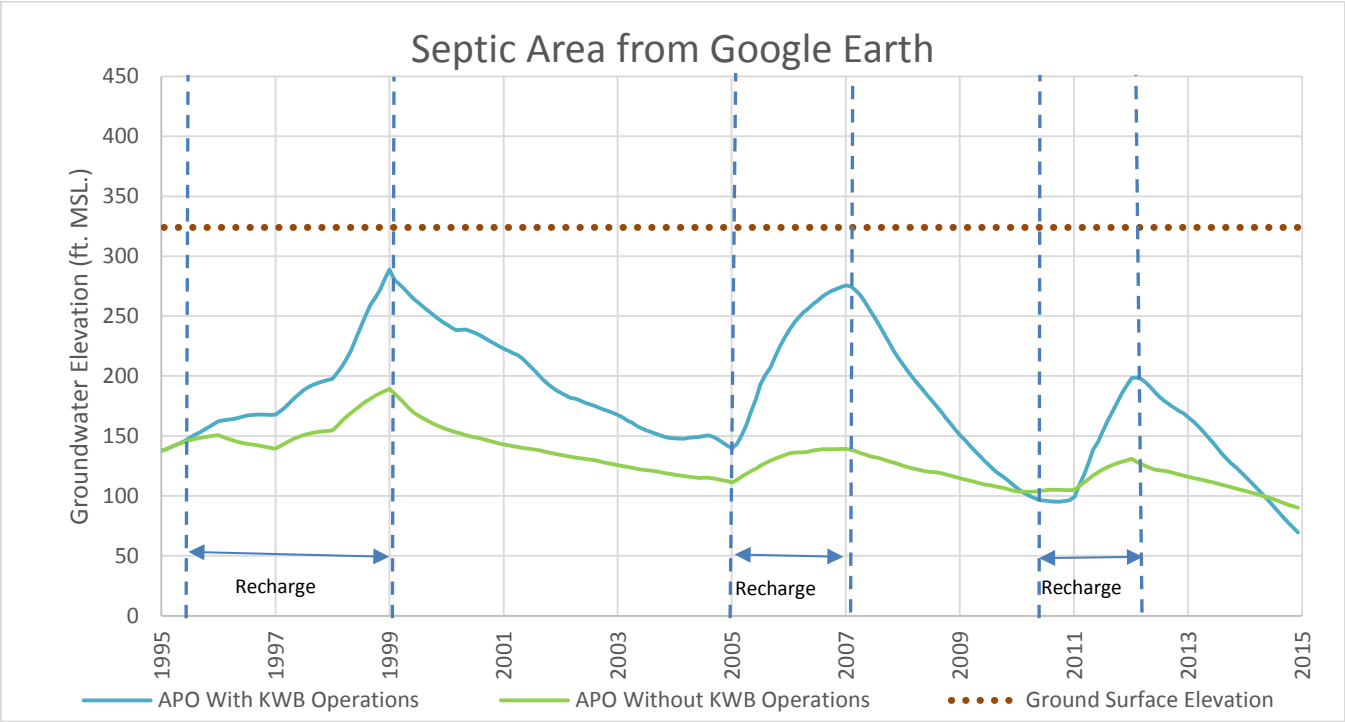


FIGURE 7.1-32. Groundwater Elevation Hydrographs at Selected Locations along the Cross Valley Canal for APO Scenario



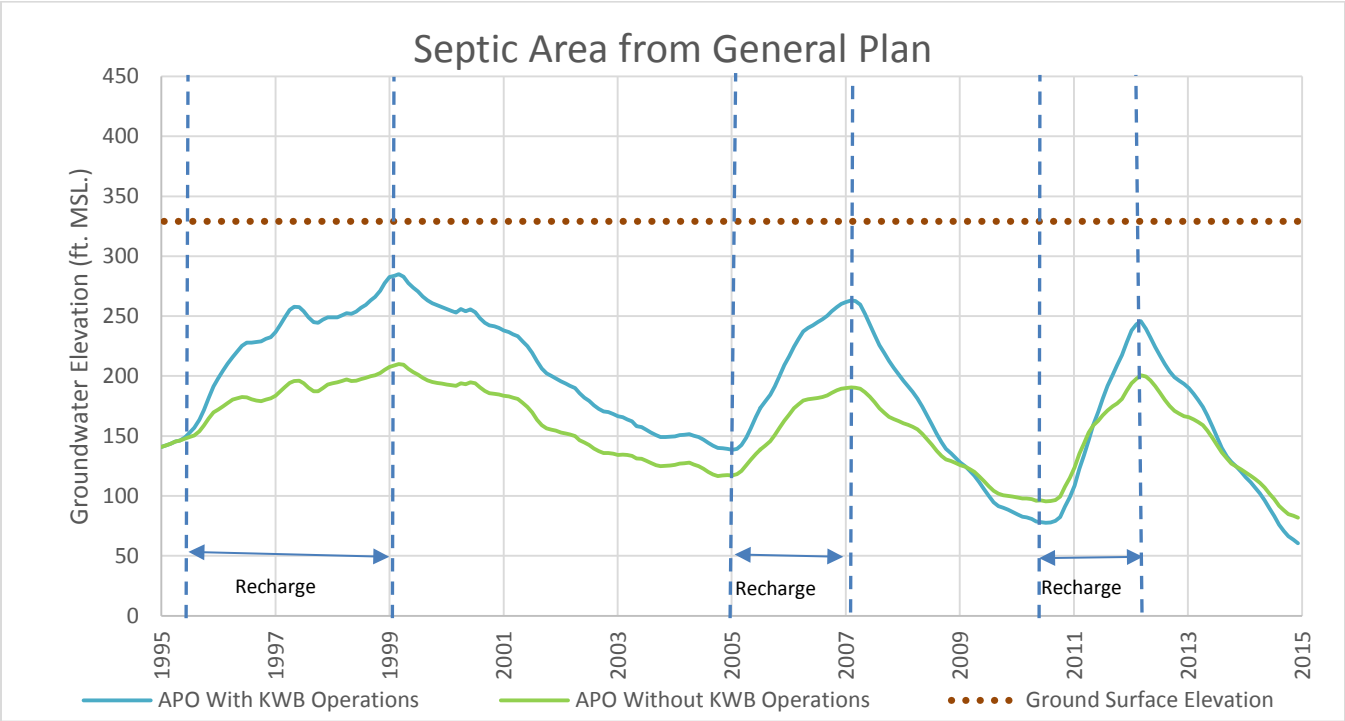


FIGURE 7.1-33. Groundwater Elevation Hydrographs at Selected Areas on Septic Systems for APO Scenario

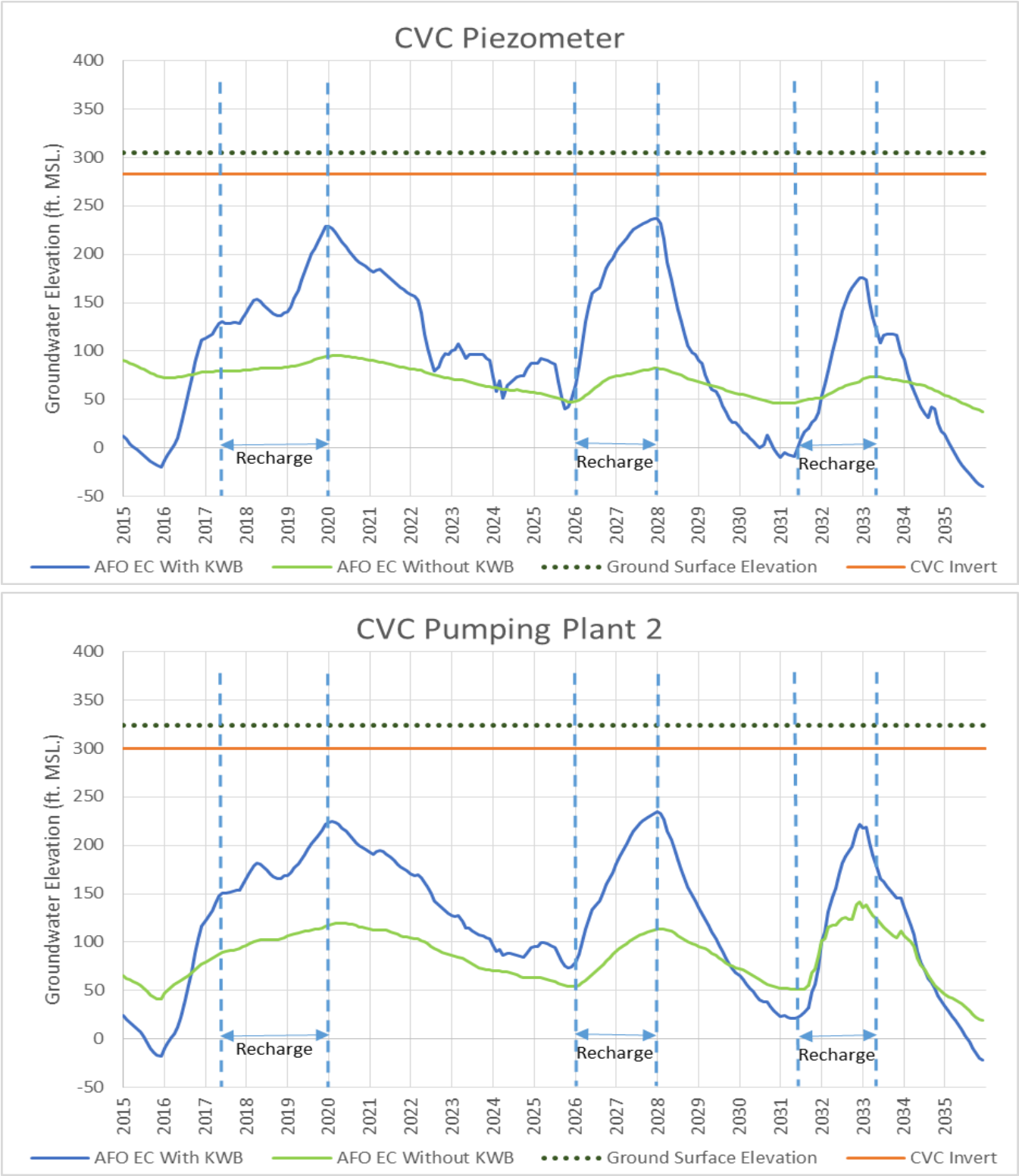
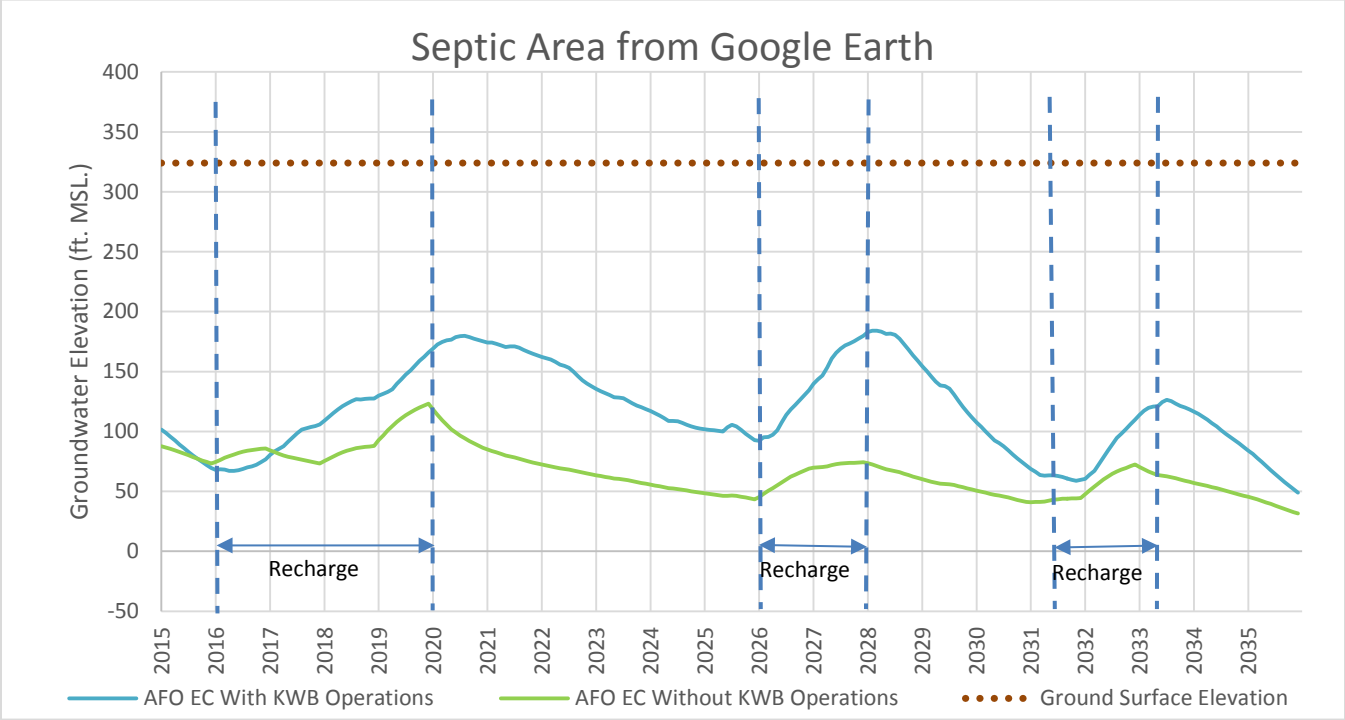


