Kern Water Bank Storage Project

Within the Kern Groundwater Authority

Groundwater Sustainability Plan

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Prepared by:

Jonathan Parker, PG 4728, HG 110

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Executive Summary

This document describes the Kern Water Bank Authority's Storage Project (KWB) within the Kern Groundwater Authority Groundwater Sustainability Agency (KGAGSA) and Groundwater Sustainability Plan. The Kern Water Bank (KWB) conserves surplus water by storing that water in the Kern Fan aquifer and recovers previously stored water in dry years, thereby reducing the reliance on native groundwater by others in the Kern Subbasin. During the KWB's 25 years of operations, the project has stored 2.8 MAF of water and recovered 1.6 MAF of water. Both the past operations of the KWB, and its' future operations, provide a significant contribution to the sustainability goals of the Kern County Subbasin.

SGMA recognizes the uniqueness of storage projects and their role within a GSA in Water Code Section 10726.2.(b) which states: "…the agency shall not alter another person's or agency's existing groundwater conjunctive use or storage program except upon a finding that the conjunctive use or storage program interferes with implementation of the agency's groundwater sustainability plan." The KGAGSA also recognizes this unique aspect of storage programs within its boundaries with the following provision in its Joint Powers Agreement: "the Authority shall not restrict or otherwise limit the extraction of water stored (whether through direct recharge or in lieu deliveries) in the Kern County Subbasin as a part of any banking or recharge project or program, or otherwise seek to regulate the operation any such project or program." With respect to environmental documents, the California Department of Water Resources (DWR) developed mitigation measures, which included a long-term operations plan, in an Environmental Impact Report for the continued operations of the KWB that reduced potential groundwater impacts to less-than-significant (DWR, 2016). This document describes the KWB with reference to SGMA regulations, including the potential for the project to cause any of the six undesirable results of SGMA.

Groundwater within the Kern County Subbasin is used for irrigation, municipal and domestic, industrial, and environmental beneficial uses. The Subbasin is critically over-drafted. Additional general information about the basin can be found throughout the KGA Umbrella GSP.

1 Introduction

1.1 Purpose

The purpose of this document is to describe the Kern Water Bank Authority Storage Project (KWB) within the Kern Groundwater Authority Groundwater Sustainability Agency (KGAGSA) and the KGA Groundwater Sustainability Plan.[1] SGMA recognizes the uniqueness of storage projects and their role within a GSA in Water Code Section 10726.2.(b) which states: "…the agency shall not alter another person's or agency's existing groundwater conjunctive use or storage program except upon a finding that the conjunctive use or storage program interferes with implementation of the agency's groundwater sustainability plan." The KGAGSA also recognizes this unique aspect of storage programs within its boundaries with the following provision in its Joint Powers Agreement: "the Authority shall not restrict or otherwise limit the extraction of water stored (whether through direct recharge or in lieu deliveries) in the Kern County Subbasin as a part of any banking or recharge project or program, or otherwise seek to regulate the operation any such project or program.." With respect to environmental documents, the California Department of Water Resources (DWR) developed mitigation measures, which included a long-term operations plan, in an Environmental Impact Report for the continued operations of the KWB that reduced potential groundwater impacts to less-than-significant (DWR, 2016). Importantly, the KWB only recovers water previously stored and cannot contribute to basin overdraft.

This document describes the KWB with reference to SGMA regulations, including the potential for the project to cause any of the six undesirable results.

1.2 Sustainability Goal

The sustainability goal of the Kern County Subbasin is to:

- Achieve sustainable groundwater management in the Kern County Subbasin through the implementation of projects and management actions at the member agency level of each GSA
- Maintain its groundwater use within the sustainable yield of the basin through as demonstrated by monitoring and reporting groundwater conditions
- Operate within the established sustainable management criteria, which are established based on the collective technical information presented in the GSPs in the Subbasin.
- Collectively bring the Subbasin into sustainability and to maintain sustainability over the implementation and planning horizon.

The KWB is an important pre-existing project that is critical to the ultimate sustainability of the basin. The project:

- Conserves surplus water by storing that water in the Kern Fan aquifer;
- Does not using groundwater consumptively; and
- Recovers previously stored water in dry years to supplement limited surface supplies, thereby reducing the reliance on native groundwater by others in the Kern Subbasin.

[1] The KWB is not a management area. Other management areas within the Kern Groundwater Authority are described in Section 2.5 of the KGA Umbrella GSP.

The KWB has been in operation for 25 years. Over that time the KWB has stored 2.8 MAF of water and recovered 1.6 MAF of water. Both the past operations of the KWB, and its' future operations, provide a significant contribution to the sustainability of the Kern Sub-basin.

1.3 Agency Information

The Kern Water Bank Authority (KWBA) is a Joint Powers Authority (JPA or KWBA) formed in October 1995 pursuant to California Government Code 6500 et seq.

1.3.1 Organization of the Kern Water Bank Authority

The JPA is a public agency that includes as its members several water districts, a water agency, and a mutual water company. The JPA is governed by a board of directors which meets regularly in compliance with the Brown Act. Regular board meetings are held on the 1st Tuesday of each month at 3:00 pm at the KWBA office (1620 Mill Rock Way, Suite 500, Bakersfield, CA 93311, 661-398-4900). The General Manager of the KWBA is Jonathan Parker (jparker@kwb.org). For information on the organization of the Kern Groundwater Authority, see Section 1.4 of the KGA Umbrella GSP.

1.3.2 Implementation Costs

The costs to develop this document is estimated to be $64,000. Ongoing costs to provide annual report data is estimated to be $16,000 per year. The costs for monitoring activities and the implementation of mitigation measures described in this document are required in existing documents and are not due to SGMA regulations.

1.4 Document Organization

This document closely follows the *GSP Annotated Outline Guidance Document* developed by DWR in 2016. The main sections include:

1. Introduction,
2. Plan Area and Basin Setting,
3. Sustainable Management Criteria,
4. Projects and Management Actions,
5. Plan Implementation,
6. References and Technical Studies, and
7. Appendices.

2 Plan Area and Basin Setting

This portion of the document describes in part KWBA lands, key documents guiding the operations of the KWB, the hydrogeology of the Kern Fan area, and historical monitoring information.

2.1 Description of Project Area

The project area consists of the lands entirely owned by the KWBA which comprise about 32 square miles southwest of the City of Bakersfield. The KWBA is a member of the Kern Groundwater Authority. See Section 2.1 of the KGA Umbrella GSP for other agencies and the boundaries of federal or State lands within the Kern Subbasin.

2.1.1 Summary of Jurisdictional Areas and Other Features

As illustrated in Figure 1, the KWB is generally located at the western limit of Bakersfield between Stockdale Highway to the north, Taft Highway (State Route 119) to the south, Tupman Road and the California Aqueduct to the west, and Heath Road to the east. Interstate Highway 5 (I-5) bisects the KWB in a northwest to southeast direction.

The KWB is undeveloped except for water banking facilities, which include recharge basin berms, water control structures, canals, groundwater wells, and power lines (Plate 1). Scattered third-party oil-field facilities are also present in some areas.

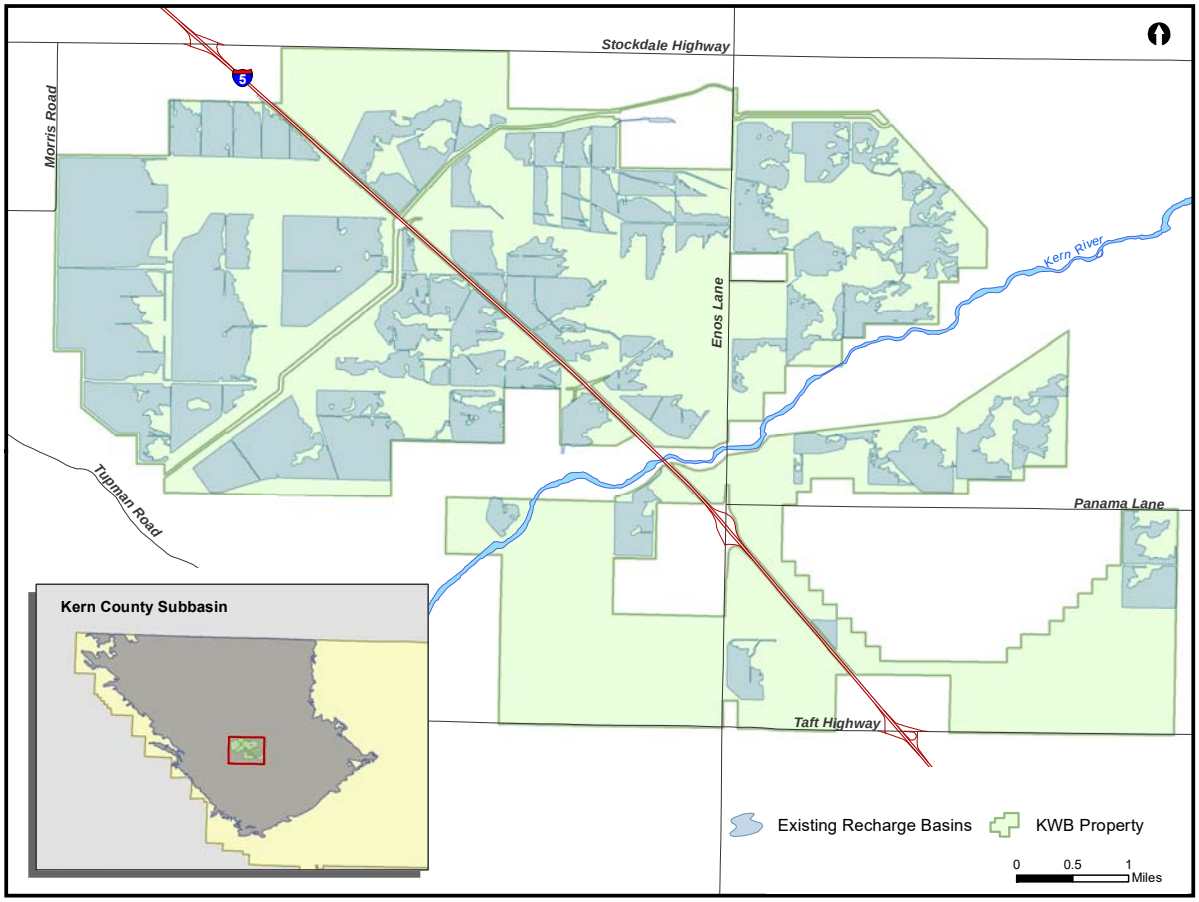

Figure 1. KWB Location.

Lands directly adjacent to the KWB to the north include undistricted agricultural lands and lands owned by Irvine Water District and Rosedale-Rio Bravo Water Storage District (RRBWSD) and used for water banking. Further north is RRBWSD. The Pioneer Project, the City of Bakersfield's 2800 Acre Facility, undeveloped land of McAllister Ranch, Kern Delta Water District (KDWD), and the Ten Section Oilfield lie to the east of the KWB. Lands to the west and south include lands owned by West Kern Water District and used for water banking, the Tule Elk Reserve operated by CalParks, Coles Levee Ecosystem Reserve, undistricted agricultural lands, and KDWD. Two inliers include land owned by Chevron, a racetrack, and agricultural land (Figure 2). For basin-wide information, see Section 2.1 of the KGA Umbrella GSP.

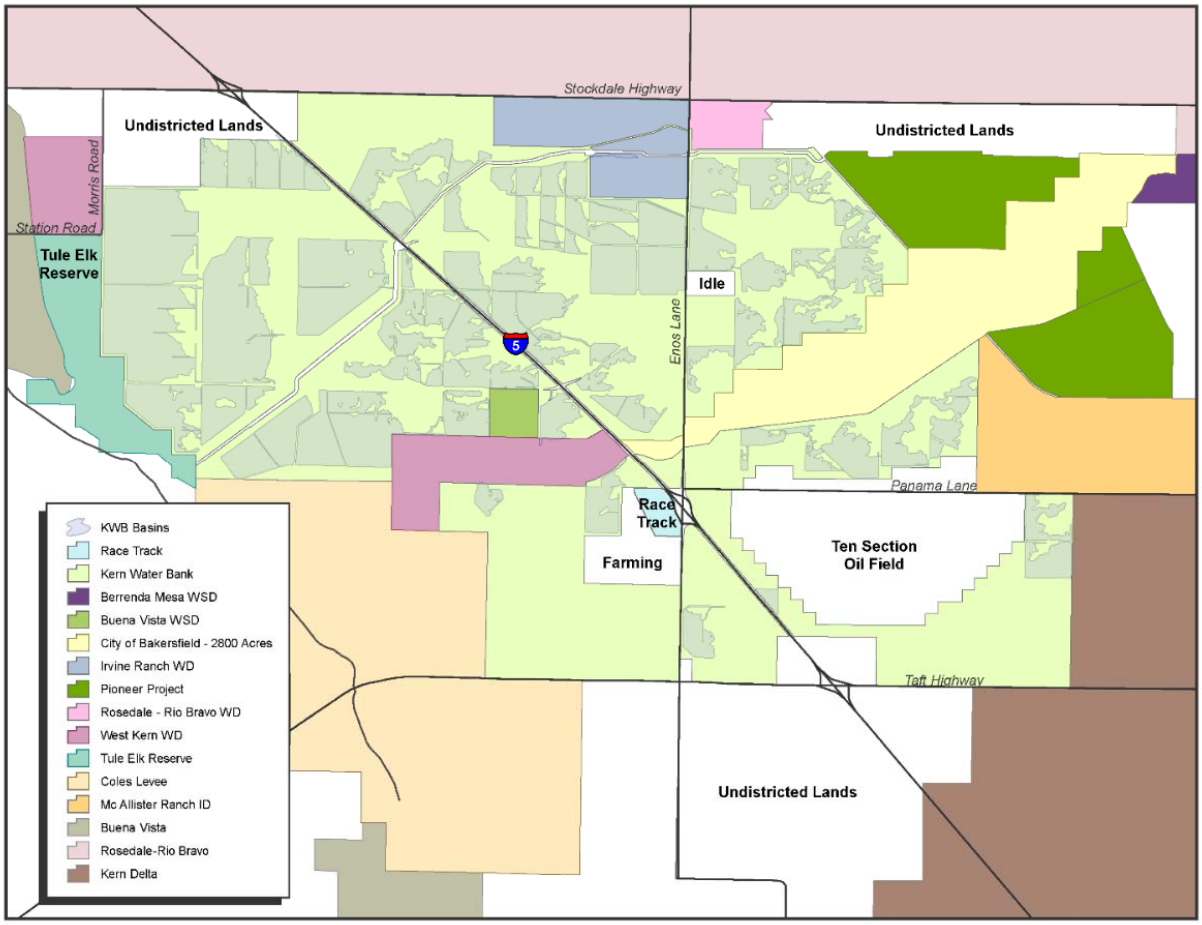

Figure 2. Lands adjoining the KWB.

2.1.2 Water Resources Monitoring and Management Programs

The Kern Water Bank operates pursuant to the following documents:

- Memorandum of Understanding Regarding Operation and Monitoring of the Kern Water Bank Groundwater Banking Program 1995 (KWB MOU; Appendix A);
- Proposed Monitoring Plan for The Kern Fan Element of the Kern Water Bank, 1996 (Kern Fan Monitoring Plan; Appendix B)
- Kern Fan Purge Pump Water Quality Sampling Procedures (Sampling Procedures: Appendix C)
- Sounder Calibration Protocol (Appendix D)

- Department of Water Resources Water Quality Policy and Implementation Process for Acceptance of Non-Project Water into the State Water Project (Pump-in Policy; Appendix E);
- Kern Water Bank Recovery Program Water Quality Monitoring Plan, Kern Water Bank Authority, August 2016 (KWBA Monitoring Plan; Appendix F).
- Cross Valley Canal/Kern Water Bank Operating Guidelines during Shallow Groundwater Conditions, 2000 (CVC Plan, Appendix G);
- Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and Associated Actions as Part of a Settlement Agreement (Monterey Plus) (2016 Monterey Plus Revised EIR – Kern Water Bank Development, and Continued Use and Operation) Mitigation Monitoring and Reporting Program (MMRP; Appendix H);
- Project Recovery Operations Plan Regarding Pioneer Project, Rosedale-Rio Bravo Water Storage District, and Kern Water Bank Authority Projects (Joint Operations Plan) (Appendix I);
- Agreement Between West Kern Water District and Kern Water Bank Authority for the Exchange and Recharge of Water (West Kern Agreement; Appendix J); and
- Kern Groundwater Authority Joint Powers Agreement (KGA JPA; Appendix K)
- Kern Subbasin Monitoring Protocols (Appendix L).

None of these programs limit the operational flexibility of other programs in the Kern Subbasin.

2.1.2.1 KWB MOU

Banking operations are subject to the conditions specified in the KWB MOU (Appendix A). The MOU's recitals include, "Adjoining Entities and Project Participants desire that the design, operation and monitoring of the Project be conducted and coordinated in a manner to insure that the beneficial effects of the Project to the Project Participants are maximized but that the Project does not result in significant adverse impacts to water levels, water quality or land subsidence within the boundaries of Adjoining Entities, or otherwise interfere with the existing and ongoing programs of Adjoining Entities." A Monitoring Committee, comprised of one representative of each of the Adjoining Entities and one representative of each of the KWBA participants, has numerous functions specified in the 1995 KWB MOU including, to "Develop procedures, review data, and recommend Project operational criteria for the purpose of identifying, verifying, avoiding, eliminating or mitigating, to the extent practicable, the creation of significant imbalances or significant adverse impacts."

A primary purpose of the monitoring committee is to evaluate groundwater information and determine if impacts are likely to occur as a result of project operations. If the monitoring committee determines that impacts are likely, then mitigation strategies are developed. Measures to prevent significant adverse impacts from occurring may include: (1) spreading out recovery areas; (2) providing buffer areas between recovery wells and neighboring overlying users; (3) limiting the monthly, seasonal, and/or annual recovery rate; (4) providing sufficient recovery wells to allow rotation of recovery wells or the use of alternate wells; (5) providing adequate well spacing; (6) adjusting pumping rates or terminate pumping to reduce impacts; and (7) imposing time restrictions between storage and extraction to allow for downward percolation of water to the aquifer. The KWB MOU also stipulates water quality is to be at least maintained and, where possible, enhanced. Some of the measures prescribed in the KWB MOU to protect water quality include: 1) giving storage priority to the best quality water available, 2) removing more salts than are stored, 3) controlling the migration of poor quality water, and 4) extracting poorer quality groundwater where practicable (and where blending with excellent quality

water from elsewhere in the project results in the water quality objectives of downstream users being met).

The MOU also prescribes losses and other adjustments to the volumes of water delivered to the KWB for storage. Surface delivery losses are 6% of all water delivered to the KWB for storage, adjoining signatories to the MOU can purchase 4% of the delivered water at low cost to offset overdraft in their districts, and an additional 5% loss is assessed for any recovered water sold outside of the Kern Subbasin to any out-of-County person.

2.1.2.2 Kern Fan Monitoring Plan

The Kern Fan Monitoring Plan (Appendix B) describes frequencies for water level measurements in both monitoring wells and recovery wells, and water quality sampling for constituents of concern in monitoring wells. Subsidence monitoring is also described. Specific protocols are not described.

2.1.2.3 Sampling Procedures

The Sampling Procedures document describes the protocols established by KCWA and the Kern Fan Monitoring committee for the collection of water quality samples (Appendix C). These procedures were followed for the historical water quality sampling described in Section 2.2.2.9. Future samples will be collected pursuant to the Kern Subbasin Monitoring Protocols (Section 2.1.2.11).

2.1.2.4 Sounder Calibration Protocol

The Sounder Calibration Protocol (Appendix D) describes the methodology used for historical data collection to ensure that the measuring tape is not stretched, and if so, how to correct for that error, as well as field measurement procedures to ensure that accurate groundwater level readings to within 0.1 feet were obtained. Future groundwater level measurements will be pursuant to the Kern Subbasin Monitoring Protocols (Section 2.1.2.11).

2.1.2.5 Pump-in Policy

The delivery of recovered water into the California Aqueduct is subject to the DWR's Pump-in Policy (Appendix E). The policy establishes a Facilitation Group of affected stakeholders and describes the requirements to implement a program including necessary monitoring and reporting. In practice, a proposal is submitted to DWR which describes the project proponents, maps showing all water sources and delivery points, rates and volumes of inflow, detailed water quality data for all recovery wells, and the expected blend of water delivered to the aqueduct. Well-water quality data and recovery rates are modeled to determine resultant blends and anticipated water quality changes in the aqueduct, and this information is reported to the Facilitation Group daily during recovery programs.

2.1.2.6 KWBA Monitoring Plan

The KWBA Monitoring Plan applies to KWB recovery wells and describes the sampling methods and frequencies necessary to meet the requirements of the Pump-in Policy (Appendix F). KWB recovery wells are sampled pursuant to the State Water Resources Control Board, Division of Drinking Water Quality Monitoring Schedule for a Community System with > 3300 population, groundwater/agricultural (CLGA). All the wells are tested every 3 years for the inorganic constituents on the CLGA, and 1/3 of the wells are tested every 3 years on a rotating basis for the organic constituents in the CLGA. Beginning in 2018, all wells are also sampled for low-level 1,2,3 trichloropropane (1,2,3-TCP). The results are provided to DWR and the Facilitation Group (described above) and used to model the quality of water delivered to conveyance facilities receiving recovered water.

2.1.2.7 CVC Plan

The CVC Plan was developed to further the requirements of the KWB MOU with respect to storage operations (Appendix G). Under the terms of the plan, KWBA monitors water levels and evaluates groundwater conditions in the vicinity of the CVC in coordination with KCWA. KWBA then manages storage operations to help ensure that groundwater gradient is away from the CVC during shallow groundwater conditions. If groundwater conditions develop that might induce piping behind the CVC's liner, KWBA minimizes storage adjacent to the CVC or increases the setbacks of adjacent recharge basins.

2.1.2.8 MMRP and Joint Operations Plan

Recovery operations are subject to a Long-Term Operations Plan established in the MMRP or the Joint Operations Plan (Appendix H and I). Consistent with the KWB MOU, both plans designate specific measures to be employed to "... prevent, eliminate or mitigate significant adverse impacts" resulting from project operations. The Joint Operations Plan designates mitigation measures similar to those contained in the Long-Term KWB Plan described in the MMRP. The Joint Operations Plan was developed to supersede the Long-Term Plan as it considers cumulative recovery operations of KWBA, Rosedale, and KCWA projects. Both plans designate a committee that regularly monitors potential groundwater level impacts of banking project recovery operations on neighboring agricultural and domestic wells based on groundwater modeling. Specific triggers are set for potential mitigation actions, with significant impacts being avoided, eliminated, or mitigated by implementing one or more corrective actions, including investigation of any claims and pump lowering, well replacement, and/or reduction or adjustment of banking project recovery operations, as appropriate. The MMRP also provides mitigation measures for cultural and paleontological resources.

The MMRP (which incorporates the KWB MOU and CVC Plan) has been subject to review by the Department of Water Resources and found sufficient to reduce potential impacts from KWB operations to less than significant.

2.1.2.9 West Kern Agreement

The West Kern Agreement provides for a sharing of adjacent facilities for storage and recovery to mitigate potential impacts from project operations in satisfaction of the requirements established in the KWB MOU (Appendix J).

2.1.2.10 KGA Joint Powers Agreement

The KGA GSP includes an "umbrella" document with chapters that provide specific information for districts/banks/etc. With respect to water-banking projects, the JPA provides that: "Such chapter or provisions may include operating conditions for groundwater banking projects that have previously been negotiated with other Members or agencies within the Basin and/or are contained within approved environmental documents. The Authority will recognize such operating conditions and/or environmental documents as meeting the requirements of consistency with the Authority's GSP and the requirements of SGMA" (Appendix K)

2.1.2.11 Kern Subbasin Monitoring Protocols

The Kern Subbasin Monitoring Protocols describe the procedures that are followed, in part, for:

- Measuring groundwater levels,

- Collecting groundwater quality samples, and
- Land subsidence.

These procedures (Appendix L) will be followed during monitoring activities

2.1.3 Land Use Elements

The land use designations as described in the Kern Water Bank Habitat Conservation Plan/Natural Communities Conservation Plan and General Plans, and the Kern County well ordinance, are discussed in this section.

2.1.3.1 Kern Water Bank Authority HCP/NCCP

The KWB operates under a Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP) that was executed on October 2, 1997 by and among the United States Fish and Wildlife Service, the California Department of Fish and Game, and KWBA. The HCP/NCCP provides for specific uses for the property through the year 2072. In addition to 5,900 acres dedicated to routine recharge activities, these uses include 960 acres of Sensitive Habitat, which is set aside for endangered species, 5,592 acres of Compatible Habitat, which can be used for recharge, conveyance, and recovery of water, the 3,267-acre Conservation Bank, which provides mitigation for other properties, 530 acres preserved and managed as mitigation for DWR projects, and a 3,170-acre Farming Sector which may also include recharge basins (Figure 3). The Farming Sector has not been farmed, but rather used in the same manner as Compatible Habitat. The HCP/NCCP provides for the commercial development of 490 acres adjacent to Interstate Highway 5 (I-5), contingent on amendment of the HCP/NCCP, but KWBA has committed not to develop this acreage. Note that the HCP/NCCP land use designations do not conflict with the General Plan designations discussed below, and, in fact, limit uses.

2.1.3.2 General Plans

The land use designations for KWBA lands are shown on Figure 4. Portions of KWBA Lands west of Enos Lane are covered by the Kern County General Plan. The general plan was adopted by the Kern County Board of Supervisors on June 15, 2004 and was last amended on September 22, 2009. The Kern County General Plan identifies policies that provide long-range guidance to county officials who make decisions affecting growth and resources in unincorporated Kern County, excluding the unincorporated portion of the county within the metropolitan Bakersfield planning area. An overarching goal of the Kern County General Plan is to ensure that environmental resources are protected and adequate water supplies are available. KWB operations contribute to both goals.

Portions of KWBA Lands east of Enos Lane are covered by the Metropolitan Bakersfield General Plan (Unincorporated Planning Area). This general plan is a separate but interrelated planning program for Kern County. The boundaries of the planning area were mutually agreed upon by the City of Bakersfield and Kern County as part of the joint adoption of the Metropolitan Bakersfield General Plan and represent the area where planning and land use decisions could affect both the City of Bakersfield and Kern County. The general plan was adopted by the City of Bakersfield Council on December 3, 2002 and was last amended on December 11, 2007. A goal of the Metropolitan Bakersfield General Plan is to encourage and implement water conservation measures and programs. KWB operations contribute to both goals.

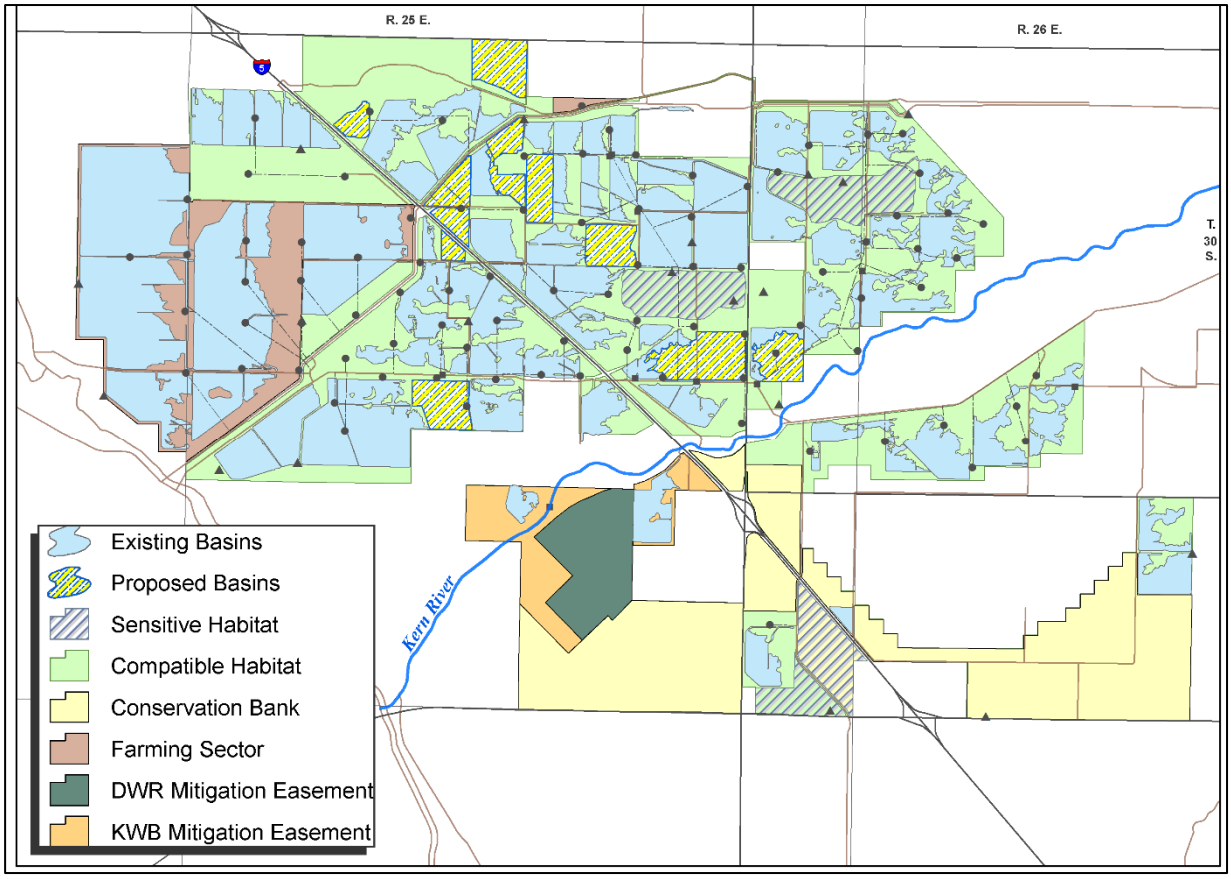

Figure 3. KWBA HCP/NCCP land use designations.

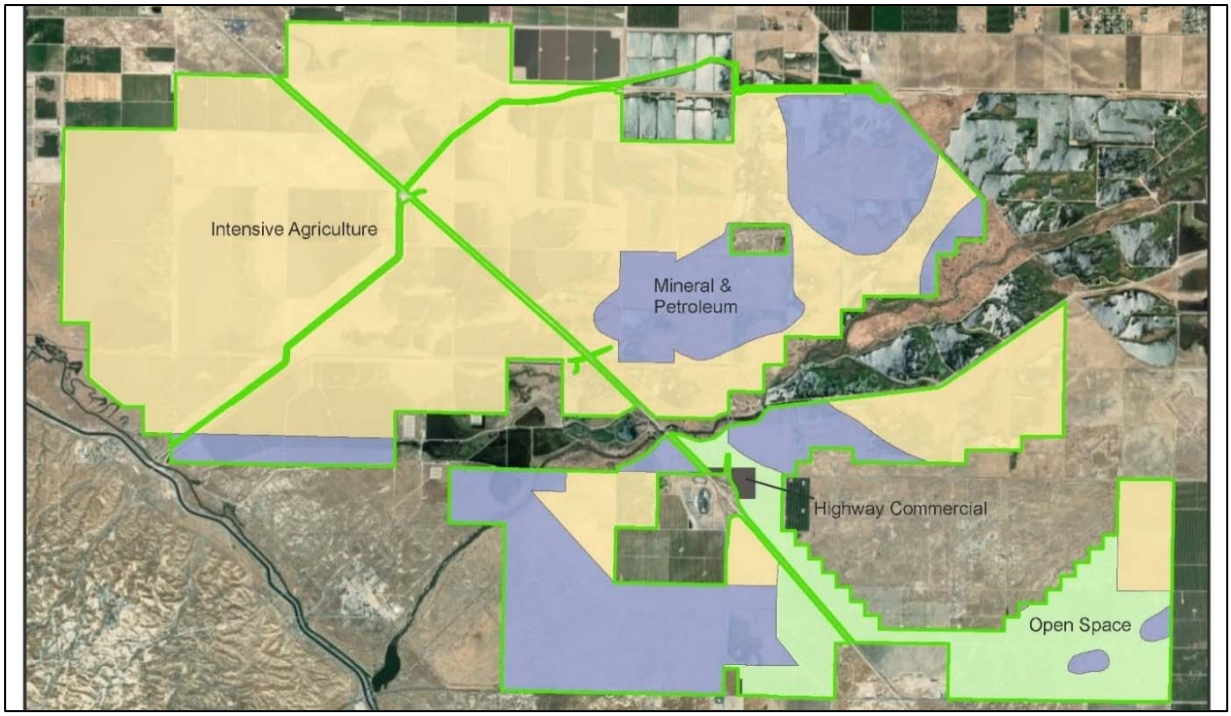

Figure 4. Kern County General Plan land use designations.

The implementation of this portion of the KGAGSP will not change water demands or water supply assumptions in either general plan, nor affect land use plans outside the Kern Subbasin. As discussed in Section 1.2, KWB operations will contribute significantly to the sustainability goals of the Kern Subbasin.

With respect to general plans, Government Code section 53091, subdivision (e), provides, in pertinent part, that "[z]oning ordinances of a county or city shall not apply to the location or construction of facilities for the production, generation, storage, treatment, or transmission of water[.]" Although section 53091 does not mention general plans, court cases have indicated this immunity extends to general plans.

2.1.3.3 Kern County Well Ordinance

Wells on the KWB are permitted, constructed, and abandoned pursuant to the Kern County Code of Ordinances Title 14, Chapter 14.08 Article III. Well Standards. These standards address wellhead protection.

2.1.4 Notice and Communication

The KGA has conducted outreach to stakeholders throughout the Kern Subbasin on behalf of its' members. These events have included:

- A series of six stakeholder workshops conducted from October 24 through December 20, 2016 in Bakersfield at multiple locations;
- Two groundwater workshops on April 26 and May 21, 2018 in Shafter and Arvin, respectively;
- An informational meeting on Sustainable Groundwater Plan, Compliance & State Intervention held on September 20, 2018 in Bakersfield; and
- SGMA Open House Events held on May 14 and September 26, 2019 in Bakersfield.

Information regarding these meetings is available at http://www.kerngwa.com/resources---outreach.html and is also provided in the umbrella document. The KGA has also developed a communication plan (Attachment C the KGA Umbrella GSP).

With respect to the KWB, the project has undergone significant public review through the CEQA process and through negotiations with adjoining entities (see Section 2.1.2.8). The public review process for the Monterey plus REIR included notifications throughout the state, providing the document for review at 29 locations, and public meetings in Fresno and Bakersfield. A more detailed discussion of the review process is provided in Appendix M.

This document has also been shared with adjoining groundwater agencies, including Rosedale – Rio Bravo Water Storage District, West Kern Water District, the Buena Vista GSA, and the Pioneer GSA, and made available to the public in draft form. No public comments were received. The joint operations plan discussed in Sections 2.1.2.8 has also been developed with several adjoining banking projects.

Finally, it should be noted that the KWBA owns all the lands on which it conducts operations, and there are no other groundwater users on the property.

2.2 Subbasin Setting

The KWB is in the central portion of the Kern County Subbasin. It is bisected by the Kern River and is at the distal end of the Kern River Alluvial Fan.

2.2.1 Hydrogeologic Conceptual Model

The umbrella document provides an overview of the hydrogeology of the entire Kern Subbasin. Information about the Subbasin pertinent to the KWB area, and particularly the Kern River alluvial fan, is provided below.

2.2.1.1 Previous Work

The hydrogeology of the southern San Joaquin Valley, and in particular the KWB area, has been the focus of several previous studies by the Department of Water Resources (DWR) and/or the United States Geological Survey (USGS). Croft (1966) studied the hydrogeology of the Kern Fan area in detail and Dale (et.al., 1972), in a broader work, studied the subsurface geology of the water bearing deposits beneath the southern San Joaquin Valley. DWR investigated the geology of the KWB in great detail during the completion of studies for the development of the Kern Fan Element of the Kern Water Bank (DWR, 1990). These earlier studies were subsequently refined by the KWBA as more information regarding the aquifer became available (Schmidt, 1997, 1999). Most importantly, the feasibility of the project has been documented by actual operations. Through the end of 2017, approximately 2.6 million acre-feet of surface water has been successfully stored and 1.5 million acre-feet of that stored water has been successfully recovered from the KWB.

The following discussion regarding regional geology is largely excerpted from the references listed above.

2.2.1.2 Regional Geologic Setting

The KWB is in the southern portion of the San Joaquin Valley, a large, deep asymmetric sedimentary basin. The basin consists of deep depositional centers separated by a basement high known as the Bakersfield Arch, located generally along the Kern River. The San Joaquin basin is bordered on the south and east by the crystalline igneous and metamorphic rocks exposed in the Sierra Nevada, Tehachapi, and San Emigdio Mountains. These rocks also underlie the basin at a depth of about 14,000 feet in the vicinity of the KWB and are considered to be generally non-water bearing. Overlying these rocks is a thick sequence of consolidated marine sedimentary rocks exposed in the Coast Range to the west and the San Emigdio Mountains to the south and extending eastward to lap onto the crystalline rocks of the Sierra Nevada. These rocks typically have poor water quality; they play no significant role in the developed part of the groundwater basin.

Miocene to Pleistocene-aged continental sediments overlie the marine sedimentary rocks in the basin. These sediments are several thousand feet thick in the subsiding portions of the basin but considerably thinner where deposited on and draped over the Bakersfield Arch. In the west, these continental sediments form the Tulare Formation, a thick sequence of water-lain sand, silt, and clay beds exposed along the western side of the San Joaquin Valley and in the Elk Hills adjacent to the Water Bank. In the east, the continental sediments form the Kern River Formation (Bartow and Pittman, 1983), a westward thickening series of sand, conglomerate, and mudstone strata. The Tulare Formation dips eastward under the alluvium in the KWB area and interfingers with the upper portion of the Kern River Formation in the subsurface.

The continental sediments of the Tulare and Kern River Formations are overlain by several hundred feet of fluvial and/or lacustrine sediments associated with the Kern River alluvial fan and the ancestral Buena Vista Lake. The alluvium from the Sierra Nevada is mainly composed of yellowish-brown gravel, fine to

very fine sand, and silt. Flood basin, lacustrine, and marsh deposits consist of blue-green or gray fine sand, silt and clay (Dale, et.al.,1972).

2.2.1.3 Geology of the Aquifer

The upper portion of the Kern River and Tulare Formations and the overlying alluvium form the groundwater aquifer in the KWB area (see Cross-Section E, Plate 2, from Dale, et.al., 1972; and Section C, Figure 10, from Croft, 1966). The base of the aquifer can be defined by salt content. Title 40, Code of Federal Regulations (40 CFR), Section 144.3 defines an Underground Source of Drinking Water (USDW) is an aquifer or part of an aquifer which supplies any public water system or contains a sufficient quantity of ground water to supply a public water system and currently supplies drinking water for human consumption or contains fewer than 10,000 mg/l of TDS. The depth at which TDS in groundwater exceeds 10,000 mg/l (the base of USDW) in the KWB ranges from below -2,200 feet MSL (~2,500 feet deep) in the eastern portion of the KWB to about -1,200 feet MSL (~1,500 feet deep) in the westernmost portion of the KWB (Figure 5; Gillespie, 2017). There are no wells producing groundwater for beneficial uses from these depths. The portion of the aquifer most suitable for beneficial uses generally lies above the base of fresh water as defined by Page (1986; EC < 3,000 micromhos per centimeter[2] or <~2,000 mg/l TDS). This level varies in depth from about -1,600 feet MSL (~1,900 feet deep) near the eastern edge of the KWB to about -800 feet MSL (~1,100 feet deep) adjacent to Elk Hills (Page, 1971). KWB wells penetrate the aquifer to levels of about -400 to -600 feet MSL, nowhere near the base of useable freshwater defined by Page. KWBA is also not aware of any groundwater wells reaching these depths adjacent to the KWB. For management purposes the KWBA focuses on the upper part of the subbasin at levels above -700 feet MSL.

The stratigraphy of the aquifer sediments is complex. Sand count data compiled by CSUB (2005) indicate the upper 300 feet of the aquifer consists of about 70% sand whereas below this depth the aquifer consists of about 50% sand. The balance of the sediments consists of silt and lesser amounts of gravel and clay. Unlike some other parts of the groundwater subbasin, no laterally extensive clay deposits (e.g. the Corcoran Clay) are present under the KWB (CSUB, 2005, Negrini, 2008). In fact, those who have studied the stratigraphy of the aquifer find it very difficult to find any single deposit that can be correlated with confidence across the Kern Fan (CSUB, 2005, DWR, 1990; Negrini, 2008, PGA, 1991; Wilson, 1993). A series of plates show the resistivity curves of several wells juxtaposed together across the KWB (See Plates 2-6). These cross sections illustrate the highly variable nature of the Kern Fan's stratigraphy.

The Kern Fan's stratigraphy has resulted in a leaky aquifer, as evidenced by hydraulic head data from monitoring wells located throughout the Kern Fan area (see Figure 10 and 11). Storage events initially result in successively higher head levels in successively shallower intervals. However, within a month or so pressure equalization occurs as water migrates down through the vadose zone, reaches the water table, and re-pressurizes the lower parts of the aquifer. This is a classic example of a leaky aquifer, where there are no distinct, laterally extensive aquitards preventing this re-pressurization, and confirms the lack of laterally extensive clay deposits such as the Corcoran Clay.

There are no structural barriers to groundwater movement on the Kern Fan with perhaps one exception. Monitoring 30S/25E-19N located at the very western end of the KWB shows little to no response to pumping programs to the east. This phenomenon may be the result of a localized structural barrier in this area.

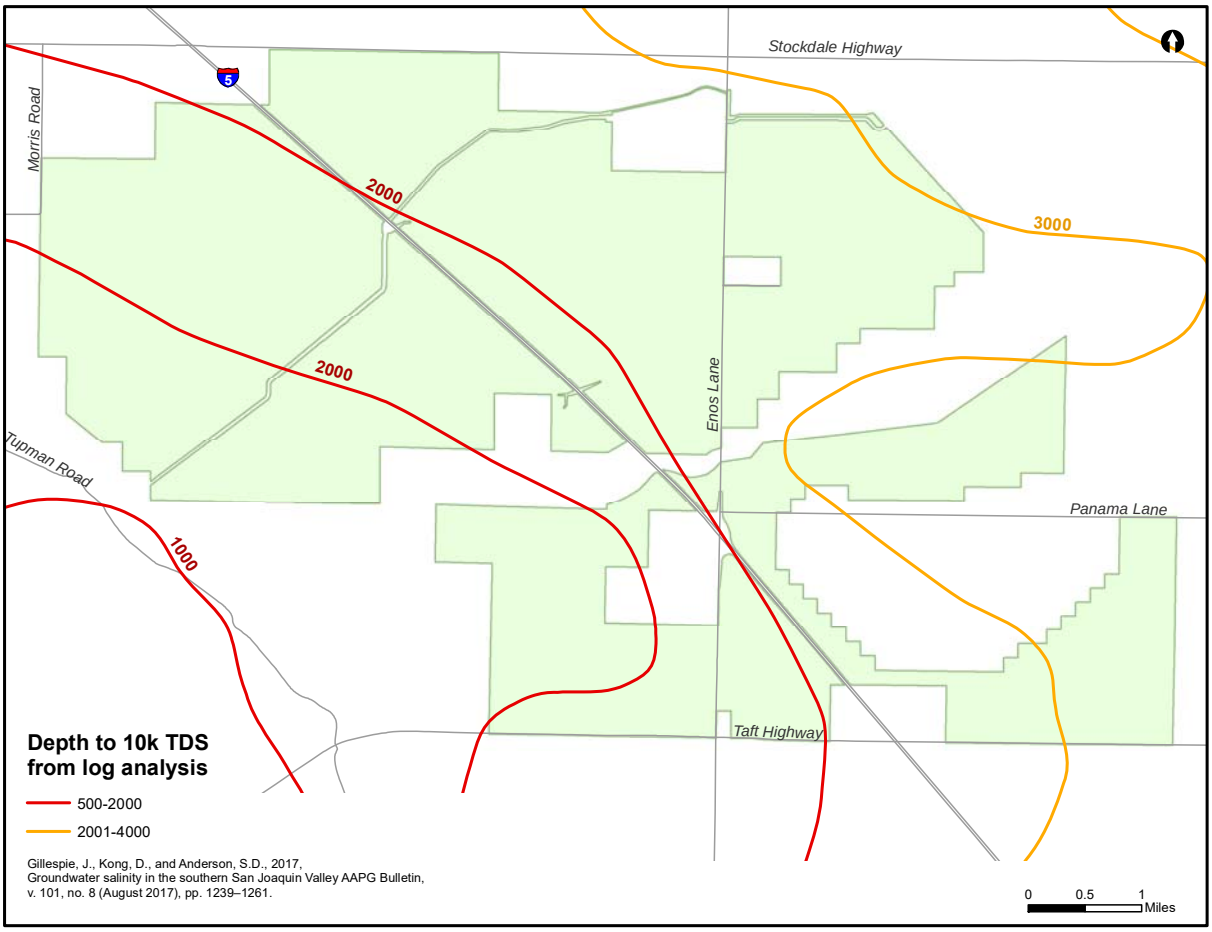

Figure 5. Depth (ft) to 10,000 mg/l TDS from log analysis.

2.2.1.4 Aquifer Parameters

The Kern Fan aquifer is well-suited to direct recharge banking. Aquifer pump-test data indicates the specific yield of the aquifer ranges from 15 to 18%, hydraulic conductivity ranges from 50 to 100 ft/d, and specific capacity ranges from 13 to 162 gpm/ft of drawdown. The suitability of the aquifer for banking is perhaps best illustrated by the fact that as much as 566,000 AF of water was stored in 2017, and some of the recovery wells have produced water at rates as high as 10 cfs.

2.2.1.5 Topography

Topography slopes gently to the southwest with elevations ranging from 335 feet to 285 feet (Figure 6).

2.2.1.6 Surficial Geology and Soil Types

Most of the surface of KWBA lands consist of recent alluvial fan deposits. Recent river-channel deposits are present along the Kern River channel and recent basin deposits are present locally in the western portion of the KWB (Figure 7; CDMG, 1965). Soil types are shown on Figure 8, and descriptions of each series is presented in Appendix N (USDA, 2009).

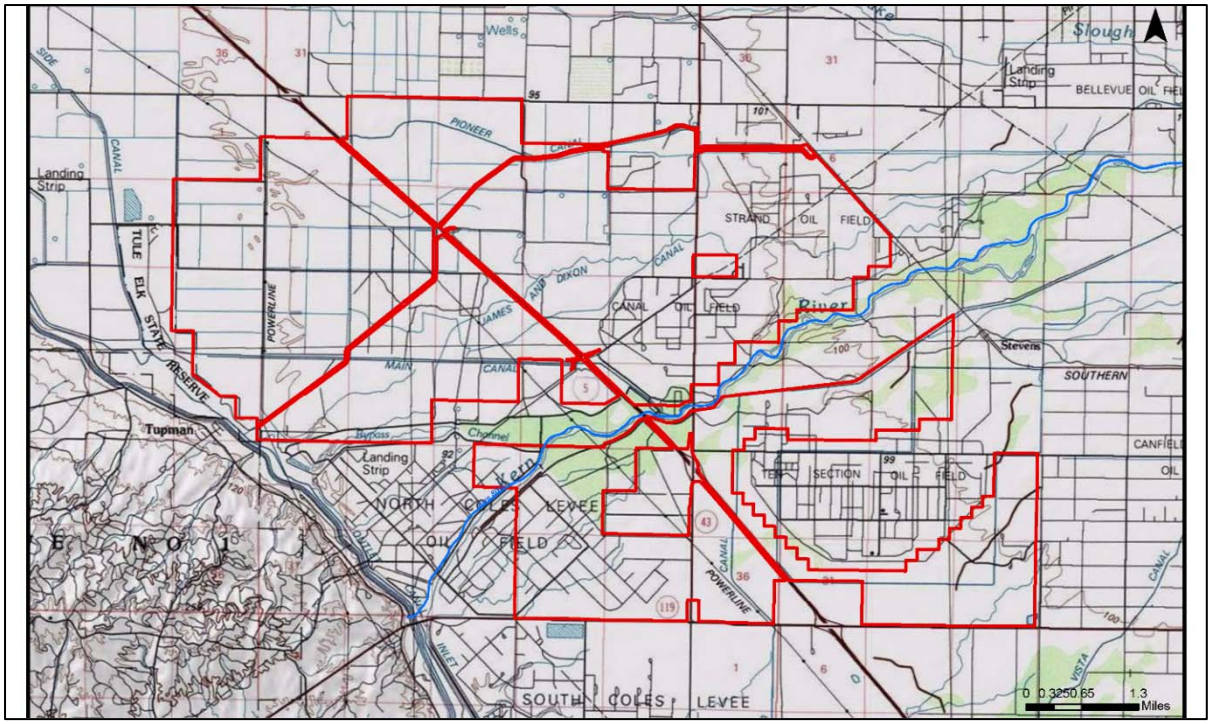

Figure 6. Topography of the KWB (outlined in red; from the Stevens and Tupman 7.5-minute topographic quadrangles).

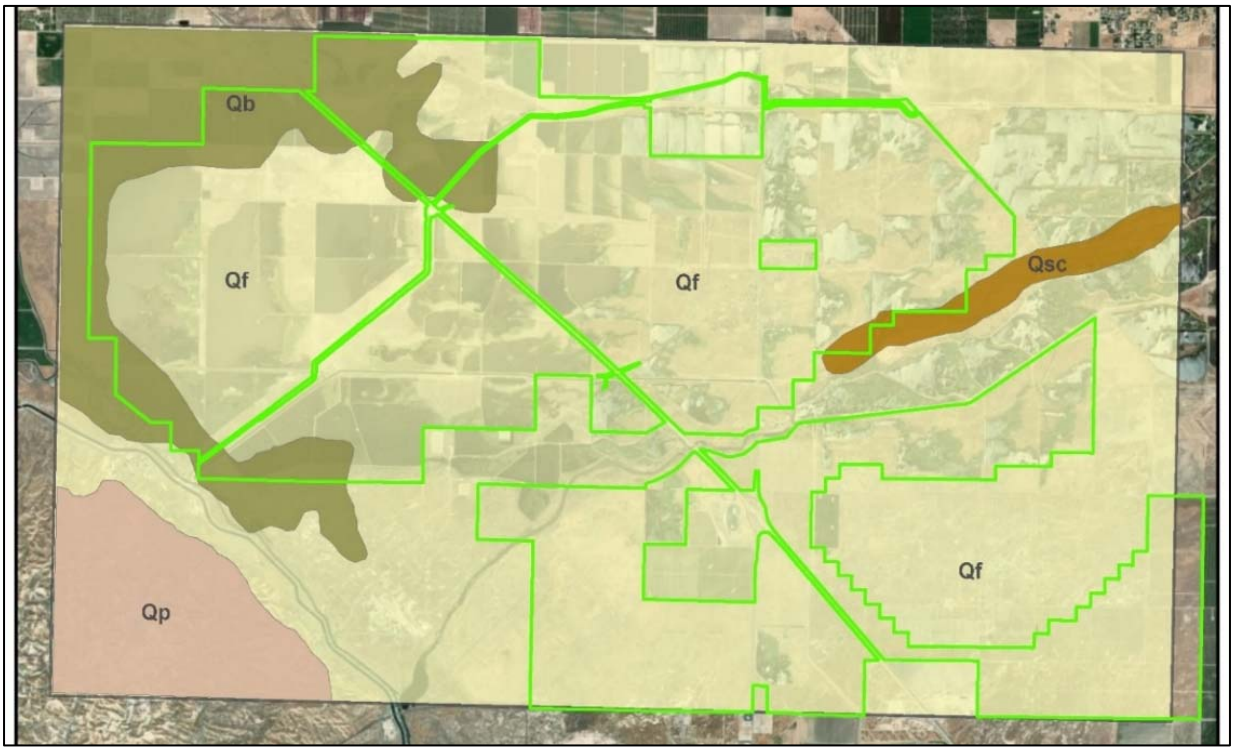

Figure 7. Geology of the surface of the KWB. Qf – Recent alluvial fan deposits; Qb – Recent basin deposits; Qsc – Recent river and major stream deposits; Qp – Pliocene-Pleistocene nonmarine deposits (from CDMG, 1965).

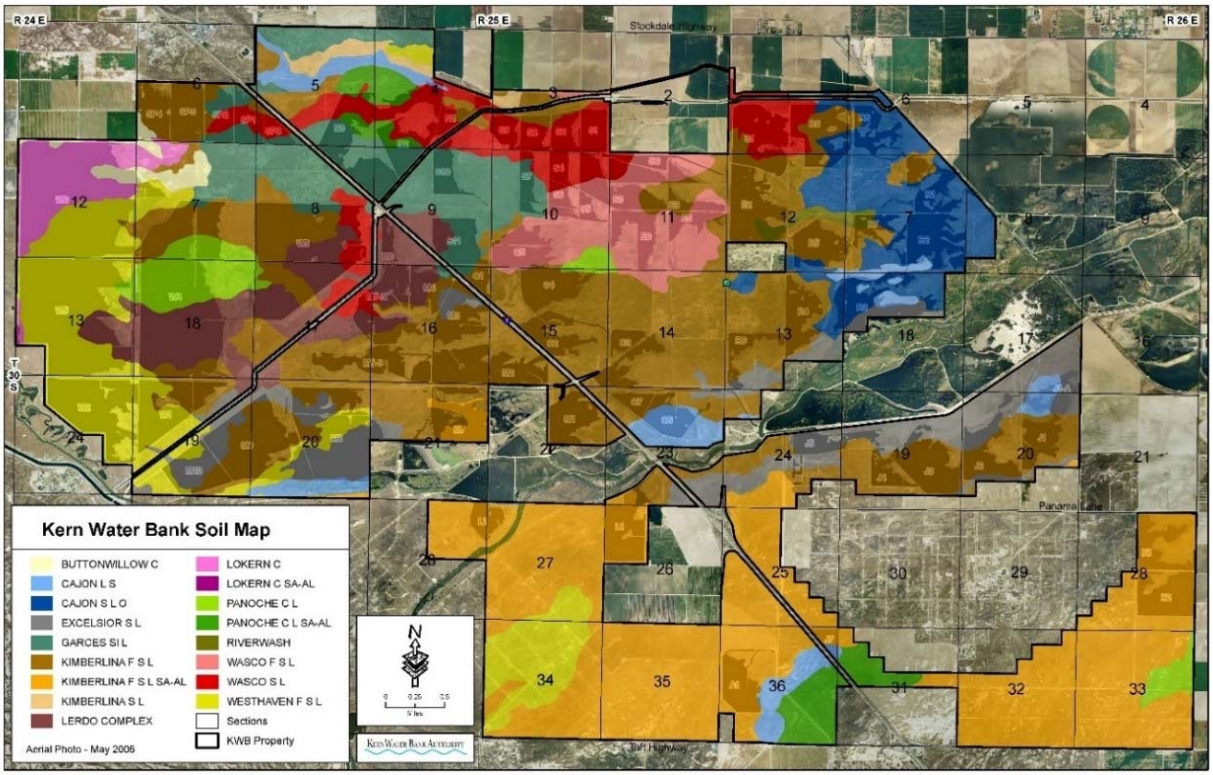

Figure 8. Soil types on the KWB (USDA, 2009)

2.2.1.7 Aquifer Storage and Recovery

The Kern Subbasin has abundant aquifer storage space for stored surface water. KCWA estimated the subbasin had 10 MAF of storage available in the early 1990's – continued overdraft in the region since that time has increased the available storage significantly. The Kern Fan area of the subbasin is very well suited to direct storage water banking. As stated in Section 2.2.1.3, the Kern Fan aquifer is unconfined to semi-confined, and there are no laterally extensive aquitards present. In 2017, the KWBA stored 566,000 AF of water net of losses, and annual recovery volumes for the KWBA have reached 270,000 AF. Section 2.2.3 describes the accounting of stored water in detail.

2.2.2 Current and Historical Groundwater Conditions

This section describes an existing monitoring network, ongoing monitoring of groundwater levels, both surface and groundwater quality, and subsidence.

2.2.2.1 Points of Delivery

Imported water is delivered to the KWB via the California Aqueduct, the Kern River, and the Friant Kern Canal. The primary points of delivery from the California Aqueduct are the KWB Canal and the Cross Valley Canal. Kern River and Friant Kern Canal water can be delivered through many different individual facilities. A map illustrating all of the turnouts on the Kern Fan and their capacities is provided in Plate 7.

2.2.2.2 Existing Monitoring Network

The Kern Fan area has been monitored extensively since the early 1990's. DWR installed a series of dedicated nested monitoring wells throughout the area in order to evaluate the aquifer for water banking (Figure 9). The wells are typically constructed of 6-inch steel casing and slotted screen. The

wells are used to monitor both water levels and groundwater quality. An extensometer was also installed in the center of the KWB in well 16L to track subsidence. The objective of the network is to thoroughly identify any impacts that may arise from project operations.

2.2.2.3 Groundwater Level Monitoring

Groundwater levels are monitored monthly in 53 nested monitoring wells at 16 locations, an areal density of 1 well per 2 square miles. The wells are nested at various depth intervals so that water level information is also available vertically within the aquifer (See Appendix O for well construction information). The monthly monitoring frequency provides abundant data to determine groundwater elevation trends, and the density of wells far exceeds the recommendations in the DWR BMP[2] so data gaps do not exist. The data is compiled and reported by the Kern Fan Monitoring Committee pursuant to the KWB MOU in Operations Reports that include hydrographs and groundwater depth and elevation maps (Appendix P). A subset of these wells will be used for annual SGMA reporting (See Figure 3.1 in the KGA Umbrella GSP). Field procedures for historic measurements are as described in the Sounder Calibration Protocol (See Section 2.1.2.4; Appendix D).

2.2.2.4 Groundwater Quality Monitoring

Extensive monitoring has been used to establish baseline groundwater quality and ensure that groundwater quality is not being degraded. This monitoring consists of two elements: 1) the sampling of 38 dedicated monitoring wells twice a year for several potential constituents of concern, and 2) the sampling of all recovery wells every 3 years. The locations of the monitoring wells and recovery wells are shown on Figure 9. Construction information for the wells is presented in Appendix O.

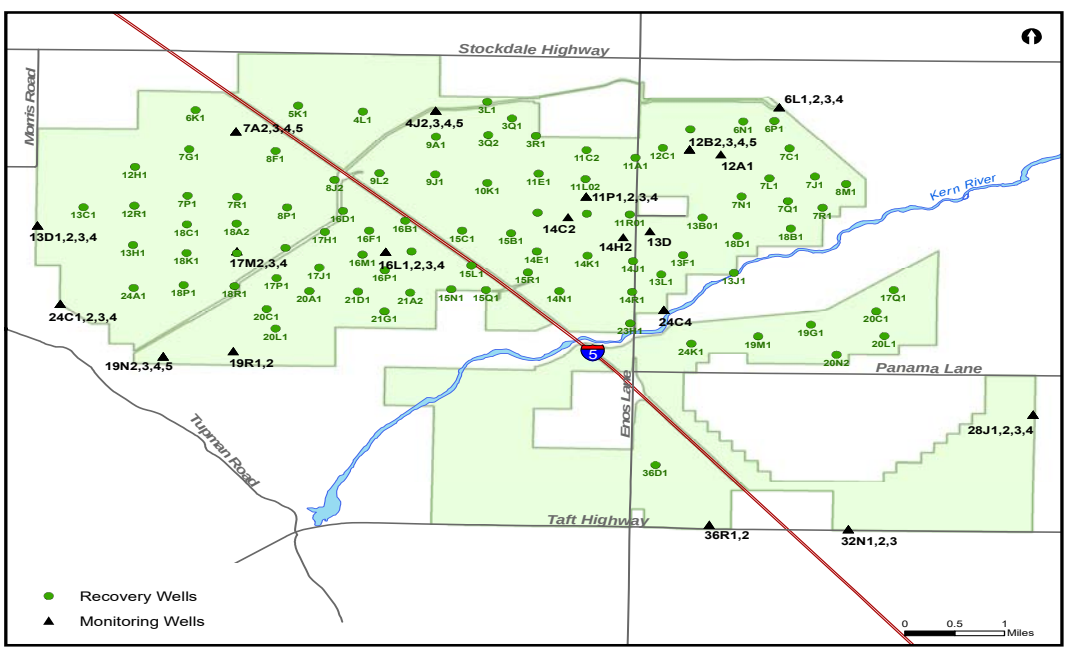

Figure 9. Monitoring and recovery well locations.

[2] This density is equivalent to 50 wells per 100 mi^2, far greater than the density of 4 wells per 100 mi^2 referenced in *Monitoring Networks and Identification of Data Gaps Best Management Practice* (DWR, 2016)

The sampling of the monitoring wells is mandated by the KWB MOU (Section 2.1.2.1; Appendix A). Under this program water samples are analyzed for several potential constituents of concern twice a year as described in the Kern Fan Monitoring Plan (Section 2.1.2.2; Appendix B). The data is compiled and reported by the Kern Fan Monitoring Committee pursuant to the KWB MOU. Water quality hydrographs, statistical trend analyses, and salt balance calculations are included. Field procedures for historical samples are as described in the Kern Fan Purge Pump Water Quality Sampling Procedures (Section 2.1.2.3; Appendix C).

The second element of groundwater monitoring includes sampling the recovery wells according to the KWBA Monitoring Plan (Section 2.1.2.6; Appendix F). In addition to providing extensive information regarding groundwater quality, the results of this sampling are used to model expected changes in water quality in conveyance facilities receiving the recovered water. The model is updated daily and forwarded to DWR and the Facilitation Group. An example of the model output is provided Appendix P, pages 144 to 148).

2.2.2.5 Surface Water Monitoring

The volumes of water delivered to the KWB for storage purposes are measured and reconciled by several agencies, including DWR, KCWA, the City of Bakersfield, Buena Vista Water Storage District, and the Army Corps of Engineers, depending on the source of the water. The results are then tabulated by the KCWA and documented in Operations Reports by the Kern Fan Monitoring Committee (see latest report in Appendix P).

KWBA relies on others, namely those providing water delivered for storage purposes, to monitor water quality in the delivered water. Kern River and CVP (Friant-Kern) water is monitored by Improvement District 4 of the KCWA and reported in annual reports (i.e. http://www.kcwa.com/wp-content/uploads/2018/07/ROWC2016.pdf), and SWP water in the California Aqueduct is monitored by DWR (https://water.ca.gov/Programs/State-Water-Project/Water-Quality).

Stored water recovered by the KWBA enters the California Aqueduct and the Cross Valley Canal. KCWA and DWR monitor the quality of water delivered to the California Aqueduct during recovery operations by collecting samples in delivery conveyances (i.e. the KWB Canal and Cross Valley Canal) and at locations upstream and downstream of delivery points at least quarterly as required by the Pump-in Policy (Section 2.1.2.5). The results are distributed to the Facilitation Group and summarized in annual reports prepared by DWR (DWR, 2017).

2.2.2.6 Subsidence Monitoring

Subsidence has been continuously monitored by DWR since June 1994 with an extensometer located near the center of the KWB in Section 16, T30S/R25E. The extensometer is anchored at a depth of approximately 800 feet and continuously monitors changes on a chart recorder.

2.2.2.7 Historic Groundwater Levels

Historic water levels in the project area have varied through time in response to wet and dry cycles and water banking operations. Long-term groundwater hydrograph plots of potentiometric surfaces are shown in Figure 10 for the 4J wells and in Figure 11 for the 16L wells (located at township and range T30S/R25E). These hydrographs are for clustered monitoring wells that are completed at various depths as indicated in the figures. The shallower completions document water levels in the aquifer, whereas the deeper completions represent hydraulic head in the aquifer. Both hydrographs show a steady decline in

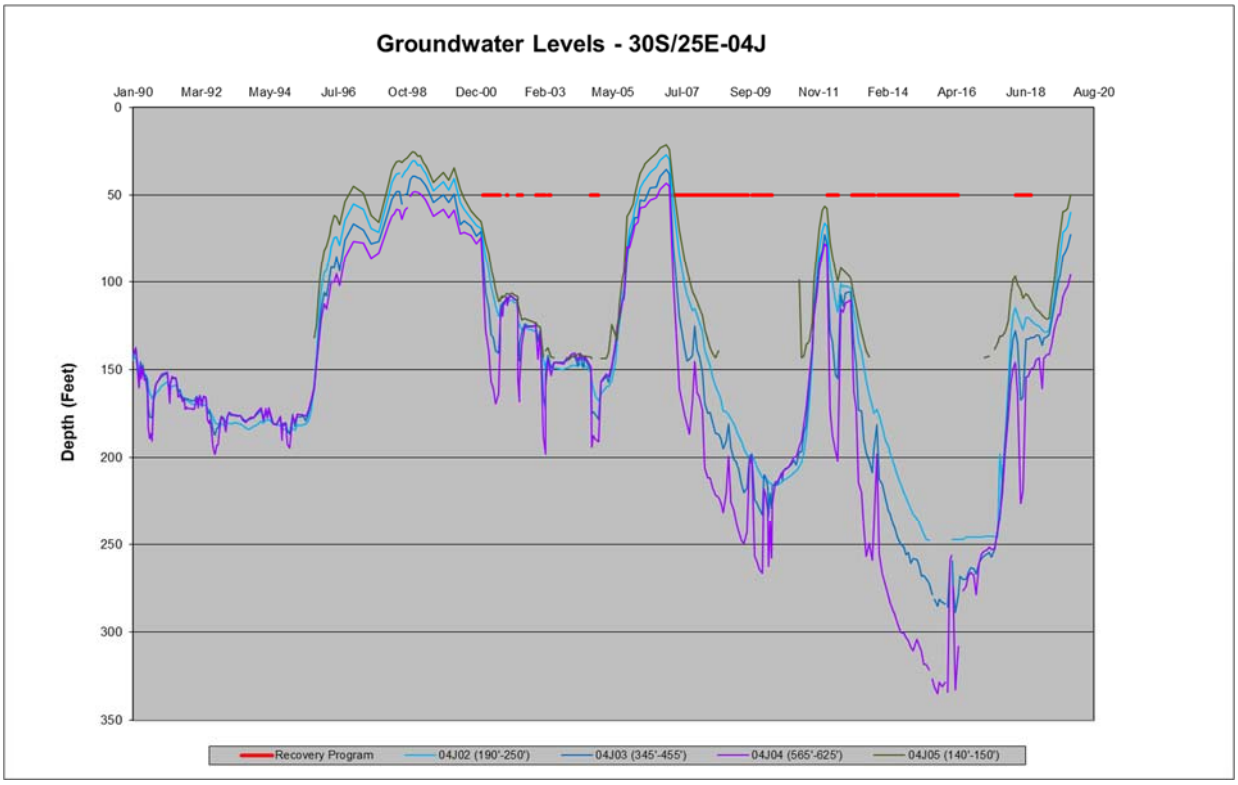

Figure 10. Hydrograph for wells 30S/25E-4J02, 03, 04, and 05.

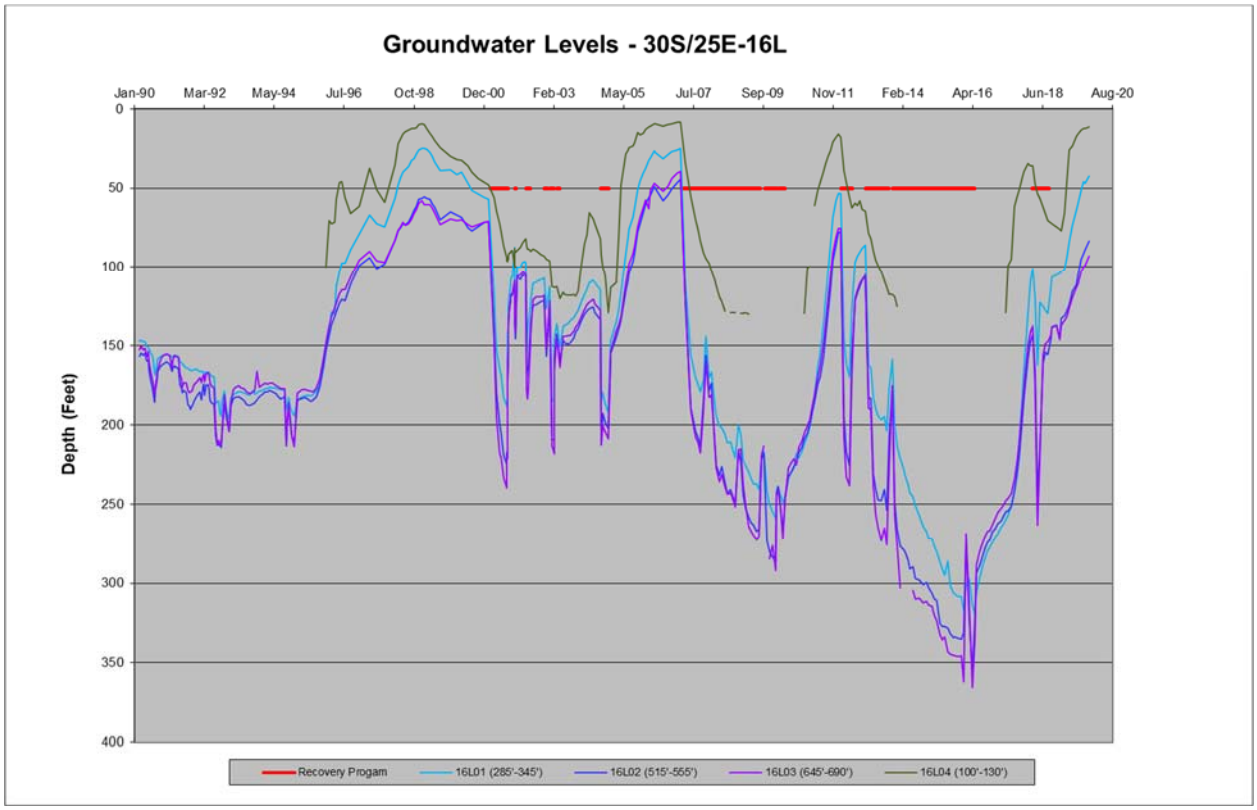

Figure 11. Hydrograph for wells 30S/25E-16L01, 02, 03, and 04.

water levels through the early 1990s due to drought conditions. The storage activities of the KWBA and other banking projects can be seen in the dramatic rise in water levels from 1995 through 1999. Several storage and recovery cycles, coinciding with wet and dry periods, are documented after this time by rises and falls in water levels and hydraulic head. A chronic lowering of water levels is not indicated, and historic KWB operations have been sustainable.

In general, the banking programs on the Kern Fan generate a mound with groundwater flow directions to both the north and south. During prolonged recovery programs, temporary depressions can develop. Extensive detail regarding groundwater conditions for the KWB and vicinity is provided in the Kern Fan Monitoring Committee report in Appendix P. Contour maps depicting groundwater elevation, depth, changes in levels, hydrologic profiles, and long-term hydrographs for numerous monitoring wells on the KWB and in near-by areas are provided.

2.2.2.8 KWB Historical and Projected Future Operations and Groundwater Levels

DWR developed a model (hereafter referred to as the DWR KWB Model)[3] in 2015 to evaluate the potential groundwater impacts of KWB operations on adjoining wells. The model domain extended well beyond the KWB, and historical operations from 1995 through 2014 and projected operations for the period 2015 through 2035 were evaluated. Three modeling scenarios were developed:

- Historical operations from 1995 through 2014;
- Future operations from 2015 to 2035 under existing conditions (i.e. no changes in land use or KWB facilities); and
- Future operations from 2015 through 2035 under projected future conditions (i.e. projected changes to land uses and KWB facilities).

Each scenario was run "With-KWB Operations" and "Without-KWB Operations," for a total of six model runs. The Without KWB Operations scenarios assumed all 20,000 acres of KWBA lands were simply fallowed; i.e. there was no groundwater consumption. This is a very conservative assumption as approximately 17,000 acres of KWBA lands had been previously farmed and, had the KWB not been developed, it would be expected that the lands would have continued to be farmed. Surface water supplies available for that farming would be limited, so consumptive use would have contributed to overdraft.

2.2.2.8.1 Historical Operations Analysis

The analysis of With and Without historical operations indicates that the KWB's activities have provided significant benefits to the region for most of the historical period. Figure 12 illustrates the difference in average groundwater elevations through time that resulted from project operations in zones that are progressively further away from KWBA lands. As shown, average groundwater elevations beyond 1 mile are all higher for the entire 1995-2014 period, and the benefits extend up to 5 miles away. Groundwater elevations are lower within the 1-mile zone as a result of project operations, but only temporarily at the end of the 2007-2010 drought and toward the end of the 2012-2015 drought. A chronic lowering of groundwater elevations has not occurred, and historic KWB operations were not only sustainable, but supported groundwater levels in the area for most of the historic period.

[3] The DWR KWB Model is built on the MODFLOW-NWT code.

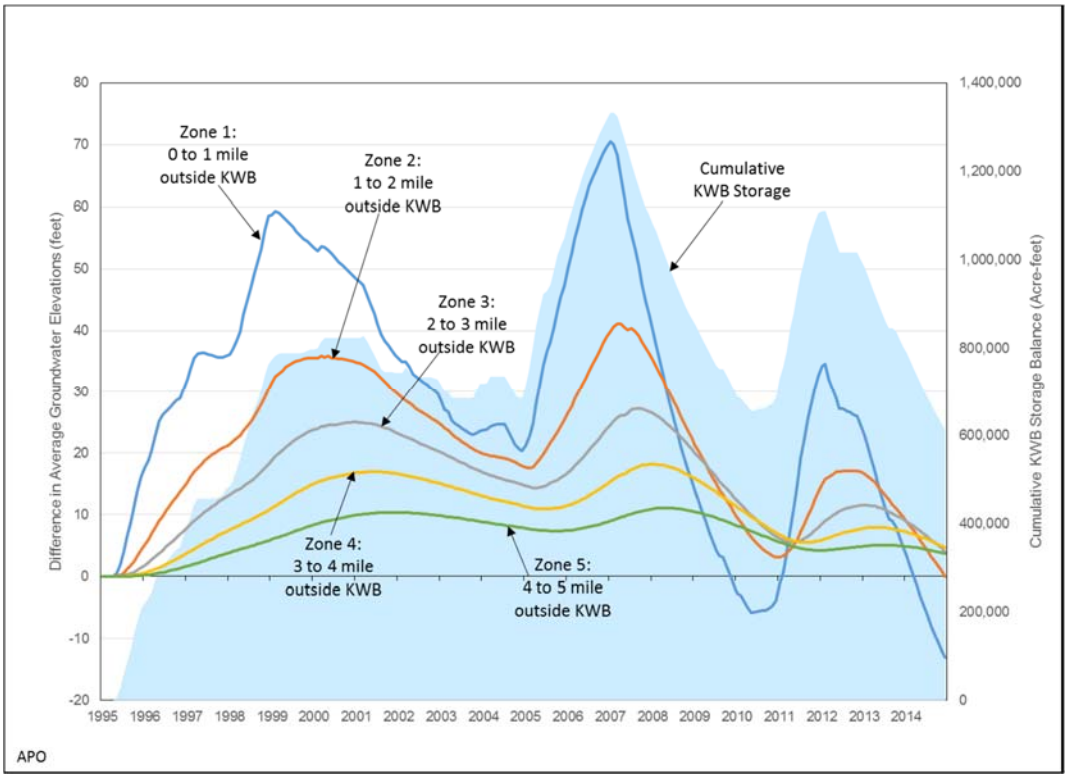

Figure 12. Analysis of Past Operations: Average Groundwater Elevation Differences in Zones Outside the KWB Boundary, 1995-2014 (Figure 3.2-16 from DWR KWB Model).

2.2.2.8.2 Future Operations Analysis

The future operations simulations considered operations under existing conditions and operations under projected build-out conditions. The latter simulation included estimated changes in land-use and the construction of additional recharge basins. As shown in both simulations, average groundwater elevations are lower in most zones at the beginning of the simulations, which reflect the continuation of the 2012-2015 drought (Figure 13 and 14). However, this lowering is temporary, not chronic, and benefits are projected for most of the balance of the simulations. Although the simulations end at 2035, they can be extended through 2040 by repeating the 2015-2020 results. In that case, by the end of 2040, all zones are showing benefits, including as far away as 5 miles. Overall, a chronic lowering of groundwater elevations is not predicted to occur in either simulation, and future KWB operations are not only sustainable, but support groundwater levels throughout the area for the foreseeable future. The foregoing is a very brief summary of the results of the DWR KWB Model. A very detailed report documenting modeling parameters, inputs, and the results of the modeling scenarios is provided in Appendix Q.

2.2.2.9 Historic Groundwater Quality

Groundwater quality in the Kern Fan aquifer is generally excellent. The concentration of total dissolved solids (TDS) in recovery well water averages about 270 mg/ℓ. The TDS in the California Aqueduct can range up to 325 mg/ℓ, and the secondary maximum contaminant level (MCL) for drinking water is 500

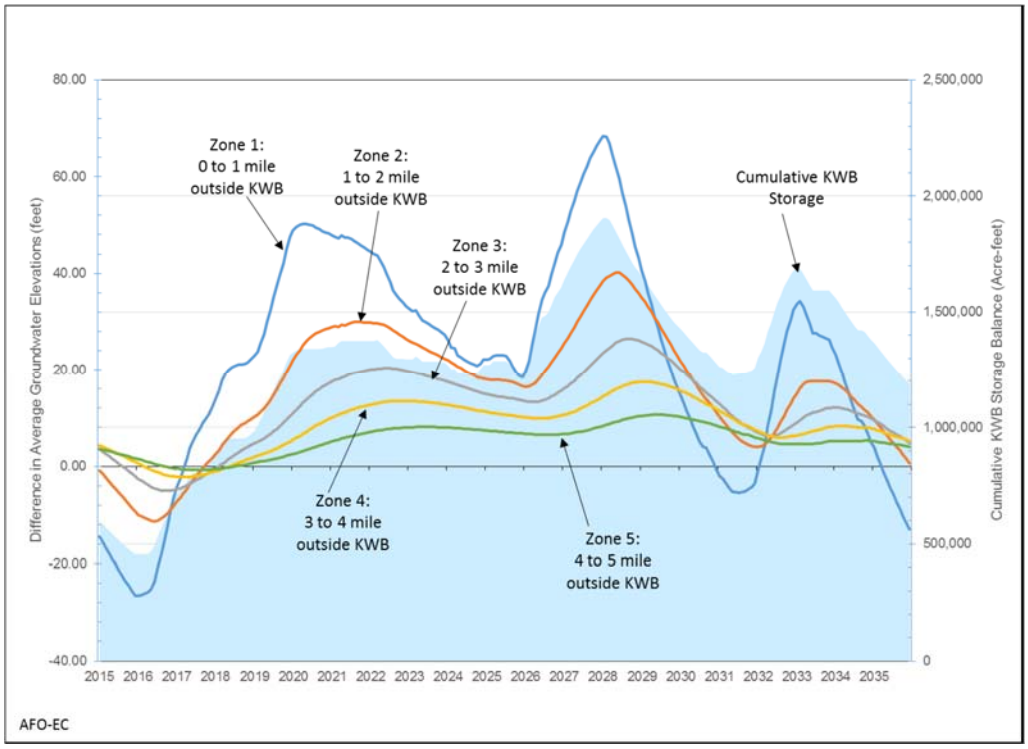

Figure 13. Analysis of Future Operations under Existing Conditions: Groundwater Elevation Differences in Zones 1 to 5, 2015-2035. (Figure 3.3-13 from DWR KWB Model)

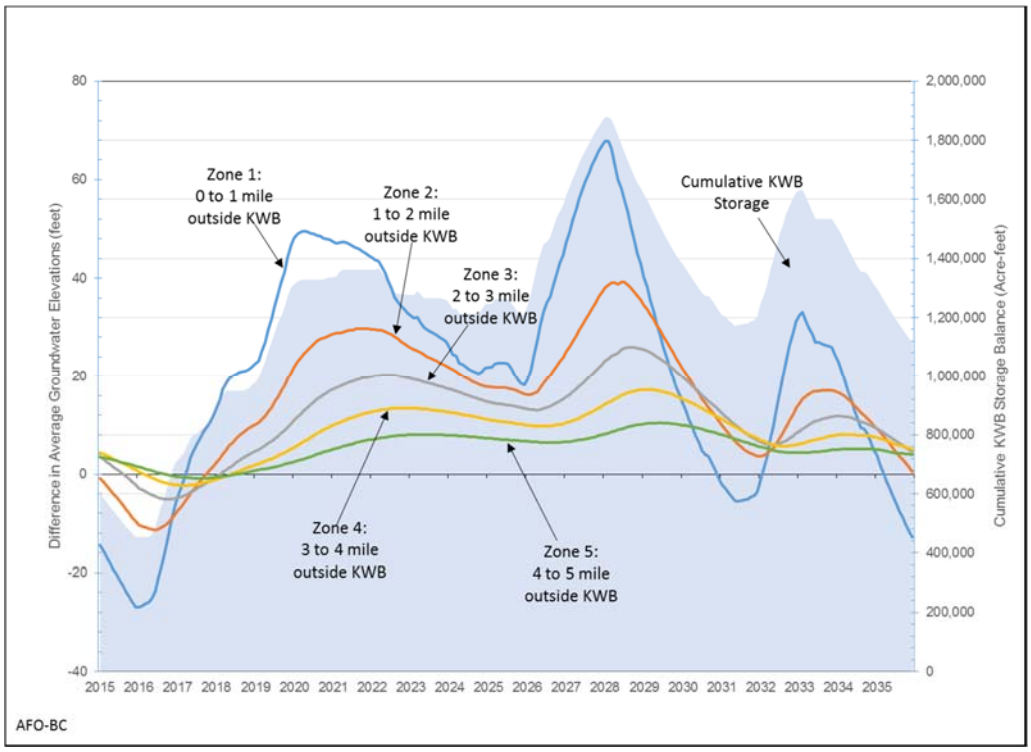

Figure 14. Analysis of Future Operations under Buildout Conditions: Groundwater Elevation Differences in Zones 1 to 5, 2015-2035. (Figure 3.4-13 from DWR KWB Model)

mg/ℓ. The water quality in each KWB recovery well is thoroughly and regularly tested in accordance with protocols developed by the California Department of Health Services for drinking water (See Section 2.1.2.6) Except for a few constituents in a few wells, the water quality of all of the KWB's recovery wells meets drinking water standards, and recovered well water entering the Aqueduct meets the Department of Water Resources' Water Quality Policy for Acceptance of Non-Project Water into the State Water Project (See Section 2.1.2.5). The most recent data for arsenic, bromide, 1,2,3-TCP, hexavalent chromium, nitrate, TDS, dissolved organic carbon, sulfate, uranium, and chloride for KWB recovery wells is presented in Appendix R.

In addition to testing each recovery well, the KWBA regularly monitors groundwater quality in a network of 38 dedicated monitoring wells for the presence of several constituents semiannually. The results of this sampling are discussed in more detail below.

2.2.2.9.1 Spatial and Temporal Variations in Groundwater Quality

Although water quality across the Kern Fan is generally excellent, there are spatial variations in quality with both laterally and with depth. For example, arsenic concentrations are locally higher in the southern part of the aquifer (Plate 8), TDS concentrations generally increase to the west (Plate 9), and the concentrations of nitrate and TDS are typically higher in the shallow part of the aquifer (Plate 9 and 10).

Elevated arsenic concentrations appear to be, at least in part, related to the nature of the sediments in the aquifer. CSUB has investigated the occurrence of arsenic in the vicinity of the KWB (Negrini, et. al, 2008). Their studies suggest that the reducing geochemical environment more likely to be found in lacustrine rather than alluvial fan settings may favor the formation of arsenic-bearing pyrite, and these types of sediments have been identified in the southern part of the Kern Fan. A later change to more oxidizing geochemical conditions potentially dissolves the pyrite and releases the arsenic into the groundwater.

The increase in TDS to the west may be related to changes in the types of sediments in the aquifer and/or the influence of groundwater from the western part of the subbasin. The eastern part of the subbasin mostly consists of sediments derived from the Sierra Nevada, which are granitic. In the western part of the subbasin, sediments are increasingly derived from the Coast Ranges which include marine sedimentary rocks. Sediments derived from marine rocks can influence the salt content of groundwater. There is also a zone of higher TDS in the shallow northeastern part of the aquifer that likely resulted from historic oilfield activities. The water in this zone has not been moving, and, as this water is pumped during recovery programs, this zone will eventually be removed.

2.2.2.9.2 Water Quality Changes in KWB Monitoring Wells

In order to evaluate water quality changes in KWB monitoring wells, the Kern Fan Monitoring Committee maintains water quality hydrographs for various constituents (Appendix P, pages 118 to 129). These hydrographs can provide qualitative information regarding potential trends with a simple visual review. However, the determination of trends is subjective, and in many cases very subjective, because the data in many cases is so sporadic (e.g. see the hydrographs for well 30S/25E-4J). In order to remove this subjectivity, the Kern Fan Monitoring Committee conducted statistical analyses (the Mann-Kendall trend test at a 95% confidence level and Sen's slope estimator) of the data through 2016 where enough data points are available to help determine the presence and magnitude of trends (KFMC, 2016). The results of the statistical analyses are shown in Table 1.

Table 1. Water quality trend analysis for KWB monitoring wells.

		Total Dissolved Solids		Nitrate		Arsenic	
Well	Perf. Int. (ft)	Mann-Kendall p-value	Sens slope	Mann-Kendall p-value	Sens slope	Mann-Kendall p-value	Sens slope
30S/24E-13D01	150-250	-		-		-	
30S/24E-13D02	320-360	-		-		-	
30S/24E-13D03	520-650	-		-		0.000 *	Down -0.02
30S/25E-04J02	190-250	-		0.038	Down -0.945	-	
30S/25E-04J03	345-455	<0.0001	Up 3.762	-		0.018	Up 0.111
30S/25E-04J04	565-625	0.001	Up 2.17	-		-	
30S/25E-07A02	220-290	-		-		0.038	0
30S/25E-07A03	420-470	-		<0.0001	Up 0.3	0.007	Up 0.641
30S/25E-07A04	530-620	-		0.014	Down -0.041	<0.0001	Up 0.8
30S/25E-11P01	150-210	0.000	Down -6.846	<0.0001	Down -1.881	-	
30S/25E-11P02	330-470	-		0.019	Down -1		
30S/25E-11P03	520-570	0.014	Up 5.0			-	
30S/25E-12B02	150-250	0.007	Down -320	-		-	
30S/25E-12B03	360-500	0.002	Up 38.75	0.001	Up 1.133		
30S/25E-12B04	590-690	-		0.009	Up 0.258	-	
30S/25E-16L01	285-345	<0.0001	Up 1.576	0.008	Up 0.167	-	
30S/25E-16L02	515-555	-		-		-	
30S/25E-16L03	645-690					<0.0001	Up 0.4
30S/25E-19N02				-		0.015	Down -2.267
30S/25E-19N03	190-230	-		-			
30S/25E-19N04		-		-		<0.0001	Up 2.429
30S/25E-19R01	485-555	0.000	Up 14.286	-		-	
30S/25E-19R02	336-376	-		-		-	
30S/25E-24C04	445-525	-		-			
30S/25E-36R01	600-640	-		0.039	Down -0.014	-	
30S/25E-36R02		0.001	Up 0.88	-		<0.0001	Up 0.86
30S/26E-06L01	210-270	-		0.001	Down -0.913	0.013	0
30S/26E-06L02	360-536	0.003	Up 7.583	0.001	Up 0.817		
30S/26E-06L03	585-620	-		-		-	
30S/26E-32N01	210-330	0.000	Up 1.517	-		-	
30S/26E-32N02	390-440	0.002	Up 7.389	-			
30S/26E-32N03	570-610	0.033	Up 0.095	-		0.015	Down -0.619

"-" = no statistical trend

Grayed out = not enough data

* '= Trend may be due to improved and lower detection limits and not actual statistical trend

2016 Statistical Mann-Kendall and Sens Slope analysis completed using XLStat Software. Sens Slope only analyzed if Mann-Kendall shows a trend. Parameters - significance level = 5%. Hamed and Rao Autocorrelation applied at 0.05% significance level. Confidence interval of Sens Slope is 95%. Non-detects recorded as half of detection limit

Water quality in the majority of wells in all portions of the aquifer show no change or a downward trend with time. Total Dissolved Solids (TDS), nitrate, and arsenic show no trend or a downward trend in 19, 25, and 20 wells each, respectively. Upward trends of TDS, nitrate, and arsenic are indicated in 11, 5, and 6 wells, respectively. Where present, upward trends for TDS are 8 mg/ℓ/y or less with two exceptions in wells 30S/25E-12B03 and 30S/25E-19R01. Well 12B03 is located in an area impacted by the past disposal of produced water from oilfield operations, and well 19R01 is located near the western boundary of the KWB, where the changes noted are not considered significant.

Where present, upward trends for nitrate are 1.1 mg/ℓ/y or less, and not considered significant. Upward trends for arsenic are less than 0.9 ug/ℓ/y with one exception in well 30S/25E-19N04. This well is on the extreme western portion of the KWB, and water level data indicates the aquifer at this location is isolated from the main Kern Fan aquifer. Therefore, any changes would be unrelated to KWB operations.

In summary, a review of TDS, nitrate and arsenic data for KWB monitoring wells dating back to 1995 indicates that, for the majority of wells, no changes or downward trends are present. Where present, increases are either negligible, or related to causes other than KWB operations. In summary, KWB operations have been sustainable with respect to groundwater quality.

2.2.2.9.3 DWR Analysis of KWB Groundwater Quality

DWR conducted an extensive independent evaluation of potential groundwater quality issues in the KWB (DWR, 2016). They included, in part, whether:

1. KWB operations could mobilize contamination in soils or the unsaturated zones associated with hazardous waste sites or oil and gas production operations and potentially degrade groundwater quality,
2. KWB recharge and recovery operations could potentially change water quality in the underlying aquifer as a result of lateral and vertical migration of low-quality water within and outside the limits of the KWB.
3. KWB operations could potentially degrade water quality in the underlying aquifer as a result of an accumulation of salts during recharge activities.

The potential impacts resulting from historical and, with one exception, future KWB operations for all of these issues was determined to be less than significant without mitigation. With respect to the first issue, the mobilization of shallow contamination, the mitigation measures necessary to reduce this potential impact to less than significant for future operations consist primarily of monitoring any activities related to soil or groundwater contamination caused by third parties as directed by regulatory agencies, should they arise (See Section 4.2.3).

2.2.2.9.4 KWB Salt Balance Benefits

The Kern Fan Monitoring Committee evaluates the mass of salts imported and exported from the KWB due to KWB operations. The evaluation determines the average tons of salts per AF of water recharged and recovered due to KWB operations and compares them. That comparison indicates the ratio of salts exported versus imported is 1.8. That is, 1.8 tons of salt per AF are exported from the KWB for every ton of salt per AF imported to the KWB, ensuring the sustainability of the KWB as a water-storage facility into the future (Appendix P, Table 1-5, page 151).

2.2.2.10 Historic Surface Water Quality Monitoring

Continued use and operations of the KWB could potentially adversely impact water quality in surface water conveyance facilities and associated water supplies for downstream users. DWR prepares reports summarizing the changes seen in the aqueduct as a result of recovery programs. A summary of the changes in water quality in the Aqueduct that resulted from a recovery program in 2016 is shown on Table 2. The water banking programs on the Kern Fan, including the KWB, are represented by the column bracketing the CVC, KWBC and WKWD. As shown, arsenic concentrations increased by an average of 0.4 ug/l, average nitrate concentrations did not change, and the average concentrations of all other constituents decreased, including bromide, chloride, chromium and hexavalent chromium, conductivity, dissolved organic carbon, sulfate, and total dissolved solids.

Under some conditions, deliveries to the Cross Valley Canal may reach the Improvement District 4 water treatment plant. That water is tested regularly pursuant to source water protocols for the treatment plant, and no issues have been reported to the KWBA.

Table 2. Concentration Changes at Water Quality Stations Bracketing the Three Turn-in Sections and San Joaquin Field Division (DWR, 2017).

	Bracketing SJFD			Bracketing SWSD			Bracketing CVC, KWBC, and WKWD			Bracketing WRMWSD and AEWSD		
Bracketing Checks	**Check 21 to Check 41**			**Check 23 to Check 27**			**Check 27 to Check 29 Tupman to Cole's Levee**			**Check 29 to Check 39 & Check 41**		
Arsenic	7 2 0	↑	0.005 **0.0016** 0	1 1 0	↑	0.001 **0.0005** 0	3 2 1	↑	0.001 **0.0004** -0.0001	1 6 0	↑	0.001 **0.0001** 0
Bromide	2 1 6	↓	0.07 **-0.061** -0.19	1 0 1	↓	0.02 **-0.005** -0.03	1 1 4	↓	0.01 **-0.008** -0.02	2 3 2	↑	0.02 **0.001** -0.01
Chloride	2 0 7	↓	16 **-23.6** -80	1 0 1	↓	5 **-0.5** -6	1 0 5	↓	2 **-5.2** -10	3 0 4	↓	3 **-0.1** -2
Dissolved Chromium[a]	6 3 0	↑	0.004 **0.0016** 0	2 0 0	↑	0.001 **0.001** 0.001	0 3 1	↓	0 **-0.0001** -0.0005	4 3 0	↑	0.001 **0.0005** 0
Hexavalent Chromium[b] (µg/L)	2 0 0	↑	1.05 **0.96** 0.86	2 0 0	↑	0.78 **0.53** 0.28	3 1 1	↓	0.04 **-0.02** -0.2	2 0 0	↑	0.77 **0.53** 0.28
Conductivity (µS/cm)	3 0 6	↓	100 **-48.8** -209	1 0 1	↓	15 **-16** -47	0 0 5	↓	-5 **-26.6** -67	4 0 3	↑	34 **4.9** -30
Nitrate	4 1 4	↑	14.4 **3.01** -0.6	2 0 0	↑	0.6 **0.4** 0.2	1 4 1	↔	0.2 **0** -0.2	1 5 1	↓	0.3 **-0.03** -0.5
Dissolved Organic Carbon	2 0 7	↓	0.5 **-1.3** -3.5	1 0 1	↓	0.3 **-0.15** -0.6	0 0 4	↓	-0.25 **-0.36** -0.65	2 0 5	↓	0.5 **-0.49** -2.95
Sulfate	7 0 2	↑	60 **10** -32	1 0 1	↓	4 **-3.5** -11	1 3 2	↓	3 **-1.8** -12	5 1 1	↑	8 **2.9** -1
Total Dissolved Solids	3 0 6	↓	64 **-20.3** -119	1 0 1	↓	7 **-8** -23	1 1 4	↓	10 **-8.1** -28	5 0 2	↑	19 **1.3** -32

Legend:

A
B
C
	D	E
		F
		G
			A = # of Increases
			B = # Equivalent
			C = # of Decreases
				D = Net Change Icon
				(based on average change)
					E = Highest Concentration Change
					F = Average Concentration Change
					G = Lowest Concentration Change

Notes: AEWSD = Arvin-Edison Water Storage District, CVC = Cross Valley Canal, SJFD = San Joaquin Field Division, KWBC = KWB Canal, SWSD = Semitropic Water Storage District, WKWD = West Kern Water District, WRMWSD = Wheeler Ridge- Maricopa Water Storage District, µg/L = micrograms per liter, µS/cm = microSiemens per centimeter.
All concentrations are in mg/L unless otherwise noted.

2.2.2.11 Historic Subsidence Monitoring

Subsidence monitoring at the KWB extensometer indicates both upward and downward changes (of at most 0.1 ft/yr) have occurred within an overall upward trend of inflation (Figure 15). As of June 2018, the land surface was 0.27 feet higher than the land surface in June 1994. The data indicates subsidence has not resulted from KWB recovery operations during extended droughts, where groundwater elevations have fluctuated as much as 250 feet.

The KWB extensometer monitors subsidence with the aquifer to depths of ~800 feet. InSAR data monitors the land surface regardless of the depth of the sediments. That data indicates the lands where stored water is recovered in the eastern portion of the KWB have risen as much as 0.16 feet and lands in the western portion of the KWB have dropped as much as 0.16 feet for the 2015-2018 period (Figure 16). This data is not in conflict with the extensometer data discussed above. Subsidence of up to 0.36 feet is indicated in the most southeasterly portion of the KWB where stored water is not recovered.

2.2.2.12 Kern River Characteristics and Groundwater Dependent Ecosystems

The Kern River is a losing stream where it crosses the KWB, having only received flows in 6 of the last 22 years. A monitoring well adjacent to the river documents an unsaturated zone exists under the riverbed (Figure 17), and the Kern River Reports prepared by the City of Bakersfield record losses throughout the lower reaches of the river from the 1st point of measurement several miles east of the KWB to the 2nd point of measurement near the KWB (Table 3). In addition, no groundwater dependent ecosystems have been identified on KWBA lands (https://gis.water.ca.gov/app/NCDatasetViewer/).

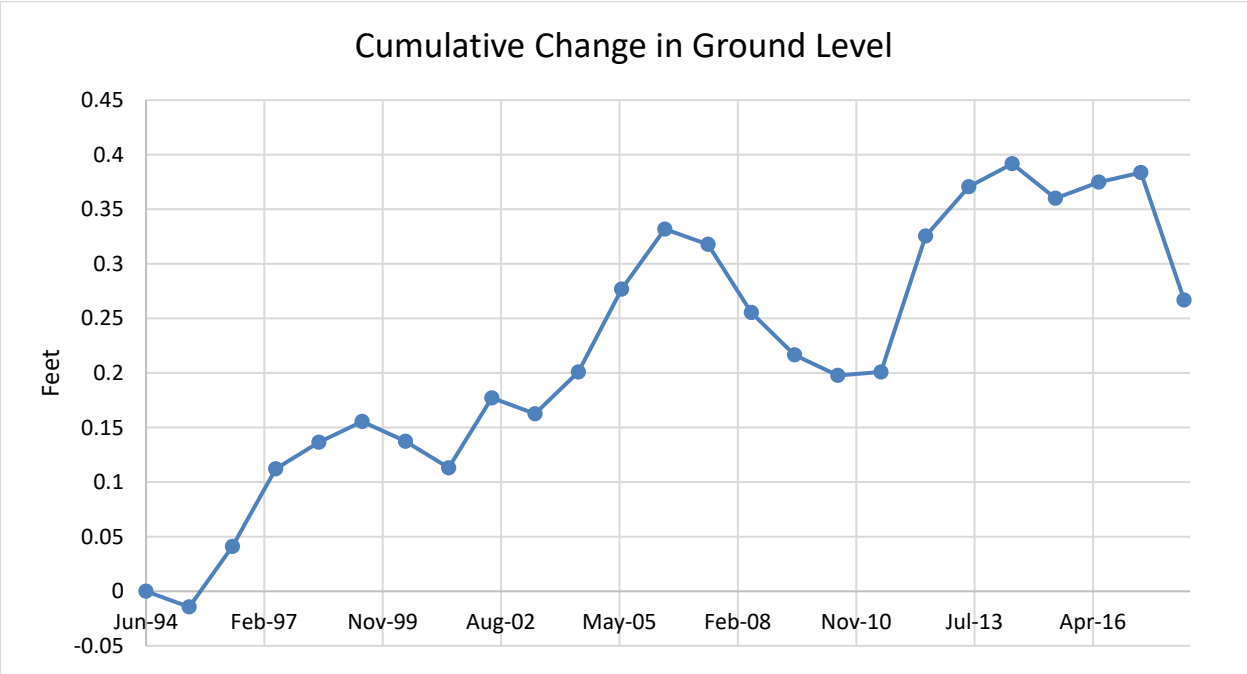

Figure 15. Ground level changes, 1994-2018.

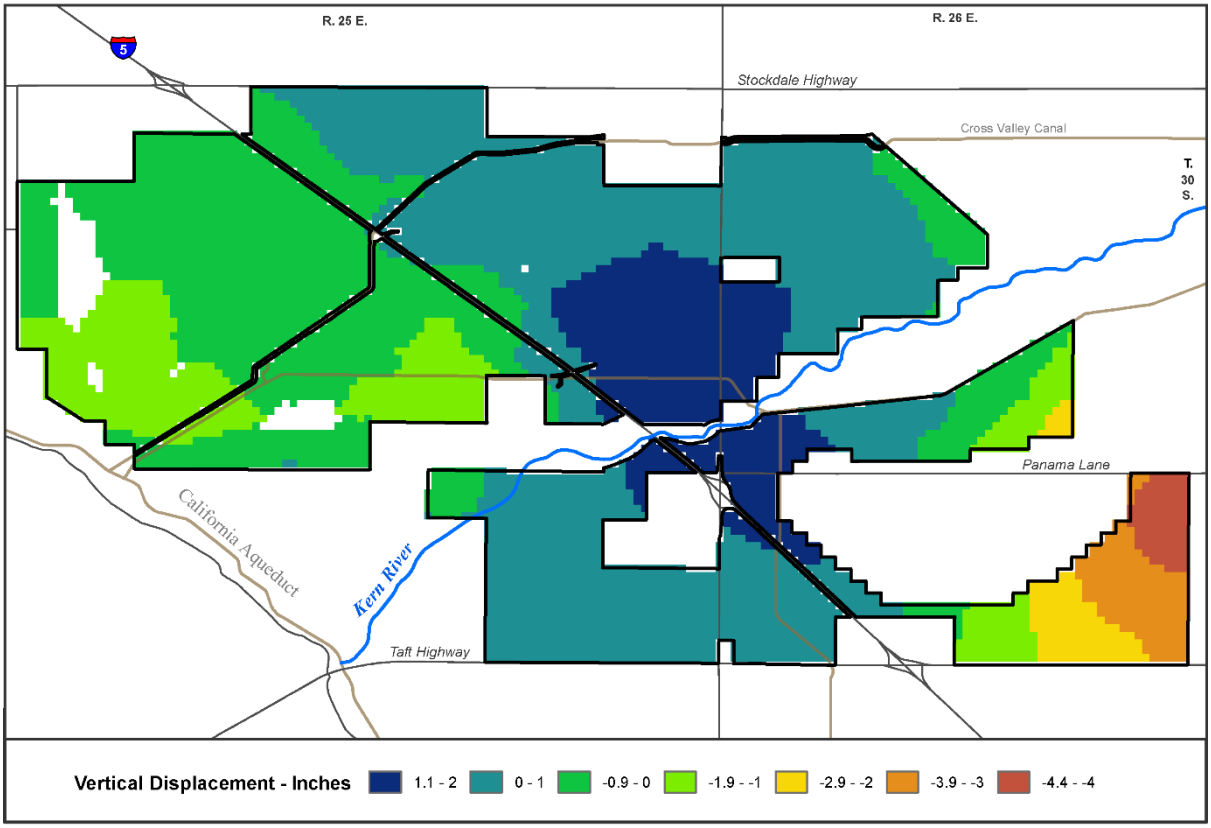

Figure 16. InSar data for 2015-2018.

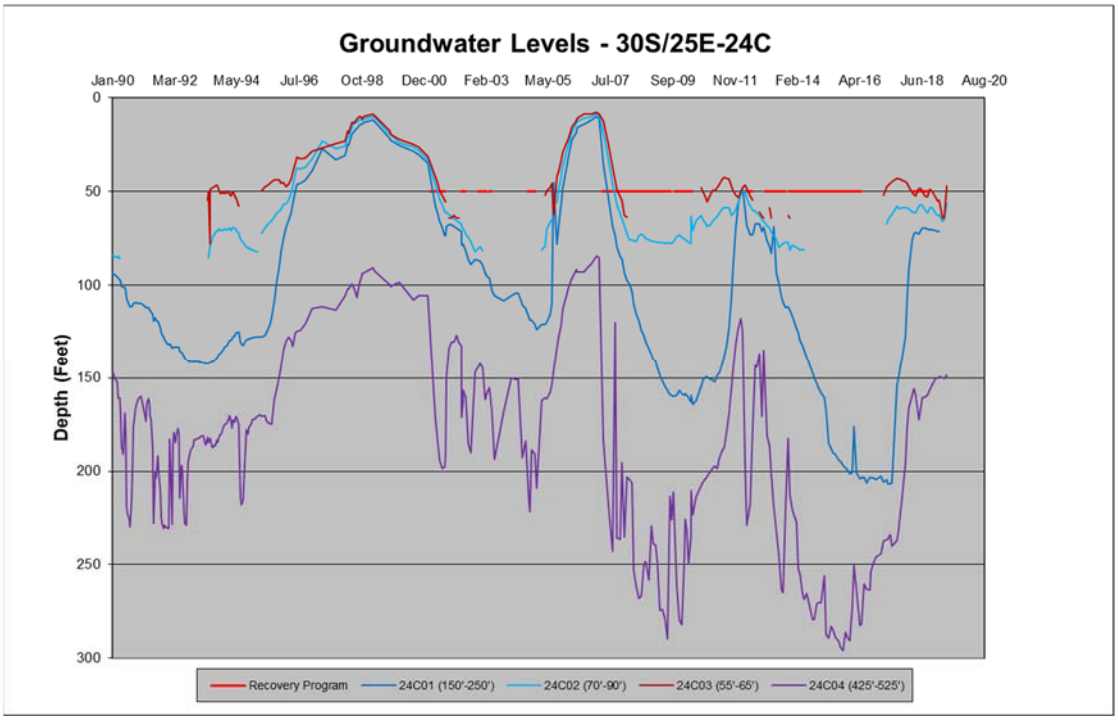

Figure 17. Groundwater levels adjacent to the Kern River within the KWB area.

Table 3. Losses in various reaches of the Kern River. The 2800 Acres to 2nd Point is adjacent to the KWB. Note that losses are recorded for every year that water flowed in the river channel adjacent to the KWB.

	Kern River Reach						
Year	Rocky Point to Calloway	Calloway Weir to River Canal Weir	River Canal to Stockdale Hwy/Bellvue Weir	Stockdale Hwy to Berrenda Mesa TO/ID4	ID4 to 2800 Acres	2800 Acres to 2nd Point (Adjacent to KWB)	2nd Pt-Intertie
1997	8,317	44,886	18,927	5,578	2,104	5,236	-
1998	8,306	45,980	17,024	4,179	3,941	7,180	781
2006	6,559	47,687	22,217	4,923	4,774	4,583	1,596
2010	9,326	52,085	16,189	7,596	5,753	4,872	-
2011	8,531	74,508	24,039	13,820	11,881	9,558	-
2017	19,388	57,524	42,122	12,206	11,819	748	-

2.2.3 Water Supply Accounting

Two types of water are present in the KWB – stored water and naturally occurring native groundwater. The accounting for the former is based on physical measurements at well-established measuring points. The accounting for the second is only an approximation. Information regarding the basin-wide water budget is presented in Section 2.4 of the KGA Umbrella GSP.

2.2.3.1 Stored Water Accounting

The volume and types of water delivered to the KWB for storage are determined by KCWA in consultation with the City of Bakersfield, Buena Vista Water Storage District, and/or DWR, depending on the source of the water. Flow measurements are determined primarily with ultrasonic meters. Other methods include Parshall flumes, rated gates and weirs. All deliveries are subject to a 6% loss factor pursuant to the KWB MOU. Recovered water is used by KWBA participants for irrigation, municipal, and industrial beneficial uses. The volume and types of water recovered are determined by KCWA in consultation with the participant recovering the water to determine the type of water, and DWR to determine the volume of water. Although individual recovery wells are all metered, and the meter data is gathered daily and downloaded to a database (see Appendix S), deliveries to the Aqueduct are determined by DWR with ultrasonic meters at turn-in facilities on the KWB Canal and Cross Valley Canal, or by KCWA within the Cross Valley Canal for recovered water flowing east. A detailed accounting is reported by the Kern Fan Monitoring Committee in Operations Reports (Appendix P). Figure 18 illustrates the KWB balance through time, and Figure 19 illustrates monthly storage and recovery volumes. As noted in Sections 1 and 2.2.3.1, the KWB storage project does not contribute to the overdraft of the basin.

2.2.3.2 Native Safe Yield

The KWB lands occupy 20,648 acres of land. The current estimate for the amount of naturally occurring native groundwater for the Kern Subbasin (i.e. safe yield) is 0.15 ft/ac/yr, or about 3,100 AF/yr for the KWB lands. As a storage project, KWB recovery programs do not recover native safe yield[4], but recovers previously stored banked water within the operating criteria, relevant agreements and monitoring established for the KWB.

[4] The KWB HCP/NCCP provides for very limited grazing as an adaptive management tool to control vegetation for the benefit of wildlife. Since 2016, and projecting to the end of 2019, the average water use for grazing has been 0.0005 AF/acre/year.

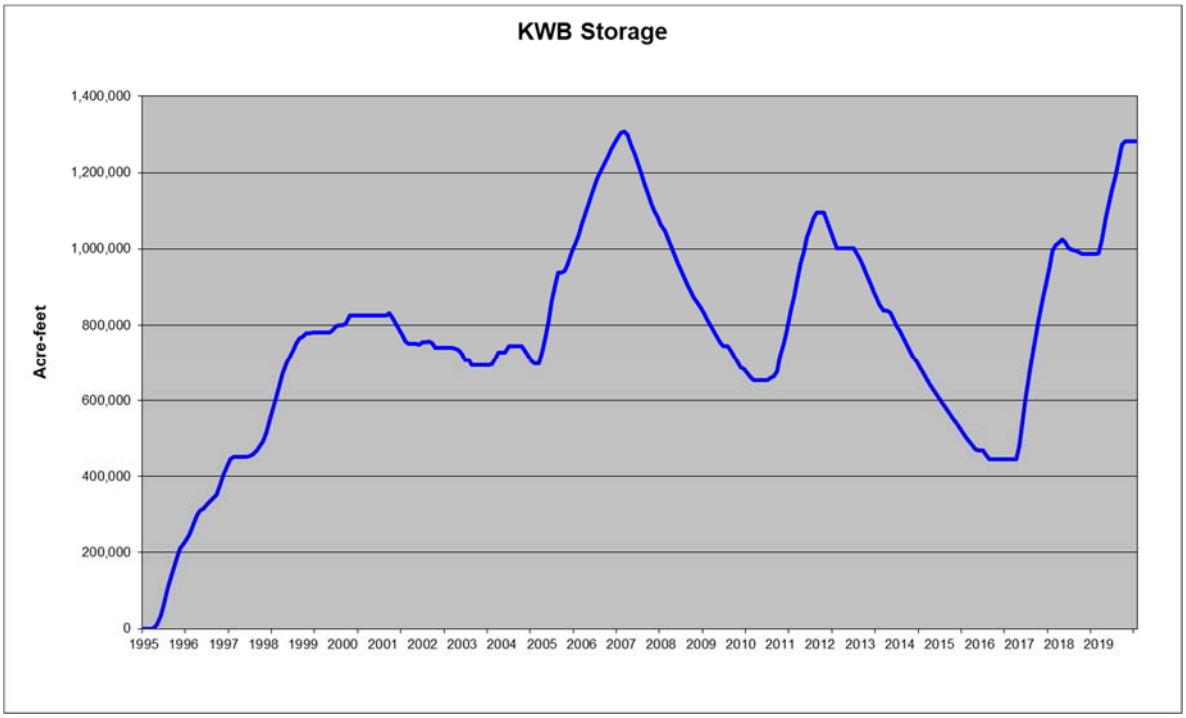

Figure 18. KWB storage project balance through time.

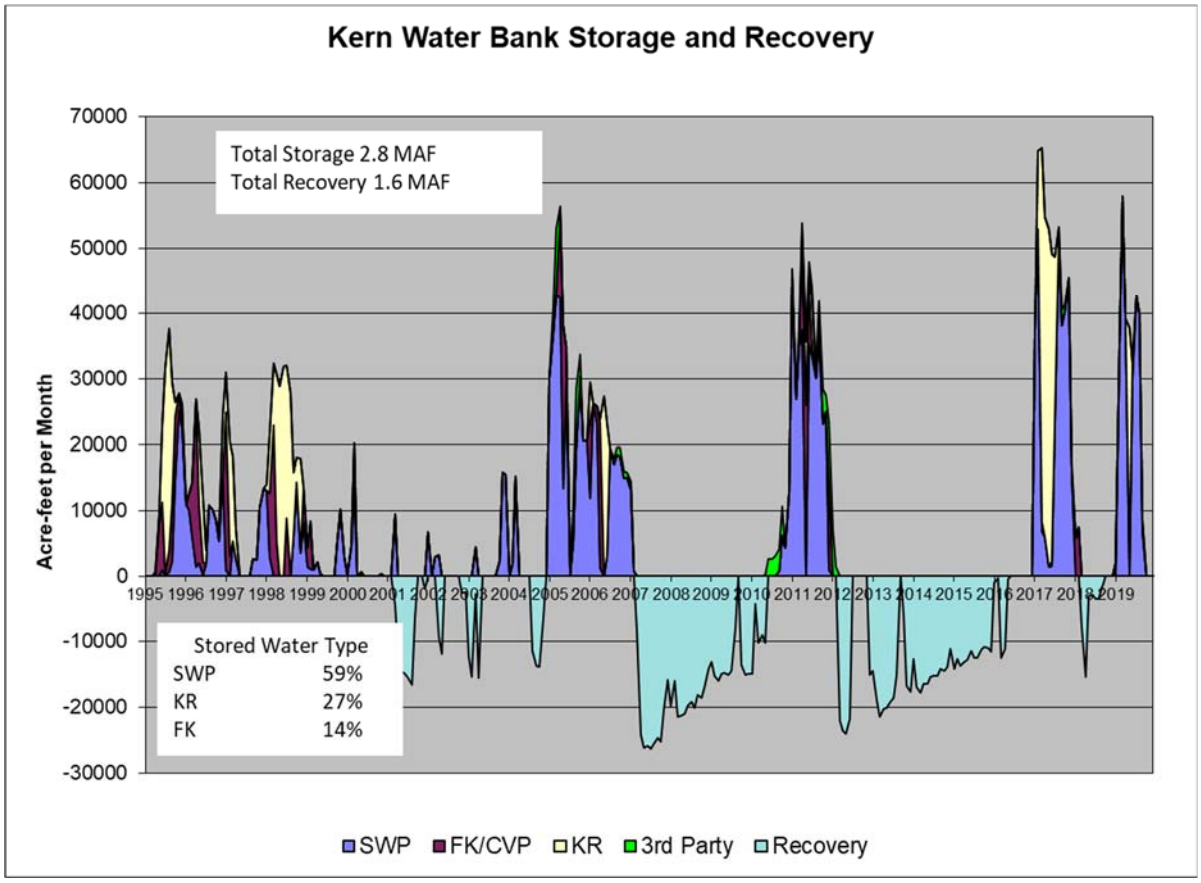

Figure 19. Monthly storage and recovery since the inception of the KWB Storage Project.

3 Sustainable Management Criteria

SGMA regulations identify six sustainability indicators that GSPs must consider. They are groundwater-level declines, groundwater storage reductions, water quality degradation, land subsidence, interconnected surface-water depletions, and seawater intrusion. Undesirable results are one or more of the following effects related to these indicators:

1. Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods;
2. Significant and unreasonable reduction of groundwater storage;
3. Significant and unreasonable seawater intrusion;
4. Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies;
5. Significant and unreasonable land subsidence that substantially interferes with surface land uses; and/or
6. Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

The Kern Subbasin is not adjacent to the Pacific Ocean, bays, deltas, or inlets and seawater intrusion is not an applicable sustainability indicator, because seawater intrusion does not exist and could not occur. As such, seawater intrusion is not considered further in this document.

Likewise, depletions of interconnected surface water is not an applicable sustainability measure in the vicinity of the KWB. The Kern River is a losing stream that has only received flows in 6 of the last 22 years where it crosses the KWB (see Section 2.2.2.12), hydrographs along the river indicate a significant unsaturated zone exists under the river (e.g. see Figure 17), and the Kern River Watermaster records river losses in each of the years that water has flowed in the river. Therefore, depletions of interconnected surface water are not an applicable sustainability indicator and are not considered further in this document. In addition, no groundwater dependent ecosystems have been identified on KWBA lands (https://gis.water.ca.gov/app/NCDatasetViewer/).

With respect to the remaining undesirable results, Cal. Code Regs., Title 23, §354.26(d) provides that: "An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators." As discussed below, undesirable results for the remaining sustainability indicators are not present or are not likely to occur within the KWB area due to the extensive Mitigation Monitoring and Reporting Program (MMRP) developed by DWR for the KWB Storage Project. With respect to the wider Kern Subbasin, see Section 3.2 of the KGA Umbrella GSP.

3.1 Sustainability Goal

The sustainability goal of the Kern County Subbasin is to:

- Achieve sustainable groundwater management in the Kern County Subbasin through the implementation of projects and management actions at the member agency level of each GSA;
- Maintain its groundwater use within the sustainable yield of the basin through as demonstrated by monitoring and reporting groundwater conditions;
- Operate within the established sustainable management criteria, which are established based on the collective technical information presented in the GSPs in the Subbasin; and
- Collectively bring the Subbasin into sustainability and to maintain sustainability over the implementation and planning horizon.

As stated in Section 1.2, the KWB is an important pre-existing project that furthers the goals of the Sustainable Groundwater Management Act and the sustainability of the Kern Subbasin by:

- Conserving surplus water by storing that water in the Kern Fan aquifer;
- Not using groundwater consumptively; and
- Recovering previously stored water in dry years, thereby reducing the reliance on native groundwater by others in the Kern Subbasin.

The KWB has been in operation for 24 years. Over that time the KWBA has stored 2.8 MAF of water and recovered 1.6 MAF of water for beneficial uses by our participants. Both the past operations of the KWB, and its' future operations, provide a significant contribution to the sustainability of the Kern Subbasin.

3.2 KWB Thresholds and Objectives

As stated above, SGMA recognizes the uniqueness of storage projects and their role within a GSA in Water Code Section 10726.2.(b) which states: "…the agency shall not alter another person's or agency's existing groundwater conjunctive use or storage program except upon a finding that the conjunctive use or storage program interferes with implementation of the agency's groundwater sustainability plan." The KGAGSA also recognizes the unique aspect of storage programs within its boundaries with the following provision in its Joint Powers Agreement: "the Authority shall not restrict or otherwise limit the extraction of water stored (whether through direct recharge or in lieu deliveries) in the Kern County Subbasin as a part of any banking or recharge project or program, or otherwise seek to regulate the operation any such project or program." Importantly, Cal. Code Regs., Title 23, §354.28(e) states "An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators." An extensive Mitigation Monitoring and Reporting Program (MMRP) has been developed by DWR for the KWB Storage Project that reduces impacts from operations to less-than-significant, and undesirable results are not present or are not likely to occur. The thresholds and objectives developed in the MMRP for the KWB are described below. Minimum thresholds and measurable objectives for the wider Kern Subbasin are described in Section 3.2 of the KGA Umbrella GSP.

3.2.1 Chronic lowering of groundwater levels

Operational limitations preclude the KWB from causing a chronic lowering of groundwater levels because the KWBA can only recover water previously stored in the aquifer after appropriate losses have been applied (see Section 2.2.3.1). Extensive monitoring of 24 years of past operations demonstrates that a chronic lowering of groundwater levels has not occurred, nor are the projected future operations of the KWB expected to cause the chronic lowering of groundwater levels (See Section 2.2.2.8). In addition, the KWBA provides a portion of the water stored to adjoining entities to help offset any overdraft they may be causing, and KWB recovery programs do not recover the native safe yield associated with KWBA lands (See Section 2.2.3.2).

KWB operations can cause a temporary lowering of groundwater levels in adjacent areas. Historically this had occurred toward the end of extended recovery programs resulting from years of drought. In order to mitigate the potential impacts that might arise from those temporary changes, DWR has developed mitigation measures for the project, which have now been coordinated with other adjacent water banking projects and incorporated into a Joint Operations Plan (Section 2.1.2.8, Appendix I). The thresholds in the Joint Operations Plan for groundwater levels are:

> "When the With-Project conditions are fifteen (15) or forty-five (45) feet deeper than the Without-Project conditions at any operative domestic or agricultural well, respectively, and mechanical failure or other operational problems have occurred or are reasonably likely to occur due to declining water levels, mitigation will be provided …"

With and Without Project conditions are determined using an updated version of the DWR KWB Model and a model developed by Rosedale – Rio Bravo Water Storage District. With-Project conditions refer to groundwater elevations predicted by the models with actual project operations included and Without-Project conditions refers to simulations wherein the water banking operations are removed (i.e. no project storage or recovery).

The thresholds apply to activities by the KWB and four other adjacent banking programs and are very protective of adjacent wells and owners. Groundwater levels adjacent to the KWB have fluctuated as much as 200 feet over the last 24 years. The With- and Without-analysis will indicate the magnitude of the banking program's influence on adjacent wells, and mitigation will be provided when the influence is as little as 15 feet for domestic wells and 45 feet for agricultural wells. The 15-foot threshold is essentially the point when the projects have had a discernable influence on a domestic well. The 45-foot threshold for agricultural wells recognizes the significant economic benefits resulting from higher groundwater elevations provided by the projects through time, and that agricultural wells in the area are completed to greater depths. DWR has determined that these thresholds, coupled with the mitigation measures discussed in Section 4.2.1, reduce potential impacts from temporary changes in groundwater levels resulting from KWB operations to less than significant (DWR REIR, 2016).

3.2.2 Reduction of Groundwater Storage

Due to operational constraints the KWB only recovers previously stored water less appropriate losses pursuant to the KWB MOU (Section 2.2.3.1) and cannot cause a reduction in groundwater storage. It should be noted that the KWBA contributes water to the subbasin to help offset overdraft caused by others in two ways. First, as described in Section 2.2.3.2, the native safe yield for the KWB, which is estimated to be 3,100 AF/yr, is not recovered during KWBA recovery programs. Second, the KWB MOU

provides that adjoining entities can (and they always do) purchase 4% of the water recharged by the KWBA to offset their overdraft. From 1995 to 2015 these two sources amount to as much as 325,000 AF of water helping to offset chronic overdraft in the subbasin. Finally, it should also be noted the KWBA has historically maintained significant storage accounts of 400,000 AF or more.

3.2.3 Degraded Water Quality

Extensive monitoring conducted during four significant storage cycles and two significant recovery cycles has indicated groundwater degradation is not occurring (see Section 2.2.2.9) and suggests degradation will not occur in the future. In fact, salts are being removed from the aquifer (see Section 2.2.2.9.4). Both recovery wells and monitoring wells in the KWB will continue to be monitored pursuant to the KWBA Monitoring Plan (Section 2.1.2.6 and Appendix F), and the Kern Fan Monitoring Plan (Section 2.1.2.2 and Appendix B) respectively, and the results provided to DWR in annual KGAGSP reports. In addition, the mitigation measures developed by DWR regarding groundwater quality will be implemented as appropriate (Section 2.1.2.8, Section 4.2.3, and Appendix H). The Kern Fan Monitoring Committee monitors groundwater quality and should persistent trends of degradation begin to develop, appropriate mitigation will be undertaken.

The water recovered and delivered to the California Aqueduct by the KWB will meet the water quality requirements provided for in the Pump-in Policy as administered by DWR (see Section 2.1.2.5, and Appendix E), and the water quality standards of the Improvement District 4 Water Treatment Plant, and as such, surface water degradation will not occur.

3.2.4 Land Subsidence

Historic KWB operations during four significant storage cycles and two significant recovery cycles, where water levels have fluctuated over 250 feet, have actually resulted in a cumulative land surface rise of about 0.27 feet, providing incontrovertible evidence that the Kern Fan Aquifer is not susceptible to subsidence due to stored-water recovery (see Section 2.2.2.11). DWR also reviewed the geology of the KWB aquifer and the extensometer data and concluded that potential impacts related to both historic and future operations would be less than significant (DWR, 2016, page 7.8-11) The extensometer will continue to be monitored and the results will be reported to DWR in annual KGAGSP reports.

3.3 Undesirable Results

The KGA has defined undesirable results for the Kern Subbasin in Section 3.2 of the KGA Umbrella GSP.

3.4 KWB Monitoring Network for SGMA Reporting

KWB monitoring information will continue to be collected and reported to DWR within the KGAGSP. The monitoring network for SGMA reporting will consist of a subset of the wells currently used to monitor KWB operations (Figure 3.1, KGA Umbrella GSP). Both the monthly monitoring frequency and the density of wells in the existing KWB monitoring network far exceed the recommendations in the DWR BMP[5] so data gaps do not exist. The network is also consistent with Cal. Code Regs., Title 23, § 352.4.

3.4.1 Monitoring Protocols

Monitoring protocols are described in Section 2.1.2.11. No representative wells are designated.

[5] This density is equivalent to 50 wells per 100 mi^2, far greater than the density of 4 wells per 100 mi^2 referenced in *Monitoring Networks and Identification of Data Gaps Best Management Practice* (DWR, 2016).

4 Projects, Management Actions and Adaptive Management

4.1 Projects

Although not in response to SGMA, the KWBA intends to construct an additional 1,025 acres of recharge basins as shown in Figure 20. These additional basins will allow the KWBA to capture more water in the future, furthering the conservation goals of SGMA.

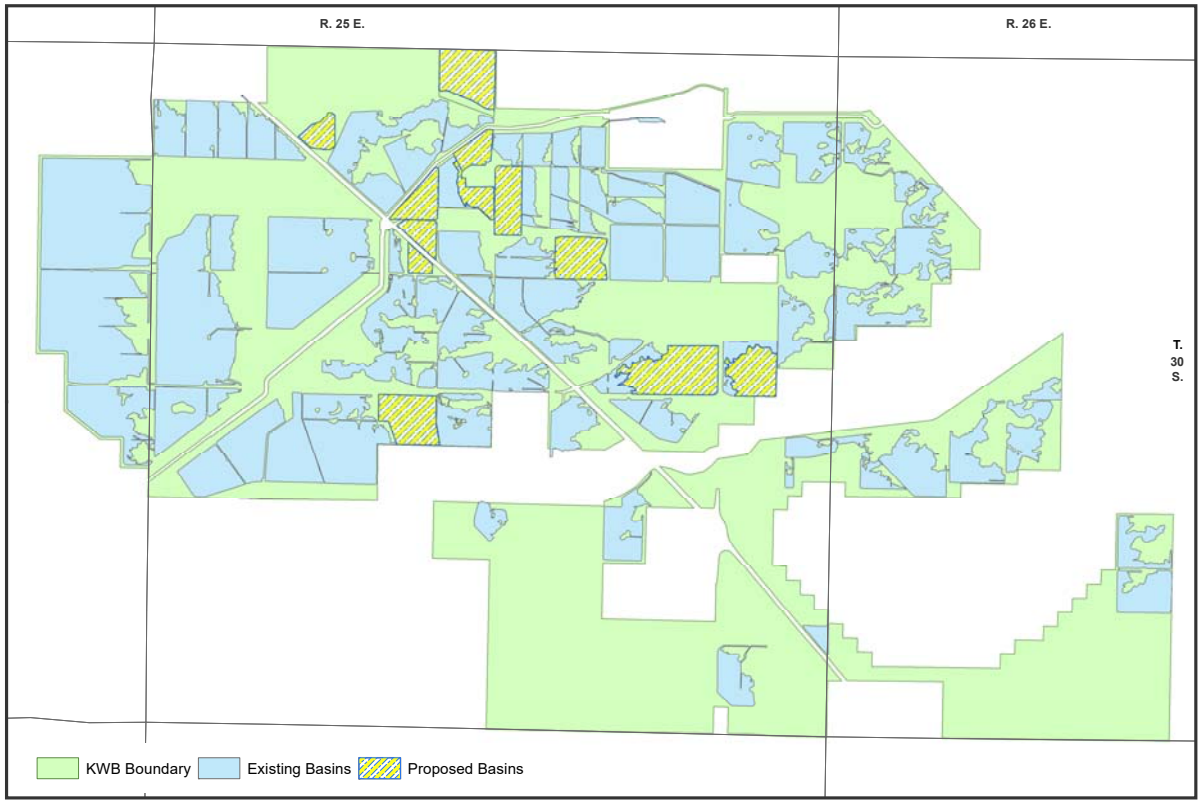

Figure 20. Location of future recharge basins.

4.2 Management Actions

Management actions are the ongoing implementation of the mitigation measures developed by DWR to reduce potential impacts from KWB operations to less than significant.[6]

4.2.1 Temporary Lowering of Groundwater Levels

As described in Sections 2.2.2.7 and 2.2.2.8, the historical operations of the KWB have not caused the chronic lowering of groundwater levels, nor are the projected future operations of the KWB expected to cause the chronic lowering of groundwater levels. However, KWB operations can cause a temporary lowering of groundwater levels in adjacent areas toward the end of extended droughts. In order to

[6] Note that all of these actions have undergone CEQA review in a comprehensive 2016 Monterey Plus Revised Environmental Impact Report (REIR) prepared and certified by DWR in 2016 (SCH #2003011118) for the Monterey Plus Project. KWBA considered the REIR and filed Notice of Determination with regard to the Kern Water Bank portion of the Project on or about September 22, 2016. On October 20, 2017, the Sacramento County Superior Court entered a judgment that rejected all challenges to the REIR in Case No. 34-2016-80002469. That judgment is the subject of a pending appeal in the Third Appellate District, Case No. C086215.

mitigate the potential impacts that might arise from those temporary changes, DWR has developed mitigation measures for the project, which have now been coordinated with other adjacent water banking projects and incorporated into a Joint Operations Plan (Section 2.1.2.8, Appendix I). The Joint Operations Plan designates measures to prevent, eliminate or mitigate significant adverse impacts resulting from project recovery operations. The Plan includes, in part, the following components:

- Formation of a Joint Operating Committee (JOC): The JOC consists of representatives of each of the banking projects and meets as needed during recovery years to evaluate groundwater conditions, model results, landowner claims, and any other topics of concern. The JOC evaluates all claims and approves or rejects such claims.
- Evaluation of Groundwater Conditions: Groundwater models are used to evaluate With Project versus Without Project groundwater levels and predict potential groundwater impacts to nearby wells. The models are updated regularly and compared to actual conditions during years in which recovery occurs. The models are used to: 1) forecast with-project and without-project groundwater levels at the outset of recovery programs; 2) forecast any localized areas for special attention and/or monitoring; 3) attempt to identify domestic wells at risk of impacts; and 4) determine if mitigation triggers (thresholds) have been met.
- Mitigation measures: The mitigation measures, if warranted, will include one or more of the following:
    - Providing a short-term emergency water supply to domestic well owners. Short-term emergency supplies shall be provided as soon as reasonably possible, but in all cases within 14 days of notification to the JOC of such needs;
    - Providing funds to lower a well pump;
    - Providing funds to complete a connection to an M&I water provider;
    - Supplying an equivalent water supply from an alternate source;
    - Providing funds to replace the affected well with a deeper well that meets Kem County well ordinance standards;
    - Reducing or adjusting recovery pumping as necessary to avoid the impact; or
    - With the consent of the affected landowner, providing other acceptable mitigation.

The Joint Operations Plan or its equivalent, which has been in use since 2015, will continue to be enforced. Given due consideration to these mitigation measures, no other management actions are necessary.

4.2.2 Reduction of Groundwater Storage

KWBA cannot recover water beyond those volumes previously stored less appropriate losses. When storage accounts reach zero, recovery pumping will stop. Given due consideration to this mitigation measure, no other management actions are necessary.

4.2.3 Degraded Water Quality

Groundwater monitoring from 1994 through 2018 indicates groundwater quality is not being degraded by KWB water banking activities, and in fact the removal of salts is benefitting the aquifer. DWR developed mitigation measures to ensure that continued KWB operations do not degrade groundwater quality. They include, in part:

- Comply with Kern County Environmental Health Program under which new wells and well deepening, reconstruction, and destruction would be subject to permits requiring compliance… ;
- Comply with NPDES permit requirements, which include preparation of a site-specific SWPPP and implementation of BMPs specifically designed to control erosion and reduce the transport of sediment and other pollutants;
- Require construction contractors to comply with applicable hazardous materials management laws and regulations which address proper storage, use, and disposal of substances such as fuels;
- Monitor and evaluate the nature and extent of any current and future contamination and remediation within KWBA lands; and
- On an annual basis, report the status of shallow groundwater level monitoring activities and water quality analysis in areas of contamination to the Kern Fan Monitoring Committee.

Given due consideration to these mitigation measures, no other management actions are necessary.

4.2.4 Subsidence

Inelastic subsidence has not occurred in over twenty years of KWB operations. DWR has also concluded that subsidence is not likely to occur as the result of future operations. Monitoring will continue, and if significant subsidence begins to develop appropriate mitigation measures will be developed.

4.3 Adaptive Management

The extensive monitoring programs conducted by the KWBA will continue, and should any undesirable results develop, appropriate mitigation measures will be developed.

5 Plan Implementation

All of the actions described in this document are already being implemented. Groundwater level, water quality, and subsidence monitoring has been ongoing since at least 1995, and all the mitigation measures described in Sections 2.1.2.8 and 4.2 have been implemented since 2016.

5.1 Estimate of GSP Implementation Costs

The costs to develop this chapter for the KGA GSP is estimated to be $64,000. Ongoing costs to provide annual report data is estimated to be $16,000 per year. The costs for monitoring activities and the implementation of mitigation measures described in this document are required in existing documents and are not due to SGMA regulations.

5.2 Annual Reporting

The KWBA will provide the KGA with all applicable information and monitoring data for annual report preparation.

6 References and Technical Studies

All references without a URL listed can be downloaded at the Kern Water Bank website: http://www.kwb.org/index.cfm/fuseaction/pages.page/id/1758

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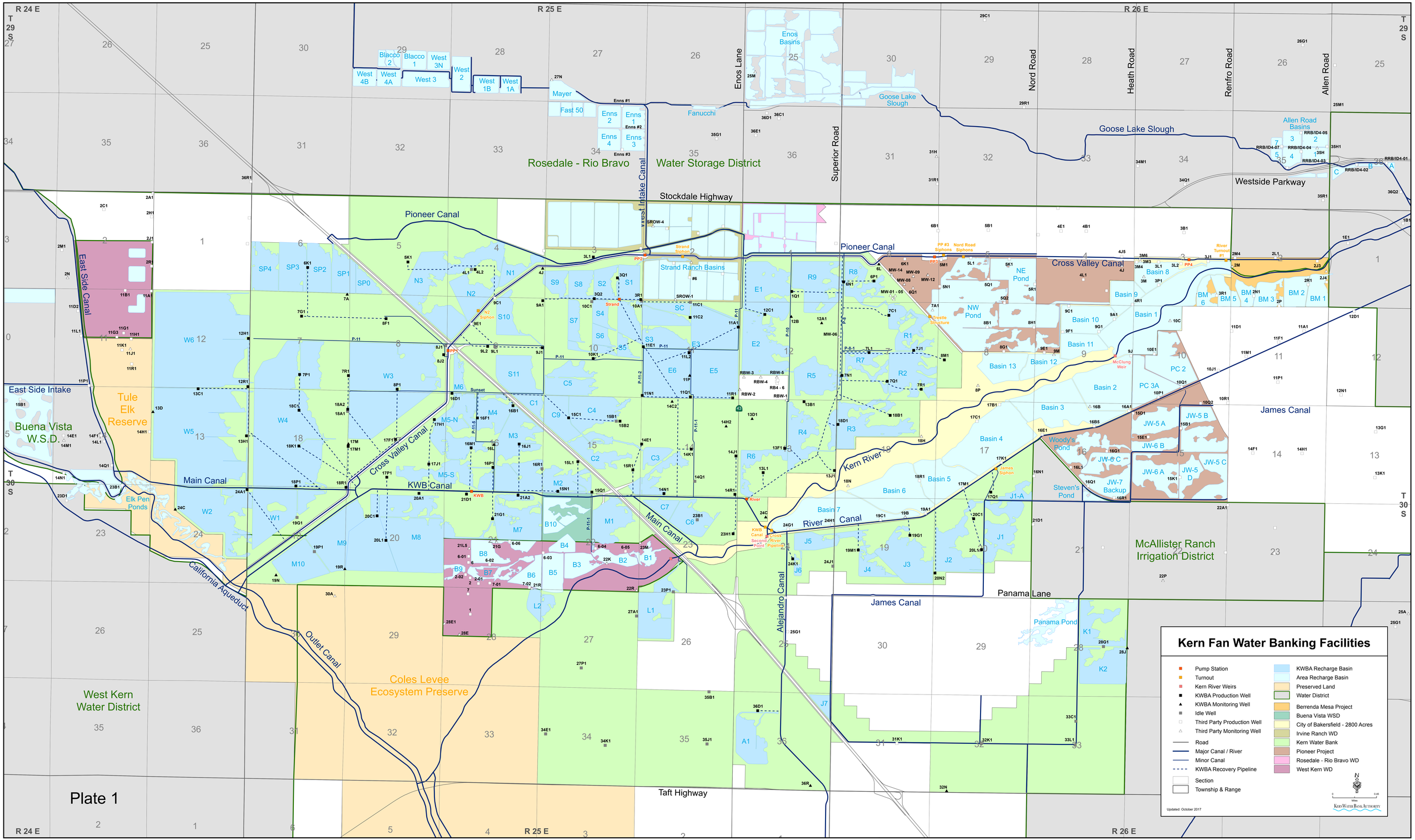
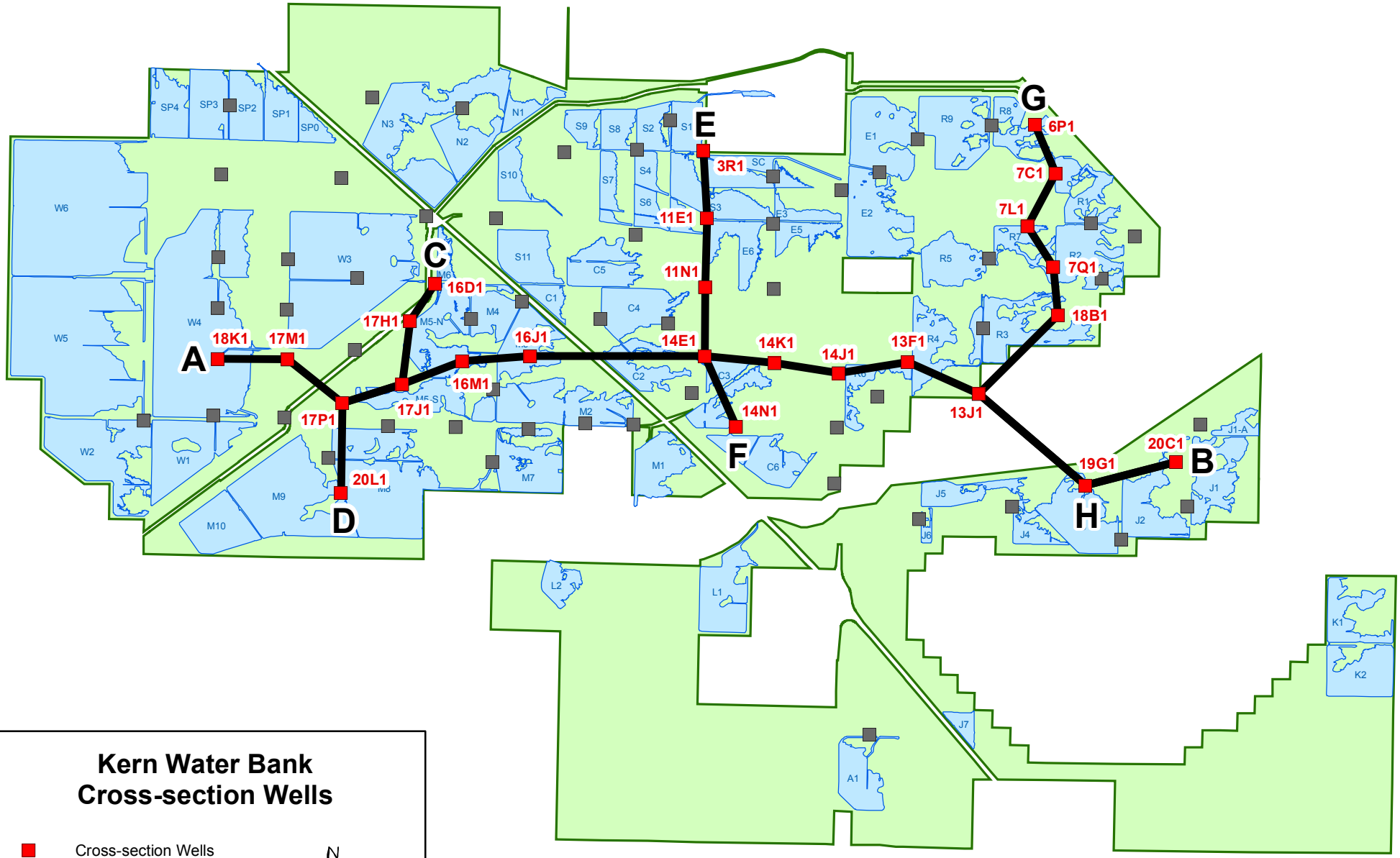
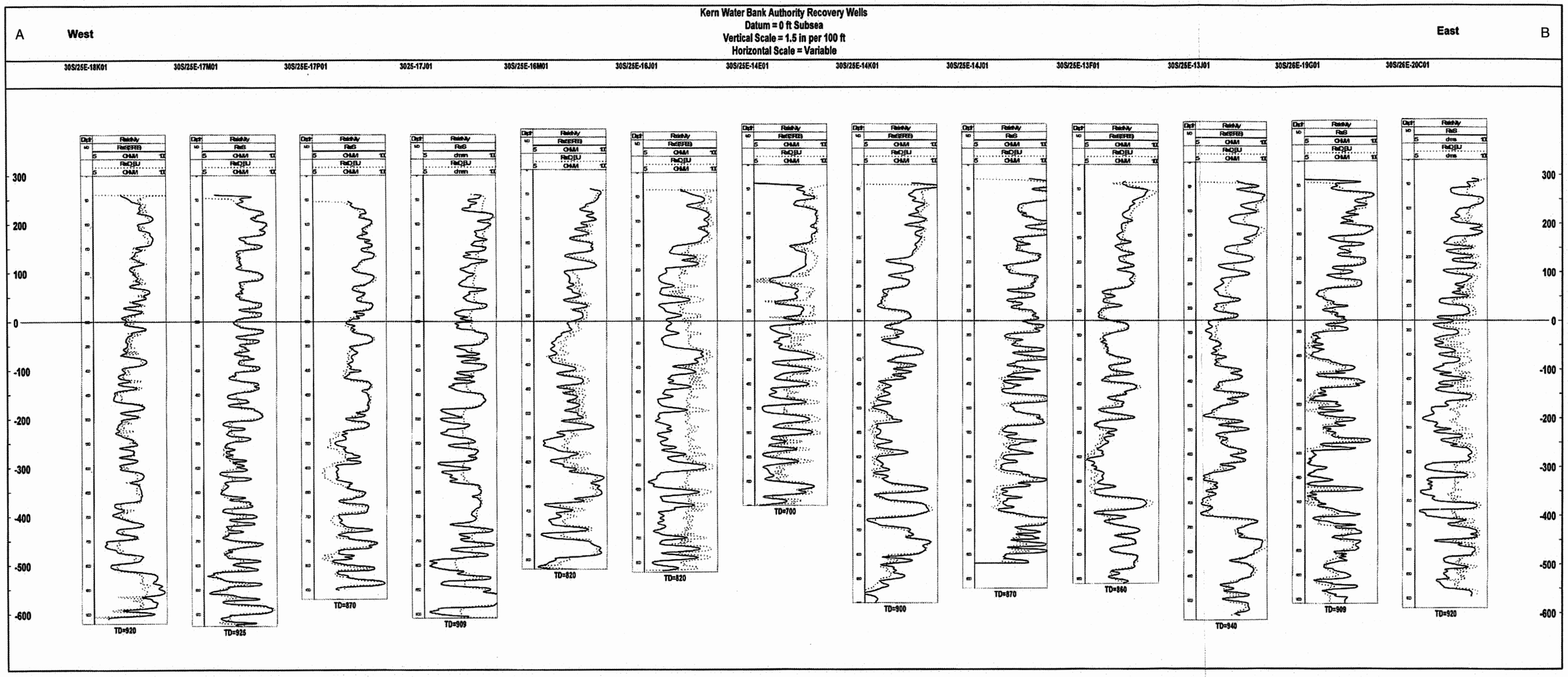
Plates


Kern Fan Water Banking Facilities
Pump Station
Turnout
Kern River Weirs
KWBA Production Well
KWBA Monitoring Well
Idle Well
Third Party Production Well
Third Party Monitoring Well
Road
Major Canal / River
Minor Canal
KWBA Recovery Pipeline
Section
Township & Range
KWBA Recharge Basin
Area Recharge Basin
Preserved Land
Water District
Berrenda Mesa Project
Buena Vista WSD
City of Bakersfield - 2800 Acres
Irvine Ranch WD
Kern Water Bank
Pioneer Project
Rosedale - Rio Bravo WD
West Kern WD
Updated: October 2017
Kern Water Bank Authority
Plate 1
R 24 E
R 25 E
R 26 E
T 29 S
T 30 S
Rosedale - Rio Bravo Water Storage District
Stockdale Highway
Westside Parkway
Goose Lake Slough
Pioneer Canal
Cross Valley Canal
Kern River
Main Canal
KWB Canal
River Canal
James Canal
Alejandro Canal
Panama Lane
Taft Highway
Outlet Canal
California Aqueduct
West Side Intake Canal
East Side Canal
East Side Intake
Buena Vista W.S.D.
Tule Elk Reserve
Elk Pen Ponds
West Kern Water District
Coles Levee Ecosystem Preserve
McAllister Ranch Irrigation District
Strand Ranch Basins
Enos Basins
Allen Road Basins
Mayer
Fast 50
Enns 1
Enns 2
Enns 3
Enns 4
Blacco 1
Blacco 2
West 1A
West 1B
West 2
West 3
West 3N
West 4A
West 4B
Fanucchi
Goose Lake Slough
Nord Road
Heath Road
Renfro Road
Allen Road
Superior Road
Enos Lane
Sunset
NE Pond
NW Pond
Basin 1
Basin 2
Basin 3
Basin 4
Basin 5
Basin 6
Basin 7
Basin 8
Basin 9
Basin 10
Basin 11
Basin 12
Basin 13
BM 1
BM 2
BM 3
BM 4
BM 5
BM 6
PC 2
PC 3A
JW-5 A
JW-5 B
JW-5 C
JW-5 D
JW-6 A
JW-6 B
JW-6 C
JW-7 Backup
Woody's Pond
Steven's Pond
Panama Pond
McClung Weir
Trestle Structure
PP #3 Siphons
Nord Road Siphons
River Turnout #1
James Siphon
Strand Siphon
N2 Siphon
KWB Canal Cross River Second Point Pipeline



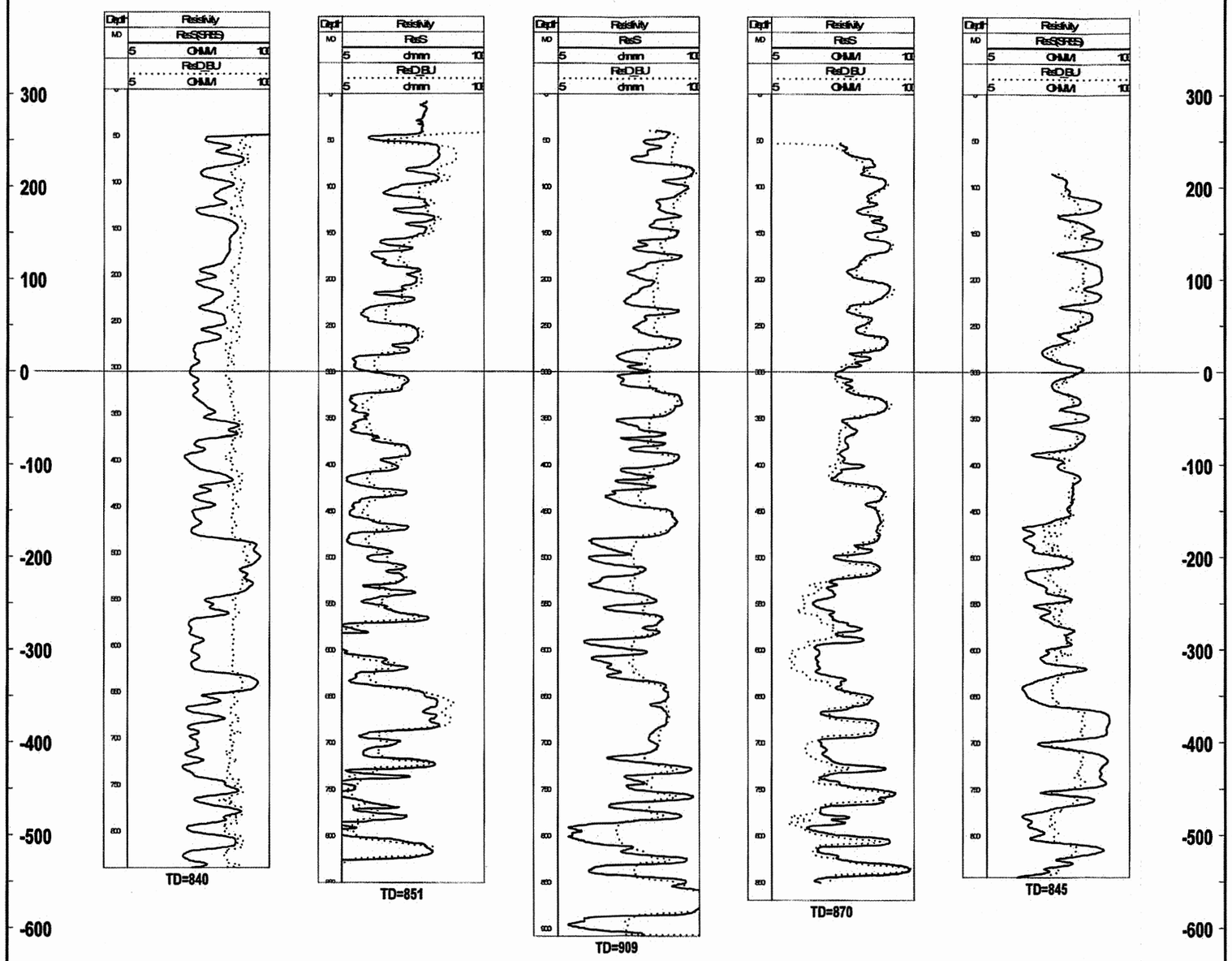
Kern Water Bank Cross-section Wells

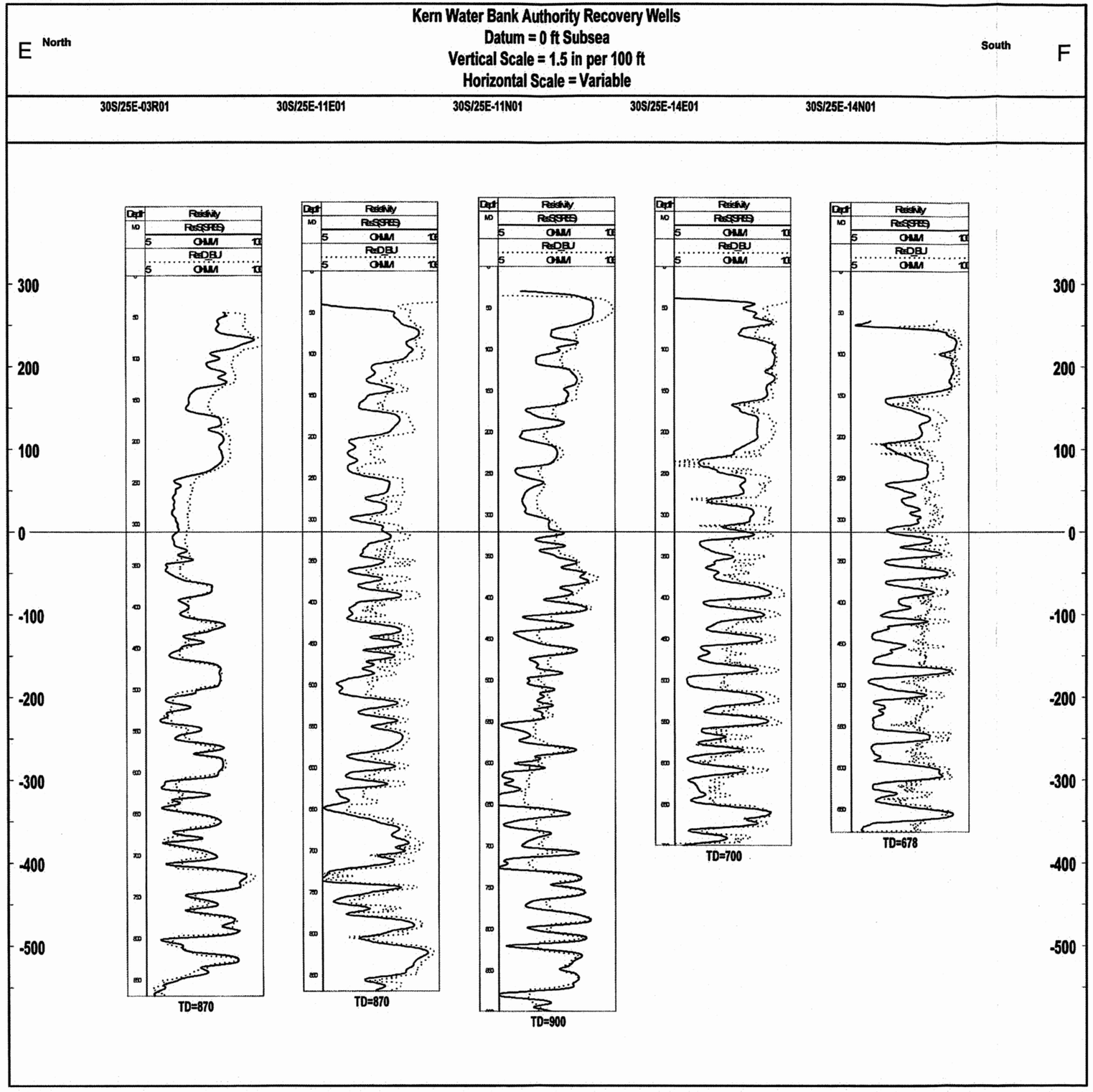
- Cross-section Wells
- KWB Production Wells
- Recharge Basins
- KWB Property


Kern Water Bank Authority Recovery Wells
Datum = 0 ft Subsea
Vertical Scale = 1.5 in per 100 ft
Horizontal Scale = Variable
A
West
East
B
30S/25E-18K01
30S/25E-17M01
30S/25E-17P01
3025-17J01
30S/25E-16M01
30S/25E-16J01
30S/25E-14E01
30S/25E-14K01
30S/25E-14J01
30S/25E-13F01
30S/25E-13J01
30S/26E-19G01
30S/26E-20C01
300
200
100
0
-100
-200
-300
-400
-500
-600
TD=920
TD=925
TD=870
TD=909
TD=820
TD=820
TD=700
TD=900
TD=870
TD=860
TD=940
TD=909
TD=920

Kern Water Bank Authority Recovery Wells
Datum = 0 ft Subsea
Vertical Scale = 1.5 in per 100 ft
Horizontal Scale = Variable

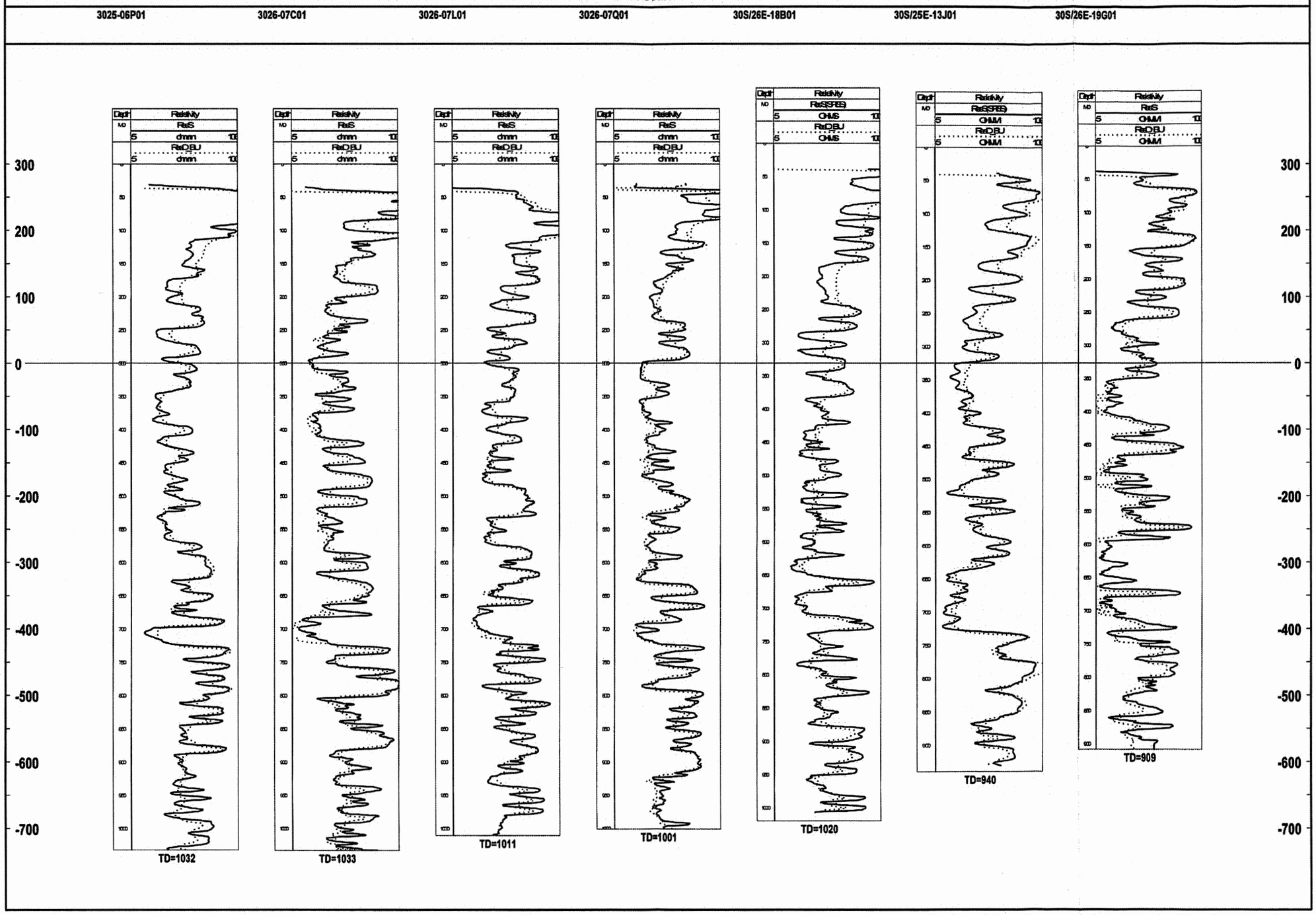
C North — South D



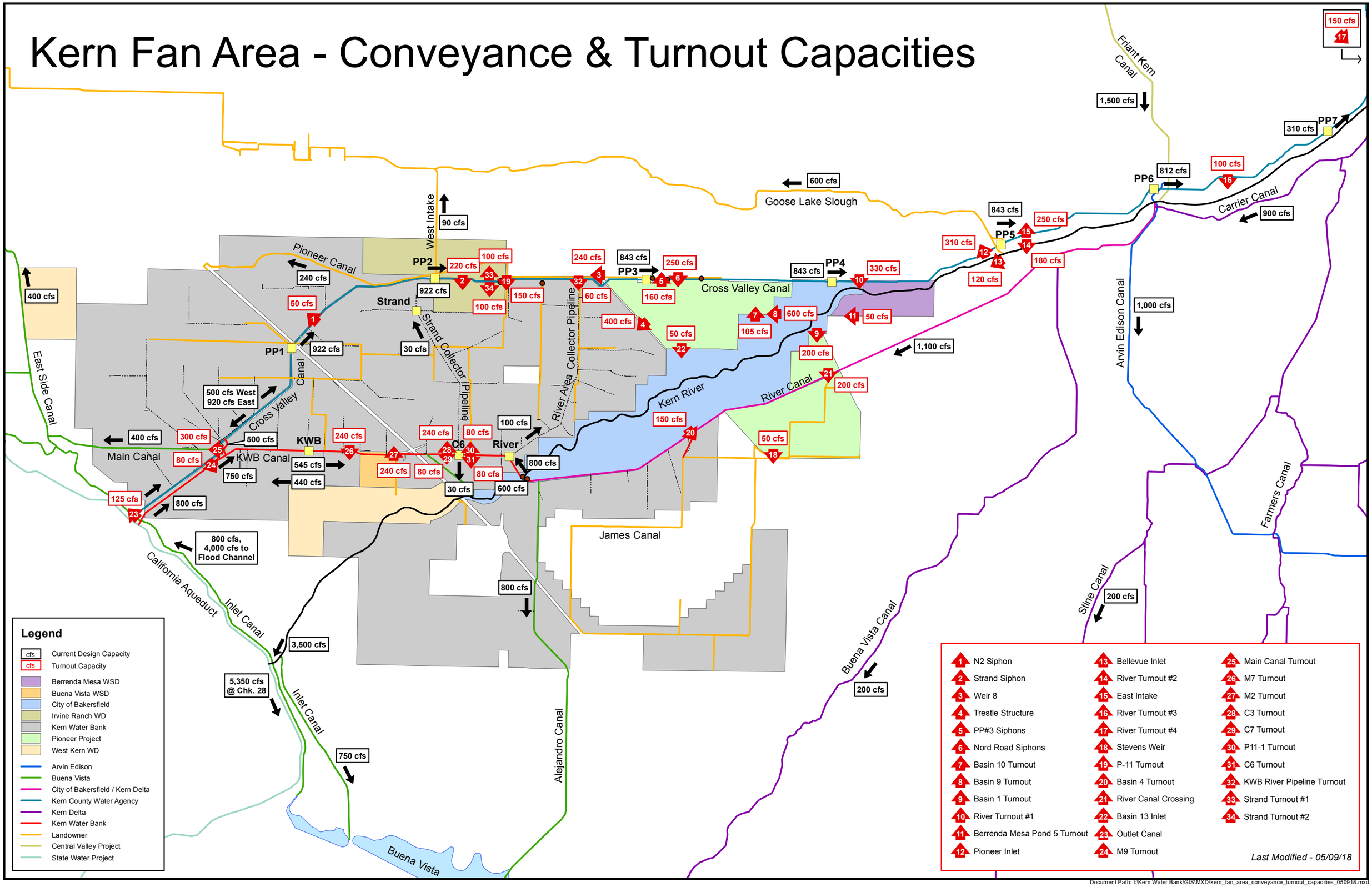

Kern Water Bank Authority Recovery Wells
Datum = 0 ft Subsea
Vertical Scale = 1.5 in per 100 ft
Horizontal Scale = Variable
E
North
South
F
30S/25E-03R01
30S/25E-11E01
30S/25E-11N01
30S/25E-14E01
30S/25E-14N01
300
200
100
0
-100
-200
-300
-400
-500
TD=870
TD=870
TD=900
TD=700
TD=678

Kern Water Bank Authority Recovery Wells
Datum = 0 ft Subsea
Vertical Scale = 1.5 in per 100 ft
Horizontal Scale = Variable

G North — South H



Kern Fan Area - Conveyance & Turnout Capacities



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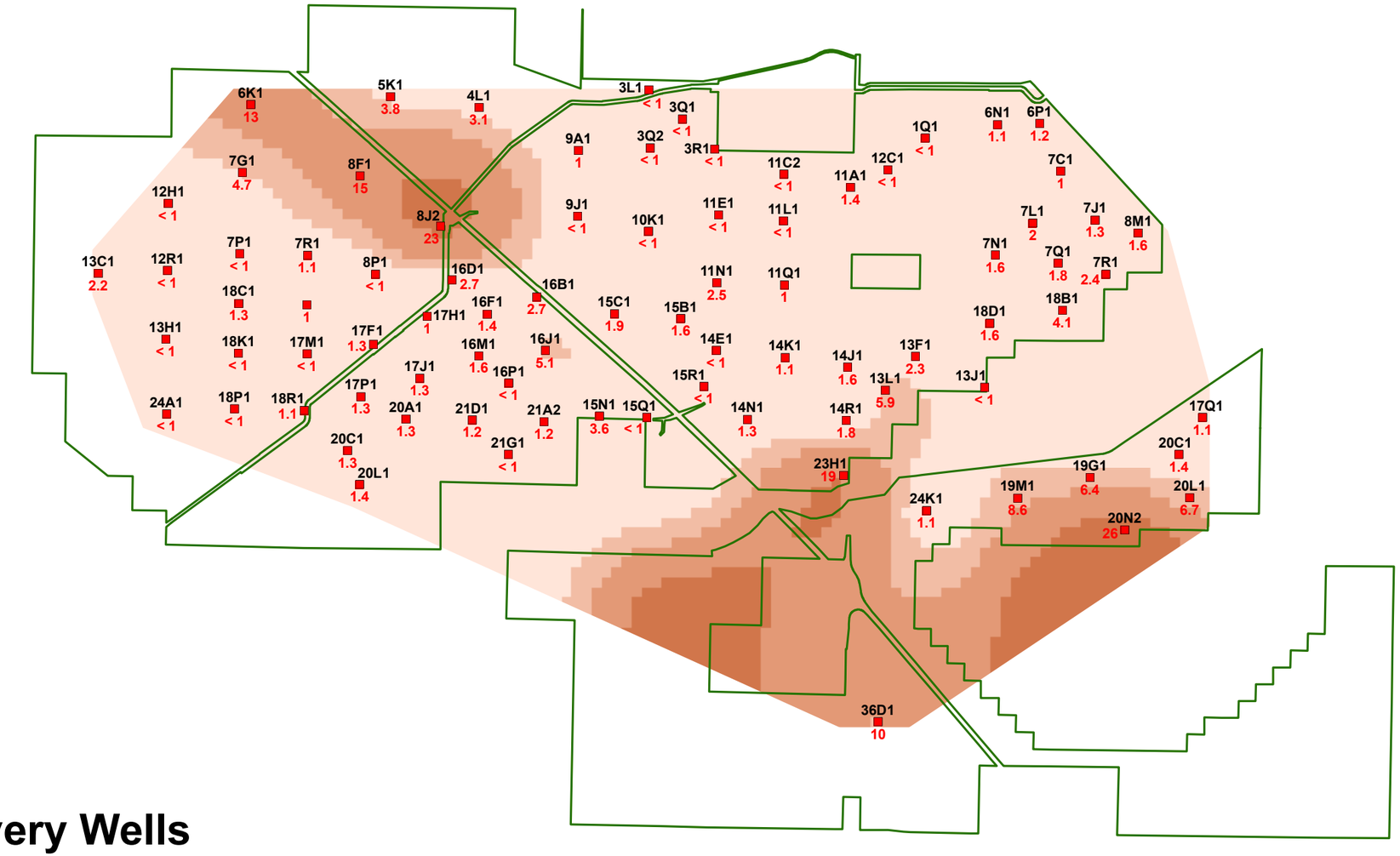
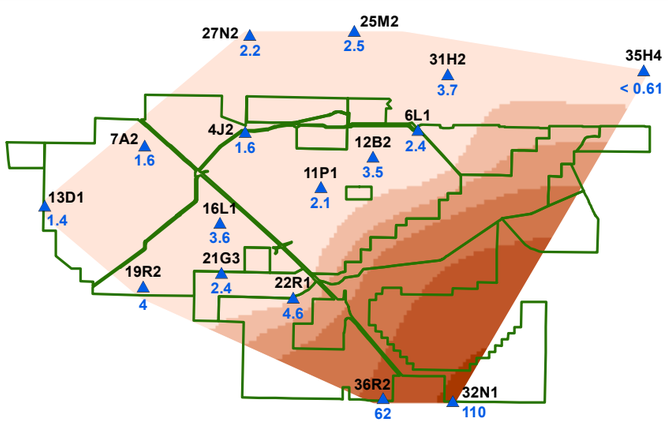
Well Arsenic Levels

2012

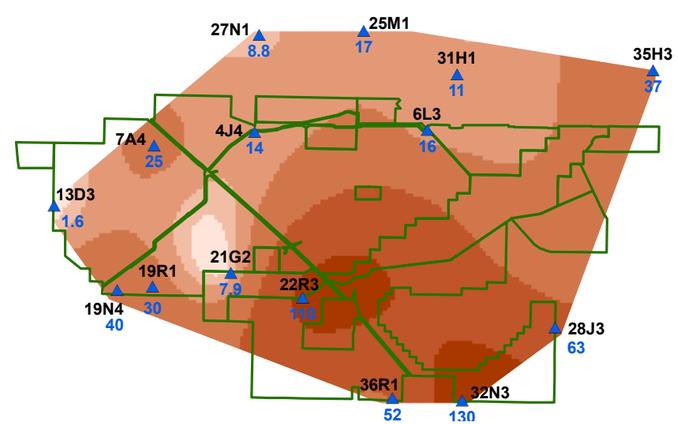


Recovery Wells



Monitoring Wells

Shallow



Monitoring Wells

Deep

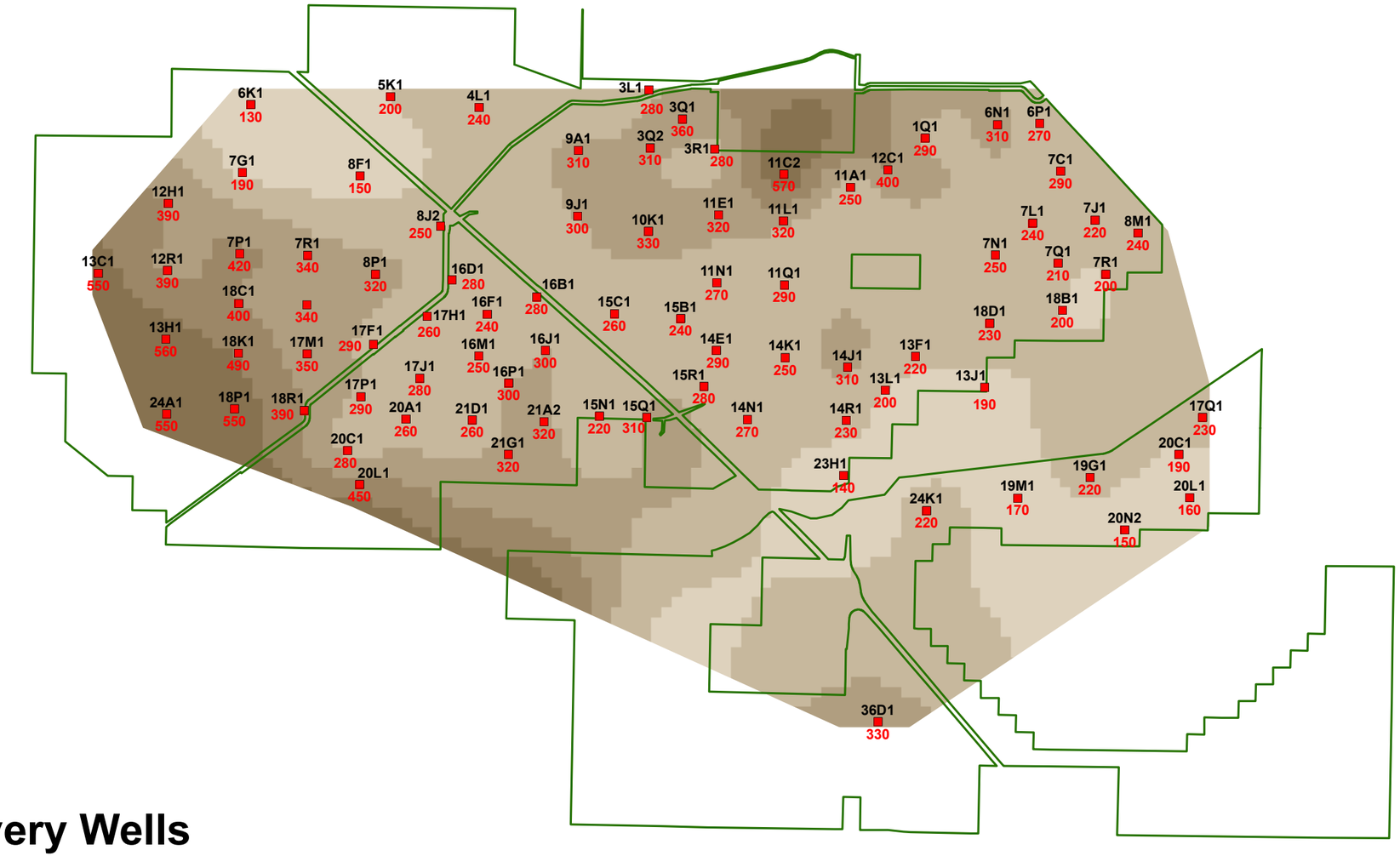
Legend

	Existing KWB Recovery Wells per Interval
0 - 5	73 Wells
5 - 10	6 Wells
10 - 20	3 Wells
20 - 50	2 Wells
50 - 100	0 Wells
100 +	0 Wells
No Data	

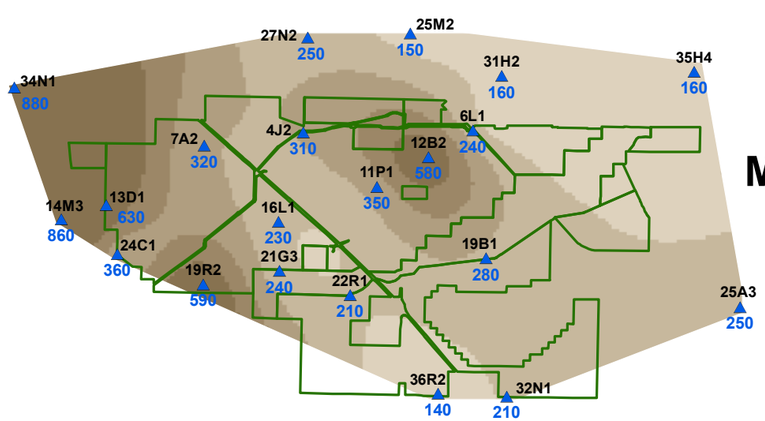
KERN WATER BANK AUTHORITY

Well TDS Levels

2012

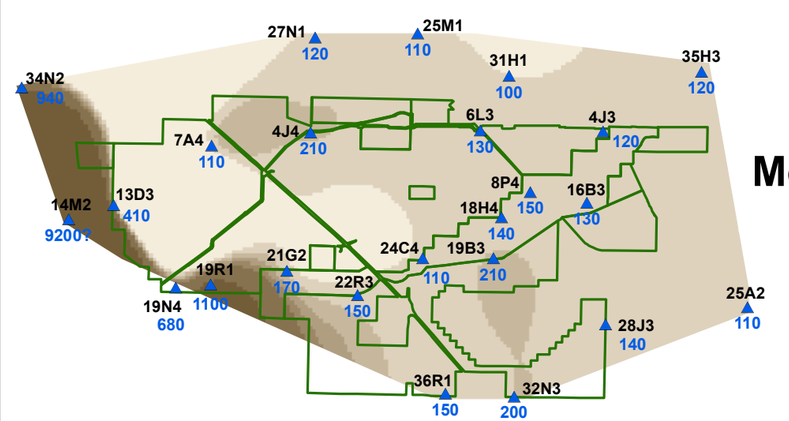


Recovery Wells



Monitoring Wells

Shallow



Monitoring Wells

Deep

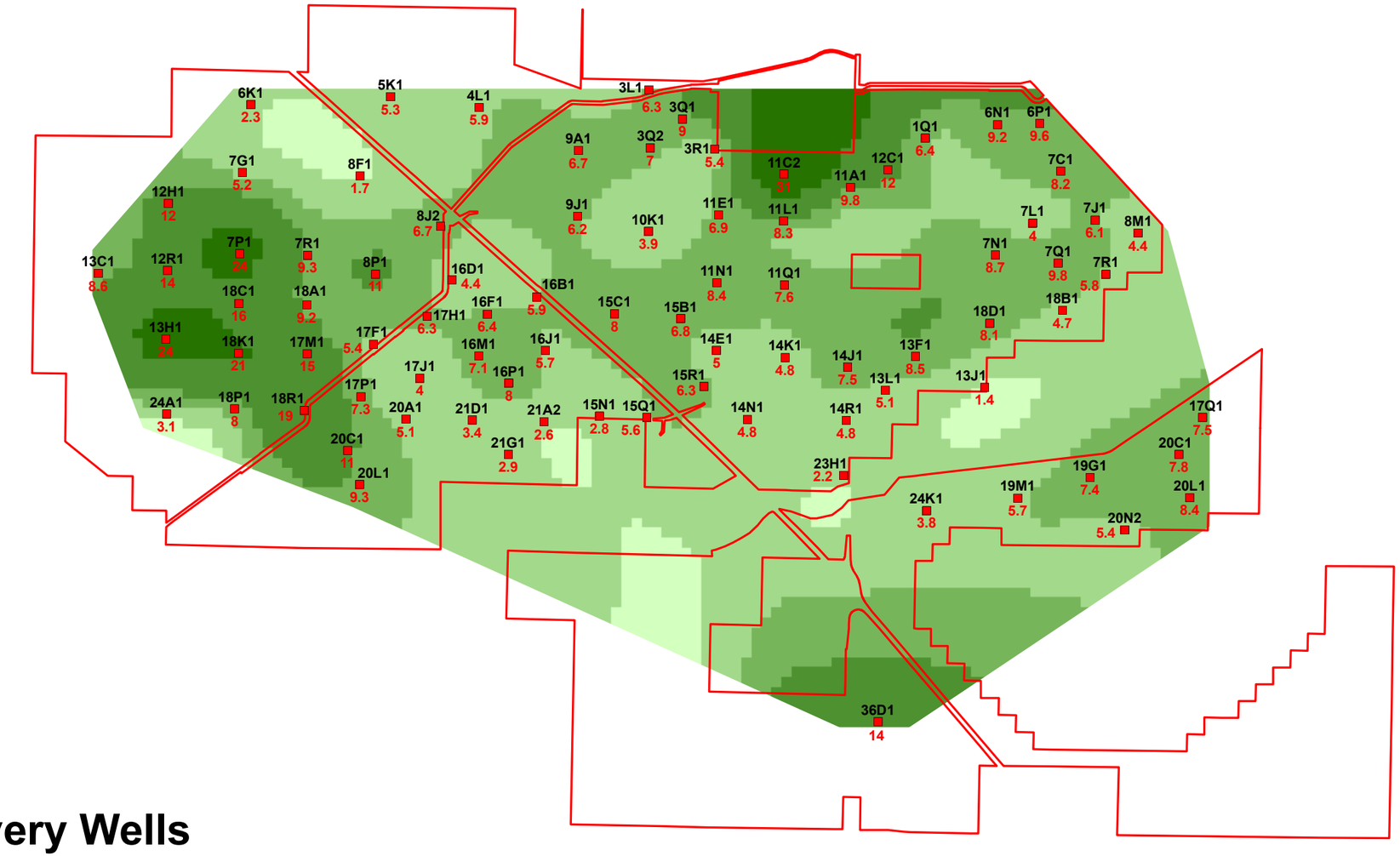
Legend

	Existing KWB Recovery Wells per Interval
0 - 100	0 Wells
100 - 200	13 Wells
200 - 300	42 Wells
300 - 400	21 Wells
400 - 500	3 Wells
500 - 1000	5 Wells
1000 +	0 Wells
No Data	

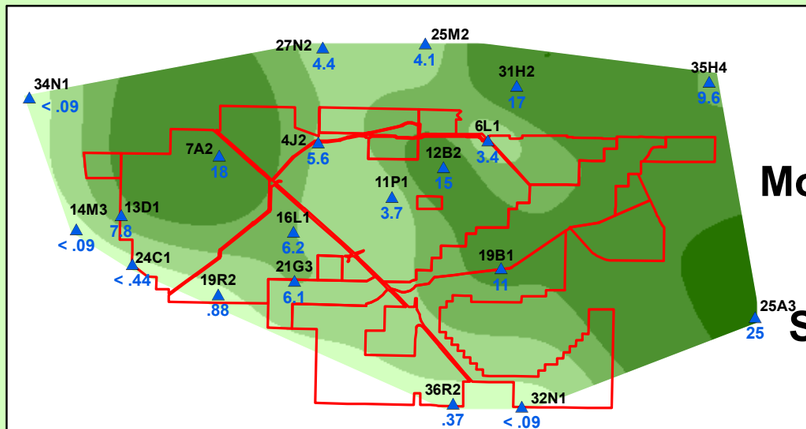
KERN WATER BANK AUTHORITY

Well Nitrate (NO3) Levels

2012

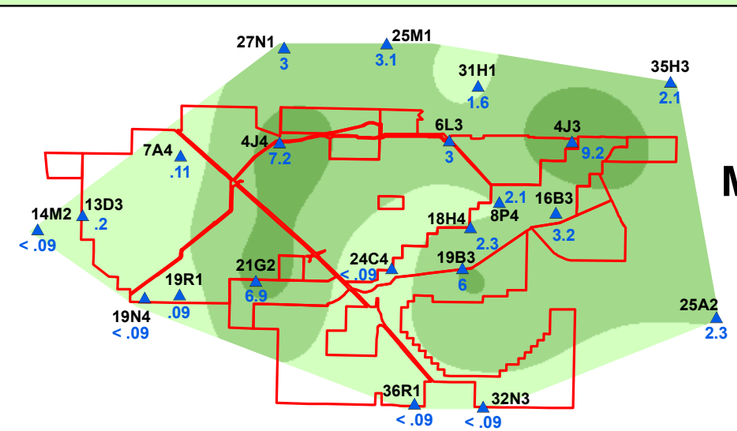


Recovery Wells



Monitoring Wells

Shallow



Monitoring Wells

Deep

Legend

Existing KWB Recovery Wells per Interval	
2 or Less	2 Wells
2 - 6	31 Wells
6 - 10	38 Wells
10 - 20	9 Wells
20 +	4 Wells
No Data	

KERN WATER BANK AUTHORITY

Appendix A

MEMORANDUM OF UNDERSTANDING

REGARDING OPERATION AND MONITORING OF THE KERN WATER BANK GROUNDWATER BANKING PROGRAM

This Memorandum of Understanding is entered into the 26th day of October, 1995, by and among DUDLEY RIDGE WATER DISTRICT, KERN COUNTY WATER AGENCY, SEMITROPIC WATER STORAGE DISTRICT, TEJON CASTAC WATER DISTRICT & WESTSIDE MUTUAL WATER COMPANY, LLC, and WHEELER RIDGE-MARICOPA WATER STORAGE DISTRICT, which have collectively formed the KERN WATER BANK AUTHORITY ("KWBA") hereinafter collectively referred to as "Project Participants," and BUENA VISTA WATER STORAGE DISTRICT ("BVWSD"), ROSEDALE-RIO BRAVO WATER STORAGE DISTRICT ("RRBWSD"), KERN DELTA WATER DISTRICT ("KDWD"), HENRY MILLER WATER DISTRICT ("HMWD"), and WEST KERN WATER DISTRICT ("WKWD"), hereinafter collectively referred to as "Adjoining Entities."

RECITALS

WHEREAS, Project Participants expect title to that certain real property more particularly shown on the map attached hereto as Exhibit "A" and incorporated herein by this reference ("Project Site") to be transferred to the KWBA as provided for in the "Statement of Principles . . . for the Development, Operation and Maintenance of the Kern Fan Element of the Kern Water Bank" ("Statement of Principles") agreed to March 30, 1995; and

WHEREAS, the KWBA intends to develop and improve the Project Site as necessary to permit the importation, percolation and storage of water in underground aquifers for later extraction, transportation and use for the benefit of Project Participants, all as more fully described in Exhibit "B" attached hereto and incorporated herein by this reference ("Project"); and

WHEREAS, Adjoining Entities encompass lands and/or operate existing projects lying adjacent to the Project Site as shown on said Exhibit A; and

WHEREAS, in recent years, water banking, extraction and transfer programs in Kern County have become increasingly numerous and complex; and

WHEREAS, it is appropriate and desirable to mitigate or eliminate any short-term and long-term significant adverse impacts of new programs upon potentially affected projects and landowners within the boundaries of Adjoining Entities; and

WHEREAS, Adjoining Entities and Project Participants desire that the design, operation and monitoring of the Project be conducted and coordinated in a manner to insure that the beneficial effects of the Project to the Project Participants are maximized but that the Project does not result in significant adverse impacts to water levels, water quality or land subsidence within the boundaries of Adjoining Entities, or otherwise interfere with the existing and ongoing programs of Adjoining Entities;

NOW THEREFORE, BE IT RESOLVED that, based upon the mutual covenants contained herein, the parties hereto agree as follows:

1. Project Design and Construction. Project Participants have completed a preliminary design of the Project described in Exhibit B hereto representing the maximum facilities for the Project. Said preliminary design has been reviewed and approved by the Parties hereto. The KWBA intends to, and if it does so will, construct all or a portion of the Project

consistent with such preliminary design. Any major modifications of the facilities and/or significant changes from that described in Exhibit B and in the environmental documentation for the Project will be subject to additional environmental review pursuant to CEQA and will be subject to review of the Monitoring Committee prior to implementation.

2. Project Operation. The Project shall be operated to achieve the maximum water storage and withdrawal benefits for Project Participants consistent with avoiding, mitigating or eliminating, to the greatest extent practicable, significant adverse impacts resulting from the Project. To that end, the Project shall be operated in accordance with the Statement of Principles and the following Project Objectives and the Minimum Operating Criteria:

a. Project Objectives. Consistent with the Project Description, the Project Participants will make a good faith effort to meet the following objectives, which may or may not be met:

(1) The Parties should operate their projects in such manner as to maintain and, when possible, enhance the quality of groundwater within the Project Site and the Kern Fan Area, as shown at Exhibit C.

(2) If supplies of acceptable recharge water exceed recharge capacity, all other things being equal, recharge priority should be given to the purest or best quality water.

(3) Each project within the Kern Fan Area should be operated with the objective that the average concentration of total dissolved salts in the recovered water will exceed the average concentration of total dissolved salts in the recharged water, at a minimum, by a percentage equal to or greater than the percentage of surface recharge losses. The average shall be calculated from the start of each Project.

(4) To maintain or improve groundwater quality, recovery operations should extract poorer quality groundwater where practicable. Blending may be used to increase

extraction of lesser quality groundwater unless doing so will exacerbate problems by generating unfavorable movement of lesser quality groundwater. It is recognized that the extent to which blending can help to resolve groundwater quality problems is limited by regulatory agency rules regarding discharges into conveyance systems used for municipal supplies, which may be changed from time to time.

(5) All groundwater pumpers should attempt to control the migration of poor quality water. Extensive monitoring will be used to identify the migration of poor quality water and give advance notice of developing problems. Problem areas may be dealt with by actions including, but not limited to:

(a) limiting or terminating extractions that tend to draw lesser quality water toward or into the usable water areas;

(b) increasing extractions in areas that might generate a beneficial, reverse gradient;

(c) increasing recharge within the usable water area to promote favorable groundwater gradients.

(6) It is intended that all recovery of recharged water be subject to the so-called "golden rule." In the context of a banking project, the "golden rule" means that, unless acceptable mitigation is provided, the banker may not operate so as to create conditions that are worse than would have prevailed absent the project giving due recognition to the benefits that may result from the project, all as more fully described at paragraph 2(b)12 below.

(7) The Project should be developed and operated so as to prevent, eliminate or mitigate significant adverse impacts. Thus, the Project shall incorporate mitigation measures as necessary. Mitigation measures to prevent significant adverse impacts from occurring include but are not limited to the following: (i) spread out recovery area; (ii) provide

buffer areas between recovery wells and neighboring overlying users; (iii) limit the monthly, seasonal, and/or annual recovery rate; (iv) provide sufficient recovery wells to allow rotation of recovery wells or the use of alternate wells; (v) provide adequate well spacing; (vi) adjust pumping rates or terminate pumping to reduce impacts, if necessary; (vii) impose time restrictions between recharge and extraction to allow for downward percolation of water to the aquifer; and (viii) provide recharge of water that would otherwise not recharge the Kern Fan Basin. Mitigation measures that compensate for unavoidable adverse impacts include but are not limited to the following: (i) with the consent of the affected overlying user, lower the pump bowls or deepen wells as necessary to restore groundwater extraction capability to such overlying user; (ii) with the consent of the affected overlying user, provide alternative water supplies to such overlying user; and (iii) with the consent of the affected overlying user, provide financial compensation to such overlying user.

b. Minimum Operating Criteria.

(1) The Monitoring Committee shall be notified prior to the recharge of potentially unacceptable water, such as "produced water" from oilfield operations, reclaimed water, or the like. The Monitoring Committee shall review the proposed recharge and make recommendations respecting the same as it deems appropriate. Where approval by the Regional Water Quality Control Board is required, the issuance of such approval by said Board shall satisfy this requirement.

(2) Recharge may not occur in, on or near contaminated areas, nor may anyone spread in, on or near an adjoining area if the effect will be to mound water near enough to the contaminated area that the contaminants will be picked up and carried into the uncontaminated groundwater supply. When contaminated areas are identified within or adjacent to the Project, the KWBA and the Project Participants shall also:

(a) participate with other groundwater pumpers to investigate the source of the contamination;

(b) work with appropriate authorities to ensure that the entity or individual, if any, responsible for the contamination meets its responsibilities to remove the contamination and thereby return the Project Site to its full recharge and storage capacity;

(c) operate the Project in cooperation with other groundwater pumpers to attempt to eliminate the migration of contaminated water toward or into usable water quality areas.

(3) Operators of projects within the Kern Fan Area will avoid operating recharge projects in a fashion so as to significantly diminish the natural, normal and unavoidable recharge of water native to the Kern Fan Area as it existed in a pre-project condition. If and to the extent this occurs as determined by the Monitoring Committee, the parties will cooperate to provide equivalent recharge capacity to offset such impact.

(4) The mitigation credit for fallowed Project land shall be .3 acre-feet per acre per year times the amount of fallowed land included in the Project Site in the year of calculation (which for the present approximately 19,890 acre Project Site is 5,967 acre-feet per year).

(5) The lands described in Exhibit A (19,883 acres) may be utilized for any purpose consistent with the Statement of Principles, by the KWBA provided, however, the use of said property shall not cause or contribute to overdraft of the groundwater basin. In this connection, any consumptive use of water on the Property which exceeds .3 acre-feet per acre (i.e., the mitigation credit) on a acre by acre basis shall be provided from supplemental sources that do not create or contribute to overdraft.

(6) Each device proposed to measure recharge water to be subsequently recovered and/or recovery of such water will be initially evaluated and periodically reviewed by the Monitoring Committee. Each measuring device shall be properly installed, calibrated, rated, monitored and maintained by and at the expense of the owner of the measuring device.

(7) It shall be the responsibility of the user to insure that all measuring devices are accurate and that the measurements are provided to the Monitoring Committee at the time and in the manner required by the Monitoring Committee.

(8) A producer's flow deposited into another facility, such as a transportation canal, shall be measured into such facility by the operator thereof and the measurement reported to the Monitoring Committee at the time and in the manner required by such Monitoring Committee.

(9) The Monitoring Committee or its designee will maintain official records of recharge and recovery activities, which records shall be open and available to the public. The Monitoring Committee will have the right to verify the accuracy of reported information by inspection, observation or access to user records (i.e., P.G.&E. bills). The Monitoring Committee will publish or cause to be published annual reports of operations.

(10) Losses shall be assessed as follows:

(a) Surface recharge losses shall be fixed and assessed at a rate of 6% of water diverted for recharge.

(b) To account for all other actual or potential losses (including migration losses), a rate of 4% of water placed in a bank account shall be deducted to the extent that the Project Participant has been compensated within three (3) years following the end of the calendar year in which the water was banked at the SWP Delta Water Rate charged by DWR at

the time of payment; provided further, however, that the water purchased and subtracted from a groundwater bank account pursuant to this provision shall only be used for overdraft correction.

(c) An additional 5% loss shall be assessed against any water diverted to the Project Site for banking by, for, or on behalf of any out-of-County person, entity or organization and/or against any banked water sold or transferred to any out-of-County person, entity or organization (except current SWP Ag Contractors).

(d) All losses provided for herein represent amounts of water that are non-bankable and non-recoverable by Project Participants.

(11) Recovery of banked water shall be from the Project Site and recovery facilities shall be located therein. Recovery from outside the Project Site may be allowed with the consent of the District or entity having jurisdiction over the area from which the recovery will occur and upon review by the Monitoring Committee.

(12) Recovery of banked water may not be allowed if not otherwise mitigated if it will result in significant adverse impacts to surrounding overlying users. "Adverse impacts" will be evaluated using data applicable in zones including the area which may be affected by the Project of approximately five miles in width from the boundaries of the Project as designated by the Monitoring Committee. In determining "adverse impacts," as provided at this paragraph and elsewhere in this MOU, consideration will be given to the benefits accrued over time during operation of the Project to landowners surrounding the Project Site including higher groundwater levels as a result of operation of the Project;. In determining non-Project conditions vs Project conditions, credit toward mitigation of any otherwise adverse impacts shall be recognized to the extent of the 4% loss and 5% loss recognized under paragraphs 2.b.(10) (b) and (c), for the mitigation credit recognized under paragraph 2.b.(4), if any, and to the extent of recharge on the Project Site for overdraft correction.