FIGURE 7.1-34. Groundwater Elevation Hydrographs at Selected Locations along the CVC for AFO-EC Scenario



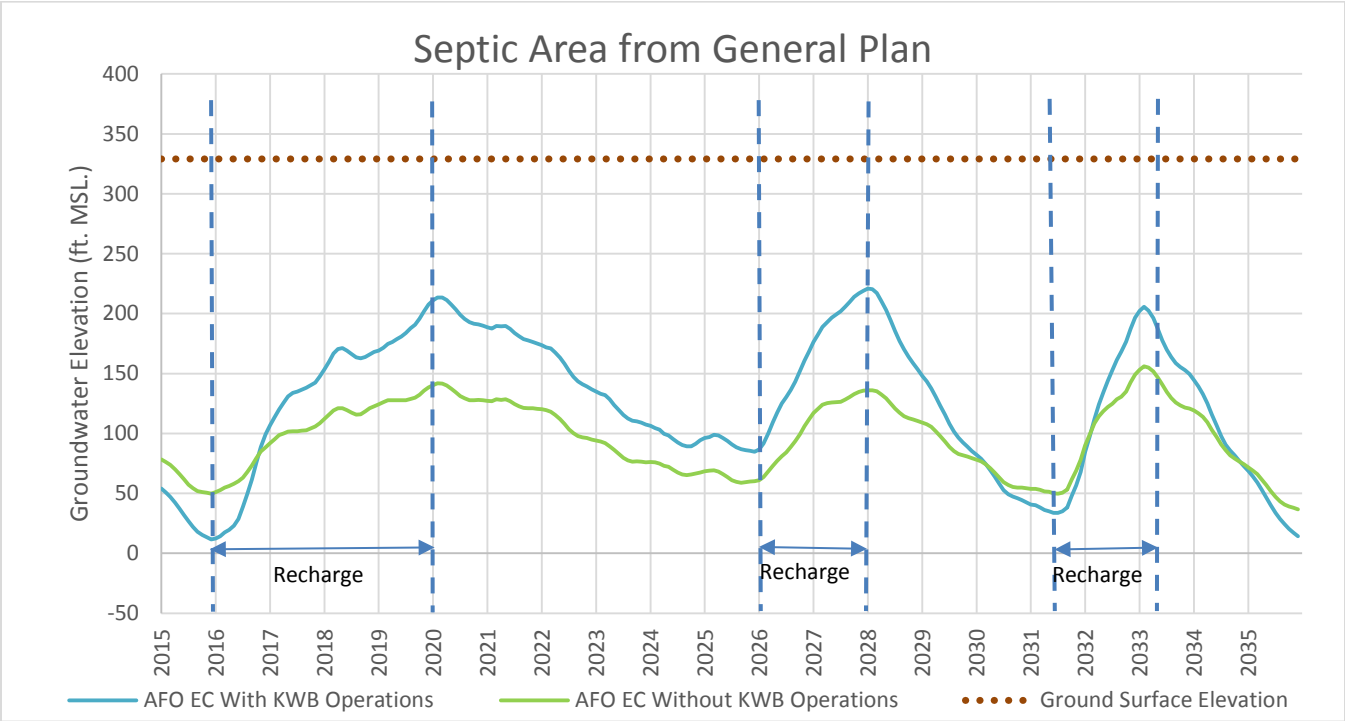
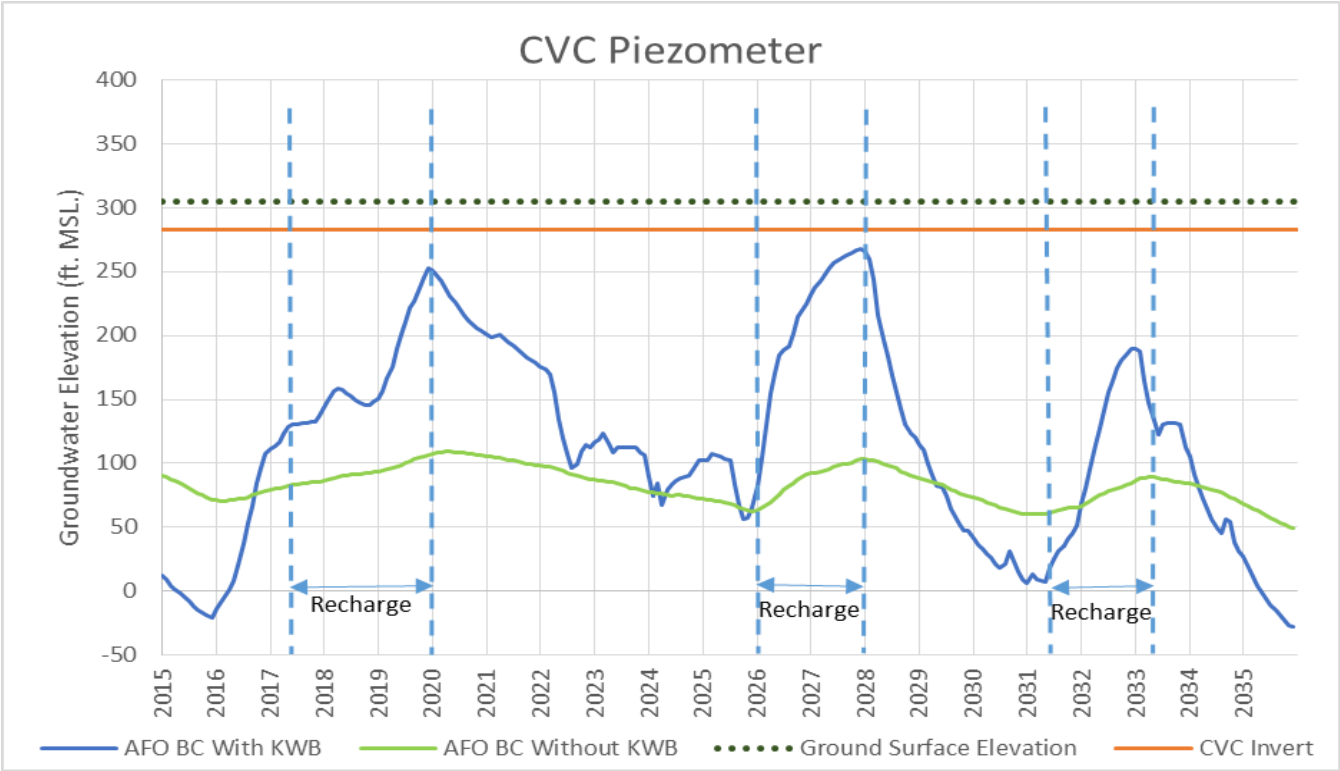


FIGURE 7.1-35. Groundwater Elevation Hydrographs at Selected Areas on Septic Systems for AFO-EC Scenario



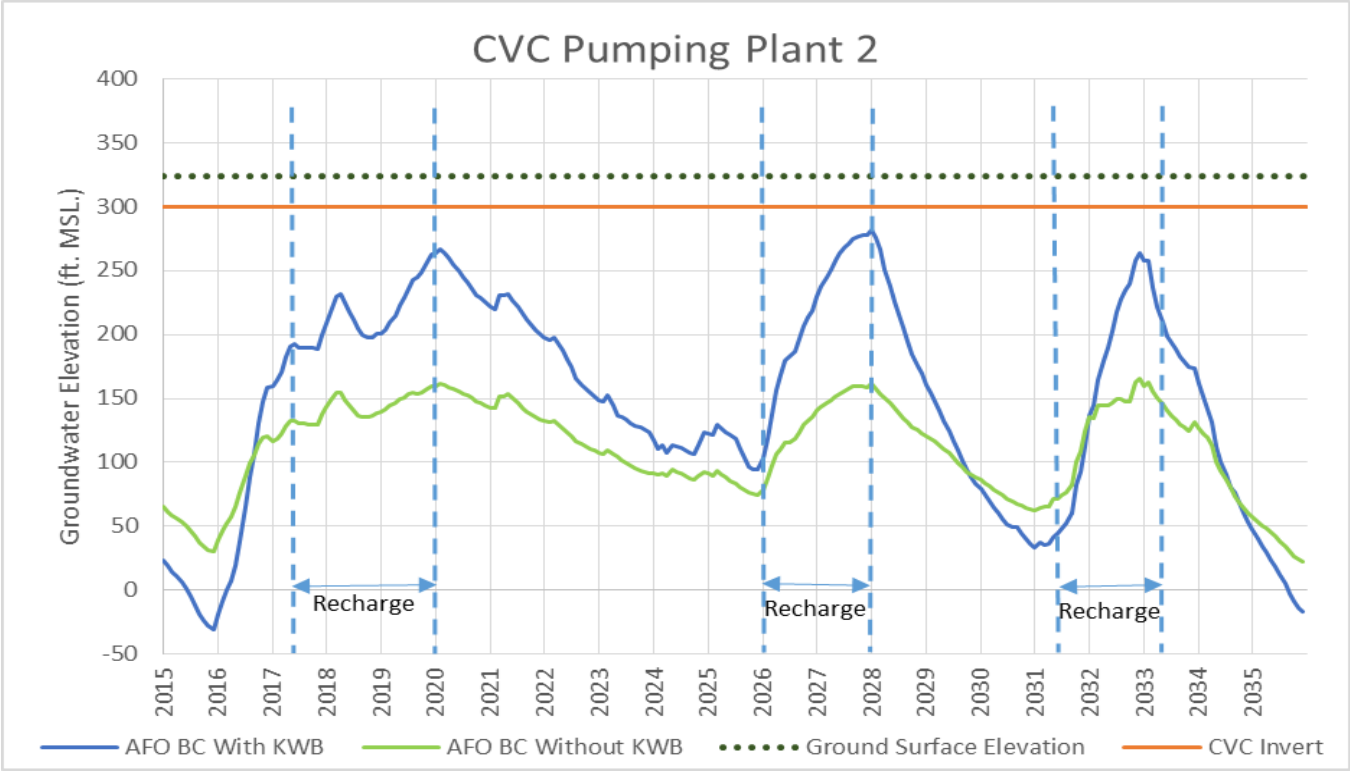
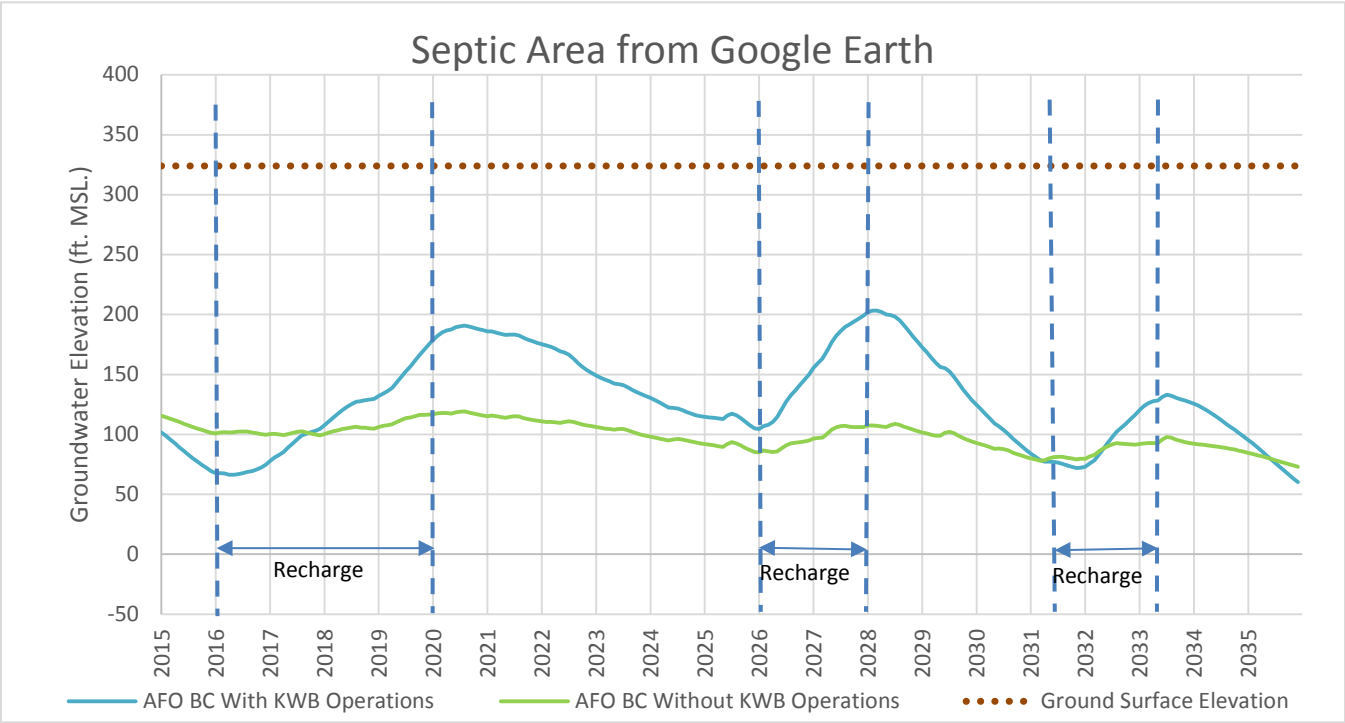


FIGURE 7.1-36. Groundwater Elevation Hydrographs at Selected Locations along the CVC for AFO-BC Scenario



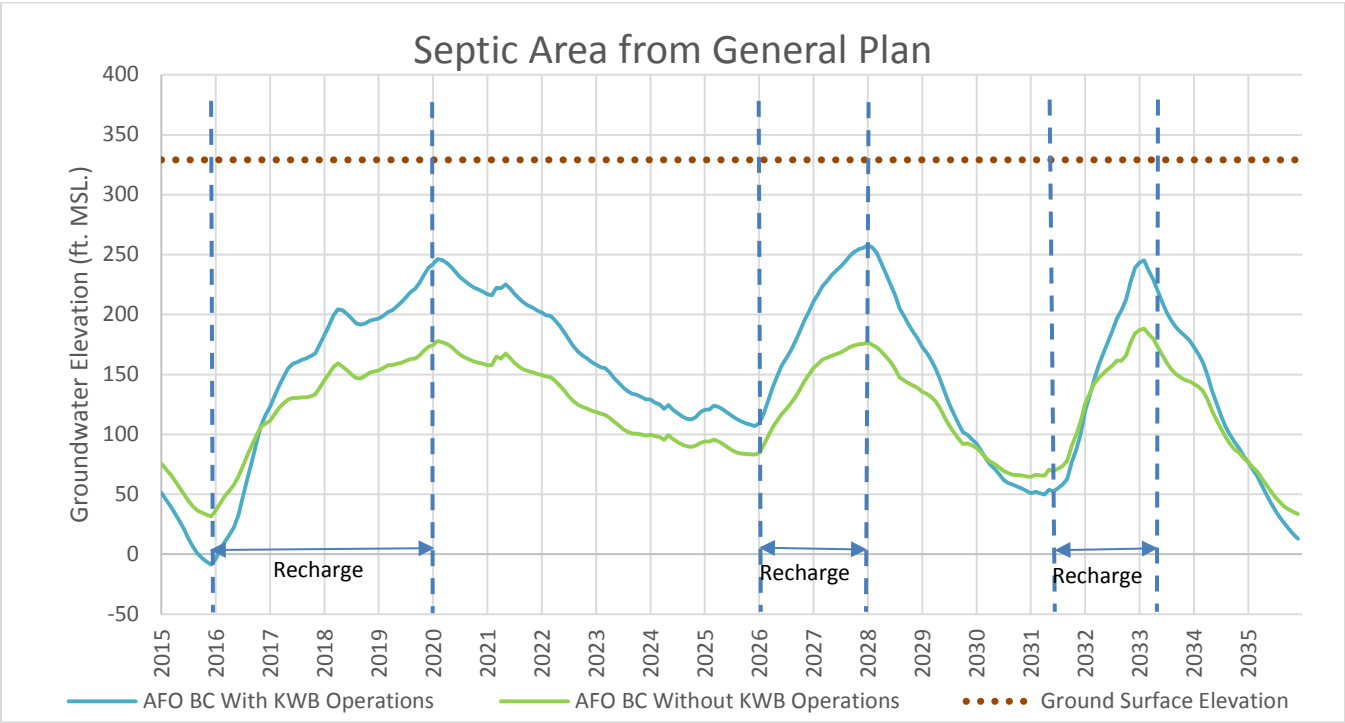


FIGURE 7.1-37. Groundwater Elevation Hydrographs at Selected Areas on Septic Systems for AFO-BC Scenario

7.1-9 Raise water levels in a groundwater basin sufficiently to substantially interfere with groundwater recharge.

Historic recharge operations at the KWB during the recharge periods of 1995-1998, 2005-2006, and 2011, in conjunction with similar recharge operations at other neighboring groundwater banks, resulted in high groundwater elevations in KWB and surrounding areas. High groundwater elevations could potentially effect recharge operations at neighboring recharge facilities, such as Rosedale recharge basins north of KWB, Pioneer and 2800 Acre recharge facilities east of KWB, and West Kern Water District recharge facilities south of KWB.

Results of APO, AFO-EC, and AFO-BC model scenarios were evaluated to determine the impact of KWB recharge operations on the neighboring recharge facilities during high groundwater elevations with all the groundwater banks operating simultaneously.

1995 – 2014 (Analysis of Past Operations)

Impacts of KWB recharge operations on the recharge operations of neighboring recharge facilities during high groundwater elevations with all the groundwater banks operating simultaneously under APO conditions were evaluated by using water level hydrographs at these recharge facilities.