(13) To the extent that interference, other than insignificant interference, with the pumping lift of any existing active well as compared to non-Project conditions, is attributable to pumping of any wells on the Project Site, KWBA will either stop pumping as necessary to mitigate the interference or compensate the owner for such interference, or any combination thereof. The Monitoring Committee will establish the criteria necessary to determine if well interference, other than insignificant interference, is attributable to pumping of Project wells by conducting pumping tests of Project wells following the installation of monitoring wells (if not already completed) and considering hydrogeologic information.

(14) The Kern Fan Element Groundwater Model, with input from the Project Participants and Adjoining Entities, and utilizing data from a comprehensive groundwater monitoring program, may be used by the Monitoring Committee as appropriate to estimate groundwater impacts of the Project.

3. Project Monitoring. Adjoining Entities agree to participate in a comprehensive monitoring program and as members of a Monitoring Committee, as hereinafter more particularly described, in order to reasonably determine groundwater level and water quality information under Project and non-Project conditions. The monitoring program will more particularly require the following:

a. Monitoring Committee. A Monitoring Committee shall be established, comprised of one representative of each of the Adjoining Entities (initially 5) and one representative of each of the Project Participants (initially 6). The Committee shall:

(1) Engage the services of a suitable independent professional groundwater specialist who shall, at the direction of the Committee, provide assistance in the performance of the tasks identified below;

(2) Meet and confer monthly or at other intervals deemed to be appropriate in furtherance of the monitoring program;

(3) Establish a groundwater evaluation methodology or methodologies;

(4) Prepare a monitoring plan and two associated maps, "Well Location, Water Quality Network," and "Well Location, Water Level Network," which plan and maps depict the location and types of wells anticipated to be used in the initial phase of groundwater monitoring (said plan and maps are expected to be modified from time to time as the monitoring program is developed and operated);

(5) Specify such additional monitoring wells and ancillary equipment as are deemed to be necessary or desirable for the purposes hereof;

(6) Prepare annual water balance studies and other interpretive studies, which will designate all sources of water and the use thereof within the study area;

(7) Develop criteria for determining whether excessive mounding or withdrawal is occurring or is likely to occur in an area of interest;

(8) Annually or as otherwise needed determine the impacts of the Project on each of the Adjoining Entities by evaluating with and without Project conditions; and

(9) Develop procedures, review data, and recommend Project operational criteria for the purpose of identifying, verifying, avoiding, eliminating or mitigating, to the extent practicable, the creation of significant imbalances or significant adverse impacts.

b. Collection and Sharing of Data. The Adjoining Entities will make available to the Monitoring Committee copies of all relevant groundwater level, groundwater quality, and other monitoring data currently collected and prepared by each. KWBA shall annually report, by areas of interest, water deliveries for banking and other purposes and groundwater withdrawals.

c. Monitoring Costs.

(1) The cost of constructing monitoring wells and ancillary equipment, as identified in Exhibit B, shall be borne by Project Participants. The cost of any additional monitoring wells and ancillary equipment shall be borne as may be determined by separate agreement of the Project Participants and Adjoining Entities.

(2) Each of the parties shall be responsible for the personnel costs of its representative on the Monitoring Committee. In addition, the Adjoining Entities shall be responsible for all costs of monitoring operations and facilities within their respective boundaries and the Project Participants shall be responsible for all costs of monitoring operations and facilities within the Project Site.

(3) All other groundwater monitoring costs, including employment of the professional groundwater specialist, collection, evaluation and analyses of data as adopted by the Monitoring Committee, shall be allocated among and borne by the parties as follows: Project Participants = 50%; Adjoining Entities = 50%. Cost sharing among Project Participants shall be as agreed by them. Cost sharing among Adjoining Entities shall be as agreed by them. Any additional monitoring costs shall be determined and allocated by separate agreement of those parties requesting such additional monitoring.

(4) It is intended that one Monitoring Committee shall deal with all projects operating within the Kern Fan Area. If, as and when existing or additional projects are brought within the purview of the Monitoring Committee, the participants in said projects and the adjoining entities for said projects may join the Monitoring Committee and, upon doing so, shall share in the costs of monitoring operations on the same basis as provided herein for the original parties.

4. Modification of Project Operations. The Monitoring Committee may make recommendations to the KWBA and Project Participants, including without limitation recommendations for modifications in Project operations based upon evaluation(s) of data which indicate that excessive mounding or withdrawal is occurring or is likely to occur in an area of interest. The Monitoring Committee and its members shall not act in an arbitrary, capricious or unreasonable manner.

5. Dispute Resolution.

a. Submission to Monitoring Committee. All disputes regarding the operation of the Project or the application of this agreement, or any provision hereof, shall first be submitted to the Monitoring Committee for review and analysis. The Monitoring Committee shall meet and review all relevant data and facts regarding the dispute and, if possible, recommend a fair and equitable resolution of the dispute. The Monitoring Committee and its members shall not act in an arbitrary, capricious or unreasonable manner. In the event that (1) the Monitoring Committee fails to act as herein provided, (2) any party disputes the Monitoring Committee's recommended resolution or (3) any party fails to implement the Monitoring Committee's recommended resolution within the time allowed, any party to this agreement may seek any legal or equitable remedy available as hereinafter provided.

b. Arbitration. If all of the parties agree that a factual dispute exists regarding any recommendation of the Monitoring Committee made pursuant hereto, or implementation thereof, such dispute shall be submitted to binding arbitration before a single neutral arbitrator appointed by unanimous consent and, in the absence of such consent, appointed by the presiding judge of the Kern County Superior Court. The neutral arbitrator shall be a registered civil engineer, preferably with a background in groundwater hydrology. The arbitration shall be called and conducted in accordance with such rules as the contestants shall agree upon, and, in the

absence of such agreement, in accordance with the procedures set forth in California Code of Civil Procedure section 1282, et seq. Any other dispute may be pursued through a court of competent jurisdiction as otherwise provided by law.

c. Burden of Proof. In the event of arbitration or litigation under this Agreement, all parties shall enjoy the benefit of such presumptions as are provided by law but, in the absence thereof, neither party shall bear the burden of proof on any contested legal or factual issue.

d. Landowner Remedies. Nothing in this agreement shall prevent any landowner within the boundaries of any party from pursuing any remedy at law or in equity in the event such landowner is damaged as a result of projects within the Kern Fan Area.

6. Term. This agreement shall commence on the day and year first above written and shall continue in force and effect until terminated by (1) operation of law, (2) unanimous consent of the parties, or (3) abandonment of the Project and a determination by the Monitoring Committee that all adverse impacts have been fully eliminated or mitigated as provided in this agreement.

7. Complete Agreement/Incorporation Into Banking Agreements. This agreement constitutes the whole and complete agreement of the parties regarding Project operation, maintenance and monitoring. Project Participants shall incorporate this agreement by reference into any further agreement they enter into respecting banking of water in or withdrawal of water from the Project Site.

8. Future Projects. With respect to any future project within the Kern Fan Area, the Parties hereto shall use good faith efforts to negotiate an agreement substantially similar in substance to this MOU.

9. Notice Clause. All notices required by this agreement shall be sent via first class United States mail to the following and shall be deemed delivered three days after deposited in the mail:

Project Participants

Dale Melville
Dudley Ridge Water District
286 W. Cromwell Avenue
Fresno, California 93711-6162

William Taube
Wheeler Ridge-Maricopa
Water Storage District
P.O. Box 9429
Bakersfield, CA 93389-9429

Tom Clark
Kern County Water Agency
P.O. Box 58
Bakersfield, California 93312

Bill Phillimore
Westside Mutual Water Company
33141 Lerdo Highway
Bakersfield, California 93302-0058

Will Boschman
Semitropic Water District
P.O. Box Z
Wasco, California 93280

Dennis Mullins
Tejon-Castac Water District
P.O. Box 1000
Lebec, CA 93243

Bill Phillimore, Chairman
Kern County Water Bank Authority
c/o YOUNG WOOLDRIDGE
1800 - 30th Street, Fourth Floor
Bakersfield, CA 93301

Adjoining Entities

Martin N. Milobar
Buena Vista Water Storage District
P.O. Box 756
Buttonwillow, CA 93206

Hal Crossley
Rosedale-Rio Bravo
Water Storage District
P.O. Box 867
Bakersfield, CA 93302-0867

L. Mark Mulkay
Kern Delta Water District
501 Taft Highway
Bakersfield, CA 93307

Joe Lutje
Henry Miller Water District
P.O. Box 9759
Bakersfield, CA 93389

Jerry Pearson
West Kern Water District
P.O. Box MM
Taft, CA 93268-0024

Notice of changes in the representative or address of a Party shall be given in the same manner.

10. California Law Clause. All provisions of this agreement and all rights and obligations of the parties hereto shall be interpreted and construed according to the laws of the State of California.

11. Amendments. This agreement may be amended by written instrument executed by all of the parties. In addition, recognizing that the parties may not now be able to contemplate all the implications of the Project, the parties agree that on the tenth anniversary of implementation of the Project, if facts and conditions not envisioned at the time of entering into this agreement are present, the parties will negotiate in good faith amendments to this agreement. If the parties cannot agree on whether conditions have changed necessitating an amendment and/or upon appropriate amendments to the agreement, such limited issues shall be submitted to an arbitrator or court, as the case may be, as provided above.

12. Successors and Assigns. This agreement shall bind and inure to the benefit of the successors and assigns of the parties.

13. Severability. The rights and privileges set forth in this agreement are severable and the failure or invalidity of any particular provision of this agreement shall not invalidate the other provisions of this agreement; rather all other provisions of this agreement shall continue and remain in full force and effect notwithstanding such partial failure or invalidity.

14. Force Majeure. All obligations of the parties shall be suspended for so long as and to the extent the performance thereof is prevented, directly or indirectly, by earthquakes, fires, tornadoes, facility failures, floods, drownings, strikes, other casualties, acts of God, orders of court or governmental agencies having competent jurisdiction, or other events or causes beyond the control of the parties. In no event shall any liability accrue against a party, or its

officers, agents or employees, for any damage arising out of or connected with a suspension of performance pursuant to this paragraph.

IN WITNESS WHEREOF the parties have executed this agreement the day and year first above written at Bakersfield, California.

PROJECT PARTICIPANTS

DUDLEY RIDGE WATER DISTRICT

BY: _____
Dale Melville, Manager

BY: _____

WHEELER RIDGE-MARICOPA WATER STORAGE DISTRICT

BY: _____
William Taube, Engineer/Manager

BY: _____

SEMITROPIC WATER STORAGE DISTRICT

BY: _____
Wil Boschman, Engineer/Manager

BY: _____

KERN COUNTY WATER AGENCY

BY: _____
Adrienne J. Mathews, President

BY: October 26, 1995

WESTSIDE MUTUAL WATER COMPANY

BY: _____
Bill Phillimore, Executive Vice-President

BY: _____

TEJON-CASTAC WATER DISTRICT

BY: _____
Dennis Mullins, President

BY: _____

KERN WATER BANK AUTHORITY

BY: _____
Bill Phillimore, Chairman

BY: _____

ADJOINING ENTITIES

BUENA VISTA WATER STORAGE DISTRICT

BY: _____
Martin Milobar, Engineer-Manager

BY: _____

WEST KERN WATER DISTRICT

BY: _____
Bob G. Bledsoe, President

BY: _____

ROSEDALE RIO BRAVO WATER STORAGE DISTRICT

BY: _____
Hal Crossley, Manager

BY: _____

KERN DELTA WATER DISTRICT

BY: _____
L. Mark Mulkay, Engineer-Manager

BY: _____

HENRY MILLER WATER DISTRICT

BY: _____
Joe Lutje, Manager

BY: _____

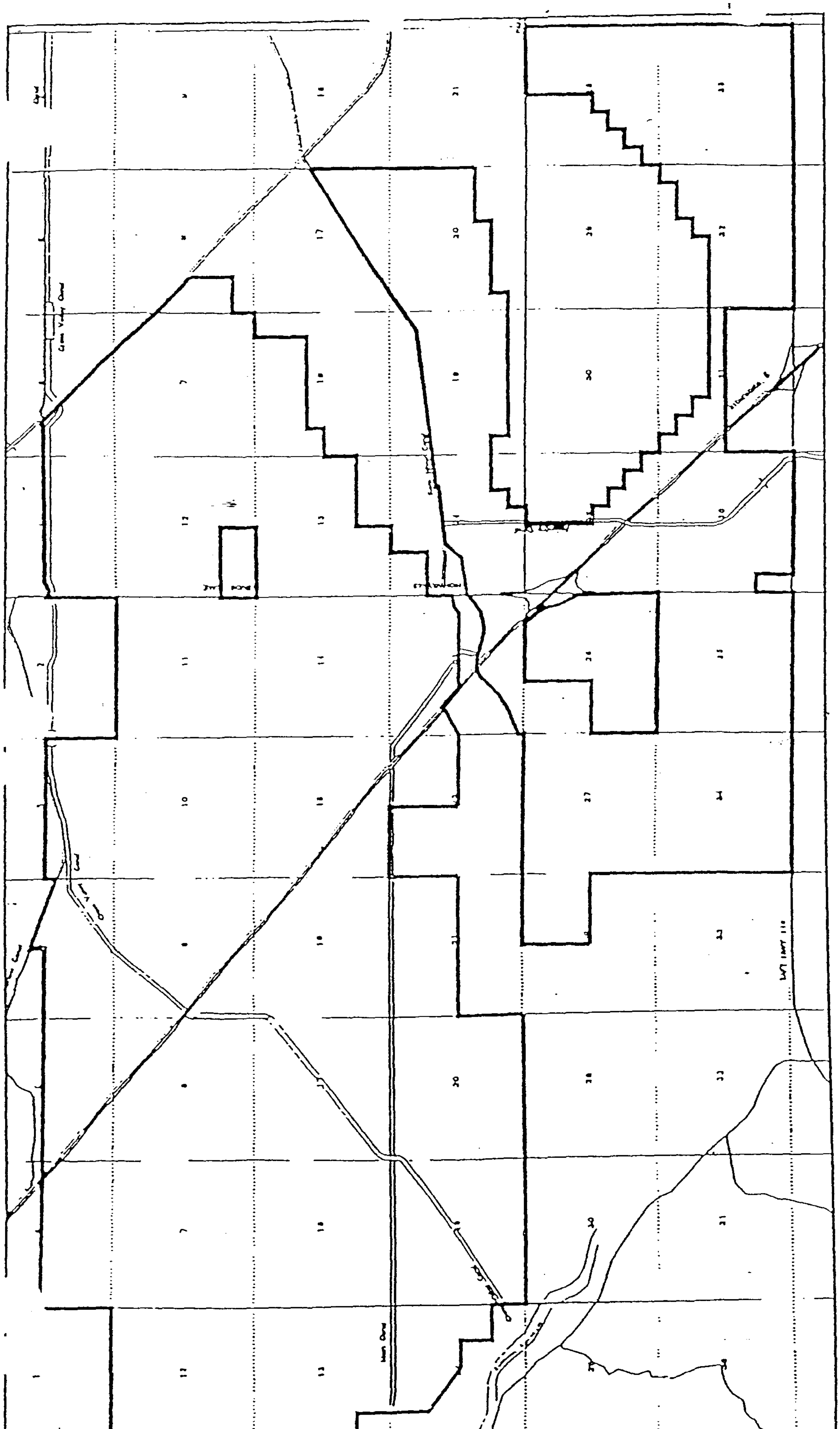


EXHIBIT A

Kern Water Bank Project Site

PROJECT DESCRIPTION

Purposes

The primary water management objective of the Kern Water Bank (KWB) is to enhance water supplies for SWP contractors and entities in Kern County. Water would be stored in aquifers during times of surplus and either recovered during times of shortage or remain in the ground to assist with overdraft correction.

Sources of Water

It is anticipated that water from numerous sources will be recharged on the property in cooperation with the water rights holders and the approval of the necessary authorities. Such sources include: the Kern River, Friant-Kern, SWP, CVP, flood water and other sources that may be available from time to time.

Facilities

To achieve its water management objectives, the KWB will require the construction of recharge ponds, water conveyance facilities, and water wells. The ponds will be created by constructing low levees along contours. The ponds bottoms would be left, as far as possible, in their natural condition. The habitat surrounding and between ponds may be modified and enhanced depending on the outcome of negotiations with resources agencies and other habitat management objectives.

Of the 19,883 acres that presently constitute the Kern Water Bank property, approximately 5,000 acres are proposed for routine recharge, although, during high flow conditions, additional acreage may be utilized which would also serve to prevent flooding elsewhere in the Valley. In the wettest of years, it is hoped that close to a million acre feet can be recharged on the property. The ponds would be formed by constructing approximately 35 miles of levees with a maximum height of 3 feet.

It is proposed that water would be conveyed to and from the property using available capacity in any of the canals and conveyance facilities that may serve the property including: the Cross Valley Canal, the Friant Kern Canal, the California Aqueduct, the Pioneer Canal, the River Canal, the Kern River, Buena Vista's Main Canal and the Alejandro Canal. In each case the permission of the relevant authority will be sought for the use of each facility. It is also proposed to build a new canal that would link the River Canal to the California Aqueduct and would convey water to and from the property. Additionally, it is proposed that a diversion and conveyance facility be constructed that would divert water from the Kern River to the eastern end of the property. Such a conveyance facility would probably cross the north Pioneer property and, as such, is subject to approval from the KCWA and the City of Bakersfield.

Fifty-seven water wells currently exist on the property. Another 43 may be added before the project is complete to provide adequate recovery capacity and the necessary operational flexibility to avoid or minimize adverse impacts. Once build out of the recovery facilities is complete, the

recovery capacity will be maintained by constructing new wells to replace the capacity of older wells as they fail. New wells shall be placed no closer than one third mile from any functioning wells off the property. Wells on the property shall be located and operated so as to prevent significant non-mitigable adverse impacts to neighboring land owners.

Operation

The project shall be managed by the Kern Water Bank Authority. Day-to-day operation of the project may be contracted to other parties. Operation of the project shall be coordinated with adjoining projects.

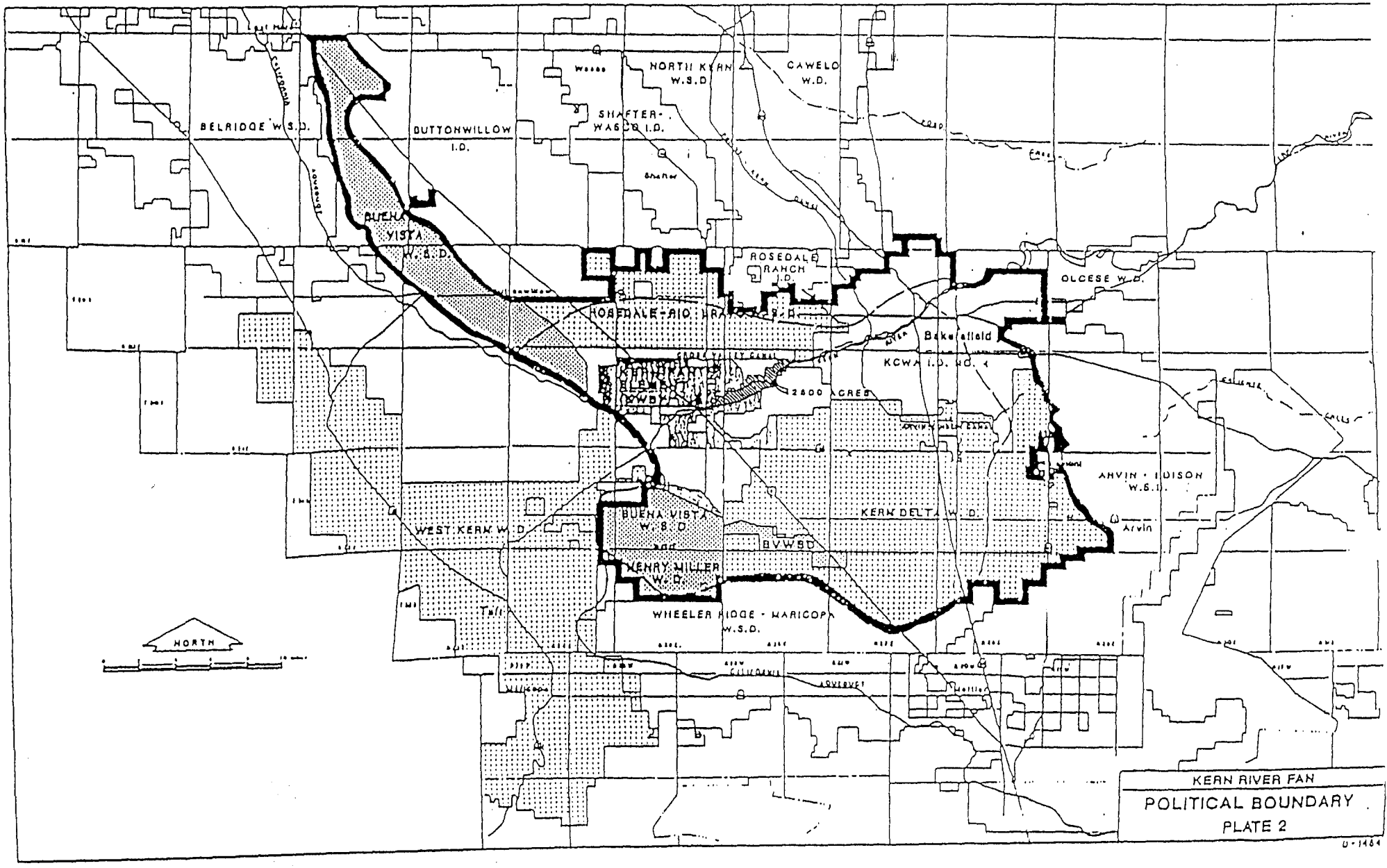

BELRIDGE W.S.D.
BUTTONWILLOW I.D.
NORTH KERN W.S.D.
CAWELO W.D.
SHAFTER-WASCO I.D.
BUENA VISTA W.S.D.
ROSEDALE RANCH I.D.
ROSEDALE-RIO BRAVO W.S.D.
OLCESE W.D.
Bakersfield
KCWA I.D. NO. 4
2500 ACRES
BVWSD
ARVIN-EDISON W.S.D.
Arvin
KERN DELTA W.D.
WEST KERN W.D.
BUENA VISTA W.S.D.
BVWSD
HENRY MILLER W.D.
WHEELER RIDGE - MARICOPA W.S.D.
NORTH
KERN RIVER FAN
POLITICAL BOUNDARY
PLATE 2

EXHIBIT C

Appendix B

PROPOSED MONITORING PLAN FOR THE KERN FAN ELEMENT OF THE KERN WATER BANK

Draft Report - For Review Purposes Only

Prepared for:

Kern County Water Agency
Bakersfield, California

Prepared by:

KENNETH D. SCHMIDT AND ASSOCIATES
Groundwater Quality Consultants
Fresno, California

August 1996

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PROPOSED MONITORING PLAN FOR THE KERN FAN ELEMENT OF THE KERN WATER BANK

INTRODUCTION

This monitoring plan was developed pursuant to the Memorandum of Understanding (MOU) regarding the operation and monitoring of the Groundwater Banking Program for the Kern Fan Element of the Kern Water Bank. This program is a cooperative effort, involving a number of participating entities, in and near the Kern River, southwest of Bakersfield. Besides maximizing the beneficial effects of the banking project, there is a goal to insure that the project does not result in significant adverse impacts to water levels or groundwater quality, or create land subsidence, within the boundaries of the adjoining entities. The adjoining entities include the Buena Vista Water Storage District, Rosedale-Rio Bravo Water Storage District, Kern Delta Water District, Henry Miller Water District, and West Kern Water District. The project objectives that are directly related to groundwater include:

1. The average total dissolved solids (TDS) concentration in the recovered water is to exceed the average TDS concentration in the recharged water, at a minimum, by a percentage equal to or greater than the percentage of surface recharge losses.
2. In order to improve groundwater quality, recovery operations should extract poorer quality groundwater where practicable.
3. All groundwater pumpers should attempt to control the migration of poor quality groundwater.

"Extensive monitoring" is to be used to identify the migration of poor quality groundwater, and to give advance notice of developing problems.

A monitoring committee was established to oversee monitoring for the project. Each of the participants and adjoining entities are represented on this committee. Among the duties of the committee are:

1. Establish a groundwater evaluation methodology or methodologies.
2. Prepare a monitoring plan and two associated maps, which depict the locations and types of wells anticipated to be used in the initial phase of groundwater monitoring.
3. Specify such additional monitor wells and ancillary equipment as are deemed necessary or desirable.
4. Prepare an annual report showing annual recharge, recovery, storage balance, losses, and reserves.
5. Prepare annual water balance and other interpretive studies.
6. Develop criteria for determining whether excessive mounding or withdrawal is occurring or is likely to occur.
7. Annually or as otherwise needed, determine the impacts of the Project on each of the adjoining entities.

The boundaries of the area selected for evaluation are Seventh Standard Road on the north, the east boundary of R27E on the east, one mile south of Bear Mountain Road on the south, and a variable boundary on the west. The western boundary ranges from the west edge of R24E at the south, to four miles west of Wasco Way on the north. Groundwater recharge, banking, and recovery programs have been conducted in the area for many years. Some monitoring of the effect of these operations has been conducted. Prior to proposing a monitoring plan pursuant to the MOU, the existing monitoring program is described.

EXISTING MONITORING PROGRAM

A number of existing groundwater monitoring programs are being conducted in the area. Included are semi-annual water-level measurements by the Kern County Water Agency (KCWA) and California Department of Water Resources (DWR), water-level and groundwater sampling programs by the adjoining entities, detailed water-level monitoring in the Kern Fan Element by the KCWA, and land

surface subsidence and compaction monitoring by the DWR. Prior to 1995, DWR also conducted extensive water sampling of monitor wells in the Kern Fan Element. Both water supply wells and dedicated monitor wells are used for monitoring. Most of these monitor wells have multiple completion intervals, allowing various depth intervals within the upper 700 to 800 feet to be monitored.

The KCWA prepares annual water supply reports that include a section on groundwater conditions in Kern County. Water-level maps (depth to water and water-level elevations) are provided for the upper (unconfined) aquifer (generally above a depth of about 300 to 400 feet). Also, maps are provided for shallow groundwater (less than 20 feet deep), which is present in the Lost Hills-Buttonwillow area and near the Buena Vista and Kern Lake beds. The Draft Supplemental EIR for the First Stage of the Kern Fan Element (December 1990) contained a description of water level and groundwater quality monitoring as of that time. The DWR and KCWA prepared a triennial monitoring report, summarizing the monitoring results for 1991-93. A number of additions to the monitoring have been made since that time, and an updated discussion is necessary.

Monitor Wells

"Monitor wells", as used in this plan, refers to non-water-supply wells that are used solely for groundwater monitoring. DWR, the City of Bakersfield, and KCWA installed multiple completion monitor wells at 21 sites, in order to allow monitoring at three or four discrete depth intervals. Ten of these sites are within the 2,800-acre recharge area and eleven are on the Kern Fan Element property. The DWR developed multiple completion monitor wells at another 22 sites as part of a regional monitoring network. Inclu-ded were one site in the Semitropic WSD, one site in the Kern Delta W.D., three sites in the Buena Vista WSD, and four sites in the Rosedale-Rio Bravo WSD. There are now 46 multiple completion and four single completion monitor wells in the program. Locations of these monitor wells are shown in Figure 1.

Water Levels

All of the monitor wells and hundreds of water supply wells are included in the water-level monitoring program (Figure 1).

Supply Wells

Following are the number of supply wells in the study area that are in the water-level monitoring program:

Entity	No. of Wells
Berrenda Mesa	8
City of Bakersfield	19
Buena Vista WSD	26
Semitropic WSD	9
Rosedale Rio Bravo WSD	42
ID 4	177
Kern Delta WSD	86
West Kern WSD	5
Kern Fan Element	112
Pioneer	6

Not all of these wells are measured by the entity indicated. Both DWR and KCWA measure water levels in wells within some of these en-tities' boundaries. There are also a number of shallow piezometers that are measured semi-annually by the KCWA and the Buena Vista WSD in two areas of shallow groundwater. These areas are shown in the annual KCWA reports. One is in the northwest part of the study area and the other is near the south boundary of the study area.

Frequency of Measurements

Transducers are installed in four wells at one site (T30S/ R25E-16L) to measure water levels, as part of the DWR subsidence monitoring program, which is described later in this report. The KCWA measures water levels on a monthly basis during recharge and recovery events and quarterly during other periods in about 80 wells. Fifty of these are monitor wells and the others are supply wells. The Henry Miller Water District measures water levels in their 24 production wells semi-annually. The Rosedale-Rio Bravo WSD measures water levels in 23 private wells and 8 monitor wells on a monthly basis. The Kern Delta Water District measures 128 wells in their district on a semi-annual basis. Of these wells, 28 are measured monthly and 13 are measured weekly. The Buena Vista WSD measures water levels

quarterly in 57 private and District supply wells and four observation (unused) wells. The District also measures water levels monthly in eight 500-foot deep monitor wells (DM-Series) and at three double completion monitor wells. The West Kern Water District measures water levels on monthly basis in their five production wells and three observation wells. Essen-tially, water-level measurements for the rest of the wells are on a semi-annual basis, corresponding to spring (high) levels and fall (low) levels, as measured throughout most of the San Joaquin Valley.

Data Management

Water-level measurements are generally available on computer printouts. Hand plotted and contoured water-level elevation contour maps are prepared for the annual spring measurements. Water-level maps for 1991, 1992, and 1993 were provided in the KCWA Kern Water Bank Monitoring Report of February 1994. The period covered by that report was during the drought, and no intentional recharge was occurring. Comparable maps for the period 1994-96 are to be provided in the next monitoring report. This later period was wet and extensive recharge was undertaken. Water-level hydrographs extending back to July 1, 1988 for nine of the multiple completion monitor well sites were presented in the February 1994 report. In addition, spring water-level measurements for 1991, 1992, and 1993 were plotted along two cross sections in that report. One section trended from southwest to northeast along the Kern River. The other extended from northwest to southeast, generally parallel to the Southern Pacific Railroad tracks.

Groundwater Quality

As for water levels, there are a number of ongoing monitoring programs for groundwater quality (Figure 2). Included are routine monitoring by adjoining entities, and monitoring of public supply wells in the area, pursuant to state and county requirements. There are a number of small water systems in the study area. Most of the large water system public-supply wells in the study area are operated by the

California Water Service Company, the City of Bakersfield, West Kern Water District, and Vaughn Water Company. Sampling frequencies for these wells vary. Comprehensive chemical analyses are generally done at least every three years. In cases where problem levels of some constituents are present, sampling is normally done more often.

Water from 60 wells in the Kern Fan Element was sampled on a monthly to quarterly basis by DWR between 1989 and 1994. These were generally either monitor wells or recovery wells (sampled in 1992). Comprehensive chemical analyses were performed early in the program (quarterly during the first year) and more limited analyses were then routinely done thereafter.

Several other water sampling programs have been completed in the study area that are important in developing this plan. The West Bakersfield Toxics Study was conducted by California State University, Fresno in 1989. Numerous water supply wells were sampled in the part of the study area that is east of Enos Lane and north of Panama Lane. This sampling focused on an area of high DBCP, EDB, and nitrate concentrations, particularly in the part of that area north of the Kern River. In July 1994, 35 Kern Water Bank production wells were sampled for analysis of Title 22 drinking water analytes. A number of recovery wells were sampled for Title 22 drinking water analytes in 1991, as part of the Emergency Well Program. The DWR prepared a uranium map. High uranium concentrations have generally been found in groundwater near Buena Vista Lake and Kern Lake, and also in part of the Rosedale area. A Master's thesis (CSUB) is available on arsenic concentrations in the groundwater of the Kern Fan. The Kern County Environmental Health Department (KCEHD) has maps of specific problem constituents in the groundwater that were developed for use in implementing the County Water Well ordinance. The KCWA has semi-annual sampling results for salinity in a number of piezometers tapping the shallow groundwater. Other information is available from the KCWA Water Quality Data Base, which includes chemical analyses of water from about 900 wells, extending back to 1940. Some of the adjoining irrigation districts also periodically sample wells for either irrigation analyses or salinity determinations.

Frequency of Sampling and Constituents Determined

In general, Title 22 drinking water analyses are available at least every three years for all public supply wells in the study area. In addition, DWR collected samples and had Title 22 drinking water analytes determined on water from 60 wells in the Kern Fan Element, on a quarterly basis for one year. Subsequently, monitoring of these wells was generally reduced to quarterly for the major inorganic chemical constituents, except in a few cases when specific constituents were detected at excessive levels. In this case, such constituents were added to the analyses. These problem constituents were discussed in the February 1994 monitoring report on the Kern Water Bank. They include sulfate, arsenic, boron, and ethylene dibromide. Barium, toxaphene, eptam, and diuron, were found in only one well in each case, and aren't considered signi-ficant at present. The DWR water quality monitoring program was discontinued after December 1994. The Buena Vista WSD has taken over sampling of the multiple completion monitor wells in their district. Plans have not been finalized in terms of the future sampling of the other monitor wells.

In terms of water sampling in the adjoining irrigation entities, analyses are normally done for irrigation parameters. The Kern Delta WD samples water from 17 supply wells on an annual basis for determination of TDS, electrical conductivity, and pH. The Henry Miller Water District periodically samples water from the 24 District wells for analyses of irrigation parameters and arsenic. The most recent set of samples was collected in 1992. The Rosedale-Rio Bravo WSD does not collect water samples for wells for chemical analyses. The Buena Vista WSD collects water samples from the monitor wells on a quarterly basis for irrigation water analyses. Samples are collected from the shallow piezometer annually for determination of salinity. Water samples are collected from private supply wells for irrigation analyses, if they are pumping during quarterly monitoring.

Subsidence

The DWR maintains a compaction recorder (extensiometer) at T30S/R25E-16L, adjacent to a triple completion monitor well. Water levels are continuously measured with transducers in the three depth zones in the monitor well and another shallow nearby well. In addition, land surface elevations are periodically determined at 28 benchmarks, distributed throughout the Kern Fan Element. The DWR intends to maintain the subsidence monitoring program into the future. Results to date show only several hundredths of a foot of compaction due to pumping in the early 1990's. Conversely, during the substantial recharge of recent years, a land surface rise of several hundredths of a foot was indicated.

Recharge

The amounts of water diverted for recharge from the Kern River, Friant-Kern Canal, and Cross Valley Canal are routinely measured. No regular direct monitoring of the recharge water quality has been done, however the chemical quality of the various sources of recharge is well known, due to other monitoring pro-grams.

COMMENTS ON EXISTING MONITORING PROGRAM

Water Levels

Presently, there are measurements for more wells than are necessary, in order to prepare water-level elevation contour maps for this program. The excessive wells are primarily in ID-4. Although measurements of many wells are made for other reasons, not all of the measurements need to be incorporated into this program. Conversely, there are several areas that are relatively close to recharge sites where few water-level measurements are available (Figure 1), in order to prepare water-level maps. One of these is south of the Taft Highway, between the California Aqueduct and the west boundary of the Kern Delta W.D. Another is between Highway 58 and Stockdale Highway, in the Rosedale-Rio

Bravo WSD. In terms of the water-level elevation contour maps, the addition of flow lines showing the direction of groundwater flow would be useful.

In terms of the frequency of measurements, semi-annual measurements are considered adequate for preparation of the water-level maps. Measurements made on a monthly basis are more than adequate for preparing water-level hydrographs. Careful evaluation of water-level hydrographs for the multiple completion monitor wells at the nine sites (presented in the February 1994 report) indicates that less frequent measurements would normally be adequate in the future.

Groundwater Quality

Much of the water sampling for the Kern Fan Element has been focused on the monitor wells. Because of the proximity to the Kern River and recharge sites, the chemical quality of this water is generally excellent. Monitoring of the good quality groundwater can be decreased in the future from what was historically done. A substantial amount of additional data is available for public supply wells and monitoring programs in adjoining Districts, but this has not yet been incorporated into this monitoring program. There is a general lack of recent analyses for several important problem constituents in some areas. In general, there are few monitor well sites in these problem areas. Future monitoring in these areas is essential to allow evaluation of the migration of poor quality groundwater. Examples of such constituents are DBCP, EDB, and nitrate in shallow groundwater north of the Kern River and east of Enos Lane. A one time intensive well sampling program was conducted in this area by CSUF in 1989. Additional examples are arsenic, uranium, and fluoride in groundwater near the old lake beds. Although one time sampling results are available in some cases for these constituents, not enough information is available to prepare up-to-date maps showing their distribution in the groundwater. The potential migration of poor quality groundwater associated with recharge and/or recovery activities of this program cannot be determined without such information.

Recharge

Little direct monitoring of the quality of the recharged water has been done. Although the chemical quality of the various sources of recharge water are well known, it would be useful to directly measure some water quality parameters, such as electrical conductivity, in the recharge water.

PROPOSED REVISIONS IN MONITORING

Water Levels

It is recommended for the part of the study area covered by ID-4, that the measurements for no more than two wells per section be incorporated into the semi-annual water-level monitoring program for this project. The times of the spring and fall water-level measurements should be coordinated before each round, particularly between the KCWA and surrounding Districts. An attempt should be made to measure water levels when they are the shallowest and deepest each spring and fall, respectively. Also, all of the measurements for each round should be made within as short a time as feasible, preferably within one or two weeks.

Transducers have been installed at one cluster monitor well site, as part of the DWR subsidence monitoring program, to allow virtually continuous water-level measurements. It is recommended that two other such monitor well sites be equipped with continuous float-type recorders. One would be in the 2,800 acre area (Section 8 or 18 of T30S/R26E), and another near the Berrenda Mesa W.D. recharge area (Section 2 of T30S/R26E). Water levels in the remaining monitor wells would be measured on a quarterly basis during recharge periods, except for wells within one mile of the soil contaminated area associated with the Chevron pipeline, which would be measured monthly in cases when the depth to water is less than 100 feet. During recovery periods, water levels in the monitor wells would be measured semi-annually, except in specific areas of concern (based on actual drawdowns observed), where more frequent measurements would be made. However, during the startup of recharge and recovery operations, measurements may be made more frequently in some areas.

Water-level measurements for the program should be placed in a computerized database, and a GIS developed to allow computerized plotting of the data. However, the contours still should be drawn by experienced groundwater geologists or hydrologists. Both fall and spring measurements should be used to prepare maps. For the water-level elevation contour maps, arrows showing the direction of groundwater flow should be added. This would allow both participants and the adjoining entities to more readily determine the direction of groundwater flow, and changes that will occur. The water-level monitoring for this program extends north to Seventh Standard Road, which is the south boundary of the groundwater monitoring program for the Semitropic WSD water banking project. Because water-level maps are made for that program, an attempt should be made to reconcile water-level contours shown for the semi-annual measurements. Depth to water contours (for the shallowest depth intervals) should also be prepared annually, based on the spring measurements.

In terms of the cross sections presented in the February 1994 report, scale should be enlarged, and additional information added, such as the locations and perforated intervals of the wells used, and the major subsurface geologic units. The major subsurface units in the area have already been determined, based on an evaluation of an extensive group of geophysical logs, including those for the monitor wells.

Water-level hydrographs should be prepared for all wells in the study area with long-term records (20 years or longer), and for all of the frequently measured wells. The long-term records are on a DWR database, and these provide perspective on long-term trends that is not provided by only evaluating the recent, short-term records (since July 1988). These hydrographs should be placed in the appendix of the annual report.

Groundwater Quality

When water levels are shallow (about 50 feet or less), economical hand pumps can readily be used to sample the monitor wells. These pumps can produce in the range of 5 to 10 gpm. For wells with a depth to water greater than 100 feet and where the ground-water is not corrosive, permanent pumps

could be considered for routine sampling. Although a one time cost is incurred for the pumps, some manpower savings would result. For example, the need to clean the portable pump and intake hose between wells would be eliminated. Normal submersible pumps, capable of pumping at least 30 to 50, are adequate.

As opposed to sampling water from all of the monitor wells on a quarterly basis, it is recommended to routinely sample at ten of the multiple completion monitor well sites, in the shallowest and deepest completion zones. Semi-annual sampling of these wells at these ten sites would be adequate. All of the monitor wells would be sampled annually. Routine water sampling would be only for a selected group of constituents, to be chosen specifically for certain areas, based on their occurrence. Examples of these constituents would be TDS, nitrate, sulfate, DBCP, EDB, arsenic, manganese, and alpha activity. Constituents would be routinely analyzed only in wells where or near such a constituent is present in the groundwater at significant levels. Irrigation type analyses would be done on all monitor wells once every two years. Comprehensive chemical analyses are to be done for water from recovery wells (generally Title 22 analyses, or a relaxed version), as required by DOHS. In order to compare the TDS of recharged and recovered water, the electrical conductivity of water from each well used for recovery should be measured semi-annually during recovery periods. Once a year during recovery, TDS (residue at 180 C) should be measured in water from the recovery wells. If problems are indicated in certain areas, then intensive sampling programs can be used to delineate the geographic extent.

In order to obtain more information on the exact location of groundwater quality problem areas, periodic intensive sampling programs utilizing large-capacity supply wells are necessary. One of the most important areas worthy of consideration is the area of high nitrate, DBCP, and EDB concentrations east of Enos Lane and north of the Kern River. The last intensive well sampling program in this area was conducted in 1989. It is recommended that approximately every three years, an intensive sampling program should be undertaken in this area. Approximately 60 wells in this area would be selected for sampling during heavy pumping conditions in the summer.

TDS is a major concern along the west edge of the study area. Existing monitoring by the Buena Vista WSD and KCWA is indicated to be adequate in this regard, except for the area southeast of the Kern River. There are several areas of high arsenic concentrations (i.e., near Enos Lane and Panama Lane and near the Taft Highway). However, these areas were delineated based on only several wells. These areas should be better delineated by sampling of other wells in the vicinity. There is a trend for higher arsenic in the deeper groundwater. Thus the deepest completion intervals for the monitor wells should be sampled periodically for arsenic. Routine monitoring is recommended for arsenic in and near areas where concentrations exceed 0.02 mg/l.

High manganese concentrations are common in shallow ground-water near streams and beneath intentional recharge facilities. Manganese concentrations have also been a problem in water from a number of deep wells that have been proposed for pumping into the California Aqueduct in areas farther north. Manganese should be routinely monitored in the shallowest completion zones of the monitor wells.

Monitoring associated with the Chevron pipeline has indicated that total organic carbon, manganese, arsenic, and volatile aroma-tics are key constituents. These constituents should be routinely monitored in groundwater within about one mile of the crude-oil contaminated soil areas along the pipeline.

A computerized database should be developed for the key chemical constituents. In terms of data management, large-scale maps should periodically be prepared, showing the most up-to-date distribution of key constituents in the groundwater. Included would be TDS, nitrate, sulfate, manganese, DBCP, EDB, arsenic, and alpha activity. In addition, for frequently sampled wells (i.e., the selected monitor wells), hydrographs of key constituents should be plotted and annually updated. Plotting of both water quality hydrographs and constituent maps should be computerized.

Recharge Water Quality

The quality of the recharged water would be measured by collecting water samples on a monthly basis at key diversion points for electrical conductivity (EC) measurements. An estimated six water sampling locations would be developed. On a semi-annual basis, TDS (residue at 180 C) would also be determined. The ratios of TDS to EC would be used to estimate TDS values for the recharge water on a monthly basis. More comprehensive chemical analyses of the various sources of recharge would be compiled on an annual basis for use in preparing the annual reports.

Appendix C

Kern Fan Purge Pump Water Quality Sampling Procedures

Background: Kern County Water Agency (KCWA) utilizes a Purge Pump rig to sample selected monitoring wells on the Kern Fan region once or twice a year. The Purge Pump was developed by the Kern Water Bank Authority (KWBA) several decades ago and is kept functional and maintained by KCWA. The purge pump samples monitoring wells by placing the high-volume (as of 2018, 30-70 gpm) submersible pump into wells and purging approximately 5 well casing volumes of water prior to collecting samples. These sampling activities include a large summer run and a smaller winter run with a subset of wells (see attached well list). Electrical Conductivity and pH measurements are collected during this purge to determine if water quality values are stable.

Materials:

Purge Pump rig

Plopper/Sounder

pH meter, buffers, buffer cups, calibration logbook

EC meter, buffer, buffer cups, calibration logbook

DI water

Sample bottles (from lab, may be unpreserved or preserved)

Gloves

Calibration Set-up: Prior to sampling, the pH meter and EC meter will be calibrated as per SOPs using buffers as stated in the calibration set-up. Date, technician, buffer lot numbers and results will be reported as shown on the SOP.

Sample collection:

1. The Depth to water will be determined via calibrated sounder or plopper. With the depth to water value the approximate well casing volume will be determined through the use of the Kern Fan Water Quality Sampling Program Pumping Notes worksheet (see attached). Through the worksheet the total gallons to be pumped is calculated. Total gallons pumped, starting time, meter readings, pumping rate and other values are recorded on this worksheet throughout the sampling session.
2. While the purge pump is purging the well of the 5 well casing volumes the technician will collect samples every 5-10 minutes in a clean reusable plastic container and analyze for pH and EC. These values, as well as date, time, well, technician, etc. will be recorded on the KFMC – Water Quality Sampling Program Field Parameters Measurement Record worksheet (see attached).
3. When the minimum required volume of water has been purged, and when the EC and pH values are stable, the technician will collect the water quality samples in the bottles provided from the lab. Unpreserved bottles require that the bottle be filled to the top. Preserved bottles require that the bottle be filled as much as possible without overflowing, as preservative will be lost and the sample integrity may be affected. No filtering of samples will be done in the field.

4. All bottles will be labeled with the well name (State Well Number format), date, time, technician and placed immediately after collection in a water cooler with ice.
5. At the completion of a well sampling day the samples are transported to KCWA. The Chain of Custody is completed and the custody of the samples is transferred for transport to the Laboratory.
6. Bottles are transported to the laboratory with the Chain of Custody.

KERN FAN MONITORING COMMITTEE
GROUNDWATER QUALITY MONITORING PROGRAM
SUMMER 2018

KERN WATER BANK		
STATE WELL NUMBER	WELL DEPTH (ft)	SUMMER
30S/24E-13D01	250.0	dissolved As,Alpha,Gen. Mineral
30S/24E-13D02	360.0	Gen. Mineral
30S/24E-13D03	650.0	dissolved As,Alpha,Gen. Mineral
30S/25E-04J02	250.0	dissolved As, Gen. Mineral
30S/25E-04J03	455.0	Gen. Mineral
30S/25E-04J04	625.0	dissolved As, Gen. Mineral
30S/25E-07A02	290.0	dissolved As, Gen. Mineral
30S/25E-07A03	470.0	Gen. Mineral
30S/25E-07A04	620.0	dissolved As, Gen. Mineral
30S/25E-11P01	210.0	dissolved As, Gen. Mineral
30S/25E-11P02	470.0	Gen. Mineral
30S/25E-11P03	570.0	dissolved As, Gen. Mineral
30S/25E-12B02	250.0	dissolved As, Gen. Mineral
30S/25E-12B03	500.0	Gen. Mineral
30S/25E-12B04	690.0	dissolved As, Gen. Mineral
30S/25E-16L01	345.0	dissolved As, Gen. Mineral
30S/25E-16L02	555.0	Gen. Mineral
30S/25E-16L03	690.0	dissolved As, Gen. Mineral
30S/25E-19N02	120.0	dissolved As, Gen. Mineral
30S/25E-19N03	230.0	Gen. Mineral
30S/25E-19N04	385.0	dissolved As, Gen. Mineral
30S/25E-19R01	555.0	dissolved As,Alpha,Gen. Mineral
30S/25E-19R02	376.0	dissolved As,Alpha,Gen. Mineral
30S/25E-21G02	660.0	dissolved As, Gen. Mineral
30S/25E-21G03	480.0	dissolved As, Gen. Mineral
30S/25E-22R01	125.0	dissolved As, Gen. Mineral
30S/25E-22R02	300.0	Gen. Mineral
30S/25E-22R03	460.0	dissolved As, Gen. Mineral
30S/25E-36R01	640.0	dissolved As, Gen. Mineral
30S/25E-36R02	500.0	dissolved As, Gen. Mineral
30S/26E-06L01	270.0	dissolved As, Gen. Mineral
30S/26E-06L02	536.0	Gen. Mineral
30S/26E-06L03	620.0	dissolved As, Gen. Mineral
30S/26E-28J01	220.0	dissolved As,Alpha,Gen. Mineral
30S/26E-28J02	330.0	Gen. Mineral
30S/26E-28J03	615.0	dissolved As,Alpha,Gen. Mineral
30S/26E-32N01	330.0	dissolved As,Alpha,Gen. Mineral
30S/26E-32N02	440.0	Gen. Mineral
30S/26E-32N03	610.0	dissolved As,Alpha,Gen. Mineral

BUENA VISTA WSD*--CALL 24 Hrs. BEFORE SAMPLING		
STATE WELL NUMBER	WELL DEPTH (ft)	SUMMER
30S/24E-06B02	650.0	dissolved As, Gen. Mineral
30S/24E-06B03	450.0	dissolved As, Gen. Mineral
29S/24E-34N01	470.0	dissolved As, Gen. Mineral
29S/24E-34N02	660.0	dissolved As, Gen. Mineral
30S/24E-14M02	700.0	dissolved As, Gen. Mineral
30S/24E-14M03	435.0	dissolved As, Gen. Mineral
29S/23E-24H #8*		dissolved As, Gen. Mineral
29S/23E-16R #7*		dissolved As, Gen. Mineral
28S/23E-31B #6*		dissolved As, Gen. Mineral
28S/22E-14R #5		dissolved As, Gen. Mineral
28S/22E-10D #4*		dissolved As, Gen. Mineral
27S/22E-33A #3*		dissolved As, Gen. Mineral
27S/22E-23D #2*		dissolved As, Gen. Mineral
27S/22E-08A #1*		dissolved As, Gen. Mineral

*Additional District monitor wells sampled for BVWSD.

KERN FAN MONITORING COMMITTEE
GROUNDWATER QUALITY MONITORING PROGRAM
SUMMER 2018

SEMITROPIC WSD* (Call before sampling…Mike Luna)		
STATE WELL NUMBER	WELL DEPTH	SUMMER
29S/24E-08L01	625.0	948L02
29S/24E-08L02	440.0	948L03
27S/22E-10J01*	340.0	S-1
27S/22E-34A03*	300.0	S-3
27S/22E-24D02*	430.0	S-2
27S/23E-29M05*	430.0	S-5
26S/22E-02J01**	700.0	S-11
25S/22E-25L01**	740.0	S-12
28S/22E-03H**	445.0	S-4

*Additional District monitor wells sampled for SWSD.
**New for 2017 Summer. Not doing darkened cells 2018

ROSEDALE-RIO BRAVO WSD		
STATE WELL NUMBER	WELL DEPTH (ft)	SUMMER - metals are dissolved
29S/25E-25M01	700.0	GM, Boron, SAR, As, Ba, Gross Alpha
29S/25E-25M02	350.0	GM, 504.1, Boron, SAR, As, Ba, Gross Alpha
29S/25E-27N01	700.0	GM, Boron, SAR, As, Ba, Gross Alpha
29S/25E-27N02	310.0	GM, 504.1, Boron, SAR, As, Ba, Gross Alpha
29S/26E-31H01	630.0	GM, Boron, SAR, As, Ba, Gross Alpha
29S/26E-31H02	430.0	GM, 504.1, Boron, SAR, As, Ba, Gross Alpha
29S/26E-35H03	660.0	GM, Boron, SAR, As, Ba, Gross Alpha
29S/26E-35H04	410.0	GM, 504.1, Boron, SAR, As, Ba, Gross Alpha

KERN DELTA WD		
STATE WELL NUMBER	WELL DEPTH	SUMMER
30S/26E-25A02	690.0	Gen. Mineral, Uranium, Alpha
30S/26E-25A03	390.0	Gen. Mineral, Uranium, Alpha

CITY OF BAKERSFIELD 2800 ACRES		
STATE WELL NUMBER	WELL DEPTH (ft)	SUMMER
30S/26E-08P04	680.0	dissolved As, Gen. Mineral
30S/26E-18H04	580.0	dissolved As, Gen. Mineral
30S/25E-24C04	505.0	dissolved As, Gen. Mineral
30S/26E-19B01	220.0	dissolved As, Gen. Mineral
30S/26E-19B02	390.0	Gen. Mineral
30S/26E-19B03	590.0	dissolved As, Gen. Mineral
30S/26E-16B01	250.0	dissolved As, Gen. Mineral
30S/26E-16B02	390.0	Gen. Mineral
30S/26E-16B03	660.0	dissolved As, Gen. Mineral

PIONEER PROJECT		
STATE WELL NUMBER	WELL DEPTH	SUMMER
30S/26E-04J01	150.0	dissolved As, Gen. Mineral
30S/26E-04J02	375.0	Gen. Mineral
30S/26E-04J03	650.0	dissolved As, Gen. Mineral
30S/26E-15N01	300	Gen. Mineral, dissolved Arsenic, Alpha
30S/26E-15N02	510	Gen. Mineral, dissolved Arsenic, Alpha
30S/26E-15N03	570.0	Gen. Mineral, dissolved Arsenic, Alpha
30S/26E-10P02		Gen. Mineral, dissolved Arsenic, Alpha
30S/26E-10P03		Gen. Mineral, dissolved Arsenic, Alpha
30S/26E-10P04		Gen. Mineral, dissolved Arsenic, Alpha

Kern Fan Water Quality Sampling Program

Pumping Notes

6 in. Monitoring Well = 1.47 gal. per foot	(Well Depth - R.P. to Water) X 1.47 gal. per foot X 5 casing volumes = Gallons to be pumped
R.P.=Reference Point	(Gallons to be pumped) / (Pumping Rate) = Total pumping time in Minutes

State Well Number	Well Name	Well Depth	DATE	Diameter of well casing	R.P. to Water	Gallons to be pumped	Total Gallons Pumped	Starting Time	Start Meter Reading	R.P. to Water @ 5 min. Pumping	Pumping Rate	End Meter Reading	Ending Time	Total Pumping Time Min.	Ending R.P. to Water

KFMC - Water Quality Sampling Program

Field Parameters Measurement Record

Water District: _____ Type of Well: _____

Well Number: _____ Well Name: _____

Date: _____ Start Time: _____

Tested By: Page of

Time (24 hr format)	Water Temperature (C°)	EC (µS/cm) at 25°C	pH	Notes

KCWA field pH Standard Operating Procedure

This Standard Operating Procedure is based on EPA method 150.1 and Eutech pHTestr20 Instruction Manual.

Precautions

Ensure that the pH meter tip is in 2-3 cm (1-2 inches) of clean water/buffer when the unit is not in use.

Buffers should be a similar temperature to each other and the samples. Although the pH meter is a temperature compensated model, all attempts should be made in keeping the buffers and pH meter out of extreme temperatures.

Calibration Procedure

1. Record the date, time, pH buffers lot numbers, and technician (tech)on the "pH meter calibration log"

2. Turn on pH Testr20 by pressing the "ON/OFF" button.

3. Put the pH Testr20 into calibration mode by pressing the "CAL" button.

4. Rinse the probe with a stream of Deionized (DI) water from the rinse bottle and gently blot mostly dry with Kimwipes.

5. Insert pH Testr20 tip in 2-3 cm (1-2 inches) of clean, fresh pH 4.01 buffer (red).

6. Allow about 2 minutes for the tester reading to stabilize before pressing the "HOLD/ENT" button to confirm the first calibration point.

7. Rinse the probe with a stream of DI water from the rinse bottle and gently blot mostly dry with Kimwipes.

8. Insert pH Testr20 tip in 2-3 cm (1-2 inches) of clean, fresh pH 7.00 buffer (yellow).

9. Allow about 2 minutes for the tester reading to stabilize before pressing the "HOLD/ENT" button to confirm the second calibration point.

10. Rinse the probe with a stream of DI water from the rinse bottle and gently blot mostly dry with Kimwipes.

11. Insert pH Testr20 tip in 2-3 cm (1-2 inches) of clean, fresh pH 10.01 buffer (blue).

12. Allow about 2 minutes for the tester reading to stabilize before pressing the "HOLD/ENT" button to confirm the final calibration point.

13. If no errors are displayed then calibration was successful. Mark either "yes" or "no" under the "errors?" column on the "pH Meter Calibration Log." If an error was received, please indicate whether it was an Err1 or Err2 (the instrument will display this information in the window.)

14. Rinse the probe with a stream of DI water from the rinse bottle and gently blot mostly dry with Kimwipes.

15. Insert pH Testr20 tip in 2-3 cm (1-2 inches) of clean, fresh CV pH 7.00 buffer (yellow). CV pH 7.00 buffer must be of a different manufacturer or lot number than the buffer used in the initial calibration above. Note the brand and lot number on the pH meter calibration log.

16. Allow two minutes for the tester reading to stabilize. If the reading for the CV pH 7.00 buffer is between 6.90 and 7.10, then the calibration procedure passed. Record the value for the CV pH 7.00 buffer under the "CV value" column.

17. Rinse the probe with a stream of DI water from the rinse bottle and gently blot mostly dry with Kimwipes.

18. Recalibrate daily or if it appears that pH Testr20 is losing calibration. To verify if the calibration is still accurate later in the day (if lost calibration is suspected), repeat steps 14-17 above, making sure to fill out the pH meter calibration log. If the CV is outside of the 6.90-7.10 range, recalibration is necessary.

Sampling Procedure

1. Turn on pH Testr20 by pressing the "ON/OFF" button.

2. Rinse the probe with a stream of Deionized (DI) water from the rinse bottle and gently blot mostly dry with Kimwipes.

3. Insert pH Testr20 tip in 2-3 cm (1-2 inches) of sample (collected in a clean, dry container).

4. Allow about 2 minutes for the tester reading to stabilize and record value on Field Sheets. Continue samples following steps 1-4.

KCWA EC meter Standard Operating Procedure

This Standard Operating Procedure is based on EPA method 120.1, Standard Methods 2510-B (through 8160) and HACH Conductivity Probe Model CDC40105 User Manual.

Precautions

Ensure that the EC meter is kept clean and dry when not in use. Do not touch the tip of the probe

Calibration solutions and check standards should be a similar temperature to each other and the samples. Every attempt should be made in keeping the meter out of extreme temperatures.

Calibration and Check Standard Solutions need to be kept tightly closed as much as possible and should be gently shaken prior to use.

Calibration Procedure

1. Record the date, time, EC calibration standard lot numbers, and technician (tech) on the "EC meter calibration log"

2. Make sure EC probe is connected to the HQ40d reader and that the cable is turn-locked in place. Turn on the EC meter by pressing the On/Off button (it looks similar to Φ .)

3. Select the Blue button under "Calibrate." Pour fresh 1,417 µS/cm conductivity standard into a clean dry beaker.

4. Rinse the probe with a stream of Deionized (DI) water from the rinse bottle (do not get DI water into standard) and gently blot mostly dry with Kimwipes.

5. Insert EC probe standard solution and stir gently. Make sure that the sensor is completely submerged.

6. Push the green button under "Read". Stir gently. The display will show "Stabilizing" and a progress bar as the probe stabilizes in the standard. The display shows the standard solution value that has just been read and shows the temperature corrected value when the reading is stable. Transfer the temperature corrected value to the "pass?" column in the "EC meter calibration log."

7. Push DONE to view the calibration summary.

8. Push STORE to accept the calibration and return to the measurement mode.

9. Rinse the EC probe with a stream of DI water from the rinse bottle and gently blot mostly dry with Kimwipes.

10. Perform a "check standard" after calibration and as needed or if it appears that EC meter is losing calibration.

Check Standard Procedure

1. Record the date, time, EC calibration standard lot numbers, and technician (tech) on the "EC meter calibration log"

2. Make sure EC probe is connected to the HQ40d reader and that the cable is turn-locked in place. Turn on the EC meter by pressing the On/Off button (it looks similar to Φ .)

3. Push the icon that looks like a wrench. The Full Access Options menu is shown.

4. Select Run Check Standard.

5. Freshly pour an adequate amount of the 1,417 µS/cm solution for use.

6. Rinse the probe with DI water and blot mostly dry with Kimwipes.

7. Put the probe in the standard solution until the temperature sensor is completely submerged. Move the probe up or down or gently tap on the beaker to remove air bubbles from the probe.

8. Push READ. The display will show "Stabilizing" and a progress bar as the reading stabilizes. The display shows the value of the check standard and either Check Standard Passed or Check Standard Failed. Record the Check Standard value under the "pass?" column beside the "Check Std" column on the "EC meter calibration log" along with any other important information in the "notes" column.

9. If the display shows "Check Standard Passed," the check standard measurement is within the accepted limits set by the administrative user. Select Done to continue with the sample measurement.

10. If the display shows "Check Standard Failed," the measurement is outside of accepted limits set by the administrative user and a recalibration is necessary.

Sampling Procedure

1. After calibration and the check standard have been recorded, rinse the probe with DI water and blot mostly dry with Kimwipes.

2. Collect sample in clean sample vessel. Submerge the probe tip into the sample and gently stir to dislodge any bubbles on probe.

3. Turn on the EC meter and select the "Read" option. Record the sample value on the field sheet.

4. After the sample has been read, rinse the EC meter tip in DI water and blot mostly dry with a Kimwipe. Repeat steps 2-4 with all samples.

pH Meter Calibration Log

		buffer brand/lot number				brand/lot		
Date	Time	ph 4.01	pH 7.00	pH 10.01	errors?	*CV pH 7.00	CV Value	tech
1-30-18	0800	OAKTON VV3	OAKTON VW1	OAKTON VW1	NO	COLE CC.5064935	7.04	KT
1-31-18	0730	"	"	"	NO	"	7.07	KT
2-1-18	0730	"	"	"	"	"	7.04	KT
2/2/18	0820	"	"	"	"	"	7.02	SY
2/5/18	0730	"	"	"	"	"	7.08	KT
2/6/18	0730	"	"	"	"	"	7.08	KT
2/7/18	0745	"	"	"	"	"	7.08	KT
6/26/18	0800	OAKTON CC.5468224	OAKTON CC559745	OAKTON UP1	"	Rec'd WCS6065402	7.05	KT
6/27/18	0800	"	"	"	"	"	7.07	KT
6/28/18	0740	"	"	"	"	"	7.06	KT
6/29/18	0700	"	"	"	"	"	7.05	KT
7/2/18	0800	"	"	"	"	"	7.05	KT
7/3/18	0645	"	"	"	"	"	7.08	KT
7/6/18	0645	"	"	"	"	"	7.06	DD
7/9/18	0755	"	"	"	"	"	7.06	WB
7/10/18	0745	"	"	"	"	"	7.07	WB
7/11/18	0726	"	"	"	"	"	7.07	WB
7/12/18	0830	"	"	"	"	"	6.99	WB
7/13/18	0730	"	"	"	"	"	7.07	WB
7/17/18	0900	"	"	"	"	"	7.06	DD
7/23/18	0820	"	"	"	"	"	7.08	KT
7/24/18	0715	"	"	"	"	"	7.05	KT
7/26/18	0800	"	"	"	"	"	7.06	DD
7/30/18	0730	"	"	"	"	"	7.05	DD
7/31/18	0730	"	"	"	"	"	7.06	DD
8/1/18	0715	"	"	"	"	"	7.05	DD
8/2/18	0655	"	"	"	"	"	7.07	DD
8/7/18	0730	"	"	"	"	"	7.04	SY
8/8/18	0700	"	"	"	"	"	7.08	SY
8/9/18	0700	"	"	"	"	"	7.04	SY
8/10/18	0730	"	"	"	"	"	7.06	KT
8/13/18	0855	"	"	"	"	"	7.03	SY
8/14/18	0700	"	S/N: CC5549 38	"	"	"	7.04	SY

*CV = Calibration Verification and must be a separate lot number (if not manufacturer) than initial calibration buffer

EC Meter Calibration Log

Date	Time	brand/lot # Cal Std.	pass?	brand/lot # Check Std. *	pass?	tech	notes
		OAKTON VT2		OAKTON VT2			
2/2/18	0830	"	YES	"	1420	SY	
2/5/18	0730	"	"	"	1424	KT	
2/6/18	0730	"	"	"	1434	KT	
2/7/18	0745	"	"	"	1419	KT	
6/26/18	0815	OAKLAND CC14986	"	OAKLAND CC16986	1411	KT	
6/27/18	0800	"	"	"	1418	KT	
6/28/18	0740	"	"	"	1423	KT	
6/29/18	0700	"	"	"	1415	KT	
7/2/18	0800	"	"	"	1410	KT	
7/3/18	0645	"	"	"	1419	KT	
7/6/18	0645	"	"	"	1420	DD	
7/9/18	0755	"	"	"	1412	WB	
7/10/18	0745	"	"	"	1426	WB	
7/11/18	0715	"	"	"	1432	WB	
7/12/18	0830	"	"	"	1431	WB	
7/13/18	0730	"	"	"	1432	WB	
7/17/18	0900	"	"	"	1408	DD	
7/23/18	0820	"	"	"	1417	KT	
7/24/18	0715	"	"	"	1411	KT	
7/26/18	0800	"	"	"	1410	DD	
7/30/18	0730	"	"	"	1413	DD	
7/31/18	0730	"	"	"	1417	DD	
8/1/18	0715	"	"	"	1416	DD	
8/2/18	0655	"	"	"	1428	DD	
8/7/18	0725	"	"	"	1420	SY	
8/8/18	0700	"	"	"	1444	SY	
8/9/18	0655	OAKTON VT2	"	OAKTON VT2	1441	SY	
8/10/18	0730	OAKTON CC17250	"	OAKTON CC17250	1428	KT	
8/13/18	0900	"	"	"	1405	SY	
8/14/18	0700	"	"	"	1413	SY	
8/16/18	1100	"	"	"	1442	MAA	

* Check standard may be the same lot as the initial calibration

Appendix D

Sounder Calibration Protocol - KCWA

Background: Sounders and ploppers are the main tools utilized for groundwater measurements. These measurements are utilized to create the maps in KCWA reports. These maps drive discussions and policy decisions for the region. As such, care needs to be taken to ensure accurate, reliable, and quality data are made with these tools.

Sounders should be housed in temperature controlled secure areas when not in use. Sounders need to be identified by a number to differentiate them from each other. Each sounder also has a Calibration and Maintenance Logbook associated with it that houses all written history on problems, repairs, calibrations associated with the sounder. Do not keep sounders in bed of a truck or exposed to heat, cold, or wet conditions while not in use. If a sounder wire gets stuck in a well, loses a tip, or could become stretched in any way, calibration must be done before further measurements are taken.

Materials:

Personal Protective Equipment (steel-toed boots, long pants)

Steel Tape (never used in field, housed in an office)

Sounder

Electrical Tape (red, yellow, white)

Calibration and Maintenance Logbook (housed in sounder casing, always with sounder)

Clean rag

Measuring tape in 0.1 feet increments

Calibration Station Set-up:

Use dedicated steel tape to measure out 100 ft. distance on flat concrete surface (pipe gallery in Train B), ensuring steel tape is as flat and straight as possible.

Sounder Calibration:

1. Turn sounder on, test sounder electrical system and verify that any repairs were made. All repairs, calibrations, and field sounder issues are to be recorded in the Calibration and Maintenance Logbook.
2. Gently unravel sounder to 100 ft. and place taut, parallel to the steel tape. Check if the marking tape on the sounder corresponds with the 10 ft. marks on the steel tape (or written value if unaltered dual wire sounder).
3. If, at any location, the center of the tape (or the center of the group of tapes) varies from the steel tape by more than 0.1 ft., recalibration must start and continue through to the end of the sounders total range.

4. Repeat steps 3 and 4 for subsequent 100 ft. lengths through to the end of the sounders total range. Remember if at any point the sounder is “off” by more than 0.1 ft. all remaining taped locations will need to be adjusted.
5. Sounders are to be recalibrated any time stretch is suspected of occurring, after a repair, tip replacement, or at least quarterly. The calibration, repairs, and observations of equipment are recorded in Calibration and Maintenance Logbook along with the initials of the person performing the work.

Measurement:

1. Prior to going in the field, confirm that:
   -battery and electrical system is working properly
   -calibration is recorded in Calibration and Maintenance Logbook
2. Make all measurements using the same deflection point on the indicator scale, or sound so that water levels will be consistent.
3. Lower the probe into the well until the indicator reads as contact with the water surface is made. Read the depth to water on the sounder for when contact is verified at the reference point (usually top of pipe or structure).
4. Continue to lower the sounder wire an additional 10 ft. or so to verify that the indicator does not go off. If the indicator does become interrupted the reading is a false reading. Redo step 3 until no interruption in indicator.
5. Record the measurement, date, time, operator onto field sheets, books, or iPad.
6. Pull sounder wire out at least 10 ft. and repeat step 3 to verify measurement. Resulting measurement should be within 0.1 ft. of original. If difference is more than 0.1 ft. repeat measurements starting with step 3 until a confident consistent value is reached. It may be necessary to pull wire completely out of well and start over.
7. After completing the measurement, dry the wire and probe and rewind on the reel.

Appendix E

DEPARTMENT OF WATER RESOURCES
WATER QUALITY POLICY AND IMPLEMENTATION PROCESS FOR ACCEPTANCE OF NON-PROJECT WATER INTO THE STATE WATER PROJECT

It is the Department of Water Resources (DWR) policy to assist with the conveyance of water to provide water supply, and to protect the State Water Project (SWP) water quality within the California Aqueduct. To facilitate this policy DWR provides the following implementation process for accepting non-project water into the SWP (Policy). For purposes of this document, SWP and California Aqueduct are interchangeable and the same.

POLICY PROVISIONS

DWR shall consider and evaluate all requests for Non-Project (NP) water input directly into the SWP conveyance facilities based upon the criteria established in this document. NP water shall be considered to be any water input into the SWP for conveyance by the SWP that is not directly diverted from the Sacramento-San Joaquin Delta or natural inflow into SWP reservoirs.

The proponent of any NP water input proposal shall demonstrate that the water is of consistent, predictable, and acceptable quality.

DWR will consult with State Water Project (Contractors), existing NP participants and the Department of Public Health (DPH) on drinking water quality issues relating to NP water as needed to assure the protection of SWP water quality.

Nothing in this document shall be construed as authorizing the objectives of Article 19 of the SWP water supply contracts or DPH drinking water maximum contaminant levels to be exceeded.

This Policy shall not constrain the ability of DWR to operate the SWP for its intended purposes and shall not adversely impact SWP water deliveries, operation or facilities.

EVALUATING NP WATER PROPOSALS

DWR shall use a two-tiered approach for evaluating NP water for input into the California Aqueduct.

NP Tier 1

Tier 1 NP pump-in proposals (PIP) shall exhibit water quality that is essentially the same, or better, than what occurs in the California Aqueduct. PIP's considered to be tier 1 shall be approved by DWR (see baseline water quality tables 1 through 4).

NP Tier 2

Tier 2 PIP's are those that exhibit water quality that is different and possibly worse than in the California Aqueduct and/or have the potential to cause adverse impacts to the Contractors. Tier 2 PIP's shall be referred to a NP Facilitation Group (FG), which would review the project and if needed make recommendations to DWR in consideration of the PIP.

SWC Facilitation Group

This advisory group consists of representatives from each Contractor that chooses to participate and DWR. The group shall review tier 2 PIP's based on the merits, impacts, mitigation, water quality monitoring, cost/benefits or other issues of each PIP and provide recommendations to DWR. Upon initial review of tier 2 PIP by DWR, it shall then be submitted to the FG for review. A consensus recommendation from the FG would be sought regarding approval of the PIP. DWR shall base its decision on the merits of the PIP, recommendations of the FG and the PIP's ability to provide overall benefits to the SWP and the State of California.

Blending Water Sources

Blending of multiple water sources prior to inflow into the SWP is acceptable and may be preferred depending upon water quality of the PIP. Blending of water in this manner may be used to quality a project as NP Tier 1.

Mixing (blending) within the California aqueduct can be considered but shall not be adjacent to municipal and industrial (M&I) delivery locations. PIP's that are coordinating water discharged to maintain or improve SWP water quality are an example of the mixing approach. The PIP shall demonstrate by model or an approach acceptable to DWR and the FG that the water is adequately mixed before reaching the first M&I customer. Generally NP PIP's that involve mixing with SWP water shall be considered NP Tier 2.

Baseline Water Quality

To aid in developing and evaluating PIP's both historical and current SWP water quality levels shall be considered. A representative baseline water quality summary is shown in Tables 1 through 4, using historical SWP water quality records at O'Neill Forebay.

NP IMPLEMENTATION PROCESS

Project Proposals

The NP project proponent requesting to introduce water into the SWP shall submit a detailed PIP to DWR. The proponent shall demonstrate that the NP water is of

consistent, predictable and reliable quality, and is responsible for preparing and complying with any and all contracts, environmental documents, permits or licenses that are necessary consistent with applicable laws, regulations, agreements, procedures, or policies.

Project Description

The proponent will submit to DWR a PIP describing the proposed program, identifying the water source(s), planned operation, characterizing the inflow water quality and any anticipated impacts to SWP water quality and/or operations. The PIP should be submitted at least one month prior to proposed start up to allow for DWR and FG review. The PIP shall include:

- Project proponent names, locations, addresses, and contact person(s).
- Maps identifying all sources of water, point of inflow to the SWP and ultimate fate of the introduced water.
- Terms and conditions of inflow, timing, rates and volumes of inflow, pumping, conveyance and storage requirements.
- Construction details of any facilities located adjacent to the SWP including valves, meters, and pump and piping size.
- All potential impacts and/or benefits to downstream SWP water contractors.
- Detailed water quality data for all sources of water and any blend of sources that will be introduced into the SWP.
- Identify anticipated water quality changes within the SWP.
- Identify other relevant environmental issues such as subsidence, ground water overdraft or, presents of endangered species.
- Provide performance measures and remedial actions that will be taken in the event projected SWP water quality levels are not met.
- Reference an existing contract or indicate that one is in process with DWR to conduct a PIP.

Water Quality Monitoring

In order to demonstrate that the water source(s) are of consistent, predictable, and acceptable quality the NP proponent shall monitor water quality. The proponent shall, for the duration of the program, regularly report on operations as they affect water quality, monitoring data and water quality changes. Both DPH title 22 and a short list of Constituents of Concern (COC) shall be monitored for based upon one of the following water quality monitoring options.

Constituents of Concern Current COC are Arsenic, Bromide, Chloride, Nitrate, Sulfate, Organic Carbon, and Total Dissolved Solids. These COC's may be changed as needed.

Water Quality Monitoring Options NP proponents shall select one of the testing options below and perform all water quality testing and provide analytical results in

a timely manner as described herein. Monitoring shall be conducted for initial well start-up, periodic well re-testing and on-going testing during operation. Well data should be no more than three years old. Title 22 results should be provided to DWR and the FG within two weeks of testing and COC results within one week of testing, unless other schedules are agreed upon by DWR and the FG.

Option 1 - Baseline tests for Individual Wells

Well Start-up: Title 22 tests are required for all wells participating in the program prior to start-up. An existing title 22 test that is no more than three years old may be used. A Title 22 test may be substituted for any well near a similar well with a Title 22 test of record.

Well Re-testing: Title 22 test for all wells participating every three years.

Ongoing Monitoring: COC tests are required for all discharge locations to the SWP at start up and quarterly thereafter for new programs and resumption of established programs. New programs or those with constituents that may potentially degrade the SWP shall conduct at least weekly COC sampling of all discharge locations until the proponent demonstrates that the NP water is of consistent, predictable and reliable quality. Once the nature of the discharge has been clearly established, the COC tests are required quarterly for each discharge point.

Option 2 - Baseline tests for Representative Wells

Well Start-up: COC tests of record are required for all wells participating in the program and Title 22 tests of record are required for representative wells comprising a subset of all wells. This would typically be a group of wells that are manifold together and discharge to one pipe. Representative wells shall be identified on a case-by-case basis to be representative of the manifold area, well proximity, and water levels.

Well Re-testing: Same as required in Option 1.

On-going Monitoring: COC tests are required for all discharge locations to the SWP at start up and monthly thereafter for the duration of the program and annually at each well. New programs or those with constituents that may potentially degrade the SWP shall conduct weekly COC sampling of all discharge locations until the proponent demonstrates that the NP water is of consistent, predictable and reliable quality.

Option 3 – Self Directed

A PIP may propose a water quality monitoring program for approval by DWR and the FG that is different from options 1 or 2. It must include COC and title 22 testing

that will fully characterize water pumped into the SWP and be at an interval to show a consistent, predictable and reliable quality.

Analytical Methods

Analytical laboratories used by project proponents shall be DPH certified by the Environmental Laboratory Accreditation Program (ELAP) and use EPA prescribed and ELAP accredited methods for drinking water analysis. Minimum Reporting Levels must be at least as low as the DPH required detection limits for purposes of reporting (DLR). The current DLRs are listed on the DPH website at Http://www.cdph.ca.gov/certlic/drinkingwater/Pages/MCLsandPHGs. DWR shall continue to use Bryte Chemical Laboratory as it's analytical and reference lab.

Flow Measurements

The project proponent shall maintain current, accurate records of water production rate and volume from each source, as well as, each point of discharge into the SWP. All flow measurements shall be submitted to regularly to DWR.

RECONSIDERATION

If an NP proponent disagrees with the FG or DWR decision or feels that there is an overriding benefit of the proposal, the proponent may request reconsideration from DWR on the basis of overriding public benefit or water supply deficiency. DWR shall consider these requests on a case-by-case basis.

ONGOING PROGRAM

Any NP Proponent who has successfully established a NP water inflow program (Including existing Kern Fan Banking Projects, Kern Water Bank, Pioneer and Berrenda Mesa Projects, Semitropic Water Storage District Wheeler Ridge Mariposa Water Storage District and Arvin Edison Water Storage District) may reinitiate the program by notifying DWR at least ten days before inflow is scheduled to begin and provide the following information:

- Updated water quality data and/or updated modeling that adequately reflects the quality of water to be introduced into the SWP.
- Turn-in location.
- Expected rate and duration of inflow. DWR shall notify the FG of this reinitiating of inflow.
- Water quality monitoring schedule that meets the objective of this policy.

FUTURE NP PROGRAMS

Future NP projects should be planned and designed considering the following items:

- Projects involving water quality exceeding primary drinking water standards shall show that the water shall be treated or blended before it enters the SWP to prevent water quality impacts.
- The project proponent of a Tier 2 proposal should clearly identify and establish that water inflow shall be managed and operated such that poor quality water will be blended with better quality water so that SWP water quality will not be degraded upon acceptable levels as determined by the FG and DWR.
- If a significant water supply deficiency exists and it is recommended by the FG that raw water quality criteria be set aside to ensure adequate supply, such action shall be subject to approval by the DPH.
- The project proponent of a NP inflow program which degrades SWP water quality shall identify mitigation to downstream water contractors for water quality impacts associated with increased water supply or treatment costs.

DWR ROLE

DWR shall seek, as needed, DPH or SWC recommendations on changes or additions to this document governing the NP water quality projects. The FG shall review proposed changes or additions prior to implementation by DWR, as needed.

DWR and or the United States Bureau of Reclamation (for San Luis Canal inflow) shall have ultimate responsibility for approving the water quality of all NP inflow, as well as, the oversight of monitoring and tracking the water quality of operating programs. DWR shall also ensure that the proponents of the NP inflow program perform according to their proposals, and will take appropriate action in the event of non-conformance.

Project Proposal Review Process

Upon receipt of a proposal for PIP, DWR shall review it for adequacy. DWR shall consider all PIPs based upon these guidelines. Review shall take no more than one month after receiving a complete program proposal. If necessary, DWR will convene timely meetings with the FG during the review. At a minimum the review will include

- Examination of all documents and data for completeness of the PIP.
- Notification of the affected Field Divisions, and the FG has been received by DWR.
- Consideration by DWR of comments from all parties before the final decision.
- Upon completion of the review DWR will notify the proponent and FG of the acceptance of the PIP or explain the reason(s) for rejecting it.
- DWR may reconsider a decision on a PIP based upon a recommendation from the FG. Reconsideration by DWR will be on a case-by-case basis.

Periodic Review

DWR may schedule periodic reviews of each operating NP inflow with input from the FG. As part of the review, program proponents shall provide the following information:

- Summary of deliveries to the Aqueduct.
- Water quality monitoring results.
- Proposed changes in the program operation.

The review may result in changes in monitoring and testing required of the program proponent as a result of;

- New constituents being added to the EPA /DPH list of drinking water standards.
- Changes in the maximum contaminant levels for the EPA/DPH list of drinking water standards.
- Identification of new constituents of concern.
- Changes in the water quality provided by the program.
- Changes in constituent background levels in the California Aqueduct.

This procedure shall recognize emerging contaminants and/or those detrimental to agricultural viability as they are identified by the regulatory agencies and shall set appropriate standards for water introduction based upon ambient levels in the California Aqueduct or State Notification Levels. Emerging contaminants are those that may pose significant risk to public health, but as yet do not have an MCL. Currently the Office of Environmental Health Hazard Assessment and the DPH establish Public Health Goals and Notification Levels, respectively. These levels, though not regulated, do provide health-based guidance to water utilities and can require public notification if exceeded.

Water Quality Review

DWR shall track and periodically report to the FG on water quality monitoring results on the SWP from NP water inflow and make all water quality data available to the public upon request.

- DWR shall review analyze and maintain all records of water quality testing conducted by the proponent of the well(s), source(s) and discharge(s) into the SWP.
- DWR shall determine what additional water quality monitoring, if any, is necessary within the SWP to ensure adequate protection of SWP water quality. DWR shall conduct all water quality monitoring within the SWP.
- DWR may prepare periodic reports of NP projects.

On-site Surveillance

The appropriate Field Division within DWR will be responsible for review and approval of all construction activities within the SWP right-of-way. Plans showing the discharge system piping, valves, sampling point, meters and locations must be submitted and approved prior to any construction. In addition, the appropriate Field Division will be responsible for confirmation of all meter readings and water quality monitoring conducted by the proponent.

- Field division staff may visit, inspect, and calibrate meters and measure flow conditions at each source or point of inflow into the SWP.
- Flow meters, sampling ports and anti-siphon valves must be conveniently located near the SWP right-of-way.
- Field division staff may collect water samples at each source or point of discharge into the SWP.
- The appropriate Field Division shall conduct additional water quality monitoring within the SWP, if deemed necessary, to assure compliance with the NP Inflow Criteria.
- DWR shall monitor aqueduct water quality and analyze several “split samples” of the water at the point of introduction into the aqueduct to ensure consistent analytical results.

POLICY APPROVAL

Approval Recommended
Date _____

_____
David V. Starks
Chief, Division of Operations and Maintenance
Department of Water Resources

Approved
Date _____

_____
Carl A. Torgersen
Deputy Director State Water Project
Department of Water Resources

Table A1 HISTORICAL WATER QUALITY CONDITIONS 1988 TO 2011 AT O'NEILL FOREBAY OUTLET (mg/L)

Parameter	Mean	Min.	Max.	Std. Dev.
Aluminum	0.03	0.01	0.527	0.05
Antimony	0.002	0.001*	0.005	0.002
Arsenic	0.002	0.001	0.004	0.001
Barium	0.05	0.05	0.068	0.002
Beryllium	0.001*	0.001*	0.001*	0.000
Bromide	0.22	0.04	0.54	0.16
Cadmium	0.003	0.001	0.005	0.002
Chromium	0.004	0.001	0.011	0.002
Copper	0.004	0.001	0.028	0.003
Fluoride	0.1	0.1	0.5	0.1
Iron	0.037	0.005	0.416	0.050
Manganese	0.009	0.005	0.06	0.007
Mercury	0.001	0.0002	0.001	0.0004
Nickel	0.001	0.001	0.004	0.0005
Nitrate	2.9	0.2	8.1	1.6
Selenium	0.001	0.001	0.002	0.0001
Silver	0.003	0.001	0.005	0.002
Sulfate	42	14	99	15
Total Organic Carbon	4.0	0.8	12.6	1.6
Zinc	0.007	0.005	0.21	0.01

*These values represent reporting limits. Actual values would be lower

Table A2 O'Neill Forebay Outlet Total Dissolved Solids Criteria by Water Year Classification, 1988-2011 (mg/L)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	227.2	262.5	295.4	228.9	213.8	231.2	184.4	226.5	181.5	171.4	195.7	157.3
Near Normal	317.9	324.7	351.7	295.4	268.1	302.7	270.0	285.1	230.1	211.9	170.9	202.6
Dry	286.4	319.6	370.0	362.0	344.2	305.2	240.4	278.2	307.3	234.8	269.0	336.6
Critical	256.6	312.9	372.9	367.0	361.0	335.0	307.1	291.8	335.1	325.7	339.4	328.8

* Year type is based on water year classification. Below normal and above normal year types have been combined into one designation called "near normal."

Table A3 O'Neill Forebay Outlet Bromide Criteria by Water Year Classification, 1988-2011 (mg/L)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0.19	0.24	0.28	0.13	0.10	0.12	0.12	0.17	0.12	0.12	0.13	0.10
Near Normal	0.31	0.31	0.34	0.21	0.15	0.15	0.18	0.22	0.15	0.15	0.14	0.19
Dry	0.25	0.29	0.35	0.35	0.24	0.20	0.17	0.24	0.27	0.13	0.29	0.41
Critical	0.26	0.28	0.32	0.37	0.33	0.27	0.22	0.22	0.28	0.28	0.32	0.37

* Year type is based on water year classification. Below normal and above normal year types have been combined into one designation called "near normal."

Table A4 O'Neill Forebay Outlet Total Organic Carbon Criteria by Water Year Classification, 1988-2011 (mg/L)

Year Type*	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	2.8	2.9	3.9	5.2	4.8	3.8	3.9	3.4	3.1	3.2	3.1	2.7
Near Normal	3.7	4.1	4.0	7.0	6.3	5.6	4.7	4.4	4.0	3.3	3.3	3.4
Dry	3.0	3.0	4.0	5.7	4.8	5.7	4.5	3.6	3.7	2.9	2.9	2.7
Critical	2.8	3.1	3.3	4.9	6.0	5.7	4.7	4.0	3.8	3.9	4.0	3.5

* Year type is based on water year classification. Below normal and above normal year types have been combined into one designation called "near normal."

Appendix F

Kern Water Bank Recovery Program

Water Quality Monitoring Plan

Kern Water Bank Authority

February 2012

The Kern Water Bank Authority (KWBA) has participated in "pump-in" programs into the California Aqueduct over the last 12 years. This Monitoring Plan presents a schedule for water quality sampling to meet the requirements of the *Interim Department of Water Resources Water Quality Criteria for Acceptance of Non-project Water into the State Water Project* (March 1, 2001; Appendix A) and the *Implementation Procedures for the Review of Water Quality from Non-Project Water Introduced into the State Water Project* (March 14, 2001; Appendix B).

Project Setting

The KWB project includes 85 wells located on 20,500 acres owned by the KWBA in parts of T30S/R24-26E. The wells recover water from the Kern Fan aquifer of the Kern County subbasin of the San Joaquin Valley Groundwater Basin (Figure 1). The Kern Fan aquifer is made up of sediments deposited by the ancestral Kern River into an alluvial fan or fan delta. The sediments consist of varying amounts of sand, silt, gravel, and clay. Sand count data indicate the upper 300 feet of the aquifer consists of about 70% sand whereas below this depth it consists of about 50% sand. The balance of the sediments consists of silt and lesser amounts of gravel and clay. Unlike some other parts of the groundwater basin, no laterally extensive clay deposits (e.g. the Corcoran Clay) are present under the KWB. This stratigraphy has resulted in a leaky aquifer, as evidenced by hydraulic head data from monitoring wells located throughout the Kern Fan area. Recharge events initially result in successively higher head levels in successively shallower intervals. With time, however, pressure equalization occurs as the head in the intervals converge as water migrates down through the vadose zone, reaches the water table, and re-pressurizes the lower parts of the aquifer. This is a classic example of a leaky aquifer, where there are no distinct, laterally extensive aquitards preventing this re-pressurization.

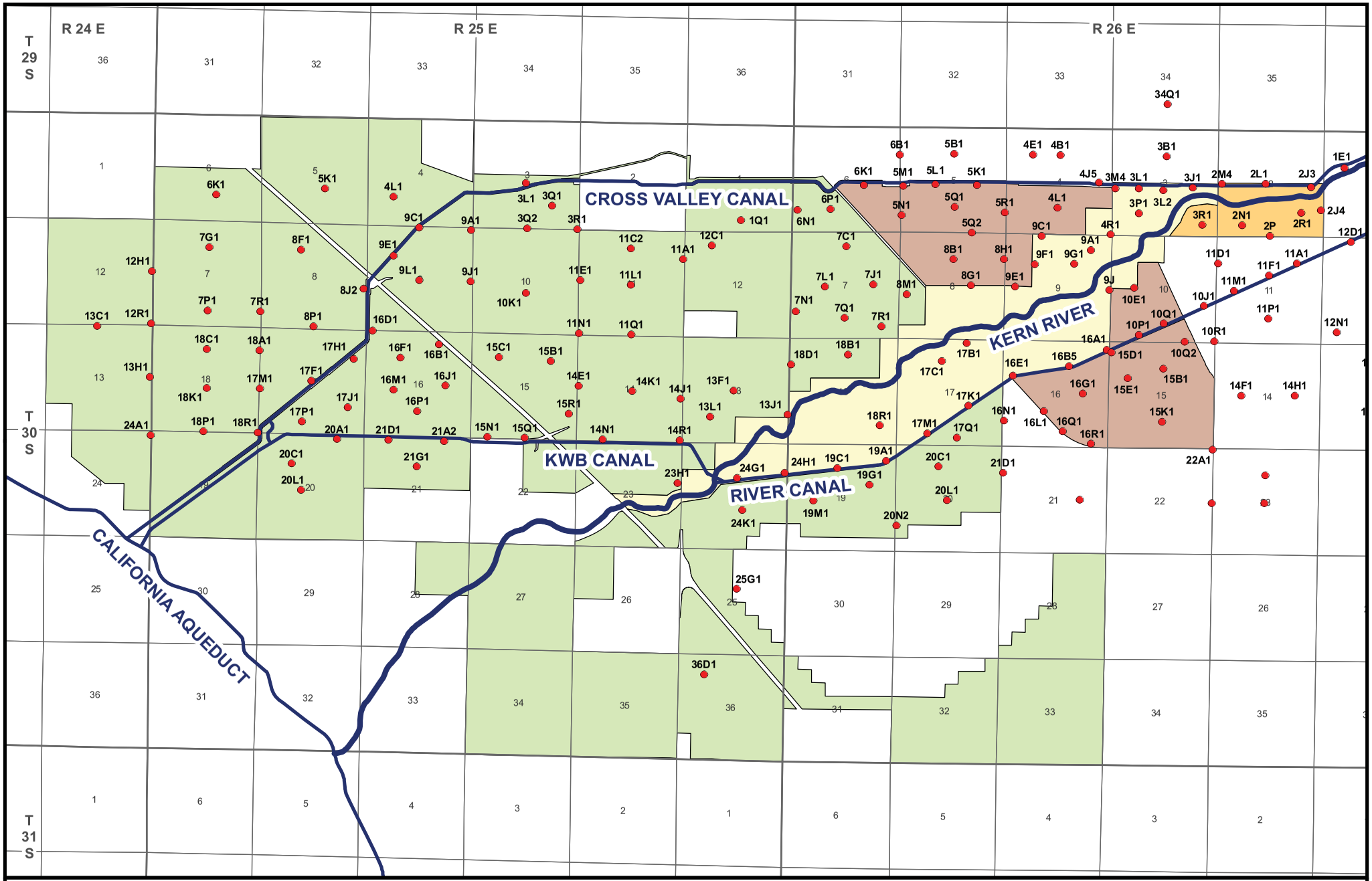
The KWBA delivers pump-in water to the California Aqueduct via the Kern Water Bank Canal and the Cross Valley Canal. No other aqueduct turnouts are located between these delivery points, which are approximately 500 feet apart.

Monitoring Plan

The KWBA pump-in programs have been conducted under the *Interim Department of Water Resources Water Quality Criteria for Acceptance of Non-project Water into the State Water Project* (March 1, 2001; Attachment A) and the *Implementation Procedures for the Review of Water Quality from Non-Project Water Introduced into the State Water Project* (March 14, 2001; Appendix B). The Implementation Procedures provide several options for program sampling. KWBA has operated under Option 1, which includes Title 22 tests of record for all wells and periodic tests for Constituents of Concern upon startup and quarterly for each discharge point. With only a few exceptions, there have been no confirmed detections of any organic constituents in any KWB wells. According to Title 22, Chapter 15, Article 2, §64416(3): "Sampling of certain wells on a rotating basis may be included in the plan if the water supplier is able to demonstrate with analytical, hydrological and geological data that those wells are producing

similar quality water from the same aquifer." As described above, geologically and hydrologically, the wells recover water from the same aquifer. The analytical data indicate the aquifer contains essentially no organic constituents, so there is no variability in organic constituent concentrations in the aquifer. The KWBA therefore proposes to sample for organic constituents on a modified schedule of 1/3 of the wells every 3 years wherein all wells are sampled every 9 years. The wells selected for each subset will be located throughout the KWB property (Figures 2 through 4). The inorganic and radiologic constituents will be sampled every 3 years in all wells. In addition, if the quarterly discharge-point sampling indicates any significant unexpected increases in constituent concentrations, that constituent will be sampled more frequently in either the discharge points or in the wells.

Figures

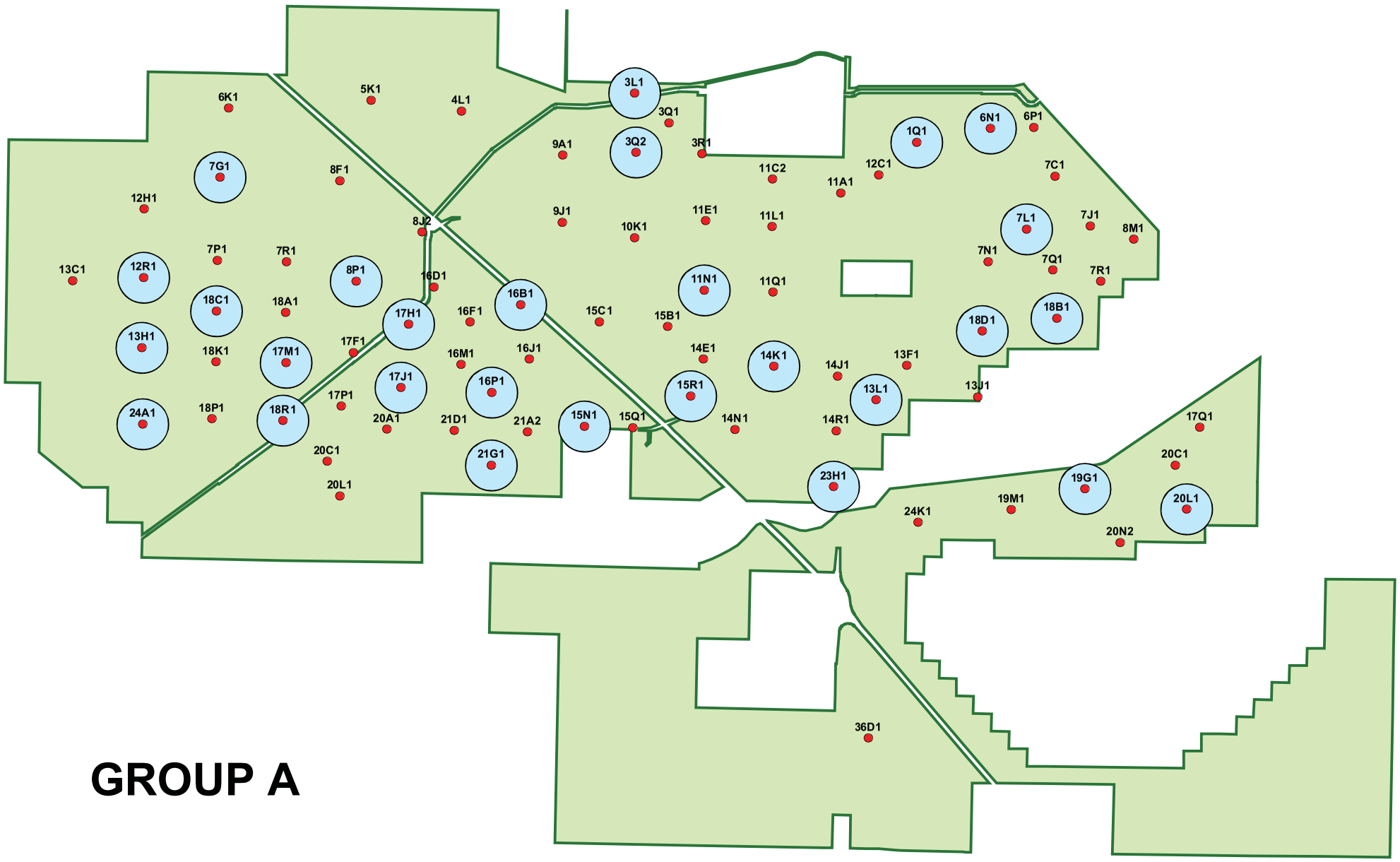


Recovery Wells
Rivers / Canals
Berrenda Mesa WSD
City of Bakersfield - 2800 Acres
Kern Water Bank
Pioneer Project

Figure 1
Kern Fan Recovery Facilities

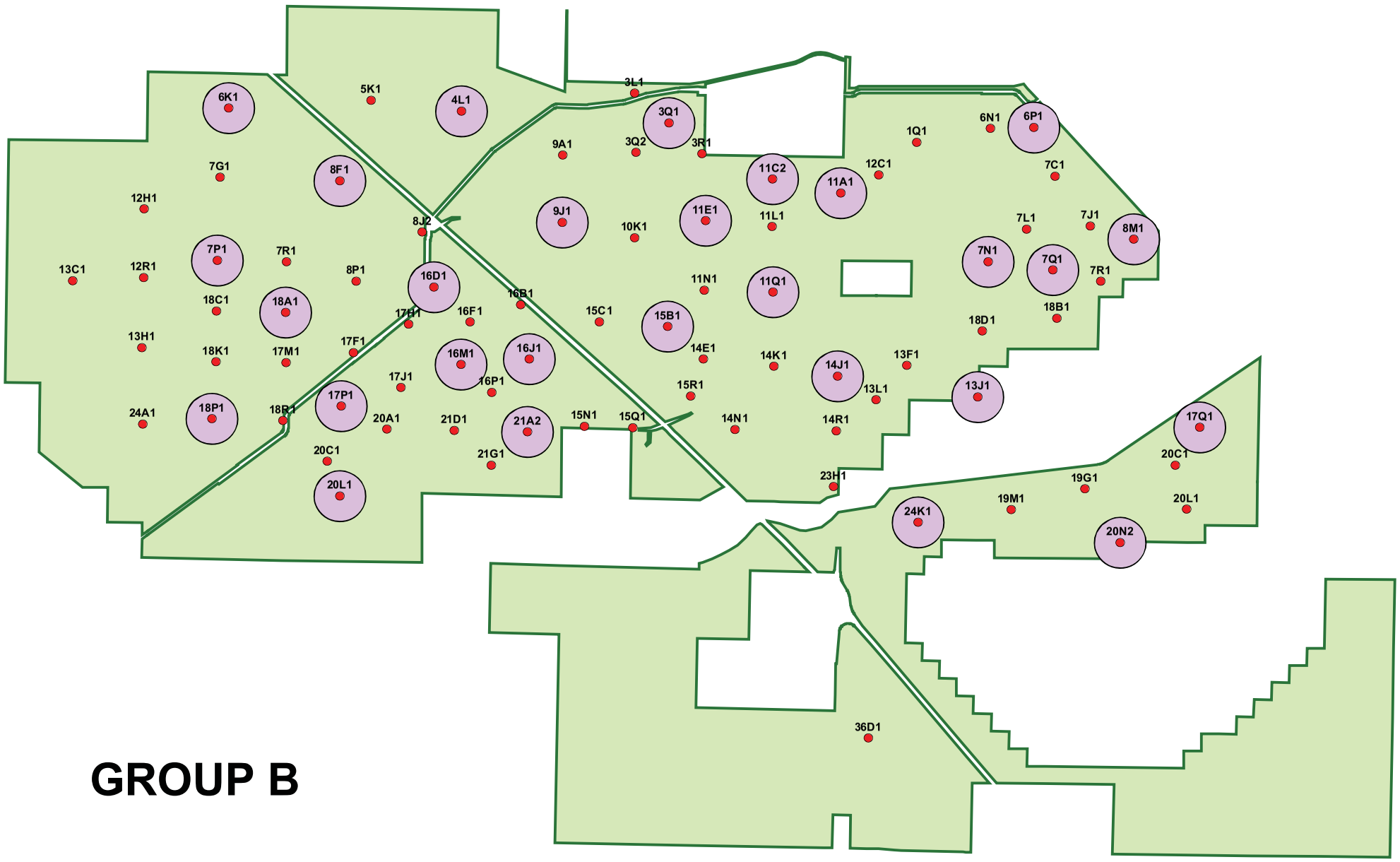
N

KERN WATER BANK AUTHORITY



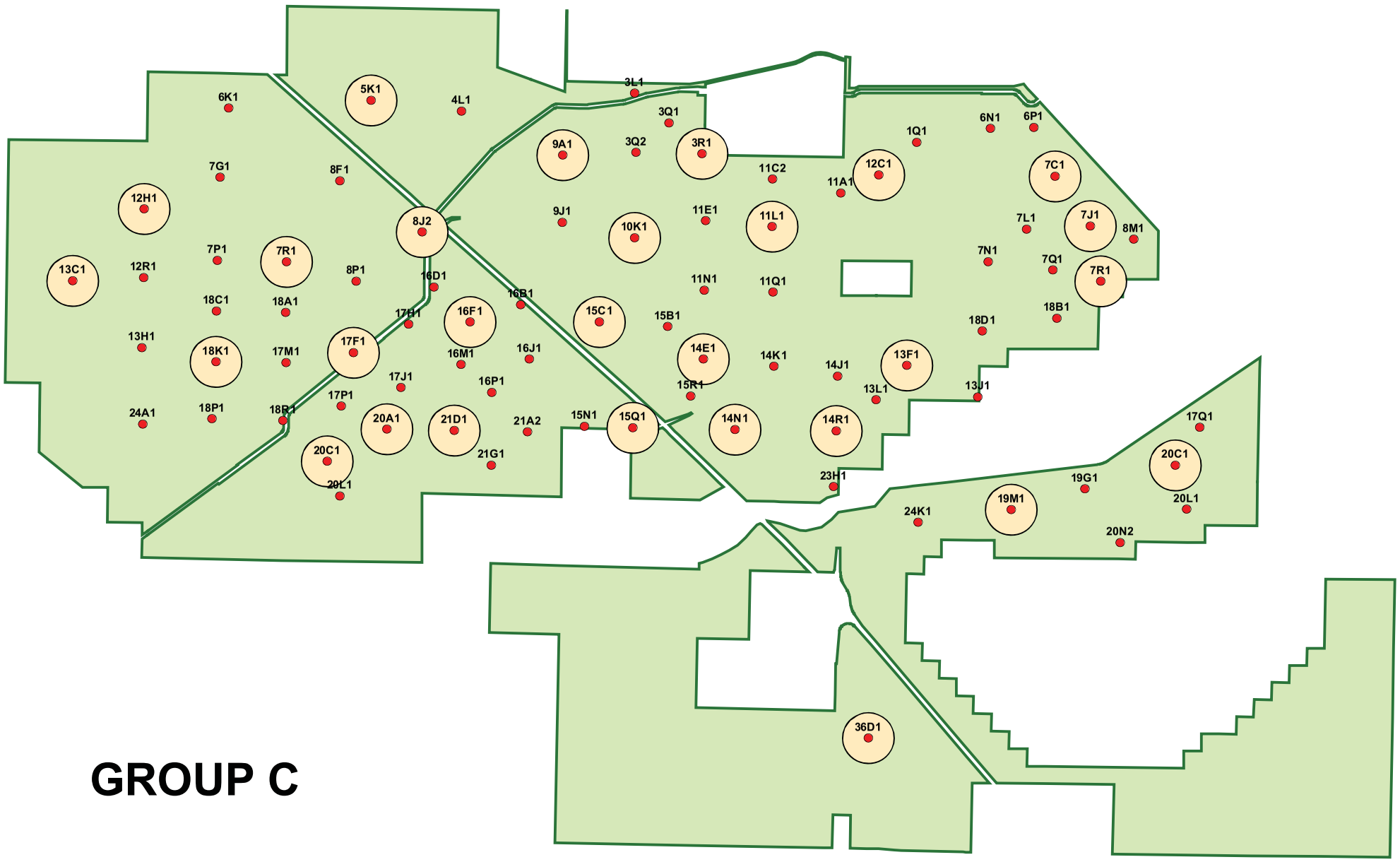
GROUP A

Figure 2



GROUP B

Figure 3



GROUP C

Figure 4

Appendix A

INTERIM
DEPARTMENT OF WATER RESOURCES WATER QUALITY CRITERIA FOR ACCEPTANCE OF NON-PROJECT WATER INTO THE STATE WATER PROJECT
MARCH 1, 2001

In accordance with the Water Code, non-project water may be conveyed, wheeled, or transferred in the State Water Project provided that water quality is protected.

GENERAL PROVISIONS

The proponent of any non-project water input proposal shall demonstrate that the water is of consistent, predictable, and acceptable quality.

The Department of Water Resources shall consider all non-project water input proposals based upon the criteria established in this document.

DWR will consult with State Water Project contractors and the Department of Health Services on drinking water quality issues relating to non-project water as needed to assure the protection of SWP water quality.

Nothing in this document shall be considered as authorizing the objectives of Article 19 of the water supply contracts or drinking water maximum contaminant levels to be exceeded.

These criteria shall not constrain DWR's ability to operate the SWP for its intended purposes or to protect its integrity during emergencies. There shall not be any adverse impacts to SWP water deliveries, operations or facilities.

DWR will use a two-tier approach for accepting non-project water into the California Aqueduct. Tier 1 programs have a "no adverse impact" criteria and shall be tied to historical water quality levels in the California Aqueduct. Programs meeting Tier 1 critieria shall be approved by DWR. Tier 2 programs, have water quality levels that exceed the historical water quality levels in the California Aqueduct and have the potential to cause adverse impacts to state water contractors. Tier 2 programs shall be referred to a state water contractor facilitation group for review. The facilitation group would review the program and if needed make recommendations to DWR to use during consideration of the project.

SPECIFIC PROVISIONS

Tier 1

Under Tier 1, all constituents of non-project water shall not exceed the historical water quality levels measured at the O'neill Forebay Outlet (formerly Check 13) on the SWP as measured by DWR's water quality monitoring program (Table 1).

Blending of multiple water sources prior to inflow into the SWP is acceptable. As part of a non-project water proposal, water may be introduced into the aqueduct that by itself might cause the ambient baseline to be exceeded, provided that the sum total of all introduced waters from a defined project do not exceed the historical baseline for the Aqueduct on an instantaneous flow weighted basis. Blending (mixing) within the aqueduct must be between and cannot overlap any active municipal and industrial delivery locations, without approval of DWR. The proponent shall demonstrate by model or an approach acceptable to DWR and the state water contractor facilitation group, that the water is adequately mixed before reaching the first M&I customer.

Non-project water proposals meeting Tier 1 water quality standards shall be approved by DWR without further review by other agencies except as is required by law. However, upon approval by DWR of any pumpin under Tier 1, the state water contractor facilitation group will be notified by DWR of the action.

Tier 2

Non-project water exceeding Tier 1 standards or contributing to aqueduct levels that exceed the historical water quality baseline may be considered for input into the SWP on a case-by-case basis by the SWP contractors and DWR. Proposals that would impact SWP water quality delivered to downstream state water contractors will be reviewed by state water contractors. The intent is that proposals that produce an overall net water quality benefit will be approved.

A state water contractor non-project inflow ***facilitation group*** will be established and will review all requests for non-project inflow that do not meet the Tier 1 water quality criteria. This group will consist of representatives from each state water contractor, that chooses to participate. DWR may participate as an observer. The group will consider the merits, impacts, mitigation, cost/benefits or other issues of each Tier 2 non-project water proposal(s) and provide recommendations to DWR. The DWR will consider the ***facilitation group*** and any individual SWP contractor recommendations in reviewing the proposal. DWR will make the final decision to approve, modify or deny the non-project water proposal. Any decision must be in compliance with law and existing contracts.

The **facilitation group** would consider the range of potential impacts along with potential benefits, mitigation, and other issues associated with the program.

A consensus recommendation from the facilitation group would be sought regarding a potential exceedance of the historical water quality levels. In the absence of consensus from the **facilitation group**, DWR will base its decision on the merits of the program and its ability to provide overall benefits to the state water project.

WATER QUALITY CHANGES

Once a program for delivery of non-project water to the Aqueduct has been approved, an annual review of the program with the state water contractors will occur.

As needed, DWR, DHS or state water contractors may recommend changes or additions to these water quality criteria governing non-project water proposals. Proposed changes or additions will be reviewed by the ***facilitation group*** prior to consideration by DWR.

MONITORING

Non-project inflow proponents are responsible for monitoring the quality of the water at the point of introduction into the Aqueduct for the duration of the program.

IMPLEMENTATION

DWR will develop procedures to implement these criteria.

Table 1 HISTORICAL WATER QUALITY CONDITIONS 1988-2001 AT O'NEILL FOREBAY OUTLET (mg/L)

Metals, Minerals and others					
	Mean	**Min**	**Max**	**Stand Dev**	**Count**
Aluminum	0.029	0.004	0.527	0.050	137
Antimony	0.005*	0.005*	0.005*	0.000	10
Arsenic	0.002	0.001*	0.004	0.000	215
Barium	0.050*	0.037	0.068	0.002	139
Beryllium	0.001*	0.001*	0.001*	0.000	11
Bromide	0.21	0.05	0.54	0.11	121
Cadmium	0.004	0.001*	0.005	0.002	139
Chromium	0.005*	0.005*	0.011	0.001	189
Copper	0.005	0.001*	0.028	0.003	214
Fluoride	0.09	0.01*	0.40	0.05	225
Iron	0.049	0.005*	0.416	0.058	214
Manganese	0.007	0.003	0.06	0.004	17
Mercury	0.0008	0.0002*	0.0010	0.0004	163
Nickel	0.002	0.001*	0.004	0.001	11
Nitrate	3.5	0.6	9.6	1.8	192
Nitrate-Nitrite	0.6	0.1	1.2	0.3	22
Nitrite	0.5	0.3	1.1	0.2	21
Selenium	0.001*	0.001*	0.001*	0	208
Silver	0.004	0.001*	0.005	0.002	139
Sulfate	43	16	99	15	228
Total Organic Carbon	4	3	10	2	131
Zinc	0.009	0.005*	0.210	0.016	206

* These values represent reporting limits, actual values would be lower.

Pesticides, herbicides and synthetic organic chemicals are not detected in water samples at this location. Therefore, historical conditions are considered to be represented by less than detection levels for these compounds.

Salinity Criteria 1979-2000 (specific conductance, us/cm)

Year Type*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	454	401	393	363	355	351	338	340	299	302	350	343
Near Normal*	474	430	511	302	415	520	462	371	430	474	528	623
Dry	566	510	472	469	403	424	441	486	613	498	715	495
Critical	673	728	642	578	548	597	586	609	648	668	604	756

* Year type is based on water year classification, below normal and above normal have been combined into one designation as near normal.

Appendix B

Implementation Procedures for the Review of Water Quality from Non-Project Water Introduced into the State Water Project

This document describes the approval and implementation procedures, as well as, responsibilities of the various parties involved in the introduction of Non-Project water into the State Water Project under the ***Department of water Resources Water Quality Criteria for Acceptance of Non-Project Water into the State Water Project*.**

This document does not in anyway affect, modify or have any bearing upon any provisions of law, contract, policy or procedure governing water resources or the State Water Project other than stated above. Non-project inflow shall not constrain the ability of DWR to operate the SWP for its intended purposes or to protect the SWP integrity during emergencies and it shall not adversely impact SWP operations, deliveries, existing contracts or any other agreements.

DWR shall consider all non-project water input proposals based upon the approved water quality ***Criteria*** and the procedures established in this document. This document describes the procedures and responsibilities of the Project Proponent, Department of Water Resources, and the Facilitation Group as identified in the ***Criteria***.

Project Proponent

The proponent of a program that will introduce Non-Project water into the SWP will submit a complete detailed proposal to the Department of Water Resources for purposes of evaluating the water quality impacts .The proponent shall demonstrate that the non-project water is of consistent, predictable and reliable quality.

The Proponent is responsible for preparation of and compliance with any and all contracts, environmental documents, permits or licenses that are necessary consistent with applicable laws, regulations, agreements, procedures, or policies external to this document.

Project Description

The proponent will submit to DWR a document describing the proposed program, identifying the water source(s), planned operation, characterizing the inflow water quality and any anticipated impacts to SWP water quality and/or operations. The proposal will at a minimum include:

- Identify names, locations, addresses, and contact person(s) for all participants.

- Detailed information including maps identifying all sources of water, point of inflow to the SWP and ultimate fate of the introduced water.
- All terms and conditions of inflow, timing, rates and volumes of inflow, pumping, conveyance and storage requirements will be described.
- All construction details adjacent to SWP facilities will be described including valves, meters, pumps and piping size, location, etc.
- All potential impacts and/or benefits to downstream users will be identified
- Detailed water quality data will be provided for all sources of water and any blend of sources that will be introduced into the SWP.
- Describe anticipated water quality changes within the SWP.
- Identify other relevant environmental issues such as subsidence, ground water overdraft or, presence of endangered species.

Water Quality Monitoring

In order to demonstrate that the source(s) of water are of consistent, predictable, and acceptable quality the Proponent will monitor water quality. The proponent is responsible for all costs associated with characterizing and monitoring water quality up to and including the point of discharge into the SWP for the duration of the program. The proponent will, for the duration of the program, regularly report on operations as they affect water quality, monitoring data and water quality changes. One of three water quality monitoring schedules will be used and all information will be submitted to DWR on a regular basis (within 30 days of sampling).

Projects proponents shall select one of the testing options below and perform and provide all water quality testing described therein.

Option 1 - *Baseline tests*: Title 22 tests of record are required for all wells (sources), but a post inflow Title 22 test is allowed for any well near a similar well with a Title 22 test of record. *Periodic tests*: Constituents of Concern tests are required upon startup and quarterly for each discharge point.

Option 2 - *Baseline tests*: Constituents of Concern tests of record are required for all wells (sources) and Title 22 tests of record are required for representative wells comprising a subset of all wells. Representative wells shall be identified on a case-by-case basis to be representative of the manifold area; proximity, water levels, and agricultural water tests are significant for this purpose. The proponent shall identify representative wells subject to approval. *Start up tests in any year*: Title 22 tests are required for all discharge points upon startup. Constituents of Concern tests are required for all wells within two weeks of inflow startup. *Periodic tests*: Constituents of Concern tests are required monthly for each discharge point.

Option 3 – A project proponent may propose a monitoring schedule that is fully protective of water quality and consistent with the *Criteria*. The proposed

monitoring schedule will be submitted to the Facilitation Group for review and seeking a recommendation of approval.

Under any of the three testing options all Title 22 tests will be repeated every three years or as otherwise acceptable to the Department of Health Services to be compliant with Title 22. Sampling for pathogens (including giardia and cryptosporidium) may be required for any waters under the influence of surface water at the discretion of DWR and/or the Facilitation Group

Flow Measurements
The proponent will provide flow measurements and analytical data for all sources and discharges into the SWP to demonstrate compliance with the *Criteria*.

- The proponent will maintain current, accurate records of production rate and volume from each source, as well as, each point of discharge into the SWP.
- Meters will be properly calibrated and maintined.
- All flow measurements will be submitted to DWR regularly.

Reconsideration
If a proponent disagrees with the DWR decision of compliance with the Non-Project inflow *criteria* or feels that there is overriding benefit of the proposal, the proponent may seek review from the Facilitation Group.

- The SWC Facilitation Group may recommend to DWR that a proposal has some overriding benefit(s) and DWR may reconsider the proposal.
- Reconsideration by DWR will be on a case-by-case basis and DWR may waive or modify the inflow *criteria* for specific proposals if conditions warrant.

DWR

DWR, in consultation with the State Water Contractors, DHS, and other appropriate parties, will develop the ***Department of water Resources Water Quality Criteria for Acceptance of Non-Project Water into the State Water Project*** *and* ***Implementation Procedures for the Review of Water Quality from Non-Project Water Introduced into the State Water Project***. The *criteria* and *procedures* will be reviewed annually and revised as needed to protect SWP water quality.

DWR will seek, as needed DHS or State Water Contractor recommendations on changes or additions to the *criteria* and *procedures* documents governing Non-Project water inflow proposals. The Facilitation Group will review proposed changes or additions prior to implementation by DWR.

DWR will have ultimate responsibility for approving the water quality of all non-project inflow, as well as, the oversight of monitoring and tracking the water quality of operating programs.

Project Proposal

Upon receipt of a proposal for Non-Project water inflow DWR will review the proposal for adequacy. DWR shall consider all non-project water inflow proposals based upon the approved *Criteria*. If necessary, DWR will convene timely meetings with the Facilitation Group during the review of a proposal. At the minimum the review will include

- Examination of all documents and data for completeness of the submittal.
- Affected Field Divisions, the Facilitation group and all affected downstream users will be immediately notified of the submittal.
- Comments from all parties may be considered by DWR before the final decision.
- Upon completion of the review, DWR will notify the proponent and downstream users of the acceptance of the proposal, the need for modification of a proposal, or explain the reason(s) for rejecting the proposal.
- DWR may reconsider a decision on a proposal based upon a recommendation from the Facilitation Group. Reconsideration by DWR will be on a case-by-case basis and DWR may waive or modify the *Criteria* for specific proposals if conditions warrant

Annual Review

Once a program for delivery of non-Project water to the Aqueduct has been approved, an annual review of the program will occur with input from the Facilitation Group. As part of the review, program proponents will provide the following information:

- Summary of deliveries to the Aqueduct.
- Water quality monitoring results.
- Proposed changes in the program operation.

The review may result in changes in program operations, monitoring and testing required of the program proponent as a result of;

- New constituents being added to the EPA /DHS list of primary drinking water standards.
- Changes in the maximum contaminant levels for the EPA/DHS list of primary drinking water standards.
- Identification of new constituents of concern
- Changes in the water quality provided by the program.
- Changes in concentrations in the California Aqueduct.

This procedure shall recognize emerging contaminants as they are identified by the regulatory agencies and shall set appropriate standards for introduction based upon ambient levels in the California Aqueduct or State Action Levels, which ever is lower. Emerging contaminants are those that may pose significant risk to public health, but as yet do not have an MCL. Currently the Office of Environmental Health Hazard Assessment and the Department of Health Services establish Public Health Goals and Action Levels, respectively. These levels, though not regulated, do provide health-based guidance to water utilities and can require public notification if exceeded.

Water Quality Review

For operating projects DWR will track and annually report on water quality impacts to the SWP from Non-Project water inflow.

- DWR will review analyze and maintain records of water quality testing conducted by the proponent of the well(s), source(s) and discharge(s) into the SWP.
- DWR will determine what additional water quality monitoring, if any, is necessary within the SWP to assure compliance with the Criteria. DWR will conduct all water quality monitoring within the SWP
- DWR will prepare an annual report of water quality impacts in the SWP from Non-Project water and make all water quality data available to interested parties.

On-site Surveillance

The appropriate Field Division within DWR will be responsible for review and approval of all construction activities within the SWP right-of-way. Plans showing the discharge system piping, valves, sampling point, meters and locations must be submitted and approved prior to any construction. In addition, the appropriate Field Division will be responsible for confirmation of all meter readings and water quality monitoring conducted by the proponent.

- Field division staff may visit, inspect, calibrate meters and measure flow conditions at each source or point of discharge into the SWP.
- Flow meters, sampling ports and anti-siphon valves must be conveniently located near the SWP right-of-way.
- Field division staff may collect water samples at each source or point of discharge into the SWP.
- The appropriate Field Division will conduct additional water quality monitoring within the SWP, if deemed necessary, to assure compliance with the Non-Project Inflow Criteria.

<u>SWC Facilitation Group</u>

Upon initial review of a Non-project water inflow proposal, DWR shall notify the State Water Contractors of its receipt, its contents, and the possible need for a Facilitation Group. The State Water Contractors may form a Facilitation Group to advise DWR on any or all proposals for introduction of Non-Project water into the SWP.

- It is the responsibility of the State Water Contractors to form and coordinate the activities of the Facilitation Group. DWR will assist in coordination of Facilitation Group activities as requested.
- The SWC Facilitation Group can consult with State Water Contractors, DWR, the project proponent, other state or federal agencies, private consultants or other interested parties as needed to fully evaluate a Non-project Inflow Proposal.

The Facilitation Group is an advisory body that will review the *criteria* and *Procedures* for approval of water quality for Non-project inflow. The Facilitation Group will review and recommend action on Proposals that could degrade SWP water quality. Also, if a proponent proposes a monitoring Schedule under Option 3, above, the Facilitation Group will review the proposal and make appropriate monitoring recommendations.

Recommendations of the Facilitation Group

The Facilitation Group will consider the merits, impacts, mitigation, cost/benefits or other issues, in addition water quality, in an effort to develop a consensus recommendation for action on Non- Project Inflow Proposals.

- State Water Contractors will make all decisions on the direction and actions of Facilitation Group activities or development of a recommendation on any proposal.
- The facilitation group may provide comment or recommendations to DWR at any time, on any aspect, of any proposal. The facilitation group can also provide comment or recommendations to DWR on the *Criteria* or *Procedures* at any time.
- The Facilitation Group will provide DWR recommendations for formal approval, disapproval or modification of each individual Non-Project Inflow Project submitted for consideration. The recommendation shall include an explanation of the reasons for the recommendation.
- If consensus among State Water Contractors is not possible the Facilitation Group may submit both majority and minority opinions and recommendations.

Appendix G

CROSS VALLEY CANAL / KERN WATER BANK
OPERATING GUIDELINES DURING SHALLOW GROUNDWATER CONDITIONS

1 INTRODUCTION

The Cross Valley Canal (CVC) and the Kern Water Bank (KWB), which coexist along 7 ¼ miles in the southwestern San Joaquin Valley, contribute significantly to water supply management and conservation in Kern County. The Kern County Water Agency (KCWA) and the KWB Authority (KWBA) believe it is in the best interests of both projects to develop guidelines that will allow the projects to operate to the fullest extent possible while at the same time being protective of facilities.

It should be noted that several proactive measures have already been undertaken by the CVC and KWBA. These include:

- Installing a shallow groundwater monitoring network and conducting regular monitoring and evaluation of shallow groundwater conditions;
- Raising the low-level cut-off float switch and installing a secondary low-level cut-off float switch at the forebay of CVC Pumping Plant No. 1;
- Increasing the range of the forebay level gauge for CVC Pumping Plant No. 1;
- Installing a low-level cut-off switch at the KWBA's Pool 1 Pump turnout;
- Conducting frequent inspections of the CVC's concrete liner for voids, displacement, etc. and making repairs as needed and as conditions permit;
- Expanding real-time forebay level monitoring and trending analyses capabilities;
- Increasing recharge pond setbacks
- Reducing recharge activities in the vicinity of the CVC

The implementation of the following guidelines should further these initial efforts to protect facilities and, at the same time, allow for project flexibility. It is expected that, as time goes on and additional information is developed, modifications to these operating guidelines may be made.

2 GROUNDWATER MONITORING PROGRAM

The groundwater monitoring program will include the installation of additional piezometers along the CVC in areas where the CVC lining is below grade and the formalization of a monitoring and evaluation plan. Each of these aspects of the program is described below.

2.1 Piezometer Installation

Several piezometers have already been installed to monitor groundwater conditions near the CVC. Approximately 32 additional piezometers will be installed at the locations shown in Figure 1 to supplement this monitoring network. Three of the piezometers will be installed to a depth of 50 feet; the remaining 29 will be installed to a depth of 20 feet. The piezometers will be

constructed with 2- inch diameter PVC to industry standard specifications. A licensed surveyor will determine the location and elevation of each. All direct costs for the installation and monitoring of the piezometers, as well as the evaluation of the resulting data shall be shared equally between the CVC and the KWBA

2.2 Groundwater Monitoring Frequency

The frequency of groundwater monitoring will vary as groundwater levels change. Unless depth to groundwater is known to exceed 75 feet, the monitoring schedule will be as follows:

- During periods of adjacent recharge:
    - Groundwater > 20 feet – monitor monthly
    - Groundwater < 20 feet – monitor weekly

- During periods with no recharge – monitor weekly until depth to groundwater is > 20 feet, then monitor semi-annually

2.3 Evaluation of Groundwater Conditions

CVC and KWBA staff will jointly evaluate groundwater conditions and, as necessary, determine appropriate modifications to operations as described in these guidelines. These evaluations will be conducted according to the following schedule:

- During periods of adjacent recharge:
    - Groundwater < 50 feet – evaluate monthly
    - Groundwater < 20 feet – evaluate weekly, prepare gradient maps weekly, prepare written recommendations regarding modifications to operations and submit to KCWA/KWBA
    - Groundwater within 5 feet of design operational levels of the CVC – implement written recommendations regarding modifications to operations
- During periods with no recharge:
    - Groundwater < 20 feet – evaluate weekly, prepare gradient maps monthly
    - Groundwater > 20 feet – evaluate semiannually
    - Groundwater > 50 feet – no evaluations

The evaluations are expected to consist of brief teleconferences between CVC and KWBA staff unless depth to groundwater is 20 feet of ground surface or less. Under these conditions and when recharge is occurring, written evaluations and recommendations will be prepared weekly as a joint effort by CVC and KWBA staff.

3 GROUNDWATER RECHARGE MANAGEMENT

The 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, the KWBA will minimize recharge adjacent to the CVC either by reducing inflow to adjacent ponds or increasing the setbacks of adjacent ponds[1]. The goal of these actions will be to prevent flow into the CVC.

It is important to note that controlling groundwater levels in the vicinity of the CVC cannot be entirely achieved by managing recharge. At times, the canal has been operated at levels above the liner, thereby recharging groundwater. As a result, groundwater elevations near the CVC are maintained at or above the level of the lining. Irrespective of the foregoing, the protective measures described above will be undertaken.

4 CVC OPERATIONS MANAGEMENT

The management of CVC operations will also play an important role in preventing future lining damage. 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.

5 CONCLUSION

CVC and KWBA staff have developed these operating guidelines to maximize the flexibility of their respective projects while preventing structural damage to facilities. Both projects will work together to ensure that the goals of the guidelines are met. It is expected that these guidelines may be modified in response to structural changes to the CVC (e.g. liner modifications) and as more knowledge is gained regarding the behavior of the shallow aquifer.

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[1] The current setback is 20:1. CVC and KWBA staff have considered engaging a consultant to determine a "safe" setback. However, given the varying soil conditions present on the KWB and CVC properties, determining a single "safe" setback would be very difficult to achieve.

Appendix H

EXHIBIT D
MONTEREY AMENDMENT TO THE STATE WATER PROJECT CONTRACTS (INCLUDING KERN WATER BANK TRANSFER) AND ASSOCIATED ACTIONS AS PART OF A SETTLEMENT AGREEMENT (MONTEREY PLUS) (2016 MONTEREY PLUS REVISED EIR – KERN WATER BANK DEVELOPMENT, AND CONTINUED USE AND OPERATION)

MITIGATION MONITORING AND REPORTING PROGRAM

1. INTRODUCTION

The California Environmental Quality Act (CEQA) requires the adoption of feasible mitigation measures to reduce the severity and magnitude of potentially significant environmental impacts associated with project development.

CEQA Guidelines Section 15091(d) states:

> When making the findings required in subdivision (a)(1), the agency shall also adopt a program for reporting on or monitoring the changes which it has either required in the project or made a condition of approval to avoid or substantially lessen significant environmental effects. These measures must be enforceable through permit conditions, agreements, or other measures.

CEQA Guidelines Section 15097(a) states:

> This section applies when a public agency has made the findings required under paragraph (1) of subdivision (a) of section 15091 relative to an EIR or adopted a mitigated negative declaration in conjunction with approving a project. In order to assure that the mitigation measures and project revisions identified in the EIR or negative declaration are implemented, the public agency shall adopt a program for monitoring

The California Department of Water Resources (Department) developed a Mitigation Monitoring and Reporting Program (MMRP) for the 2010 Monterey Plus Final Environmental Impact Report (FEIR) and adopted the MMRP on May 4, 2010. The MMRP covered mitigation measures that are within the jurisdiction and responsibility of the Department. The Department has implemented and continues to implement these mitigation measures as stated in the 2010 MMRP.

The Monterey Plus Final Revised Environmental Impact Report (REIR), which includes the 2007 Draft EIR (DEIR) and 2010 Final EIR (FEIR) for the proposed project, contains new and revised mitigation measures covering the Kern Water Bank (KWB) transfer, development and continued use and operation. These mitigation measures in the Draft REIR replace the two mitigation measures, Mitigation Measures 7.4-3 and 7.13-3, identified in the 2010 FEIR to be implemented by the Kern Water Bank Authority (KWBA). The Department has completed this 2016 MMRP, but all mitigation measures are within the jurisdiction and responsibility of KWBA, not the Department. KWBA has already committed to implementing all mitigation measures contained herein in its 2016 Resolution (see Draft REIR Appendix 7-6b. 2016 Kern Water Bank Authority Resolution).

In addition, mitigation measures for potentially significant and unavoidable impacts were identified for yet-to-be built projects, Plumas County lands, and for yet-to-be built Southern San Joaquin groundwater banks on Kern County and Kings County lands are within the responsibility and jurisdiction of the individual counties and not the Department or KWBA. Since these actions depend upon actions to occur in the future and are covered within the Statement of Overriding Considerations as potentially significant and unavoidable impacts, the 2010 Monterey Plus FEIR Mitigation Measures 7.4-3, 7.13-2, , 7.13-6, 10.1-3, 10.1-19, and 10.1-20 are not included in the 2010 or 2016 MMRPs.

Findings and Determinations were made in Exhibit B as required under the CEQA Guidelines Section 15091 (a)(1) which includes mitigation measures. Following the Department's certification of the Final

REIR and approval of the Findings of the proposed project and of this new MMRP, the mitigation measures that are within the jurisdiction and responsibility of KWBA that have been required in, or incorporated into the approved project, will be monitored in the manner specified by this MMRP.

The mitigation measures identified and adopted within the 2010 MMRP remain effective and unchanged except for the replacement of the two Mitigation Measures relating to the Kern Water Bank. This MMRP is not intended to supersede the previously adopted 2010 MMRP and instead identifies only the new mitigation measures identified within the REIR.

1.1 2016 FINDINGS

The Department) has prepared the 2016 Monterey Plus REIR to evaluate the potentially significant impacts of the transfer of the Kern Fan Element and the development and continued use and operation of the KWB. The 2016 REIR did not identify any new significant impacts related to the transfer of the Kern Fan Element. The Monterey Plus REIR does, however, identify a number of potentially significant impacts related to the development and continued use and operation of the KWB. The Monterey Plus REIR also identifies feasible mitigation measures that will be implemented to reduce all but one of the potentially significant impacts to a less-than-significant level.

This MMRP contains mitigation measures related to the KWB development and continued use and operation from the REIR. All mitigation measures included herein will be implemented by KWBA, as identified in each mitigation measure (see Draft REIR Section 7.1 for a description of the different types of mitigation measures) and may be modified by KWBA during project implementation, as necessary and if legally appropriate, in response to changing conditions or other refinements.

Table 1 has been prepared to assist KWBA in implementing the MMRP. The table identifies the individual mitigation measure number, mitigation measure, monitoring or reporting entity, mitigation timing, and enforcement entity. The numbering of mitigation measures follows the numbering sequence found in the Monterey Plus REIR.

Unless otherwise specified herein, KWBA is responsible for taking all actions necessary to implement the mitigation measures according to the specifications provided for each measure, and for demonstrating that the action has been successfully completed. It is expected that KWBA, as the responsible agency for KWB development and continued use and operation, will adopt this MMRP as part of its own CEQA compliance. KWBA, at its discretion, may delegate implementation responsibility or portions thereof to a licensed contractor or other designated agent as long as KWBA maintains final responsibility for ensuring that the actions are taken. KWBA is responsible for overall administration of the MMRP and for verifying that KWBA staff members and/or other individuals designated by KWBA have completed the necessary actions for each measure.

1.2 MITIGATION MONITORING PLAN

The column categories identified in **Table 1** are described below:

- **Mitigation Number**—This column lists the mitigation measures according to the number in the Monterey Plus REIR.
- **Mitigation Measure**—This column provides the text of the mitigation measures identified in the Monterey Plus REIR.
- **Monitoring or Reporting Entity**—This column identifies the entity(ies) responsible for conducting the monitoring and reporting compliance with the requirements of the mitigation measure.

- **Timing—**This column specifies the timing of mitigation measure implementation.
- **Enforcement Entity**—This column identifies the entity(ies), if any, responsible for enforcing compliance.

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
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.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	KWBA

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Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	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. 1) 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			

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	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			

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	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 K W B A 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 o u t s i d e the current and potential operating range of the well. 2) KCWA actions will be completed within 6 0 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.			

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	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			

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	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.			
7.1-7	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	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	KWBA

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	ponds or increasing the setbacks of adjacent ponds.			
7.2-1	KWBA will implement the following measures: a) Comply with Mitigation Measure 7.11-1(a). b) Comply with Mitigation Measure 7.8-1(a). c) Comply with Kern County Environmental Health Program under which new wells and well deepening, reconstruction, and destruction would be subject to permits requiring compliance. (see Section 7.0.4.1.6).	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	a-KWBA b-CVRWQCB c-Kern County Environmental Health Department
7.2-2	KWBA will implement the following measures: a) Comply with Mitigation Measure 7.11-4. b) Hazardous waste sites would be subject to the county public health department and/or the CVRWQCB oversight with the responsible parties (see Section 7.0.4.1.7). KWBA will cooperate with the regulatory agency(s) during the process and provide pertinent groundwater elevations and water quality data the regulatory agencies may request. c) On an annual basis, KWBA shall report the status of shallow groundwater level monitoring activities and water quality analysis in areas of contamination to the Kern Fan Monitoring Committee. d) KWBA will continue to monitor and evaluate the nature and extent of any current and future contamination and remediation within KWB Lands as follows: (i) For all evaluation and monitoring activities performed by third parties on KWB Lands, KWBA shall obtain reports and sampling data as soon as they become available. Monitoring and evaluation shall continue until verification by third party documentation, regulatory correspondence, and/or laboratory analysis is obtained that indicates soil or groundwater contamination has been remedied and no longer provides a threat to groundwater quality. (ii) On an annual basis, KWBA shall report the status of contamination for each issue and provide water quality data monitoring activities, where available, to the Kern Fan Monitoring Committee. Any newly discovered contamination shall be reported to the Kern Fan Monitoring Committee immediately.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	a-see MM 7.11-4 b-Kern County Health Department or CVRWQCB c-KWBA d-KWBA
7.2-3	KWBA will implement the following measures:	KWBA	Adopted by KWBA on May	a-KWBA

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	a) Prior to construction, identify all plugged and abandoned wells through agency contacts. This includes identification of abandoned wells through the DOGGR website, field verification of an abandoned well prior to construction, notifying DOGGR of intent to construct a recharge pond adjacent to or over an abandoned well. b) Modify excavation and grading activities to ensure the near surface seals and wellhead remain undamaged. c) If the top of an abandoned well or wellhead is damaged during pond construction, appropriate authorities (i.e., DOGGR, CVRWQCB, and/or Kern County Environmental Health) will be notified as to the nature and extent of the damage along with plans to repair the damage, as needed and in accordance with existing regulations.		15, 2016 (Appendix 7-6b)	b-KWBA c-DOGGR, CVRWQCB, and/or Kern County Environmental Health Department
7.2-6	KWBA will implement Mitigation Measures 7.2-1, 7.2-2, 7.2-3, 7.8-1(a) and (b), and 7.11-2.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	See MM 7.2-1, 7.2-2, 7.8-1(a) and (b), and 7.11-2.
7.4-3	KWBA will implement the following terms required of KWBA as specified in the 1997 Monterey IS and Addendum (Appendix 7-6a), 2016 KWBA Resolution, and KWB HCP/NCCP, including Appendix A (Kern Water Bank Operations Manual), Appendix C (Kern Water Bank Vegetation Management Plan, and Appendix D (Kern Water Bank Waterbird Management Plan) (see Appendices 7-7a, 7-7b, 7-7c, and 7-7d, respectively): a) Biological Monitor A qualified biologist shall monitor all ground disturbing activities during construction in the Sensitive Habitat Sector and will oversee measures undertaken to reduce the take of listed species. b) Construction Practices i. Delineation of Disturbance Areas – During construction, KWBA shall clearly delineate disturbance area boundaries by stakes, flagging, or by reference to terrain features, as provided in the KWB HCP/NCCP~~directed by CDFG and USFWS~~ to minimize degradation or loss of adjacent wildlife habitats during operation. ii. Signage – During construction, KWBA shall post signs and/or place fencing around construction sites to restrict access of vehicles and equipment unrelated to site operations. iii. Resource Agency Notification – At least 20 working days prior to	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	USFWS and/or CDFW

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Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	initiating ground disturbance for project facilities in designated salvage/relocation areas, KWBA shall notify the Fresno Field Office of CDFWG and the Sacramento Field Office of USFWS of its intention to begin construction activities at a specific location and on a specific date. The agencies will have ten working days to notify the KWBA of their intention to salvage or relocate listed species in the construction area. If KWBA is notified, it shall wait an additional five days to allow the salvage/relocation to take place. iv. Salvage and Relocation – KWBA shall allow time and access to USFWS and/or CDFWG, or their designees, to relocated listed species, at the Resource Agencies' expense, from construction areas prior to disturbance of areas that have been identified by the Resource Agencies as having known populations of the listed species they wish to salvage or relocate. v. Construction Site Review – All construction pipes, culverts, or similar structures with a diameter of three inches or greater that are stored at a construction site on the Kern Water Bank for one or more overnight periods shall be thoroughly inspected for trapped kit foxes and other animals before the subject pipe is subsequently buried, capped, or otherwise used or moved in any way. Pipes laid in trenches overnight shall be capped. If during construction a kit fox or other animal is discovered inside a pipe, that section of pipe shall not be moved or, if necessary, shall be moved only once to remove it from the path of construction activity until the animal has escaped. vi. Employee Orientation – An employee orientation program for construction crews, and others who will work on-site during construction, shall be conducted and shall consist of a brief consultation in which persons knowledgeable in endangered species biology and legislative protection explain endangered species concerns. The education program shall include a discussion of the biology of the listed species, the habitat needs of these species, their status under FESA and CESA, and measures being taken for the protection of these species and their habitats as a part of the project. The orientation program shall be conducted on an as needed basis prior to any new employees commencing work on the Kern Water Bank. Every two years or at the beginning of construction for the Supply/Recovery canal, a refresher course will be conducted for employees previously trained. A fact sheet conveying this information shall also be prepared for distribution to all employees. Upon			

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	completion of the orientation, employees shall sign a form stating that they attended the program and understand all protection measures. These forms shall be filed at KWBA's office and shall be accessible by CDWFG and USFWS. vii. Standards for Construction of Canals – Concrete-lined canals will have a side slope of 1.5 to 1 or less and the sides will have a concrete finish which will assist in the escape of animals. If canals are determined by CDFWG or USFWS to be substantial impediments to kit fox movement, plank or pipe crossings will be provided across concrete canals in areas identified as having high kit fox activity. c) On-Going Practices i. Equipment Storage - All equipment storage and parking during site development and operation shall be confined to the construction site or to previously disturbed off site areas that are not habitat for listed species. ii. Traffic Control - KWBA's project representative shall establish and issue traffic restraints and signs to minimize temporary disturbances. All construction related vehicle traffic shall be restricted to established roads, construction areas, storage areas, and staging and parking areas. Project related vehicles shall observe a 25 MPH speed limit in all project areas except on county roads and state and federal highways. iii. Food Control - All food-related trash items such as wrappers, cans, bottles, and food scraps generated both during construction and during subsequent facility operation shall be disposed of in closed containers and shall be regularly removed from the site. Food items may attract kit foxes onto a project site, consequently exposing such animals to increased risk of injury or mortality. iv. Dog Control - To prevent harassment or mortality of kit foxes or destruction of kit fox dens or predation on this species; no domestic dogs or cats, other than hunting dogs, shall be permitted on-site. v. Pesticide Use - Use of rodenticides and herbicides on the site shall be permitted in accordance with the Vegetation Management Plan, which incorporates by reference the Interim Measures for Use of Rodenticides in Kern County, and which will incorporate by reference any other applicable laws, rules, and regulations regarding the use of pesticides as they take effect.			

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	d) Project Representatives KWBA shall designate a specific individual as a contact representative between KWBA, USFWS, and CDFW~~G~~ to oversee compliance with protection measures-detailed herein. KWBA shall provide written notification of the contact representative to CDFW~~G~~ and USFWS within 30 days of issuance of the Permits and the Management Authorizations. Written notification shall also be provided by KWBA to CDFW~~G~~ and USFWS in the event that the designee is changed. e) Notification Regarding Dead, Injured or Entrapped Listed Animals Any employee or agent of KWBA who kills or injures a San Joaquin kit fox, blunt nosed leopard lizard, Tipton kangaroo rat, San Joaquin antelope squirrel, or other listed species listed as a threatened or endangered animal under FESA or CESA, or who finds any such animal either dead, injured, or entrapped on the Kern Water Bank shall report the incident immediately to KWBA's representative who shall, in turn, report the incident or finding to USFWS and CDFW~~G~~. In the event that such observations are of entrapped animals, escape ramps or structures shall be installed immediately to allow the animal(s) to escape unimpeded. In the event that such, observations are of injured or dead animals, KWBA shall immediately notify USFWS and CDFW~~G~~ by telephone or other expedient means. KWBA shall then provide formal notification to USFWS and CDFW~~G~~, in writing, within three working days of the finding of any such animal(s). Written notification shall include the date, time, location, and circumstances of the incident. The USFWS contact for this information shall be the Assistant Field Supervisor for Endangered Species, Sacramento Field Office. The CDFWG contact shall be the Environmental Services Supervisor at the San Joaquin Valley-Southern Sierra Region Headquarters. USFWS or CDFW~~G~~ will be notified if any other animal, which is otherwise a listed species, is found dead or injured. f) Construction of Supply/Recovery Canal Within 60 days prior to the construction of the supply/recovery canal within the zone marked within the Map of the Kern Water Bank, KWBA shall conduct a limited survey within the area of the Kern Water Bank, which will be affected by that construction, with the sole			

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	goal of identifying potential San Joaquin kit fox dens. KWBA shall contact USFWS and CDFW~~G~~ pursuant to the salvage procedures set forth above if any kit fox dens are found. g) Take Avoidance Protocol for Fully Protected Species Although a population of blunt nosed leopard lizards was relocated to the Kern Water Bank, there is no known present occurrence of them. Existing data on the blunt nosed leopard lizard at the Kern Water Bank indicates that populations, if they exist, occur within habitat set asides (either sensitive, compatible, or conservation bank habitat), thus the likelihood of take from project construction, operation, and maintenance is negligible. However, in the future adaptive management measures may expand to areas of suitable habitat. Three other species, which may be found on the Kern Water Bank, are also state designated fully protected species: American peregrine falcon, Greater sandhill crane, and White-tailed kite. The likelihood of the take of any of these species from project construction, operation, and maintenance is negligible due to their mobility and preferred habitats. ~~However, to avoid any take of these species, the same take avoidance protocol as set out for the blunt nosed leopold lizard shall apply to each of these three species.~~ KWBA will comply with the terms of the NCCP Approval and Take Authorization as it relates to ~~Until such time that the KWBA obtains appropriate authorization for take of the~~ state-designated fully protected species (Appendix 7-e)~~blunt nosed leopard lizard by the Fish and Game Commission, t~~The following take avoidance protocol shall apply in any areas that contain suitable habitat for fully protected species not covered by authorization for take of state-designated fully protected species identified in this subsection (g) ~~of the blunt nosed leopard lizard:~~ i. A qualified biologist shall survey any areas proposed for project related disturbance that contain suitable habitat for fully protected species ~~the blunt nosed leopard lizard~~ to determine the likelihood of presence. ~~Suitable habitat consists of valley and foothill grasslands, saltbrush scrubland, iodine bush grassland, and alkali flats.~~ ii. If these fully protected species ~~blunt nosed leopard lizards~~ are found to occur in areas proposed for project facilities construction or maintenance, ~~construction of~~ avoidance should take place. ~~first. If~~			

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Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	~~avoidance is not practicable, then the blunt nosed leopard lizard will be trapped and relocated prior to disturbance of KWBA's expense in accordance with the applicable annual management plan. This work must be done by or under the direction of the USFWS staff be persons with appropriate experience and with their own take for scientific purposes permits. This procedure will avoid any violation of state law.~~ The use of a biological monitor, and special construction activities and on- going practices will result in a heightened awareness and education regarding sensitive biological resources, which will reduce the potential for impacts on special-status species. In addition, the use of a project representative as a liaison between the KWBA and the resource agencies will expedite notification regarding any take of a listed animal. ~~While take of a fully protected species is not anticipated, this mitigation outlines avoidance protocol to further reduce the likelihood of said take.~~ Together these mitigation measures and the beneficial net increase of habitat for special-status species through implementation of the HCP/NCCP will reduce any potential impact to a less-than-significant level.			
7.8-1	KWBA will implement the following measures: a) Comply with NPDES permit requirements, which include preparation of a site-specific SWPPP and implementation of BMPs specifically designed to control erosion and reduce the transport of sediment and other pollutants (see Section 7.0.4.1.1). b) Comply with measures in the KWB HCP/NCCP Vegetation Management Plan, including the following specified for sediment removal and erosion control (see Appendix 7-7c): i. Sediment build up in canals and recharge basins must be removed to maintain adequate flow and water capacity in canals and to maintain good percolation in recharge basin. Sediment is typically removed mechanically with an excavator. To minimize transport costs of disposal, the loose soil sediments are typically placed on or near levees and canals. When feasible, islands in the recharge basis will be constructed from the spoil of the removal process. If this practice is to continue, then newly placed soils will be compacted onto the levee side slopes and tops where appropriate in areas that are not known to support kit fox dens, Tipton kangaroo rat burrows, blunt-	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	a-CVRWQCB b-USFWS/CDFW c-KWBA

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	nosed leopard lizards or burrowing owl holes. Hay mulch may be applied to the bare slopes and seed would occur at the proper time of year as appropriate. The elimination of bare soil conditions will decrease erosion. In addition, establishing marsh vegetation at the head of stream flow patterns will filter water and reduce sediment transport through the system. ii. Water conveyance structures and control devices require periodic erosion control protection measures. Concrete riprap is typically used near the structures to prevent excessive erosion. Sidebank blowouts near conveyance structures shall be refilled and revegetated where appropriate. c) Use a watering truck to minimize fugitive dust generated during grading when conditions require, such as on dry, windy days (1997 Monterey IS and Addendum, Measure E-1)(see Appendix 7-6a).			
7.11-1	KWBA will implement the following measures: a) Require construction contracts to include specific language requiring contractors to comply with applicable hazardous materials management laws and regulations adopted at the State level in Titles 19 and 22 of the CCR, which address proper storage and disposal of substances such as fuels and Title 8 of the CCR which addresses the use of hazardous products in the work environment, which would apply to construction contractors. (See Section 7.0.4.1.2.) b) Ensure that the use of herbicides on the site shall be permitted in accordance with the KWB HCP/NCCP Vegetation Management Plan, which will incorporate by reference any other applicable laws, rules, and regulations regarding the use of pesticides as they take effect. (Measure B-3(e), Ongoing Pesticide Use, in 1997 Monterey IS and Addendum)(see Appendix 7-6a and Section 7.0.4.1.5). c) Provide a comprehensive Worker Environmental Awareness Program (WEAP) that will include all training requirements identified in Best Management Practices, Worker Site Specific Health and Safety Plan, and mitigation measures, including training for all field personnel (e.g., KWBA employees, agents, and contractors). The WEAP shall include protocols and training for responding to and handling of hazardous materials and hazardous waste management, and emergency preparedness, release reporting, and response requirements. KWBA will ensure that all construction workers at risk	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	a-KWBA b-USFWS/CDFW c-KWBA d-see MM 7.8-1

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	of inhaling dust shall be provided masks with filters designed to trap spores of the size of Valley Fever fungus. (See Appendix 7.6b, 2016 KWBA Resolution). d) Comply with Mitigation Measure 7.8-1.			
7.11-2	KWBA will implement Mitigation Measure 7.11-1.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	See MM 7.11-1
7.11-4	KWBA will implement the following measures: a) Implement Mitigation Measure 7.11-1. b) Continue to monitor the remediation of the current and any future hydrocarbon contamination from third-party oil and gas activities. (Measure C-2, Hydrocarbon Contamination Monitoring, in 1997 Monterey IS and Addendum)(See Appendix 7-6a.) c) KWBA shall implement the following measures before and during ground-disturbing activities to reduce health hazards associated with potential exposure to hazardous substances (2016 KWBA Resolution)(see Appendix 7-6b.) i. If stained or odorous soil is discovered during project-related construction activities, KWBA shall retain a qualified environmental professional to conduct a Phase II Environmental Site Assessment and/or other appropriate testing. Recommendations in the Phase II Environmental Site Assessment to address any contamination that is found shall be implemented before continuing with ground-disturbing activities in these areas. ii. As required by law, notify the appropriate federal, state, and local agencies if evidence of previously undiscovered soil or groundwater contamination (e.g., stained soil, odorous groundwater) or if unknown or previously undiscovered underground storage tanks are encountered during construction activities.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	a–see MM 7.11-1 b-KWBA c-KWBA
7.11-6:	KWBA will implement the following: a) Implement Mitigation Measure 7.11-1(c). b) Implement Measure P-1, Implementation of Mosquito Abatement Plan, in the 1997 Monterey IS and Addendum (see Appendix 7-6a) with modifications for measures that proved infeasible or unsuccessful. In accordance with the Mosquito Abatement Plan,	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	a–CVRWQCB b–USFWS/CDFW c-KWBA

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	KWBA will engage in the following procedures which are expected to reduce any impact due to the breeding of mosquitoes in the recharge basins to insignificance: i. KWBA will notify staff of the Kern and Westside Mosquito Abatement Districts (District) of planned use of recharge basins. ii. Roads on the KWB will be kept in a reasonable condition to allow the District access to the KWB. iii. KWBA will assist District staff in adaptive management planning to review the success of mosquito control techniques and to develop improved mosquito control techniques.			
7.13-1a	KWBA will implement the following measures to minimize potential adverse impacts on cultural resources (see Appendix 7-6b, 2016 KWBA Resolution): a) Prior to ground disturbance for new pond or well construction and associated facilities, an analysis to identify the potential presence of archaeological resources on the project site shall be conducted. The analysis shall include, at a minimum, a records check and literature survey from the appropriate California Historical Resources Information System (CHRIS) center and a Phase I Cultural Resources Investigation by an archaeologist meeting the Secretary of the Interior's Standards. If resources are known to exist on a project site, the analysis shall include an assessment of the resource and shall include measures for the in-situ protection, or the recovery, preservation, study, and curation of the resource, as appropriate. The analysis and the measures developed shall be consistent with the practices and intent described in Section 21083.2 et seq. of the Public Resources Code, as well as Sections 15064.5 et seq. and 15126.4(b) of the California Code of Regulations, and shall be consistent with current professional archaeological standards. The archaeologist shall prepare a report of the results of any study prepared, following accepted professional practice. Copies of the report shall be submitted to the KWBA and to the appropriate CHRIS information center. KWBA shall also consult, as appropriate, with the Native American Heritage Commission and appropriate Native American tribal representatives to address Native American cultural values with respect to archaeological contexts and places of traditional use or importance. b) As a condition of all contracts for new pond or well construction and	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	KWBA

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	associated facilities and prior to ground-disturbing activities, all earth-moving and excavation contractor employees shall attend an orientation session informing them of the potential for inadvertently discovered cultural resources and/or human remains and protection measures to be followed to prevent destruction of any and all cultural resources discovered on site. The applicant's designated project construction manager, a qualified archaeologist, and a qualified cultural resource manager/monitor from a local California Native American tribe shall conduct the orientation (unless the local tribe opts not to participate). The orientation will include information regarding the potential for objects to occur on site, a summary of applicable environmental law, procedures to follow if potential cultural resources are found, and the measures to be taken if cultural resources and/or human remains are unearthed as part of the project. c) Construction areas for new ponds and wells and associated facilities shall be staked prior to earthmoving by a qualified archaeologist in consultation with the contractor to indicate the construction area, construction staging area, and buffer. No earthmoving, parking, or materials storage will be allowed outside the staked areas. Prior to construction, the archaeologist shall survey the area to identify any surface artifacts within the staked area. An archaeologist and qualified cultural resource manager/monitor from a local California Native American tribe (unless the local tribe opts not to participate) shall be present during any grubbing or topsoil grading within the staked area. If previously unknown buried cultural resources, such as flaked or ground stone, historic debris, building foundations, or nonhuman bone (unless determined to be from present day grazing operations), are discovered during ground-disturbing activities, work will stop in that area and within an appropriate buffer area, as determined by the archaeologist. The archaeologist shall assess the significance of the affected cultural resources and, if necessary, develop feasible and appropriate treatment measures in consultation with the project staff, such as avoidance, capping with geotextile and fill, or Phase III data recovery consistent with applicable standards adopted pursuant to the National Historic Preservation Act. d) In the event of the discovery of a burial, human bone, or suspected human bone, all excavation or grading in the vicinity of the find shall halt immediately, the area of the find shall be protected, and KWBA			

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	immediately shall notify the County Coroner of the find and comply with the provisions of PRC Section 5097 with respect to Native American involvement, burial treatment, and re-burial, if necessary. 7.13-1b. KWBA will implement the following measures to minimize potential adverse impacts on previously unknown potentially unique, scientifically important paleontological resources: (see Appendix 7-6b, 2016 KWBA Resolution): a) Before the start of any well-drilling activities, KWBA shall retain a qualified paleontologist or other qualified individual to train all personnel involved with earthmoving and/or well drilling activities regarding the possibility of encountering fossils, the appearance and types of fossils likely to be seen during construction, and proper notification procedures should fossils be encountered (this training can take place at the same time as the orientation required by 7.13-1a). b) In the event that paleontological resources are discovered, KWBA will notify a qualified paleontologist. The paleontologist will document the discovery as needed, evaluate the potential resource, according to the Society of Vertebrate Paleontology (SVP) Guidelines. If fossil or fossil bearing deposits are discovered during construction, excavations within 50 feet of the find will be temporarily halted or diverted until the discovery is examined by a qualified paleontologist. The paleontologist will notify the appropriate agencies to determine procedures that would be followed before construction is allowed to resume at the location of the find. If KWBA determines that avoidance is not feasible, the paleontologist will prepare an excavation plan for mitigating the effect of the project on the qualities that make the resource important. The plan will be submitted to KWBA for review and approval prior to implementation. The analysis and measures developed shall be consistent with the Conformable Impact Mitigation Guidelines developed by the Society of Vertebrate Paleontology and current professional paleontological standards.			
7.16-2	KWBA will implement Mitigation Measure 12-1.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	KWBA
12-1	KWBA will implement the following measures (2016 KWBA Resolution, Appendix 7.6b): a) Pump Efficiency Monitoring: KWBA will conduct pump efficiency	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	KWBA

00012885.1

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	monitoring to ensure that all KWB pumps are monitored and evaluated at regular intervals during recovery periods. i. Daily Pump Efficiency Monitoring: Pumps shall be monitored daily for their total water volume pumped (acre-feet [AF]) and electricity consumption (kilowatt-hours [kWh]), which will be used to calculate a daily energy efficiency value (i.e., kWh/AF). ii. Pump Efficiency Software: Metro or an equivalent water system management program will be used to provide up-to-date and streamlined methods to analyze KWB's individual pump and total system efficiency. b) Pump Rehabilitation, Retrofits, and Replacement: KWBA shall use data from the Pump Efficiency Monitoring component to strategically and actively rehabilitate, retrofit, and/or replace pumps as needed during recovery periods. i. Pump Prioritization and Testing: Pump rehabilitation, retrofit, and replacement shall be prioritized by accounting for the relative efficiency of each pump with respect to the total pump system and water volume pumped through each pump. Data obtained from the Pump Efficiency Monitoring component shall be used to prioritize which pumps will be rehabilitated, retrofitted, and/or replaced. In addition efficiency testing by external entities if available (e.g., pump company, Pacific Gas & Electric Company [PG&E]) or other similar analysis will also be used for the prioritization process. ii. Schedule: KWBA shall rehabilitate, retrofit, and/or replace pumps/wells at the earliest possible time without substantially disturbing ongoing O&M activities, but at a minimum will rehabilitate, retrofit, and/or replace at least an annual average of 5 pumps per year during a prolonged recovery period such as occurred between 2013 and 2016. c) Reporting: KWBA will maintain a quarterly and annual reporting program that will be publicly available online. Annual reports will cover calendar years and be posted online by March 30 to cover the previous year. Quarterly reports will be posted online within 30 days of the end of each calendar quarter. The annual and quarterly reports will include, but are not limited to, the following components: i. KWB O&M Totals: Total quarterly electricity consumption for recovery pumping activities along with total acre-feet recovered shall			

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
	be provided online. A running total of the annual electricity consumption and acre-feet recovered by quarter shall also be provided. ii. Pump Efficiency: A summary of the pump efficiency (kWh/acre-feet) for each of KWB's pumps will be provided quarterly. Similar to the KWB O&M Totals, a running annual average efficiency for each pump shall be provided. These data shall be used to identify the 5 pumps per year that will be rehabilitated, retrofitted, or replaced. If a pump/well is adjusted for depth, notes shall be made within the reports to explain these changes in pump efficiency. iii. Electricity Efficiency Actions: Each report should include actions taken in the previous quarter to rehabilitate, retrofit, and/or replace pumps. Any other energy efficiency measures taken will be reported. When information is available from PG&E's Advanced Pumping Efficiency Program or other similar programs, annual electricity savings from these actions shall be included in the quarterly and annual reports to clearly show the electricity savings associated with rehabilitation, retrofit, and/or replacement actions. If annual energy savings cannot be determined through pre- and post-pump improvement testing, KWBA shall report the empirical annual energy savings (kWh/year) from these improvements in its annual reports. iv. Identifying Next Steps: Each annual report will include the list of 5 or more pumps planned to be evaluated for potential rehabilitation, retrofit, or replacement during that year. If all five of the least efficient pumps are not scheduled for rehabilitation, retrofit, and/or replacement in the coming year, the annual report shall explain what KWB operation requires the pump to remain in service that year. d) Pump Compliance: KWBA will only purchase new pumps that comply with United States Department of Energy pump efficiency regulations (10 CFR Part 429 and 431) when those regulations become effective in the marketplace in 2020. e) Future Increases in Technology and Emissions Standards: KWBA shall actively consider replacing older pumps with new pumps with increased efficiency technology. All future requirements for pumps at the federal, state, and/or local level shall be complied with.			
10.1-24	KWBA will implement Mitigation Measure 7.1-2.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	KWBA

Mitigation No.	Mitigation Measure	Monitoring or Reporting Entity	Timing	Enforcement Entity
10.1-25	KWBA will implement Mitigation Measure 7.1-7.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	KWBA
10.1-28	KWBA will implement Mitigation Measure 7.2-1.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	See MM 7.2-1
10.1-29	KWBA will implement Mitigation Measures 7.2-2.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	See MM 7.2-2
10.1-30	KWBA will implement Mitigation Measure 7.2-3.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	See MM 7.2-3
10.1-39	KWBA will implement Mitigation Measure 7.4-3.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	USFWS and/or CDFW
10.1-58	KWBA will implement Mitigation Measure 7.11-6.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	See MM 7.11-6
10.1-61	KWBA will implement Mitigation Measures 7.13-1(a) and 7.13-1(b).	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	KWBA
10.1-66	KWBA will implement Mitigation Measure 12-1.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	KWBA
10.1-68	KWBA will implement Mitigation Measure 12-1.	KWBA	Adopted by KWBA on May 15, 2016 (Appendix 7-6b)	KWBA
10.1-69	No feasible mitigation available.	N/A	N/A	N/A

Appendix I

PROJECT RECOVERY OPERATIONS PLAN REGARDING PIONEER PROJECT, ROSEDALE-RIO BRAVO WATER STORAGE DISTRICT, AND KERN WATER BANK AUTHORITY PROJECTS

Purpose:

The Kern County Water Agency, on behalf of itself and the Pioneer Project Recovery Participants, Rosedale- Rio Bravo Water Storage District, and the Kern Water Bank Authority (the Parties) have developed this Operating Plan to designate measures, consistent with the MOUs[1] governing their respective projects, to *"... prevent, eliminate or mitigate significant adverse impacts"* resulting from project recovery operations. This plan applies to all recovery programs undertaken by any of the Parties' projects that are governed by MOUs. Pioneer mitigation includes the Pioneer Project, Berrenda Mesa Banking Project and Improvement District No. 4's Allen Road well field. This plan applies to landowners using groundwater for overlying agricultural or domestic uses as of the date this plan is executed. It does not apply to wells installed after the date of this plan that are installed to unsuitable depths based on historic water level fluctuations.

Plan Components:

1. **Establish a Joint Operations Committee (JOC):**

   a. Representatives from each of the Parties will participate in the JOC. Each Party will have equal representation on the JOC and an equal voice in its determinations, except that with respect to claims made to the JOC, only those parties contributing to mitigation will have a vote in determinations made on such claims.

   b. The JOC will meet as needed during years in which recovery operations are occurring (or expected to occur) to evaluate groundwater conditions, model results, landowner claims, and any other topics of concern. It is expected that the JOC will meet at least monthly during years when recovery operations are occurring.

   c. The JOC may establish a technical subcommittee to assist with compiling information to use in evaluating claims.

   d. The JOC will evaluate all claims with respect to model results and other appropriate information and the triggers established in Section 3, and approve or reject such claims. If claims are approved, appropriate mitigation will be determined as further described in Section 3. If mitigation is provided, the JOC will fund and/or contribute to the actions as described in Section 4.

[1] MOU refers to all of those MOUs executed by the parties that contain terms substantially similar to the *Memorandum of Understanding Regarding Operation and Monitoring of the Kern Water Bank Groundwater Banking Program* (dated October 26, 1995).

2. Evaluate Groundwater Conditions

a. The Parties have developed groundwater models (AMEC and Harder) as a tool to evaluate With Project versus Without Project groundwater levels and predict potential groundwater impacts. The Parties shall mutually agree on the assumptions used for Without Project conditions, and for purposes of making determinations hereunder an average of the output for the two models shall be utilized. The Pioneer Without Project condition shall assume farming is continued on its footprint.

b. The models will be updated regularly (at least annually) and compared to actual conditions during years in which recovery occurs. The Parties shall mutually cooperate to attain all data necessary for such updates. The Parties will utilize the water quality and water level monitoring data collected by the Kern Fan Monitoring Committee, and may conduct additional monitoring as needed. The Parties will report the results of the modeling to their respective Boards of Directors and shall publish on their respective websites maps and data showing current and projected water level information in the general area of the projects. As a matter of practice, the Parties will use the best and latest science and information available in all modeling and technical matters.

c. Absent unanimous approval of the JOC, recovery in any calendar year beyond March 15 of that year shall not commence (or continue) until the Models have been run for the projected operations and the Committee has met to review the results.[2]

d. The Models will be used to:
   i. Forecast With Project and Without Project groundwater levels at the outset of recovery programs.
   ii. Forecast any localized areas for special attention and/or monitoring.
   iii. Attempt to identify domestic wells at risk of impacts.
   iv. Determine if mitigation triggers have been met (See Section 3b).

e. The Parties may, based on experience gained, select a mutually agreeable groundwater model capable of accurately predicting groundwater impacts resulting from project operations.

f. In case of a dispute concerning a technical issue with a model, such as data inputs or the results based thereon, the Parties shall consult with a third party to resolve the matter.

3. Triggers and Actions

a. These actions will not occur in years when average water levels (measured at the following wells: 29S/25E-25M1&2, 29S/26E-31H1&2, 29S/26E-34M1, and 29S/26E-35H) are less than 140 feet from the surface as measured on March 31 of a given year

[2] 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.

because it is expected that water levels will not decline during such year to an extent resulting in a mitigatable impact.

b. The trigger for whether mitigation is considered shall be based upon an analysis and comparison of Model generated Without Project conditions to Model generated With Project conditions. When the With Project conditions are fifteen (15) or forty-five (45) feet deeper than the Without Project conditions at any operative domestic or agricultural well, respectively, and mechanical failure or other operational problems have occurred or are reasonably likely to occur due to declining water levels, mitigation will be provided as described below.

c. To be eligible for mitigation as provided below, the affected landowner shall allow the JOC (or representatives thereof) to perform a field inspection as described in 3.d. below, and provide claim information concerning the condition of the well and casing and pumping equipment, as determined appropriate by the JOC. The JOC shall evaluate all submitted claims within forty-five (45) days of receipt, provided that the landowner cooperates with the collection of necessary information. All mitigation actions are contingent upon the claimant executing an appropriate release, the terms of which will depend upon the nature of the mitigation provided.

d. For all claims, a field inspection will be conducted with the consent and coordination of the landowner to determine static depth to groundwater levels within the well and verify well construction information and pump setting information, if possible.

e. Well construction information and pump setting information will be compared to Model projected pumping water levels to determine pump submergence levels and evaluate the necessity and feasibility of mitigation measures. Mitigation measures, if warranted, will include one or more of the following:
   i. Providing a short-term emergency water supply to domestic well owners. Short-term emergency supplies shall be provided as soon as reasonably possible, but in all cases within 14 days of notification to the JOC of such needs;
   ii. Providing funds to lower a well pump;
   iii. Providing funds to complete a connection to an M&I water provider;
   iv. Supplying an equivalent water supply from an alternate source;
   v. Providing funds to replace the affected well with a deeper well that meets Kern County well ordinance standards;
   vi. Reducing or adjusting recovery pumping as necessary to avoid the impact; or
   vii. With the consent of the affected landowner, providing other acceptable mitigation.

f. Mitigation will not be provided where it can be demonstrated that the affected well requires remediation for reasons other than temporary groundwater level declines resulting from Project operations (i.e., general overdraft conditions, lack of well maintenance, normal wear and tear, failure of well equipment, etc.).

4. Mitigation Funding

a. It is the intent of the Parties to mitigate and/or compensate for legitimate Project impacts; it is not the intent of the Parties or the Plan to generate a windfall for landowners. Accordingly, adjustments will be made for depreciation of existing equipment and landowner contributions based on betterment for all mitigation measures. See Exhibit A for an example of such adjustments.

b. All costs paid, water supplies provided, and/or pumping reductions used by the Parties to prevent, eliminate or mitigate claimed impacts at a well site shall be initially allocated among the parties according to their respective projects' proportionate contributions to the With Project water level as compared to Without Project water level, as determined by using an average of the most recent versions of the models. After years end, the models shall be updated with the actual operations data for that year and recalibrated, and the average of the results of such modeling shall be used for a final allocation of the projects' proportionate contributions levels. If appropriate, the parties shall exchange funds and/or water supplies among them in accordance with the final allocation. For administrative ease, only an initial and final allocation for a given year shall be required. This procedure shall apply to mitigation for both domestic and agricultural wells.

c. All costs expended by any Party for equipment, water supplies or labor that is/are purchased or provided to address emergency health and safety concerns at domestic wells (exclusive of the costs described in 4.b. above) shall initially be allocated equally between the Parties. These costs shall be reallocated among the parties after years end per the procedure described in 4.b. above, provided that only those domestic wells for which emergency health and safety costs were incurred by a party shall be included in such reallocation, and further provided that the projects' proportionate contribution levels shall be based on the melded average of the results of the reallocation at all of the wells included in the reallocation.

d. All costs expended by any JOC participant in the administration of the JOC on behalf of all participants (e.g., processing claim response letters, calls from claimants, postage, notary public services, etc.) shall initially be allocated equally between the Parties. These costs shall be reallocated after years end per the procedure described in 4.b. above.

5. Additional Actions and Miscellaneous.

a. The term of this Operations Plan shall commence on February 1, 2017, and shall terminate on January 31, 2019. The Parties may agree to extend this Operations Plan and will meet starting October 1, 2018 to discuss any extension.

b. Modification language - This Operations Plan may not be altered, amended, or modified in any respect, except by unanimous consent of the Parties. Any modification to this Operations Plan must be made in writing and executed by all the Parties.

c. Except as set forth below, in the event the Joint Operations Committee cannot agree on (1) the implementation of this agreement, or (2) the proper action in response to a landowner claim, such dispute shall be submitted to binding arbitration before a single neutral arbitrator appointed by the Parties, and in absence of such consent, appointed by the presiding judge of the Kern County Superior Court. Any arbitrator selected by the parties shall have experience arbitrating groundwater disputes. The arbitration shall be called and conducted in accordance with such rules as the Parties shall agree upon, and in the absence of such agreement, in accordance with the procedures set forth in California Code of Civil Procedure section 1282, et seq. Notwithstanding the foregoing, in any arbitration the Parties agree that discovery will be allowed pursuant to Code of Civil Procedure section 1283.05. The Parties shall attempt to jointly appoint the neutral arbitrator within ten (10) days after a dispute arises, and in the event the Parties cannot agree to a neutral arbitrator within said ten-day period, either Party may make a request to the presiding judge of the Kern County Superior Court immediately thereafter. In the event a landowner submits a claim and the Joint Operations Committee cannot agree on the proper action in response, the arbitration requirement shall be contingent upon the landowner's express written consent to proceed and be bound by arbitration and to pay his/her/its proportionate share of arbitrator fees and related costs. Absent such landowner consent, there shall be no obligation on the part of either Party to arbitrate any such dispute.

d. With respect to the interpretation and enforcement of this Plan, and with respect to the resolution of any matter left for future determination or implementation, the Parties agree to carry out such duties and responsibilities in good faith and in cooperation with one another, to the end that the objectives and purposes of this agreement will be achieved and/or carried out to the greatest extent practicable.

APPROVED this ___ day of _____, 2017

"PARTIES"

KERN COUNTY WATER AGENCY, on behalf of itself and the Pioneer Project Recovery Participants

By:_____

KERN WATER BANK AUTHORITY

By:_____

ROSEDALE-RIO BRAVO WATER STORAGE DISTRICT

By:_____

Exhibit A

Joint Operations Committee
Well Cost Alternatives Worksheet

Date: October 13, 2015
Case No. 15-017
Name: Ross Johnson

A. Notes:

1. Pump was lowered in 2015.
2. Pump was pulled in October 2015 and found to be sanded up. (ME Beggs Invoice)
3. Bottom of well was tagged in October 2015 at 288 ft or 6 ft shallower than a year ago. (ME Beggs Invoice)
4. Casing is flaking off (ME Beggs Invoice)

B. Exhibit A Analysis:

i. Pump Capacity Analysis:

Required Pump Flow Rate (Estimated)					10 GPM
Measured Pump Flow Rate (Estimated)					0 GPM
Difference					10 GPM
Adequate Capacity	Yes		No	X	

ii. Pump Setting Analysis:

Depth of Casing:					288 Ft
Depth to Water (Static)					222 Ft
Depth to Pumping Water Level (Estimated)					231.5 Ft
Drawdown					9.5 Ft
Pump Setting					284 Ft
Pump Submergence					52.5 Ft
Adequate Submergence	Yes	X	No		
Projected static depth to water level (From Study)					250 Ft
Drawdown					9.5
Required Submergence					50
Projected 10 Year Casing Setting					175
Modified Pump Setting					485 Ft
Existing Casing Depth					288 Ft
Modified Pump Setting					485 Ft
15 feet minimum pump clearance					15 Ft
Required casing depth in ten years					500 Ft
Existing Casing Depth below Required Casing Depth					(212) Ft
Adequate Clearance	Yes		No	X	

C. Well Replacement Analysis

Well Replacement Depreciation Analysis:

Existing well casing - Expected Life	50 Years
Existing well casing - Age	38
Existing well casing - Expected Remaining Life (Casing has failed)	0
Existing pump -- Expected Life	15 Years
Existing pump - (Pump replaced in July 2015)	0
Existing pump - Expected Remaining Life	15

Note: In some cases, existing column, tube, shaft and motor should also be evaluated, or included with Existing pump.

Facility Remaining Replacement Cost Analysis:

	Cost	Cont. Amount	Total
Drilling and casing cost for new well.	90,000	9,000	$99,000
Purchase and installation of new pumping equipment.	5,000	500	$5,500
Salvage Value			$0
Total:			$104,500

Unit Well Replacement Cost	$99,000	/	500 FT =		$198 /FT
Existing Well - Replace Cost	$198	/FT x	288 FT =		57,024
Existing Well - Depreciated Value					57,024
Existing Well - Remaining Value					0
New Well - Incremental Cost	$198	/FT x	212 FT =		41,976
Action Fund Mitigation Cost					$41,976
Unit Pump Replacement Cost	$5,500	/	485 FT =		$11 /FT
Existing Pump - Replace Cost	$11	/FT x	284 FT =		3,224
Existing Pump - Depreciated Value					0
Existing Pump - Remaining Value					3,224
New Pump - Incremental Cost	$11	/FT x	201 FT =		2,276
Action Fund Mitigation Cost					$5,500

Facility Replacement Cost Summary:

Owner Cost for Facility Replacement	**$57,024**
Action Fund Cost for Facility Replacement	**$47,476**
Total Replacement Cost	**$104,500**

D. Cost Alternative Summary:

1) Cost to drill new well to a depth of 495 ft.	$99,000
2) Incremental cost to drill new well from 288 ft down to 495 ft.	$41,976
3) Drill New Well & Provide Pump (Full Cost)	$104,500

E. Action Fund Cost

Exhibit A - Incremental cost to drill new well from 288 ft down to 495 ft and lower pump from 284 ft to 485 ft.	**$47,476**

Appendix J

AGREEMENT BETWEEN
WEST KERN WATER DISTRICT AND KERN WATER BANK AUTHORITY
FOR THE EXCHANGE AND RECHARGE OF WATER

THIS AGREEMENT ("Agreement") is made and effective as of December 1, 2013, by and between WEST KERN WATER DISTRICT ("West Kern"), a County water district, and the KERN WATER BANK AUTHORITY ("KWBA"), a California joint powers authority. West Kern and KWBA will be collectively referred to in this Agreement as the "Parties."

RECITALS

A. West Kern and KWBA entered into the Agreement between West Kern Water District and Kern Water Bank Authority for the Annual Exchange and Recharge of Water (the "Exchange Agreement") as of September 30, 2003. The purpose of the Exchange Agreement was to establish a long-term agreement between West Kern and KWBA to exchange water supplies to help achieve and enhance their respective water management goals and programs. Paragraph 3.3.1 of the Exchange Agreement provides that West Kern may terminate the Exchange Agreement if the recharge provided by KWBA proves ineffective in meeting West Kern's operational needs in the West Kern Project and a mutually agreeable solution cannot be negotiated. The Parties have negotiated and wish to enter into this Agreement to augment and enhance the purposes of the Exchange Agreement to more effectively meet the Parties' operational needs on a long term basis.

B. West Kern and KWBA have, since 2002, from time to time implemented operating plans, the objectives of which were to (a) improve water security for both West Kern and KWBA, (b) protect water quality, and (c) monitor and mitigate potential threats to water supplies. Performance of those operating plans has resulted in information and knowledge that the Parties now wish to implement by way of this Agreement to accomplish the same objectives.

December 1, 2013

AGREEMENT

NOW, THEREFORE, the parties agree as follows:

1. DEFINITIONS

1.1 "Additional Recharge Water" means the water recharged by West Kern under this Agreement.

1.2 "CC&R's" means the Declaration of Covenants, Conditions and Restrictions dated December 14, 1995, recorded August 9, 1996 between KWBA and the Kern County Water Agency.

1.3 "Easement" means an easement in a form acceptable to Parties for the construction of one well site and one discharge pipeline in the area shown on the attached **Exhibit A**, including ingress to and egress from those facilities.

1.4 "Member Entities" means the member entities of KWBA.

1.5 "Recharge Capacity" means a first priority recharge capacity in the Kern Water Bank consisting of (a) 20,000 AF per calendar year in the West Kern Project Vicinity and (b) 11,000 AF per calendar year in the 'W' ponds of the Kern Water Bank, as those areas are identified on the attached **Exhibit A**.

1.6 "Recharge Fee" and "Recovery Fee" means the same operation, maintenance and capital rates that Member Entities pay to KWBA for their recharge of water upon or recovery of water from the KWBA project, which is currently less than 'fair compensation' under the CC&R's.

1.7 "Right of First Refusal" means a right of first refusal applicable to any proposal from a third party for (a) expansion of the capacity of the Kern Water Bank Canal

up to an additional 100 cfs, and/or (b) any long-term use of unused capacity for KWBA wells 21G1, 21D1, and 21A2.

1.8 "Resolved Operational Issues" means any operational issues, including claims, causes of actions and liabilities that either of the Parties might hold against the other, or its respective officers, directors, employees, legal representatives and agents, relating to any past, present and future groundwater and surface water impacts that the operation of either the West Kern Project or the West Kern North Project on the one hand, or the Kern Water Bank project on the other hand, may have had, is having, or will have in the future, on the other project. Resolved Operational Issues will not include, however, operational issues relating to groundwater and surface water impacts arising after termination of this Agreement.

1.9 "West Kern North Project" means the recharge and recovery project as defined in West Kern's Groundwater Banking Project Environmental Impact Report State Clearinghouse No. 2009071022, March 2010.

1.10 "West Kern Project" means the property owned by West Kern located in Township 30, Range 25, Sections 21, 22, 23 and 28, M.D.B. & M.

2. TERM

2.1 The term of this Agreement will commence on the date first above written and will terminate on December 31, 2035, unless terminated sooner by mutual agreement of the Parties or by operation of law. This Agreement shall extend thereafter from year to year unless by October 1, 2035, or October 1st of any year following, either party provides notice to the other of termination of this Agreement, in which event

this agreement shall terminate on December 31st of that year. This Agreement will survive any earlier termination of the Exchange Agreement.

2.2 Upon termination of this Agreement, West Kern shall within 60 days quitclaim the Easement to KWBA together with any well constructed on that site. West Kern may, however, remove any pumps, motors and equipment associated with that well prior to delivering the quitclaim Easement to KWBA. Additionally, the Parties shall within that 60 day period meet and confer in a good faith attempt to develop a new agreement to achieve the same purpose as this Agreement consistent with the conditions then existing. Upon termination, West Kern shall also quitclaim to KWBA any pipeline easement conveyed pursuant to section 4.2.

3. RECHARGE CAPACITY PROVIDED BY KWBA TO WEST KERN

3.1 KWBA shall provide the Recharge Capacity to West Kern. The right of West Kern to the Recharge Capacity is subject to all of the following:

3.1.1. West Kern is entitled to recharge water at any rate of flow up to 75 cfs. Any recharge rates above 75 cfs must be approved by KWBA.

3.1.2. KWBA may suspend West Kern's right to the Recharge Capacity at any time that unregulated or at-risk water supplies are available to Member Entities. In that event, the Recharge Capacity will be reduced by a proportionate amount for such times as those water supplies are available to Member Entities. For example, if high-flow Kern River flood water is available for three weeks, then the Recharge Capacity will be reduced to 18,846 AF [(49/52) x 20,000] and 10,365 AF [(49/52) x 11,000)] for that calendar year.

3.1.3. The Recharge Capacity is deemed a first priority exchange and/or program under sections 4.1 and 4.1.2 of the CC&R's.

3.2 KWBA may redirect the Additional Recharge Water to exchange programs without payment of compensation to West Kern.

3.3 The Recharge Capacity will be subject to (a) whatever additional or revised rules and policies governing recharge of water that apply to Member Entities, (b) applicable legal requirements and constraints, and (c) reasonable and customary terms and conditions as KWBA may require, including those that regulate the quality of water to be recharged.

3.4 West Kern shall pay to KWBA the Recharge Fee for any portion of the Recharge Capacity that West Kern elects to use.

4. CONVEYANCE OF WELL SITE TO WEST KERN AND USE OF KWBA WELL

4.1 KWBA shall convey the Easement to West Kern. KWBA reserves the right to review and approve the design of the well allowed under the Easement to ensure that the design is compatible with Kern Water Bank project operations. Conveyance of the Easement will be at no cost to West Kern.

4.2 Upon request by West Kern, KWBA shall convey to West Kern a first priority right to use Kern Water Bank Well T30S/R25E-21G, together with a pipeline easement to construct, operate, maintain, repair and replace a pipeline along a mutually agreeable alignment that is least costly to West Kern and least intrusive to KWBA, generally along the levee road that extends southeast from such Well to the West Kern Property. Following that conveyance, West Kern shall pay KWBA an annual charge of $20,000 for the use of the well so long as the well is operational. The

pipeline will be owned by West Kern and its construction, operation, maintenance, repair and replacement will be at no cost to KWBA. The well will be owned and operated by KWBA and its maintenance, repair and replacement will be at KWBA's discretion. West Kern shall pay to KWBA the Recovery Fee for use of this well.

4.3 Construction of the well and any future pipeline as provided in sections 4.1 and 4.2 will be mitigated under the provisions of the KWBA HCP. Such mitigation for disturbance on KWBA property shall be permanent and temporary for the well and temporary for any future pipeline.

5. RIGHTS OF FIRST REFUSAL FOR WEST KERN

KWBA hereby grants the Right of First Refusal to West Kern. Upon receipt by KWBA of a proposal that is otherwise acceptable to KWBA for expansion of the Kern Water Bank Canal or use of the wells identified in the Right of First Refusal, KWBA shall promptly notify West Kern of the proposal. West Kern will then have 45 days within which to notify KWBA if West Kern wishes to exercise the Right of First Refusal under substantially the same terms and conditions as that proposed by the third party to KWBA (including the time for completing the proposed transaction). If West Kern does not timely respond in the affirmative under substantially same terms and conditions, or does not timely consummate such transaction, that portion of the Right of First Refusal will terminate (although the other portions of the Right of First Refusal will continue if not already triggered).

6. RIGHTS NOT TRANSFERRABLE

West Kern may not transfer the Recharge Right, Easement, or Right of First Refusal.

7. ACKNOWLEDGMENT OF WEST KERN'S 3,000 AF PRESCRIPTIVE RIGHT

West Kern has entered into agreements with others that describe a right to annually pump 3,000 AF of groundwater. KWBA shall not contest or challenge those prescriptive rights.

8. USE OF WEST KERN'S UNUSED CVC CAPACITY BY KWBA

8.1 KWBA may use any and all of West Kern's capacity that West Kern is not using for West Kern's own uses at any point in time in the Cross Valley Canal in either a westward or eastward direction, including West Kern's rights to unused capacity of other Cross Valley Canal participants, as that capacity is available under the provisions of the "Agreement for the Assignment of Certain Rights and Obligations of the Kern County Water Agency in the Construction and Operation of the Cross Valley Canal Expansion Program," dated December 1, 2006.. West Kern's capacity in the Cross Valley Canal is currently 4.35 cfs in the eastward direction.

8.2 KWBA shall reimburse West Kern for the costs associated with KWBA's use of West Kern's capacity in the CVC and any incremental costs that West Kern incurs as a result of KWBA using that unused capacity. West Kern shall invoice KWBA for those costs. KWBA shall pay each invoice within 45 days of receipt.

9. COMPLETE AND FINAL COMPROMISE AND SETTLEMENT

This Agreement is a complete and final compromise between the Parties of the Resolved Operational Issues, and will be deemed to be satisfactory mitigation for any of the Resolved Operational Issues. This Agreement will not, however, constitute an admission by either of the Parties that its project has caused, is causing or may cause harm to the other entity or project, or of any wrong doing whatsoever. Except as provided in this Agreement, the Parties understand and agree that this Agreement is a full and final release of all claims, known or unknown, related to or

arising out of the Resolved Operational Issues. With respect to claims related to or arising out of the Resolved Operational Issues, the Parties expressly waive all rights or benefits available under section 1542 of the Civil Code of the State of California, which provides as follows:

> A general release does not extend to claims which the creditor does not know or suspect to exist in his or her favor at the time of executing the release, which if known to him or her must have materially affected his or her settlement with the debtor.

The Parties are executing this Agreement voluntarily, with full knowledge of its significance, and with the express intention of altering the legal consequences provided for in the provisions of Civil Code section 1542, regarding the extinguishing of all obligations and liabilities of the Parties, known or unknown, related to or arising out of the Resolved Operational Issues.

10. MISCELLANEOUS PROVISIONS

10.1 Effect of Headings. The subject headings of the paragraphs and subparagraphs of this Agreement are included for purposes of convenience only and shall not affect the construction or interpretation of any of its provisions.

10.2 Entire Agreement. This Agreement constitutes the entire agreement between the parties pertaining to the subject matter contained in it and supersedes all prior and contemporaneous agreements, representations, and understandings of the parties, except for the Exchange Agreement. No supplement, modification, or amendment of this Agreement shall be binding unless executed in writing by all of the parties hereto.

10.3 Counterparts and Facsimile Signatures. This Agreement may be executed in any number of counterparts and each such counterpart shall be deemed to be an original instrument, all of which together shall constitute one and the same instrument. Facsimile and electronic signature pages shall constitute originals.

10.4 Binding Effect. This Agreement shall be binding upon and inure to the benefit of the heirs, executors, administrators, assigns, and successors of the parties hereto.

10.5 Professionals' Fees. Should any action or proceeding be commenced between the parties hereto concerning this Agreement, or the rights and duties of any party in relation thereto, the party prevailing in such action or proceeding shall be entitled, in addition to such other relief as may be granted, to recover from the losing party a reasonable sum for its attorneys', paralegals', accountants', and other professional fees and costs incurred in connection with such action or proceeding.

10.6 Governing Law. This Agreement shall be governed by the laws of the State of California. Venue for any action arising hereunder shall be in Kern County, California.

10.7 Notices. All notices under this Agreement shall be effective (i) when personally delivered to either Party, (ii) when sent by facsimile or email on a business day between the hours of 8 a.m. and 5 p.m. Pacific time (with written confirmation of transmission) to either Party, at the numbers set forth below, provided that a copy is mailed as indicated below, or (iii) three business days after deposit in the United States mail, registered or certified, postage fully prepaid and addressed to the respective parties as follows:

To KWBA: Kern Water Bank Authority
1620 Mill Rock Way, Suite 500
Bakersfield, CA 93311

To West Kern: West Kern Water District
800 Kern Street
Taft, CA 93268-1105

or such other address, facsimile number or email addresses as the parties may from time to time designate in writing.

10.8 Severability. If any provision of this Agreement is declared invalid, illegal or unenforceable, such provision shall be deemed reformed so as to valid, legal and enforceable to the maximum extent permitted by law, and the balance of this Agreement shall remain in full force and effect notwithstanding such invalidity, illegality or unenforceability.

10.9 Cumulative Rights; Waiver. No failure by either party to exercise, and no delay in exercising any rights, shall be construed or deemed to be a waiver thereof, nor shall any single or partial exercise by either party preclude any other or future exercise thereof or the exercise of any other right. Any waiver of any provision or of any breach of any provision of this Agreement must be in writing, and any waiver by either party of any breach of any provision of this Agreement shall not operate as or be construed to be a waiver of any other breach of that provision or of any breach of any other provision of this Agreement.

10.10 Further Action. The parties agree to perform all further acts, and to execute, acknowledge, and deliver any documents that may be reasonably necessary, appropriate or desirable to carry out the purposes of this Agreement.

10.11 Ambiguities. This Agreement shall not be construed against any party in the event of an ambiguity. The transactions contemplated herein have been negotiated at arms-length, between persons sophisticated and knowledgeable in the matters dealt with in this Agreement. In addition, each party has been advised by legal counsel. Accordingly, any rule of law or legal decision that requires interpretation of ambiguities against the party who has drafted it is inapplicable and waived. The provisions of this Agreement shall be interpreted in a reasonable manner to effectuate the intent and purposes of the parties to this Agreement as if they had been jointly drafted by the parties.

10.12 Authority. The signatories represent and warrant that they have been duly authorized by their respective governing boards to enter into this Agreement on behalf of the party for which they sign.

10.13 Opinions and Determinations. Where the terms of this Agreement provide for action to be based upon the opinion, judgment, approval, review or determination of either of the Parties, those terms are not intended to allow and may not be construed as allowing that opinion, judgment, approval, review or determination to be arbitrary, capricious or unreasonable.

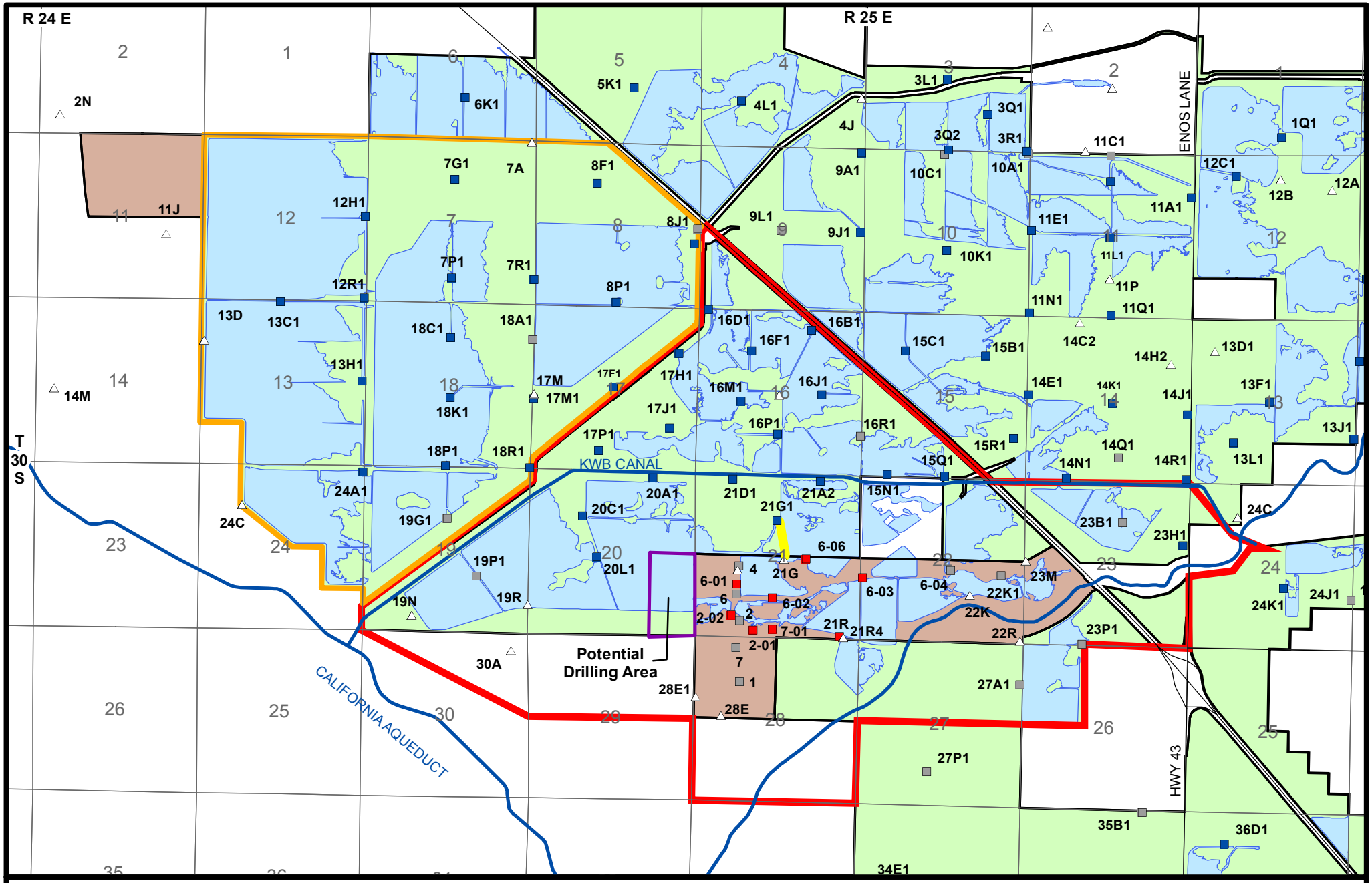
KERN WATER BANK AUTHORITY

By _____
William D. Phillimore,
Chairman of the Board

WEST KERN WATER DISTRICT

By _____
David Wells, President

By _____
Secretary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HWY 43
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Potential Drilling Area
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11J
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3R1
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7G1
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8F1
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8J1
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18C1
18A1
16D1
16B1
16F1
15C1
15B1
14C2
14H2
13D1
13H1
17M
17F1
17H1
16M1
16J1
14E1
14K1
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13F1
18K1
17M1
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14Q1
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13L1
24A1
20A1
21D1
21A2
15N1
20C1
21G1
23B1
23H1
19G1
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19P1
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21G
23M
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6-04
22K1
19N
19R
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6-02
22K
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7-01
21R
21R4
22R
23P1
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Well 21G1 PL Easement
W Ponds
West Kern Project Vicinity
Potential Drilling Area
West Kern WD
Kern Water Bank
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0.5 Mi.
KERN WATER BANK AUTHORITY

Exhibit A

Appendix K

FINAL DRAFT

KERN GROUNDWATER AUTHORITY FOR THE TULARE LAKE BASIN PORTIONS OF KERN COUNTY AMENDED AND RESTATED JOINT POWERS AGREEMENT

THIS AMENDED AND RESTATED AGREEMENT ("Agreement") is made and effective as of_____, 2016, pursuant to the Joint Exercise of Powers Act (Government Code Sections 6500, *et seq.*) by and between the public agencies listed on the attached Exhibit A.