Figure 7.1-38 shows the locations of the selected water level hydrographs at the neighboring recharge facilities. Figure 7.1-39 shows the water level hydrographs at these locations. Table 7.1-8 shows the modeled minimum depth to water under APO conditions at the four selected recharge facilities. The impact of the KWB recharge operations on the neighboring recharge facilities during high groundwater elevations with all the groundwater banks operating simultaneously are discussed below.

- 1995-1998 Recharge Operations – The water level analysis shows that at the adjacent recharge facilities, groundwater levels almost reached the ground surface in 2800 Acre recharge facility with all other groundwater banks in the area operating simultaneously; the groundwater mounding associated with the KWB operations and all the groundwater banks operating simultaneously would potentially interfere with recharge operations of neighboring groundwater banks at individual ponds. Any impact of KWB operations in West Kern Water District is resolved by an existing agreement between West Kern Water District and KWBA (see Appendix 7-5e). This agreement is discussed in Revised Appendix E Section VI.B.2.
- 2005-2006 Recharge Operations – The water levels at the adjacent recharge facilities were generally lower than 1995-1998 conditions and groundwater levels did not reach the ground surface; thus, the groundwater mounding associated with the KWB operations and all the groundwater banks operating simultaneously did not preclude recharge operations of neighboring groundwater banks.

TABLE 7.1-8

MODEL-GENERATED MINIMUM DEPTH TO WATER FOR APO CONDITIONS

Simulation Period	Recharge Facility			
	Rosedale	Pioneer	2800 Acre	West Kern WD
1995-1998	33	6.3	0.1	4.2
2005-2006	50.9	19.4	4.5	13.6
2011	66.6	48.3	44.3	33.4

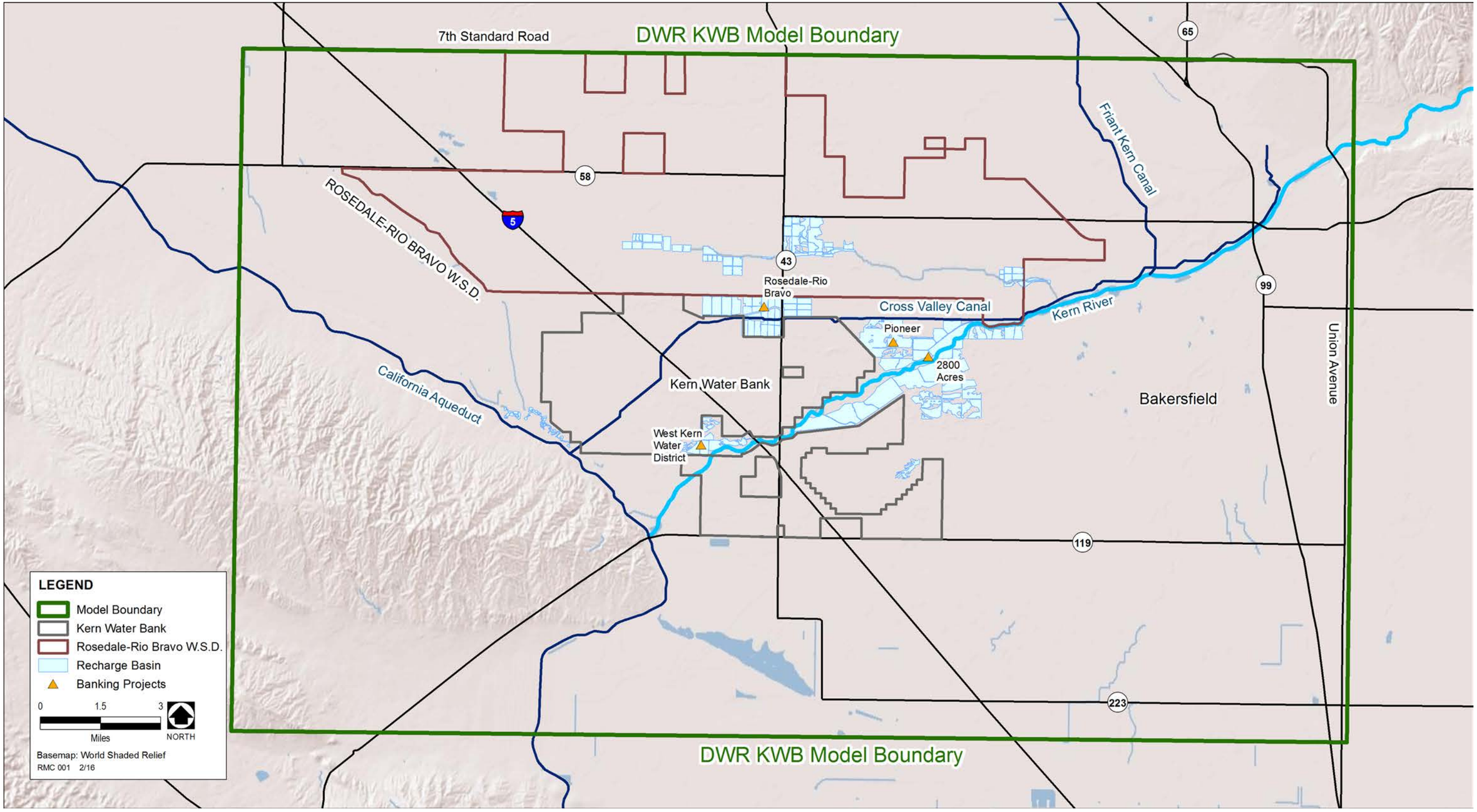


FIGURE 7.1-38. Groundwater Recharge Projects Neighboring Kern Water Bank and Locations of Selected Water Levels Hydrographs

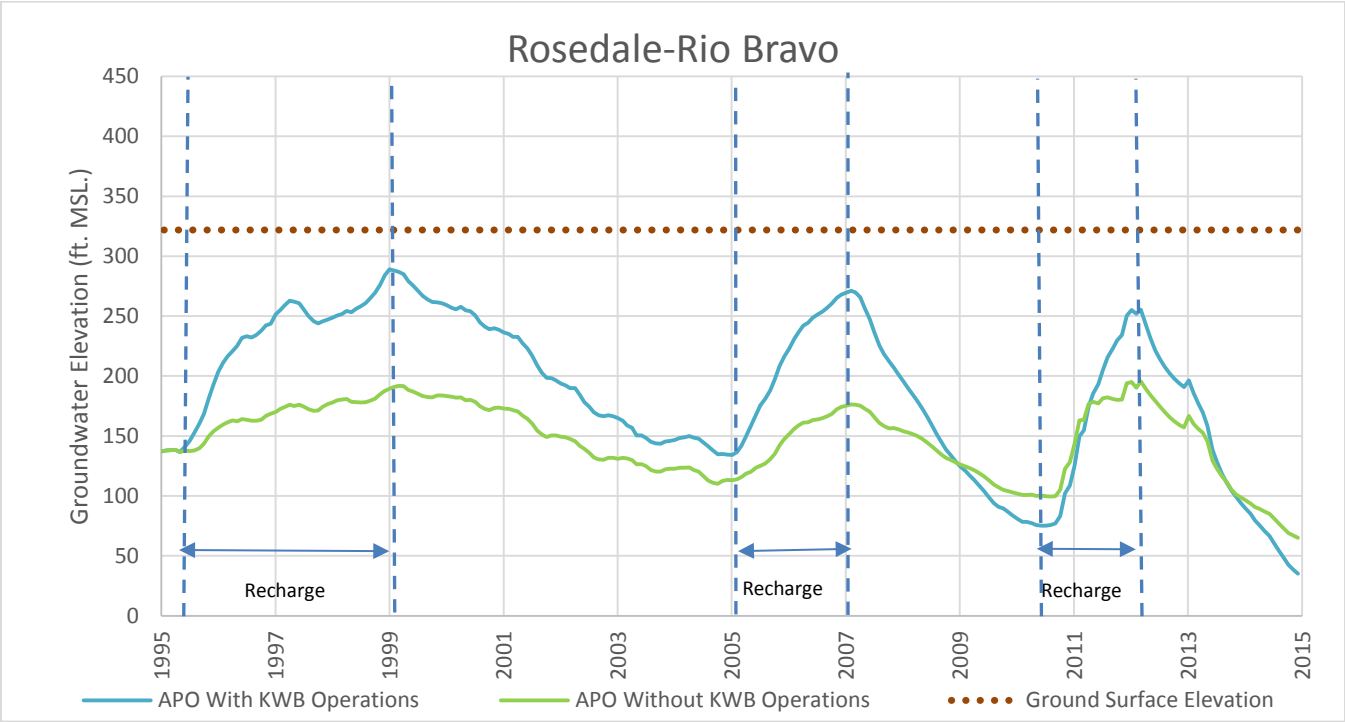


FIGURE 7.1-39a. Groundwater Elevation Hydrographs at Rosedale-Rio Bravo Recharge Pond for APO