This Agreement is made with reference to the following facts and understandings.

A. Each of the parties to this Agreement (the "Members") provides water service to landowners and/or residents and/or provides water to retail water entities within its respective service area and the County of Kern has various oversight and active roles relative to water resources within the County, including, but not limited to, flood control, police powers, and water service.

B. Pursuant to a Joint Powers Agreement dated as of May 27, 2014 (the "Original Agreement"), the Kern Groundwater Authority (the "Authority") was created to carry out the purposes of Part 2.75 of Division 6 (commencing at Section 10750 of the California Water Code) and develop, adopt and implement a groundwater management plan that would be available to those lands within the boundaries of the Authority's members and within the Tulare Lake Groundwater Basin.

C. On August 29, 2014, the California Legislature passed comprehensive groundwater legislation contained in SB 1168, SB 1319 and AB 1739. Collectively, those bills, as subsequently amended, enacted the "Sustainable Groundwater Management Act" ("SGMA"). Governor Brown signed the legislation on September 16, 2014 and it became effective on January 1, 2015. In adopting SGMA, the Legislature intended "[t]o provide local groundwater agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater." (California Water Code Section 10720(d).)

D. SGMA anticipates that each affected groundwater basin or subbasin will be regulated separately by one or more Groundwater Sustainable Agencies (each, a "GSA"). A local agency or combination of local agencies may elect to be the GSA for a basin or sub-basin. SGMA generally provides that a combination of local agencies may form a GSA through a joint powers agreement, memorandum of understanding or other legal agreement. (California Water Code Section 10723.6)

E. Groundwater sustainability under SGMA is to be achieved through Groundwater Sustainability Plans ("GSPs"). Under SGMA, a GSP can be a single plan developed by one or more GSAs, or multiple coordinated plans within a basin or subbasin by multiple GSAs (California Water Code Section 10727).

F. The Members, individually and collectively, have the goal of cost-effective, sustainable groundwater management in the Kern County Subbasin that considers the interests and concerns of the Members and other stakeholders.

G. As used in this Agreement "Kern County Subbasin" means such basin as defined in Department of Water Resources Bulletin 118, as its boundaries may be modified from time to time through the procedures described in California Water Code Section 10722.2.

H. The intent of the Members under this Agreement is to provide each Member with the sole right and responsibility to implement SGMA within its respective boundaries and/or Management Areas, as defined herein, in a manner determined by the Member, whether through the Authority or as a GSA. To facilitate coordination within the Kern County Subbasin, the Members desire for the Authority to have the authority to serve as a GSA for some or all of the Members within the Kern County Subbasin in a manner that allows the Members (individually or collectively) to directly implement SGMA and a GSP within their respective Management Areas as defined herein, while the Authority serves primarily a coordinating and administrative role in order to provide for sustainable groundwater management through the subbasin. The Members expressly intend that the Authority will not have the authority to limit or interfere with the respective Members' rights and authorities over their own internal matters, including, but not limited to, a Member's surface water supplies, groundwater supplies, facilities, operations, water management, and Water Supply Matters, as defined herein. Nothing in this Agreement is intended to modify or limit Members' police powers.

I. The Members expressly intend that neither SGMA, nor this Agreement, nor any GSP adopted by the Authority shall be construed as authorizing the Authority, or any dispute resolution process contained herein, to:

(i) determine or alter surface water rights or groundwater rights (California Water Code Section 10720.5 (b));

(ii) make binding determinations of the water rights of any person or entity (California Water Code Section 10726.8 (b)); or

(iii) supersede the existing land use authority of cities or counties, including the city or county general plan, within the overlying basin (California Water Code Section 10726.8 (f)).

J. In light of the enactment of SGMA together with the goals and intent described above, the Members wish to amend and restate the Original Agreement in its entirety as provided herein.

THEREFORE, in consideration of the mutual promises, covenants and conditions herein set forth, it is agreed by and among the Members that the Original Agreement is hereby amended and restated to read in its entirety as follows:

Article I: Definitions

As used in this Agreement, unless the context requires otherwise, the meaning of the terms hereinafter set forth shall be as follows:

(a) "Associate Members" shall mean those Members of the Authority admitted in accordance with the terms and provisions of this Agreement that are not General Members. The Board of Directors may from time to time admit Associate Members on terms and conditions

consistent with SGMA and as determined by the Board. Representatives of Associate Members may not serve on the Board and/or Board Committees. Likewise, while the Board of Directors welcomes their input, the representatives of Associate Members shall be non-voting, their presence shall not be counted in determining whether a quorum is present, and they shall not be permitted in closed sessions of the Board of Directors.

(b) "Authority" shall mean the Kern Groundwater Authority, being the separate entity created pursuant to the provisions of Government Code sections 6500 *et seq*. by this Agreement.

(c) "Board of Directors" or "Board" shall mean the governing body of the Authority as established by Section 3.01 of this Agreement.

(d) "Committee" shall mean any committee established pursuant to Section 3.03 of this Agreement.

(e) "Fiscal Year" shall mean that period of 12 months established as the Fiscal Year of the Authority pursuant to Section 4.01 of this Agreement.

(f) "General Members" shall mean those Members of the Authority more particularly identified as General Members on Exhibit A, and any parties which shall hereafter become General Members in accordance with the terms and provisions of this Agreement. A local agency as defined by SGMA may participate as a General Member on its own behalf or join with one or more agencies as a single General Member. Multiple agencies which elect to coordinate their representation as one General Member shall, for purposes of this Agreement, be treated as one General Member.

(g) "GSA" shall mean Groundwater Sustainability Agency as defined in SGMA.

(h) "GSA Notice Date" shall mean March 1, 2017.

(i) "Kern County Subbasin" means the groundwater subbasin described in Recital G of this Agreement.

(j) "GSP" shall mean Groundwater Sustainability Plan as defined in SGMA.

(k) "Management Area" shall mean the area within the boundaries of a Member or group of Members to be managed by that Member or group of Members under any GSP adopted by the Authority.

(l) "Members" shall mean the General Members and Associate Members.

(m) "SGMA" shall mean the Sustainable Groundwater Management Act.

(n) "Special Activities" shall mean activities that are consistent with the purpose of this Agreement, but which are undertaken by fewer than all the Members in the name of the Authority pursuant to Section 3.07.

(o) "Water Supply Matters" shall mean a Member's surface water supplies, groundwater supplies, facilities, operations, water management, water supply projects and financial affairs.

Article II: Creation of Authority

Section 2.01 – Creation.

The Members hereby reaffirm that, pursuant to their joint exercise of powers under the provisions of Government Code sections 6500 *et seq.*, they have created a public entity to be known as the "Kern Groundwater Authority."

Section 2.02 – Term.

This Agreement is an amendment of the Original Agreement and shall therefore become effective, including without limitation on General Members not executing it, upon its execution by at least 75% of the General Members and will remain in effect until terminated by agreement of a majority of then participating General Members. Notwithstanding the above, once the Authority has adopted and approved a GSP for some or all of the Kern County Subbasin, this Agreement shall not be terminated except by agreement of 75% of the General Members (as described in Section 3.05 below). Unless it is terminated, this Agreement shall remain in effect and be binding upon the Members and upon all future Members for such a period as the Authority engages in any activities under this Agreement, except as to any party which withdraws or is terminated from its participation in the Authority in accordance with this Agreement. This Agreement shall supersede the Original Agreement and the Interim Funding Agreement effective 2013. Any monies collected pursuant to the Interim Funding Agreement which have not been expended as of the date of this Agreement shall be credited towards each Member's financial commitment as identified herein.

Section 2.03 – Purpose.

(a) The purposes of this Agreement are to:

(i) provide for the joint exercise of powers common to each of the Members and powers granted pursuant to SGMA (subject to the restrictions contained in this Agreement), through the Authority, to cooperatively carry out the purposes of SGMA and develop, adopt and implement a legally sufficient GSP covering those portions of the Kern County Subbasin that are within the jurisdictional boundaries of the Members, subject to the limitations set forth herein; and

(ii) provide a mechanism for the coordination of groundwater management activities by and among the Members, in accordance with SGMA.

(b) Each of the General Members (or group of General Members) shall have the sole and absolute right, in its sole discretion, to:

(i) become a GSA individually or collectively within the General Member's boundaries or the Management Area managed in whole or in part by such General Member;

(ii) approve the portion, section or chapter of the GSP adopted by the Authority as applicable within the General Member's boundaries or the Management Area managed in whole or in part by such General Member, as provided for in Section 7.01 of this Agreement; and

(iii) implement SGMA and the GSP adopted by the Authority within the General Member's boundaries or the Management Area managed in whole or in part by such General Member.

(c) Except to the extent requested by a General Member with respect to the lands within its boundaries, the Authority shall serve primarily a coordinating and administrative role in order to provide for sustainable groundwater management of the Kern County Subbasin in a manner that does not limit any Member's rights or authority over its own water supply matters, including, but not limited to, a Member's Water Supply Matters. Subject to the provisions, limitations and restrictions contained in this Agreement, activities unrelated to coordinating and administrative tasks necessary for groundwater management and sustainability shall not be undertaken by the Authority.

(d) Notwithstanding any other provision of this Agreement, the Authority shall not seek status as a GSA or approve a GSP prior to the GSA Notice Date.

(e) Not later than the GSA Notice Date, or such later date as determined by the Board of Directors, each Member shall provide the Authority with written notice that such Member will:

(i) continue as a Member and request the Authority to act as the GSA within such Member's boundaries or for the Management Area managed in whole or in part by such Member pursuant to a separate agreement between the Authority and the Member setting forth the terms and conditions of the Authority's role as the GSA within such Member's boundaries or for the Management Area managed in whole or in part by such Member;

(ii) continue as a Member and confirm that it will implement the GSP adopted by the Authority within such Member's boundaries or for the Management Area managed in whole or in part by such Member continue as a Member;

(iii) continue as a Member but seek GSA status within its boundaries or within the Management Area managed in whole or in part by such Member in order to implement SGMA and the GSP adopted by the Authority therein; or

(iv) seek GSA status within its boundaries or within the Management Area managed in whole or in part by such Member and adopt its own GSP, in which case such Member shall be deemed to have withdrawn from the Authority pursuant to Article VI but will endeavor in good faith to develop and execute a coordination agreement with the Authority in accordance with SGMA. Such Member may still be eligible to become an Associate Member pursuant to Section 6.02 (a).

The County of Kern may form a separate GSA or be part of a GSA for areas not within the boundaries of other Members and also be a GSA or participate in a GSA formed pursuant to this Agreement.

Section 2.04 – Powers.

(a) Subject to the limitations and restrictions contained within this Agreement, the Authority shall have the power to take any action, for the benefit of its Members, to carry out the purposes of this Agreement, including, but not limited to, applying for loans and grants, becoming a GSA for any or all of the Kern County Subbasin except the portions thereof for which Members become the GSA, and developing, adopting and implementing a GSP, subject to the paramount right of Members to become GSAs as specified in Section 2.03. The Authority shall have the power to sue and be sued. Notwithstanding the foregoing, the Authority shall not have the power to control, limit or empower a Member's rights and authorities over its own Water Supply Matters. Likewise, unless a Member requests it, the Authority shall have no power to interfere with (i) the Member's rights, use or management of the Member's water or water supply or (ii) the rights of individual landowners within the Member's boundaries to utilize, apply, store, or otherwise use surface or groundwater. Subject to the limitations and restrictions contained in this Agreement, the Authority is authorized, in its own name, to do all acts necessary for the exercise of said powers provided that said acts are duly adopted by the then seated Board of Directors and are consistent with this Agreement. Except as provided in Section 4.05, the Authority may not levy assessments on its Members. In accordance with California Government Code Section 6509, the foregoing powers shall be subject to the restrictions upon the manner of exercising such powers pertaining to the Cawelo Water District.

(b) Notwithstanding anything to the contrary in this Agreement, the Authority shall not (i) undertake any activities within any Member's boundaries, or within a Management Area managed in whole or in part by such Member, unless the Member formally and expressly requests, consents to and agrees, in writing, to the activity proposed in accordance with Section 7.4 or (ii) acquire or seek to acquire by eminent domain any property of a Member. Nothing in this Agreement shall modify or limit the police powers of Members, if any.

Article III: Internal Organization

Section 3.01 – Governing Body.

(a) The Authority shall be governed by a Board of Directors which is hereby established and which shall be initially composed of representatives of the General Members, as shown on Exhibit A. Without amending this Agreement, the Board of Directors composition shall be altered from time to time to reflect the termination and/or admission of any new General Members.

(b) Each General Member's governing board shall select a representative from its governing body or the governing body of one of the agencies within the General Member to serve as their Board member. A General Member may designate from its governing body or the governing body of one of the agencies within the General Member to serve as its alternative Director. The role of each alternate Director shall be to assume the duties of the Director appointed by his/her Member entity in case of the absence or unavailability of such Director, including without limitation such Director's duties as a member of any Committee established pursuant to Section 3.03. The Directors and alternates so named shall continue to serve until their respective successors are appointed.

(c) Nothing in this Agreement shall preclude a future amendment of this Agreement to reconfigure the Board of Directors into a smaller body comprised of representatives of General Members or other individuals, all as defined in such amendment.

Section 3.02 – Officers.

The Board shall select a Chair from among the Board of Directors who shall be the presiding officer of the Board meetings. The Board shall select a Vice Chair from among the Board of Directors who shall serve as the presiding officer in the absence of the Chair. The Board shall also select a Secretary, who need not be a member of the Board of Directors. The terms of such Officers shall be established by the Board of Directors from time to time and as necessary.

Section 3.03 – Committees.

There shall be established such Committees as the Board of Directors shall determine from time to time. Each such Committee shall be comprised of representatives of General Members, shall exist for the term specified in the action establishing the Committee, shall meet as directed by the Board of Directors, and shall make recommendations to the Board of Directors on the various activities of the Authority. The Board of Directors may delegate authority to the Committee to administer and implement the various activities of the Authority, subject at all times to the limitations on the Authority set forth in this Agreement; provided, that no power to enforce any aspect of SGMA or the GSP adopted by the Authority shall be delegated to a Committee.

Members shall be give reasonable advance notice of all Committee meetings, including without limitation ad hoc Committee meetings, all of which meetings shall be open to Members and their representatives.

Section 3.04 – Seal; Bylaws.

The Board may (but need not) adopt an official seal for the Authority and adopt such bylaws as it may deem necessary to regulate the affairs of the Authority in accordance with this Agreement. The bylaws may be amended from time to time by a majority vote of the Board of Directors as it may deem necessary.

Section 3.05 – Voting; Quorum.

(a) Subject to Section 3.05(c), each member of the Board of Directors shall be entitled to a vote determined as follows:

(i) Each member of the Board shall have one (1) vote on matters with respect to which such member is entitled to vote.

(ii) Voting on actions related to Special Activities shall be weighted as determined by each Special Activity agreement.

(b) Directors holding two-thirds of the voting power on the entire Board of Directors on a matter shall constitute a quorum for the transaction of Authority business. Any Board member abstaining from a vote shall be counted for purposes of determining the existence of a quorum, but shall not be deemed to be voting.

(c) A Director (including a Director serving as a member of a Committee) shall be entitled to vote on any matter or action (i) that would affect the General Member represented by such Director, (ii) relating to the general business or administration of the Authority, or (iii) that would impact any land or landowners within the boundaries of the General Member represented by such Director or the Management Area managed in whole or in part by such General Member.

(d) Examples of matters and actions on which a Director shall be entitled to vote include without limitation matters or actions relating to the implementation of SGMA within the boundaries of the General Member represented by such Director, amounts to be paid by the General Member represented by such Director to the Authority, the imposition of fees or charges within the boundaries of the General Member represented by such Director, the adoption or amendment of the Authority's GSP.

(e) In the event of a disagreement as to whether a Director is entitled to vote on a matter or action coming before the Board or a Committee, such Director shall be entitled to vote on the matter or action unless 75% of the Directors present at the meeting determine that such Director is not so entitled.

(f) Except as otherwise provided in this Agreement, any action by the Board of Directors shall require a two-thirds vote of the Directors entitled to vote thereon that are present at the meeting. Any amendment of this Agreement shall be governed by Section 8.01.

(g) Two-thirds of the members of a Committee entitled to vote thereon shall constitute a quorum for a matter or action before the Committee. All questions and matters of any nature whatsoever coming before any Committee shall be determined, provided a quorum is present, by the concurrence of 75% of the members of such Committee entitled to vote thereon present and voting on such matter. Any Committee member entitled to vote thereon abstaining from a vote shall be counted for purposes of determining the existence of a quorum, but shall not be deemed to be voting.

(h) This Section 3.05 shall not apply to matters affecting implementation of SGMA within a particular Management Area. Such matters shall be governed by the Member or

Members implementing SGMA within that Management Area, except to the extent otherwise agreed upon by such Member(s) pursuant to 2.04(b) or in a Special Activity agreement.

Section 3.06 – Meetings.

Meetings of the Board of Directors and any Committee (to the extent applicable) shall be conducted in accordance with the Ralph M. Brown Act, California Government Code Sections 54950, *et seq.*

Section 3.07 - Special Activities.

With the prior approval of the entire Board of Directors, Members may undertake Special Activities in the name of the Authority. All Members shall be given the opportunity to participate in each Special Activity of the Authority unless the Special Activity is an action described in Section 7.04. Prior to undertaking a Special Activity, the Members electing to participate in the Special Activity shall enter into an activity agreement. Such activity agreement shall provide that (i) no Special Activity undertaken pursuant to such agreement shall conflict with the terms of this Agreement and (ii) the Members to the activity agreement shall indemnify, defend and hold the Authority, and the Authority's other Members, harmless from and against any liabilities, costs or expenses of any kind arising as a result of the Special Activity described in the activity agreement. All assets, rights, benefits, debts, liabilities and obligations attributable to a Special Activity shall be assets, rights, benefits debts, liabilities and obligations solely of the Members that have entered into the activity agreement for that Special Activity, in accordance with the terms of the activity agreement, and shall not be the assets, rights, benefits, debts, liabilities and obligations of those Members that have not executed the activity agreement. Members not electing to participate in the Special Activity shall have no rights, benefits, debts, liabilities or obligations attributable to such Special Activity.

Article IV: Financial Provisions

Section 4.01 – Fiscal Year.

The Fiscal Year of the Authority shall be from January 1 through December 31 of each year.

Section 4.02 – Funds; Accounts.

(a) The North Kern Water Storage District shall serve as the Fiscal Agent and Treasurer for the Authority unless otherwise determined by the entire Board. The Fiscal Agent shall be responsible for all money of the Authority from whatever source. The Board may compensate the fiscal agent for services rendered.

(b) All funds of the Authority shall be strictly and separately accounted for and regular reports shall be rendered of all receipts and disbursements at least quarterly during the Fiscal Year. The books and records of the Authority shall be open to inspection by the Members.

(c) The Authority shall contract with a certified public accountant to make an audit or review of the accounts and records of the Authority which shall be conducted in compliance with Section 6505 of the California Government Code. The Fiscal Agent shall have the right to reject

any proposed certified public accountant. All costs associated with this Audit will be the full responsibility of the Authority.

Section 4.03 – Property; Bonds.

The Board of Directors shall from time to time designate the officers and persons, in addition to those specified in Section 4.02 above, who shall have charge of, handle, or have access to any property of the Authority. Each such officer and person shall file a bond in an amount designated by the Board of Directors.

Section 4.04 – Budget.

By a date set by the Board of Directors each Fiscal Year, the Board of Directors shall adopt a budget for the Authority for the ensuing Fiscal Year; provided, that except as provided in Section 4.05, the Authority shall not impose assessments or other charges on Members. Notwithstanding the foregoing, by its execution of this Agreement, each Member confirms that it has authorized its Director and Alternate Director to approve actions and expenditures by the Authority over and above the approved annual budget of the Authority for a Fiscal Year that do not create a fiscal obligation greater than $5,000 on such Member without further action of such Member.

Section 4.05 – Payments To The Authority.

(a) Except as otherwise provided, all fees, costs and expenses incurred by the Authority for general administrative services, such as legal, preparation of audits, and other general administrative functions shall be funded (i) from permissible contributions from third parties and (ii) assessments on the General Members, levied from time to time by the Board of Directors to carry out the activities of the Authority generally applicable to all General Members, which shall be equal per General Member, as initially shown on Exhibit A.

(b) No Member shall be bound, financially or otherwise, by any obligation, contract or activity undertaken by the Authority unless and except to the extent agreed upon by the Member, except that each Member shall be obligated to fund its then current annual share of the general basic budget of the Authority, provided such budgets are otherwise approved as provided herein. Funding of other matters shall be through Special Activity agreements or as otherwise agreed to by the Members in writing.

Section 4.06 – GSP Fees.

The Authority may impose reasonable fees, charges, assessments and other levies to implement its GSP and/or SGMA; provided, that the Authority shall have no authority to impose any such fees, charges, assessments or other levies on any of its Members or within a Management Area without the express consent and approval of the affected Member(s), or the Member or Member implementing the Authority's GSP and SGMA within such Management Area.

Article V: Management

Section 5.01 – Management.

In addition to, or in lieu of, hiring employees, the Authority may engage one or more General Member(s) or third party(ies) to manage any or all of the business of the Authority on terms and conditions acceptable to the Board of Directors. Any General Member or third party so engaged shall have such responsibilities as are set forth in the contract for such General Member's or third party's services.

Article VI: Relationship of Authority And Its Members

Section 6.01 – Separate Entity; Property.

In accordance with California Government Code Sections 6506 and 6507, the Authority shall be a public entity separate and apart from the parties to this Agreement. Unless, and to the extent otherwise agreed herein, the debts, liabilities and obligations of the Authority shall not be debts, liabilities or obligations of the Member entities. The Authority shall own and hold title to all funds, property and works acquired by it during the term of this Agreement.

Section 6.02 – Admission, Withdrawal and Termination of Members.

(a) Additional qualified parties may join in this Agreement and become General Members upon the approval of the entire Board of Directors, subject to terms and conditions as may be established by the Board of Directors. Associate Members may be admitted on terms and conditions established by the entire Board of Directors. Prior to being admitted as a new Member, an entity shall execute an agreement to be bound by the terms of this Agreement and any other terms and conditions established by the Board of Directors.

(b) Notwithstanding anything herein to the contrary, any Member may withdraw from this Agreement by giving 30 days written notice of its election to do so, which notice shall be given to the Board of Directors and to each of the other parties.

(c) Upon withdrawal, the Member shall not be relieved of all obligations for assessments to pay costs or liabilities of the Authority which were incurred prior to the date of the withdrawing Member's notice of withdrawal, but shall remain responsible for all obligations for assessments to pay costs or liabilities of the Authority which were incurred prior to the date of the withdrawing Member's notice of withdrawal.

(d) Subject to any contrary provisions of SGMA, a Member may be terminated by a three-fourths vote of the Directors representing Members not subject to the termination vote if such Member is then in breach of this Agreement and the breach is identified in the vote of the Board of Directors. Upon termination, the breaching Member shall no longer be a Member of the Authority; provided, that such termination shall become effective no earlier than 90 days after such vote of the Board of Directors and shall only be effective if the breach identified in the vote of the Board of Directors has not be cured by the effective date for the termination.

(e) Upon termination, the Member shall be entitled to a reimbursement for all assessments collected within 12 months prior to the termination vote and they shall be relieved

of all ongoing obligations for assessments to pay costs or liabilities of the Authority which were incurred prior to the date of the termination.

(f) Upon withdrawal or termination as a Member, the provisions of Section 2.04(b) shall remain applicable to any such withdrawing or terminated Member. The withdrawing or terminated Member will also be entitled to copies of all documents, information, and material developed by the Authority and paid for in whole or in part by the Member prior to the Member's withdrawal or termination.

(g) Upon withdrawal or termination as a Member, whether occurring before or after the GSA Notice Date and/or the date the Authority becomes a GSA as provided for in SGMA, or whether occurring before or after June 30, 2017, it is contemplated the withdrawing or terminated Member would concurrently become (or designate) a GSA for the lands within its boundaries (or a Management Area managed in whole or in part by such Member), so that such lands of the withdrawing or terminated Member would continue to be subject to a GSA and if applicable a GSP and the powers of such withdrawing Member within its boundaries would not be limited by this Agreement. In such event the Authority and its remaining Members shall (i) not object to or interfere with the lands in the withdrawing or terminated Member's boundaries (or a Management Area managed in whole or in part by such Member) being in a GSA, as designated by such withdrawing or terminated Member, (ii) facilitate such transition to the extent reasonably necessary, and (iii) in cooperation with the withdrawing or terminated Member, withdraw from managing the Kern County Subbasin as a GSA (if it has already elected to be a GSA) for that portion of the Basin within the boundaries of the withdrawing or terminated Member and so notify the Department of Water Resources..

Section 6.03 – Disposition Of Property Upon Termination Or Determination By Board Of Directors Of Surplus.

(a) Upon termination of this Agreement or upon determination by the Board of Directors that any surplus money is on hand, such surplus money shall be returned to the Members of the Authority. The distribution of said surplus shall be proportionate to the current year percentages as shown in Exhibit A, or as modified after the inclusion of new Members.

(b) The Board of Directors shall first offer any surplus properties, works, rights and interests of the Authority for sale to the Members and the sale shall be at the Authority's actual cost unless otherwise required by law. If no such sale is consummated, then the Board of Directors shall offer the surplus properties, works, rights and interests of the Authority for sale in accordance with applicable law to any governmental agency, private entity or persons for good and adequate consideration.

Section 6.04 –Liability For Debts.

The Members do not intend hereby to be obligated either jointly or severally for the debts, liabilities or obligations of the Authority, except as may be specifically provided for in California Government Code Section 895.2 as amended or supplemented. Provided, however, if any General Member(s) of the Authority are, under such applicable law, held liable for the acts or omissions of the Authority caused by negligent or wrongful act or omission occurring in the performance of this Agreement, such parties shall be entitled to contribution from the other Members so that after said contributions each General Member shall bear an equal share of such liability, as shown on the then-current Exhibit A. This Section 6.04 does not apply to acts or omissions of a Member in implementing the GSP adopted by the Authority within such

Member's boundaries or a Management Area managed in whole or in part by such Member.

Section 6.05 – SGMA-Related Expenses Incurred by Members.

Expenses incurred by a Member, or group of Members, for the implementation of the SGMA within a Management Area shall be borne solely by that Member or group of Members. Neither the Authority nor its other Members shall be liable for such expenses.

Article VII – Implementation of SGMA

Section 7.01 – Development of GSP.

Any Member or group of Members may create its or their own chapter or provisions governing SGMA implementation within their respective boundaries or a Management Area managed in whole or in part by such Member(s) for inclusion by the Authority into the Authority's GSP. The Authority shall promptly review the proposed chapter or provisions for consistency with the Authority's GSP and to determine that it meets the requirements of SGMA. If the Authority determines by a vote of 75% of the Directors that a Member's proposed chapter or provisions is/are consistent with SGMA and the Authority's GSP, it shall incorporate such chapter or provisions into the Authority's GSP. Such chapter or provisions may include operating conditions and criteria for groundwater banking projects that have previously been negotiated with other Members or agencies within the Basin and/or are contained within approved environmental documents, and in reviewing a Member's chapter the Authority shall not reject or fail to approve a Member's chapter based solely upon such operating conditions and criteria. The Authority shall not adopt a GSP that will be implemented within any Member's boundaries or Management Area without the prior approval of the Member.

Section 7.02 – Authorization to Carry Out the Terms of the GSP.

The Authority is authorized to carry out any of the following powers for the benefit of its Members that are included in the GSP adopted by the Authority without any further approval of the Board of Directors, subject at all times to the limitations and restrictions contained within this Agreement:

(a) Collection and maintenance of water extraction information and other technical data.

(b) Coordination of actions within, and reporting by, a Management Area.

(c) Carrying out studies and other technical investigations.

(d) Establishment and administration of conjunctive use and land fallowing programs.

(e) Requiring permitting of water extraction facilities.

(f) Requiring installation of meters.

(g) Buy, sell, exchange, recharge, and/or store water if the benefits thereof are made available to all General Members.

(h) Fix and collect rates for replenishment and other activities as a regulatory or service fee provided for at Water Code Sections 10730 through 10731.

Section 7.03 – Actions Requiring Additional Approval.

Subject to the limitations of this Agreement, the Authority shall not do any of the following without the approval of 75% of the voting power of the Board of Directors:

(a) Restrict or otherwise limit extraction of native groundwater other than through economic incentives and disincentives.

(b) Fund capital construction projects.

Notwithstanding any other provision of this Agreement, the Authority shall not restrict or otherwise limit the extraction of water stored (whether through direct recharge or in lieu deliveries) in the Kern County Subbasin as a part of any banking or recharge project or program, or otherwise seek to regulate the operation any such project or program.

Section 7.04 – Management Areas.

Any General Member (or group of General Members) may request that the Authority directly assume the responsibility of implementing SGMA and the Authority's GSP within its Management Area by giving written notice to the Authority, which notice may be given at any time. Where the service areas of multiple Members overlap a Management Area, the Members within the Management Area shall unanimously join the request. The Board of Directors shall take action to accept or reject such request. If the Authority accepts such request, the Authority and the requesting General Member(s) shall develop a mutually acceptable agreement describing the respective roles and responsibilities of the Authority and the requesting General Member(s) with respect to such implementation.

Except as otherwise expressly provided, the Authority's role within a Management Area, unless otherwise unanimously requested by the Member(s) managing such Management Area, shall be primarily coordinating and administrative. In particular, the roles and responsibilities for implementing SGMA and the GSP within a Management Area shall be the subject of a Special Activity agreement between the Member(s) and the Authority.

Article VIII: Miscellaneous Provisions

Section 8.01 – Amendment.

This Agreement may be amended from time to time by the concurrence of 75% of the General Members. To provide non-concurring parties an opportunity to withdraw from the Authority as provided herein, an amendment shall be binding on all parties 60 days after the required concurrence has been obtained.

Section 8.02 – Severability And Validity Of Agreement.

Should the participation of any party to this Agreement, or any part, term or provision of this Agreement be decided by a courts or the Legislature to be illegal, in excess of that party's authority, in conflict with any law of the State of California, or otherwise rendered unenforceable or ineffectual, the validity of the remaining portions, terms or provisions of this Agreement shall

not be affected thereby and each party hereby agrees it would have entered into this Agreement upon the remaining terms and provisions.

Section 8.03 – Assignment.

Except as otherwise provided in this Agreement, the rights and duties of the parties to this Agreement may not be assigned or delegated without the advance written consent of the Authority (as evidenced by a majority vote of the Board of Directors), and any attempt to assign or delegate such rights or duties in contravention of this section shall be null and void. Any assignment or delegation permitted under the terms of this Agreement shall be consistent with the terms of any contracts, resolutions or indentures of the Authority then in effect, including without any Special Activity agreement to which the assigning or delegating Member is a party. This Agreement shall inure to the benefit of and be binding upon the successors and assigns of the parties hereto. This section does not prohibit a party from entering into an independent agreement with another agency regarding the financing of that party's contributions to the Authority or the disposition of proceeds which that party receives under this Agreement so long as such independent agreement does not affect, or purport to affect, the rights and duties of the Authority or the parties under this Agreement.

Section 8.04 – Execution In Parts Or Counterparts.

This Agreement may be executed in parts or counterparts, each part or counterpart being an exact duplicate of all other parts or counterparts, and all parts or counterparts shall be considered as constituting one complete original and may be attached together when executed by the parties hereto. Facsimile or electronic signatures shall be binding.

Section 8.05 – Notices.

Notices authorized or required to be given pursuant to this Agreement shall be in writing and shall be deemed to have been given when mailed, postage prepaid, or delivered during working hours to the addresses set forth for each of the parties hereto on Exhibit "A" of this Agreement, or to such other changed addresses communicated to the Authority and the Member entities in writing, and to such other entities that become Members.

Section 8.06 – Dispute Resolution.

(a) A dispute resolution group shall be established by the Board of Directors to resolve disputes and/or controversies through mediation relating to the interpretation, construction, performance, termination, breach of, or withdrawal from this Agreement (the "Dispute Resolution Group"). The Dispute Resolution Group shall meet with the parties involved no later than 30 days following notification of the dispute or controversy. Thereafter, the Dispute Resolution Group will have 90 days to endeavor to resolve the dispute.

(b) Following conclusion of the dispute resolution process as herein provided, any Member may pursue any judicial or administrative remedies otherwise available. Notwithstanding this Section 8.06, a Member may seek a preliminary injunction or other interlocutory judicial relief if necessary to avoid irreparable damages or to preserve the status quo.

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Arvin-Edison Water Storage District
Name of Member

By: _____

Print Name: Edwin Camp

Title: President

By: _____

Print Name: John Moore

Title: Secretary-Treasurer

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Cawelo

Name of Member

By: _____

Print Name: David Fenn

Title: Director

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

City of Shafter

Name of Member

By: _____

Print Name: Michael James

Title: Public Works Director

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Kern County Water Agency
Name of Member

By: Curtis Creel

Print Name: Curtis Creel

Title: General Manager

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

COUNTY OF KERN

By: _____ APR 05 2016

Mick Gleason
Chairman of Board of Supervisors

APPROVED AS TO CONTENT:
County Administrative Office

By: _____

John Nilon
County Administrative Officer

APPROVED AS TO FORM:
Office of the County Counsel

By: _____

Phillip W. Hall

Dated: 4-5-2016

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Kern-Tulare Water District
Name of Member

By: S. C. Dolke

Print Name: Steven C. Dolke

Title: General Manager

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

KERN WATERBANK AUTHORITY
Name of Member

By: William A. Talbe

Print Name: William A. Talbe

Title: Board member

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

North Kern Water Storage District
Name of Member

By: _____

Print Name: Kevin Ansorn

Title: Board President

By: _____

Print Name: Patrick Mize

Title: Asst Secretary

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Olcese Water District_____
Name of Member

By:_____

Print Name:_____

Title: James L. Nickel, President

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Rosedale-Rio Bravo W.S.D
Name of Member

By: _____

Print Name: Jason Selvidge

Title: Director

By: _____

Print Name: Gary Unruh

Title: Director

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

SWSD Semitropic Water Storage District
Name of Member

By: _____

Print Name: Fredrick A. Wegis

Title: Director

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Shaffer Wasco Irr. Dist
Name of Member

By: _____

Print Name: Roger Riley

Title: Board member

By: _____

Print Name: DANA MUNN

Title: General Manager

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

SSJMUD
Name of Member

By: James R. Regan
Print Name: James R. Regan
Title: Board member

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Tejon-Castaic Water District
Name of Member

By: _____

Print Name: Dennis Atkinson

Title: President

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

WEST KERN WATER DISTRICT
Name of Member

By: Gary Morris

Print Name: GARY MORRIS

Title: BOARD MEMBER

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Westside District Water Authority____
Name of Member

By:_____

Print Name: GREG A. HAMMETT

Title: Co-Manager

(b) Following conclusion of the dispute resolution process as herein provided, any Member may pursue any judicial or administrative remedies otherwise available. Notwithstanding this Section 8.06, a Member may seek a preliminary injunction or other interlocutory judicial relief if necessary to avoid irreparable damages or to preserve the status quo.

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

_____
Wheeler Ridge-Maricopa Water Storage District

By: _____

Print Name: George Cappello

Title: President

By: _____

Print Name: Jose Marin

Title: Secretary

EXHIBIT A

GENERAL MEMBERS

Arvin-Edison Water Storage District

Cawelo Water District

City of Shafter

Kern County Water Agency

Kern County

Kern-Tulare Water District

Kern Water Bank Authority

North Kern Water Storage District

Olcese Water District

Rosedale-Rio Bravo Water Storage District

Semitropic Water Storage District

Shafter-Wasco Irrigation District

Southern San Joaquin Municipal Utility District

Tejon-Castaic Water District

West Kern Water District

Westside District Water Authority

Wheeler Ridge-Maricopa Water Storage District

Appendix L

Monitoring Network & Protocols

Monitoring Network shall be developed to be capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan implementation. The monitoring network objectives shall be implemented to accomplish the following:

1) Demonstrate progress toward achieving measurable objectives described in the Plan
2) Monitor impacts to the beneficial uses and users of groundwater
3) Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds
4) Quantify annual changes in water budget components

Monitoring Network shall be designed to ensure adequate coverage of sustainability indicators. If management areas are established, the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the basin setting and sustainable management criteria specific to that area. To the extent possible, the use of existing monitoring data and infrastructure should be utilized to meet the needs for characterization, historical record documentation and continued monitoring requirements.

Monitoring Network shall describe the scientific rationale for the monitoring site selection and for each sustainability indicator, the quantitative values for the minimum threshold, measurable objective and interim milestones shall be indicated at each monitoring site.

Monitoring Protocols developed shall include a description of technical standards, data collection methods, and other procedures or protocols for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies. There is no definitive rule for the density of groundwater monitoring points needed in a basin. The table below provides guidance for the density of monitoring wells per hundred square miles. One important item to consider is how the definitions of undesirable results will be impacted to provide the necessary information to indicate compliance.

Reference	Monitoring Well Density (wells per 100 miles2)
Heath (1976)	0.2 - 10
Sophocleous (1983)	6.3
Basins pumping more than 10,000 acrefeet/year per 100 miles	4.0
Basins pumping between 1,000 and 10,000 acre-feet/year per 100 miles	2.0
Basins pumping between 250 and 1,000 acre-feet/year per 100 miles	1.0
Basins pumping between 100 and 250 acre-feet/year per 100 miles	0.7

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Measuring Groundwater Levels

Given the significant variations in groundwater elevations throughout the Kern subbasin which are due to variations in hydrologic conditions, no single groundwater elevation surface should be considered a representation of groundwater flow directions in this basin.

Requirements for well selections:

- A long-term access agreement that includes year-round site access to allow for increased monitoring frequency
- A unique identifier that includes a general written description of the site location, date established, access instructions and point of contact, type of information to be collected, latitude, longitude and elevation
- Monitoring location should also track all modifications to the site in a modification log

The following data collection protocols are to be followed within the Kern subbasin:

- Groundwater level data shall be sufficient to produce seasonal maps of potentiometric surfaces or water table surfaces throughout the basin that clearly identify changes in groundwater flow direction and gradient.
- Use the Well Data form provided (see attached)
- Groundwater level data shall be collected from each principal aquifer in the basin
- Collection of data between the approved time frames only
    - January 15th to March 30th
    - September 15th to November 15th
- A weighted water level meter will be used to measure the depth to groundwater
- Depth to groundwater must be measured relative to an established Reference Point on the well casing. If no mark or reference point is apparent, the person performing the measurement should measure the depth to groundwater from the north side of the top of the well casing
- The elevation of the Reference Point of the well must be surveyed to the North American Vertical Datum of 1988. The elevation must be accurate to within 0.1 foot.
- Each well's Reference Point will be cataloged to ensure identical procedures are followed for subsequent measurements.
- The data collector should remove the appropriate cap, lid or plug that covers the monitoring access point listening for pressure release. If a release is observed, the measurement should follow a period of time to allow the water level to equilibrate.
- Depth to groundwater must be measured to an accuracy of 0.1 foot below the Reference Point.
- The water level meter shall be decontaminated after measuring each well.
- The data collector shall calculate the groundwater elevation as:
    - GWE = RPE – DTW
    - GWE = Groundwater Elevation
    - RPE = Reference Point Elevation
    - DTW = Depth to Water
- The data collector must ensure that all measurements are consistent units of feet, tenths of feet or hundredths of feet. Measurements and Reference Point Elevations should not be recorded in feet and inches.

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Groundwater Quality

Groundwater quality monitoring networks shall be designed to demonstrate that the degraded water quality sustainability indicator is being observed for the purpose of meeting the definition of the sustainability goal.

Requirements for well selections:

- A long-term access agreement that includes year-round site access to allow for increased monitoring frequency
- A unique identifier that includes a general written description of the site location, date established, access instructions and point of contact, type of information to be collected, latitude, longitude and elevation
- Monitoring location should also track all modifications to the site in a modification log
- The use of existing water quality data within the basin should be done to the greatest extent possible
- Monitoring network should consist largely as a supplemental monitoring locations where known groundwater contamination plumes are under existing regulatory management

The following data collection protocols are to be followed within the Kern subbasin:

- Monitor groundwater quality data from each principal aquifer in the basin
- Data should be sufficient for mapping movement of degraded water quality
- Data should be sufficient to assess groundwater quality impacts to beneficial uses and users
- Data should be sufficient to evaluate whether management activities are contributing to water quality degradation.
- All analyses should be performed by a laboratory certified under the State Environmental Laboratory Accreditation Program
- Samples will be collected according to the standards listed in the Standard Methods for the Examination of Water and Wastewater, USGS National Field Manual for the Collection of Water Quality Data
- Prior to sampling, the sampler must contact the laboratory to schedule laboratory time, obtain appropriate sampler containers, and clarify any sample holding times or sample preservation requirements
- Each well used for groundwater quality monitoring must have a unique identifier. This identifier must appear on the well housing or the well casing to avoid confusion
- In the case of wells with dedicated pumps, samples should be collected at or near the wellhead. Samples are not to be taken/collected from storage tanks, at the end of long pipe runs or after any water treatment infrastructure
- Samples will be taken/collected only after the appropriate volume of water has been purged from the casing and field parameters have stabilized
- Sampler will clean the sampling port and/or sampling equipment. The sampling port and/or sampling equipment must be free of any contaminants

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- Groundwater elevation in the well should be measured following the protocols described in the groundwater level measuring protocols
- Field parameters of pH, electrical conductivity and temperature should be collected for each sample. Lab pH analysis are typically unachievable due to short hold times.
- All field instruments should be calibrated daily and evaluated for drift throughout the day
- Sample containers should be labeled prior to sample collection. The sample label must include:
    - Sample ID (well ID)
    - Sample date and time
    - Sample personnel
    - Sample location
    - Preservative used
    - Analytes and analytical method
- Samples shall be collected under laminar flow conditions. This may require reducing pumping rates prior to sample collection
- Samples requiring preservation must be preserved as soon as practically possible
- Samples to be analyzed for metals should be field-filtered prior to preservation. Do not collect an unfiltered sample in a preserved container
- Samples will be chilled and maintained at 4 C to prevent degradation of the sample
- Samples will be shipped under a chain of custody documentation to the appropriate laboratory promptly to avoid violating holding time restrictions
- Custody Seal will be used by the field technician if a third-party transportation service is used
- A Field Sampling Log will be maintained for each sampling event and will include:
    - Sampler's identification
    - Well identification
    - Climatic conditions
    - Depth to water prior to purging
    - Type of purging and sampling device
    - Purging rate and volume
    - Relative well yield volume
    - Field parameter measurements (pH, temperature, EC, DO)
    - Type and number of samples collected
    - Date and time collected

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Reduction of Groundwater Storage

The reduction of groundwater storage is to provide an estimate of the change in annual groundwater storage.

Since the groundwater storage is not a directly measurable condition, it does rely heavily on the collection of accurate groundwater levels. The changes in groundwater levels reflect changes in storage and can thus be estimated with assumptions of thickness of units, porosity, and connectivity. These observations will be essential for use in calculating the water budget.

A water budget is a foundational tool used to compile water flows (supplies) and outflows (demands). It is an accounting of the total groundwater and surface water entering and leaving a basin or user-defined area. The difference between flows and outflows is a change in the amount of water stored.

Coordination of Water Budget Data to comply with groundwater storage:

- Surface water supply
- Total water use
- Water budget
- Sustainable yield

The change in the annual volume of groundwater storage between seasonal high conditions shall be quantify in the water budget.

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Land Subsidence

Land subsidence protocols are to be set up to identify the rate and extent of land subsidence, which maybe measured by extensometers, surveying, remote sensing technology, or other appropriate method. To the extent possible, the use of existing data should be utilized.

Prior to development of a specific subsidence monitoring network a screening level analysis should be conducted. The screening of subsidence occurrence should include:

- Review of the HCM and understanding of grain-size distributions and potential for subsidence to occur
- Review of any known regional or correlative geologic conditions where subsidence has been observed.
- Review of historic range of groundwater levels in the principal aquifers of the basin
- Review of historic records of infrastructure impacts, including but not limited to damage to pipelines, canals, roadways or bridges or well collapse potentially associated with land surface elevation changes
- Review of remote sending results such as InSAR or other land surface monitoring data
- Review of existing CGPS surveys

This basin has decided to work together on this protocol with a consultant to obtain the required data.

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Appendix M

1.3 PUBLIC PARTICIPATION AND REVIEW

The Department notified all responsible and trustee agencies and interested groups, organizations, and individuals (including all those that commented on the 2007 Monterey Plus DEIR and 2010 Monterey Plus FEIR) that the Draft REIR on the proposed project was available for review. The following list of actions took place during the preparation, distribution, and review of the Draft REIR:

- A Notice of Completion (NOC) and copies of the Draft REIR were filed with the State Clearinghouse on April 28, 2016 with an ending period of June 13, 2016.
- Notices of the two public hearings on the Draft REIR were included in the Draft REIR, on the Department website, and in 19 newspapers: Bakersfield Californian, Chester Progressive, Chico Enterprise-Record, Feather River Bulletin, Fresno Bee, Indian Valley Record, Portola Reporter, Ontario Inland Valley Daily Bulletin, Los Angeles Times, Oroville Mercury-Register, Riverside Press-Enterprise, Sacramento Bee, San Bernardino County Sun, San Diego Union-Tribute, San Francisco Chronicle, San Jose Mercury-News, Santa Barbara News Press, the Tribune (Newspaper of Central Coast), and the Ventura County Star.
- Public hearings to receive comments on the Draft REIR were held in Fresno and Bakersfield on June 1 and 2, 2016, respectively.
- Copies of the Draft REIR, including its technical appendices and all pages from documents referenced in the Draft REIR, were available for public review by request from the Department, on the Department's website, at the Department's South Central Region office in Fresno, and at the following libraries:

Beale Memorial Library, 701 Truxtun Avenue Bakersfield, CA 93301

Colusa County Library, 738 Market Street Colusa, CA 95932

Mary L. Stephens Davis Branch Library, 315 E. 14th Street Davis, CA 95616

El Centro Public Library Community Center Branch, 1140 N. Imperial Avenue El Centro, CA 92243

Fairfield Civic Center Library, 1150 Kentucky Street Fairfield, CA 94533

Fremont Library, 2400 Stevenson Boulevard Fremont, CA 94538

Hanford Branch Library, 401 North Douty Street Hanford, CA 93230

Los Angeles Public Library Central Library, 630 West 5th Street Los Angeles, CA 90071

Merced County Library Merced Branch, 2100 O Street Merced, CA 95340

Modesto Public Library 1500, I Street Modesto, CA 95354

Napa Main Library 580 Coombs Street, Napa, CA 94559

Oroville Branch Library, 1820 Mitchell Avenue Oroville, CA 95966

Pleasant Hill Library, 1750 Oak Park Boulevard Pleasant Hill, CA 94523

Quincy Public Library, 445 Jackson Street Quincy, CA 95971

Red Bluff Library, 645 Madison Street Red Bluff, CA 96080

Redding Library, 1100 Parkview Avenue Redding, CA 96001

Riverside Public Library Main Library, 3581 Mission Inn Avenue Riverside, CA 92501

Sacramento Public Library Central Library, 828 I Street Sacramento, CA 95814

Norman F. Feldheym Central Library, 555 West 6th Street San Bernardino, CA 92410

San Diego Public Library Central Library, 330 Park Blvd. San Diego, CA 92101

Dr. Martin Luther King, Jr. Library, 150 East San Fernando Street San Jose, CA 95112

Central Library, 40 East Anapamu Street Santa Barbara, CA 93101

Cesar Chavez Central Library, 605 N. El Dorado Street Stockton, CA 95202-1907

E. P. Foster Library, 651 East Main Street Ventura, CA 93001

Visalia Branch Library, 200 West Oak Avenue Visalia, CA 93291

Willows Public Library, 201 North Lassen Street Willows, CA 95988

Sutter County Library Main Branch, 750 Forbes Avenue Yuba City, CA 95991

Betty Rodriguez Regional Library, 3040 N. Cedar Avenue Fresno, CA 93703

Appendix N

LOCATION CAJON CA

Established Series
Rev. GAW/TDC/MAV/KJO/ET
04/2015

CAJON SERIES

The Cajon series consists of very deep, somewhat excessively drained soils that formed in sandy alluvium from dominantly granitic rocks. Cajon soils are on alluvial fans, fan aprons, fan skirts, inset fans and river terraces. Slopes are 0 to 15 percent. The average annual precipitation is about 6 inches and the mean annual temperature is about 65 degrees F.

TAXONOMIC CLASS: Mixed, thermic Typic Torripsamments

TYPICAL PEDON: Cajon sand, on a 1 1/2 percent slope under creosotebush, spiny hopsage, and Mormon-tea at 3,060 feet elevation. (Colors are for dry soil unless otherwise stated. When described on 4/29/75 the soil was moist to 18 inches and dry below).

A--0 to 2 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; weak fine and medium subangular blocky structure; soft, very friable; few fine roots; many very fine interstitial pores; strongly effervescent; moderately alkaline (pH 8.0); abrupt smooth boundary. (0 to 14 inches thick).

C1--2 to 7 inches; very pale brown (10YR 7/3) sand, light gray (10YR 7/2) moist; single grained; loose; common fine roots; many very fine interstitial pores; 1 to 2 percent 3/8 to 1/2 inch gravel; strongly effervescent; moderately alkaline (pH 8.0); clear wavy boundary. (3 to 6 inches thick).

C2--7 to 13 inches; very pale brown (10YR 7/3) sand, brown (10YR 5/3) moist; single grained; loose; common fine roots; common very fine interstitial pores; strongly effervescent; moderately alkaline (pH 8.0); clear wavy boundary. (3 to 7 inches thick).

C3--13 to 18 inches; very pale brown (10YR 7/3) sand, brown (10YR 5/3) moist; single grained; loose; common fine roots; many very fine interstitial pores; strongly effervescent; moderately alkaline (pH 8.0); clear wavy boundary. (3 to 7 inches thick).

C4--18 to 25 inches; very pale brown (10YR 7/3) sand, pale brown (10YR 6/3) moist; single grained; loose; common fine roots; many very fine interstitial pores; about 4 percent 1/2 inch gravel; strongly effervescent; moderately alkaline (pH 8.0); abrupt wavy boundary. (3 to 8 inches thick).

2C5--25 to 38 inches; very pale brown (10YR 7/4) gravelly sand, light yellowish brown (10YR 6/4) moist; single grained; loose; common fine roots; many fine interstitial pores; 25 percent 1/2 to 1 inch gravel;

strongly effervescent; moderately alkaline (pH 8.0); clear wavy boundary. (10 to 15 inches thick).

2C6--38 to 45 inches; very pale brown (10YR 7/3) gravelly sand, pale brown (10YR 6/3) moist; single grained; loose; few very fine roots; many fine interstitial pores; 20 percent 1/2 to 1 inch gravel; strongly effervescent; moderately alkaline (pH 8.0); clear wavy boundary. (3 to 8 inches thick).

2C7--45 to 60 inches; very pale brown (10YR 7/4) sand, light yellowish brown (10YR 6/4) moist; single grained; loose; few very fine roots; common fine interstitial pores; strongly effervescent; moderately alkaline (pH 8.0).

TYPE LOCATION: San Bernardino County, California; about 5 miles east of Lucerne Valley, 0.5 mile east of intersection of Visalia Avenue and Foothill Road; and 0.3 mile north in NE1/4, SE1/4, SE1/4 section 16, T.4N., R.1E.

RANGE IN CHARACTERISTICS:

Soil moisture- usually dry from mid March to mid December and is not continuously moist for as long as 90 days in the winter.

Soil temperature: 59 degrees to 72 degrees F. and soil temperature usually is not below 47 degrees F. at any time.

Control section - Rock fragments are mostly gravel size and they make up as much as 35 percent though many pedons have less than 15 percent gravel. There is weak stratification of sandy material in some or all parts.

Typically the soil is slightly effervescent to strongly effervescent throughout although some pedons are noneffervescent in the A horizon.

Typically the profile is slightly alkaline or moderately alkaline although some pedons are neutral.

Some pedons are strongly alkaline and mildly saline-alkali to strongly saline-alkali. Electrical conductivity ranges up to 16 ds/m and the SAR to 20.

The A - Hue: 10YR or 2.5Y
Value: 5 through 7 dry and 3 through 6 moist
Chroma: 2 through 6 dry and moist.
Texture: Coarse sand, loamy coarse sand, sand and loamy sand. Some pedons have sandy loam overblown phases. Some pedons have as much as 60 percent gravel within 2 inches.

The C horizon - Hue: 10YR or 2.5Y
Value: 5 through 7 dry and 3 through 6 moist
Chroma: 2 through 6 dry and moist

Texture: Coarse sand, loamy coarse sand, sand, loamy sand, fine sand, or loamy fine sand or their gravelly or cobbly equivalents. Some pedons have a sandy loam horizon at a depth of more than 40 inches.

COMPETING SERIES: These are the Bluepoint (NV), Brazito (NM), Maynard Lake (NV), Moapa (NV), Pintura (UT), Toquop (NV), University (T NM) and Yturbide (NM) series in the same family and the Carsitas series in another family. Bluepoint soils are dominantly in hue of 5YR and have chroma of 3 through 6. Brazito soils are not dry in all parts of the moisture control section for months following the summer solstice. Carsitas and Myoma soils have a hyperthermic temperature regime. Maynard Lake soils contain a significant amount of volcanic ash. Moapa soils have a paralithic contact at a depth of 20 to 40 inches. Pintura soils have hue of 5YR or redder and lack stratification. Toquop soils typically have hue redder than 10YR. Yturbide soils are noncalcareous or have small amounts of disseminated lime. Also, Yturbide soils are moist in the summer.

GEOGRAPHIC SETTING: The Cajon soils have gradients of 0 to 15 percent and are on recent fans, fan skirts, fan aprons, inset fans and river terraces at elevations of 200 to 4,300 feet. The lower elevations commonly occur in the San Joaquin Valley. They formed in sandy alluvium, mostly granitic rock sources, but also a variety of sources are included. The climate is arid with hot dry summers and somewhat moist winters. Average annual precipitation is 2 to 9 inches, mostly in the form of winter rain. Mean January temperature is 43 degrees to 48 degrees F., mean July temperature is 82 degrees to 84 degrees F., mean annual temperature is 57 degrees to 70 degrees F. Frost-free season is 150 to 340 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Adelanto, Arizo, Calcio, Edalph, Goldivide, Gravesumit, Hesperia, Livefire and Rosamond soils. Adelanto soils have an argillic horizon. Arizo soils have a sandy skeletal particle size control section. Calcio, Goldivide and Gravesumit soils have an argillic horizon and a calcic horiaon. Edalph and Hesperia soils have a coarse-loamy control section. Livefire soils have sandy loam textures within the particle size control section. Rosamond soils have a fine-loamy particlr size control section.

DRAINAGE AND PERMEABILITY: Somewhat excessively drained; negligible to low runoff; rapid permeability. Cajon soils with sandy loam surface textures have moderately rapid over rapid permeability. Flooding is none to rare.

USE AND VEGETATION: Used mostly for range, watershed, and recreation. A few areas are irrigated and are used for growing alfalfa and other crops. Vegetation is mostly desert shrubs including creosotebush, saltbush, Mormon-tea, Joshua trees, some Indian ricegrass, annual grasses and forbs.

DISTRIBUTION AND EXTENT: Southeastern California, southern Nevada, and Arizona. The soils are extensive. The central concept for the series is in MLRA 30. Use in other MLRA's should be reevaluated.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: PHOENIX, ARIZONA

SERIES ESTABLISHED: Central-Southern California Reconnaissance, 1917.

REMARKS: The ranges of the Bluepoint, Cajon and Toquop series overlap.

Runoff classes based on Ksat and slope as described in "Terminology Used in Soil Survey Data Entry or Manuscript Editing of: 9-23-94 MAV." Runoff changed from slow or very slow; runoff is now negligible to low.

Responsibility for this series was transferred from Davis to Phoenix 4/2015. The last revision to the series was 1/2002. ET

National Cooperative Soil Survey
U.S.A.

LOCATION EXCELSIOR CA

Established Series
Rev. KKC/ARW/JJJ
12/2002

EXCELSIOR SERIES

The Excelsior series consists of very deep, well drained soils on alluvial fans and bars and channels on flood plains. These soils formed in mixed alluvium dominantly from igneous and calcareous sedimentary rocks. Slope is 0 to 2 percent. The mean annual temperature is about 63 degrees F. and the mean annual precipitation is about 7 inches.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, calcareous, thermic Typic Torrifluvents

TYPICAL PEDON: Excelsior sandy loam, on a slope of less than 1 percent under cotton at 235 feet elevation. (Colors are for dry soil unless otherwise stated. When described on 3/24/76 the soil was slightly moist below 2 inches.)

Ap--0 to 8 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; moderately alkaline (pH 8.1); abrupt smooth boundary. (6 to 10 inches thick)

C1--8 to 20 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; slightly effervescent, carbonates disseminated; strongly alkaline (pH 8.8); abrupt smooth boundary. (8 to 22 inches thick)

C2--20 to 26 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; strongly effervescent, carbonates disseminated; strongly alkaline (pH 9.0); clear smooth boundary. (4 to 10 inches thick)

C3--26 to 60 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; common very fine and fine tubular pores; strongly effervescent, carbonates disseminated; very strongly alkaline (pH 9.5).

TYPE LOCATION: Kings County, California; approximately 1,500 feet west of Highway 43 and 250 feet south of Iona Avenue; 1500 feet west and 250 feet south of the northeast corner of section 17, T. 19 S., R. 22 E., MDB&M; Latitude 36 degrees, 17 minutes, 00 seconds north and Longitude 119 degrees, 36 minutes, 17 seconds west; USGS Remnoy Topographic Quadrangle, NAD 27.

RANGE IN CHARACTERISTICS: The soil moisture control section of 8 to 20 inches is dry in all parts from April 1 through December and is not continuously moist for 90 consecutive days. The organic matter is less than 1 percent at the surface and decreases irregularly with increasing depth. The mean annual soil temperature ranges from 61 degrees to 65 degrees F.

The A horizon has color of 10YR 5/2, 5/3, 6/2, 6/3, 7/2; 2.5Y 6/2 or 7/2. Moist color is 10YR 4/2, 5/2; 2.5Y 4/2 or 5/2. Texture is loamy sand, sandy loam, fine sandy loam or loam. Calcium carbonate equivalent is 0 to 3 percent. It is noneffervescent to strongly effervescent with disseminated carbonates. Electrical conductivity is 0 to 8 decisiemens per meter. Sodium adsorption ratio is 0 to 13. Electrical conductivity and sodium adsorption ratio are affected by agricultural practices. Reaction is slightly alkaline to strongly alkaline. Eroded phases are present in some areas.

The C horizon has color of 10YR 6/2, 6/3, 7/2, 7/3,; 2.5Y 6/2, 6/4, 7/2 or 7/4. Moist color is 10YR 4/2, 4/3, 5/2; 2.5Y 4/2, 5/2 or 5/4. Texture is stratified loamy sand, sandy loam, fine sandy loam, loam and silt loam. Few fine distinct relict redoximorphic masses of iron accumulation occur in the lower C horizon in some pedons. Calcium carbonate equivalent is 1 to 5 percent. It is very slightly effervescent to violently effervescent and has disseminated and/or segregated carbonates. Electrical conductivity is 0 to 16 decisiemens per meter. Sodium adsorption ratio is 0 to 80. Electrical conductivity and sodium adsorption ratio are affected by agricultural practices. Reaction is moderately alkaline or very strongly alkaline.

COMPETING SERIES: These are the Anthony, Gila, Rucker, and Tobler series. Anthony soils (MLRA 40, 41, 42), Gila soils (MLRA 40, 41, 42), Rucker soils (MLRA 41) and Tobler soils (MLRA 30, 42, 70) are all on alluvial fans and flood plains. They are all intermittently moist in some part of soil moisture control section as a result of precipitation in the late summer months. Rucker soils have mean annual precipitation of 10 to 12 inches. Tobler soils have color hues of 2.5YR and 5YR.

GEOGRAPHIC SETTING: Excelsior soils are on alluvial fans and bars and channels on flood plains. Slope is 0 to 2 percent. These soils formed in mixed alluvium dominantly from igneous and calcareous sedimentary rocks. Elevation is 180 to 1,000 feet. The climate is arid with hot dry summers and cool moist winters. The mean annual precipitation is 5 to 8 inches. Mean January temperature is 45 degrees F.; mean July temperature is 80 degrees F.; mean annual temperature is 62 to 65 degrees F. Frost-free season is 240 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Grangeville, Nord, Panoche and Wasco soils. Grangeville and Nord soils, on alluvial fans and flood plains, have a mollic epipedon. Panoche soils, on alluvial fans, have a fine-loamy particle-size control section. Wasco soils, on alluvial fans, have a regular decrease in organic-carbon with increasing depth and are not calcareous in all parts between the depths of 10 and 20 inches.

DRAINAGE AND PERMEABILITY: Well drained; negligible to medium runoff; moderate to slow permeability, with slow permeability in saline-sodic horizons.

USE AND VEGETATION: This soil is used for irrigated cropland growing alfalfa, barley, cotton and grapes. It is also used for dairy and cattle production and building site development.

DISTRIBUTION AND EXTENT: San Joaquin Valley. The series is of moderate extent. MLRA 17.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Kings County, California, 1980.

National Cooperative Soil Survey
U.S.A.

LOCATION GARCES CA

Established Series
Rev. JFR-ARW-CAF
10/1999

GARCES SERIES

The Garces series consists of very deep, well drained saline-sodic soils that formed in granitic alluvium. Garces soils are on alluvial fans, terraces, and basin rims and have slopes of 0 to 2 percent. The mean annual precipitation is about 6 inches, and the mean annual temperature is about 64 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, thermic Typic Natrargids

TYPICAL PEDON: Garces silt loam, on a slope of less than 1 percent in rangeland at an elevation of 235 feet. Common plants are red brome, atriplex spp., and filaree. (Colors are for dry soil unless otherwise stated. When described on July 24, 1974, the soil was dry throughout the profile.)

A1--0 to 1 inch; pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) strong thin platy structure; slightly hard, friable, nonsticky and slightly plastic; common very fine roots; many very fine interstitial and tubular pores, and common very fine and fine vesicular pores; slightly effervescent, carbonates disseminated; moderately alkaline (pH 8.2); abrupt smooth boundary. (1/2 to 1 inch thick)

A2--1 to 2 inches; pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) moist; strong coarse subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common very fine roots; many very fine tubular and interstitial pores; strongly effervescent, carbonates disseminated; moderately alkaline (pH 8.2); abrupt smooth boundary. (0 to 2 inches thick)

E--2 to 5 inches; very pale brown (10YR 8/3) silt loam, dark brown (10YR 3/3) moist; moderate coarse subangular blocky structure; hard, friable, nonsticky and slightly plastic; common very fine roots; many very fine, few fine and medium tubular and many very fine interstitial pores; moderately alkaline (pH 8.2); abrupt wavy boundary. (2 to 10 inches thick)

Btnz--5 to 9 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; strong medium columnar structure; extremely hard, friable, sticky and plastic; many very fine roots; many very fine tubular and interstitial pores; many thin clay films on peds and few thin clay films in pores; slightly effervescent, carbonates disseminated; moderately alkaline (pH 8.4); abrupt smooth boundary. (0 to 8 inches thick)

Btknz1--9 to 23 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; strong coarse prismatic structure; slightly hard, friable, sticky and plastic; common very fine roots; common very fine tubular and many

very fine interstitial pores; few thin clay films on peds and in pores; violently effervescent; carbonates segregated as few fine irregularly shaped soft masses; very strongly alkaline (pH 9.2); gradual smooth boundary. (8 to 20 inches thick)

Btknz2--23 to 37 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular and many very fine interstitial pores; very few thin clay bridges between mineral grains; strongly effervescent, carbonates segregated as few fine irregularly shaped soft masses; very strongly alkaline (pH 9.2); clear smooth boundary. (5 to 23 inches thick)

Bknz--37 to 55 inches; very pale brown (10YR 7/3) loam, light brownish gray (10YR 6/2) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine roots; many very fine tubular and interstitial pores; strongly effervescent, carbonates segregated as few fine irregular shaped filaments; very strongly alkaline (pH 9.2); clear smooth boundary. (16 to 34 inches thick)

C--55 to 60 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine interstitial pores; strongly alkaline (pH 9.0).

TYPE LOCATION: Kern County, California; about 11 miles west of Wasco, about 2.5 miles north of Semitropic School; 2550 feet south and 1300 feet west of the northeast corner of section 30, T. 26 S., R. 23 E, MDB&M; Latitude 35 degrees, 38 minutes, 17 seconds north and Longitude 119 degrees, 31 minutes, 50 seconds west; Lost Hills Northeast Quadrangle.

RANGE IN CHARACTERISTICS: Mean annual soil temperature is 64 degrees to 68 degrees F. The difference between summer and mean winter temperatures is less than 40 degrees F. The soil temperature is always above 47 degrees F. The soil between the depths of 4 and 12 inches is dry in all parts from April 1 until January 1 and is moist in some or all parts for only 60 to 90 consecutive days from January through March. Organic matter content is less than 0.5 percent. These soils are typically effervescent below a depth of 10 inches and some pedons are effervescent throughout.

The A horizon has dry color of 10YR 5/1, 5/2, 5/3, 6/2, 6/3, 6/4, 7/1, 7/2, 8/3; 2.5Y 5/2, 6/2, 6/4 or 7/2 and moist color of 10YR 3/1, 3/2, 3/3, 4/2, 4/3, 5/2, 5/3, 5/4, 6/3; 2.5Y 3/2, 4/2 or 4/4. It is loam or, silt loam. Clay percentage is 10 to 18. Reaction is slightly alkaline to strongly alkaline. Effervescence ranges from noneffervescent to strongly effervescent. The sodium adsorption ratio is 1 to 25. Electrical conductivity is 2 to 8 decisiemens per meter. Some pedons lack an E horizon.

The B horizon has dry color of 10YR 5/1, 5/2, 5/3, 6/2, 6/3, 6/4, 7/2 or 2.5Y 5/2,6/2, 6/4 or 7/2 and moist color of 10YR 3/2, 3/3, 4/2, 4/3, 5/2, 5/3, 5/4, 6/3 or 2.5Y 3/2, 5/2 or 5/4. It is loam, clay loam, silty clay

loam, or sandy clay loam. Clay percentage is 20 to 35. Structure is prismatic or columnar in the upper part and may be blocky in the lower part. Reaction ranges from moderately alkaline to very strongly alkaline. Carbonates are 0 to 5 percent. The sodium adsorption ratio is 13 to 100. Electrical conductivity is 8 to 16 decisiemens per meter. Some pedons have few to common filaments and veins of gypsum.

The C horizon has dry color of 10YR 6/2, 6/3, 7/2, 7/3; 2.5Y 4/2, 5/2, 6/2, 7/2, 7/4 and moist color of 10YR 4/2, 4/3, 5/2, 5/3, 6/2, 6/3; 2.5Y 3/2, 4/2, 4/3, 4/4, 5/2 or 5/4. Textures are stratified sandy loam to clay loam. Some pedons have a brittle layer or weakly to moderately silica and lime cemented soil material that does not meet the requirements of a duripan at a depth of 40 to 60 inches. Some pedons have a lithologic discontinuity within this horizon, and this horizon is absent in some pedons.

COMPETING SERIES: These are the Casaga (NV), Corum (T-CA), Gothard (AZ), Leuhman (T-CA), Norob (CA) and Polvadero (T-CA) series. Casaga soils have a strong varnished desert pavement with a very gravelly A horizon and C horizons with 30 to 75 percent gravel. Corum soils are 20 to 40 inches to weathered granitic rock. Gothard soils are moist for 30 to 40 days in the summer and are moderately well drained. Leuhman and Polvadero soils have calcic horizons. Norob soils are moderately well drained, have soil temperatures less than 47 degrees F. and have mean summer and winter soil temperatures differences of more than 40 degrees F.

GEOGRAPHIC SETTING: Garces soils are on alluvial fans, terraces, and basin rims and have slopes of 0 to 2 percent. The soils formed in alluvium from granitic rock sources. Elevations are 200 to 400 feet. The climate is arid with dry summers and cool, somewhat moist winters. Mean annual precipitation is 5 to 8 inches. Mean January temperature is 45 degrees F.; mean July temperature is 83 degrees F.; mean annual temperature is 62 to 65 degrees F. Frost-free is 250 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Kimberlina, Panoche, Milham, and Wasco soils. All these soils lack a natric horizon.

DRAINAGE AND PERMEABILITY: Well drained; medium or high runoff; some areas are ponded; very slow permeability.

USE AND VEGETATION: Much of this soil is being reclaimed and used for irrigated agriculture. Where fully reclaimed the natric horizon is completely destroyed and the soil becomes the Gareck series (T-CA). In the native state some of the soil is used for livestock grazing. Vegetation is scattered saltbush with annual grasses and forbs.

DISTRIBUTION AND EXTENT: The southern part of the San Joaquin Valley of California. The soil is extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Kings County, California, 1980.

REMARKS: Some areas of this soil were originally mapped as the Pond series. Pond series is presently classified as having a xeric moisture regime. Reaction is by thymol blue indicator.

National Cooperative Soil Survey
U.S.A.

LOCATION KIMBERLINA CA

Established Series
Rev. KDA/ARW/CAF
05/2003

KIMBERLINA SERIES

The Kimberlina series consists of very deep, well drained soils on flood plains and recent alluvial fans. These soils formed in mixed alluvium derived dominantly from igneous and/or sedimentary rock sources. Slope is 0 to 9 percent. The mean annual precipitation is about 6 inches and the mean annual temperature is about 64 degrees F.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, calcareous, thermic Typic Torriorthents

TYPICAL PEDON: Kimberlina fine sandy loam - on a slope of less than 1 percent in a cultivated field at 296 feet elevation. (Colors are for dry soil unless otherwise stated. When described on May 11, 1970, the soil was moist throughout from irrigation.)

Ap--0 to 9 inches; brown (10YR 5/3) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky and nonplastic; many very fine roots; many very fine tubular and interstitial pores; moderately alkaline (pH 8.0); clear smooth boundary. (1 to 18 inches thick)

C1--9 to 31 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine tubular and interstitial pores; slightly effervescent, carbonates disseminated; moderately alkaline (pH 8.2); clear smooth boundary. (20 to 22 inches thick)

C2--31 to 45 inches; pale brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine tubular and interstitial pores; slightly effervescent, carbonates disseminated; moderately alkaline (pH 8.4); abrupt wavy boundary. (13 to 19 inches thick)

2C3--45 to 71 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular and few very fine interstitial pores; strongly effervescent, carbonates segregated as few fine irregularly shaped threads; moderately alkaline (pH 8.4).

TYPE LOCATION: Kern County, California; about 7 miles northwest of Shafter; approximately 1800 feet west and 100 feet north of the southeast corner of section 33, T. 27 S., R. 24 E., MDB&M; Latitude 35 degrees, 31 minutes, 45 seconds north and Longitude 119 degrees, 23 minutes, 30 seconds west; USGS Wasco Southwest Topographic Quadrangle, NAD 27.

RANGE IN CHARACTERISTICS: The soil between the depths of 8 and 24 inches is dry all the time from April until mid-January and is moist in all parts for less than 60 consecutive days in the winter. Mean annual soil temperature is 62 degrees to 67 degrees F. Rock fragment content is 0 to 25 percent and is usually less than 2 inches in diameter. Some pedons have few to common gypsum crystals, which occur where gypsum has been added to the soil by farmers.

The A horizon has color of 10YR 5/3, 6/2, 6/3, 6/4, 7/2, 7/3, 7/4; 2.5Y 5/2, 6/2, 6/4 or 7/2. Moist color is 10YR 4/2, 4/3, 4/4, 5/2 or 2.5Y 4/2. Texture is loamy sand, loamy fine sand, fine sandy loam, sandy loam or loam and may have a gravelly modifier. Clay content averages 5 to 20 percent. Calcium carbonate equivalent is 0 to 5 percent. Reaction is neutral to moderately alkaline. Organic matter content is less than 1 percent.

The C horizon has color of 10YR 5/2, 5/3, 6/2, 6/3, 6/4, 7/2, 7/3, 7/4; 2.5Y 5/2, 6/2,6/3, 6/4 or 7/2. Moist color is 10YR 4/2, 4/3, 4/4, 5/2, 5/3, 5/4; 2.5Y 3/2, 4/2, 4/4, 5/2 or 5/3. Texture is sandy loam or fine sandy loam and may have a gravelly modifier. Clay content averages 10 to 18 percent. Carbonates are disseminated but some pedons also have segregated carbonates. Some pedons may not have carbonates in some parts of the profile but the 10 to 20 inch calcareous class control section is always calcareous. Reaction is neutral to moderately alkaline. Organic matter is less than 0.5 percent and decreases regularly with increasing depth. Organic matter content is less than 0.2 percent below 49 inches depth.

The 2C horizon, where present, is similar to the C horizon and has weakly defined thick stratification of silt loam, loam, or sandy clay loam textures, but distinct thin stratification is not present. Some pedons have texture of loamy sand or loamy fine sand and do not have silt loam, loam or sandy clay loam.

COMPETING SERIES: These are the Elkhills, Granitepass, Herbel, Machone, and Seaman series. Elkhills soils (MLRA 17), on uplifted fan remnants, have 5 to 20 percent calcium carbonate equivalent, have slopes of 9 to 50 percent and consistently have stratified textures in the lower part of the C horizon. Granitepass soils (MLRA 30), on alluvial fans, are moist for 10 to 20 days cumulative between July and October following convection storms, have gravel content of 30 to 80 percent on the surface and 10 to 50 percent in the A horizon, and typically have a 2Btkb horizon. Herbel soils (MLRA 42), on alluvial fans and coalescent fan piedmonts, are intermittently moist for more than 20 days cumulative during July through September, have color hue of 7.5YR and 10YR and have Bk horizons. Machone soils (MLRA 30), on hills and rock pediments, are 20 to 40 inches deep to strongly weathered granitic rock. Seaman soils (MLRA 29, 30), on fan skirts and inset fans and fan aprons of the fan piedmont, are moist for a few brief intermittent periods following summer convection storms, have color hue of 7.5YR and 10YR and are formed in mixed alluvium with a component ofvolcanic ash or pyroclastic materials.

GEOGRAPHIC SETTING: Kimberlina soils are on alluvial fans and flood plains. Slope is 0 to 9 percent. These soils formed in mixed alluvium derived dominantly from igneous and/or sedimentary rock sources. Elevation is 125 to 2,250 feet in the San Joaquin Valley and cool phases occur at 1,800 to 4,100 feet in the Mojave Desert. Slope is 0 to 9 percent. The climate is arid (desert) with hot, dry summers and cool winters. Mean annual precipitation is 4 to 8 inches. Mean January temperature is 44 degrees to 47 degrees F.; mean July temperature is 80 degrees to 85 degrees F.;, mean annual temperature is 59 degrees to 62 degrees F. in the Mojave Desert and 61 degrees to 65 degrees F in the San Joaquin Valley. The frost-free season is 240 to 300 days in the San Joaquin Valley and 190 to 250 days in the Mojave Desert.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Garces, McFarland, Milham, Panoche, and Wasco soils. Garces soils, on fan remnants and basin rims, have a natric horizon with a sodium adsorption ratio greater than 13. McFarland soils, on alluvial fans and flood plains, have a fine-loamy particle-size control section. Milham soils, on fan remnants, alluvial fans, plains and low terraces, have an argillic horizon that has a fine-loamy particle-size control section. Panoche soils, on alluvial fans and plains, have afine-loamy particle-size control section. Wasco soils, on alluvial fans and plains, do not have carbonates in all parts of the 10 to 20 inch calcareous class control section.

DRAINAGE AND PERMEABILITY: Well drained; negligible to medium runoff; moderately rapid and moderate permeability, however saline-sodic phases and soils with sandy clay loam substratums have moderately slow permeability.

USE AND VEGETATION: Used for growing irrigated field, forage, and row crops. Some areas used for livestock grazing. When not irrigated, vegetation is annual grasses, forbs, and atriplex spp. in the San Joaquin Valley.

DISTRIBUTION AND EXTENT: Mainly in the southern part of the San Joaquin Valley. The series is of large extent. MLRA 17, 30.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: San Bernardino County, California, Mojave River Area, 1978.

REMARKS: The Kimberlina soils were initially mapped as San Emigdio soils which are now recognized as having a xeric moisture regime and an irregular decrease in organic matter.

National Cooperative Soil Survey
U.S.A.

LOCATION PANOCHE CA

Established Series
Rev. GWH/LCL/RCH/TDC/KDA
10/2002

PANOCHE SERIES

The Panoche series consists of very deep, well drained soils on alluvial fans and flood plains. These soils formed in loamy calcareous alluvium from sedimentary rock. Slope is 0 to 15 percent. The mean annual precipitation is about 6 inches and the mean annual temperature is about 63 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, thermic Typic Haplocambids

TYPICAL PEDON: Panoche loam - on a slope of 1 percent in a cultivated barley field at 755 feet elevation. (Colors are for dry soil unless otherwise stated. When described on October 21, 1970 the soil was dry throughout.)

Ap--0 to 7 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial and many very fine tubular pores; moderately alkaline (pH 8.0); abrupt smooth boundary. (0 to 10 inches thick)

Bw--7 to 24 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic structure parting to moderate coarse subangular blocky; hard, firm, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial and many very fine tubular pores; slightly effervescent, disseminated carbonates; moderately alkaline (pH 8.0); abrupt smooth boundary. (6 to 18 inches thick)

Bk--24 to 60 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; massive; hard, firm, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial and many fine tubular pores; slightly effervescent, carbonates disseminated, strongly effervescent, carbonates segregated as few fine irregularly shaped threads; moderately alkaline (pH 8.0).

TYPE LOCATION: Kings County, California; 0.5 miles south of the community of Avenal, 700 feet southwest of the intersection of Highway 33 and Big Tar Canyon Road; 700 feet south and 100 feet west of the northeast corner of section 28, T. 22 S., R. 17 E., MDB&M; Latitude 35 degrees, 59 minutes, 29 seconds north and Longitude 120 degrees, 07 minutes, 43 seconds west; USGS Garza Peak Topographic Quadrangle, NAD 27.

RANGE IN CHARACTERISTICS: The soil between the depths of 5 and 15 inches becomes moist in some part in the latter part of December and stays moist until about the end of February or March. It is usually dry the rest of

the year. Mean annual soil temperature is about 60 degrees to 66 degrees F. The soil temperature is always above 47 degrees F. Coarse fragments are generally less than 5 percent, though some pedons have thin strata with up to 35 percent below 40 inches. Organic matter is less than 1 percent and decreases regularly with increasing depth. They generally are calcareous below a depth of 1 to 7 inches. Some pedons are weakly stratified while others are very uniform in texture.

The A horizon has color of 10YR 5/2, 5/3, 5/4, 6/2, 6/3, 6/4, 7/3, 7/4; 2.5Y 5/2, 5/4 or 6/2. Moist color is 10YR 3/3, 4/2, 4/3, 4/4, 5/2, 5/3, 5/4; 2.5Y 4/2, 4/4 or 5/2. Texture is sandy loam, loam, clay loam or silty clay loam. Clay content is 15 to 35 percent. Most pedons have subangular blocky or prismatic structure but those that have been plowed are often massive. Reaction is slightly alkaline or moderately alkaline.

The Bw horizon has color of 10YR 5/2, 5/3, 5/4, 6/2, 6/3, 6/4, 7/3, 7/4; 2.5Y 5/2, 5/4 or 6/2. Moist color is 10YR 3/3, 4/2, 4/3, 4/4, 5/2, 5/3, 5/4; 2.5Y 4/2, 4/4 or 5/2. Texture is sandy loam, loam, clay loam or silty clay loam. Clay content is 18 to 35 percent. Most pedons have subangular blocky or prismatic structure. Reaction is slightly alkaline or moderately alkaline.

The Bk and Bky horizons, when present, have color of 10YR 5/2, 5/3, 5/4, 6/2, 6/3, 6/4, 7/3, 7/4; 2.5Y 5/2, 5/4, 6/2, 6/4 or 7/2. Moist color is 10YR 4/2, 4/3, 4/4, 5/2, 5/3, 5/4; 2.5Y 4/2, 4/4, 5/2 or 5/4. Texture is sandy loam, fine sandy loam, loam, clay loam, silty clay loam or sandy clay loam. The sand fraction of the sandy clay loam consists of 50 to 80 percent fine and very fine sands. Sandy loam texture may occur below a depth of 50 inches. Clay content is 18 to 35 percent. Gypsum crystals are present in some pedons. Bk horizons with segregated carbonates are present in most pedons and calcium carbonate equivalent is less than 5 percent. Reaction is slightly alkaline or moderately alkaline.

The C horizon, when present, has color of 10YR 5/2, 5/3, 5/4, 6/2, 6/3, 6/4, 7/3, 7/4; 2.5Y 5/2, 5/4, 6/2 or 6/4. Moist color is 10YR 4/2, 4/3, 5/2, 5/3, 5/4; 2.5Y 4/2, 4/4, 5/2 or 5/4. Texture is loam, clay loam, silty clay loam or sandy clay loam in the lower part. The sand fraction of the sandy clay loam consists of 50 to 80 percent fine and very fine sands. Clay content is 18 to 35 percent. Reaction is moderately alkaline or strongly alkaline.

COMPETING SERIES: These are the Adelino, Kettleman and Voyager series. Adelino soils (MLRA 42) are on alluvial fans and are intermittently moist in the summer and have 7.5YR hue. Kettleman soils (MLRA 15) are on hills and uplands and have a paralithic contact at a depth of 20 to 40 inches. Voyager soils (MLRA 30) formed in eolian material on alluvial flats at elevations of more than 2,270 feet and have Bt horizons.

GEOGRAPHIC SETTING: Panoche soils are on alluvial fans and flood plains.Slope is 0 to 15 percent. They formed in alluvium derived mainly from sedimentary rock. They occur at elevations of 185 to 1,800 feet in an arid mesothermal climate having warm summers and cool moist winters. Mean annual precipitation is 5 to 8 inches. Mean January temperature is about 46 degrees F.; mean July temperature is about 82 degrees F.; and

the mean annual temperature is 62 degrees to 65 degrees F. The frost-free season is 250 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Delano, Garces, Kimberlina, McFarland, Milham and Wasco soils and the competing Kettleman soils. Delano and Milham soils are on alluvial fans and fan remnants and have an argillic horizon. McFarland soils are on flood plains and alluvial fans and do not have a cambic horizon. Garces soils have a natric horizon and are on fan remnants. Kimberlina and Wasco soils are on alluvial fans and have a coarse-loamy particle-size control section.

DRAINAGE AND PERMEABILITY: Well drained; negligible to medium runoff; moderate permeability.

USE AND VEGETATION: Used for irrigated crops such as alfalfa, almonds, barley, cotton, sugar beets and sorghum. Dryland areas are used as range following seasonal rains. A few areas are used for dryland grain, but are seldom successful.

DISTRIBUTION AND EXTENT: Southern part of the San Joaquin Valley in California. The soils are extensive. MLRA 17.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Reconnaissance Survey of the Lower San Joaquin Valley, California, 1915.

REMARKS: The Panoche series formerly included soils with an aridic bordering on a xeric moisture regime. Such soils will now be within the Polonio series. The Panoche series was historically classified as Typic Torriorthents. This was changed to Typic Haplocambids when a cambic horizon was describedin the Panoche profile. The presence of a cambic horizon is based on the following characteristic:
1. Soil structure in the cambic horizon (unless moist from irrigation or rainfall or drastically modified by deep ripping).
2. Removal of carbonates or gypsum from the cambic horizon.
3. Accumulation of carbonates or gypsum below the cambic horizon which supports loss of carbonates or gypsum from overlying horizons.
4. Higher chroma in the cambic horizon in some pedons.
5. Most areas of Panoche soil are irrigated with 2 to 3 feet of water per year applied for crop production. Previous to irrigation, only about 7 inches of precipitation coupled with flood water, was available for soil development. Movement of carbonates, gypsum, fertilizers, and salt through the soil profile has created more pronounced cambic horizons because of application of irrigation water.
The recognition of a cambic horizon in this soil necessitates the placing of all saline-sodic and saline-alkali phases of Panoche series into another soil series. These soils would classify as Sodic Haplocambids. Many of these soils will be called Calflax series. Calflax series has an irregular decrease in organic carbon content with increasing depth, which appears to be the case with soils mapped as Panoche, saline sodic. They also occur on lower positions in the landscape (fan skirts) than Panoche soils, which are not saline-sodic (alluvial fans and flood plains).
Major Diagnostic Horizons:

1. Ochric Epipedon--0 to 7 inches (Ap).
2. Cambic Horizon--7 to 24 inches (Bw).
2.1 Removal of carbonates or gypsum from the cambic horizon.
3. Zone of redistribution--24 to 60 inches (Bk).

National Cooperative Soil Survey
U.S.A.

LOCATION LERDO CA

Established Series
Rev. KKC/MAV/GWH/TDC/ET
02/2003

LERDO SERIES

The Lerdo series consists of deep, somewhat poorly drained soils formed in granitic or sedimentary alluvium. Lerdo soils are on alluvial plains and saline-alkali basins and have slopes of 0 to 2 percent. The mean annual precipitation is about 5 inches, and the mean annual temperature is about 64 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, calcareous, thermic Typic Torrifluvents

TYPICAL PEDON: Lerdo clay loam - on a southwest-facing slope of less than 1 percent under cultivation at 255 feet elevation. (Colors are for dry soil unless otherwise stated. When described on 4/4/73, the soil was moist throughout.)

Ap--0 to 7 inches; gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; moderate coarse and medium angular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine interstitial and tubular pores; slightly effervescent, disseminated lime; moderately alkaline (pH 8.2); abrupt smooth boundary. (6 to 11 inches thick)

A12--7 to 22 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak coarse angular blocky structure; slightly hard, firm, sticky and plastic; common very fine and few fine roots; many very fine interstitial and tubular pores; slightly effervescent, disseminated lime; moderately alkaline (pH 8.2); clear smooth boundary. (14 to 17 inches thick)

C1--22 to 50 inches; light gray (10YR 6/1) loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic and moderate coarse angular blocky structure; slightly hard, firm, sticky and plastic; common very fine and few fine roots; many very fine and common fine tubular pores; strongly effervescent, disseminated lime; strongly alkaline (pH 8.8); abrupt smooth boundary. (3 to 28 inches thick)

C2ca--50 to 60 inches; light gray (10YR 7/1) loam, pale brown (10YR 6/3) moist; massive; very hard, friable, slightly plastic; few very fine and fine roots; many very fine interstitial and many very fine and few fine tubular pores; few thin clay films in pores; violently effervescent, disseminated lime; strongly alkaline (pH 9.0).

TYPE LOCATION: Kern County, California; about 10 1/2 miles north of Buttonwillow and about 50 feet northeast of the southwest corner of the southwest 1/4, southeast 1/4, northwest 1/4 of section 11, T. 28 S., R. 23 E., MDB&M.

RANGE IN CHARACTERISTICS: The soil between depths of 4 and 12 inches is dry in all parts from April 1 until December 1 and is moist in some or all parts for 50 to 90 consecutive days during the winter. It is not moist for as long as 90 cumulative days. Mean annual soil temperature is 66 degrees F. and is always above 47 degrees F. Saline-alkali phases are recognized. The soil is moderately or strongly alkaline (pH 7.8-9.0).

The A horizon has dry color of 10YR 5/1 or 5/2 and moist color of 10YR 3/1 or 3/2. Organic matter ranges from 1 to 3 percent to a depth of more than 20 inches and decreases irregularly with increasing depth. It is heavy loam, clay loam, or silty clay loam and averages 25 to 35 percent clay. The EC is less than 3.0 mmhos/cm and the ESP is less than 11.

The C horizon has dry color of 10YR 5/1, 6/1, 6/2, 7/2; 2.5Y 6/2, 7/1 or 7/2 and moist color of 10YR 3/1, 4/2, 5/3, 6/3; 2.5Y 4/2 or 5/2. It is loam or light clay loam and is weakly stratified. Clay content is 20 to 30 percent. The C horizons have an EC of 1 to 8, but average 6 mmhos/cm and the ESP ranges from 1 to more than 70 but averages 30.

COMPETING SERIES: These are the Leeds and Rosamond series and the Glendale, Pima, and Westhaven series in another family. Glendale soils have less than 1 percent organic matter in the A horizon and are fine-silty. Pima soils are fine-silty. Leeds soils have 5YR or 2.5YR hue in the C horizon. Rosamond soils have less than 1 percent organic matter in the A horizon. Westhaven soils are fine-silty.

GEOGRAPHIC SETTING: Lerdo soils are on alluvial plains and basins. Slopes are 0 to 2 percent. The soils formed in alluvium from granite, shale, or sandstone. Elevations are 235 to 275 feet. The climate is arid with hot, dry summers and cool, somewhat moist winters. Summer rains are rare. Mean annual precipitation is 5 or 6 inches. Mean January temperature is about 46 degrees F., mean July temperature is about 83 degrees F., mean annual temperature is 63 degrees to 65 degrees F. Frost-free season is 250 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Buttonwillow, Garces, Kimberlina, Lokern, Milham, Panoche, and Jerryslu soils. Buttonwillow soils are clayey over loamy. Garces and Milham soils have an argillic horizon. Kimberlina soils are coarse-loamy. Lokern soils are fine. Panoche soils have an organic carbon content that decreases regularly with increasing depth. Jerryslu soils have a duripan and a natric horizon.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; slow runoff; moderately slow permeability. These soils are subject to rare flooding but are protected by dams and/or levees. The drainage of these soils has been altered.

USE AND VEGETATION: Used mainly for irrigated crops such as alfalfa, barley, cotton, grain sorghum, sugar beets, and wheat. The choice of crops is governed by the degree of reclamation that has taken place. Natural vegetation consists of annual grasses, forbs, and saltbush.

DISTRIBUTION AND EXTENT: The southern part of the San Joaquin Valley of California. The soils are of small extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Kern County, Northwestern Part, California, 1982.

REMARKS: This soil is not classified as a Mollisol because the epipedon is not moist for 90 cumulative days in 7 out of 10 years when not irrigated. It would be classified as a Mollic Torrifluvent if this subgroup were adopted.

The activity class was added to the classification in February of 2003. Competing series were not checked at that time. - ET

National Cooperative Soil Survey
U.S.A.

LOCATION WASCO CA

Established Series
Rev. KKC/ARW/CAF/KDA
05/2003

WASCO SERIES

The Wasco series consists of very deep, well drained soils on recent alluvial fans and flood plains. These soils formed in mixed alluvium derived mainly from igneous and/or sedimentary rock sources. Slope is 0 to 5 percent slopes. The mean annual precipitation is about 6 inches and the mean annual temperature is about 64 degrees F.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, nonacid, thermic Typic Torriorthents

TYPICAL PEDON: Wasco sandy loam, cultivated. (Colors are for dry soil unless otherwise stated.)

Ap1--0 to 9 inches; brown (10YR 5/3) sandy loam, dark gray (10YR 4/1) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; slightly acid (pH 6.4); abrupt smooth boundary.

Ap2--9 to 15 inches; yellowish brown (10YR 5/4) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; few very fine tubular and many very fine interstitial pores; neutral (pH 6.6); abrupt smooth boundary. (Combined thickness of the A horizon ranges from 9 to 40 inches)

C1--15 to 32 inches; brown (10YR 5/3) sandy loam, dark gray (10YR 4/1) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; common very fine tubular and many very fine interstitial pores; neutral (pH 7.2); abrupt smooth boundary. (14 to 21 inches thick)

C2--32 to 65 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; common very fine tubular and many very fine interstitial pores; slightly effervescent, carbonates disseminated; moderately alkaline (pH 8.2).

TYPE LOCATION: Kern County, California; about 3.5 miles southeast of the community of Wasco; approximately 300 feet east and 2,550 feet south of the northwest corner of section 32, T. 27 S., R. 25 E., MDB&M; Latitude 35 degrees, 32 minutes, 11 seconds north and Longitude 119 degrees, 18 minutes, 41 seconds west; USGS Wasco Topographic Quadrangle, NAD 27.

RANGE IN CHARACTERISTICS: The soil between the depths of 8 and 24 inches is dry in all parts from mid-April until mid-January and is continuously moist in some parts for 60 to 90 consecutive days in the winter. Mean annual soil temperature is 62 degrees to 67 degrees F. The soil

temperature is never below 47 degrees F. in the San Joaquin Valley. Some pedons have disseminated carbonates at depths below 16 to 40 inches. Rock fragment content is 0 to 15 percent. Rock fragments are less than 0.5 inch in diameter. Organic matter is less than 1 percent in the upper part of the profile and decreases regularly with increasing depth. Organic matter content is less than 0.2 percent below 49 inches depth.

The A horizon has color of 10YR 5/2, 5/3, 5/4, 6/2, 6/3, 6/4; 2.5Y 5/2 or 6/2. Moist color is 10YR 3/3, 4/2, 4/3, 5/2; 2.5Y 4/2 or 5/2. Texture is sandy loam or fine sandy loam. Reaction is slightly acid to moderately alkaline.

The C horizon has color of 10YR 5/3, 5/4, 6/3, 6/4, 7/2; 2.5Y 5/2, 5/4, 6/2, 7/2 or 7/4. Moist color is 10YR 3/3, 4/2, 4/3, 5/3; 2.5Y 4/2, 4/4, 5/2, 5/4 or 6/2. Texture is coarse sandy loam, sandy loam or fine sandy loam. Some pedons have thick stratification below a depth of 40 inches with texture of loamy sand to silt loam. Distinct thin stratification is not present. Reaction is neutral to moderately alkaline.

COMPETING SERIES: These are the Cantua and Uxo series. Cantua soils (MLRA 15), on uplands, are 40 to 60 inches deep to a paralithic contact of soft, calcareous sandstone. Uxo soils (MLRA 30), on alluvial fans and fan aprons, are moist for 10 to 20 days cumulative between July and October following convection storms, have gravel content in the A horizon of 40 to 75 percent and have Btk horizons.

GEOGRAPHIC SETTING: Wasco soils are on recent alluvial fans and flood plains. Slope is 0 to 5 percent. These soils formed in mixed alluvium derived dominantly from igneous and/or sedimentary rock sources. Elevation is 225 to 1,000 feet in the southern part of San Joaquin Valley and cool phases occur at elevations as high as 3,700 feet in the Mojave Desert. The climate is arid to semiarid with hot, dry summers and cool, somewhat moist winters. Mean annual precipitation is 4 to 7 inches. Mean January temperature is 44 degrees to 47 degrees F.; mean July temperature is 80 degrees to 85 degrees F.; mean annual temperature is 59 degrees to 62 degrees F. in the Mojave Desert and 62 degrees to 65 degrees F. in the San Joaquin Valley. Frost-free season is 250 to 300 days in the San Joaquin Valley and 210 to 250 days in the Mojave Desert.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Milham and Panoche series. Milham soils, on fan remnants, alluvial fans, plains and low terraces, have an argillic horizon that has a fine-loamy particle-size control section. Panoche soils, on alluvial fans and plains, have a fine-loamy particle-size control section.

DRAINAGE AND PERMEABILITY: Well drained; negligible or very low runoff; moderately rapid permeability.

USE AND VEGETATION: Used for growing field, forage and row crops. Some areas are used for livestock grazing, wildlife habitat, recreation and homesites. Native vegetation is Atriplex spp., annual grasses and forbs.

DISTRIBUTION AND EXTENT: Mainly in the southern part of the San Joaquin Valley and to a lessor extent in the Mojave Desert. The series is of large extent. MLRA 17, 30.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: San Bernardino County, California, Mojave River Area, 1978.

REMARKS: The Wasco soils were formerly mapped as Hesperia series. Hesperia soils are now recognized as having a torric bordering on a xeric moisture regime. The cool phases at the higher elevations and shorter FFS should be a new series with near mesic soil temperature.

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LOCATION WESTHAVEN CA

Established Series
Rev. KDA/ARW/JJJ/KDA
02/2003

WESTHAVEN SERIES

The Westhaven series consists of very deep, well drained soils that formed in stratified mixed alluvium weathered from sedimentary and/or igneous rocks. Westhaven soils are on alluvial fans and flood plains. Slope is 0 to 5 percent. The mean annual precipitation is about 7 inches and the mean annual temperature is about 64 degrees F.

TAXONOMIC CLASS: Fine-silty, mixed, superactive, thermic Fluventic Haplocambids

TYPICAL PEDON: Westhaven loam, on a southeast-facing slope of 1 percent under an almond orchard at 278 feet elevation. (Colors are for dry soil unless otherwise stated. When described 11/6/78 the soil was dry from 0 to 29 inches and slightly moist below.)

Ap--0 to 7 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; common very fine and few fine roots; common very fine tubular and many very fine interstitial pores; slightly effervescent, carbonates disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary. (7 to 14 inches thick)

Bw--7 to 19 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; few very fine, fine and medium roots; common very fine tubular and many very fine interstitial pores; slightly effervescent, carbonates disseminated; moderately alkaline (pH 8.1); clear wavy boundary. (9 to 15 inches thick)

Bk1--19 to 24 inches; light brownish gray (2.5Y 6/2) silty clay loam, with many discontinuous thin strata of silty clay and silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, moderately sticky and moderately plastic; few very fine, fine and medium roots; many very fine tubular and interstitial pores; strongly effervescent, carbonates disseminated and segregated as common fine irregularly shaped soft masses; moderately alkaline (pH 8.0); abrupt wavy boundary. (5 to 22 inches thick)

Bk2--24 to 29 inches; light brownish gray (2.5Y 6/2) silt loam, with many discontinuous thin strata of silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, moderately sticky and moderately plastic; few fine roots; many very fine tubular and interstitial pores; strongly effervescent, carbonates disseminated and segregated as common fine irregularly shaped soft masses; common fine prominent dark yellowish brown (10YR 3/6) moist relict redoximorphic

concentrations of iron; moderately alkaline (pH 8.1); gradual wavy boundary. (5 to 22 inches thick)

C1--29 to 45 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard; very friable, moderately sticky and moderately plastic; few very fine roots; many very fine tubular and interstitial pores; strongly effervescent, carbonates disseminated; moderately alkaline (pH 8.2); clear wavy boundary. (0 to 16 inches thick)

2C2--45 to 72 inches; light brownish gray (2.5Y 6/2) silty clay dark grayish brown (2.5Y 4/2) moist; massive, hard, friable, moderately sticky and very plastic; few very fine tubular pores; strongly effervescent, carbonates disseminated; moderately alkaline (pH 7.9); abrupt wavy boundary. (0 to 27 inches thick)

3C3--72 to 84 inches; light gray (2.5Y 7/2) loamy sand, dark grayish brown (2.5Y 4/2) moist; massive; loose; many very fine interstitial pores; slightly alkaline (pH 7.8).

TYPE LOCATION: Kings County, California; approximately 2,600 feet south of Nevada Avenue and 250 feet west of 30th Avenue; about 2,600 feet south and 250 feet west of the northeast corner of section 3, T. 21 S., R. 18 E.; MDB&M; Latitude 36 degrees, 07 minutes, 51 seconds north and Longitude 120 degrees, 00 minutes, 16 seconds west; USGS Huron Topographic Quadrangle, NAD 27.

RANGE IN CHARACTERISTICS: The mean annual soil temperature ranges from 64 degrees to 67 degrees F. and the soil temperature is always above 47 degrees F. The soil between depths of 4 and 12 inches is dry in all parts from April through December and is not moist in some or all parts for as long as 90 consecutive days. The particle-size control section averages 18 to 35 percent clay. Less than 15 percent of the particles are fine sand or coarser, by weighted average, between depths of 10 to 40 inches. Electrical conductivity is 0 to 4.0 decisiemens per meter, and sodium adsorption ratio is 0 to 12. Calcium carbonate equivalent is 0 to 5 percent. Organic matter decreases irregularly with increasing depth.

The A horizon has color of 10YR 5/3, 5/4, 6/2, 6/3, 6/4, 7/4; 2.5Y 6/2 or 6/4. Moist color is 10YR 3/2, 3/3, 4/3, 4/4; 2.5Y 4/2 or 4/3. Texture is fine sandy loam, sandy loam, silt loam, loam or clay loam. It is noneffervescent to strongly effervescent. Reaction is slightly alkaline or moderately alkaline.

The Bw horizon has color of 10YR 5/3, 5/4, 6/3, 6/4, 7/2; 2.5Y 4/2, 5/2, 5/4, 6/2, 6/4 or 7/4. Moist color is 10YR 4/2, 4/3, 5/2, 5/3; 2.5Y 4/2, 4/3, 4/4, 5/2 or 5/4. Texture is fine sandy loam, silt loam, loam, silty clay loam or clay loam. It is very slightly effervescent to slightly effervescent. Reaction is slightly alkaline or moderately alkaline.

The Bk horizon has color of 10YR 5/3, 5/4, 6/3, 6/4, 7/2: 2.5Y 4/2, 5/2, 5/4, 6/2, 6/4, 7/2 or 7/4. Moist color is 10YR 4/2, 4/3, 5/2, 5/3; 2.5Y 4/2, 4/4, 5/2 or 5/4. It is stratified loamy sand, loamy fine sand, fine sandy loam, very fine sandy loam, silt loam, loam, sandy clay loam, silty

clay loam and clay loam. Texture is slightly effervescent to strongly effervescent. Carbonates are disseminated and segregated with common threads or soft masses.

The C horizon, when present, has color of 10YR 5/3, 5/4, 6/3, 6/4, 7/2; 2.5Y 4/2, 5/2, 5/4, 6/2, 6/4, 7/2 or 7/4. Moist color is 10YR 4/2, 4/3, 5/2, 5/3, 6/1; 2.5Y 4/2, 4/4, 5/2 or 5/4. Relict redoximorphic concentrations of iron occur in some pedons below a depth of 20 inches. Texture is loamy sand to clay below a depth of 40 inches. It is noneffervescent to strongly effervescent with disseminated carbonates. Reaction is slightly alkaline or moderately alkaline.

COMPETING SERIES: This is the Tornillo series. Tornillo soils (MLRA 42) are on broad valley floors and are intermittently moist in the summer and have color hue of 7.5YR or 10YR in the A horizon and 5YR to 10YR in the B horizon.

GEOGRAPHIC SETTING: Westhaven soils are on stratified alluvial fans and flood plains at elevations of 200 to 850 feet. They formed in mixed alluvium from sedimentary and/or igneous rocks. Slope is 0 to 5 percent. The climate is arid and has hot, dry summers and cool, somewhat moist winters. The mean annual precipitation is 4 to 8 inches. The mean January temperature is 46 degrees F., mean July temperature is 80 degrees F., and the mean annual temperature is 62 degrees to 65 degrees F. The frost-free season is 240 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Excelsior, Kimberlina, Lethent, Panoche, Twisselman, Wasco, and Westcamp soils. Excelsior, Kimberlina, and Wasco soils have a coarse-loamy particle-size control section. Kimberlina, Panoche, Twisselman, and Wasco soils have a regular decrease in organic carbon with increasing depth. Lethent soils are on fan skirts and basin rims and have a natric horizon. Panoche soils have a fine-loamy particle-size control section. Twisselman soils have a fine particle-size control section. Westcamp soils are on basin rims and have an aquic moisture regime. Excelsior, Kimberlina, Wasco, Panoche and Twisselman are on alluvial fans.

DRAINAGE AND PERMEABILITY: Well drained; low runoff; moderately slow permeability. These soils are subject to very rare to occasional flooding in some places, in others they are protected by dams and levees.

USE AND VEGETATION: This soil is used for irrigated cropland to grow wheat, lettuce, cotton, tomatoes, almonds, grapes, and peaches. The natural vegetation was mainly saltbush (Atriplex spp.) and annual grasses and forbs. Some areas are used for building site development.

DISTRIBUTION AND EXTENT: San Joaquin Valley, California. Westhaven series is moderately extensive. MLRA 17.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Kings County, California, 1980.

REMARKS: Fluventic subgroup based on irregular distribution of organic matter in the highly stratified layers between 19 and 84 inches. Distribution of carbonates within the profile has been affected by irrigation. In some pedons, segregated carbonates are present throughout the entire profile below the Bw horizon. These are designated Bk horizons and no C horizon is designated.
The original competing series before taxonomy change were the Glendale (AZ) and Pima (AZ) series. Glendale and Pima soils are intermittently moist in the moisture control section during July, August and September from summer thunderstorms.
Previously mapped as Panoche series in the Soil Survey of Mendota Area, California, Series 1940, No. 18 and Coalinga Area, California, Series 1944, No. 1. The classification of Westhaven series was established as Typic Torrifluvents. This was changed to Fluventic Haplocambids when a cambic horizon was recognized in the Westhaven profile. The presence of a cambic horizon is based on the following characteristics:
1. Soil structure in the cambic horizon (unless moist from irrigation or rainfall or drastically modified by deep ripping)
2. Removal of carbonates from the cambic horizon
3. Accumulation of carbonates below the cambic horizon which supports loss of carbonate from overlying horizons
4. Higher chroma in the cambic horizon in some pedons
5. Most areas of Westhaven soils are irrigated with 2 to 3 feet of water per year applied for crop production. Previous to irrigation only about 7 inches of precipitation coupled with flood water, was available for soil development. Movement of carbonates, fertilizer and salt through the soil profile has created more pronounced cambic horizons because of application of irrigation water. The recognition of a cambic horizon in this soil necessitates the placing of all saline-sodic and saline-alkali phases of Westhaven series into another soil series. These soils would classify as fine-silty, mixed, superactive, thermic Sodic Haplocambids. Many of these soils will be called Posochanet series. Posochanet soils occur on lower position in the landscape (fan skirts) than Westhaven soils (alluvial fans), which are not saline-sodic. Map unit 178 in Kings County should be correlated from Westhaven to Posochanet series.

Major Diagnostic Horizons:
1. Ochric epipedon--0 to 7 inches (Ap)
2. Cambic horizon--7 to 19 inches (Bw)
2.1 Removal of carbonates from the cambic horizon
3. Zone of redistribution--19 to 29 inches (Bk)

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Appendix O

Kern Water Bank Storage Project Monitoring Wells

State Well Number	Date Constructed	GS Elevation	RP Elevation	Sceen Interval	Casing Material	Casing Size	Total Depth
30S/24E-13D01	1990-06-05	287.50	289.50	150' - 250'	Steel	6"	250
30S/24E-13D02	1990-06-05	287.50	289.00	320' - 360'	Steel	6"	360
30S/24E-13D03	1990-06-05	287.50	288.50	520' - 650'	Steel	6"	650
30S/24E-13D04	1993-08-11	288.00	289.00	65' - 120'	PVC	2"	120
30S/24E-24C01	2006-02-14	290.00	291.00	140' - 160'	PVC	2"	800
30S/24E-24C02	2006-02-14	290.00	291.30	330' - 350'	PVC	2"	
30S/24E-24C03	2006-02-14	290.00	291.50	640' - 660'	PVC	2"	
30S/25E-04J02	1989-06-15	311.00	313.01	190' - 250'	Steel		
30S/25E-04J03	1989-06-15	311.00	312.50	345' - 455'	Steel		
30S/25E-04J04	1989-06-15	311.00	312.00	565' - 625'	Steel		
30S/25E-04J05	1993-08-12	311.00	313.00	140' - 150'	PVC	2"	150
30S/25E-07A02	1990-05-18	297.50	299.50	220' - 290'	Steel		
30S/25E-07A03	1990-05-18	297.50	299.00	420' - 470'	Steel		
30S/25E-07A04	1990-05-18	297.50	298.50	530' - 620'	Steel		
30S/25E-07A05	1993-08-12	298.00	299.00	100' - 120'	Steel		
30S/25E-11P01	1990-03-02	317.20	319.20	150' - 210'	Steel	6"	700
30S/25E-11P02	1990-03-02	317.20	318.70	330' - 470'	Steel	6"	470
30S/25E-11P03	1990-03-02	317.20	318.20	520' - 570'	Steel	6"	570
30S/25E-11P04	1993-08-12	317.20	319.00	80' - 130'	PVC	2"	130
30S/25E-12A01	1968-01-25	328.00	328.00	90' - 150'	Steel		
30S/25E-12B02	1990-03-01	324.50	325.50	150' - 250'	Steel	6"	250
30S/25E-12B03	1990-03-01	324.50	325.00	360' - 500'	Steel	6"	500
30S/25E-12B04	1990-03-01	323.50	324.50	590' - 690'	Steel	6"	690
30S/25E-12B05	1993-08-12	324.00	325.00	50' - 80'	PVC	2"	80
30S/25E-13D01				131' - 151'	PVC	2"	
30S/25E-14C02		318.00		Unknown	Steel		
30S/25E-14H02	1995-02-07	320.00	321.00	140' - 210'	Steel	6"	210
30S/25E-16L01	1990-03-01	304.00	305.50	285' - 345'	Steel	6"	345
30S/25E-16L02	1990-03-01	304.00	305.00	515' - 555'	Steel	6"	555
30S/25E-16L03	1990-03-01	304.00	304.50	645' - 690'	Steel	6"	690
30S/25E-16L04	1993-08-12	304.00	305.00	100' - 130'	PVC	2"	130
30S/25E-17M02	2006			195' - 215'	PVC	2"	800
30S/25E-17M03	2006			430' - 450'	PVC	2"	800
30S/25E-17M04	2006			705' - 725'	PVC	2"	800
30S/25E-19N02	1989-07-17	295.77	296.77	90' - 120'	Steel	6"	120
30S/25E-19N03	1989-07-17	295.31	296.31	190' - 230'	Steel	6"	230
30S/25E-19N04	1989-07-17	294.78	295.78	310' - 385'	Steel	6"	385
30S/25E-19N05	2006			45' - 85'	PVC	2"	675
30S/25E-19R01	1992-11-18	300.00	301.00	485' - 555'	Steel	6"	555
30S/25E-19R02	1992-11-18	300.00	301.00	336' - 376'	Steel	6"	376
30S/25E-24C01	1982-07-16	322.30	322.90	150' - 250'	Steel	6"	250
30S/25E-24C02	1988-07-01	322.30	322.95	70' - 90'	PVC	2"	95
30S/25E-24C03	1993-02-02	321.38	322.38	55' - 65'			
30S/25E-24C04	1989-02-01	322.50	322.90	425' - 525'			
30S/25E-36R01	1992-11-18	307.00	308.00	600' - 640'	Steel	6"	640
30S/25E-36R02	1992-11-18	307.00	308.00	410' - 500'	Steel	6"	500
30S/26E-06L01	1989-06-15	331.00	333.32	210' - 270'	Steel	6"	270
30S/26E-06L02	1989-06-15	331.00	332.73	360' - 536'	Steel	6"	536
30S/26E-06L03	1989-06-15	331.00	332.23	585' - 620'	Steel	6"	620
30S/26E-06L04	1993-08-12	331.00	333.00	125' - 150'	PVC	2"	150
30S/26E-28J01	1990-05-17	336.00	336.50	120' - 220'	Steel	6"	220
30S/26E-28J02	1990-05-17	335.00	336.00	280' - 330'	Steel	6"	320
30S/26E-28J03	1990-05-17	335.00	335.50	540' - 615'	Steel	6"	615
30S/26E-28J04	1993-08-11	329.00	330.00	75' - 95'	PVC	2"	95
30S/26E-32N01	1989-06-15	312.00	314.12	210' - 330'	Steel	6"	330
30S/26E-32N02	1989-06-15	312.00	313.67	390' - 440'	Steel	6"	440
30S/26E-32N03	1989-06-15	312.00	313.17	570' - 610'	Steel	6"	610

Appendix P

2011-2016 KERN FAN AREA OPERATIONS AND MONITORING REPORT

Prepared by

Kern Fan Monitoring Committee

September 2017

2011-2016 Kern Fan Area Operations and Monitoring Report

Kern Fan Monitoring Committee

September 2017

Mark Mulkay
Chairman

Jon Parker
Vice Chairman

Wendy Adams - Rosenberger
Treasurer

Prepared under the direction of the Kern Fan Operations Report Subcommittee and Martin Varga - Kern County Water Agency Engineering and Groundwater Services Manager

<u>Major Contributors</u>

Wendy Adams-Rosenberger – WKWD Regulatory Administrator
Maegan Allen - KCWA Water Resources Planner
Michelle Anderson - KCWA Geologist
Andrew Bell – BVWSD Assistant Engineer
Nick Gatti - KCWA Water Resources Planner
Mark Mulkay – KDWD General Manager
Jon Parker – KWBA General Manager
Zach Smith – RRBWSD Operations Manager

The data presented in the Kern Fan Area Operations and Monitoring Report are derived from multiple sources and are the best available at the time of publication and subject to change. The groundwater analyses presented are the interpretations of Ken Schmidt, Kenneth D. Schmidt and Associates, independent hydrogeologist to the Kern Fan Monitoring Committee, and other participants in the Kern Fan Monitoring Committee (for a full list of participants please see the next page) and are not intended to support, refute or replace any analyses by other parties. All supporting data and calculations used to prepare this report are available for public review through the Kern Fan Monitoring Committee.

Kern Fan Monitoring Committee Participants:

Belridge Water Storage District
Berrenda Mesa Water District
Buena Vista Water Storage District
Dudley Ridge
Henry Miller Water District
Improvement District No. 4
Kern County Water Agency
Kern Delta Water District
Kern Water Bank Authority
Lost Hills Water District
McAllister Ranch Irrigation District
North Kern Water Storage District
Rosedale-Rio Bravo Water Storage District
Semitropic Improvement District
Tejon-Castac Water District
West Kern Water District
Westside Mutual Water District
Wheeler Ridge-Maricopa WSD
Kenneth Schmidt - Consultant
Monique Roberts – Consultant

Kern Fan Operations Report Subcommittee Participants:

Maegan Allen – KCWA
Michelle Anderson – KCWA
Mark Mulkay – KDWD
Jon Parker – KWBA
Zach Smith – RRBWSD
Harry Starkey – WKWD
Tom Suggs - WRMWSD

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Chapter 1

KERN FAN OPERATIONS REPORT 2011-2016

BACKGROUND

In 1995, a Memorandum of Understanding (MOU) was developed between the Kern Water Bank Authority's project participants and adjoining entities. As part of the MOU, the Kern Fan Monitoring Committee (Committee) was established to oversee the development and implementation of a monitoring program for the KWB and the surrounding area. From 1997 through 2016, several additional banking projects were developed on the Kern Fan. These included the Pioneer (1997), Berrenda Mesa (1999), Buena Vista WSD (2003), Rosedale - Rio Bravo WSD (2003), Kern Delta WD (2003), and West Kern WD (2010) projects. All of these projects entered into agreements similar to the KWB MOU, and all agreed to participate in the Committee's monitoring program developed as part of the original MOU.

Recharge and recovery activities on portions of the Kern Fan have been monitored by the Kern County Water Agency (KCWA) or Department of Water Resources (DWR) since the 1980's. Two triennial reports on the results of the Kern Fan monitoring were prepared by the KCWA and DWR: 1) in 1994 for 1991-1993 and 2) in 1997 for 1994-1996. It is intended that the Committee publish reports that include information on groundwater conditions and water banking activities. This is the seventh of such reports. The first report, titled "1995 Kern Fan Operations Report," was published in July 1999. The second report, titled "2001 Kern Fan Area Groundwater Recovery Operations and Monitoring Program," was published in April 2005. The third report, titled "1996-2000 Kern Fan Area Operations and Monitoring Report," was published in September 2007. The fourth report, titled "2002-2004 Kern Fan Area Operations and Monitoring Report," was published in December 2009. The fifth report, titled "Amended 2005-2006 Kern Fan Area Operations and Monitoring Report," was published in December 2013. The sixth report, titled "2007-2010 Kern Fan Area Operations and Monitoring Report," was published in May 2016.

The data presented in the Kern Fan Area Operations and Monitoring Report are derived from multiple sources and are the best available at the time of publication and subject to change. All supporting data and calculations used to prepare this report are available for public review through the Kern Fan Monitoring Committee.

MONITORING PROGRAM

The monitoring program involves measuring deliveries for recharge and recovery pumping, measuring water levels in wells, and sampling wells to assess groundwater quality. The approximate monitoring area is shown on Plate 1-1. The Committee documents the operations of the projects and the activities of surrounding groundwater districts. This report documents the results of the monitoring program.

PROJECT OPERATIONS

During the 2011-2016 reporting period there was recharge during 2011 tapering off by 2013 followed by extensive recovery through 2016 with some recharge activity beginning again during 2016 on the Kern Fan. Previous Kern Fan Area Operations and Monitoring Reports have focused on a core group of projects. A total of 1,103,134 gross acre-feet were recovered and 746,467 gross acre-feet were delivered to recharge facilities in this core group of Kern Fan projects during 2011-2016, as reflected in Table 1-1 below.

Table 1-1
Summary of Operations
Recharge and Recovery by Project (core groups)

Recharge							**2011-2016**
Project	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Totals**
KWB	476,501	9,010	-	-	-	-	**485,511**
Pioneer	146,766	2,791	-	-	-	-	**149,557**
2800 Acres	46,058	1,739	-	-	-	-	**47,797**
Berrenda Mesa	37,250	6,294	-	-	-	-	**43,544**
Kern River Channel	19,840	218	-	-	-	-	**20,058**
Totals	**726,415**	**20,052**	**-**	**-**	**-**	**-**	**746,467**
Recovery							**2011-2016**
Project	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Totals**
KWB	-	110,830	197,171	189,695	159,085	27,194	**683,975**
Pioneer	-	10,276	40,469	62,056	45,154	25,494	**183,449**
2800 Acres	-	9,038	27,165	22,983	10,511	7,932	**77,629**
Berrenda Mesa	-	6,362	2,879	29,281	25,492	14,006	**78,020**
ID4 Wells	-	1,319	3,280	40,069	32,363	3,030	**80,061**
Totals	**-**	**137,825**	**270,964**	**344,084**	**272,605**	**77,656**	**1,103,134**

* - 2800 Acres includes Olcese and Pioneer wells on 2800 Acre property.

Additional projects began self-reporting their recharge and recovery operations starting in 2007. These projects are maintained individually by specific water districts. The operations for these additional projects are reflected in Table 1-2 below.

Table 1-2							
Summary of Operations							
Recharge and Recovery by Project (additional projects)							
Recharge							**2011-2016**
Project	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Totals**
Buena Vista[1]	52,427	35,101	16,132	-	-	18,859	**122,519**
Kern Delta	62,113	109,600	-	-	-	-	**171,713**
Rosedale-Rio Bravo	248,310	33,686	-	-	-	4,119	**286,115**
West Kern	86,970	15,131	-	-	-	12,433	**114,534**
Joint Use Recovery	24,665	6,556	-	-	-	2,226	**33,447**
Totals	**474,485**	**200,074**	**16,132**	**-**	**-**	**37,637**	**728,328**
Recovery							**2011-2016**
Project	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Totals**
Buena Vista[1]	189	1,337	2,829	3,169	1,238	1,530	**10,292**
Kern Delta	-	3,515	20,940	38,690	33,940	20,231	**117,316**
Rosedale-Rio Bravo	-	-	20,482	27,424	24,976	4,959	**77,841**
West Kern	18,361	20,899	23,776	30,297	19,056	20,070	**132,459**
Joint Use Recovery	-	-	19,349	-	12,513	13,963	**45,825**
Totals	**18,550**	**25,751**	**87,376**	**99,580**	**91,723**	**60,753**	**383,733**
[1] - Buena Vista recharge is through canal recharge. Recovery is from District and private wells							

Facilities used for recharge operations during 2011-2016 are depicted graphically in Plate 1-3.

MONITORING RESULTS

Hydrographs are presented which show short-term and long-term trends in groundwater levels (Figure 1-3).

Spring groundwater levels are represented on contour maps in the form of groundwater elevation and depth to water level maps for 2011 to 2016 (Plate 1-4 to Plate 1-15). Also included are groundwater level profiles perpendicular and parallel to the Kern River (Figure 1-1 and Figure 1-2.) Spring groundwater change maps are provided for the years spanning 2011 to 2016 (Plate 1-16 to Plate 1-17).

Semi-annual groundwater quality monitoring as part of the Kern Fan Monitoring Committee Groundwater Quality Sampling Program was performed on the Kern Fan area in 2011-2016. Plate 1-2 shows the wells sampled in 2011-2016. Water quality results from the monitoring wells are shown in Figure 1-4. Statistical analyses on the water quality results from the monitoring wells are shown in Table 1-3. Various

aspects related to the Aqueduct Pump-In Program are displayed in Table 1-4 and Figure 1-5 to Figure 1-8. Salt balance (TDS load) information is presented in Figure 1-9 and Figure 1-10 as well as Table 1-6.

Water Level Results

Depth to Water Contours

Plate 1-4 shows depth to water for Spring 2012 in the middle zone (layer 2, intermediate zone). This map may not be representative of groundwater depths in the shallowest intervals in a specific area.

Plate 1-5 depicts depth to water for Spring 2013.

Plate 1-6 depicts depth to water for Spring 2014.

Plate 1-7 depicts depth to water for Spring 2015.

Plate 1-8 depicts depth to water for Spring 2016.

Plate 1-9 depicts depth to water for Spring 2017.

Water-Level Elevations

Plate 1-10 shows water-level elevations for Spring 2012 in the middle zone (layer 2). This map is considered representative of its strata tapped by most recovery wells, but may not be representative of groundwater depths in the shallowest intervals in a specific area.

Plate 1-11 depicts water-level elevations for Spring 2013.

Plate 1-12 depicts water-level elevations for Spring 2014.

Plate 1-13 depicts water-level elevations for Spring 2015.

Plate 1-14 depicts water-level elevations for Spring 2016.

Plate 1-15 depicts water-level elevations for Spring 2017.

Water-Level Profiles

Figure 1-1 shows spring water-level profiles along a section extending from northwest to southeast through the area. Figure 1-2 shows the water-level profiles from the southwest to the northeast along the Kern River. The period covered by these profiles extends from Spring 1993 to Spring 2016. The water levels that are plotted generally correspond to the middle intervals of the cluster monitoring wells. These are considered representative of water levels in most recovery wells, but aren't necessarily representative of the shallowest groundwater in a specific area.

Water-Level Change Map

Plate 1-16 represents water-level changes for Spring 2012 to Spring 2015.

Plate 1-17 represents water-level changes for Spring 2015 to Spring 2016.

Water-Level Hydrographs
Figure 1-3 contains groundwater level hydrographs for selected monitoring wells on the Kern Fan. Plate 1-2 depicts the location of selected monitoring wells.

Water Quality Results

Water quality was determined for monitoring wells, recovery wells, and canals prior to 2011 and during banking operations through 2016. This data is evaluated and summarized with various graphs. In addition, a comparison of the concentrations of total dissolved solids (TDS) in the recharge water and the recovered water is provided.

Sampling Programs

Groundwater Quality Monitoring Program – The semi-annual Groundwater Quality Monitoring Program was completed for the 2011-2016 time period. This program sampled monitoring wells using the Kern Water Bank purge pump unit. Prior to sampling of each well, three-to-five casing volumes were pumped and frequent measurements were obtained for electrical conductivity, pH, and temperature. The water quality samples are taken when these parameters stabilize. Concentrations of various constituents were determined with the most common constituents used to generate water quality graphs for the wells.

Statistical analyses performed on monitoring well water quality data are included in this chapter. These analyses include data through 2016. The statistical analyses that were determined to most adequately demonstrate whether any statistical trends were evident were the Mann-Kendall test and the Sens Slope analysis. The Mann-Kendall test determines if a trend exists in a time-ordered data set. If a trend exists, Sen's Slope Estimator was used to estimate the magnitude of that trend. Table 1-3 displays the summary of these two analyses on the monitoring wells. The boxes that are grayed out do not have enough data points to adequately perform the analysis and the boxes with an '-' have no statistical trend. The Mann-Kendall box displays the p-value if it is under 0.05 and indicates that a trend exists within the 95% confidence level. If a trend is present, the Sens Slope box displays the median Q value, also referred to as Sen's Estimator of Slope as well as the direction of the trend.

Recovery Well Sampling – Water samples were taken for modified Title 22 drinking water analyses from each of the recovery wells that were used on the Kern Water Bank, Pioneer, Berrenda Mesa, and 2800 Acres project during the recovery program. Approximately 80 constituents were included in the initial Title 22 analyses shown on the Table from the Department of Health Services in Appendix B. In all cases, the wells were sampled and the resultant data was reviewed prior to deliveries into the CVC, KWB Canal or the Kern River Canal. This data was used to model potential changes the recovery program deliveries might have on the California Aqueduct and CVC.

Aqueduct and Canal Sampling – The Kern Water Bank Canal and the Cross Valley Canal were sampled pursuant to the standards shown in Appendix B. Samples were collected at the outset of the pump-in program and then quarterly for as long as the wells ran. The samples were analyzed for a variety of constituents. The Department of Water Resources also monitored

water quality in the California Aqueduct upstream and downstream of recovery program delivery points. Samples were collected once or twice a month and analyzed. This data was used to validate recovery program modeling and evaluate recovery program impacts.

Data Evaluation

Water Quality Graphs –Water quality graphs were prepared for several constituents of concern, including TDS, alpha activity, nitrate, and arsenic. Time trends in constituent concentrations were evaluated particularly in terms of influences of recharge and recovery operations for the Kern Fan water banking projects. The results of the sampling program are reflected in Figure 1-4.

Total Dissolved Solids (Salts) Ratio

Evaluation of TDS imported into the basin is displayed in Figure 1-9. Total dissolved solids is calculated on a monthly basis for recharged water (from mg/l to tons/acre-foot) and summed on an annual basis for each water source and project. The equation is:

Solids/Salts Load (Tons) =

$$\frac{\text{Gross Recharge(Acre-feet) X 43560 (ft}^3\text{/acre-foot) X 7.48 (gallons/ft}^3\text{) X 8.3451 (pounds/gallon) X TDS (mg/l)}}{\text{2000 (pounds/ton) X 1,000,000 (mg/l)}}$$

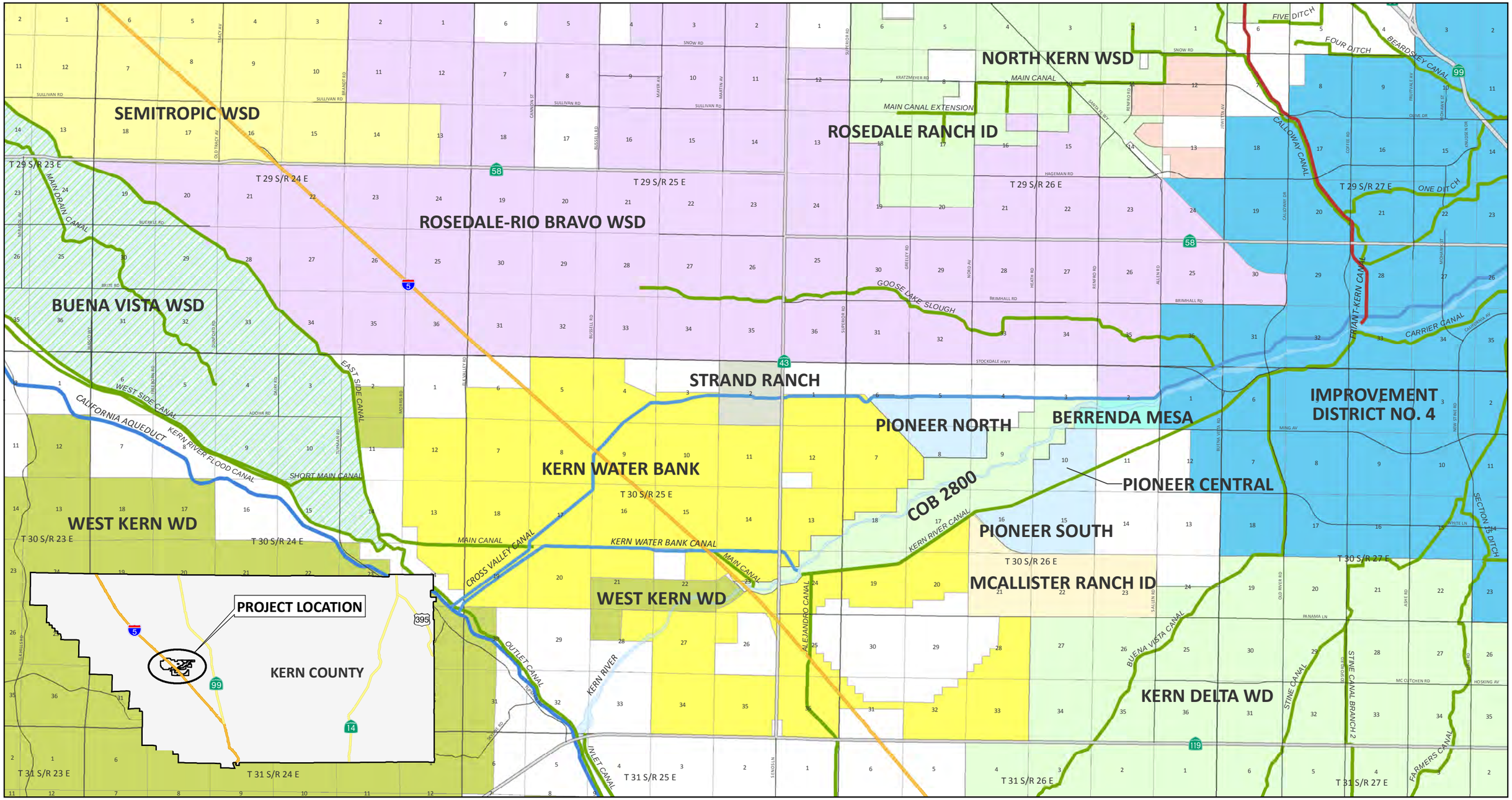
Solids in tons is added for all of the projects and divided by the total recharge to provide tons/acre-foot.

The TDS in "all-project" recharge water for 1995-2016 was 0.20 tons/acre-foot. The TDS in the cumulative "all-project" recovered water was 0.34 tons/acre-foot. Figure 1-10 shows the cumulative recharge and recovery in the region by source. Table 1-5 shows the recharged TDS brought into the Kern Fan region by project. Table 1-6 shows the historical TDS of SWP water at Check 29. Background tables used to calculate the TDS Ratio can be found in Appendix G.

Recovery Program Water Quality Evaluations – The Department of Water Resources (DWR), downstream stakeholders in the Aqueduct, and Kern County banking interests developed water quality guidelines under which banked groundwater can be introduced into the Aqueduct as shown in Appendix B. Th ese guidelines require that introduced water not have a detrimental effect on the existing water quality.

The canal sampling which was conducted during the program was then used to validate the results of the blending model.

The DWR prepares a yearly operations report (Bulletin 132) summarizing the effects of the program on water quality in the Aqueduct. Links to these reports are listed in Appendix C.



KERN FAN GENERAL VICINITY

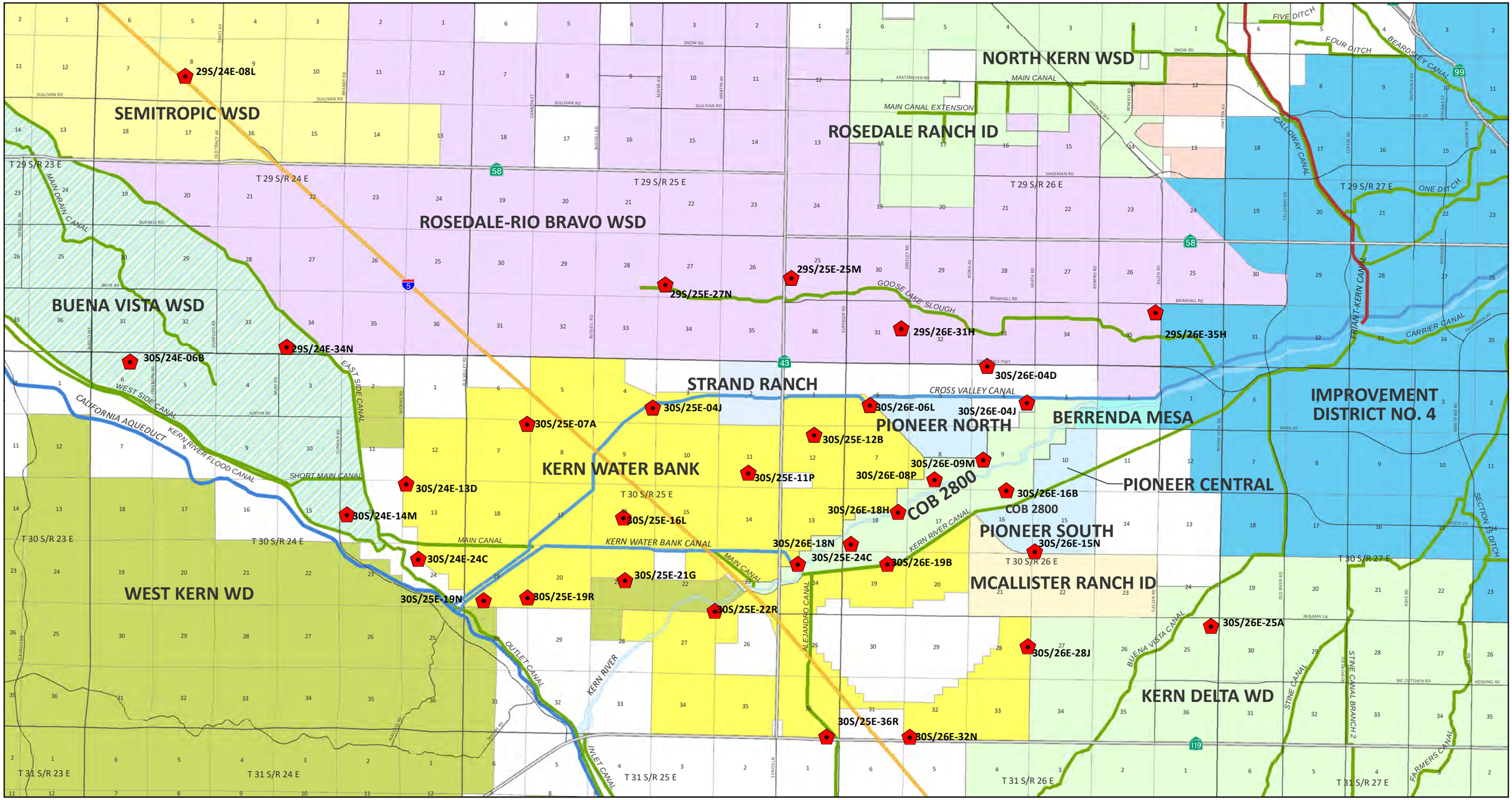
PLATE 1-1

Created: 2011-1010, S. CHAMBLESS
Modified: 2015-0824, M. ALLEN
Filename: Plate 1-1 General Vicinity (15-0824).mxd

N

0 0.5 1 2 3 Miles

1 inch = 1.5 miles



KERN FAN MONITORING WELL LOCATIONS

PLATE 1-2

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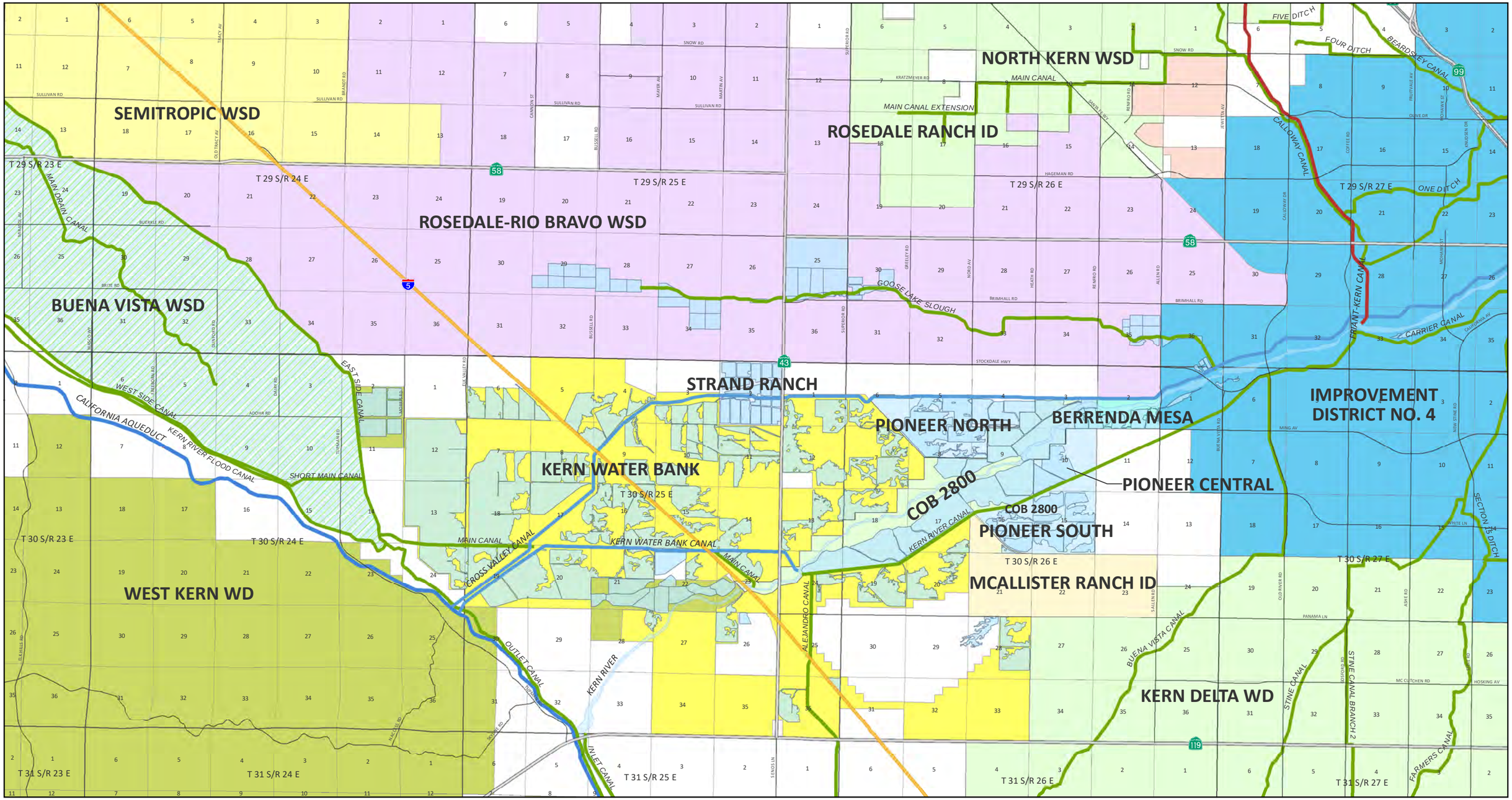
Modified: 2017-0601, M. ALLEN
Filename: Plate 1-2 Monitoring Well Locations.mxd



KERN FAN RECHARGE FACILITIES MAP

PLATE 1-3

Created: 2010-1110, S. CHAMBLESS
Modified: 2017-0712, M. ALLEN
Filename: Plate 1-3 Recharge Facilities.mxd

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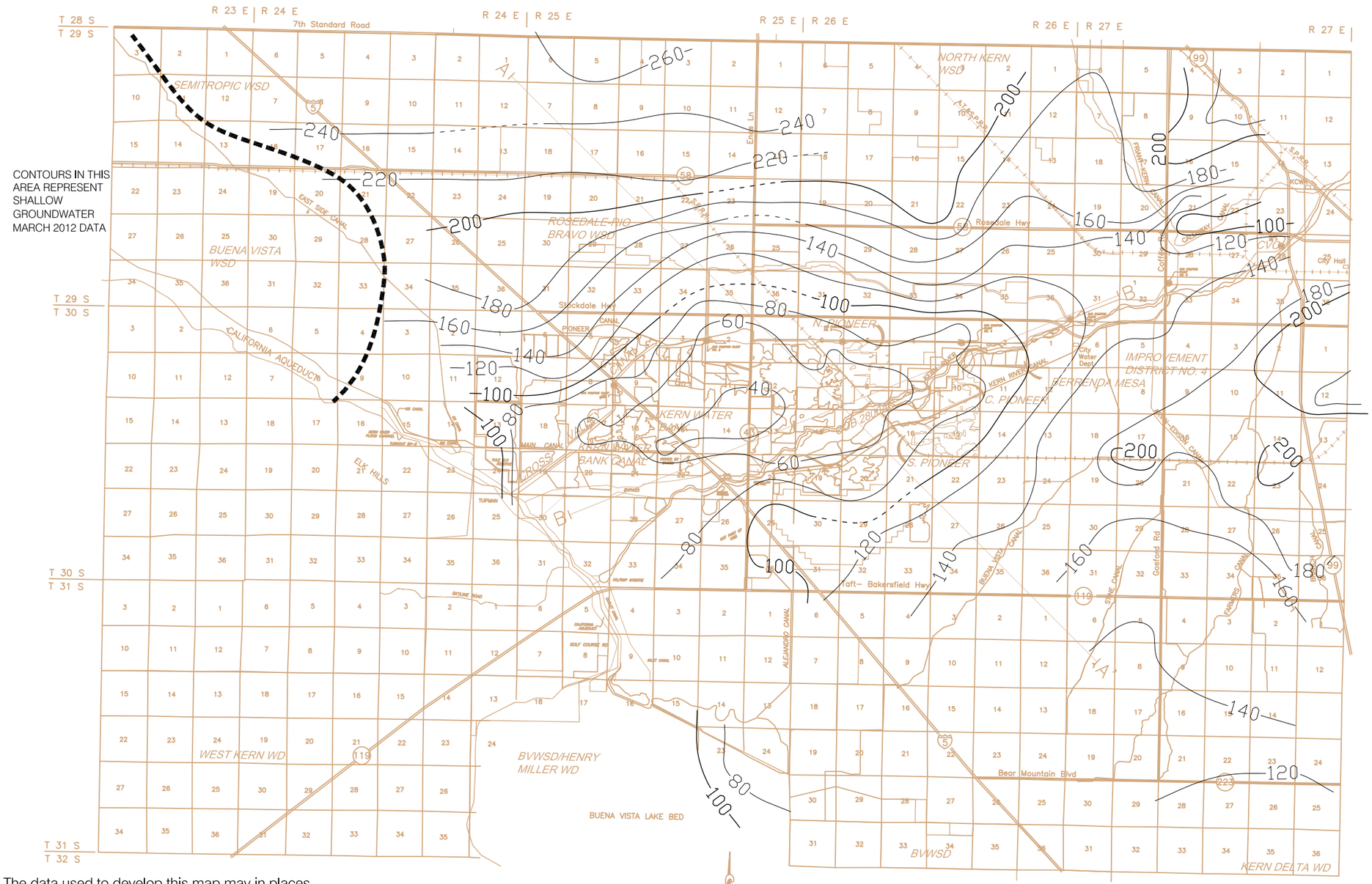
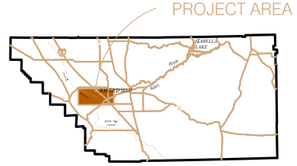


Note: The data used to develop this map may in places represent the water table in the shallower unconfined portion of the aquifer or may represent head (pressure levels) in the deeper semi-confined portion of the aquifer. When and where head in the semi-confined portion of the aquifer is represented, these values are typically lower (i.e deeper) than the actual water table level in the aquifer. This is especially the case after significant recharge events or when nearby wells are pumping.



VICINITY MAP

Miles
0 1 2 3 4

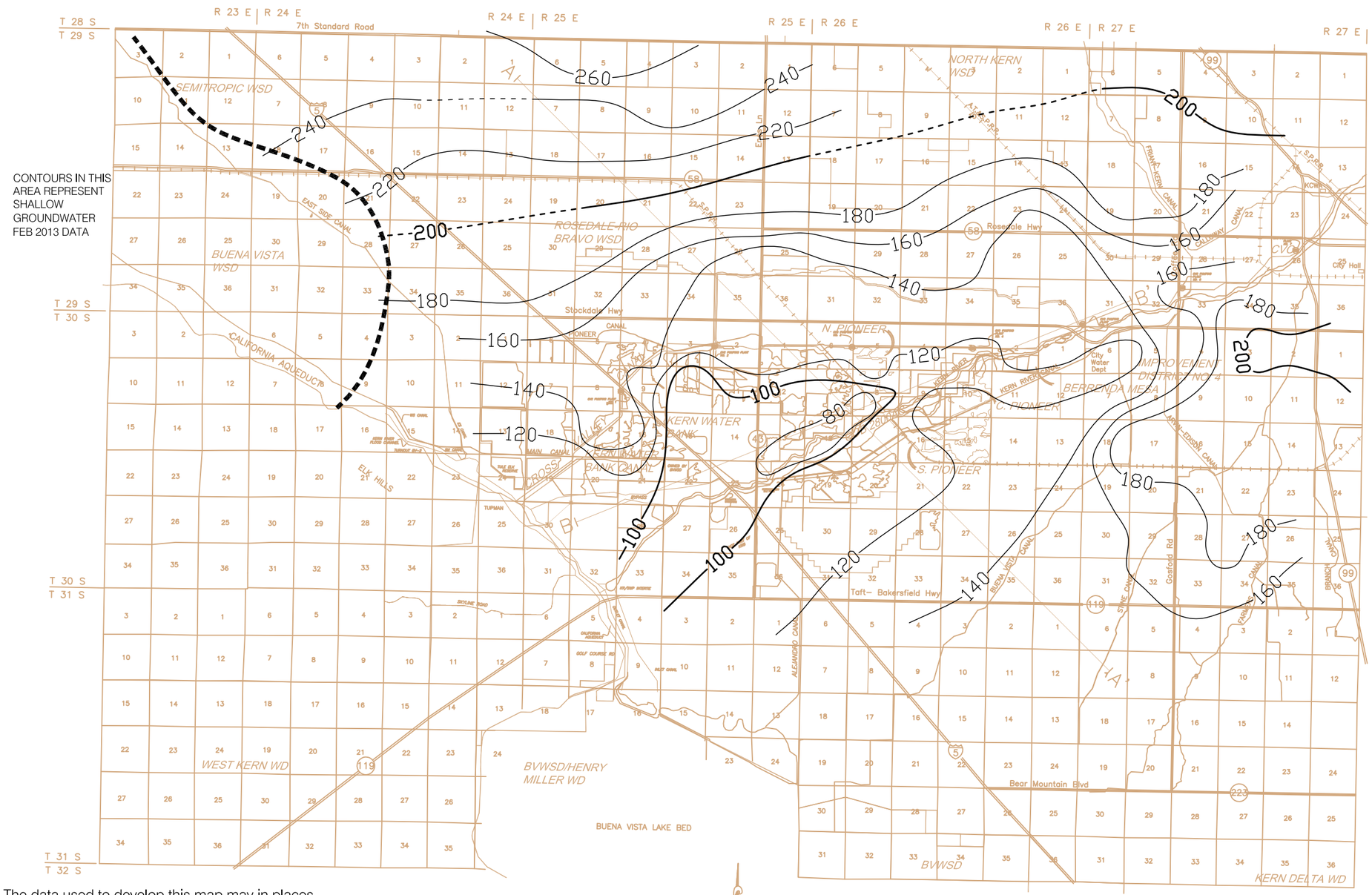
Contour Interval=20 feet

Kern Fan Monitoring Committee
Kern County, California

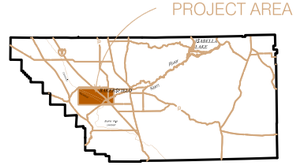
DEPTH TO POTENTIOMETRIC SURFACE
MIDDLE ZONE
SPRING 2012

K.D. SCHMIDT (hand contours)

October 24, 2012



Note: The data used to develop this map may in places represent the water table in the shallower unconfined portion of the aquifer or may represent head (pressure levels) in the deeper semi-confined portion of the aquifer. When and where head in the semi-confined portion of the aquifer is represented, these values are typically lower (i.e deeper) than the actual water table level in the aquifer. This is especially the case after significant recharge events or when nearby wells are pumping.



VICINITY MAP

Miles
0 1 2 3 4

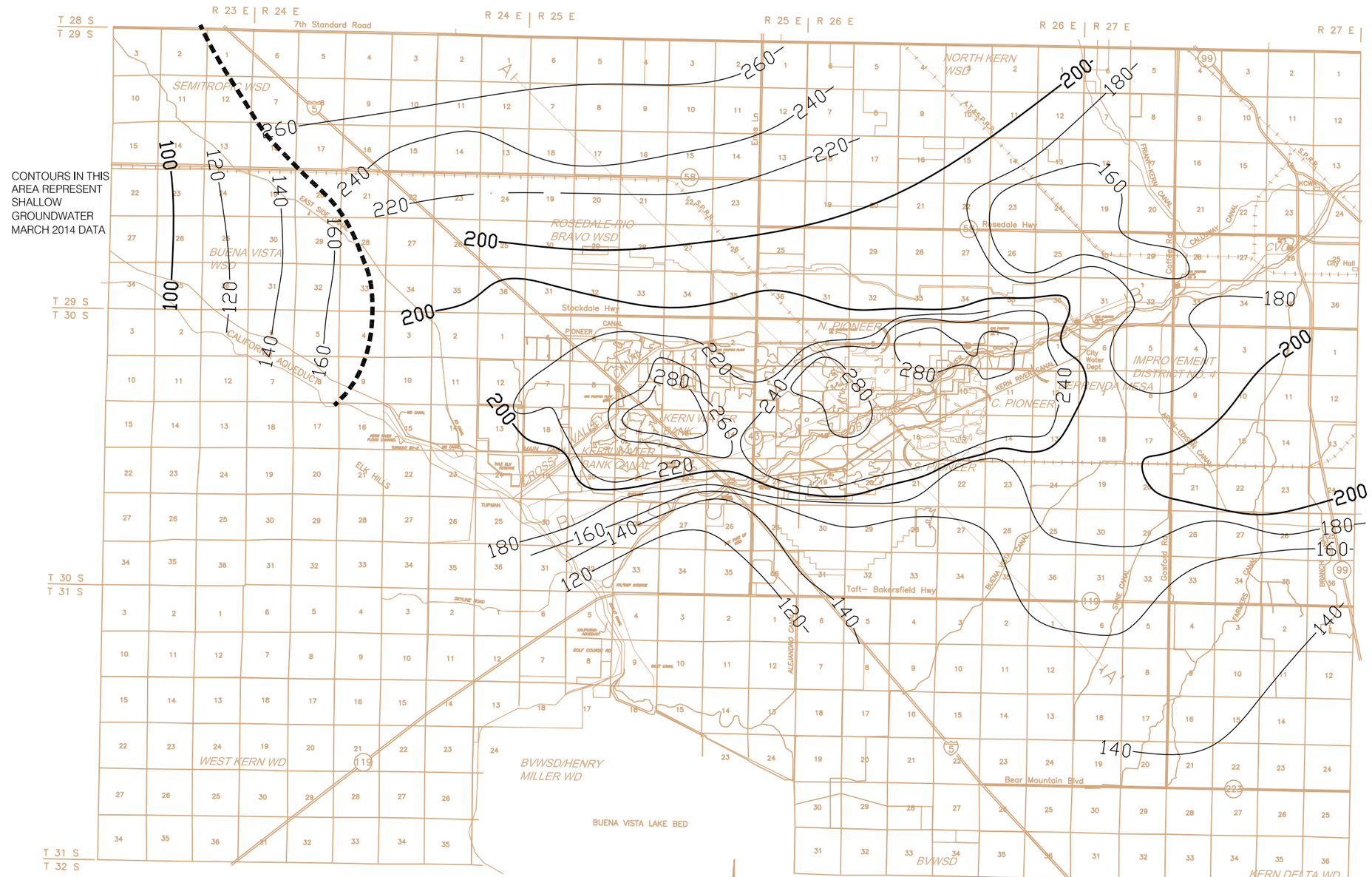
Contour Interval=20 feet

Kern Fan Monitoring Committee
Kern County, California

DEPTH TO POTENTIOMETRIC SURFACE
MIDDLE ZONE
SPRING 2013

K.D. SCHMIDT (hand contours)

June 12, 2013



Note: The data used to develop this map may in places represent the water table in the shallower unconfined portion of the aquifer or may represent head (pressure levels) in the deeper semi-confined portion of the aquifer. When and where head in the semi-confined portion of the aquifer is represented, these values are typically lower (i.e deeper) than the actual water table level in the aquifer. This is especially the case after significant recharge events or when nearby wells are pumping.

VICINITY MAP

Miles
0 1 2 3 4

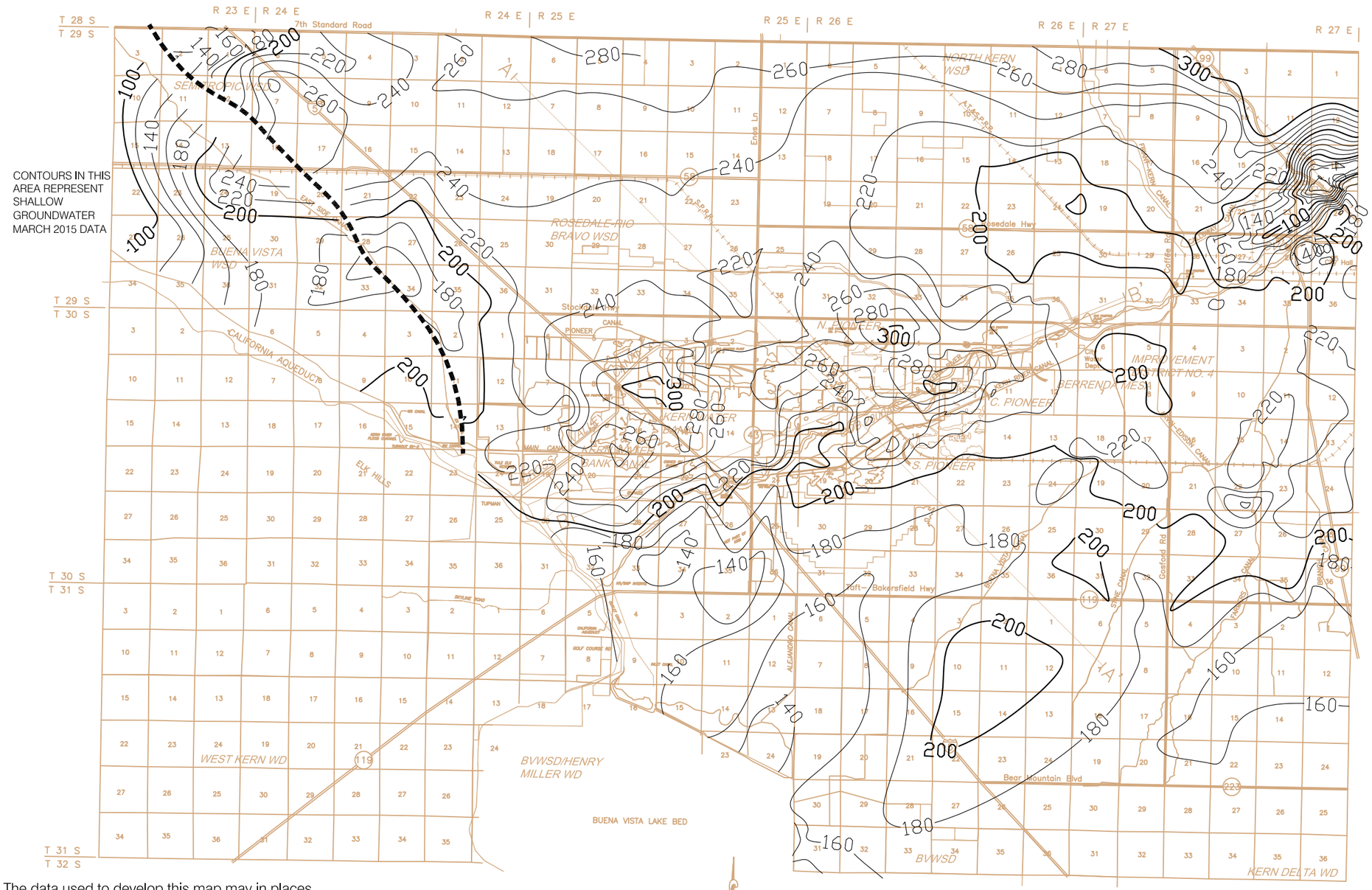
Contour Interval=20 feet

Kern Fan Monitoring Committee
Kern County, California

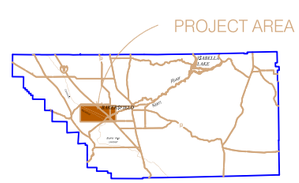
DEPTH TO POTENTIOMETRIC SURFACE
MIDDLE ZONE
SPRING 2014

K.D. SCHMIDT (hand contours)

September, 2014



Note: The data used to develop this map may in places represent the water table in the shallower unconfined portion of the aquifer or may represent head (pressure levels) in the deeper semi-confined portion of the aquifer. When and where head in the semi-confined portion of the aquifer is represented, these values are typically lower (i.e deeper) than the actual water table level in the aquifer. This is especially the case after significant recharge events or when nearby wells are pumping.



VICINITY MAP

Miles
0 1 2 3 4

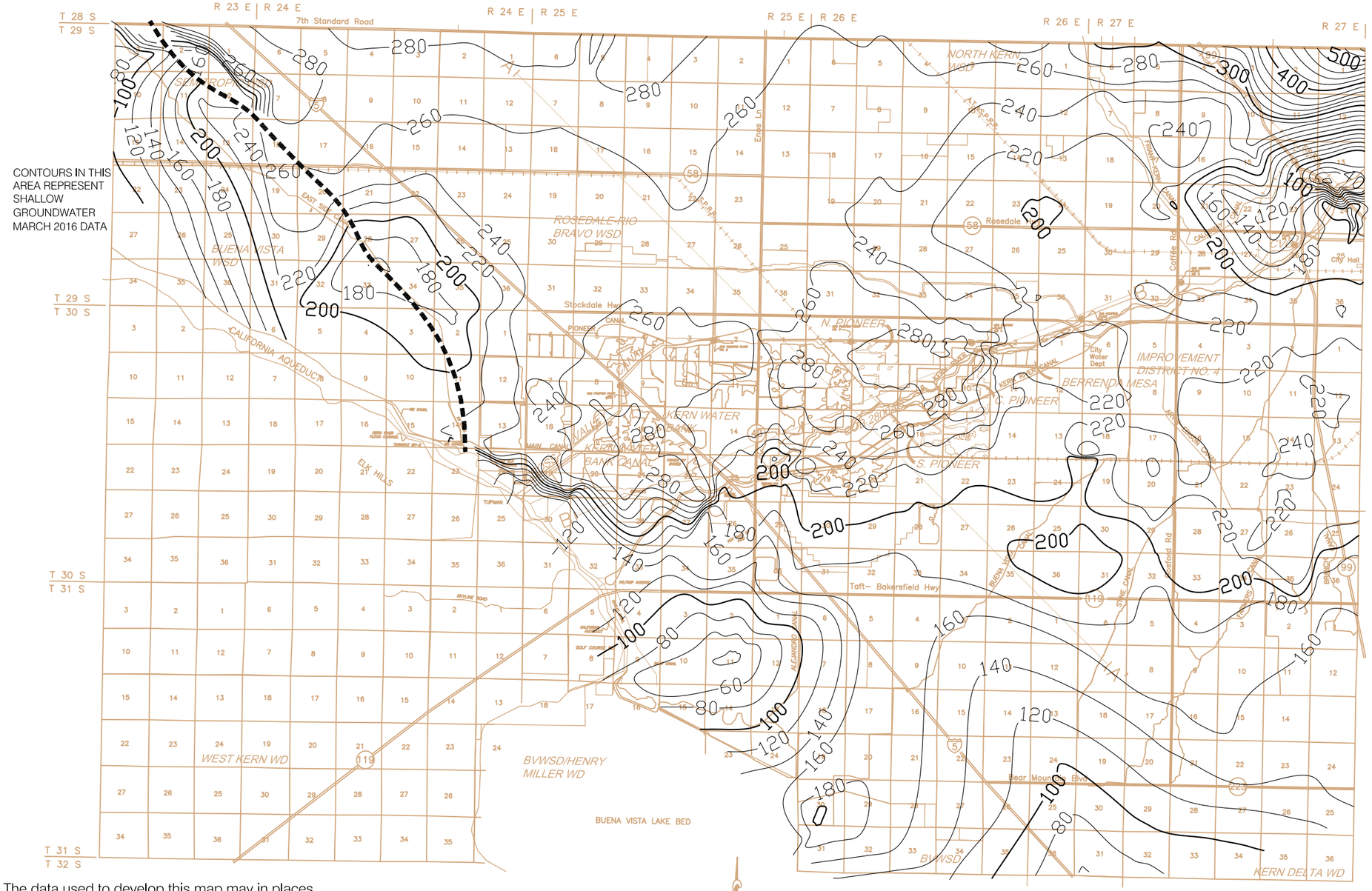
Contour Interval=20 feet

Kern Fan Monitoring Committee
Kern County, California

DEPTH TO POTENTIOMETRIC SURFACE
MIDDLE ZONE
SPRING 2015

Michelle Anderson PG #8898

August 5, 2015



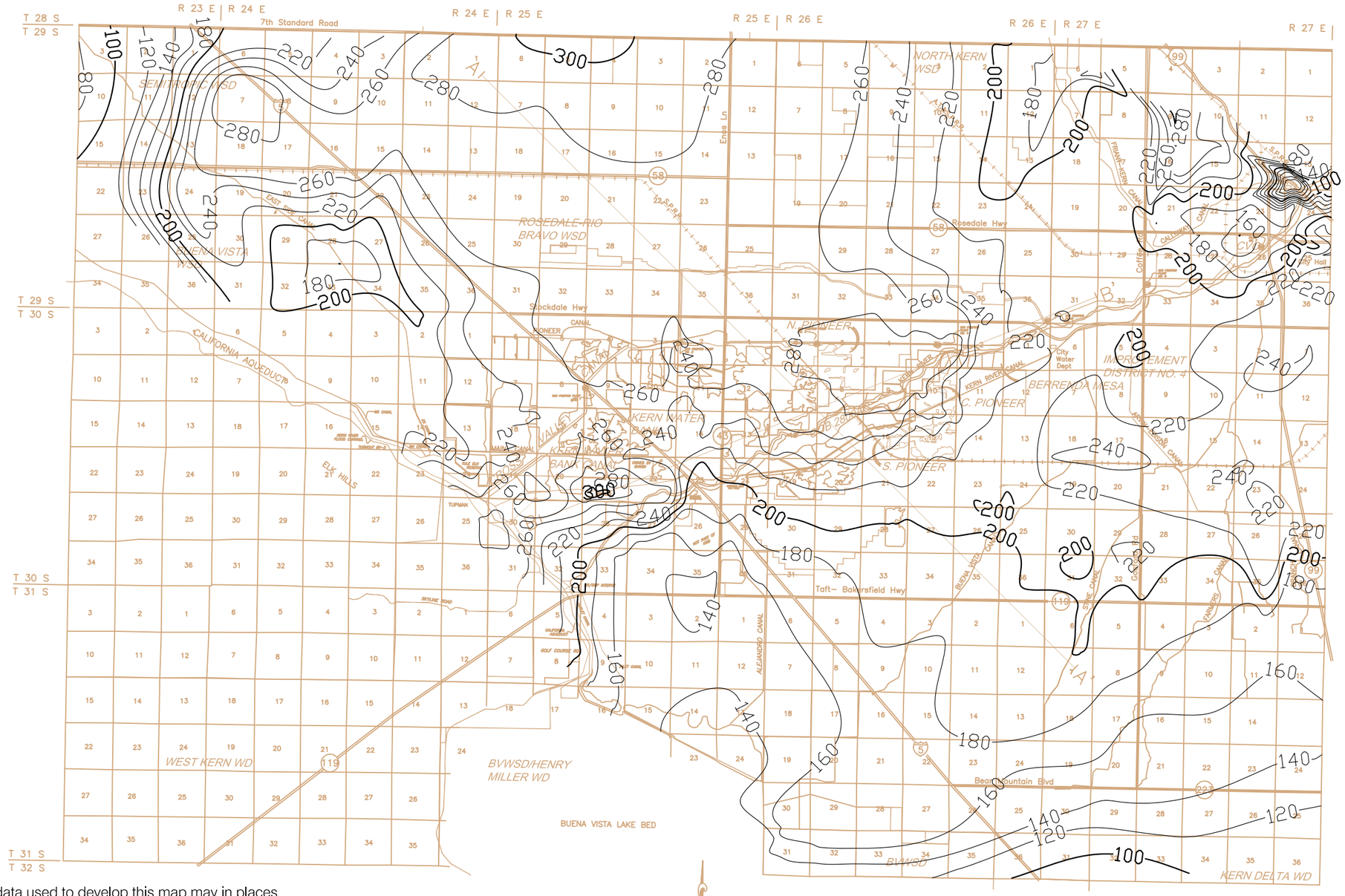
Note: The data used to develop this map may in places represent the water table in the shallower unconfined portion of the aquifer or may represent head (pressure levels) in the deeper semi-confined portion of the aquifer. When and where head in the semi-confined portion of the aquifer is represented, these values are typically lower (i.e deeper) than the actual water table level in the aquifer. This is especially the case after significant recharge events or when nearby wells are pumping.