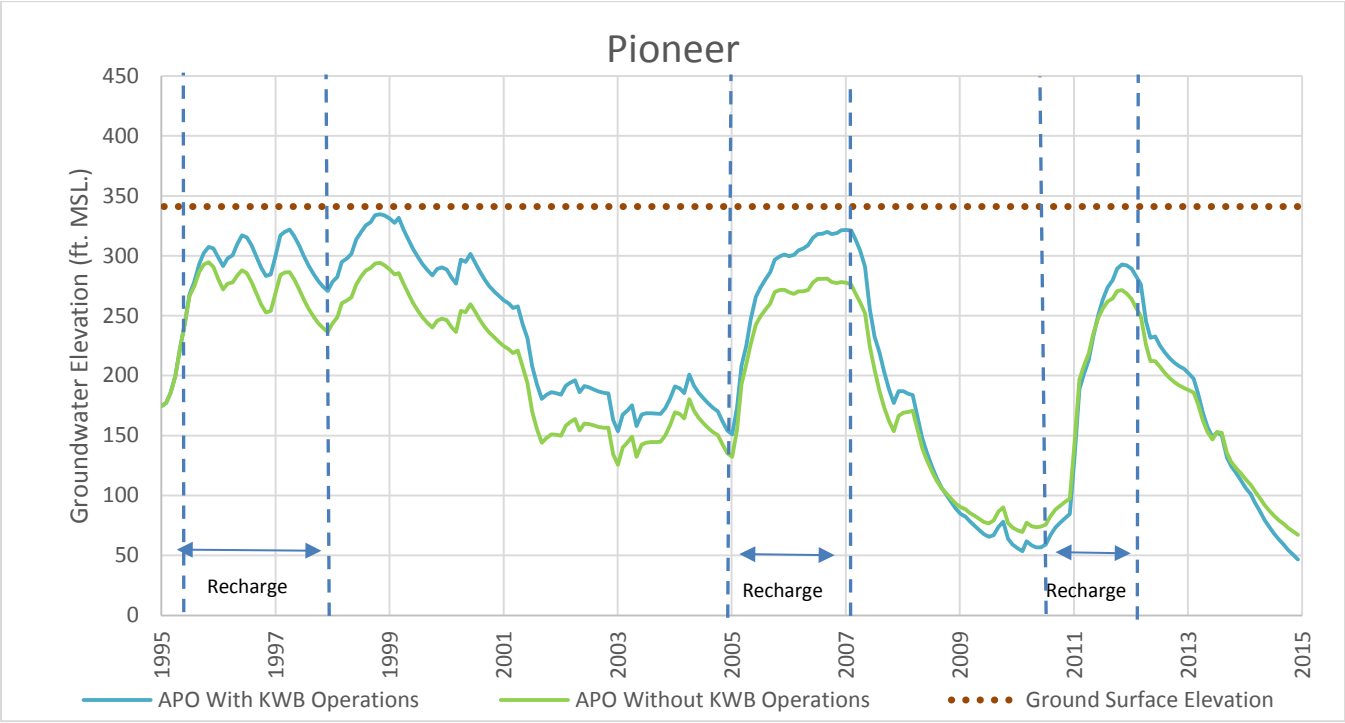


FIGURE 7.1-39b. Groundwater Elevation Hydrographs at Pioneer Recharge Pond for APO

- 2011 Recharge Operations – Water levels for 2011 recharge operations were significantly lower than the previous two recharge operations in 1995-1998 and 2005-2006 and groundwater levels did not reach the ground surface; thus, simultaneous operations of KWB and all other groundwater banks in the area were not expected to impact neighboring groundwater banks.

As summarized in the analysis above, KWB operations, in conjunction with the operations of other neighboring groundwater banks, under the APO scenario did not substantially interfere with recharge operations at neighboring groundwater banks due to high water table during the 1995-1998 recharge period.

Therefore, the impacts from KWB operations during 1995-2014 in terms of raising water levels in a groundwater basin sufficiently to substantially interfere with groundwater recharge at neighboring basins was ***less than significant***.

2015 – 2035 (Analysis of Future Operations – Existing Conditions)

Potential impacts of KWB recharge operations on the recharge operations of neighboring recharge facilities during high groundwater elevations were analyzed with all the groundwater banks operating simultaneously under AFO-EC recharge facilities. Figure 7.1-38 shows the locations of the selected water level hydrographs at the neighboring recharge facilities. Figure 7.1-40 shows the representative water level hydrographs at these locations. Table 7.1-9 shows the minimum depth to water under AFO-EC conditions at the four selected recharge facilities. The impact of the KWB recharge operations on the neighboring recharge facilities during high groundwater elevations with all the groundwater banks operating simultaneously are discussed below.

- 2016-2019 Recharge Operations – The water level analysis shows that at the adjacent recharge facilities, groundwater levels were lower than 63 feet below the ground surface; thus, the groundwater mounding associated with the simultaneous operations of KWB and all other neighboring groundwater banks would not interfere with recharge operations of neighboring basins.
- 2026-2027 Recharge Operations – The water levels at the adjacent recharge facilities were generally lower than 2016-2019 conditions and lower than 41 feet below the ground surface; thus, the groundwater mounding associated with simultaneous operations of KWB and all other neighboring groundwater banks would not interfere with recharge operations of neighboring basins.
- 2032 Recharge Operations – The water levels for 2032 recharge operations were significantly lower than the previous two recharge operations in 2016-2019 and 2026-2027 and groundwater levels were lower than 85 feet below the ground surface; thus, the groundwater mounding associated with simultaneous operations of KWB and all other neighboring groundwater banks are not expected to interfere with recharge operations of neighboring basins.

Groundwater levels rise during recharge operations; this rise in water tables would be the result of the mutual interactions of the KWB and the neighboring groundwater banks and not due to the operation of any single groundwater bank. As summarized in the analysis above, KWB operations, in conjunction with the operations of all other neighboring groundwater banks, under AFO-EC scenario could contribute to a resulting groundwater level of approximately 41 feet below the ground surface. This would not result in a significant interference with groundwater recharge.

Therefore, the impacts from KWB operations during 2015-2035 under AFO-EC scenario conditions in terms of raising water levels in a groundwater basin sufficiently to substantially interfere with groundwater recharge at neighboring basins would be ***less than significant***.

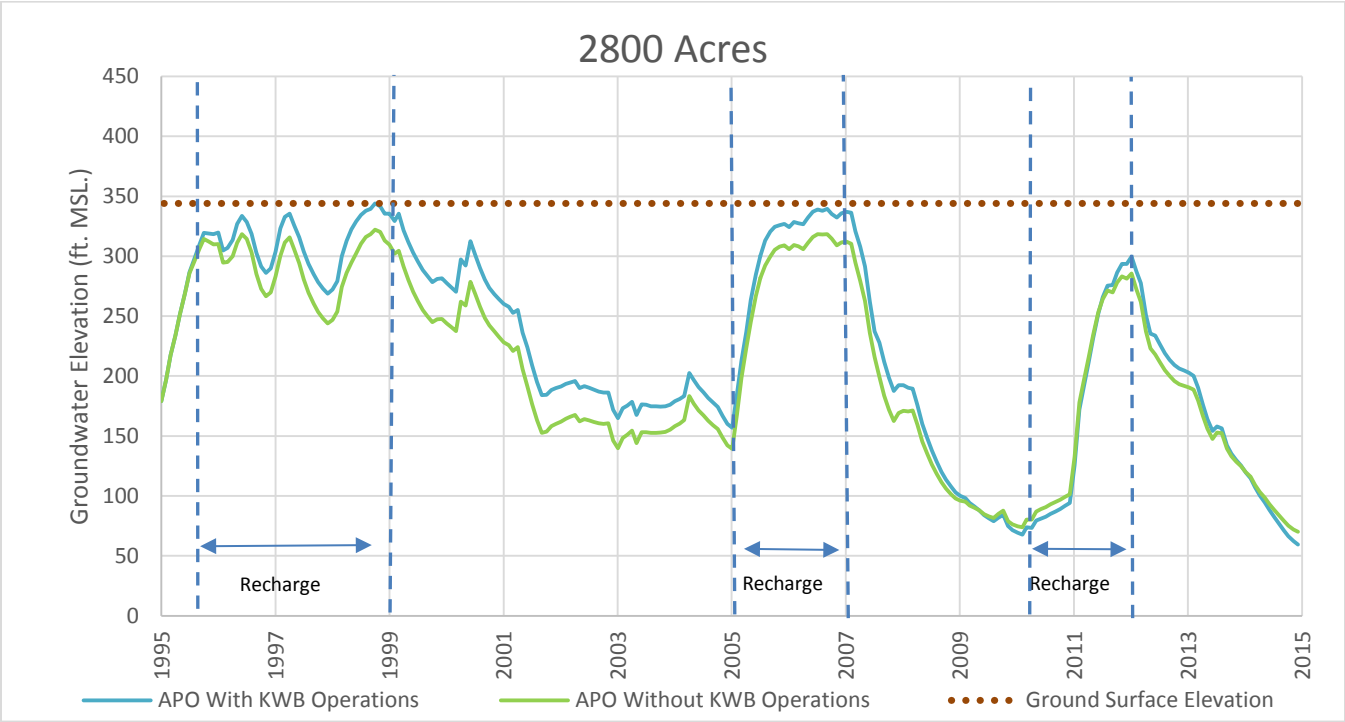


FIGURE 7.1-39c. Groundwater Elevation Hydrographs at 2800 Acres Recharge Pond for APO

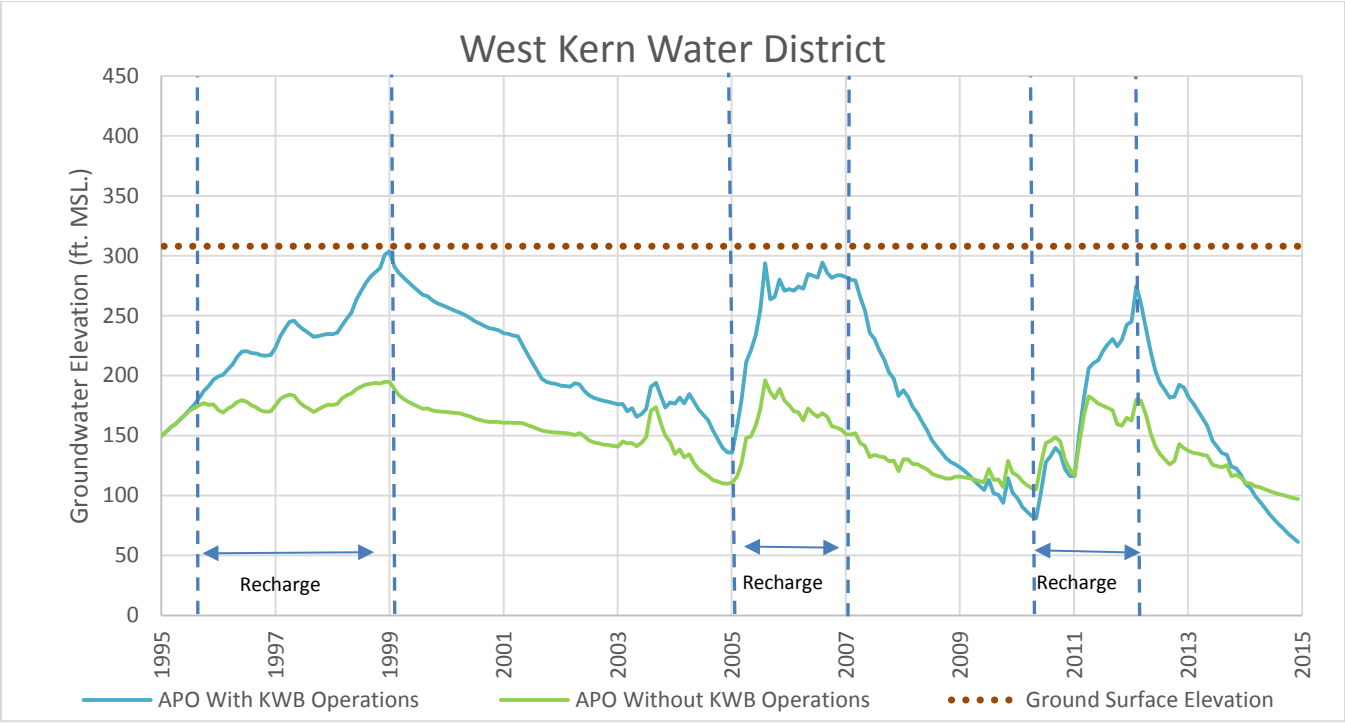


FIGURE 7.1-39d. Groundwater Elevation Hydrographs at West Kern Water District Recharge Pond for APO