Kern Fan Monitoring Committee
Kern County, California

DEPTH TO POTENTIOMETRIC SURFACE
MIDDLE ZONE
SPRING 2016

Michelle Anderson PG #8898

July 27, 2016



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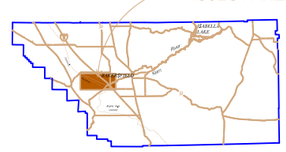


VICINITY MAP

Miles
0 1 2 3 4

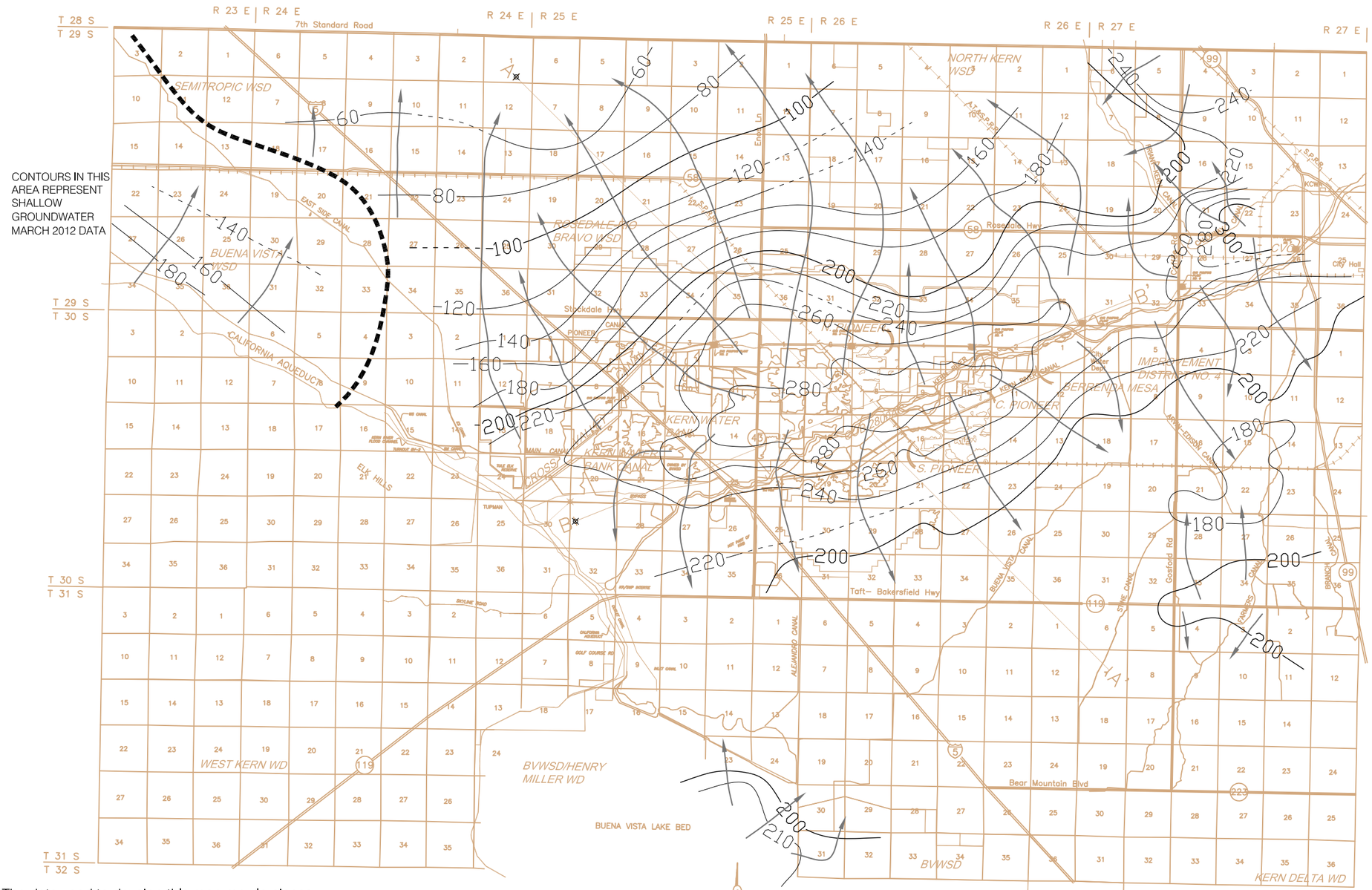
Contour Interval=20 feet

Kern Fan Monitoring Committee
Kern County, California

DEPTH TO POTENTIOMETRIC SURFACE
MIDDLE ZONE
SPRING 2017

Michelle Anderson PG #8898

July 11, 2017



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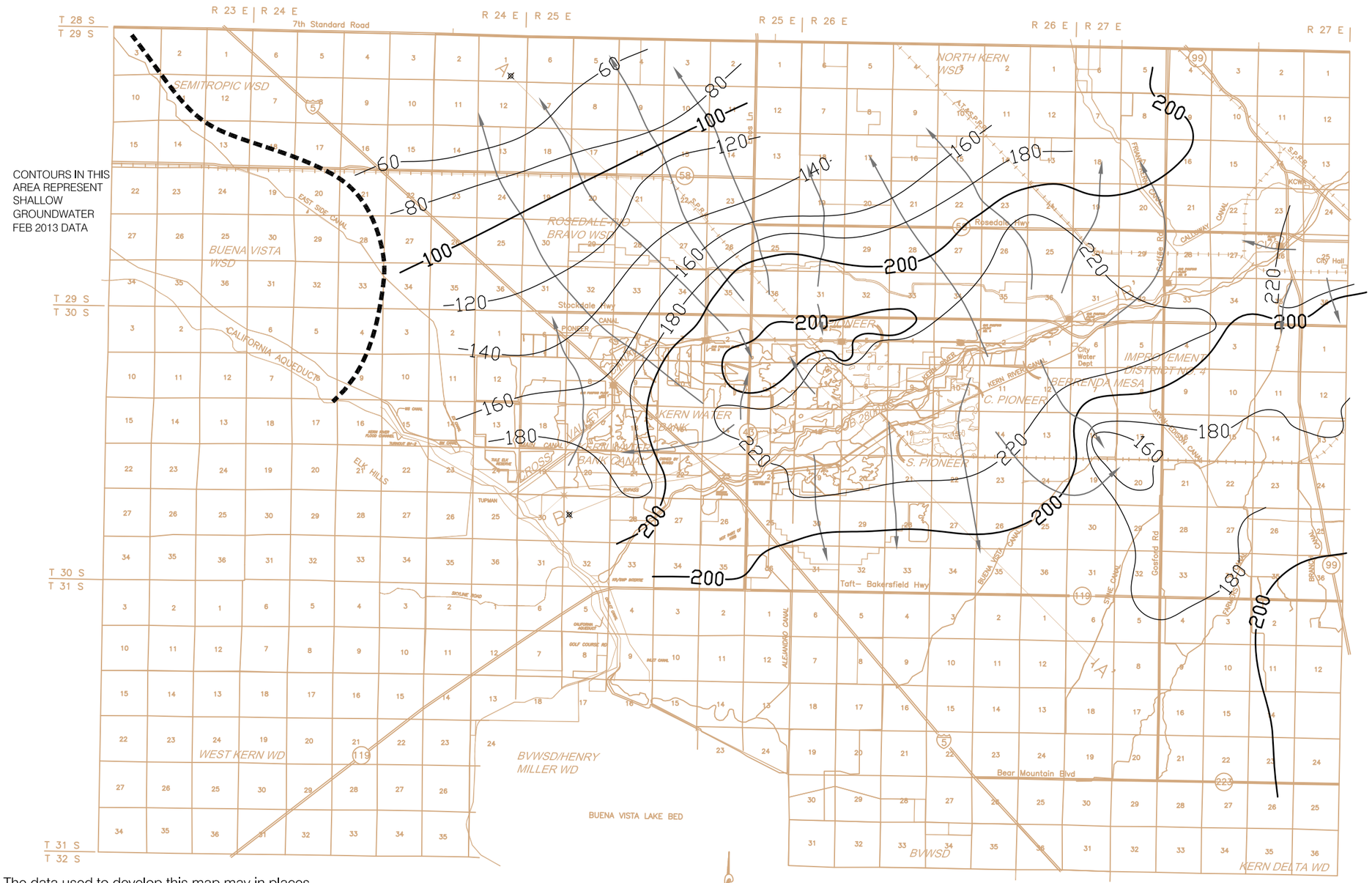
Kern Fan Monitoring Committee
Kern County, California

ELEVATION OF POTENTIOMETRIC SURFACE
DIRECTION OF GROUNDWATER FLOW
MIDDLE ZONE
SPRING 2012

K.D. SCHMIDT (hand contoured)

October 24, 2012



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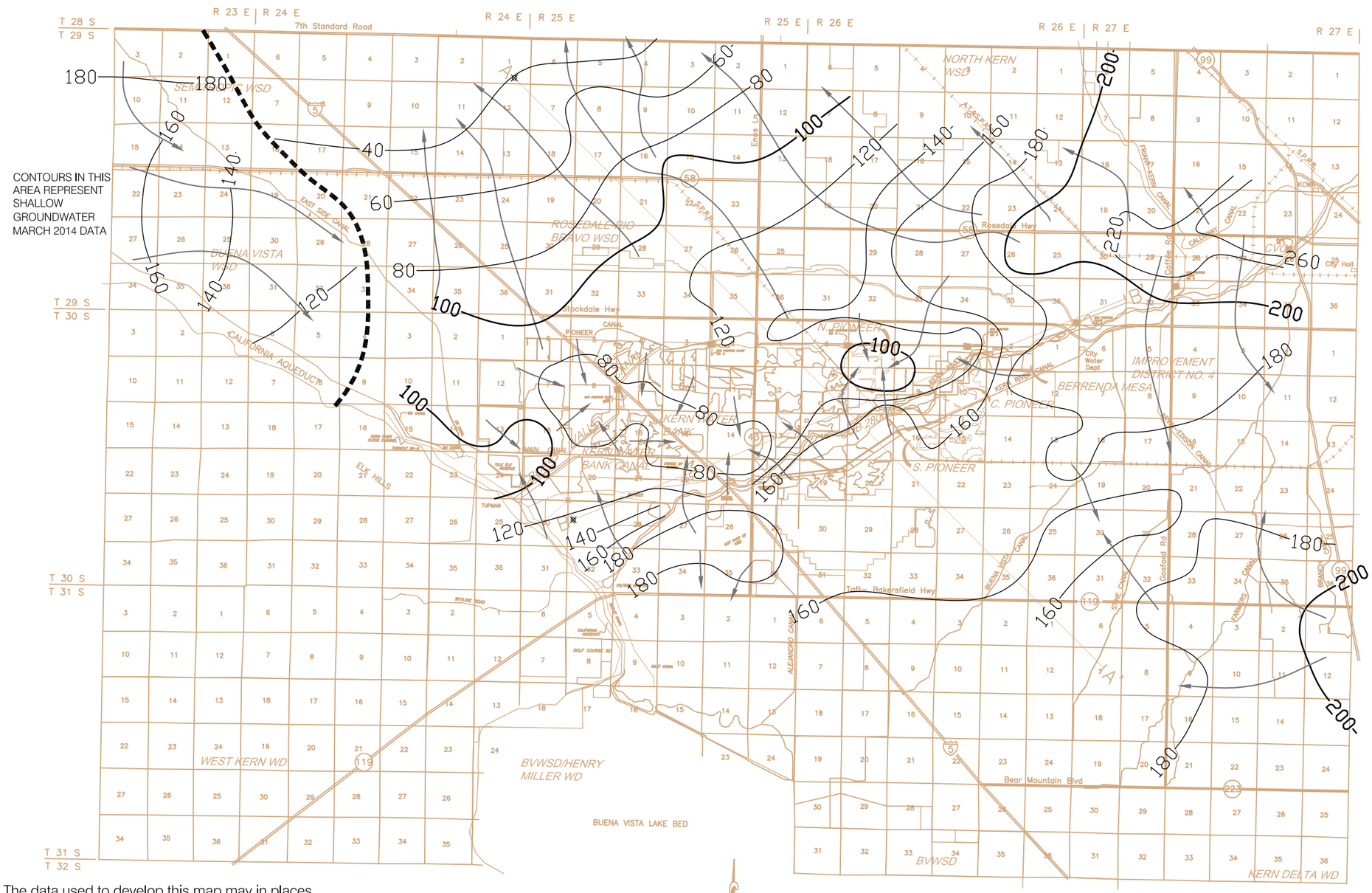
Kern Fan Monitoring Committee
Kern County, California

ELEVATION OF POTENTIOMETRIC SURFACE
DIRECTION OF GROUNDWATER FLOW
MIDDLE ZONE
SPRING 2013

K.D. SCHMIDT (hand contoured)

June 12, 2013



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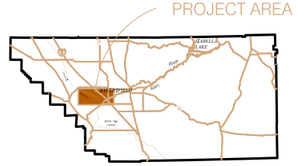


VICINITY MAP

Miles
0 1 2 3 4

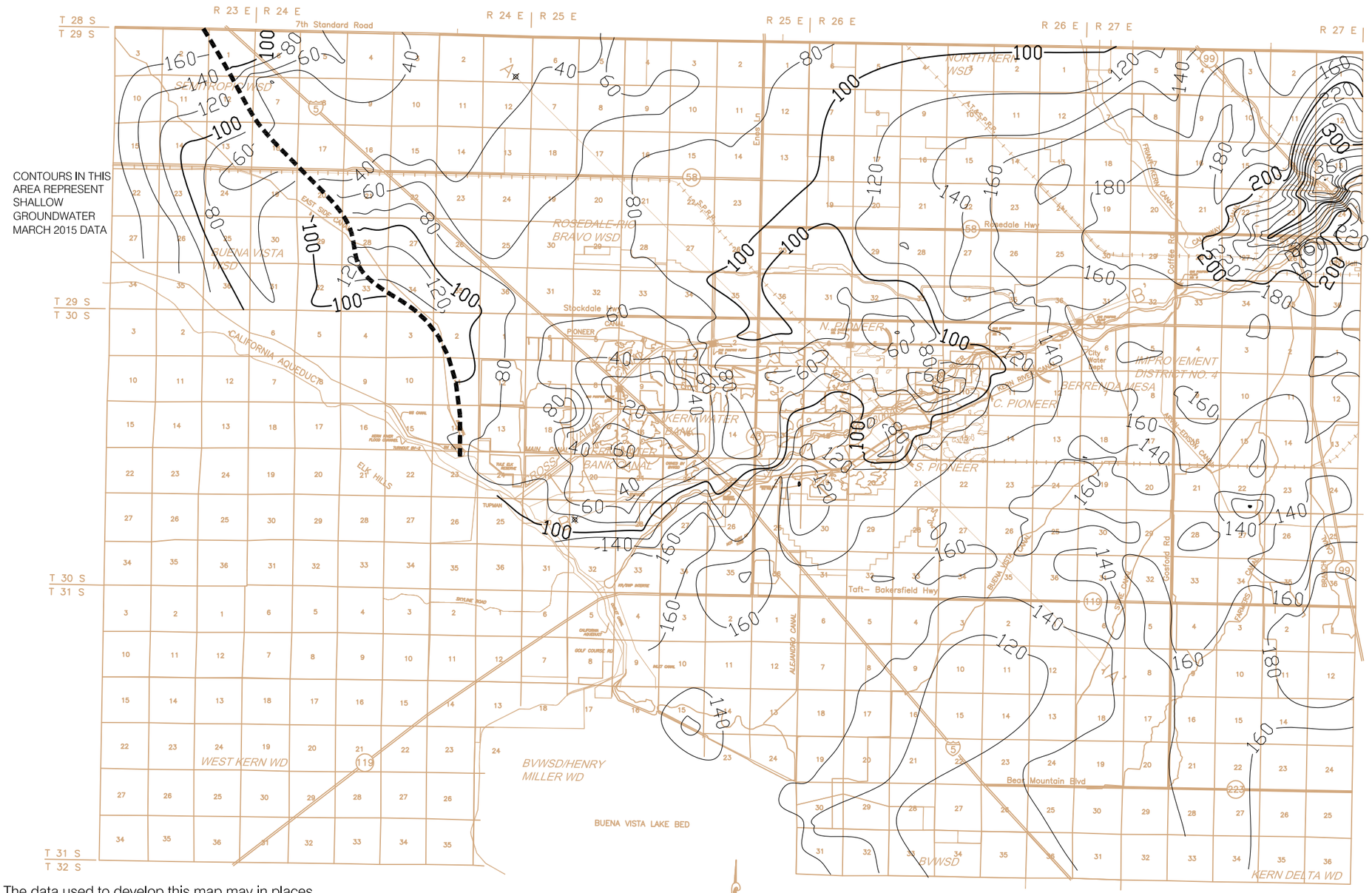
Contour Interval=20 feet

Kern Fan Monitoring Committee
Kern County, California

ELEVATION OF POTENTIOMETRIC SURFACE
DIRECTION OF GROUNDWATER FLOW
MIDDLE ZONE
SPRING 2014

K.D. SCHMIDT (hand contoured)

September 2014



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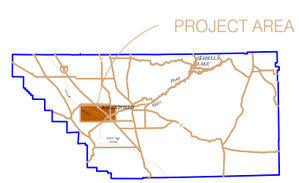


VICINITY MAP

Miles
0 1 2 3 4

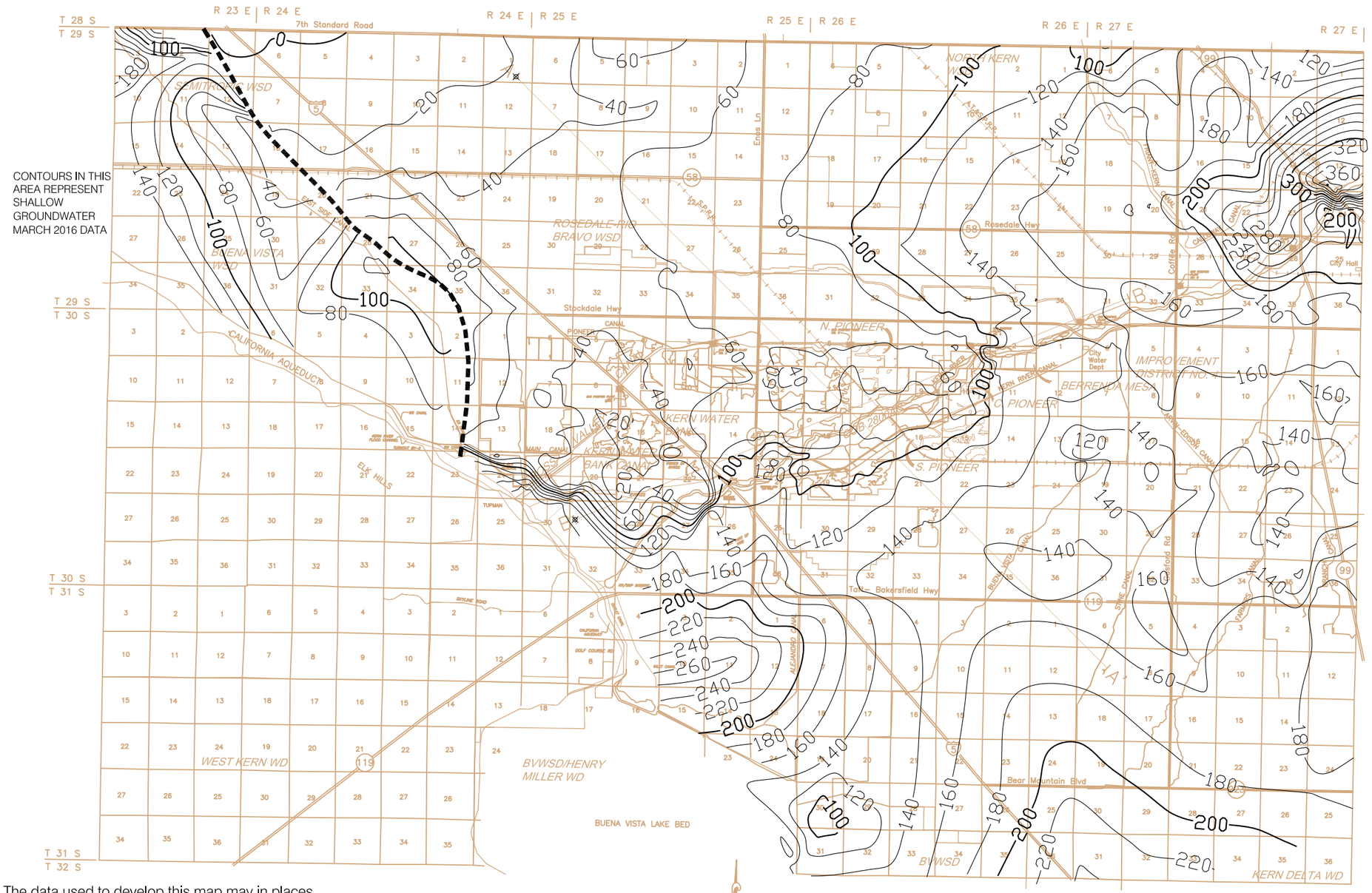
Contour Interval=20 feet

Kern Fan Monitoring Committee
Kern County, California

ELEVATION OF POTENTIOMETRIC SURFACE
DIRECTION OF GROUNDWATER FLOW
MIDDLE ZONE
SPRING 2015

Michelle Anderson PG #8898

August 5, 2015



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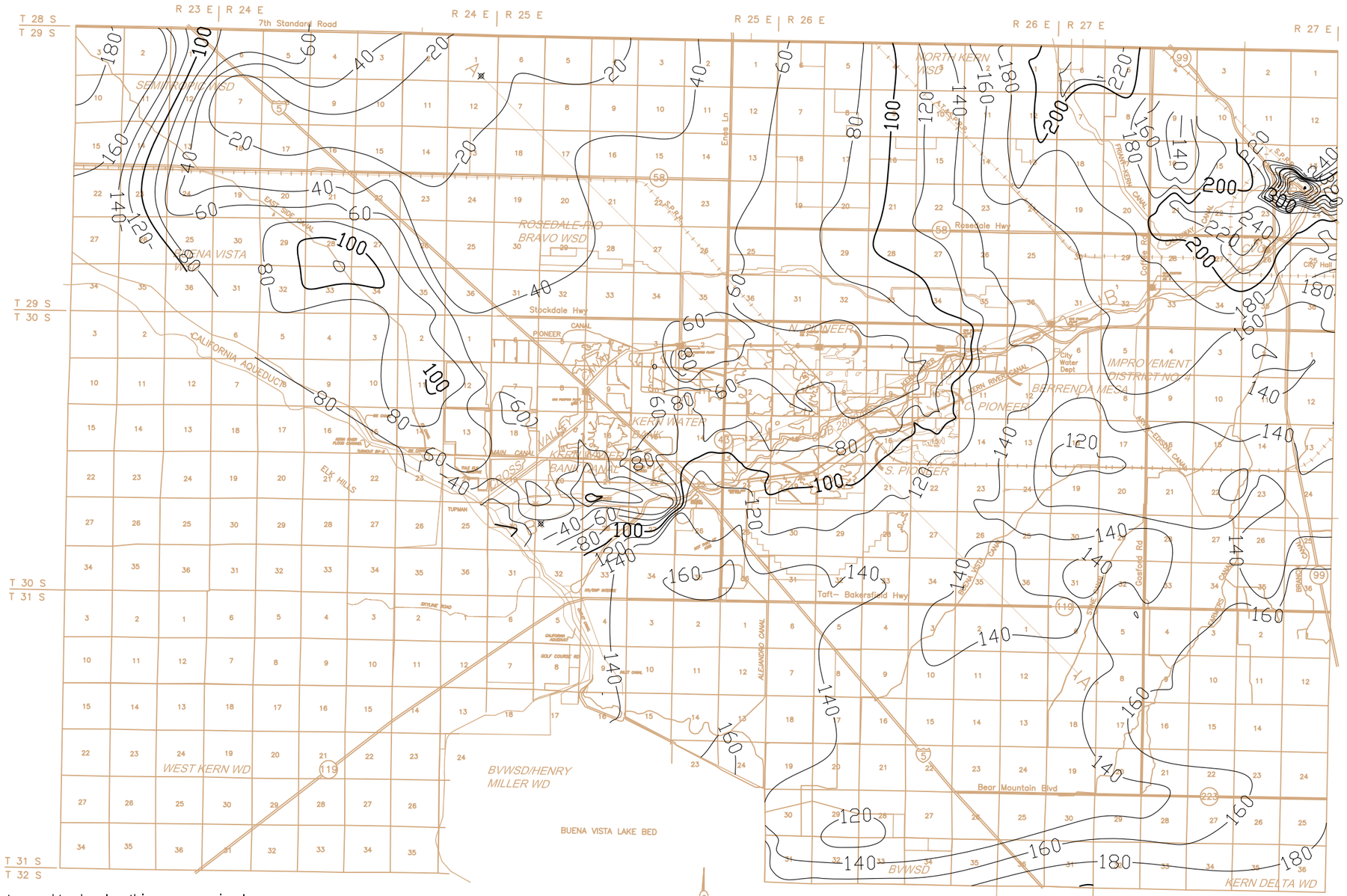
Kern Fan Monitoring Committee
Kern County, California

ELEVATION OF POTENTIOMETRIC SURFACE
DIRECTION OF GROUNDWATER FLOW
MIDDLE ZONE
SPRING 2016

Michelle Anderson PG #8898

July 27, 2016



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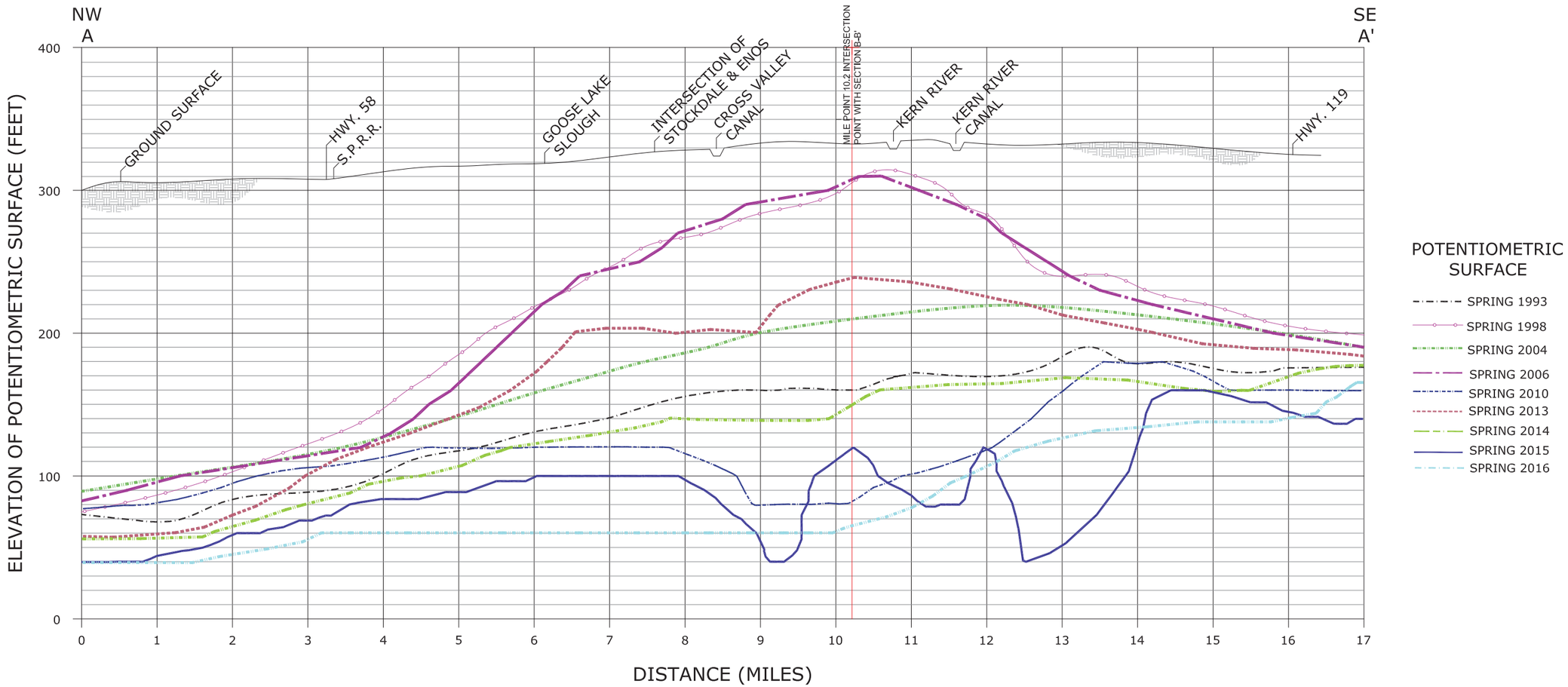
Kern Fan Monitoring Committee
Kern County, California

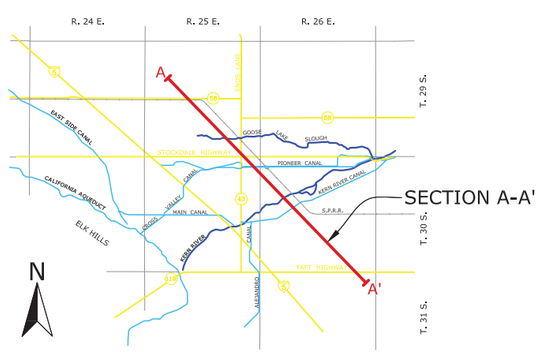
ELEVATION OF POTENTIOMETRIC SURFACE
DIRECTION OF GROUNDWATER FLOW
MIDDLE ZONE
SPRING 2017

Michelle Anderson PG #8898

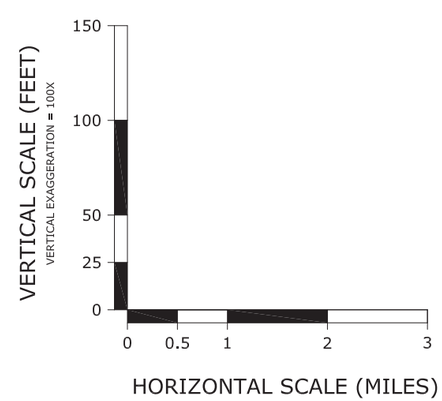
July 11, 2017

ELEVATION OF POTENTIOMETRIC SURFACE





VICINITY MAP
(NOT TO SCALE)



KERN FAN OPERATIONS REPORT

HYDROLOGIC PROFILE A-A'

NO.	BY	DATE	DESCRIPTION

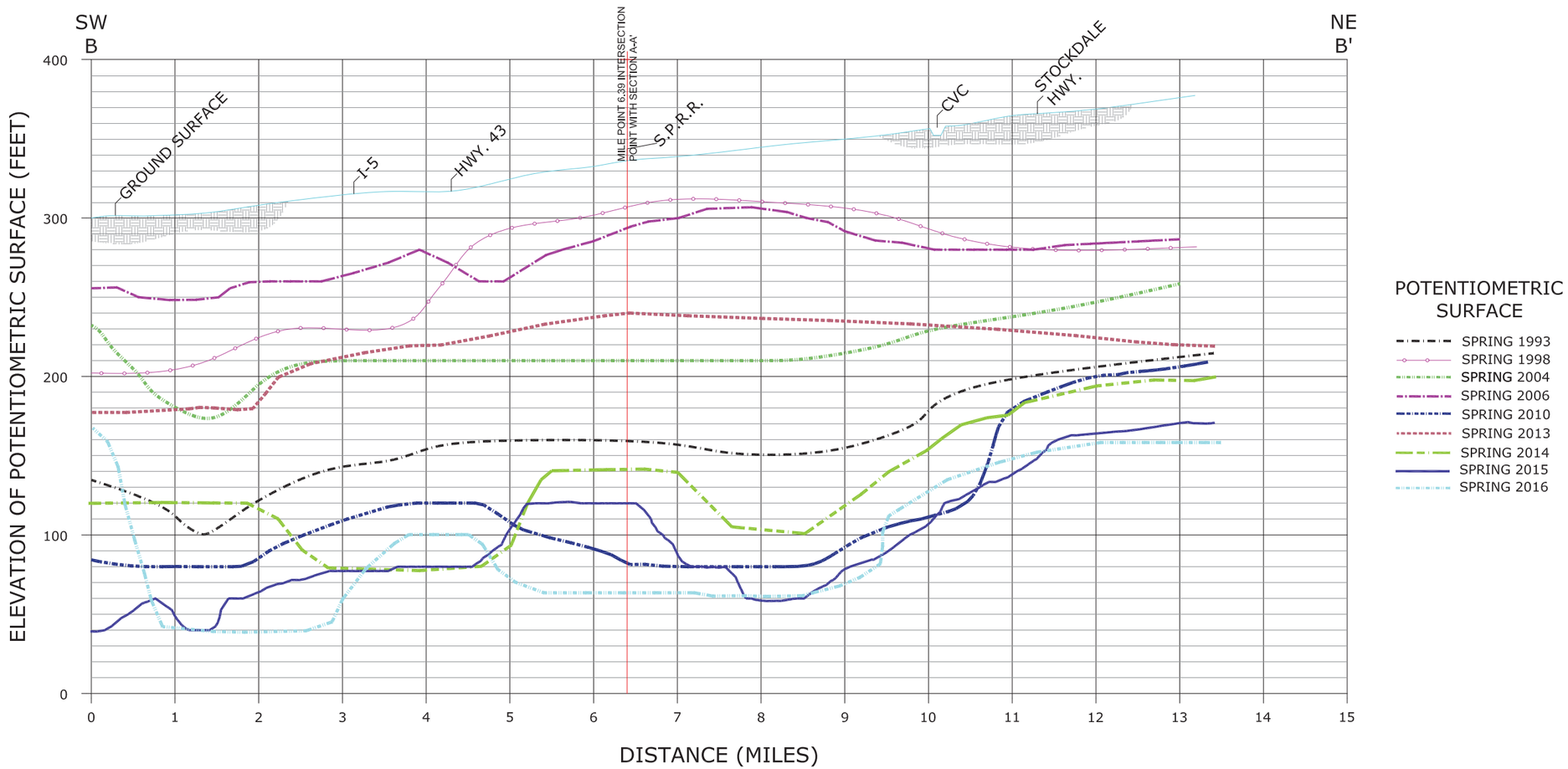
PROJECT: KERN FAN OPS REPORT
FILE NAME: Profile A-A' 2016.dwg
DATE: 2017-6-28
DRAWN BY: M. ANDERSON
REVIEWED BY: M. ANDERSON
APPROVED BY: M. ANDERSON

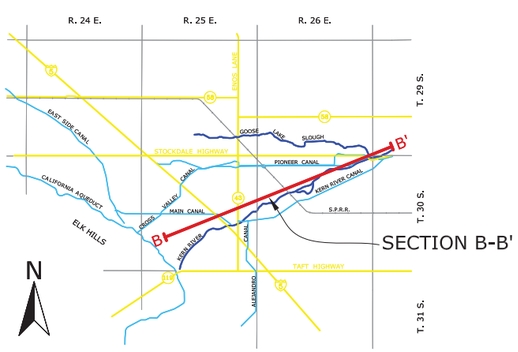
N

SCALE: AS SHOWN

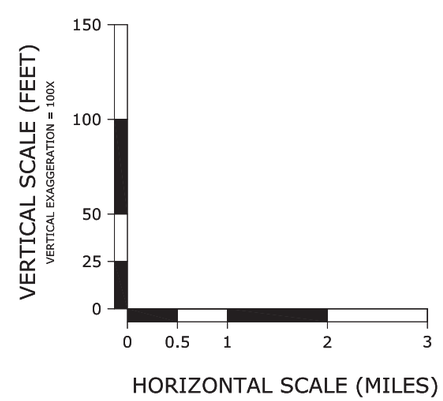
FIGURE 1-1

ELEVATION OF POTENTIOMETRIC SURFACE





VICINITY MAP
(NOT TO SCALE)



KERN FAN OPERATIONS REPORT

HYDROLOGIC PROFILE B-B'

NO.	BY	DATE	DESCRIPTION

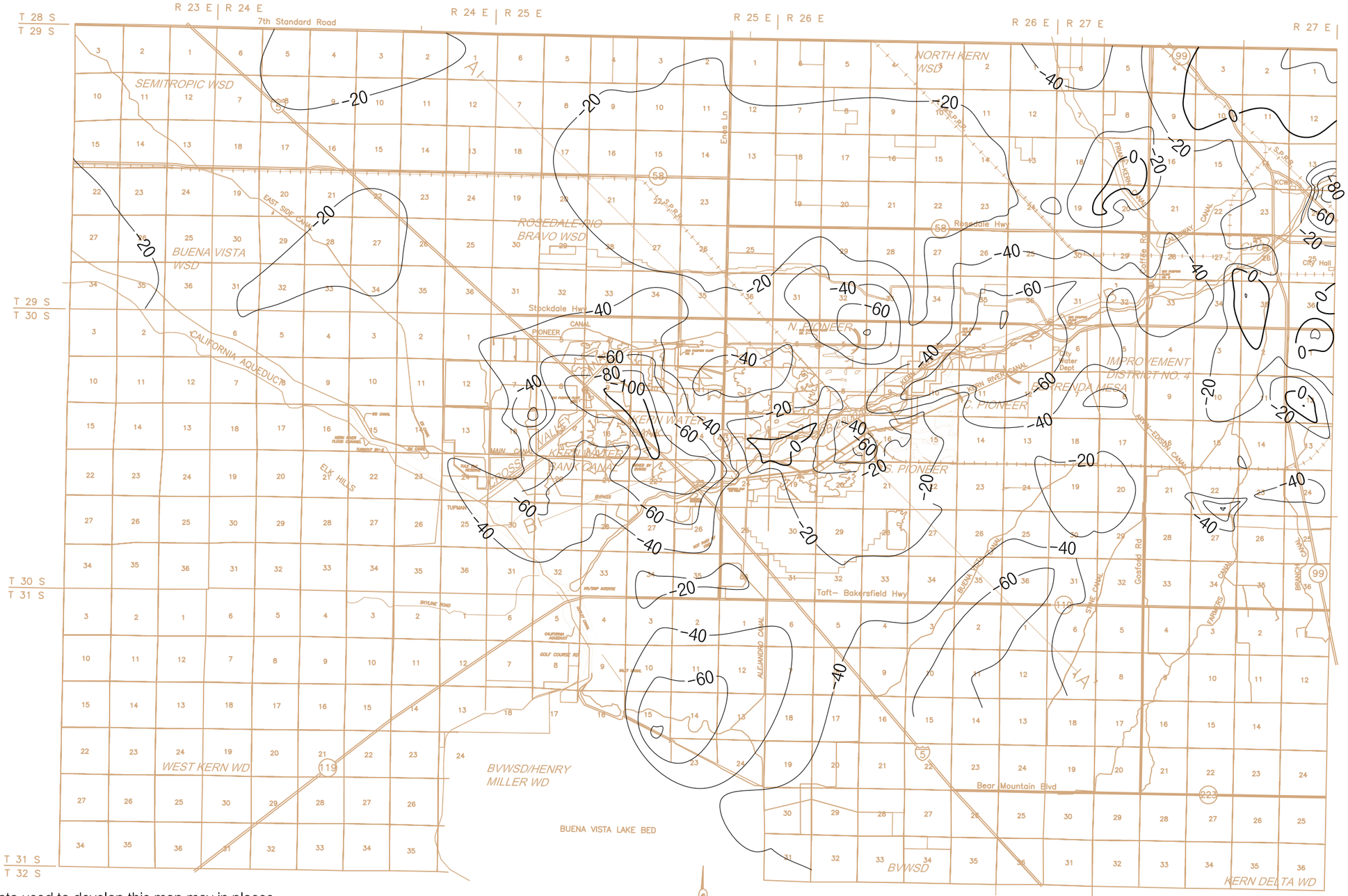
PROJECT: KERN FAN OPS REPORT
FILE NAME: Profile B-B' 2016.dwg
DATE: 2017-06-28
DRAWN BY: M. ANDERSON
REVIEWED BY: M. ANDERSON
APPROVED BY: M. ANDERSON

N

SCALE: AS SHOWN

FIGURE 1-2

Plate 1-16



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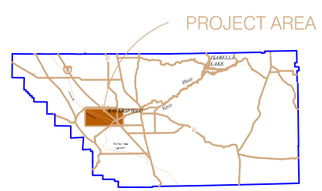


VICINITY MAP

Miles
0 1 2 3 4

Contour Interval=20 feet

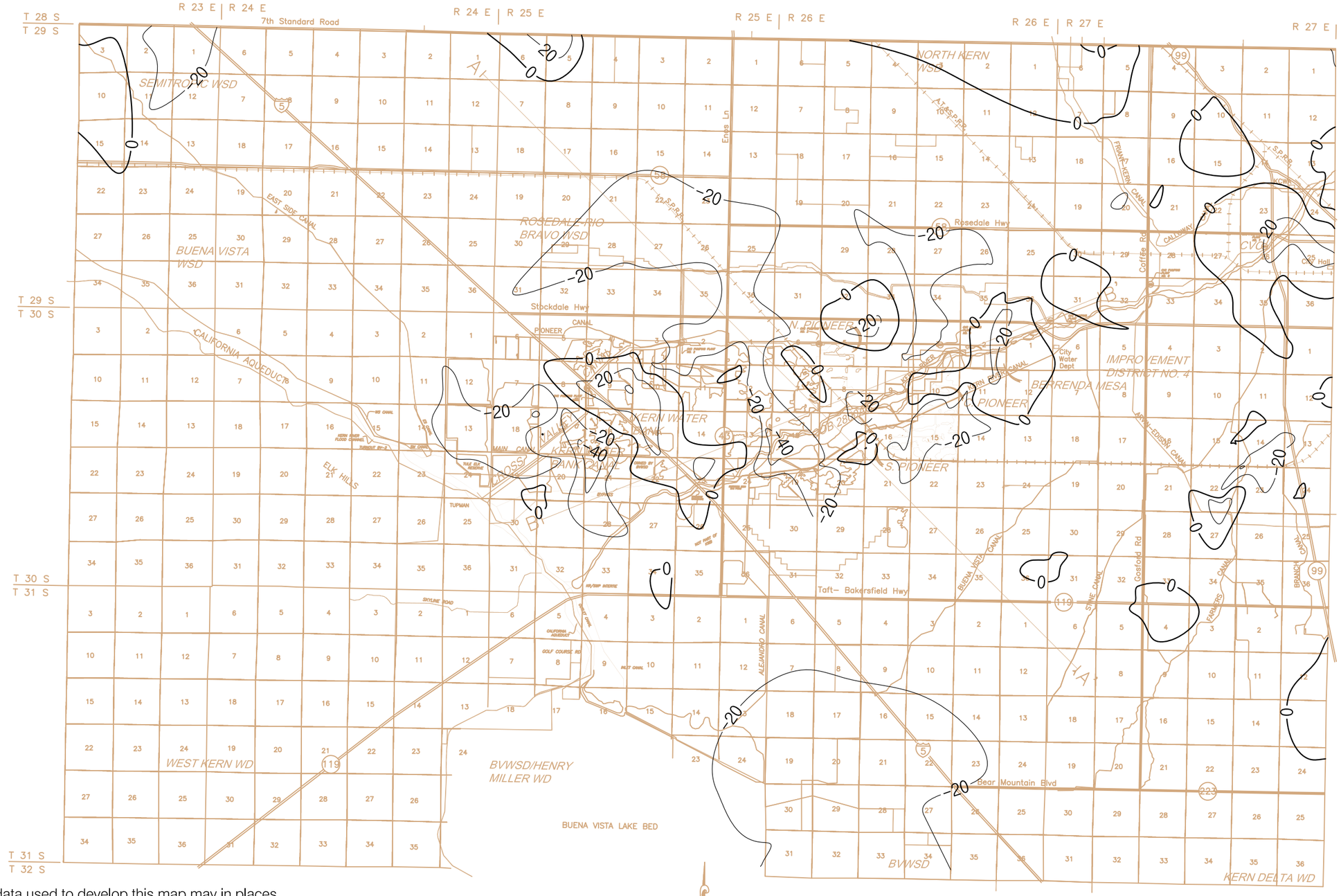
Kern Fan Monitoring Committee
Kern County, California

CHANGE IN POTENTIOMETRIC SURFACE ELEVATION
Middle Zone
SPRING 2012-SPRING 2015

Michelle Anderson PG #8898

September 10, 2015

Plate 1-17



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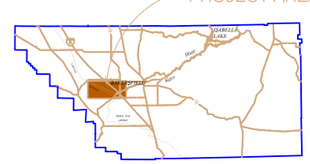


VICINITY MAP

Miles
0 1 2 3 4

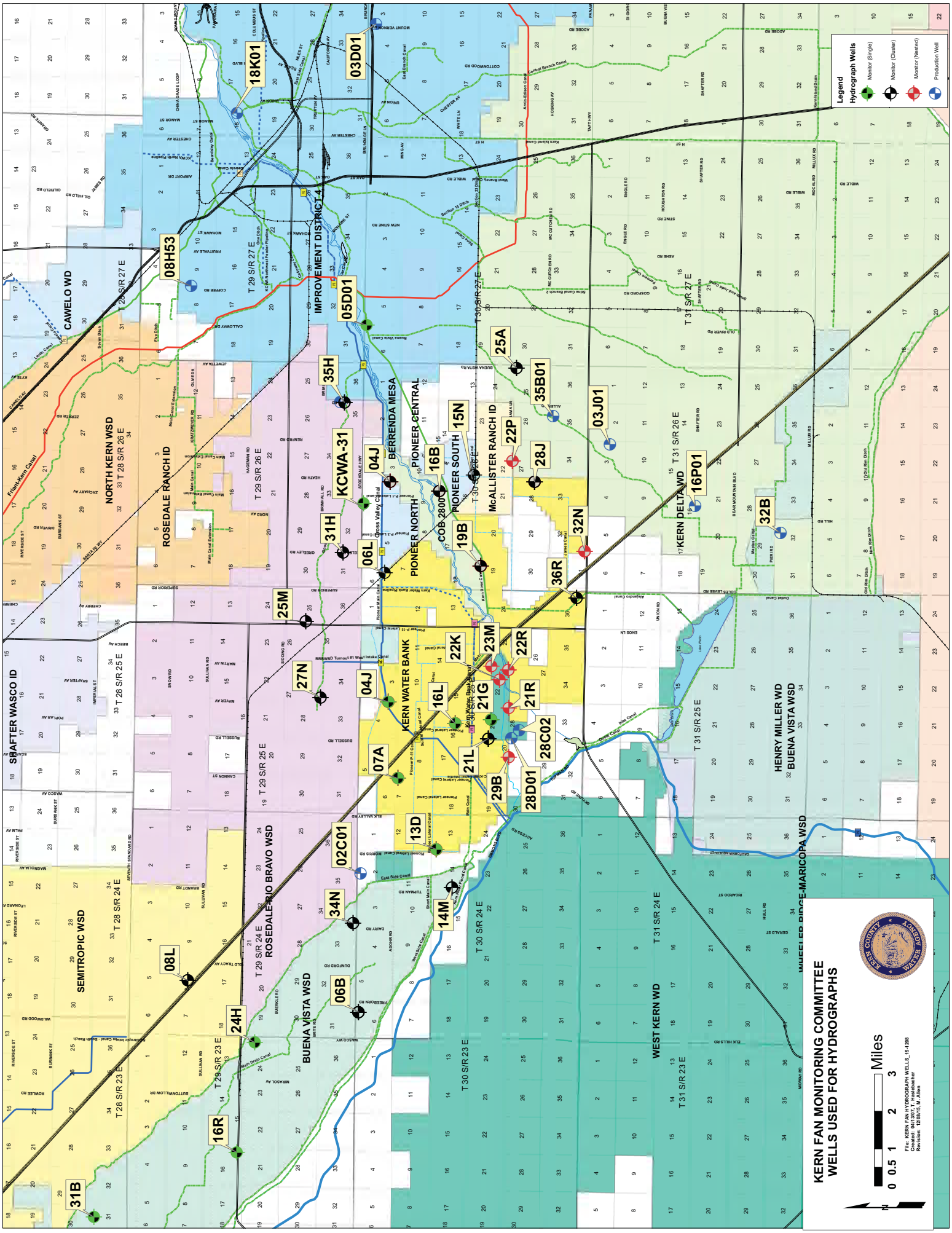
Contour Interval=20 feet

Kern Fan Monitoring Committee
Kern County, California

CHANGE IN POTENTIOMETRIC SURFACE ELEVATION
Middle Zone
SPRING 2015-SPRING 2016

Michelle Anderson PG #8898

July 27, 2016


KERN FAN MONITORING COMMITTEE
WELLS USED FOR HYDROGRAPHS
Legend
Hydrograph Wells
Monitor (Single)
Monitor (Cluster)
Monitor (Nested)
Production Well
Miles
0 0.5 1 2 3
File: KERN FAN HYDROGRAPH WELLS_15-1208
Created: 04/13/07, T. Haelebacher
Revision: 12/08/15, M. Allen
CAWELO WD
NORTH KERN WSD
ROSEDALE RANCH ID
IMPROVEMENT DISTRICT 4
BERRENDA MESA
PIONEER CENTRAL
PIONEER NORTH
PIONEER SOUTH
McALLISTER RANCH ID
KERN DELTA WD
KERN WATER BANK
SHAFTER WASCO ID
SEMITROPIC WSD
ROSEDALE-RIO BRAVO WSD
BUENA VISTA WSD
WEST KERN WD
HENRY MILLER WD
BUENA VISTA WSD
WHEELER RIDGE-MARICOPA WSD
Friant-Kern Canal
18K01
03D01
08H53
05D01
35H
25A
35B01
03J01
KCWA-31
04J
16B
15N
22P
28J
16P01
31H
06L
19B
32N
32B
36R
25M
23M
22K
22R
27N
04J
16L
21G
21R
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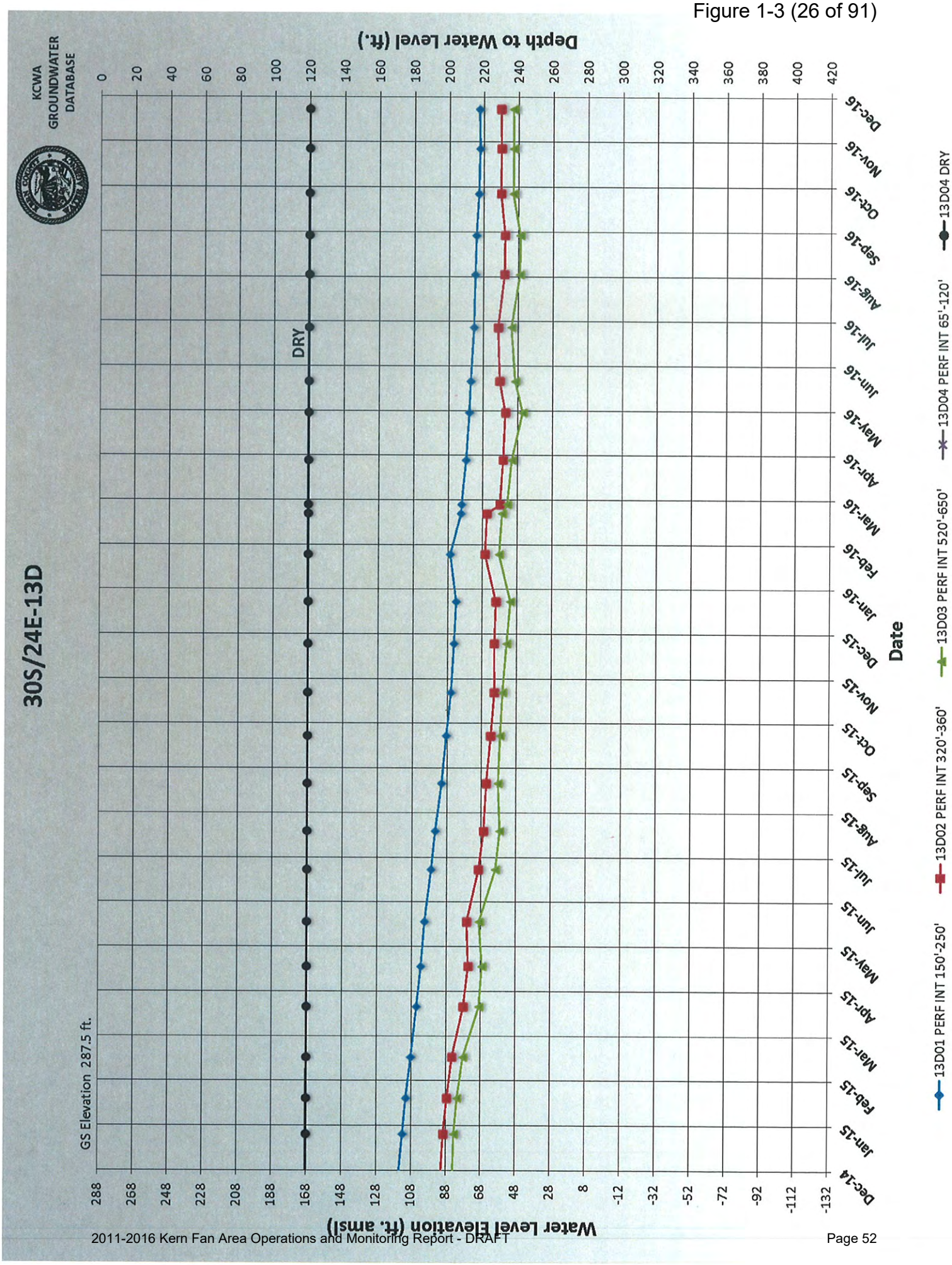
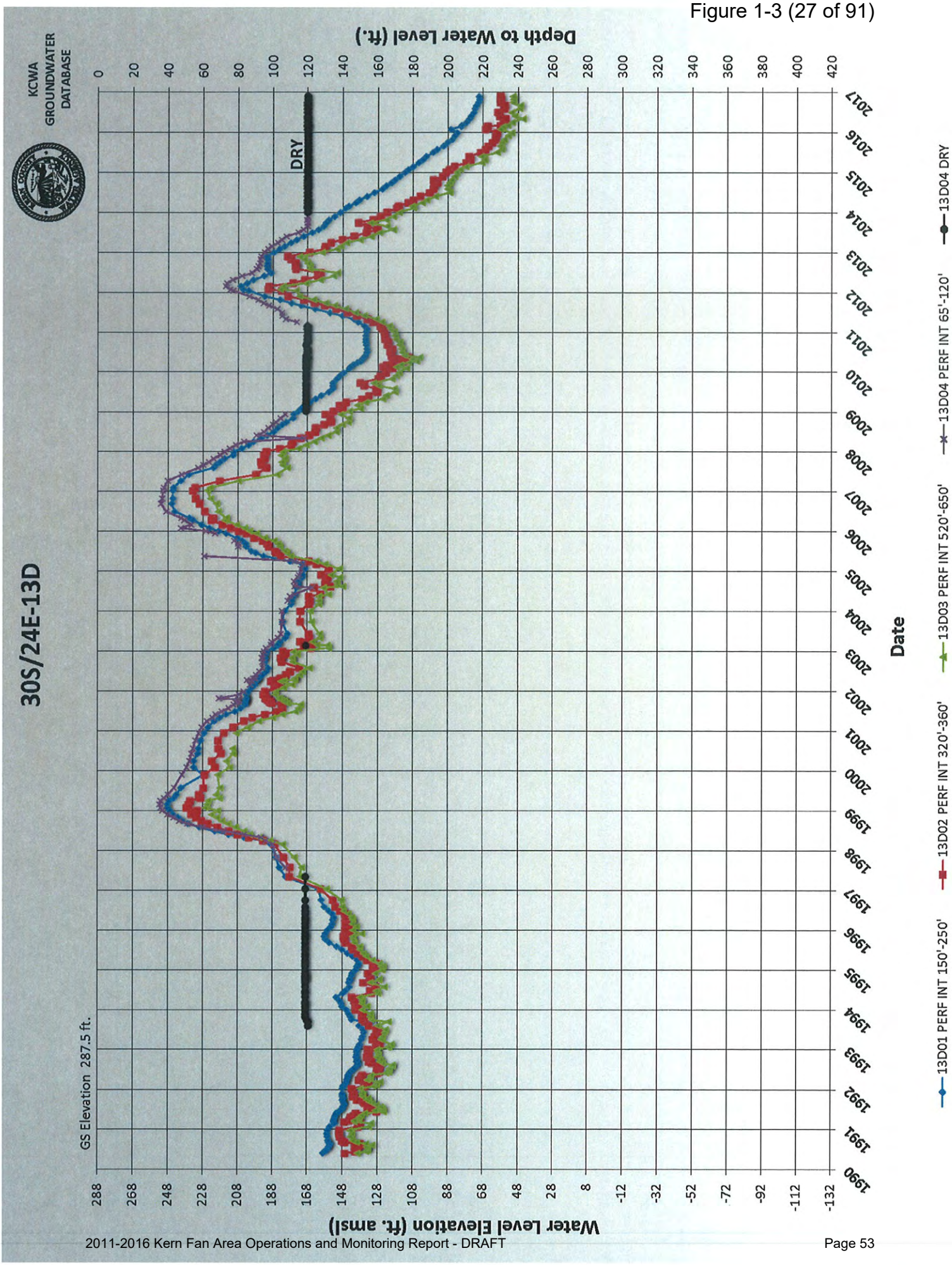
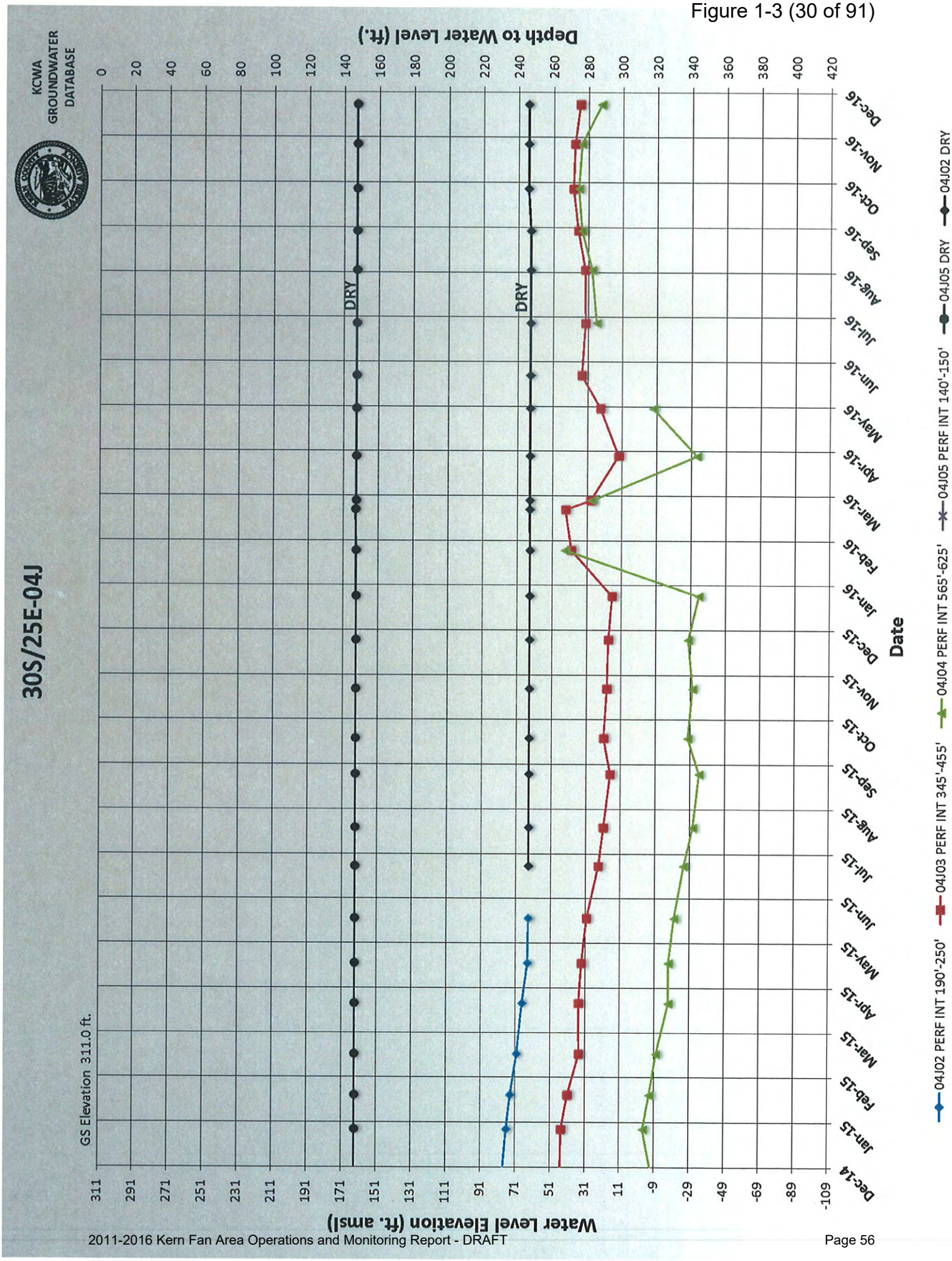
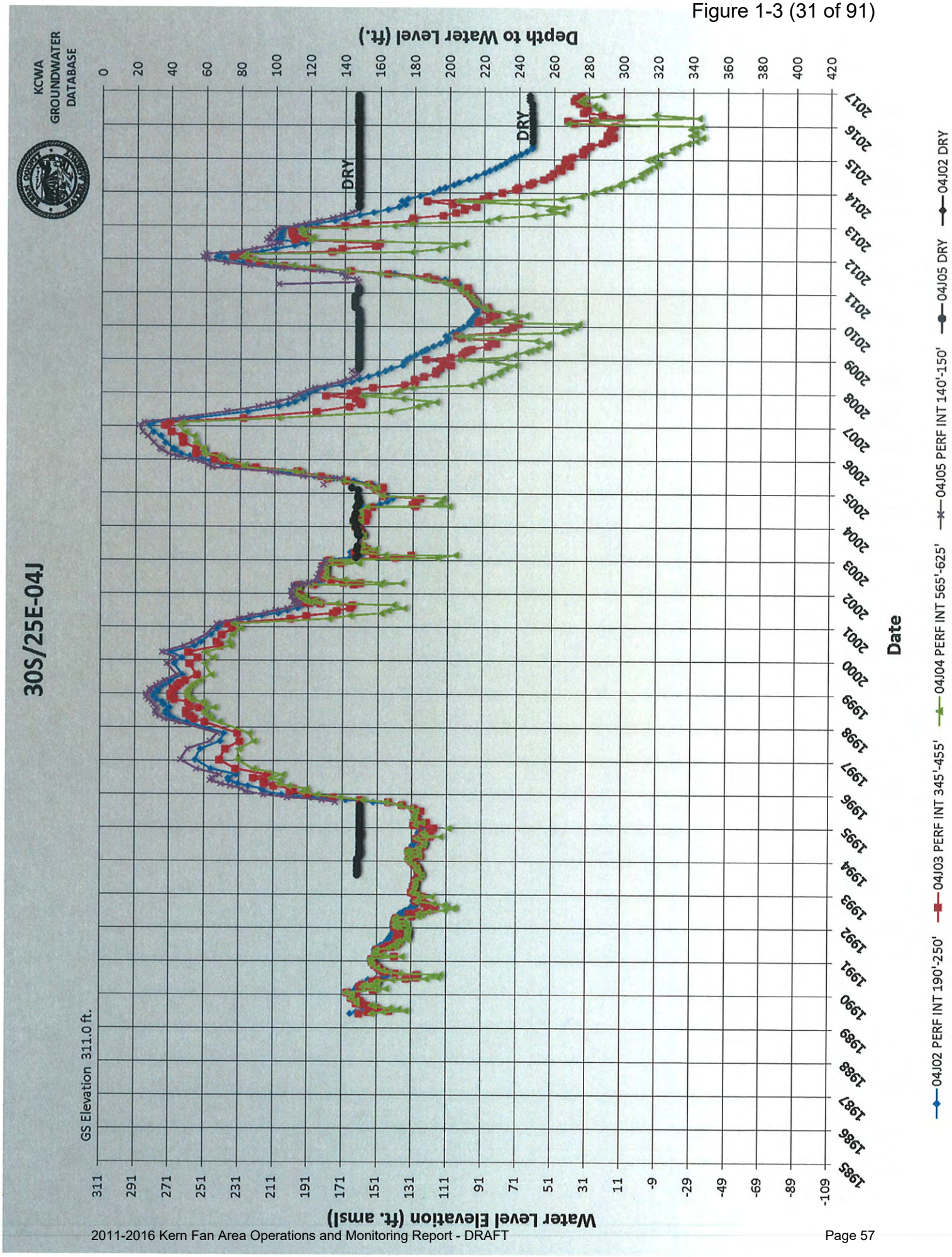
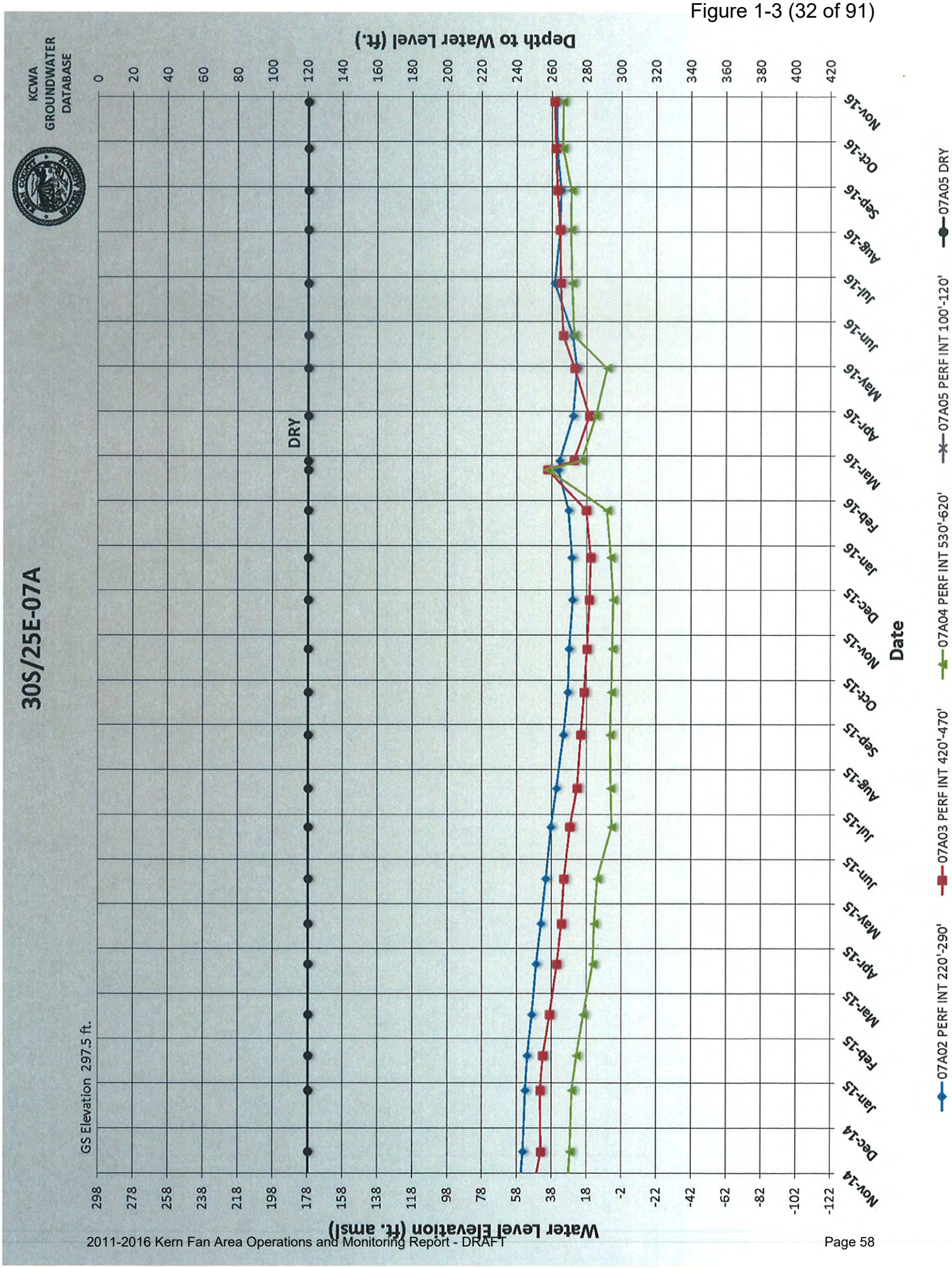
24H
16R
31B


30S/24E-13D
KCWA GROUNDWATER DATABASE
GS Elevation 287.5 ft.
DRY
Water Level Elevation (ft. amsl)
Depth to Water Level (ft.)
Date
13D01 PERF INT 150'-250'
13D02 PERF INT 320'-360'
13D03 PERF INT 520'-650'
13D04 PERF INT 65'-120'
13D04 DRY


30S/24E-13D
KCWA GROUNDWATER DATABASE
GS Elevation 287.5 ft.
DRY
Water Level Elevation (ft. amsl)
Depth to Water Level (ft.)
Date
13D01 PERF INT 150'-250'
13D02 PERF INT 320'-360'
13D03 PERF INT 520'-650'
13D04 PERF INT 65'-120'
13D04 DRY


30S/25E-04J
KCWA GROUNDWATER DATABASE
GS Elevation 311.0 ft.
Depth to Water Level (ft.)
Water Level Elevation (ft. amsl)
DRY
DRY
Date
04J02 PERF INT 190'-250'
04J03 PERF INT 345'-455'
04J04 PERF INT 565'-625'
04J05 PERF INT 140'-150'
04J05 DRY
04J02 DRY


30S/25E-04J
KCWA GROUNDWATER DATABASE
GS Elevation 311.0 ft.
Depth to Water Level (ft.)
Water Level Elevation (ft. amsl)
Date
DRY
DRY
04J02 PERF INT 190'-250'
04J03 PERF INT 345'-455'
04J04 PERF INT 565'-625'
04J05 PERF INT 140'-150'
04J05 DRY
04J02 DRY


30S/25E-07A
KCWA GROUNDWATER DATABASE
GS Elevation 297.5 ft.
DRY
Depth to Water Level (ft.)
Water Level Elevation (ft. amsl)
Date
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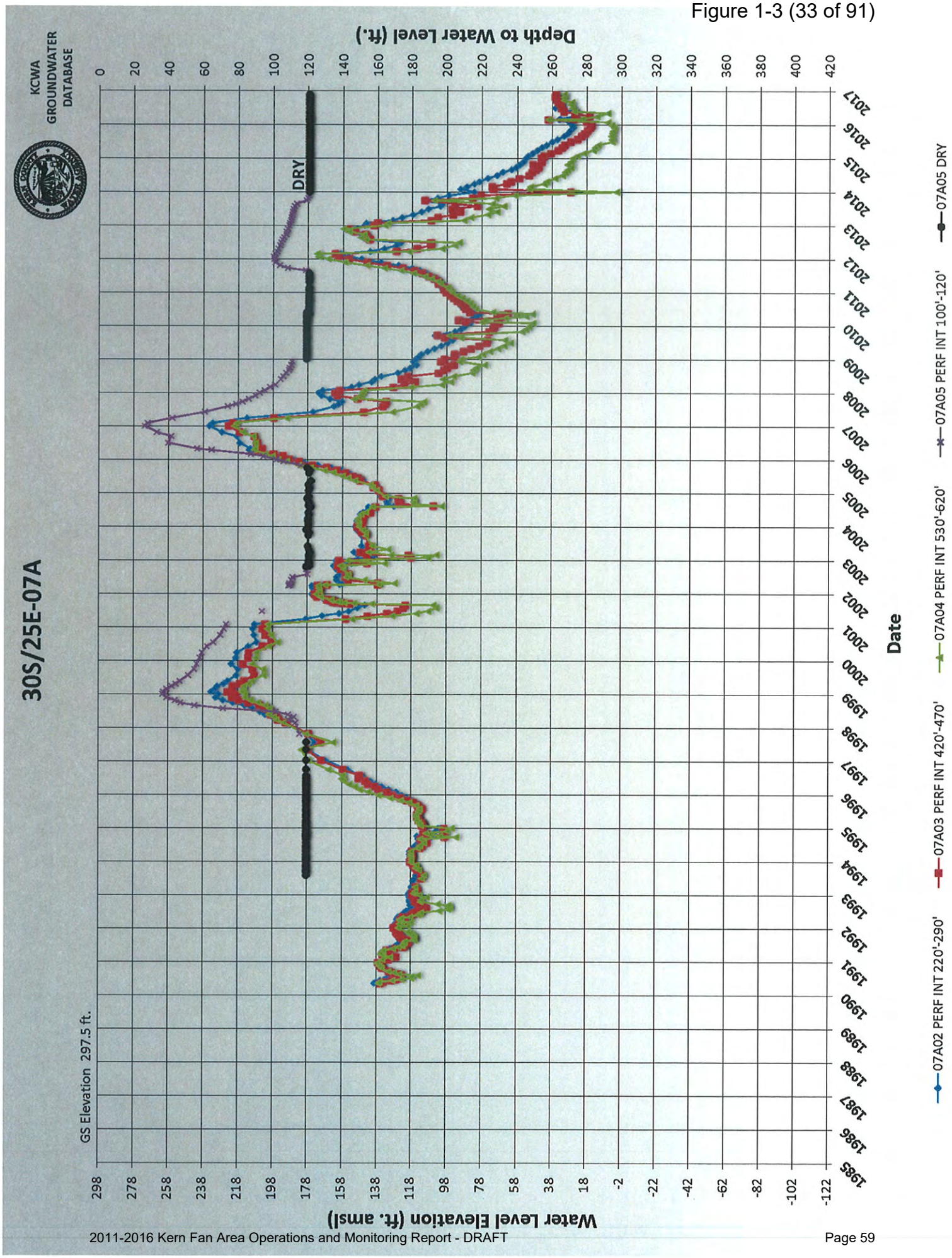
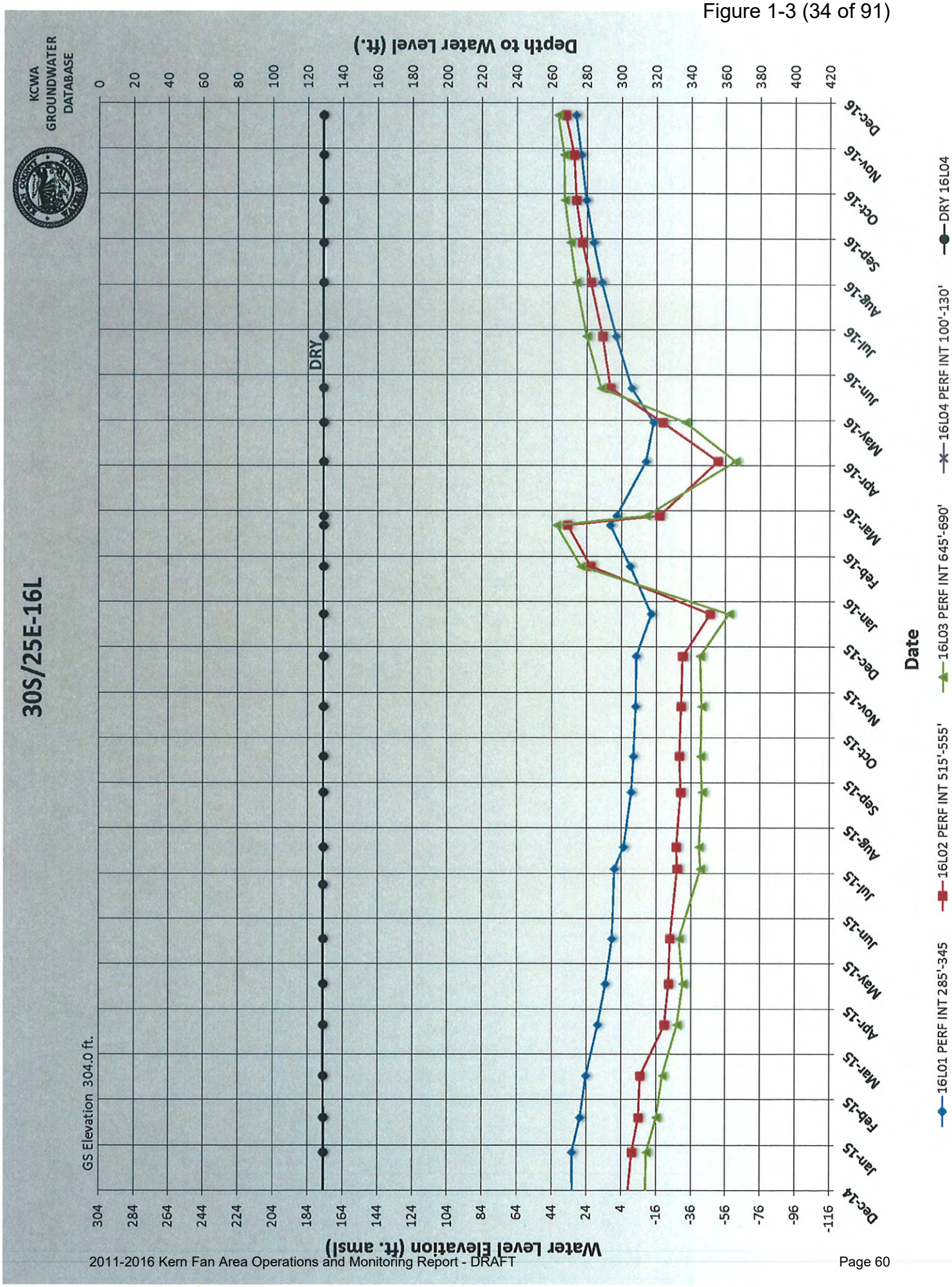
07A03 PERF INT 420'-470'
07A04 PERF INT 530'-620'
07A05 PERF INT 100'-120'
07A05 DRY


30S/25E-07A
KCWA GROUNDWATER DATABASE
GS Elevation 297.5 ft.
Depth to Water Level (ft.)
Water Level Elevation (ft. amsl)
DRY
Date
07A02 PERF INT 220'-290'
07A03 PERF INT 420'-470'
07A04 PERF INT 530'-620'
07A05 PERF INT 100'-120'
07A05 DRY


30S/25E-16L
KCWA GROUNDWATER DATABASE
GS Elevation 304.0 ft.
Water Level Elevation (ft. amsl)
Depth to Water Level (ft.)
DRY
Date
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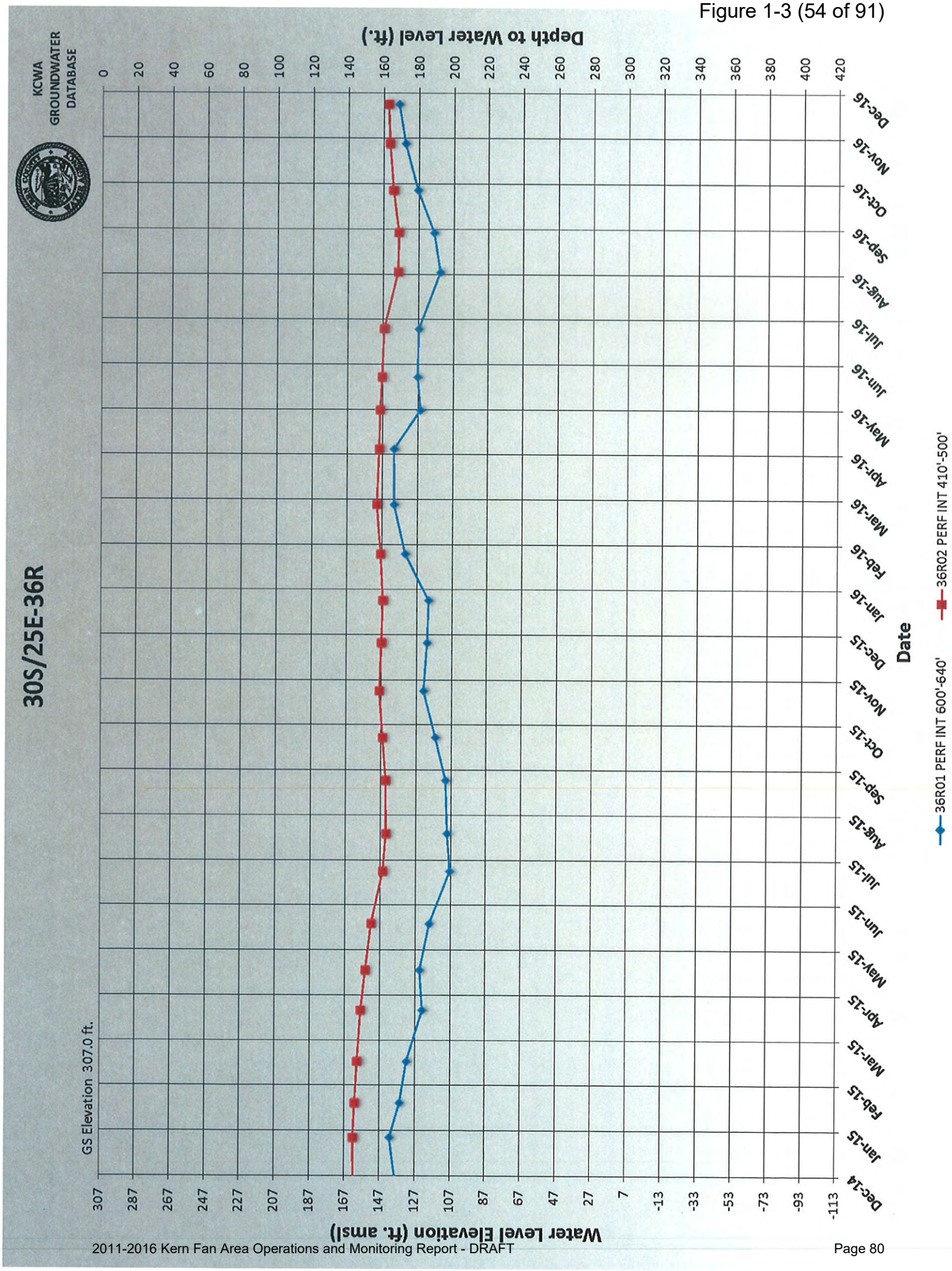
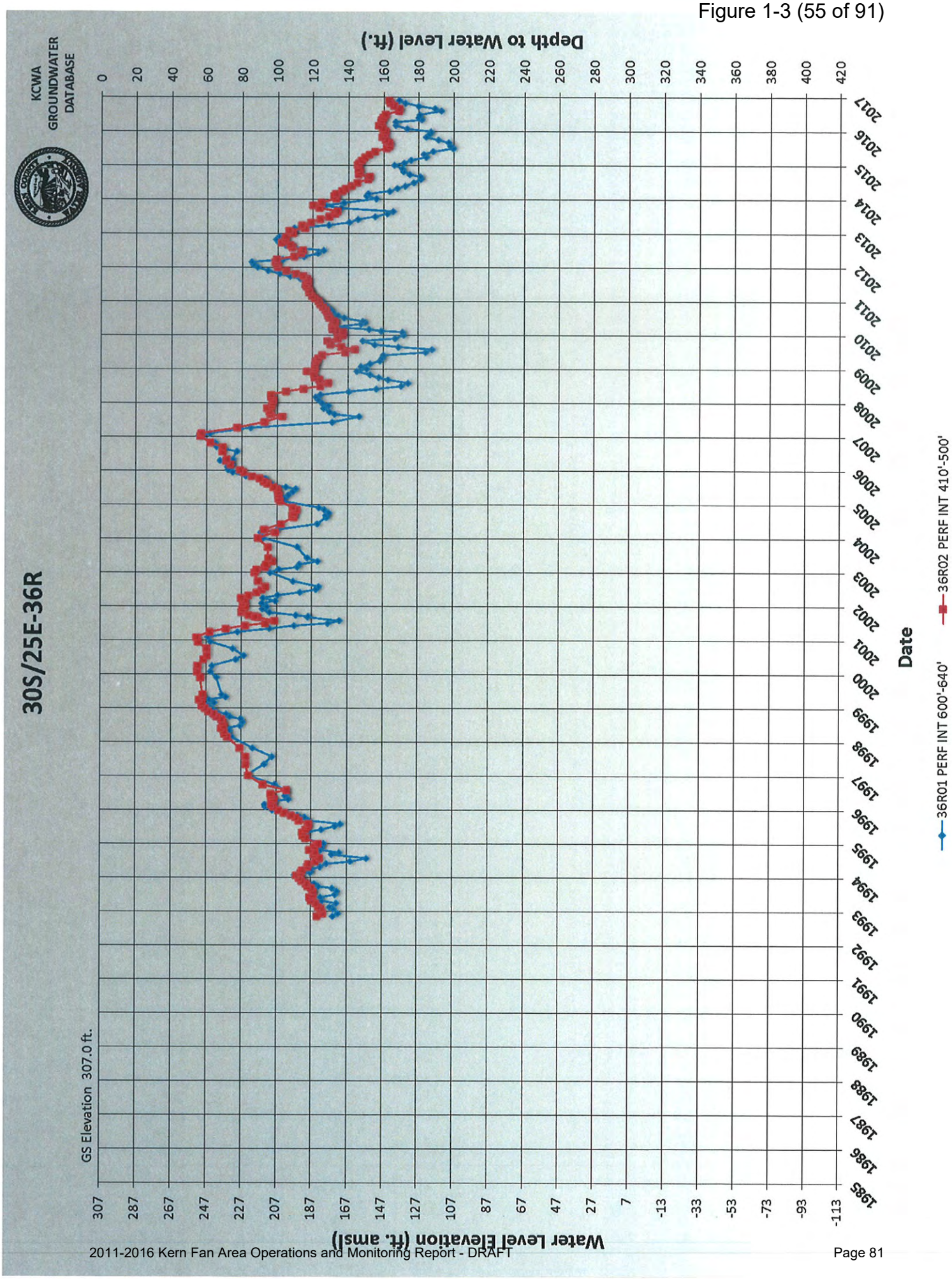
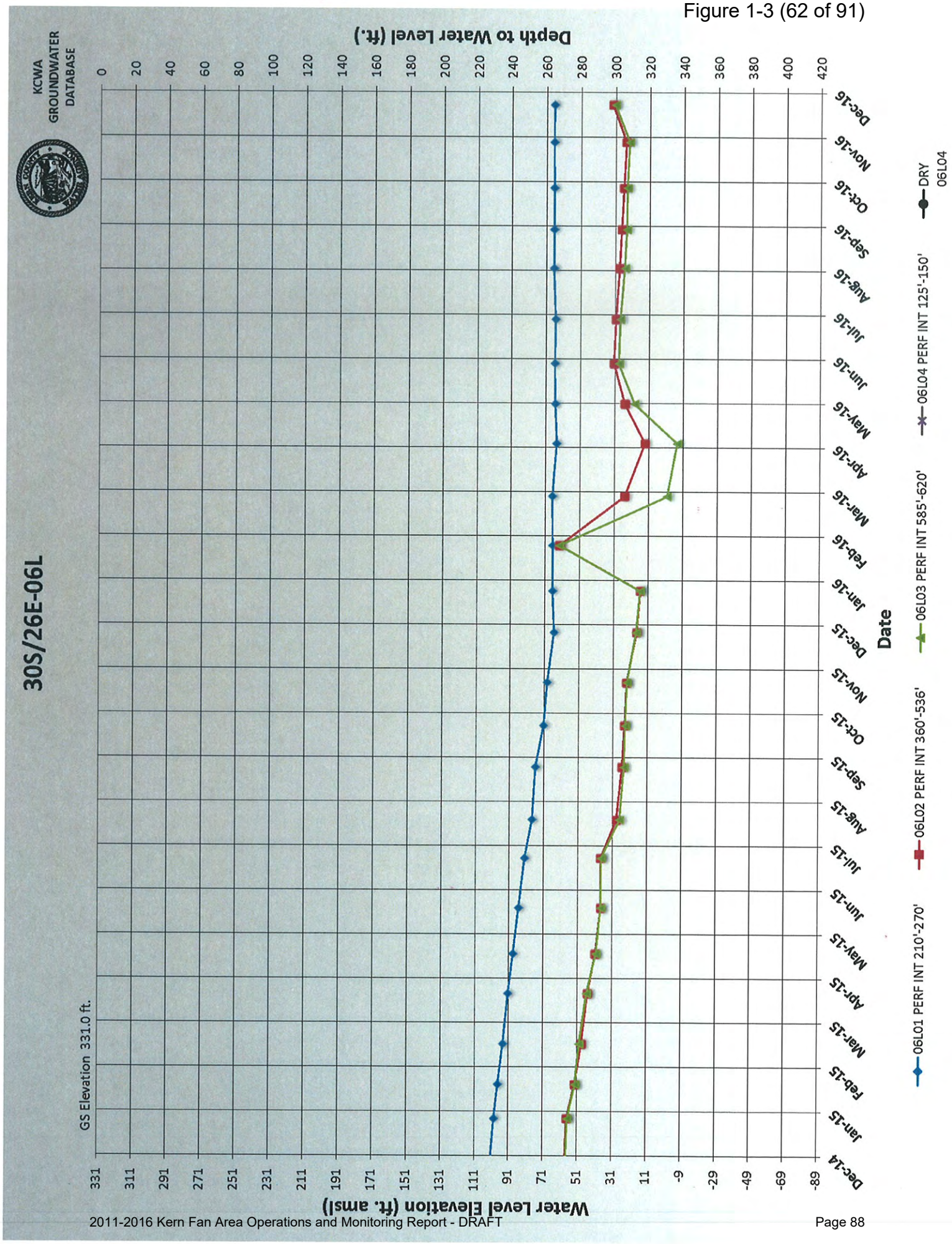
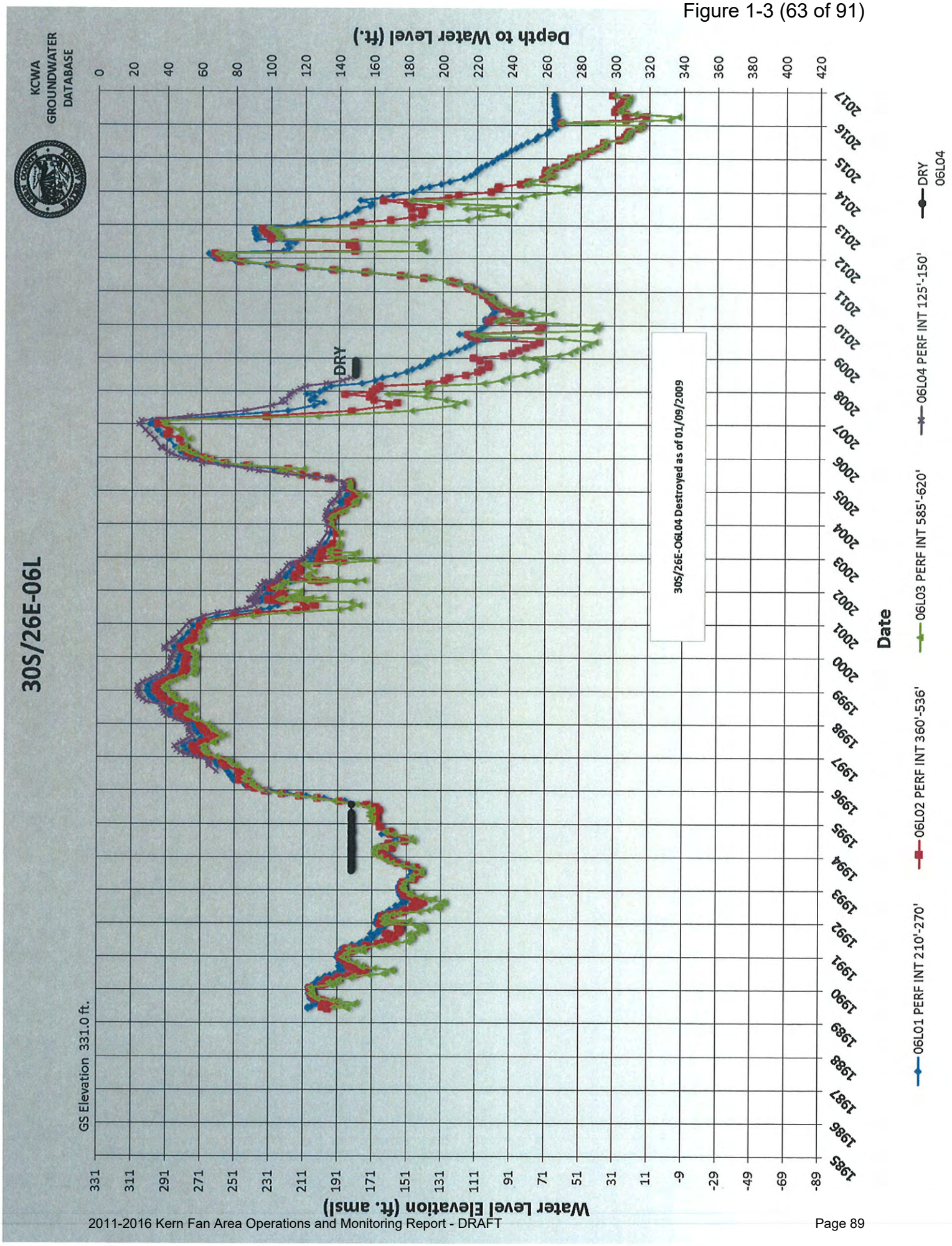
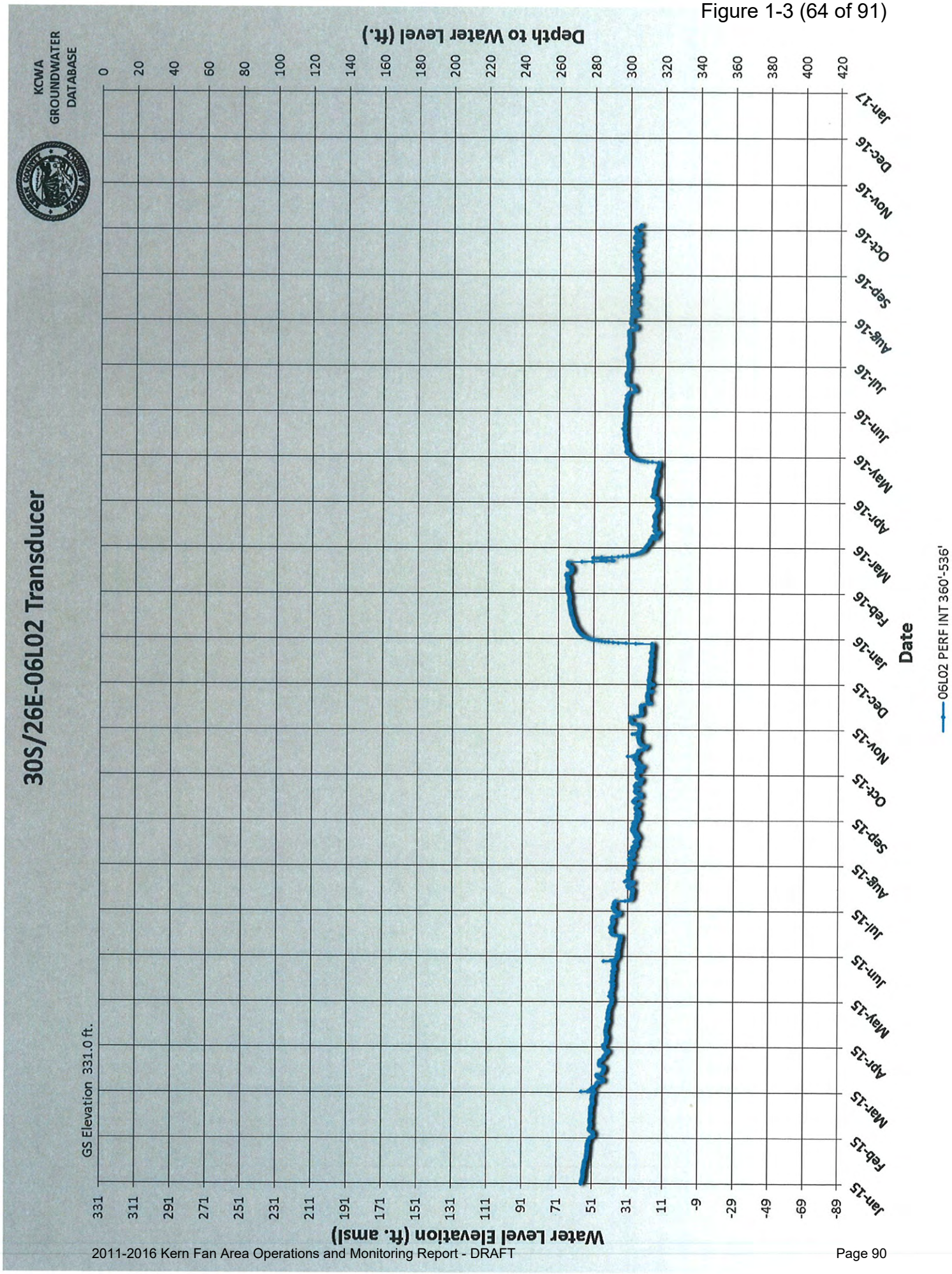
16L02 PERF INT 515'-555'
16L03 PERF INT 645'-690'
16L04 PERF INT 100'-130'
DRY 16L04

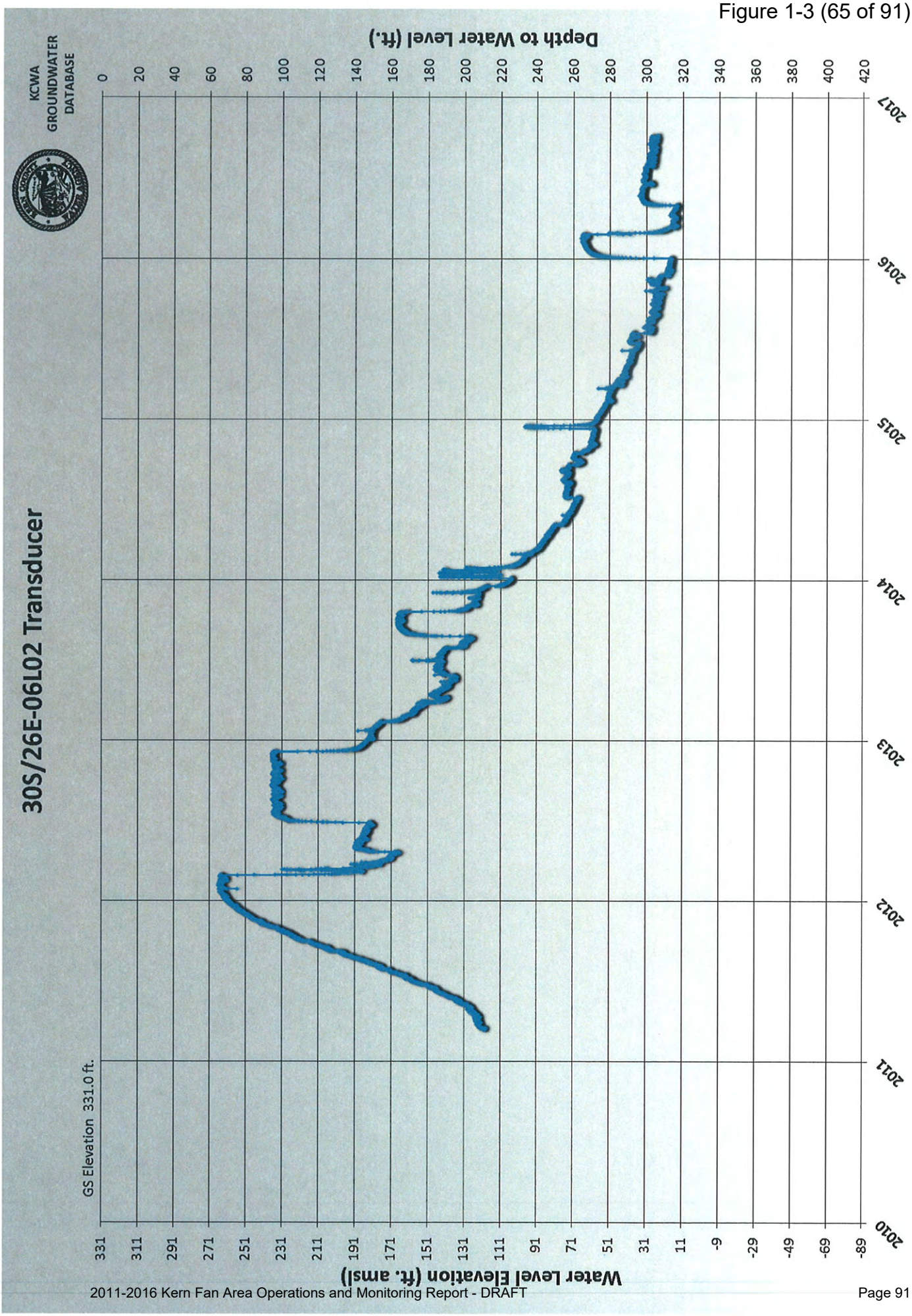

30S/25E-36R
KCWA GROUNDWATER DATABASE
GS Elevation 307.0 ft.
Depth to Water Level (ft.)
Water Level Elevation (ft. amsl)
Date
36R01 PERF INT 600'-640'
36R02 PERF INT 410'-500'

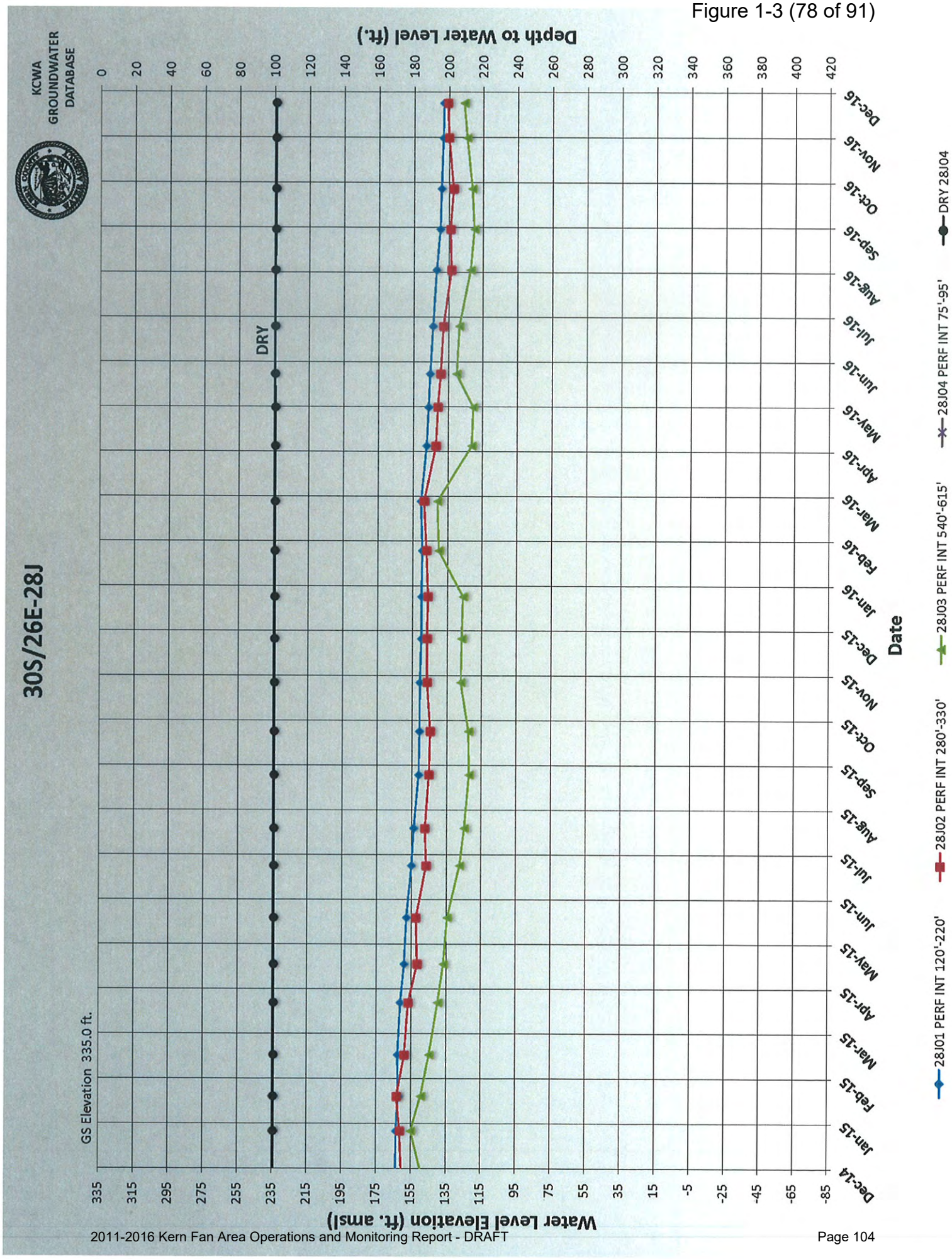

30S/25E-36R
KCWA GROUNDWATER DATABASE
GS Elevation 307.0 ft.
Water Level Elevation (ft. amsl)
Depth to Water Level (ft.)
Date
36R01 PERF INT 600'-640'
36R02 PERF INT 410'-500'

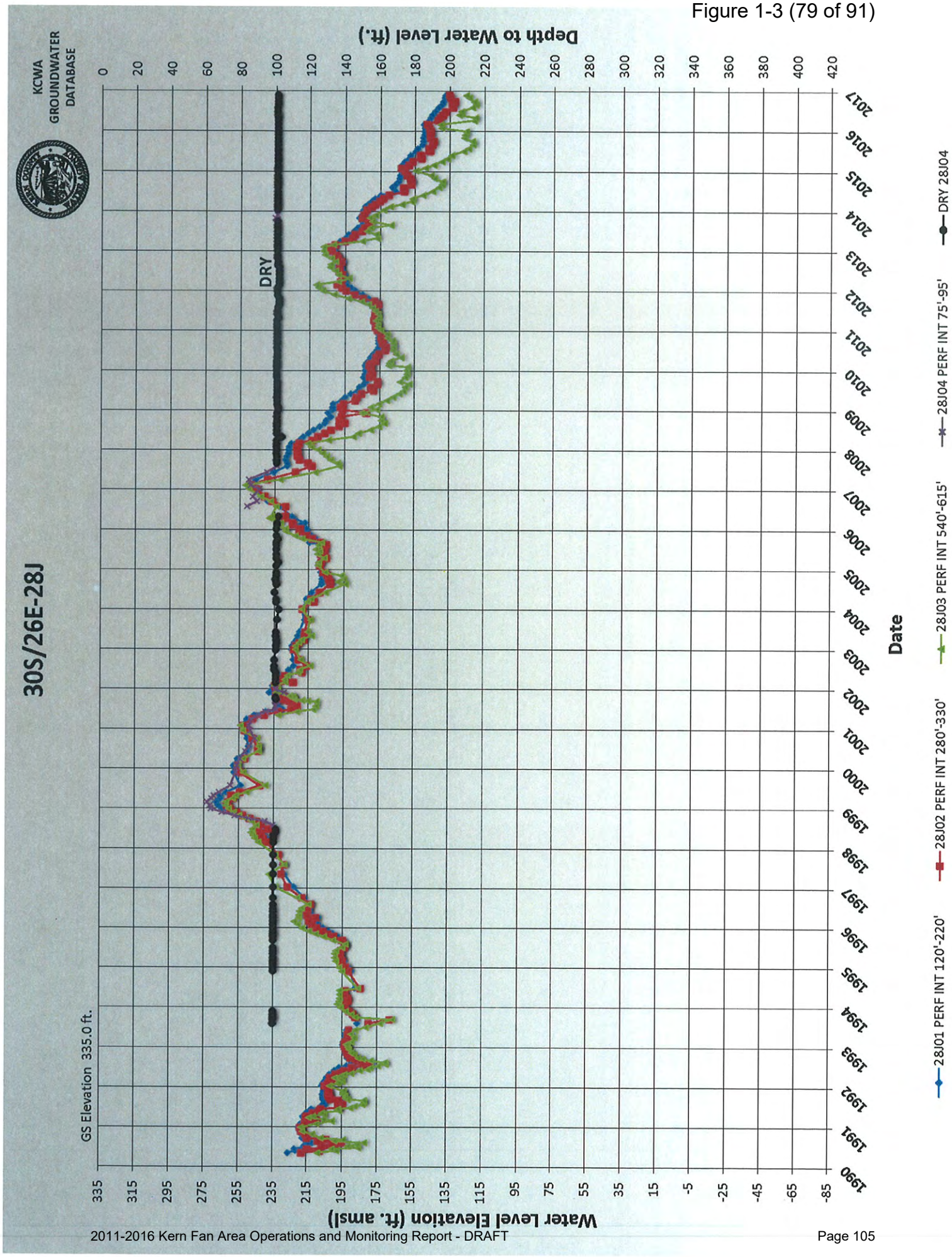

30S/26E-06L
KCWA GROUNDWATER DATABASE
GS Elevation 331.0 ft.
Depth to Water Level (ft.)
Water Level Elevation (ft. amsl)
Date
06L01 PERF INT 210'-270'
06L02 PERF INT 360'-536'
06L03 PERF INT 585'-620'
06L04 PERF INT 125'-150'
DRY 06L04

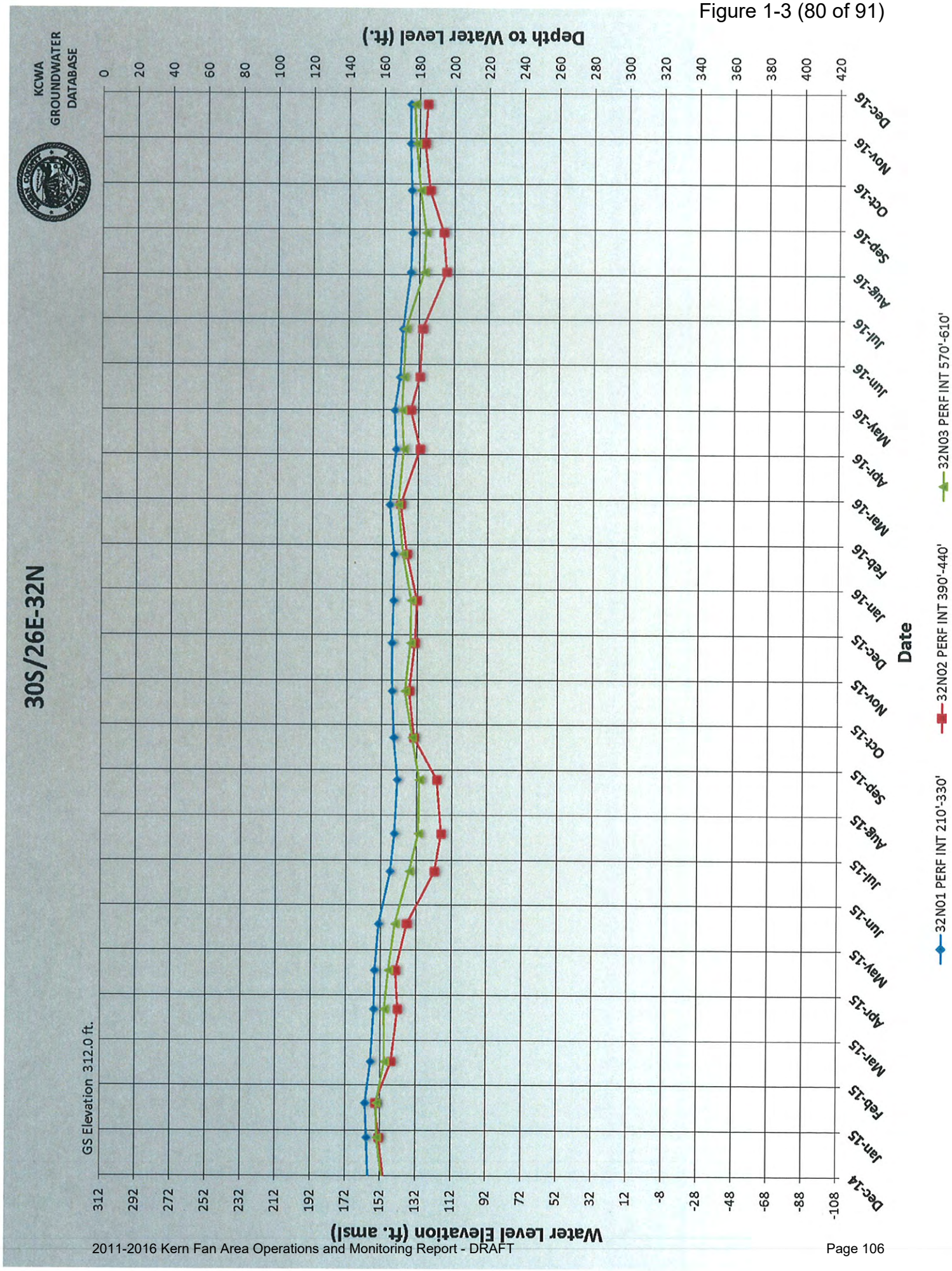

30S/26E-06L
KCWA GROUNDWATER DATABASE
GS Elevation 331.0 ft.
Water Level Elevation (ft. amsl)
Depth to Water Level (ft.)
DRY
30S/26E-06L04 Destroyed as of 01/09/2009
Date
06L01 PERF INT 210'-270'
06L02 PERF INT 360'-536'
06L03 PERF INT 585'-620'
06L04 PERF INT 125'-150'
DRY
06L04

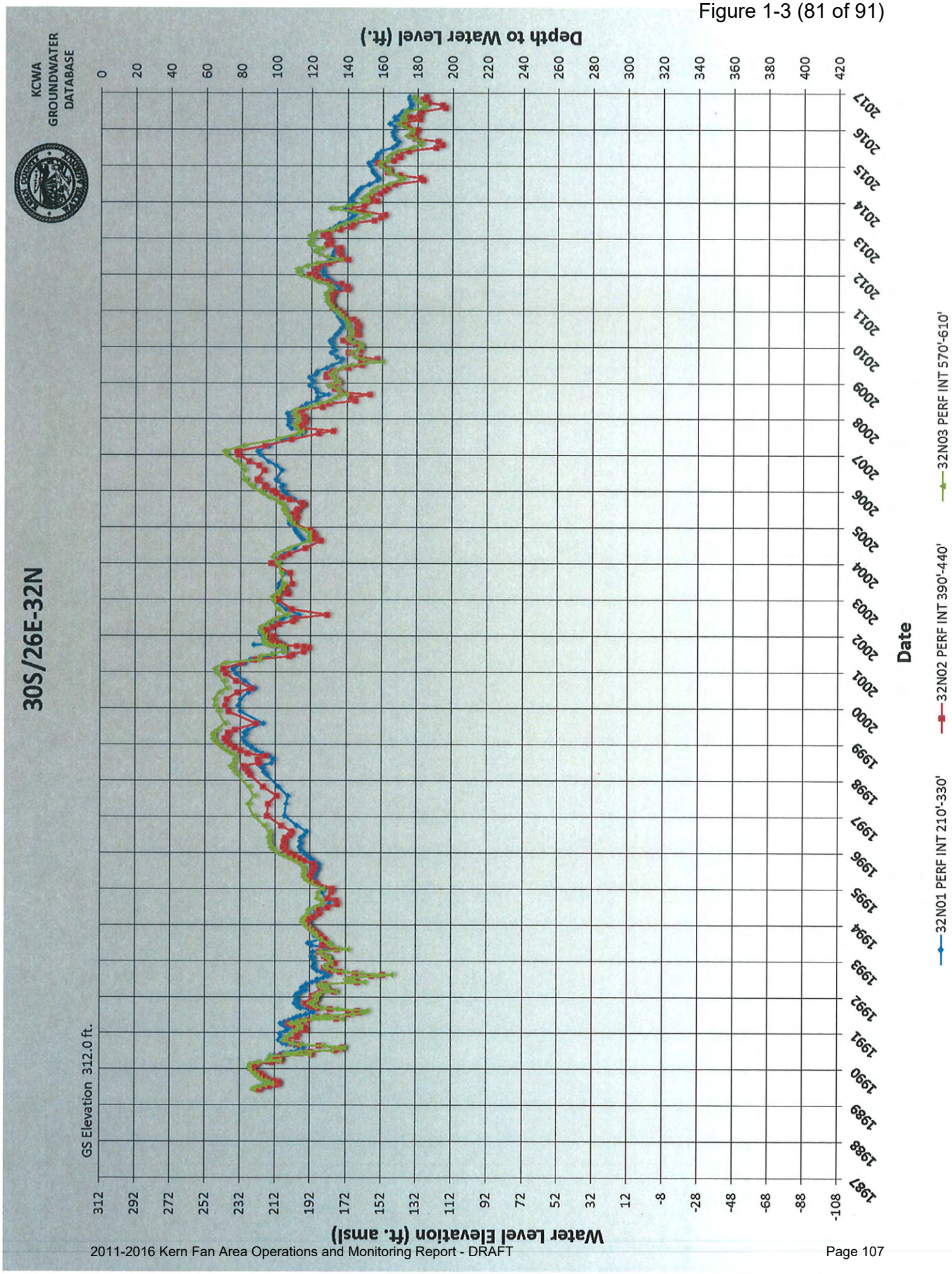

30S/26E-06L02 Transducer
KCWA GROUNDWATER DATABASE
GS Elevation 331.0 ft.
Water Level Elevation (ft. amsl)
Depth to Water Level (ft.)
Date
06L02 PERF INT 360'-536'
331
311
291
271
251
231
211
191
171
151
131
111
91
71
51
31
11
-9
-29
-49
-69
-89
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Jan-17

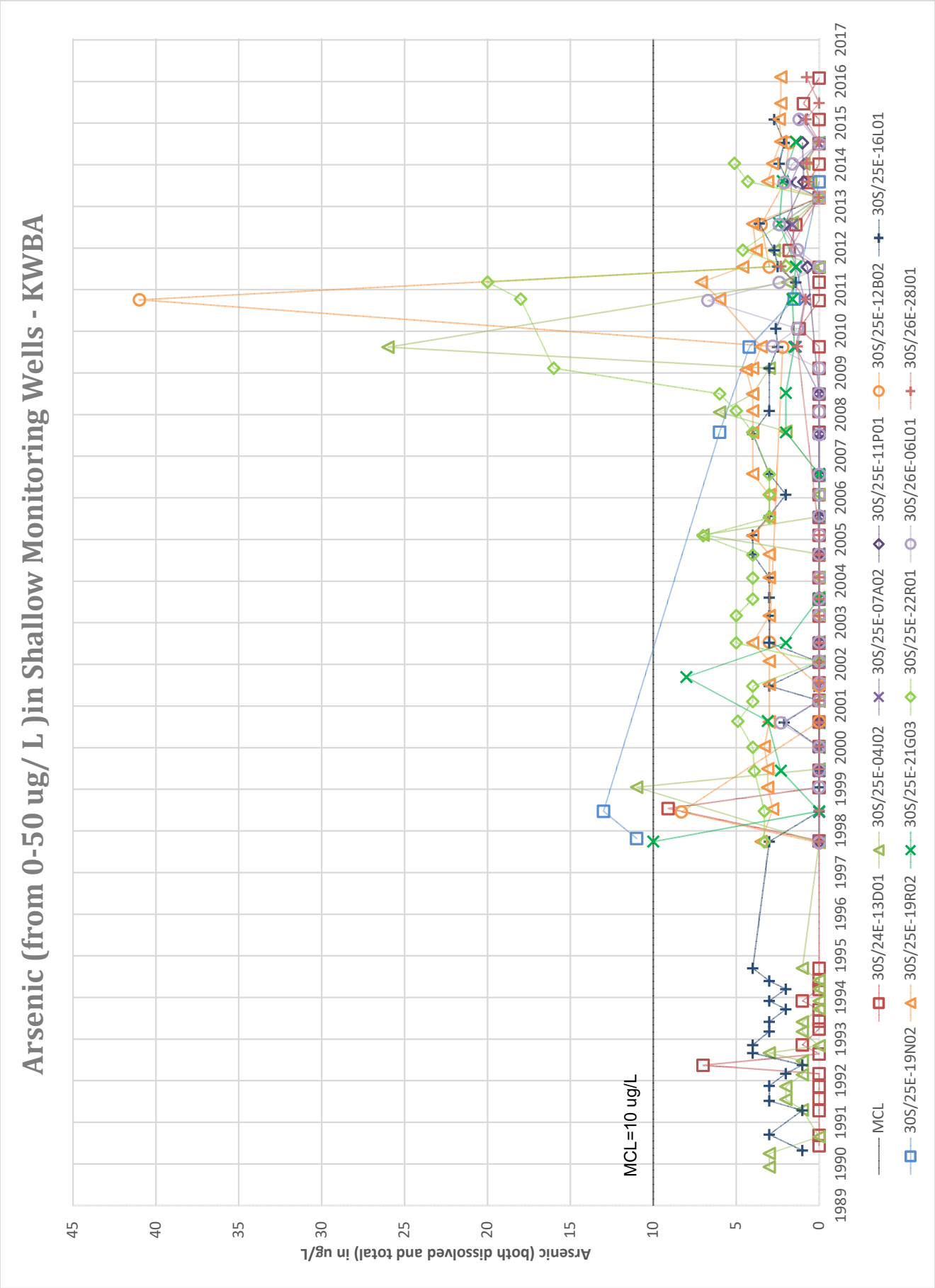

30S/26E-06L02 Transducer
KCWA GROUNDWATER DATABASE
GS Elevation 331.0 ft.
Water Level Elevation (ft. amsl)
331
311
291
271
251
231
211
191
171
151
131
111
91
71
51
31
11
-9
-29
-49
-69
-89
Depth to Water Level (ft.)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
2010
2011
2012
2013
2014
2015
2016
2017
Date
06L02 PERF INT 360'-536'

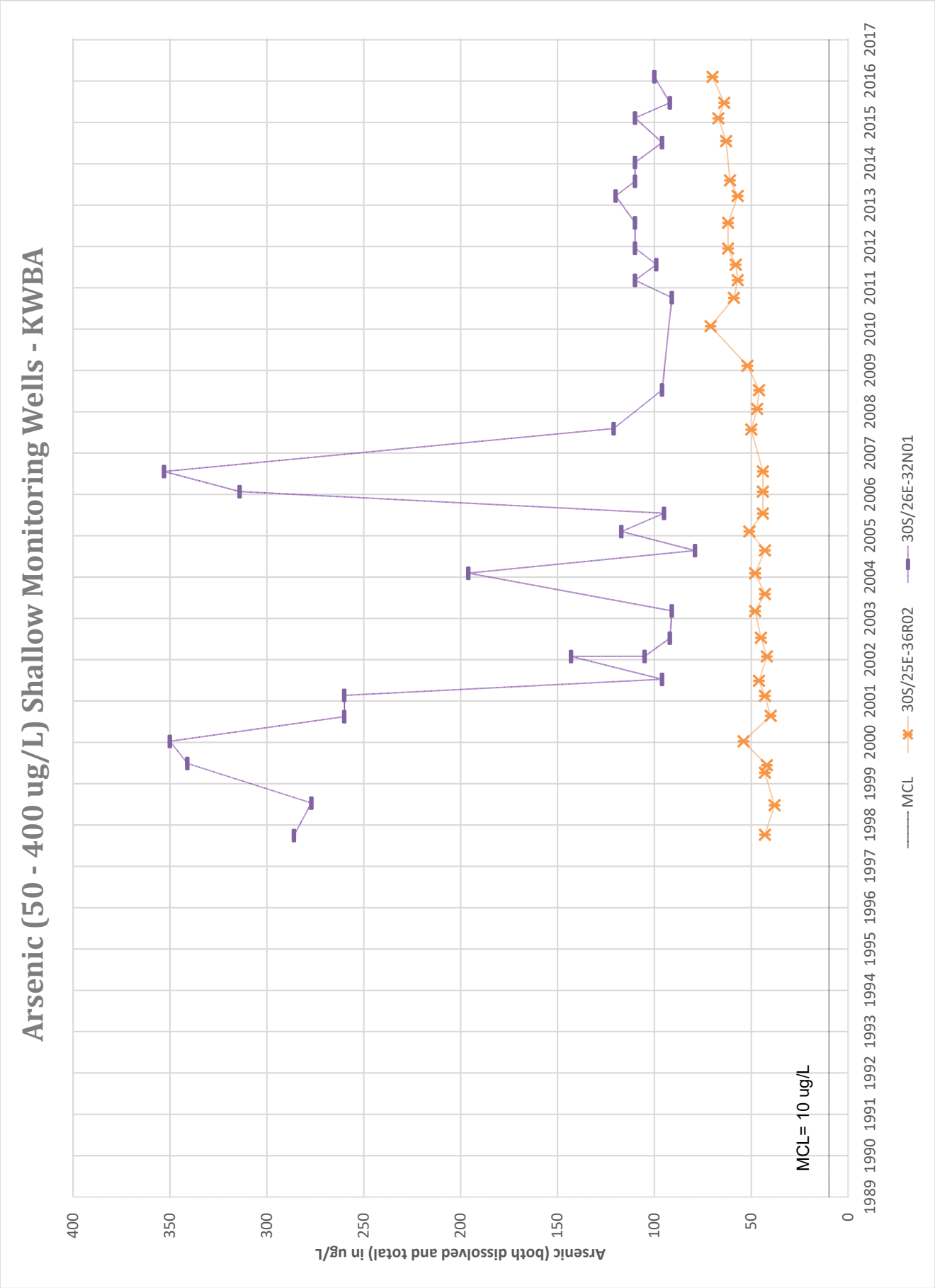

30S/26E-28J
KCWA GROUNDWATER DATABASE
GS Elevation 335.0 ft.
Depth to Water Level (ft.)
Water Level Elevation (ft. amsl)
DRY
Date
28J01 PERF INT 120'-220'
28J02 PERF INT 280'-330'
28J03 PERF INT 540'-615'
28J04 PERF INT 75'-95'
DRY 28J04

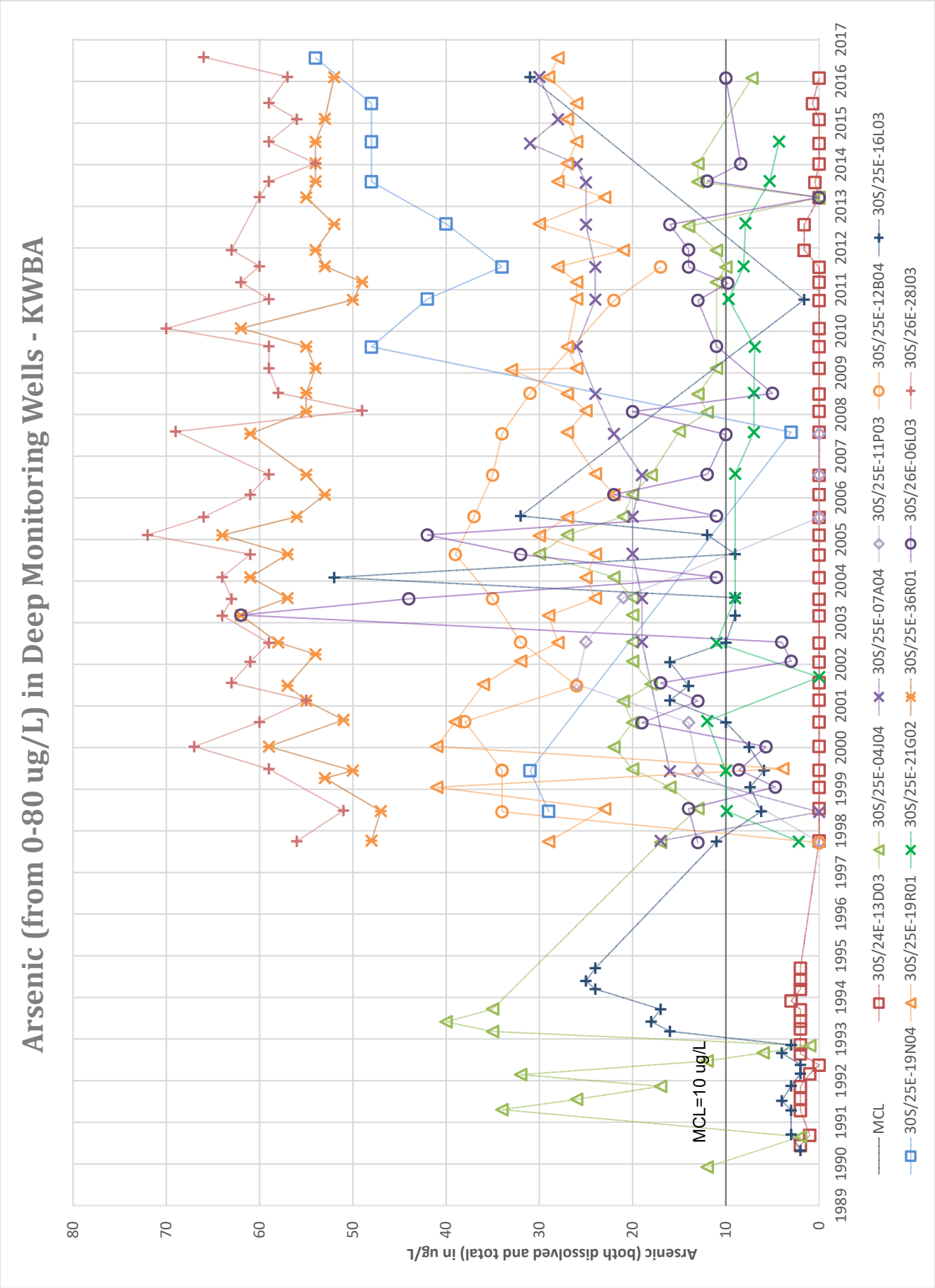

30S/26E-28J
KCWA GROUNDWATER DATABASE
GS Elevation 335.0 ft.
DRY
Depth to Water Level (ft.)
Water Level Elevation (ft. amsl)
Date
28J01 PERF INT 120'-220'
28J02 PERF INT 280'-330'
28J03 PERF INT 540'-615'
28J04 PERF INT 75'-95'
DRY 28J04

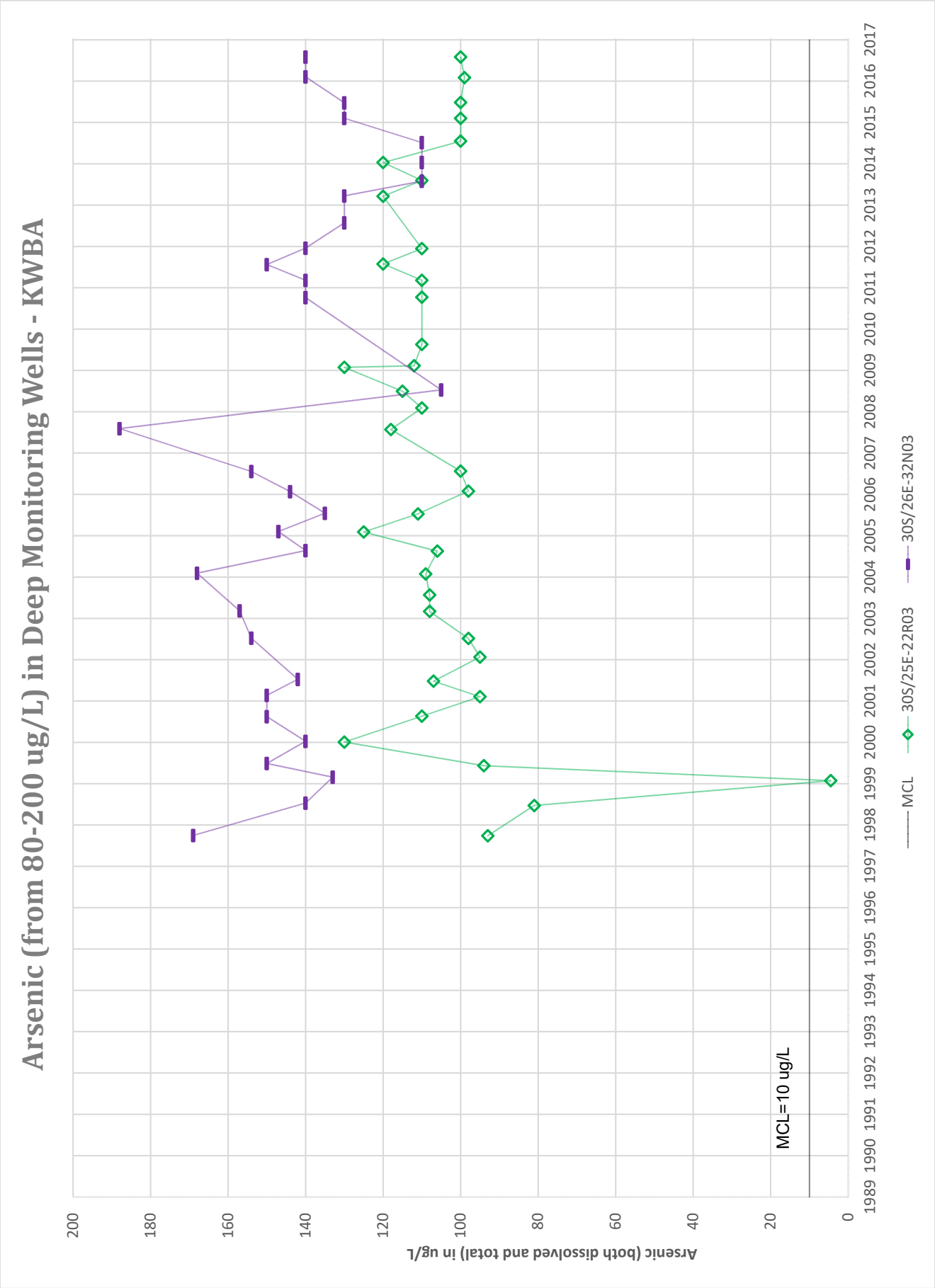

30S/26E-32N
KCWA GROUNDWATER DATABASE
GS Elevation 312.0 ft.
Depth to Water Level (ft.)
Water Level Elevation (ft. amsl)
Date
32N01 PERF INT 210'-330'
32N02 PERF INT 390'-440'
32N03 PERF INT 570'-610'

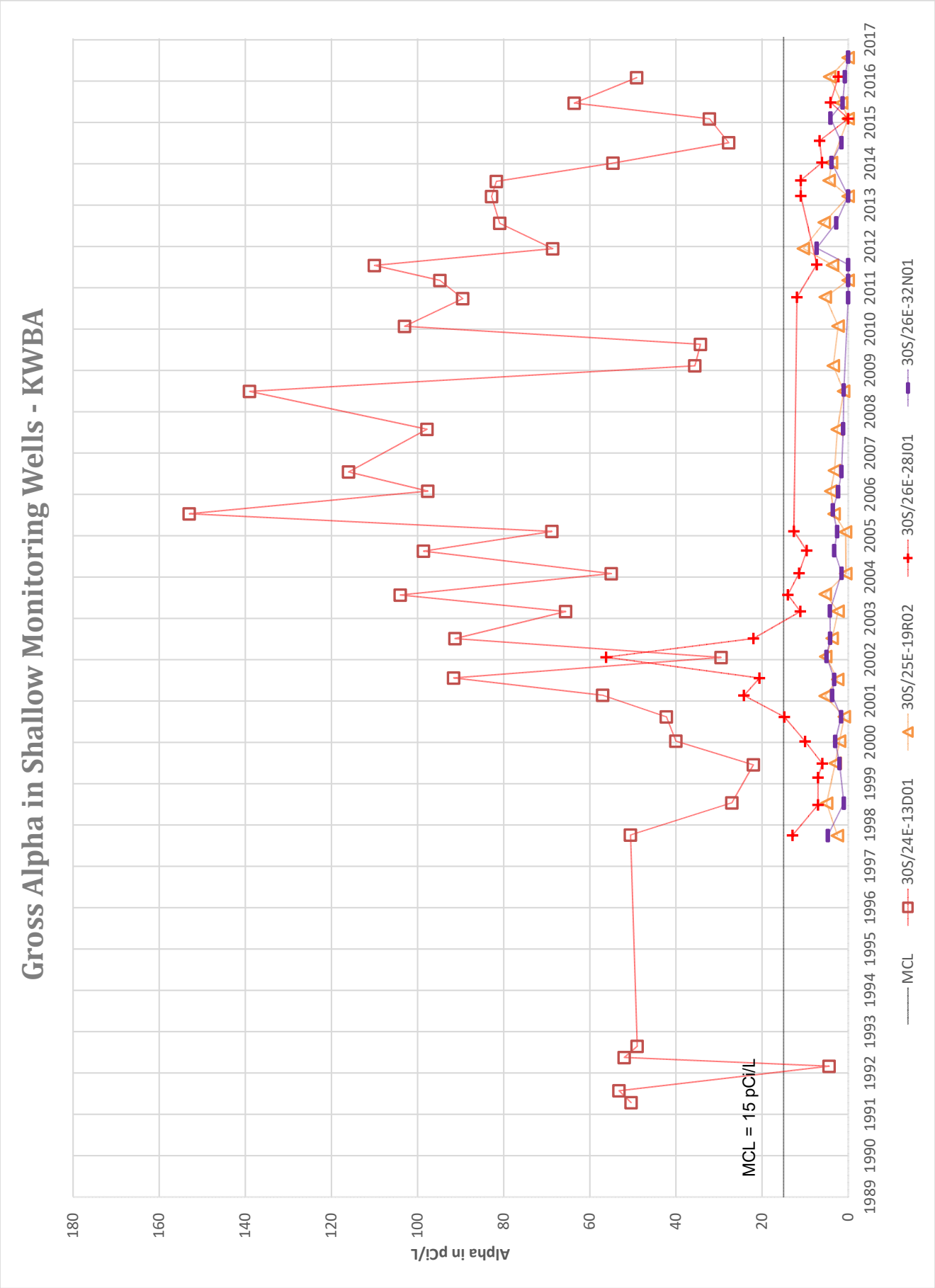

30S/26E-32N
KCWA GROUNDWATER DATABASE
GS Elevation 312.0 ft.
Water Level Elevation (ft. amsl)
Depth to Water Level (ft.)
Date
32N01 PERF INT 210'-330'
32N02 PERF INT 390'-440'
32N03 PERF INT 570'-610'

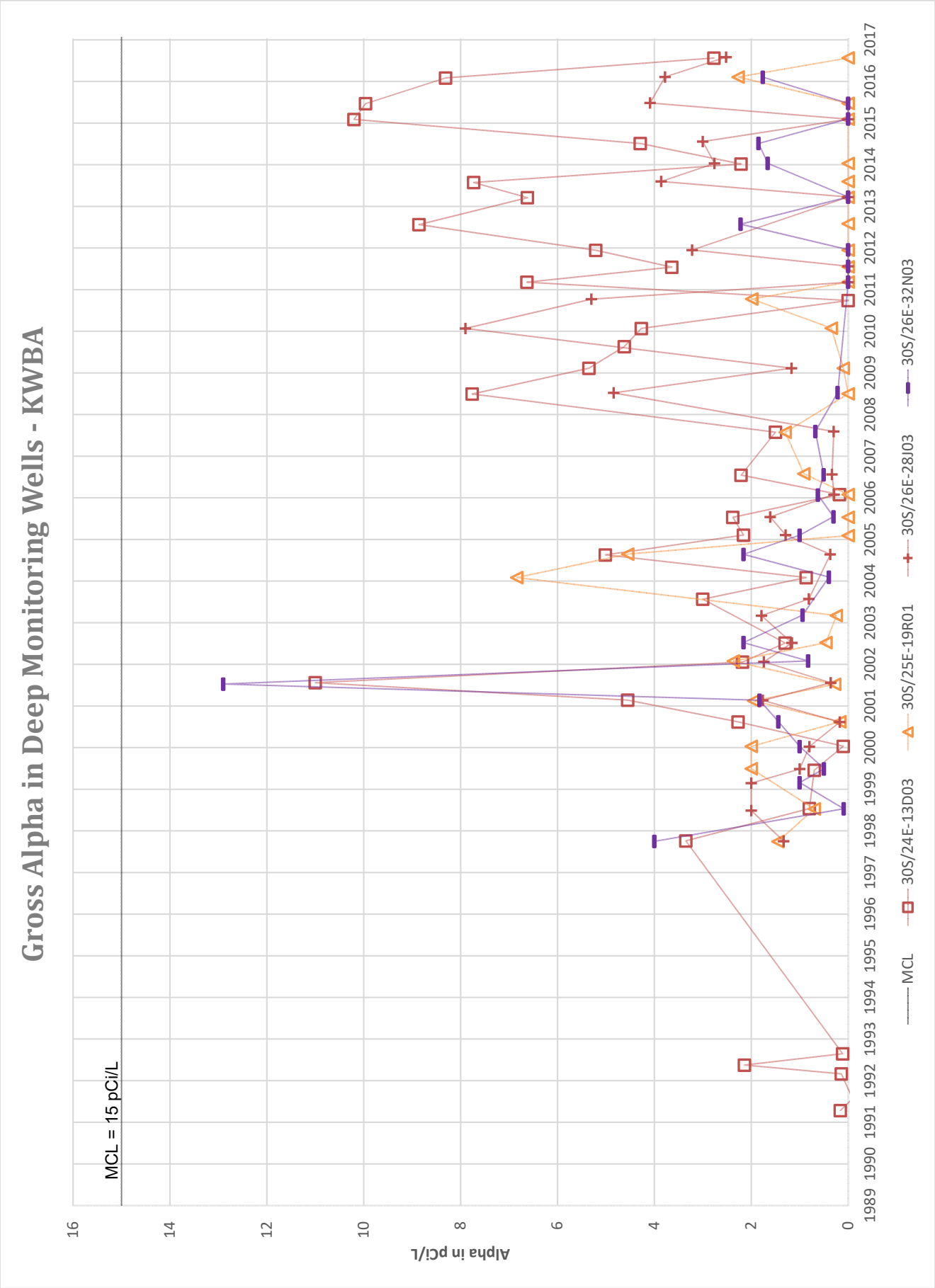

Arsenic (from 0-50 ug/ L)in Shallow Monitoring Wells - KWBA
Arsenic (both dissolved and total) in ug/L
45
40
35
30
25
20
15
10
5
0
MCL=10 ug/L
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
MCL
30S/24E-13D01
30S/25E-04J02
30S/25E-07A02
30S/25E-11P01
30S/25E-12B02
30S/25E-16L01
30S/25E-19N02
30S/25E-19R02
30S/25E-21G03
30S/25E-22R01
30S/26E-06L01
30S/26E-28J01

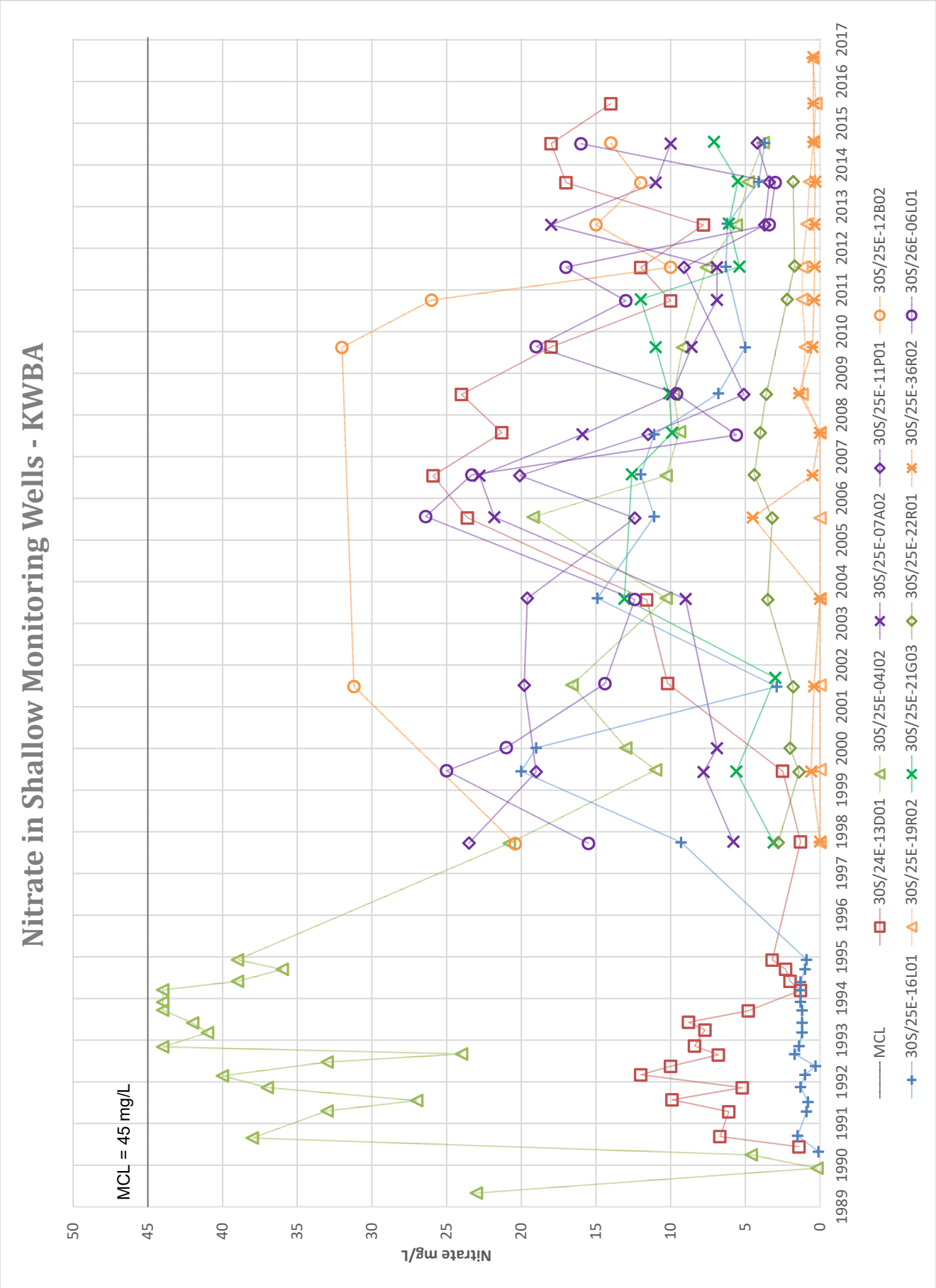

Arsenic (50 - 400 ug/L) Shallow Monitoring Wells - KWBA
Arsenic (both dissolved and total) in ug/L
400
350
300
250
200
150
100
50
0
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
MCL= 10 ug/L
MCL
30S/25E-36R02
30S/26E-32N01

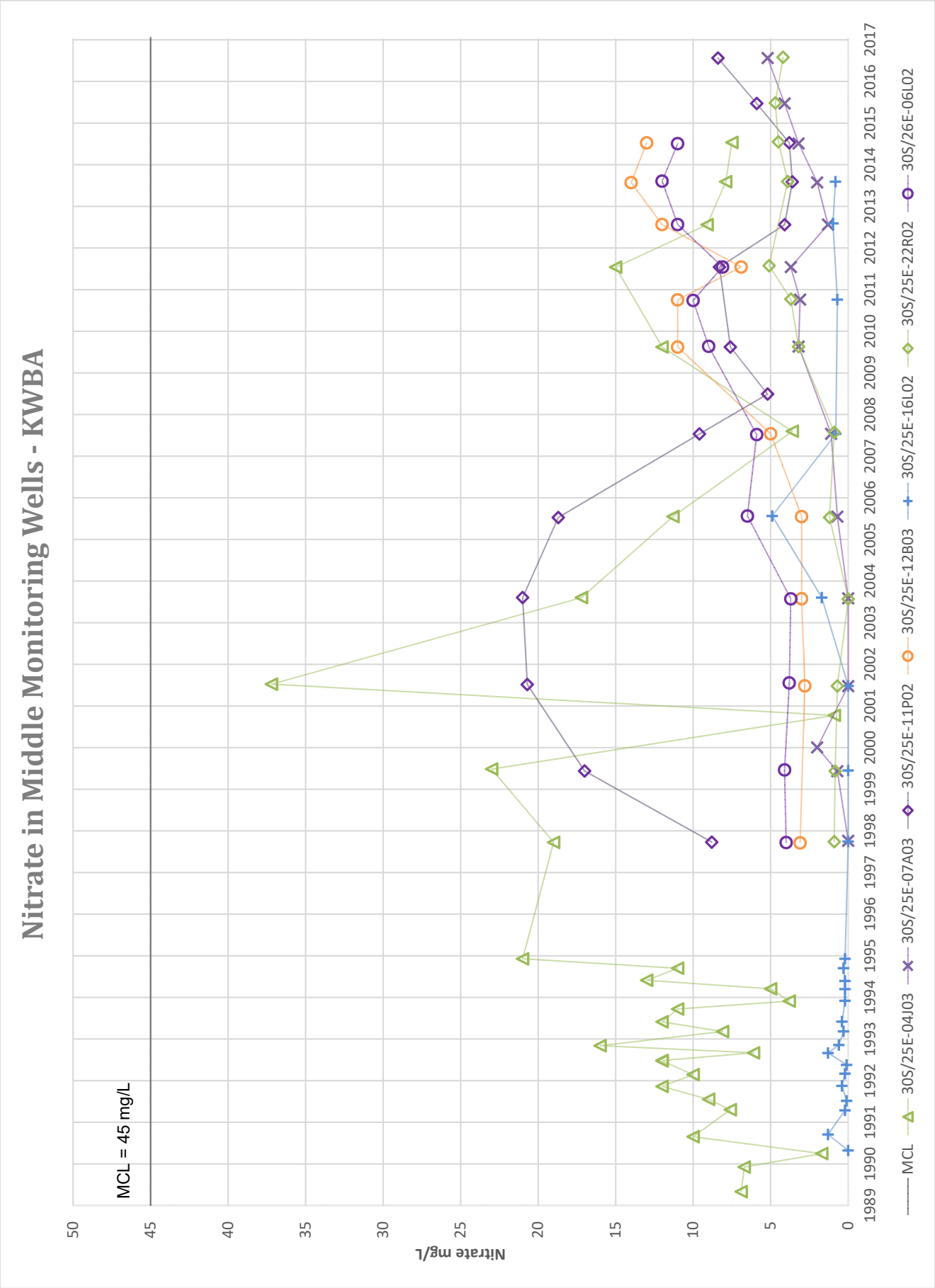

Arsenic (from 0-80 ug/L) in Deep Monitoring Wells - KWBA
Arsenic (both dissolved and total) in ug/L
80
70
60
50
40
30
20
10
0
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
MCL=10 ug/L
MCL
30S/24E-13D03
30S/25E-04J04
30S/25E-07A04
30S/25E-11P03
30S/25E-12B04
30S/25E-16L03
30S/25E-19N04
30S/25E-19R01
30S/25E-21G02
30S/25E-36R01
30S/26E-06L03
30S/26E-28J03

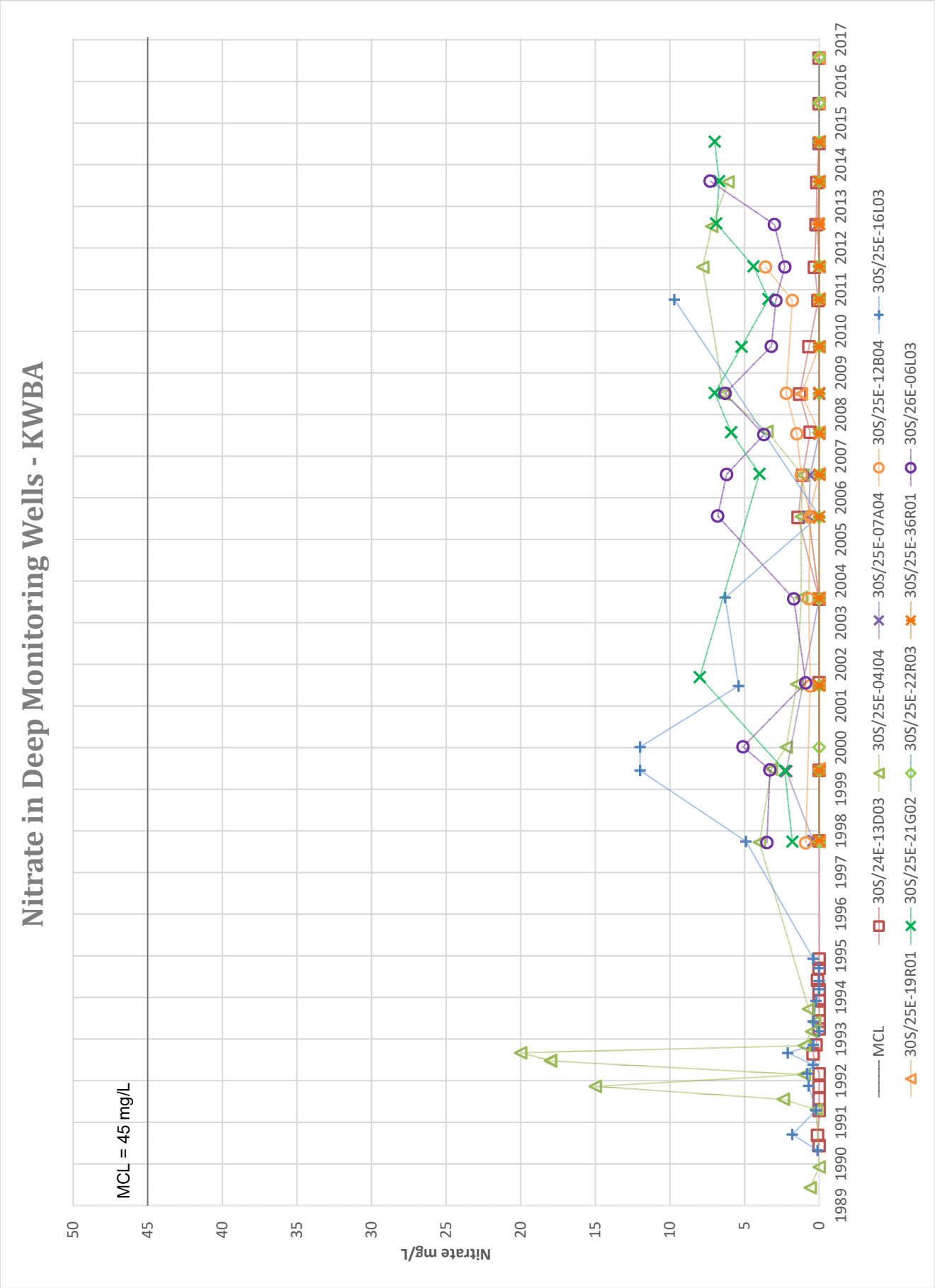

Arsenic (from 80-200 ug/L) in Deep Monitoring Wells - KWBA
Arsenic (both dissolved and total) in ug/L
200
180
160
140
120
100
80
60
40
20
0
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
MCL=10 ug/L
MCL
30S/25E-22R03
30S/26E-32N03

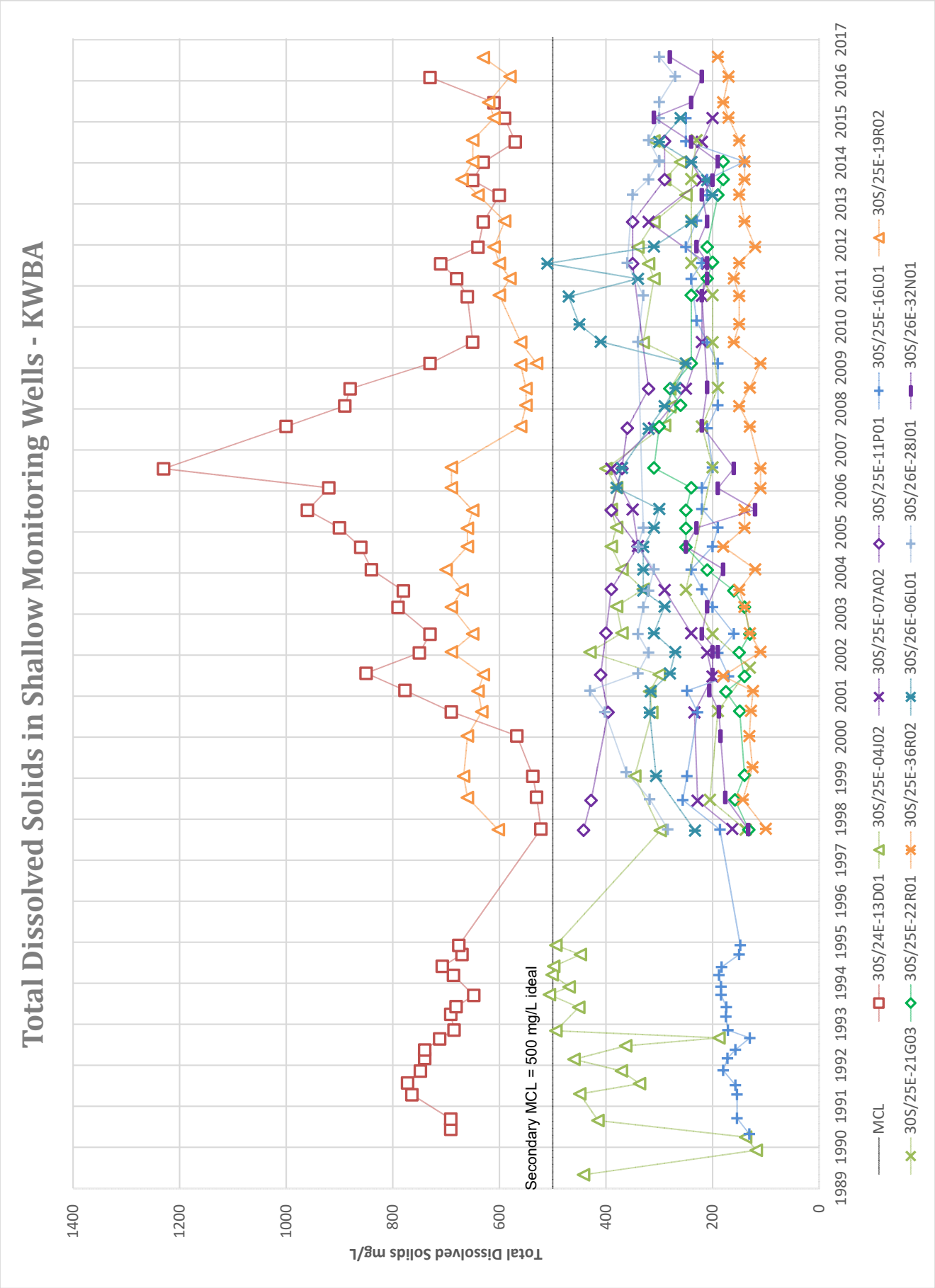

Gross Alpha in Shallow Monitoring Wells - KWBA
Alpha in pCi/L
180
160
140
120
100
80
60
40
20
0
MCL = 15 pCi/L
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
MCL
30S/24E-13D01
30S/25E-19R02
30S/26E-28J01
30S/26E-32N01

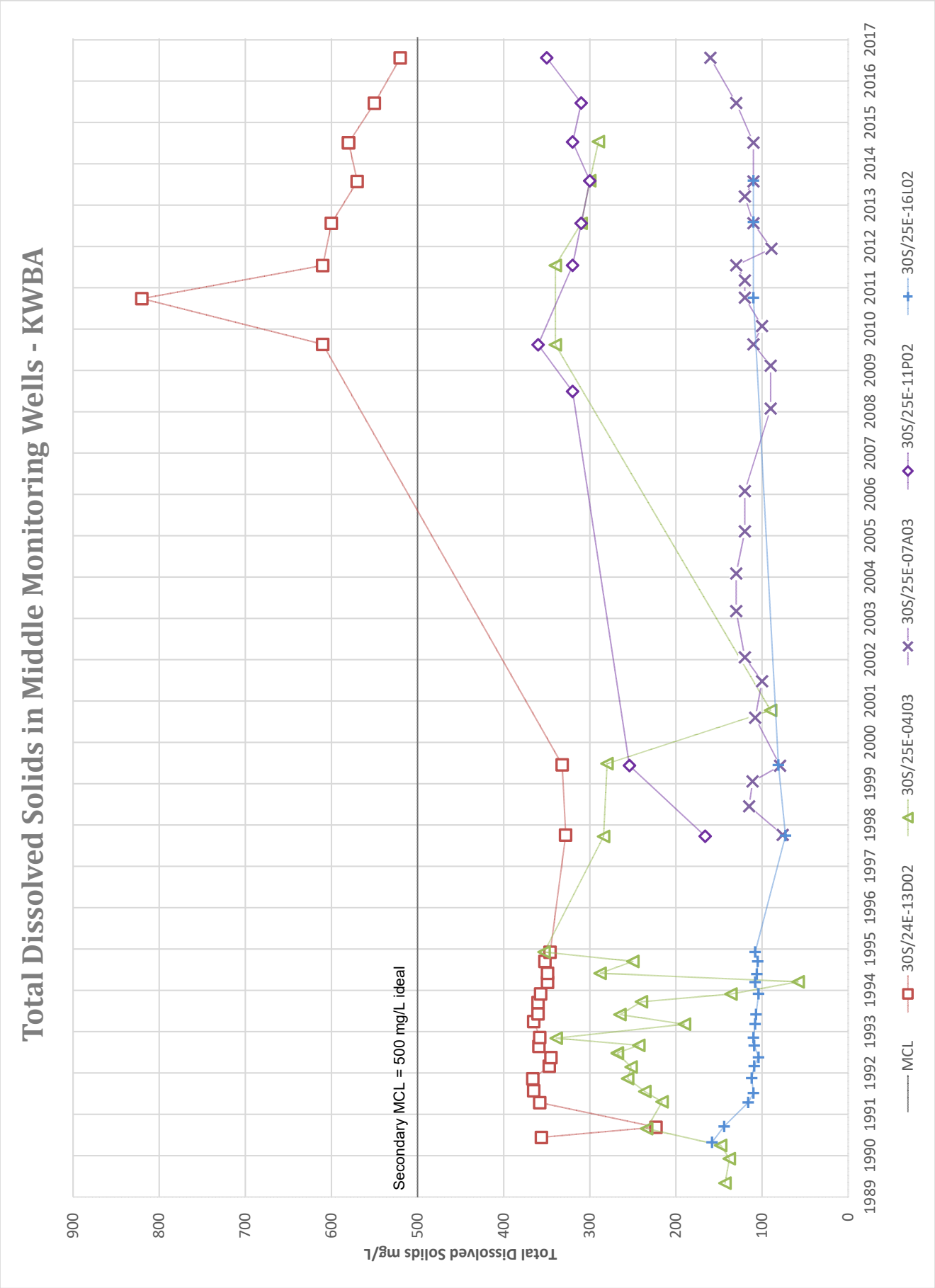

Gross Alpha in Deep Monitoring Wells - KWBA
MCL = 15 pCi/L
Alpha in pCi/L
0
2
4
6
8
10
12
14
16
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
MCL
30S/24E-13D03
30S/25E-19R01
30S/26E-28J03
30S/26E-32N03

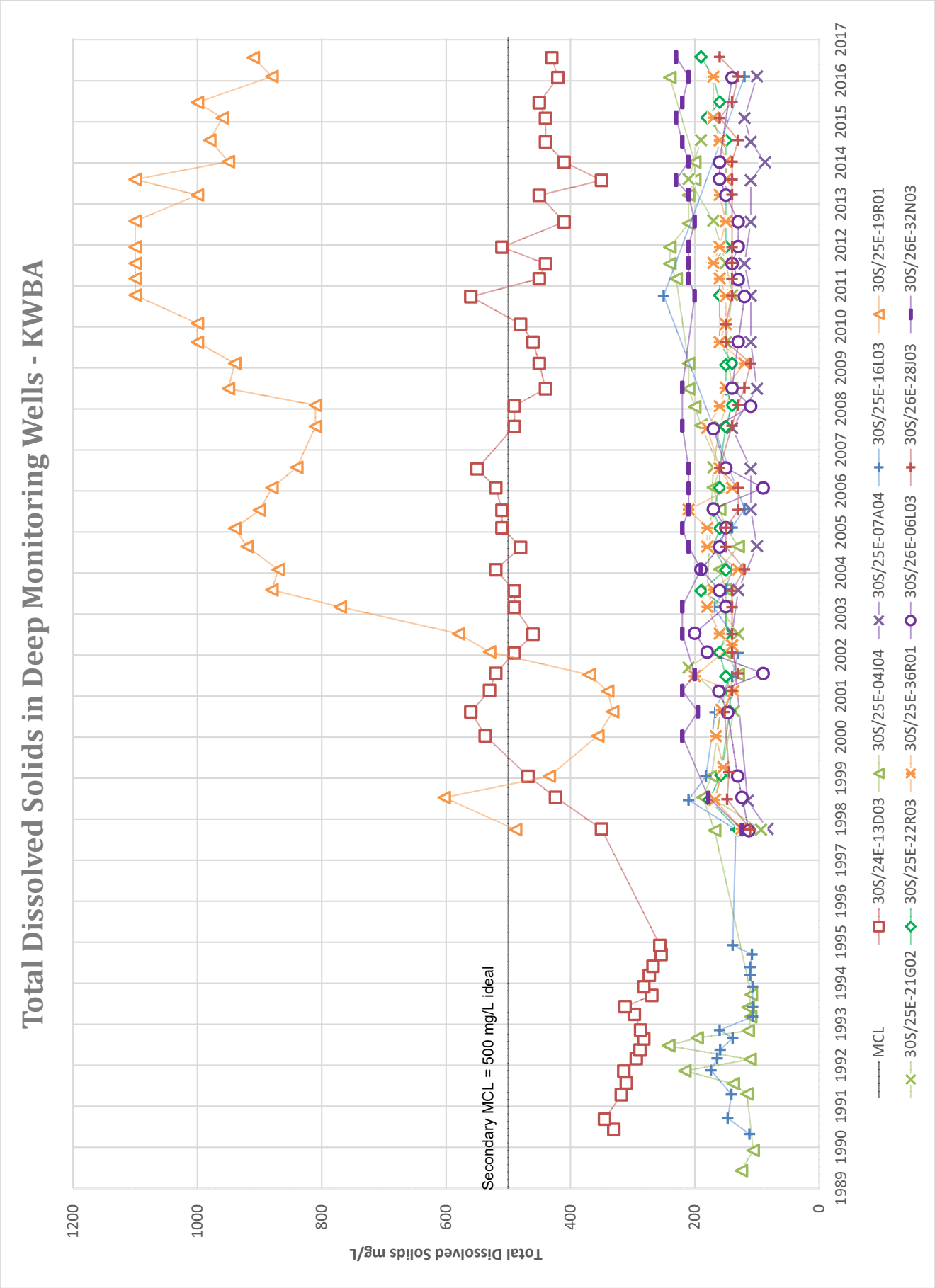

Nitrate in Shallow Monitoring Wells - KWBA
MCL = 45 mg/L
Nitrate mg/L
50
45
40
35
30
25
20
15
10
5
0
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
MCL
30S/24E-13D01
30S/25E-04J02
30S/25E-07A02
30S/25E-11P01
30S/25E-12B02
30S/25E-16L01
30S/25E-19R02
30S/25E-21G03
30S/25E-22R01
30S/25E-36R02
30S/26E-06L01


Nitrate in Middle Monitoring Wells - KWBA
MCL = 45 mg/L
Nitrate mg/L
50
45
40
35
30
25
20
15
10
5
0
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
MCL
30S/25E-04J03
30S/25E-07A03
30S/25E-11P02
30S/25E-12B03
30S/25E-16L02
30S/25E-22R02
30S/26E-06L02


Nitrate in Deep Monitoring Wells - KWBA
MCL = 45 mg/L
Nitrate mg/L
50
45
40
35
30
25
20
15
10
5
0
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
MCL
30S/24E-13D03
30S/25E-04J04
30S/25E-07A04
30S/25E-12B04
30S/25E-16L03
30S/25E-19R01
30S/25E-21G02
30S/25E-22R03
30S/25E-36R01
30S/26E-06L03


Total Dissolved Solids in Shallow Monitoring Wells - KWBA
Total Dissolved Solids mg/L
1400
1200
1000
800
600
400
200
0
Secondary MCL = 500 mg/L ideal
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
MCL
30S/24E-13D01
30S/25E-04J02
30S/25E-07A02
30S/25E-11P01
30S/25E-16L01
30S/25E-19R02
30S/25E-21G03
30S/25E-22R01
30S/25E-36R02
30S/26E-06L01
30S/26E-28J01
30S/26E-32N01


Total Dissolved Solids in Middle Monitoring Wells - KWBA
Total Dissolved Solids mg/L
900
800
700
600
500
400
300
200
100
0
Secondary MCL = 500 mg/L ideal
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
MCL
30S/24E-13D02
30S/25E-04J03
30S/25E-07A03
30S/25E-11P02
30S/25E-16L02


Total Dissolved Solids in Deep Monitoring Wells - KWBA
Total Dissolved Solids mg/L
1200
1000
800
600
400
200
0
Secondary MCL = 500 mg/L ideal
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
MCL
30S/24E-13D03
30S/25E-04J04
30S/25E-07A04
30S/25E-16L03
30S/25E-19R01
30S/25E-21G02
30S/25E-22R03
30S/25E-36R01
30S/26E-06L03
30S/26E-28J03
30S/26E-32N03

Monitoring Wells trends
T29S/24E, T29S/25E, T29S/26E, T30S/24E, T30S/25E and T30S/26E
through 2016

		Total Dissolved Solids		Nitrate		Arsenic		Total Alpha	
Well	Perf. Int. (ft)	Mann-Kendall p-value	Sens slope	Mann-Kendall p-value	Sens slope	Mann-Kendall p-value	Sens slope	Mann-Kendall p-value	Sens slope
29S/24E-08L02	525-625	-		-		-			
29S/24E-08L03	360-440	-		-		-			
29S/24E-34N01	560-660	0.001	Up 17.75	-		-			
29S/24E-34N02	370-470	-		0.036	Down -0.011	-			
29S/25E-25M01	600-700	<0.0001	Up 2.029	0.000	Up 0.329	-		-	
29S/25E-25M02	260-350	-		0.008	Down -0.223	-		-	
29S/25E-27N01	610-700	0.001	Up 5.029	0.003	Up 0.35	<0.0001 *	Down -0.5	-	
29S/25E-27N02	210-310	-		-		-		0.049	Down -0.473
29S/26E-31H01	560-630	0.000	Up 1.429	-		-		-	
29S/26E-31H02	360-430	<0.0001	Up 3.818	0.001	Up 0.679	<0.0001 *	Down -0.182	-	
29S/26E-35H03	590-680	<0.0001	Up 1.892	0.001	Up 0.175	0.000	Down -0.642	0.003	Down -0.035
29S/26E-35H04	310-410	-		-		-		0.001	Down -0.076
30S/24E-06B02	550-650	0.002	Up 11.786	0.026	Down -0.025	-			
30S/24E-13D01	150-250	-		-		-		-	
30S/24E-13D02	320-360	-		-		-			
30S/24E-13D03	520-650	-		-		0.000 *	Down -0.02	<0.0001 *	Up 0.169
30S/24E-14M02	355-455	<0.0001	Up 110.9	-		0.032	Up 1.6		
30S/24E-14M03	600-700	-							
30S/24E-24C01		0.015	Down -30.8			-			
30S/24E-24C02		0.024	Down -230			-			
30S/24E-24C03		0.035	Up 151.5			-			
30S/25E-04J02	190-250	-		0.038	Down -0.945	-			
30S/25E-04J03	345-455	<0.0001	Up 3.762	-		0.018	Up 0.111		
30S/25E-04J04	565-625	0.001	Up 2.17	-		-			
30S/25E-07A02	220-290	-		-		0.038	0		
30S/25E-07A03	420-470	-		<0.0001	Up 0.3	0.007	Up 0.641		
30S/25E-07A04	530-620	-		0.014	Down -0.041	<0.0001	Up 0.8		
30S/25E-11P01	150-210	0.000	Down -6.846	<0.0001	Down -1.881	-			
30S/25E-11P02	330-470	-		0.019	Down -1				
30S/25E-11P03	520-570	0.014	Up 5.0			-			
30S/25E-12B02	150-250	0.007	Down -320	-		-			
30S/25E-12B03	360-500	0.002	Up 38.75	0.001	Up 1.133				
30S/25E-12B04	590-690	-		0.009	Up 0.258	-			
30S/25E-16L01	285-345	<0.0001	Up 1.576	0.008	Up 0.167	-			
30S/25E-16L02	515-555	-		-		-			
30S/25E-16L03	645-690					<0.0001	Up 0.4		
30S/25E-19N02				-		0.015	Down -2.267		
30S/25E-19N03	190-230	-		-					
30S/25E-19N04		-		-		<0.0001	Up 2.429		
30S/25E-19R01	485-555	0.000	Up 14.286	-		-		-	
30S/25E-19R02	336-376	-		-		-		-	
30S/25E-21G02	590-660	-		-		-			
30S/25E-21G03	420-480	0.046	Up 3.333	-		-			
30S/25E-22R01	80-125	-		-		0.027	Up 0.05		
30S/25E-22R02		<0.0001	Up 5.1	0.002	Up 0.385	0.042	Down -9.0		
30S/25E-22R03	380-460	-		0.028	Down -0.008	-			
30S/25E-24C04	445-525	-		-					
30S/25E-36R01	600-640	-		0.039	Down -0.014	-			
30S/25E-36R02		0.001	Up 0.88	-		<0.0001	Up 0.86		
30S/26E-04J02	223-375	-		-					
30S/26E-04J03	560-650	-		0.037	Up 0.3				
30S/26E-06L01	210-270	-		0.001	Down -0.913	0.013	0		
30S/26E-06L02	360-536	0.003	Up 7.583	0.001	Up 0.817				
30S/26E-06L03	585-620	-		-		-			
30S/26E-08P04	600-680	0.001	Up 2.75	0.008	Up 0.12				
30S/26E-16B01	140-250	-		-					
30S/26E-16B02	330-390	-		0.002	Up 0.081				
30S/26E-16B03	530-660	-		0.004	Up 0.046				
30S/26E-16B04	35-50	-							
30S/26E-18H04	440-540	-		-					
30S/26E-19B01	120-220	0.032	Down -7.5	-					
30S/26E-19B02		-		0.013	Up 0.207				
30S/26E-19B03	500-590	0.000	Up 7.327	0.000	Up 0.453	-			
30S/26E-25A02	590-690	-		0.005	Up 0.216			-	
30S/26E-25A03	290-390	-		<0.0001	Up 1.75			-	
30S/26E-28J01	120-220	0.005	Down -2.5	-		-		-	
30S/26E-28J02	280-330	0.006	Up 9.413	0.027	Up 1.803				
30S/26E-28J03	540-615	-		0.006	Down -0.013	-		0.027	Up 0.065
30S/26E-32N01	210-330	0.000	Up 1.517	-		-		0.014	Down -0.069
30S/26E-32N02	390-440	0.002	Up 7.389	-					
30S/26E-32N03	570-610	0.033	Up 0.095	-		0.015	Down -0.619	-	

- = no statistical trend
= not enough data
* = Trend may be due to improved and lower detection limits and not actual statistical trend

2016 Statistical Mann-Kendall and Sens Slope analysis completed using XLStat Software. Sens Slope only analyzed if Mann-Kendall shows a trend
Parameters - significance level = 5%. Hamed and Rao Autocorrelation applied at 0.05% significance level. Confidence interval of Sens Slope is 95%. Non-detects recorded as half of detection limit

Pump-in Operations Blending Calculations

September 24, 2016

Values in blue are for user entry.
Values in black are calculated results or labels.

	Demand	Constituent Concentrations									
		As	Br	Cr	Cr+6	NO3	TDS	DOC	SO4	U	Cl
Units	cfs	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l	pCi/l	mg/l
MCL		10	None	50	10	45	500	None	250	20	250
Aqueduct (8/25/16)**	2207	2.0	300	1.0	1.0	2.2	191	4.8	53	NA	105
Aqueduct (7/19/16)***	2207	3.0	160	1.0	1.0	2.0	206	3.1	30	NA	55
Kern River (into RC)	0	-	-	-	-	-	-	-	-	-	-
Kern River (into CVC)	0	-	-	-	-	-	-	-	-	-	-
Friant (into CVC)*	225	1.7	100	0.7	1.0	0.4	83	2.5	12	0.5	9.2

* These Kern River & Friant flows modeled into CVC Pool 5. Enter Kern River and Friant data on "Well Data by Pool" sheet.

Use DWR Aqueduct Sample (Y/N)? y **If N, background will assume WWD model info.**

** WWD Model at Check 21.

*** Sample collected by DWR at Check 21

Well Manifold Blends

Manifold		Flow	As	Br	Cr	Cr+6	NO3	TDS	DOC	SO4	U	Cl
		cfs	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l	pCi/l	mg/l
Semitropic*		0	-	-	-	-	-	-	-	-	-	-
CVC Pool 1		0	-	-	-	-	-	-	-	-	-	-
CVC Pool 2		4	21.6	196	1.8	1.4	6.7	201	1.3	40	6.9	41.6
CVC Pool 3		4	0.9	130	2.1	1.6	17.0	230	1.4	29	8.6	30.0
CVC Pool 4		47	3.8	123	1.4	1.1	8.9	224	0.9	26	8.8	30.3
CVC Pool 5 & 6		269	1.8	98	0.8	1.0	1.2	94	2.2	13	0.9	11.3
CVC Subtotals	East	70	1.8	98	0.8	1.0	1.2	94	2.2	13	0.9	11.3
	West	253	2.5	104	1.0	1.0	3.0	122	1.9	16	2.5	15.6
River Canal		0	-	-	-	-	-	-	-	-	-	-
KWB Canal		0	-	-	-	-	-	-	-	-	-	-
West Kern		0	-	-	-	-	-	-	-	-	-	-
WRM6		16	2.3	181	8.3	0.2	1.9	792	0.8	424	3.7	33.5
WRM7		5	7.4	217	9.4	0.2	4.1	639	0.2	300	1.3	30.2
WRM8		0	-	-	-	-	-	-	-	-	-	-
WRM9		7	4.6	166	10.0	0.3	8.1	721	0.4	367	3.9	24.1
WRM9A-10		2	3.0	203	9.5	0.3	19.8	697	0.3	261	7.6	51.3
WRM13A		0	-	-	-	-	-	-	-	-	-	-
WRM15		0	-	-	-	-	-	-	-	-	-	-
WRMWSD Subtotal		29	3.7	185	8.9	0.2	4.8	745	0.6	381	3.6	31.9
Arvin-Edison		0	-	-	-	-	-	-	-	-	-	-
Well Blend in Aqueduct		282	2.6	113	1.8	0.9	3.2	185	1.8	53	2.6	17.2

Note: Enter Semitropic and Arvin data on "Daily Input & Inflow Summaries" sheet. Enter Aquatic Lakes on "Well Data by Pool" sheet.

* Semitropic exchange delivery = 0

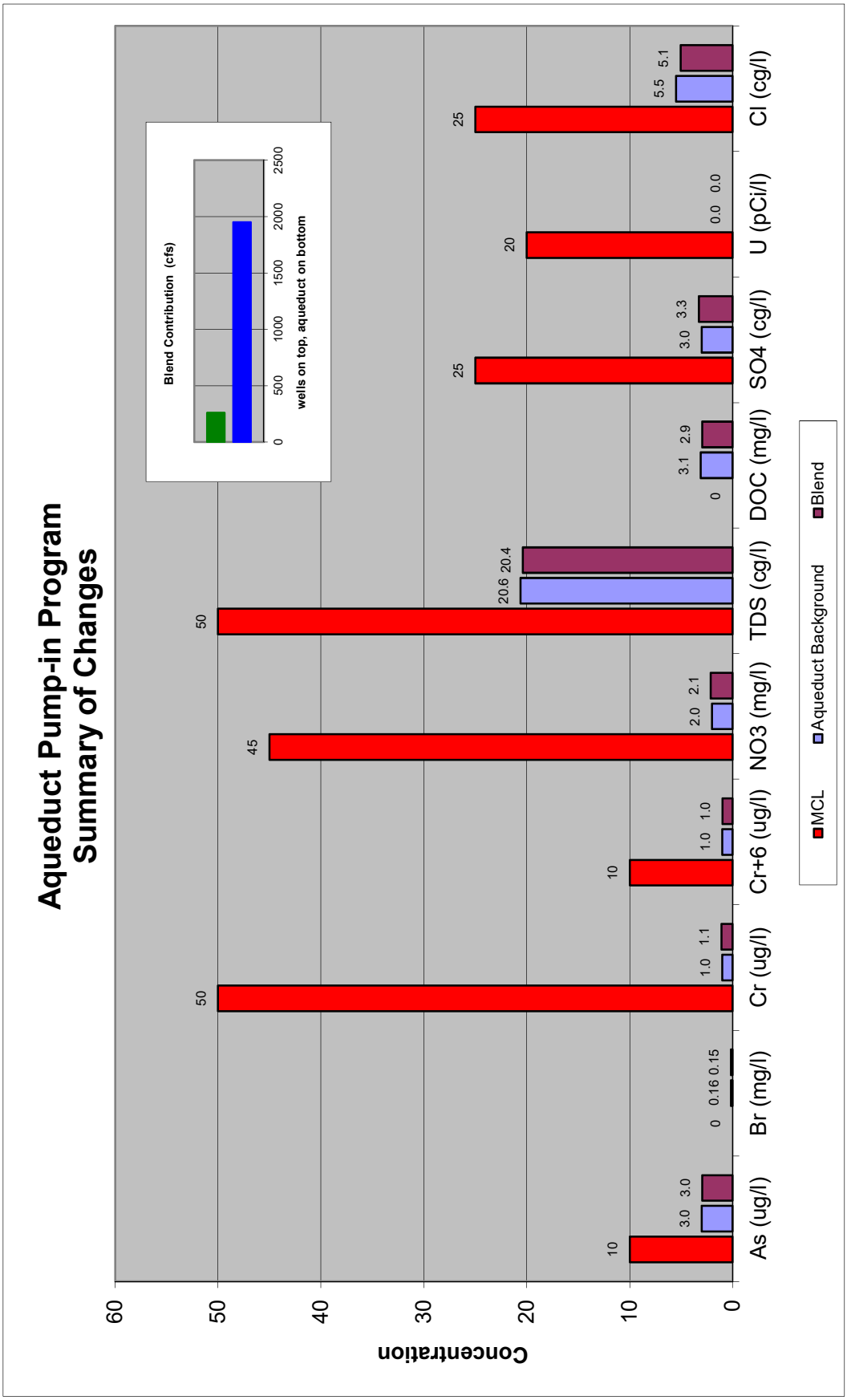
0

Canal Blends

	Total Flow	Constituent Concentrations									
		As	Br	Cr	Cr+6	NO3	TDS	DOC	SO4	U	Cl
Units	cfs	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l	pCi/l	mg/l
MCL		10	None	50	10	45	500	None	250	20	250
Alejandro in District	0	No Flow	No Flow	No Flow	No Flow	No Flow	No Flow	No Flow	No Flow	No Flow	No Flow
CVC Eastward Flow	70	1.8	98	0.8	1.0	1.2	94	2.2	13	NA	11.3
Change	70	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% of the MCL	NA	18%	NA	2%	0.10	3%	19%	NA	5%	NA	5%
Aqueduct Blends											
Background	2321	3.0	160	1.0	1.0	2.0	206	3.1	30	NA	55.0
After Semitropic	2321	3.0	160	1.0	1.0	2.0	206	3.1	30	NA	55.0
After CVC	2393	2.9	154	1.0	1.0	2.1	197	3.0	29	NA	50.8
After KWB	2393	2.9	154	1.0	1.0	2.1	197	3.0	29	NA	50.8
After West Kern	2393	2.9	154	1.0	1.0	2.1	197	3.0	29	NA	50.8
After WRMWSD 6	2294	2.9	154	1.0	1.0	2.1	201	3.0	31	NA	50.7
After WRMWSD 7	2277	2.9	154	1.1	1.0	2.1	202	3.0	32	NA	50.7
After WRMWSD 8	2253	2.9	154	1.1	1.0	2.1	202	3.0	32	NA	50.7
After WRMWSD 9	2255	3.0	154	1.1	1.0	2.1	204	2.9	33	NA	50.6
After Arvin-Edison	2255	3.0	154	1.1	1.0	2.1	204	2.9	33	NA	50.6
After WRMWSD 9A-10	2244	3.0	154	1.1	1.0	2.1	204	2.9	33	NA	50.6
After WRMWSD 13A	2234	3.0	154	1.1	1.0	2.1	204	2.9	33	NA	50.6
After WRMWSD 15	2207	3.0	154	1.1	1.0	2.1	204	2.9	33	NA	50.6
Total Change	-114	0.0	-6	0.1	0.0	0.1	-2	-0.2	3	NA	-4.4
% of the MCL	NA	-0.5%	NA	0.2%	0%	0.3%	-0.4%	NA	1.2%	NA	0.0
Recent DWR Sample (03/15/16)	Check 23	2.0	180	1.0	NA	4.4	276	6.8	49	NA	67
Recent DWR Sample (03/15/16)	Check 27	3.0	200	1.0	NA	5.0	283	6.2	53	NA	72
Recent DWR Sample (03/15/16)	Check 29	4.0	200	1.0	NA	5.0	281	5.7	53	NA	70
Recent DWR Sample (03/15/16)	Check 39	5.0	220	1.0	NA	5.3	300	5.2	61	NA	73

1

6/6/2017



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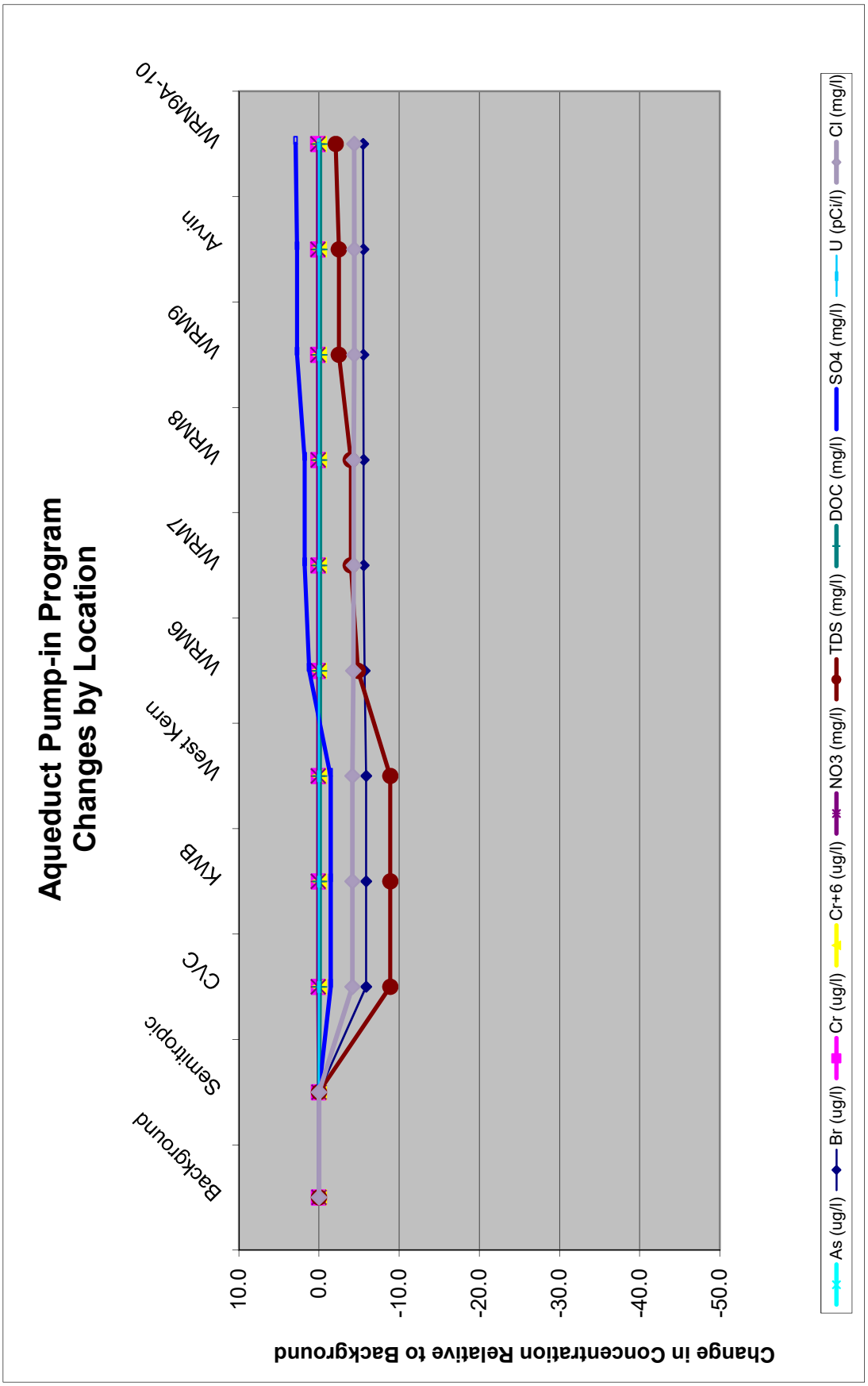

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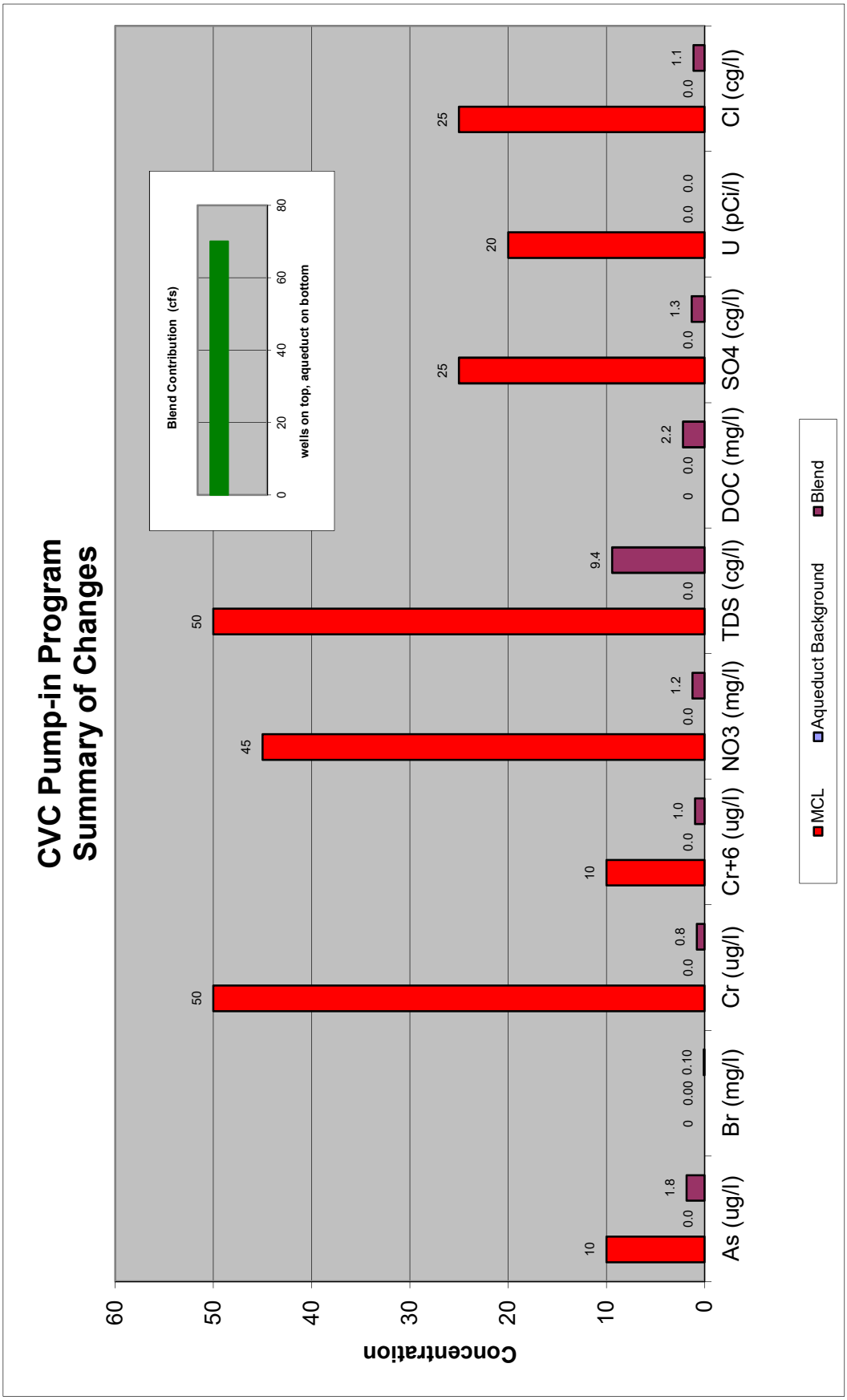

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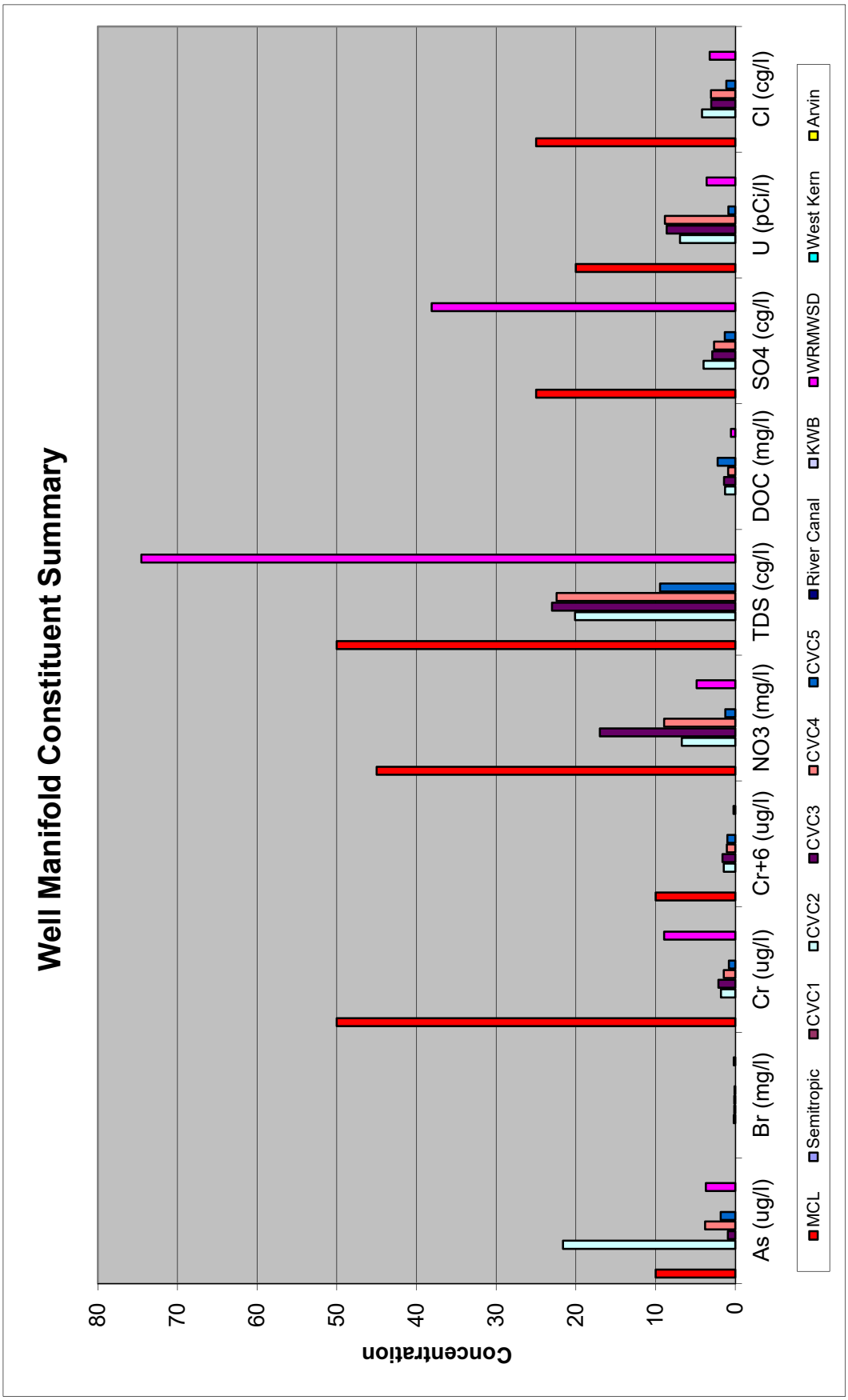

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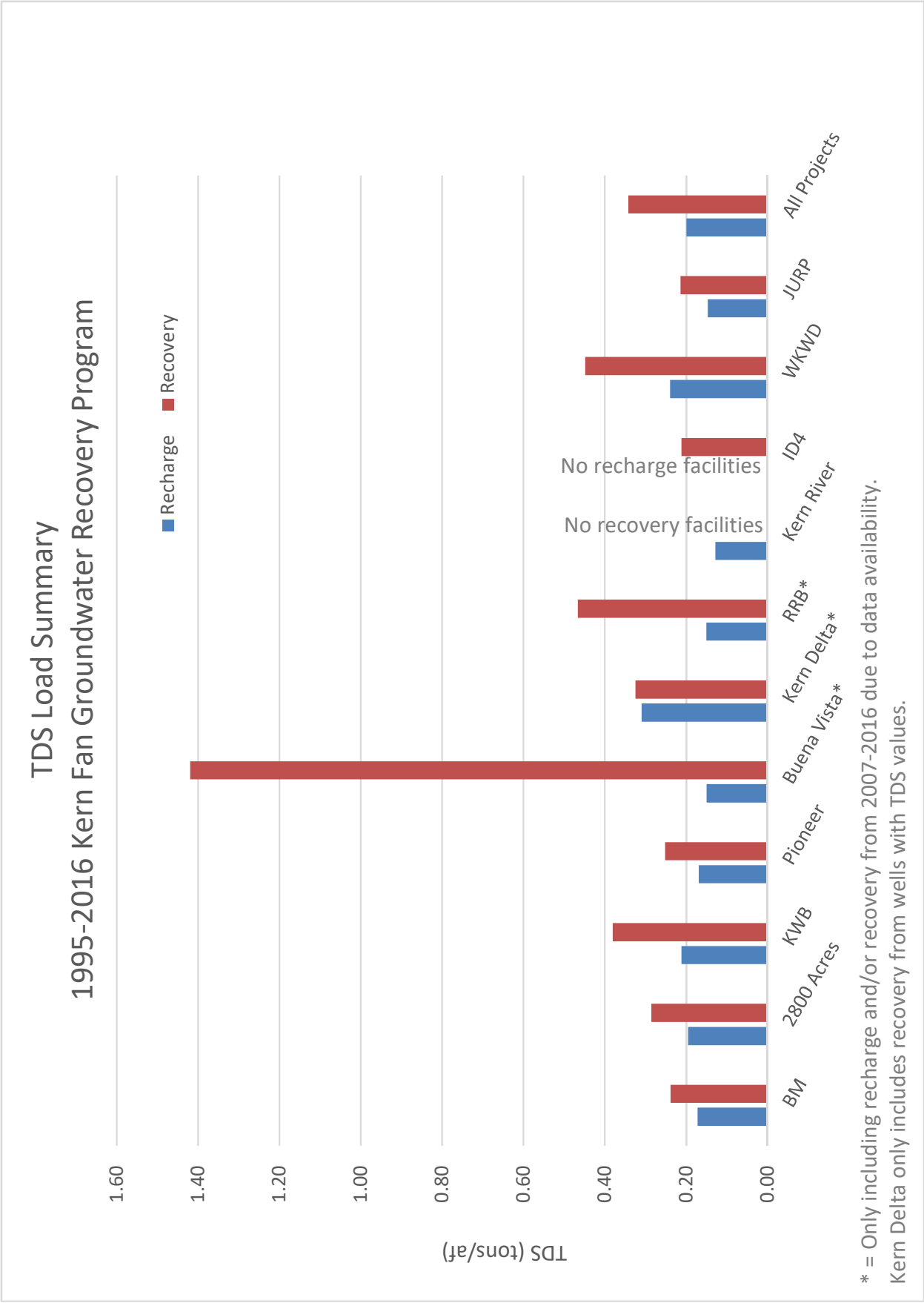
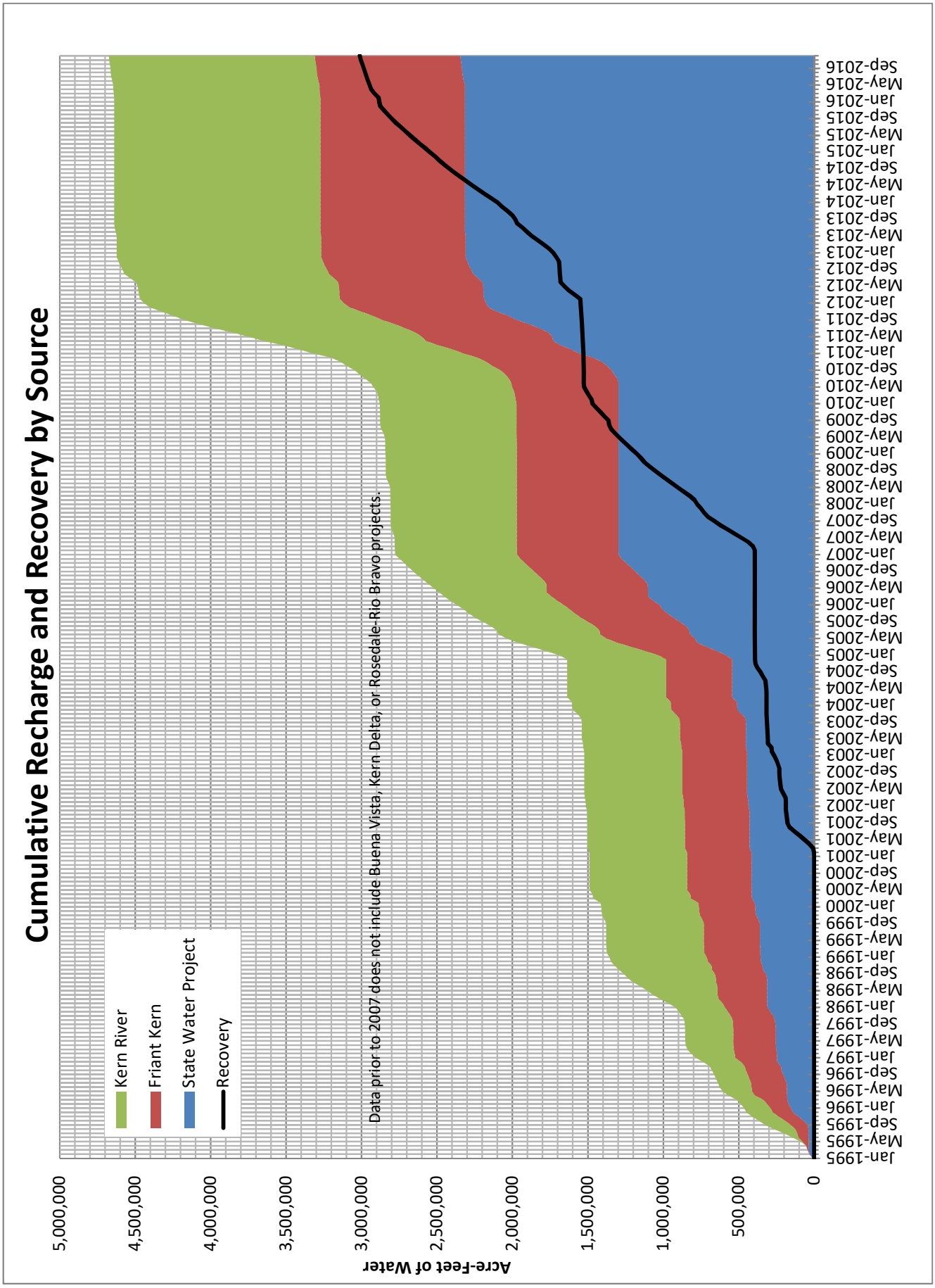

TDS Load Summary
1995-2016 Kern Fan Groundwater Recovery Program
Recharge
Recovery
TDS (tons/af)
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
BM
2800 Acres
KWB
Pioneer
Buena Vista*
Kern Delta*
RRB*
Kern River
ID4
WKWD
JURP
All Projects
No recharge facilities
No recovery facilities
* = Only including recharge and/or recovery from 2007-2016 due to data availability.
Kern Delta only includes recovery from wells with TDS values.


Cumulative Recharge and Recovery by Source
Kern River
Friant Kern
State Water Project
Recovery
Data prior to 2007 does not include Buena Vista, Kern Delta, or Rosedale-Rio Bravo projects.
Acre-Feet of Water
5,000,000
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Jan-1995
May-1995
Sep-1995
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May-2014
Sep-2014
Jan-2015
May-2015
Sep-2015
Jan-2016
May-2016
Sep-2016

KERN FAN MONITORING COMMITTEE

TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN WITH RECHARGE WATER SUPPLIES - SUMMARY

PROJECT	GROSS RECHARGE (AF)	NET RECHARGE (AF)	SALT LOAD (TONS)	AVERAGE TDS (MG/L) GROSS (MG/L)	NET (MG/L)	NET (TONS/AF)
BERRENDA MESA						
1995	34,486	32,417	5,840	125	133	0.18
1996	9,966	9,368	1,033	76	81	0.11
1997	6,555	6,162	500	56	60	0.08
1998	20,349	19,128	1,918	69	74	0.10
1999	633	595	22	26	28	0.04
2000	1,027	965	36	26	28	0.04
2001	-	-	-	-	-	-
2002	-	-	-	-	-	-
2003	719	676	288	295	314	0.43
2004	2,872	2,700	1,053	270	287	0.39
2005	34,896	32,802	5,302	112	119	0.16
2006	26,229	24,655	4,554	128	136	0.18
2007	2,098	1,972	895	314	334	0.45
2008	-	-	-	-	-	-
2009	-	-	-	-	-	-
2010	1,047	984	414	291	310	0.42
2011	37,250	35,015	5,561	110	117	0.16
2012	6,294	5,916	2,365	276	294	0.40
2013	-	-	-	-	-	-
2014	-	-	-	-	-	-
2015	-	-	-	-	-	-
2016	-	-	-	-	-	-
TOTAL	**184,421**	**173,356**	**29,782**	**119**	**126**	**0.17**
2800 ACRE FACILITY						
1995	109,215	102,662	19,896	134	143	0.19
1996	39,483	37,114	5,627	105	112	0.15
1997	5,740	5,396	1,332	171	182	0.25
1998	56,397	53,013	7,424	97	103	0.14
1999	10,263	9,647	1,751	126	134	0.18
2000	30,918	29,063	2,131	51	54	0.07
2001	2,539	2,387	966	280	298	0.40
2002	1,480	1,391	581	289	307	0.42
2003	1,788	1,681	407	167	178	0.24
2004	6,956	6,539	2,479	262	279	0.38
2005	123,410	116,005	28,573	170	181	0.25
2006	50,781	47,734	10,701	155	165	0.22
2007	4,495	4,225	460	75	80	0.11
2008	-	-	-	-	-	-
2009	-	-	-	-	-	-
2010	1,107	1,041	438	291	310	0.42
2011	46,058	43,295	7,719	123	131	0.18
2012	1,739	1,635	52	22	23	0.03
2013	-	-	-	-	-	-
2014	-	-	-	-	-	-
2015	-	-	-	-	-	-
2016	-	-	-	-	-	-
TOTAL	**492,369**	**462,827**	**90,536**	**135**	**144**	**0.20**
KERN WATER BANK						
1995	222,260	208,924	28,092	93	99	0.13
1996	173,875	163,443	33,216	141	150	0.20
1997	112,262	105,526	20,582	135	144	0.20
1998	302,715	284,552	37,604	91	97	0.13
1999	36,753	34,548	9,270	186	197	0.27
2000	27,579	25,924	5,769	154	164	0.22
2001	10,030	9,428	3,817	280	298	0.40
2002	13,439	12,633	5,120	280	298	0.41
2003	40,374	37,952	17,895	326	347	0.47
2004	18,065	16,981	6,436	262	279	0.38
2005	387,557	364,304	114,436	217	231	0.31
2006	283,233	266,239	51,311	133	142	0.19
2007	16,728	15,724	7,675	338	359	0.49
2008	-	-	-	-	-	-
2009	-	-	-	-	-	-
2010	33,131	31,143	12,338	274	292	0.40
2011	476,501	447,911	77,374	119	127	0.17
2012	9,010	8,469	920	75	80	0.11
2013	-	-	-	-	-	-
2014	-	-	-	-	-	-
2015	-	-	-	-	-	-
2016	-	-	-	-	-	-
TOTAL	**2,163,512**	**2,033,701**	**431,855**	**147**	**156**	**0.21**
PIONEER PROPERTY						
1995	79,513	74,742	6,975	65	69	0.09
1996	45,676	42,935	5,471	88	94	0.13
1997	30,085	28,280	4,002	98	104	0.14
1998	69,115	64,968	8,566	91	97	0.13
1999	13,732	12,908	2,750	147	157	0.21
2000	15,296	14,378	2,355	113	121	0.16
2001	1,253	1,178	477	280	298	0.40
2002	1,434	1,348	561	288	306	0.42
2003	8,372	7,870	3,771	331	353	0.48
2004	6,811	6,402	2,527	273	290	0.39
2005	111,199	104,527	20,265	134	143	0.19
2006	61,228	57,554	10,660	128	136	0.19
2007	4,813	4,524	1,248	191	203	0.28
2008	-	-	-	-	-	-
2009	-	-	-	-	-	-
2010	10,056	9,453	3,977	291	310	0.42
2011	146,766	137,960	22,944	115	122	0
2012	2,791	2,624	133	35	37	0
2013	-	-	-	-	-	-
2014	-	-	-	-	-	-
2015	-	-	-	-	-	-
2016	-	-	-	-	-	-
TOTAL	**608,140**	**571,652**	**96,682**	**117**	**124**	**0.17**

PROJECT	GROSS RECHARGE (AF)	NET RECHARGE (AF)	SALT LOAD (TONS)	AVERAGE TDS (MG/L) GROSS (MG/L)	NET (MG/L)	NET (TONS/AF)
BUENA VISTA WATER DISTRICT						
1995	-	-	-	-	-	-
1996	-	-	-	-	-	-
1997	-	-	-	-	-	-
1998	-	-	-	-	-	-
1999	-	-	-	-	-	-
2000	-	-	-	-	-	-
2001	-	-	-	-	-	-
2002	-	-	-	-	-	-
2003	-	-	-	-	-	-
2004	-	-	-	-	-	-
2005	-	-	-	-	-	-
2006	-	-	-	-	-	-
2007	29,527	27,755	4,570	114	121	0.16
2008	32,866	30,894	3,313	74	79	0.11
2009	35,091	32,986	3,421	72	76	0.10
2010	50,542	47,509	5,013	73	78	0.11
2011	52,427	49,281	5,760	81	86	0.12
2012	35,101	32,995	6,183	130	138	0.19
2013	16,132	15,164	3,389	155	164	0.22
2014	-	-	-	-	-	-
2015	-	-	-	-	-	-
2016	18,859	17,727	6,001	234	249	0.34
TOTAL	**270,545**	**254,312**	**37,649**	**102**	**109**	**0.15**
KERN DELTA WATER DISTRICT						
1995	-	-	-	-	-	-
1996	-	-	-	-	-	-
1997	-	-	-	-	-	-
1998	-	-	-	-	-	-
1999	-	-	-	-	-	-
2000	-	-	-	-	-	-
2001	-	-	-	-	-	-
2002	-	-	-	-	-	-
2003	-	-	-	-	-	-
2004	-	-	-	-	-	-
2005	-	-	-	-	-	-
2006	-	-	-	-	-	-
2007	-	-	-	-	-	-
2008	-	-	-	-	-	-
2009	-	-	-	-	-	-
2010	73,303	68,905	24,058	241	257	0.35
2011	62,113	58,386	11,756	139	148	0.20
2012	109,600	103,024	35,565	239	254	0.35
2013	-	-	-	-	-	-
2014	-	-	-	-	-	-
2015	-	-	-	-	-	-
2016	-	-	-	-	-	-
TOTAL	**245,016**	**230,315**	**71,379**	**214**	**228**	**0.31**
ROSEDALE-RIO BRAVO[1]						
1995	-	-	-	-	-	-
1996	-	-	-	-	-	-
1997	-	-	-	-	-	-
1998	-	-	-	-	-	-
1999	-	-	-	-	-	-
2000	-	-	-	-	-	-
2001	-	-	-	-	-	-
2002	-	-	-	-	-	-
2003	-	-	-	-	-	-
2004	-	-	-	-	-	-
2005	-	-	-	-	-	-
2006	-	project totals not included until 2007				
2007	3,847	3,616	686	131	140	0.19
2008	-	-	-	-	-	-
2009	515	484	93	133	141	0.19
2010	131,785	123,878	18,799	105	112	0.15
2011	248,310	233,411	35,278	105	111	0.15
2012	33,686	31,665	3,861	84	90	0.12
2013	-	-	-	-	-	-
2014	-	-	-	-	-	-
2015	-	-	-	-	-	-
2016	4,119	3,872	712	127	135	0.18
TOTAL	**422,262**	**396,926**	**59,429**	**104**	**110**	**0.15**
KERN RIVER CHANNEL						
1995	3,258	3,063	193	44	46	0.06
1996	18,325	17,226	1,426	57	61	0.08
1997	6,471	6,083	802	91	97	0.13
1998	872	820	47	40	43	0.06
1999	2,043	1,920	77	28	30	0.04
2000	4,073	3,829	144	26	28	0.04
2001	2,214	2,081	180	60	64	0.09
2002	2,305	2,167	443	141	150	0.20
2003	24,441	22,975	6,723	202	215	0.29
2004	1,863	1,751	239	94	100	0.14
2005	29,997	28,197	1,664	41	43	0.06
2006	825	776	53	47	50	0.07
2007	-	-	-	-	-	-
2008	-	-	-	-	-	-
2009	-	-	-	-	-	-
2010	-	-	-	-	-	-
2011	19,840	18,650	2,112	78	83	0.11
2012	218	205	13	42	45	0.06
2013	-	-	-	-	-	-
2014	-	-	-	-	-	-
2015	-	-	-	-	-	-
2016	-	-	-	-	-	-
TOTAL	**116,745**	**109,740**	**14,116**	**89**	**95**	**0.13**

PROJECT	GROSS RECHARGE (AF)	NET RECHARGE (AF)	SALT LOAD (TONS)	AVERAGE TDS (MG/L) GROSS (MG/L)	NET (MG/L)	NET (TONS/AF)
IMPROVEMENT DISTRICT NO. 4						
1995	-	-	-	-	-	-
1996	-	-	-	-	-	-
1997	-	-	-	-	-	-
1998	-	-	-	-	-	-
1999	-	-	-	-	-	-
2000	-	-	-	-	-	-
2001	-	-	-	-	-	-
2002	-	-	-	-	-	-
2003	-	-	-	-	-	-
2004	-	-	-	-	-	-
2005	-	-	-	-	-	-
2006	-	-	-	-	-	-
2007	-	-	-	-	-	-
2008	-	-	-	-	-	-
2009	-	-	-	-	-	-
2010	-	-	-	-	-	-
2011	-	-	-	-	-	-
2012	-	-	-	-	-	-
2013	-	-	-	-	-	-
2014	-	-	-	-	-	-
2015	-	-	-	-	-	-
2016	-	-	-	-	-	-
TOTAL	**0**	**0**	**0**	**0**	**0**	**0**
WEST KERN WATER DISTRICT						
1995	-	-	-	-	-	-
1996	-	-	-	-	-	-
1997	-	-	-	-	-	-
1998	-	-	-	-	-	-
1999	-	-	-	-	-	-
2000	-	-	-	-	-	-
2001	-	-	-	-	-	-
2002	-	-	-	-	-	-
2003	-	-	-	-	-	-
2004	-	-	-	-	-	-
2005	-	-	-	-	-	-
2006	-	-	-	-	-	-
2007	-	-	-	-	-	-
2008	-	-	-	-	-	-
2009	-	-	-	project complete		-
2010	93	87	14	111	118	0.16
2011	86,970	81,752	14,503	123	131	0.18
2012	15,131	14,223	6,686	325	346	0.47
2013	-	-	-	-	-	-
2014	-	-	-	-	-	-
2015	-	-	-	-	-	-
2016	12,433	11,687	5,145	305	324	0.44
TOTAL	**114,627**	**107,749**	**26,348**	**169**	**180**	**0.24**
JOINT USE RECOVERY PROJECT						
1995	-	-	-	-	-	-
1996	-	-	-	-	-	-
1997	-	-	-	-	-	-
1998	-	-	-	-	-	-
1999	-	-	-	-	-	-
2000	-	-	-	-	-	-
2001	-	-	-	-	-	-
2002	-	-	-	-	-	-
2003	-	-	-	-	-	-
2004	-	-	-	-	-	-
2005	-	-	-	-	-	-
2006	-	-	-	-	-	-
2007	-	-	-	-	-	-
2008	-	-		project complete		
2009	1,839	1,729	332	133	141	0.19
2010	22,321	20,982	2,832	93	99	0.13
2011	24,665	23,185	3,066	91	97	0.13
2012	6,556	6,163	1,333	150	159	0.22
2013	-	-	-	-	-	-
2014	-	-	-	-	-	-
2015	-	-	-	-	-	-
2016	2,226	2,092	420	139	148	0.20
TOTAL	**57,607**	**54,151**	**7,983**	**102**	**108**	**0.15**
COMBINED AREAS						
1995	448,732	421,808	60,995	100	106	0.14
1996	287,325	270,086	46,773	120	127	0.17
1997	161,113	151,446	27,219	124	132	0.18
1998	449,448	422,481	55,559	91	97	0.13
1999	63,424	59,619	13,871	161	171	0.23
2000	78,893	74,159	10,435	97	104	0.14
2001	16,036	15,074	5,440	250	266	0.36
2002	18,658	17,539	6,705	264	281	0.38
2003	75,694	71,152	29,084	283	301	0.41
2004	36,567	34,373	12,734	256	273	0.37
2005	687,059	645,835	170,240	182	194	0.26
2006	422,296	396,958	77,279	135	143	0.19
2007	61,508	57,818	15,534	186	198	0.27
2008	32,866	30,894	3,313	74	79	0.11
2009	37,445	35,198	3,846	76	80	0.11
2010	323,385	303,982	67,883	154	164	0.22
2011	1,200,900	1,128,846	186,074	114	121	0.16
2012	220,126	206,918	57,109	191	203	0.28
2013	16,132	15,164	3,389	155	164	0.22
2014	-	-	-	-	-	-
2015	-	-	-	-	-	-
2016	37,637	35,379	12,279	240	255	0.35
TOTAL	**4,675,244**	**4,394,729**	**865,759**	**136**	**145**	**0.20**

Table 1-5

State Water Project
California Aqueduct Near Highway 119 (Check 29)
Water Quality - Total Dissolved Solids (TDS) (1)

Year	Month	TDS (mg/l)	Year	Month	TDS (mg/l)	Year	Month	TDS (mg/l)	Year	Month	TDS (mg/l)	Year	Month	TDS (mg/l)	Year	Month	TDS (mg/l)	Year	Month	TDS (mg/l)	Year	Month	TDS (mg/l)	Year	Month	TDS (mg/l)
1990	Jan	382	1993	Jan	499	1996	Jan	284	1999	Jan	315	2002	Jan	273	2005	Jan	343	2008	Jan	321	2011	Jan	144	2014	Jan	335
	Feb	369		Feb	472		Feb	251		Feb	216		Feb	237		Feb	306		Feb	343		Feb	171		Feb	276
	Mar	306		Mar	470		Mar	236		Mar	158		Mar	290		Mar	311		Mar	281		Mar	172		Mar	259
	Apr	335		Apr	441		Apr	211		Apr	231		Apr	287		Apr	186		Apr	311		Apr	105		Apr	241
	May	355		May	326		May	265		May	232		May	316		May	245		May	286		May	136		May	231
	Jun	343		Jun	346		Jun	260		Jun	228		Jun	295		Jun	161		Jun	290		Jun	156		Jun	327
	Jul	338		Jul	334		Jul	214		Jul	199		Jul	245		Jul	203		Jul	257		Jul	135		Jul	330
	Aug	319		Aug	339		Aug	197		Aug	153		Aug	309		Aug	209		Aug	279		Aug	158		Aug	369
	Sep	280		Sep	174		Sep	146		Sep	164		Sep	309		Sep	229		Sep	265		Sep	120		Sep	326
	Oct	310		Oct	206		Oct	152		Oct	258		Oct	412		Oct	204		Oct	301		Oct	127		Oct	336
	Nov	357		Nov	214		Nov	195		Nov	242		Nov	412		Nov	230		Nov	258		Nov	127		Nov	289
	Dec	438		Dec	311		Dec	266		Dec	291		Dec	355		Dec	329		Dec	309		Dec	180		Dec	417
1991	Jan	469	1994	Jan	297	1997	Jan	66	2000	Jan	295	2003	Jan	306	2006	Jan	171	2009	Jan	324	2012	Jan	322	2015	Jan	243
	Feb	448		Feb	328		Feb	88		Feb	250		Feb	273		Feb	203		Feb	300		Feb	330		Feb	243
	Mar	433		Mar	363		Mar	147		Mar	187		Mar	231		Mar	178		Mar	297		Mar	250		Mar	306
	Apr	382		Apr	357		Apr	225		Apr	206		Apr	242		Apr	148		Apr	281		Apr	298		Apr	289
	May	No Rec.		May	340		May	227		May	239		May	316		May	151		May	303		May	252		May	306
	Jun	361		Jun	339		Jun	219		Jun	239		Jun	167		Jun	118		Jun	315		Jun	233		Jun	315
	Jul	363		Jul	333		Jul	210		Jul	189		Jul	231		Jul	198		Jul	230		Jul	192		Jul	348
	Aug	359		Aug	310		Aug	224		Aug	213		Aug	178		Aug	159		Aug	223		Aug	190		Aug	327
	Sep	326		Sep	395		Sep	154		Sep	164		Sep	175		Sep	154		Sep	283		Sep	253		Sep	400
	Oct	329		Oct	479		Oct	180		Oct	248		Oct	273		Oct	160		Oct	332		Oct	334		Oct	311
	Nov	329		Nov	480		Nov	331		Nov	262		Nov	303		Nov	167		Nov	230		Nov	258		Nov	351
	Dec	356		Dec	427		Dec	293		Dec	301		Dec	384		Dec	269		Dec	271		Dec	269		Dec	365
1992	Jan	439	1995	Jan	417	1998	Jan	297	2001	Jan	374	2004	Jan	306	2007	Jan	343	2010	Jan	215	2013	Jan	301	2016	Jan	NR
	Feb	485		Feb	219		Feb	227		Feb	337		Feb	238		Feb	294		Feb	144		Feb	318		Feb	NR
	Mar	563		Mar	263		Mar	218		Mar	280		Mar	265		Mar	250		Mar	260		Mar	289		Mar	281
	Apr	358		Apr	274		Apr	108		Apr	275		Apr	210		Apr	235		Apr	192		Apr	272		Apr	272
	May	366		May	144		May	78		May	239		May	275		May	241		May	260		May	284		May	332
	Jun	353		Jun	152		Jun	78		Jun	227		Jun	261		Jun	254		Jun	246		Jun	276		Jun	306
	Jul	377		Jul	158		Jul	124		Jul	291		Jul	199		Jul	191		Jul	244		Jul	190		Jul	217
	Aug	410		Aug	178		Aug	186		Aug	245		Aug	208		Aug	223		Aug	162		Aug	262		Aug	155
	Sep	361		Sep	165		Sep	206		Sep	323		Sep	234		Sep	325		Sep	229		Sep	325		Sep	217
	Oct	337		Oct	141		Oct	142		Oct	365		Oct	292		Oct	274		Oct	269		Oct	336		Oct	320
	Nov	464		Nov	160		Nov	130		Nov	333		Nov	317		Nov	274		Nov	237		Nov	345		Nov	309
	Dec	456		Dec	270		Dec	207		Dec	310		Dec	284		Dec	281		Dec	291		Dec	NR		Dec	280

Notes:
1. Source of data: Table 32 of State Water Project Operations Data published monthly by State of California, Department of Water Resources, Division of Operations and Maintenance.
http://www.water.ca.gov/swp/operationscontrol/monthly.cfm

2016 values received via email request June 6, 2016

NR = no value.