TABLE 7.1-9

MODEL-GENERATED MINIMUM DEPTH TO WATER FOR AFO-EC CONDITIONS

Simulation Period	Recharge Facility			
	Rosedale	Pioneer	2800 Acre	West Kern WD
2016-2019	104.4	75.2	63.7	78.3
2026-2027	94.9	62.4	41.5	87
2032	105.6	88.7	85	99.1

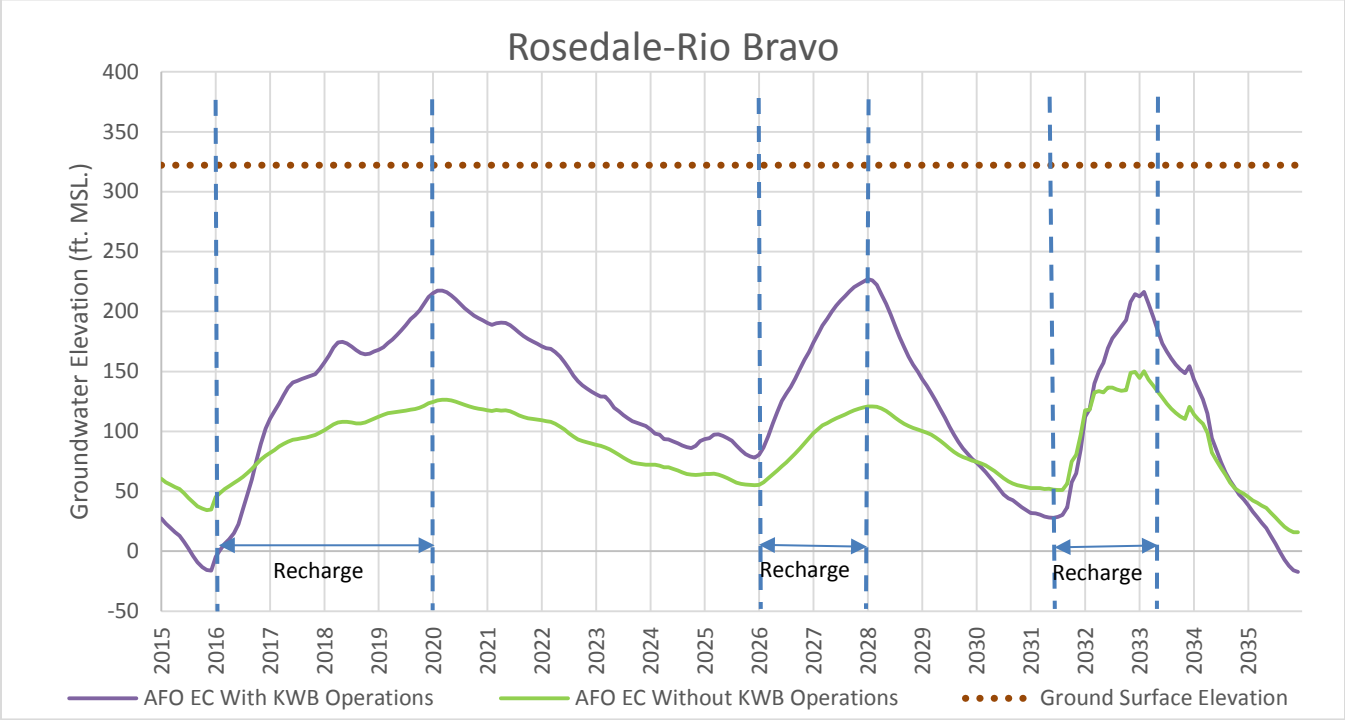


FIGURE 7.1-40a. Groundwater Elevation Hydrographs at Rosedale-Rio Bravo Recharge Pond for AFO-EC

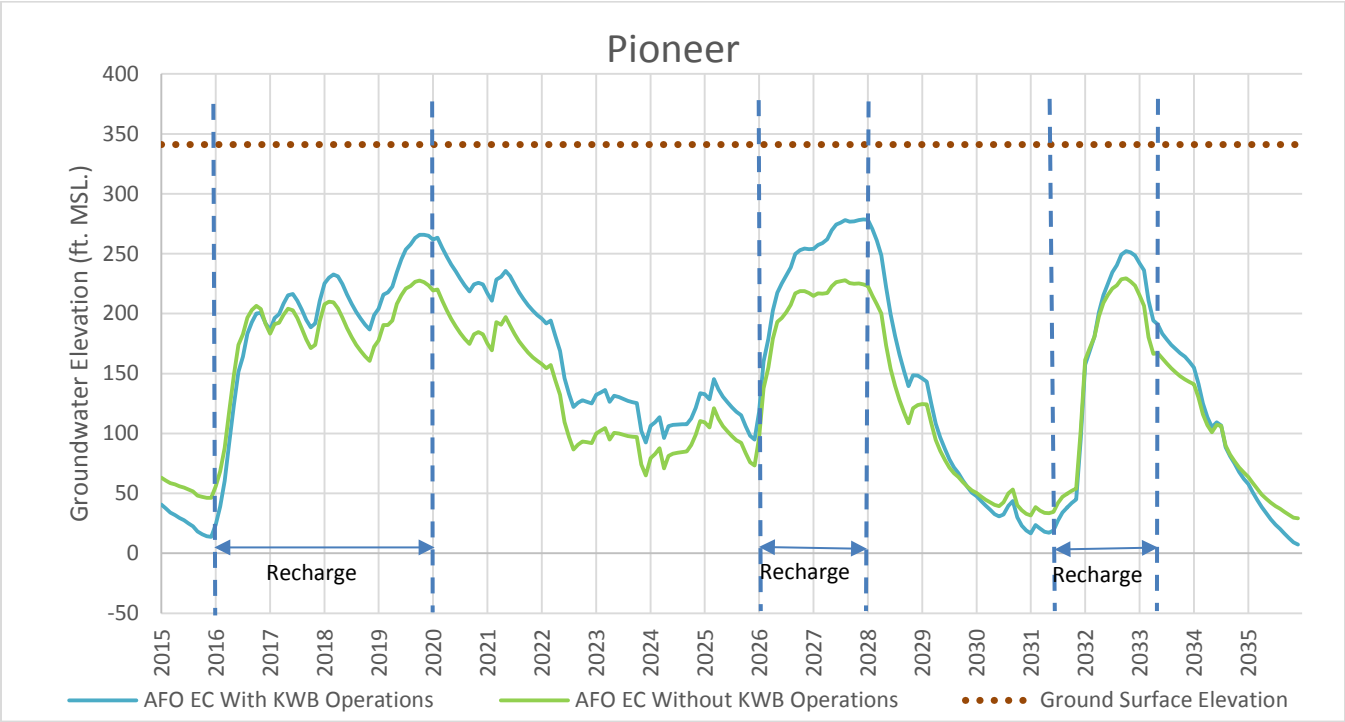


FIGURE 7.1-40b. Groundwater Elevation Hydrographs at Pioneer Recharge Pond for AFO-EC

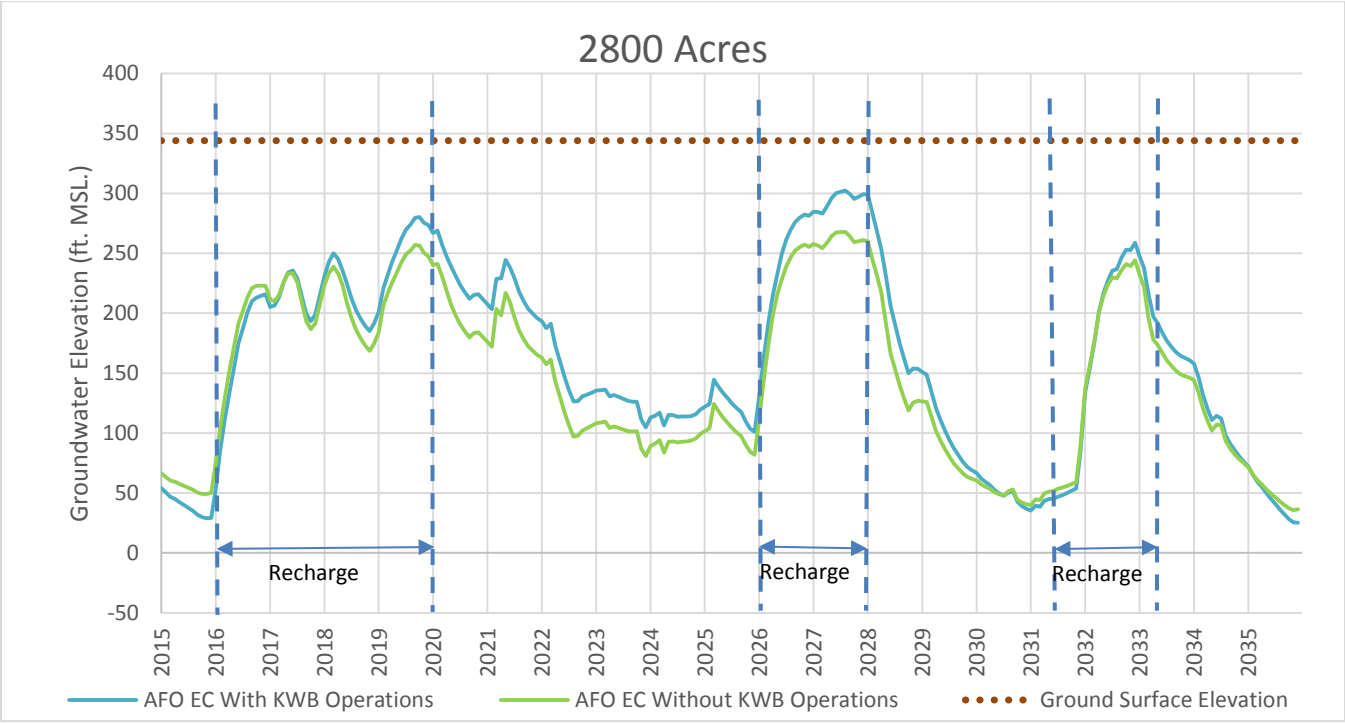


FIGURE 7.1-40c. Groundwater Elevation Hydrographs at 2800 Acres Recharge Pond for AFO-EC

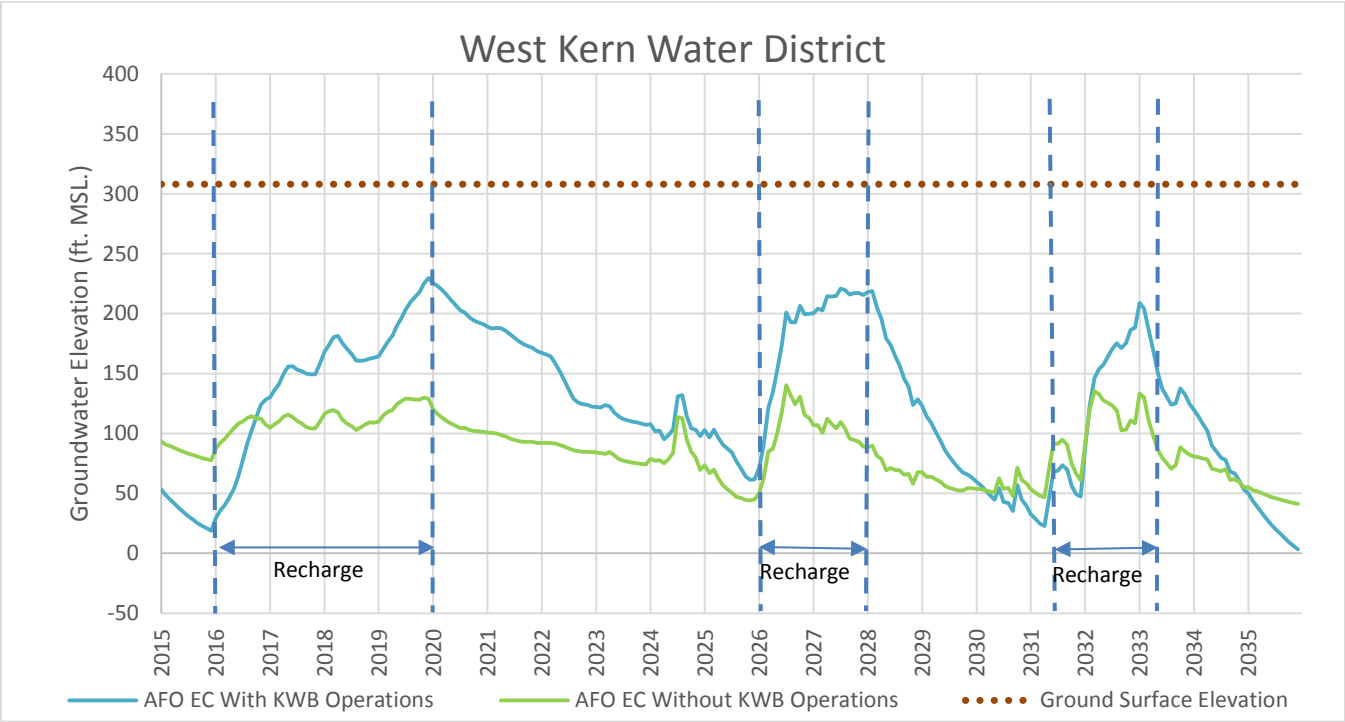


FIGURE 7.1-40d. Groundwater Elevation Hydrographs at West Kern Water District Recharge Pond for AFO-EC

TABLE 7.1-10

MODEL-GENERATED MINIMUM DEPTH TO WATER FOR AFO-BC CONDITIONS

Simulation Period	Recharge Facility			
	Rosedale	Pioneer	2800 Acre	West Kern WD
2016-2019	65	50.2	40.3	64.4
2026-2027	53.2	39.9	15.7	63.4
2032	65.7	67	48.9	86.9

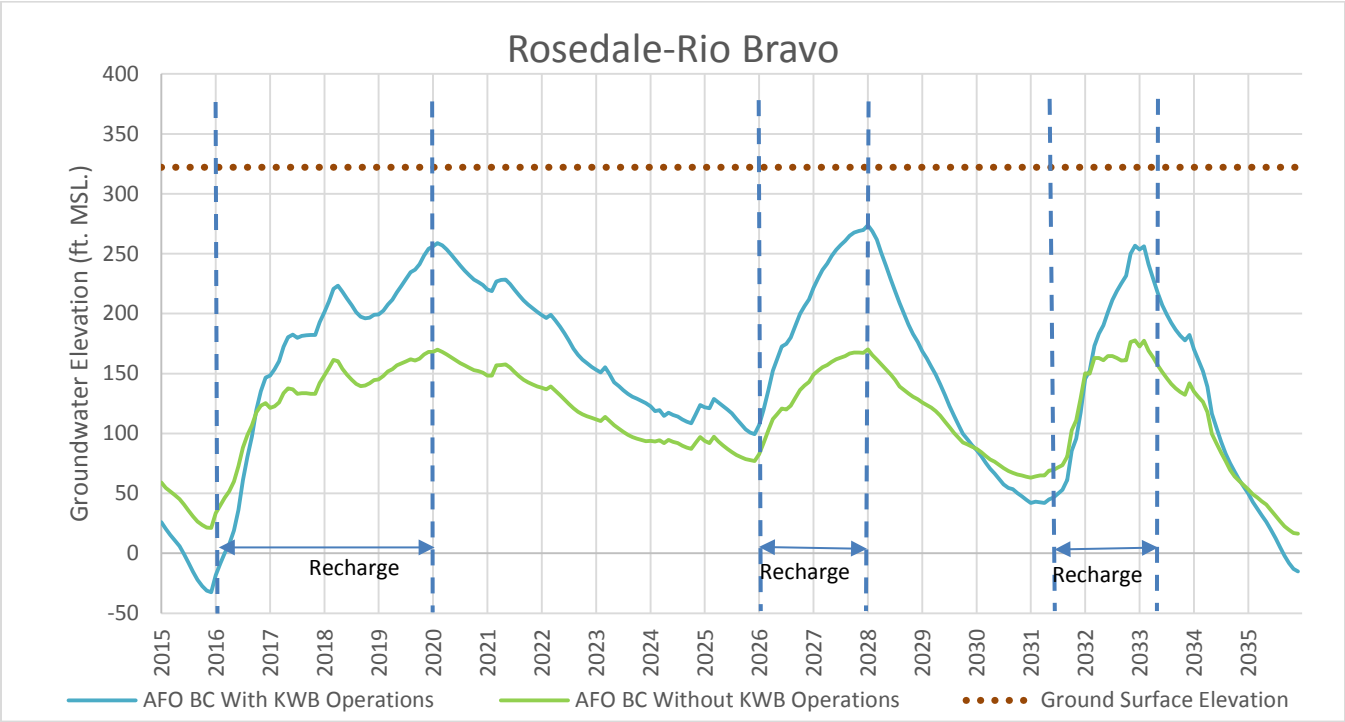


FIGURE 7.1-41a. Groundwater Elevation Hydrographs at Rosedale-Rio Bravo Recharge Pond for AFO-BC

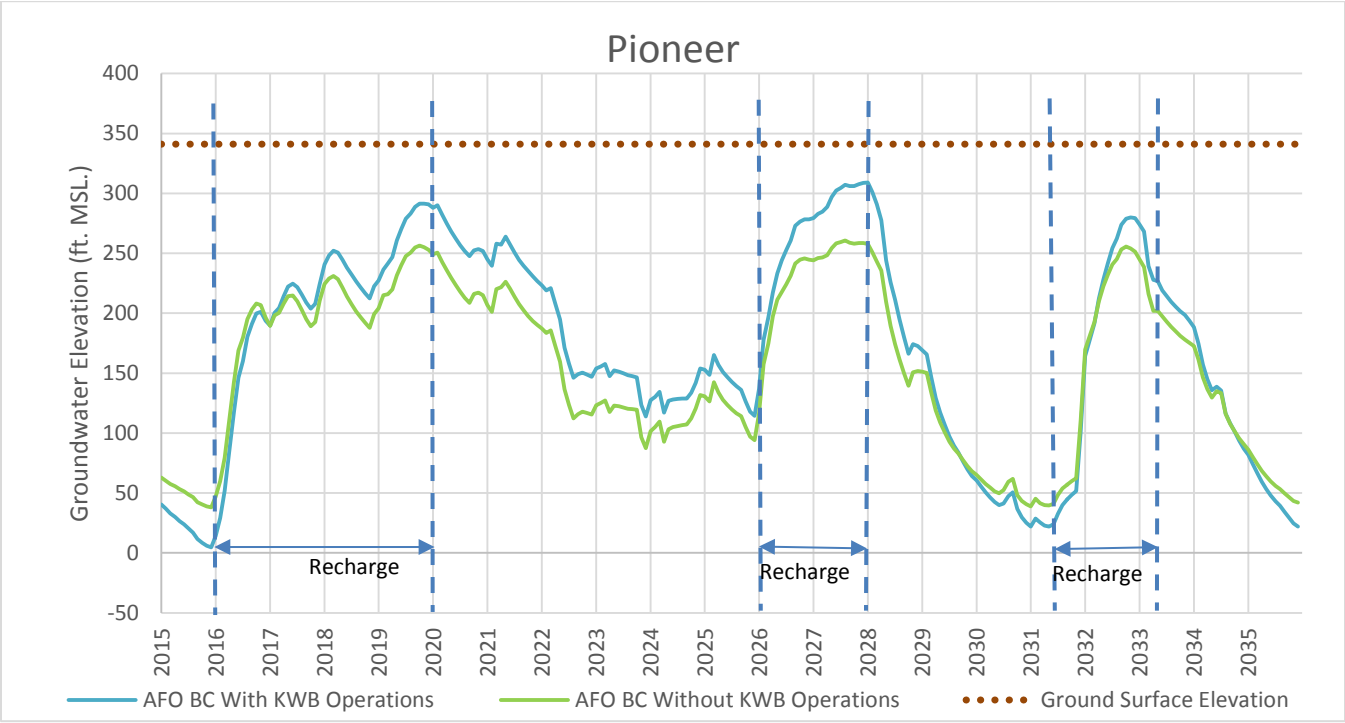


FIGURE 7.1-41b. Groundwater Elevation Hydrographs at Pioneer Recharge Pond for AFO-BC