Kern Water Bank Authority
Summary of Recovery (in Acre-Feet)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	**TOTAL**
2011	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	-	66	22,983	24,012	24,858	22,462	-	-	-	-	139	16,310	110,830
2013	15,422	19,722	22,458	21,145	20,661	20,076	19,717	15,977	-	6,548	18,005	17,440	197,171
2014	13,467	17,613	18,616	17,265	17,385	16,313	16,212	16,059	15,039	15,242	14,710	11,774	189,695
2015	15,158	13,453	14,676	14,002	13,717	12,338	13,476	13,491	12,243	11,754	12,075	12,702	159,085
2016	1,009	675	13,143	11,862	505	-	-	-	-	-	-	-	27,194
												Total	**683,975**

Table 2C-1

Kern Water Bank

Detailed Recharge (in Acre-Feet)

	January			February			March			April			May			June			July			August			September			October			November			December			Subtotal			
	SWP	FK	KR	SWP	FK	KR	SWP	FK	KR	SWP	FK	KR	SWP	FK	KR	SWP	FK	KR	SWP	FK	KR	SWP	FK	KR	SWP	FK	KR	SWP	FK	KR	SWP	FK	KR	SWP	FK	KR	SWP	FK	KR	Total
2011	48,408	-	1,483	27,454	1,163	1,549	37,081	1,265	1,938	32,578	16,809	7,978	-	14,003	24,687	19,000	8,672	23,391	36,975	494	9,410	32,292	-	1,049	41,837	-	2,757	29,572	-	582	28,561	633	-	10,706	14,174	-	344,464	57,213	74,824	**476,501**
2012	-	7,456	-	1,554	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,554	7,456	0	**9,010**
2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	**0**
2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	**0**
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	**0**
2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	**0**
Totals	**48,408**	**7,456**	**1,483**	**29,008**	**1,163**	**1,549**	**37,081**	**1,265**	**1,938**	**32,578**	**16,809**	**7,978**	**0**	**14,003**	**24,687**	**19,000**	**8,672**	**23,391**	**36,975**	**494**	**9,410**	**32,292**	**0**	**1,049**	**41,837**	**0**	**2,757**	**29,572**	**0**	**582**	**28,561**	**633**	**0**	**10,706**	**14,174**	**0**	**346,018**	**64,669**	**74,824**	**485,511**

2011
Kern County Water Agency
SWP Supply and Delivery Summary

(Quantities in Acre-Feet)

Estimated deliveries through December 31, 2011

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
	2011 State Water Project Supply						Turn-in Water Program Groundwater & Other Supplies			Agency Approved Transfers																	
Entity:	Current 2011 Ent Allocation (80% Firm)	2010 Carryover Into 2011	DWR Turn-Back Pool A Purchase	DWR Turn-Back Pool B Purchase	DWR Article 21 Water Program	Total SWP Supply (Cols 1...7)	KCWA	Other	Total	Misc. Trans / Exch Out of Kern County	Misc. Transfers Into Kern County	Misc. Transfers Into Kern County	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Operational Exchanges Feb. & Apr.	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Operational Exchanges	Total Water Supply Available (Cols 8+11...19)	Year to Date Deliveries	Balance to be Delivered
Berrenda Mesa	74,080	19,335	428	1,204	28,056	123,103		2,681	2,681		200 [4]	1,524 [32]	3,200 [20]		705 [22]	(2,170) [37]	1,293 [24]		914 [31]		(2,913) [28]	17,000 [12]	(1,377)	131 [34]	144,291	140,164	4,127
Lost Hills	95,288	14,930	550	1,549	28,373	140,690		4,905	4,905		3,000 [4]	1,966 [32]					3,048 [24]		1,100 [31]		(2,902) [28]				151,807	152,323	(516)
Belridge	97,206	27,840	561	1,580	33,237	160,424		20,045	20,045		3,800 [4]	20,405 [32]	0 [1]		803 [22]	(1,558) [37]	4,464 [24]	(284) [25]	1,123 [31]	3,829 [39]	(4,665) [28]		(623)	16,193 [34]	223,956	217,977	5,979
Semitropic	124,000	23,390	716	2,015	41,813	191,934			0		248,253 [3]		785 [1]	20,000 [5]	1,853 [6]		303 [23]	(40) [25]	196 [31]		(884) [28]			(23,629) [34]	438,771	447,674	(8,903)
Cawelo	30,560	6,456			2,156	39,172			0		10,000 [17]					(10,000) [24]	(8,805) [24]		415 [31]	(3,829) [39]	(708) [28]			(1,192) [34]	25,053	20,791	4,262
Imp Dist #4	66,357	8,182	383	1,079	15,424	91,425		2,797	2,797				(785) [1]	(5,000) [5]	(1,508) [22]	(228) [2]	(584) [27]	(56) [25]	774 [31]	(7,000) [33]	(474) [28]	(27,250) [12]		2,203 [34]	54,314	54,103	211
Rosedale-Rio Bravo	23,920	1,786	138	389	4,355	30,588			0		5,608 [11]					3,728 [37]					(10) [28]	0 [12]	2,000		41,914	26,760	15,154
Buena Vista	17,040	7,166	98		121	24,425		716	716				25,000 [7]	(10,000) [5]	13,500 [16]	10,000 [24]		20,518 [30]						2,441 [34]	86,600	69,490	17,110
Kern Delta	20,400	0	118	331	1,000	21,849			0		69,424 [13]		(25,000) [7]	(845) [40]			(303) [23]	(20,518) [30]							44,607	44,664	(57)
Henry Miller	28,400	4,277	164	462		33,303			0																33,303	29,325	3,978
West Kern	25,200	2,511	145	410	2,588	30,854			0		7,000 [8]	5,000 [36]	750 [9]	2,000 [10]	(13,500) [16]			6,000 [29]							38,104	38,214	(110)
Wheeler Ridge	157,670	42,037	910	2,563	34,802	237,982		5,620	5,620			6,018 [32]			(1,853) [6]			448 [25]	2,137 [31]		(420) [28]			3,500 [34]	253,432	250,801	2,631
Tehachapi - AG	3,440	325				3,765			0																3,765	3,765	0
Tehachapi - M&I	12,000	3,160		251	1,086	16,497		400	400				(750) [9]	(2,000) [10]			584 [27]	(6,000) [29]						187 [34]	8,918	8,918	0
Tejon Castac - M&I	1,600	1,423	24			3,047			0									(12) [25]							3,035	3,050	(15)
Tejon Castac - AG	2,623	3,727			1,108	7,458			0				(3,200) [20]								(62)				4,196	4,243	(47)
Westside Mutual						0			0																0	0	0
Arvin-Edison WSD						0	9,536	16,065	25,601	(39,484)	101,600		[1]	845 [40]		228 [2]					13,038 [28]	10,250 [12]			112,078	112,078	0
Kern-Tulare WD						0			0		1,000 [14]														1,000	1,000	0
Dudley Ridge WD						0			0		31,833 [15]	2,900 [32]						(56) [25]						65 [34]	34,742	34,798	(56)
MWD						0			0	39,484															39,484	39,484	0
Coachella VWD						0			0																0	0	0
Alameda County WD						0			0																0	0	0
Santa Clara VWD						0			0																0	0	0
Castaic Lake WA						0			0																0	0	0
Westlands WD						0			0																0	0	0
Tulare Lake Basin WD						0			0																0	0	0
North Kern WSD						0			0																0	0	0
Newhall						0			0																0	0	0
Palmdale WD						0			0																0	0	0
DMB						0			0					0 [5]											0	0	0
KCWA	6,400	223				6,623		6,100	6,100	(1,112) [21]				(5,000) [5]					(6,659) [31]	7,000 [33]				101 [34]	7,053	7,000	53
KCWA / Nickel						0			0																0	0	0
Western Hills WD						0			0	1,112															1,112	1,112	0
Total	786,184	166,768	4,235	11,833	194,119	1,163,139	9,536	59,329	68,865	0	481,718	37,813	0	0	0	0	0	0	0	0	0	0	0	0	1,751,535	1,707,734	43,801

** This water supply may be adjusted dependent upon whether it was delivered to the CA Aqueduct.*

[1] - Transfer of BWSD 2010 SWP c/o water (2,231 AF) to AEWSD and for a like amount of AE/ID4/KT 2011 ID4 SWP Table A water (2,231 af) to Belridge WSD; and exchange of ID4 Article 21 water (785 AF) with SWSD for a like amount of KWB banked groundwater.
[2] - Transfer of ID4 2010 SWP carryover water (228 AF) to Arvin-Edison WSD under annual KTWD exchange.
[3] - Transfer of 2011 CVP water (3,220 AF) from Westlands WD; C/O water from SCVWD (4,000 AF), ACWD (6,441 AF), Zone 7 (5,745 AF); and Art 21 water from MWD (4,568 AF), SCVWD (3,780 AF), ACWD (1,959 AF); and Table A water from MWD (144,444 AF), SCVWD (22,285 AF) & ACWD (13,000 AF) and DRWD/Sandridge L/O transfer (2,400 AF); and SCVWD CVP water (36,411 AF).

[4] - Landowner transfer of Tulare Lake Basin WSD SWP water to LHWD (2,500 AF) and BWSD (3,500 AF); and landowner transfer of Dudley Ridge WD SWP water to BMWD (200AF), LHWD (500 AF) and BWSD (300 AF).
[5] - Nickel obligation (10,000 AF) transferred to DMB Communities II, Inc (Homer) (8,393 AF) and Newhall Land & Farming Co. for storage in Semitropic (1,607 AF); transfer of BVWSD (KDWD) Table A water (10,000 AF) to SWSD.
[6] - Landowner transfer of Article 21 water (1,853 AF) from Wheeler Ridge-Maricopa WSD to Semitropic WSD on behalf of common landowner Poso Creek WC.
[7] - Exchange of Buena Vista WSD Kern River water (25,000 AF) for a like amount of Kern Delta (MWD) WD 2011 SWP Table A water.
[8] - Transfer of 2011 SWP water (6,889 af) from Palmdale WD to West Kern WD as a partial payback for a previous exchange of West Kern's Table A.
[9] - Transfer of 2010 SWP water (750 af) from Tehachapi-Cummings CWD to West Kern WD as a 2-for-1 exchange program with water to be retuned in a future year.
[10] - Transfer of 2010 SWP water (2,000 af) from Tehachapi-Cummings CWD to West Kern WD as part of a multi-year transfer program.
[11] - Exchange of Castaic Lake WA carryover water (5,608 AF) to Rosedale-Rio Bravo WSD) for a like amount of RRBWSD 2011 SWP Table A.
[12] - Transfer of 2011 SWP water (2,000 af) from Berrenda Mesa WD (1,377 AF) and Belridge WSD (623 AF) to Rosedale-Rio Bravo WSD for a like amount of Rosedale's groundwater currently stored in the Pioneer Project.
[13] - Transfer of MWD Table A water (49,150 AF) and SBVWD SWP Table A water (8,066 AF) to KDWD for banking.
[14] - Transfer of KTWD CVP water (1,000 AF) for banking in RRBWSD.
[15] - Transfer of DRWD C/O water (5,010 AF) and Article 21 water (8,129 AF).
[16] - Transfer of WKWD SWP Table A water (13,500 AF) to BVWSD pursuant to annual program.
[17] - Transfer of Alameda County Flood Control & Water Conservation District - Zone 7 2011 SWP water (10,000 AF) to Cawelo WD in exchange for 5,000 AF to be returned in a future year.
[18] - Transfer of ID4 SWP Water (584 AF) to Tehachapi-Cummings County WD for a like amount of Kern River Water.
[19] - Exchange of Buena Vista WSD Kern River water (20,804 AF) for a like amount of Kern Delta WD 2011 SWP Table A water.
[20] - Transfer of Tejon-Castac WD banked Friant-Kern water (3,200 AF) via TCWD 2011 SWP Table A water.
[21] - Transfer of Western Hills WD 2011 water supply to Western Hills WD (1,112 AF).
[22] - Exchange of ID4 SWP water (1,508 AF) for a like amount of Lower Kern River water from BMWD (705 AF) and BWSD (803 AF).
[23] - Exchange of KDWD/MWD SWP water (303 AF) for a like amount of Lower Kern River water from SWSD (303 AF).
[24] - Exchange of Cawelo WD SWP water (5,000 AF) for a like amount of Kern River water to BWSD (1,400 AF) and Lower Kern River water to (BMWD (1,293 AF), LHWD (3,048 AF) and BWSD (3,064 AF) and Cawelo Carmel KR water (1,400 AF) to Belridge for a like amount of Cawleo SWP Table A water.
[25] - Transfer water (588 af) from KWB participants to Pastoria Energy from Semitropic (40 af), ID4 (56 af), Wheeler Ridge (140 af), Tejon Castac (12 af), Westside Mutual (284 af) and Dudley Ridge (56 af).
[26] - Transfer exchange of TCCWD SWP Table A water (6,000 AF) to West Kern for a 2:1 future payback.
[27] - Exchange of ID4 SWP Table A water (584 AF) with Tehachapi-Cummings CWD for a like amount of Lower River water.
[28] - Exchange of 2011 Article 21 water (Feb: 2,171 AF and Apr: 7,485 AF), to Arvin-Edison WSD on the Aqueduct for a like amount of F-K CVP water to the banking projects.
[29] - Exchange of Tehachapi-Cummings CWD 2011 SWP Table A water (6,000 AF) to West Kern under a 2:1 exchange program.
[30] - Exchange of Kern Delta 2011 SWP Table A water (10,518 AF) to Buena Vista WSD for a like amount of Buena Vista WSD Kern River water.
[31] - KCWA Table A water (6,659 AF) sale to MUs (BMWD=914, LHWD=1,100, BWSD=1,123, SWSD=196, CWD=415, ID4=774, WRMWSD=2,137).
[32] - Transfer of Santa Barbara FCWA 2011 SWP Table A water (14,795 AF) to the Westside 5 (BMWD=971, LHWD=651, BWSD=8,933, WRMWSD=1,340 and DRWD =2,900); and Friant Recirculation water (18,018 AF) to the Westside 5 (BMWD=553, LHWD=1,315, BWSD=11,472 and WRMWSD=4,678 [note: all WMWC (8,189 AF) and DRWD (1,940 AF) delivered to BWSD - KWB to do GW transfer to DRWD later].
[33] - Exchange of Improvement District No. 4 2011 SWP Table A water for a like amount of Lower River water BMWD (705 AF) and BWSD (803 AF).
[34] - Operational exchange of MU Lower River water for Semitropic 2011 SWP Table A water.
[35] - Exchange of BMWD SWP Table A water (1,939 AF) and BWSD (1,789 AF) to RRBWSD for previously banked water in the Pioneer Project.
[36] - Transfer of CLWA 2011 SWP Table A water (5,000 AF) to WKWD.
[37] - Exchange of 2010 SWP carryover water (BM=2,170 AF and BWSD=1,558 AF) for a like amount of Rosedale-Rio Bravo WSD Pioneer bank account water.
[38] - Transfer of ID4 2011 Table A water (15,000 AF) to Rosedale-Rio Bravo WSD on behalf of Kern-Tulare WD and landowner transfer (15,000 AF) from Rosedale-Rio Bravo WSD to Berrenda Mesa WD on behalf of Paramount Farming Co.
[39] - Exchange of Belridge Friant-Kern water (3,829 AF) for a like amount of Cawelo 2011 SWP Table A water.
[40] - Transfer of KDWD MWD SWP water (845 AF) to AEWSD (MWD) for a like amount of AEWSD F-K water.

2012
Kern County Water Agency
SWP Supply and Delivery Summary

(Quantities in Acre-Feet)

Estimated deliveries through December 30, 2012

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
	2012 State Water Project Supply									Agency Approved Transfers																	
							Turn-in Water Program																				
							Groundwater & Other Supplies																				
Entity:	Current 2012 Ent Allocation (65% Firm)	2011 Carryover Into 2012	DWR Turn-Back Pool A Purchase	Yuba Water Purchase Program	Dry Year Water Purchase Program	Total SWP Supply (Cols 1...7)	KCWA	Other	Total	Misc. Trans / Exch Out of Kern County	Misc. Transfers Into Kern County	Misc. Transfers Into Kern County	Misc. Transfers Into Kern County	Misc. Transfers Into Kern County	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Transfers, Exchanges, Other	Misc. Operational Exchanges	Total Water Supply Available (Cols 8+11..19)	Year to Date Deliveries	Balance to be Delivered
Berrenda Mesa	60,190	4,127	208	625	0	65,150	7,803		7,803		800 [3]	35,243 [18]	442 [42]	980 [45]	1,250 [5]	1,977 [6]	917 [4]	899 [11]	8,393 [47]	(11,000) [38]	(1,050) [48]	766 [16]	(5,602) [49]	666	107,634	92,919	14,715
Lost Hills	77,422	(516)	268	804	0	77,978	4,110		4,110		2,900 [3]	1,954 [18]	2,177 [42]	1,000 [45]		3,805 [6]	1,764 [4]	1,729 [11]				985 [16]		751	99,153	89,589	9,564
Belridge	78,980	5,979	273	820	0	86,052	45,186		45,186		4,060 [3]	1,973 [18]	1,398 [42]	1,048 [45]	520 [25]	2,251 [6]	1,044 [4]	2,023 [11,35]		1,000 [21]		1,004 [16]	602 [49]	758	148,919	126,407	22,512
Semitropic	100,750	(8,903)	349			92,196	50,237		50,237	(17,000) [9]	62,169 [1]							(5,000) [30]	1,607 [47]	11,000 [38]	(204) [36]				195,005	200,627	(5,622)
Cawelo	24,830	4,262	86			29,178			0		20,308 [37]				(520) [25]				(5,000) [29]						43,966	40,446	3,520
Imp Dist #4	53,915	211	187	559		54,872	1,286		1,286						(2,500) [19]		(5,000) [47]	(9,200) [11]	(8,866) [44]	(1,000) [21]	(291) [36]	529 [16]	5,000 [49]		34,830	31,005	3,825
Rosedale-Rio Bravo	19,435	15,154	67	202		34,858			0	(4,000) [34]	15,900 [7]	200 [20]				(8,250) [6]	(1,000) [35]								37,708	18,367	19,341
Buena Vista	13,845	17,110	48	144		31,147		19,850	19,850		2,500 [7]	10,000 [28]			2,500 [19]	(2,750) [6]	16,632 [26]	5,000 [30]	5,000 [29]	11,250 [31]					101,129	85,538	15,591
Kern Delta	16,575	(57)	57	172		16,747			0		21,934 [12]	50,088 [24]			(1,460) [8]		(16,632) [26]								70,677	70,734	(57)
Henry Miller	23,075	3,978	80	239		27,372			0		8,000 [23]				1,460 [8]							226 [16]			37,058	34,322	2,736
West Kern	20,475	(110)	71			20,436			0	(2,000) [2]	12,631 [43]	2,500 [39]			(1,250) [5]		1,000 [35]	(1,000) [35]		(11,250) [31]		60 [16]			21,127	19,404	1,723
Wheeler Ridge	128,107	2,631	443	1,330	0	132,511	16,500	1,340	17,840		3,086 [40]	2,599 [18]	1,483 [42]		500 [22]	2,967 [6]	1,375 [4]	1,349 [11]			2,311 [36]	1,630 [16]		999	168,650	157,865	10,785
Tehachapi - AG	2,795	0	43			2,838			0																2,838	2,239	599
Tehachapi - M&I	9,750	0				9,750			0								(5,100) [4]	1,000 [35]							5,650	4,650	1,000
Tejon Castac - M&I	1,300	(15)				1,285			0												(61) [36]				1,224	378	846
Tejon Castac - AG	2,131	(47)				2,084			0						(500) [22]										1,584	0	1,584
Westside Mutual						0	1,464		1,464												(1,464) [36]				0	0	0
Arvin-Edison WSD						0		10,010	10,010	(10,010) [17]	7,518 [17]	88,561 [17]						3,200 [11]							99,279	99,531	(252)
Kern-Tulare WD						0			0		1,428 [41]	20,320 [46]													21,748	23,844	(2,096)
Dudley Ridge WD		(56)				(56)	1,935		1,935	2,000 [2]											(291) [36]			531	4,119	3,168	951
MWD						0			0	10,010 [17]															10,010	10,010	0
Coachella VWD						0			0	4,000 [34]															4,000	4,000	0
Alameda County WD						0			0																0	0	0
Santa Clara VWD						0			0	17,000 [9]															17,000	17,000	0
Castaic Lake WA						0			0																0	0	0
Westlands WD						0			0																0	0	0
Tulare Lake Basin WD						0			0																0	0	0
North Kern WSD						0			0																0	0	0
Newhall						0			0																0	0	0
Palmdale WD						0			0																0	0	0
O'Neill						0			0																0	0	0
KCWA	5,200	53				5,253			0	(1,258)							(5,000) [47]		8,866 [44]		1,050 [48]	(5,200) [16]		(3,705)	6	0	6
KCWA / Nickel						0			0								10,000 [47]		(10,000) [47]						0	0	0
Western Hills WD						0			0	1,258															1,258	1,258	0
Total	638,775	43,801	2,180	4,895	0	689,651	128,521	31,200	159,721	0	163,234	213,438	5,500	3,028	0	0	0	0	0	0	0	0	0	0	1,234,572	1,133,301	101,271

[1] - Transfer of Metropolitan WD 2012 SWP water (45,000 AF), Alameda County WD 2011 SWP C/O water (7,500 AF), City of Tracy CVP water (6,000 AF), 2012 Kern-Tulare WD water (2,369 AF) to Semitropic WSD for banking and DRWD SWP water (1,300 AF) on behalf of Sandridge.
[2] - Exchange of West Kern WD 2012 Table A water (2,000 AF) to Dudley Ridge WD for a like amount of banked KWB water.
[3] - Common landowner (Sandridge) transfer of Dudley Ridge WD 2012 SWP Table A water to BMWD (800 AF), LHWD (900 AF), BWSD (4,060 AF) and common landowner transfer (Sandridge) of Tulare Lake Basin WSD 2012 SWP Table A water (2,000 AF) to LHWD.
[4] - Multi-year transfer of Tehachapi-Cummings CWD 2012 Table A water (5,100 AF) to BMWD (917 AF), LHWD (1,764 AF), BWSD (1,044 AF) and WRMWSD (1,375 AF).
[5] - Exchange of West Kern WD 2012 Table A water (1,250 AF) to Berrenda Mesa WD for a like amount of banked KWB water.
[6] - Transfer of banked Kern River water from RRBWSD (8,250 AF) & BVWSD (2,750 AF) to CLWA and transfer from CLWA (11,000 AF) to BMWD (1,977 AF), LHWD (3,805 AF), BWSD (2,251 AF) and WRMWSD (2,967 AF) via RRB & BV 2012 SWP Table A exchange.
[7] - Transfer of SLWD/DEID CVP F-K recirculation water (12,000 TAF) to RRBWSD; transfer of 2012 SWP Table A water from Antelope Valley-East Kern WA (3,047 AF) and Santa Barbara FC& WCD (853 AF) to Rosedale-Rio Bravo WSD on behalf of Irvine Ranch WD.
[8] - Exchange of Henry Miller Carmel River Right water (1,460 AF) to Kern Delta WD in exchange of a like amount of Kern Delta WD 2012 SWP Table A water.
[9] - Transfer of Semitropic WSD 2012 SWP Table A water (17,000 AF) to Santa Clara Valley WD as a return of previously banked water.
[10] - Transfer of KCWA 2012 SWP water (4,134 AF) to BMWD (590 AF), LHWD (759 AF), BWSD (774 AF), ID4 (529 AF), HMWD (226 AF) and WRMWSD (1,256 AF).
[11] - Transfer of ID4 2012 SWP Table A water (5,000 AF) to BMWD (899 AF), LHWD (1,729 AF), BWSD (1,023 AF), WRMWSD (1,349 AF); transfer of ID4/KTWD SWP Table A water (1,000 AF) to BWSD for a like amount of CVP water to KTWD; and AEWSD (3,200 AF) pursuant to the KTWD annual exchange program.
[12] - Transfer of San Bernardino Valley WD 2012 SWP water (21,934 AF) to Kern Delta WD for storage.
[13] - Common landowner transfer (JG Boswell) from
[14] - Common landowner (Sandridge) transfer of Dudley Ridge WD 2012 SWP Table A water (200 AF) to Rosedale-Rio Bravo WSD.
[15] - Transfer of Metropolitan WD 2012 SWP water (21,934 AF) to Kern Delta WD for banking.
[16] - Transfer of KCWA 2012 SWP Table A water to BMWD (766 AF), LHWD (985 AF), BWSD (1004 AF), ID4 (529 AF), HMWD (226 AF), WKWD (60 AF) and WRMWSD (1,630 AF).
[17] - Transfer of banked water (10,010 AF) from AEWSD to MWD; transfer of MWD 2012 SWP Table A water (69,968 AF) to AEWSD, transfer of CVC Contractor water (7,518 AF) to AEWSD and transfer of F-K recirc water (18,593 AF) to AEWSD.
[18] - Transfer of Butte County SWP Table A water (8,258 AF) to BMWD (1,732 AF), LHWD (1,954 AF), BWSD (1,973 AF) and WRMWSD (2,599 AF); and transfer of AVEK SWP water (33,511 AF) to BMWD.
[19] - Transfer of ID4 2012 SWP Table A water (2,500 AF) as a partial payback from a previous exchange for Kern River water.
[20] - Common landowner (Sandridge) transfer of Dudley Ridge 2012 SWP Table A water (200 AF) to RRBWSD and transfer of CLWA SWP Table A water (10,000 AF) to RRBWSD for storage.
[21] - Transfer exchange of ID4 2012 SWP Table A water (1,000 AF) to BWSD for a like amount of DEID/CVP water to KTWD and a like amount of KTWD Kern River water to ID4.
[22] - Common landowner (Tejon Ranch) transfer (500 AF) from TCWD to WRMWSD.
[23] - Common landowner transfer (J.G. Boswell) of Tulare Lake Basin WSD 2012 SWP Table A water (8,000 AF) to HMWD.
[24] - Transfer of MWD 2012 SWP water (48,628 AF) to Kern Delta WD for storage.
[25] - Transfer of Cawelo 2012 SWP Table A water (520 AF) to Belridge WSD for a like amount of Friant-Kern water.
[26] - Transfers to BVWSD purusant to their annual exchange agreements from: KDWD (16,632 AF), CWD (1,500 AF) and WKWD (11,250 AF), and transfer paybacks to WKWD from SWSD (5,000 AF), ID4 (2,500 AF) and RRBWSD (10,000 AF).
[27] - Transfer of Rosedale-Rio Bravo WSD high flow Kern River water (4,000 AF) via excahnge of 2012 SWP Table A to Coachella WD (GCID).
[28] - Transfer of Castaic Lake WA Table A water (10,000 AF) to Buena Vista WSD for a like amount of banked water in Rosedale Rio-Bravo WSD.
[29] - Transfer of Cawelo WD SWP water (5,000 AF) to Buena Vista WSD as part of their annual long-term exchange for a like amount of Kern River water.
[30] - Transfer of Semitropic WSD SWP water (5,000 AF) to Buena Vista WSD as payback from a prior exchange.
[31] - Transfer of West Kern WD SWP water (11,250 AF) to Buena Vista WSD for a ground water account.
[32] - Transfer of Alameda County Flood Control & Water Conservation District - Zone 7 2012 SWP water (12,308 AF) to Cawelo WD.
[33] - Transfer of Kern-Tulare WD to West Kern WD
[34] - Transfer of KCWA / Rosedale-Rio Bravo WSD 2012 SWP Table A water (4,000 AF) to Coachella Valley WD
[35] - Transfer of RRBWSD 2012 SWP Table A water (1,000 AF) to WKWD as a partial payback from a previous exchange of WKWD groundwater and transfer of WKWD 2013 SWP Table A water (1,000 AF) to TCCWD as a partial payback of a previous exchange of TCCWD banked water in WKWD.
[36] - Transfer to Pastoria Energy Facilities: SWSD (204 AF), ID4 (291 AF), WRMWSD (732 AF), TCWD (61 AF), WMWC (1,464 AF) and DRWD (291 AF).
[37] - Transfer of Alameda County Zone 7 SWP Tabel A water (20,308 AF) to Cawelo WD for storage.
[38] - Transfer of Berrenda Mesa WD SWP Table A water (11,000 AF) to Semitropic WSD for banking.
[39] - Transfer of Palmdale
[40] - Transfer of Friant-Ke
[41] - Transfer of Kern-Tulare WD CVP carryover water (1,428 AF) to Rosedale-Rio Bravo for banking.
[42] - Transfer of Castaic Lake WA SWP Table A water to the Westside Districts: BMWD (442 AF), LHWD (2,177 AF), BWSD (1,398 AF) and WRMWSD (1,483 AF).
[43] - Transfer of Kern-Tulare WD CVP carryover water (12,631 AF) to West Kern WD.
[44] - Transfer of Improvement District No. 4 SWP Table A water (8,866 AF) to KCWA for a like amount of Lower Kern River water.
[45] - Transfer of Friant-Kern Recirculation water (3,028 AF) to BMWD (980 AF), LHWD (1,000 AF) and BWSD (1,048 AF).
[46] - Transfer of Kern Tulare WD CVC Contractor water (20,320 AF) into Kern County for delivery via exchange with KCWA SWP Table A water.
[47] - Transfer of ID4 SWP Table A water (5,000 AF) and KCWA Lower Kern River water (5,000 AF) via SWP Table A water acquired from ID4 under the Nickel obligation and Nickel transfer to Newhall (1,607 AF in SWSD and transfer to DMB/BMWD (8,393 AF).
[48] - Exchange of Berrenda Mesa WD SWP Table A water (1,050 AF) for a like amount of KCWA banked Lower Kern River water.
[49] - Exchange of Berrenda Mesa WD 2012 SWP Table A water (5,000 AF) for a like amount of Improvement District No. 4 2003 SWP water banked in the Pioneer Project and exchange of Berrenda Mesa WD 2012 SWP Table A water (602 AF) for a like amount of Belridge WSD banked 2011 Friant-Kern CVP recirculation water in the BM Project.

2013
Kern County Water Agency
SWP Supply and Delivery Summary

(Quantities in Acre-Feet)

Deliveries through December 31, 2013

Entity:	(1) 2013 State Water Project Supply: Current 2013 Ent Allocation (35% Firm)	(2) 2012 Carryover Into 2013	(3) DWR Turn-Back Pool A Purchase	(4) Yuba Water Purchase Program	(5) Multi-Year Water Purchase Program	(6) NOD Transfer Program	(7) Total SWP Supply (Cols 1...6)	(8) Turn-in Water Program Groundwater & Other Supplies: KCWA	(9) Other	(10) Total	(11) Agency Approved Transfers: Misc. Trans / Exch Out of Kern County	(12) Misc. Transfers Into Kern County	(13) Misc. Transfers Into Kern County	(14) Misc. Transfers, Exchanges, Other	(15) Misc. Transfers, Exchanges, Other	(16) Misc. Transfers, Exchanges, Other	(17) Misc. Transfers, Exchanges, Other	(18) 2013 KCWA Lease Water	(19) Misc. Transfers, Exchanges, Other	(20) Misc. Transfers, Exchanges, Other	(21) Misc. Transfers, Exchanges, Other	(22) Misc. Transfers, Exchanges, Other	(23) Misc. Transfers, Exchanges, Other	(24) 2012 Dry Year Transfer Water	(25) Total Water Supply Available (Cols 8+11..19)	(26) Year to Date Deliveries	(27) Balance to be Delivered
Berrenda Mesa	32,410	14,715	111	3,184	4,599	2,682	57,701	28,440		28,440		911 [6]	2,500 [10]	1,977 [7]		3,295 [4]		266	592 [19]	150 [23]	2,574 [26]	295 [30]	539 [29]	8,880	108,120	94,279	13,841
Lost Hills	41,689	9,564	143	4,095	5,915	3,448	64,854	19,456		19,456		1,027 [6]	1,941 [10]	3,806 [7]		5,809 [4]		342	1,141 [19]	3,897 [23]	3,869 [26]	333 [30]	1,039 [29]	9,738	117,252	94,882	22,370
Belridge	42,528	22,512	146	4,178	6,034	3,520	78,918	55,236		55,236		1,037 [6]	2,500 [10]	2,250 [7]	1,447 [22]	3,896 [4]		349	674 [19]	2,953 [23]	2,931 [26]	336 [30]	614 [29]	9,935	163,076	141,475	21,601
Semitropic	54,250	(5,622)	186				48,814	40,594	64,651	105,245	(103,179) [1]						(232) [16]	445		(7,000) [23]	1,607 [28]				45,700	46,440	(740)
Cawelo	13,370	3,520	46		1,897	834	19,667	3,329		3,329	(874) [17]				(12,578) [8]			110							9,654	5,592	4,062
Imp Dist #4	29,031	2,301	100	2,852	3,600		37,884	30,080		30,080				(26,366) [11]	(6,055) [14]	(4,064)	(335) [16]	238	(3,296) [19]	(5,000) [28]	263				23,349	30,574	(7,225)
Rosedale-Rio Bravo	10,465	19,341	36		1,485		31,327	20,089		20,089	(16,777) [2]			(8,250) [7]	(10,435) [5]	(4,274) [24]		86	4,188				(10,000) [27]		5,954	0	5,954
Buena Vista	7,455	15,591	25				23,071	14,180		14,180				(2,750) [7]	30,253 [8]	(13,000) [4]	5,080 [13]	61							56,895	44,689	12,206
Kern Delta	8,925	(57)	31				8,899			0	(11,500) [12]			26,366 [11]	(8,925) [8]		(5,080) [13]	73							9,833	10,183	(350)
Henry Miller	12,425	2,736	43	287			15,491	998		998								102							16,591	14,868	1,723
West Kern	11,025	1,723	38		1,564		14,350	3,309	1,260	4,569	(3,000) [18]				(8,750) [8]			91							7,260	5,004	2,256
Wheeler Ridge	68,981	10,785	237	6,778	9,788	4,307	100,876	54,224	5,361	59,585	(804) [2]	1,367 [6]		2,967 [7]	120 [9]		2,642 [16]	566	889 [19]		1,626 [26]	443 [30]	809 [29]	16,114	187,200	158,444	28,756
Tehachapi - AG	1,505	599	23		958		3,085			0													(3,001) [29]		84	84	0
Tehachapi - M&I	5,250	1,000					6,250	2,000		2,000								56							8,306	7,284	1,022
Tejon Castac - M&I	700	846					1,546			0															1,546	353	1,193
Tejon Castac - AG	1,147	1,584					2,731			0					(120) [9]		(69) [16]	15							2,557	0	2,557
																									0		
Westside Mutual							0	1,671		1,671							(1,671) [16]								0	0	0
Arvin-Edison WSD							0	0	33,205	33,205	(33,205) [3]	13,409 [20]											10,000 [27]		23,409	23,446	(37)
Kern-Tulare WD							0	11,547		11,547	3,000 [18]	6,660 [25]			(1,447) [22]	4,274 [24]			(4,188)		(263)				19,583	19,490	93
Dudley Ridge WD							0	3,700		3,700	874 [17]						(335) [16]					237 [30]			4,476	4,239	237
Delano-Earlimart ID							0			0					10,435 [5]										10,435	10,435	0
MWD							0			0	90,384 [1,3]														90,384	90,384	0
Coachella VWD							0			0	16,500 [2]														16,500	16,500	0
Alameda County WD							0			0	4,000 [1]														4,000	4,000	0
Santa Clara VWD							0			0	45,000 [1]														45,000	45,000	0
Zone 7							0			0	4,000 [1]														4,000	4,000	0
Castaic Lake WA							0			0	11,000 [26]										(11,000) [26]				0	0	0
Westlands WD							0			0	3,000 [1]										8,393 [28]				11,393	11,393	0
San Bernardino VMWD							0			0	1,500 [12]														1,500	1,500	0
North Kern WSD							0			0					6,055 [14]	4,064									10,119	10,119	0
Central Coast WA							0			0	1,081 [2]														1,081	1,081	0
Palmdale WD							0			0															0	0	0
O'Neill							0			0															0	0	0
KCWA	2,800	(36)					2,764	11,944		11,944	(1,156)							(2,800)		(5,000) [28]		(1,644) [30]			4,108	0	4,108
KCWA / Nickel							0			0										10,000 [28]	(10,000) [28]				0	0	0
Western Hills WD							0			0	1,156														1,156	1,156	0
Total	343,956	101,102	1,165	21,374	35,840	14,791	518,228	300,797	104,477	405,274	11,000	24,411	6,941	0	0	0	0	0	0	0	0	0	0	44,667	1,010,521	896,894	113,627

[1] - Transfer to Metropolitan WD 2013 SWP water (47,179 AF), Santa Clara WD (45,000 AF), Alameda County WD (4,000 AF), Alameda Zone 7 (4,000 AF) and Westlands WD (3,000 AF) for banking returns.
[2] - Transfer of RRBWSD SWP water (277 AF) to Central Coast WA as payback for a prior exchange; transfer of RRBWSD water (16,500 AF to Coachella Valley WD under their long-term transfer program; and transfer of Wheeler Ridge-Maricopa WSD SWP Water (804 AF) to Central Coast WA as payback for a prior exchange.
[3] - Transfer of previously banked water (33,205 AF) from Arvin-Edison WSD to MWD and transfer of KDWD SWP water (10,000 AF) to MWD.
[4] - Transfer of Buena Vista WSD SWP water (3,000 AF: BM=834 AF, LH=1,072 AF, BEL=1,094 AF) and banked Kern River water (6,667 AF) and SWP water (3,000 AF) to: BM=2,461 AF, LH=4,737 AF, BEL=2,802 AF) to the Westside Districts .
[5] - Transfer of RRBWSD water (10,136 AF) to DEID as a return of previously banked CVP water.
[6] - Transfer of Butte Co. water (4,342 AF) to the Westside Districts (BM=911 AF, LH=1,027 AF, BEL=1,037 AF, WRM=1,367 AF).
[7] - Transfer of CLWA water (11,000 AF) pursuant to the RRBWSD/BVWSD long-term program to the Westside Districts (BM=1,977 AF, LH=3,806 AF, BEL=2,250 AF, WRM=2,967 AF).
[8] - Transfer of Kern Delta WD SWP water (8,925 AF), Cawelo WD SWP water (12,578 AF), and West Kern SWP water (8,750 AF) to Buena Vista WSD pursuant to their long-term exchange programs.
[9] - Common landowner transfer of Tejon-Castac WD SWP water (120 AF) to Wheeler Ridge-Maricopa WSD on behalf of common landowner Tejon Ranch.
[10] - Common landowner transfer of Dudley Ridge WD SWP water (13,000 AF) to Berrenda Mesa WD (2,500 AF), Lost Hills WD (8,000 AF) and Belridge WSD (2,500 AF) on behalf of common landowner Sandridge Partners.
[11] - Exchange of Improvement District No. 4 SWP water (26,366 AF) to Kern Delta WSD for a like amount of Kern River water and banked water.
[12] - Transfer of Kern Delta WD SWP water (1,500 AF) to San Bernardino Valley MWD as a return for previously banked water.
[13] - Transfer payback of Kern Delta WD SWP water (5,080 AF) to Buena Vista WSD for an over delivery of Kern River water in 2012.
[14] - Transfer of Improvement District No. 4 SWP water (6,055 AF) to North Kern WSD for a like amount of Kern River water.
[15] -
[16] - Transfer to Pastoria Energy Facilities: SWSD (232 AF), ID4 (335 AF), WRMWSD (836 AF), TCWD (69 AF), WMWC (1,671 AF) and DRWD (335 AF).
[17] - Transfer of Cawelo WD SWP water (874 AF) to Dudley Ridge WD for previously banked water.
[18] - Transfer of West Kern WD SWP water (1,447 AF & 1,553 AF) to Kern-Tulare WD for a like amount of banked water.
[19] - Transfer of Improvement District No. 4 (KTWD) SWP water (3,296 AF) to BMWD (592 AF), LHWD (1,141 AF), BWSD (674 AF) and WRMWSD (889 AF) by exchange for FID water to Kern-Tulare WD.
[20] - Transfer of MWD SWP water (6,592 AF) pursuant to their long-term banking program; transfer 2,292 AF of CVC Contractor water (Fresno Co = 600 AF; Hills Valley = 630 AF; Tulare Co = 1,062 AF); and transfer of San Joaquin River Restoration CVP water (4,525 AF) to Arvin-Edison WSD .
[21] - Transfer of Improvement District No. 4 recovered SWP water (6,500 AF) to North Kern WSD for a like amount of Kern River water.
[22] - Transfer of Kern Tulare/WKWD SWP water (1,447 AF) to Belridge WSD for a like amount of Lindsay-Strathmore ID CVP water on the Friant-Kern canal.
[23] - Transfer of Semitropic WSD recovered SWP water (5,000 AF) to BMWD (150 AF), LHWD (3897 AF), and BWSD (2,953 AF) for banked groundwater.
[24] - Transfer of RRB SWP water (4,274 AF) to Kern-Tulare WD as a partial exchange payback.
[25] - Transfer of Kern-Tulare WD CVP/CVC water (6,660 AF) to KCWA pursuant to a long-term exchange agreement.
[26] - Transfer of Castaic Lake WA SWP Table A water (11,000 AF) to the Westside Districts: BMWD=2,574 AF, LHWD=3,869 AF, BWSD=2,931 AF, WRMWSD=1,626 AF.
[27] - Transfer of recovered water (10,000 AF) from the JURP wells as payback to Arvin-Edison WSD.
[28] - Nickel obligation water (10,000 AF) provided by ID4 (5,000 AF) and KCWA (5,000 AF) and transfered to Semitropic on behalf of Newhall (1,607 AF) and Westlands WD (8,393 AF).
[29] - Transfer of Tehachapi-Cummings CWD SWP water (3,001 AF) to BMWD=539 AF), LHWD (1,038 AF), BWSD (614 AF) and WRMWSD (810 AF).
[30] - Transfer of Western Hills WD unused supply (1,644 AF) to: BMWD=295 AF, LHWD=333 AF, BWSD=336 AF, WRMWSD=443 AF and DRWD=237 AF.
[31] - Transfer payback water (4,188 AF) from KTWD to RRBWSD.
[32] - Transfer of West Kern WD (Kern-Tulare WD) SWP water (263 AF) to ID4 in San Luis Reservoir.

2014
Kern County Water Agency
SWP Supply and Delivery Summary

(Quantities in Acre-Feet)

Supplies and Deliveries through December 31, 2014

Entity:	(1) 2014 State Water Project Supply: Current 2014 Ent Allocation (5% Firm)	(2) 2013 Carryover Into 2014	(3) Multi-Year Pool	(4) Yuba Water Purchase (20% loss)	(5) Dry Year Transfer Purchase (20% loss)	(6) Total SWP Supply (Cols 1...6)	(7) Turn-in Water Program Groundwater & Other Supplies: KCWA	(8) Other	(9) Total	(10) Agency Approved Transfers: Misc. Trans / Exch Out of Kern County	(11) Misc. Transfers Into Kern County	(12) Misc. Transfers Into Kern County	(13) Misc. Transfers, Exchanges, Other	(14) Misc. Transfers, Exchanges, Other	(15) Misc. Transfers, Exchanges, Other	(16) Misc. Transfers, Exchanges, Other	(17) Misc. Transfers, Exchanges, Other	(18) Pastoria Energy Facility [11]	(19) Misc. Transfers, Exchanges, Other	(20) Misc. Transfers, Exchanges, Other	(21) Misc. Transfers, Exchanges, Other	(22) Agency Lease Water	(23) Misc. Transfers, Exchanges, Other	(24) Total Water Supply Available (Col 7+8 +11..23)	(25) Year to Date Deliveries	(26) Balance to be Delivered
Berrenda Mesa	4,630	13,841	69	4,724	16,597	39,861	49,839		49,839	(72) [4]	24 [23]	154 [38]		250 [18]	5,000 [27]	1,607 [9]	250 [13]		2,067 [14]	134 [15]		38		99,152	78,572	20,580
Lost Hills	5,956	22,370	89	6,076	21,348	55,839	36,224		36,224	(138) [4]	7,013 [23]	171 [38]		2,000 [5]	500 [17]	1,693 [9]	1,100 [13]		1,700 [14]	174 [15]	(1,100) [28]	49	2,900 [37]	108,125	79,403	28,722
Belridge	6,075	21,601	90	6,198	21,779	55,743	65,363		65,363	(82) [4]	28 [23]	219 [38]			990 [8]	3,061 [9]	10,856 [13]		2,295 [14]	176 [15]		50	6,390 [37]	145,089	114,555	30,534
Semitropic	7,750	(740)		1,230	1,200	9,440	21,939	91,302	113,241	(107,652) [1]		11 [38]	(2,000) [34]	(2,000) [16]	(5,000) [27]			(224)	(1,840) [14]			64		4,040	5,748	(1,708)
Cawelo	1,910	4,062	28		2,784	8,784	1,251		1,251	(8,388) [29]			3,679		(5,042) [32]		1,114		(660) [32]	56 [15]	(143) [30]	16		667	0	667
Imp Dist #4	4,147	(7,225)	62	470		(2,546)	63,424		63,424				(13,240)	(698) [24]		(5,000) [9]	(1,114)	(324)	(462) [36]	(826) [15]		34		39,248	36,295	2,953
Rosedale-Rio Bravo	1,495	5,954	22	169		7,640	39,524		39,524	(18,408) [3]			(3,679)	(2,000) [6]	(990) [8]	(7,547) [19]	(7,775) [20]		462 [36]			12		7,239	0	7,239
Buena Vista	1,065	12,206				13,271	3,333	1,920	5,253	(2,750) [7]	3,800 [23]			929 [32]	5,042 [32]		(12,206) [13]		660 [32]	1,250 [32]		9	(15,000) [37]	258	0	258
Kern Delta	1,275	(350)				925		12,851	12,851	(26,091) [2]			13,240	(929) [32]			555 [22]					10		561	555	6
Henry Miller	1,775	1,723				3,498			0			6 [38]				555 [21]	(555) [22]					14		3,518	2,246	1,272
West Kern	1,575	2,256		179		4,010	3,187	8,877	12,064	(2,000) [7]		9 [38]	(2,000) [35]	2,000 [6]	(2,370) [12]	(555) [21]				(1,250) [32]		13		9,921	5,225	4,696
Wheeler Ridge	9,855	28,756	146	1,117	10,080	49,954	64,649	23,633	88,282	(108) [4]	1,061 [23,26]	212 [38]	2,000 [34]	2,000 [16]	(500) [17]	2,946 [9]	2,700 [25]	2,555	1,955 [14]	286 [15]	143 [30]	81	5,710 [37]	159,277	124,347	34,930
Tehachapi - AG	215	0				215			0															215	206	9
Tehachapi - M&I	750	1,022	14			1,786			0			10 [38]			2,370 [12]							8		4,174	4,150	24
Tejon Castac - M&I	100	1,193				1,293	3,012		3,012			1 [38]		(250) [18]		693 [9]	(2,700) [25]	(66)				2		1,985	256	1,729
Tejon Castac - AG	164	2,557				2,721			0					(2,000) [5]										721	0	721
Westside Mutual						0	1,617		1,617									(1,617)						0	0	0
Arvin-Edison WSD						0	526	34,507	35,033	(34,507) [1]						7,547 [19]					1,100 [28]			9,173	16,706	(7,533)
Kern-Tulare WD						0	8,852		8,852				2,000 [35]						(6,177) [14]					4,675	4,036	639
Dudley Ridge WD						0	17,113		17,113	3,554 [29]								(324)						20,343	20,343	0
Delano-Earlimart ID						0			0								7,775 [20]							7,775	4,378	3,397
MWD						0			0	99,237 [1,2,3]														99,237	102,366	(3,129)
Coachella VWD						0			0	5,000 [3]														5,000	5,207	(207)
Alameda County WD						0			0	14,740 [1]														14,740	14,740	0
Santa Clara VWD						0			0	34,387 [1]														34,387	34,387	0
Zone 7						0			0	14,769 [1,29]														14,769	14,769	0
Castaic Lake WA						0			0	20,775 [1,7]														20,775	20,775	0
Antelope Valley-East Kern						0			0	2,127 [3]														2,127	2,127	0
San Bernardino VMWD						0			0	5,000 [1]														5,000	5,000	0
North Kern WSD						0			0					698 [24]										698	698	0
Carpinteria VWD						0			0	207														207	0	207
Palmdale WD						0			0															0	0	0
						0			0															0	0	0
KCWA	400	4,150				4,550	3,749		3,749	(209) [4]						(5,000) [9]						(400)		2,690	0	2,690
KCWA / Nickel						0			0															0	0	0
Western Hills WD						0			0	609 [4]														609	609	0
Total	49,137	113,376	520	20,163	73,788	256,984	383,602	173,090	556,692	0	11,926	793	0	0	0	0	0	0	0	0	0	0	0	826,395	697,699	128,696

[1] - Transfer from Semitropic WSD to Metropolitan WD (43,639 AF), Santa Clara Valley WD (34,387 AF), Alameda CWD (14,740 AF), Zone 7 (9,935 AF) and Castaic Lake WA (4,951 AF); transfer from AEWSD to MWD water (26,442 AF); transfer from KDWD to MWD (21,046 AF) and KDWD to SBVMWD (5,000 AF).
[2] - Exchange of Improvement District No. 4 SWP/banked water (13,240 AF) to Kern Delta WD (MWD) for a like amount of Kern River water.
[3] - Transfer of RRBWSD banked GW (8,250 AF) and (2,824 AF) to Castaic Lake WA, banked GW (5,000 AF) to Coachella Valley WD under their long-term transfer program; transfer of Irvine Ranch WD banked water (207 AF) to Carpinteria VWD; and transfer of Irvine Ranch WD banked water (2,127 AF) to Antelope Valley-East Kern WD.
[4] - Transfer of previously banked water (400 AF) to Western Hills WD: BMWD=72 AF, LHWD=138 AF, BWSD=82 AF, WRM=108 AF and KCWA obligation to WHWD=24 AF.
[5] - Transfer of Tejon-Castac WD 2013 SWP carryover water (2,000 AF) to Lost Hills WD.
[6] - Exchange of Rosedale-Rio Bravo WSD 2013 SWP carryover water (2,000 AF) to West Kern WD for a like amount of banked groundwater.
[7] - Transfer of West Kern WD SWP water (2,000 AF) to Castaic Lake WA as payback for previous 2:1 exchange and transfer of BVWSD water (2,750 AF) to Castaic Lake WA.
[8] - Transfer of Irvine Ranch WD (Diamond Farms) banked water (990 AF) to Belridge WSD (Paramount Farms).
[9] - Transfer of DMB/TCWD Nickel water (6,000 AF) to: BMWD=950 AF, LHWD=350 AF, BWSD=2,200 AF, WRMWSD=2,500 AF; transfer of Newhall/Nickel water (1,607 AF) to: BMWD=447 AF, LHWD=574 Af, BWSD=586 af; transfer of CV Communities/Nickel water (1,700 AF) to: BMWD=210 AF, LHWD=269 AF, BWSD=275 AF, WRMWSD=446 AF.
[10] - Transfer of banked water (833 AF) from Semitropic WSD to Wheeler Ridge-Maricopa WSD.
[11] - Transfer of water (3,364 AF) to Pastoria from: SWSD=224 AF, ID4=324 AF, WRMWSD=809 AF, TCWD=66 AF, WMWC=1,617 AF, DRWD=324 AF.
[12] - Transfer of previously banked water (2,370 AF) in West Kern WD to Tehachapi-Cummings CWD
[13] - Transfer of Kern River water (12,206 AF) from Buena Vista WSD to BMWD=250 AF, LHWD=1,100 AF, BWSD=10,856 AF.
[14] - Transfer of North Kern WSD banked CVP water (6,177 AF) via exchange with Kern-Tulare WD to: BMWD=1,895 AF, LHWD=1,367 AF, BWSD=2,099 AF, WRMWSD=816 AF and transfer of NKWSD water (1,840 AF) via Semitropic pump-in to: BMWD=172 AF), LHWD (333 AF), BWSD (196 AF) and WRMWSD (1,139 AF).
[15] - Transfer of ID4 banked water (961 AF) to BMWD=134 AF, LHWD=174 AF, BWSD=176 AF, CWD=78 AF and WRMWSD=399 AF via exchange for Rio Bravo well water.
[16] - Transfer of Wheeler Ridge-Maricopa WSD SWP water (6,496 AF) to Semitropic WSD for a like amount of recovered GW to help SWSD return Poso Creek banked water to WWD. However, 4,496 AF was retained in Semitropic and 2,000 AF was transfered back to WRMWSD for Poso Creek. Note: the 4,496 AF was carried over into 2015 by SWSD and 1,341 AF was delivered in March 2015. As of November 2015, the balance of 3,155 AF has not been delivered to WWD on behalf of Poso Creek.
[17] - Transfer of Wheeler Ridge-Maricopa WSD banked SWP water (500 AF) to Lost Hills WD on behalf of common landowner CA Heavy Oil, Inc.
[18] - Transfer of Tejon-Castac WD Nickel water (250 AF) to Berrenda Mesa WD.
[19] - Transfer of RRBWSD JURP well water (7,547 AF) to AEWSD.
[20] - Transfer of RRBWSD JURP well water (7,775 AF) to DEID.
[21] - Exchange of recovered SWP water (555/2,000 AF) from West Kern WD to Henry Miller WD for a future 3:1 payback.
[22] - Transfer of Henry Miller WD SWP water (2,000 AF) to Kern Delta WD on behalf of common landowner, J.G. Boswell.
[23] - Transfer of Dudley Ridge WD SWP water (986 AF) to Lost Hills WD and transfer of DRWD water (3,800 AF) to BVWSD on behalf of common landowner, Sandridge Partners, transfer of DRWD SWP water (6,000 AF) on behalf of Paramount Farming and transfer of Butte WD water to BMWD (24 AF), LHWD (27 AF), BWSD (28 AF) and WRMWSD (37 AF).
[24] - Transfer of ID4 banked recovered water (698 AF) for a like amount of North Kern WSD Kern River water.
[25] - Transfer of banked SWP water (2,700 AF) from Tejon-Castac WD to Wheeler Ridge-Maricopa WSD on behalf of common landowner Tejon Ranch.
[26] - Transfer of Friant-Kern recirculation water (1,024 AF) to Wheeler Ridge-Maricopa WSD.
[27] - Transfer of previously banked SWP water (5,000 AF) to Berrenda Mesa WD (WDS/Homer) from Semitropic WSD.
[28] - Transfer of banked SWP water (637 AF) from Lost Hills WD to Arvin Edison WSD on behalf of common landowner Sandridge.
[29] - Transfer of previously banked water (3,554 AF) from Cawelo WD to Dudley Ridge WD and transfer of previously banked water (4,834 AF) to Zone 7.
[30] - Transfer of Cawelo WD water (143 AF) to Wheeler Ridge-Maricopa WSD as an operational exchange for Rio Bravo well water.
[31] - Transfer of recovered water (1,227 AF) from the Enns wells in RRBWSD to Buena Vista WSD.
[32] - Exchange of SWP water to Buena Vista WSD from Kern Delta WD (929 AF), Cawelo WD (5,042 AF), West Kern WD (1,250 AF) and Cawelo WD (660 AF).
[33] - Operational exchange of Cawelo recovered water (3,679 AF) to the Friant-Kern canal on behalf of Rosedale-Rio Bravo WSD (DEID) for RRB/KTWD SWP water.
[34] - Transfer of Semitropic WSD recovered water (2,000 AF) to Wheeler Ridge-Maricopa WSD on behalf of common landowner, Maricopa Orchards.
[35] - Transfer of previoulsy banked water (2,000 AF) in West Kern WD banking project to Kern-Tulare WD.
[36] - Exchange of ID4 SWP water (462 AF) to Rosedale-Rio Bravo WSD for a like amount of groundwater in the JURP.
[37] - Transfer of water (15,000 AF) from Buena Vista WSD to LHWD=2,900 AF, BWSD=6,390 AF and WRMWSD=5,710 AF.
[38] - Transfer of Westlands WD Aqueduct pump-in mitigation water to BMWD (154 AF), LHWD (171 AF), BWSD (219 AF), SWSD (11 AF), , HMWD (6 AF), WKWD (9 AF), WRMWSD (212 AF), TCCWD (10 AF) and TCWD (1 AF).

2015
Kern County Water Agency
SWP Supply and Delivery Summary

(Quantities in Acre-Feet)

Supplies and Deliveries through December 31, 2015

Entity:	(1) 2015 State Water Project Supply: Current 2015 Ent Allocation (20% Firm)	(2) 2014 Carryover Into 2015	(3) Multi-Year Pool	(4) Yuba Water Purchase (20% loss)	(5) Dry Year Transfer Purchase (20% loss)	(6) Total SWP Supply (Cols 1…6)	(7) Turn-in Water Program Groundwater & Other Supplies: KCWA	(8) Other	(9) Total	(10) Agency Approved Transfers: Misc. Trans / Exch Out of Kern County	(11) Misc. Transfers Into Kern County	(12) Misc. Transfers, Exchanges, Other	(13) Misc. Transfers, Exchanges, Other	(14) Misc. Transfers, Exchanges, Other	(15) Misc. Transfers, Exchanges, Other	(16) Misc. Transfers, Exchanges, Other	(17) Pastoria Energy Facility [1.1]	(18) Misc. Transfers, Exchanges, Other	(19) Misc. Transfers, Exchanges, Other	(20) Misc. Transfers, Exchanges, Other	(21) Agency Lease Water	(22) Misc. Transfers, Exchanges, Other	(23) Total Water Supply Available (Col 7+8 +11..22)	(24) Year to Date Deliveries	(25) Balance to be Delivered
Berrenda Mesa	18,520	20,580	80	342	650	40,172	41,936		41,936		8,926 [7]	1,793 [3]	5,400 [4]		818 [12]	282 [17]		1,251 [21]		188 [23]	152	158 [26]	101,076	81,279	19,797
Lost Hills	23,822	28,722	103	440	837	53,924	24,017		24,017		5,918 [7]	2,498 [3]	1,800 [6]	500 [8]	(1,717) [15]	210 [24]		1,808 [21]	1,000 [22]	363 [23]	196	306 [26]	90,823	80,279	10,544
Belridge	24,302	30,534	106	449	854	56,245	53,147		53,147		3,171 [7]	2,656 [3]		1,000 [8]	9,100 [9]	5,000 [18]		2,641 [21]		214 [23]	199	180 [26]	133,553	115,203	18,350
Semitropic	31,000	(1,708)		573	1,089	30,954	16,112	109,580	125,692	(137,534) [1]			(4,900) [4]			(282) [17]	(209)		1,000 [22]	(1,147) [23]	254		13,828	9,658	4,170
Cawelo	7,640	667	33		268	8,608	5,029		5,029	(7,029) [1]		222 [3]	500 [14]		617 [15]						63		8,010	6,551	1,459
Imp Dist #4	16,589	2,953	72	306		19,920	45,830		45,830		1,500 [20]	(5,000) [3]	(9,000) [5]		(3,693) [13]	(210) [24]	(299)			(1,394) [23]	136		47,790	34,416	13,374
Rosedale-Rio Bravo	5,980	988	26	110		7,104	31,375		31,375	(21,158) [2]			(5,705) [2]	(5,911) [10]	(4,293) [16]						49		1,461	11	1,450
Buena Vista	4,260	258	19	79		4,616	508		508	(2,750) [2]		1,000 [5]	(1,800) [6]	5,100 [11]	4,293 [16]			(5,700) [21]	(2,000) [22]		35		3,302	502	2,800
Kern Delta	5,100	6	22	94		5,222		28,120	28,120	(31,977) [1]				(5,100) [11]	3,693 [13]						42		0	0	0
Henry Miller	7,100	1,272	31	131		8,534			0			(1,000) [5]			(7,100) [9]						58		492	481	11
West Kern	6,300	4,696	27	116		11,139	2,125	2,103	4,228				(2,000) [5]			(5,000) [18]					52		8,419	4,471	3,948
Wheeler Ridge	39,418	34,930	171	728	1,385	76,632	53,523	27,222	80,745	(1,000) [5]	1,307 [7,12]	1,147 [3]	(500) [4]	(975) [6,8]	(818) [12]		2,368			1,776 [23]	323	238 [26]	161,243	115,536	45,707
Tehachapi - AG	860	9				869			0														869	869	0
Tehachapi - M&I	3,000	24	17			3,041			0					1,200 [6]							32		4,273	4,291	(18)
Tejon Castac - M&I	400	1,729				2,129	2,515		2,515			139 [3]	(500) [14]	(1,725) [8]	(1,729) [9]		(61)				9		777	276	501
Tejon Castac - AG	655	721				1,376			0						(271) [9]								1,105	0	1,105
Westside Mutual						0	1,500		1,500								(1,500)						0	0	0
Arvin-Edison WSD						0		42,080	42,080	(42,080) [1]		1,545 [3]		5,911 [10]	1,100 [15]								8,556	9,875	(1,319)
Kern-Tulare WD						0			0	(15,705) [5]			16,705 [5]										1,000	1,000	0
Dudley Ridge WD						0	14,618		14,618	2,000 [1]							(299)						16,319	16,460	(141)
Delano-Earlimart ID						0			0				0 [5]										0	0	0
MWD						0			0	141,051 [1,2]													141,051	140,190	861
Coachella VWD						0			0														0	0	0
Alameda County WD						0			0	16,212 [1]													16,212	16,212	0
Santa Clara VWD						0			0	45,485 [1]													45,485	45,485	0
Zone 7						0			0	17,814 [1]													17,814	17,814	0
Castaic Lake WA						0			0	13,998 [2]													13,998	13,993	5
Antelope Valley-East Kern						0			0														0	0	0
San Bernardino VMWD						0			0														0	0	0
North Kern WSD						0			0														0	0	0
OCID, HVWD TVWD						0			0														0	0	0
San Joaquin Ex. Cont.						0			0	16,705 [5]													16,705	16,705	0
Westlands WD						0			0	5,968 [1]													5,968	5,968	0
KCWA	1,600	2,690				4,290	4,618		4,618	(718)		(5,000) [3]									(1,600)	(882) [26]	708	0	708
KCWA / Nickel						0			0														0	0	0
Western Hills WD						0			0	718													718	718	0
Total	196,546	129,071	707	3,368	5,083	334,775	296,853	209,105	505,958	0	20,822	0	0	0	0	0	0	0	0	0	0	0	861,555	738,243	123,312
					5,083																				

[1] - Transfer from Semitropic WSD to Metropolitan WD (34,936 AF), Santa Clara Valley WD (29,878 AF), Alameda CWD (12,804 AF), Zone 7 (8,276 AF), Westlands/Poso Creek (1,341 AF), and Westlands/Harris Ranch (4,627 AF); transfer from AEWSD to MWD (23,535 AF); transfer from KDWD to MWD (32,898 AF); transfer from Cawelo WD to Zone 7 (4,871 AF); and transfer from Cawelo WD to Dudley Ridge WD (2,000 AF).
[2] - Transfer from Buena Vista WSD (2,750 AF), Rosedale-Rio Bravo WSD (8,250 AF) to Castaic Lake WA pursuant to their long-term transfer program; transfer from Rosedale-Rio Bravo WSD (2,998 AF) to Castaic Lake WA pursuant to their banking program; and transfer from Rosedale-Rio Bravo WSD to Carpinteria VWD/MWD (410 AF) and Coachella/MWD (9,500 AF).
[3] - Transfer of Nickel water from Newhall to: BMWD (262 AF), LHWD (337 AF), BWSD (343 AF) CWD (108 AF) & WRMWSD (557 AF); Transfer of Nickel water from CV Communities to: BMWD (277 AF), LHWD (356 AF), BWSD (363 AF), CWD (114 AF) & WRMWSD (590 AF); and transfer of Nickel water from TCWD to: BMWD (1,254 AF), LHWD (1805 AF), BWSD (1,950 AF), and delivered by exchange with Arvin-Edison WSD: TCWD to OCID, Tri-Valley & Hills Valley (1,545 AF).
[4] - Transfer of Wheeler Ridge-Maricopa WSD 2015 SWP water (500 AF) to Berrenda Mesa WD on behalf of landowner Maricopa Orchards and transfer of previously banked Homer water 4,900 AF) from Semitropic WSD to Berrenda Mesa WD.
[5] - Transfer of Henry Miller WD SWP carryover water (1,000 AF) to Buena Vista WSD as payback for Kern River water exchanged in 2014; exchange of West Kern WD 2015 SWP water (2,000 AF), ID4 SWP water (9,000 AF); DEID/RRB water (5,705 AF) to Kern-Tulare WD for banked CVP water (16,705 AF) delivered to the San Joaquin River exchange contractors in in SLR; and transfer of Wheeler Ridge-Maricopa WSD banked CVP water (1,000 AF) to Kern-Tulare WD.
[6] - Transfer of Wheeler Ridge-Maricopa WSD 2015 SWP water (1,200 AF) to Tehachapi-Cummings CWD for 1,500 AF of banked water in the KWB and transfer of Buena Vista WSD SWP water (1,800 AF) to Lost Hills WD on behalf of landowner Sandridge.
[7] - Transfer of Dudley Ridge SWP carryover water to : BMWD (1,100 AF), LHWD (5,550 AF), and BWSD (2,800 AF) on behalf of landowner Sandridge; transfer of SWP carryover water (7,500 AF) to Berrenda Mesa WD on behalf of common landowner Wonderful Orchards; and transfer of Butte WD water (1,554 AF) to BMWD (326 AF), LHWD (368 AF), BWSD (371 AF) and WRMWSD (489 AF).
[8] - Transfer of 2015 KWB recovered water from Tejon-Castac WD to Lost Hills WD (500 AF), Belridge WSD (1,000 AF) and WRMWSD (225 AF).
[9] - Transfer of previously banked SWP water (2,000 AF) from Tejon-Castac WD to Belridge WSD and transfer of SWP water (7,100 AF) from Henry Miller WD to Belridge WSD .
[10] - Transfer of Rosedale-Rio Bravo WSD JURP water (5,911 AF) to Arvin-Edison WSD.
[11] - Transfer of Kern Delta SWP water (5,100 AF) to Buena Vista for a like amount of Kern River water.
[12] - Transfer of Antelope Valley-East Kern WA SWP water (818 AF) to Wheeler Ridge-Maricopa WSD on behalf of common landowner, Tejon Ranch and transfer from Wheeler Ridge-Maricopa WSD SWP water (818 AF) to Berrenda Mesa WD.
[13] - Exchange of ID4 SWP water (3,693 AF) to Kern Delta WD for a like amount of Kern River water.
[14] - Transfer of Tejon-Castac WD SWP water (500 AF) to Cawelo WD.
[15] - Transfer of WMWC KWB GW recovery water (1,100 AF) to Arvin-Edison WSD and to Cawelo WD (617 AF). 1,554
[16] - Irvine Ranch/Strand previuosly banked water (4,293 AF) to Buena Vista WSD
[17] - Transfer of Semitropic WSD banked water (282 AF) to BMWD on behalf of Maricopa orchards.
[18] - Transfer of SWP water (5,000 AF) from West Kern WD to Belridge WSD.
[19] - Transfer of Tejon-Castac recovered water (30 AF) to Wheeler Ridge-Maricopa WSD on behalf of common landowner Tejon Ranch.
[20] - Exchange of ID4 banked water (1,500 AF) to Kern-Tulare WD for a like amount of Kern-Tulare WD CVP water off of the Friant-Kern.
[21] - Transfer of Buena Vista water (5,100 + 600 AF) to Berrenda Mesa WD (1,251 AF), Lost Hills WD (1,808 AF) and Belridge WSD (2,641 AF).
[22] - Transfer of Buena Vista WSD water (2,000 AF) to Lost Hills WD (1,000 AF) and Semitropic WSD (1,000 AF) on behalf of common landowner Sandridge Partners.
[23] - Transfer of North Kern WSD banked CVP floodwater to BMWD (188 AF), LHWD (363 AF), BWSD (214 AF) and WRMWSD (1,776 AF) via operational exchange with ID4 (1,394 AF) and via SWSD turn-in (1,147 AF).
[24] - Exchange of ID4 SWP water (210 AF) to Lost Hills WD for a like amount of Delano-Earlimart ID water.
[25] - Exchange of ID4 SWP Tabel A water (210 AF) to Lost Hills WD for a like amont of LHWD/DEID water off the Friant-Kern.
[26] - Transfer of Western Hills WD unused supplies (882 AF) to BMWD=158 AF, LHWD=179 AF, BWSD=180 AF, WRMWSD=238 AF, and DRWD 127 AF pursuant to their long-term bnaking agreement.

2016
Kern County Water Agency
SWP Supply and Delivery Summary

(Quantities in Acre-Feet)

Supplies and Deliveries through December 31, 2016

Entity:	(1) 2016 State Water Project Supply: Current 2016 Ent Allocation (60% Firm)	(2) 2015 Carryover Into 2016	(3) DWR Multi-Year Pool	(4)	(5)	(6) Total SWP Supply (Cols 1…6)	(7) [18] Tum-in Water Program Groundwater & Other Supplies: KCWA	(8) Other	(9) Total	(10) Agency Approved Transfers: Misc. Trans / Exch Out of Kern County	(11) Misc. Transfers Into Kern County	(12) Misc. Transfers, Exchanges, Other	(13) Misc. Transfers, Exchanges, Other	(14) Misc. Transfers, Exchanges, Other	(15) Misc. Transfers, Exchanges, Other	(16) Misc. Transfers, Exchanges, Other	(17) Pastoria Energy Facility [1.1]	(18) Misc. Transfers, Exchanges, Other	(19) Misc. Transfers, Exchanges, Other	(20) Misc. Transfers, Exchanges, Other	(21) Agency Lease Water	(22) Misc. Transfers, Exchanges, Other	(23) Total Water Supply Available (Col 6+9+10..22)	(24) Year to Date Deliveries	(25) Balance to be Delivered
Berrenda Mesa	55,560	19,797	402			75,759	24,722		24,722	(1,809) [22]	3,165 [7,18]		1,969 [6]		327 [11]	578 [12]		19,135 [17]	(4,878) [18]	1,867 [19]	456	741 [24]	122,032	89,906	32,126
Lost Hills	71,466	10,544	517			82,527	13,763		13,763	(1,809) [22]	6,792 [7,18]		3,790 [6]	2,451 [8]	629 [11]	2,443 [12]			(6,275) [18]	1,681 [19]	587	836 [24]	107,415	82,958	24,457
Belridge	72,905	18,350	527			91,782	20,428		20,428	(2,413) [22]	5,308 [7,18]	1,000 [5]	2,241 [6]	4,000 [8]	372 [11]	5,807 [12]		500 [17]	(6,401) [18]	1,288 [19]	598	844 [24]	125,354	103,727	21,627
Semitropic	93,000	4,170				97,170	4,658	14,512	19,170	(25,641) [1]	[10]						(140)		(8,165) [18]		763		83,157	112,917	(29,760)
Cawelo	22,920	1,459	166			24,545			0		7,000 [14]		(29,320) [15]			500 [12]					188		2,913	0	2,913
Imp Dist #4	49,767	11,904	360			62,031	14,117		14,117			(31,716) [3]		(11,451) [8]	(1,818) [11]	(5,000) [12]	(205)	(3,998) [25]	(4,370) [18]	(238) [19]	408	(763) [27]	16,997	10,186	6,811
Rosedale-Rio Bravo	17,940	267	130			18,337	12,465		12,465	(19,690) [2]	608 [23]			0 [21]	0 [20]	(608) [23]			(1,575) [18]	(5,000) [19]	147	(37) [27]	4,647	4,119	528
Buena Vista	12,780	2,800	92			15,672	2,118		2,118	(2,750) [2]			44,620 [15]	8,500 [16]	(5,000) [20]						105		63,265	51,735	11,530
Kern Delta	15,300	0	110			15,410		14,215	14,215	(19,843) [1]		31,716 [3]	(15,300) [15]								126		26,324	26,214	110
Henry Miller	21,300	11	154			21,465			0			(1,665) [4]						(19,635) [17]			175		340	304	36
West Kern	18,900	3,948	136			22,984	3,521	2,172	5,693			1,665 [4]	(8,000) [6]	(8,500) [16]	5,000 [20]	608 [23]			(1,659) [18]		155		17,946	15,330	2,616
Wheeler Ridge	118,253	45,707	855			164,815	19,283	16,864	36,147		2,514 [18]		20 [13]	0 [21]	490 [11]	632 [12]	1,614		(10,382) [18]	402 [19]	971		197,223	136,640	60,583
Tehachapi - AG	2,580	0				2,580			0												95		2,675	2,675	0
Tehachapi - M&I	9,000	(18)	84			9,066	1,109		1,109										(1,017) [18]				9,158	4,882	4,276
Tejon Castac - M&I	1,200	501				1,701	301		301				(20) [13]			(557) [12]	(44)		(278) [18]		26		1,129	298	831
Tejon Castac - AG	1,967	1,105				3,072			0			(1,000) [5]											2,072	0	2,072
Westside Mutual						0	1,020		1,020								(1,020)						0	0	0
Arvin-Edison WSD						0	26,692	15,604	42,296	(33,365) [1]	5,744 [9]											[27]	14,675	15,414	(739)
Kern-Tulare WD						0	0		0	(5,000) [8]				5,000 [8]				3,998 [25]					3,998	0	3,998
Dudley Ridge WD						0	140		140		205 [7]						(205)						140	140	0
Delano-Earlimart ID						0			0														0	0	0
MWD						0			0	65,648 [1]													65,648	65,648	0
Coachella VWD						0			0	16,500 [2]													16,500	16,500	0
Alameda County WD						0			0														0	0	0
Santa Clara VWD						0			0	1,122 [1]													1,122	1,122	0
Zone 7						0			0	324 [1]													324	324	0
Castaic Lake WA						0			0	5,940 [2]													5,940	5,940	0
Antelope Valley-East Kern						0			0														0	0	0
Central Coast WA						0			0	6,031 [22]													6,031	6,031	0
USBR						0			0										45,000 [18]				45,000	45,000	0
OCID, HVWD TVWD						0			0														0	0	0
San Joaquin Ex. Cont.						0			0														0	0	0
Westlands WD						0			0	16,755 [1,8]													16,755	16,755	0
KCWA	4,800	708				5,508	11,802		11,802	(677)						(4,403) [12]					(4,800)	(2,421)	5,009	0	5,009
KCWA / Nickel						0			0														0	0	0
Western Hills WD						0			0	677													677	677	0
Total	589,638	121,253	3,533	0	0	714,424	156,139	63,367	219,506	0	31,336	0	0	0	0	0	0	0	0	0	0	(800)	964,466	815,442	149,024

[1] - Transfer from Semitropic WSD to Metropolitan WD (10,646 AF), Santa Clara Valley WD (1,122 AF), Alameda CWD (0 AF), Zone 7 (324 AF), Westlands WD/Poso Creek (4,202 AF), Westlands WD (7,553 AF); and transfer from AEWSD to MWD (21,019 AF); transfer from KDWD to MWD (19,843 AF).
[2] - Transfer from Buena Vista WSD (2,750 AF) and Rosedale-Rio Bravo WSD (3,190 AF) to Castaic Lake WA pursuant to their long-term transfer program; transfer SWP water (16,500 AF) from Rosedale-Rio Bravo WSD to Coachella Valley WD.
[3] - Exchange of Kern Delta WD Kern River water (31,716 AF) for a like amount of ID4 SWP water.
[4] - Transfer of SWP water (1,665 AF) from Henry Miller WD to West Kern WD as payback for a previous 3:1 exchange.
[5] - Transfer of SWP carrover water (1,000 AF) from Tejon-Castac WD to Belridge WSD on behalf of common landowner, Wonderful Orchards.
[6] - Transfer of SWP water (8,000 AF) from West Kern WD to Berrenda Mesa WD (1,969 AF), Lost Hills WD (3,790 AF) and Belridge WSD (2,241 AF).
[7] - Transfer of Dudley Ridge SWP water to: LHWD (4,900 AF), and BWSD (3,400 AF) on behalf of common landowner, Sandridge Partners; and transfer of DRWD water (205 AF) for Pastoria.
[8] - Transfer of ID4 SWP water (11,451 AF) for a like amount of Kern-Tulare JURP water and transfer of acquired Kern-Tulare SWP water (4,000 AF) to Belridge WSD, (5,000) AF to Westlands WD and (2,451 AF) to Lost Hills WD.
[9] - Transfer of MWD SWP water (5,744 AF) to Arvin-Edison WSD for storage.
[10] - Transfer of Santa Clara WD water (9,634 AF), Alameda County WD water (18,272 AF), Zone 7 WA water (5,000 AF), Dudley Ridge WD (1,000 AF) on behalf of Sandridge Partners and transfer of Kern-Tulare WD CVP water (2,055 AF) to Semitropic WSD.
[11] - Transfer of North Kern WSD banked CVP floodwater (1,818 AF) to BMWD (327 AF), LHWD (629 AF), BWSD (372 AF) and WRMWSD (490 AF) via operational exchange with ID4.
[12] - Transfer of Nickel (KCWA/ID4) water from Newhall to: BMWD (281 AF), LHWD (361 AF), BWSD (368 AF), & WRMWSD (597 AF); Transfer of Nickel water from CV Communities to: BMWD (297 AF), LHWD (382 AF), BWSD (389 AF), & WRMWSD (632 AF); and transfer of Nickel water from TCWD to: LHWD (1,700 AF), BWSD (5,050 AF) & Cawelo WD (500 AF).
[13] - Transfer of Tejon-Castac WD SWP water (20 AF) to Wheeler Ridge-Maricopa WSD on behalf of common landowner, Tejon Ranch.
[14] - Transfer of Zone 7 WA water (7,000 AF) to Cawelo WD for storage.
[15] - Exchange of Cawelo SWP water (29,320 AF) and Kern Delta WD SWP water (15,300 AF) to Buena Vista WSD for a like amount of Kern River water.
[16] - Exchange of West Kern WD SWP water (8,500 AF) to Bunea Vista WSD for a like amount of banked Kern River water.
[17] - Transfer of Henry Miller WD SWP water to Berrenda Mesa WD (19,135 AF) and Belridge WSD (500 AF).
[18] - Exchange of Agency SWP Table A water (45,000 AF) with the USBR for 49,500 of CVP Friant-Kern water (before losses) [BMWD=5,366, LHWD=6,902, BWSD=7,041, SWSD=8,982, ID4=4,807, RRBWSD=1,732, WKWD=1,825, WRMWSD=11,420, TCCWD=1,119, TCWD=306] and Butte WD water (7,990 AF) to BMWD (1,676 AF), LHWD (1,892 AF), BWSD (1,908 AF), WRMWSD (2,514 AF) and landowner transfer of AVEK (WDS/Tule Fog) SWP water (1,489 AF) to BMWD.
[19] - Exchange of ID4 SWP water (238 AF) in exchange for Lost Hills Kern River (Carmel) water and an exchange (2:1) of Rosedale groundwater (5,000 AF) via SWP Table A exchange to BMWD (1,867 AF), LHWD (1,443 AF), BWSD (1,288 AF) and WRMWSD (402 AF).
[20] - Transfer of Buena Vista WSD SWP water (5,000 AF) to Rosedale-Rio Bravo WSD as payback to a prior exchange and transfer of Rosedale-Rio Bravo WSD acquired SWP Table A water (5,000 AF) to West Kern WD as payback of a prior 3:1 exchange.
[21] - Exchange of Wheeler Ridge-Maricopa WSD SWP water (1,941 AF) to Rosedale-Rio Bravo WSD in exchange for Friant-Kern (DEID) water.
[22] -Transfer of SWP water BMWD (1,809 AF), LHWD (1,809 AF), BWSD (2,413 AF) to Central Coast WA (Santa Barbara) as a return for a previous 2011 3:2 exchange.
[23] - Transfer of Delano-Earlimart Irrigation District Friant-Kern water (608 AF) to Rosedale-Rio Bravo WSD for banking and transfer of Rosedale-Rio Bravo WSD banked water (608 AF) to West Kern WD as payback for a prior 2004 exchange.
[24] - Transfer of Western Hills WD water (2,421 AF) to BMWD (739 AF), LHWD (836 AF) and BWSD (844 AF).
[25] - Exchange of ID4 SWP water (3,998/4218 AF) with Kern-Tulare WD for a like amount of groundwater.
[27] - True up losses (37 AF) associated with the RRBWSD/AEWSD JURP deliveries within the CVC; and operational exchange of ID4 SWP for Arvin-Edison JURP supplies.

DEPARTMENT OF WATER RESOURCES
WATER QUALITY POLICY AND IMPLEMENTATION PROCESS FOR ACCEPTANCE OF NON-PROJECT WATER INTO THE STATE WATER PROJECT

It is the Department of Water Resources (DWR) policy to assist with the conveyance of water to provide water supply, and to protect the State Water Project (SWP) water quality within the California Aqueduct. To facilitate this policy DWR provides the following implementation process for accepting non-project water into the SWP (Policy). For purposes of this document, SWP and California Aqueduct are interchangeable and the same.

POLICY PROVISIONS

DWR shall consider and evaluate all requests for Non-Project (NP) water input directly into the SWP conveyance facilities based upon the criteria established in this document. NP water shall be considered to be any water input into the SWP for conveyance by the SWP that is not directly diverted from the Sacramento-San Joaquin Delta or natural inflow into SWP reservoirs.

The proponent of any NP water input proposal shall demonstrate that the water is of consistent, predictable, and acceptable quality.

DWR will consult with State Water Project (Contractors), existing NP participants and the Department of Public Health (DPH) on drinking water quality issues relating to NP water as needed to assure the protection of SWP water quality.

Nothing in this document shall be construed as authorizing the objectives of Article 19 of the SWP water supply contracts or DPH drinking water maximum contaminant levels to be exceeded.

This Policy shall not constrain the ability of DWR to operate the SWP for its intended purposes and shall not adversely impact SWP water deliveries, operation or facilities.

EVALUATING NP WATER PROPOSALS

DWR shall use a two-tiered approach for evaluating NP water for input into the California Aqueduct.

NP Tier 1

Tier 1 NP pump-in proposals (PIP) shall exhibit water quality that is essentially the same, or better, than what occurs in the California Aqueduct. PIP's considered to be tier 1 shall be approved by DWR (see baseline water quality tables 1 through 4).

NP Tier 2

Tier 2 PIP's are those that exhibit water quality that is different and possibly worse than in the California Aqueduct and/or have the potential to cause adverse impacts to the Contractors. Tier 2 PIP's shall be referred to a NP Facilitation Group (FG), which would review the project and if needed make recommendations to DWR in consideration of the PIP.

SWC Facilitation Group

This advisory group consists of representatives from each Contractor that chooses to participate and DWR. The group shall review tier 2 PIP's based on the merits, impacts, mitigation, water quality monitoring, cost/benefits or other issues of each PIP and provide recommendations to DWR. Upon initial review of tier 2 PIP by DWR, it shall then be submitted to the FG for review. A consensus recommendation from the FG would be sought regarding approval of the PIP. DWR shall base its decision on the merits of the PIP, recommendations of the FG and the PIP's ability to provide overall benefits to the SWP and the State of California.

Blending Water Sources

Blending of multiple water sources prior to inflow into the SWP is acceptable and may be preferred depending upon water quality of the PIP. Blending of water in this manner may be used to quality a project as NP Tier 1.

Mixing (blending) within the California aqueduct can be considered but shall not be adjacent to municipal and industrial (M&I) delivery locations. PIP's that are coordinating water discharged to maintain or improve SWP water quality are an example of the mixing approach. The PIP shall demonstrate by model or an approach acceptable to DWR and the FG that the water is adequately mixed before reaching the first M&I customer. Generally NP PIP's that involve mixing with SWP water shall be considered NP Tier 2.

Baseline Water Quality

To aid in developing and evaluating PIP's both historical and current SWP water quality levels shall be considered. A representative baseline water quality summary is shown in Tables 1 through 4, using historical SWP water quality records at O'Neill Forebay.

NP IMPLEMENTATION PROCESS

Project Proposals

The NP project proponent requesting to introduce water into the SWP shall submit a detailed PIP to DWR. The proponent shall demonstrate that the NP water is of

consistent, predictable and reliable quality, and is responsible for preparing and complying with any and all contracts, environmental documents, permits or licenses that are necessary consistent with applicable laws, regulations, agreements, procedures, or policies.

Project Description

The proponent will submit to DWR a PIP describing the proposed program, identifying the water source(s), planned operation, characterizing the inflow water quality and any anticipated impacts to SWP water quality and/or operations. The PIP should be submitted at least one month prior to proposed start up to allow for DWR and FG review. The PIP shall include:

- Project proponent names, locations, addresses, and contact person(s).
- Maps identifying all sources of water, point of inflow to the SWP and ultimate fate of the introduced water.
- Terms and conditions of inflow, timing, rates and volumes of inflow, pumping, conveyance and storage requirements.
- Construction details of any facilities located adjacent to the SWP including valves, meters, and pump and piping size.
- All potential impacts and/or benefits to downstream SWP water contractors.
- Detailed water quality data for all sources of water and any blend of sources that will be introduced into the SWP.
- Identify anticipated water quality changes within the SWP.
- Identify other relevant environmental issues such as subsidence, ground water overdraft or, presents of endangered species.
- Provide performance measures and remedial actions that will be taken in the event projected SWP water quality levels are not met.
- Reference an existing contract or indicate that one is in process with DWR to conduct a PIP.

Water Quality Monitoring

In order to demonstrate that the water source(s) are of consistent, predictable, and acceptable quality the NP proponent shall monitor water quality. The proponent shall, for the duration of the program, regularly report on operations as they affect water quality, monitoring data and water quality changes. Both DPH title 22 and a short list of Constituents of Concern (COC) shall be monitored for based upon one of the following water quality monitoring options.

Constituents of Concern Current COC are Arsenic, Bromide, Chloride, Nitrate, Sulfate, Organic Carbon, and Total Dissolved Solids. These COC's may be changed as needed.

Water Quality Monitoring Options NP proponents shall select one of the testing options below and perform all water quality testing and provide analytical results in

a timely manner as described herein. Monitoring shall be conducted for initial well start-up, periodic well re-testing and on-going testing during operation. Well data should be no more than three years old. Title 22 results should be provided to DWR and the FG within two weeks of testing and COC results within one week of testing, unless other schedules are agreed upon by DWR and the FG.

Option 1 - Baseline tests for Individual Wells

Well Start-up: Title 22 tests are required for all wells participating in the program prior to start-up. An existing title 22 test that is no more than three years old may be used. A Title 22 test may be substituted for any well near a similar well with a Title 22 test of record.

Well Re-testing: Title 22 test for all wells participating every three years.

Ongoing Monitoring: COC tests are required for all discharge locations to the SWP at start up and quarterly thereafter for new programs and resumption of established programs. New programs or those with constituents that may potentially degrade the SWP shall conduct at least weekly COC sampling of all discharge locations until the proponent demonstrates that the NP water is of consistent, predictable and reliable quality. Once the nature of the discharge has been clearly established, the COC tests are required quarterly for each discharge point.

Option 2 - Baseline tests for Representative Wells

Well Start-up: COC tests of record are required for all wells participating in the program and Title 22 tests of record are required for representative wells comprising a subset of all wells. This would typically be a group of wells that are manifold together and discharge to one pipe. Representative wells shall be identified on a case-by-case basis to be representative of the manifold area, well proximity, and water levels.

Well Re-testing: Same as required in Option 1.

On-going Monitoring: COC tests are required for all discharge locations to the SWP at start up and monthly thereafter for the duration of the program and annually at each well. New programs or those with constituents that may potentially degrade the SWP shall conduct weekly COC sampling of all discharge locations until the proponent demonstrates that the NP water is of consistent, predictable and reliable quality.

Option 3 – Self Directed

A PIP may propose a water quality monitoring program for approval by DWR and the FG that is different from options 1 or 2. It must include COC and title 22 testing

that will fully characterize water pumped into the SWP and be at an interval to show a consistent, predictable and reliable quality.

Analytical Methods

Analytical laboratories used by project proponents shall be DPH certified by the Environmental Laboratory Accreditation Program (ELAP) and use EPA prescribed and ELAP accredited methods for drinking water analysis. Minimum Reporting Levels must be at least as low as the DPH required detection limits for purposes of reporting (DLR). The current DLRs are listed on the DPH website at Http://www.cdph.ca.gov/certlic/drinkingwater/Pages/MCLsandPHGs. DWR shall continue to use Bryte Chemical Laboratory as it's analytical and reference lab.

Flow Measurements

The project proponent shall maintain current, accurate records of water production rate and volume from each source, as well as, each point of discharge into the SWP. All flow measurements shall be submitted to regularly to DWR.

RECONSIDERATION

If an NP proponent disagrees with the FG or DWR decision or feels that there is an overriding benefit of the proposal, the proponent may request reconsideration from DWR on the basis of overriding public benefit or water supply deficiency. DWR shall consider these requests on a case-by-case basis.

ONGOING PROGRAM

Any NP Proponent who has successfully established a NP water inflow program (Including existing Kern Fan Banking Projects, Kern Water Bank, Pioneer and Berrenda Mesa Projects, Semitropic Water Storage District Wheeler Ridge Mariposa Water Storage District and Arvin Edison Water Storage District) may reinitiate the program by notifying DWR at least ten days before inflow is scheduled to begin and provide the following information:

- Updated water quality data and/or updated modeling that adequately reflects the quality of water to be introduced into the SWP.
- Turn-in location.
- Expected rate and duration of inflow. DWR shall notify the FG of this reinitiating of inflow.
- Water quality monitoring schedule that meets the objective of this policy.

FUTURE NP PROGRAMS

Future NP projects should be planned and designed considering the following items:

- Projects involving water quality exceeding primary drinking water standards shall show that the water shall be treated or blended before it enters the SWP to prevent water quality impacts.
- The project proponent of a Tier 2 proposal should clearly identify and establish that water inflow shall be managed and operated such that poor quality water will be blended with better quality water so that SWP water quality will not be degraded upon acceptable levels as determined by the FG and DWR.
- If a significant water supply deficiency exists and it is recommended by the FG that raw water quality criteria be set aside to ensure adequate supply, such action shall be subject to approval by the DPH.
- The project proponent of a NP inflow program which degrades SWP water quality shall identify mitigation to downstream water contractors for water quality impacts associated with increased water supply or treatment costs.

DWR ROLE

DWR shall seek, as needed, DPH or SWC recommendations on changes or additions to this document governing the NP water quality projects. The FG shall review proposed changes or additions prior to implementation by DWR, as needed.

DWR and or the United States Bureau of Reclamation (for San Luis Canal inflow) shall have ultimate responsibility for approving the water quality of all NP inflow, as well as, the oversight of monitoring and tracking the water quality of operating programs. DWR shall also ensure that the proponents of the NP inflow program perform according to their proposals, and will take appropriate action in the event of non-conformance.

Project Proposal Review Process

Upon receipt of a proposal for PIP, DWR shall review it for adequacy. DWR shall consider all PIPs based upon these guidelines. Review shall take no more than one month after receiving a complete program proposal. If necessary, DWR will convene timely meetings with the FG during the review. At a minimum the review will include

- Examination of all documents and data for completeness of the PIP.
- Notification of the affected Field Divisions, and the FG has been received by DWR.
- Consideration by DWR of comments from all parties before the final decision.
- Upon completion of the review DWR will notify the proponent and FG of the acceptance of the PIP or explain the reason(s) for rejecting it.
- DWR may reconsider a decision on a PIP based upon a recommendation from the FG. Reconsideration by DWR will be on a case-by-case basis.

Periodic Review

DWR may schedule periodic reviews of each operating NP inflow with input from the FG. As part of the review, program proponents shall provide the following information:

- Summary of deliveries to the Aqueduct.
- Water quality monitoring results.
- Proposed changes in the program operation.

The review may result in changes in monitoring and testing required of the program proponent as a result of;

- New constituents being added to the EPA /DPH list of drinking water standards.
- Changes in the maximum contaminant levels for the EPA/DPH list of drinking water standards.
- Identification of new constituents of concern.
- Changes in the water quality provided by the program.
- Changes in constituent background levels in the California Aqueduct.

This procedure shall recognize emerging contaminants and/or those detrimental to agricultural viability as they are identified by the regulatory agencies and shall set appropriate standards for water introduction based upon ambient levels in the California Aqueduct or State Notification Levels. Emerging contaminants are those that may pose significant risk to public health, but as yet do not have an MCL. Currently the Office of Environmental Health Hazard Assessment and the DPH establish Public Health Goals and Notification Levels, respectively. These levels, though not regulated, do provide health-based guidance to water utilities and can require public notification if exceeded.

Water Quality Review

DWR shall track and periodically report to the FG on water quality monitoring results on the SWP from NP water inflow and make all water quality data available to the public upon request.

- DWR shall review analyze and maintain all records of water quality testing conducted by the proponent of the well(s), source(s) and discharge(s) into the SWP.
- DWR shall determine what additional water quality monitoring, if any, is necessary within the SWP to ensure adequate protection of SWP water quality. DWR shall conduct all water quality monitoring within the SWP.
- DWR may prepare periodic reports of NP projects.

On-site Surveillance

The appropriate Field Division within DWR will be responsible for review and approval of all construction activities within the SWP right-of-way. Plans showing the discharge system piping, valves, sampling point, meters and locations must be submitted and approved prior to any construction. In addition, the appropriate Field Division will be responsible for confirmation of all meter readings and water quality monitoring conducted by the proponent.

- Field division staff may visit, inspect, and calibrate meters and measure flow conditions at each source or point of inflow into the SWP.
- Flow meters, sampling ports and anti-siphon valves must be conveniently located near the SWP right-of-way.
- Field division staff may collect water samples at each source or point of discharge into the SWP.
- The appropriate Field Division shall conduct additional water quality monitoring within the SWP, if deemed necessary, to assure compliance with the NP Inflow Criteria.
- DWR shall monitor aqueduct water quality and analyze several “split samples” of the water at the point of introduction into the aqueduct to ensure consistent analytical results.

POLICY APPROVAL

Approval Recommended
Date _____

_____
David V. Starks
Chief, Division of Operations and Maintenance
Department of Water Resources

Approved
Date _____

_____
Carl A. Torgersen
Deputy Director State Water Project
Department of Water Resources

Table A1 HISTORICAL WATER QUALITY CONDITIONS 1988 TO 2011 AT O'NEILL FOREBAY OUTLET (mg/L)

Parameter	Mean	Min.	Max.	Std. Dev.
Aluminum	0.03	0.01	0.527	0.05
Antimony	0.002	0.001*	0.005	0.002
Arsenic	0.002	0.001	0.004	0.001
Barium	0.05	0.05	0.068	0.002
Beryllium	0.001*	0.001*	0.001*	0.000
Bromide	0.22	0.04	0.54	0.16
Cadmium	0.003	0.001	0.005	0.002
Chromium	0.004	0.001	0.011	0.002
Copper	0.004	0.001	0.028	0.003
Fluoride	0.1	0.1	0.5	0.1
Iron	0.037	0.005	0.416	0.050
Manganese	0.009	0.005	0.06	0.007
Mercury	0.001	0.0002	0.001	0.0004
Nickel	0.001	0.001	0.004	0.0005
Nitrate	2.9	0.2	8.1	1.6
Selenium	0.001	0.001	0.002	0.0001
Silver	0.003	0.001	0.005	0.002
Sulfate	42	14	99	15
Total Organic Carbon	4.0	0.8	12.6	1.6
Zinc	0.007	0.005	0.21	0.01

*These values represent reporting limits. Actual values would be lower

Table A2 O'Neill Forebay Outlet Total Dissolved Solids Criteria by Water Year Classification, 1988-2011 (mg/L)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	227.2	262.5	295.4	228.9	213.8	231.2	184.4	226.5	181.5	171.4	195.7	157.3
Near Normal	317.9	324.7	351.7	295.4	268.1	302.7	270.0	285.1	230.1	211.9	170.9	202.6
Dry	286.4	319.6	370.0	362.0	344.2	305.2	240.4	278.2	307.3	234.8	269.0	336.6
Critical	256.6	312.9	372.9	367.0	361.0	335.0	307.1	291.8	335.1	325.7	339.4	328.8

* Year type is based on water year classification. Below normal and above normal year types have been combined into one designation called "near normal."

Table A3 O'Neill Forebay Outlet Bromide Criteria by Water Year Classification, 1988-2011 (mg/L)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0.19	0.24	0.28	0.13	0.10	0.12	0.12	0.17	0.12	0.12	0.13	0.10
Near Normal	0.31	0.31	0.34	0.21	0.15	0.15	0.18	0.22	0.15	0.15	0.14	0.19
Dry	0.25	0.29	0.35	0.35	0.24	0.20	0.17	0.24	0.27	0.13	0.29	0.41
Critical	0.26	0.28	0.32	0.37	0.33	0.27	0.22	0.22	0.28	0.28	0.32	0.37

* Year type is based on water year classification. Below normal and above normal year types have been combined into one designation called "near normal."

Table A4 O'Neill Forebay Outlet Total Organic Carbon Criteria by Water Year Classification, 1988-2011 (mg/L)

Year Type*	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	2.8	2.9	3.9	5.2	4.8	3.8	3.9	3.4	3.1	3.2	3.1	2.7
Near Normal	3.7	4.1	4.0	7.0	6.3	5.6	4.7	4.4	4.0	3.3	3.3	3.4
Dry	3.0	3.0	4.0	5.7	4.8	5.7	4.5	3.6	3.7	2.9	2.9	2.7
Critical	2.8	3.1	3.3	4.9	6.0	5.7	4.7	4.0	3.8	3.9	4.0	3.5

* Year type is based on water year classification. Below normal and above normal year types have been combined into one designation called "near normal."

WATER QUALITY MONITORING SCHEDULE

Community System, > 3300 population, groundwater/agricultural (CLGA)

UPDATED JUNE 2012

This schedule supersedes all previous monitoring schedules.

Chemical - Title 22	MCL (mg/L)	EPA Method	Frequency
Primary Inorganics - Section 64432			
Aluminum	1		Every 3 years
Antimony	0.006		Every 3 years
Arsenic	0.010		Every 3 years*
Barium	1		Every 3 years
Beryllium	0.004		Every 3 years
Cadmium	0.005		Every 3 years
Chromium	0.05		Every 3 years
Cyanide	0.15		Waived
Fluoride	2.0		Every 3 years
Mercury	0.002		Every 3 years
Nickel	0.1		Every 3 years
Perchlorate	**0.006**		**Every 3 years****
Selenium	0.05		Every 3 years
Thallium	0.002		Every 3 years
Asbestos - Section 64432.2			
Asbestos - Source Water	7 MFL		Waived
Asbestos - Distribution System sampling if Asbestos-Cement pipe used	7 MFL		Every 9 years if Aggressive Index ≤ 11.5
Nitrate/Nitrite - Section 64432.1			
Nitrate (as NO3)***	45		Annually if < 23 mg/L***
Nitrite (as nitrogen)****	1		Every 3 years if <0.5 mg/L****
Nitrate + Nitrite (sum as nitrogen)	10		N/A
Secondary Standards - Table 64449-A			
Aluminum	0.2		Every 3 years
Color	15		Every 3 years
Copper	1.0		Every 3 years
Foaming Agents	0.5		Every 3 years
Iron	0.3		Every 3 years
Manganese	0.05		Every 3 years
Methyl-*tert*-butyl ether (MTBE)	0.005	502.2, 524.2	See MTBE frequency on page 2
Odor	3		Every 3 years
Silver	0.1		Every 3 years
Thiobencarb	0.001		Waived
Turbidity	5		Every 3 years
Zinc	5		Every 3 years
General Minerals - Section 64449			
Bicarbonate	N/A		Every 3 years
Carbonate	N/A		Every 3 years
Hydroxide Alkalinity	N/A		Every 3 years
Calcium	N/A		Every 3 years
Magnesium	N/A		Every 3 years
Sodium	N/A		Every 3 years
Hardness	N/A		Every 3 years
pH	N/A		Every 3 years
Secondary Standards - Table 64449-B			
TDS	500-1000;1500		Every 3 years
Specific Conductance	900-1600; 2200		Every 3 years
Chloride	250-500;600		Every 3 years
Sulfate	250-500;600		Every 3 years

MCL = Maximum Contaminant Level

*__Arsenic__ sampling shall be increased to quarterly following any result > 0.010 mg/L.

**__This frequency applies only if initial monitoring shows no detectable perchlorate (<0.004 mg/L).__

***__Nitrate__ sampling shall be increased to quarterly following any result ≥ 23 mg/L.
This may be reduced to annual, upon request, if all 4 quarterly results are < 45 mg/L.

****__Nitrite__ sampling shall be increased to quarterly following any result ≥ 0.5 mg/L.
This may be reduced to annual, upon request, if all 4 quarterly results are < 1.0 mg/L.

WATER QUALITY MONITORING SCHEDULE

Community System, > 3300 population, groundwater/agricultural (CLGA)

UPDATED JUNE 2012

This schedule supersedes all previous monitoring schedules.

Chemical - Title 22	MCL (mg/L)	EPA Method	Frequency *
VOCs - Table 64444-A (a)			
Benzene	0.001	502.2, 524.2	Every 3 years *
Carbon Tetrachloride	0.0005	502.2, 524.2	Every 3 years *
1,2-Dichlorobenzene	0.6	502.2, 524.2	Every 3 years *
1,4-Dichlorobenzene	0.005	502.2, 524.2	Every 3 years *
1,1-Dichloroethane	0.005	502.2, 524.2	Every 3 years *
1,2-Dichloroethane	0.0005	502.2, 524.2	Every 3 years *
1,1-Dichloroethylene	0.006	502.2, 524.2	Every 3 years *
cis-1,2-Dichloroethylene	0.006	502.2, 524.2	Every 3 years *
trans-1,2-Dichloroethylene	0.01	502.2, 524.2	Every 3 years *
Dichloromethane	0.005	502.2, 524.2	Every 3 years *
1,2-Dichloropropane	0.005	502.2, 524.2	Every 3 years *
1,3-Dichloropropene	0.0005	502.2, 524.2	Every 3 years *
Ethylbenzene	0.3	502.2, 524.2	Every 3 years *
Methyl-*tert*-butyl ether (MTBE)	0.013	502.2, 524.2	Every 3 years *
Monochlorobenzene	0.07	502.2, 524.2	Every 3 years *
Styrene	0.1	502.2, 524.2	Every 3 years *
1,1,2,2-Tetrachloroethane	0.001	502.2, 524.2	Every 3 years *
Tetrachloroethylene (PCE)	0.005	502.2, 524.2	Every 3 years *
Toluene	0.15	502.2, 524.2	Every 3 years *
1,2,4-Trichlorobenzene	0.005	502.2, 524.2	Every 3 years *
1,1,1-Trichloroethane	0.200	502.2, 524.2	Every 3 years *
1,1,2-Trichloroethane	0.005	502.2, 524.2	Every 3 years *
Trichloroethylene (TCE)	0.005	502.2, 524.2	Every 3 years *
Trichlorofluoromethane	0.15	502.2, 524.2	Every 3 years *
1,1,2-Trichloro-1,2,2-Trifluoroethane	1.2	502.2, 524.2	Every 3 years *
Vinyl Chloride	0.0005	502.2, 524.2	Every 3 years *
Xylenes (total)	1.750	502.2, 524.2	Every 3 years *
SOCs - Table 64444-A (b)			
Alachlor	0.002	505, 507, 508.1, 525.2	Every 3 years *
Atrazine	0.001	505, 507, 508.1, 525.2	Every 3 years *
Bentazon	0.018		Waived *
Benzo(a)pyrene	0.0002		Waived *
Carbofuran	0.018		Waived *
Chlordane	0.0001		Waived *
2,4-D	0.07		Waived *
Dalapon	0.2		Waived *
Dibromochloropropane (DBCP)	0.0002	504.1, 551.1	Every 3 years *
Di(2-ethylhexyl)adipate	0.4		Waived *
Di(2-ethylhexyl)phthalate	0.004		Waived *
Dinoseb	0.007		Waived *
Diquat	0.02		Waived *
Endothall	0.1		Waived *
Endrin	0.002		Waived *
Ethylene Dibromide (EDB)	0.00005	504.1, 551.1	Every 3 years *
Glyphosate	0.7		Waived *
Heptachlor	0.00001		Waived *
Heptachlor Epoxide	0.00001		Waived *
Hexachlorobenzene	0.001		Waived *
Hexachlorocyclopentadiene	0.05		Waived *
Lindane	0.0002		Waived *
Methoxychlor	0.03		Waived *
Molinate	0.02		Waived *
Oxamyl	0.05		Waived *
Pentachlorophenol	0.001		Waived *
Picloram	0.5		Waived *
Polychlorinated Biphenyls	0.0005		Waived *
Simazine	0.004	505, 507, 508.1, 525.2	Every 3 years *
Thiobencarb	0.07		Waived *
Toxaphene	0.003		Waived *
2,3,7,8-TCDD (Dioxin)	0.00000003		Waived *
2,4,5-TP (Silvex)	0.05		Waived *

*** This frequency applies only to chemicals for which previous results have shown no detectable results (ND). Contact DWP for a special monitoring schedule when positive results are found.**

WATER QUALITY MONITORING SCHEDULE
Community System, > 3300 population, groundwater/agricultural (CLGA)
UPDATED JUNE 2012
This schedule supersedes all previous monitoring schedules.

Radiological Monitoring - Revised

1. Monitoring Requirements

Radioactivity - Section 64442	MCL**	EPA Method	Frequency
Gross Alpha	15 pCi/L		(1)
Radium-226	5 pCi/L		When GA > 5 pCi/L*
Radium-228	Radium-226 & -228		(1)
Uranium	20 pCi/L		When GA > 5 pCi/L*
Man Made Radioactivity - Section 64443			
Tritium	20000 pCi/L		Not Required
Strontium	8 pCi/L		Not Required
Gross Beta	50 pCi/L		Not Required

(1) Gross alpha and Radium-228 frequency already established by Department based on either grandfathered data from Jan. 1, 2001 to Dec. 31, 2004, or the initial monitoring conducted for a new source. Please contact the Visalia District Office if a frequency is needed or you may vist the following website: **http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Monitoring.aspx** to view the assigned frequencies to the water system's sources.

* If the gross alpha (GA) activity is more than 5 pCi/L, analysis for uranium may be used to obtain the radium-226 activity (Gross alpha - Uranium = Radium-226). If Gross alpha - Uranium > 0, call the DWP for further instructions. If Gross alpha - Uranium < 0, report only the Gross alpha and Uranium results. If the GA activity is more than 15 pCi/L, analysis for uranium must be performed.

** Contact the Visalia District Office if the MCL is exceeded.

2. Subsequent monitoring frequencies based on the initial monitoring.

Gross Alpha	Monitoring Frequency
Less than 3 pCi/L	1 sample every 9 years
≥ 3 and ≤ 7.5 pCi/L	1 sample every 6 years
> 7.5 and ≤ 15 pCi/L	1 sample every 3 years

Radium-228	Monitoring Frequency
Less than 1 pCi/L	1 sample every 9 years
≥ 1 and ≤ 2.5 pCi/L	1 sample every 6 years
> 2.5 and ≤ 5 pCi/L	1 sample every 3 years

Important Notes.

1. The subsequent monitoring frequencies assigned to each source by the Department will not change unless there are extenuating circumstances that would require it, such as an exceedance of an MCL.

2. A frequency is generally not assigned to radium-226 or uranium as the monitoring for these constituents is dependent on the gross alpha results.

   a) If the Gross Alpha particle activity is less than or equal to 5 pCi/L, analysis for Uranium is not required.

   b) If the Gross Alpha particle activity for any single sample is greater than 5 pCi/L, analysis for Uranium in that same sample is required. If any single sample for Uranium is greater than 20 pCi/L, monitor at least 4 quarters for Uranium.

   c) If (Gross Alpha – Uranium) average is less than 15 pCi/L, but greater than 5 pCi/L, analyze for Radium 226 and Radium 228. If (Ra-226 + Ra-228) > 5 pCi/L, monitor at least 4 quarters of Ra-226 and Ra-228.

3. The monitoring frequencies for gross alpha, radium -226, radium-228, and uranium may be different.

California Department of Water Resources produces an annual report titled "Water Quality Assessment of Non-Project Turn-ins to the California Aqueduct, 20XX". In the past the portion of the report dedicated to Kern Fan Project Turn-Ins was a few pages in length and would be attached as an Appendix to the Kern Fan Area Operations and Monitoring Report. However, the portion of the "Water Quality Assessment of Non-Project Turn-ins to the California Aqueduct, 20XX" dedicated to the Kern Fan region has grown to include a large part of the report as of 2012. There were no pump-ins in the region for 2011. As a result the links to the reports are listed below:

The home page of the O&M Pump-In Project Monitoring website contains (as of August 2017) the links for currently available reports and can be found at
http://www.water.ca.gov/swp/waterquality/PumpIns/index.cfm

Titles and links to the specific reports are shown below:

"Water Quality Assessment of Non-Project Turn-ins to the California Aqueduct, 2012", Technical Memorandum Report, State of California, Natural Resources Agency, Department of Water Resources – July 2013

http://www.water.ca.gov/swp/waterquality/docs/AqueductTurninReport08_2013.pdf

"Water Quality Assessment of Non-Project Turn-ins to the California Aqueduct, 2013", Technical Memorandum Report, State of California, Natural Resources Agency, Department of Water Resources - December 2014

http://www.water.ca.gov/swp/waterquality/docs/Water%20Quality%20Assessment%20of%20Non-Project%20Water%20to%20the%20California%20Aqueduct%202013%20(December%202014).pdf

"Water Quality Assessment of Non-Project Turn-ins to the California Aqueduct, 2014", Technical Memorandum Report, State of California, Natural Resources Agency, Department of Water Resources - October 2015

http://www.water.ca.gov/swp/waterquality/docs/Water%20Quality%20Assessment%20of%20Non-Project%20Turn-ins%20to%20the%20California%20Aqueduct,%202014_Final.pdf

"Water Quality Assessment of Non-Project Turn-ins to the California Aqueduct, 2015", Technical Memorandum Report, State of California, Natural Resources Agency, Department of Water Resources - December 2016

http://www.water.ca.gov/swp/waterquality/docs/Water%20Quality%20Assessment%20of%20Non-Project%20Turn-ins%20to%20the%20California%20Aqueduct,%202015.pdf

A 2016 report is not yet available, as of August 2017.

Construction Activities

Kern Water Bank Authority Construction Activities

The Kern Water Bank completed three replacement wells in 2013 (30S/25E-9L2, 30S/25E-15L1, and 30S/25E-18A2) in 2013. Beginning in 2013, wells were also rehabilitated as needed during the extend drought (13 in 2013, 12 in 2014, 21 in 2015, and 16 in 2016). Well rehabilitation consisted of cleaning, testing, inspecting, and sizing pumps and equipment for the select wells. An additional three replacement wells were completed in 2105 as part of an IRWM project (30S/25E-11L2, 30S/25E-11R1, 30S/25E-13B1). Other projects competed during the reporting period included upgrading SCADA systems, installing security cameras, installing a traveling screen at the cross-river pipeline, constructing an intermediate berm in pond M9, replacing several road culverts, and installing a booster pump in pond C6. A turnout was also installed between the Pioneer NE and NW ponds to increase flow capacity to the KWB Trestle turnout.

Kern Delta Water District Construction Activities

In 2015, Kern Delta Water District expanded its water banking facilities by adding approximately 207 acres of recharge with the construction of the Romero Spreading Basins and the Di Giorgio Spreading Basins, 137 acres and 70 acres respectively. These projects were completed by the end of 2015. Currently the District owns and operates approximately 815 acres of gravity fed spreading basins located along the Kern Island, Stine, Farmers, Buena Vista, and Eastside Canals.

Kern Delta Water District completed the Arvin-Edison Intake Well Tie-In project in late summer of 2016. The project consisted of plumbing two wells, FR-03 and KD02, into the Arvin-Edison Intake Canal. The District now owns and operates 18 groundwater wells associated with its water banking programs

Pioneer and Berrenda Mesa Projects

Pioneer and Berrenda Mesa Projects saw the rehabilitation of a number of wells during 2011-2016. Below is the list and date of repair of wells.

Pioneer

Well	Date	Well	Date
KCWA-19	6/12/2013	KCWA-20	12/14/2015
KCWA-18	6/12/2013	KCWA-16	12/10/2015
KCWA-15	11/15/2013	KCWA-08	02/29/2016
KCWA-R02	2/27/2014	KCWA-01	03/22/2016
KCWA-11	3/07/2014	KCWA-05	03/08/2016
KCWA-25	6/4/2014	KCWA-14	04/05/2016

DEFINITIONS

Acre-Foot (AF)	The quantity of water required to cover one acre of land to a depth of one foot (325,851 gallons).
Agency	Kern County Water Agency (KCWA)
Aquifer	Geologic formations or parts of formations which store and convey water through pore spaces and/or fractures and when tapped (as by a well) may yield water.
Bank Account	An amount of water that is recoverable by a Participant as a result of such Participants spreading and banking or transfer of water.
Berrenda Mesa Participants	The group of Water Districts that entered into the "Agreement Regarding Joint Water Banking Project on the Berrenda Mesa Property" with the Kern County Water Agency and Berrenda Mesa Water District in October 1999. The Districts include: Berrenda Mesa WD, Belridge WSD, Lost Hills WD and Wheeler Ridge-Maricopa WSD.
Berrenda Mesa Project	Facilities available for use by the Berrenda Mesa Participants which include recharge on the 369 acre Berrenda Mesa WD property located in the Kern Fan west of Allen Road and generally east of Renfro Road, north of Ming Avenue and ½ mile south of Stockdale Hwy. The project also includes six water production (recovery) wells located on the Berrenda Mesa property and six water production (recovery) wells located on the Pioneer Property.
cfs	Cubic feet per second, a rate of flow. = 448.8 gallons per minute = 646,317 gallons per day = 1.98347 acre-feet per day
Change in Groundwater Storage	The change in volume of water stored in aquifers within the groundwater basin.
Groundwater Storage	A volume of water stored in aquifers within the groundwater basin.
City	City of Bakersfield
Composite Well	A well tapping two or more major water producing zones.
Confined Aquifer	Groundwater bearing strata constrained at its upper and lower surfaces by impervious units (aquitards).
Confining Bed	The least permeable bed, below the water level, in a stratigraphic sequence; beds may be permeable enough to transmit water vertically, but their permeability is generally not sufficient to allow the completion of production (recovery) wells within them. Formerly referred to as an aquitard.

Corcoran Clay	A thick, low permeability layer of clay, of middle to lower Pleistocene age, which lies under much of the western San Joaquin Valley. This clay layer separates the water producing strata into two aquifers. The unconfined aquifer lies above the Corcoran Clay. The confined aquifer lies below the Corcoran Clay.
CVC	The Cross Valley Canal
CVP	The federal Central Valley Project. The Friant-Kern Canal is its major feature in Kern County.
Delivery	The amount of water conveyed or act of conveying water to recharge projects.
DWR	California Department of Water Resources. The operators of the State Water Project (California Aqueduct).
Electrical Conductivity (EC) (also called Conductance)	A measure of the ability of water to conduct an electrical current, which can be related to the concentration of total dissolved solids (TDS). The normal unit of measurement is microsiemens per centimeter. This term is also referred to as Specific Electrical Conductivity (SEC).
Evapotranspiration	The combination of evaporation from soil surfaces, and transpiration of water by plants.
ft/yr	Feet per year, often referring to recharge rates derived from acre-feet per acre-year.
gpm	Gallons per minute, rate of flow.
Groundwater	Water that occurs beneath the water table in geologic materials that are fully saturated.
Groundwater Level Profile	A line along a given vertical plane, which shows the water level at a specific point in time. Also referred to as Hydrologic Profile and Subsurface Hydrologic Cross-Section.
Head	Pressure of water upon a unit area due to the height at which the surface of the water stands above the point where the pressure is determined.
Hydraulic Conductivity	The quantity of water that will flow through a unit cross-sectional area of a porous medium per unit time under a hydraulic gradient of 1 (100 percent) at a specified temperature. Usually expressed as the flow in gallons per day through a cross section of one square foot of water bearing medium under a hydraulic gradient of 1 at a temperature of 60 degrees Fahrenheit.
Hydraulic Gradient	The vertical change in head divided by the horizontal distance of flow. Also termed the water level slope.
Infiltration	The entry into the soil of water from the ground surface.

In-lieu Recharge	The process of recharging groundwater supplies by substituting surface water for groundwater that would otherwise have been pumped.
Irrigation Efficiency	The amount of applied irrigation water that actually goes to satisfy net crop water demands, (i.e. evapotranspiration), expressed as a percent of the applied water.
Kern Fan	The portion of the Kern River alluvial fan west of Buena Vista Road, east of the California Aqueduct, north of Bear Mountain Blvd., and south of Rosedale Highway that includes the following Projects: Kern Water Bank, City of Bakersfield 2800 Acre Spreading Facility, Pioneer Project, Kern River Channel, Berrenda Mesa Spreading Facility, West Kern Water District and Buena Vista Recharge Facilities, Joint Use Recovery Project, Buena Vista Canal (Kern Delta Water District), and Rosedale-Rio Bravo Water District Spreading Facilities.
Kern Fan Monitoring Committee	A group comprised of representatives from adjoining entities, water banking entities and an independent groundwater specialist initially as per the MOU.
Kern Water Bank	The water recharge and recovery project owned by the Kern Water Bank Authority
Kern Water Bank Adjoining Entities	The water districts that encompass lands and/or operate existing projects lying adjacent to the boundaries of the Kern Water Bank. Those water districts include: Buena Vista Water Storage District (BVWSD), Rosedale-Rio Bravo Water Storage District (RRBWSD), Kern Delta Water District (KDWD), Henry Miller Water District (HMWD) and West Kern Water District (WKWD).
Kern Water Bank Participants	The group of water districts and other water entities that have collectively formed the Kern Water Bank Authority (KWBA). The group includes: Dudley Ridge Water District (DRWD), Kern County Water Agency/Improvement District 4 (KCWA/ID4), Semitropic Water Storage District (SWSD), Tejon-Castac Water District (TJWD), Westside Mutual Water Company, LLC (WMWC), and Wheeler Ridge-Maricopa Water Storage District (WRMWSD).
Kern Water Bank Project	19,900 acres of land located west of the Southern Pacific Railroad, east of Elk Hills Naval Petroleum Reserve, south of Stockdale Highway and north of Taft Highway transferred from the State of California Department of Water Resources to the Kern Water Bank Authority in August, 1996.
Losses	Water that is considered non-bankable and non-recoverable. A. Surface Recharge Losses ▪ An agreed upon percentage (6%) of water diverted for recharge that does not add to groundwater storage as established in the MOU. B. Other Losses ▪ An agreed upon percentage (4%) of the water recharged (Deliveries minus Surface Recharge Losses) to account for all other actual or potential losses (including migration losses) as established in the MOU.

MOU	Memorandum of Understanding signed by participants and adjoining entities. The Kern Water Bank MOU established the Kern Fan Monitoring Committee with subsequent MOUs being developed.
Overdraft	A long-term condition in which groundwater extractions exceed groundwater recharge.
Overdraft Correction	The delivery and recharge of surface water for the replacement of groundwater previously overdrafted.
Overdraft Correction Account	An amount of water that is recharged by a participant for the purpose of overdraft correction. Special conditions apply to the management of this water as described in the Pioneer Project Participant Agreement.
Pioneer Project	The Pioneer Property and the Agency•s rights to spread or recover water, or both, in 1) the 2800-Acres; 2) the Kern River channel east of the 2800-Acres; and 3) any land, other than the Pioneer Property, which the Agency has or acquires the use of in Sections 4, 5, 6, 11, 12, 13, and 14 of T30S, R26E, and Section 9, T30S, R25E, MDB&M for similar purposes.
Pioneer Project Participants	The group of Water Districts that entered into the "Pioneer Project Participation Agreement" in 1998. The group includes Kern County Water Agency, Buena Vista WSD, Henry Miller WD, Kern Delta WS, Rosedale-Rio Bravo WSD, Wheeler Ridge-Maricopa WSD, Tejon-Castac WD, Semitropic WSD, Lost Hills WD, Belridge WSD, Berrenda Mesa WS and Kern County Water Agency on behalf of Improvement District 4.
Potentiometric Surface	The surface to which the ground water in a confined aquifer rises when tapped by a well.
ppb	Part per billion, equivalent to one microgram per liter (µg/L).
ppm	Part per million, practically equivalent to one milligram per liter (mg/L).
Recharge	Water percolating from spreading facilities or canals to the underlying groundwater.
Recharge Water	A quantity of water that adds to groundwater storage.
Sacramento River Index	An index used by the California Department of Water Resources to forecast available water supplies and SWP delivery capabilities. The index consists of the forecasted or computed unimpaired flows of the Sacramento River near Red Bluff, Feather River at Oroville Reservoir, Yuba River and Smartville and American River at Folsom Reservoir.
Specific Electrical Conductivity (SEC)	A measure of the ability of water to conduct an electrical current, which is related to the concentration of total dissolved solids. The normal unit of measurement is microsiemens per centimeter. (see also Electrical Conductivity)
Specific Yield	The volume of water that an unconfined aquifer releases from storage per unit surface area of aquifer per unit decline in the water table.

Spreading	The amount of water delivered or act of delivering water into recharge facilities.
SWP	The State Water Project.
TDS	Total dissolved solids. A measurement of the dissolved matter in water, consisting mainly of inorganic salts. Expressed in milligrams per liter (mg/L) or tons per acre-foot (tons/AF).
Transmissivity	A value that equates to the saturated thickness of an aquifer, multiplied by the hydraulic conductivity. The transmissivity governs the amount of groundwater flow through a given width of the aquifer at a unit hydraulic gradient (100%).
Turbidity	A measure of the presence of suspended and colloidal matter that causes light to be scattered in water. Usually reported in NTU•s (Nephelometric Turbidity Units).
2800-Acres	Approximately 2800-acres of land owned by the City along the Kern River channel between Renfro Road and Interstate 5 used for groundwater recharge and banking projects.
Unconfined Aquifer	A groundwater bearing geologic formation that is not constrained at is upper surface by an impervious or semi-impervious stratum, such as a confining bed.
Unsaturated Zone	That portion of the soil below ground surface that is above the water table and capillary fringe, and in which the soil pores are only partially filled with water. Also referred to as the Vadose Zone or Zone of Acration.
USBR	United States Bureau of Reclamation. The operators of the Federal Central Valley Project.
USEPA	United States Environmental Protection Agency.
Water Budget	A mathematical accounting of water in a system or watershed. Also referred to as Water Balance or Hydrologic Budget.
Water Board	City of Bakersfield, Water Board.
Water Table	The surface on which the fluid pressure in the subsurface pores is exactly atmospheric. The location of this surface is revealed by the level at which water stands in a shallow well open along its length and penetrating the surficial deposits just deeply enough to encounter the shallowest groundwater.

2011 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET **January 2011**

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			Poso Creek			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	3,306	0	0	2,612	0	0	48,408	0	1,483	17,034	0	0	1,414	0	0	4,544	0	0	135	0	0	0	0	0	77,453	0	1,483	78,936

2011 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET

February 2011

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			Poso Creek			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	1,639	1,695	0	3,818	1,636	0	27,454	1,163	1,549	6,040	0	0	992	202	0	5,121	40	0	626	1,712	541	0	0	0	45,690	6,448	2,090	54,228

54,228

2011 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET **March 2011**

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	1,406	2,382	0	8,191	1,967	0	37,081	1,265	1,938	6,899	315	0	1,482	448	0	3,233	1,148	0	1,625	913	0	137	12	0	60,054	8,450	1,938	70,442

2011 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET **April 2011**

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	36	1,302	740	159	1,735	0	32,578	16,809	7,978	1,964	2,805	3,699	0	543	2,850	0	0	0	0	1,356	71	12	53	0	34,749	24,603	15,338	74,690

2011 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET **May 2011**

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	0	818	2,172	0	25	158	0	14,003	24,687	0	4,915	2,766	0	0	3,554	0	0	3,122	0	733	0	0	0	0	0	20,494	36,459	56,953

2011 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET **June 2011**

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	0	0	2,243	0	0	121	19,000	8,672	23,391	284	2,498	3,699	0	0	1,740	0	0	4,609	0	0	0	0	0	0	19,284	11,170	35,803	66,257

2011 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET **July 2011**

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	0	0	3,291	2,303	0	5,641	36,975	494	9,410	4,175	0	2,474	726	0	1,093	1,146	0	2,398	234	0	1,424	0	0	0	45,559	494	25,731	71,784

2011 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET

August 2011

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	1,277	0	1,880	1,193	0	3,206	32,292	0	1,049	5,814	0	299	402	0	947	1,240	0	1,273	1	0	2,792	0	0	0	42,219	0	11,446	53,665

2011 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET

September 2011

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	3,540	0	0	176	0	831	41,837	0	2,757	6,556	0	28	1,131	0	214	0	0	4,388	37	0	532	0	0	0	53,277	0	8,750	62,027

2011 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET **October 2011**

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	1,224	0	1,216	1,190	0	1,559	29,572	0	582	3,303	0	1,747	964	0	857	1,045	0	2,307	50	0	2,928	0	0	0	37,348	0	11,196	48,544

2011 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET **November 2011**

	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			
District	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	Total
Total	3,555	0	0	3,922	0	0	28,561	633	0	3,654	0	0	989	197	0	3,204	638	0	14	503	0	0	0	0	43,899	1,971	0	45,870

2011 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET **December 2011**

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	2,766	762	0	5,096	519	0	10,706	14,174	0	1,631	513	0	768	164	0	1,692	829	0	361	3,038	0	0	0	0	23,020	19,999	0	43,019

2012 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET **January 2012**

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	159	385	0	0	700	0	0	7,456	0	121	1,103	0	0	216	0	0	399	0	0	200	0	0	0	0	280	10,459	0	10,739

2012 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET **February 2012**

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	0	0	0	0	1,039	0	1,554	0	0	0	952	0	0	0	0	0	0	0	0	0	0	0	0	0	1,554	1,991	0	3,545

2012 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET **October 2012**

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	2,588	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,588	0	0	2,588

2012 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET **November 2012**

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	3,136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,136	0	0	3,136

2012 Spreading Program
Water Deliveries by Physical Source and Location

QUANTITIES ACRE-FEET **December 2012**

District	Berrenda Mesa			2800 Acres			Kern Water Bank			Pioneer North			Pioneer Central			Pioneer South			Kern River Channel			2nd Point			Subtotal			Total
	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	SWP	F-K	KR	
Total	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	44	0	0	44

Kern County Water Agency
Kern Fan Projects
Summary of Recovery
2012

Quantities in acre-feet

Year: **2012**

PROJECT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2800 Acres (Pioneer)		0	2,285	1,696	0	0							3,981
2800 Acres (Olcese)		0	0	1,773	1,708	1,576							5,057
Pioneer		0	5,263	5,013	0	0							10,276
Berrenda Mesa		0	3,551	2,811	0	0							6,362
Kern Water Bank		66	22,983	24,012	24,858	22,462					139	16,310	110,830
ID4 Wells		0	535	784	0	0							1,319
TOTAL	**0**	**66**	**34,617**	**36,089**	**26,566**	**24,038**	**0**	**0**	**0**	**0**	**139**	**16,310**	**137,825**

Kern County Water Agency
Kern Water Bank
Summary of Recovery
Through 12/07/12

Quantities in acre-feet

Year: **2012**

WELL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
North													
30S/24E-12H01		0	178	220	224	203					0	195	1,020
30S/24E-12R01		0	188	229	234	210					21	230	1,112
30S/24E-13C01		0	83	108	62	103					0	0	356
30S/24E-13H01		0	250	305	310	282					0	201	1,348
30S/24E-24A01		0	68	128	129	113					0	29	467
30S/25E-01Q01		0	451	456	449	387					0	364	2,107
30S/25E-03L01		0	166	224	227	203					0	51	871
30S/25E-03Q01		0	363	348	350	309					0	283	1,653
30S/25E-03Q02		0	359	397	407	363					0	321	1,847
30S/25E-03R01		0	395	352	352	310					0	284	1,693
30S/25E-04L01		0	209	275	284	254					0	70	1,092
30S/25E-05K01		0	133	282	283	253					0	69	1,020
30S/25E-06K01		0	222	357	377	340					0	90	1,386
30S/25E-07G01		0	331	437	469	429					0	109	1,775
30S/25E-07P01		0	169	198	200	177					0	160	904
30S/25E-07R01		0	209	238	237	208					0	200	1,092
30S/25E-08F01		0	172	266	289	261					0	68	1,056
30S/25E-08J02		0	224	298	358	321					0	85	1,286
30S/25E-08P01		0	136	170	178	160					0	143	787
30S/25E-09A01		0	189	0	201	214					0	39	643
30S/25E-09J01		0	238	317	164	0					0	0	719
30S/25E-09L01		0	0	0	0	0					0	0	0
30S/25E-10K01		0	205	309	317	283					0	0	1,114
30S/25E-11A01		0	243	256	261	232					0	204	1,196
30S/25E-11C01		0	0	0	0	0					0	0	0
30S/25E-11C02		0	516	483	486	434					0	347	2,266
30S/25E-11E01		0	325	277	276	243					0	232	1,353
30S/25E-11L01		0	309	288	295	265					0	236	1,393
30S/25E-11N01		0	160	164	166	149					0	0	639
30S/25E-11Q01		0	267	346	353	314					0	286	1,566
30S/25E-12C01		0	182	238	242	220					0	57	939
30S/25E-13F01		5	200	214	212	188					0	170	989
30S/25E-13J01		7	268	196	177	142					0	0	790
30S/25E-13L01		5	188	196	197	180					0	168	934
30S/25E-14E01		0	342	411	419	376					0	334	1,882
30S/25E-14J01		0	312	300	302	272					0	269	1,455
30S/25E-14K01		0	297	180	0	32					0	211	720
30S/25E-14N01		0	189	182	181	158					0	0	710
30S/25E-14R01		0	223	246	248	223					24	245	1,209
30S/25E-15B01		0	130	144	80	131					0	0	485
30S/25E-15C01		0	209	260	258	229					0	66	1,022
30S/25E-15N01		0	125	50	0	0					18	177	370
30S/25E-15Q01		0	135	150	147	126					21	186	765
30S/25E-15R01		0	226	216	217	195					0	183	1,037
30S/25E-16B01		0	268	342	346	313					0	86	1,355
30S/25E-16D01		0	206	231	229	202					0	0	868
30S/25E-16F01		0	193	245	244	220					0	61	963
30S/25E-16J01		0	174	189	190	170					0	160	883
30S/25E-16M01		0	310	341	335	296					0	296	1,578
30S/25E-16P01		0	338	379	378	342					0	270	1,707
30S/25E-17F01		0	209	294	304	274					0	241	1,322
30S/25E-17H01		0	504	579	592	535					0	498	2,708
30S/25E-17J01		9	420	36	0	0					55	608	1,128
30S/25E-17M01		0	456	546	560	502					0	437	2,501
30S/25E-17P01		10	449	504	521	472					0	415	2,371
30S/25E-18A01		0	8	0	0	0					0	0	8
30S/25E-18C01		0	204	240	241	214					0	185	1,084
30S/25E-18K01		0	425	544	560	504					0	447	2,480
30S/25E-18P01		0	278	352	365	330					0	290	1,615
30S/25E-18R01		0	286	351	367	334					0	292	1,630
30S/25E-20A01		7	423	410	430	391					0	336	1,997
30S/25E-20C01		9	422	398	405	368					0	323	1,925
30S/25E-20L01		3	422	408	425	385					0	343	1,986
30S/25E-21A02		0	205	215	203	173					0	177	973
30S/25E-21D01		11	420	346	332	289					0	263	1,661
30S/25E-21G01		0	311	373	389	354					0	315	1,742
30S/25E-23H01		0	52	0	0	0					0	169	221
30S/25E-24K01		0	203	226	229	211					0	0	869
30S/25E-36D01		0	0	0	0	0					0	0	0
30S/25E-36D01		0	0	0	0	0					0	0	0
30S/26E-06N01		0	378	401	410	372					0	330	1,891
30S/26E-06P01		0	495	503	530	476					0	426	2,430
30S/26E-07C01		0	329	320	344	304					0	280	1,577
30S/26E-07J01		0	415	338	234	377					0	331	1,695
30S/26E-07L01		0	442	481	491	423					0	380	2,217
30S/26E-07N01		0	281	253	258	227					0	210	1,229
30S/26E-07Q01		0	177	0	425	403					0	334	1,339
30S/26E-07R01		0	450	426	433	391					0	345	2,045
30S/26E-08M01		0	397	100	472	423					0	376	1,768
30S/26E-17Q01		0	295	310	326	287					0	0	1,218
30S/26E-18B01		0	534	531	538	477					0	444	2,524
30S/26E-18D01		0	360	333	339	309					0	280	1,621
30S/26E-19G01		0	285	297	293	262					0	0	1,137
30S/26E-19M01		0	254	332	329	298					0	0	1,213
30S/26E-20C01		0	346	409	424	382					0	0	1,561
30S/26E-20L01		0	301	376	392	357					0	0	1,426
30S/26E-20N02		0	274	342	357	323					0	0	1,296
TOTAL		66	22,983	24,012	24,858	22,462					139	16,310	110,830

Kern County Water Agency
Kern Fan Projects
Summary of Recovery
Through 12/31/13

Quantities in acre-feet

Year: **2013**

PROJECT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2800 Acres (Pioneer)	0	1,216	2,387	2,094	1,996	0	106	2,238	2,111	2,016	1,964	1,880	18,008
2800 Acres (Olcese)	0	0	549	1,348	1,452	1,818	1,438	1,406	0	0	0	1,146	9,157
Pioneer	0	2,445	6,783	6,788	6,090	0	154	4,545	2,790	2,737	2,711	5,426	40,469
Berrenda Mesa	0	0	492	887	0	0	0	0	0	0	0	1,500	2,879
Kern Water Bank	15,422	19,722	22,458	21,145	20,661	20,076	19,717	15,977	0	6,548	18,005	17,440	197,171
ID4 Wells	0	0	0	193	1,062	0	15	661	321	249	0	779	3,280
TOTAL	**15,422**	**23,383**	**32,669**	**32,455**	**31,261**	**21,894**	**21,430**	**24,827**	**5,222**	**11,550**	**22,680**	**28,171**	**270,964**

Kern County Water Agency
Kern Water Bank
Summary of Recovery
Through 12/31/13

Quantities in acre-feet

Year: **2013**

WELL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
North													
30S/24E-12H01	227	201	209	190	215	203	206	167	0	56	196	189	2,059
30S/24E-12R01	230	204	210	215	219	208	214	172	0	54	204	196	2,126
30S/24E-13C01	0	0	0	0	165	161	159	137	0	47	161	156	986
30S/24E-13H01	309	269	276	255	284	273	277	226	0	77	263	251	2,760
30S/24E-24A01	0	123	134	93	100	95	98	79	0	47	96	94	959
30S/25E-01Q01	433	378	404	368	372	363	365	293	0	128	342	340	3,786
30S/25E-03L01	0	154	207	194	191	178	183	148	0	87	169	163	1,674
30S/25E-03Q01	348	290	299	275	256	243	248	201	0	84	229	222	2,695
30S/25E-03Q02	392	341	361	335	304	290	285	234	0	104	269	260	3,175
30S/25E-03R01	341	278	277	253	224	206	201	165	0	74	175	170	2,364
30S/25E-04L01	0	199	239	236	231	224	225	178	0	111	206	192	2,041
30S/25E-05K01	0	209	258	260	253	248	251	201	0	119	229	222	2,250
30S/25E-06K01	0	253	352	343	334	334	321	270	0	138	321	313	2,979
30S/25E-07G01	0	315	441	396	435	443	433	375	0	211	458	445	3,952
30S/25E-07P01	97	100	143	160	157	149	140	114	0	31	133	126	1,350
30S/25E-07R01	131	208	201	199	175	179	178	140	0	53	164	152	1,780
30S/25E-08F01	0	209	264	242	271	261	266	214	0	127	239	238	2,331
30S/25E-08J02	0	273	340	314	339	338	331	279	0	167	323	314	3,018
30S/25E-08P01	94	157	160	144	161	161	158	132	0	43	155	149	1,514
30S/25E-09A01	111	219	231	219	221	209	215	172	0	73	168	192	2,030
30S/25E-09J01	0	96	129	120	122	117	104	96	0	38	127	120	1,069
30S/25E-09L01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-10K01	162	299	314	293	274	247	251	205	0	96	227	217	2,585
30S/25E-11A01	259	223	232	213	184	179	185	151	0	63	169	166	2,024
30S/25E-11C01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-11C02	468	390	432	400	362	325	331	269	0	123	271	14	3,385
30S/25E-11E01	276	233	229	209	185	172	179	145	0	68	172	163	2,031
30S/25E-11L01	289	256	277	265	262	249	241	95	0	0	0	0	1,934
30S/25E-11N01	0	0	0	0	38	128	88	27	0	54	138	135	608
30S/25E-11Q01	345	304	327	305	293	284	12	0	0	84	302	34	2,290
30S/25E-12C01	0	168	218	204	194	184	191	151	0	85	172	166	1,733
30S/25E-13F01	205	183	195	183	183	175	174	143	0	64	171	162	1,838
30S/25E-13J01	0	0	0	0	0	56	59	139	0	67	172	154	647
30S/25E-13L01	206	181	192	178	176	164	160	128	0	61	164	143	1,753
30S/25E-14E01	412	365	370	339	296	276	278	235	0	106	261	237	3,175
30S/25E-14J01	299	261	276	254	248	231	238	137	0	86	227	214	2,471
30S/25E-14K01	244	211	214	194	176	166	170	143	0	59	174	160	1,911
30S/25E-14N01	0	0	0	0	16	152	159	131	0	0	0	0	458
30S/25E-14R01	227	199	216	206	186	189	189	150	0	72	185	170	1,989
30S/25E-15B01	0	0	0	0	73	80	84	0	0	119	185	171	712
30S/25E-15C01	0	183	228	209	193	158	179	140	0	104	167	156	1,717
30S/25E-15N01	89	144	142	138	140	131	135	111	0	44	132	121	1,327
30S/25E-15Q01	177	134	121	116	106	89	87	75	0	31	87	78	1,101
30S/25E-15R01	136	164	210	201	199	183	191	157	0	72	188	182	1,883
30S/25E-16B01	0	40	295	291	269	266	258	199	0	149	242	214	2,223
30S/25E-16D01	0	163	180	179	166	162	162	121	0	96	143	126	1,498
30S/25E-16F01	0	181	219	223	225	218	222	172	0	113	212	192	1,977
30S/25E-16J01	107	174	167	168	167	159	157	125	0	49	153	134	1,560
30S/25E-16M01	195	290	261	261	262	252	255	204	0	74	232	220	2,506
30S/25E-16P01	200	332	353	333	337	328	327	257	0	95	308	285	3,155
30S/25E-17F01	156	262	272	231	274	270	276	224	0	72	264	251	2,552
30S/25E-17H01	408	534	534	506	474	521	506	423	0	139	495	466	5,006
30S/25E-17J01	511	533	549	545	506	559	546	465	0	145	540	518	5,417
30S/25E-17M01	291	482	484	424	426	450	429	361	0	89	415	390	4,241
30S/25E-17P01	536	453	462	458	421	463	447	378	0	121	448	418	4,605
30S/25E-18A01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-18C01	119	135	163	205	207	192	203	162	0	43	187	176	1,792
30S/25E-18K01	292	485	493	479	434	469	449	378	0	119	440	413	4,451
30S/25E-18P01	48	315	321	296	332	316	307	261	0	90	306	291	2,883
30S/25E-18R01	192	323	336	301	340	338	344	284	0	91	330	315	3,194
30S/25E-20A01	205	374	387	129	0	1	425	365	0	114	421	403	2,824
30S/25E-20C01	210	356	365	373	342	367	370	303	0	105	352	177	3,320
30S/25E-20L01	225	336	379	385	341	367	211	313	0	101	362	301	3,321
30S/25E-21A02	111	166	155	155	131	144	139	114	0	0	0	0	1,115
30S/25E-21D01	172	263	249	262	205	0	0	0	0	51	234	220	1,656
30S/25E-21G01	192	350	359	366	330	0	0	0	0	0	0	0	1,597
30S/25E-23H01	201	174	126	123	175	173	178	141	0	65	173	166	1,695
30S/25E-24K01	0	62	235	212	210	185	178	130	0	0	0	120	1,332
30S/25E-36D01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-36D01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/26E-06N01	404	357	381	360	358	350	347	285	0	120	320	306	3,588
30S/26E-06P01	515	446	442	403	384	404	408	297	0	99	334	298	4,030
30S/26E-07C01	324	283	271	232	219	48	0	0	0	107	298	274	2,056
30S/26E-07J01	411	363	372	340	336	344	348	272	0	118	312	282	3,498
30S/26E-07L01	465	405	408	366	340	336	339	250	0	115	274	245	3,543
30S/26E-07N01	253	221	27	198	197	191	202	153	0	69	178	165	1,854
30S/26E-07Q01	405	362	390	373	389	373	375	355	0	133	406	408	3,969
30S/26E-07R01	425	379	405	378	381	353	132	311	0	133	366	346	3,609
30S/26E-08M01	461	406	418	384	387	397	401	318	0	139	373	358	4,042
30S/26E-17Q01	0	86	290	190	166	185	201	124	0	0	0	107	1,349
30S/26E-18B01	537	475	494	443	423	416	427	323	0	155	391	360	4,444
30S/26E-18D01	344	308	333	315	319	308	318	254	0	112	305	291	3,207
30S/26E-19G01	0	88	317	238	218	200	213	158	0	0	0	146	1,578
30S/26E-19M01	0	85	74	265	103	242	126	0	0	0	0	230	1,125
30S/26E-20C01	0	111	421	360	365	356	371	287	0	0	0	244	2,515
30S/26E-20L01	0	101	389	358	360	355	367	290	0	0	0	237	2,457
30S/26E-20N02	0	89	354	319	329	317	314	195	0	0	0	0	1,917
TOTAL	15,422	19,722	22,458	21,145	20,661	20,076	19,717	15,977	0	6,548	18,005	17,440	197,171

Kern County Water Agency
Kern Fan Projects
Summary of Recovery
Through 12/31/14

Quantities in acre-feet

Year: **2014**

PROJECT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2800 Acres (Pioneer)	1,549	1,682	1,823	1,495	1,364	1,186	1,184	1,244	1,207	1,137	1,263	963	16,097
2800 Acres (Olcese)	510	1,221	1,275	1,146	1,101	961	916	890	857	0	0	0	8,877
Pioneer	3,912	6,058	6,512	5,438	6,004	5,804	5,578	5,066	4,763	4,448	3,928	2,554	60,065
Berrenda Mesa	1,588	2,785	2,824	2,461	2,754	2,760	2,546	2,386	2,287	2,527	2,485	1,878	29,281
Kern Water Bank	13,467	17,613	18,616	17,265	17,385	16,313	16,212	16,059	15,039	15,242	14,710	11,774	189,695
ID4 Wells	749	1,933	4,242	4,013	4,058	3,567	3,883	3,798	3,613	3,735	3,600	2,878	40,069
TOTAL	**21,775**	**31,292**	**35,292**	**31,818**	**32,666**	**30,591**	**30,319**	**29,443**	**27,766**	**27,089**	**25,986**	**20,047**	**344,084**

Kern County Water Agency
Kern Water Bank
Summary of Recovery
Through 12/31/14

Quantities in acre-feet

Year: **2014**

WELL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
North													
30S/24E-12H01	147	178	195	184	190	174	185	184	173	171	173	142	2,096
30S/24E-12R01	153	189	207	196	203	192	197	197	187	188	185	152	2,246
30S/24E-13C01	121	144	160	154	154	149	151	150	143	136	143	117	1,722
30S/24E-13H01	194	236	258	249	252	234	244	240	232	234	226	181	2,780
30S/24E-24A01	81	88	90	89	79	75	77	72	69	65	68	60	913
30S/25E-01Q01	173	325	354	331	324	293	287	291	279	273	247	228	3,405
30S/25E-03L01	155	149	161	154	154	145	147	141	133	136	130	118	1,723
30S/25E-03Q01	166	200	217	205	209	202	209	204	196	198	186	148	2,340
30S/25E-03Q02	197	231	253	240	238	223	98	229	211	211	199	171	2,501
30S/25E-03R01	125	131	136	126	122	110	111	102	92	90	7	0	1,152
30S/25E-04L01	185	149	143	125	118	107	97	94	94	87	90	104	1,393
30S/25E-05K01	209	190	206	188	204	193	109	197	179	186	185	168	2,214
30S/25E-06K01	256	288	302	292	296	271	273	272	258	245	245	222	3,220
30S/25E-07G01	426	422	449	441	461	432	455	453	435	446	431	393	5,244
30S/25E-07P01	107	110	143	144	150	118	103	87	78	80	82	73	1,275
30S/25E-07R01	108	108	117	121	96	77	71	78	56	56	50	43	981
30S/25E-08F01	197	221	240	226	232	220	222	218	208	215	207	186	2,592
30S/25E-08J02	262	292	319	303	311	120	308	307	293	302	293	271	3,381
30S/25E-08P01	114	136	142	139	141	133	147	140	139	73	170	71	1,545
30S/25E-09A01	145	182	199	190	193	184	191	191	184	190	184	152	2,185
30S/25E-09J01	117	106	116	107	109	105	104	102	95	98	94	45	1,198
30S/25E-09L01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-09L02	57	171	179	169	163	160	154	149	140	146	149	139	1,776
30S/25E-10K01	167	179	183	167	157	144	142	134	128	126	118	107	1,752
30S/25E-11A01	122	141	155	146	144	133	135	129	117	118	108	78	1,526
30S/25E-11C01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-11C02	174	249	268	243	236	218	219	220	206	201	189	168	2,591
30S/25E-11E01	125	145	156	148	148	140	142	135	127	129	123	105	1,623
30S/25E-11L01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-11N01	102	112	121	108	109	101	100	102	95	93	95	78	1,216
30S/25E-11Q01	0	243	310	299	308	297	302	295	291	295	286	237	3,163
30S/25E-12C01	161	143	155	144	144	134	135	129	122	121	112	107	1,607
30S/25E-13F01	124	147	162	154	154	149	153	149	143	148	143	120	1,746
30S/25E-13J01	122	132	150	135	133	123	123	125	115	115	108	101	1,482
30S/25E-13L01	114	126	140	131	135	129	129	123	119	123	119	99	1,487
30S/25E-14E01	139	177	178	159	148	132	126	119	107	109	99	87	1,580
30S/25E-14J01	166	191	204	191	191	182	184	179	172	177	167	144	2,148
30S/25E-14K01	73	10	0	34	217	212	209	217	211	216	209	177	1,785
30S/25E-14N01	17	109	121	110	100	91	90	90	65	0	0	0	793
30S/25E-14R01	132	148	155	141	137	127	122	117	107	106	98	25	1,415
30S/25E-15B01	173	127	131	114	108	100	98	92	86	85	83	88	1,285
30S/25E-15C01	158	121	104	112	109	104	100	93	83	87	86	92	1,249
30S/25E-15L01	57	168	169	163	162	155	154	152	143	147	143	127	1,740
30S/25E-15N01	94	106	112	107	110	103	105	104	101	104	101	87	1,234
30S/25E-15Q01	51	53	57	50	49	46	43	39	36	37	4	0	465
30S/25E-15R01	141	136	139	128	119	111	111	104	103	117	113	95	1,417
30S/25E-16B01	217	173	181	161	162	154	149	137	129	131	130	135	1,859
30S/25E-16D01	128	96	97	86	84	84	74	65	58	15	0	6	793
30S/25E-16F01	189	147	145	132	125	118	104	109	97	89	83	95	1,433
30S/25E-16J01	79	105	100	92	89	82	78	70	65	64	60	60	944
30S/25E-16M01	128	190	199	182	183	165	158	145	132	131	126	108	1,847
30S/25E-16P01	217	255	276	263	267	252	250	235	221	219	205	169	2,829
30S/25E-17F01	195	232	245	238	246	230	240	234	226	222	219	178	2,705
30S/25E-17H01	357	419	431	414	423	394	388	372	346	348	331	276	4,499
30S/25E-17J01	399	487	512	502	521	499	510	505	483	491	472	390	5,771
30S/25E-17M01	284	348	357	349	352	311	314	295	274	243	253	209	3,589
30S/25E-17P01	317	379	393	380	383	353	157	325	294	273	264	215	3,733
30S/25E-18A01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-18A02	99	324	365	352	358	340	339	185	328	338	321	265	3,614
30S/25E-18C01	138	161	175	167	171	138	101	79	50	0	0	0	1,180
30S/25E-18K01	317	369	381	40	25	411	480	476	454	444	443	367	4,207
30S/25E-18P01	224	268	290	278	282	264	265	260	245	249	236	191	3,052
30S/25E-18R01	244	289	303	295	307	286	300	278	268	263	261	216	3,310
30S/25E-20A01	314	375	412	395	405	387	396	390	375	382	366	304	4,501
30S/25E-20C01	262	313	339	325	331	315	320	311	298	303	291	236	3,644
30S/25E-20L01	266	309	319	291	293	266	266	254	240	229	223	180	3,136
30S/25E-21A02	53	81	80	70	73	57	50	29	20	4	0	0	517
30S/25E-21D01	128	169	180	167	157	150	143	126	119	119	0	0	1,458
30S/25E-21G01	108	310	325	319	333	308	318	303	298	300	285	239	3,446
30S/25E-23H01	128	152	162	150	150	142	141	141	133	136	131	119	1,685
30S/25E-24K01	89	154	152	146	147	138	119	111	103	118	116	28	1,421
30S/25E-36D01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-36D01	0	0	0	0	0	0							0
30S/26E-06N01	183	260	276	258	258	240	243	85	0	151	273	233	2,460
30S/26E-06P01	147	227	206	182	162	141	141	141	131	119	91	87	1,775
30S/26E-07C01	140	266	286	274	277	268	277	273	266	269	256	212	3,064
30S/26E-07J01	143	235	252	236	240	228	232	227	216	207	167	163	2,546
30S/26E-07L01	127	188	180	152	141	123	117	47	0	199	288	251	1,813
30S/26E-07N01	104	146	154	140	61	0	9	211	204	204	191	163	1,587
30S/26E-07Q01	189	389	426	348	336	289	293	291	268	263	243	225	3,560
30S/26E-07R01	171	305	318	316	320	305	314	313	299	306	288	245	3,500
30S/26E-08M01	186	320	348	326	328	312	320	318	301	307	292	249	3,607
30S/26E-17Q01	75	101	92	82	77	23	0	162	236	256	258	62	1,424
30S/26E-18B01	179	295	298	266	257	232	229	220	204	207	192	177	2,756
30S/26E-18D01	144	267	294	277	289	275	282	263	242	244	217	199	2,993
30S/26E-19G01	107	146	142	130	124	116	124	122	116	129	135	32	1,423
30S/26E-19M01	161	286	259	282	287	278	295	293	282	289	278	69	3,059
30S/26E-20C01	173	283	286	267	265	245	244	226	209	231	224	54	2,707
30S/26E-20L01	165	289	305	280	280	266	278	272	258	270	253	61	2,977
30S/26E-20N02	86	296	319	298	299	280	292	215	0	0	0	0	2,085
TOTAL	13,467	17,613	18,616	17,265	17,385	16,313	16,212	16,059	15,039	15,242	14,710	11,774	189,695

Kern County Water Agency
Kern Fan Projects
Summary of Recovery
Through 12/31/15

Quantities in acre-feet

Year: **2015**

PROJECT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2800 Acres (Pioneer)	1,207	1,083	1,149	1,024	1,008	940	837	761	698	521	534	521	10,283
2800 Acres (Olcese)	518	895	994	0	0	0	0	0	0	0	0	0	2,407
Pioneer	3,951	3,763	4,001	3,697	3,722	3,530	3,766	3,637	3,567	2,793	3,391	3,157	42,975
Berrenda Mesa	2,339	2,181	2,269	2,117	2,218	2,127	2,136	2,071	1,950	1,879	1,944	2,261	25,492
Kern Water Bank	15,158	13,453	14,676	14,002	13,717	12,338	13,476	13,491	12,243	11,754	12,075	12,702	159,085
ID4 Wells	3,542	3,302	3,537	3,331	3,398	3,213	3,257	2,855	2,419	2,192	657	660	32,363
TOTAL	**26,715**	**24,677**	**26,626**	**24,171**	**24,063**	**22,148**	**23,472**	**22,815**	**20,877**	**19,139**	**18,601**	**19,301**	**272,605**

Kern County Water Agency
Kern Water Bank
Summary of Recovery
Through 12/31/15

Quantities in acre-feet

Year: **2015**

WELL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
North													
30S/25E-04L01	94	74	72	34	0	0	0	0	0	0	0	0	274
30S/25E-05K01	186	165	180	170	171	165	164	162	154	153	144	138	1,952
Strand												0	0
30S/25E-03L01	127	111	122	115	111	106	97	74	29	0	0	0	892
30S/25E-03Q01	175	70	0	0	0	0	139	242	232	238	229	232	1,557
30S/25E-03Q02	207	174	191	176	174	170	162	156	145	152	144	149	2,000
30S/25E-03R01	151	173	211	201	213	208	198	197	189	198	189	197	2,325
30S/25E-09A01	189	165	184	176	178	135	256	340	329	340	306	259	2,857
30S/25E-09J01	0	0	33	81	79	76	76	75	49	0	0	0	469
30S/25E-09L01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-09L02	150	129	114	60	117	106	103	99	96	99	104	95	1,272
30S/25E-10K01	122	100	108	96	95	89	82	80	8	0	0	127	907
30S/25E-11A01	92	77	33	0	0	0	144	147	142	146	140	143	1,064
30S/25E-11C01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-11C02	199	167	189	180	173	164	142	127	107	108	105	91	1,752
30S/25E-11E01	124	105	108	100	100	92	90	90	94	96	92	89	1,180
30S/25E-11L01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-11N01	92	86	93	85	86	81	78	79	73	76	72	69	970
30S/25E-11Q01	295	261	278	266	218	198	213	232	227	229	212	170	2,799
30S/25E-14E01	94	75	70	61	57	32	0	0	0	0	64	125	578
30S/25E-14J01	176	155	167	160	162	149	148	150	141	145	139	138	1,830
30S/25E-14K01	218	191	204	200	198	189	187	184	49	0	0	0	1,620
30S/25E-14N01	89	79	81	74	75	73	64	63	66	42	0	0	706
30S/25E-14R01	0	0	0	131	170	152	148	146	144	154	149	151	1,345
30S/25E-15B01	50	68	68	63	66	64	26	0	0	0	0	0	405
30S/25E-15C01	88	56	42	15	0	0	0	0	0	0	0	0	201
30S/25E-15R01	110	84	85	81	85	83	73	71	74	82	80	68	976
30S/25E-23H01	149	128	139	122	115	108	107	106	28	0	0	0	1,002
James												0	0
30S/25E-36D01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-24K01	81	81	82	87	86	77	75	69	69	44	73	73	897
30S/26E-17Q01	194	175	165	245	247	232	223	226	207	127	212	205	2,458
30S/26E-19G01	93	96	98	96	95	86	83	81	74	45	73	69	989
30S/26E-19M01	209	243	263	259	248	254	255	255	241	141	221	221	2,810
30S/26E-20C01	164	182	172	164	161	161	142	135	121	71	113	109	1,695
30S/26E-20L01	185	112	239	228	234	103	222	224	213	121	209	212	2,302
30S/26E-20N02	259	333	344	338	347	336	249	213	202	117	187	188	3,113
River												0	0
30S/25E-01Q01	283	237	265	244	243	235	221	235	217	226	219	210	2,835
30S/25E-12C01	24	95	104	98	97	90	82	77	71	72	67	62	939
30S/25E-13F01	145	127	136	135	136	132	134	134	129	133	121	129	1,591
30S/25E-13J01	117	96	112	110	107	108	106	72	0	0	0	0	828
30S/25E-13L01	117	100	108	108	109	106	108	107	103	106	99	102	1,273
30S/26E-06N01	281	240	251	239	231	205	148	0	0	0	47	210	1,852
30S/26E-06P01	90	72	49	0	0	0	181	406	386	391	308	388	2,271
30S/26E-07C01	264	234	258	248	254	244	238	223	209	216	205	174	2,767
30S/26E-07J01	175	127	60	0	0	0	143	262	247	244	228	227	1,713
30S/26E-07L01	357	300	325	308	303	288	278	272	259	269	258	247	3,464
30S/26E-07N01	199	174	191	181	186	168	169	167	160	166	155	154	2,070
30S/26E-07Q01	268	223	240	229	228	219	211	212	202	218	189	173	2,612
30S/26E-07R01	298	251	269	243	243	231	226	73	0	0	208	226	2,268
30S/26E-08M01	302	261	284	279	263	229	225	218	208	227	221	229	2,946
30S/26E-18B01	204	169	181	178	177	167	169	42	0	0	0	230	1,517
30S/26E-18D01	226	183	197	187	190	180	180	180	172	185	161	156	2,197
Main												0	0
30S/25E-15L01	149	122	128	122	126	119	106	74	0	0	0	0	946
30S/25E-15N01	105	88	89	84	86	54	69	69	69	71	66	63	913
30S/25E-15Q01	0	59	106	40	0	36	185	192	194	202	197	192	1,403
30S/25E-16B01	119	102	95	81	75	74	30	0	0	0	0	106	682
30S/25E-16D01	277	250	273	263	268	257	264	266	255	266	255	251	3,145
30S/25E-16F01	77	64	34	57	45	22	0	0	0	0	0	87	386
30S/25E-16J01	60	42	28	0	0	6	106	109	103	103	98	93	748
30S/25E-16M01	129	117	119	104	104	98	93	95	91	90	83	78	1,201
30S/25E-16P01	204	178	183	131	73	22	0	0	0	0	0	252	1,043
30S/25E-17H01	328	284	294	265	256	229	232	225	211	207	165	105	2,801
30S/25E-17J01	485	436	471	452	457	442	449	450	431	441	420	425	5,359
30S/25E-17P01	260	226	221	177	165	152	135	122	113	113	101	100	1,885
30S/25E-20A01	380	198	371	356	361	343	348	349	336	345	333	343	4,063
30S/25E-20C01	294	262	280	259	251	229	206	164	125	89	9	0	2,168
30S/25E-20L01	214	198	202	179	170	56	0	0	0	0	359	395	1,773
30S/25E-21A02	146	156	168	161	166	160	162	162	156	160	153	156	1,906
30S/25E-21D01	0	0	134	329	327	328	342	346	333	332	244	0	2,715
30S/25E-21G01	297	266	277	256	253	242	239	230	214	211	198	133	2,816
West												0	0
30S/24E-12H01	178	159	171	164	166	118	121	157	148	149	143	146	1,820
30S/24E-12R01	191	171	184	177	182	170	179	177	170	173	164	168	2,106
30S/24E-13C01	147	129	141	135	116	128	134	134	128	132	127	129	1,580
30S/24E-13H01	223	199	215	205	209	199	200	197	186	188	178	180	2,379
30S/24E-24A01	63	54	51	43	43	26	0	0	0	131	177	180	768
30S/25E-06K01	252	222	238	226	228	213	223	218	209	215	207	213	2,664
30S/25E-07G01	448	401	439	426	433	408	433	431	416	428	402	425	5,090
30S/25E-07P01	87	91	79	55	52	28	0	0	0	0	124	104	620
30S/25E-07R01	64	26	3	0	0	0	132	189	179	183	177	183	1,136
30S/25E-08F01	204	178	192	177	162	151	158	154	148	147	134	131	1,936
30S/25E-08J02	302	267	291	281	282	277	276	272	265	274	261	272	3,320
30S/25E-08P01	0	150	298	288	289	283	291	292	276	137	104	98	2,506
30S/25E-17F01	222	190	206	182	184	176	190	209	195	148	102	97	2,101
30S/25E-17M01	253	220	224	203	97	0	206	192	175	169	153	151	2,043
30S/25E-18A01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-18A02	330	292	315	289	291	272	261	254	241	244	232	235	3,256
30S/25E-18C01	0	0	76	110	142	215	220	219	210	216	207	212	1,827
30S/25E-18K01	456	409	444	430	429	78	295	429	411	421	399	414	4,615
30S/25E-18P01	235	208	223	210	169	205	194	182	171	170	150	141	2,258
30S/25E-18R01	267	235	248	234	232	231	232	229	218	222	210	209	2,767
Subtotal	15,158	13,453	14,676	14,002	13,717	12,338	13,476	13,491	12,243	11,754	12,075	12,702	159,085
30S/25E-36D01	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	15,158	13,453	14,676	14,002	13,717	12,338	13,476	13,491	12,243	11,754	12,075	12,702	159,085

Kern County Water Agency
Kern Fan Projects
Summary of Recovery
Through 12/31/16

Quantities in acre-feet

Year: **2016**

PROJECT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2800 Acres (Pioneer)	41	5	884	896	742	748	843	860	811	830	826	865	8,351
2800 Acres (Olcese)	0	0	0	0	0	0	0	0	0	0	0	0	0
Pioneer	239	256	3,941	3,429	2,319	2,180	2,239	2,147	2,037	2,107	1,996	2,185	25,075
Berrenda Mesa	324	163	2,074	1,872	1,619	1,570	1,668	1,636	1,451	1,348	281	0	14,006
Kern Water Bank	1,009	675	13,143	11,862	505	0	0	0	0	0	0	0	27,194
ID4 Banking Wells	65	31	668	724	249	208	211	207	197	199	61	210	3,030
TOTAL	**1,678**	**1,130**	**20,710**	**18,783**	**5,434**	**4,706**	**4,961**	**4,850**	**4,496**	**4,484**	**3,164**	**3,260**	**77,656**

Kern County Water Agency
Kern Water Bank
Summary of Recovery
Through 12/31/16

Quantities in acre-feet

Year: **2016**

WELL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
North													
30S/25E-04L01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-05K01	10	2	144	117	5	0	0	0	0	0	0	0	278
Strand													
30S/25E-03L01	0	0	142	133	2	0	0	0	0	0	0	0	277
30S/25E-03Q01	18	5	132	209	9	0	0	0	0	0	0	0	373
30S/25E-03Q02	11	5	162	148	6	0	0	0	0	0	0	0	332
30S/25E-03R01	15	6	231	213	9	0	0	0	0	0	0	0	474
30S/25E-09A01	27	4	3	0	0	0	0	0	0	0	0	0	34
30S/25E-09J01	0	0	97	89	4	0	0	0	0	0	0	0	190
30S/25E-09L01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-09L02	7	3	116	87	3	0	0	0	0	0	0	0	216
30S/25E-10K01	10	5	153	132	6	0	0	0	0	0	0	0	306
30S/25E-11A01	12	0	0	54	6	0	0	0	0	0	0	0	72
30S/25E-11C01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-11C02	7	0	0	0	0	0	0	0	0	0	0	0	7
30S/25E-11E01	7	3	104	96	4	0	0	0	0	0	0	0	214
30S/25E-11L01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-11N01	6	2	82	70	3	0	0	0	0	0	0	0	163
30S/25E-11Q01	13	6	254	214	9	0	0	0	0	0	0	0	496
30S/25E-14E01	10	4	127	57	0	0	0	0	0	0	0	0	198
30S/25E-14J01	11	4	154	136	5	0	0	0	0	0	0	0	310
30S/25E-14K01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-14N01	0	3	66	0	0	0	0	0	0	0	0	0	69
30S/25E-14R01	12	5	170	152	6	0	0	0	0	0	0	0	345
30S/25E-15B01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-15C01	0	0	53	0	0	0	0	0	0	0	0	0	53
30S/25E-15R01	5	4	83	76	3	0	0	0	0	0	0	0	171
30S/25E-23H01	0	0	0	0	0	0	0	0	0	0	0	0	0
James													
30S/25E-36D01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-24K01	6	3	89	79	3	0	0	0	0	0	0	0	180
30S/26E-17Q01	16	6	236	203	8	0	0	0	0	0	0	0	469
30S/26E-19G01	4	2	68	60	2	0	0	0	0	0	0	0	136
30S/26E-19M01	17	6	108	23	8	0	0	0	0	0	0	0	162
30S/26E-20C01	8	4	116	97	4	0	0	0	0	0	0	0	229
30S/26E-20L01	17	5	203	202	8	0	0	0	0	0	0	0	435
30S/26E-20N02	15	5	220	197	8	0	0	0	0	0	0	0	445
River													
30S/25E-01Q01	16	20	241	220	9	0	0	0	0	0	0	0	506
30S/25E-12C01	5	3	72	71	2	0	0	0	0	0	0	0	153
30S/25E-13F01	10	8	132	122	5	0	0	0	0	0	0	0	277
30S/25E-13J01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-13L01	8	6	100	91	4	0	0	0	0	0	0	0	209
30S/26E-06N01	17	19	227	217	9	0	0	0	0	0	0	0	489
30S/26E-06P01	31	25	387	368	15	0	0	0	0	0	0	0	826
30S/26E-07C01	13	15	202	168	7	0	0	0	0	0	0	0	405
30S/26E-07J01	18	17	256	219	9	0	0	0	0	0	0	0	519
30S/26E-07L01	19	45	309	240	9	0	0	0	0	0	0	0	622
30S/26E-07N01	12	0	0	107	6	0	0	0	0	0	0	0	125
30S/26E-07Q01	13	19	226	168	7	0	0	0	0	0	0	0	433
30S/26E-07R01	18	18	242	209	8	0	0	0	0	0	0	0	495
30S/26E-08M01	18	33	239	207	9	0	0	0	0	0	0	0	506
30S/26E-18B01	23	24	377	329	13	0	0	0	0	0	0	0	766
30S/26E-18D01	12	15	181	159	3	0	0	0	0	0	0	0	370
Main													
30S/25E-15L01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-15N01	5	3	5	58	2	0	0	0	0	0	0	0	73
30S/25E-15Q01	16	7	231	182	8	0	0	0	0	0	0	0	444
30S/25E-16B01	10	4	152	124	6	0	0	0	0	0	0	0	296
30S/25E-16D01	19	5	253	229	9	0	0	0	0	0	0	0	515
30S/25E-16F01	16	4	207	181	7	0	0	0	0	0	0	0	415
30S/25E-16J01	7	3	94	81	3	0	0	0	0	0	0	0	188
30S/25E-16M01	6	8	82	63	2	0	0	0	0	0	0	0	161
30S/25E-16P01	26	7	335	308	13	0	0	0	0	0	0	0	689
30S/25E-17H01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-17J01	35	23	427	394	17	0	0	0	0	0	0	0	896
30S/25E-17P01	8	10	132	101	4	0	0	0	0	0	0	0	255
30S/25E-20A01	27	18	351	329	14	0	0	0	0	0	0	0	739
30S/25E-20C01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-20L01	31	20	400	379	16	0	0	0	0	0	0	0	846
30S/25E-21A02	12	3	162	152	6	0	0	0	0	0	0	0	335
30S/25E-21D01	0	0	0	70	9	0	0	0	0	0	0	0	79
30S/25E-21G01	0	0	0	0	0	0	0	0	0	0	0	0	0
West													
30S/24E-12H01	12	8	148	136	6	0	0	0	0	0	0	0	310
30S/24E-12R01	14	9	168	157	6	0	0	0	0	0	0	0	354
30S/24E-13C01	10	7	125	112	5	0	0	0	0	0	0	0	259
30S/24E-13H01	14	9	181	169	7	0	0	0	0	0	0	0	380
30S/24E-24A01	14	3	178	160	7	0	0	0	0	0	0	0	362
30S/25E-06K01	17	4	212	196	8	0	0	0	0	0	0	0	437
30S/25E-07G01	34	8	425	398	17	0	0	0	0	0	0	0	882
30S/25E-07P01	11	4	76	77	2	0	0	0	0	0	0	0	170
30S/25E-07R01	14	10	185	177	7	0	0	0	0	0	0	0	393
30S/25E-08F01	9	4	149	117	5	0	0	0	0	0	0	0	284
30S/25E-08J02	21	6	276	254	10	0	0	0	0	0	0	0	567
30S/25E-08P01	8	15	110	260	11	0	0	0	0	0	0	0	404
30S/25E-17F01	8	23	186	172	10	0	0	0	0	0	0	0	399
30S/25E-17M01	12	26	174	142	6	0	0	0	0	0	0	0	360
30S/25E-18A01	0	0	0	0	0	0	0	0	0	0	0	0	0
30S/25E-18A02	19	13	253	227	10	0	0	0	0	0	0	0	522
30S/25E-18C01	17	11	186	24	8	0	0	0	0	0	0	0	246
30S/25E-18K01	33	21	416	384	16	0	0	0	0	0	0	0	870
30S/25E-18P01	11	8	141	124	5	0	0	0	0	0	0	0	289
30S/25E-18R01	16	12	219	186	7	0	0	0	0	0	0	0	440
Subtotal	1,009	675	13,143	11,862	505	0	0	0	0	0	0	0	27,194
30S/25E-36D01	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1,009	675	13,143	11,862	505	0	0	0	0	0	0	0	27,194

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **1995**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)
BERRENDA MESA												
SWP	3,008	417	1,705	3,774	219	1,123	1,255	263	449	-	274	-
FK	-	43	-	734	43	43	1,150	43	67	2,327	43	136
KR	-		-	-		-	-	104	-	-	78	-
TOTALS	**3,008**		**1,705**	**4,508**		**1,166**	**2,405**		**516**	**2,327**		**136**
2800 ACRES												
SWP	7,432	417	4,212	14,181	219	4,221	6,303	263	2,253	-	274	-
FK	-	43	-	2,100	43	123	175	43	10	264	43	15
KR	-		-	-		-	-	104	-	-	78	-
TOTALS	**7,432**		**4,212**	**16,281**		**4,344**	**6,478**		**2,263**	**264**		**15**
KERN WATER BANK												
SWP	-	417	-	-	219	-	-	263	-	-	274	-
FK	-	43	-	-	43	-	43	43	3	-	43	-
KR	-		-	-		-	-	104	-	714	78	76
TOTALS	**0**		**0**	**0**		**0**	**43**		**3**	**714**		**76**
PIONEER PROPERTY												
SWP	-	417	-	-	219	-	-	263	-	-	274	-
FK	-	43	-	-	43	-	2,253	43	132	6,551	43	383
KR	-		-	-		-	-	104	-	1,067	78	113
TOTALS	**0**		**0**	**0**		**0**	**2,253**		**132**	**7,618**		**496**
KERN RIVER CHANNEL												
SWP	-	417	-	-	219	-	-	263	-	-	274	-
FK	-	43	-	-	43	-	226	43	13	-	43	-
KR	-		-	-		-	-	104	-	-	78	-
TOTALS	**0**		**0**	**0**		**0**	**226**		**13**	**0**		**0**

PROJECT/SOURCE	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	144	-	-	152	-	-	158	-	-	178	-
FK	1,787	43	104	2,214	43	129	1,984	43	116	2,341	43	137
KR	523	87	62	1,036	62	87	581	43	34	319	38	16
TOTALS	**2,310**		**166**	**3,250**		**217**	**2,565**		**150**	**2,660**		**153**
2800 ACRES												
SWP	-	144	-	-	152	-	-	158	-	-	178	-
FK	7,658	43	448	7,804	43	456	1,079	43	63	4,558	43	266
KR	4,543	87	537	7,267	62	612	8,118	43	474	8,090	38	418
TOTALS	**12,201**		**985**	**15,071**		**1,068**	**9,197**		**537**	**12,648**		**684**
KERN WATER BANK												
SWP	-	144	-	988	152	204	-	158	-	708	178	171
FK	8,659	43	506	10,933	43	639	577	43	34	3,557	43	208
KR	1,461	87	173	12,254	62	1,033	32,945	43	1,925	35,816	38	1,850
TOTALS	**10,120**		**679**	**24,175**		**1,876**	**33,522**		**1,959**	**40,081**		**2,229**
PIONEER PROPERTY												
SWP	-	144	-	-	152	-	-	158	-	-	178	-
FK	6,442	43	376	4,966	43	290	3,669	43	214	2,780	43	162
KR	4,586	87	542	6,514	62	549	5,785	43	338	8,782	38	454
TOTALS	**11,028**		**919**	**11,480**		**839**	**9,454**		**552**	**11,562**		**616**
KERN RIVER CHANNEL												
SWP	-	144	-	-	152	-	-	158	-	-	178	-
FK	589	43	34	889	43	52	-	43	-	-	43	-
KR	-	87	-	88	62	7	803	43	47	-	38	-
TOTALS	**589**		**34**	**977**		**59**	**803**		**47**	**0**		**0**

PROJECT/SOURCE	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA														
SWP	-	165	-	73	141	14	778	160	169	2,549	270	935	**11,437**	**4,395**
FK	3,616	43	211	-	43	-	2,699	43	158	65	43	4	**18,917**	**1,106**
KR	-	61	-	1,626	61	135	47	73	5	-	117	-	**4,132**	**339**
TOTALS	**3,616**		**211**	**1,699**		**149**	**3,524**		**332**	**2,614**		**939**	**34,486**	**5,840**
2800 ACRES														
SWP	2,988	165	670	6,452	141	1,236	4,971	160	1,081	5,960	270	2,187	**48,287**	**15,860**
FK	5,930	43	347	377	43	22	75	43	4	-	43	-	**30,020**	**1,754**
KR	2,890	61	240	-	61	-	-	73	-	-	117	-	**30,908**	**2,281**
TOTALS	**11,808**		**1,256**	**6,829**		**1,258**	**5,046**		**1,085**	**5,960**		**2,187**	**109,215**	**19,896**
KERN WATER BANK														
SWP	2,421	165	543	15,481	141	2,967	26,844	160	5,837	23,887	270	8,765	**70,329**	**18,487**
FK	9,527	43	557	10,351	43	605	2,668	43	156	720	43	42	**47,035**	**2,749**
KR	19,386	61	1,607	2,320	61	192	-	73	-	-	117	-	**104,896**	**6,856**
TOTALS	**31,334**		**2,707**	**28,152**		**3,764**	**29,512**		**5,993**	**24,607**		**8,807**	**222,260**	**28,092**
PIONEER PROPERTY														
SWP	20	165	4	5,208	141	998	3,342	160	727	1,607	270	590	**10,177**	**2,319**
FK	4,052	43	237	254	43	15	3,164	43	185	1,548	43	90	**35,679**	**2,085**
KR	4,807	61	399	2,027	61	168	89	73	9	-	117	-	**33,657**	**2,571**
TOTALS	**8,879**		**640**	**7,489**		**1,181**	**6,595**		**920**	**3,155**		**680**	**79,513**	**6,975**
KERN RIVER CHANNEL														
SWP	-	165	-	-	141	-	-	160	-	-	270	-	**0**	**0**
FK	324	43	19	-	43	-	121	43	7	218	43	13	**2,367**	**138**
KR	-	61	-	-	61	-	-	73	-	-	117	-	**891**	**54**
TOTALS	**324**		**19**	**0**		**0**	**121**		**7**	**218**		**13**	**3,258**	**193**
													448,732	**60,995**

AVG TDS

100 MG/L

Water Quality Data Sources:

SWP - Table 32 of State Water Project Operations Data published monthly by State of California.

FK - 43 mg/l represents average of 10 samples collected by KCWA between Nov 94 and Feb 02 (range 19 mg/l to 112 mg/l)

KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and the value displayed is the average of 1995-2004

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **1996**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)
BERRENDA MESA															
SWP	111	284	43	184	251	63	-	236	-	-	211	-	-	265	-
FK	107	43	6	135	43	8	636	43	37	3,156	43	184	2,098	43	123
KR	-	95	-	-	92	-	-	102	-	-	92	-	-	80	-
TOTALS	**218**		**49**	**319**		**71**	**636**		**37**	**3,156**		**184**	**2,098**		**123**
2800 ACRES															
SWP	1,307	284	504	2,860	251	976	46	236	15	-	211	-	-	265	-
FK	-	43	-	644	43	38	3,289	43	192	11,428	43	668	664	43	39
KR	-	95	-	601	92	75	1,301	102	180	98	92	12	-	80	-
TOTALS	**1,307**		**504**	**4,105**		**1,088**	**4,636**		**387**	**11,526**		**680**	**664**		**39**
KERN WATER BANK															
SWP	11,587	284	4,472	10,740	251	3,664	6,497	236	2,084	1,409	211	404	2,103	265	757
FK	32	43	2	2,677	43	156	8,585	43	502	27,123	43	1,585	9,437	43	551
KR	-	95	-	-	92	-	-	102	-	-	92	-	12,259	80	1,333
TOTALS	**11,619**		**4,474**	**13,417**		**3,820**	**15,082**		**2,586**	**28,532**		**1,989**	**23,799**		**2,642**
PIONEER PROPERTY															
SWP	903	284	349	1,803	251	615	355	236	114	-	211	-	-	265	-
FK	466	43	27	2,703	43	158	4,334	43	253	7,070	43	413	3,904	43	228
KR	-	95	-	-	92	-	-	102	-	-	92	-	3,048	80	331
TOTALS	**1,369**		**376**	**4,506**		**773**	**4,689**		**367**	**7,070**		**413**	**6,952**		**560**
KERN RIVER CHANNEL															
SWP	-	284	-	254	251	87	-	236	-	-	211	-	-	265	-
FK	165	43	10	252	43	15	2,389	43	140	4,173	43	244	1,920	43	112
KR	-	95	-	-	92	-	-	102	-	649	92	81	2,097	80	228
TOTALS	**165**		**10**	**506**		**101**	**2,389**		**140**	**4,822**		**325**	**4,017**		**340**

PROJECT/SOURCE	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)
BERRENDA MESA															
SWP	-	260	-	-	214	-	-	197	-	-	146	-	-	152	-
FK	293	43	17	-	43	-	-	43	-	-	43	-	379	43	22
KR	-	50	-	-	50	-	-	60	-	-	77	-	524	75	53
TOTALS	**293**		**17**	**0**		**0**	**0**		**0**	**0**		**0**	**903**		**76**
2800 ACRES															
SWP	-	260	-	-	214	-	-	197	-	-	146	-	-	152	-
FK	-	43	-	-	43	-	-	43	-	-	43	-	603	43	35
KR	2,614	50	178	2,541	50	173	105	60	9	-	77	-	-	75	-
TOTALS	**2,614**		**178**	**2,541**		**173**	**105**		**9**	**0**		**0**	**603**		**35**
KERN WATER BANK															
SWP	255	260	90	2,015	214	586	11,456	197	3,067	10,695	146	2,122	9,079	152	1,876
FK	2,039	43	119	-	43	-	-	43	-	-	43	-	-	43	-
KR	10,369	50	705	2,282	50	155	-	60	-	-	77	-	-	75	-
TOTALS	**12,663**		**914**	**4,297**		**741**	**11,456**		**3,067**	**10,695**		**2,122**	**9,079**		**1,876**
PIONEER PROPERTY															
SWP	-	260	-	-	214	-	447	197	120	-	146	-	-	152	-
FK	838	43	49	-	43	-	-	43	-	-	43	-	605	43	35
KR	3,258	50	221	2,403	50	163	1,409	60	115	1,150	77	120	980	75	100
TOTALS	**4,096**		**270**	**2,403**		**163**	**1,856**		**235**	**1,150**		**120**	**1,585**		**135**
KERN RIVER CHANNEL															
SWP	22	260	8	-	214	-	-	197	-	-	146	-	-	152	-
FK	-	43	-	-	43	-	-	43	-	-	43	-	1,546	43	90
KR	457	50	31	884	50	60	-	60	-	-	77	-	2,214	75	226
TOTALS	**479**		**39**	**884**		**60**	**0**		**0**	**0**		**0**	**3,760**		**316**

PROJECT/SOURCE	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA								
SWP	-	195	-	625	266	226	**920**	**332**
FK	-	43	-	-	43	-	**6,804**	**398**
KR	321	99	43	1,397	109	207	**2,242**	**304**
TOTALS	**321**		**43**	**2,022**		**433**	**9,966**	**1,033**
2800 ACRES								
SWP	-	195	-	4,586	266	1,658	**8,799**	**3,153**
FK	1,109	43	65	-	43	-	**17,737**	**1,037**
KR	2,311	99	311	3,376	109	500	**12,947**	**1,438**
TOTALS	**3,420**		**376**	**7,962**		**2,158**	**39,483**	**5,627**
KERN WATER BANK								
SWP	5,601	195	1,484	16,055	266	5,804	**87,492**	**26,411**
FK	-	43	-	-	43	-	**49,893**	**2,916**
KR	1,398	99	188	10,182	109	1,508	**36,490**	**3,889**
TOTALS	**6,999**		**1,672**	**26,237**		**7,312**	**173,875**	**33,216**
PIONEER PROPERTY								
SWP	58	195	15	3,054	266	1,104	**6,620**	**2,317**
FK	601	43	35	-	43	-	**20,521**	**1,199**
KR	2,020	99	272	4,267	109	632	**18,535**	**1,955**
TOTALS	**2,679**		**322**	**7,321**		**1,736**	**45,676**	**5,471**
KERN RIVER CHANNEL								
SWP	-	195	-	64	266	23	**340**	**118**
FK	1,239	43	72	-	43	-	**11,684**	**683**
KR	-	99	-	-	109	-	**6,301**	**626**
TOTALS	**1,239**		**72**	**64**		**23**	**18,325**	**1,426**
							287,325	**46,773**

AVG TDS **120** MG/L

Water Quality Data Sources:

SWP - Table 32 of State Water Project Operations Data published monthly by State of California.

FK - 43 mg/l represents average of 10 samples collected by KCWA between Nov 94 and Feb 02 (range 19 mg/l to 112 mg/l).

KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and the value displayed is the average of 1995-2004.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **1997**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)
BERRENDA MESA												
SWP	52	66	5	-	88	-	-	147	-	-	225	-
FK	2,932	43	171	1,544	43	90	-	43	-	-	43	-
KR	139	86	16	506	87	60	1,366	84	156	16	72	2
TOTALS	**3,123**		**192**	**2,050**		**150**	**1,366**		**156**	**16**		**2**
2800 ACRES												
SWP	65	66	6	-	88	-	-	147	-	-	225	-
FK	-	43	-	-	43	-	-	43	-	-	43	-
KR	875	86	102	-	87	-	-	84	-	623	72	61
TOTALS	**940**		**108**	**0**		**0**	**0**		**0**	**623**		**61**
KERN WATER BANK												
SWP	987	66	89	-	88	-	5,627	147	1,124	2,772	225	848
FK	25,506	43	1,491	3,300	43	193	-	43	-	-	43	-
KR	6,418	86	750	18,330	87	2,167	13,771	84	1,572	4,781	72	468
TOTALS	**32,911**		**2,329**	**21,630**		**2,360**	**19,398**		**2,696**	**7,553**		**1,315**
PIONEER PROPERTY												
SWP	131	66	12	-	88	-	-	147	-	-	225	-
FK	7,304	43	427	-	43	-	24	43	1	-	43	-
KR	2,501	86	292	7,185	87	850	5,965	84	681	1,534	72	150
TOTALS	**9,936**		**731**	**7,185**		**850**	**5,989**		**682**	**1,534**		**150**
KERN RIVER CHANNEL												
SWP	-	66	-	-	88	-	-	147	-	-	225	-
FK	-	43	-	-	43	-	-	43	-	-	43	-
KR	-	86	-	-	87	-	-	84	-	188	72	18
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**188**		**18**

PROJECT/SOURCE	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	227	-	-	219	-	-	210	-	-	224	-
FK	-	43	-	-	43	-	-	43	-	-	43	-
KR	-	74	-	-	74	-	-	60	-	-	57	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	227	-	-	219	-	-	210	-	-	224	-
FK	-	43	-	-	43	-	-	43	-	-	43	-
KR	1,680	74	169	-	74	-	-	60	-	-	57	-
TOTALS	**1,680**		**169**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	227	-	-	219	-	-	210	-	-	224	-
FK	-	43	-	-	43	-	-	43	-	-	43	-
KR	107	74	11	-	74	-	-	60	-	-	57	-
TOTALS	**107**		**11**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	227	-	-	219	-	-	210	-	-	224	-
FK	-	43	-	-	43	-	-	43	-	-	43	-
KR	1,450	74	146	490	74	49	-	60	-	-	57	-
TOTALS	**1,450**		**146**	**490**		**49**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	227	-	-	219	-	-	210	-	-	224	-
FK	-	43	-	-	43	-	-	43	-	-	43	-
KR	79	74	8	-	74	-	-	60	-	-	57	-
TOTALS	**79**		**8**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA														
SWP	-	154	-	-	180	-	-	331	-	-	293	-	**52**	**5**
FK	-	43	-	-	43	-	-	43	-	-	43	-	**4,476**	**262**
KR	-	54	-	-		-	-	92	-	-		-	**2,027**	**234**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**6,555**	**500**
2800 ACRES														
SWP	-	154	-	-	180	-	-	331	-	2,497	293	994	**2,562**	**1,000**
FK	-	43	-	-	43	-	-	43	-	-	43	-	**0**	**0**
KR	-	54	-	-		-	-	92	-	-		-	**3,178**	**332**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**2,497**		**994**	**5,740**	**1,332**
KERN WATER BANK														
SWP	2,769	154	580	2,563	180	627	11,165	331	5,023	14,166	293	5,641	**40,049**	**13,931**
FK	-	43	-	-	43	-	-	43	-	-	43	-	**28,806**	**1,683**
KR	-	54	-	-		-	-	92	-	-		-	**43,407**	**4,968**
TOTALS	**2,769**		**580**	**2,563**		**627**	**11,165**		**5,023**	**14,166**		**5,641**	**112,262**	**20,582**
PIONEER PROPERTY														
SWP	-	154	-	-	180	-	-	331	-	3,501	293	1,394	**3,632**	**1,406**
FK	-	43	-	-	43	-	-	43	-	-	43	-	**7,328**	**428**
KR	-	54	-	-		-	-	92	-	-		-	**19,125**	**2,168**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**3,501**		**1,394**	**30,085**	**4,002**
KERN RIVER CHANNEL														
SWP	-	154	-	-	180	-	-	331	-	-	293	-	**0**	**0**
FK	-	43	-	-	43	-	-	43	-	-	43	-	**0**	**0**
KR	-	54	-	-		-	6,204	92	776	-		-	**6,471**	**802**
TOTALS	**0**		**0**	**0**		**0**	**6,204**		**776**	**0**		**0**	**6,471**	**802**
													161,113	**27,219**

AVG TDS **124** MG/L

Water Quality Data Sources:

SWP - Table 32 of State Water Project Operations Data published monthly by State of California.

FK - 43 mg/l represents average of 10 samples collected by KCWA between Nov 94 and Feb 02 (range 19 mg/l to 112 mg/l).

KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and the value displayed is the average of 1995-2004.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **1998**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	297	-	-	227	-	-	218	-	-	108	-
FK	-	20	-	412	20	11	1,505	20	41	857	20	23
KR	-	92	-	2,331	92	291	609	111	92	66	129	12
TOTALS	**0**		**0**	**2,743**		**303**	**2,114**		**133**	**923**		**35**
2800 ACRES												
SWP	1,631	297	658	-	227	-	-	218	-	-	108	-
FK	-	20	-	1,335	20	36	-	20	-	-	20	-
KR	2,539	92	317	12,949	92	1,619	10,965	111	1,654	8,495	129	1,489
TOTALS	**4,170**		**976**	**14,284**		**1,655**	**10,965**		**1,654**	**8,495**		**1,489**
KERN WATER BANK												
SWP	13,952	297	5,632	3,118	227	962	-	218	-	-	108	-
FK	-	20	-	10,259	20	279	24,391	20	663	5,717	20	155
KR	887	92	111	9,625	92	1,203	10,020	111	1,512	26,924	129	4,720
TOTALS	**14,839**		**5,743**	**23,002**		**2,444**	**34,411**		**2,175**	**32,641**		**4,876**
PIONEER PROPERTY												
SWP	2,677	297	1,081	-	227	-	-	218	-	-	108	-
FK	-	20	-	421	20	11	1,573	20	43	159	20	4
KR	-	92	-	5,018	92	627	4,055	111	612	5,037	129	883
TOTALS	**2,677**		**1,081**	**5,439**		**639**	**5,628**		**654**	**5,196**		**887**
KERN RIVER CHANNEL												
SWP	-	297	-	-	227	-	-	218	-	-	108	-
FK	-	20	-	-	20	-	-	20	-	-	20	-
KR	264	92	33	-	92	-	-	111	-	-	129	-
TOTALS	**264**		**33**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	78	-	-	78	-	-	124	-	-	186	-
FK	-	20	-	-	20	-	424	20	12	-	20	-
KR	2,015	76	208	1,698	90	208	1,246	64	108	1,809	51	125
TOTALS	**2,015**		**208**	**1,698**		**208**	**1,670**		**120**	**1,809**		**125**
2800 ACRES												
SWP	-	78	-	-	78	-	-	124	-	-	186	-
FK	-	20	-	-	20	-	-	20	-	-	20	-
KR	-	76	-	-	90	-	6,271	64	545	-	51	-
TOTALS	**0**		**0**	**0**		**0**	**6,271**		**545**	**0**		**0**
KERN WATER BANK												
SWP	-	78	-	-	78	-	-	124	-	-	186	-
FK	-	20	-	-	20	-	9,404	20	256	-	20	-
KR	30,701	76	3,171	33,968	90	4,155	24,710	64	2,149	29,615	51	2,053
TOTALS	**30,701**		**3,171**	**33,968**		**4,155**	**34,114**		**2,405**	**29,615**		**2,053**
PIONEER PROPERTY												
SWP	-	78	-	-	78	-	-	124	-	-	186	-
FK	-	20	-	-	20	-	-	20	-	-	20	-
KR	8,452	76	873	7,456	90	912	7,073	64	615	5,826	51	404
TOTALS	**8,452**		**873**	**7,456**		**912**	**7,073**		**615**	**5,826**		**404**
KERN RIVER CHANNEL												
SWP	-	78	-	-	78	-	-	124	-	-	186	-
FK	-	20	-	-	20	-	-	20	-	-	20	-
KR	-	76	-	-	90	-	-	64	-	-	51	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA														
SWP	607	206	170	60	142	12	-	130	-	319	207	90	**986**	**271**
FK	-	20	-	-	20	-	-	15	-	1,034	15	21	**4,232**	**108**
KR	1,380	54	101	2,070	76	214	1,889	69	177	18	97	2	**15,131**	**1,539**
TOTALS	**1,987**		**271**	**2,130**		**225**	**1,889**		**177**	**1,371**		**113**	**20,349**	**1,918**
2800 ACRES														
SWP	-	206	-	986	142	190	-	130	-	30	207	8	**2,647**	**857**
FK	-	20	-	-	20	-	-	15	-	2,910	15	59	**4,245**	**96**
KR	-	54	-	4,471	76	462	3,137	69	294	678	97	89	**49,505**	**6,471**
TOTALS	**0**		**0**	**5,457**		**652**	**3,137**		**294**	**3,618**		**157**	**56,397**	**7,424**
KERN WATER BANK														
SWP	6,447	206	1,805	15,270	142	2,947	3,804	130	672	8,564	207	2,409	**51,155**	**14,427**
FK	-	20	-	-	20	-	-	15	-	5,477	15	112	**55,248**	**1,465**
KR	10,305	54	756	3,987	76	412	15,298	69	1,435	272	97	36	**196,312**	**21,713**
TOTALS	**16,752**		**2,561**	**19,257**		**3,359**	**19,102**		**2,107**	**14,313**		**2,557**	**302,715**	**37,604**
PIONEER PROPERTY														
SWP	1,644	206	460	1,989	142	384	43	130	8	1,293	207	364	**7,646**	**2,296**
FK	-	20	-	-	20	-	-	15	-	2,682	15	55	**4,835**	**113**
KR	4,836	54	355	3,961	76	409	4,797	69	450	123	97	16	**56,634**	**6,156**
TOTALS	**6,480**		**815**	**5,950**		**793**	**4,840**		**457**			**435**	**69,115**	**8,566**
KERN RIVER CHANNEL														
SWP	-	206	-	-	142	-	-	130	-	8	207	2	**8**	**2**
FK	-	20	-	-	20	-	-	15	-	600	15	12	**600**	**12**
KR	-	54	-	-	76	-	-	69	-	-	97	-	**264**	**33**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**608**		**14**	**872**	**47**
													449,448	**55,559**

AVG TDS 91 MG/L

Water Quality Data Sources:

SWP - Table 32 of State Water Project Operations Data published monthly by State of California.

FK - 20 mg/L value reported on Henry C. Garnett Water Purification Plant Annual Report. 15 mg/L value (Nov.) reported in Friant Kern Canal Total Dissolved Solids Data Tables, U.S. Bureau of Reclamation, Mid-Pacific Region.

KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and the value displayed is the average of 1995-2004.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **1999**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)
BERRENDA MESA															
SWP	-	315	-	-	216	-	-	158	-	-	231	-	-	232	-
FK	401	15	8	198	33	9	-	33	-	-	33	-	-	36	-
KR	34	116	5	-	100	-	-	114	-	-	125	-	-	107	-
TOTALS	**435**		**14**	**198**		**9**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES															
SWP	-	315	-	-	216	-	-	158	-	-	231	-	-	232	-
FK	1,313	15	27	2,639	33	118	-	33	-	-	33	-	-	36	-
KR	650	116	102	2,093	100	284	-	114	-	-	125	-	-	107	-
TOTALS	**1,963**		**129**	**4,732**		**403**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK															
SWP	1,525	315	653	1,149	216	337	1,022	158	219	2,274	231	714	347	232	109
FK	3,002	15	61	7,561	33	339	-	33	-	-	33	-	-	36	-
KR	-	116	-	179	100	24	-	114	-	-	125	-	-	107	-
TOTALS	**4,527**		**714**	**8,889**		**701**	**1,022**		**219**	**2,274**		**714**	**347**		**109**
PIONEER PROPERTY															
SWP	-	315	-	-	216	-	-	158	-	-	231	-	-	232	-
FK	2,119	15	43	3,773	33	169	-	33	-	-	33	-	-	36	-
KR	-	116	-	1,104	100	150	-	114	-	-	125	-	-	107	-
TOTALS	**2,119**		**43**	**4,877**		**319**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL															
SWP	-	315	-	-	216	-	-	158	-	-	231	-	-	232	-
FK	160	15	3	-	33	-	-	33	-	-	33	-	-	36	-
KR	-	116	-	-	100	-	-	114	-	-	125	-	-	107	-
TOTALS	**160**		**3**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	228	-	-	199	-	-	153	-	-	164	-
FK	-	36	-	-	36	-	-	20	-	-	20	-
KR	-	95	-	-	76	-	-	66	-	-	95	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	228	-	-	199	-	-	153	-	-	164	-
FK	-	36	-	-	36	-	-	20	-	-	20	-
KR	-	95	-	-	76	-	-	66	-	-	95	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	228	-	-	199	-	-	153	-	-	164	-
FK	-	36	-	-	36	-	-	20	-	-	20	-
KR	-	95	-	-	76	-	-	66	-	-	95	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	228	-	-	199	-	-	153	-	-	164	-
FK	-	36	-	-	36	-	-	20	-	-	20	-
KR	-	95	-	-	76	-	-	66	-	-	95	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	228	-	-	199	-	-	153	-	-	164	-
FK	-	36	-	-	36	-	-	20	-	-	20	-
KR	-	95	-	-	76	-	-	66	-	-	95	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA											
SWP	-	258	-	-	242	-	-	291	-	**0**	**0**
FK	-	20	-	-	29	-	-	29	-	**599**	**17**
KR	-	111	-	-	105	-	-		-	**34**	**5**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**633**	**22**
2800 ACRES											
SWP	2,073	258	727	1,495	242	492	-	291	-	**3,568**	**1,219**
FK	-	20	-	-	29	-	-	29	-	**3,952**	**145**
KR	-	111	-	-	105	-	-		-	**2,743**	**387**
TOTALS	**2,073**		**727**	**1,495**		**492**	**0**		**0**	**10,263**	**1,751**
KERN WATER BANK											
SWP	5,758	258	2,019	10,780	242	3,545	3,156	291	1,248	**26,011**	**8,846**
FK	-	20	-	-	29	-	-	29	-	**10,563**	**400**
KR	-	111	-	-	105	-	-		-	**179**	**24**
TOTALS	**5,758**		**2,019**	**10,780**		**3,545**	**3,156**		**1,248**	**36,753**	**9,270**
PIONEER PROPERTY											
SWP	2,890	258	1,013	2,206	242	726	1,640	291	649	**6,736**	**2,387**
FK	-	20	-	-	29	-	-	29	-	**5,892**	**212**
KR	-	111	-	-	105	-	-		-	**1,104**	**150**
TOTALS	**2,890**		**1,013**	**2,206**		**726**	**1,640**		**649**	**13,732**	**2,750**
KERN RIVER CHANNEL											
SWP	-	258	-	-	242	-	-	291	-	**0**	**0**
FK	-	20	-	35	29	1	1,848	29	73	**2,043**	**77**
KR	-	111	-	-	105	-	-		-	**0**	**0**
TOTALS	**0**		**0**	**35**		**1**	**1,848**		**73**	**2,043**	**77**
										63,424	**13,871**

AVG TDS **161** MG/L

Water Quality Data Sources:

SWP - Table 32 of State Water Project Operations Data published monthly by State of California.

FK - value taken from Friant Kern Canal Total Dissolved Solids Data Tables, U.S. Bureau of Reclamation, Mid-Pacific Region.

KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and the value displayed is the average of 1995-2004.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2000**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	295	-	-	250	-	-	187	-	-	206	-
FK	-	29	-	-	29	-	1,027	26	36	-	26	-
KR	-	119	-	-	117	-	-	144	-	-	105	-
TOTALS	**0**		**0**	**0**		**0**	**1,027**		**36**	**0**		**0**
2800 ACRES												
SWP	-	295	-	-	250	-	79	187	20	-	206	-
FK	-	29	-	-	29	-	16,958	26	599	968	26	34
KR	-	119	-	-	117	-	-	144	-	-	105	-
TOTALS	**0**		**0**	**0**		**0**	**17,037**		**619**	**968**		**34**
KERN WATER BANK												
SWP	224	295	90	4,896	250	1,664	14,002	187	3,559	-	206	-
FK	-	29	-	-	29	-	7,448	26	263	-	26	-
KR	-	119	-	-	117	-	-	144	-	-	105	-
TOTALS	**224**		**90**	**4,896**		**1,664**	**21,450**		**3,822**	**0**		**0**
PIONEER PROPERTY												
SWP	2	295	1	-	250	-	3,062	187	778	1,472	206	412
FK	-	29	-	-	29	-	3,288	26	116	127	26	4
KR	-	119	-	-	117	-	-	144	-	-	105	-
TOTALS	**2**		**1**	**0**		**0**	**6,350**		**894**	**1,599**		**417**
KERN RIVER CHANNEL												
SWP	-	295	-	-	250	-	-	187	-	-	206	-
FK	-	29	-	-	29	-	3,858	26	136	215	26	8
KR	-	119	-	-	117	-	-	144	-	-	105	-
TOTALS	**0**		**0**	**0**		**0**	**3,858**		**136**	**215**		**8**

PROJECT/SOURCE	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	239	-	-	239	-	-	189	-	-	213	-
FK	-	82	-	-	82	-	-	82	-	-	15	-
KR	-	99	-	-	79	-	-	65	-	-	74	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	179	239	58	-	239	-	-	189	-	-	213	-
FK	12,247	82	1,365	487	82	54	-	82	-	-	15	-
KR	-	99	-	-	79	-	-	65	-	-	74	-
TOTALS	**12,426**		**1,423**	**487**		**54**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	239	-	-	239	-	-	189	-	-	213	-
FK	676	82	75	-	82	-	-	82	-	-	15	-
KR	-	99	-	-	79	-	-	65	-	-	74	-
TOTALS	**676**		**75**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	1,053	239	342	-	239	-	-	189	-	-	213	-
FK	6,050	82	674	242	82	27	-	82	-	-	15	-
KR	-	99	-	-	79	-	-	65	-	-	74	-
TOTALS	**7,103**		**1,016**	**242**		**27**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	239	-	-	239	-	-	189	-	-	213	-
FK	-	82	-	-	82	-	-	82	-	-	15	-
KR	-	99	-	-	79	-	-	65	-	-	74	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA														
SWP	-	164	-	-	248	-	-	262	-	-	301	-	**0**	**0**
FK	-	15	-	-	15	-	-	16	-	-	16	-	**1,027**	**36**
KR	-	95	-	-	121	-	-	129	-	-	123	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**1,027**	**36**
2800 ACRES														
SWP	-	164	-	-	248	-	-	262	-	-	301	-	**258**	**78**
FK	-	15	-	-	15	-	-	16	-	-	16	-	**30,660**	**2,053**
KR	-	95	-	-	121	-	-	129	-	-	123	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**30,918**	**2,131**
KERN WATER BANK														
SWP	-	164	-	-	248	-	333	262	119	-	301	-	**19,455**	**5,430**
FK	-	15	-	-	15	-	-	16	-	-	16	-	**8,124**	**339**
KR	-	95	-	-	121	-	-	129	-	-	123	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**333**		**119**	**0**		**0**	**27,579**	**5,769**
PIONEER PROPERTY														
SWP	-	164	-	-	248	-	-	262	-	-	301	-	**5,589**	**1,533**
FK	-	15	-	-	15	-	-	16	-	-	16	-	**9,707**	**822**
KR	-	95	-	-	121	-	-	129	-	-	123	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**15,296**	**2,355**
KERN RIVER CHANNEL														
SWP	-	164	-	-	248	-	-	262	-	-	301	-	**0**	**0**
FK	-	15	-	-	15	-	-	16	-	-	16	-	**4,073**	**144**
KR	-	95	-	-	121	-	-	129	-	-	123	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**4,073**	**144**
													78,893	**10,435**

AVG TDS **97 MG/L**

Water Quality Data Sources:

SWP - Table 32 of State Water Project Operations Data published monthly by State of California.

FK - value taken from Friant Kern Canal Total Dissolved Solids Data Tables, U.S. Bureau of Reclamation, Mid-Pacific Region.

KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and the value displayed is the average of 1995-2004.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2001**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)
BERRENDA MESA															
SWP	-	374	-	-	337	-	-	280	-	-	275	-	-	239	-
FK	-	16	-	-	29	-	-	29	-	-	29	-	-	29	-
KR	-		-	-		-	-	122	-	-		-	-	94	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES															
SWP	-	374	-	-	337	-	2,539	280	966	-	275	-	-	239	-
FK	-	16	-	-	29	-	-	29	-	-	29	-	-	29	-
KR	-		-	-		-	-	122	-	-		-	-	94	-
TOTALS	**0**		**0**	**0**		**0**	**2,539**		**966**	**0**		**0**	**0**		**0**
KERN WATER BANK															
SWP	-	374	-	-	337	-	10,030	280	3,817	-	275	-	-	239	-
FK	-	16	-	-	29	-	-	29	-	-	29	-	-	29	-
KR	-		-	-		-	-	122	-	-		-	-	94	-
TOTALS	**0**		**0**	**0**		**0**	**10,030**		**3,817**	**0**		**0**	**0**		**0**
PIONEER PROPERTY															
SWP	-	374	-	-	337	-	1,253	280	477	-	275	-	-	239	-
FK	-	16	-	-	29	-	-	29	-	-	29	-	-	29	-
KR	-		-	-		-	-	122	-	-		-	-	94	-
TOTALS	**0**		**0**	**0**		**0**	**1,253**		**477**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL															
SWP	-	374	-	-	337	-	139	280	53	-	275	-	-	239	-
FK	-	16	-	-	29	-	-	29	-	-	29	-	-	29	-
KR	-		-	-		-	-	122	-	-		-	-	94	-
TOTALS	**0**		**0**	**0**		**0**	**139**		**53**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	227	-	-	291	-	-	245	-	-	323	-
FK	-	29	-	-	29	-	-	15	-	-	15	-
KR	-	72	-	-		-	-		-	-		-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	227	-	-	291	-	-	245	-	-	323	-
FK	-	29	-	-	29	-	-	15	-	-	15	-
KR	-	72	-	-		-	-		-	-		-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	227	-	-	291	-	-	245	-	-	323	-
FK	-	29	-	-	29	-	-	15	-	-	15	-
KR	-	72	-	-		-	-		-	-		-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	227	-	-	291	-	-	245	-	-	323	-
FK	-	29	-	-	29	-	-	15	-	-	15	-
KR	-	72	-	-		-	-		-	-		-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	227	-	-	291	-	-	245	-	-	323	-
FK	-	29	-	-	29	-	-	15	-	-	15	-
KR	-	72	-	-		-	-		-	-		-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA											
SWP	-	365	-	-	333	-	-	310	-	**0**	**0**
FK	-	15	-	-	30	-	-	30	-	**0**	**0**
KR	-		-	-	92	-	-	92	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
2800 ACRES											
SWP	-	365	-	-	333	-	-	310	-	**2,539**	**966**
FK	-	15	-	-	30	-	-	30	-	**0**	**0**
KR	-		-	-	92	-	-	92	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**2,539**	**966**
KERN WATER BANK											
SWP	-	365	-	-	333	-	-	310	-	**10,030**	**3,817**
FK	-	15	-	-	30	-	-	30	-	**0**	**0**
KR	-		-	-	92	-	-	92	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**10,030**	**3,817**
PIONEER PROPERTY											
SWP	-	365	-	-	333	-	-	310	-	**1,253**	**477**
FK	-	15	-	-	30	-	-	30	-	**0**	**0**
KR	-		-	-	92	-	-	92	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**1,253**	**477**
KERN RIVER CHANNEL											
SWP	-	365	-	-	333	-	-	310	-	**139**	**53**
FK	1,262	15	26	-	30	-	-	30	-	**1,262**	**26**
KR	-		-	8	92	1	805	92	101	**813**	**102**
TOTALS	**1,262**		**26**	**8**		**1**	**805**		**101**	**2,214**	**180**
										16,036	**5,440**

AVG TDS **250 MG/L**

Water Quality Data Sources:

SWP - Table 32 of State Water Project Operations Data published monthly by State of California.

FK - value taken from Friant Kern Canal Total Dissolved Solids Data Tables, U.S. Bureau of Reclamation, Mid-Pacific Region.

KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is inred, then no sample was taken and the value displayed is the average of 1995-2004.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2002**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	273	-	-	237	-	-	290	-	-	287	-
FK	-	30	-	-	30	-	-	30	-	-	30	-
KR	-	127	-	-	153	-	-	118	-	-	124	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	273	-	-	237	-	929	290	366	551	287	215
FK	-	30	-	-	30	-	-	30	-	-	30	-
KR	-	127	-	-	153	-	-	118	-	-	124	-
TOTALS	**0**		**0**	**0**		**0**	**929**		**366**	**551**		**215**
KERN WATER BANK												
SWP	7,059	273	2,619	-	237	-	3,039	290	1,198	3,341	287	1,303
FK	-	30	-	-	30	-	-	30	-	-	30	-
KR	-	127	-	-	153	-	-	118	-	-	124	-
TOTALS	**7,059**		**2,619**	**0**		**0**	**3,039**		**1,198**	**3,341**		**1,303**
PIONEER PROPERTY												
SWP	-	273	-	-	237	-	506	290	199	928	287	362
FK	-	30	-	-	30	-	-	30	-	-	30	-
KR	-	127	-	-	153	-	-	118	-	-	124	-
TOTALS	**0**		**0**	**0**		**0**	**506**		**199**	**928**		**362**
KERN RIVER CHANNEL												
SWP	-	273	-	-	237	-	-	290	-	-	287	-
FK	-	30	-	-	30	-	-	30	-	-	30	-
KR	1,038	127	179	1,267	153	263	-	118	-	-	124	-
TOTALS	**1,038**		**179**	**1,267**		**263**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	316	-	-	295	-	-	245	-	-	309	-
FK	-	38	-	-	38	-	-	38	-	-	22	-
KR	-	100	-	-		-	-		-	-	91	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	316	-	-	295	-	-	245	-	-	309	-
FK	-	38	-	-	38	-	-	38	-	-	22	-
KR	-	100	-	-		-	-		-	-	91	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	316	-	-	295	-	-	245	-	-	309	-
FK	-	38	-	-	38	-	-	38	-	-	22	-
KR	-	100	-	-		-	-		-	-	91	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	316	-	-	295	-	-	245	-	-	309	-
FK	-	38	-	-	38	-	-	38	-	-	22	-
KR	-	100	-	-		-	-		-	-	91	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	316	-	-	295	-	-	245	-	-	309	-
FK	-	38	-	-	38	-	-	38	-	-	22	-
KR	-	100	-	-		-	-		-	-	91	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA														
SWP	-	309	-	-	412	-	-	412	-	-	355	-	**0**	**0**
FK	-	22	-	-	22	-	-	30	-	-	30	-	**0**	**0**
KR	-	132	-	-	120	-	-		-	-		-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
2800 ACRES														
SWP	-	309	-	-	412	-	-	412	-	-	355	-	**1,480**	**581**
FK	-	22	-	-	22	-	-	30	-	-	30	-	**0**	**0**
KR	-	132	-	-	120	-	-		-	-		-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**1,480**	**581**
KERN WATER BANK														
SWP	-	309	-	-	412	-	-	412	-	-	355	-	**13,439**	**5,120**
FK	-	22	-	-	22	-	-	30	-	-	30	-	**0**	**0**
KR	-	132	-	-	120	-	-		-	-		-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**13,439**	**5,120**
PIONEER PROPERTY														
SWP	-	309	-	-	412	-	-	412	-	-	355	-	**1,434**	**561**
FK	-	22	-	-	22	-	-	30	-	-	30	-	**0**	**0**
KR	-	132	-	-	120	-	-		-	-		-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**1,434**	**561**
KERN RIVER CHANNEL														
SWP	-	309	-	-	412	-	-	412	-	-	355	-	**0**	**0**
FK	-	22	-	-	22	-	-	30	-	-	30	-	**0**	**0**
KR	-	132	-	-	120	-	-		-	-		-	**2,305**	**443**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**2,305**	**443**
													18,658	**6,705**

AVG TDS **264 MG/L**

Water Quality Data Sources:
- SWP - Table 32 of State Water Project Operations Data published monthly by State of California.
- FK - value taken from Friant Kern Canal Total Dissolved Solids Data Tables, U.S. Bureau of Reclamation, Mid-Pacific Region.
- KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and the value displayed is the average of 1995-2004

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2003**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)
BERRENDA MESA																		
SWP	-	306	-	-	273	-	419	231	132	-	242	-	-	316	-	-	167	-
FK	-	30	-	-	33	-	-	33	-	-	33	-	-	19	-	-	19	-
KR	-	133	-	-	117	-	-	122	-	-	128	-	-	109	-	-	85	-
TOTALS	**0**		**0**	**0**		**0**	**419**		**132**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES																		
SWP	-	306	-	-	273	-	589	231	185	71	242	23	-	316	-	-	167	-
FK	-	30	-	-	33	-	-	33	-	-	33	-	787	19	20	-	19	-
KR	-	133	-	-	117	-	-	122	-	-	128	-	-	109	-	-	85	-
TOTALS	**0**		**0**	**0**		**0**	**589**		**185**	**71**		**23**	**787**		**20**	**0**		**0**
KERN WATER BANK																		
SWP	-	306	-	-	273	-	4,632	231	1,454	-	242	-	-	316	-	-	167	-
FK	-	30	-	-	33	-	-	33	-	-	33	-	-	19	-	-	19	-
KR	-	133	-	-	117	-	-	122	-	-	128	-	-	109	-	-	85	-
TOTALS	**0**		**0**	**0**		**0**	**4,632**		**1,454**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY																		
SWP	-	306	-	-	273	-	611	231	192	6	242	2	-	316	-	-	167	-
FK	-	30	-	-	33	-	-	33	-	-	33	-	-	19	-	-	19	-
KR	-	133	-	-	117	-	-	122	-	-	128	-	-	109	-	-	85	-
TOTALS	**0**		**0**	**0**		**0**	**611**		**192**	**6**		**2**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL																		
SWP	-	306	-	-	273	-	398	231	125	-	242	-	-	316	-	-	167	-
FK	-	30	-	-	33	-	-	33	-	828	33	37	7,252	19	187	239	19	6
KR	-	133	-	169	117	27	-	122	-	-	128	-	-	109	-	-	85	-
TOTALS	**0**		**0**	**169**		**27**	**398**		**125**	**828**		**37**	**7,252**		**187**	**239**		**6**

PROJECT/SOURCE	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA																				
SWP	-	231	-	-	178	-	-	175	-	-	273	-	-	303	-	300	384	157	**719**	**288**
FK	-	19	-	-	29	-	-	29	-	-	29	-	-	26	-	-	26	-	**0**	**0**
KR	-		-	-		-	-		-	-		-	-		-	-	92	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**300**		**157**	**719**	**288**
2800 ACRES																				
SWP	-	231	-	-	178	-	-	175	-	-	273	-	-	303	-	341	384	178	**1,001**	**386**
FK	-	19	-	-	29	-	-	29	-	-	29	-	-	26	-	-	26	-	**787**	**20**
KR	-		-	-		-	-		-	-		-	-		-	-	92	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**341**		**178**	**1,788**	**407**
KERN WATER BANK																				
SWP	-	231	-	-	178	-	-	175	-	2,413	273	895	16,789	303	6,914	16,540	384	8,632	**40,374**	**17,895**
FK	-	19	-	-	29	-	-	29	-	-	29	-	-	26	-	-	26	-	**0**	**0**
KR	-		-	-		-	-		-	-		-	-		-	-	92	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**2,413**		**895**	**16,789**		**6,914**	**16,540**		**8,632**	**40,374**	**17,895**
PIONEER PROPERTY																				
SWP	-	231	-	-	178	-	-	175	-	1,277	273	474	2,521	303	1,038	3,957	384	2,065	**8,372**	**3,771**
FK	-	19	-	-	29	-	-	29	-	-	29	-	-	26	-	-	26	-	**0**	**0**
KR	-		-	-		-	-		-	-		-	-		-	-	92	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**1,277**		**474**	**2,521**		**1,038**	**3,957**		**2,065**	**8,372**	**3,771**
KERN RIVER CHANNEL																				
SWP	-	231	-	-	178	-	-	175	-	-	273	-	6,002	303	2,472	6,740	384	3,517	**13,140**	**6,114**
FK	-	19	-	-	29	-	-	29	-	-	29	-	-	26	-	-	26	-	**8,319**	**231**
KR	-		-	-		-	-		-	-		-	-		-	2,813	92	352	**2,982**	**379**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**6,002**		**2,472**	**9,553**		**3,869**	**24,441**	**6,723**
																			75,694	**29,084**

AVG TDS **283 MG/L**

Water Quality Data Sources: SWP - Table 32 of State Water Project Operations Data published monthly by State of California.
FK - value taken from Friant Kern Canal Total Dissolved Solids Data Tables, U.S. Bureau of Reclamation, Mid-Pacific Region.
KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and the value displayed is the average of 1995-2004.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2004**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)
BERRENDA MESA															
SWP	343	306	143	-	238	-	2,529	265	911	-	210	-	-	275	-
FK	-	26	-	-	26	-	-	26	-	-	26	-	-	36	-
KR	-	92	-	-		-	-		-	-	101	-	-	82	-
TOTALS	**343**		**143**	**0**		**0**	**2,529**		**911**	**0**		**0**	**0**		**0**
2800 ACRES															
SWP	50	306	21	797	238	258	6,109	265	2,200	-	210	-	-	275	-
FK	-	26	-	-	26	-	-	26	-	-	26	-	-	36	-
KR	-	92	-	-		-	-		-	-	101	-	-	82	-
TOTALS	**50**		**21**	**797**		**258**	**6,109**		**2,200**	**0**		**0**	**0**		**0**
KERN WATER BANK															
SWP	-	306	-	1,914	238	619	16,151	265	5,817	-	210	-	-	275	-
FK	-	26	-	-	26	-	-	26	-	-	26	-	-	36	-
KR	-	92	-	-		-	-		-	-	101	-	-	82	-
TOTALS	**0**		**0**	**1,914**		**619**	**16,151**		**5,817**	**0**		**0**	**0**		**0**
PIONEER PROPERTY															
SWP	1,696	306	705	559	238	181	4,556	265	1,641	-	210	-	-	275	-
FK	-	26	-	-	26	-	-	26	-	-	26	-	-	36	-
KR	-	92	-	-		-	-		-	-	101	-	-	82	-
TOTALS	**1,696**		**705**	**559**		**181**	**4,556**		**1,641**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL															
SWP	-	306	-	-	238	-	24	265	9	-	210	-	-	275	-
FK	-	26	-	-	26	-	-	26	-	-	26	-	-	36	-
KR	1,839	92	230	-		-	-		-	-	101	-	-	82	-
TOTALS	**1,839**		**230**	**0**		**0**	**24**		**9**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)
BERRENDA MESA															
SWP	-	261	-	-	158	-	-	208	-	-	234	-	-	292	-
FK	-	36	-	-	36	-	-	20	-	-	20	-	-	20	-
KR	-	72	-	-	84	-	-	79	-	-	116	-	-	99	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES															
SWP	-	261	-	-	158	-	-	208	-	-	234	-	-	292	-
FK	-	36	-	-	36	-	-	20	-	-	20	-	-	20	-
KR	-	72	-	-	84	-	-	79	-	-	116	-	-	99	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK															
SWP	-	261	-	-	158	-	-	208	-	-	234	-	-	292	-
FK	-	36	-	-	36	-	-	20	-	-	20	-	-	20	-
KR	-	72	-	-	84	-	-	79	-	-	116	-	-	99	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY															
SWP	-	261	-	-	158	-	-	208	-	-	234	-	-	292	-
FK	-	36	-	-	36	-	-	20	-	-	20	-	-	20	-
KR	-	72	-	-	84	-	-	79	-	-	116	-	-	99	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL															
SWP	-	261	-	-	158	-	-	208	-	-	234	-	-	292	-
FK	-	36	-	-	36	-	-	20	-	-	20	-	-	20	-
KR	-	72	-	-	84	-	-	79	-	-	116	-	-	99	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)	
BERRENDA MESA									
SWP	-	317	-	-	284	-	**2,872**	**1,053**	
FK	-	17	-	-	17	-	**0**	**0**	
KR	-		-	-		-	**0**	**0**	
TOTALS	**0**		**0**	**0**		**0**	**2,872**	**1,053**	
2800 ACRES									
SWP	-	317	-	-	284	-	**6,956**	**2,479**	
FK	-	17	-	-	17	-	**0**	**0**	
KR	-		-	-		-	**0**	**0**	
TOTALS	**0**		**0**	**0**		**0**	**6,956**	**2,479**	
KERN WATER BANK									
SWP	-	317	-	-	284	-	**18,065**	**6,436**	
FK	-	17	-	-	17	-	**0**	**0**	
KR	-		-	-		-	**0**	**0**	
TOTALS	**0**		**0**	**0**		**0**	**18,065**	**6,436**	
PIONEER PROPERTY									
SWP	-	317	-	-	284	-	**6,811**	**2,527**	
FK	-	17	-	-	17	-	**0**	**0**	
KR	-		-	-		-	**0**	**0**	
TOTALS	**0**		**0**	**0**		**0**	**6,811**	**2,527**	
KERN RIVER CHANNEL									
SWP	-	317	-	-	284	-	**24**	**9**	
FK	-	17	-	-	17	-	**0**	**0**	
KR	-		-	-		-	**1,839**	**230**	
TOTALS	**0**		**0**	**0**		**0**	**1,863**	**239**	AVG TDS
							36,567	**12,734**	**256 MG/L**

Water Quality Data Sources: SWP - Table 32 of State Water Project Operations Data published monthly by State of California.
FK - value taken from Friant Kern Canal Total Dissolved Solids Data Tables, U.S. Bureau of Reclamation, Mid-Pacific Region.
KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and the value displayed is the average of 1995-2004.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2005**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)	
BERRENDA MESA																																								
SWP	1,057	343	493	3,077	306	1,280	589	311	249	169	186	43	329	245	110	391	161	86	1,031	203	284	268	209	76	293	229	91	709	204	197	401	230	125	2,112	329	944	**10,426**	**3,977**	
FK	-	17	-	1,158	26	41	3,539	26	125	3,636	26	128	3,483	24	114	636	24	21	512	24	17	1,434	24	47	1,139	24	37	-	24	-	-	28	-	-	28	-	**15,537**	**529**	
KR	-	92	-	-	139	-	-	132	-	-	121	-	22	86	3	1,577	61	131	1,720	70	164	1,460	61	121	1,500	63	128	2,113	67	192	541	77	57	-	92	-	**8,933**	**795**	
TOTALS	**1,057**		**493**	**4,235**		**1,321**	**4,128**		**374**	**3,805**		**171**	**3,834**		**226**	**2,604**		**237**	**3,263**		**465**	**3,162**		**244**	**2,932**		**257**	**2,822**		**389**	**942**		**182**	**2,112**		**944**	**34,896**	**5,302**	
2800 ACRES																																								
SWP	5,238	343	2,442	10,358	306	4,308	11,189	311	4,729	9,384	186	2,372	-	245	-	-	161	-	1,974	203	545	9,051	209	2,571	8,743	229	2,721	8,142	204	2,257	7,611	230	2,379	5,512	329	2,465	**77,202**	**26,788**	
FK	5,244	17	121	11,977	26	423	2,581	26	91	5,572	26	197	13,710	24	447	-	24	-	-	24	-	579	24	19	1,541	24	50	-	24	-	-	28	-	-	28	-	**41,204**	**1,349**	
KR	133	92	17	-	139	-	-	132	-	-	121	-	-	86	-	-	61	-	-	70	-	2,390	61	198	833	63	71	1,648	67	150	-	77	-	-	92	-	**5,004**	**436**	
TOTALS	**10,615**		**2,580**	**22,335**		**4,731**	**13,770**		**4,820**	**14,956**		**2,569**	**13,710**		**447**	**0**		**0**	**1,974**		**545**	**12,020**		**2,788**	**11,117**		**2,843**	**9,790**		**2,407**	**7,611**		**2,379**	**5,512**		**2,465**	**123,410**	**28,573**	
KERN WATER BANK																																								
SWP	29,486	343	13,745	39,919	306	16,601	50,106	311	21,178	49,900	186	12,614	14,278	245	4,754	30,897	161	6,761	234	203	65	11,025	209	3,132	25,520	229	7,943	32,256	204	8,943	21,818	230	6,820	21,979	329	9,828	**327,418**	**112,383**	
FK	-	17	-	545	26	19	6,446	26	228	9,891	26	350	28,099	24	917	5,734	24	187	301	24	10	-	24	-	4,692	24	153	3,531	24	115	-	28	-	-	28	-	**59,239**	**1,978**	
KR	-	92	-	-	139	-	-	132	-	-	121	-	-	86	-	900	61	75	-	70	-	-	61	-	-	63	-	-	67	-	-	77	-	-	92	-	**900**	**75**	
TOTALS	**29,486**		**13,745**	**40,464**		**16,621**	**56,552**		**21,406**	**59,791**		**12,964**	**42,377**		**5,671**	**37,531**		**7,022**	**535**		**74**	**11,025**		**3,132**	**30,212**		**8,096**	**35,787**		**9,058**	**21,818**		**6,820**	**21,979**		**9,828**	**387,557**	**114,436**	
PIONEER PROPERTY																																								
SWP	3,291	343	1,534	6,910	306	2,874	4,106	311	1,735	5,763	186	1,457	474	245	158	1,316	161	288	2,364	203	652	2,862	209	813	4,114	229	1,280	3,593	204	996	6,358	230	1,987	5,970	329	2,669	**47,121**	**16,444**	
FK	20	17	0	4,334	26	153	9,832	26	347	8,537	26	302	8,758	24	286	421	24	14	236	24	8	2,793	24	91	1,476	24	48	-	24	-	-	28	-	-	28	-	**36,407**	**1,249**	
KR	-	92	-	-	139	-	-	132	-	1,281	121	211	1,973	86	231	8,288	61	687	6,666	70	634	4,808	61	399	2,843	63	243	1,641	67	149	171	77	18	-	92	-	**27,671**	**2,572**	
TOTALS	**3,311**		**1,535**	**11,244**		**3,027**	**13,938**		**2,083**	**15,581**		**1,969**	**11,205**		**674**	**10,025**		**989**	**9,266**		**1,294**	**10,463**		**1,303**	**8,433**		**1,572**	**5,234**		**1,146**	**6,529**		**2,005**	**5,970**		**2,669**	**111,199**	**20,265**	
KERN RIVER CHANNEL																																								
SWP	-	343	-	-	306	-	-	311	-	-	186	-	-	245	-	-	161	-	-	203	-	-	209	-	-	229	-	50	204	14	978	230	306	99	329	44	**1,127**	**364**	
FK	4,852	17	112	10,642	26	376	599	26	21	2,416	26	85	5,210	24	170	-	24	-	-	24	-	83	24	3	90	24	3	-	24	-	-	28	-	-	28	-	**23,892**	**770**	
KR	454	92	57	-	139	-	-	132	-	-	121	-	2,055	86	240	170	61	14	467	70	44	535	61	44	89	63	8	705	67	64	235	77	25	268	92	34	**4,978**	**530**	
TOTALS	**5,306**		**169**	**10,642**		**376**	**599**		**21**	**2,416**		**85**	**7,265**		**410**	**170**		**14**	**467**		**44**	**618**		**47**	**179**		**11**	**755**		**78**	**1,213**		**330**	**367**		**78**	**29,997**	**1,664**	AVG TDS
																																					687,059	**170,241**	**182 MG/L**

Water Quality Data Sources: SWP - Table 32 of State Water Project Operations Data published monthly by State of California.
FK - value taken from Friant Kern Canal Total Dissolved Solids Data Tables, U.S. Bureau of Reclamation, Mid-Pacific Region.
KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and the value displayed is the average of 1995-2004.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2006**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)
BERRENDA MESA																		
SWP	737	171	171	2,267	203	625	1,838	178	445	-	148	-	-	151	-	-	118	-
FK	1,097	28	42	-	28	-	524	28	20	1,799	28	68	-	12	-	-	12	-
KR	638	92	80	-	95	-	-	98	-	109	104	15	2,158	74	217	1,868	43	109
TOTALS	**2,472**		**293**	**2,267**		**625**	**2,362**		**465**	**1,908**		**84**	**2,158**		**217**	**1,868**		**109**
2800 ACRES																		
SWP	1,458	171	339	5,456	203	1,505	4,659	178	1,127	-	148	-	-	151	-	-	118	-
FK	2,187	28	83	-	28	-	960	28	37	367	28	14	-	12	-	-	12	-
KR	-	92	-	-	95	-	-	98	-	-	104	-	-	74	-	1,484	43	87
TOTALS	**3,645**		**422**	**5,456**		**1,505**	**5,619**		**1,164**	**367**		**14**	**0**		**0**	**1,484**		**87**
KERN WATER BANK																		
SWP	13,084	171	3,041	27,903	203	7,698	24,527	178	5,933	1,732	148	348	-	151	-	2,114	118	339
FK	14,325	28	545	-	28	-	2,879	28	110	23,040	28	877	-	12	-	-	12	-
KR	6,282	92	785	-	95	-	-	98	-	526	104	74	29,088	74	2,925	22,609	43	1,321
TOTALS	**33,691**		**4,371**	**27,903**		**7,698**	**27,406**		**6,043**	**25,298**		**1,299**	**29,088**		**2,925**	**24,723**		**1,660**
PIONEER PROPERTY																		
SWP	1,945	171	452	5,374	203	1,483	3,898	178	943	-	148	-	-	151	-	-	118	-
FK	3,602	28	137	-	28	-	770	28	29	4,929	28	188	-	12	-	-	12	-
KR	-	92	-	-	95	-	-	98	-	215	104	30	6,387	74	642	5,855	43	342
TOTALS	**5,547**		**589**	**5,374**		**1,483**	**4,668**		**972**	**5,144**		**218**	**6,387**		**642**	**5,855**		**342**
KERN RIVER CHANNEL																		
SWP	-	171	-	-	203	-	-	178	-	-	148	-	-	151	-	-	118	-
FK	289	28	11	-	28	-	-	28	-	-	28	-	-	12	-	-	12	-
KR	167	92	21	-	95	-	-	98	-	-	104	-	-	74	-	-	43	-
TOTALS	**456**		**32**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA																				
SWP	433	198	117	453	159	98	1,985	154	415	2,198	160	478	2,486	167	564	2,392	269	874	**14,789**	**3,788**
FK	-	12	-	-	23	-	-	23	-	-	23	-	-	23	-	-	23	-	**3,420**	**130**
KR	1,515	43	89	1,732	55	129	-	92	-	-	96	-	-		-	-		-	**8,020**	**639**
TOTALS	**1,948**		**205**	**2,185**		**227**	**1,985**		**415**	**2,198**		**478**	**2,486**		**564**	**2,392**		**874**	**26,229**	**4,557**
2800 ACRES																				
SWP	3,546	198	954	5,289	159	1,143	5,250	154	1,099	4,457	160	969	5,123	167	1,163	5,059	269	1,850	**40,297**	**10,149**
FK	-	12	-	-	23	-	-	23	-	-	23	-	-	23	-	-	23	-	**3,514**	**134**
KR	3,507	43	205	1,694	55	127	-	92	-	-	96	-	-		-	285		-	**6,970**	**418**
TOTALS	**7,053**		**1,159**	**6,983**		**1,270**	**5,250**		**1,099**	**4,457**		**969**	**5,123**		**1,163**	**5,344**		**1,850**	**50,781**	**10,701**
KERN WATER BANK																				
SWP	16,243	198	4,371	18,972	159	4,100	20,077	154	4,202	19,646	160	4,272	17,037	167	3,867	16,730	269	6,116	**178,065**	**44,288**
FK	-	12	-	-	23	-	-	23	-	-	23	-	-	23	-	-	23	-	**40,244**	**1,531**
KR	4,911	43	287	1,097	55	82	411	92	51	-	96	-	-		-	-		-	**64,924**	**5,527**
TOTALS	**21,154**		**4,658**	**20,069**		**4,182**	**20,488**		**4,253**	**19,646**		**4,272**	**17,037**		**3,867**	**16,730**		**6,116**	**283,233**	**51,346**
PIONEER PROPERTY																				
SWP	955	198	257	4,708	159	1,017	3,561	154	745	3,186	160	693	5,307	167	1,205	6,080	269	2,223	**35,014**	**9,017**
FK	-	12	-	-	23	-	-	23	-	-	23	-	-	23	-	-	23	-	**9,301**	**354**
KR	3,635	43	212	821	55	61	-	92	-	-	96	-	-		-	-		-	**16,913**	**1,289**
TOTALS	**4,590**		**469**	**5,529**		**1,079**	**3,561**		**745**	**3,186**		**693**	**5,307**		**1,205**	**6,080**		**2,223**	**61,228**	**10,660**
KERN RIVER CHANNEL																				
SWP	-	198	-	-	159	-	-	154	-	-	160	-	-	167	-	-	269	-	**0**	**0**
FK	-	12	-	-	23	-	-	23	-	-	23	-	-	23	-	-	23	-	**289**	**11**
KR	369	43	22	-	55	-	-	92	-	-	96	-	-		-	-		-	**536**	**42**
TOTALS	**369**		**22**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**825**	**53**
																			422,296	**77,318**

AVG TDS **135 MG/L**

Water Quality Data Sources: SWP - Table 32 of State Water Project Operations Data published monthly by State of California.
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KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and the value displayed is the average of 1995-2004.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2007**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)
BERRENDA MESA															
SWP	1,843	343	859	-	294	-	-	250	-	-	235	-	-	241	-
FK	-	23	-	-	23	-	-	23	-	-	32	-	-	32	-
KR	255	104	36	-	102	-	-	105	-	-	101	-	-	101	-
TOTALS	**2,098**		**895**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES															
SWP	212	343	99	-	294	-	-	250	-	-	235	-	-	241	-
FK	2,220	23	69	-	23	-	-	23	-	-	32	-	-	32	-
KR	2,063	104	292	-	102	-	-	105	-	-	101	-	-	101	-
TOTALS	**4,495**		**460**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK															
SWP	15,350	343	7,156	857	294	342	521	250	177	-	235	-	-	241	-
FK	-	23	-	-	23	-	-	23	-	-	32	-	-	32	-
KR	-	104	-	-	102	-	-	105	-	-	101	-	-	101	-
TOTALS	**15,350**		**7,156**	**857**		**342**	**521**		**177**	**0**		**0**	**0**		**0**
PIONEER PROPERTY															
SWP	2,093	343	976	-	294	-	-	250	-	-	235	-	-	241	-
FK	1,020	23	32	-	23	-	-	23	-	-	32	-	-	32	-
KR	1,700	104	240	-	102	-	-	105	-	-	101	-	-	101	-
TOTALS	**4,813**		**1,248**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]															
SWP	-	343	-	-	294	-	-	250	-	-	235	-	-	241	-
FK	-	23	-	-	23	-	-	23	-	-	32	-	-	32	-
KR	519	104	73	872	102	121	240	105	34	384	101	53	613	101	84
TOTALS	**519**		**73**	**872**		**121**	**240**		**34**	**384**		**53**	**613**		**84**
RRBWSD PROJECTS (INCLUDING STRAND)															
SWP	-	343	-	552	294	221	-	250	-	-	235	-	-	241	-
FK	-	23	-	-	23	-	-	23	-	-	32	-		32	-
KR	3,295	104	466	-	102	-	-	105	-	-	101	-	-	101	-
TOTALS	**3,295**		**466**	**552**		**221**	**0**		**0**	**0**		**0**	**0**		**0**
JOINT USE RECOVERY PROJECT															
SWP	-	343	-	-	294	-	-	250	-	-	235	-	-	241	-
FK	-	23	-	-	23	-	-	23	-	-	32	-		32	-
KR	-	104	-	-	102	-	-	105	-	-	101	-	-	101	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL															
SWP	-	343	-	-	294	-	-	250	-	-	235	-	-	241	-
FK	-	23	-	-	23	-	-	23	-	-	32	-	-	32	-
KR	-	104	-	-	102	-	-	105	-	-	101	-	-	101	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	254	-	-	191	-	-	223	-	-	325	-
FK	-	32	-	-	233	-	-	233	-	-	233	-
KR	-	101	-	-	120	-	-	120	-	-	120	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	254	-	-	191	-	-	223	-	-	325	-
FK	-	32	-	-	233	-	-	233	-	-	233	-
KR	-	101	-	-	120	-	-	120	-	-	120	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	254	-	-	191	-	-	223	-	-	325	-
FK	-	32	-	-	233	-	-	233	-	-	233	-
KR	-	101	-	-	120	-	-	120	-	-	120	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	254	-	-	191	-	-	223	-	-	325	-
FK	-	32	-	-	233	-	-	233	-	-	233	-
KR	-	101	-	-	120	-	-	120	-	-	120	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	-	254	-	-	191	-	-	223	-	-	325	-
FK	-	32	-	-	233	-	-	233	-	-	233	-
KR	7,121	101	977	12,812	120	2,089	6,592	120	1,075	172	120	28
TOTALS	**7,121**		**977**	**12,812**		**2,089**	**6,592**		**1,075**	**172**		**28**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-	254	-	-	191	-	-	223	-	-	325	-
FK	-	32	-	-	233	-	-	233	-	-	233	-
KR	-	101	-	-	120	-	-	120	-	-	120	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
JOINT USE RECOVERY PROJECT												
SWP	-	254	-	-	191	-	-	223	-	-	325	-
FK	-	32	-	-	233	-	-	233	-	-	233	-
KR	-	101	-	-	120	-	-	120	-	-	120	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	254	-	-	191	-	-	223	-	-	325	-
FK	-	32	-	-	233	-	-	233	-	-	233	-
KR	-	101	-	-	120	-	-	120	-	-	120	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)	
BERRENDA MESA												
SWP	-	274	-	-	274	-	-	281	-	**1,843**	**859**	
FK	-	220	-	-	220	-	-	220	-	**0**	**0**	
KR	-	121	-	-	127	-	-	129	-	**255**	**36**	
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**2,098**	**895**	
2800 ACRES												
SWP	-	274	-	-	274	-	-	281	-	**212**	**99**	
FK	-	220	-	-	220	-	-	220	-	**2,220**	**69**	
KR	-	121	-	-	127	-	-	129	-	**2,063**	**292**	
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**4,495**	**460**	
KERN WATER BANK												
SWP	-	274	-	-	274	-	-	281	-	**16,728**	**7,675**	
FK	-	220	-	-	220	-	-	220	-	**0**	**0**	
KR	-	121	-	-	127	-	-	129	-	**0**	**0**	
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**16,728**	**7,675**	
PIONEER PROPERTY												
SWP	-	274	-	-	274	-	-	281	-	**2,093**	**976**	
FK	-	220	-	-	220	-	-	220	-	**1,020**	**32**	
KR	-	121	-	-	127	-	-	129	-	**1,700**	**240**	
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**4,813**	**1,248**	
BUENA VISTA PROPERTY[1]												
SWP	-	274	-	-	274	-	-	281	-	**0**	**0**	
FK	-	220	-	-	220	-	-	220	-	**0**	**0**	
KR	16	121	3	69	127	12	117	129	21	**29,527**	**4,570**	
TOTALS	**16**		**3**	**69**		**12**	**117**		**21**	**29,527**	**4,570**	
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-	274	-	-	274	-	-	281	-	**552**	**221**	
FK	-	220	-	-	220	-	-	220	-	**0**	**0**	
KR	-	121	-	-	127	-	-	129	-	**3,295**	**466**	
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**3,847**	**686**	
JOINT USE RECOVERY PROJECT												
SWP	-	274	-	-	274	-	-	281	-	**0**	**0**	
FK	-	220	-	-	220	-	-	220	-	**0**	**0**	
KR	-	121	-	-	127	-	-	129	-	**0**	**0**	
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**	
KERN RIVER CHANNEL												
SWP	-	274	-	-	274	-	-	281	-	**0**	**0**	
FK	-	220	-	-	220	-	-	220	-	**0**	**0**	
KR	-	121	-	-	127	-	-	129	-	**0**	**0**	
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**	AVG TDS
										61,508	**15,535**	**186 MG/L**

1 - Buena Vista Property monthly breakdown is estimated.

Water Quality Data Sources: SWP - Table 32 of State Water Project Operations Data published monthly by State of California.

FK - quarterly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and value is most recent available

KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and value is most recent available

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2008**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	321	-	-	343	-	-	281	-	-	311	-
FK	-	220	-	-	164	-	-	164	-	-	44	-
KR	-	152	-	-	126	-	-	123	-	-	101	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	321	-	-	343	-	-	281	-	-	311	-
FK	-	220	-	-	164	-	-	164	-	-	44	-
KR	-	152	-	-	126	-	-	123	-	-	101	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	321	-	-	343	-	-	281	-	-	311	-
FK	-	220	-	-	164	-	-	164	-	-	44	-
KR	-	152	-	-	126	-	-	123	-	-	101	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	321	-	-	343	-	-	281	-	-	311	-
FK	-	220	-	-	164	-	-	164	-	-	44	-
KR	-	152	-	-	126	-	-	123	-	-	101	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	-	321	-	-	343	-	-	281	-	-	311	-
FK	-	220	-	-	164	-	-	164	-	-	44	-
KR	577	152	119	971	126	166	267	123	45	427	101	59
TOTALS	**577**		**119**	**971**		**166**	**267**		**45**	**427**		**59**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-	321	-	-	343	-	-	281	-	-	311	-
FK	-	220	-	-	164	-	-	164	-	-	44	-
KR	-	152	-	-	126	-	-	123	-	-	101	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
JOINT USE RECOVERY PROJECT												
SWP	-	321	-	-	343	-	-	281	-	-	311	-
FK	-	220	-	-	164	-	-	164	-	-	44	-
KR	-	152	-	-	126	-	-	123	-	-	101	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	321	-	-	343	-	-	281	-	-	311	-
FK	-	220	-	-	164	-	-	164	-	-	44	-
KR	-	152	-	-	126	-	-	123	-	-	101	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	286	-	-	290	-	-	257	-	-	279	-
FK	-	44	-	-	44	-	-	51	-	-	51	-
KR	-	92	-	-	69	-	-	65	-	-	79	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	286	-	-	290	-	-	257	-	-	279	-
FK	-	44	-	-	44	-	-	51	-	-	51	-
KR	-	92	-	-	69	-	-	65	-	-	79	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	286	-	-	290	-	-	257	-	-	279	-
FK	-	44	-	-	44	-	-	51	-	-	51	-
KR	-	92	-	-	69	-	-	65	-	-	79	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	286	-	-	290	-	-	257	-	-	279	-
FK	-	44	-	-	44	-	-	51	-	-	51	-
KR	-	92	-	-	69	-	-	65	-	-	79	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	-	286	-	-	290	-	-	257	-	-	279	-
FK	-	44	-	-	44	-	-	51	-	-	51	-
KR	683	92	85	7,927	69	743	14,261	65	1,260	7,338	79	788
TOTALS	**683**		**85**	**7,927**		**743**	**14,261**		**1,260**	**7,338**		**788**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-	286	-	-	290	-	-	257	-	-	279	-
FK		44	-	-	44	-	-	51	-	-	51	-
KR	-	92	-	-	69	-	-	65	-	-	79	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
JOINT USE RECOVERY PROJECT												
SWP	-	286	-	-	290	-	-	257	-	-	279	-
FK		44	-	-	44	-	-	51	-	-	51	-
KR	-	92	-	-	69	-	-	65	-	-	79	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	286	-	-	290	-	-	257	-	-	279	-
FK	-	44	-	-	44	-	-	51	-	-	51	-
KR	-	92	-	-	69	-	-	65	-	-	79	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA														
SWP	-	265	-	-	301	-	-	258	-	-	309	-	**0**	**0**
FK	-	51	-	-	36	-	-	36	-	-	36	-	**0**	**0**
KR	-	48	-	-	105	-	-	111	-	-	120	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
2800 ACRES														
SWP	-	265	-	-	301	-	-	258	-	-	309	-	**0**	**0**
FK	-	51	-	-	36	-	-	36	-	-	36	-	**0**	**0**
KR	-	48	-	-	105	-	-	111	-	-	120	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
KERN WATER BANK														
SWP	-	265	-	-	301	-	-	258	-	-	309	-	**0**	**0**
FK	-	51	-	-	36	-	-	36	-	-	36	-	**0**	**0**
KR	-	48	-	-	105	-	-	111	-	-	120	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
PIONEER PROPERTY														
SWP	-	265	-	-	301	-	-	258	-	-	309	-	**0**	**0**
FK	-	51	-	-	36	-	-	36	-	-	36	-	**0**	**0**
KR	-	48	-	-	105	-	-	111	-	-	120	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
BUENA VISTA PROPERTY[1]														
SWP	-	265	-	-	301	-	-	258	-	-	309	-	**0**	**0**
FK	-	51	-	-	36	-	-	36	-	-	36	-	**0**	**0**
KR	191	48	12	18	105	3	77	111	12	129	120	21	**32,866**	**3,313**
TOTALS	**191**		**12**	**18**		**3**	**77**		**12**	**129**		**21**	**32,866**	**3,313**
RRBWSD PROJECTS (INCLUDING STRAND)														
SWP	-	265	-	-	301	-	-	258	-	-	309	-	**0**	**0**
FK	-	51	-	-	36	-	-	36	-	-	36	-	**0**	**0**
KR	-	48	-	-	105	-	-	111	-	-	120	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
JOINT USE RECOVERY PROJECT														
SWP	-	265	-	-	301	-	-	258	-	-	309	-	**0**	**0**
FK	-	51	-	-	36	-	-	36	-	-	36	-	**0**	**0**
KR	-	48	-	-	105	-	-	111	-	-	120	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
KERN RIVER CHANNEL														
SWP	-	265	-	-	301	-	-	258	-	-	309	-	**0**	**0**
FK	-	51	-	-	36	-	-	36	-	-	36	-	**0**	**0**
KR	-	48	-	-	105	-	-	111	-	-	120	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
													32,866	**3,313**

AVG TDS **74 MG/L**

1 - Buena Vista Property monthly breakdown is estimated.

Water Quality Data Sources: SWP - Table 32 of State Water Project Operations Data published monthly by State of California.

FK - quarterly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and value is most recent available

KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and value is most recent available

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2009**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	324	-	-	300	-	-	297	-	-	281	-
FK	-	157	-	-	157	-	-	157	-	-	133	-
KR	-	155	-	-	120	-	-	109	-	-	106	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	324	-	-	300	-	-	297	-	-	281	-
FK	-	157	-	-	157	-	-	157	-	-	133	-
KR	-	155	-	-	120	-	-	109	-	-	106	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	324	-	-	300	-	-	297	-	-	281	-
FK	-	157	-	-	157	-	-	157	-	-	133	-
KR	-	155	-	-	120	-	-	109	-	-	106	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	324	-	-	300	-	-	297	-	-	281	-
FK	-	157	-	-	157	-	-	157	-	-	133	-
KR	-	155	-	-	120	-	-	109	-	-	106	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	-	324	-	-	300	-	-	297	-	-	281	-
FK	-	157	-	-	157	-	-	157	-	-	133	-
KR	616	155	130	1,036	120	169	286	109	42	456	106	66
TOTALS	**616**		**130**	**1,036**		**169**	**286**		**42**	**456**		**66**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-	324	-	-	300	-	-	297	-	-	281	-
FK	-	157	-	-	157	-	-	157	-	-	133	-
KR	-	155	-	-	120	-	-	109	-	-	106	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
JOINT USE RECOVERY PROJECT												
SWP	-	324	-	-	300	-	-	297	-	-	281	-
FK	-	157	-	-	157	-	-	157	-	-	133	-
KR	-	155	-	-	120	-	-	109	-	-	106	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	324	-	-	300	-	-	297	-	-	281	-
FK	-	157	-	-	157	-	-	157	-	-	133	-
KR	-	155	-	-	120	-	-	109	-	-	106	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	303	-	-	315	-	-	230	-	-	223	-
FK	-	133	-	-	133	-	-	44	-	-	44	-
KR	-	85	-	-	66	-	-	66	-	-	70	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	303	-	-	315	-	-	230	-	-	223	-
FK	-	133	-	-	133	-	-	44	-	-	44	-
KR	-	85	-	-	66	-	-	66	-	-	70	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	303	-	-	315	-	-	230	-	-	223	-
FK	-	133	-	-	133	-	-	44	-	-	44	-
KR	-	85	-	-	66	-	-	66	-	-	70	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	303	-	-	315	-	-	230	-	-	223	-
FK	-	133	-	-	133	-	-	44	-	-	44	-
KR	-	85	-	-	66	-	-	66	-	-	70	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	-	303	-	-	315	-	-	230	-	-	223	-
FK	-	133	-	-	133	-	-	44	-	-	44	-
KR	729	85	84	8,463	66	759	15,226	66	1,366	7,834	70	745
TOTALS	**729**		**84**	**8,463**		**759**	**15,226**		**1,366**	**7,834**		**745**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-	303	-	-	315	-	-	230	-	-	223	-
FK	515	133	93	-	133	-	-	44	-	-	44	-
KR	-	85	-	-	66	-	-	66	-	-	70	-
TOTALS	**515**		**93**	**0**		**0**	**0**		**0**	**0**		**0**
JOINT USE RECOVERY PROJECT												
SWP	-	303	-	-	315	-	-	230	-	-	223	-
FK	1,839	133	332	-	133	-	-	44	-	-	44	-
KR	-	85	-	-	66	-	-	66	-	-	70	-
TOTALS	**1,839**		**332**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	303	-	-	315	-	-	230	-	-	223	-
FK	-	133	-	-	133	-	-	44	-	-	44	-
KR	-	85	-	-	66	-	-	66	-	-	70	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA														
SWP	-	283	-	-	332	-	-	230	-	-	271	-	**0**	**0**
FK	-	44	-	-	23	-	-	23	-	-	23	-	**0**	**0**
KR	-	90	-	-	107	-	-	106	-	-	109	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
2800 ACRES														
SWP	-	283	-	-	332	-	-	230	-	-	271	-	**0**	**0**
FK	-	44	-	-	23	-	-	23	-	-	23	-	**0**	**0**
KR	-	90	-	-	107	-	-	106	-	-	109	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
KERN WATER BANK														
SWP	-	283	-	-	332	-	-	230	-	-	271	-	**0**	**0**
FK	-	44	-	-	23	-	-	23	-	-	23	-	**0**	**0**
KR	-	90	-	-	107	-	-	106	-	-	109	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
PIONEER PROPERTY														
SWP	-	283	-	-	332	-	-	230	-	-	271	-	**0**	**0**
FK	-	44	-	-	23	-	-	23	-	-	23	-	**0**	**0**
KR	-	90	-	-	107	-	-	106	-	-	109	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
BUENA VISTA PROPERTY[1]														
SWP	-	283	-	-	332	-	-	230	-	-	271	-	**0**	**0**
FK	-	44	-	-	23	-	-	23	-	-	23	-	**0**	**0**
KR	204	90	25	19	107	3	82	106	12	140	109	21	**35,091**	**3,421**
TOTALS	**204**		**25**	**19**		**3**	**82**		**12**	**140**		**21**	**35,091**	**3,421**
RRBWSD PROJECTS (INCLUDING STRAND)														
SWP	-	283	-	-	332	-	-	230	-	-	271	-	**0**	**0**
FK	-	44	-	-	23	-	-	23	-	-	23	-	**515**	**93**
KR	-	90	-	-	107	-	-	106	-	-	109	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**515**	**93**
JOINT USE RECOVERY PROJECT														
SWP	-	283	-	-	332	-	-	230	-	-	271	-	**0**	**0**
FK	-	44	-	-	23	-	-	23	-	-	23	-	**1,839**	**332**
KR	-	90	-	-	107	-	-	106	-	-	109	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**1,839**	**332**
KERN RIVER CHANNEL														
SWP	-	283	-	-	332	-	-	230	-	-	271	-	**0**	**0**
FK	-	44	-	-	23	-	-	23	-	-	23	-	**0**	**0**
KR	-	90	-	-	107	-	-	106	-	-	109	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
													37,445	**3,847**

AVG TDS **76 MG/L**

1 - Buena Vista Property monthly breakdown is estimated.

Water Quality Data Sources: SWP - Table 32 of State Water Project Operations Data published monthly by State of California.

FK - quarterly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and value is most recent available

KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and value is most recent available

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2010**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	215	-	-	144	-	-	260	-	-	192	-
FK	-	25	-	-	25	-	-	25	-	-	39	-
KR	-	125	-	-	124	-	-	124	-	-	98	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	215	-	-	144	-	-	260	-	-	192	-
FK	-	25	-	-	25	-	-	25	-	-	39	-
KR	-	125	-	-	124	-	-	124	-	-	98	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	215	-	-	144	-	-	260	-	-	192	-
FK	-	25	-	-	25	-	-	25	-	-	39	-
KR	-	125	-	-	124	-	-	124	-	-	98	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	215	-	-	144	-	-	260	-	-	192	-
FK	-	25	-	-	25	-	-	25	-	-	39	-
KR	-	125	-	-	124	-	-	124	-	-	98	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	-	215	-	-	144	-	-	260	-	-	192	-
FK	-	25	-	-	25	-	-	25	-	-	39	-
KR	888	125	151	1,493	124	252	411	124	69	657	98	88
TOTALS	**888**		**151**	**1,493**		**252**	**411**		**69**	**657**		**88**
KDWD PROJECT												
SWP	-	215	-	-	144	-	-	260	-	-	192	-
FK	-	25	-	-	25	-	-	25	-	-	39	-
KR	-	125	-	-	124	-	-	124	-	-	98	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-	215	-	-	144	-	-	260	-	-	192	-
FK	-	25	-	3,884	25	132	2,535	25	86	4,661	39	247
KR	-	125	-	73	124	12	-	124	-	1,987	98	265
TOTALS	**0**		**0**	**3,957**		**144**	**2,535**		**86**	**6,648**		**512**
JOINT USE RECOVERY PROJECT												
SWP	-	215	-	-	144	-	-	260	-	-	192	-
FK	-	25	-	2,400	25	82	950	25	32	1,332	39	71
KR	-	125	-	44	124	7	-	124	-	568	98	76
TOTALS	**0**		**0**	**2,444**		**89**	**950**		**32**	**1,900**		**146**
KERN RIVER CHANNEL												
SWP	-	215	-	-	144	-	-	260	-	-	192	-
FK	-	25	-	-	25	-	-	25	-	-	39	-
KR	-	125	-	-	124	-	-	124	-	-	98	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
WEST KERN WATER DISTRICT												
SWP	-	215	-	-	144	-	-	260	-	-	192	-
FK	-	25	-	-	25	-	-	25	-	-	39	-
KR	-	125	-	-	124	-	-	124	-	-	98	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	260	-	-	246	-	-	244	-	-	162	-
FK	-	39	-	-	39	-	-	19	-	-	19	-
KR	-	95	-	-	79	-	-	66	-	-	63	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	260	-	-	246	-	-	244	-	-	162	-
FK	-	39	-	-	39	-	-	19	-	-	19	-
KR	-	95	-	-	79	-	-	66	-	-	63	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	260	-	-	246	-	-	244	-	-	162	-
FK	-	39	-	-	39	-	-	19	-	-	19	-
KR	-	95	-	-	79	-	-	66	-	-	63	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	260	-	-	246	-	-	244	-	-	162	-
FK	-	39	-	-	39	-	-	19	-	-	19	-
KR	-	95	-	-	79	-	-	66	-	-	63	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	-	260	-	-	246	-	-	244	-	-	162	-
FK	-	39	-	-	39	-	-	19	-	-	19	-
KR	1,050	95	136	12,190	79	1,309	21,930	66	1,967	11,284	63	966
TOTALS	**1,050**		**136**	**12,190**		**1,309**	**21,930**		**1,967**	**11,284**		**966**
KDWD PROJECT												
SWP	-	260	-	-	246	-	1,857	244	616	10,078	162	2,219
FK	-	39	-	-	39	-	-	19	-	-	19	-
KR	-	95	-	-	79	-	-	66	-	-	63	-
TOTALS	**0**		**0**	**0**		**0**	**1,857**		**616**	**10,078**		**2,219**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	61	260	22	610	246	204	4,562	244	1,513	8,599	162	1,893
FK	10,782	39	571	4,811	39	255	7,312	19	189	2,058	19	53
KR	7,128	95	920	-	79	-	-	66	-	-	63	-
TOTALS	**17,971**		**1,513**	**5,421**		**459**	**11,874**		**1,702**	**10,657**		**1,946**
JOINT USE RECOVERY PROJECT												
SWP	8	260	3	60	246	20	994	244	330	1,455	162	320
FK	1,536	39	81	470	39	25	1,594	19	41	348	19	9
KR	1,016	95	131	-	79	-	-	66	-	-	63	-
TOTALS	**2,560**		**215**	**530**		**45**	**2,588**		**371**	**1,803**		**329**
KERN RIVER CHANNEL												
SWP	-	260	-	-	246	-	-	244	-	-	162	-
FK	-	39	-	-	39	-	-	19	-	-	19	-
KR	-	95	-	-	79	-	-	66	-	-	63	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
WEST KERN WATER DISTRICT												
SWP	-	260	-	-	246	-	-	244	-	-	162	-
FK	-	39	-	-	39	-	-	19	-	-	19	-
KR	-	95	-	-	79	-	-	66	-	-	63	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA														
SWP	-	229	-	-	269	-	-	237	-	1,047	291	414	**1,047**	**414**
FK	-	19	-	-	22	-	-	22	-	-	22	-	**0**	**0**
KR	-	72	-	-	74	-	-	94	-	-	110	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**1,047**		**414**	**1,047**	**414**
2800 ACRES														
SWP	-	229	-	-	269	-	-	237	-	1,107	291	438	**1,107**	**438**
FK	-	19	-	-	22	-	-	22	-	-	22	-	**0**	**0**
KR	-	72	-	-	74	-	-	94	-	-	110	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**1,107**		**438**	**1,107**	**438**
KERN WATER BANK														
SWP	1,125	229	350	11,284	269	4,125	4,532	237	1,460	16,190	291	6,403	**33,131**	**12,338**
FK	-	19	-	-	22	-	-	22	-	-	22	-	**0**	**0**
KR	-	72	-	-	74	-	-	94	-	-	110	-	**0**	**0**
TOTALS	**1,125**		**350**	**11,284**		**4,125**	**4,532**		**1,460**	**16,190**		**6,403**	**33,131**	**12,338**
PIONEER PROPERTY														
SWP	-	229	-	-	269	-	-	237	-	10,056	291	3,977	**10,056**	**3,977**
FK	-	19	-	-	22	-	-	22	-	-	22	-	**0**	**0**
KR	-	72	-	-	74	-	-	94	-	-	110	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**10,056**		**3,977**	**10,056**	**3,977**
BUENA VISTA PROPERTY[1]														
SWP	-	229	-	-	269	-	-	237	-	-	291	-	**0**	**0**
FK	-	19	-	-	22	-	-	22	-	-	22	-	**0**	**0**
KR	294	72	29	27	74	3	118	94	15	200	110	30	**50,542**	**5,013**
TOTALS	**294**		**29**	**27**		**3**	**118**		**15**	**200**		**30**	**50,542**	**5,013**
KDWD PROJECT														
SWP	15,292	229	4,759	17,029	269	6,226	17,018	237	5,481	12,029	291	4,757	**73,303**	**24,058**
FK	-	19	-	-	22	-	-	22	-	-	22	-	**0**	**0**
KR	-	72	-	-	74	-	-	94	-	-	110	-	**0**	**0**
TOTALS	**15,292**		**4,759**	**17,029**		**6,226**	**17,018**		**5,481**	**12,029**		**4,757**	**73,303**	**24,058**
RRBWSD PROJECTS (INCLUDING STRAND)														
SWP	139	229	43	1,131	269	413	11,993	237	3,863	16,290	291	6,443	**43,385**	**14,394**
FK	14,583	19	377	20,905	22	625	3,976	22	119	-	22	-	**75,507**	**2,654**
KR	-	72	-	-	74	-	-	94	-	3,705	110	554	**12,893**	**1,751**
TOTALS	**14,722**		**420**	**22,036**		**1,039**	**15,969**		**3,982**	**19,995**		**6,996**	**131,785**	**18,799**
JOINT USE RECOVERY PROJECT														
SWP	20	229	6	146	269	53	1,720	237	554	1,960	291	775	**6,363**	**2,062**
FK	1,968	19	51	2,716	22	81	572	22	17	-	22	-	**13,886**	**490**
KR	-	72	-	-	74	-	-	94	-	444	110	66	**2,072**	**281**
TOTALS	**1,988**		**57**	**2,862**		**135**	**2,292**		**571**	**2,404**		**842**	**22,321**	**2,832**
KERN RIVER CHANNEL														
SWP	-	229	-	-	269	-	-	237	-	-	291	-	**0**	**0**
FK	-	19	-	-	22	-	-	22	-	-	22	-	**0**	**0**
KR	-	72	-	-	74	-	-	94	-	-	110	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
WEST KERN WATER DISTRICT														
SWP	-	229	-	-	269	-	-	237	-	-	291	-	**0**	**0**
FK	-	19	-	-	22	-	-	22	-	-	22	-	**0**	**0**
KR	-	72	-	-	74	-	-	94	-	93	110	14	**93**	**14**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**93**		**14**	**93**	**14**
													323,385	**72,897**

AVG TDS
166 MG/L

1 - Buena Vista Property monthly breakdown is estimated.

Water Quality Data Sources: SWP - Table 32 of State Water Project Operations Data published monthly by State of California.

FK - quarterly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and value is most recent available

KR - monthly TDS values from HCGWPP samples. If field is blank, then no data is available. If value is in red, then no sample was taken and value is most recent available

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2011**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)
BERRENDA MESA																		
SWP	3,306	144	647	1,639	171	381	1,406	172	329	36	105	5	-	136	-	-	156	-
FK	-	127	-	1,695	127	293	2,382	127	411	1,302	47	83	818	47	52	-	47	-
KR	-	105	-	-	118	-	-	108	-	740	96	97	2,172	88	260	2,243	63	192
TOTALS	**3,306**		**647**	**3,334**		**673**	**3,788**		**740**	**2,078**		**185**	**2,990**		**312**	**2,243**		**192**
2800 ACRES																		
SWP	2,612	144	511	3,818	171	887	8,191	172	1,915	159	105	23	-	136	-	-	156	-
FK	-	127	-	1,636	127	282	1,967	127	340	1,735	47	111	25	47	2	-	47	-
KR	-	105	-	-	118	-	-	108	-	-	96	-	158	88	19	121	63	10
TOTALS	**2,612**		**511**	**5,454**		**1,170**	**10,158**		**2,254**	**1,894**		**134**	**183**		**20**	**121**		**10**
KERN WATER BANK																		
SWP	48,408	144	9,474	27,454	171	6,380	37,081	172	8,668	32,578	105	4,649	-	136	-	19,000	156	4,028
FK	-	127	-	1,163	127	201	1,265	127	218	16,809	47	1,074	14,003	47	894	8,672	47	554
KR	1,483	105	212	1,549	118	248	1,938	108	284	7,978	96	1,041	24,687	88	2,953	23,391	63	2,003
TOTALS	**49,891**		**9,685**	**30,166**		**6,829**	**40,284**		**9,171**	**57,365**		**6,764**	**38,690**		**3,847**	**51,063**		**6,585**
PIONEER PROPERTY																		
SWP	22,992	144	4,500	12,153	171	2,824	11,614	172	2,715	1,964	105	280	-	136	-	284	156	60
FK	-		-	242	127	42	1,911	127	330	3,348	47	214	4,915	47	314	2,498	47	160
KR	-	105	-	-	118	-	-	108	-	6,549	96	854	9,442	88	1,129	10,048	63	860
TOTALS	**22,992**		**4,500**	**12,395**		**2,866**	**13,525**		**3,045**	**11,861**		**1,349**	**14,357**		**1,443**	**12,830**		**1,080**
BUENA VISTA PROPERTY[1]																		
SWP	151	144	30	-	171	-	-	172	-	-	105	-	-	136	-	-	156	-
FK	-	127	-	-	127	-	-	127	-	-	47	-	-	47	-	-	47	-
KR	762	105	109	7,754	118	1,244	940	108	138	8,592	96	1,121	11,941	88	1,428	6,939	63	594
TOTALS	**913**		**138**	**7,754**		**1,244**	**940**		**138**	**8,592**		**1,121**	**11,941**		**1,428**	**6,939**		**594**
KDWD PROJECT																		
SWP	-	144	-	4,283	171	995	5,609	172	1,311	10,588	105	1,511	7,126	136	1,317	2,922	156	620
FK	-	127	-	-	127	-	-	127	-	-	47	-	-	47	-	-	47	-
KR	-	105	-	-	118	-	-	108	-	-	96	-	-	88	-	-	63	-
TOTALS	**0**		**0**	**4,283**		**995**	**5,609**		**1,311**	**10,588**		**1,511**	**7,126**		**1,317**	**2,922**		**620**
RRBWSD PROJECTS (INCLUDING STRAND)																		
SWP	8,878	144	1,737	1,698	171	395	422	172	99	-	105	-	-	136	-	141	156	30
FK	-	127	-	10,851	127	1,873	15,479	127	2,672	4,848	47	310	-	47	-	4,789	47	306
KR	18,120	105	2,586	6,373	118	1,022	6,207	108	911	14,340	96	1,871	19,908	88	2,381	15,612	63	1,337
TOTALS	**26,998**		**4,323**	**18,922**		**3,290**	**22,108**		**3,681**	**19,188**		**2,181**	**19,908**		**2,381**	**20,542**		**1,673**
JOINT USE RECOVERY PROJECT																		
SWP	1,666	144	326	-	171	-	-	172	-	-	105	-	-	136	-	-	156	-
FK	1,292	127	223	2,237	127	386	2,665	127	460	1,143	47	73	-	47	-	2,152	47	137
KR	361	105	52	-	118	-	-	108	-	-	96	-	2,114	88	253	-	63	-
TOTALS	**3,319**		**601**	**2,237**		**386**	**2,665**		**460**	**1,143**		**73**	**2,114**		**253**	**2,152**		**137**
KERN RIVER CHANNEL																		
SWP	135	144	26	626	171	145	1,762	172	412	12	105	2	-	136	-	-	156	-
FK	-	127	-	1,712	127	295	925	127	160	1,409	47	90	733	47	47	-	47	-
KR	-	105	-	541	118	87	-	108	-	71	96	9	-	88	-	-	63	-
TOTALS	**135**		**26**	**2,879**		**528**	**2,687**		**572**	**1,492**		**101**	**733**		**47**	**0**		**0**
WEST KERN WATER DISTRICT																		
SWP	1,773	144	347	6,173	171	1,435	4,352	172	1,017	643	105	92	-	136	-	-	156	-
FK	-	127	-	-	127	-	-	127	-	-	47	-	-	47	-	-	47	-
KR	4,907	105	700	4,133	118	663	5,349	108	785	4,954	96	646	4,318	88	516	5,096	63	436
TOTALS	**6,680**		**1,047**	**10,306**		**2,097**	**9,701**		**1,802**	**5,597**		**738**	**4,318**		**516**	**5,096**		**436**

PROJECT/SOURCE	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA																				
SWP	-	135	-	1,277	158	274	3,540	120	577	1,224	127	211	3,555	127	614	2,766	180	677	**18,749**	**3,715**
FK	-	19	-	-	19	-	-	19	-	-	19	-	-	19	-	762	19	20	**6,959**	**859**
KR	3,291	43	192	1,880	52	133	-	60	-	1,216	69	114	-	94	-	-	94	-	**11,542**	**988**
TOTALS	**3,291**		**192**	**3,157**		**407**	**3,540**		**577**	**2,440**		**325**	**3,555**		**614**	**3,528**		**696**	**37,250**	**5,561**
2800 ACRES																				
SWP	2,303	135	423	1,193	158	256	176	120	29	1,190	127	205	3,922	127	677	5,096	180	1,247	**28,660**	**6,172**
FK	-	19	-	-	19	-	-	19	-	-	19	-	-	19	-	519	19	13	**5,882**	**748**
KR	5,641	43	330	3,206	52	227	831	60	68	1,559	69	146	-	94	-	-	94	-	**11,516**	**799**
TOTALS	**7,944**		**752**	**4,399**		**483**	**1,007**		**96**	**2,749**		**352**	**3,922**		**677**	**5,615**		**1,260**	**46,058**	**7,719**
KERN WATER BANK																				
SWP	36,975	135	6,784	32,292	158	6,934	41,837	120	6,823	29,572	127	5,104	28,561	127	4,930	10,706	180	2,619	**344,464**	**66,394**
FK	494	19	13	-	19	-	-	19	-	-	19	-	633	19	16	14,174	19	366	**57,213**	**3,336**
KR	9,410	43	550	1,049	52	74	2,757	60	225	582	69	55	-	94	-	-	94	-	**74,824**	**7,644**
TOTALS	**46,879**		**7,347**	**33,341**		**7,008**	**44,594**		**7,048**	**30,154**		**5,159**	**29,194**		**4,946**	**24,880**		**2,985**	**476,501**	**77,374**
PIONEER PROPERTY																				
SWP	6,047	135	1,109	7,456	158	1,601	7,687	120	1,254	5,312	127	917	7,847	127	1,354	4,091	180	1,001	**87,447**	**17,616**
FK	-	19	-	-	19	-	-	19	-	-	19	-	835	19	22	1,506	19	39	**15,255**	**1,119**
KR	5,965	43	349	2,519	52	178	4,630	60	378	4,911	69	461	-	94	-	-	94	-	**44,064**	**4,209**
TOTALS	**12,012**		**1,458**	**9,975**		**1,779**	**12,317**		**1,631**	**10,223**		**1,377**	**8,682**		**1,376**	**5,597**		**1,040**	**146,766**	**22,944**
BUENA VISTA PROPERTY[1]																				
SWP	-	135	-	-	158	-	-	120	-	-	127	-	-	127	-	-	180	-	**151**	**30**
FK	-	19	-	-	19	-	-	19	-	-	19	-	-	19	-	-	19	-	**0**	**0**
KR	6,553	43	383	6,772	52	479	506	60	41	-	69	-	-	94	-	1,517	94	194	**52,276**	**5,730**
TOTALS	**6,553**		**383**	**6,772**		**479**	**506**		**41**	**0**		**0**	**0**		**0**	**1,517**		**194**	**52,427**	**5,760**
KDWD PROJECT																				
SWP	4,262	135	782	11,028	158	2,368	11,127	120	1,815	2,606	127	450	543	127	94	2,019	180	494	**62,113**	**11,756**
FK	-	19	-	-	19	-	-	19	-	-	19	-	-	19	-	-	19	-	**0**	**0**
KR	-	43	-	-	52	-	-	60	-	-	69	-	-	94	-	-	94	-	**0**	**0**
TOTALS	**4,262**		**782**	**11,028**		**2,368**	**11,127**		**1,815**	**2,606**		**450**	**543**		**94**	**2,019**		**494**	**62,113**	**11,756**
RRBWSD PROJECTS (INCLUDING STRAND)																				
SWP	2,351	135	431	8,053	158	1,729	10,266	120	1,674	12,509	127	2,159	26,206	127	4,523	20,109	180	4,919	**90,633**	**17,697**
FK	3,917	19	101	-	19	-	2,688	19	69	3,489	19	90	-	19	-	-	19	-	**46,061**	**5,421**
KR	14,457	43	845	13,674	52	966	2,684	60	219	241	69	23	-	94	-	-	94	-	**111,616**	**12,160**
TOTALS	**20,725**		**1,377**	**21,727**		**2,696**	**15,638**		**1,963**	**16,239**		**2,272**	**26,206**		**4,523**	**20,109**		**4,919**	**248,310**	**35,278**
JOINT USE RECOVERY PROJECT																				
SWP	-	135	-	2,254	158	484	-	120	-	627	127	108	1,665	127	287	498	180	122	**6,710**	**1,327**
FK	1,664	19	43	-	19	-	1,196	19	31	2,059	19	53	-	19	-	1,072	19	28	**15,480**	**1,434**
KR	-	43	-	-	52	-	-	60	-	-	69	-	-	94	-	-	94	-	**2,475**	**304**
TOTALS	**1,664**		**43**	**2,254**		**484**	**1,196**		**31**	**2,686**		**161**	**1,665**		**287**	**1,570**		**150**	**24,665**	**3,066**
KERN RIVER CHANNEL																				
SWP	234	135	43	1	158	0	37	120	6	50	127	9	14	127	2	361	180	88	**3,232**	**734**
FK	-	19	-	-	19	-	-	19	-	-	19	-	503	19	13	3,038	19	78	**8,320**	**683**
KR	1,424	43	83	2,792	52	197	532	60	43	2,928	69	275	-	94	-	-	94	-	**8,288**	**695**
TOTALS	**1,658**		**126**	**2,793**		**198**	**569**		**49**	**2,978**		**283**	**517**		**15**	**3,399**		**167**	**19,840**	**2,112**
WEST KERN WATER DISTRICT																				
SWP	8,876	135	1,629	7,784	158	1,671	3,545	120	578	5,753	127	993	5,230	127	903	6,547	180	1,602	**50,676**	**10,266**
FK	-	19	-	-	19	-	-	19	-	-	19	-	-	19	-	-	19	-	**0**	**0**
KR	3,520	43	206	4,017	52	284	-	60	-	-	69	-	-	94	-	-	94	-	**36,294**	**4,237**
TOTALS	**12,396**		**1,834**	**11,801**		**1,955**	**3,545**		**578**	**5,753**		**993**	**5,230**		**903**	**6,547**		**1,602**	**86,970**	**14,503**
																			1,200,900	**191,833**

AVG TDS **118 MG/L**

1 - Buena Vista Property monthly breakdown is estimated.

Water Quality Data Sources: SWP - Table 32 of State Water Project Operations Data published monthly by State of California.
FK - most recent value, quarterly TDS values from HCGWPP samples.
KR - most recent value, quarterly TDS values from HCGWPP samples.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2012**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)
BERRENDA MESA																		
SWP	159	322	70	-	330	-	-	250	-	-	298	-	-	252	-	-	233	-
FK	385	22	12	-	22	-	-	22	-	-	196	-	-	196	-	-	196	-
KR	-	103	-	-	114	-	-	118	-	-	104	-	-	74	-	-	71	-
TOTALS	**544**		**81**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES																		
SWP	-	322	-	-	330	-	-	250	-	-	298	-	-	252	-	-	233	-
FK	700	22	21	1,039	22	31	-	22	-	-	196	-	-	196	-	-	196	-
KR	-	103	-	-	114	-	-	118	-	-	104	-	-	74	-	-	71	-
TOTALS	**700**		**21**	**1,039**		**31**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK																		
SWP	-	322	-	1,554	330	697	-	250	-	-	298	-	-	252	-	-	233	-
FK	7,456	22	223	-	22	-	-	22	-	-	196	-	-	196	-	-	196	-
KR	-	103	-	-	114	-	-	118	-	-	104	-	-	74	-	-	71	-
TOTALS	**7,456**		**223**	**1,554**		**697**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY																		
SWP	121	322	53	-	330	-	-	250	-	-	298	-	-	252	-	-	233	-
FK	1,718	22	51	952	22	28	-	22	-	-	196	-	-	196	-	-	196	-
KR	-	103	-	-	114	-	-	118	-	-	104	-	-	74	-	-	71	-
TOTALS	**1,839**		**104**	**952**		**28**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]																		
SWP	312	322	137	331	330	148	-	250	-	8	298	3	1,789	252	613	3,382	233	1,071
FK	-	22	-	-	22	-	-	22	-	-	196	-	-	196	-	-	196	-
KR	-	103	-	-	114	-	-	118	-	-	104	-	454	74	46	8,281	71	799
TOTALS	**312**		**137**	**331**		**148**	**0**		**0**	**8**		**3**	**2,243**		**658**	**11,663**		**1,870**
KDWD PROJECT																		
SWP	4,250	322	1,860	7,742	330	3,472	5,402	250	1,835	-	298	-	-	252	-	2,028	233	642
FK	-	22	-	-	22	-	-	22	-	-	196	-	-	196	-	-	196	-
KR	-	103	-	-	114	-	-	118	-	-	104	-	-	74	-	-	71	-
TOTALS	**4,250**		**1,860**	**7,742**		**3,472**	**5,402**		**1,835**	**0**		**0**	**0**		**0**	**2,028**		**642**
RRBWSD PROJECTS (INCLUDING STRAND)																		
SWP	1,009	322	442	92	330	41	-	250	-	-	298	-	-	252	-	226	233	72
FK	9,515	22	284	10,847	22	324	-	22	-	-	196	-	-	196	-	-	196	-
KR	910	103	127	387	114	60	1,759	118	282	4,272	104	604	-	74	-	-	71	-
TOTALS	**11,434**		**853**	**11,326**		**426**	**1,759**		**282**	**4,272**		**604**	**0**		**0**	**226**		**72**
JOINT USE RECOVERY PROJECT																		
SWP	-	322	-	-	330	-	-	250	-	-	298	-	-	252	-	-	233	-
FK	1,391	22	42	1,072	22	32	-	22	-	-	196	-	-	196	-	-	196	-
KR	-	103	-	-	114	-	417	118	67	1,034	104	146	-	74	-	-	71	-
TOTALS	**1,391**		**42**	**1,072**		**32**	**417**		**67**	**1,034**		**146**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL																		
SWP	-	322	-	-	330	-	-	250	-	-	298	-	-	252	-	-	233	-
FK	200	22	6	-	22	-	-	22	-	-	196	-	-	196	-	-	196	-
KR	-	103	-	-	114	-	-	118	-	-	104	-	-	74	-	-	71	-
TOTALS	**200**		**6**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
WEST KERN WATER DISTRICT																		
SWP	10,477	322	4,585	2,154	330	966	-	250	-	-	298	-	-	252	-	-	233	-
FK	-	22	-	-	22	-	-	22	-	-	196	-	-	196	-	-	196	-
KR	-	103	-	-	114	-	-	118	-	-	104	-	-	74	-	-	71	-
TOTALS	**10,477**		**4,585**	**2,154**		**966**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA																				
SWP	-	192	-	-	190	-	-	253	-	2,588	334	1,175	3,136	258	1,100	26	269	10	**5,909**	**2,353**
FK	-	174	-	-	174	-	-	174	-	-	303	-	-	303	-	-	303	-	**385**	**12**
KR	-	87	-	-	87	-	-	87	-	-	148	-	-	148	-	-	148	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**2,588**		**1,175**	**3,136**		**1,100**	**26**		**10**	**6,294**	**2,365**
2800 ACRES																				
SWP	-	192	-	-	190	-	-	253	-	-	334	-	-	258	-	-	269	-	**0**	**0**
FK	-	174	-	-	174	-	-	174	-	-	303	-	-	303	-	-	303	-	**1,739**	**52**
KR	-	87	-	-	87	-	-	87	-	-	148	-	-	148	-	-	148	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**1,739**	**52**
KERN WATER BANK																				
SWP	-	192	-	-	190	-	-	253	-	-	334	-	-	258	-	-	269	-	**1,554**	**697**
FK	-	174	-	-	174	-	-	174	-	-	303	-	-	303	-	-	303	-	**7,456**	**223**
KR	-	87	-	-	87	-	-	87	-	-	148	-	-	148	-	-	148	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**9,010**	**920**
PIONEER PROPERTY																				
SWP	-	192	-	-	190	-	-	253	-	-	334	-	-	258	-	-	269	-	**121**	**53**
FK	-	174	-	-	174	-	-	174	-	-	303	-	-	303	-	-	303	-	**2,670**	**80**
KR	-	87	-	-	87	-	-	87	-	-	148	-	-	148	-	-	148	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**2,791**	**133**
BUENA VISTA PROPERTY[1]																				
SWP	3,718	192	970	2,570	190	664	170	253	58	-	334	-	-	258	-	-	269	-	**12,280**	**3,664**
FK	-	174	-	-	174	-	-	174	-	-	303	-	-	303	-	-	303	-	**0**	**0**
KR	8,792	87	1,040	5,194	87	614	-	87	-	-	148	-	-	148	-	100	148	20	**22,821**	**2,519**
TOTALS	**12,510**		**2,010**	**7,764**		**1,278**	**170**		**58**	**0**		**0**	**0**		**0**	**100**		**20**	**35,101**	**6,183**
KDWD PROJECT																				
SWP	24,089	192	6,286	30,023	190	7,753	12,439	253	4,277	10,486	334	4,760	8,340	258	2,924	4,801	269	1,755	**109,600**	**35,565**
FK	-	174	-	-	174	-	-	174	-	-	303	-	-	303	-	-	303	-	**0**	**0**
KR	-	87	-	-	87	-	-	87	-	-	148	-	-	148	-	-	148	-	**0**	**0**
TOTALS	**24,089**		**6,286**	**30,023**		**7,753**	**12,439**		**4,277**	**10,486**		**4,760**	**8,340**		**2,924**	**4,801**		**1,755**	**109,600**	**35,565**
RRBWSD PROJECTS (INCLUDING STRAND)																				
SWP	554	192	145	230	190	59	-	253	-	-	334	-	-	258	-	3,885	269	1,420	**5,996**	**2,179**
FK	-	174	-	-	174	-	-	174	-	-	303	-	-	303	-	-	303	-	**20,362**	**609**
KR	-	87	-	-	87	-	-	87	-	-	148	-	-	148	-	-	148	-	**7,328**	**1,073**
TOTALS	**554**		**145**	**230**		**59**	**0**		**0**	**0**		**0**	**0**		**0**	**3,885**		**1,420**	**33,686**	**3,861**
JOINT USE RECOVERY PROJECT																				
SWP	-	192	-	-	190	-	-	253	-	-	334	-	-	258	-	905	269	331	**905**	**331**
FK	-	174	-	-	174	-	-	174	-	-	303	-	542	303	223	1,195	303	492	**4,200**	**789**
KR	-	87	-	-	87	-	-	87	-	-	148	-	-	148	-	-	148	-	**1,451**	**213**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**542**		**223**	**2,100**		**823**	**6,556**	**1,333**
KERN RIVER CHANNEL																				
SWP	-	192	-	-	190	-	-	253	-	-	334	-	-	258	-	18	269	7	**18**	**7**
FK	-	174	-	-	174	-	-	174	-	-	303	-	-	303	-	-	303	-	**200**	**6**
KR	-	87	-	-	87	-	-	87	-	-	148	-	-	148	-	-	148	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**18**		**7**	**218**	**13**
WEST KERN WATER DISTRICT																				
SWP	-	192	-	-	190	-	-	253	-	2,500	334	1,135	-	258	-	-	269	-	**15,131**	**6,686**
FK	-	174	-	-	174	-	-	174	-	-	303	-	-	303	-	-	303	-	**0**	**0**
KR	-	87	-	-	87	-	-	87	-	-	148	-	-	148	-	-	148	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**2,500**		**1,135**	**0**		**0**	**0**		**0**	**15,131**	**6,686**
																			220,126	**63,292**

AVG TDS **212 MG/L**

1 - Buena Vista Property monthly breakdown is estimated.

Water Quality Data Sources: SWP - Table 32 of State Water Project Operations Data published monthly by State of California.
FK - most recent value, quarterly TDS values from HCGWPP samples.
KR - most recent value, quarterly TDS values from HCGWPP samples.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2013**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	301	-	-	318	-	-	289	-	-	272	-
FK	-	44	-	-	44	-	-	44	-	-	167	-
KR	-	122	-	-	122	-	-	122	-	-	110	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	301	-	-	318	-	-	289	-	-	272	-
FK	-	44	-	-	44	-	-	44	-	-	167	-
KR	-	122	-	-	122	-	-	122	-	-	110	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	301	-	-	318	-	-	289	-	-	272	-
FK	-	44	-	-	44	-	-	44	-	-	167	-
KR	-	122	-	-	122	-	-	122	-	-	110	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	301	-	-	318	-	-	289	-	-	272	-
FK	-	44	-	-	44	-	-	44	-	-	167	-
KR	-	122	-	-	122	-	-	122	-	-	110	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	-	301	-	369	318	159	21	289	8	16	272	6
FK	-	44	-	-	44	-	-	44	-	-	167	-
KR	-	122	-	66	122	11	-	122	-	-	110	-
TOTALS	**0**		**0**	**435**		**170**	**21**		**8**	**16**		**6**
KDWD PROJECT												
SWP	-	301	-	-	318	-	-	289	-	-	272	-
FK	-	44	-	-	44	-	-	44	-	-	167	-
KR	-	122	-	-	122	-	-	122	-	-	110	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-	301	-	-	318	-	-	289	-	-	272	-
FK	-	44	-	-	44	-	-	44	-	-	167	-
KR	-	122	-	-	122	-	-	122	-	-	110	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
JOINT USE RECOVERY PROJECT												
SWP	-	301	-	-	318	-	-	289	-	-	272	-
FK	-	44	-	-	44	-	-	44	-	-	167	-
KR	-	122	-	-	122	-	-	122	-	-	110	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	301	-	-	318	-	-	289	-	-	272	-
FK	-	44	-	-	44	-	-	44	-	-	167	-
KR	-	122	-	-	122	-	-	122	-	-	110	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
WEST KERN WATER DISTRICT												
SWP	-	301	-	-	318	-	-	289	-	-	272	-
FK	-	44	-	-	44	-	-	44	-	-	167	-
KR	-	122	-	-	122	-	-	122	-	-	110	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	284	-	-	276	-	-	190	-	-	262	-
FK	-	167	-	-	167	-	-	233	-	-	233	-
KR	-	110	-	-	110	-	-	99	-	-	99	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	284	-	-	276	-	-	190	-	-	262	-
FK	-	167	-	-	167	-	-	233	-	-	233	-
KR	-	110	-	-	110	-	-	99	-	-	99	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	284	-	-	276	-	-	190	-	-	262	-
FK	-	167	-	-	167	-	-	233	-	-	233	-
KR	-	110	-	-	110	-	-	99	-	-	99	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	284	-	-	276	-	-	190	-	-	262	-
FK	-	167	-	-	167	-	-	233	-	-	233	-
KR	-	110	-	-	110	-	-	99	-	-	99	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	32	284	12	4,330	276	1,624	126	190	33	-	262	-
FK	-	167	-	-	167	-	-	233	-	-	233	-
KR	167	110	25	1,952	110	292	7,374	99	992	1,644	99	221
TOTALS	**199**		**37**	**6,282**		**1,916**	**7,500**		**1,025**	**1,644**		**221**
KDWD PROJECT												
SWP	-	284	-	-	276	-	-	190	-	-	262	-
FK	-	167	-	-	167	-	-	233	-	-	233	-
KR	-	110	-	-	110	-	-	99	-	-	99	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-	284	-	-	276	-	-	190	-	-	262	-
FK	-	167	-	-	167	-	-	233	-	-	233	-
KR	-	110	-	-	110	-	-	99	-	-	99	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
JOINT USE RECOVERY PROJECT												
SWP	-	284	-	-	276	-	-	190	-	-	262	-
FK	-	167	-	-	167	-	-	233	-	-	233	-
KR	-	110	-	-	110	-	-	99	-	-	99	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	284	-	-	276	-	-	190	-	-	262	-
FK	-	167	-	-	167	-	-	233	-	-	233	-
KR	-	110	-	-	110	-	-	99	-	-	99	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
WEST KERN WATER DISTRICT												
SWP	-	284	-	-	276	-	-	190	-	-	262	-
FK	-	167	-	-	167	-	-	233	-	-	233	-
KR	-	110	-	-	110	-	-	99	-	-	99	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA														
SWP	-	325	-	-	336	-	-	345	-	-	345	-	**0**	**0**
FK	-	233	-	-	234	-	-	234	-	-	234	-	**0**	**0**
KR	-	99	-	-	166	-	-	166	-	-	166	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
2800 ACRES														
SWP	-	325	-	-	336	-	-	345	-	-	345	-	**0**	**0**
FK	-	233	-	-	234	-	-	234	-	-	234	-	**0**	**0**
KR	-	99	-	-	166	-	-	166	-	-	166	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
KERN WATER BANK														
SWP	-	325	-	-	336	-	-	345	-	-	345	-	**0**	**0**
FK	-	233	-	-	234	-	-	234	-	-	234	-	**0**	**0**
KR	-	99	-	-	166	-	-	166	-	-	166	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
PIONEER PROPERTY														
SWP	-	325	-	-	336	-	-	345	-	-	345	-	**0**	**0**
FK	-	233	-	-	234	-	-	234	-	-	234	-	**0**	**0**
KR	-	99	-	-	166	-	-	166	-	-	166	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
BUENA VISTA PROPERTY[1]														
SWP	-	325	-	-	336	-	-	345	-	-	345	-	**4,894**	**1,843**
FK	-	233	-	-	234	-	-	234	-	-	234	-	**0**	**0**
KR	35	99	5	-	166	-	-	166	-	-	166	-	**11,238**	**1,546**
TOTALS	**35**		**5**	**0**		**0**	**0**		**0**	**0**		**0**	**16,132**	**3,389**
KDWD PROJECT														
SWP	-	325	-	-	336	-	-	345	-	-	345	-	**0**	**0**
FK	-	233	-	-	234	-	-	234	-	-	234	-	**0**	**0**
KR	-	99	-	-	166	-	-	166	-	-	166	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
RRBWSD PROJECTS (INCLUDING STRAND)														
SWP	-	325	-	-	336	-	-	345	-	-	345	-	**0**	**0**
FK	-	233	-	-	234	-	-	234	-	-	234	-	**0**	**0**
KR	-	99	-	-	166	-	-	166	-	-	166	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
JOINT USE RECOVERY PROJECT														
SWP	-	325	-	-	336	-	-	345	-	-	345	-	**0**	**0**
FK	-	233	-	-	234	-	-	234	-	-	234	-	**0**	**0**
KR	-	99	-	-	166	-	-	166	-	-	166	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
KERN RIVER CHANNEL														
SWP	-	325	-	-	336	-	-	345	-	-	345	-	**0**	**0**
FK	-	233	-	-	234	-	-	234	-	-	234	-	**0**	**0**
KR	-	99	-	-	166	-	-	166	-	-	166	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
WEST KERN WATER DISTRICT														
SWP	-	325	-	-	336	-	-	345	-	-	345	-	**0**	**0**
FK	-	233	-	-	234	-	-	234	-	-	234	-	**0**	**0**
KR	-	99	-	-	166	-	-	166	-	-	166	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
													16,132	**6,777**

AVG TDS **309 MG/L**

1 - Buena Vista Property monthly breakdown is estimated.

Water Quality Data Sources: SWP - Table 32 of State Water Project Operations Data published monthly by State of California.
FK - most recent value, quarterly TDS values from HCGWPP samples.
KR - most recent value, quarterly TDS values from HCGWPP samples.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2014**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	335	-	-	276	-	-	259	-	-	241	-
FK	-	73	-	-	73	-	-	73	-	-	136	-
KR	-	162	-	-	162	-	-	162	-	-	126	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	335	-	-	276	-	-	259	-	-	241	-
FK	-	73	-	-	73	-	-	73	-	-	136	-
KR	-	162	-	-	162	-	-	162	-	-	126	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	335	-	-	276	-	-	259	-	-	241	-
FK	-	73	-	-	73	-	-	73	-	-	136	-
KR	-	162	-	-	162	-	-	162	-	-	126	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	335	-	-	276	-	-	259	-	-	241	-
FK	-	73	-	-	73	-	-	73	-	-	136	-
KR	-	162	-	-	162	-	-	162	-	-	126	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	-	335	-	-	276	-	-	259	-	-	241	-
FK	-	73	-	-	73	-	-	73	-	-	136	-
KR	-	162	-	-	162	-	-	162	-	-	126	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KDWD PROJECT												
SWP	-	335	-	-	276	-	-	259	-	-	241	-
FK	-	73	-	-	73	-	-	73	-	-	136	-
KR	-	162	-	-	162	-	-	162	-	-	126	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-	335	-	-	276	-	-	259	-	-	241	-
FK	-	73	-	-	73	-	-	73	-	-	136	-
KR	-	162	-	-	162	-	-	162	-	-	126	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
JOINT USE RECOVERY PROJECT												
SWP	-	335	-	-	276	-	-	259	-	-	241	-
FK	-	73	-	-	73	-	-	73	-	-	136	-
KR	-	162	-	-	162	-	-	162	-	-	126	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	335	-	-	276	-	-	259	-	-	241	-
FK	-	73	-	-	73	-	-	73	-	-	136	-
KR	-	162	-	-	162	-	-	162	-	-	126	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
WEST KERN WATER DISTRICT												
SWP	-	335	-	-	276	-	-	259	-	-	241	-
FK	-	73	-	-	73	-	-	73	-	-	136	-
KR	-	162	-	-	162	-	-	162	-	-	126	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	231	-	-	327	-	-	330	-	-	369	-
FK	-	136	-	-	136	-	-	99	-	-	99	-
KR	-	126	-	-	126	-	-	102	-	-	102	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	231	-	-	327	-	-	330	-	-	369	-
FK	-	136	-	-	136	-	-	99	-	-	99	-
KR	-	126	-	-	126	-	-	102	-	-	102	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	231	-	-	327	-	-	330	-	-	369	-
FK	-	136	-	-	136	-	-	99	-	-	99	-
KR	-	126	-	-	126	-	-	102	-	-	102	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	231	-	-	327	-	-	330	-	-	369	-
FK	-	136	-	-	136	-	-	99	-	-	99	-
KR	-	126	-	-	126	-	-	102	-	-	102	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	-	231	-	-	327	-	-	330	-	-	369	-
FK	-	136	-	-	136	-	-	99	-	-	99	-
KR	-	126	-	-	126	-	-	102	-	-	102	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KDWD PROJECT												
SWP	-	231	-	-	327	-	-	330	-	-	369	-
FK	-	136	-	-	136	-	-	99	-	-	99	-
KR	-	126	-	-	126	-	-	102	-	-	102	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-	231	-	-	327	-	-	330	-	-	369	-
FK	-	136	-	-	136	-	-	99	-	-	99	-
KR	-	126	-	-	126	-	-	102	-	-	102	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
JOINT USE RECOVERY PROJECT												
SWP	-	231	-	-	327	-	-	330	-	-	369	-
FK	-	136	-	-	136	-	-	99	-	-	99	-
KR	-	126	-	-	126	-	-	102	-	-	102	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	231	-	-	327	-	-	330	-	-	369	-
FK	-	136	-	-	136	-	-	99	-	-	99	-
KR	-	126	-	-	126	-	-	102	-	-	102	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
WEST KERN WATER DISTRICT												
SWP	-	231	-	-	327	-	-	330	-	-	369	-
FK	-	136	-	-	136	-	-	99	-	-	99	-
KR	-	126	-	-	126	-	-	102	-	-	102	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA														
SWP	-	326	-	-	336	-	-	289	-	-	417	-	**0**	**0**
FK	-	99	-	-	174	-	-	174	-	-	174	-	**0**	**0**
KR	-	102	-	-	150	-	-	150	-	-	150	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
2800 ACRES														
SWP	-	326	-	-	336	-	-	289	-	-	417	-	**0**	**0**
FK	-	99	-	-	174	-	-	174	-	-	174	-	**0**	**0**
KR	-	102	-	-	150	-	-	150	-	-	150	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
KERN WATER BANK														
SWP	-	326	-	-	336	-	-	289	-	-	417	-	**0**	**0**
FK	-	99	-	-	174	-	-	174	-	-	174	-	**0**	**0**
KR	-	102	-	-	150	-	-	150	-	-	150	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
PIONEER PROPERTY														
SWP	-	326	-	-	336	-	-	289	-	-	417	-	**0**	**0**
FK	-	99	-	-	174	-	-	174	-	-	174	-	**0**	**0**
KR	-	102	-	-	150	-	-	150	-	-	150	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
BUENA VISTA PROPERTY[1]														
SWP	-	326	-	-	336	-	-	289	-	-	417	-	**0**	**0**
FK	-	99	-	-	174	-	-	174	-	-	174	-	**0**	**0**
KR	-	102	-	-	150	-	-	150	-	-	150	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
KDWD PROJECT														
SWP	-	326	-	-	336	-	-	289	-	-	417	-	**0**	**0**
FK	-	99	-	-	174	-	-	174	-	-	174	-	**0**	**0**
KR	-	102	-	-	150	-	-	150	-	-	150	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
RRBWSD PROJECTS (INCLUDING STRAND)														
SWP	-	326	-	-	336	-	-	289	-	-	417	-	**0**	**0**
FK	-	99	-	-	174	-	-	174	-	-	174	-	**0**	**0**
KR	-	102	-	-	150	-	-	150	-	-	150	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
JOINT USE RECOVERY PROJECT														
SWP	-	326	-	-	336	-	-	289	-	-	417	-	**0**	**0**
FK	-	99	-	-	174	-	-	174	-	-	174	-	**0**	**0**
KR	-	102	-	-	150	-	-	150	-	-	150	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
KERN RIVER CHANNEL														
SWP	-	326	-	-	336	-	-	289	-	-	417	-	**0**	**0**
FK	-	99	-	-	174	-	-	174	-	-	174	-	**0**	**0**
KR	-	102	-	-	150	-	-	150	-	-	150	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
WEST KERN WATER DISTRICT														
SWP	-	326	-	-	336	-	-	289	-	-	417	-	**0**	**0**
FK	-	99	-	-	174	-	-	174	-	-	174	-	**0**	**0**
KR	-	102	-	-	150	-	-	150	-	-	150	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
													0	**0**

AVG TDS	
#DIV/0!	**MG/L**

1 - Buena Vista Property monthly breakdown is estimated.

Water Quality Data Sources: SWP - Table 32 of State Water Project Operations Data published monthly by State of California.
FK - most recent value, quarterly TDS values from HCGWPP samples.
KR - most recent value, quarterly TDS values from HCGWPP samples.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2015**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	243	-	-	243	-	-	306	-	-	289	-
FK	-	208	-	-	208	-	-	208	-	-	349	-
KR	-	163	-	-	163	-	-	163	-	-	152	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	243	-	-	243	-	-	306	-	-	289	-
FK	-	208	-	-	208	-	-	208	-	-	349	-
KR	-	163	-	-	163	-	-	163	-	-	152	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	243	-	-	243	-	-	306	-	-	289	-
FK	-	208	-	-	208	-	-	208	-	-	349	-
KR	-	163	-	-	163	-	-	163	-	-	152	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	243	-	-	243	-	-	306	-	-	289	-
FK	-	208	-	-	208	-	-	208	-	-	349	-
KR	-	163	-	-	163	-	-	163	-	-	152	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	-	243	-	-	243	-	-	306	-	-	289	-
FK	-	208	-	-	208	-	-	208	-	-	349	-
KR	-	163	-	-	163	-	-	163	-	-	152	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KDWD PROJECT												
SWP	-	243	-	-	243	-	-	306	-	-	289	-
FK	-	208	-	-	208	-	-	208	-	-	349	-
KR	-	163	-	-	163	-	-	163	-	-	152	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-	243	-	-	243	-	-	306	-	-	289	-
FK	-	208	-	-	208	-	-	208	-	-	349	-
KR	-	163	-	-	163	-	-	163	-	-	152	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
JOINT USE RECOVERY PROJECT												
SWP	-	243	-	-	243	-	-	306	-	-	289	-
FK	-	208	-	-	208	-	-	208	-	-	349	-
KR	-	163	-	-	163	-	-	163	-	-	152	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	243	-	-	243	-	-	306	-	-	289	-
FK	-	208	-	-	208	-	-	208	-	-	349	-
KR	-	163	-	-	163	-	-	163	-	-	152	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
WEST KERN WATER DISTRICT												
SWP	-	243	-	-	243	-	-	306	-	-	289	-
FK	-	208	-	-	208	-	-	208	-	-	349	-
KR	-	163	-	-	163	-	-	163	-	-	152	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	306	-	-	315	-	-	348	-	-	327	-
FK	-	349	-	-	349	-	-	380	-	-	380	-
KR	-	152	-	-	152	-	-	133	-	-	133	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	306	-	-	315	-	-	348	-	-	327	-
FK	-	349	-	-	349	-	-	380	-	-	380	-
KR	-	152	-	-	152	-	-	133	-	-	133	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	306	-	-	315	-	-	348	-	-	327	-
FK	-	349	-	-	349	-	-	380	-	-	380	-
KR	-	152	-	-	152	-	-	133	-	-	133	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	306	-	-	315	-	-	348	-	-	327	-
FK	-	349	-	-	349	-	-	380	-	-	380	-
KR	-	152	-	-	152	-	-	133	-	-	133	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	-	306	-	-	315	-	-	348	-	-	327	-
FK	-	349	-	-	349	-	-	380	-	-	380	-
KR	-	152	-	-	152	-	-	133	-	-	133	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KDWD PROJECT												
SWP	-	306	-	-	315	-	-	348	-	-	327	-
FK	-	349	-	-	349	-	-	380	-	-	380	-
KR	-	152	-	-	152	-	-	133	-	-	133	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-	306	-	-	315	-	-	348	-	-	327	-
FK	-	349	-	-	349	-	-	380	-	-	380	-
KR	-	152	-	-	152	-	-	133	-	-	133	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
JOINT USE RECOVERY PROJECT												
SWP	-	306	-	-	315	-	-	348	-	-	327	-
FK	-	349	-	-	349	-	-	380	-	-	380	-
KR	-	152	-	-	152	-	-	133	-	-	133	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	306	-	-	315	-	-	348	-	-	327	-
FK	-	349	-	-	349	-	-	380	-	-	380	-
KR	-	152	-	-	152	-	-	133	-	-	133	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
WEST KERN WATER DISTRICT												
SWP	-	306	-	-	315	-	-	348	-	-	327	-
FK	-	349	-	-	349	-	-	380	-	-	380	-
KR	-	152	-	-	152	-	-	133	-	-	133	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA														
SWP	-	400	-	-	311	-	-	351	-	-	365	-	**0**	**0**
FK	-	380	-	-	125	-	-	125	-	-	125	-	**0**	**0**
KR	-	133	-	-	214	-	-	214	-	-	214	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
2800 ACRES														
SWP	-	400	-	-	311	-	-	351	-	-	365	-	**0**	**0**
FK	-	380	-	-	125	-	-	125	-	-	125	-	**0**	**0**
KR	-	133	-	-	214	-	-	214	-	-	214	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
KERN WATER BANK														
SWP	-	400	-	-	311	-	-	351	-	-	365	-	**0**	**0**
FK	-	380	-	-	125	-	-	125	-	-	125	-	**0**	**0**
KR	-	133	-	-	214	-	-	214	-	-	214	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
PIONEER PROPERTY														
SWP	-	400	-	-	311	-	-	351	-	-	365	-	**0**	**0**
FK	-	380	-	-	125	-	-	125	-	-	125	-	**0**	**0**
KR	-	133	-	-	214	-	-	214	-	-	214	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
BUENA VISTA PROPERTY[1]														
SWP	-	400	-	-	311	-	-	351	-	-	365	-	**0**	**0**
FK	-	380	-	-	125	-	-	125	-	-	125	-	**0**	**0**
KR	-	133	-	-	214	-	-	214	-	-	214	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
KDWD PROJECT														
SWP	-	400	-	-	311	-	-	351	-	-	365	-	**0**	**0**
FK	-	380	-	-	125	-	-	125	-	-	125	-	**0**	**0**
KR	-	133	-	-	214	-	-	214	-	-	214	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
RRBWSD PROJECTS (INCLUDING STRAND)														
SWP	-	400	-	-	311	-	-	351	-	-	365	-	**0**	**0**
FK	-	380	-	-	125	-	-	125	-	-	125	-	**0**	**0**
KR	-	133	-	-	214	-	-	214	-	-	214	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
JOINT USE RECOVERY PROJECT														
SWP	-	400	-	-	311	-	-	351	-	-	365	-	**0**	**0**
FK	-	380	-	-	125	-	-	125	-	-	125	-	**0**	**0**
KR	-	133	-	-	214	-	-	214	-	-	214	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
KERN RIVER CHANNEL														
SWP	-	400	-	-	311	-	-	351	-	-	365	-	**0**	**0**
FK	-	380	-	-	125	-	-	125	-	-	125	-	**0**	**0**
KR	-	133	-	-	214	-	-	214	-	-	214	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
WEST KERN WATER DISTRICT														
SWP	-	400	-	-	311	-	-	351	-	-	365	-	**0**	**0**
FK	-	380	-	-	125	-	-	125	-	-	125	-	**0**	**0**
KR	-	133	-	-	214	-	-	214	-	-	214	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
													0	**0**

AVG TDS	
#DIV/0!	**MG/L**

1 - Buena Vista Property monthly breakdown is estimated.

Water Quality Data Sources: SWP - Table 32 of State Water Project Operations Data published monthly by State of California.
FK - most recent value, quarterly TDS values from HCGWPP samples.
KR - most recent value, quarterly TDS values from HCGWPP samples.

KERN FAN MONITORING COMMITTEE

ANALYSIS OF TOTAL DISSOLVED SOLIDS IMPORTED TO BASIN

WITH RECHARGE WATER SUPPLIES

YEAR: **2016**

PROJECT/SOURCE	JANUARY GROSS RECHARGE (AF)	JANUARY W. Q. TDS (MG/L)	JANUARY SALT LOAD (TONS)	FEBRUARY GROSS RECHARGE (AF)	FEBRUARY W. Q. TDS (MG/L)	FEBRUARY SALT LOAD (TONS)	MARCH GROSS RECHARGE (AF)	MARCH W. Q. TDS (MG/L)	MARCH SALT LOAD (TONS)	APRIL GROSS RECHARGE (AF)	APRIL W. Q. TDS (MG/L)	APRIL SALT LOAD (TONS)
BERRENDA MESA												
SWP	-		-	-		-	-	281	-	-	272	-
FK	-	181	-	-	181	-	-	181	-	-	31	-
KR	-	172	-	-	172	-	-	172	-	-	115	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-		-	-		-	-	281	-	-	272	-
FK	-	181	-	-	181	-	-	181	-	-	31	-
KR	-	172	-	-	172	-	-	172	-	-	115	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-		-	-		-	-	281	-	-	272	-
FK	-	181	-	-	181	-	-	181	-	-	31	-
KR	-	172	-	-	172	-	-	172	-	-	115	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-		-	-		-	-	281	-	-	272	-
FK	-	181	-	-	181	-	-	181	-	-	31	-
KR	-	172	-	-	172	-	-	172	-	-	115	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	-		-	-		-	-	281	-	-	272	-
FK	-	181	-	-	181	-	-	181	-	-	31	-
KR	-	172	-	-	172	-	-	172	-	-	115	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KDWD PROJECT												
SWP	-		-	-		-	-	281	-	-	272	-
FK	-	181	-	-	181	-	-	181	-	-	31	-
KR	-	172	-	-	172	-	-	172	-	-	115	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-		-	-		-	-	281	-	-	272	-
FK	-	181	-	-	181	-	2,643	181	650	1,476	31	62
KR	-	172	-	-	172	-	-	172	-	-	115	-
TOTALS	**0**		**0**	**0**		**0**	**2,643**		**650**	**1,476**		**62**
JOINT USE RECOVERY PROJECT												
SWP	-		-	-		-	-	281	-	-	272	-
FK	-	181	-	-	181	-	1,601	181	394	625	31	26
KR	-	172	-	-	172	-	-	172	-	-	115	-
TOTALS	**0**		**0**	**0**		**0**	**1,601**		**394**	**625**		**26**
KERN RIVER CHANNEL												
SWP	-		-	-		-	-	281	-	-	272	-
FK	-	181	-	-	181	-	-	181	-	-	31	-
KR	-	172	-	-	172	-	-	172	-	-	115	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
WEST KERN WATER DISTRICT												
SWP	-		-	-		-	-	281	-	-	272	-
FK	-	181	-	-	181	-	-	181	-	-	31	-
KR	-	172	-	-	172	-	-	172	-	-	115	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	MAY GROSS RECHARGE (AF)	MAY W. Q. TDS (MG/L)	MAY SALT LOAD (TONS)	JUNE GROSS RECHARGE (AF)	JUNE W. Q. TDS (MG/L)	JUNE SALT LOAD (TONS)	JULY GROSS RECHARGE (AF)	JULY W. Q. TDS (MG/L)	JULY SALT LOAD (TONS)	AUGUST GROSS RECHARGE (AF)	AUGUST W. Q. TDS (MG/L)	AUGUST SALT LOAD (TONS)
BERRENDA MESA												
SWP	-	332	-	-	306	-	-	217	-	-	155	-
FK	-	31	-	-	31	-	-	20	-	-	20	-
KR	-	115	-	-	115	-	-	66	-	-	66	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
2800 ACRES												
SWP	-	332	-	-	306	-	-	217	-	-	155	-
FK	-	31	-	-	31	-	-	20	-	-	20	-
KR	-	115	-	-	115	-	-	66	-	-	66	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN WATER BANK												
SWP	-	332	-	-	306	-	-	217	-	-	155	-
FK	-	31	-	-	31	-	-	20	-	-	20	-
KR	-	115	-	-	115	-	-	66	-	-	66	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
PIONEER PROPERTY												
SWP	-	332	-	-	306	-	-	217	-	-	155	-
FK	-	31	-	-	31	-	-	20	-	-	20	-
KR	-	115	-	-	115	-	-	66	-	-	66	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
BUENA VISTA PROPERTY[1]												
SWP	-	332	-	7,096	306	2,951	6,184	217	1,824	4,972	155	1,047
FK	-	31	-	-	31	-	-	20	-	-	20	-
KR	-	115	-	-	115	-	-	66	-	-	66	-
TOTALS	**0**		**0**	**7,096**		**2,951**	**6,184**		**1,824**	**4,972**		**1,047**
KDWD PROJECT												
SWP	-	332	-	-	306	-	-	217	-	-	155	-
FK	-	31	-	-	31	-	-	20	-	-	20	-
KR	-	115	-	-	115	-	-	66	-	-	66	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
RRBWSD PROJECTS (INCLUDING STRAND)												
SWP	-	332	-	-	306	-	-	217	-	-	155	-
FK	-	31	-	-	31	-	-	20	-	-	20	-
KR	-	115	-	-	115	-	-	66	-	-	66	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
JOINT USE RECOVERY PROJECT												
SWP	-	332	-	-	306	-	-	217	-	-	155	-
FK	-	31	-	-	31	-	-	20	-	-	20	-
KR	-	115	-	-	115	-	-	66	-	-	66	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
KERN RIVER CHANNEL												
SWP	-	332	-	-	306	-	-	217	-	-	155	-
FK	-	31	-	-	31	-	-	20	-	-	20	-
KR	-	115	-	-	115	-	-	66	-	-	66	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
WEST KERN WATER DISTRICT												
SWP	-	332	-	-	306	-	-	217	-	-	155	-
FK	-	31	-	-	31	-	-	20	-	-	20	-
KR	-	115	-	-	115	-	-	66	-	-	66	-
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**

PROJECT/SOURCE	SEPTEMBER GROSS RECHARGE (AF)	SEPTEMBER W. Q. TDS (MG/L)	SEPTEMBER SALT LOAD (TONS)	OCTOBER GROSS RECHARGE (AF)	OCTOBER W. Q. TDS (MG/L)	OCTOBER SALT LOAD (TONS)	NOVEMBER GROSS RECHARGE (AF)	NOVEMBER W. Q. TDS (MG/L)	NOVEMBER SALT LOAD (TONS)	DECEMBER GROSS RECHARGE (AF)	DECEMBER W. Q. TDS (MG/L)	DECEMBER SALT LOAD (TONS)	TOTALS GROSS RECHARGE (AF)	TOTALS SALT LOAD (TONS)
BERRENDA MESA														
SWP	-	217	-	-	320	-	-	309	-	-	280	-	**0**	**0**
FK	-	20	-	-	28	-	-	28	-	-	28	-	**0**	**0**
KR	-	66	-	-	119	-	-	119	-	-	119	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
2800 ACRES														
SWP	-	217	-	-	320	-	-	309	-	-	280	-	**0**	**0**
FK	-	20	-	-	28	-	-	28	-	-	28	-	**0**	**0**
KR	-	66	-	-	119	-	-	119	-	-	119	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
KERN WATER BANK														
SWP	-	217	-	-	320	-	-	309	-	-	280	-	**0**	**0**
FK	-	20	-	-	28	-	-	28	-	-	28	-	**0**	**0**
KR	-	66	-	-	119	-	-	119	-	-	119	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
PIONEER PROPERTY														
SWP	-	217	-	-	320	-	-	309	-	-	280	-	**0**	**0**
FK	-	20	-	-	28	-	-	28	-	-	28	-	**0**	**0**
KR	-	66	-	-	119	-	-	119	-	-	119	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
BUENA VISTA PROPERTY[1]														
SWP	607	217	179	-	320	-	-	309	-	-	280	-	**18,859**	**6,001**
FK	-	20	-	-	28	-	-	28	-	-	28	-	**0**	**0**
KR	-	66	-	-	119	-	-	119	-	-	119	-	**0**	**0**
TOTALS	**607**		**179**	**0**		**0**	**0**		**0**	**0**		**0**	**18,859**	**6,001**
KDWD PROJECT														
SWP	-	217	-	-	320	-	-	309	-	-	280	-	**0**	**0**
FK	-	20	-	-	28	-	-	28	-	-	28	-	**0**	**0**
KR	-	66	-	-	119	-	-	119	-	-	119	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
RRBWSD PROJECTS (INCLUDING STRAND)														
SWP	-	217	-	-	320	-	-	309	-	-	280	-	**0**	**0**
FK	-	20	-	-	28	-	-	28	-	-	28	-	**4,119**	**712**
KR	-	66	-	-	119	-	-	119	-	-	119	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**4,119**	**712**
JOINT USE RECOVERY PROJECT														
SWP	-	217	-	-	320	-	-	309	-	-	280	-	**0**	**0**
FK	-	20	-	-	28	-	-	28	-	-	28	-	**2,226**	**420**
KR	-	66	-	-	119	-	-	119	-	-	119	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**2,226**	**420**
KERN RIVER CHANNEL														
SWP	-	217	-	-	320	-	-	309	-	-	280	-	**0**	**0**
FK	-	20	-	-	28	-	-	28	-	-	28	-	**0**	**0**
KR	-	66	-	-	119	-	-	119	-	-	119	-	**0**	**0**
TOTALS	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**	**0**
WEST KERN WATER DISTRICT														
SWP	-	217	-	5,000	320	2,175	3,608	309	1,515	3,825	280	1,456	**12,433**	**5,145**
FK	-	20	-	-	28	-	-	28	-	-	28	-	**0**	**0**
KR	-	66	-	-	119	-	-	119	-	-	119	-	**0**	**0**
TOTALS	**0**		**0**	**5,000**		**2,175**	**3,608**		**1,515**	**3,825**		**1,456**	**12,433**	**5,145**
													37,637	**18,280**

AVG TDS **357 MG/L**

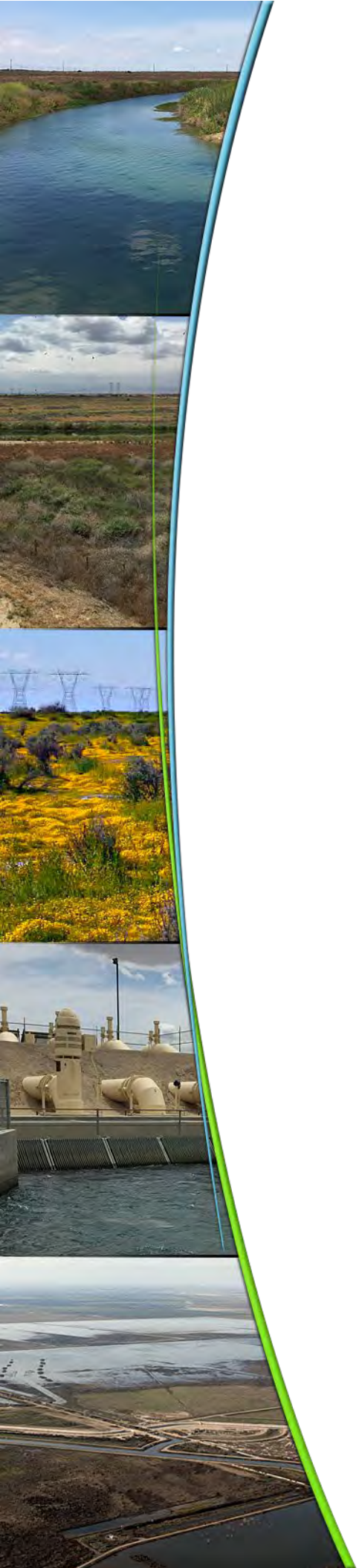
1 - Buena Vista Property monthly breakdown is estimated.

Water Quality Data Sources: SWP - Table 32 of State Water Project Operations Data published monthly by State of California.
FK - most recent value, quarterly TDS values from HCGWPP samples.
KR - most recent value, quarterly TDS values from HCGWPP samples.

Kern Fan Monitoring Committee
Kern Water Bank
Recovery Summary and Solids Content

			2011			2012			2013			2014			2015			2016			Year: 2001-2016		
WELL	Total Volume 2001-2010 (AF)	Total Salt/Solid Recovered 2001 - 2010	Volume (AF)	TDS values used (mg/L)	Salt/Solids Recovered (tons)	Volume (AF)	TDS values used (mg/L)	Salt/Solids Recovered (tons)	Volume (AF)	TDS values used (mg/L)	Salt/Solids Recovered (tons)	Volume (AF)	TDS values used (mg/L)	Salt/Solids Recovered (tons)	Volume (AF)	TDS values used (mg/L)	Salt/Solids Recovered (tons)	Volume (AF)	TDS values used (mg/L)	Salt/Solids Recovered (tons)	2001-2016 Total Volume (AF)	2001-2016 Salt/Solids Recovered (tons)	TDS (tons/af)
30S/24E-12H01	971	462	0	390	0	1,020	390	541	2,059	390	1,091	2,096	390	1,111	1,820	370	915	310	370	156	8,276	4,276	0.52
30S/24E-12R01	1,092	594	0	390	0	1,112	390	589	2,126	390	1,127	2,246	390	1,190	2,106	460	1,317	354	460	221	9,036	5,038	0.56
30S/24E-13C01	613	475	0	550	0	356	550	266	986	550	737	1,722	550	1,287	1,580	530	1,138	259	530	187	5,516	4,090	0.74
30S/24E-13H01	1,329	1,246	0	560	0	1,348	560	1,026	2,760	560	2,101	2,780	560	2,116	2,379	550	1,778	380	550	284	10,976	8,551	0.78
30S/24E-24A01	4,389	4,474	0	550	0	467	550	349	959	550	717	913	550	682	768	590	616	362	590	290	7,858	7,129	0.91
30S/25E-01Q01	10,418	4,474	0	290	0	2,107	290	830	3,786	290	1,492	3,405	260	1,203	2,835	260	1,002	506	260	179	23,057	9,181	0.40
30S/25E-03L01	954	389	0	280	0	871	280	331	1,674	280	637	1,723	280	656	892	290	352	277	290	109	6,391	2,474	0.39
30S/25E-03Q01	13,618	5,404	0	360	0	1,653	360	809	2,695	360	1,319	2,340	360	1,145	1,557	310	656	373	310	157	22,236	9,490	0.43
30S/25E-03Q02	11,657	470	0	310	0	1,847	310	778	3,175	310	1,338	2,501	310	1,054	2,000	230	625	332	230	104	21,512	4,368	0.20
30S/25E-03R01	11,123	540	0	280	0	1,693	280	644	2,364	280	900	1,152	280	438	2,325	260	822	474	260	167	19,131	3,511	0.18
30S/25E-04L01	9,199	2,826	0	240	0	1,092	240	356	2,041	240	666	1,393	240	454	274	260	97	0	260	0	13,999	4,399	0.31
30S/25E-05K01	10,313	2,943	0	200	0	1,020	200	277	2,250	200	612	2,214	200	602	1,952	220	584	278	220	83	18,027	5,101	0.28
30S/25E-06K01	15,005	2,814	0	130	0	1,386	130	245	2,979	130	526	3,220	130	569	2,664	170	615	437	170	101	25,691	4,871	0.19
30S/25E-07G01	18,990	5,884	0	190	0	1,775	190	458	3,952	190	1,020	5,244	190	1,354	5,090	260	1,799	882	260	312	35,933	10,828	0.30
30S/25E-07P01	7,667	3,355	0	420	0	904	420	516	1,350	420	771	1,275	420	728	620	320	270	170	320	74	11,986	5,713	0.48
30S/25E-07R01	8,375	3,164	0	340	0	1,092	340	505	1,780	340	823	981	340	453	1,136	320	494	393	320	171	13,757	5,609	0.41
30S/25E-08F01	11,441	3,110	0	150	0	1,056	150	215	2,331	150	475	2,592	150	528	1,936	190	500	284	190	73	19,640	4,902	0.25
30S/25E-08J01/02	7,803	3,075	0	250	0	1,286	250	437	3,018	250	1,025	3,381	260	1,195	3,320	260	1,173	567	260	200	19,375	7,106	0.37
30S/25E-08P01	7,410	3,162	0	320	0	787	320	342	1,514	320	658	1,545	320	672	2,506	320	1,090	404	320	176	14,166	6,101	0.43
30S/25E-09A01	9,456	3,187	0	310	0	643	310	271	2,030	310	855	2,185	310	921	2,857	270	1,048	34	270	12	17,205	6,295	0.37
30S/25E-09J01	3,663	1,294	0	300	0	719	300	293	1,069	300	436	1,198	300	488	469	230	147	190	230	59	7,308	2,718	0.37
30S/25E-09L01	8,517	3,056	0		0	0		0	0		0	0		0	0		0	0		0	8,517	3,056	0.36
30S/25E-09L02	-	-	0	360	0	0	360	0	0	360	0	1,776	250	603	1,272	250	432	216	250	73	3,264	1,109	0.34
30S/25E-10K01	11,770	4,255	0	330	0	1,114	330	500	2,585	330	1,159	1,752	220	524	907	220	271	306	220	91	18,434	6,801	0.37
30S/25E-11A01	9,459	2,365	0	250	0	1,196	250	406	2,024	250	688	1,526	250	518	1,064	250	362	72	250	24	15,341	4,364	0.28
30S/25E-11C01	1,179	850	0		0	0		0	0		0	0		0	0		0	0		0	1,179	850	0.72
30S/25E-11C02	6,984	2,867	0	570	0	2,266	570	1,755	3,385	570	2,622	2,591	570	2,007	1,752	310	738	7	310	3	16,985	9,992	0.59
30S/25E-11E01	10,093	3,018	0	320	0	1,353	320	588	2,031	320	883	1,623	320	706	1,180	200	321	214	200	58	16,494	5,574	0.34
30S/25E-11L01	5,625	2,523	0	0	0	1,393	0	0	1,934	0	0	0	0	0	0	0	0	0		0	8,952	2,523	0.28
30S/25E-11N01	6,413	2,248	0	270	0	639	270	234	608	270	223	1,216	340	562	970	340	448	163	340	75	10,009	3,792	0.38
30S/25E-11Q01	13,397	3,860	0	290	0	1,566	290	617	2,290	290	903	3,163	250	1,075	2,799	250	951	496	250	169	23,711	7,574	0.32
30S/25E-11R01	-	-	0		0	0		0	0		0	0		0	0		0	0		0	0	0	0.00
30S/25E-12C01	6,709	4,450	0	400	0	939	400	510	1,733	400	942	1,607	400	874	939	400	510	153	400	83	12,080	7,370	0.61
30S/25E-13F01	4,679	1,183	0	220	0	989	220	296	1,838	220	550	1,746	230	546	1,591	230	497	277	230	87	11,120	3,158	0.28
30S/25E-13J01	6,740	1,118	0	190	0	790	190	204	647	190	167	1,482	160	322	828	160	180	0	160	0	10,487	1,991	0.19
30S/25E-13L01	5,428	1,416	0	200	0	934	200	254	1,753	200	476	1,487	200	404	1,273	230	398	209	230	65	11,084	3,014	0.27
30S/25E-14E01	16,501	6,055	0	290	0	1,882	290	742	3,175	290	1,251	1,580	290	623	578	250	196	198	250	67	23,914	8,935	0.37
30S/25E-14J01	14,605	5,042	0	310	0	1,455	310	613	2,471	310	1,041	2,148	310	905	1,830	270	672	310	270	114	22,819	8,386	0.37
30S/25E-14K01	9,528	772	0	250	0	720	250	245	1,911	250	649	1,785	260	631	1,620	260	572	0	260	0	15,564	2,869	0.18
30S/25E-14N01	7,995	1,782	0	270	0	710	270	261	458	270	168	793	270	291	706	240	230	69	240	23	10,731	2,754	0.26
30S/25E-14R01	9,776	5,846	0	230	0	1,209	230	378	1,989	230	622	1,415	230	442	1,345	250	457	345	250	117	16,079	7,862	0.49
30S/25E-15B01	5,878	1,693	0	240	0	485	240	158	712	240	232	1,285	240	419	405	180	99	0	180	0	8,765	2,602	0.30
30S/25E-15C01	6,051	1,974	0	260	0	1,022	260	361	1,717	260	607	1,249	260	441	201	180	49	53	180	13	10,293	3,445	0.33
30S/25E-15L01	-	-	0			0		0	0	240	0	1,740	180	426	946	180	231	0	180	0	2,686	657	0.24
30S/25E-15N01	5,479	2,130	0	220	0	370	220	111	1,327	220	397	1,234	180	302	913	180	223	73	180	18	9,396	3,180	0.34
30S/25E-15Q01	6,767	1,655	0	310	0	765	310	322	1,101	310	464	465	310	196	1,403	310	591	444	310	187	10,945	3,416	0.31
30S/25E-15R01	6,740	1,979	0	280	0	1,037	280	395	1,883	280	717	1,417	280	539	976	210	279	171	210	49	12,224	3,956	0.32
30S/25E-16B01	9,878	3,222	0	280	0	1,355	280	516	2,223	280	846	1,859	160	404	682	160	148	296	160	64	16,293	5,201	0.32
30S/25E-16D01	9,534	2,643	0	280	0	868	280	330	1,498	280	570	793	280	302	3,145	130	556	515	130	91	16,353	4,492	0.27
30S/25E-16F01	10,327	3,537	0	240	0	963	240	314	1,977	240	645	1,433	240	467	386	230	121	415	230	130	15,501	5,214	0.34
30S/25E-16J01	7,121	2,303	0	300	0	883	300	360	1,560	300	636	944	210	269	748	210	213	188	210	54	11,444	3,836	0.34
30S/25E-16M01	14,435	4,159	0	250	0	1,578	250	536	2,506	250	851	1,847	250	628	1,201	240	392	161	240	53	21,728	6,618	0.30
30S/25E-16P01	13,197	4,448	0	300	0	1,707	300	696	3,155	300	1,286	2,829	300	1,153	1,043	270	383	689	270	253	22,620	8,219	0.36
30S/25E-16R01	1,661	406	0		0	0		0	0		0	0		0	0		0	0		0	1,661	406	0.24
30S/25E-17F01	11,777	4,226	0	290	0	1,322	290	521	2,552	290	1,006	2,705	290	1,066	2,101	260	742	399	260	141	20,856	7,702	0.37
30S/25E-17H01	25,592	8,695	0	260	0	2,708	260	957	5,006	260	1,769	4,499	260	1,590	2,801	200	761	0	200	0	40,606	13,772	0.34
30S/25E-17J01	26,971	7,918	0	280	0	1,128	280	429	5,417	280	2,061	5,771	280	2,196	5,359	250	1,821	896	250	304	45,542	14,730	0.32
30S/25E-17M01	20,499	10,253	0	350	0	2,501	350	1,190	4,241	350	2,017	3,589	350	1,707	2,043	440	1,222	360	440	215	33,233	16,604	0.50
30S/25E-17P01	22,748	13,170	0	290	0	2,371	290	934	4,605	290	1,815	3,733	290	1,471	1,885	420	1,076	255	420	146	35,597	18,612	0.52
30S/25E-18A01	5,593	2,235	0	294	0	8	294	3	0	294	0	0	294	0	0	294	0	0	294	0	5,601	2,238	0.40
30S/25E-18A02	-	-	0	300	0	0	300	0	0	300	0	3,614	300	1,474	3,256	300	1,328	522	300	213	7,392	3,014	0.41
30S/25E-18C01	9,812	4,747	0	400	0	1,084	400	589	1,792	400	974	1,180	400	641	1,827	400	993	246	400	134	15,941	8,079	0.51
30S/25E-18K01	21,338	19,198	0	490	0	2,480	490	1,652	4,451	490	2,964	4,207	490	2,802	4,615	530	3,324	870	530	627	37,961	30,566	0.81
30S/25E-18P01	12,357	10,648	0	550	0	1,615	550	1,207	2,883	550	2,155	3,052	550	2,281	2,258	460	1,412	289	460	181	22,454	17,884	0.80
30S/25E-18R01	12,445	7,645	0	390	0	1,630	390	864	3,194	390	1,693	3,310	390	1,754	2,767	480	1,805	440	480	287	23,786	14,048	0.59
30S/25E-20A01	18,485	5,879	0	260	0	1,997	260	706	2,824	260	998	4,501	260	1,590	4,063	230	1,270	739	230	231	32,609	10,674	0.33
30S/25E-20C01	15,872	12,166	0	280	0	1,925	280	733	3,320	280	1,263	3,644	280	1,387	2,168	510	1,503	0	510	0	26,929	17,052	0.63
30S/25E-20L01	17,633	11,455	0	450	0	1,986	450	1,215	3,321	450	2,031	3,136	450	1,918	1,773	470	1,133	846	470	540	28,695	18,292	0.64
30S/25E-21A02	6,217	2,704	0	320	0	973	320	423	1,115	320	485	517	320	225	1,906	280	725	335	280	127	11,063	4,689	0.42
30S/25E-21D01	14,100	5,366	0	260	0	1,661	260	587	1,656	260	585	1,458	260	515	2,715	260	959	79	260	28	21,669	8,040	0.37
30S/25E-21G01	9,105	3,465	0	320	0	1,742	320	758	1,597	320	695	3,446	320	1,499	2,816	260	995	0	260	0	18,706	7,411	0.40
30S/25E-23H01	7,947	6,480	0	140	0	221	140	42	1,695	140	323	1,685	700	1,603	1,002	700	953	0	700	0	12,550	9,401	0.75
30S/25E-24K01	6,961	4,314	0	220	0	869	220	260	1,332	220	398	1,421	220	425	897	160	195	180		0	11,660	5,592	0.48
30S/25E-36D01	3,295	1,299	0	330	0	0	330	0	0	330	0	0	330	0	0	330	0	0	330	0	3,295	1,299	0.39
30S/26E-06N01	14,916	4,622	0	310	0	1,891	310	797	3,588	310	1,512	2,460	310	1,036	1,852	280	705	489	280	186	25,196	8,858	0.35
30S/26E-06P01	13,484	4,581	0	270	0	2,430	270	892	4,030	270	1,479	1,775	270	651	2,271	270	833	826	270	303	24,816	8,740	0.35
30S/26E-07C01	8,293	2,006	0	290	0	1,577	290	622	2,056	290	810	3,064	290	1,208	2,767	200	752	405	200	110	18,162	5,508	0.30
30S/26E-07J01	11,337	3,297	0	220	0	1,695	220	507	3,498	220	1,046	2,546	220	761	1,713	180	419	519	180	127	21,308	6,157	0.29
30S/26E-07L01	11,424	3,323	0	240	0	2,217	240	723	3,543	240	1,156	1,813	240	591	3,464	200	942	622	200	169	23,083	6,903	0.30
30S/26E-07N01	6,710	1,970	0	250	0	1,229	250	418	1,854	250	630	1,587	250	539	2,070	230	647	125	230	39	13,575	4,243	0.31
30S/26E-07Q01	11,194	3,256	0	210	0	1,339	210	382	3,969	210	1,133	3,560	190	919	2,612	190	674	433	190	112	23,107	6,476	0.28
30S/26E-07R01	9,843	3,237	0	200	0	2,045	200	556	3,609	200	981	3,500	180	856	2,268	180	555	495	180	121	21,760	6,306	0.29
30S/26E-08M01	12,444	2,706	0	240	0	1,768	240	577	4,042	240	1,318	3,607	150	735	2,946	150	601	506	150	103	25,313	6,040	0.24
30S/26E-17Q01	9,584	2,918	0	230	0	1,218	230	381	1,349	230	422	1,424	230	445	2,458	170	568	469	170	108	16,502	4,841	0.29
30S/26E-18B01	15,322	3,748	0	200	0	2,524	200	686	4,444	200	1,208	2,756	200	749	1,517	200	412	766	200	208	27,329	7,012	0.26
30S/26E-18D01	10,638	3,267	0	230	0	1,621	230	507	3,207	230	1,002	2,993	230	936	2,197	190	567	370	190	96	21,026	6,375	0.30
30S/26R-19G01	10,260	2,984	0	220	0	1,137	220	340	1,578	220	472	1,423	220	425	989	220	296	136	220	41	15,523	4,558	0.29
30S/26E-19M01	13,460	3,512	0	170	0	1,213	170	280	1,125	170	260	3,059	170	707	2,810	180	687	162	180	40	21,829	5,486	0.25
30S/26E-20C01	12,458	3,725	0	190	0	1,561	190	403	2,515	190	649	2,707	190	699	1,695	190	438	229	190	59	21,165	5,973	0.28
30S/26E-20L01	16,421	3,928	0	160	0	1,426	160	310	2,457	160	534	2,977	160	647	2,302	170	532	435	170	101	26,018	6,052	0.23
30S/26E-20N02	13,411	2,916	0	150	0	1,296	150	264	1,917	150	391	2,085	150	425	3,113	180	762	445	180	109	22,267	4,867	0.22
TOTAL	**887,898**	**334,056**	0		0	110,830		43,495	197,171		77,156	189,695		73,903	159,085		60,165	27,194		10,283	1,571,873	599,057	0.38
											Volume (AF) from 2011-2016			683,975							TDS (tons/af) of recharged water		0.21
																					ratio of salt removed/salt loaded		1.8

Appendix Q



Appendix 7-2

DWR Kern Water Bank Model Results Technical Report

Prepared for:

State of California
California Natural Resources Agency
Department of Water Resources

Prepared by:

AECOM
2020 L Street, Suite 400
Sacramento, CA 95814

With Technical Assistance from:

RMC Water and Environment
Fugro Consultants
The Sandberg Group

April 2016

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April 2016

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ACRONYMS AND OTHER ABBREVIATIONS

AF	acre-feet
AFO	Analysis of Future Operations
AFY	acre-feet per year
Amec	Amec Foster Wheeler
APO	Analysis of Past Operations
BC	Buildout Conditions
bgs	below ground surface
C2VSim	California Central Valley Groundwater–Surface Water Simulation
Cal Water	California Water Service Company
CASGEM	California Statewide Groundwater Elevation Monitoring
CHD	MODFLOW time-variant specified-head
COB	City of Bakersfield
Court	Sacramento County Superior Court
CVHM	Central Valley Hydrologic Model
Department	California Department of Water Resources
EC	Existing Conditions
EIR	environmental impact report
GHB	general head boundary
GIS	geographic information system
ID4	Improvement District No. 4
KCWA	Kern County Water Agency
KFMC	Kern Fan Monitoring Committee
KWB	Kern Water Bank
KWBA	Kern Water Bank Authority
Kx/Kz ratio	horizontal to vertical conductivity ratio
LOD	level of development
LsCuS	Large-Scale Coarsening-Upward Sequences
MAF	million acre-feet
Monterey Plus	Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and Associated Actions as Part of a Settlement Agreement
Monterey Plus EIR	*Environmental Impact Report for the Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and Associated Actions as Part of a Settlement Agreement*
Monterey Plus Revised EIR or REIR	*Revised Environmental Impact Report for the Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and Associated Actions as Part of a Settlement Agreement*
NRMS	normalized root mean squared
REIR	*Revised Environmental Impact Report for the Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and Associated Actions as Part of a Settlement Agreement*
Rosedale or RRBWSD	Rosedale–Rio Bravo Water Storage District
SWP	State Water Project
TAF	thousand acre-feet

USGS	U.S. Geological Survey
UWMP	urban water management plan
WD	Water District
WEL	MODFLOW Well
WSD	Water Storage District

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1. INTRODUCTION

1.1 PURPOSE AND SCOPE OF THIS TECHNICAL REPORT

To evaluate the potential groundwater impacts of the Kern Water Bank (KWB) operations, the California Department of Water Resources (Department or DWR) developed a groundwater model, called the DWR Kern Water Bank Model (DWR KWB Model), in 2015.

Quantitative assessment of the impacts of KWB activities on groundwater resources in the Kern County subbasin No. 5-22.14 (as identified in DWR Bulletin 118) was conducted using the DWR KWB Model. The purpose of this technical report is to:

- describe the three modeling scenarios used to evaluate the impacts of KWB activities, and
- document the results of the modeling analysis for each scenario.

This technical report is organized into the following four major chapters:

- Chapter 1 presents the purpose and scope of this technical report,
- Chapter 2 describes the modeling scenarios and assumptions for the Revised Environmental Impact Report (REIR) analysis,
- Chapter 3 describes the results of the modeling analysis, and
- Chapter 4 lists the references cited in this technical report.

2. MODELING SCENARIOS AND ASSUMPTIONS

Three primary modeling scenarios were constructed to evaluate the effects of KWB activities under different levels of development (historical, existing conditions, and buildout conditions) within the model domain. The primary differences among the three scenarios are changes in agricultural and urban pumping attributable to different land uses and additional groundwater-related projects within the model domain. Each scenario is introduced below and described in detail in the following subsections:

1. The Analysis of Past Operations (APO) scenario examines historical groundwater conditions during the period of KWB operations (i.e., from 1995 through 2014).

2. The Analysis of Future Operations (AFO) under Existing Conditions (EC) scenario, referred to here as "AFO-EC," examines a similar duration as the APO scenario, but fixes land use at 2015 conditions and uses groundwater banking facilities constructed as of 2014.

3. The AFO under Buildout Conditions (BC) scenario, referred to here as "AFO-BC," examines groundwater conditions under 2030 land use conditions, groundwater banking facilities constructed as of 2014, and selected groundwater banking facilities likely to be operational by 2030.

Each scenario was run "With KWB Operations" and "Without KWB Operations," for a total of six model runs. The model simulation period for the APO scenario is a 20-year past period (1995-2014) using the historical hydrology from 1995 through 2015. 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).

Additional descriptions of these scenarios are provided below.

2.1 ANALYSIS OF PAST OPERATIONS

The APO "With KWB Operations" scenario is equivalent to the DWR KWB Model historical calibration described in Technical Report entitled "Development of DWR Kern Water Bank Model: Model Review, Selection, and Enhancements" (DWR, 2016). The DWR KWB Model simulates the period from 1988 through 2014, but the focus of the APO scenario is the 20-year period of KWB activities, from 1995 through 2014. This scenario includes historical urban and agricultural land uses, operation of recharge and recovery facilities, and hydrologic conditions (Table 2.1-1).

2.2 SCENARIOS WITHOUT KERN WATER BANK OPERATIONS

KWB recharge and recovery operations were removed from the model as if the land was fallowed for all "Without KWB Operations" scenarios (Table 2.1-1). Historical recharge of floodwater on KWB Lands was also removed from the model for "Without KWB Operations" scenarios. Lack of recharge and recovery at KWB facilities under "Without KWB Operations" scenarios was not offset by increased recharge and recovery at other groundwater banking facilities. These "Without KWB Operations" assumptions are not discussed separately in the subsections below because they are shared for the APO, AFO-EC, and AFO-BC scenarios.

TABLE 2.1-1

SUMMARY OF KERN WATER BANK REVISED ENVIRONMENTAL IMPACT REPORT 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

TABLE 2.1-1

SUMMARY OF KERN WATER BANK REVISED ENVIRONMENTAL IMPACT REPORT 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
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 Operations"	Simulated December 2014 conditions generated by the APO-run "Without KWB Operations"	Simulated December 2014 conditions generated by the APO-run "With KWB Operations"	Simulated December 2014 conditions generated by the APO-run "Without 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.	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.	Groundwater operations related projects.

Notes: AF = acre-feet; APO = Analysis of Past Operations; DWR = Department of Water Resources; KWB = Kern Water Bank; KWBA = Kern Water Bank Authority; N/A = not applicable

2.3 ANALYSIS OF FUTURE OPERATIONS

The AFO scenarios evaluate potential future operations of recharge and recovery facilities within the model domain. APO scenarios include the historical timing of recharge and recovery facilities as they are brought into operation; AFO scenarios assume that all infrastructure for recharge and recovery is in place at the start of the simulation period. The following subsections discuss elements of the AFO that are common to both the EC and BC scenarios and those model elements that are unique to EC or BC scenarios.

2.3.1 COMMON ELEMENTS BETWEEN SCENARIOS: ANALYSES OF FUTURE OPERATIONS UNDER EXISTING AND BUILDOUT CONDITIONS

This subsection describes model components that changed for both the AFO-EC and AFO-BC scenarios relative to the APO scenario.

2.3.1.1 Simulation Period

Both the AFO-EC and AFO-BC scenarios consist of a 21-year simulation period. Year 1 hydrology for AFO scenarios is similar to 2015, while Years 2–21 of the AFO scenarios use similar hydrology as 1995.

The decision to approximate 2015 conditions for Year 1 of AFO scenarios was made because of evidence (e.g., from discussions with representatives from groundwater banking projects) that significant groundwater banking recovery was occurring in 2015 because of drought conditions. Simply repeating the 1995–2014 historical hydrology for AFO runs would ignore that evidence and potential impacts that could result from starting the future analysis in a recovery cycle (as was the case for 2015). Additional details regarding the approximation of 2015 conditions in the model (e.g., locations and quantity of groundwater banking recovery) are provided below.

2.3.1.2 Initial Conditions

Initial heads for the AFO “With KWB Operations” and AFO “Without KWB Operations” scenarios were taken from the final time step of the APO “With KWB Operations” and APO “Without KWB Operations” simulations, respectively. This assumption, therefore, allows comparisons of the differences between continued operations of the KWB into the future versus a scenario in which the KWB never operated. Any impacts (positive or negative) that accrued over the 1995–2014 operation of the KWB are carried over to the start of the AFO scenarios.

2.3.1.3 Boundary Conditions

AFO general head boundary (GHB) conditions are assumed to follow similar patterns of fluctuations as those that occurred under historical hydrology. Transient heads for AFO GHBs were developed as follows (see Figure 2.3-1):

- The starting elevation for Year 1 of the simulation is the same as the ending elevation for the APO simulation (i.e., from the end of 2014).
- Transient head fluctuations (i.e., the monthly change relative to starting elevation) in Year 1 are copied from the GHB heads for the period corresponding to calendar year 2014 in the Kern Water Bank Authority (KWBA) historical model.
- Transient head fluctuations for Years 2–21 are copied from the GHB heads in the KWBA historical model and pasted to the levels at the end of Year 1.

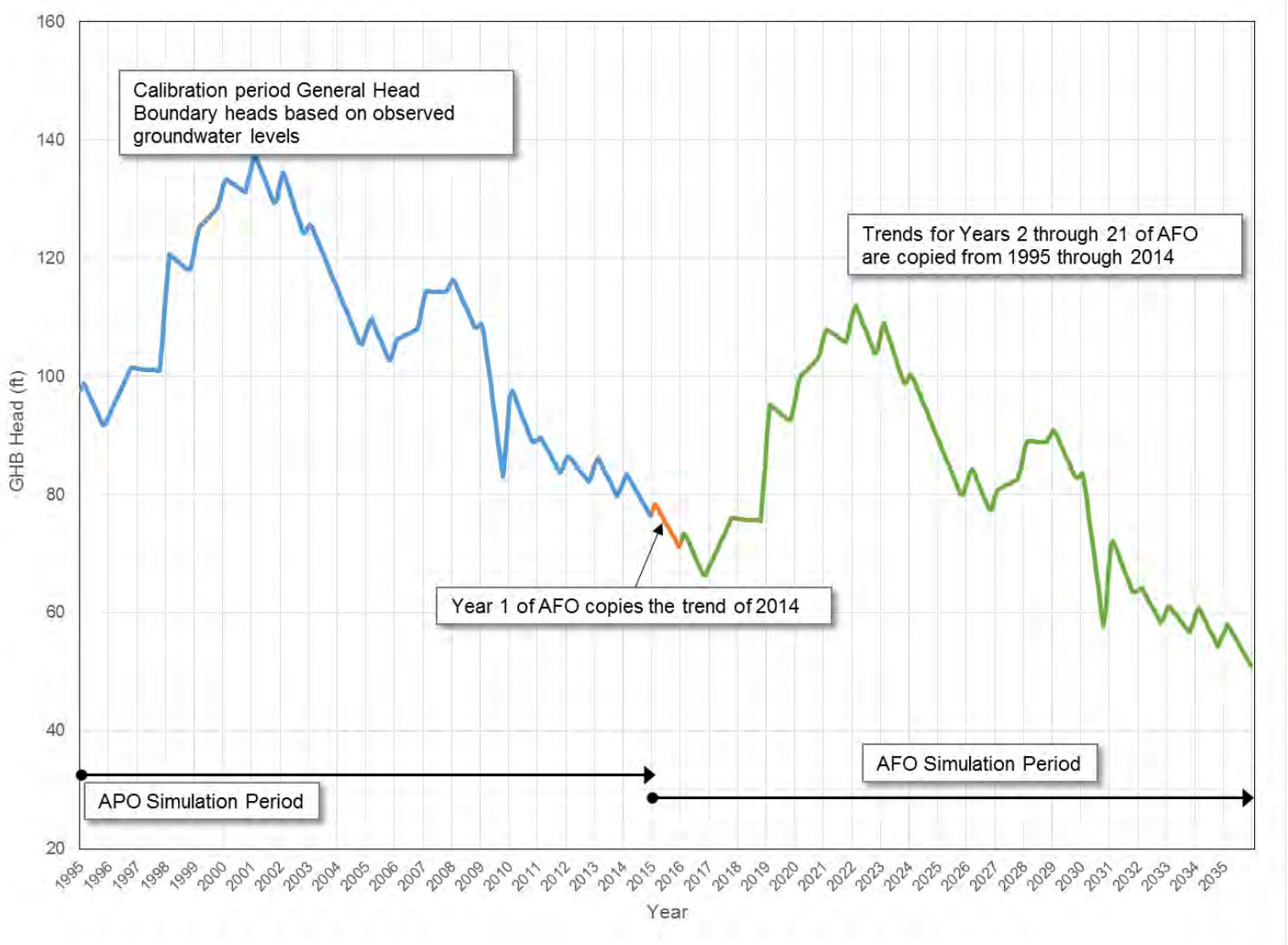


FIGURE 2.3-1. Example of Heads for General Head Boundary Condition Cells in the Analysis of Past Operations and Analysis of Future Operations Scenarios, 1995-2035

These transient GHB heads were used for both the AFO-EC and AFO-BC scenarios. GHB conductance was not modified relative to the DWR KWB Model.

2.3.2 ANALYSIS OF FUTURE OPERATIONS UNDER EXISTING CONDITIONS

For this study, "existing conditions" refers to a 2015 level of development (LOD). The AFO-EC scenarios assume that the footprint of groundwater banking facilities, agricultural lands, and urban lands is held constant at the 2015 LOD for the entire simulation. Recharge and recovery facilities that were constructed as of the end of 2014 are available to operate throughout the AFO-EC simulation period. Historical hydrology from 1995 through 2014 is incorporated into the AFO-EC scenario via the timing of groundwater banking recharge and recovery operations. Specific components of the AFO-EC are noted in Table 2.1-1 and described below.

2.3.2.1 Existing Conditions Groundwater Banking Operations

Since the start of the APO model simulation in 1988, groundwater banking projects within the model domain have expanded facilities and increased capacity for both recharge and recovery. The AFO-EC "With KWB Operations" scenario includes all existing groundwater banking recharge ponds and recovery wells active by the end of 2014 and assumes that no changes to infrastructure occur during the 21-year simulation period. Existing recharge and recovery capacity at the end of 2014 is held constant for the entire AFO-EC simulation period. The AFO-EC "Without KWB Operations" scenario is the same, except that recharge and recovery for the KWB is set to zero for the entire simulation period.

Kern Water Bank Recharge Operations

Within the KWB, recharge practices and facilities have changed throughout KWB's lifetime. Since KWB operations began in 1995, the KWB has adjusted recharge practices to recharge more water in the eastern portion of KWB Lands. Additionally, new ponds have come into existence. AFO-EC KWB recharge (Figure 2.3-2) is based on historical recharge rates from 1995 through 2014, with modifications to account for the capacity for additional recharge volume and the distribution of recharged water, as described below.

<u>Additional Recharge Volume</u>

Historically, the KWB has maximized its recharge capacity during flood years. Construction of additional recharge ponds has increased KWB's recharge capacity beyond what was available historically. Additional capacity for each month of the AFO-EC was estimated by assigning historically averaged, pond-specific recharge rates to ponds that were inactive or did not exist during past recharge cycles. The volumes that could have filled the additional ponds are considered the additional capacity for recharge.

Flood years were identified as those where April–July Kern River flows exceeded 170 percent of the historical average flow. These years were identified as 1995, 1998, 2005, 2006, and 2011. During years of high flow, Kern River water that is not recharged to the KWB or other projects is routed to the Kern River–California Aqueduct Intertie and taken out of the region through the California Aqueduct. With the addition of new ponds, the KWB has increased capacity to recharge a portion of this excess floodwater that otherwise would leave the region. Additional Kern River water recharged to the KWB is limited based on the availability of excess Kern River water and the capacity for recharge within the bank. Historical data showed that excess Kern River water was available for recharge in 1995, 1998, and 2006. In 1995, 42,000 acre-feet (AF) of Kern River water flooded farmland, while in 1998 and 2006, 132,266 and 70,624 AF of Kern River water reached the intertie, respectively. Based on capacity and availability, an additional 39,480 AF, 55,785 AF, and 17,459 AF of water could be recharged in the KWB in the 1995, 1998, and 2006 hydrologic years, respectively.

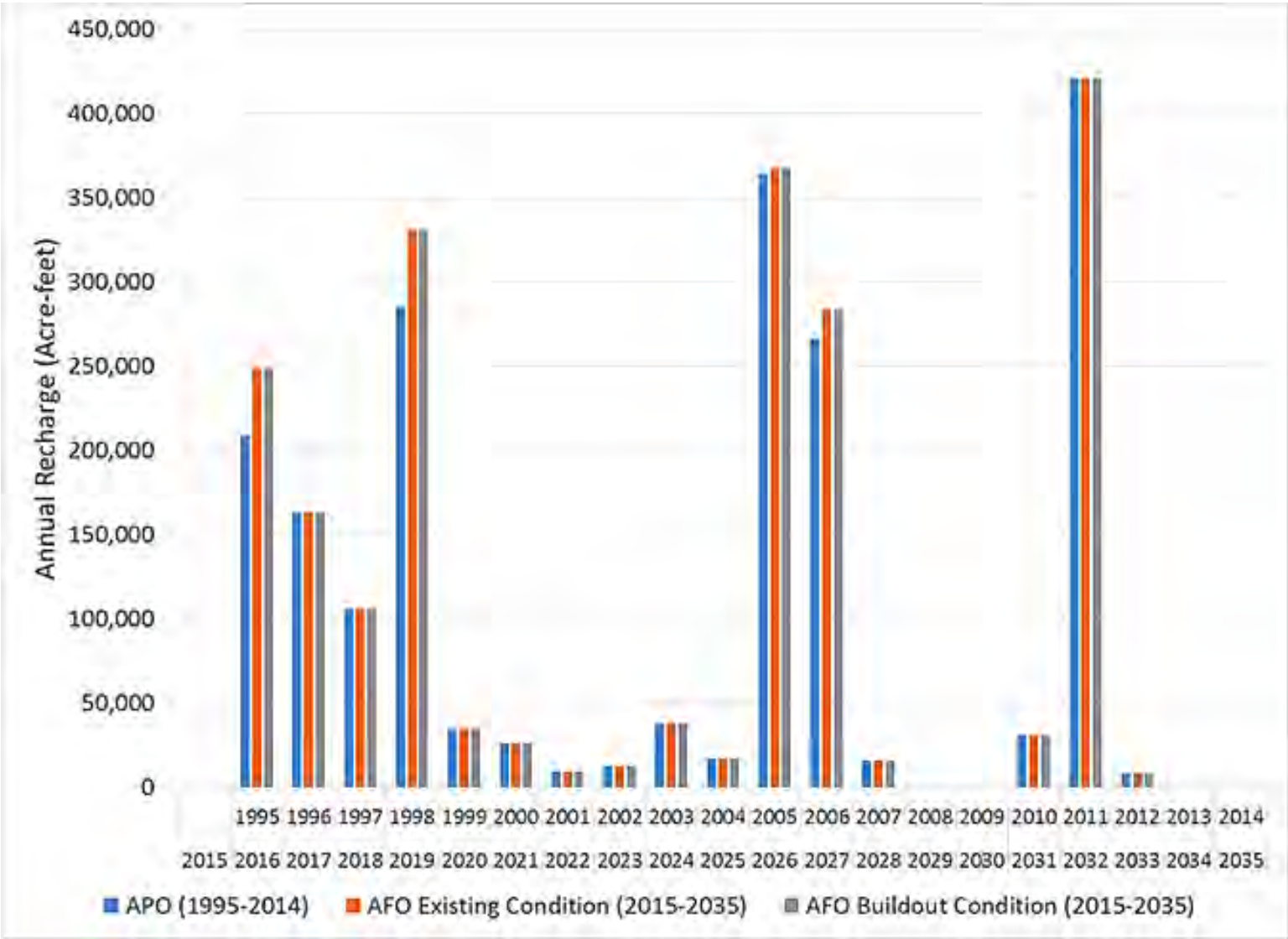


FIGURE 2.3-2. Kern Water Bank Recharge Volumes for the Analysis of Past Operations and Analysis of Future Operations Scenarios, 1995-2035

To avoid surface ponding from four consecutive years of high recharge, the additional water allocated for KWB in 2019 (1998 hydrology) was reduced by 10,000 AF from 55,785 AF to 45,785 AF.

In addition to Kern River water, Article 21 State Water Project (SWP) water is available in some months. For the AFO, the KWB first recharges available Kern River water and then takes Article 21 water if additional recharge capacity is available. Under these assumptions, an additional 3,230 AF of Article 21 water is recharged to the KWB in the AFO year corresponding to 2005 hydrology.

Recharge Distribution

Once the increased recharge volumes from floodwater and Article 21 water are determined (as described above), AFO-EC recharge is distributed to ponds according to 2011 patterns, the only historical recharge year when current recharge practices were employed. Current KWB recharge practices specify that when there is insufficient water to fill all ponds, water is recharged preferentially to the C, M1–M8, N, S, E, and R ponds (referred to hereafter as the preferential ponds; see Figure 2.3-3). In 2011, 301,032 AF of water was recharged to the preferential ponds while 132,403 AF went to remaining ponds. In AFO-EC years when total recharge is less than 301,032 AF, water is distributed only to the preferential ponds, and each pond receives the same relative percentage as in 2011. In years when total recharge exceeds 301,032 AF, preferential ponds receive the same volume as in 2011 and the remaining water is distributed across remaining ponds with the same percentages as those ponds received in 2011. During years of very high recharge (1998, 2005, 2006 hydrology), the recharge distribution is iteratively adjusted to avoid surface ponding.

After annual recharge volumes are calculated for each pond in the AFO-EC, volumes are distributed monthly based on the historical availability of water. The fraction of total annual water delivered to the KWB each month is calculated based on historical deliveries plus additional floodwater and Article 21 water. The new annual recharge volumes are then scaled accordingly, preserving the historical timing of deliveries to the KWB.

Kern Water Bank Recovery Operations

The AFO-EC KWB recovery operations repeated historical pumping volumes (Figure 2.3-4). KWB participants do not anticipate increasing requests for water from the KWB in the future. The operational philosophy is to save water in the KWB for the worst drought years.

Non–Kern Water Bank Groundwater Banking Operations

For non-KWB groundwater banking projects, historical recharge and recovery volumes are repeated for the corresponding hydrologic year of the AFO-EC model simulation. The historical recharge volumes for each project are distributed over the ponds existing in 2014. Between 1995 and 2014, non-KWB groundwater banking projects expanded existing ponds but did not add new ponds, meaning that no changes had to be made regarding the location of recharged water.

2.3.2.2 Existing Conditions Land Use and Derived Data

Land use drives the calculation of pumping in agricultural areas and return flows in agricultural and urban areas. Following are discussions of AFO-EC urban and agricultural land use distributions and their derived datasets.

Urban Area and Calculated Return Flows

Two types of urban areas were defined for the DWR KWB Model: urban areas on sewer systems (referred to hereafter simply as “urban” areas) and urban areas on septic systems (referred to hereafter as “urban on septic” areas). Urban areas define a single recharge zone in the model that accounts for time-varying return flows (i.e., recharge to groundwater) in areas with sewer systems. Twelve separate urban on septic recharge zones were defined in the DWR KWB Model to account for return flows in areas without sewer systems. The 12 different zones are used to account for variations in return flows for areas with different population density.

An urban area coverage corresponding to the 2015 LOD was developed (Figure 2.3-5), using the DWR KWB Model urban area at the end of the historical calibration period (i.e., 2014) as a starting point. Additional urban area was added based on an evaluation of aerial imagery to account for areas where urbanization (e.g., construction of new homes) had occurred but that were not included in the DWR KWB Model. Relative to the 2014 urban area in the DWR KWB Model, an additional 9,658 acres of urban area was added to the AFO-EC urban footprint. Nearly all of the updated urban footprint replaced areas of native vegetation in the DWR KWB Model. Therefore, the expanded urban area did not result in a significant decrease in calculated agricultural pumping.

The volume of urban return flow in the KWBA historical model was taken directly from the Rosedale-Rio Bravo Water Storage District (Rosedale or RRBWSD) Model. The Rosedale Model’s urban return flow is based on the assumption that 12.5 percent of urban water deliveries end up as groundwater recharge, primarily from inefficient irrigation of outdoor landscaping. To maintain a consistent methodology, urban water management plan (UWMP) projections of 2015 total water demand in the City of Bakersfield (COB) water service area and the California Water Service Company (Cal Water) service area were compiled (Table 2.3-1), and 12.5 percent of those projections was used as the total annual urban return flow for each year of the AFO-EC simulation. Note that only 60 percent of the Cal Water UWMP projection was used for the return flow calculation, to account for the fact that roughly 40 percent of the Cal Water service area is outside the model domain. Annual urban return flow was apportioned among each monthly stress period based on the same monthly pattern as the 2014 urban return flow in the KWBA historical model. Monthly return flow volume was apportioned among each model cell in the urban recharge zone based on the cell area.

Urban on septic areas corresponding to the 2015 LOD were similarly developed using 2014 urban on septic areas from the DWR KWB Model as a starting point. Additional urban on septic areas were added based on an analysis of aerial imagery (i.e., by finding developed areas outside the urban footprint and not included in the KWBA urban on septic zones). The distinction between areas on sewer versus septic systems was made based on published information on city limit boundaries and sewer pipelines available from the COB GIS Web portal. Figure 2.3-5 shows urban on septic areas used for AFO-EC simulations.

Urban on septic recharge rates in the DWR KWB Model were taken directly from the Rodale Model. The Rosedale Model used different recharge volumes for each zone that appear to be based on housing density within the zone. Recharge volumes for the expanded AFO-EC urban on septic areas were determined based on proximity to the historical urban on septic zones and visual inspection of the new areas in aerial imagery (e.g., Google Earth) to determine the approximate housing density.

Agricultural Area and Calculated Agricultural Pumping and Return Flow

Agricultural areas (i.e., generally those areas outside of the urban and urban on septic areas, and outside of the groundwater banking areas) were held constant at their 2014 conditions from the DWR KWB Model for the entire AFO-EC simulation period (i.e., the extent and types of crops did not change).

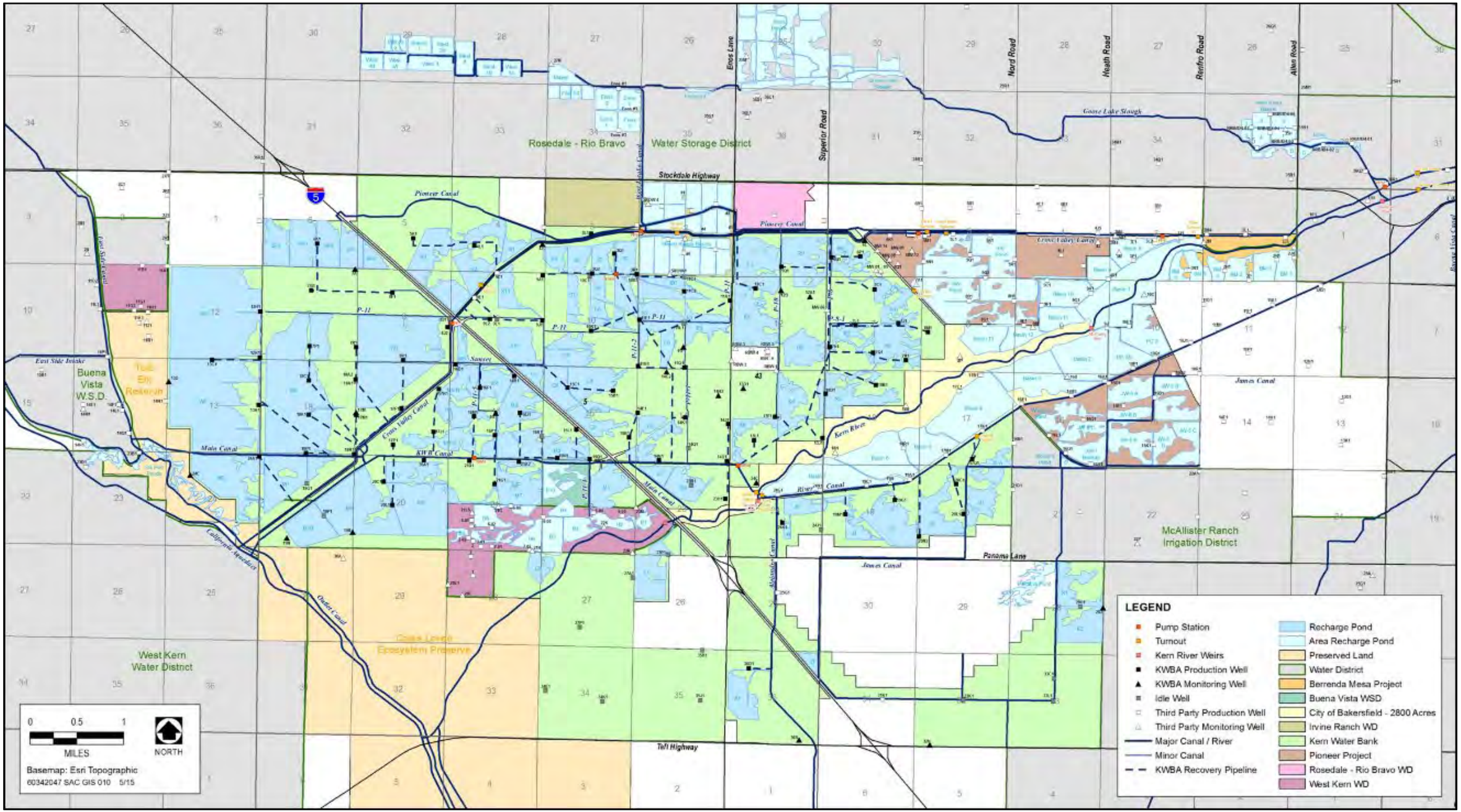


FIGURE 2.3-3. Groundwater Bank Infrastructure in the Kern Water Bank Area

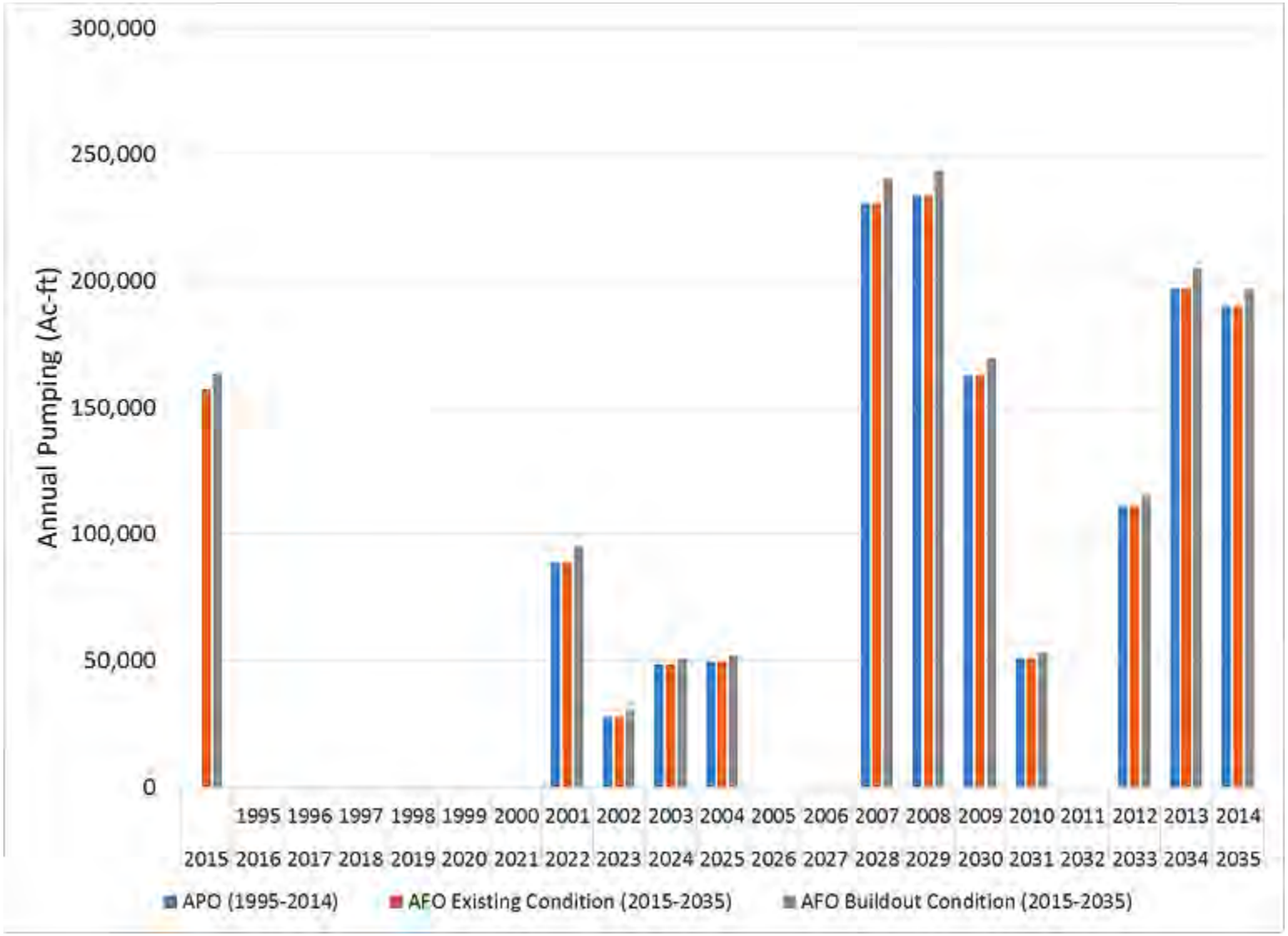


FIGURE 2.3-4. Kern Water Bank Recovery Volumes for the Analysis of Past Operations and Analysis of Future Operations Scenarios, 1995-2035

TABLE 2.3-1 URBAN DEMANDS USED FOR ANALYSIS OF FUTURE OPERATIONS RETURN FLOW CALCULATIONS			
Agency	**Existing Conditions (2015) Urban Water Demand (acre-feet per year)**	**Future Conditions (2030) Total Water Demand (acre-feet per year)**	**Comment**
City of Bakersfield	45,906	52,735	Source: City of Bakersfield 2010 UWMP; Table 10
California Water Service Company	84,029	93,400	Source: 2010 Urban Water Management Plan—Bakersfield District; Table 4.1-1 AFO scenarios use 60 percent of these values because of partial overlap of the Cal Water service area and the DWR KWB Model domain
Notes: AFO = Analysis of Future Operations; Cal Water = California Water Service Company; KWBA = Kern Water Bank Authority; UWMP = Urban Water Management Plan Sources: City of Bakersfield 2010 UWMP, 2010 Urban Water Management Plan—Bakersfield District			

Agricultural pumping in the KWBA historical model was calculated using a preprocessor that considered water demands by crop type and area, as well as the long-term average precipitation. Agricultural return flows (i.e., recharge to groundwater from deep percolation of applied water) were also calculated by the preprocessor, and were based entirely on the volume of groundwater pumping (i.e., they did not consider return flows from surface water deliveries).

For the AFO simulations, agricultural pumping and return flows were calculated using a modified version of the existing preprocessor. The preprocessor was modified to include consideration of historical variations in precipitation when calculating agricultural pumping. Each year of the period from 1995 through 2014 was classified as either critical, dry, below normal, above normal, or wet using the San Joaquin Water Year Type (Table 2.3-2). Historical precipitation, as measured at the Bakersfield Meadows Field Airport for each year within each year type classification, was averaged to develop an annual average precipitation by year type. The appropriate annual average precipitation values were then used to calculate agricultural pumping for the AFO scenarios.

The preprocessor was modified for AFO simulations to consider the total water use (i.e., pumping of groundwater plus surface water delivery) when calculating return flow.

Annual agricultural pumping for the AFO-EC scenario is compared to pumping for the APO scenario in Figure 2.3-6.

Use of Recycled Water from Wastewater Treatment Plant No. 3

There are several wastewater treatment plants in Kern County; however, only COB's Wastewater Treatment Plant No. 3 is located within the DWR KWB Model domain. Recycled water from this plant is used to irrigate nearby soccer fields and the Green Acres Farm, which occupies approximately 4,700 acres 16 miles southwest of Bakersfield and 1 mile northeast of Lake Buena Vista. The Green Acres Farm has been purchased by the City of Los Angeles to ensure a reliable place to manage the city's biosolids produced at wastewater treatment plants. The biosolids are used as a soil conditioner and fertilizer to help promote crop growth. Farm activities produce non-food-chain crops that are sold as feedstock to local dairies. Model files were modified for the AFO scenarios to include irrigation of the soccer fields and the Green Acres Farm by recycled water.

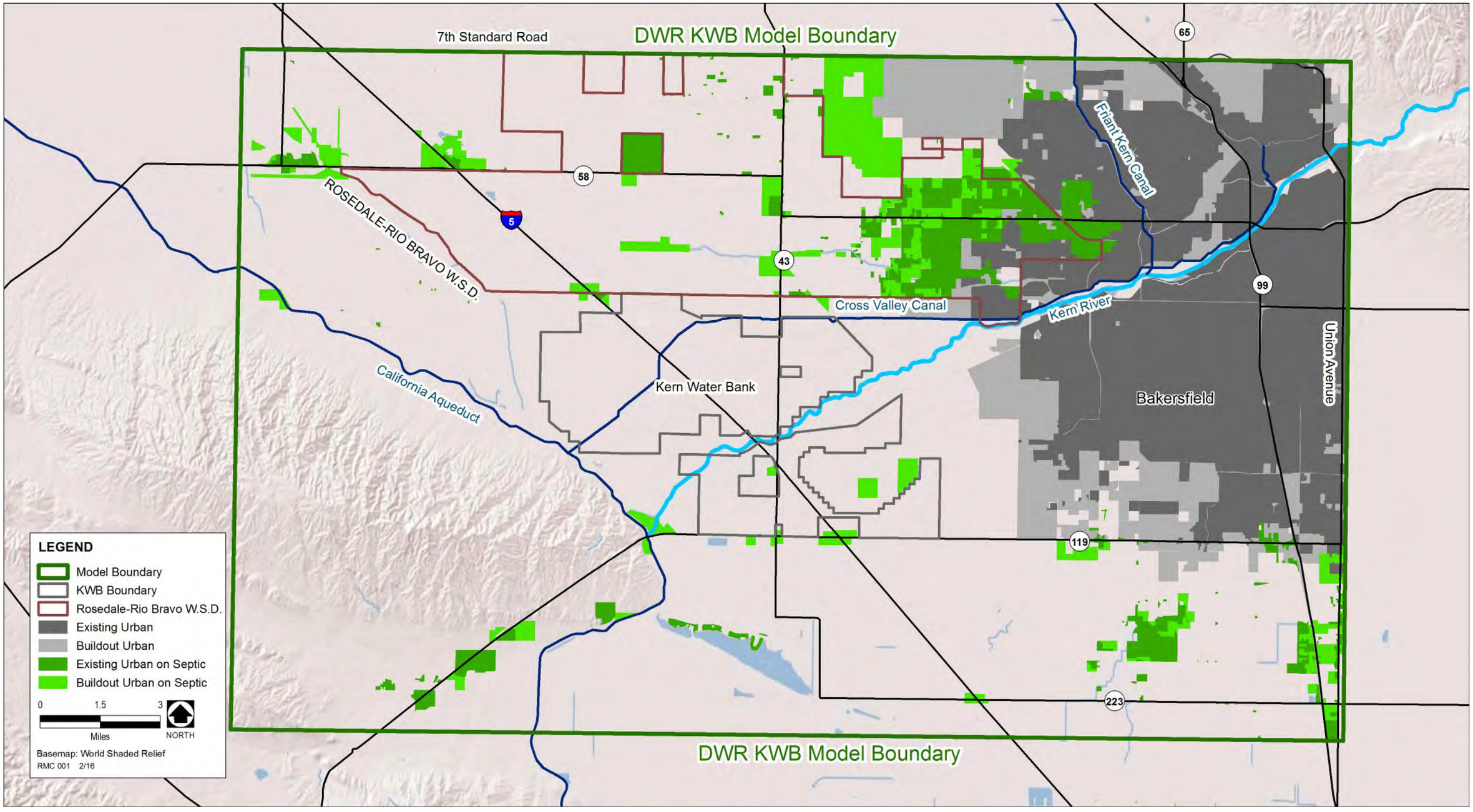


FIGURE 2.3-5. Urban Areas Used for Analysis of Future Operations Scenarios

TABLE 2.3-2 HYDROLOGIC YEAR TYPE AND MEASURED PRECIPITATION, 1995–2014		
Year	**San Joaquin Valley Water Year Type**	**Bakersfield Meadows Field Airport Measured Precipitation (inches)**
1995	Wet	9.84
1996	Wet	8.07
1997	Wet	5.87
1998	Wet	13.33
1999	Above Normal	6.00
2000	Above Normal	4.96
2001	Dry	7.39
2002	Dry	4.29
2003	Below Normal	5.15
2004	Dry	5.57
2005	Wet	8.03
2006	Wet	6.17
2007	Critical	2.98
2008	Critical	3.24
2009	Below Normal	5.12
2010	Above Normal	12.52
2011	Wet	4.39
2012	Dry	4.42
2013	Critical	3.44
2014	Critical	4.03
Sources: CDEC 2015, NOAA 2015		

2.3.2.3 Existing Conditions Urban Pumping

Unlike agricultural pumping, urban pumping in the KWBA historical model is based on reported values from municipal water providers. The initial plan for AFO-EC scenario development was to base urban pumping on 2014 rates in the DWR KWB Model because they would closely represent the 2015 LOD demands. However, during preparation of the AFO scenarios, it was found that the DWR KWB Model omits municipal pumping from large areas within its domain, including the Cal Water service area and portions of the COB water service area. The DWR KWB Model developers used urban pumping locations and rates from the Rosedale Model but did not account for urban pumping outside of the smaller Rosedale Model domain. Use of 2014 urban pumping as represented in the DWR KWB Model for AFO-EC would thus underestimate actual pumping. Therefore, annual AFO-EC urban pumping was developed based on UWMP 2015 projections, as shown in Table 2.3-3.

The AFO-EC scenarios used projected groundwater pumping volumes from COB, Cal Water, Vaughn Mutual Water Company, and Improvement District No. 4 (ID4). Only 60 percent of the Cal Water UWMP projection was used because approximately 40 percent of Cal Water's service area is outside the model domain. Municipal providers' annual groundwater pumping volumes were apportioned among months based on the demand pattern from 2014 in the KWBA historical model. Monthly pumping was then distributed to each municipal well based on the well's pumping pattern in 2014.

Cal Water wells were not included in the KWBA historical model and information on the wells was not provided by Cal Water for this study. Based on well capacity information in Cal Water's UWMP, 18 assumed wells are evenly distributed throughout the service area. Annual pumping (based on the 2015 UWMP projections) was apportioned to months based on the demand pattern from COB wells. Monthly pumping was evenly distributed to each of the assumed wells.

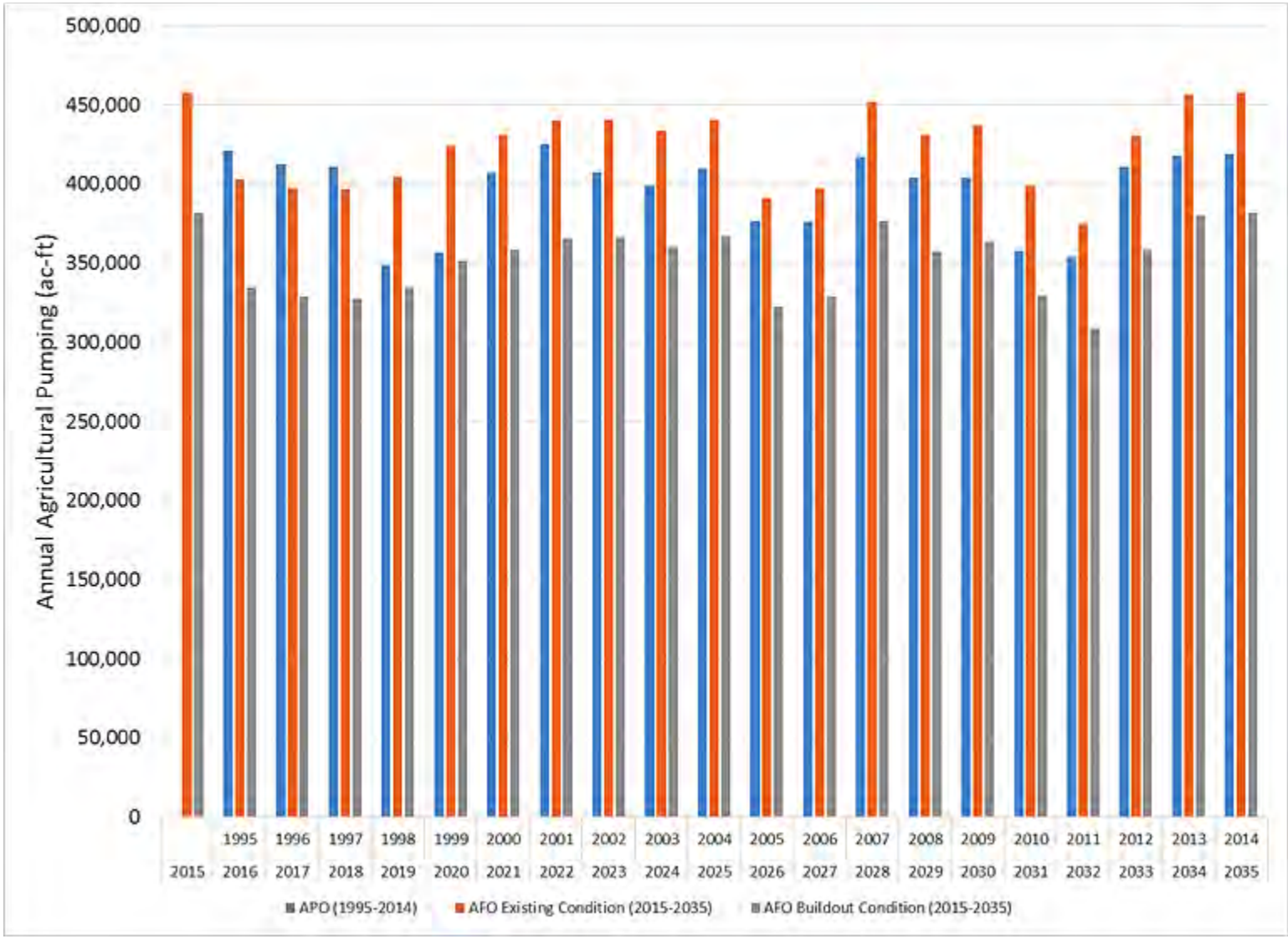


FIGURE 2.3-6. Calculated Agricultural Pumping for the Analysis of Past Operations and Analysis of Future Operations Scenarios, 1995-2035

TABLE 2.3-3 URBAN DEMANDS USED FOR ANALYSIS OF FUTURE OPERATIONS RETURN FLOW CALCULATIONS			
Agency	**Existing Conditions (2015) Urban Pumping (acre-feet per year)**	**Future Conditions (2030) Urban Pumping (acre-feet per year)**	**Comment**
City of Bakersfield	36,406	41,735	Source: City of Bakersfield 2010 UWMP; Table 10
California Water Service Company	35,345	18,013	Source: 2010 Urban Water Management Plan—Bakersfield District; Table 4.1-1 AFO scenarios use 60 percent of these values because of partial overlap of the Cal Water service area and the DWR KWB Model domain
Vaughn Water Company	14,962	19,576	Source: Vaughn Water Company 2010 Water Management Plan; Table 9
ID4	9,620	10,600	Source: ID4 2010 Urban Water Management Plan; Table 3-10

Notes:
AFO = Analysis of Future Operations; Cal Water = California Water Service Company; ID4 = Improvement District No. 4;. KWBA = Kern Water Bank Authority; UWMP = Urban Water Management Plan
Sources: City of Bakersfield 2010 UWMP, 2010 Urban Water Management Plan—Bakersfield District, Vaughn Water Company 2010 Water Management Plan, ID4 2010 Urban Water Management Plan

2.3.3 ANALYSIS OF FUTURE OPERATIONS UNDER BUILDOUT CONDITIONS

The AFO-BC scenario is similar to the AFO-EC scenario, except that (1) the urban footprint is expanded to represent a future urban buildout condition, and (2) selected planned recharge and recovery projects are added to the model.

2.3.3.1 Buildout Conditions Groundwater Banking Operations

The AFO-BC simulation includes several proposed new or expanded groundwater banking projects (Table 2.3-4). Within KWB Lands, 1,090 acres of ponds (nine expansions to existing ponds and seven entirely new ponds) were added along with three new recovery wells. In addition to the new KWB facilities, the AFO-BC simulation considers the operations of the James Groundwater Storage and Recovery Project, the Stockdale Projects, and Strand Ranch (Figure 2.3-7).