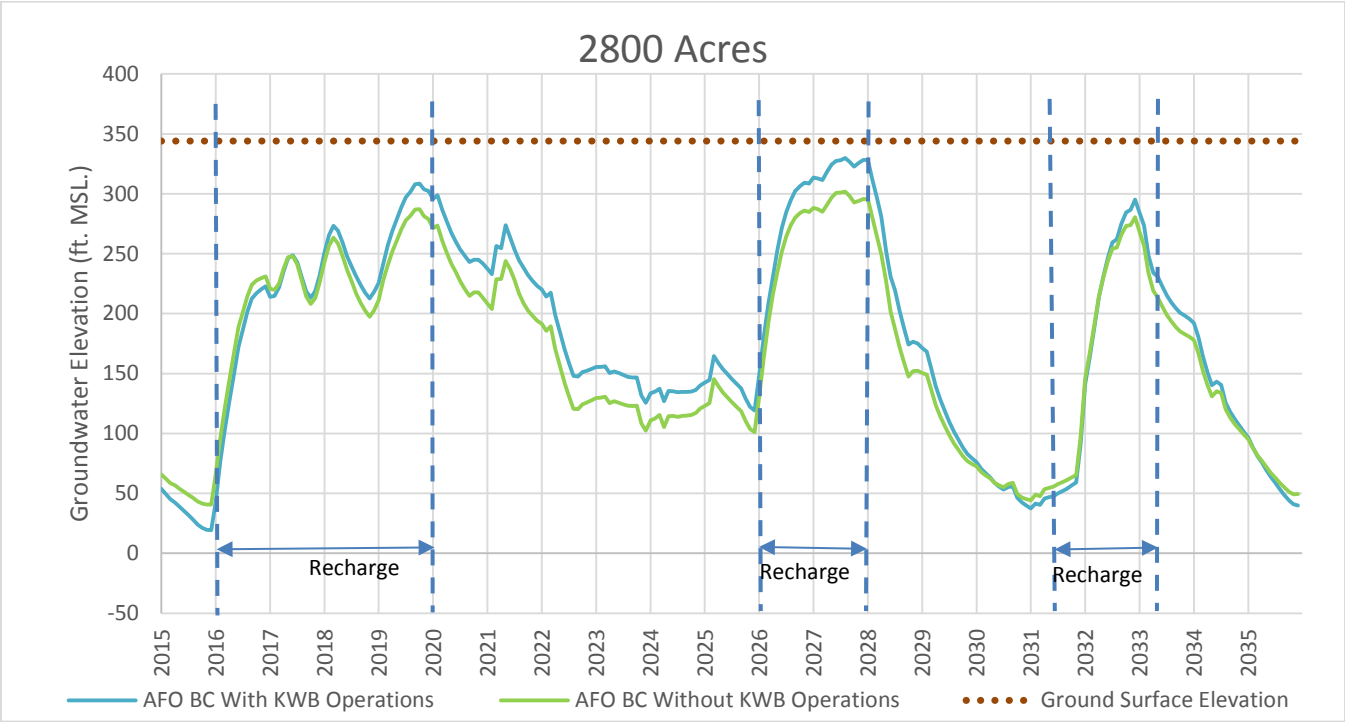


FIGURE 7.1-41c. Groundwater Elevation Hydrographs at 2800 Acres Recharge Pond for AFO-BC

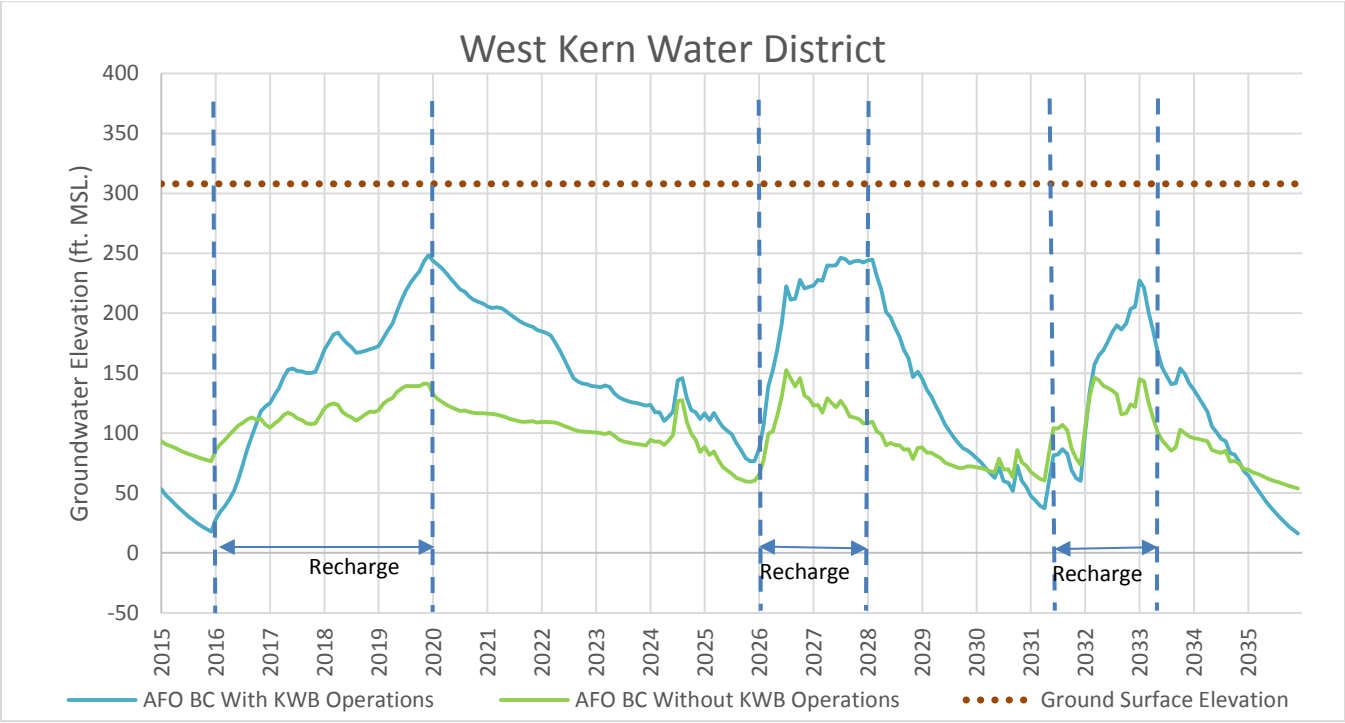


FIGURE 7.1-41d. Groundwater Elevation Hydrographs at West Kern Water District Recharge Pond for AFO-BC

Mitigation Measures

None required.

2015 – 2035 (Analysis of Future Operations – Build-out Conditions)

During recharge operations groundwater levels rise. The rise in water tables would be the result of the mutual interactions of the KWB and the neighboring groundwater banks and not due to the operation of any single groundwater bank. Impacts of KWB recharge operations on the recharge operations of neighboring recharge facilities were evaluated by using water level hydrographs at the neighboring recharge facilities. The evaluation showed a resulting groundwater level of approximately 16 feet below the ground surface. This would not result in a significant interference with groundwater recharge.

Therefore, the impacts from KWB operations during 2015-2035 under AFO-BC scenario conditions in terms of raising water levels in a groundwater basin sufficiently to substantially interfere with groundwater recharge at neighboring basins would be ***less than significant***.

Mitigation Measures

None required.

ENDNOTES

1. Kern Water Bank Authority. 2015. *Kern River Alluvial Fan Groundwater Flow Model Report.* Prepared by Amec Foster Wheeler.

2. California Department of Water Resources. 2016. *Development of DWR Kern Water Bank Model: Model Review, Selection, and Enhancements.*

3. California Department of Water Resources. 2013. *The State Water Project Delivery Reliability Report 2013*. Bay-Delta Office, Sacramento, CA.

4. California Department of Water Resources. 2013. *The State Water Project Delivery Reliability Report 2013*. Bay-Delta Office, Sacramento, CA.

5. California Department of Water Resources. 2003. *California Groundwater.* Bulletin 118.

6. Kern Water Bank Authority. 2009 (May 1). *Kern Water Bank Authority Habitat Conservation Plan/Natural Community Conservation Plan, 2008 Compliance Report and Management Plan.* Bakersfield, CA. Pages 5 and 22–32.

7. Kern Water Bank Authority. 2010 (May 1). *Kern Water Bank Authority Habitat Conservation Plan/Natural Community Conservation Plan, 2009 Compliance Report and 2010–2011 Management Plan.* Bakersfield, CA. Pages 5, 8, and 31–39.

8. Kern Water Bank Authority. 2011 (May 1). *Kern Water Bank Authority Habitat Conservation Plan/Natural Community Conservation Plan, 2010 Compliance Report and 2011 Management Plan*. Bakersfield, CA. Pages 4, 7, and 23–28.

9. Kern Water Bank Authority. 2012 (May). *Kern Water Bank Authority Habitat Conservation Plan/Natural Community Conservation Plan, 2011 Compliance Report and 2012 Management Plan.* Bakersfield*,* CA. Pages 9 and 25.

10. Kern Water Bank Authority. 2013 (May). *Kern Water Bank Authority Habitat Conservation Plan/Natural Community Conservation Plan, 2012 Compliance Report and 2013 Management Plan*. Bakersfield, CA. Pages 7 and 25.

11. Kern Water Bank Authority. 2014 (May). *Kern Water Bank Authority Habitat Conservation Plan/Natural Community Conservation Plan, 2013 Compliance Report and 2014 Management Plan*. Bakersfield, CA. Pages 7 and 25.

12. U.S. Environmental Protection Agency website, https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance-nuisance-chemicals#what-are-secondary, accessed April 21, 2016.

13. U.S. Environmental Protection Agency website, https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance-nuisance-chemicals#what-are-secondary, accessed April 21, 2016.