Kern Water Bank Recharge Operations

KWB recharge for the AFO-BC simulation (Figure 2.3-2) is calculated using the same methodology as used for the AFO-EC simulation. Historically, the KWB has maximized its recharge capacity during flood years. The projected construction of an additional 1,090 acres of recharge ponds by 2030 increases the project's recharge capacity beyond what was available historically. Additional capacity for each month is estimated by assigning pond-specific recharge rates to ponds that were inactive or did not exist during past recharge cycles. For expansions to existing ponds, the recharge rate is assumed to remain the same as the rate during historical operations and volumes are scaled up by area. New ponds are assumed to follow the average recharge rate of existing ponds in the same group (e.g., a new pond in Group C is assumed to follow the average recharge rate of the existing Group C ponds for the purposes of estimating capacity). The volumes that could have potentially filled the new and expanded ponds are considered the additional capacity for recharge under the AFO-BC scenario.

TABLE 2.3-4

FUTURE PROJECTS INCLUDED IN ANALYSIS OF FUTURE OPERATIONS BUILDOUT CONDITIONS SCENARIOS

Project Type	Agency	Project	Description
Groundwater Banking	Kern Water Bank Authority	Kern Water Bank Recharge and Recovery Project	Additional basins and three new wells within the Kern Water Bank
	Buena Vista Water Storage District	James Groundwater Storage and Recovery Project	NOP shows project footprint and anticipated maximum recharge capacity
	Rosedale–Rio Bravo Water Storage District	Drought Relief Project	11 new wells (three on West Basins, six in the vicinity of Superior Basins, two on Stockdale East), pumping plant, turnout, development of Stockdale East basins
Urban Development	Regional and Local Development Plans and Programs	City of Bakersfield General Plan	Implemented via revised urban footprint
		Kern County General Plan	Implemented via revised urban footprint
	City of Bakersfield	West Ming Specific Plan	Specific Plan outlines development areas
		Rosedale Ranch (approved residential development)	Implemented via revised urban footprint
		Saco Ranch (approved commercial development)	Implemented via revised urban footprint
		Strand Ranch (approved residential and commercial development)	Implemented via revised urban footprint
		Stockdale Ranch (approved residential development)	Implemented via revised urban footprint
		Old River Ranch (approved residential and commercial development)	Implemented via revised urban footprint
		Bakersfield Commons (approved commercial development)	Implemented via revised urban footprint
		Ashe No. 4 (approved residential development)	Implemented via revised urban footprint
		Hosking Commercial Center (proposed commercial development)	Implemented via revised urban footprint
	Kern County	Reina Ranch (proposed residential development and drill island for petroleum extraction)	Implemented via revised urban footprint
		Rosedale & Renfro Precise Development Plan	Implemented via revised urban footprint

Notes:
NOP = Notice of Preparation
Sources: KWBA 2015, RRBWSD 2015, City of Bakersfield General Plan 2010

Historical flood years were identified as those where April–July Kern River flows exceeded 170 percent of the historical average flow; these years were identified as 1995, 1998, 2005, 2006, and 2011. During years of high flow, Kern River water that is not recharged to the KWB or other projects is routed to the Kern River–California Aqueduct Intertie and taken out of the region through the California Aqueduct. With the addition of new ponds, the KWB has increased capacity to recharge a portion of this excess floodwater that otherwise would leave the region. Additional Kern River water recharged to the KWB is limited based on the availability of excess Kern River water and the capacity for recharge within the bank. Historical data showed that excess Kern River water was available for recharge in 1995, 1998,

and 2006. In 1995, 42,000 AF of Kern River water flooded farmland, while in 1998 and 2006, 132,266 and 70,624 AF of Kern River water reached the intertie, respectively. Based on capacity and availability, an additional 39,480 AF, 122,412 AF, and 66,387 AF of water could be recharged in the KWB in the 1995, 1998, and 2006 hydrologic years, respectively. However, to avoid surface ponding due to additional recharge from KWB operations as well as recharge from other banking projects, volumes were kept consistent with existing condition levels.

In addition to Kern River water, Article 21 SWP water is available in some months. For the AFO-BC, the KWB first recharges available Kern River water and takes Article 21 water if additional recharge capacity is available. Under these assumptions, an additional 3,230 AF of Article 21 water is recharged to the KWB in 2005, the same as in the AFO-EC simulation.

Kern Water Bank Recovery Operations

For the AFO-BC simulation, the KWB includes three new wells in addition to the existing wells from the historical simulation. Pumping from existing wells repeats historical pumping patterns and volumes according to the corresponding hydrologic year. The three new wells are assumed to be active during all historical KWB recovery cycles. Each of the three wells is assigned a pumping rate equal to the average historical rate for wells active during the corresponding hydrologic month. During the 21-year simulation, the three new wells recover a total of 67,868 AF of water, with a maximum annual per-well recovery rate of 3,275 AF in Year 15 of the AFO-BC simulation (hydrologically equivalent to 2008).

Non–Kern Water Bank Groundwater Banking Operations

<u>James Groundwater Banking Project</u>

The James Groundwater Banking Project, referred to here as the “James Project,” consists of 1,400 acres of recharge ponds with a recharge capacity of up to 150,000 acre-feet per year (AFY) and 14 groundwater wells that can recover up to 50,000 AFY during times of need. The James Project is located directly south of the South Pioneer ponds and recovery wells. Recharge rates and patterns for the South Pioneer project were scaled proportionately and used to estimate operations for the James Project. The maximum historical recharge year for the Pioneer Project was scaled up to the maximum estimated recharge capacity of the James Project (150,000 AFY), and the ratio is used to scale the remaining recharge years accordingly. Recovery patterns for James Project wells were assumed to follow the same timing as South Pioneer wells. Each of the 14 James Project recovery wells is assigned a pumping rate equal to the average historical rate for South Pioneer wells active during the corresponding hydrologic month.

<u>Stockdale Integrated Banking Project and Strand Ranch</u>

The Stockdale Integrated Banking Project consists of the Stockdale East and Stockdale West recharge ponds and 11 new recovery wells. Stockdale East and Stockdale West have estimated recharge capacities of 19,000 AFY and 27,100 AFY, respectively. Strand Ranch has an estimated annual recharge capacity of 37,000 AFY. Future recharge to Stockdale East, Stockdale West, and Strand Ranch are assumed to follow the same recharge patterns as the rest of the Rosedale ponds. The maximum historical recharge year for Rosedale is scaled up to the estimated recharge capacity of each respective project. The corresponding ratios are then used to estimate the volumes recharged in the remaining years. Strand Ranch and Stockdale West began operations in 2010 and 2011, respectively. Historical recharge values were applied to the two projects in the corresponding hydrologic years for the AFO-BC simulation.

For the three new banking projects, recharge during exceptionally high recharge years (1998, 2005, 2006), was reduced by 50% to avoid surface ponding within the basin.

2.3.3.2 Buildout Conditions Land Use and Derived Data

As noted in Section 2.3.2.2, land use drives the calculation of pumping in agricultural areas and return flows in agricultural and urban areas. Following are discussions of AFO-BC urban and agricultural land use distributions and their derived datasets.

Urban Area and Calculated Return Flows

Background information on urban areas and the ways they are used to generate model inputs is provided in Section 2.3.2.2 for the AFO-EC scenarios. The AFO-BC urban area was developed using the AFO-EC urban area as a starting point. Additional area was added to the AFO-BC urban footprint based on general plan land use GIS data from COB and Kern County. General plan areas designated with urban uses (e.g., various types of residential, commercial, recreation, and industrial classifications) were added to the urban footprint. The general plan areas were inclusive of many smaller planned urban developments, a list of which is provided in Table 2.3-4. Relative to the AFO-EC urban area, the AFO-BC urban area expanded by roughly 18,850 acres. Similar to the AFO-EC, AFO-BC urban return flows were calculated using 12.5 percent of 2030 UWMP water demand projections (Table 2.3-1).

AFO-BC urban on septic zones were developed by expanding the AFO-EC urban on septic areas to include locations where general plan data indicated that urban development is likely to occur. AFO-BC urban on septic recharge rates were assumed based on the closest nearby recharge rates from the APO simulation.

Agricultural Area

Agricultural areas outside of the AFO-BC banking project, urban, and urban on septic footprints were held constant at their 2014 conditions (i.e., extent and crop type) from the DWR KWB Model for the entire AFO-BC simulation period. Pumping and return flows for these agricultural areas were calculated using the same preprocessor used for the AFO-EC.

2.3.3.3 Buildout Conditions Urban Pumping

Similar to the development of AFO-EC urban pumping, AFO-BC urban pumping was developed using 2030 UWMP pumping projections (Table 2.3-3). Annual flows were apportioned into monthly values for each well using a similar methodology as described for the AFO-EC in Section 0. No additional municipal supply wells were simulated except for Vaughn Mutual Water Company, where seven additional wells were estimated to be required to meet 2030 demand projections based on existing well capacities.

2.4 MODEL INPUTS

The information collected and processed during scenario development was used to build new model input files. As described in Section 2, the DWR KWB Model is built on the MODFLOW-NWT code. MODFLOW models allow the user to specify various packages and processes that each represent different components of the groundwater flow system (e.g., for simulation of wells, streams, or recharge). In general, data for each package or process are contained in one or more ASCII text files. The collection of these text files is referred to collectively as the “input files.” The user specifies the name of each package or process input file in a Name (or NAM) file. The NAM file directs MODFLOW where to find the required inputs for each package and process used in the model.

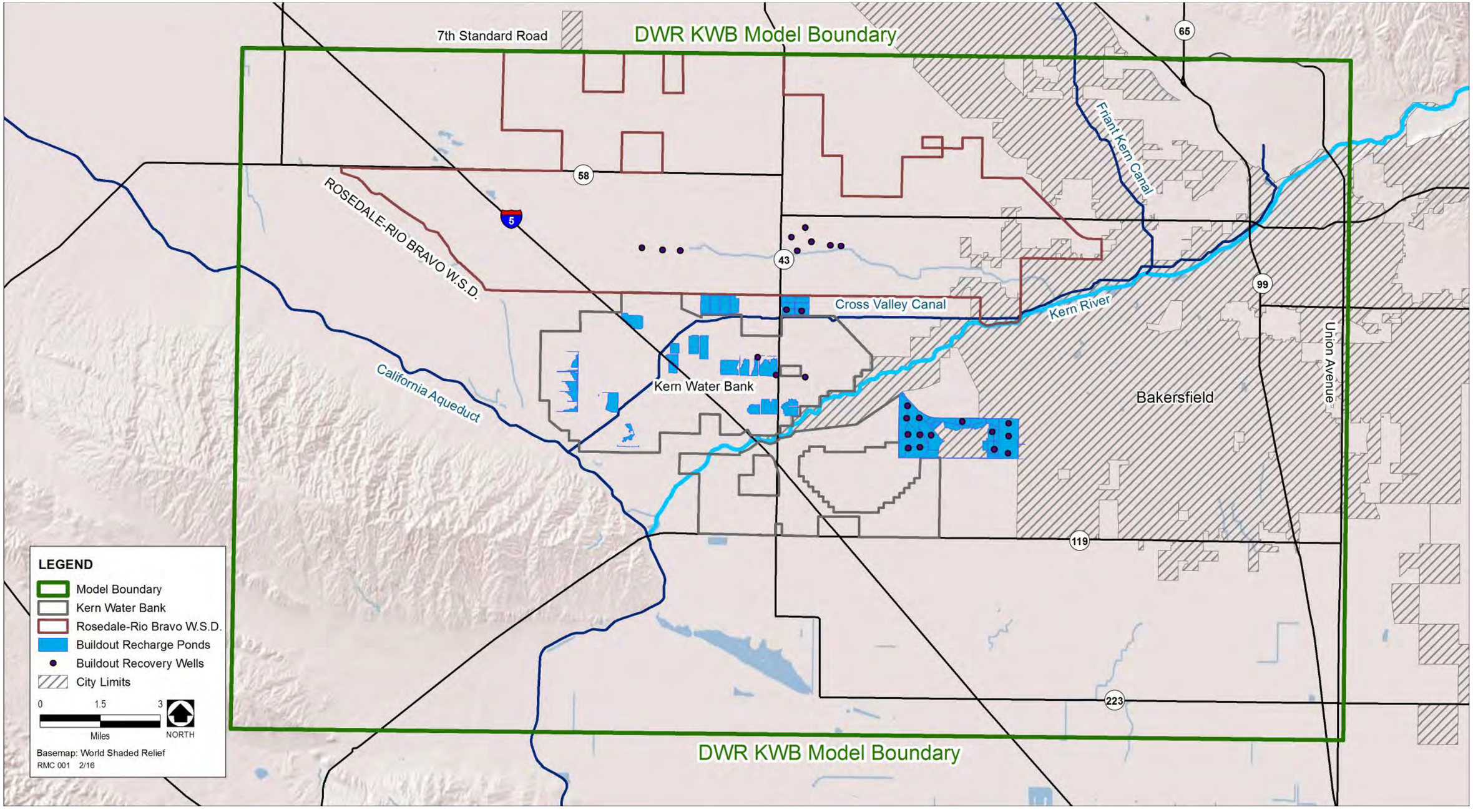


FIGURE 2.3-7 Future Groundwater Banking Projects Used in the Analysis of Future Operations under Buildout Conditions Scenario

Table 2.4-1 specifies all of the input files required to run the DWR KWB Model. Some of the input files were taken directly from the DWR KWB Model calibration run described in the technical report, "Development of DWR Kern Water Bank Model: Model Review, Selection, and Enhancements" and used for each model scenario without modification (DWR, 2016). An example is the Upstream Weighting (or UPW) file, which is used to specify the properties controlling flow between cells in the model (e.g., horizontal and vertical hydraulic conductivity, specific yield, storage). Other files, including those representing pumping and recharge, changed significantly for the different scenarios. Table 2.4-1 specifies where changes to the model input files were required during scenario development.

TABLE 2.4-1

KERN WATER BANK AUTHORITY MODEL INPUT FILES

File (Abbreviation)	Description	Modified from KBWA Calibration Model[1]?	
		For APO Without Project	For AFO
Name (NAM)	The Name file contains the names of all model inputs, and directs MODFLOW where to find each file	No	No
Basic (BAS6)	The Basic package specifies (1) locations of active, inactive, and specified head cells; (2) head stored in inactive cells; and (3) the initial heads in all cells.	No	Yes
Discretization (DIS)	The Discretization file is used to specify (1) the number of rows, columns, and layers; (2) cell sizes; (3) the presence of Quasi-3D confining beds; and (4) time discretization.	No	Yes (time discretization only)
Upstream Weighting (UPW)	The Upstream Weighting package is used to specify properties controlling flow between cells in MODFLOW-NWT.	No	No
Multi-Node Well, version 2 (MNW2)	The Multi-Node Well package is used to simulate wells that are connected to more than one node of the finite-difference grid. Nearly all irrigation, recovery, and urban wells in the model are simulated as multi-node wells.	Yes	Yes
Multi-Node Well Information (MNWI)	The Multi-Node Well Information package controls how multi-node well output is printed.	No	No
Well (WEL)	Relative to MNW2, the Well package offers a simplified, specified flux representation of wells. The Well package is used to simulate leakage from canals (positive pumpage) and pumping from a few selected wells.	No	Yes
General-Head Boundary (GHB)	General-head boundaries are a type of head-dependent boundary condition where a head and conductance are specified at each GHB cell. Water can flow into or out of these cells based on the GHB properties and heads in surrounding cells.	No	Yes
Recharge (RCH)	The Recharge package is specified flux boundary condition package whereby recharge entering the water table (uppermost saturated cell) is assigned on a cell by cell basis. The Recharge package is used to represent urban and agricultural return flows and to represent recharge operations.	Yes	Yes
Output Control (OC)	Controls the frequency and types of output data printed as the model runs.	No	No
Newton Solver (NWT)	The Newton solver is used to solve the finite difference equations in each step of a MODFLOW-NWT stress period.	No	No

TABLE 2.4-1

KERN WATER BANK AUTHORITY MODEL INPUT FILES

File (Abbreviation)	Description	Modified from KBWA Calibration Model[1]?	
		For APO Without Project	For AFO
Stream (STR)	The Stream package is used to simulate streams in a model. The DWR KWB Model uses the Stream package to route discharges to the Kern River from groundwater to downstream reaches.	No	No

Notes:

AFO = Analysis of Future Operations; APO = Analysis of Past Operations; KWBA = Kern Water Bank Authority

[1] Includes enhancements to DWR KWB Model described in Appendix 7-2 Section 3.

Source: USGS 2015

3. MODEL RESULTS

This section describes the model results for simulations conducted to evaluate the impact of historical (1995–2014), existing, and future KWB facilities and operations on the groundwater table within the DWR KWB Model domain.

3.1 MODEL COMPARISON METHODS

Numerous possible methods and metrics can be used to compare model scenarios. The discussion below focuses on those comparison methods that are most relevant to supporting the analysis of the impacts of KWB operation. The methods described in this section include comparing changes in groundwater levels and storage between the "With KWB Operations" and "Without KWB Operations" variations of the three primary model scenarios (APO, AFO-EC, and AFO-BC). The comparison methods include:

1. **Groundwater budgets**—Tables are generated to show annual rates of inflow and outflow components of the groundwater flow system.

2. **Groundwater elevation difference contour maps**—The modeling results from one layer and at one point in time for the "Without KWB Operations" scenario are subtracted from the results in the same layer and time as the "With KWB Operations" scenario. Areas where the elevation difference is positive (greater than zero) indicate locations where groundwater levels are higher under the "With KWB Operations" scenario. Negative values mean that water levels are lower under the "With KWB Operations" scenario.

3. **Groundwater level hydrographs**—Simulated groundwater elevations for the "With KWB Operations" and "Without KWB Operations" scenarios are plotted for selected monitoring wells for the 1995–2014 simulation period.

4. **Time series of affected area**—Areas outside KWB Lands with head differences between the "With KWB Operations" and "Without KWB Operations" scenarios exceeding specified levels are identified and calculated for each month of the simulation period.

5. **Maps showing the spatial extent of negative and positive head differences—**Maps show the extent of areas with various levels of head difference (-60 feet, -45 feet, -30 feet, -20 feet, -10 feet, -5 feet, +5 feet, +10 feet, +20 feet, +30 feet, +45 feet, +60 feet) for "With KWB Operations" and "Without KWB Operations" scenarios at any time during the simulation period. These boundary lines show the outermost edge of all model cells that have ever exceeded the corresponding specified level of elevation difference at any time during the model simulation period. No model cells outside the boundary line have ever exceeded the corresponding specified level of elevation difference. These maps were constructed by identifying all model cells where the groundwater elevation difference exceed the specified level at any time step and drawing a boundary line by connecting the outermost edges of the identified cells.

6. **Maps showing the frequency distribution of groundwater elevation difference—**Maps showing the percent of months in the simulation period when groundwater elevation differences exceed specified levels are examined to show how often these specified levels of impacts may occur over an affected area.

7. **Zonal average groundwater elevation and elevation difference hydrographs—**Charts of average groundwater elevation and elevation differences over specified zones (0–1 mile, 1–2 miles, 2–3 miles, 3–4 miles, and 4–5 miles) outside the KWB boundary are examined to show the rise and attenuation of the groundwater mound as it moves away from the KWB boundary.

8. **Total area of negative and positive elevation differences—**Total areas of "positive elevation difference" and "negative elevation difference" outside KWB Lands are examined to show the overall groundwater response to KWB recharge and recovery operations.

3.2 RESULTS OF ANALYSIS OF PAST OPERATIONS SCENARIOS

The results of the APO "With KWB Operations" and "Without KWB Operations" scenarios are presented in the following subsections.

3.2.1 WATER BUDGET AND RECHARGE AND RECOVERY AT KERN WATER BANK

The historical DWR KWB Model was used to develop an annual water budget for the entire model domain for the 1995–2014 KWB operation period. Table 3.2-1 shows key components of the water budget, including the change in groundwater storage within the model domain.

Boundary inflow and outflow are the largest components of the DWR KWB Model water budget. Boundary inflow, with an annual average of approximately 546,000 AFY, is approximately 10,925,000 AF for the 1995–2014 period. Boundary outflow, with an annual average of approximately 527,000 AFY, is approximately 10,534,000 AF for the same period.

Agricultural and urban water demand during the 1995–2014 period is partially met by a total of 7,935,000 AF of agricultural pumping and 700,000 AF of urban pumping. Approximately 1,536,000 AF of applied water returns to the aquifer as deep percolation.

During the 1995–2014 period, the KWB recharged surface water into the underlying aquifer in high-flow years and recovered some of the stored groundwater in relatively dry years. The KWB has recharged 2,006,000 AF (after a 6 percent evaporation loss) of water from 1995 through 2014 while recharge at other banking projects within the DWR KWB Model domain during the same period was 3,383,000 AF. The KWB has recovered 1,389,000 AF of the recharged water from 1995 through 2014 while other projects within the model domain have recovered 1,247,000 AF. This results in a balance of 617,000 AF of stored water for the KWB and 2,136,000 AF of stored water for other banking projects. The KWB annual recharge, recovery, and cumulative balance of stored water are shown in Figure 3-2.1.

3.2.2 GROUNDWATER ELEVATION DIFFERENCE FOR WITH AND WITHOUT KERN WATER BANK OPERATIONS

KWB operations result in the rise (during recharge periods) and fall (during recovery periods) of the local groundwater table. The largest changes in groundwater elevation occur within the KWB and in the area immediately adjacent to it. Groundwater elevation differences for the APO "With KWB Operations" and "Without KWB Operations" scenarios were evaluated by (1) comparing simulated groundwater elevation hydrographs at several monitoring wells (Method No. 3 in Section 3.1), and (2) developing groundwater elevation difference contour maps at the end of several representative recharge and recovery cycles (Method No. 2 in Section 3.1).

TABLE 3.2-1

WATER BUDGET FOR ANALYSIS OF PAST OPERATIONS WITH KERN WATER BANK OPERATIONS, 1995–2014

Year	INFLOW Into Model						OUTFLOW from Model						Calculated Change in Storage
	Deep Percolation of Applied Water	KWB Recharge	Other Banking Projects Recharge	River and Canal Seepage	Boundary Inflow through DWR KWB Model Domain	Total Inflow	Agricultural Pumping	Urban Pumping	KWB Pumping	Other Banking Projects Pumping	Boundary Outflow through DWR KWB Model Domain	Total Outflow (Positive)	
	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY
1995	84,545	208,924	441,854	178,936	545,738	1,459,997	(421,043)	(15,659)	–	(17,928)	(507,390)	962,020	497,977
1996	82,417	163,443	245,865	166,869	599,272	1,257,867	(412,395)	(16,936)	–	(19,083)	(502,367)	950,781	307,086
1997	82,819	105,526	218,780	164,725	617,828	1,189,678	(410,830)	(19,175)	–	(18,136)	(487,990)	936,130	253,548
1998	68,681	284,901	373,720	152,887	594,141	1,474,331	(348,574)	(15,217)	–	(18,411)	(508,336)	890,538	583,793
1999	67,197	34,548	66,269	146,220	585,953	900,187	(356,515)	(21,780)	–	(21,134)	(540,184)	939,613	(39,426)
2000	75,704	25,924	90,944	117,264	593,947	903,783	(406,632)	(21,853)	–	(24,687)	(526,859)	980,032	(76,249)
2001	79,320	9,428	13,784	83,336	488,151	674,020	(425,390)	(43,099)	(88,699)	(99,660)	(586,962)	1,243,810	(569,790)
2002	76,515	12,633	10,815	106,200	530,104	736,267	(407,749)	(28,009)	(27,596)	(54,607)	(548,585)	1,066,545	(330,278)
2003	75,983	37,952	54,469	140,967	553,785	863,156	(399,019)	(30,289)	(48,367)	(35,501)	(533,262)	1,046,438	(183,281)
2004	77,259	16,981	35,728	92,596	535,366	757,930	(409,965)	(29,545)	(49,289)	(53,768)	(531,476)	1,074,043	(316,113)
2005	76,378	364,304	576,669	187,847	590,181	1,795,378	(376,566)	(26,677)	–	(34,346)	(504,703)	942,292	853,087
2006	76,845	266,239	357,693	171,055	591,154	1,462,987	(376,300)	(27,628)	–	(29,280)	(509,484)	942,692	520,295
2007	78,297	15,724	22,711	56,251	498,929	671,912	(417,412)	(59,464)	(230,686)	(124,924)	(567,567)	1,400,053	(728,141)
2008	79,491	–	10,626	63,460	444,553	598,130	(403,843)	(77,102)	(233,703)	(144,984)	(577,926)	1,437,559	(839,429)
2009	77,068	–	14,413	63,825	479,246	634,552	(404,194)	(60,206)	(162,461)	(116,792)	(529,256)	1,272,910	(638,357)
2010	73,493	31,143	195,061	198,235	537,514	1,035,446	(357,623)	(32,882)	(50,969)	(50,256)	(499,837)	991,566	43,880
2011	74,115	420,319	583,911	262,648	606,634	1,947,627	(354,040)	(23,151)	–	(26,735)	(477,414)	881,339	1,066,288
2012	77,726	8,383	69,909	77,153	538,882	772,053	(411,068)	(29,562)	(110,830)	(47,061)	(530,423)	1,128,945	(356,891)
2013	75,806	–	–	54,142	499,711	629,659	(417,457)	(29,642)	(196,819)	(136,997)	(566,377)	1,347,292	(717,633)
2014	76,215	–	–	51,390	493,828	621,434	(418,816)	(92,396)	(189,695)	(173,046)	(497,433)	1,371,385	(749,952)
Total 1995–2014	**1,535,875**	**2,006,372**	**3,383,223**	**2,536,007**	**10,924,917**	**20,386,393**	**(7,935,432)**	**(700,272)**	**(1,389,113)**	**(1,247,334)**	**(10,533,831)**	**21,805,983**	

Notes: AFY = acre-feet per year; KWB = Kern Water Bank; KWBA = Kern Water Bank Authority

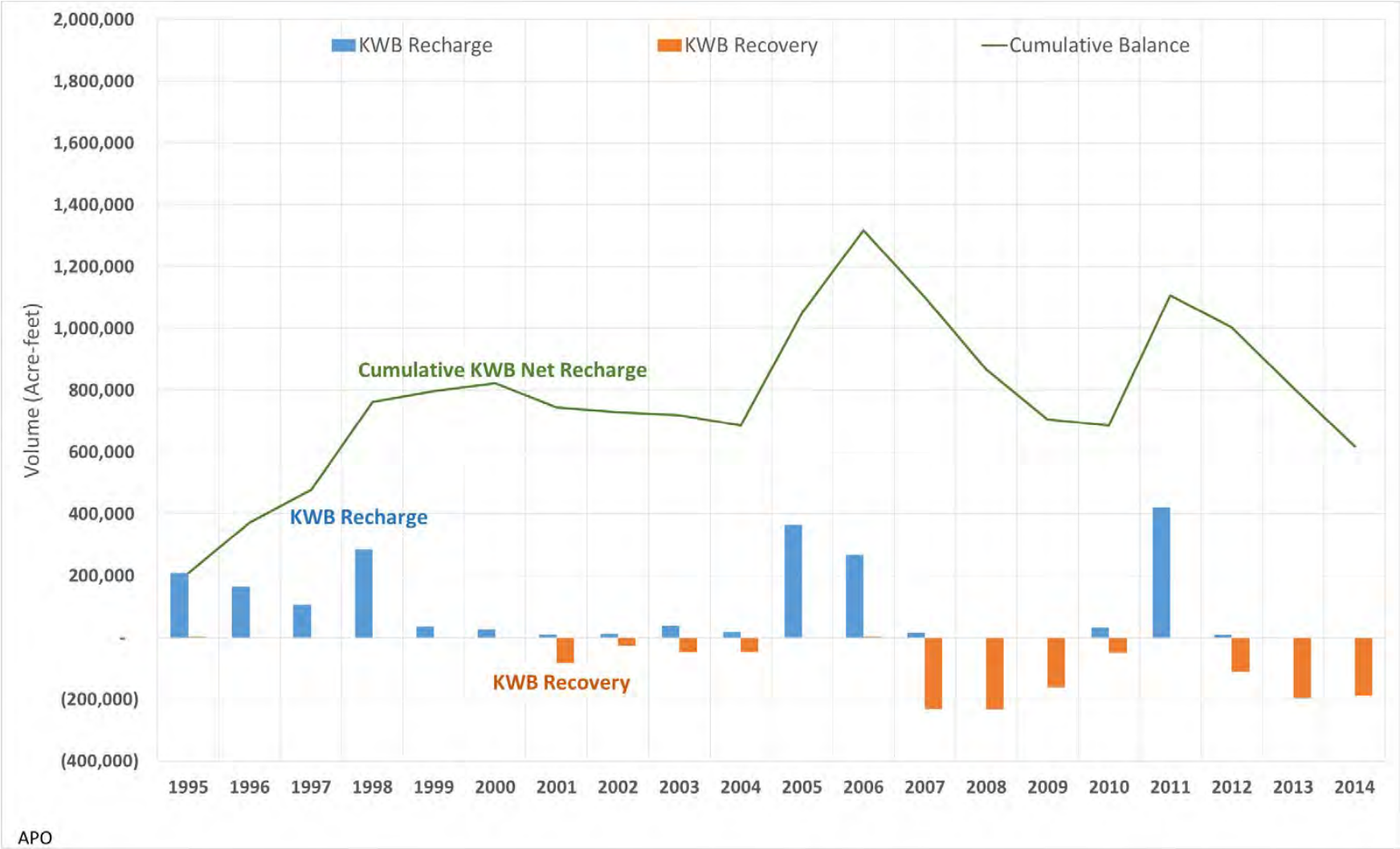


FIGURE 3.2-1 Analysis of Past Operations—Historical (1995–2014) Kern Water Bank Annual and Cumulative Recharge and Recovery, and Cumulative Stored Water, 1995-2014

3.2.2.1 Hydrographs

Hydrographs of simulated groundwater levels for “With KWB Operations” and “Without KWB Operations” scenarios were developed at 31 wells (14 wells inside KWB Lands and 17 wells outside KWB Lands; Appendix 7-2D). The locations and hydrographs for three of these wells are shown in Figures 3.2-2 and 3.2-3a to 3.2-3c.

3.2.2.2 Contour Maps

The distribution of groundwater elevation differences between the “With KWB Operations” and “Without KWB Operations” scenarios after major KWB recharge and recovery cycles is shown in Figures 3.2-5 and 3.2-6. Figures 3.2-5a through 3.2-5c show groundwater elevation differences after the 1995–2000, 2005–2006, and 2011 recharge cycles, respectively. Figures 3.2-6a through 5.2-6c show groundwater elevation differences after the 2001–2004, 2007–2009, and 2012–2014 recovery cycles, respectively.

3.2.3 AFFECTED AREAS OUTSIDE THE KERN WATER BANK

The impact of KWB activities on groundwater elevations outside KWB Lands for the APO “With KWB Operations” and “Without KWB Operations” scenarios are evaluated using time series charts showing areas affected by head differences of ±5 feet (Method No. 4 in Section 3.1), maps of the spatial extent of negatively and positively impacted areas (Method No. 5 in Section 3.1), and tables summarizing the acreage of impacted areas.

3.2.3.1 Time Series of Affected Area

At every time step of the simulation, the total area of the model with groundwater elevation difference greater than 5 feet and groundwater elevation difference less than -5 feet was calculated. Time series of these areas are shown in Figure 3.2-7. A detailed chart showing areas impacted by less than -5, -10, -20, -30, -45, and -60 feet is shown in Figure 3.2-8. Figure 3.2-9 shows areas impacted by groundwater levels greater than 5, 10, 20, 30, and 45 feet.

Negative differences exceeding -5 feet occur after about 2 years of recovery, as in the 2007–2009 and 2011–2014 periods (Figure 3.2-7). In the first 13 years of KWB operations (1995–2007), there are no elevation differences more negative than -5 feet outside KWB Lands. Negative groundwater elevation differences occur over a maximum area of about 22,000 acres at the end of 2014, after 497,000 AF was recovered during 2012–2014.

Figure 3.2-8 indicates that negative differences exceeding -30 feet in areas outside KWB Lands are limited to years of groundwater pumping, occurring in 3 of the 7 recovery years, and that the impacted area is less than 5,000 acres outside and near KWB Lands.

3.2.3.2 Spatial Extent of Affected Area

Figure 3.2-10 shows the maximum spatial extent of negative elevation differences exceeding -60 feet, -45 feet, -30 feet, -20 feet, -10 feet, and -5 feet. This figure shows that negative elevation differences do not spread beyond approximately 2 to 3 miles outside the KWB boundary. Negative elevation differences exceeding -30 feet do not occur inside the Rosedale boundary; but negative elevation differences between -5 feet and -20 feet do occur inside the Rosedale boundary. The total area affected by negative elevation differences between -5 feet and -20 feet inside the Rosedale boundary is approximately 4,600 acres of agricultural land.

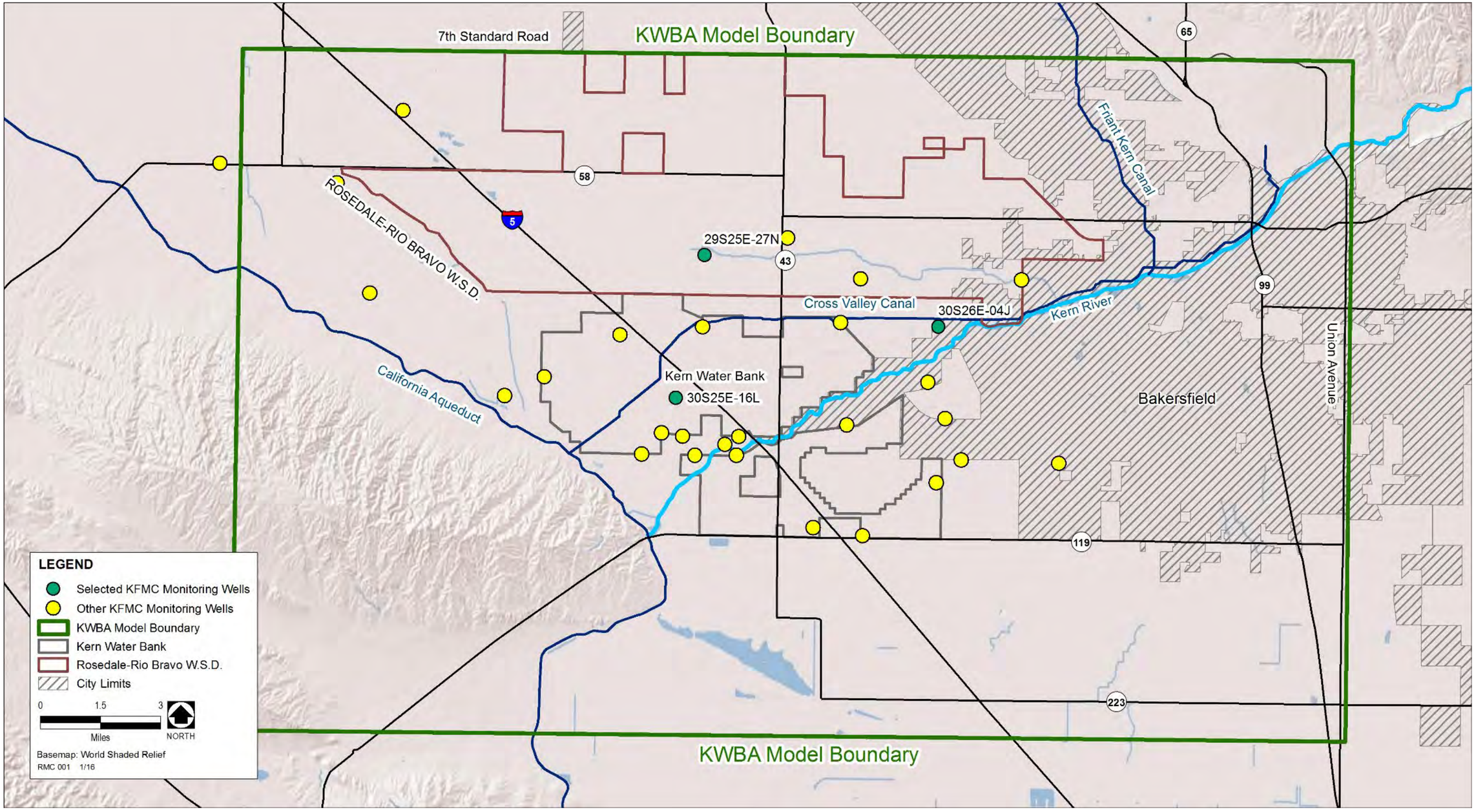


FIGURE 3.2-2. Location of Three Selected Monitoring Wells within and outside Kern Water Bank Lands

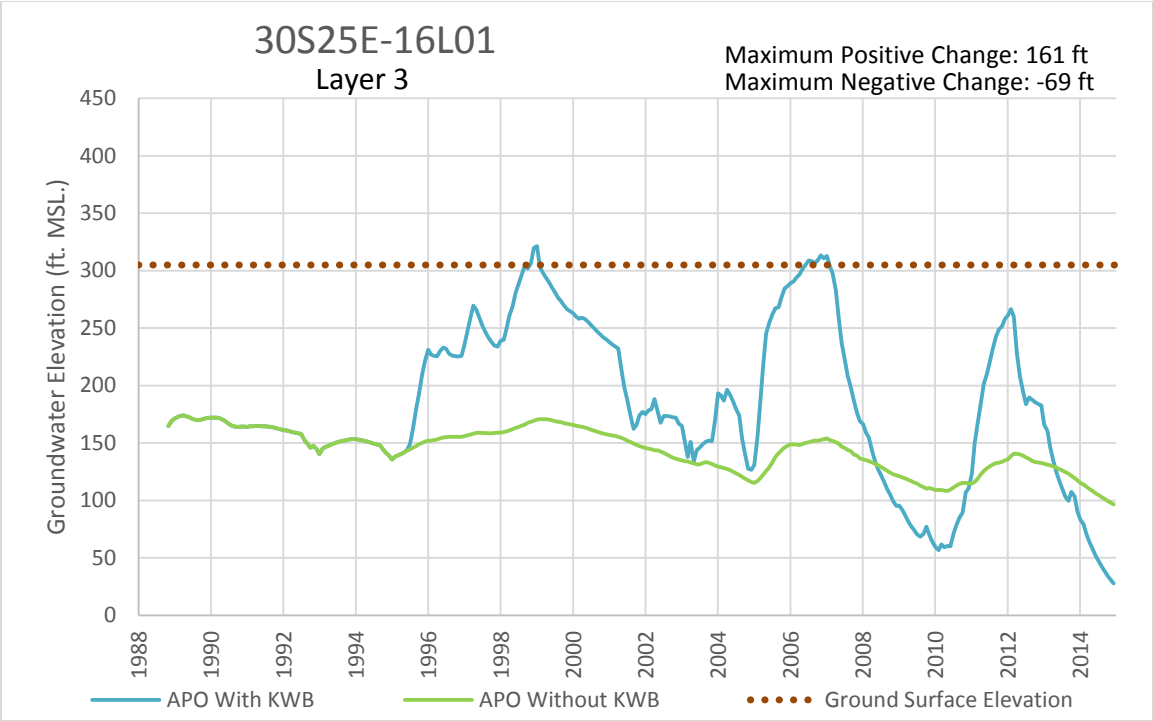


FIGURE 3.2-3. Hydrographs of Analysis of Past Operations Simulated Water Levels at Monitoring Well 30S25E-16L, 1988-2014

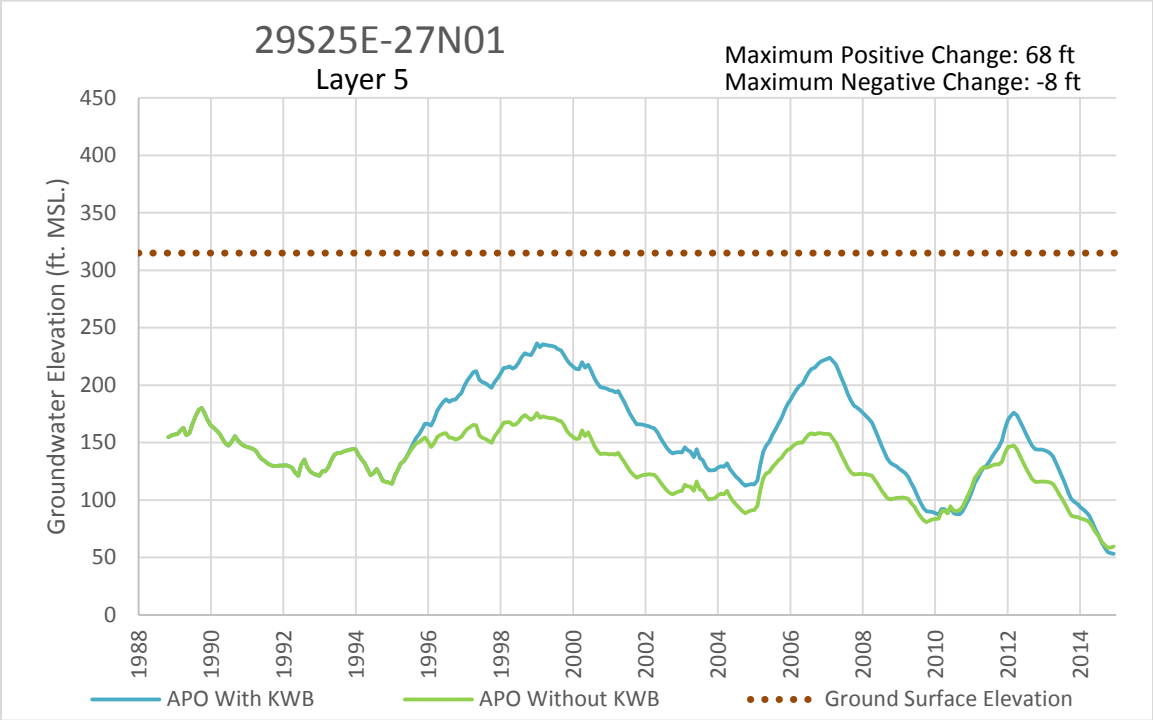


FIGURE 3.2-3b. Hydrographs of Analysis of Past Operations Simulated Water Levels at Monitoring Well 29S25E-27N, 1988-2014

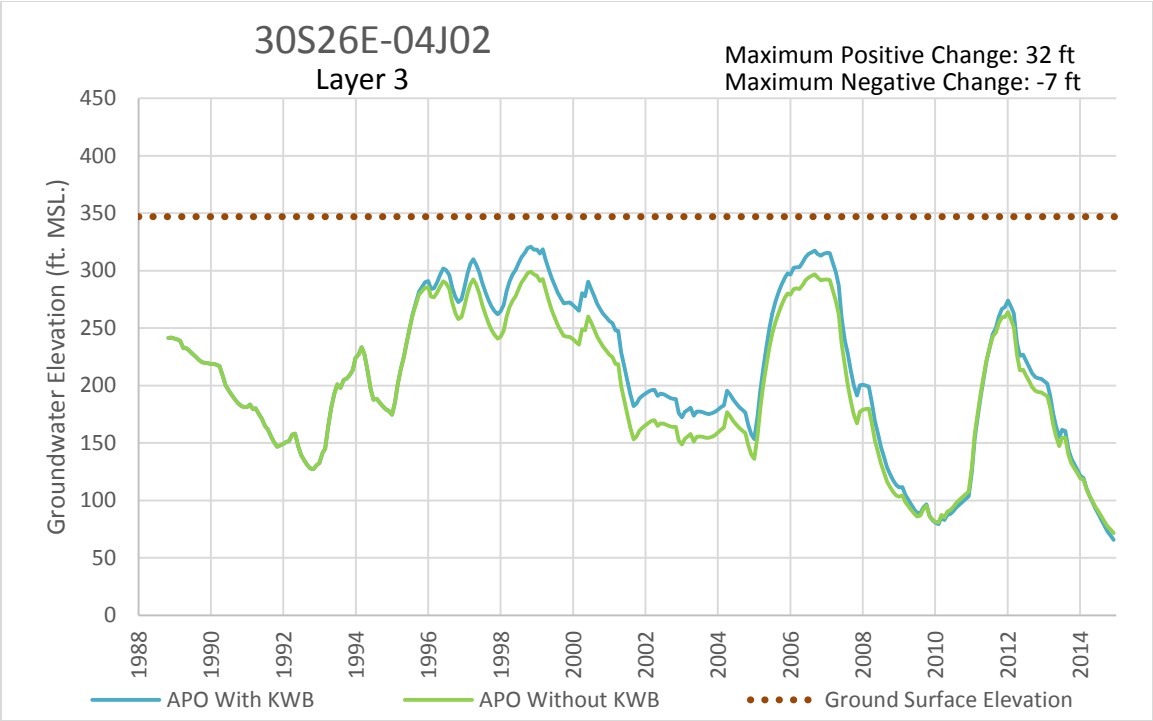


FIGURE 3.2-3c. Hydrographs of Analysis of Past Operations Simulated Water Levels at Monitoring Well 30S26E-04J, 1988-2014

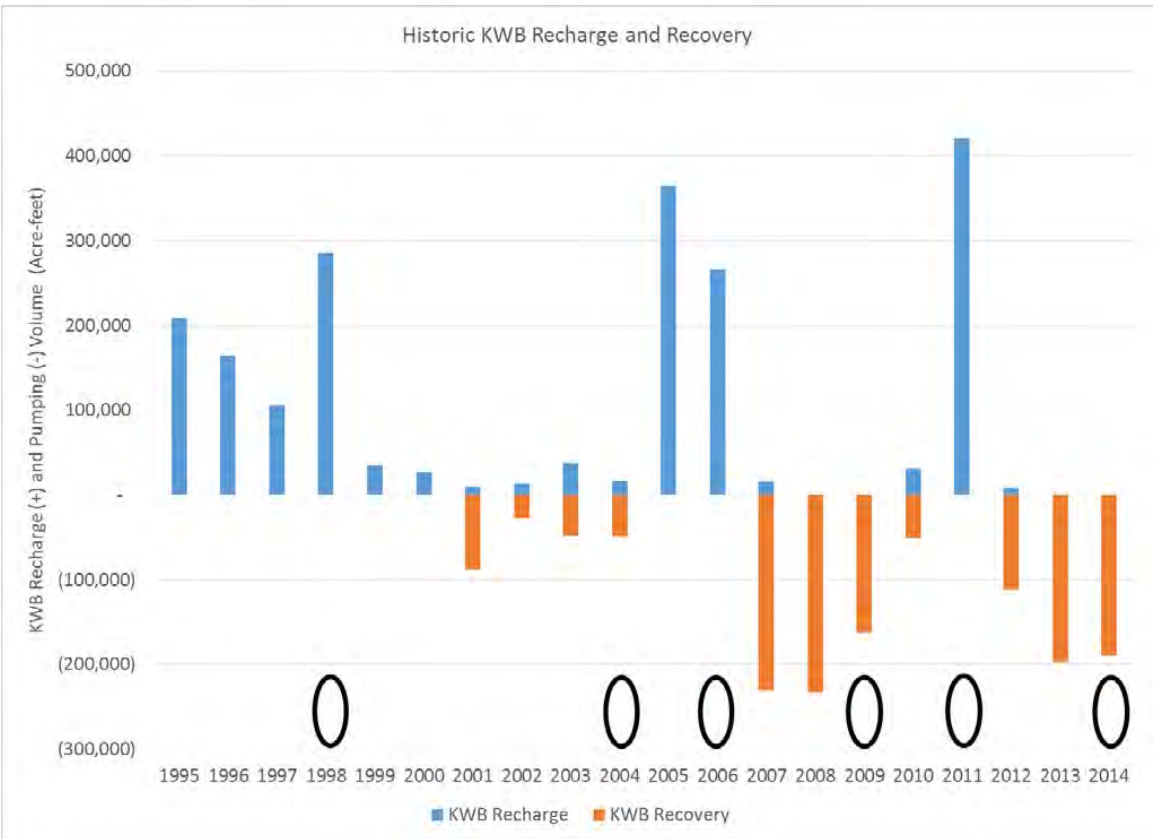


FIGURE 3.2-4. Selected Recharge and Recovery Cycles for Developing the Head Difference Contour Maps, 1995-2014

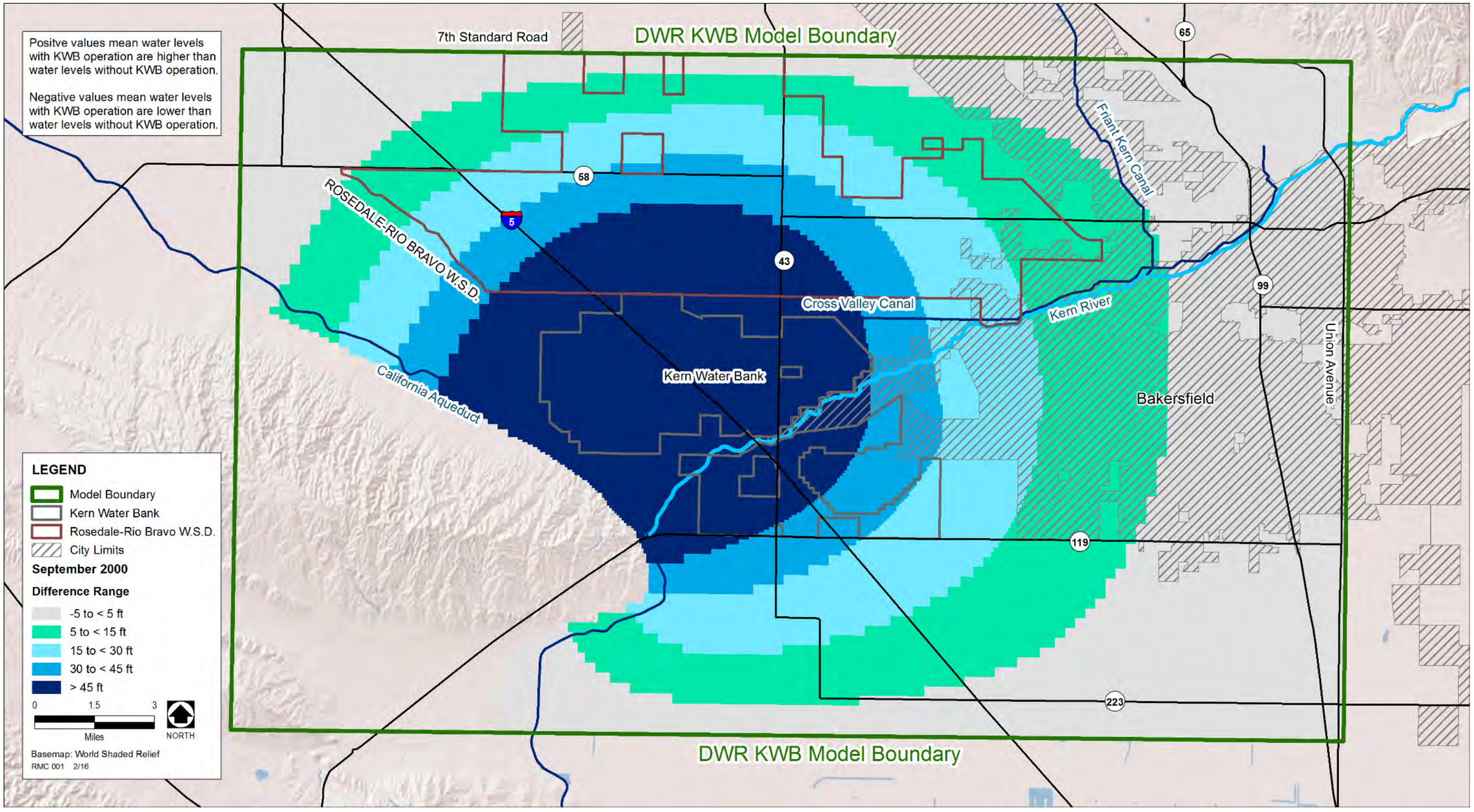


FIGURE 3.2-5a. Analysis of Past Operations: Groundwater Elevation Difference Contour Map at the End of the 1995–2000 Recharge Cycle

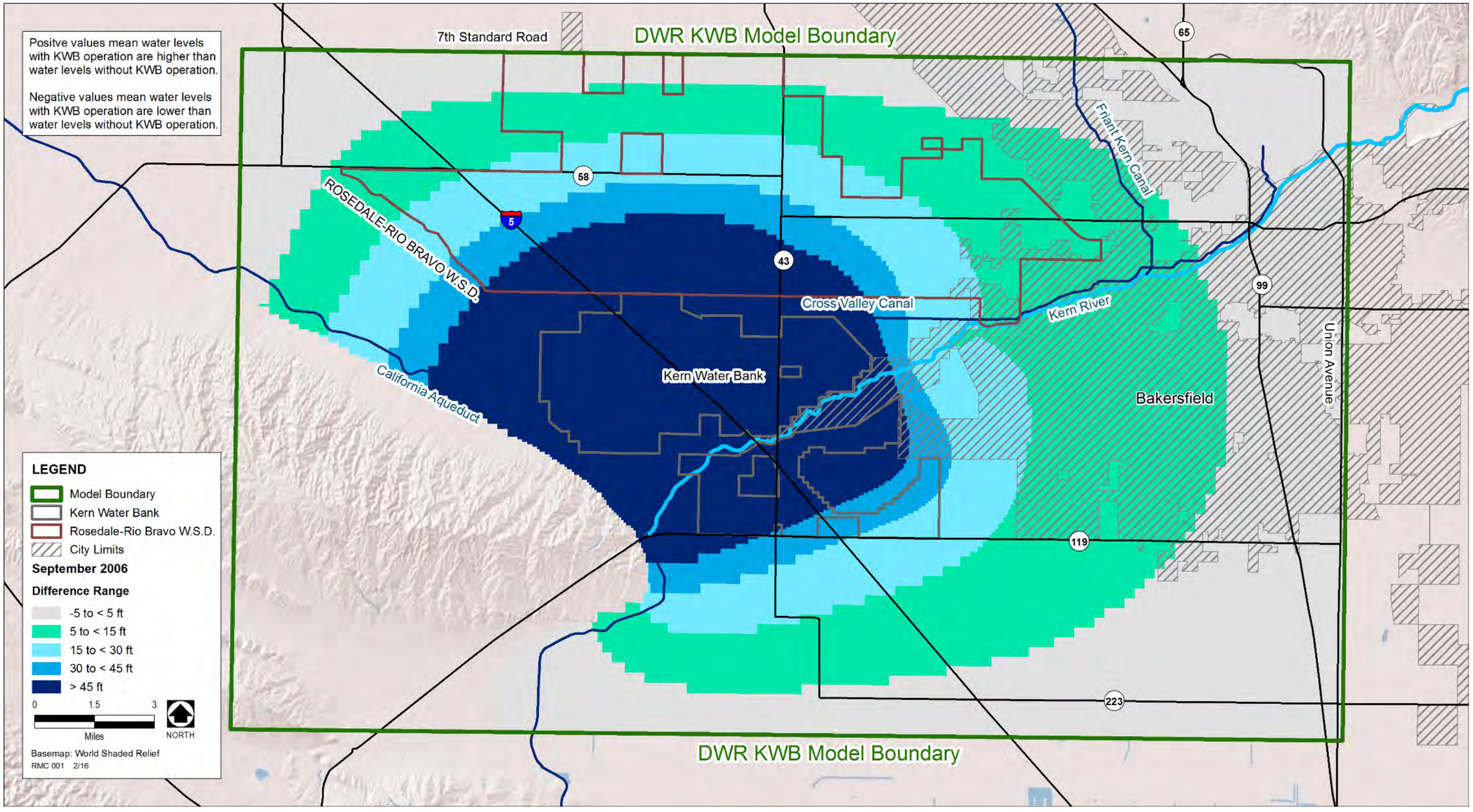


FIGURE 3.2-5b. Analysis of Past Operations: Groundwater Elevation Difference Contour Map at the End of the 2006 Recharge Cycle

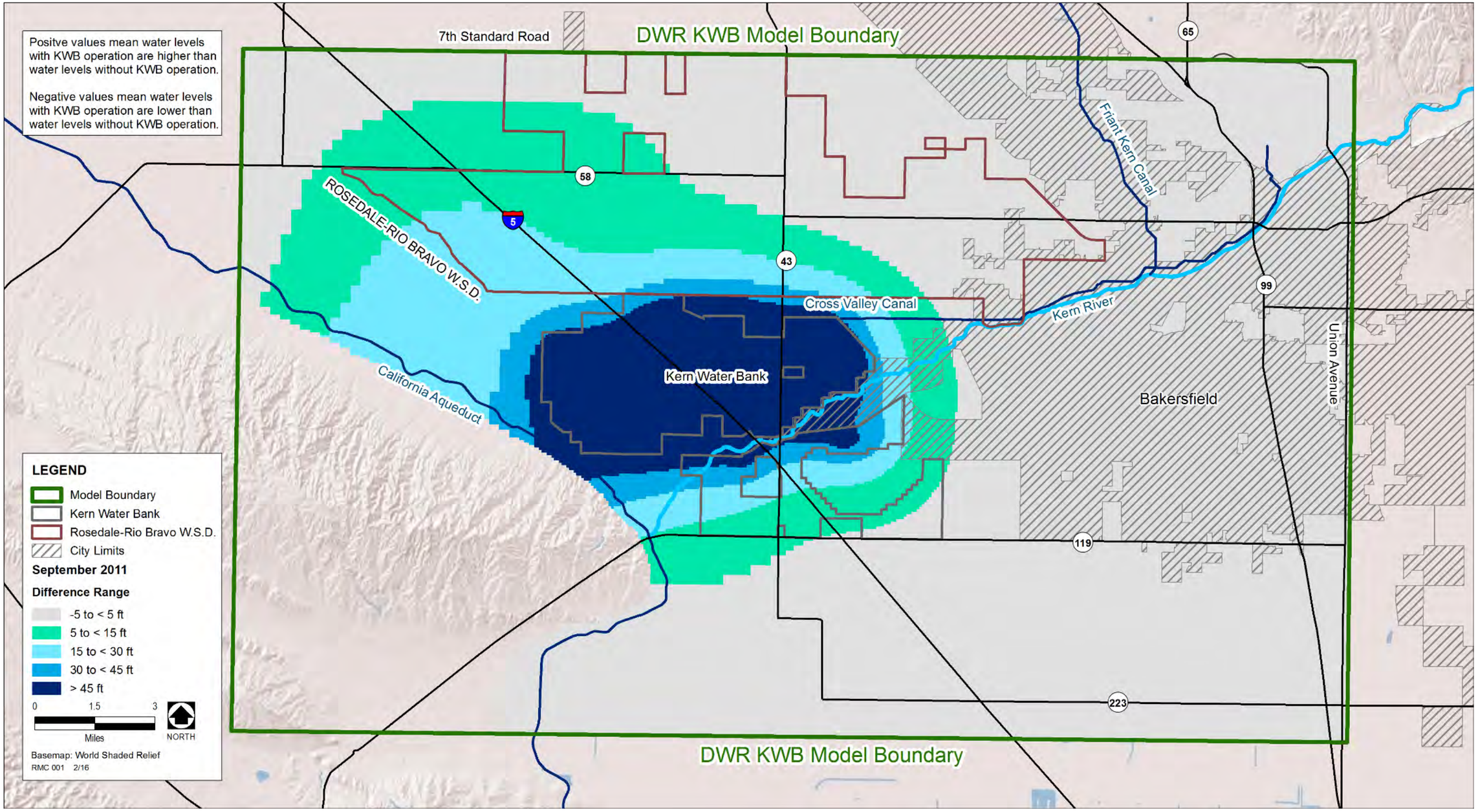


FIGURE 3.2-5c. Analysis of Past Operations: Groundwater Elevation Difference Contour Map at the End of the 2011 Recharge Cycle

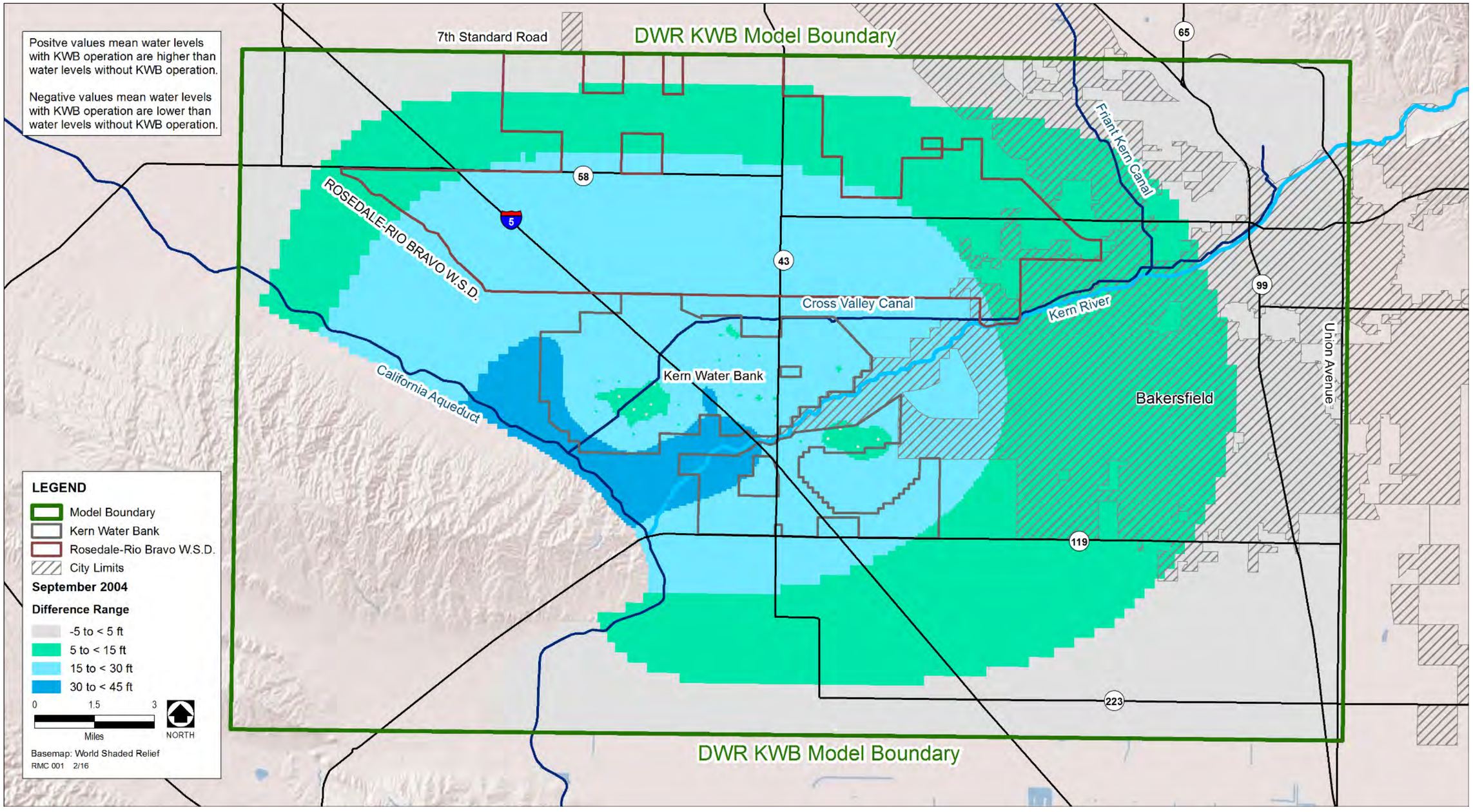


FIGURE 3.2-6a. Analysis of Past Operations: Groundwater Elevation Difference Contour Map at the End of the 2001–2004 Recovery Cycle

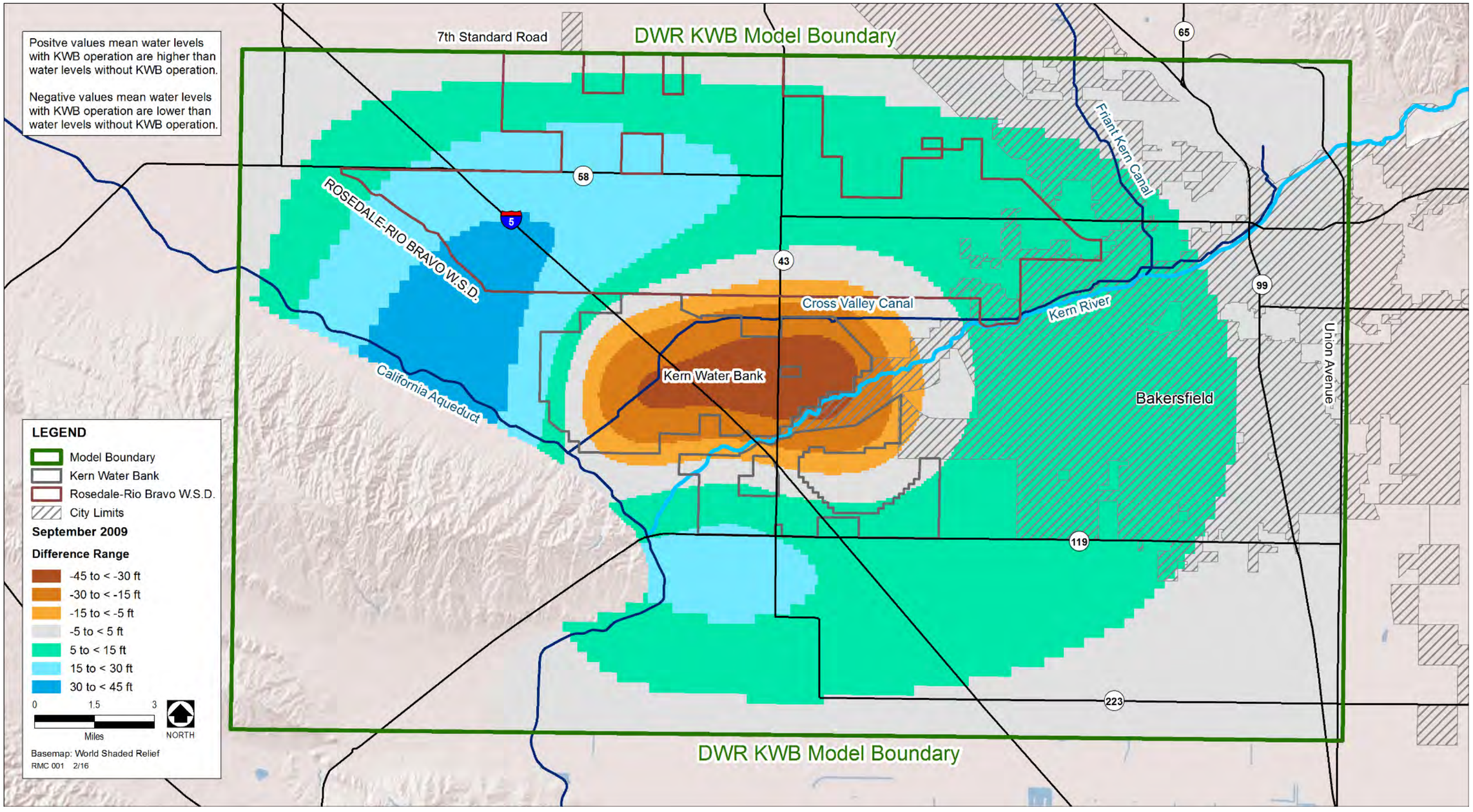


FIGURE 3.2-6b. Analysis of Past Operations: Groundwater Elevation Difference Contour Map at the End of the 2009 Recovery Cycle

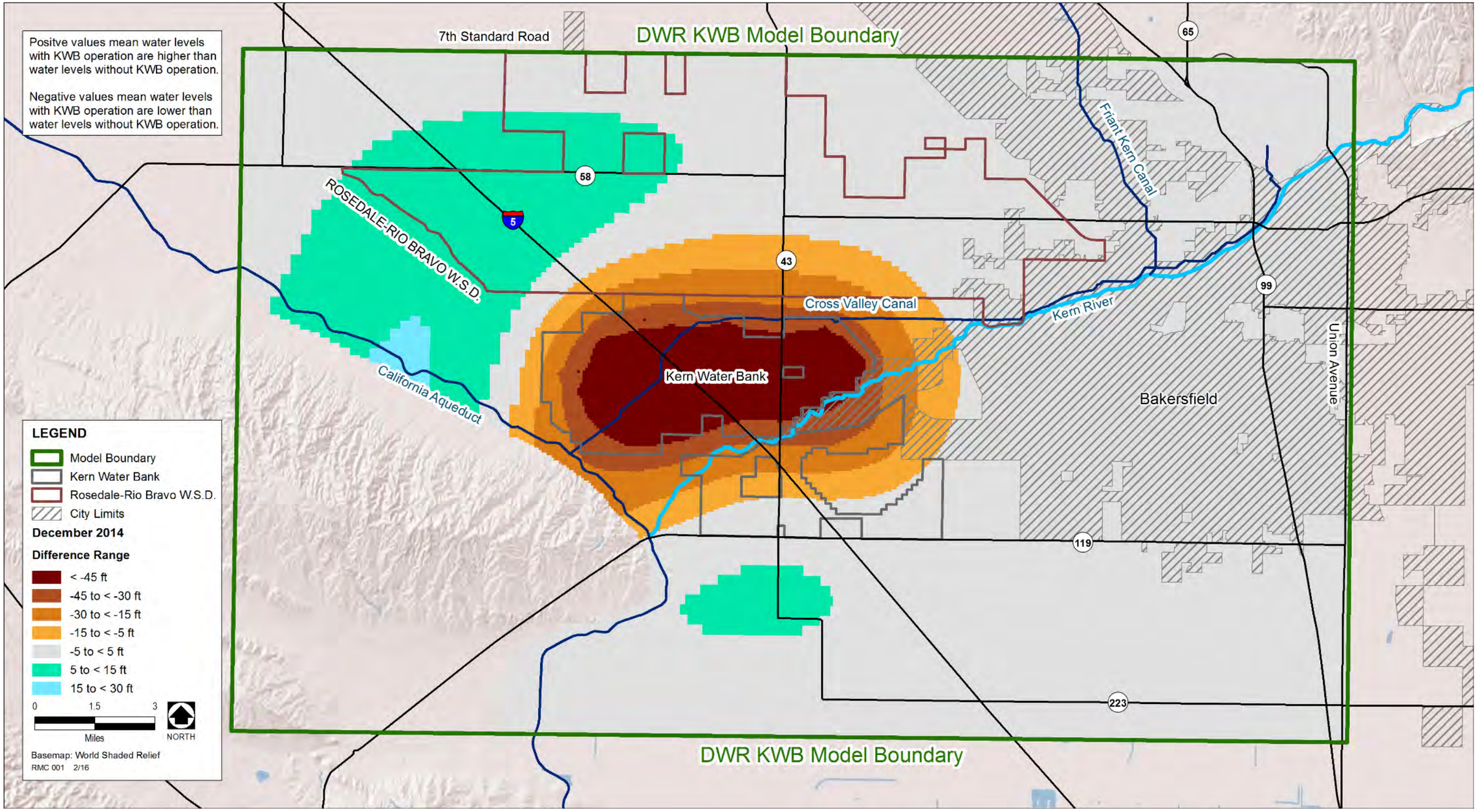


FIGURE 3.2-6c. Analysis of Past Operations: Groundwater Elevation Difference Contour Map at the End of the 2014 Recharge Cycle

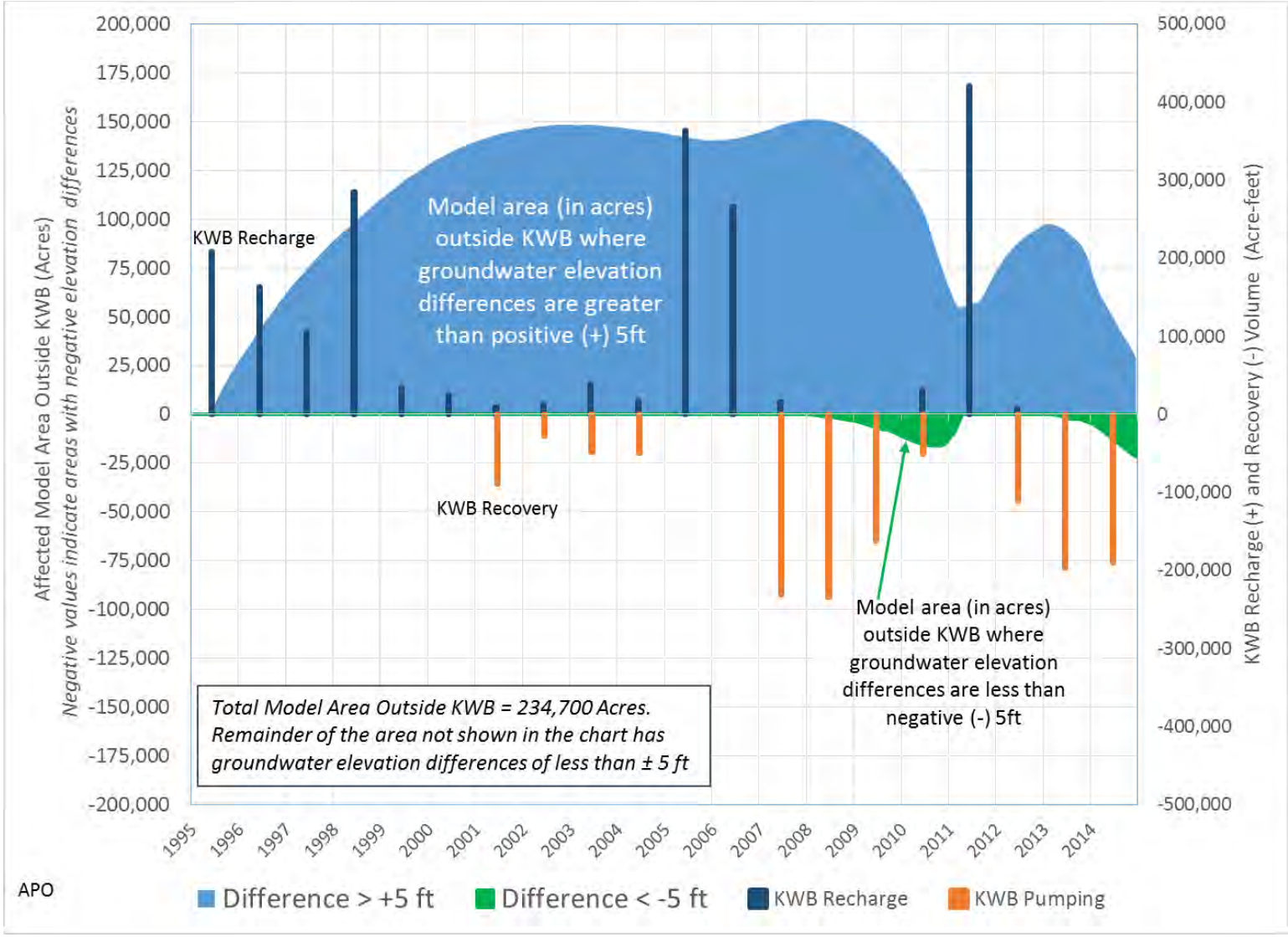


FIGURE 3.2-7. Analysis of Past Operations: Time vs. Affected Area Outside the Kern Water Bank Exceeding ± 5 Feet Differences in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 1995-2014

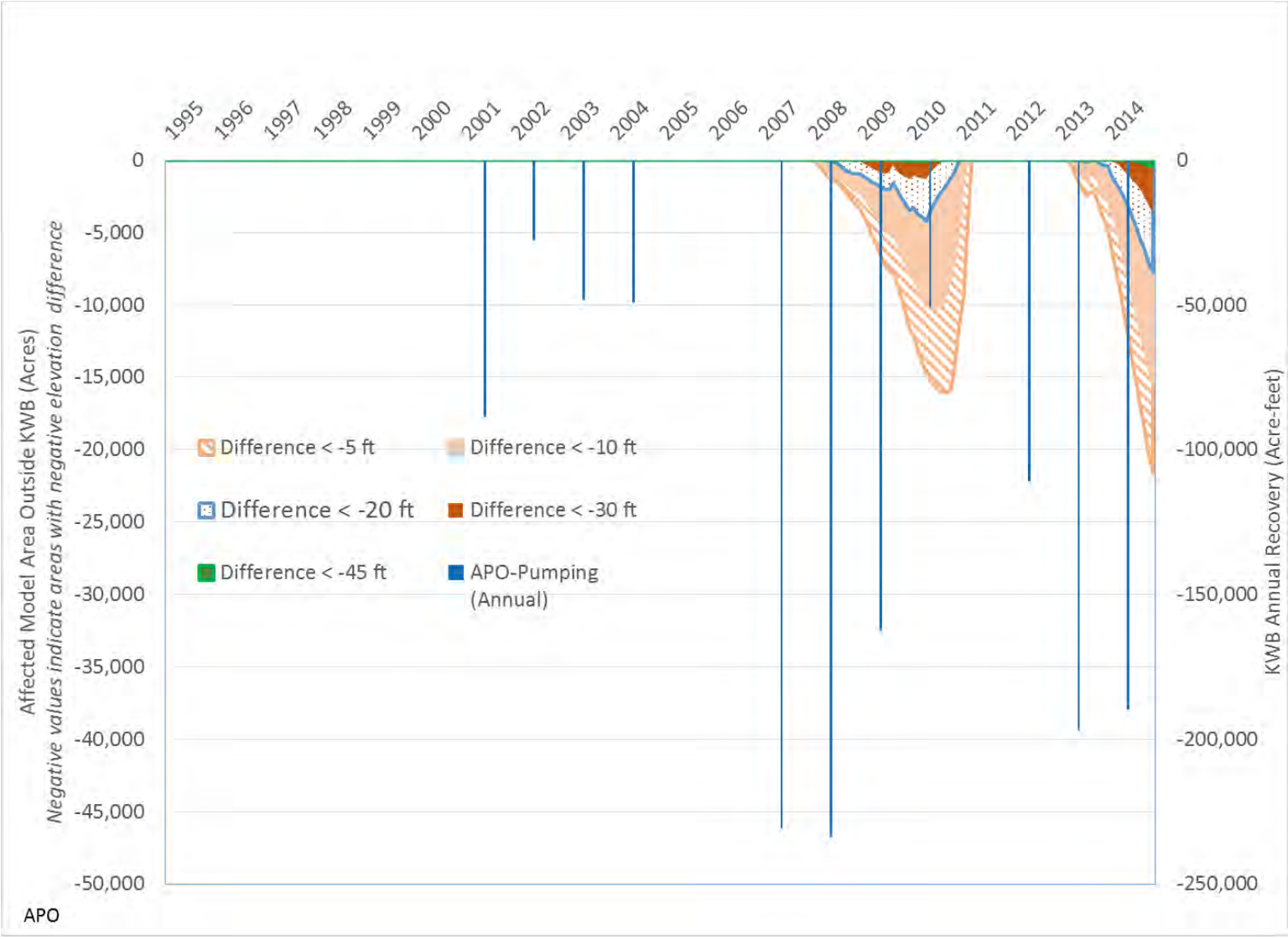


FIGURE 3.2-8. Analysis of Past Operations: Time vs. Affected Area Outside Kern Water Bank at Various Levels of Negative Elevation Differences ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 1995-2014

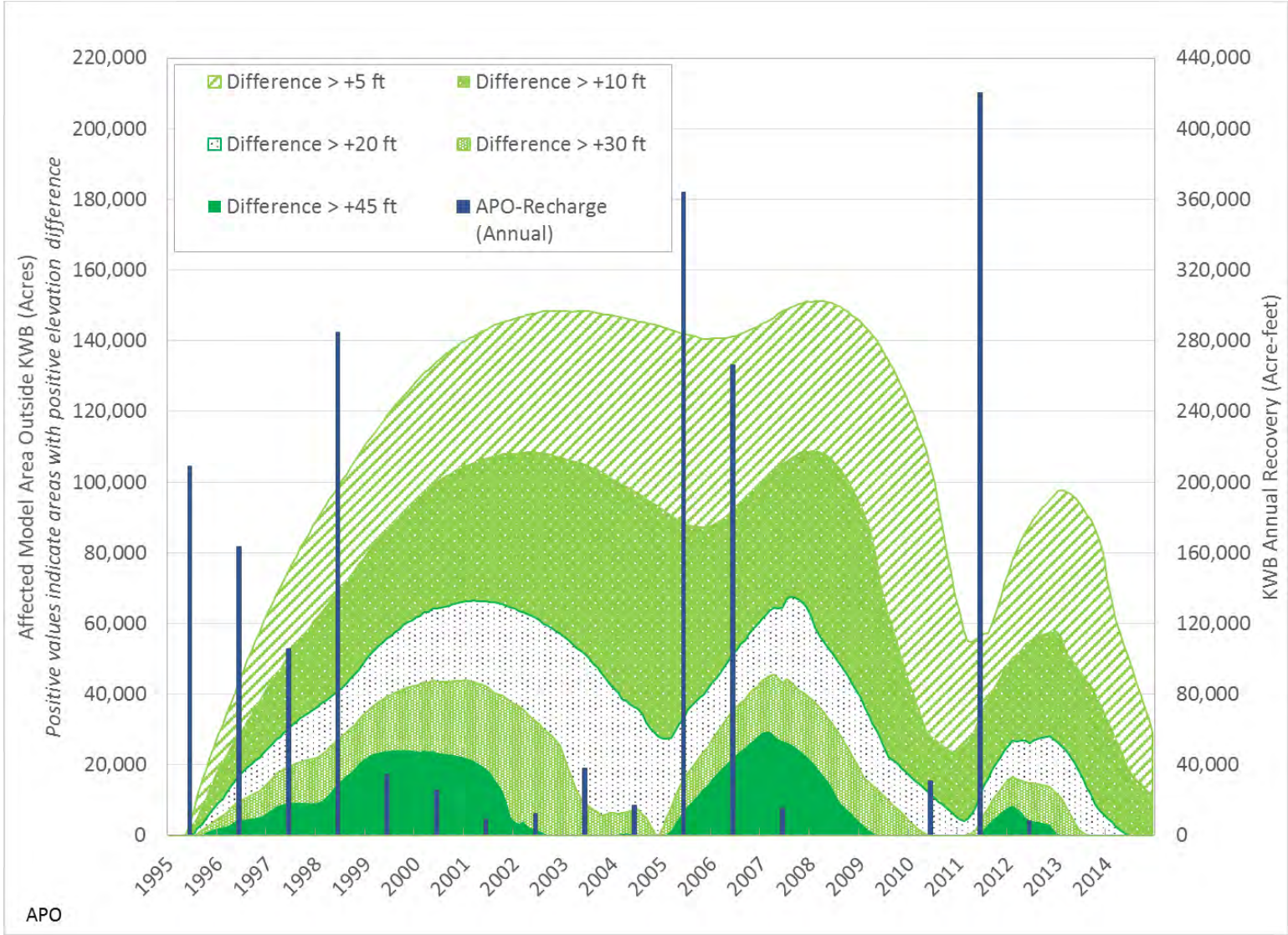


FIGURE 3.2-9. Analysis of Past Operations: Time vs. Affected Area Outside Kern Water Bank at Various Levels of Positive Elevation Differences ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 1995-2014

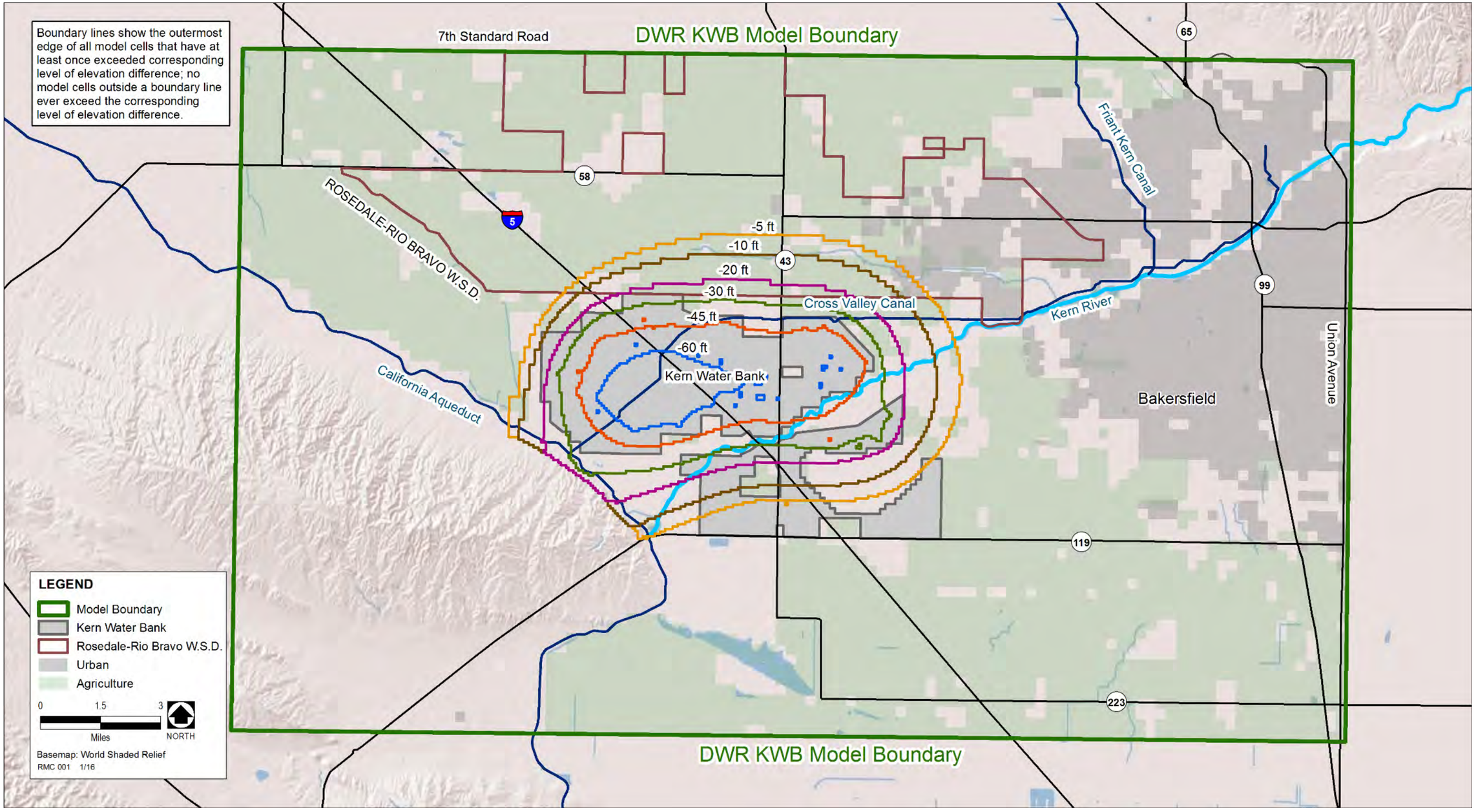


FIGURE 3.2-10. Analysis of Past Operations: Contours of Maximum Negative Differences ("With" minus "Without"), 1995-2014

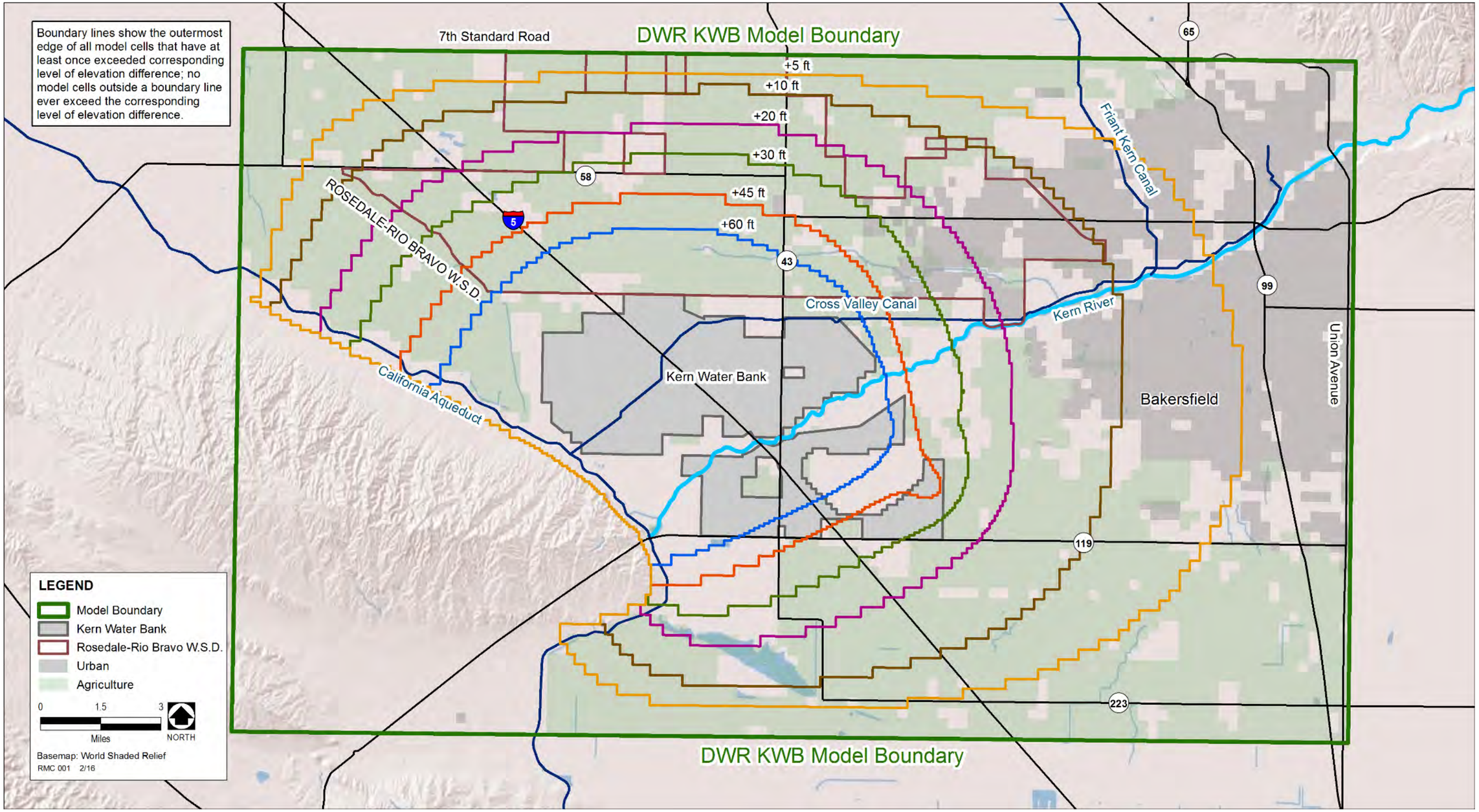


FIGURE 3.2-11. Analysis of Past Operations: Contours of Maximum Positive Elevation Differences ("With" minus "Without"), 1995–2014

Figure 3.2-11 shows the maximum spatial extent of positive elevation differences exceeding +5 feet, +10 feet, +20 feet, +30 feet, +45 feet, and +60 feet. Positive differences in groundwater elevation attributable to KWB operations spread as far as 6 miles from the northern and eastern edges of KWB Lands and as far as 4 miles from the southern edge of KWB Lands.

3.2.3.3 Acreages of Affected Areas

The -30 feet negative elevation difference boundary line (see Figure 3.2-10) extends into the agricultural area north and east of the KWB boundary. The negative differences in groundwater elevations between "With" and "Without" KWB operations spread into more agricultural areas as the specified levels change from -30 feet to -5 feet. Acreages where water level differences exceed specified levels are shown in Tables 3.2-2 and 3.2-3. Areas of affected agricultural and urban lands are shown in Tables 3.2-4 and 3.2-5.

3.2.4 FREQUENCY DISTRIBUTION OF GROUNDWATER ELEVATION DIFFERENCE

Maps were prepared to evaluate the location and frequency with which groundwater elevation differences between the APO "With KWB Operations" and "Without KWB Operations" scenarios exceeded selected values (Metric 6 of Section 3.1). Frequency distributions of negative groundwater elevation differences exceeding -45 feet, -30 feet, -20 feet, and -10 feet are shown in Figures 3.2-12a to 3.2-12d, respectively. Frequency distributions of groundwater elevation differences exceeding +10 feet, +30 feet, and +60 feet are shown in Figures 3.2-13a to 3.2-13c, respectively.

Figure 3.2-12a shows that negative elevation differences exceeding -45 feet are contained entirely within the KWB boundary at all times. Figure 3.2-12b shows that negative elevation differences exceeding -30 feet are contained entirely within the KWB boundary approximately 90 percent of the time.

Positive elevation differences exceeding +60 feet (Figure 3.2-13c) are mostly contained within the KWB boundary. Approximately 25 percent of the time such differences occur outside the KWB boundary, but in the immediate vicinity.

3.2.5 ZONAL AVERAGE GROUNDWATER ELEVATION HYDROGRAPHS

Average groundwater elevations outside KWB Lands (Metric 7 of Section 3.1) were evaluated at five 1-mile zones (Figure 3.2-14). Simulated head was averaged for each cell in a particular zone for each monthly time step of the simulation period. Average groundwater elevations for Zones 1–5 are shown in Figures 3.2-15a to 3.2-15e. Figure 3.2-16 shows the average elevation difference in each zone, which was calculated by subtracting the "Without KWB Operations" run from the "With KWB Operations" run data shown in Figures 3.2-15a to 3.2-15e. These figures indicate that the rise and fall of the groundwater mound follows KWB recharge and recovery cycles, and is correlated with the cumulative KWB storage balance. At a distance beyond approximately 2 miles outside the KWB boundary, the average groundwater elevation difference between the "With KWB Operations" and "Without KWB Operations" run is always positive.

3.2.6 HIGH GROUNDWATER LEVELS AND IMPACT ON INFRASTRUCTURE

Historic recharge operations at KWB during the recharge periods of 1996–1998, 2005–2006, and 2011, concomitant with similar recharge operations at other neighboring groundwater banks, resulted in high groundwater elevations within KWB Lands and the surrounding areas. High groundwater elevations resulted in some damages to Cross Valley Canal (CVC) lining in the mid-1990s.

High groundwater elevations could impact the existing infrastructure within and in the vicinity of the KWB. Large urban areas to the east and northeast of KWB Lands use septic system. Additionally, there are

small residential areas in the vicinity of KWB Lands that are on septic systems or dry wells. The CVC and residential area septic systems are the main infrastructure in the DWR KWB Model domain that might potentially be impacted by high water levels.

Results of APO model scenario were evaluated to determine the potential impact of KWB recharge operation during high groundwater elevations on the CVC and nearby areas on septic systems.

Figures 3.2-17 to 3.2-19 show the spatial characteristics of the groundwater mounds that form during recharge operations of 1999-1998, 2005-2006, and 2011 under APO conditions "With KWB Operations."

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

Figure 3.2-20 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 3.2-21 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 3.2-22 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 KWB Operations" and "Without KWB Operations" scenarios, 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.

Figure 3.2-23 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 KWB Operations" and "Without KWB Operations" scenarios and the ground surface elevation.

3.2.6.1 1995-1998 Recharge Operations

As shown in Figures 3.2-17 and 3.2-22, 1995-1999 recharge operations resulted in water levels rising to within 5 feet from ground surface along the section of the CVC in the western parts of KWB Lands, while the water levels were lower along the section of the CVC in the northern parts of KWB Lands and only rose to 20 feet from ground surface.

The recharge operations in 1995-1999 did not result in high enough water levels to impact the septic systems as the depth to water in residential areas with septic systems located north of KWB Lands exceeds 50 feet. As shown in Figure 3.2-23, 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

3.2.6.2 2005-2006 Recharge Operations

As shown in Figures 3.2-18 and 3.2-22, 2005-2006 recharge operations resulted in water levels rising to within 5 feet from ground surface along most of the CVC in western parts of KWB Lands, while the water levels were about 40 feet from ground surface along the section of the CVC in the northern parts of KWB Lands.

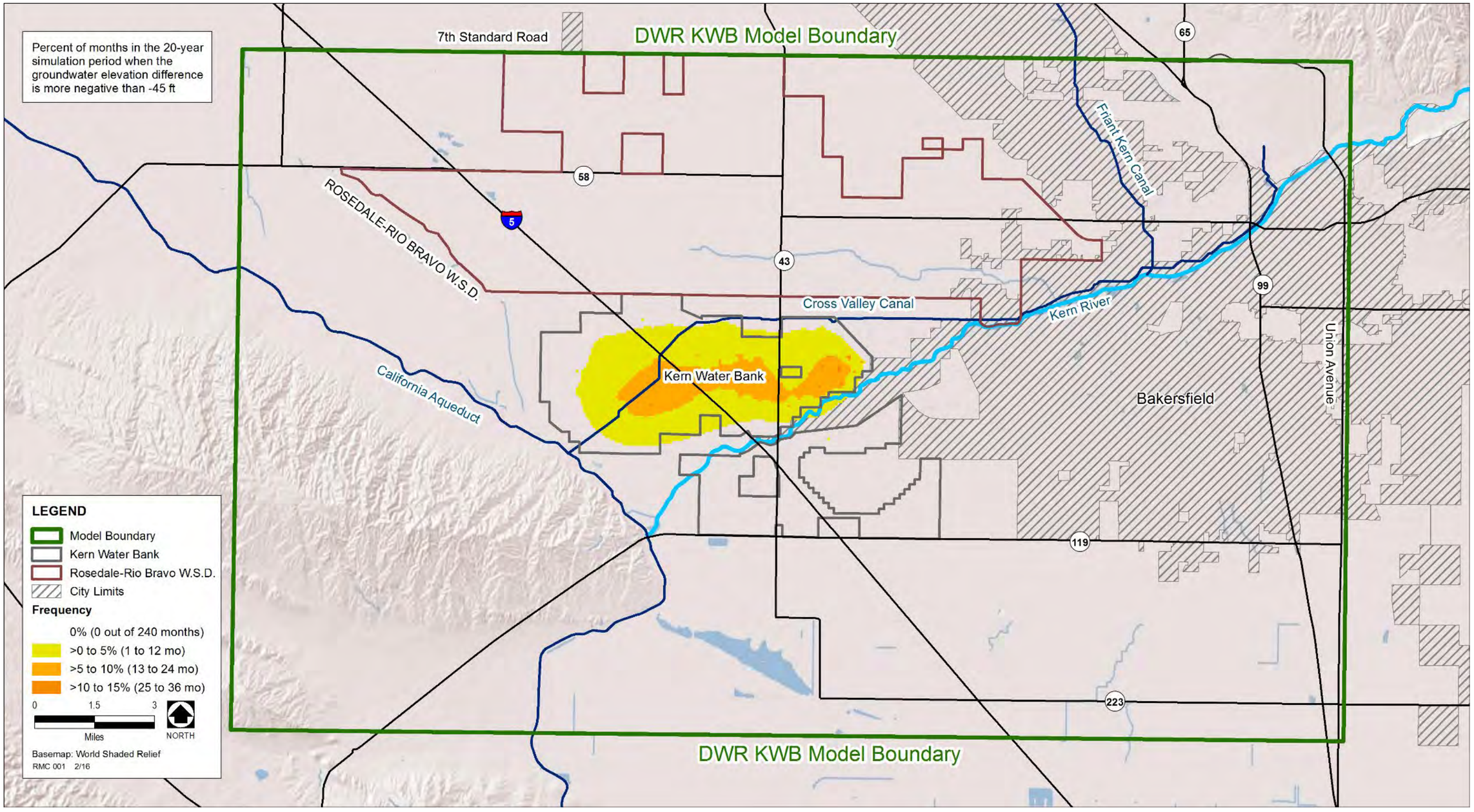


FIGURE 3.2-12a. Analysis of Past Operations: Frequency Distribution (% of Months) of Areas with > -45 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 1995-2014

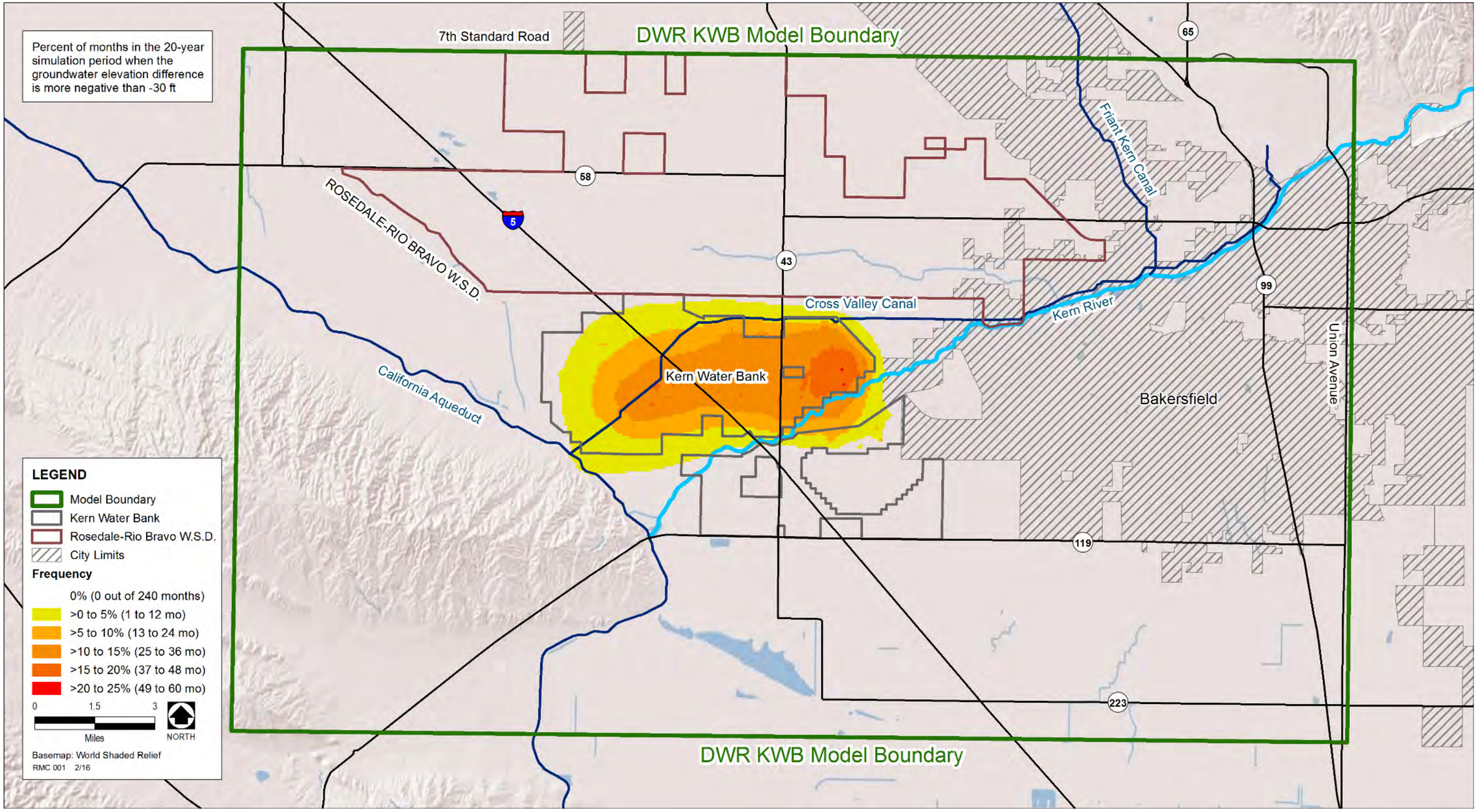


FIGURE 3.2-12b. Analysis of Past Operations: Frequency Distribution (% of Months) of Areas with > -30 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 1995-2014

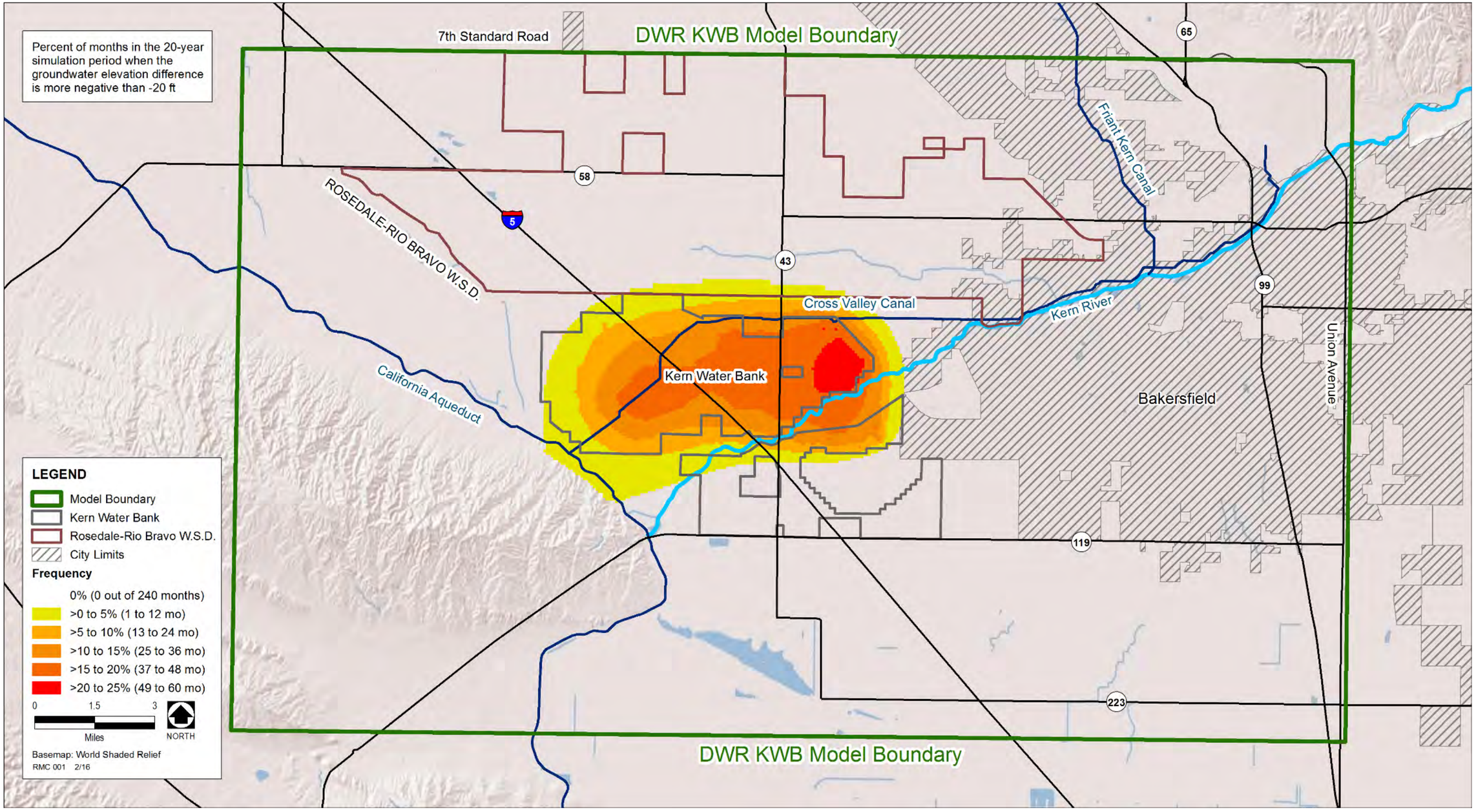


FIGURE 3.2-12c. Analysis of Past Operations: Frequency Distribution (% of Months) of Areas with > -20 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 1995-2014

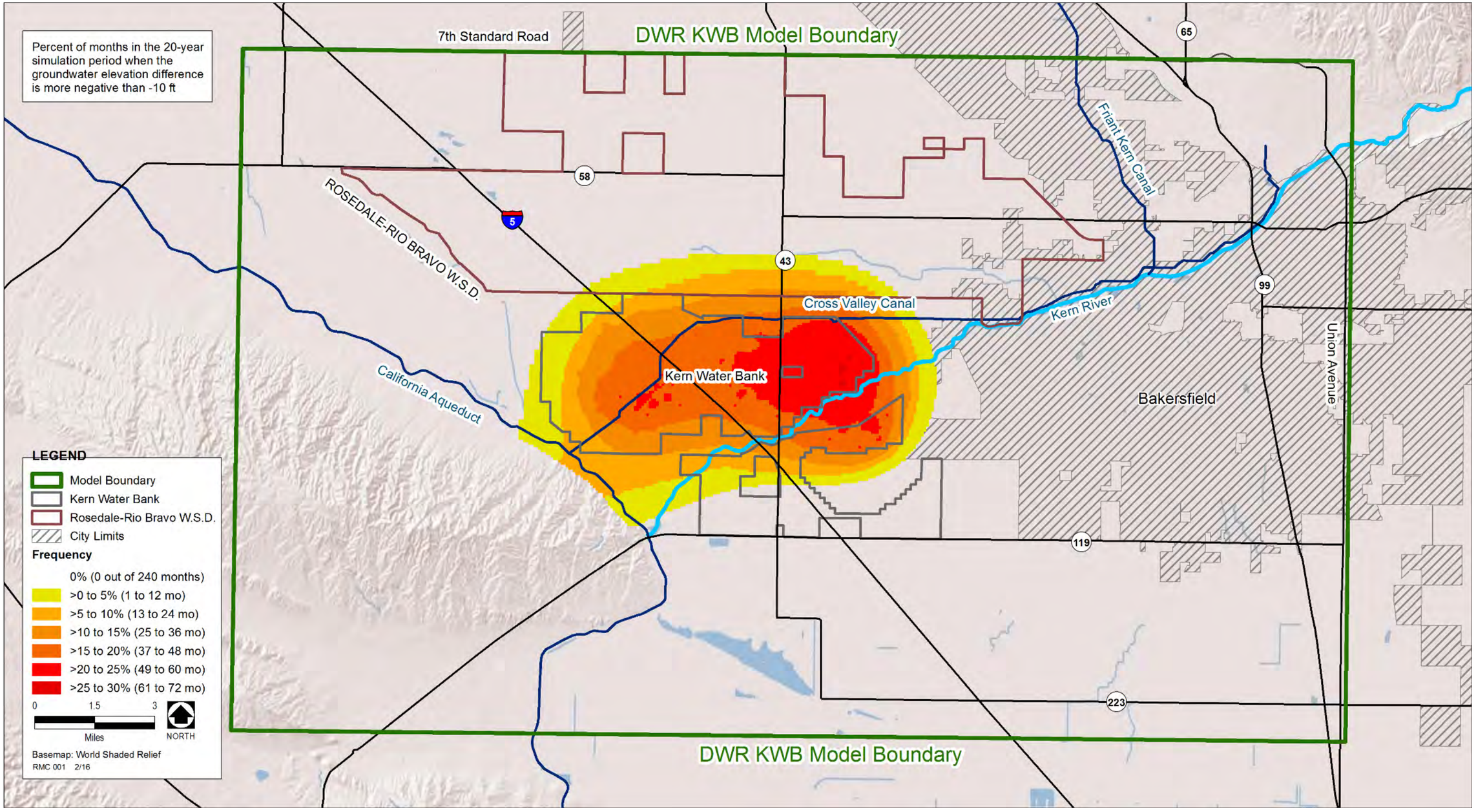


FIGURE 3.2-12d. Analysis of Past Operations: Frequency Distribution (% of Months) of Areas with > -10 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 1995-2014

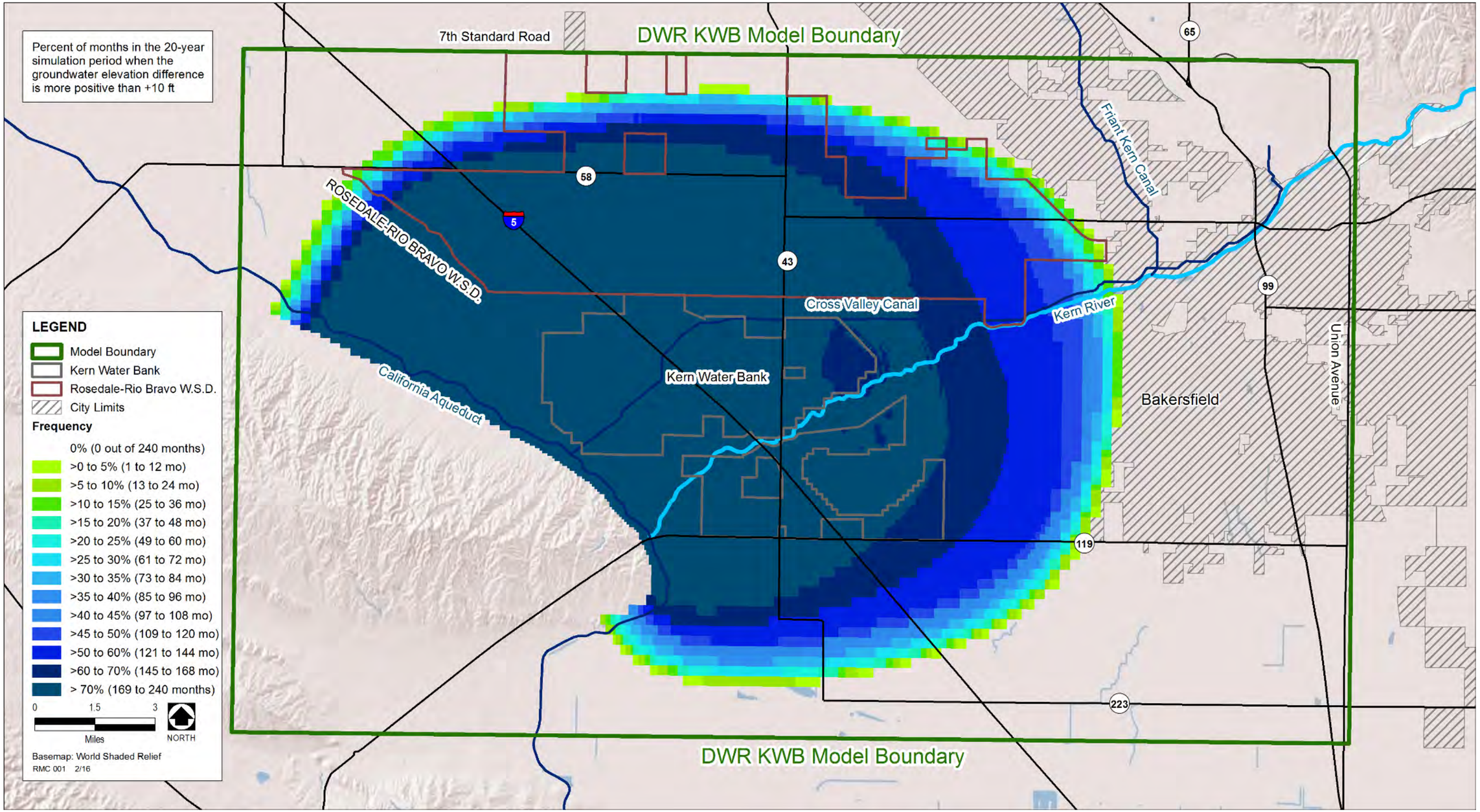


FIGURE 3.2-13a. Analysis of Past Operations: Frequency Distribution (% of Months) of Areas with > +10 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 1995-2014

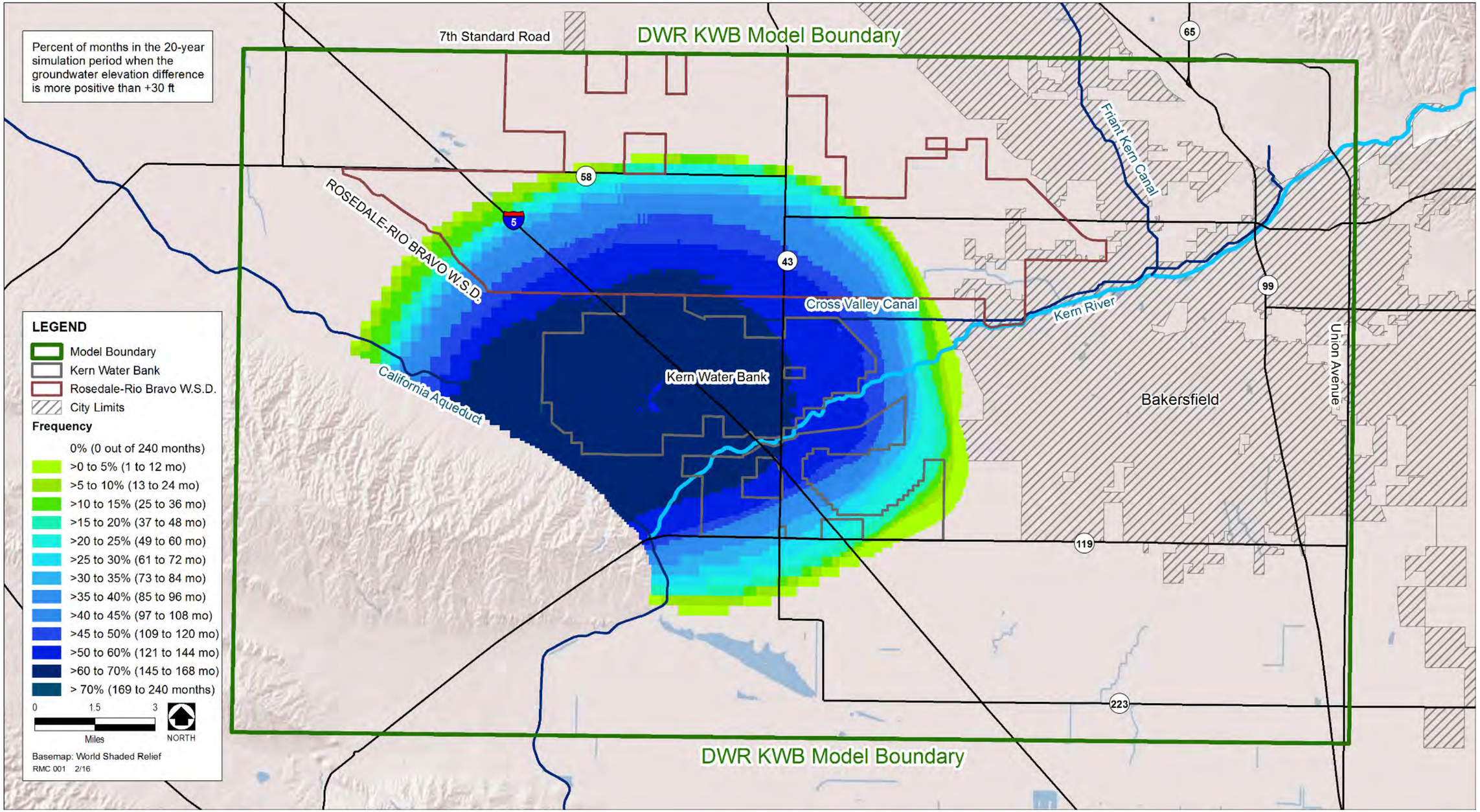


FIGURE 3.2-13b. Analysis of Past Operations: Frequency Distribution (% of Months) of Areas with > +30 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 1995-2014

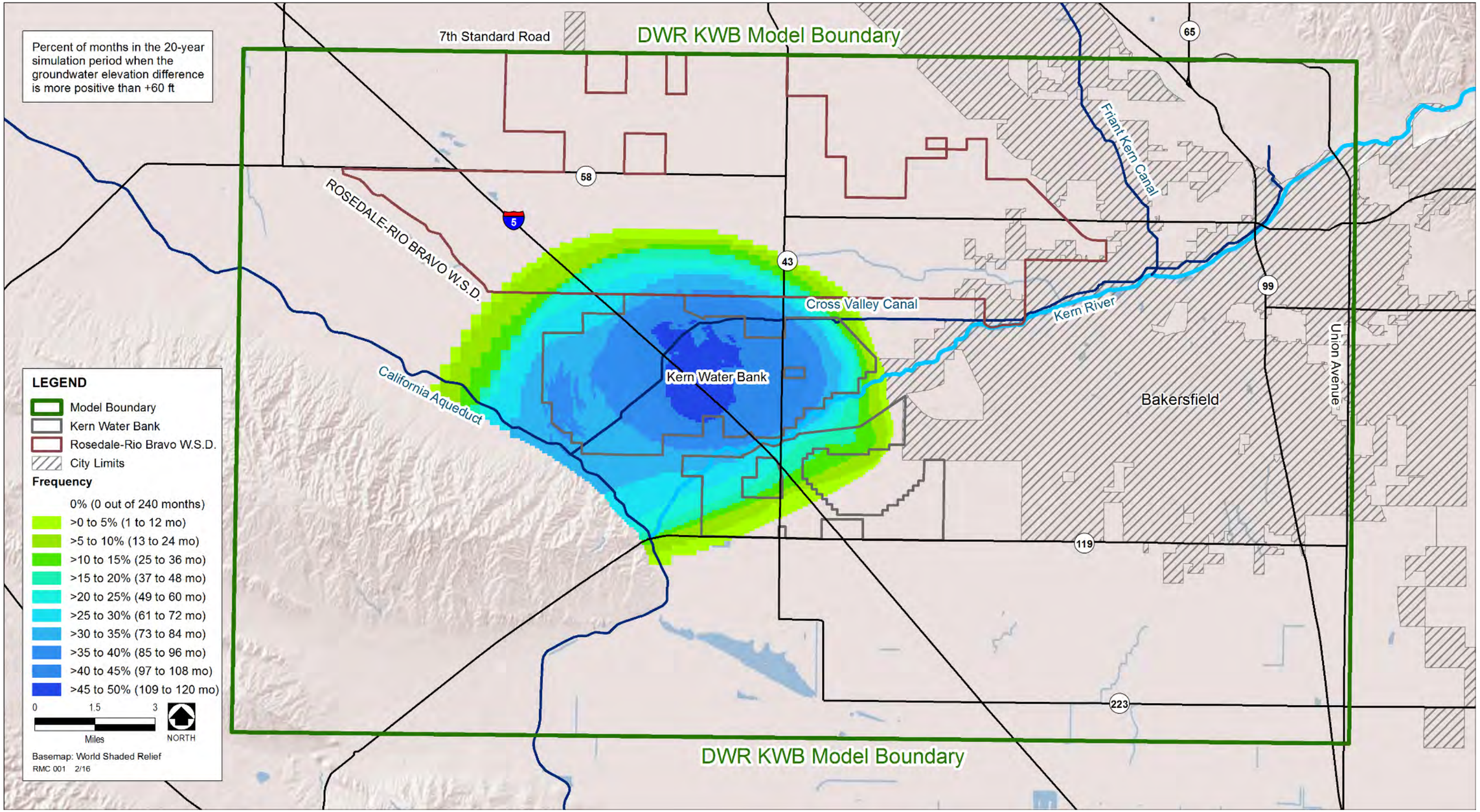


FIGURE 3.2-13c. Analysis of Past Operations: Frequency Distribution (% of Months) of Areas with > +60 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 1995-2014

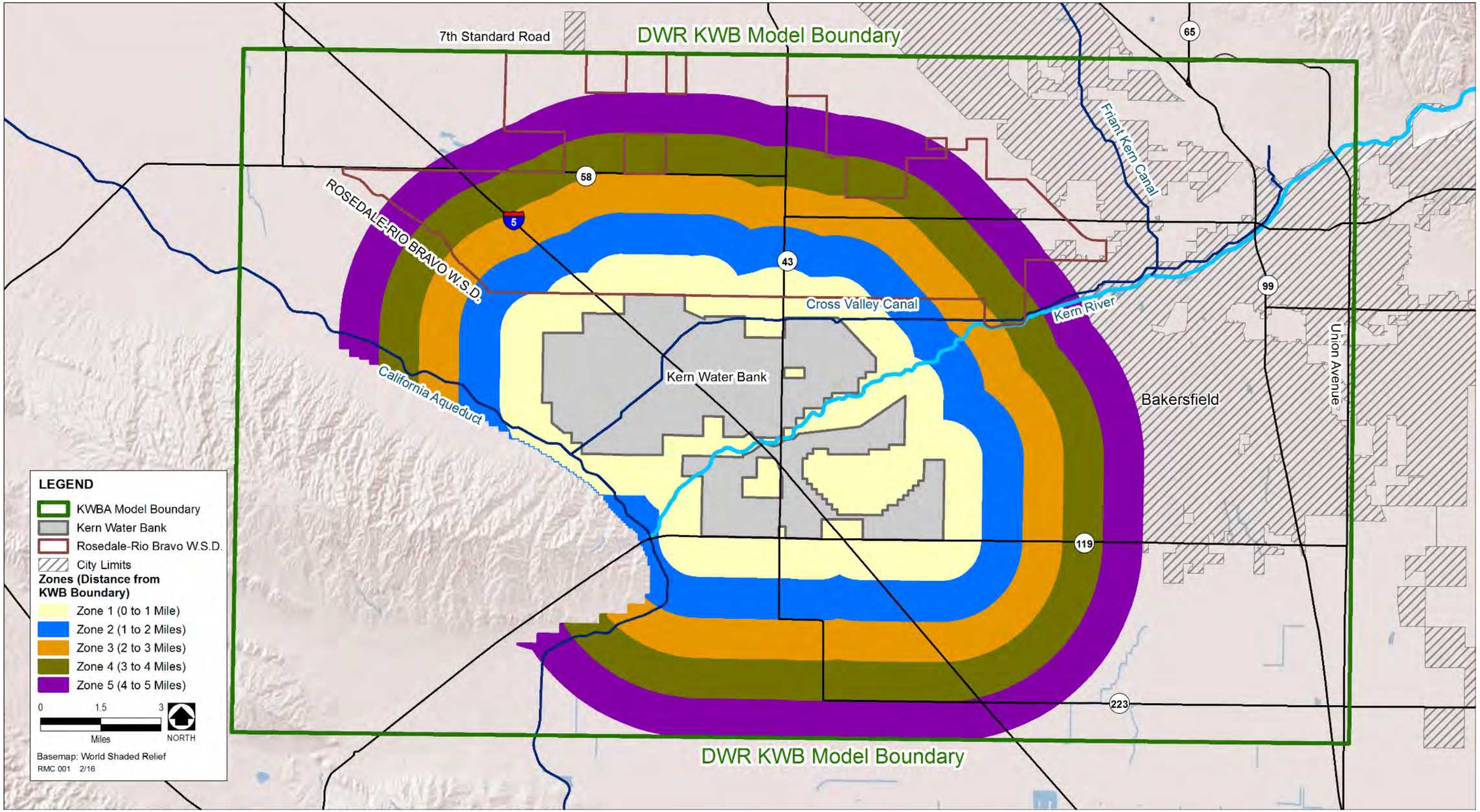


FIGURE 3.2-14. Area Zones Outside the Kern Water Bank Boundary

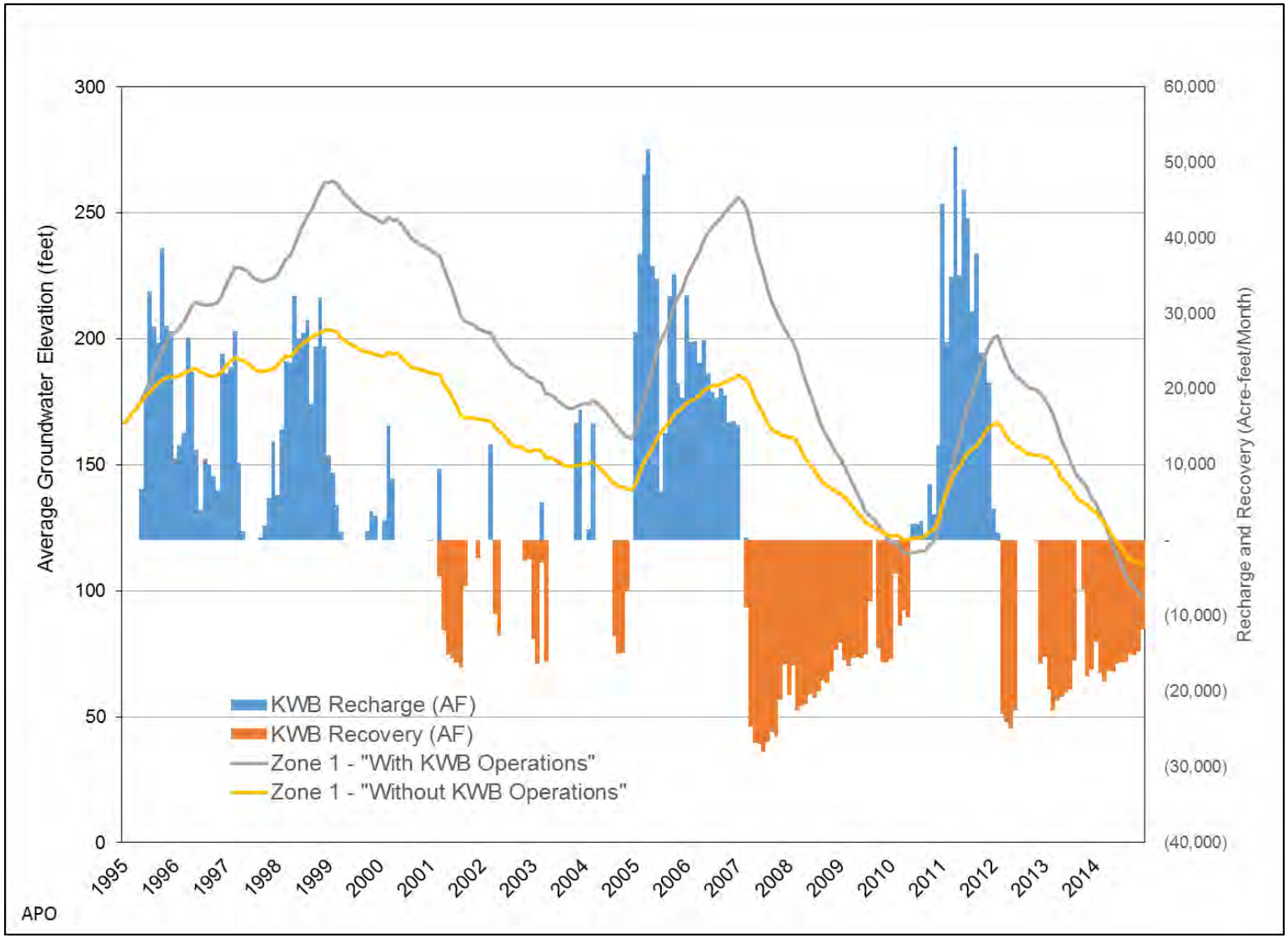


FIGURE 3.2-15a. Analysis of Past Operations: Average Groundwater Elevation Over Zone 1 (0 to 1 Mile Outside the Kern Water Bank Boundary), 1995-2014

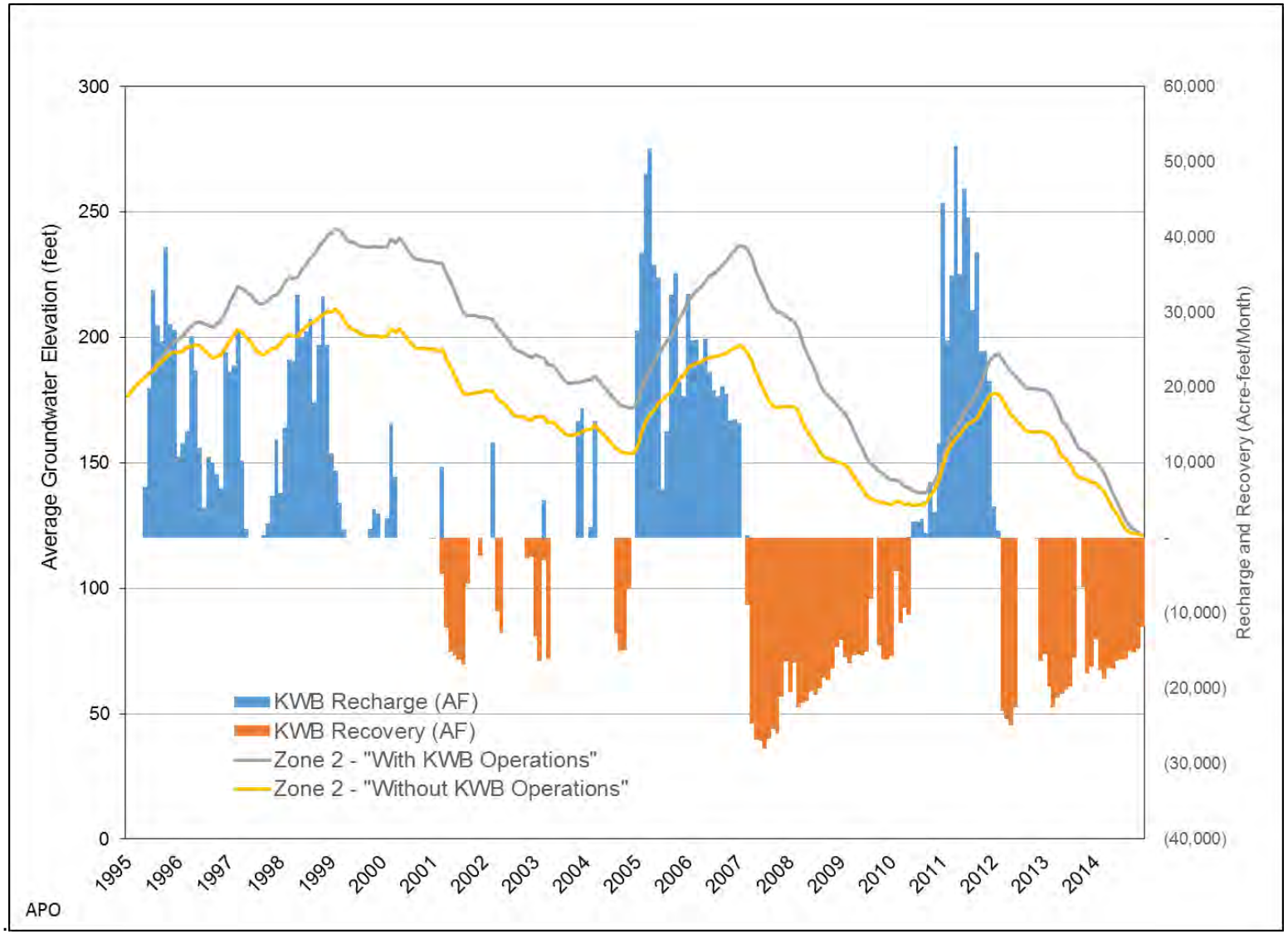


FIGURE 3.2-15b. Analysis of Past Operations: Average Groundwater Elevation Over Zone 2 (1 to 2 Miles Outside the Kern Water Bank Boundary), 1995-2014

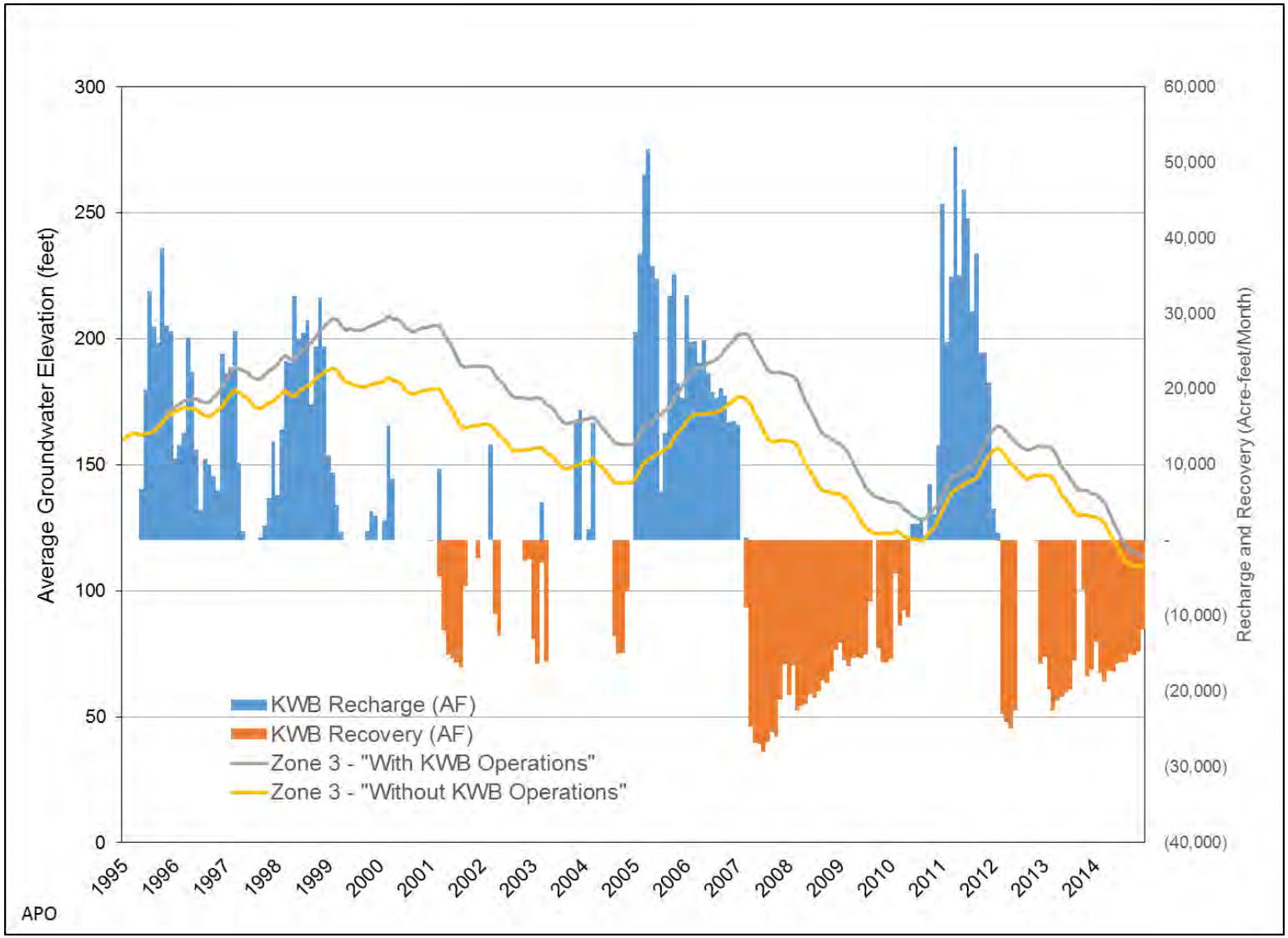


FIGURE 3.2-15c. Analysis of Past Operations: Average Groundwater Elevation Over Zone 3 (2 to 3 Miles Outside the Kern Water Bank Boundary), 1995-2014

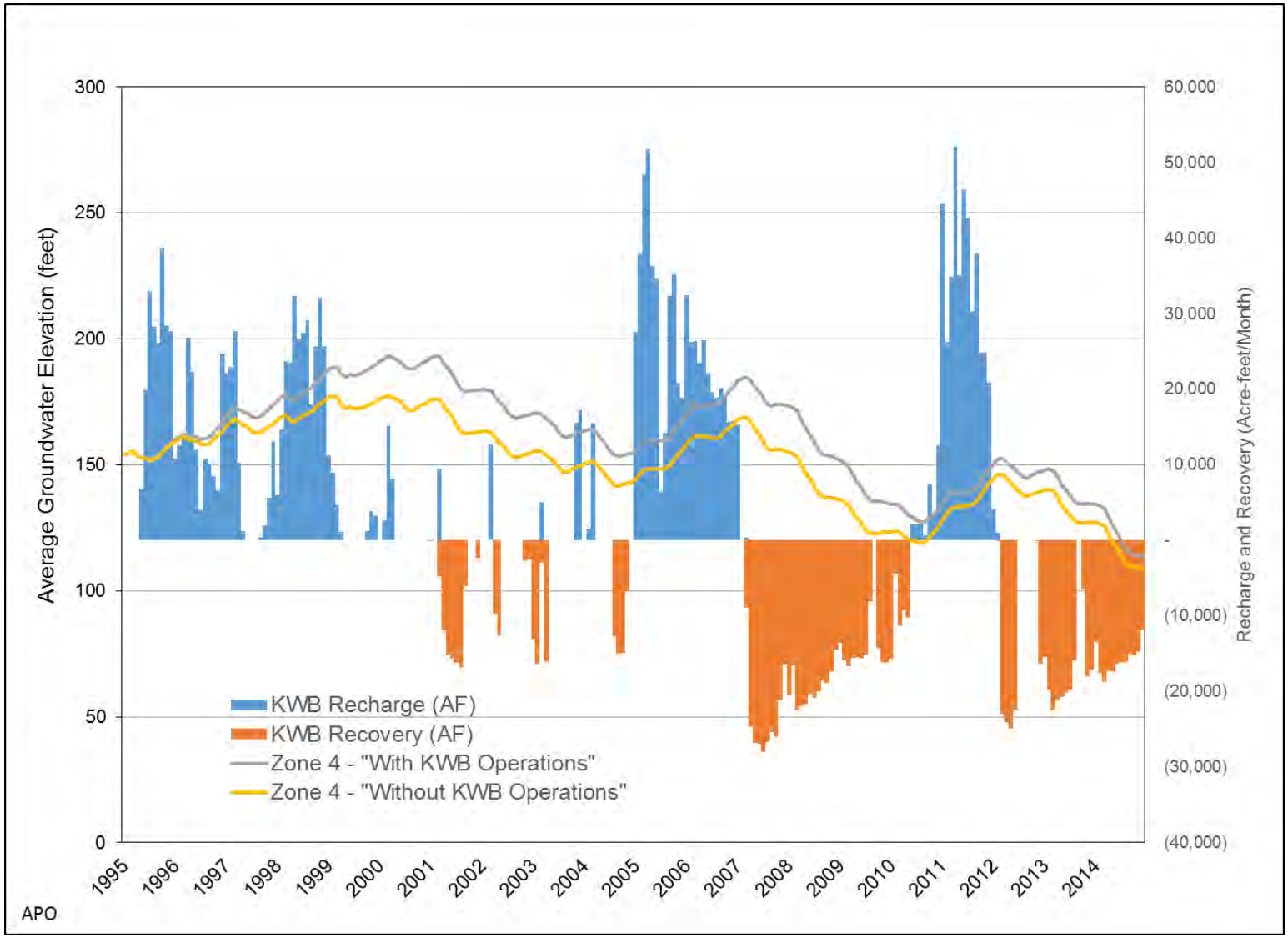


FIGURE 3.2-15d. Analysis of Past Operations: Average Groundwater Elevation Over Zone 4 (3 to 4 Miles Outside the Kern Water Bank Boundary), 1995-2014

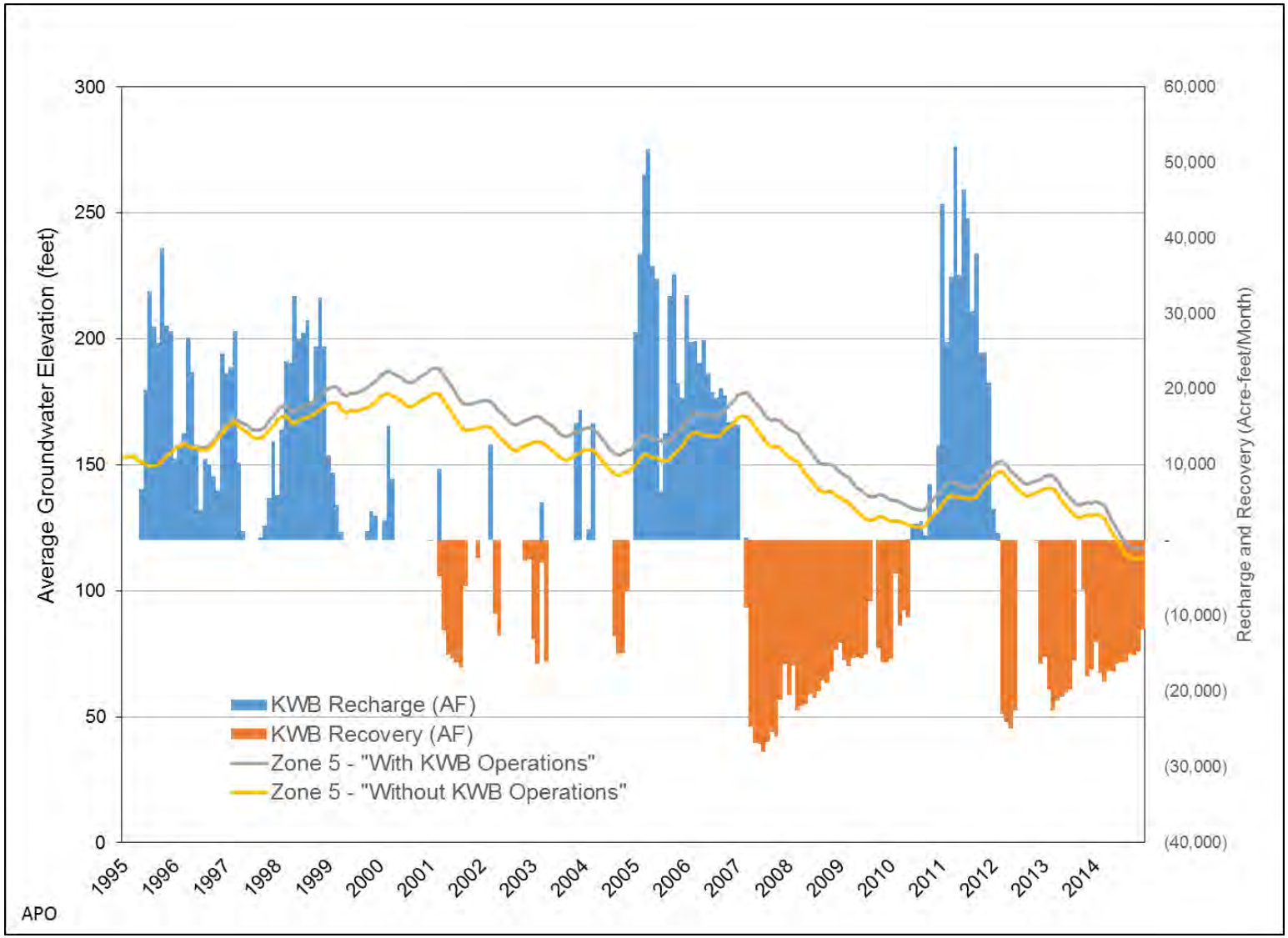


FIGURE 3.2-15e. Analysis of Past Operations: Average Groundwater Elevation Over Zone 5 (4 to 5 Miles Outside the Kern Water Bank Boundary), 1995-2014

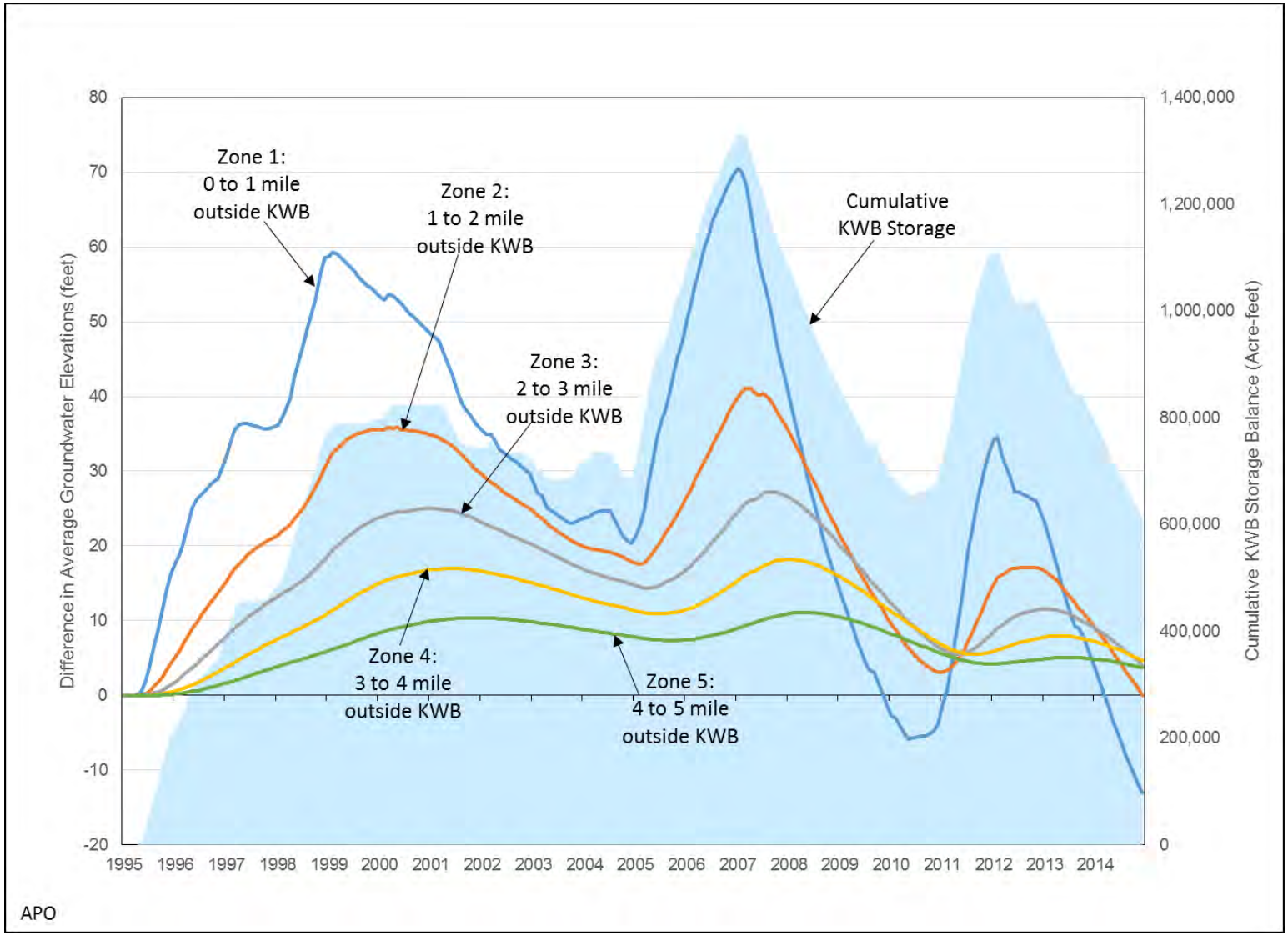


FIGURE 3.2-16. Analysis of Past Operations: Average Groundwater Elevation Differences in Zones Outside the Kern Water Bank Boundary, 1995-2014

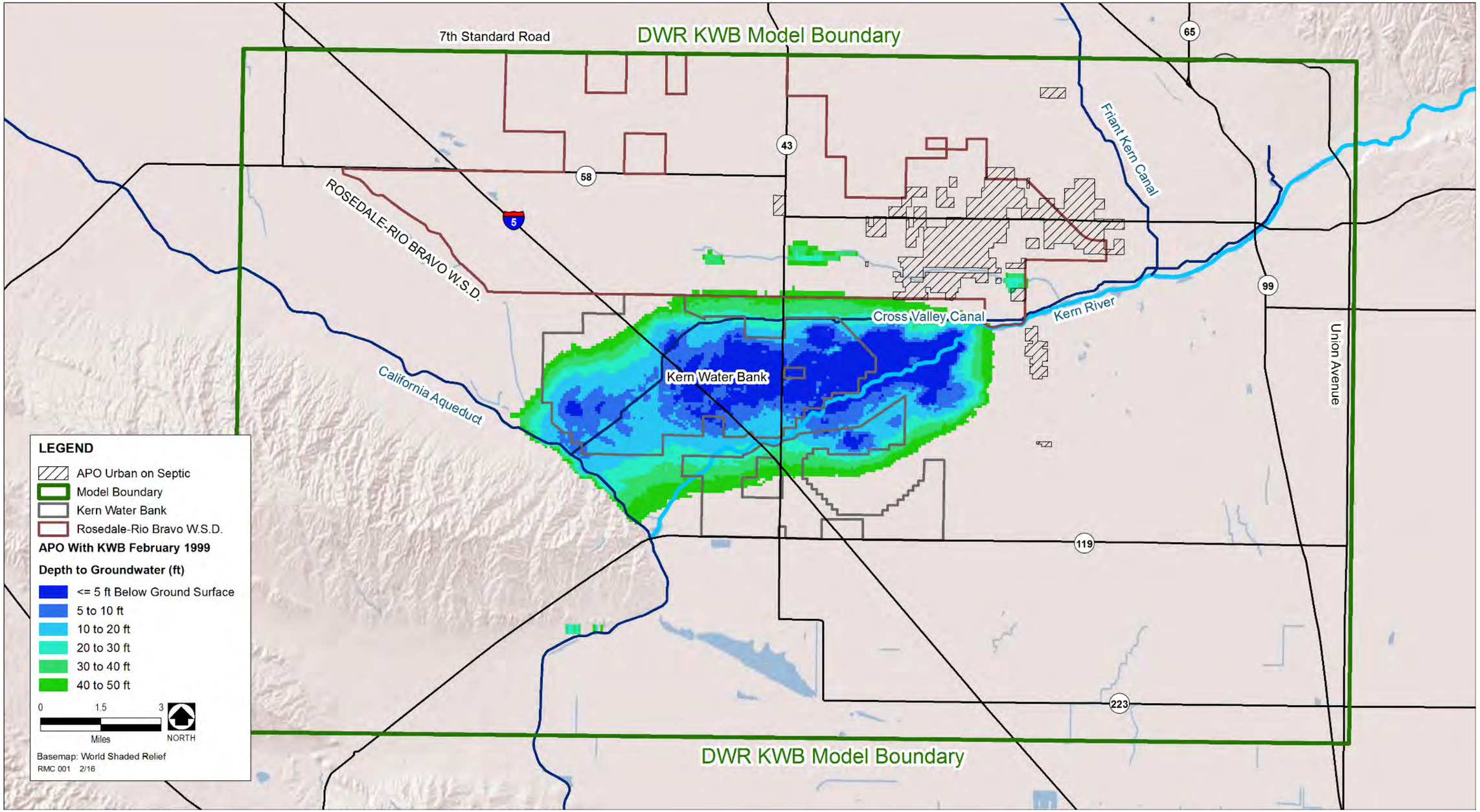


FIGURE 3.2-17. Analysis of Past Operations: Depth to Groundwater Contour Map, February 1999

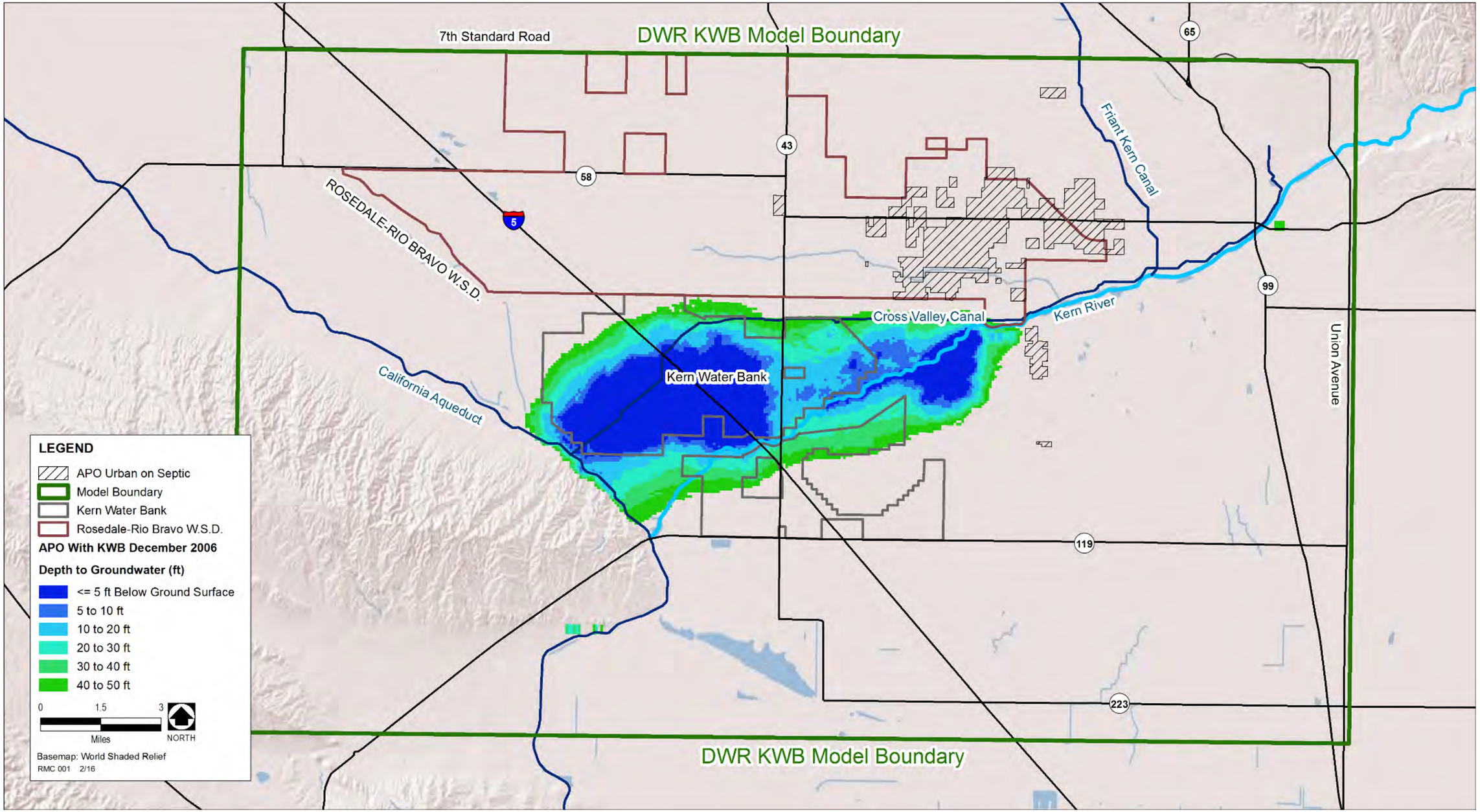


FIGURE 3.2-18. Analysis of Past Operations: Depth to Groundwater Contour Map, December 2006

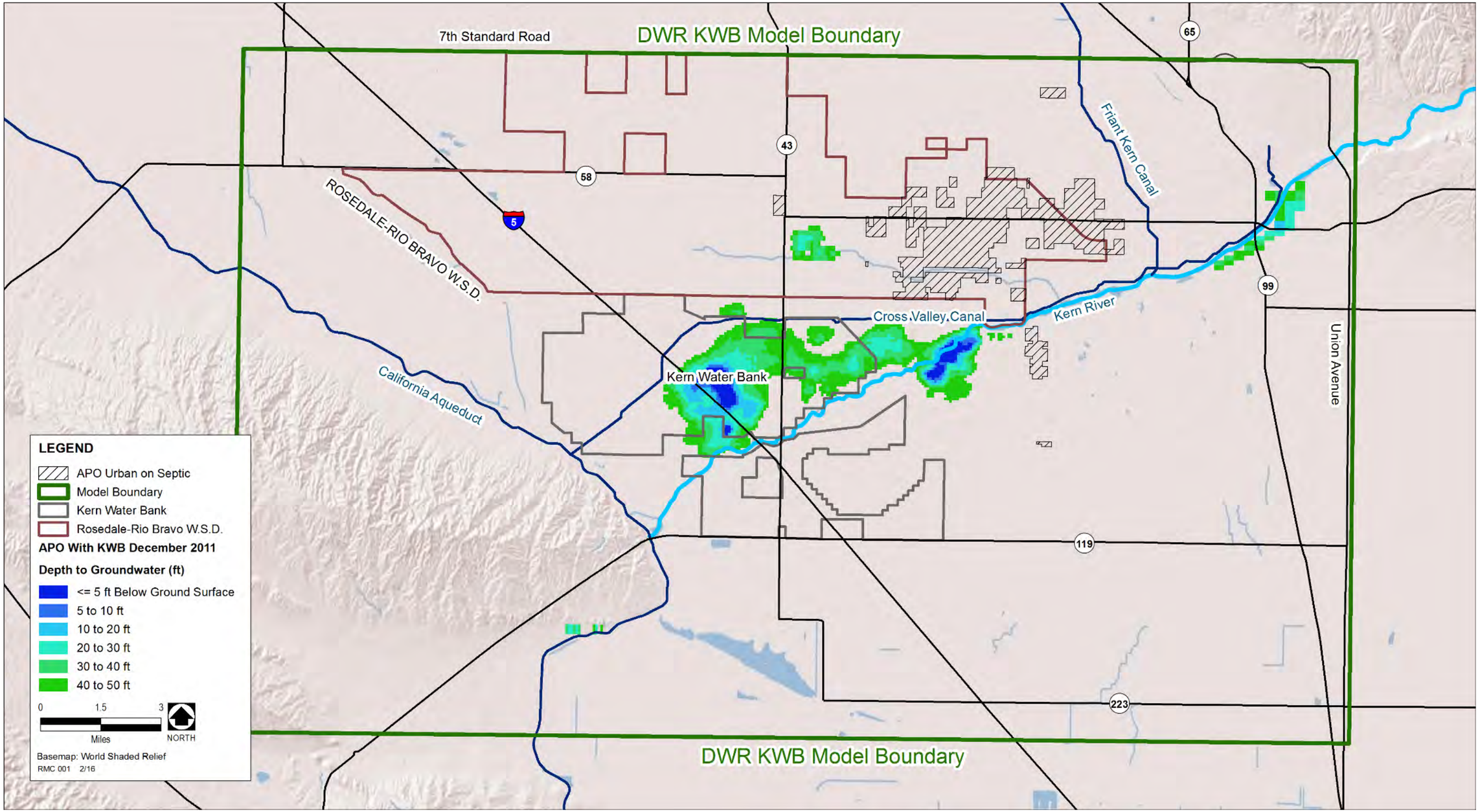


FIGURE 3.2-19. Analysis of Past Operations: Depth to Groundwater Contour Map, December 2011

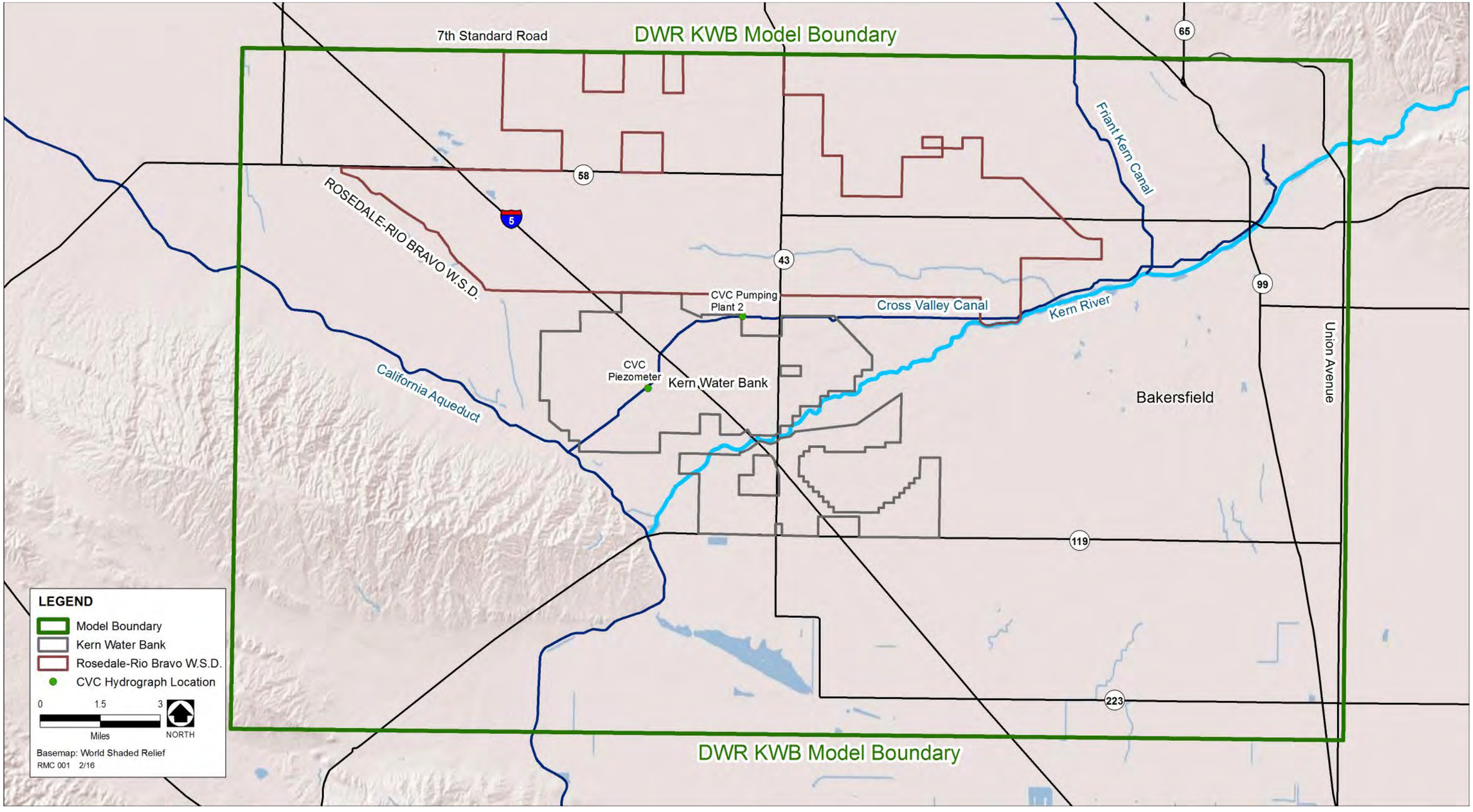


FIGURE 3.2-20. Selected Hydrograph Locations along the CVC

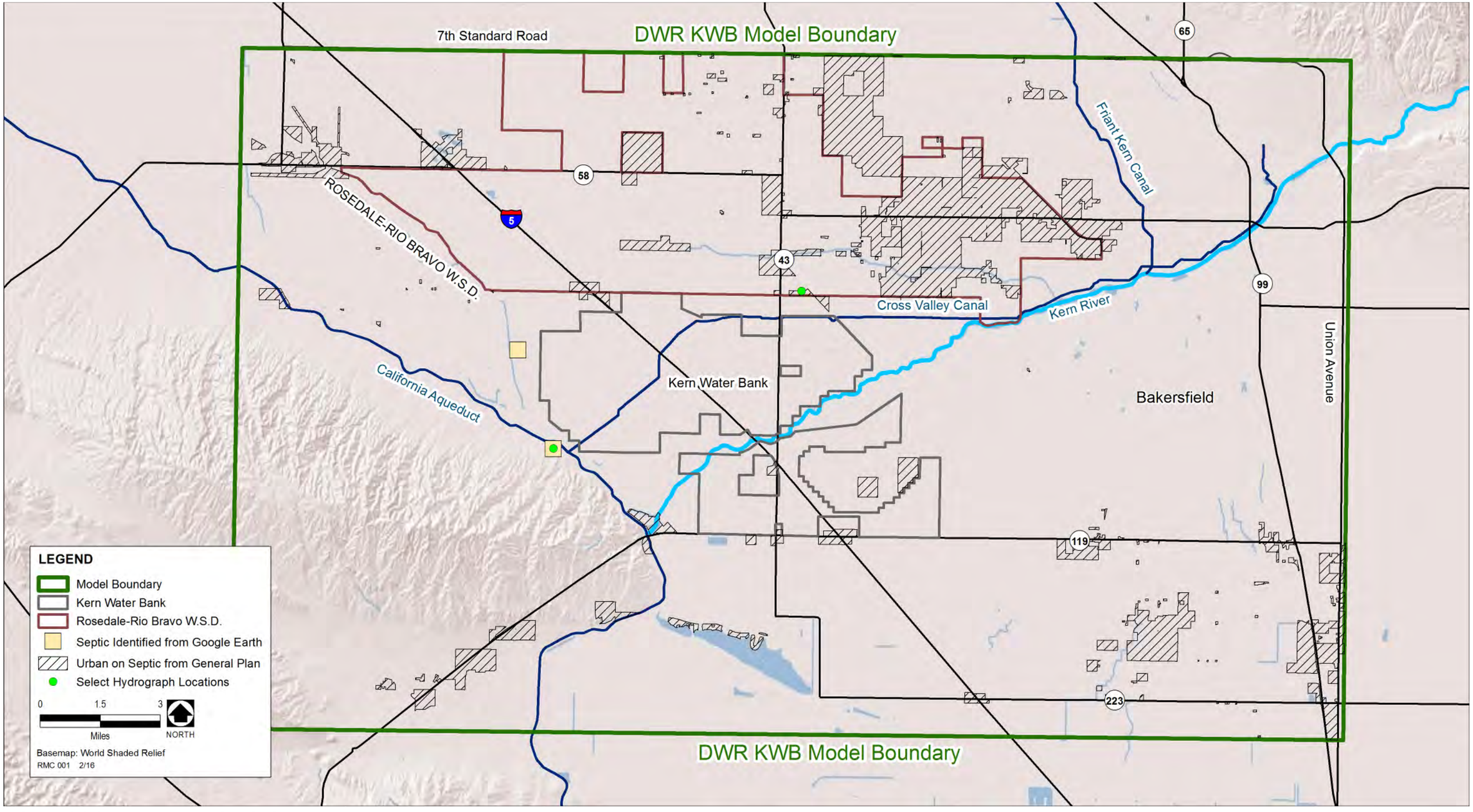
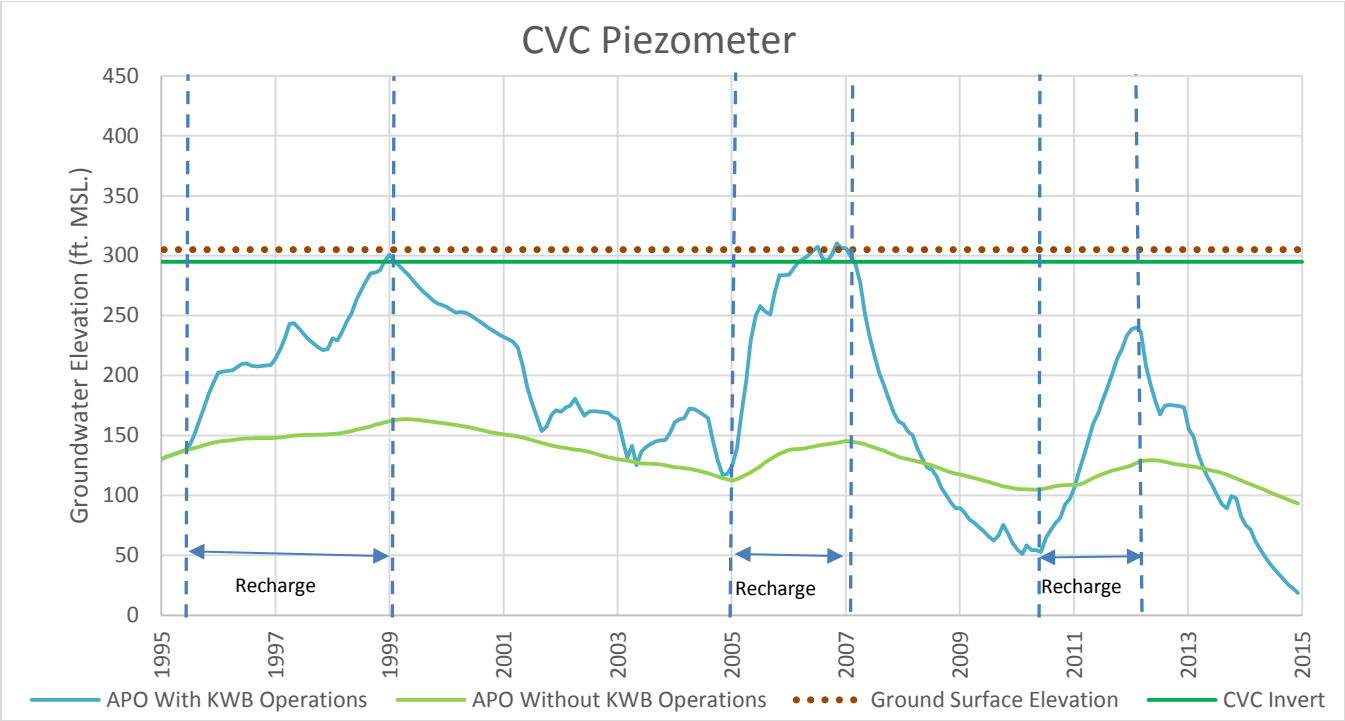


FIGURE 3.2-21. Areas on Septic Systems



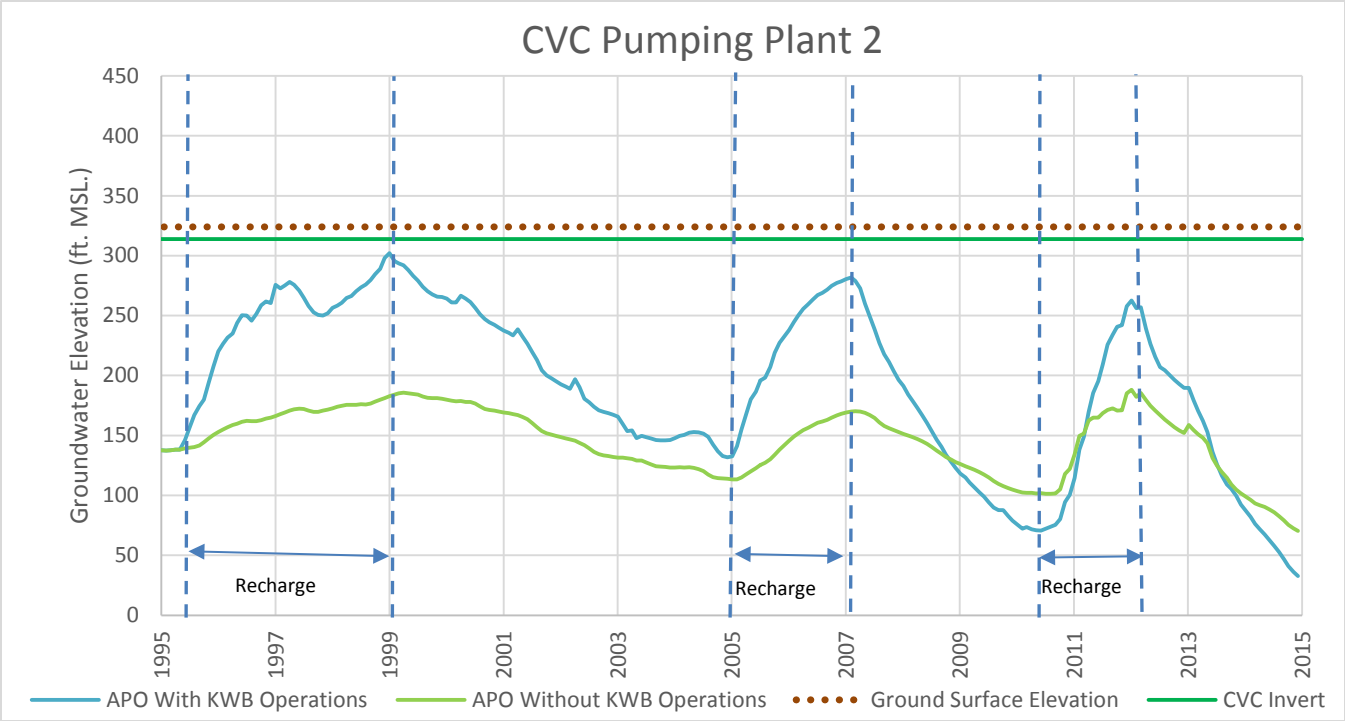


FIGURE 3.2-22. Groundwater Elevation Hydrographs at Selected Locations along the Cross Valley Canal for APO Scenario, 1995-2015

As shown in Figure 3.2-23 and 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.

3.2.6.3 2011 Recharge Operations

As shown in Figure 3.2-19 and 3.2-22, water levels were lower than 50 feet from surface along the entire length of the CVC in the KWB area. Water levels were generally lower than 1995-1999 and 2005-2006 levels. This is partly due to 2011 being a single-year recharge period while the other two recharge periods are 4- and 2-year recharge periods, respectively. KWBA also shifted a larger percentage of recharge water in 2011 to mitigate the low water levels on the east side of KWB Lands.

As shown in Figure 3.2-23, 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.

Piezometers have been installed along the CVC for detecting and monitoring shallow groundwater conditions near the CVC. Kern County Water Agency (KCWA) and KWBA have developed operating guidelines during shallow groundwater conditions. The Operating Guidelines include three major components: piezometer installation, groundwater monitoring, and evaluation of groundwater condition.

3.2.7 HIGH GROUNDWATER LEVELS AND IMPACT ON NEIGHBORING RECHARGE FACILITIES

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

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 3.2-24 shows the locations of the selected water level hydrographs at the neighboring recharge facilities. Figure 3.2-25 shows the water level hydrographs at these locations. Table 3.2-6 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.

3.2.7.1 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 (West Kern WD) is resolved by an existing agreement between West Kern WD and KWBA.

3.2.7.2 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 would not preclude recharge operations of neighboring groundwater banks.

3.2.7.3 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 are not expected to impact neighboring groundwater banks.

3.2.8 ANALYSIS OF PAST OPERATIONS RESULTS SUMMARY

A summary of the evaluation of effects of KWB historical operations during 1995–2014 on the groundwater table is provided in Table 3.2-7 for the APO scenario. Consecutive years of recovery attributable to historical KWB operations under the historical level of development may cause groundwater levels to fall such that existing wells in the area immediately outside the KWB boundary are impacted. In contrast, consecutive years of recharge may cause groundwater levels to rise and impact sections of the CVC within KWB Lands.

3.3 RESULTS OF ANALYSIS OF FUTURE OPERATIONS UNDER EXISTING CONDITIONS SCENARIOS

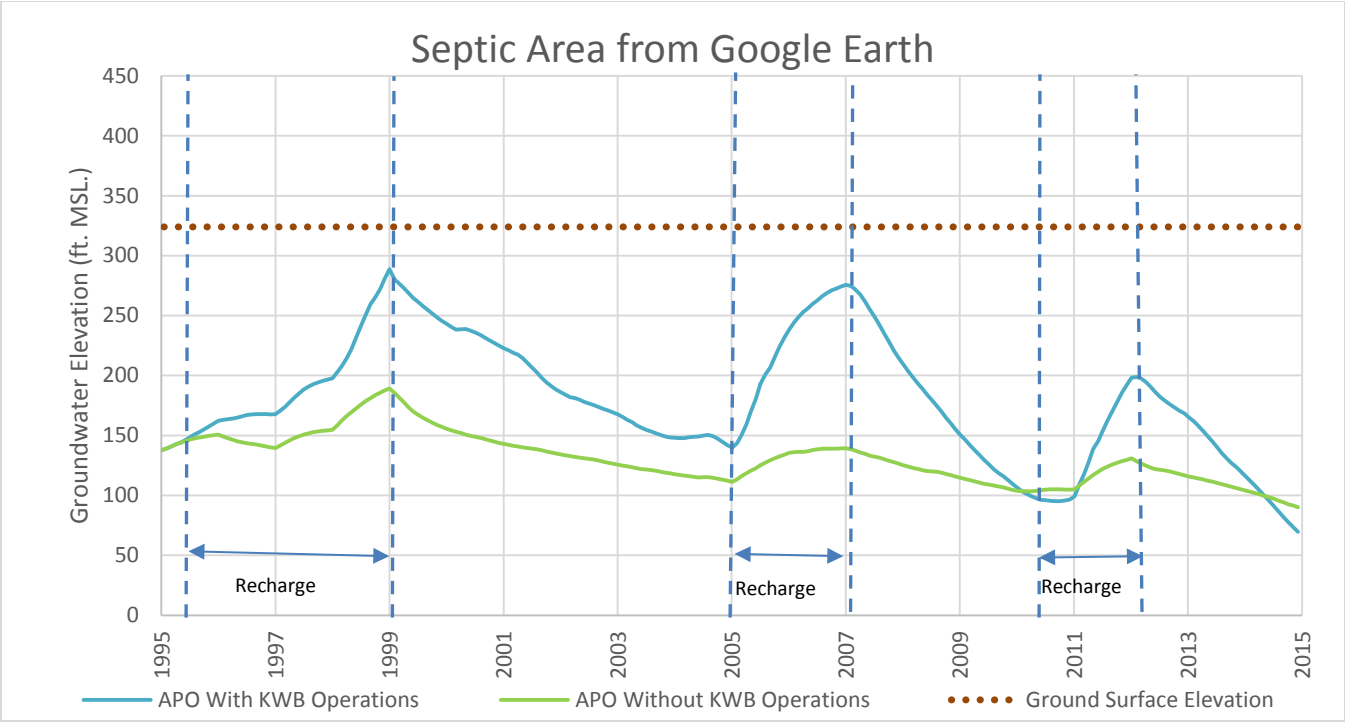
The results of the AFO-EC “With KWB Operations” and “Without KWB Operations” runs are presented in the following subsections.

3.3.1 WATER BUDGET AND RECHARGE AND RECOVERY AT THE KERN WATER BANK

The AFO-EC “With KWB Operations” run was used to develop an annual water budget for the entire model domain for the 2015–2035 future operation period. Table 3.3-1 shows key components of the water budget, including the change in groundwater storage.

As with the APO scenario (Section 3.2.1), boundary inflow and outflow components are the largest components of the water budget for the DWR KWB Model area. Boundary inflow, with an annual average of approximately 300,000 AFY, is approximately 8,413,000 AF for the 2015–2035 AFO-EC future operation period. Boundary outflow, with an annual average of approximately 272,000 AFY, is approximately 5,720,000 AF over the same period.

Agricultural and urban water demands during the 2015–2035 period are partially met by a total of 8,845,000 AF of agricultural pumping and 1,727,000 AF of urban pumping. Approximately 1,947,000 AF of applied water is projected to return to the aquifer as deep percolation.



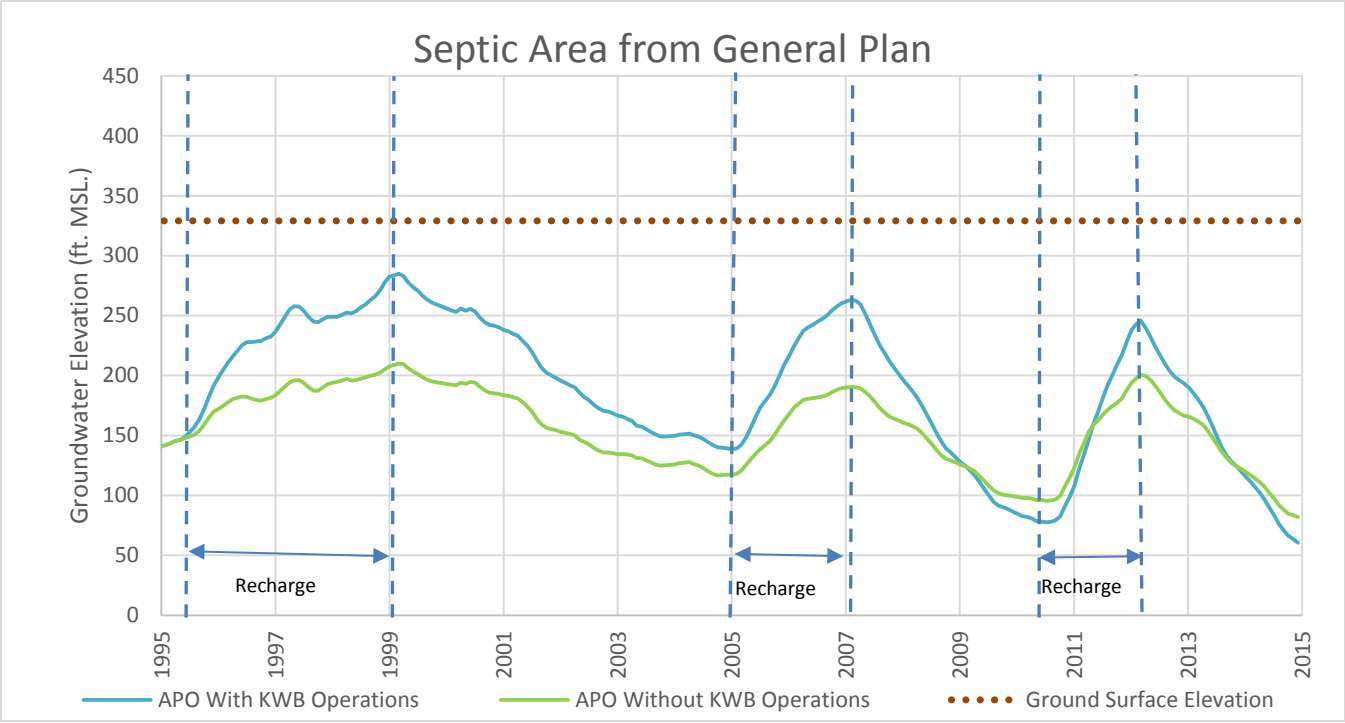


FIGURE 3.2-23. Groundwater Elevation Hydrographs at Selected Areas on Septic Systems for APO Scenario, 1995-2015

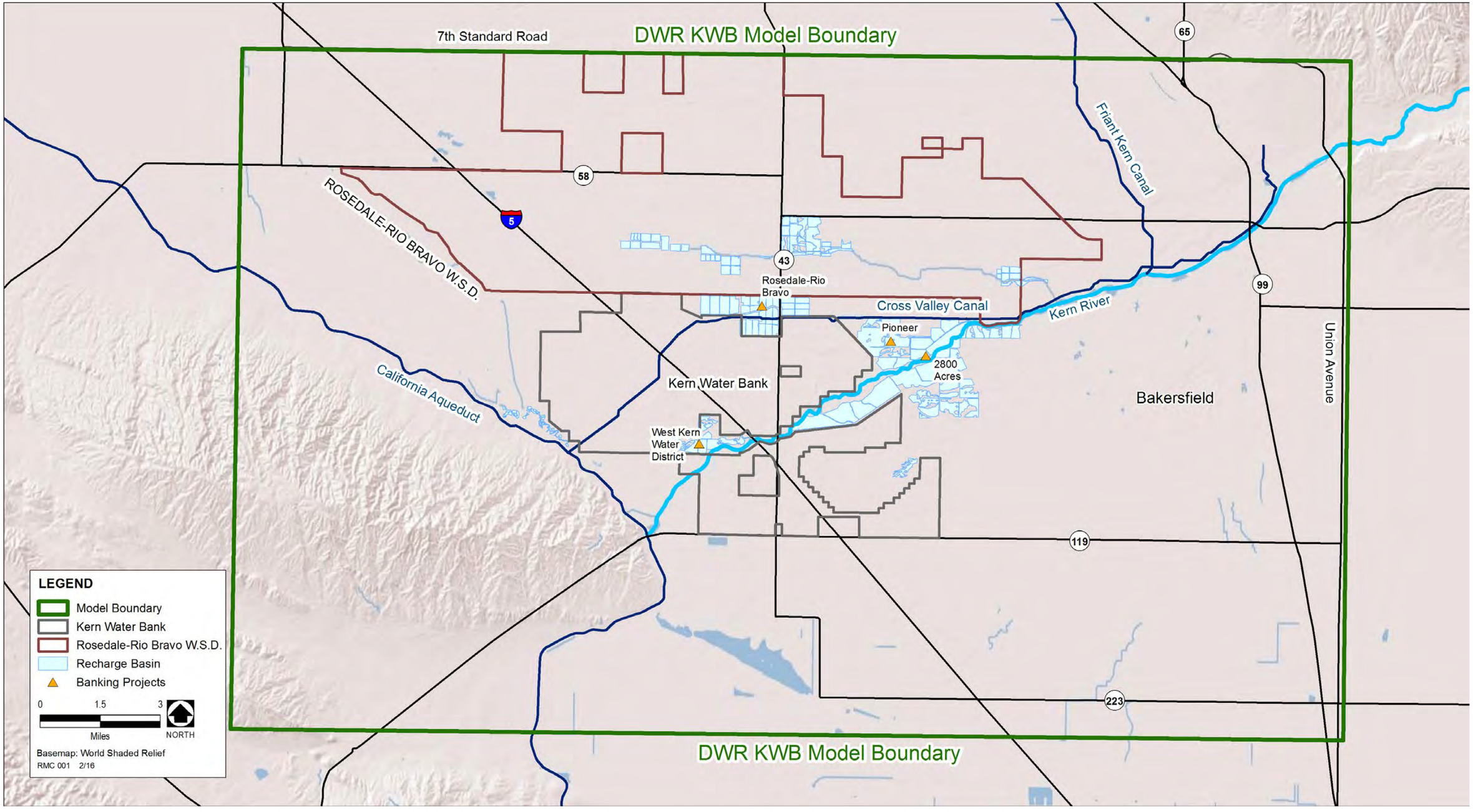


FIGURE 3.2-24. Groundwater Recharge Projects Neighboring Kern Water Bank and Locations of Selected Water Levels Hydrographs

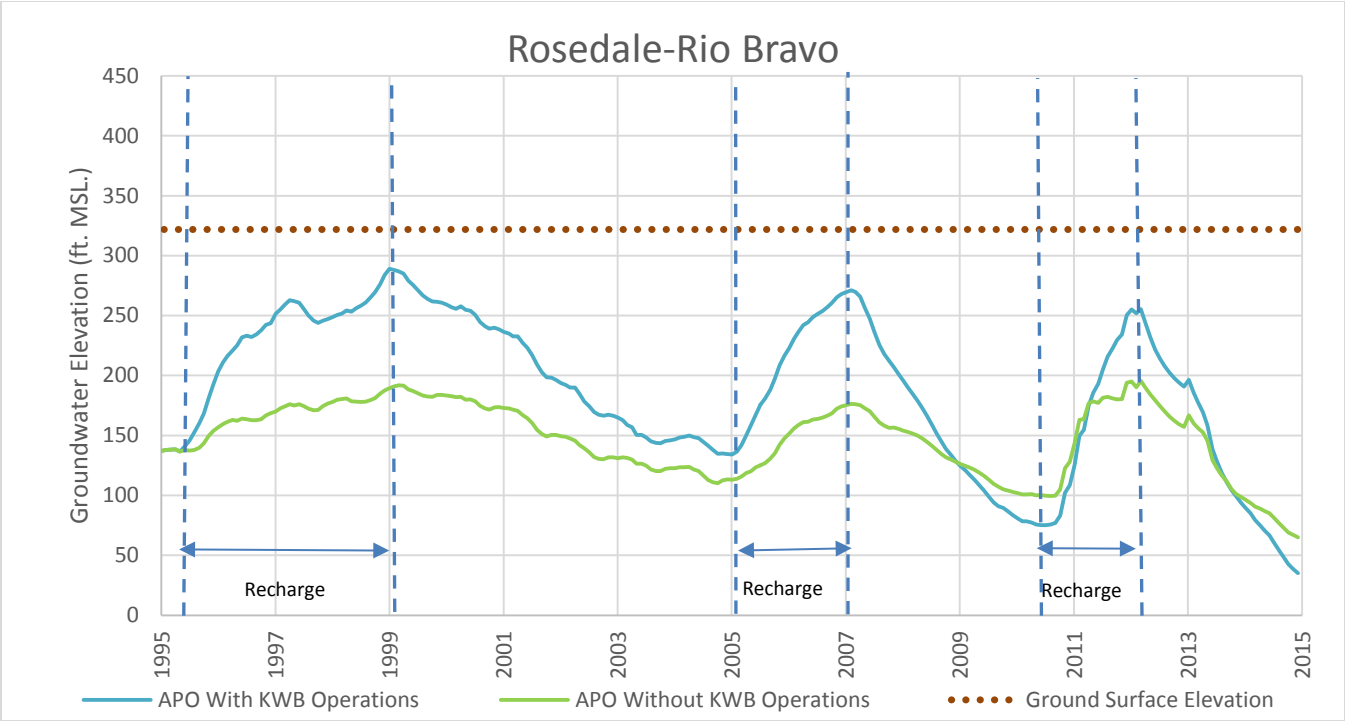


FIGURE 3.2-25a. Groundwater Elevation Hydrographs at Rosedale-Rio Bravo Water Storage District Recharge Pond for APO, 1995-2015

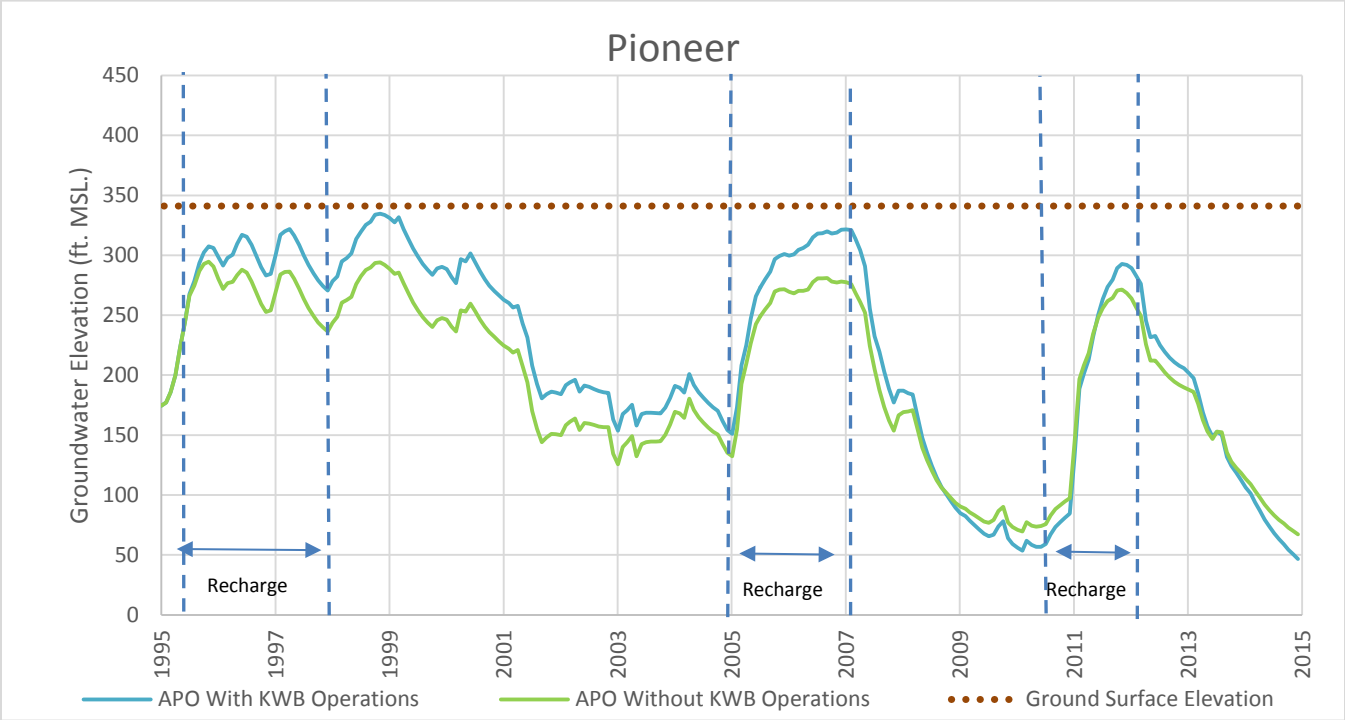


FIGURE 3.2-25b. Groundwater Elevation Hydrographs at Pioneer Recharge Pond for APO, 1995-2015

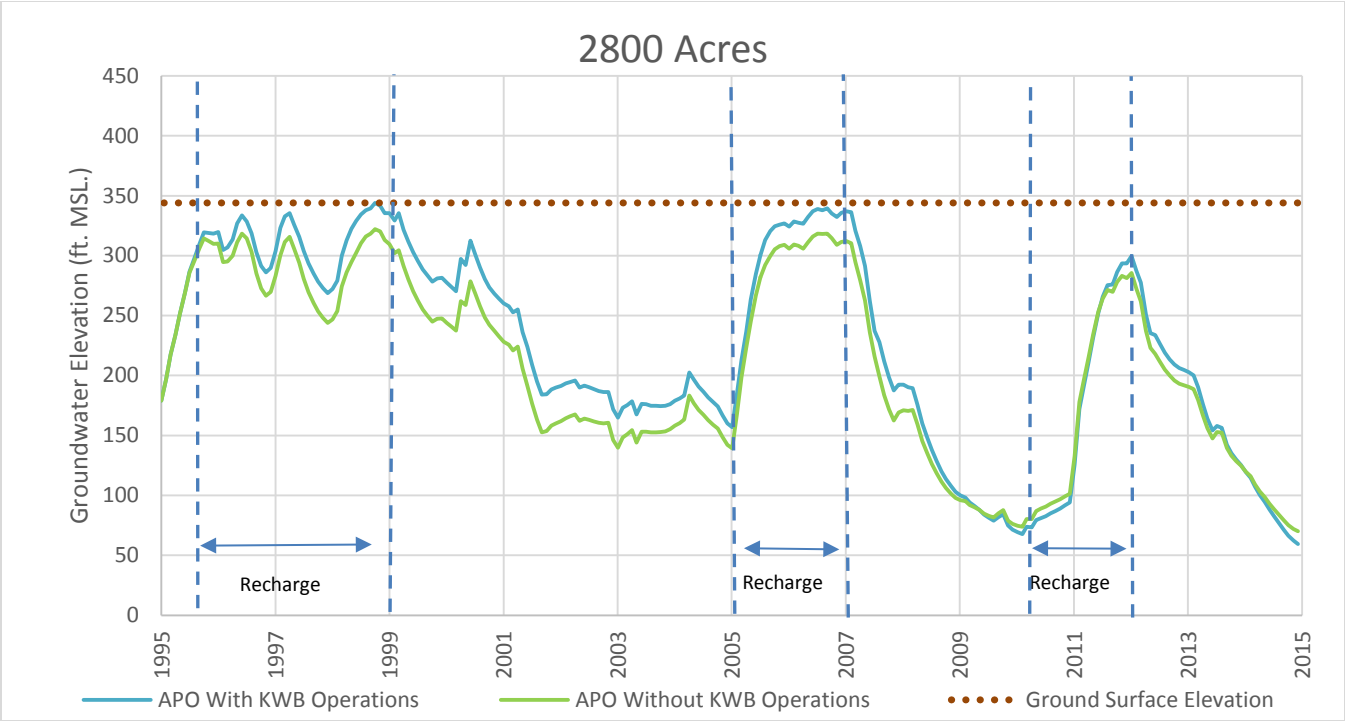


FIGURE 3.2-25c. Groundwater Elevation Hydrographs at 2800 Acres Recharge Pond for APO, 1995-2015

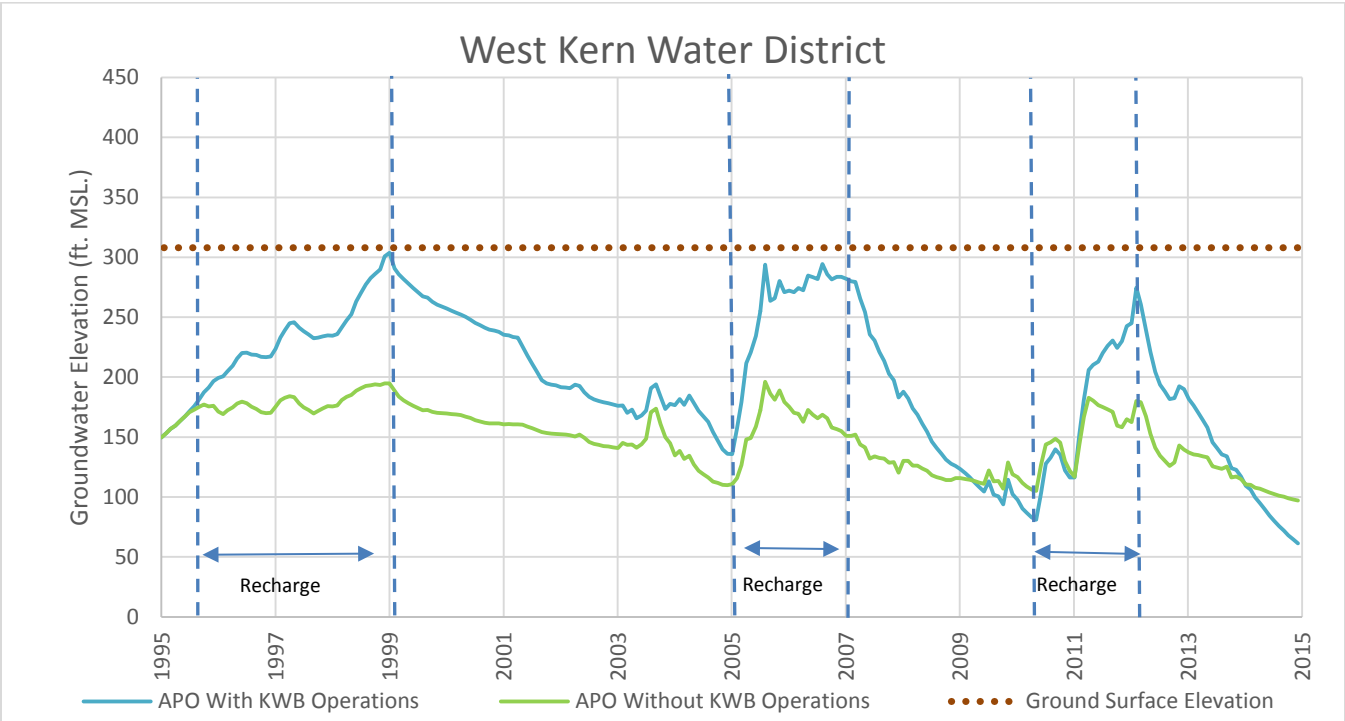


FIGURE 3.2-25d. Groundwater Elevation Hydrographs at West Kern Water District Recharge Pond for APO, 1995-2015

TABLE 3.2-2

MODEL AREA OUTSIDE THE KERN WATER BANK AREA AFFECTED AT DIFFERENT WATER LEVELS (ANALYSIS OF PAST OPERATIONS), 1995–2014

	Impacted Area Outside Kern Water Bank Lands (acres)									
Frequency for 20- Year Simulation	**-60 Feet**	**-45 Feet**	**-30 Feet**	**-20 Feet**	**-10 Feet**	**+10 Feet**	**+20 Feet**	**+30 Feet**	**+45 Feet**	**+60 Feet**
Never Occurs	232,404	231,919	228,599	224,354	216,414	116,731	159,016	180,609	199,641	211,277
1–12 months	0	485	2,675	4,725	6,403	1,490	2,015	2,628	2,775	2,433
13–24 months	0	0	715	1,540	4,350	2,220	2,308	2,635	3,385	3,653
25–36 months	0	0	415	985	2,880	2,160	2,870	2,665	2,813	2,210
37–58 months	0	0	0	795	1,408	2,000	2,810	2,428	2,180	1,773
59–60 months	0	0	0	5	950	1,950	2,915	3,798	2,855	2,383
61–72 months	0	0	0	0	0	3,030	3,770	3,578	3,140	3,463
73–84 months	0	0	0	0	0	2,820	3,935	3,605	4,138	3,500
85–96 months	0	0	0	0	0	3,215	3,785	4,040	4,313	1,080
97–108 months	0	0	0	0	0	4,090	4,258	4,455	3,243	623
109–120 months	0	0	0	0	0	5,158	4,848	5,313	3,633	13
121–144 months	0	0	0	0	0	16,498	9,008	7,880	290	0
145–168 months	0	0	0	0	0	15,775	9,165	8,758	0	0
168 or more months	0	0	0	0	0	55,268	21,703	15	0	0

TABLE 3.2-3

MODEL AREA AFFECTED AT DIFFERENT WATER LEVELS FOR THE ENTIRE MODEL AREA (ANALYSIS OF PAST OPERATIONS), 1995–2014

	Impacted Area in Model Domain (acres)									
Frequency for 20-Year Simulation	**-60 Feet**	**-45 Feet**	**-30 Feet**	**-20 Feet**	**-10 Feet**	**+10 Feet**	**+20 Feet**	**+30 Feet**	**+45 Feet**	**+60 Feet**
Never Occurs	251,354	243,772	236,054	229,527	220,462	116,731	159,016	180,794	201,076	214,037
1–12 months	3,090	7,730	7,308	8,115	8,085	1,490	2,015	3,095	3,293	3,200
13–24 months	5	2,920	4,160	4,518	6,753	2,220	2,308	2,835	3,605	4,475
25–36 months	0	28	6,090	5,323	6,373	2,160	2,870	2,945	3,165	3,038
37–58 months	0	0	833	6,133	7,938	2,000	2,810	2,830	2,623	2,633
59–60 months	0	0	5	835	4,760	1,950	2,933	3,940	3,918	3,163
61–72 months	0	0	0	0	80	3,030	3,893	3,725	4,045	4,635
73–84 months	0	0	0	0	0	2,820	4,330	4,028	4,723	7,098
85–96 months	0	0	0	0	0	3,215	4,478	4,770	5,403	5,008
97–108 months	0	0	0	0	0	4,090	4,628	5,133	7,003	4,913
109–120 months	0	0	0	0	0	5,158	4,943	6,100	10,510	2,253
121–144 months	0	0	0	0	0	16,498	9,653	12,040	5,088	0
145–168 months	0	0	0	0	0	17,935	18,718	22,188	0	0
168 or more months	0	0	0	0	0	75,153	31,858	28	0	0

TABLE 3.2-4

AREA AFFECTED AT DIFFERENT LEVELS OF NEGATIVE DIFFERENCES (ANALYSIS OF PAST OPERATIONS) ("WITH KERN WATER BANK OPERATIONS" MINUS "WITHOUT KERN WATER BANK OPERATIONS"), 1995–2014

Level of Negative Difference	Agricultural Area (Acres)	Urban Area (Acres)
-45 feet	95	–
-30 feet	843	–
-20 feet	2,677	–
-10 feet	6,700	28
-5 feet	9,660	250

TABLE 3.2-5

AREA AFFECTED AT DIFFERENT LEVELS OF POSITIVE DIFFERENCES (ANALYSIS OF PAST OPERATIONS) ("WITH KERN WATER BANK OPERATIONS" MINUS "WITHOUT KERN WATER BANK OPERATIONS"), 1995–2014

Level of Positive Difference	Agricultural Area (Acres)	Urban Area (Acres)
5 feet	95,160	22,355
10 feet	72,600	9,665
20 feet	45,010	2,390
30 feet	30,065	640
45 feet	18,308	-

TABLE 3.2-6

MODEL-GENERATED MINIMUM DEPTH TO WATER FOR APO CONDITIONS

Simulation Period	Recharge Facility			
	Rosedale	Pioneer	2800 Acre	West Kern Water District
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

TABLE 3.2-7

SUMMARY OF ANALYSIS OF PAST OPERATIONS MODEL SCENARIO RESULTS AFFECTING THE LOCAL GROUNDWATER TABLE, 1995–2014

Evaluation Metric	Conclusion
Water Budgets (Section 3.2.1)	The KWB had a balance off +617,000 AF of stored water at the end of 2014.
Groundwater Elevation Differences (Hydrographs and Contour Maps) (Section 3.2.2)	The positive groundwater elevation differences extend to almost all of the model domain. The negative groundwater elevation differences are limited to KWB Lands and the surrounding area.
Temporal Variation in Area of Negative and Positive Elevation	Outside the KWB boundary, negative elevation differences

TABLE 3.2-7 SUMMARY OF ANALYSIS OF PAST OPERATIONS MODEL SCENARIO RESULTS AFFECTING THE LOCAL GROUNDWATER TABLE, 1995–2014	
Evaluation Metric	**Conclusion**
Differences (Section 3.2.3)	occur after about 2 years of recovery.
Spatial Extent of Negative and Positive Elevation Differences (Section 3.2.3)	Outside the KWB boundary, negative elevation differences exceeding -30 feet are contained within 1 mile of the KWB boundary and do not spread inside the Rosedale boundary. Outside the KWB boundary, negative elevation differences exceeding -30 feet affect less than 900 acres of agricultural land in the immediate vicinity of KWB Lands, which represents less than one percent of the total agricultural area within the model domain. Outside the KWB boundary, positive elevation differences exceeding +60 feet (indicative of a high water table) are contained within 2 miles of the KWB boundary.
Frequency Distribution of Negative and Positive Elevation Difference (Section 3.2.4)	Negative elevation differences exceeding -30 feet remain within the KWB boundary 90% of the time. Positive elevation differences exceeding +60 feet remain within the KWB boundary 75% of the time.
Average Elevation and Elevation Difference in Selected Zones (Section 3.2.5)	On an average basis, there is always a groundwater mound beyond 2 miles of the KWB boundary that exceeds at least 5 feet in groundwater elevation when compared to the elevation of “Without KWB Operations.”
High Groundwater Levels and Existing Infrastructure (Section 3.2.6)	Groundwater levels may rise to within 5 feet from ground surface and impact sections of the CVC in the western parts of KWB Lands.
High Groundwater Levels and Neighboring Recharge Facilities (Section 3.2.7)	KWB operations, concomitant with the operations of other neighboring groundwater banks, may potentially interfere with the recharge operations at neighboring groundwater banks.
Notes: AF = acre-feet; CVC = Cross Valley Canal; KWB = Kern Water Bank	

During the 21-year (2015–2035) simulation period of the AFO-EC scenario, the KWB is projected to recharge 2,112,000 AF of water while recharge by other banking projects in the model domain is projected to be 3,383,000 AF. AFO-EC KWB recharge is slightly higher than KWB recharge during the historical (1995–2014) period because increased recharge pond areas under existing conditions allow the KWB to recharge additional water (e.g., floodwater) that was available under a hydrologic conditionsimilar to the 1995–2014 period. The KWB is projected to recover 1,546,000 AF during the AFO-EC simulation period, while recovery at other projects is projected to be 1,401,000 AF. The total volume of water recovered from the KWB and other banking projects in the AFO-EC scenario is higher than the historical amount because of an additional year of pumping in 2015. This generates a balance of 566,000 AF of stored water for the KWB and 1,982,168 AF of stored water for other banking projects. The KWB annual recharge, recovery, and cumulative balance of stored water amounts are shown in Figure 3-3.1.

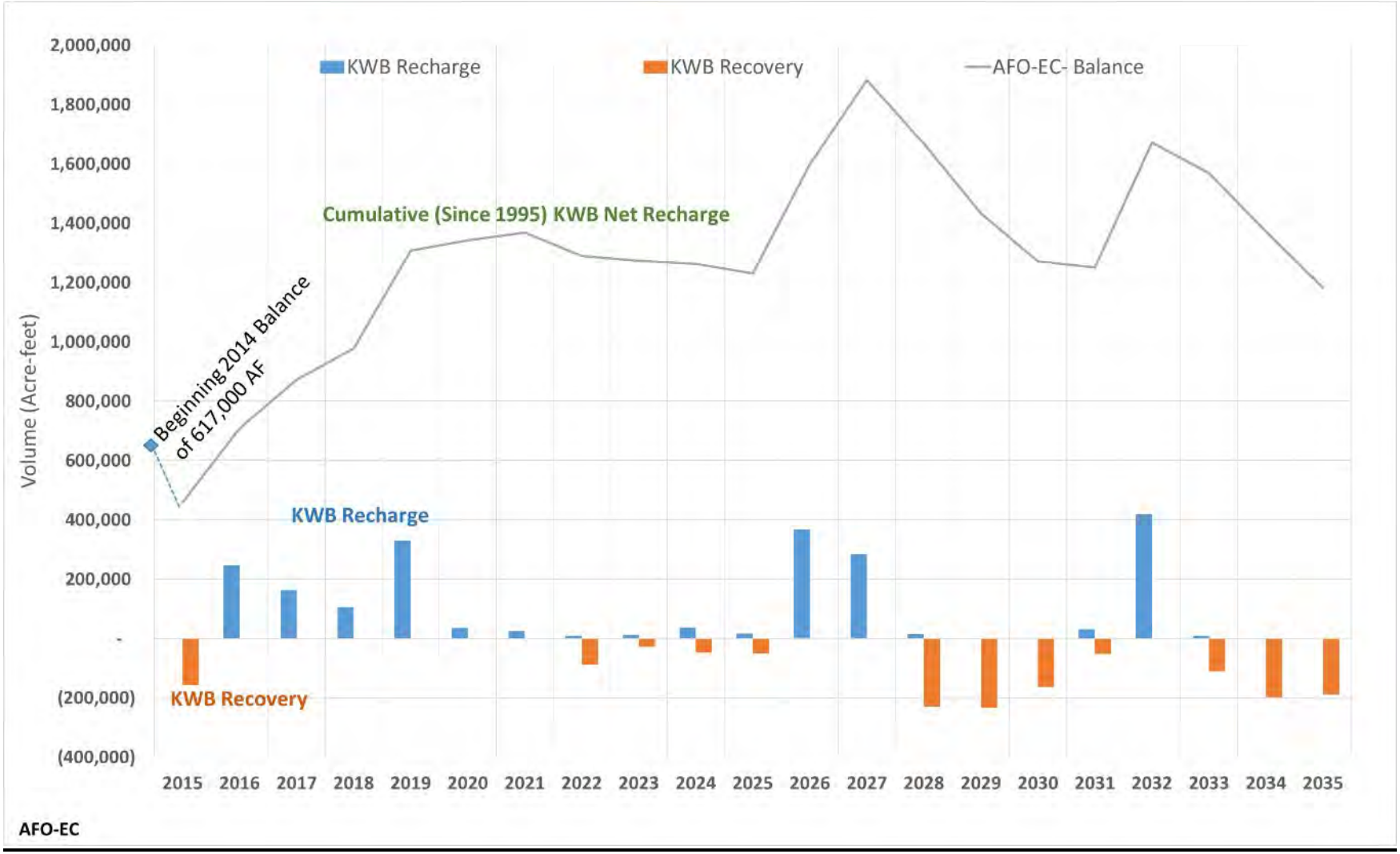


FIGURE 3.3-1. Analysis of Future Operations under Existing Conditions: Kern Water Bank Annual and Cumulative Recharge and Recovery, and Cumulative Stored Water, 2015-2035

Note that there was an accumulated balance of 617,000 AF of stored water at the end of the 1995–2014 historical KWB operations period. When this prior balance is added to the additional 2015–2035 stored water, there is a total balance of 1,183,216 AF of stored water in the aquifer at the end of 2035 under the AFO-EC scenario.

3.3.2 GROUNDWATER ELEVATION DIFFERENCE FOR WITH AND WITHOUT KERN WATER BANK OPERATIONS

As with the APO (see Section 3.2.2), groundwater elevation differences for the AFO-EC "With KWB Operations" and "Without KWB Operations" scenarios were evaluated by comparing simulated groundwater elevation hydrographs at several monitoring wells (Method No. 3 in Section 3.1) and developing groundwater elevation difference contour maps at the end of several representative recharge and recovery cycles (Method No. 2 in Section 3.1).

3.3.2.1 Hydrographs

Hydrographs of simulated groundwater levels for the "With KWB Operations" and "Without KWB Operations" scenarios were developed at 31 wells (14 wells inside the KWB boundary and 17 wells outside the KWB boundary (Appendix 7-2E).

3.3.2.2 Contour Maps

The distribution of groundwater elevation differences between "With KWB Operations" and "Without KWB Operations" scenarios after major KWB recharge and recovery cycles is shown in Figures 3.3-3 and 3.3-4. Figures 3.3-3a to 3.3-3c show groundwater elevation differences after the 1995–2000, 2005–2006, and 2011 recharge cycles, respectively. Figures 3.3-4a to 3.3-4c show groundwater elevation differences after the 2001–2004, 2007–2009, and 2012–2014 recovery cycles, respectively.

3.3.3 AFFECTED AREAS OUTSIDE THE KERN WATER BANK LANDS

The impact of KWB operations on groundwater elevations outside KWB Lands for the AFO-EC "With KWB Operations" and "Without KWB Operations" scenarios are evaluated using time series charts showing areas affected by head differences of ±5 feet (Method No. 4 in Section 3.1), maps of the spatial extent of negatively and positively impacted areas (Method No. 5 in Section 3.1), and tables summarizing acreage of impacted areas.

3.3.3.1 Time Series of Affected Area

At every time step of the simulation, the total area of the model was calculated with (1) groundwater elevation difference greater than 5 feet, and (2) groundwater elevation difference less than -5 feet. Time series of these areas are shown in Figure 3.3-5. A detailed chart showing areas impacted by less than -5, -10, -20, -30, -45, and -60 feet is shown in Figure 3.3-6. Figure 3.3-7 shows areas impacted by groundwater levels greater than 5, 10, 20, 30, and 45 feet.

Negative elevation differences exceeding -5 feet continue to spread over a large area (52,000 acres in 2015) because of continued recovery in 2015 (the first year of the AFO-EC scenario), which was preceded by 3 consecutive years of recovery from 2012 to 2014 (the last 3 years of the APO scenario). Three consecutive years of recharge from 2016 through 2018 reduce the area with negative elevation differences exceeding -5 feet to zero. Areas with negative elevation differences reappear after periods of about 2 years of recovery (e.g., 2028–2029 and 2033–2034).

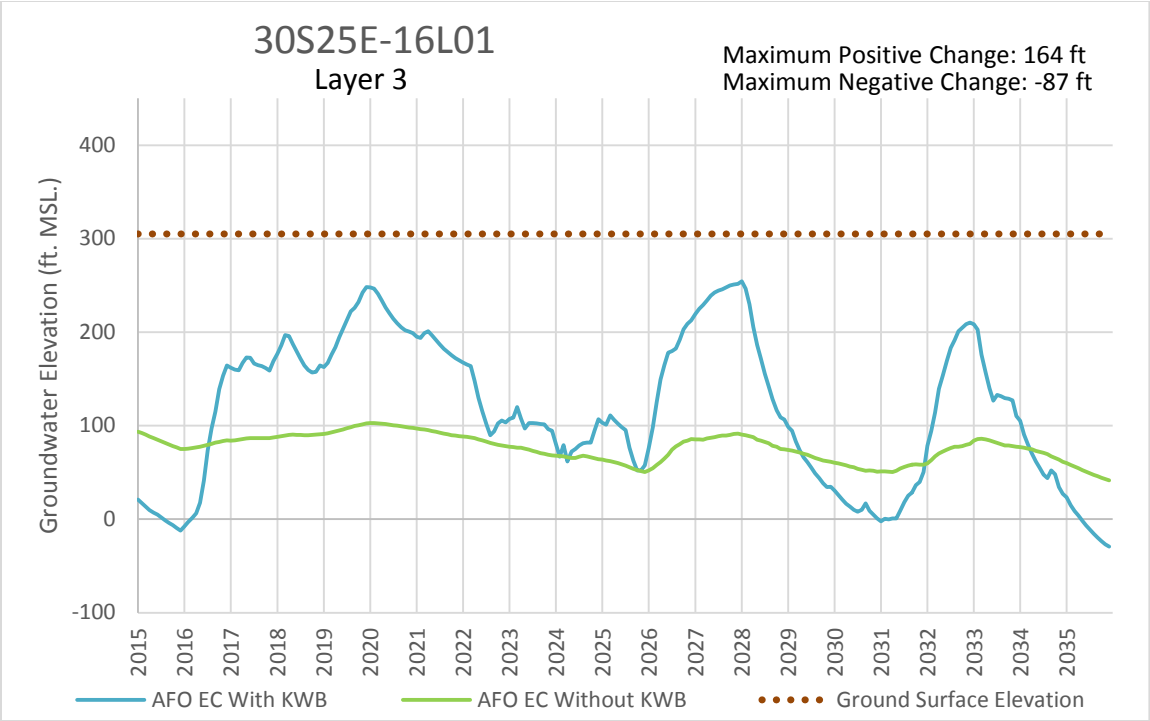


FIGURE 3.3-2a. Hydrographs of Analysis of Future Operations under Existing Conditions: Simulated Water Levels at Monitoring Well 30S25E-16L, 2015-2035

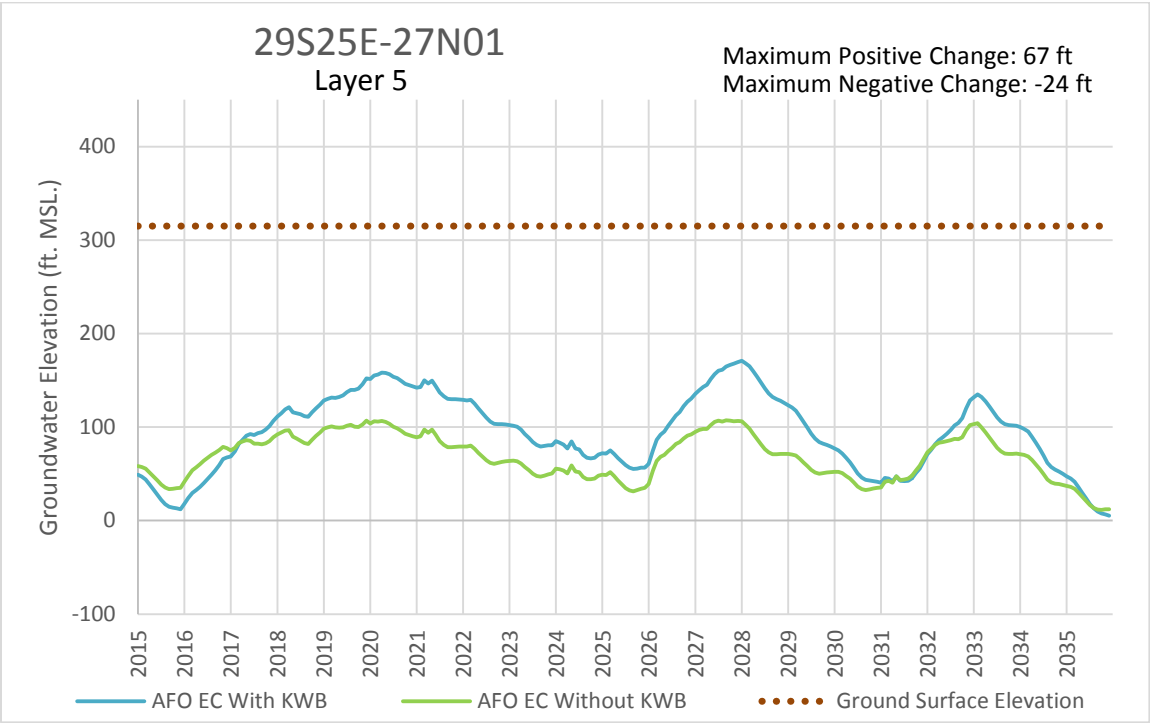


FIGURE 3.3-2b. Hydrographs of Analysis of Future Operations under Existing Conditions: Simulated Water Levels at Monitoring Well 29S36E-27N, 2015-2035

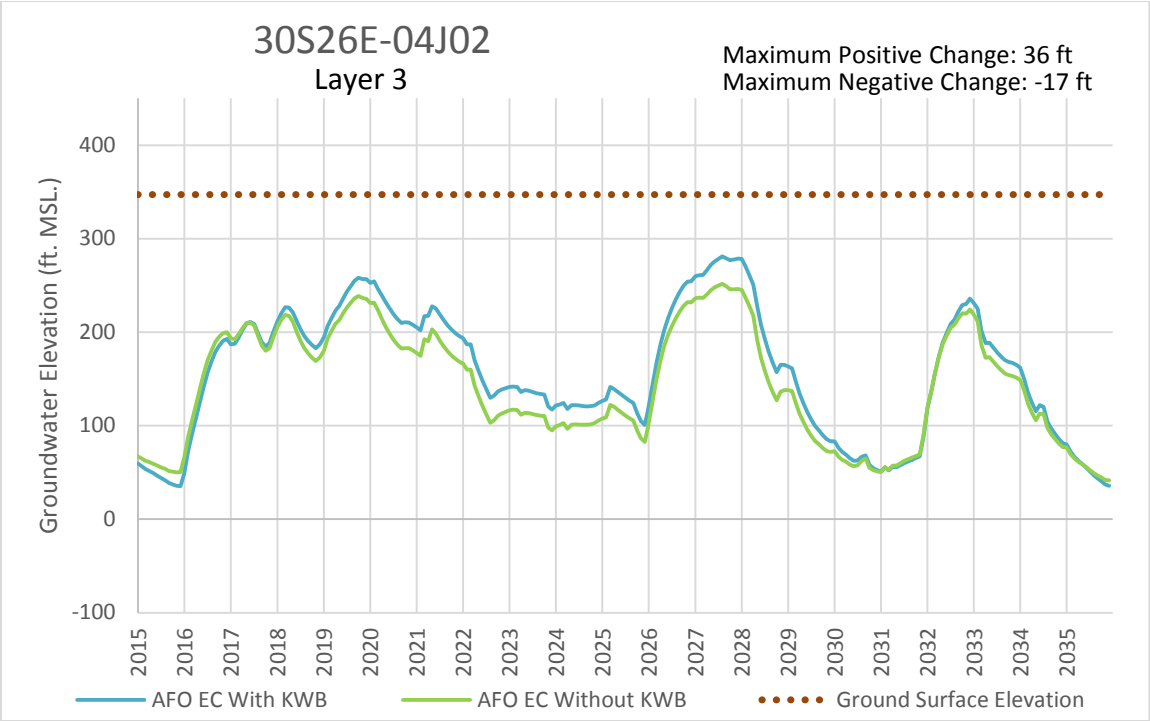


FIGURE 3.3-2c. Hydrographs of Analysis of Future Operations under Existing Conditions: Simulated Water Levels at Monitoring Well 30S26E-04J, 2015-2035

Figure 3.3-6 indicates that any negative differences exceeding -30 feet in areas outside KWB Lands are limited to years of groundwater recovery, affecting a maximum area of about 10,000 acres near KWB Lands in 2015 after 4 consecutive years of recovery (2012–2015).

3.3.3.2 Spatial Extent of Affected Area

Figure 3.3-8 shows the maximum spatial extent of negative elevation differences exceeding -60 feet, -45 feet, -30 feet, -20 feet, -10 feet, and -5 feet. This figure shows that negative elevation differences under the AFO-EC scenario spread about 5 miles outside the KWB boundary. Inside the Rosedale boundary, negative elevation differences exceeding -45 feet do not occur, but negative elevation differences between -5 feet and -45 feet do occur. The total area affected by negative elevation differences between -5 feet and -45 feet inside the Rosedale boundary is 18,781 acres of agricultural land.

Figure 3.3-9 shows the maximum spatial extent of positive elevation differences exceeding +5 feet, +10 feet, +20 feet, +30 feet, +45 feet, and +60 feet. Positive differences in groundwater elevation attributable to KWB operations spread as far as 5.5 miles from the northern and eastern edges of KWB Lands and as far as 4 miles from the southern edge of KWB Lands.

3.3.3.3 Acreages of Affected Areas

The -30 feet negative elevation difference boundary line (see Figure 3.3-8) extends into agricultural area north and east of the KWB boundary. The negative differences in groundwater elevations between “With” and “Without” KWB operations spread into more agricultural areas as the specified levels change from -30 feet to -5 feet. Tables 3.3-2 and 3.3-3 show the area affected at different water level differences for the area outside KWB Lands and the entire model area. Tables 3.3-4 and 3.3-5 show the agricultural areas affected by different levels of negative and positive differences, respectively.

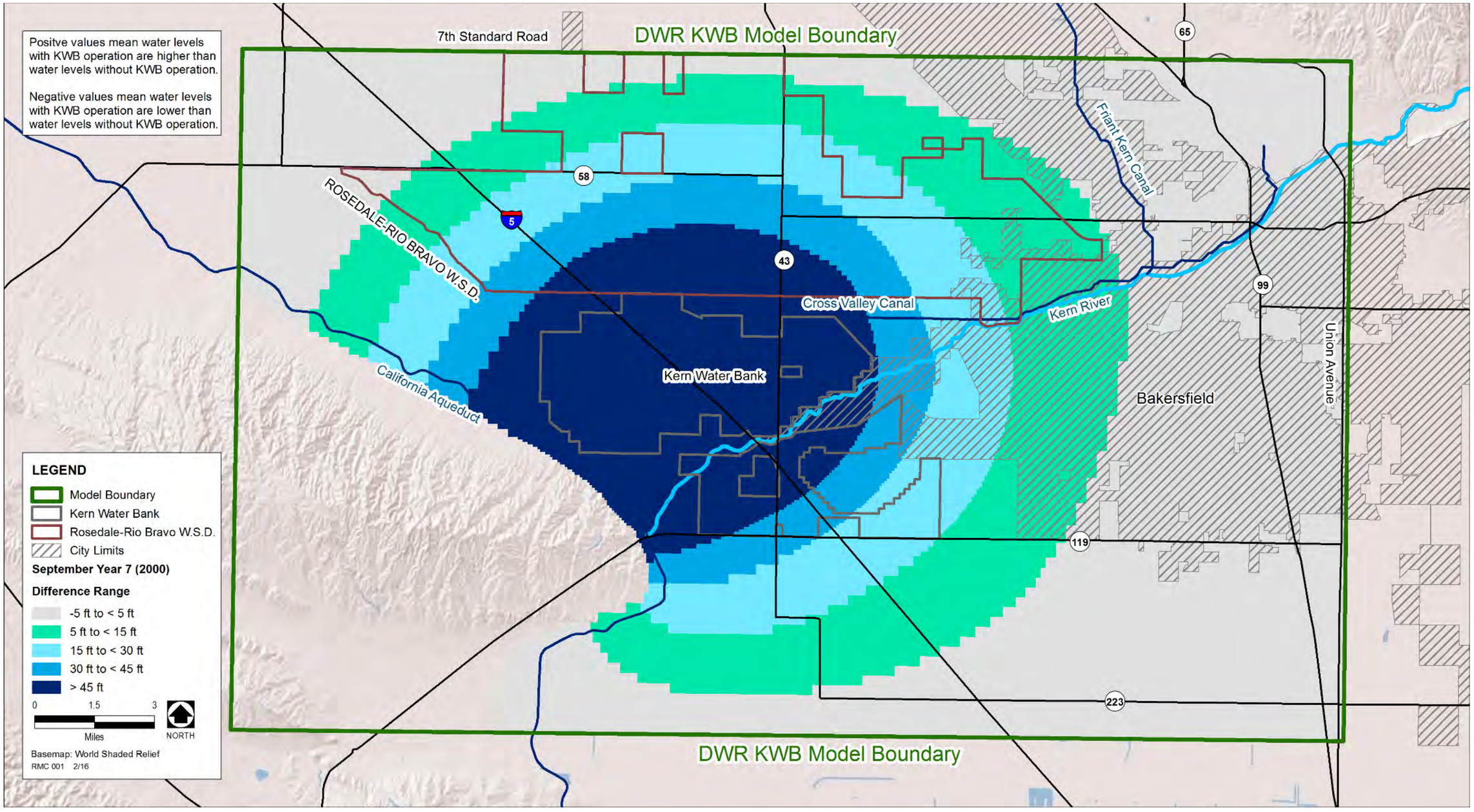


FIGURE 3.3-3a. Analysis of Future Operations under Existing Conditions: Groundwater Elevation Difference Contour Map at the End of the 1995–2000 Equivalent Recharge Cycle

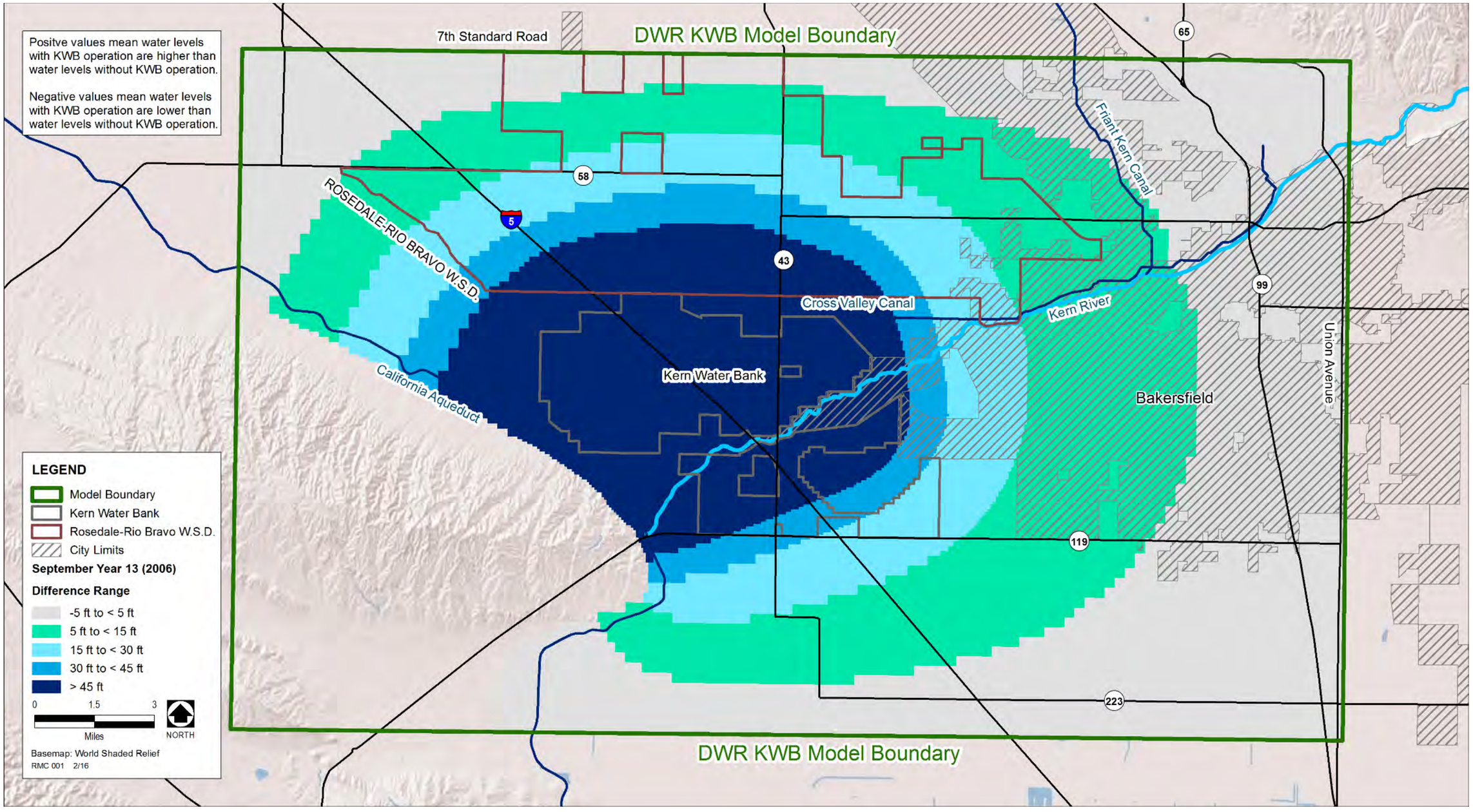


FIGURE 3.3-3b. Analysis of Future Operations under Existing Conditions: Groundwater Elevation Difference Contour Map at the End of the 2006 Equivalent Recharge Cycle

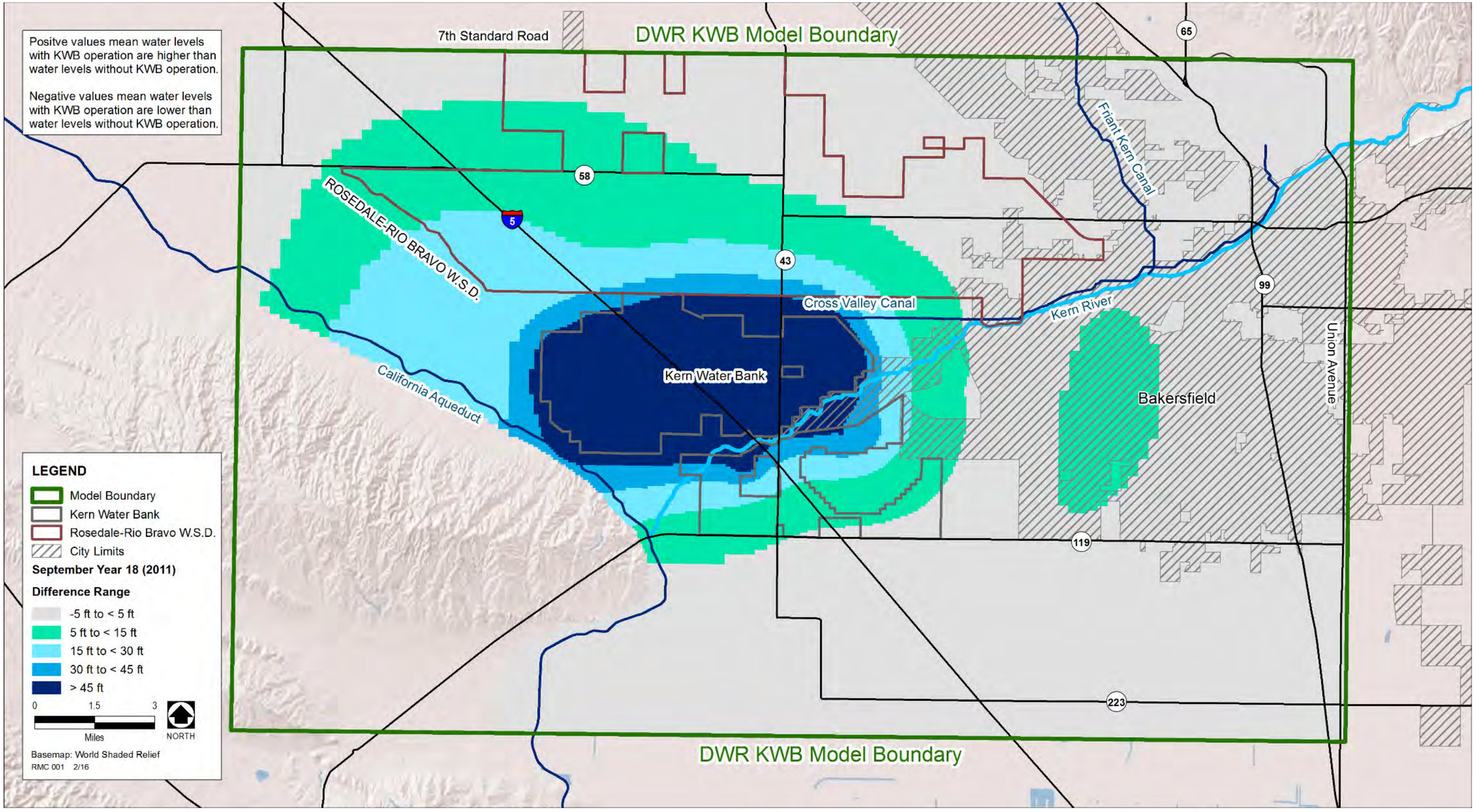


FIGURE 3.3-3c. Analysis of Future Operations under Existing Conditions: Groundwater Elevation Difference Contour Map at the End of the 2011 Equivalent Recharge Cycle

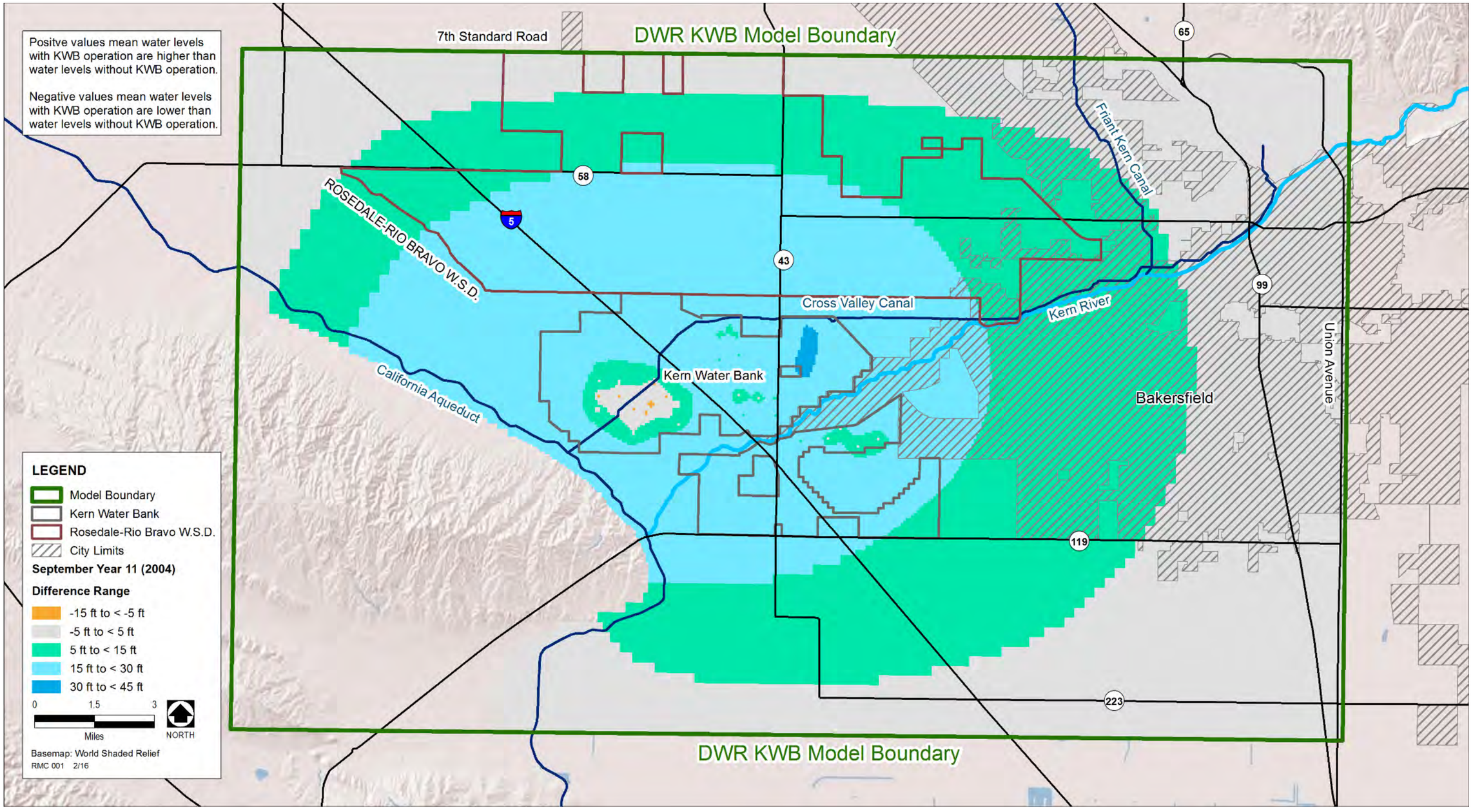


FIGURE 3.3-4a. Analysis of Future Operations under Existing Conditions: Groundwater Elevation Difference Contour Map at the End of the 2001–2004 Equivalent Recovery Cycle

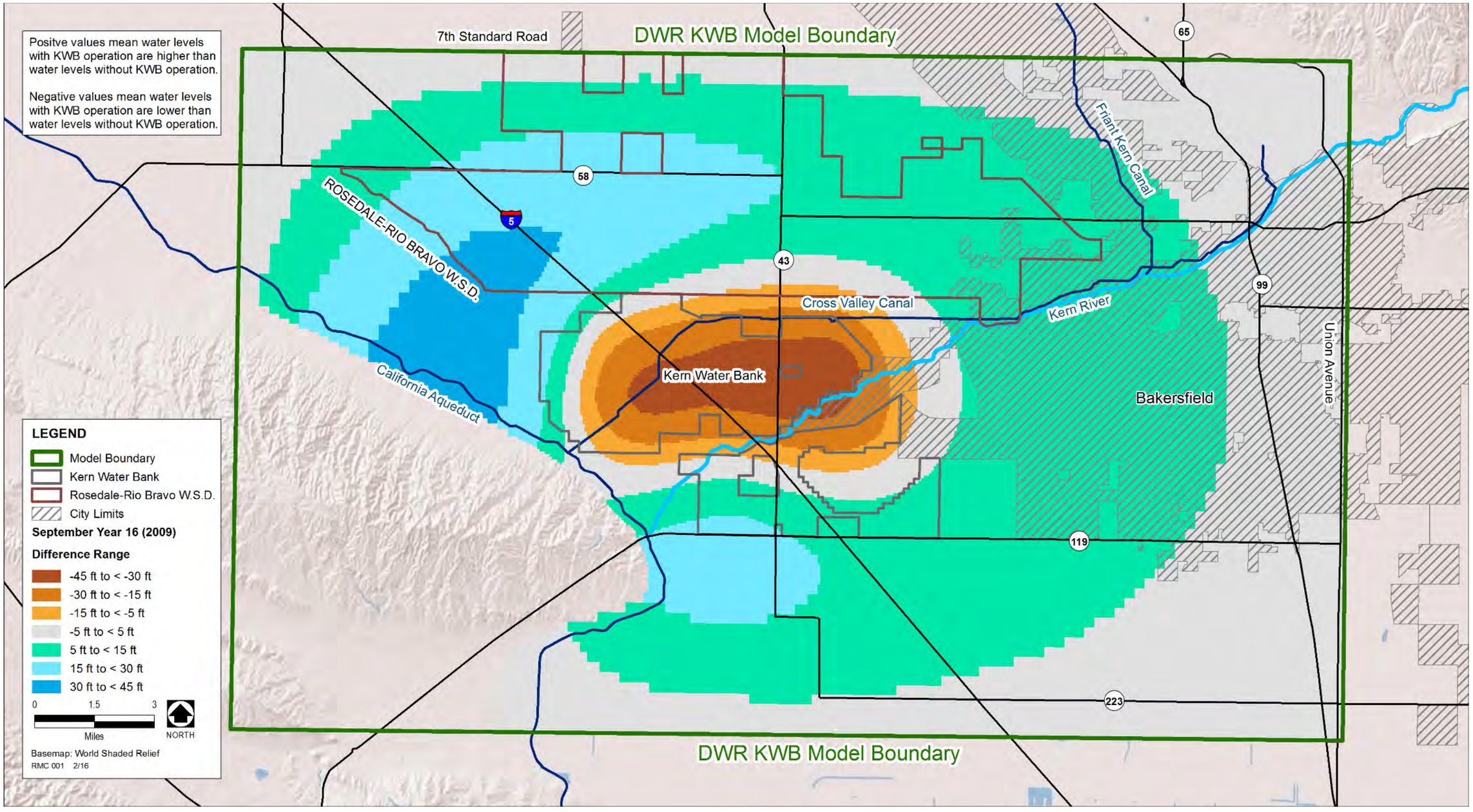


FIGURE 3.3-4b. Analysis of Future Operations under Existing Conditions: Groundwater Elevation Difference Contour Map at the End of the 2009 Equivalent Recovery Cycle

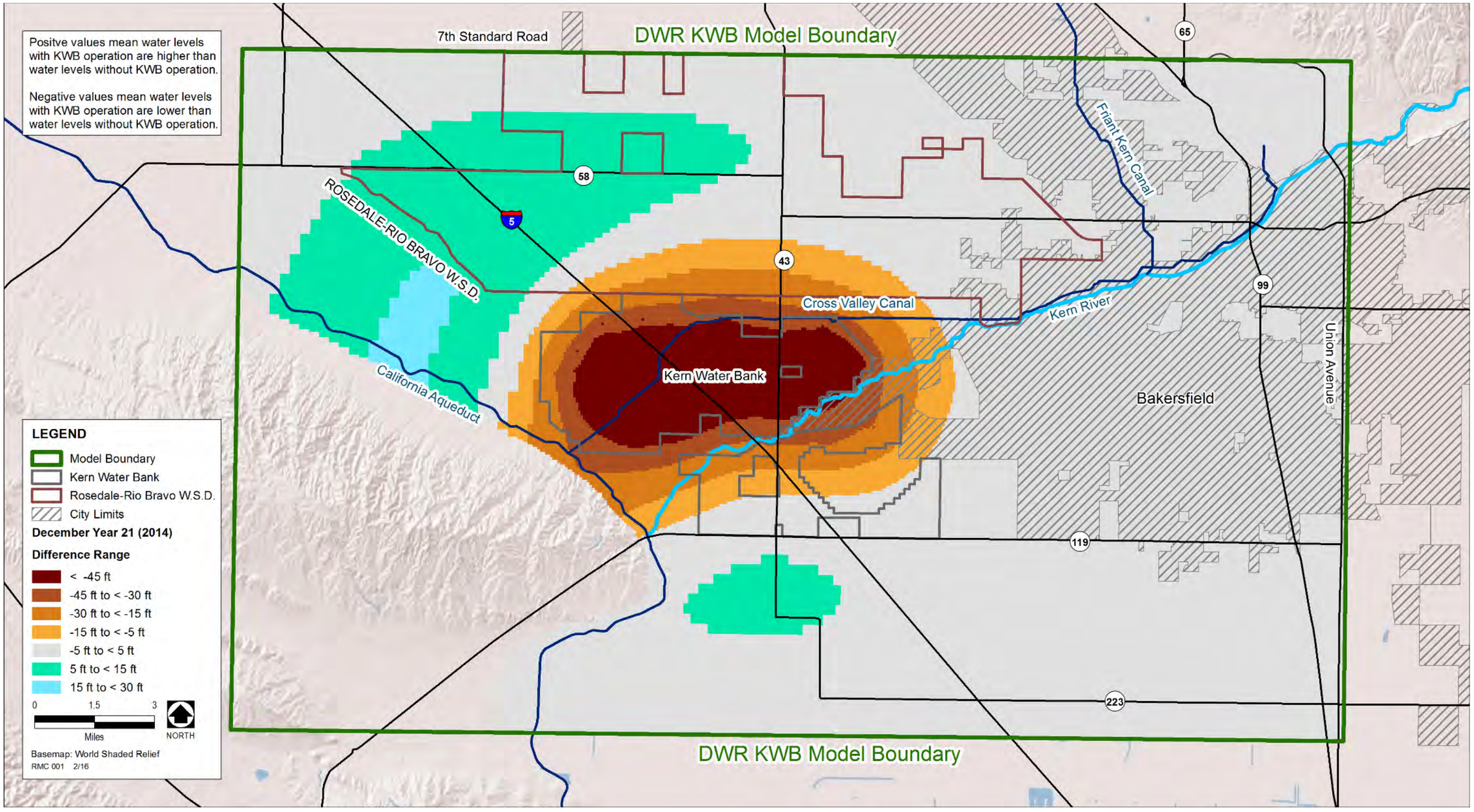


FIGURE 3.3-4c. Analysis of Future Operations under Existing Conditions: Groundwater Elevation Difference Contour Map at the End of the 2014 Equivalent Recovery Cycle

TABLE 3.3-1

WATER BUDGET FOR THE ANALYSIS OF FUTURE OPERATIONS UNDER EXISTING CONDITIONS SCENARIO WITH KERN WATER BANK OPERATIONS, 2015–2035

Year	INFLOW Into Model						OUTFLOW from Model						Calculated Change in Storage
	Deep Percolation of Applied Water	KWB Recharge	Other Banking Projects Recharge	River and Canal Seepage	Boundary Inflow through DWR KWB Model Domain	Total Inflow	Agricultural Pumping	Urban Pumping	KWB Pumping	Other Banking Projects Pumping	Boundary Outflow through DWR KWB Model Domain	Total Outflow (Positive)	
	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY
2015	95,214	-	-	-	401,426	496,641	(455,364)	(82,240)	(157,255)	(148,911)	(258,014)	1,101,784	(605,143)
2016	86,793	248,404	441,854	178,936	397,151	1,353,137	(400,515)	(82,240)	-	(17,463)	(243,186)	743,404	609,733
2017	88,425	163,443	245,865	166,869	430,529	1,095,131	(395,174)	(82,240)	-	(18,618)	(223,050)	719,081	376,049
2018	88,521	105,526	218,780	164,725	473,458	1,051,010	(394,117)	(82,240)	-	(17,671)	(218,268)	712,296	338,714
2019	89,222	330,686	373,720	152,887	441,202	1,387,718	(402,296)	(82,240)	-	(18,168)	(227,933)	730,637	657,081
2020	93,165	34,548	66,269	146,220	447,890	788,092	(421,696)	(82,240)	-	(20,942)	(254,533)	779,411	8,681
2021	92,756	25,924	90,944	117,264	445,227	772,114	(428,578)	(82,240)	-	(23,473)	(243,469)	777,760	(5,646)
2022	94,160	9,428	13,784	83,336	330,790	531,498	(437,431)	(82,240)	(88,699)	(98,833)	(300,603)	1,007,806	(476,308)
2023	94,200	12,633	10,815	106,200	373,807	597,656	(438,160)	(82,240)	(27,596)	(55,517)	(276,158)	879,671	(282,015)
2024	94,166	37,952	54,469	140,967	411,196	738,750	(431,147)	(82,240)	(48,367)	(36,789)	(278,090)	876,633	(137,882)
2025	94,209	16,981	35,728	92,596	400,021	639,534	(438,096)	(82,240)	(49,289)	(53,401)	(287,919)	910,945	(271,411)
2026	91,087	367,533	576,669	187,847	425,256	1,648,392	(388,665)	(82,240)	-	(34,127)	(263,945)	768,976	879,416
2027	91,531	283,698	357,693	171,055	420,029	1,324,006	(395,042)	(82,240)	-	(31,057)	(256,502)	764,842	559,164
2028	95,214	15,724	22,711	56,251	349,425	539,325	(449,579)	(82,240)	(230,686)	(126,812)	(309,102)	1,198,419	(659,094)
2029	95,280	-	10,626	63,460	331,459	500,825	(428,202)	(82,240)	(233,703)	(145,551)	(348,833)	1,238,529	(737,704)
2030	94,443	-	14,413	63,825	356,841	529,522	(434,533)	(82,240)	(162,461)	(117,154)	(308,669)	1,105,057	(575,535)
2031	92,990	31,143	195,061	198,235	392,052	909,481	(396,670)	(82,240)	(50,969)	(51,656)	(279,118)	860,653	48,828
2032	91,547	420,319	583,911	262,648	454,809	1,813,234	(372,534)	(82,240)	-	(27,811)	(247,511)	730,097	1,083,138
2033	94,110	8,383	69,909	77,153	389,893	639,448	(428,063)	(82,240)	(110,830)	(47,016)	(286,371)	954,520	(315,072)
2034	95,214	-	-	54,142	350,415		(453,805)	(82,240)	(196,819)	(137,019)	(322,573)	1,192,455	(692,684)
2035	95,214	-	-	51,390	390,424	537,029	(455,364)	(82,240)	(189,695)	(173,067)	(285,742)	1,186,108	(649,080)
Total 2015–2035	1,947,460	2,112,325	3,383,223	2,536,007	8,413,299	17,892,543	(8,845,032)	(1,727,040)	(1,546,368)	(1,401,055)	(5,719,589)	19,239,083	

Notes: AFY = acre-feet per year; KWB = Kern Water Bank; KWBA = Kern Water Bank Authority

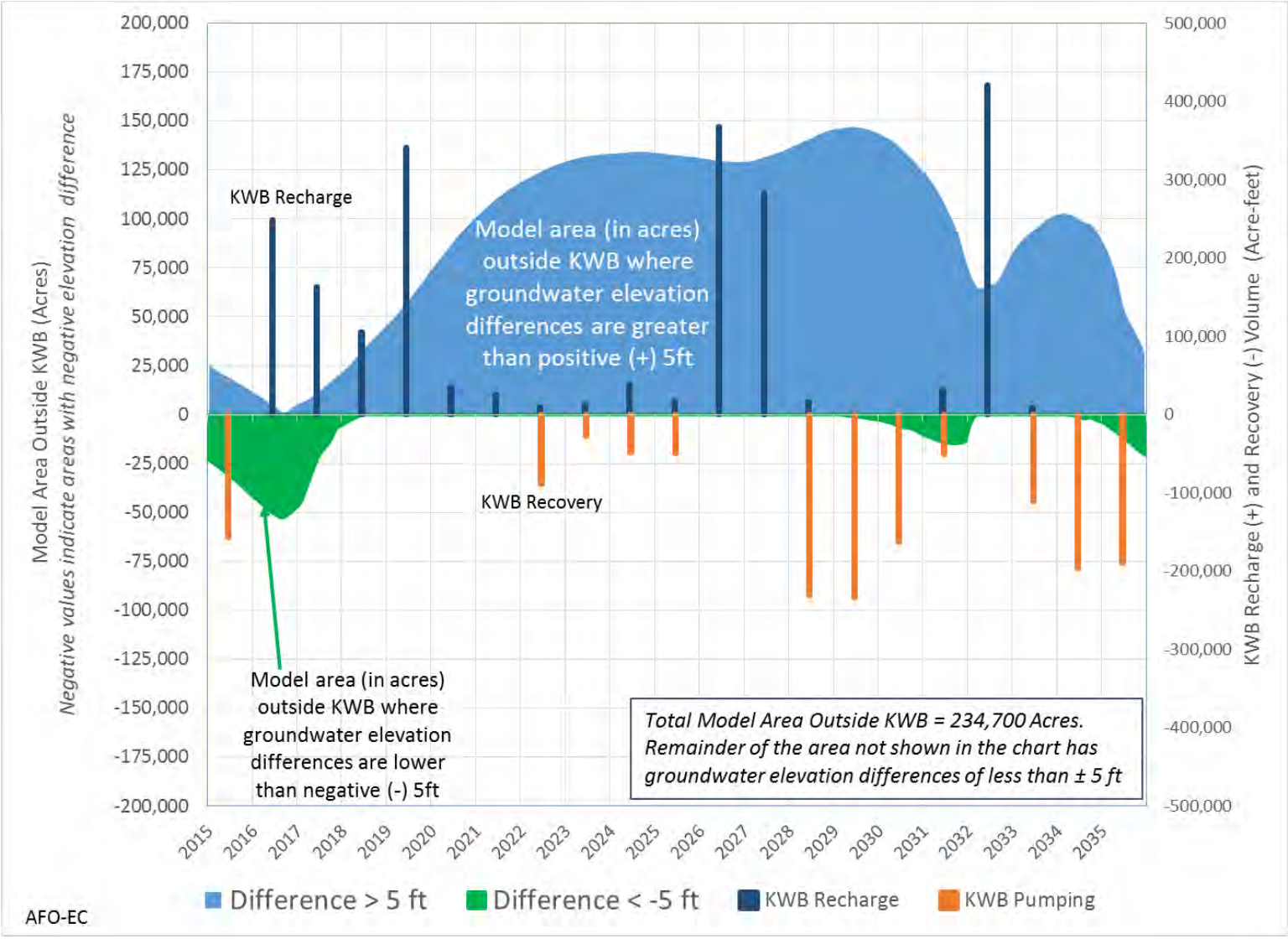


FIGURE 3.3-5. Analysis of Future Operations under Existing Conditions: Time vs. Affected Area Outside Kern Water Bank Exceeding ± 5 Feet Differences in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

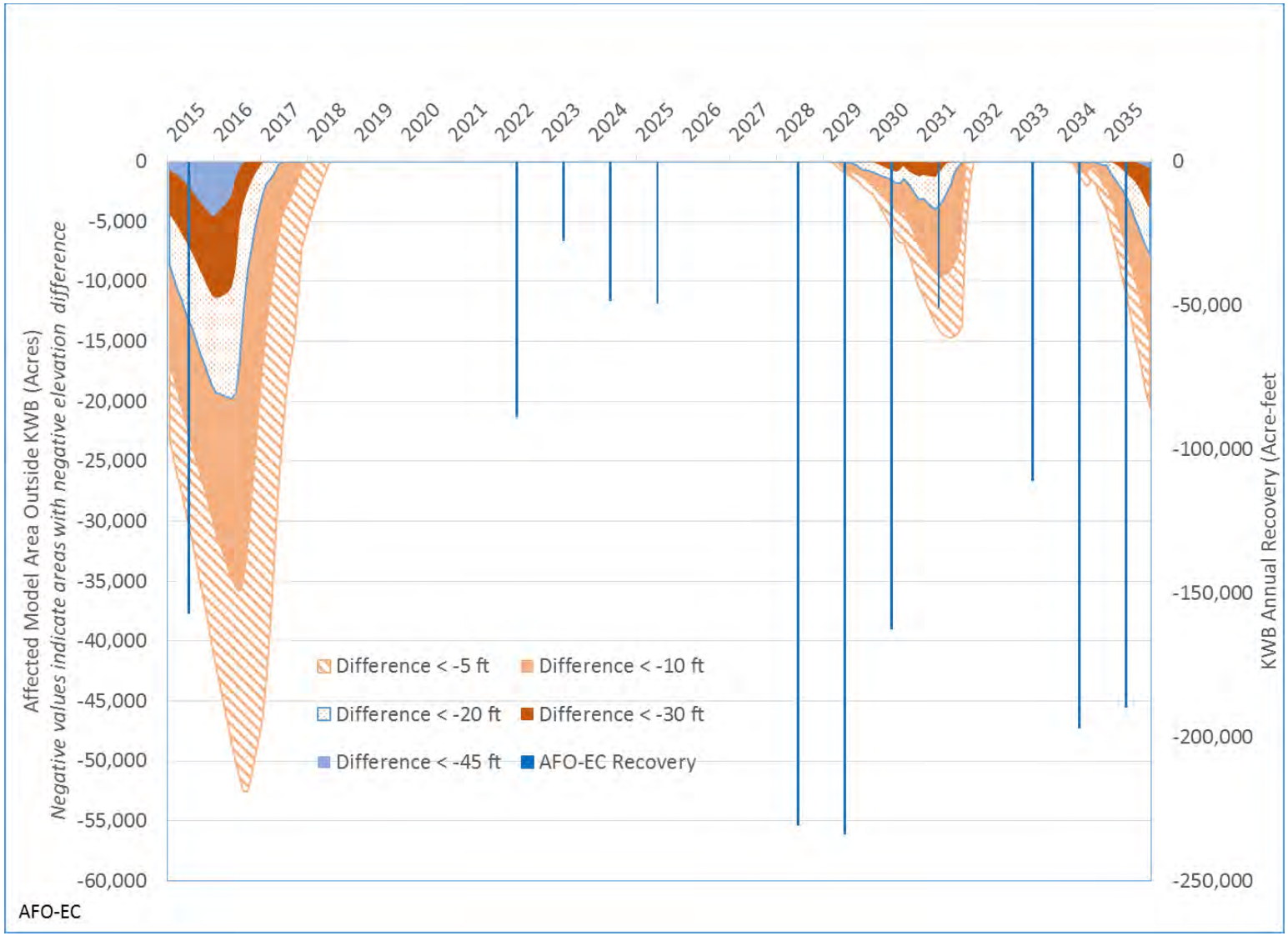


FIGURE 3.3-6. Analysis of Future Operations under Existing Conditions: Time vs. Affected Area Outside Kern Water Bank at Various Levels of Negative Elevation Differences ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

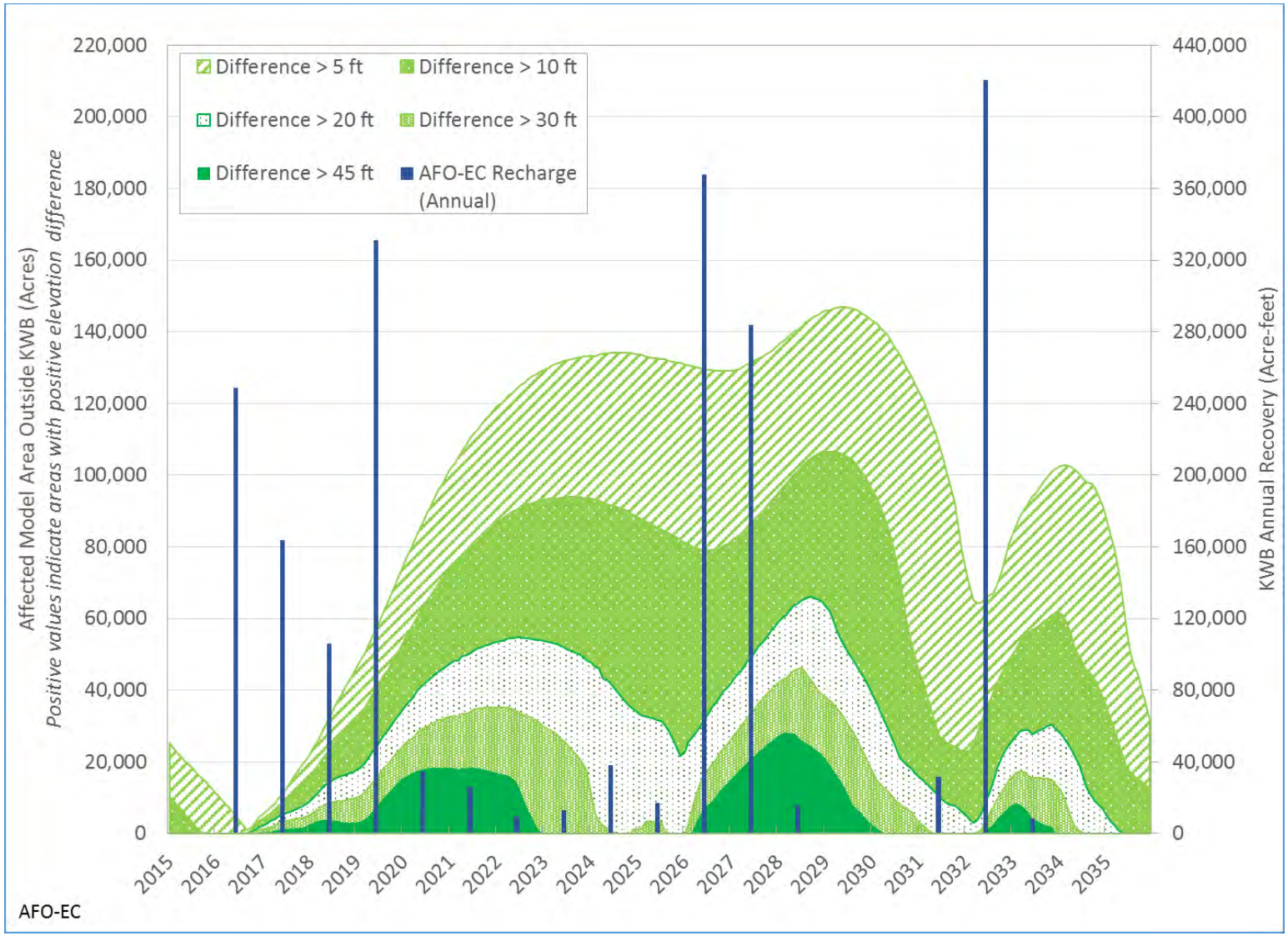


FIGURE 3.3-7. Analysis of Future Operations under Existing Conditions: Time vs. Affected Area Outside Kern Water Bank at Various Levels of Positive Elevation Differences ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

3.3.4 FREQUENCY DISTRIBUTION OF GROUNDWATER ELEVATION DIFFERENCES

Maps were prepared to evaluate the location and frequency with which groundwater elevation differences between the AFO-EC "With KWB Operations" and "Without KWB Operations" scenarios exceeded selected values (Metric 6 of Section 3.1). Frequency distributions of negative groundwater elevation differences exceeding -45 feet, -30 feet, -20 feet, and -10 feet are shown in Figures 3.3-10a to 3.3-10d, respectively. Frequency distributions of groundwater elevation differences exceeding +10 feet, +30 feet, and + 60 feet are shown in Figures 3.3-11a to 3.3-11c, respectively.

Figure 3.3-10a shows that negative elevation differences exceeding -45 feet are contained entirely within the KWB boundary at all times. Figure 3.3-10b shows that negative elevation differences exceeding -30 feet are contained entirely within the KWB boundary approximately 90 percent of the time during future (2015–2035) operations under the AFO-EC scenario.

Positive elevation differences exceeding +60 feet (Figure 3.3-11c) are mostly contained within the KWB boundary. Approximately 25 percent of the time such differences occur outside the KWB boundary, but in the immediate vicinity.

3.3.5 ZONAL AVERAGE GROUNDWATER ELEVATION HYDROGRAPHS

Average groundwater elevations outside KWB Lands (Metric 7 of Section 3.1) were evaluated at five 1-mile zones (Figure 3.2-14). Simulated head was averaged for each cell in a particular zone for each monthly time step of the simulation period. Average groundwater elevations for Zones 1–5 are shown in Figures 3.3-12a to 3.3-12e. Figure 3.3-13 shows the average elevation difference in each zone, which was calculated by subtracting the "Without KWB Operations" run from the "With KWB Operations" run data shown in Figures 3.3-12a to 3.3-12e. These figures indicate that the rise and fall of the groundwater mound follows KWB recharge and recovery cycles, and is correlated with the cumulative KWB storage balance. The impacts of consecutive years of pumping, such as the 4-year period of 2012–2015, are seen in the lowering of the average groundwater elevation in Zones 1–3 in the first few years of the AFO-EC scenario, until successive years of recharge in 2016–2017 (hydrologically similar to 1995–1996) result in an increase in the average groundwater level.

3.3.6 HIGH GROUNDWATER LEVELS AND IMPACT ON INFRASTRUCTURE

Future recharge operations at KWB during the recharge periods of 2016–2019, 2026–2027, and 2032 under AFO-EC conditions (similar to 1995–1998, 2005–2006, and 2011 hydrologic conditions, respectively) could result in high groundwater elevations (<50 feet bgs) within KWB Lands and surrounding areas.

High groundwater elevations could impact the existing infrastructure within and in the vicinity of the KWB. Large 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. The CVC and residential areas on septic systems are the main infrastructure in the DWR KWB Model domain that might potentially be impacted by high water levels.

Results of the AFO-EC model scenario were evaluated to determine the impact of high groundwater elevations on the CVC and nearby residential areas on septic systems.

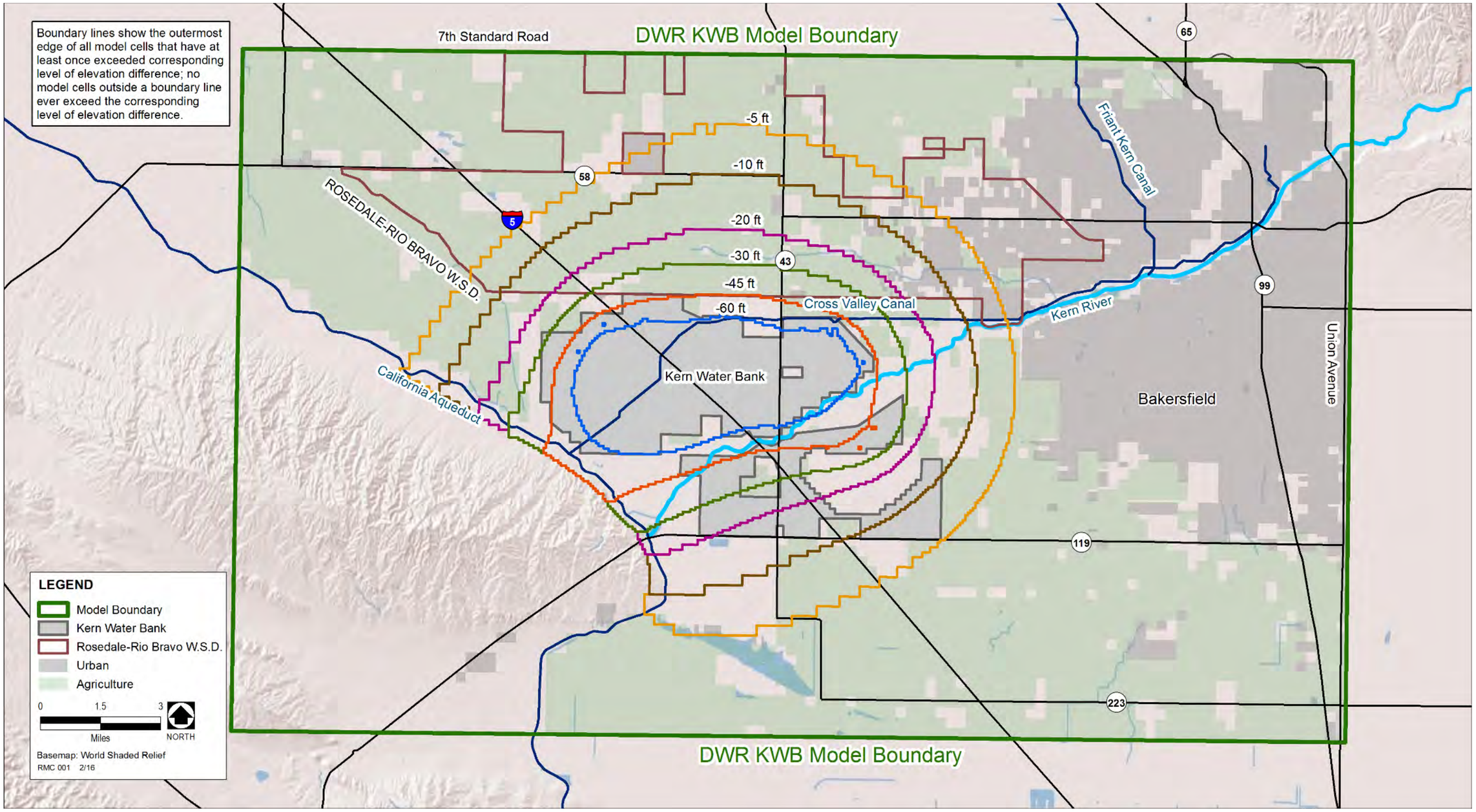


FIGURE 3.3-8. Analysis of Future Operations under Existing Conditions: Contours of Negative Differences ("With" minus "Without"), 2015–2035

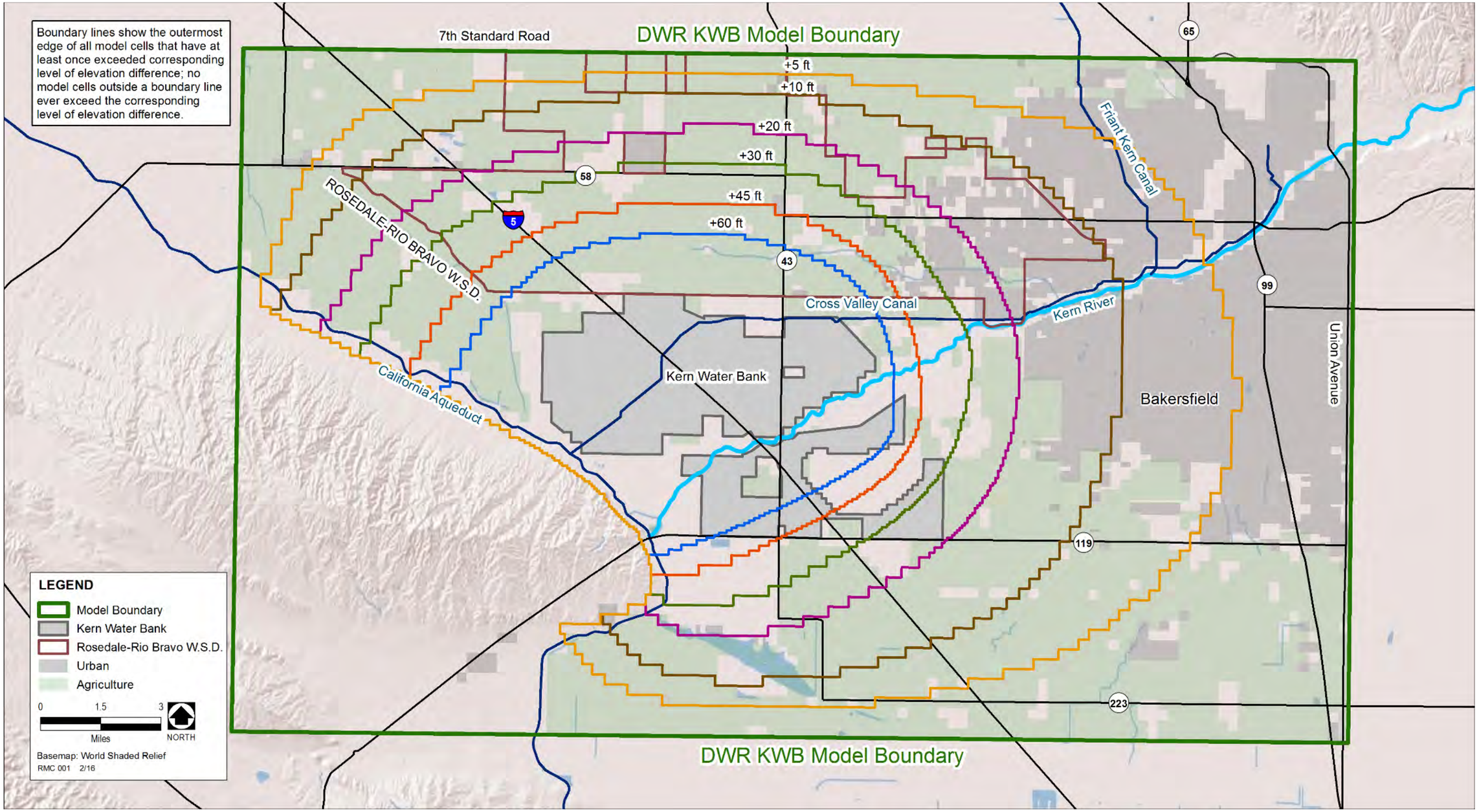


FIGURE 3.3-9. Analysis of Future Operations under Existing Conditions: Contours of Positive Elevation Differences ("With" minus "Without"), 2015–2035

TABLE 3.3-2

AREA AFFECTED AT DIFFERENT WATER LEVELS FOR THE AREA OUTSIDE THE KERN WATER BANK LANDS (ANALYSIS OF FUTURE OPERATIONS UNDER EXISTING CONDITIONS), 2015–2035

	Impacted Area Outside the Kern Water Bank Lands (acres)									
Frequency for 20-Year Simulation	**-60 Feet**	**-45 Feet**	**-30 Feet**	**-20 Feet**	**-10 Feet**	**+10 Feet**	**+20 Feet**	**+30 Feet**	**+45 Feet**	**+60 Feet**
Never Occurs	231,742	227,554	220,112	211,139	193,714	121,061	162,459	183,114	201,534	212,059
1–12 months	580	2,905	4,200	4,860	6,123	1,770	3,150	3,333	3,735	3,825
13–24 months	83	1,928	6,703	10,415	15,998	6,035	6,308	5,448	4,623	4,533
25–36 months	0	18	703	3,778	7,993	5,198	2,750	3,118	3,618	2,840
37–58 months	0	0	683	1,268	5,245	2,348	3,255	3,793	2,478	2,128
59–60 months	0	0	5	928	2,205	2,400	3,195	3,528	3,085	2,625
61–72 months	0	0	0	18	1,128	2,928	3,330	4,265	4,548	2,603
73–84 months	0	0	0	0	0	3,163	4,830	4,663	3,188	1,248
85–96 months	0	0	0	0	0	3,000	5,173	2,918	3,238	250
97–108 months	0	0	0	0	0	5,100	3,905	3,060	1,663	295
109–120 months	0	0	0	0	0	8,480	2,828	4,950	698	0
121–144 months	0	0	0	0	0	13,298	5,963	9,465	0	0
145–168 months	0	0	0	0	0	20,948	24,908	753	0	0
168 or more months	0	0	0	0	0	36,678	353	0	0	0

TABLE 3.3-3

AREA AFFECTED AT DIFFERENT WATER LEVELS FOR THE ENTIRE MODEL AREA (ANALYSIS OF FUTURE OPERATIONS UNDER EXISTING CONDITIONS), 2015–2035

	Impacted Area in Model Domain (acres)									
Frequency for 20-Year Simulation	**-60 Feet**	**-45 Feet**	**-30 Feet**	**-20 Feet**	**-10 Feet**	**+10 Feet**	**+20 Feet**	**+30 Feet**	**+45 Feet**	**+60 Feet**
Never Occurs	242,669	234,504	224,287	213,892	194,754	121,061	162,459	184,084	203,452	215,207
1–12 months	5,180	5,293	5,088	5,668	6,518	1,770	3,173	3,913	4,143	4,783
13–24 months	6,555	9,440	11,030	12,980	18,375	6,035	6,648	5,570	5,348	5,483
25–36 months	45	4,643	4,958	6,443	9,413	5,198	2,883	3,130	3,910	3,358
37–58 months	0	570	7,068	5,853	7,953	2,348	3,438	3,860	3,033	2,778
59–60 months	0	0	2,013	8,285	8,233	2,400	3,398	3,775	3,948	3,920
61–72 months	0	0	8	1,330	8,950	2,928	3,720	4,953	5,645	6,465
73–84 months	0	0	0	0	255	3,163	5,205	5,643	5,918	5,545
85–96 months	0	0	0	0	0	3,000	5,245	3,570	7,253	1,608
97–108 months	0	0	0	0	0	5,100	4,215	3,748	4,600	5,288
109–120 months	0	0	0	0	0	8,505	3,178	7,350	6,105	18
121–144 months	0	0	0	0	0	14,830	9,330	20,285	1,098	0
145–168 months	0	0	0	0	0	31,795	40,958	4,570	0	0
168 or more months	0	0	0	0	0	46,318	603	0	0	0

TABLE 3.3-4 ANALYSIS OF FUTURE OPERATIONS UNDER EXISTING CONDITIONS: AREA AFFECTED AT DIFFERENT LEVELS OF NEGATIVE DIFFERENCES ("WITH KERN WATER BANK OPERATIONS" MINUS "WITHOUT KERN WATER BANK OPERATIONS"), 2015–2035		
Level of Negative Difference	**Agricultural Area (Acres)**	**Urban Area (Acres)**
-45 feet	770	0
-30 feet	4,702	68
-20 feet	9,830	110
-10 feet	19,815	748
-5 feet	33,023	2,790

Table 3.3-5 Analysis of Future Operations Under Existing Conditions: Area Affected at Different Levels of Positive Differences ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015–2035		
Level of Positive Difference	**Agricultural Area (Acres)**	**Urban Area (Acres)**
5 feet	90,180	27,698
10 feet	67,250	13,270
20 feet	41,145	3,138
30 feet	28,093	860
45 feet	17,378	125

Figures 3.3-14 to 3.3-16 show the spatial characteristics of the groundwater mound that form during recharge operations of 2016-2019, 2026-2027, and 2032 under AFO-EC "With KWB Operations" conditions.

Figure 3.2-20 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 3.2-21 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 3.3-17 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 KWB Operations" and "Without KWB operations" scenarios, 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.

Figure 3.3-18 shows the water level hydrographs at two locations near KWB Lands, as shown in Figure 3.2-21. The hydrographs show the water levels for the AFO-EC "With KWB Operations" and "Without KWB Operations" scenarios and the ground surface elevation. The impact on the KWB recharge operations on the septic systems is discussed below.

3.3.6.1 2016-2019 Recharge Operations

As shown in Figures 3.3-14 and 3.3-17, 2016-2019 recharge operations resulted in water levels lower than 50 feet from surface along the entire length of the CVC in the KWB area. As shown in Figure 3.3-18, depth to groundwater in residential areas on septic systems located northeast of KWB Lands exceeds 50 feet. Groundwater elevations are not high enough to impact the CVC and the septic systems.

3.3.6.2 2026-2027 Recharge Operations

As shown in Figures 3.3-15 and 3.3-17, similar to 2016-2019 conditions, 2026-2027 recharge operations resulted in water levels lower than 50 feet from surface along the entire length of the CVC in the KWB area. High groundwater levels would be limited to the area within KWB Lands and east of the CVC. As shown in Figure 3.3-18, depth to groundwater in residential areas using septic systems located northeast of KWB Lands would exceed 50 feet. Groundwater elevations are not high enough to impact the CVC and the septic systems.

3.3.6.3 2032 Recharge Operations

As shown in Figure 3.3-16 and 3.3-18, water levels would be lower than 50 feet from surface along the entire length of the CVC and within almost all of the KWB area. Water levels in 2032 would be generally lower than 2019 and 2027 levels due to 2032 being a single-year recharge period while the other two recharge periods are 4- and 2-year recharge periods, respectively. Also, a higher percentage of KWB recharge is shifted to eastern ponds to be consistent with current recharge management practices of the KWB.

3.3.7 HIGH GROUNDWATER LEVELS AND IMPACT ON NEIGHBORING RECHARGE FACILITIES

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 AFO-EC conditions were evaluated by using water level hydrographs at the neighboring recharge facilities.

Figure 3.2-24 shows the locations of the selected water level hydrographs at the neighboring recharge facilities. Figure 3.3-19 shows the representative water level hydrographs at these locations. Table 3.3-6 shows the minimum depth to water under AFO-EC conditions at the four selected recharge facilities. The impact of KWB recharge operations on the neighboring recharge facilities during high groundwater elevations with all the groundwater banks operating simultaneously are discussed below.

TABLE 3.3-6

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

Simulation Period	Recharge Facility			
	Rosedale	Pioneer	2800 Acre	West Kern Water District
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

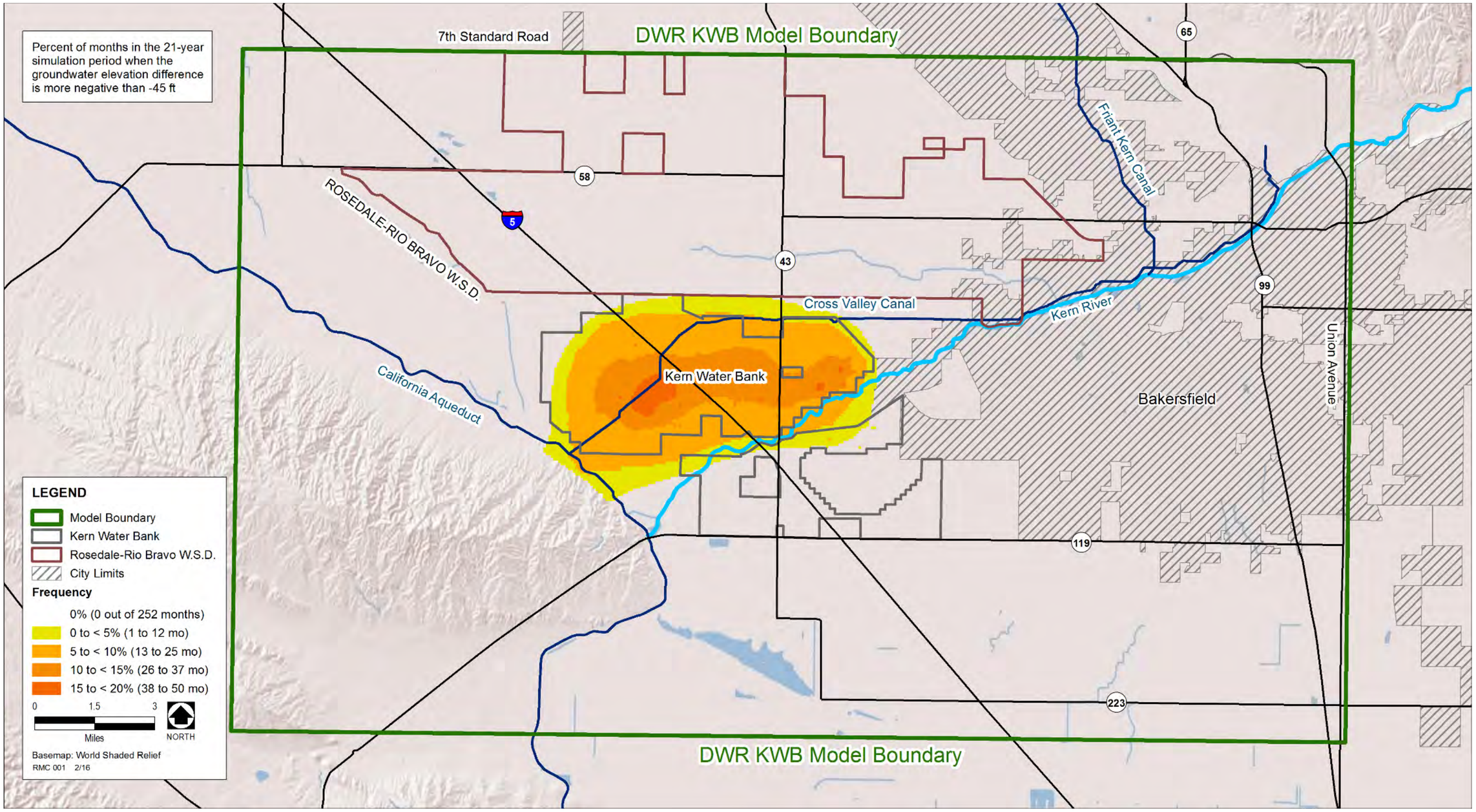


Figure 3.3-10a. Analysis of Future Operations under Existing Conditions: Frequency Distribution (% of Months) of Areas with > -45 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

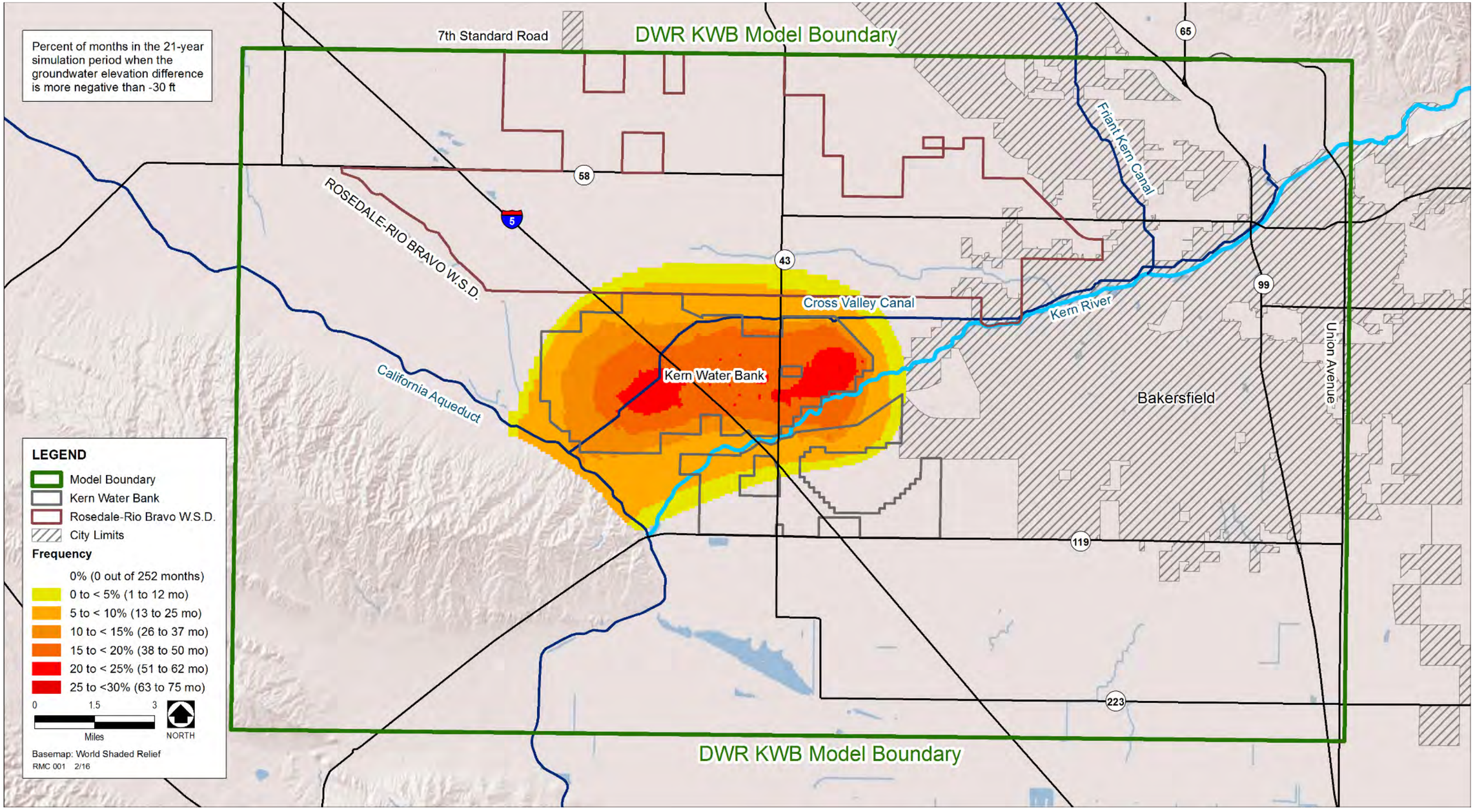


FIGURE 3.3-10b. Analysis of Future Operations under Existing Conditions: Frequency Distribution (% of Months) of Areas with > -30 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

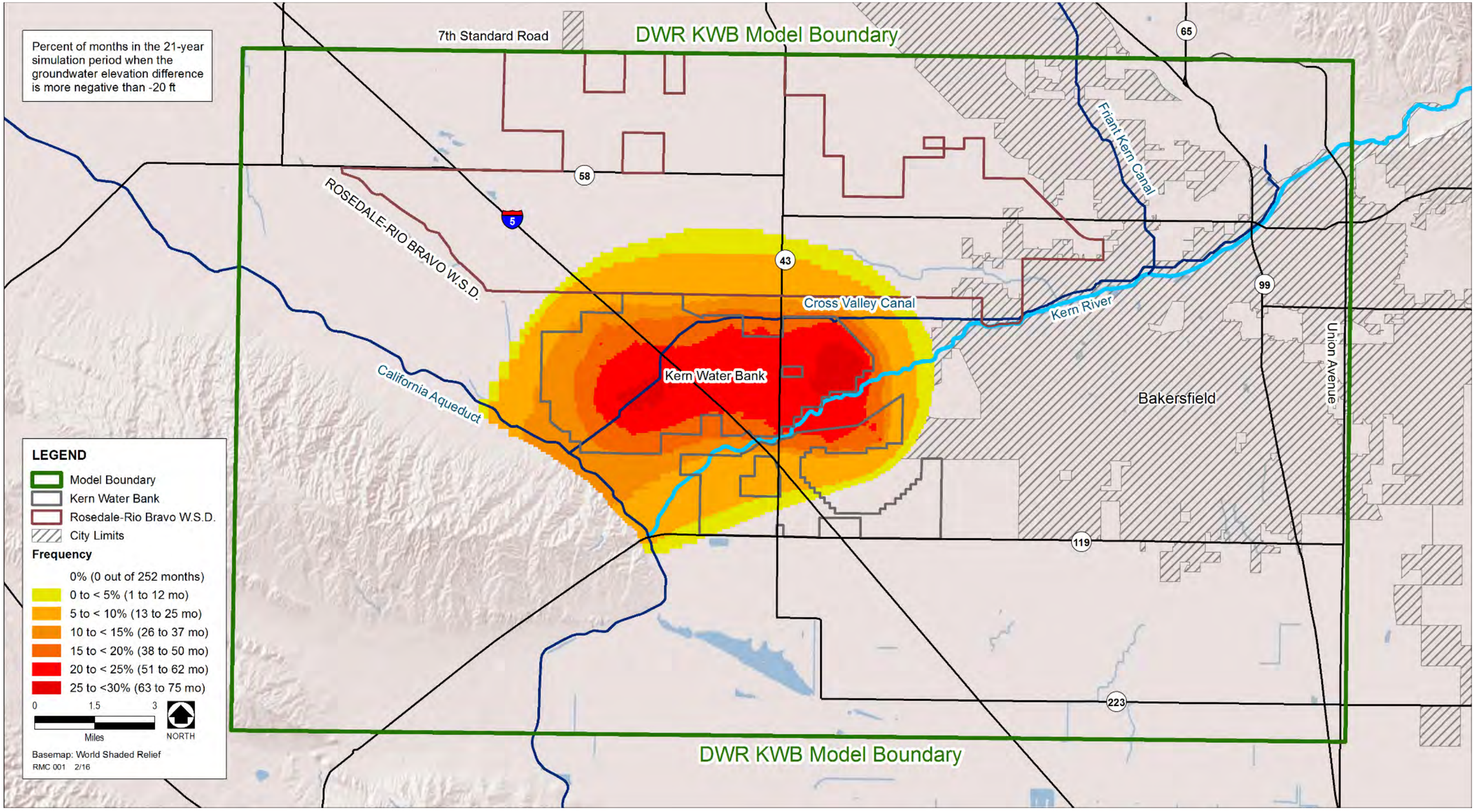


FIGURE 3.3-10c. Analysis of Future Operations under Existing Conditions: Frequency Distribution (% of Months) of Areas with > -20 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

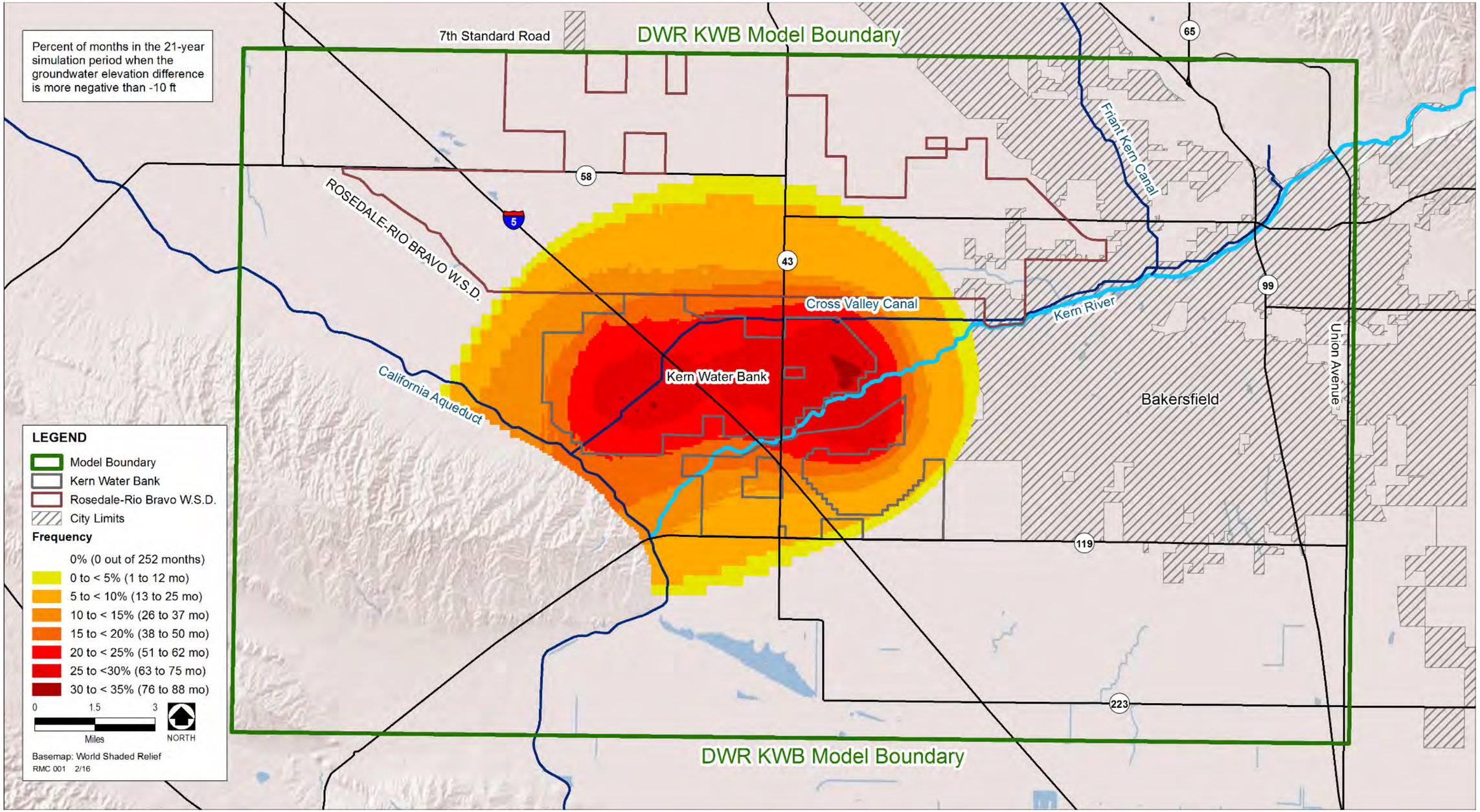


FIGURE 3.3-10d. Analysis of Future Operations under Existing Conditions: Frequency Distribution (% of Months) of Areas with > -10 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

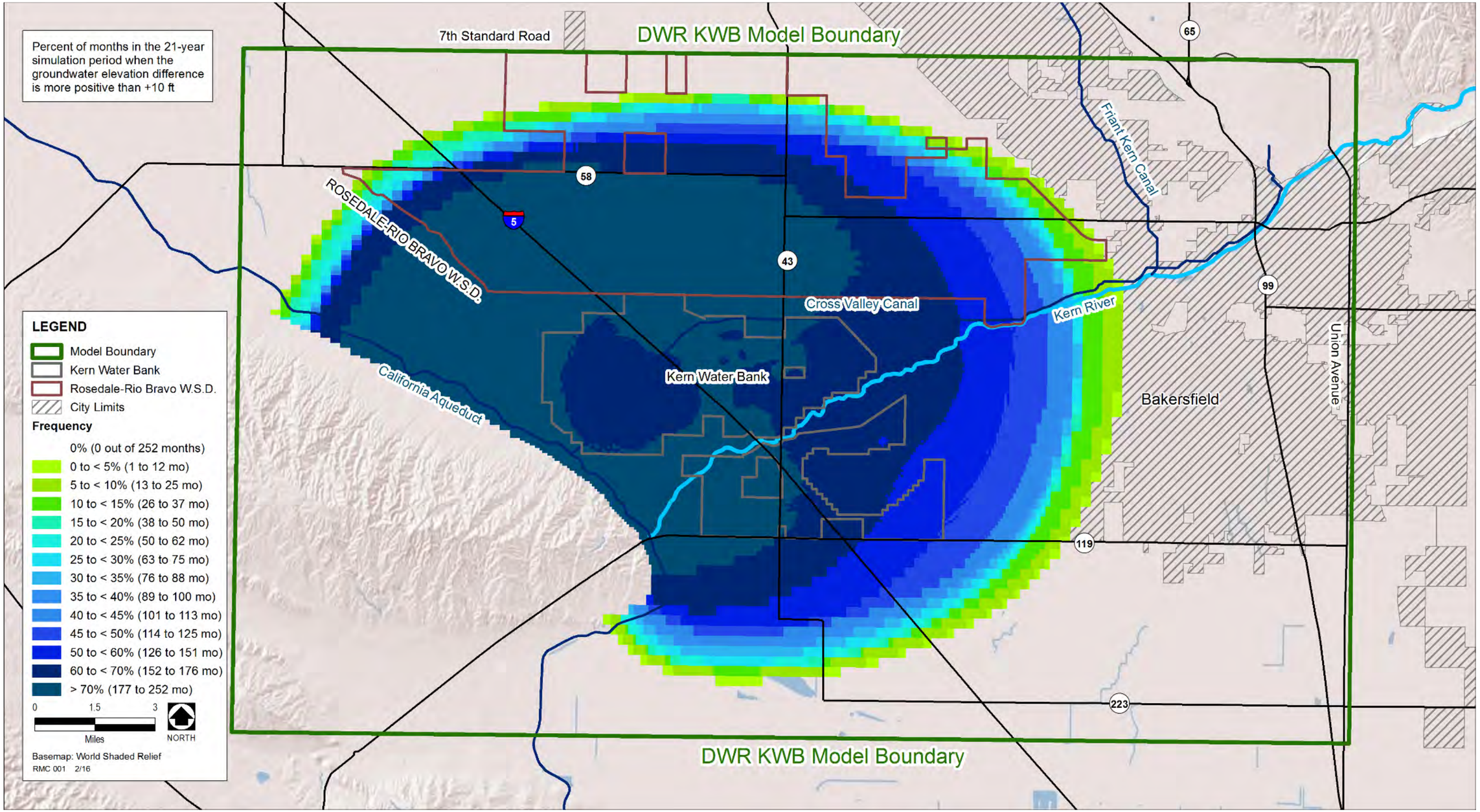


FIGURE 3.3-11a. Analysis of Future Operations under Existing Conditions: Frequency Distribution (% of Months) of Areas with > +10 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

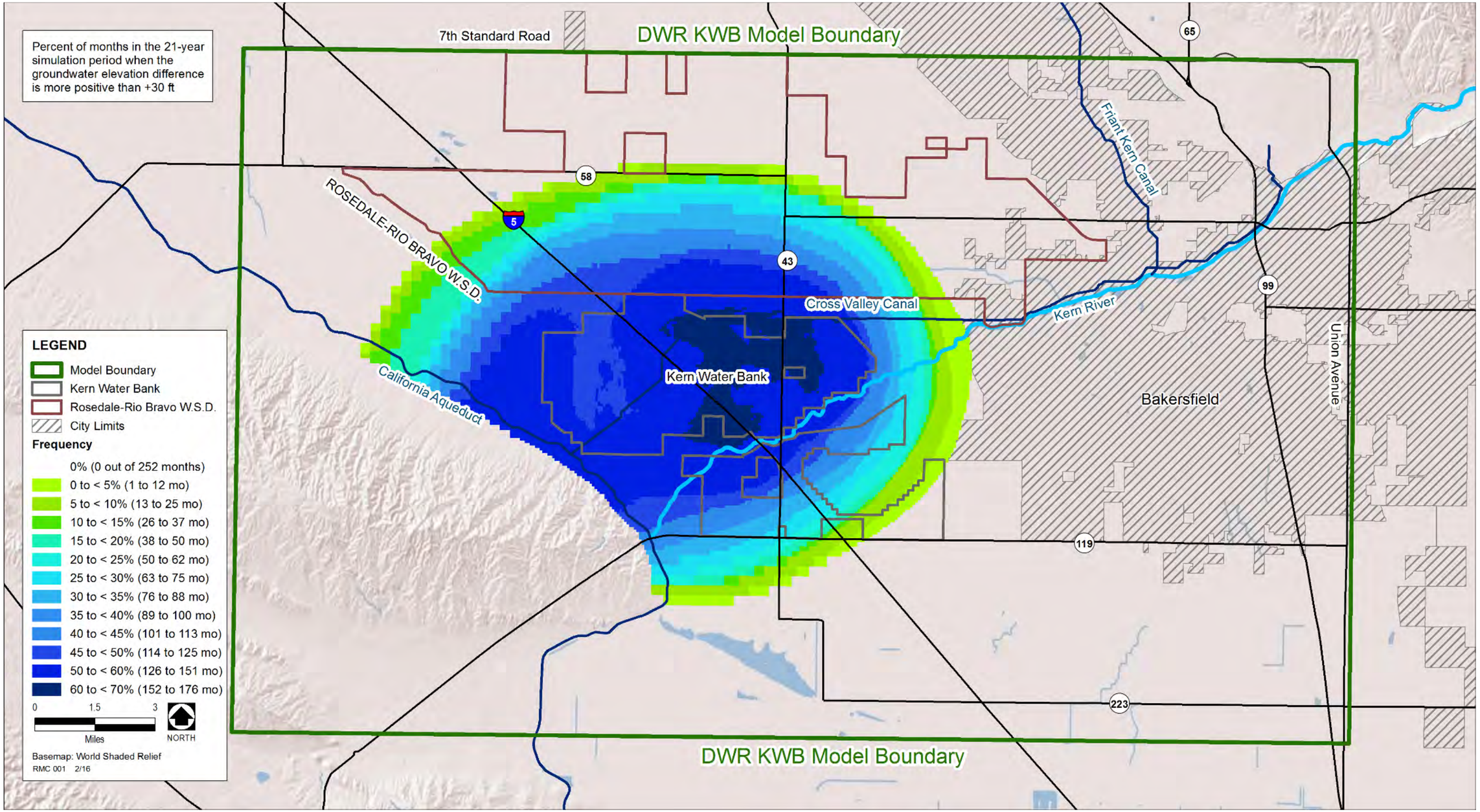


FIGURE 3.3-11b. Analysis of Future Operations under Existing Conditions: Frequency Distribution (% of Months) of Areas with > +30 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

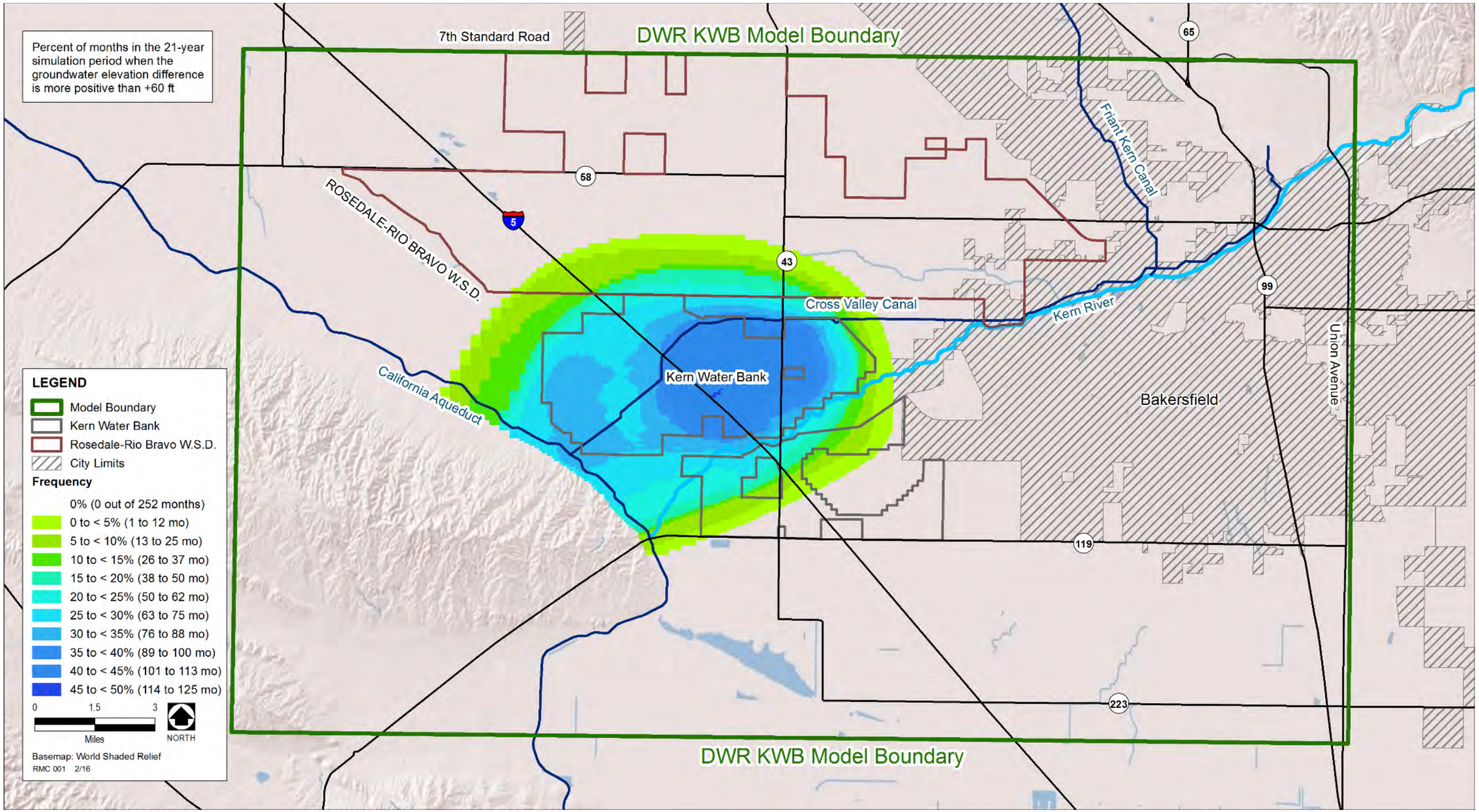


FIGURE 3.3-11c. Analysis of Future Operations under Existing Conditions: Frequency Distribution (% of Months) of Areas with > +60 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

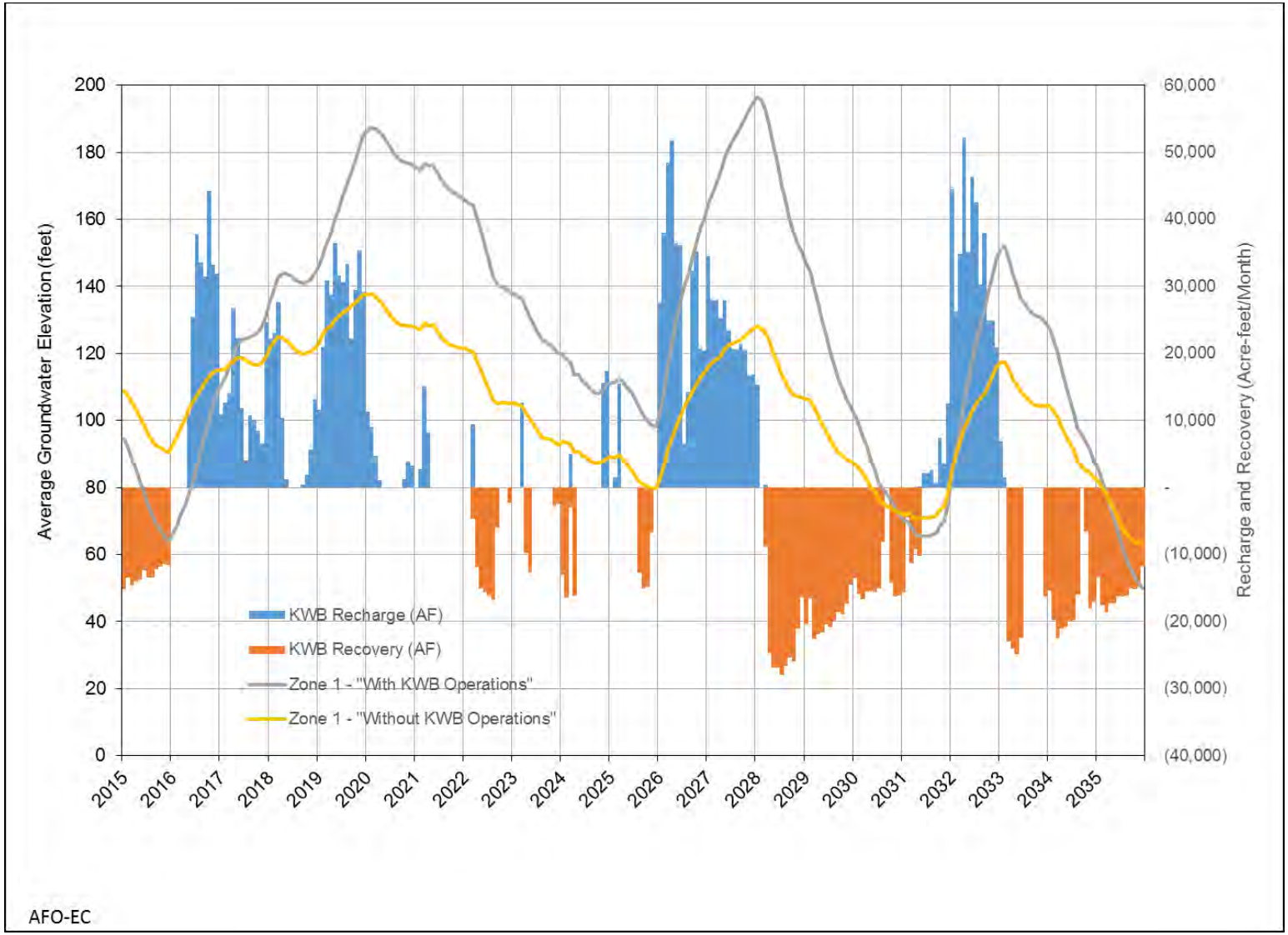


FIGURE 3.3-12a. Analysis of Future Operations under Existing Conditions: Average Groundwater Elevation Over Zone 1 (0 to 1 Mile Outside the Kern Water Bank Boundary), 2015-2035

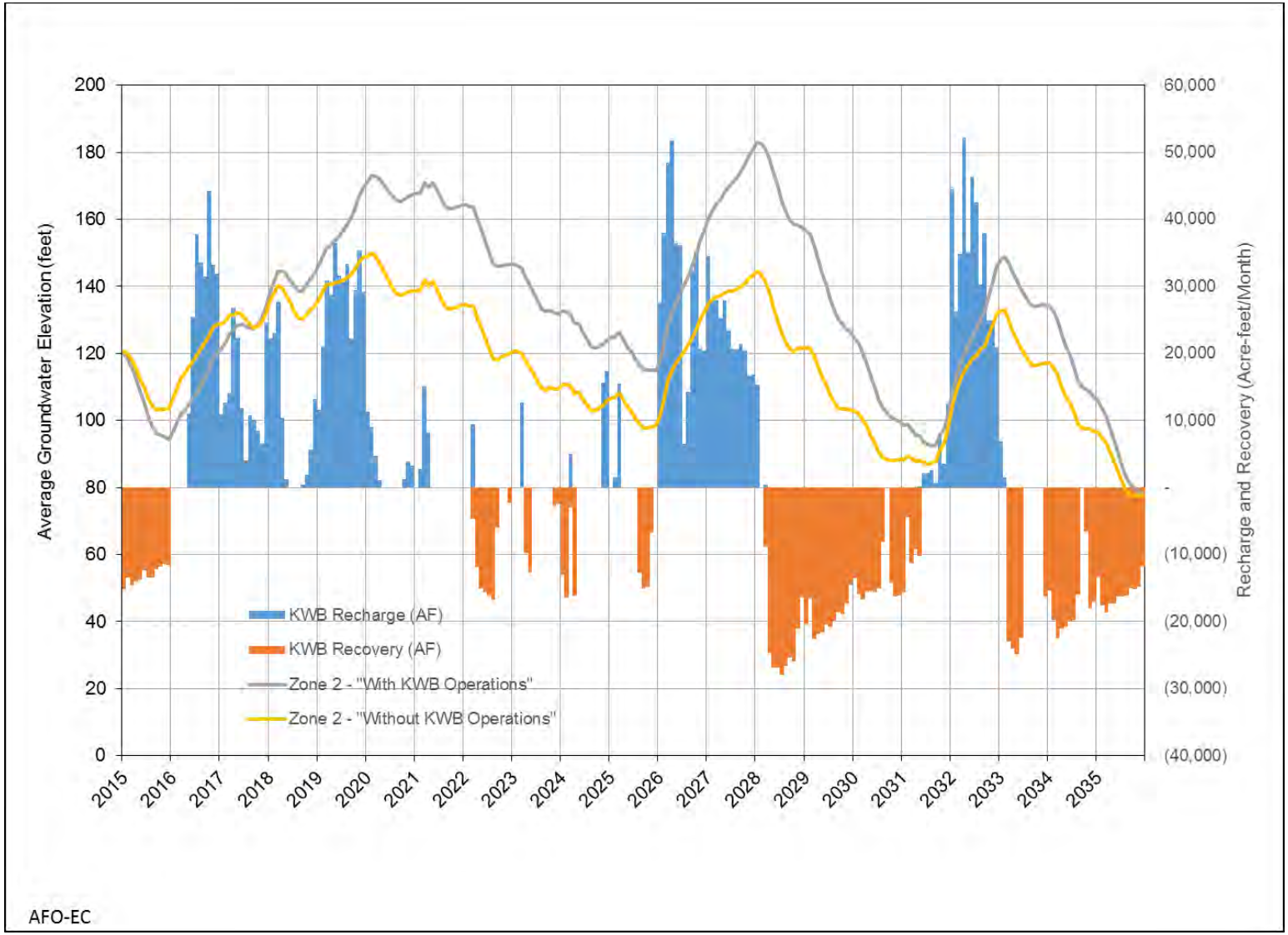


FIGURE 3.3-12b. Analysis of Future Operations under Existing Conditions: Average Groundwater Elevation Over Zone 2 (1 to 2 Miles Outside the Kern Water Bank Boundary), 2015-2035

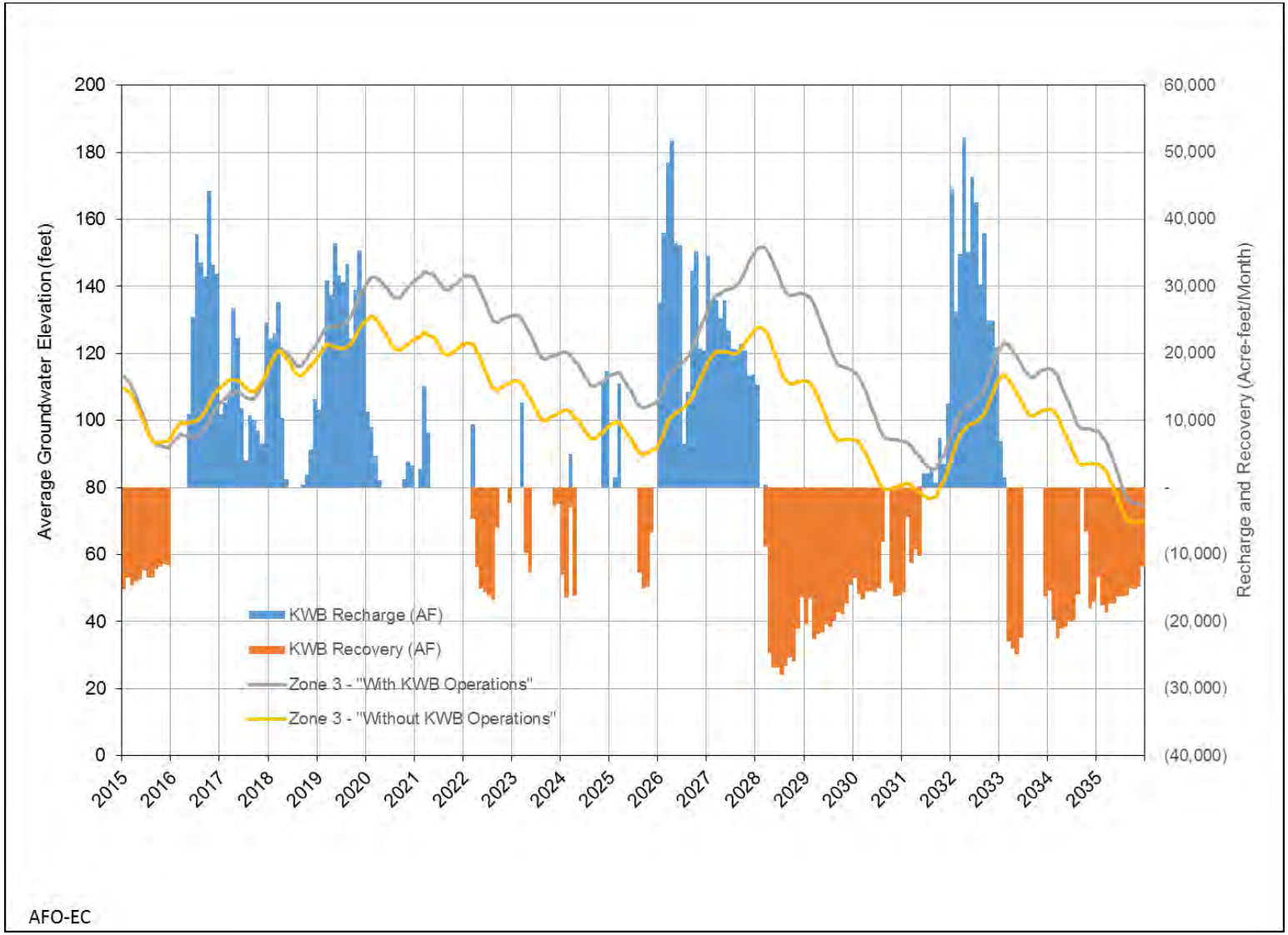


FIGURE 3.3-12c. Analysis of Future Operations under Existing Conditions: Average Groundwater Elevation Over Zone 3 (2 to 3 Miles Outside the Kern Water Bank Boundary), 2015-2035

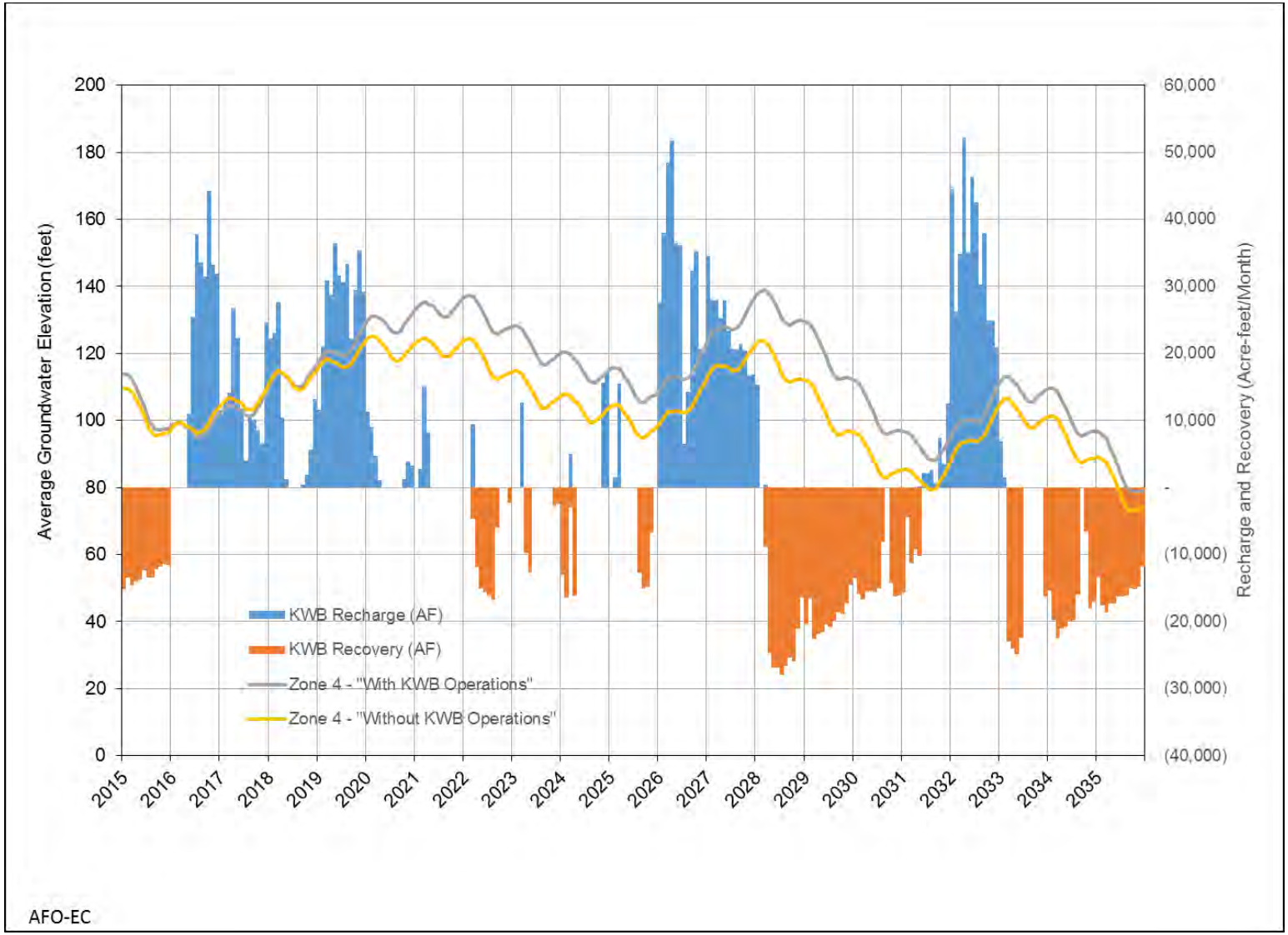


FIGURE 3.3-12d. Analysis of Future Operations under Existing Conditions: Average Groundwater Elevation Over Zone 4 (3 to 4 Miles Outside the Kern Water Bank Boundary), 2015-2035

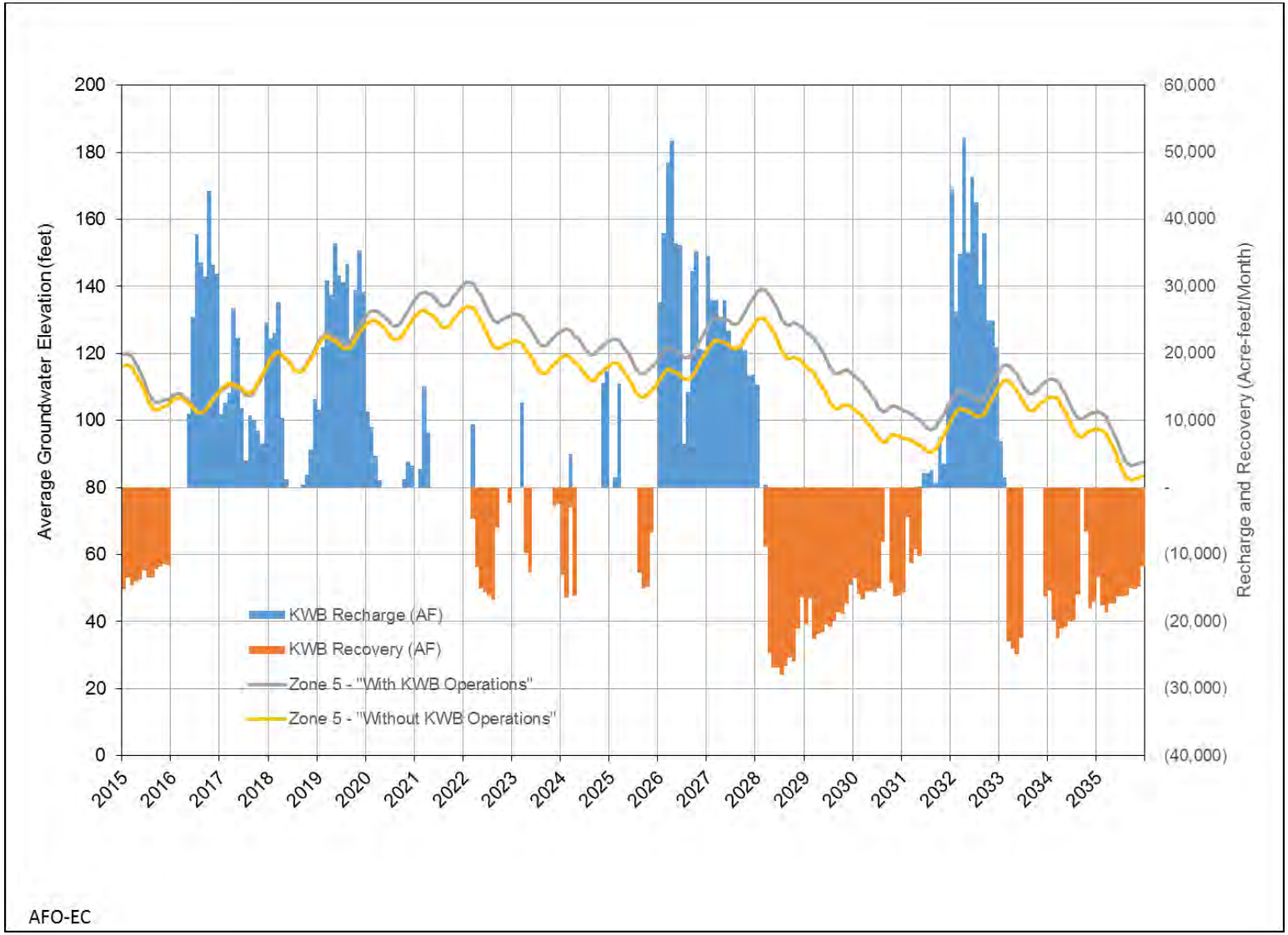


FIGURE 3.3-12e. Analysis of Future Operations under Existing Conditions: Average Groundwater Elevation Over Zone 5 (4 to 5 Mile Outside the Kern Water Bank Boundary), 2015-2035

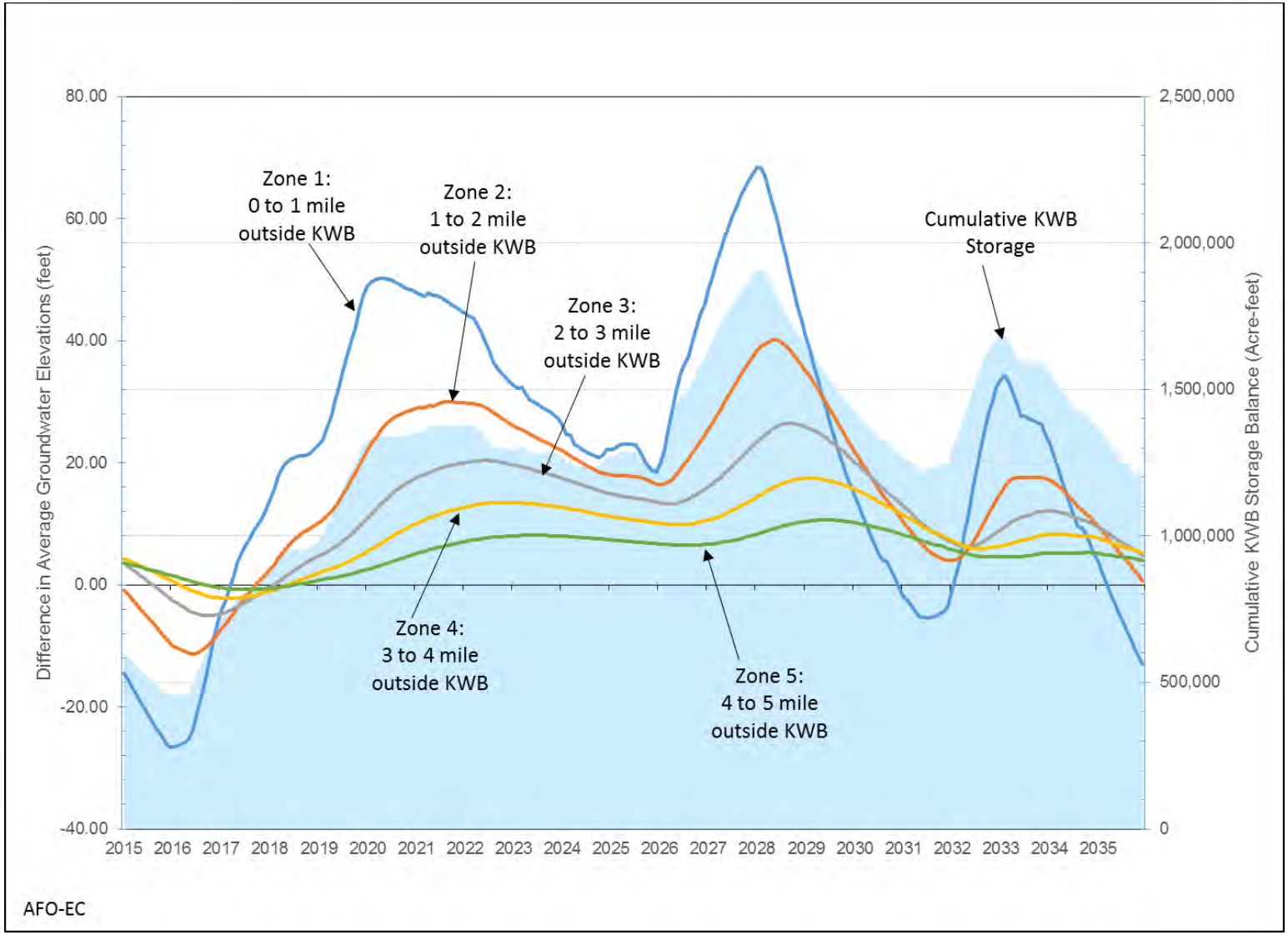


FIGURE 3.3-13. Analysis of Future Operations under Existing Conditions: Groundwater Elevation Differences in Zones 1 to 5, 2015-2035

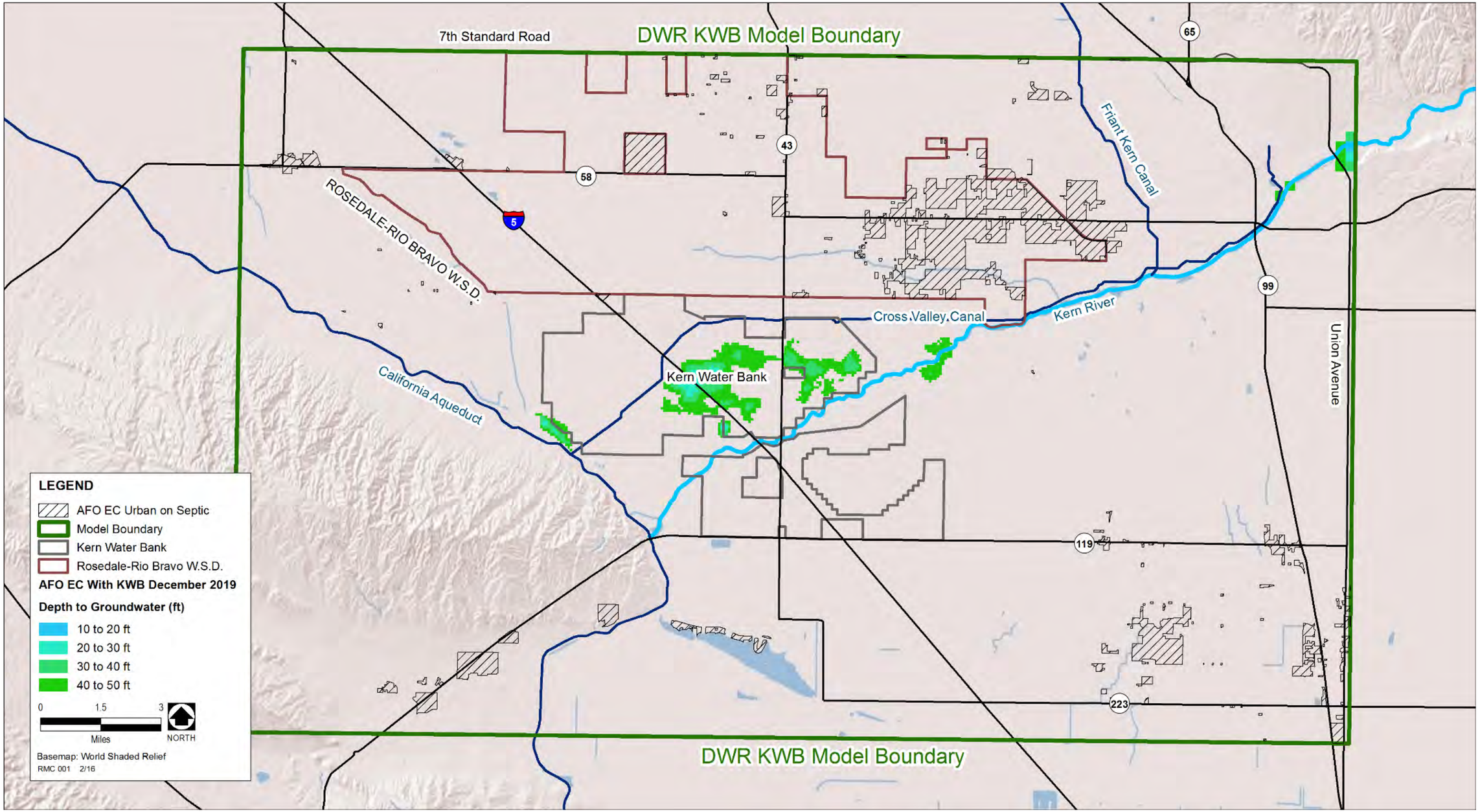


FIGURE 3.3-14. Analysis of Future Operations under Existing Conditions: Depth-to-Groundwater Contour Map, December 2019

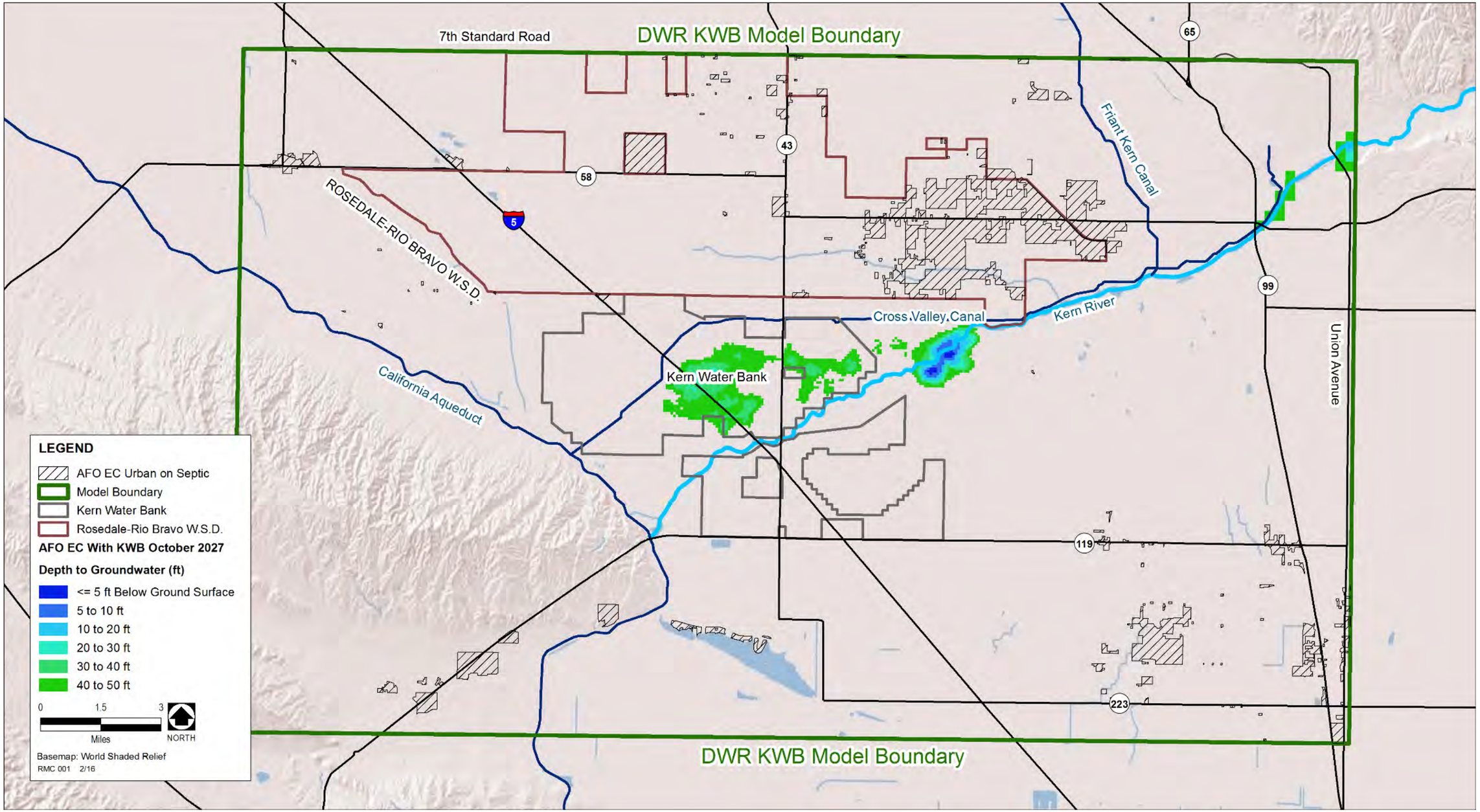


FIGURE 3.3-15. Analysis of Future Operations under Existing Conditions: Depth-to-Groundwater Contour Map, October 2027

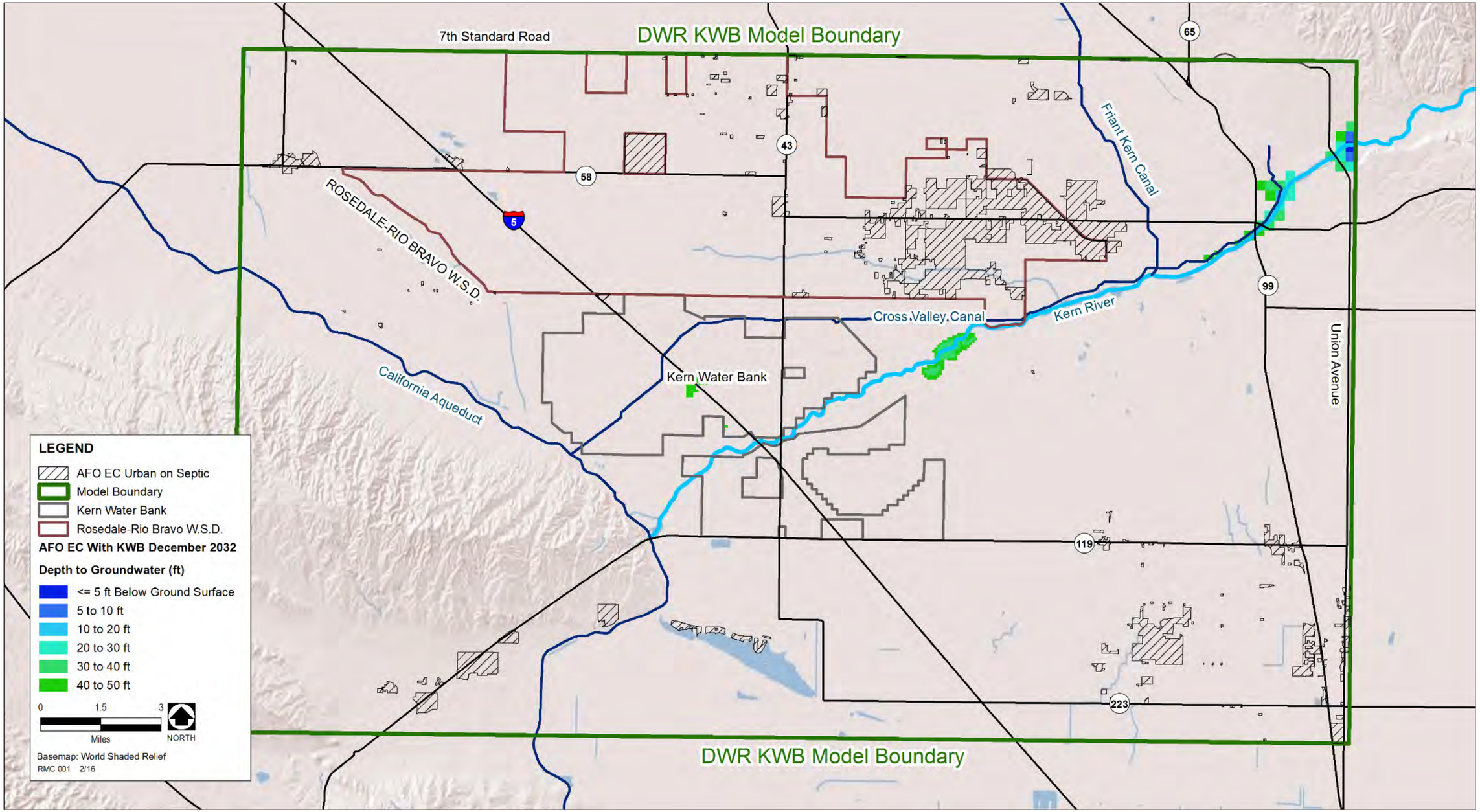
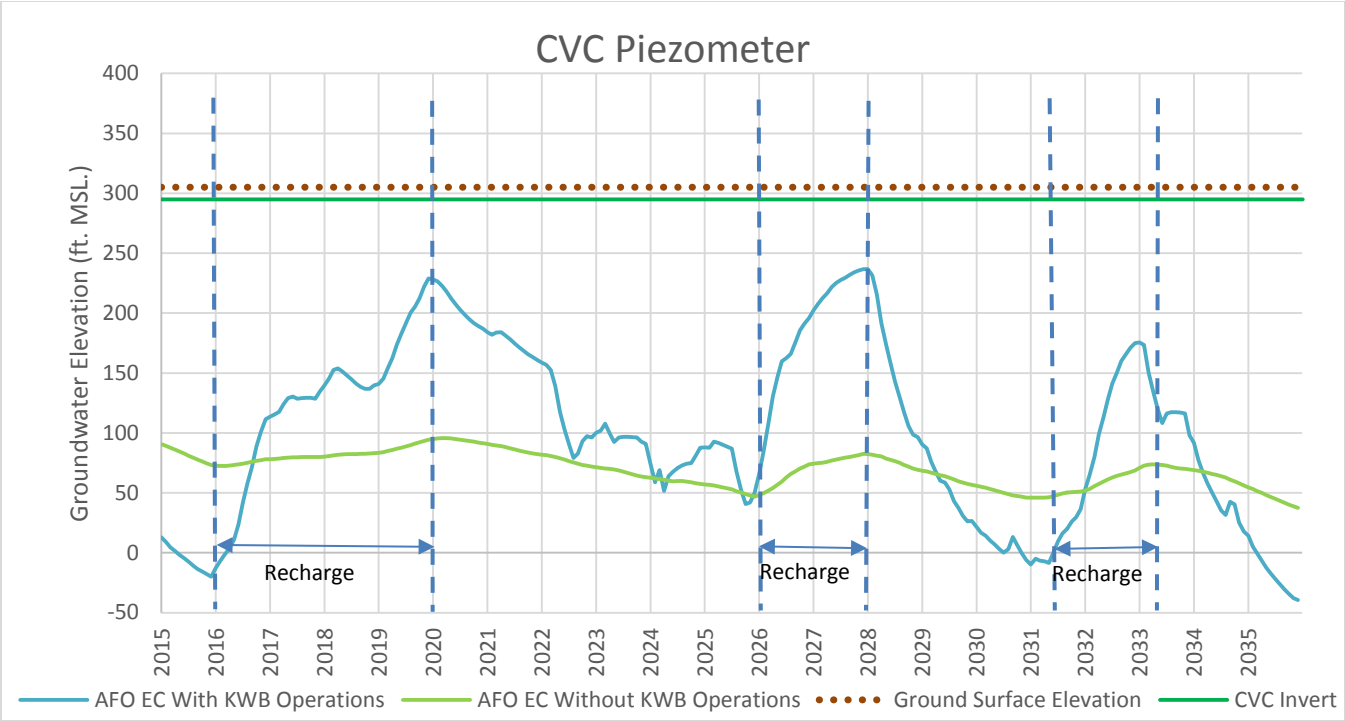


FIGURE 3.3-16. Analysis of Future Operations under Existing Conditions: Depth-to-Groundwater Contour Map, December 2032



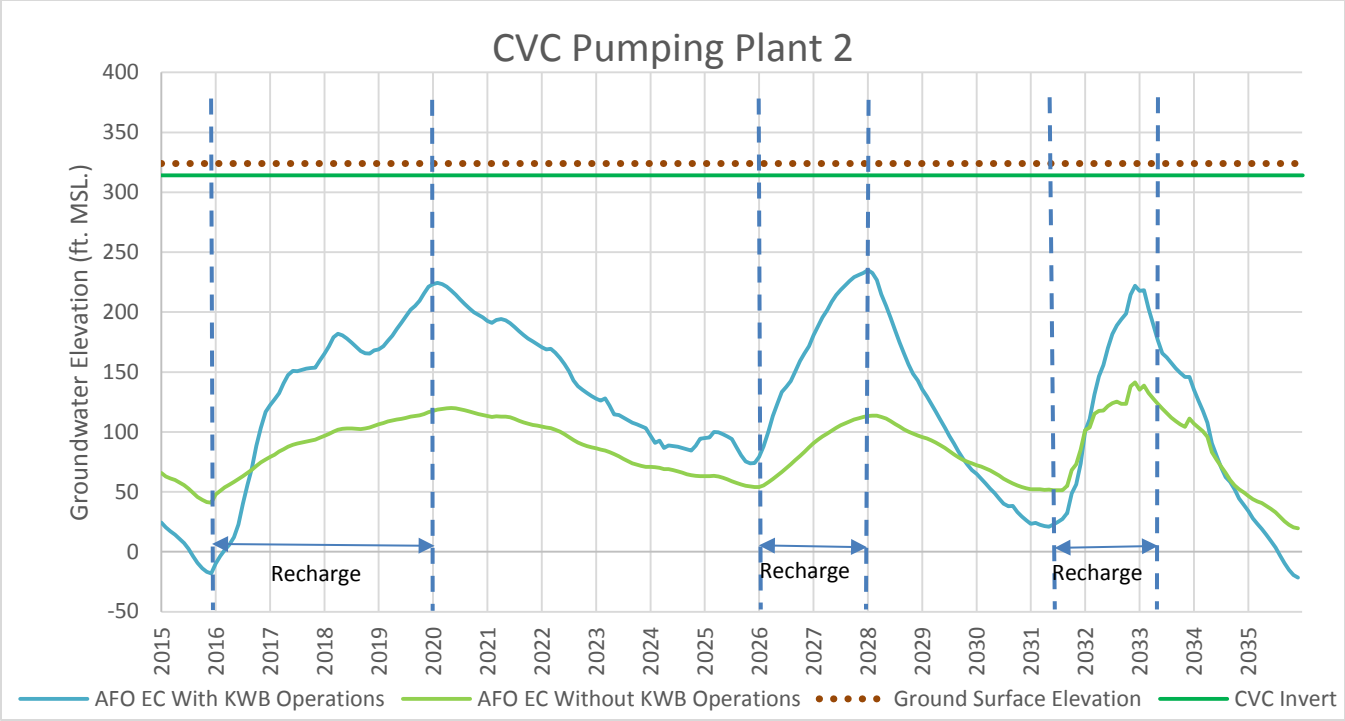


FIGURE 3.3-17. Groundwater Elevation Hydrographs at Selected Locations along the CVC for AFO-EC Scenario, 2015-2035

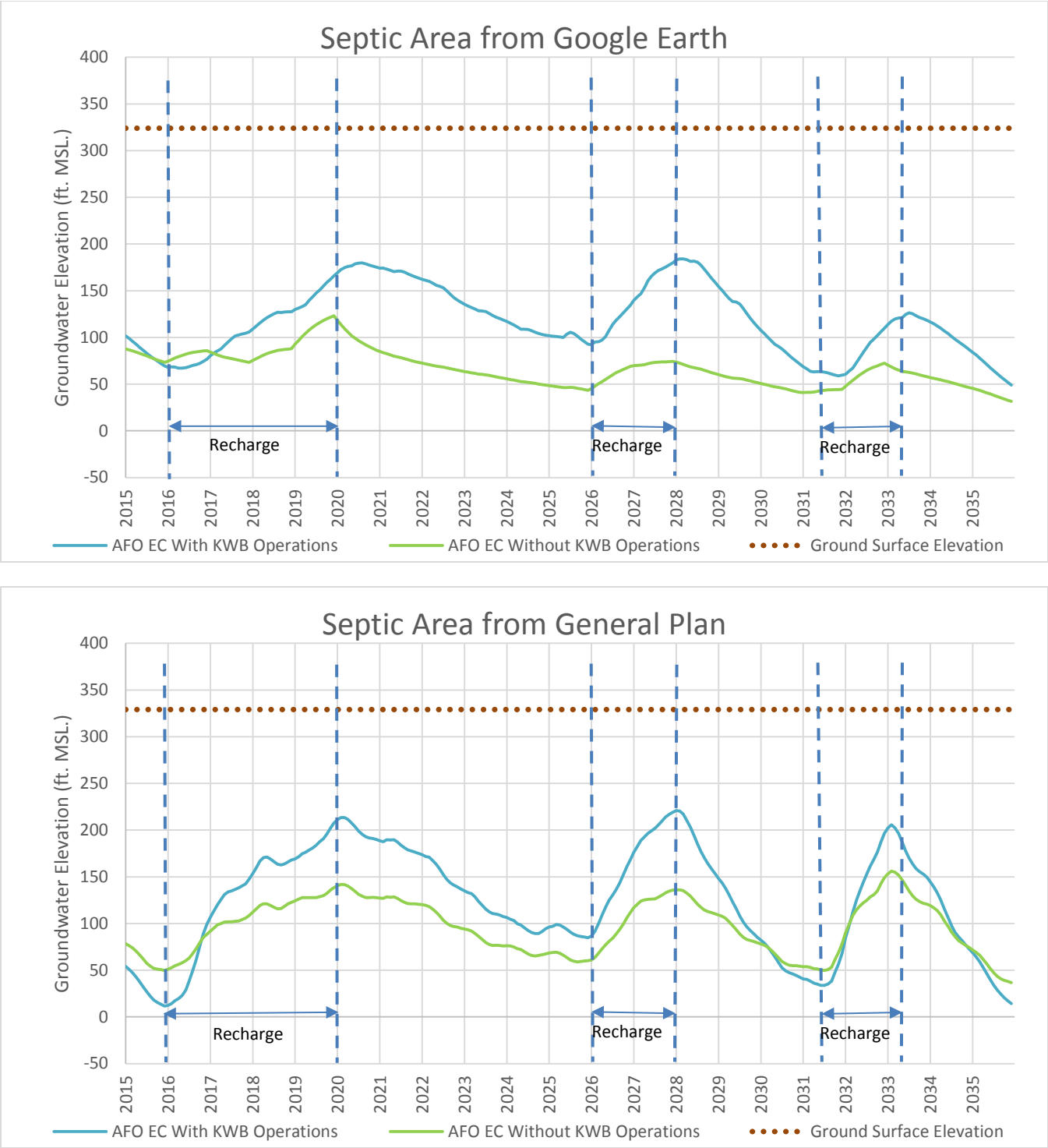


FIGURE 3.3-18. Groundwater Elevation Hydrographs at Selected Areas on Septic Systems for AFO-EC Scenario, 2015-2035

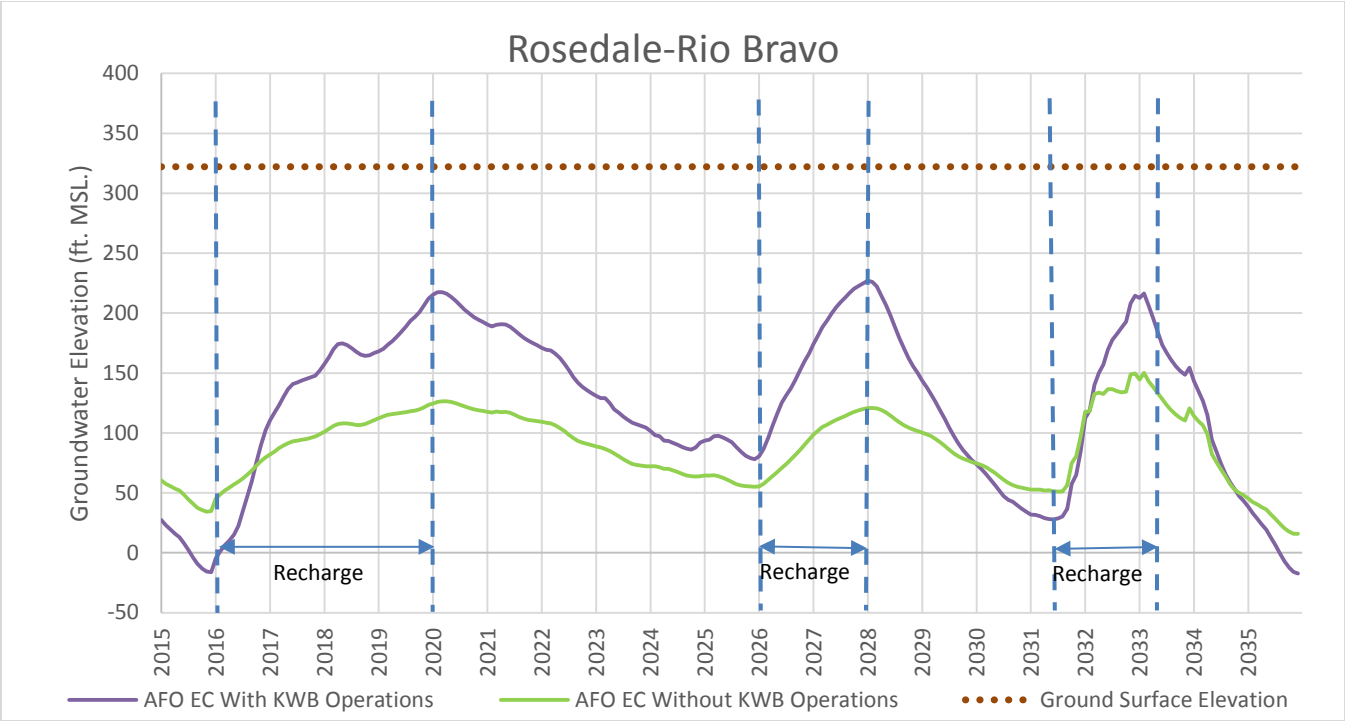


FIGURE 3.3-19a. Groundwater Elevation Hydrographs at Rosedale-Rio Bravo Recharge Pond for AFO-EC, 2015-2035

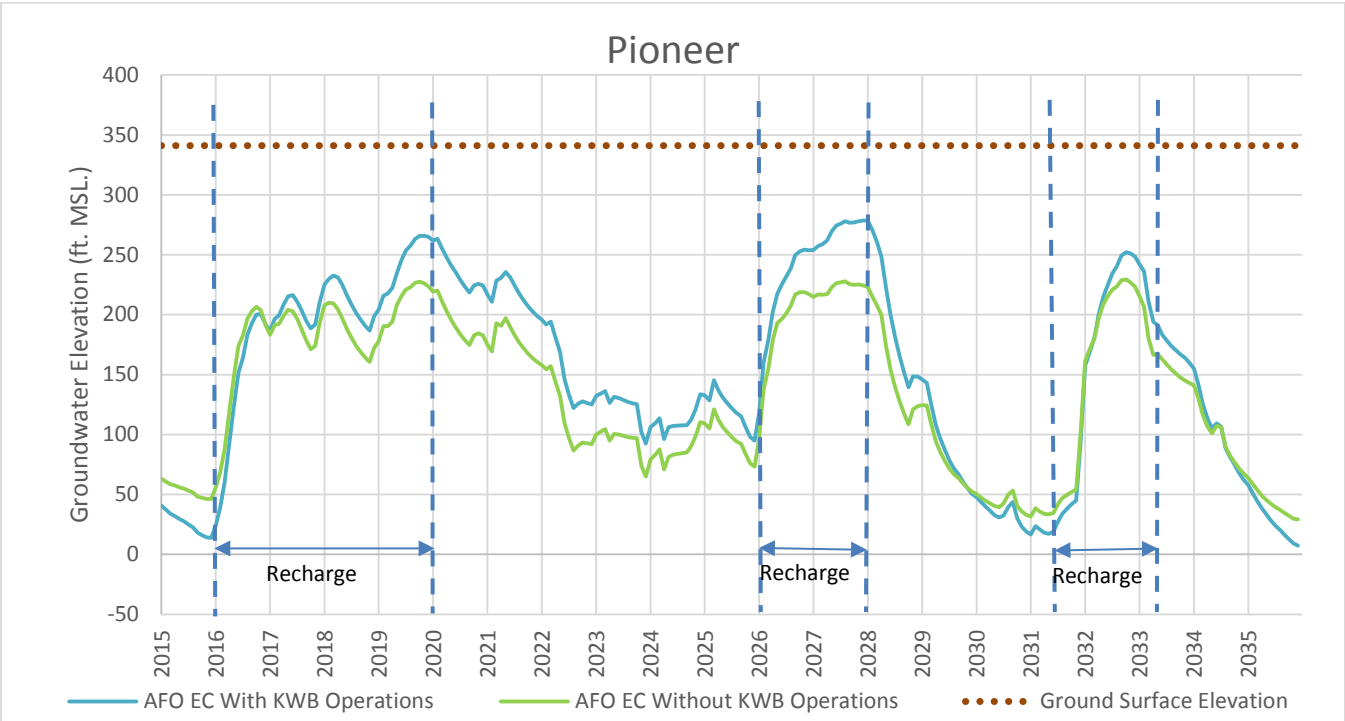


FIGURE 3.3-19b. Groundwater Elevation Hydrographs at Pioneer Recharge Pond for AFO-EC, 2015-2035

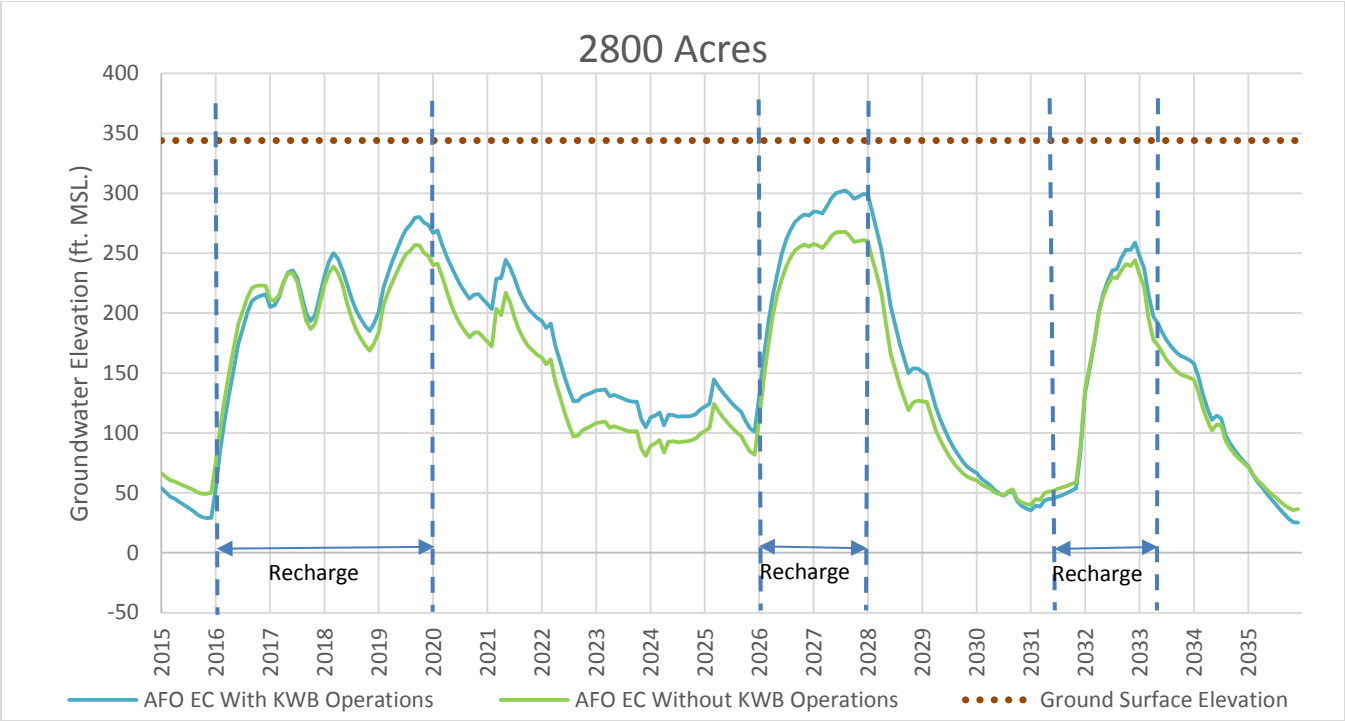


FIGURE 3.3-19c. Groundwater Elevation Hydrographs at 2800 Acres Recharge Pond for AFO-EC, 2015-2035

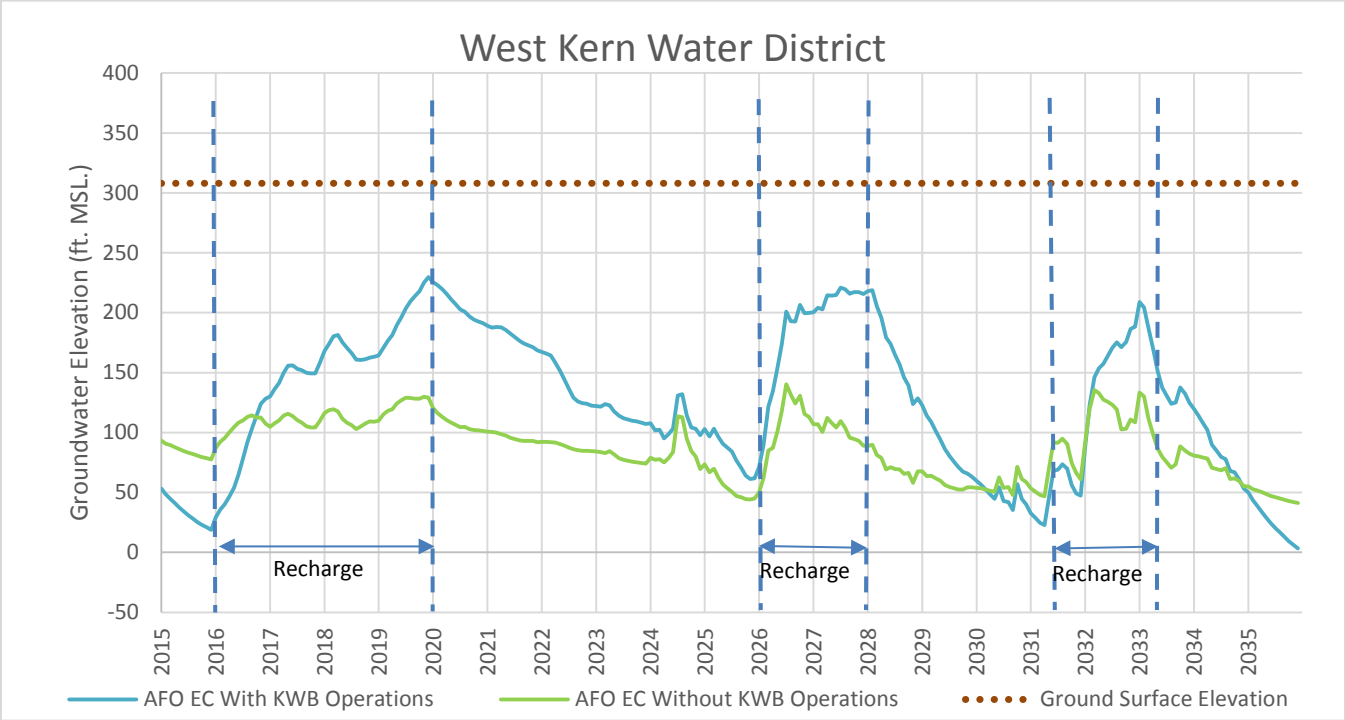


FIGURE 3.3-19d. Groundwater Elevation Hydrographs at West Kern Water District Recharge Pond for AFO-EC, 2015-2035

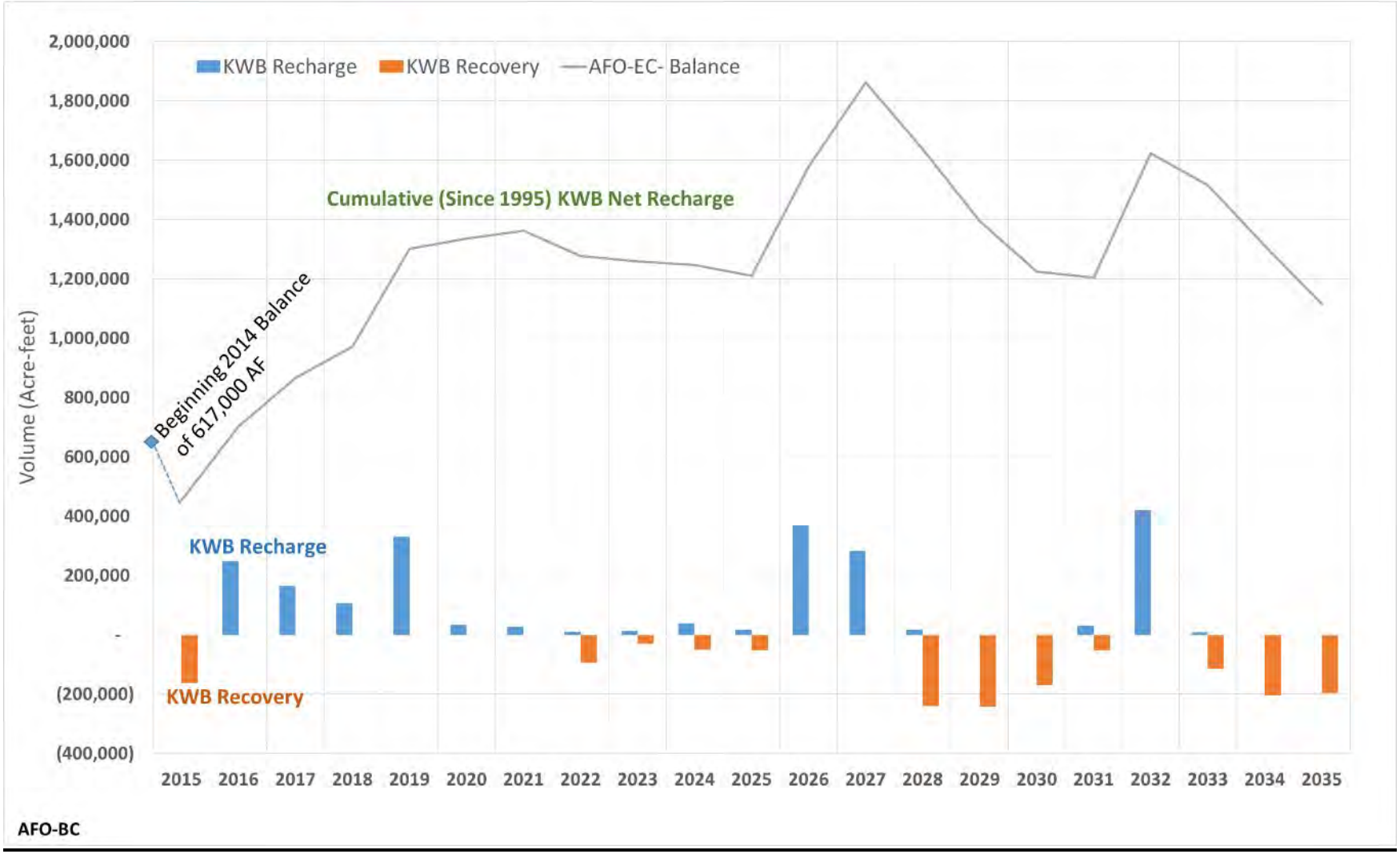


FIGURE 3.4-1. Analysis of Future Operations under Buildout Conditions: Kern Water Bank Annual and Cumulative Recharge and Recovery, and Cumulative Stored Water, 2015-2035

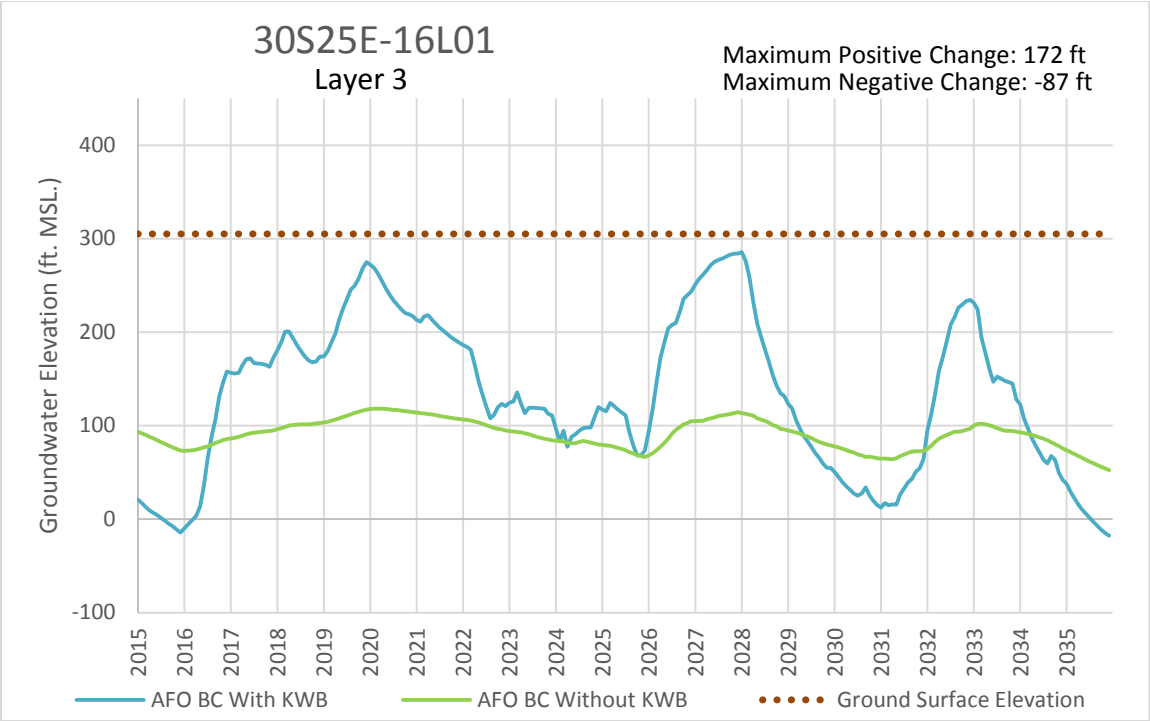


FIGURE 3.4-2a. Hydrographs of Analysis of Future Operations under Buildout Conditions: Simulated Water Levels at Monitoring Well 30S25E-16L, 2015-2035

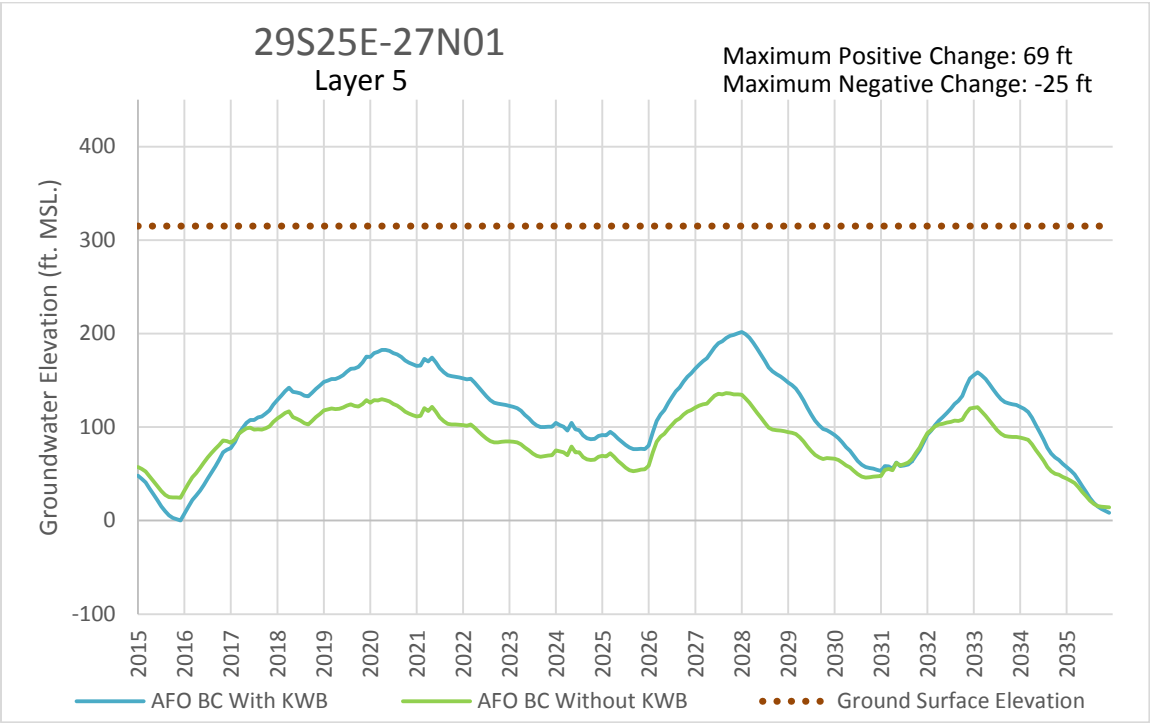


FIGURE 3.4-2b. Hydrographs of Analysis of Future Operations under Buildout Conditions: Simulated Water Levels at Monitoring Well 29S25E-27N, 2015-2035

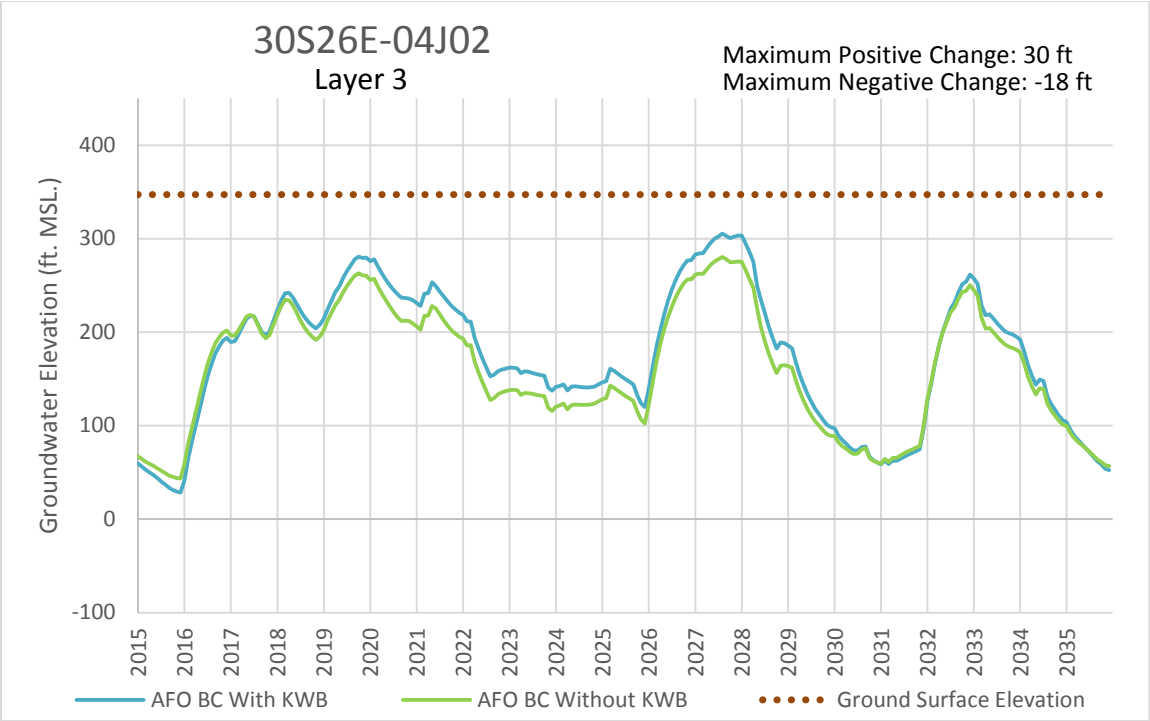


FIGURE 3.4-2c. Hydrographs of Analysis of Future Operations under Buildout Conditions: Simulated Water Levels at Monitoring Well 30S26E-04J, 2015-2035

3.3.7.1 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.

3.3.7.2 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.

3.3.7.3 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.

3.3.8 ANALYSIS OF FUTURE OPERATIONS UNDER EXISTING CONDITIONS RESULTS SUMMARY

A summary of the evaluation of impacts on the groundwater table from KWB future operations under the AFO-EC scenario is provided in Table 3.3-7. Consecutive years of recovery attributable to future KWB operations under the existing level of development may cause groundwater levels to fall such that existing wells in the area immediately outside the KWB boundary are impacted. Unlike, APO conditions, recharge operations under AFO-EC conditions did not cause groundwater levels to rise enough to impact the CVC and residential area septic systems.

TABLE 3.3-7

SUMMARY OF ANALYSIS OF FUTURE OPERATIONS UNDER EXISTING CONDITIONS: MODEL SCENARIO RESULTS AFFECTING THE LOCAL GROUNDWATER TABLE, 2015-2035

Evaluation Metric	Conclusion
Water Budgets (Section 3.3.1)	The KWB has a balance of +566,000 AF of stored water at the end of 2035. With the addition of APO balance of +617,000 AF, KWB has a cumulative balance of +1,183,000 AF in aquifer volume of stored water at the end of 2035 under the AFO-EC scenario.
Groundwater Elevation Differences (Hydrographs & Contour Maps) (Section 3.3.2)	The positive groundwater elevation differences extend to almost all of the model domain. The negative groundwater elevation differences are limited to KWB Lands and the surrounding area.
Temporal Variation Area of Negative and Positive Elevation Differences (Section 3.3.3)	Outside the KWB boundary, negative elevation differences occur in the first year of simulation because of the prior 3 years of recovery; thereafter, negative elevation differences occur after about 2 years of recovery following a recharge cycle.
Spatial Extent of Negative and Positive Elevation Differences (Section 3.3.3)	Outside the KWB boundary, negative elevation differences exceeding -30 feet are contained within 1.5 mile of the KWB boundary. Outside the KWB boundary, negative elevation differences exceeding -30 feet affect less than 5,000 acres of agricultural land in the immediate vicinity of KWB Lands, which represents less than four percent of the total agricultural area within the model domain. Outside the KWB boundary, positive elevation differences exceeding +60 feet (indicative of a high water table) are contained within 2.5 miles of the KWB boundary.
Frequency Distribution of Negative and Positive Elevation Difference (Section 3.3.4)	Negative elevation differences exceeding -30 feet remain within the KWB boundary 90% of the time. Positive elevation differences exceeding +60 feet remain within the KWB boundary 75% of the time.
Average Elevation and Elevation Difference in Selected Zones (Section 3.3.5)	The average groundwater elevation of "With KWB Operations" in Zones 1–3 is lower than that of "Without KWB Operations" in 2015 and 2016, because of 4 consecutive years of recovery from 2012 through 2015.
High Groundwater Levels and Existing Infrastructure (Section 3.3.6)	Groundwater levels will not rise enough to impact the CVC and residential septic systems.
High Groundwater Level and Neighboring Recharge Facilities (Section 3.3.7)	KWB operations, concomitant with the operations of other neighboring groundwater banks, may not potentially interfere with the recharge operations at neighboring groundwater banks.

Notes: AF = acre-feet; AFO-EC = Analysis of Future Operations under Existing Conditions; APO = Analysis of Past Operations; KWB = Kern Water Bank

3.4 RESULTS OF ANALYSIS OF FUTURE OPERATIONS UNDER BUILDOUT CONDITIONS SCENARIOS

The results of the AFO-BC "With KWB Operations" and "Without KWB Operations" scenarios are presented in the following subsections.

3.4.1 WATER BUDGET AND RECHARGE AND RECOVERY AT THE KERN WATER BANK

The AFO-BC "With KWB Operations" model was used to develop an annual water budget for the entire model domain for the 2015–2035 KWB future operations period. Table 3.4-1 shows key components of the water budget, including the change in groundwater storage.

Boundary inflow and outflow components are the largest components of the water budget. Boundary inflow, with an annual average of approximately 377,000 AFY, is approximately 7,910,000 AF for the 2015–2035 AFO-BC future operation period. Boundary outflow, with an annual average of approximately 300,000 AFY, is approximately 6,297,000 AF for the same period.

Agricultural and urban water demand during the 2015–2035 period is partially met by a total of 7,383,000 AF of agricultural pumping and 1,736,000 AF of urban pumping. Approximately 1,680,000 AF of applied water is projected to return to the aquifer as deep percolation.

During the 21-year (2015–2035) simulation period for the AFO-BC scenario, the KWB is projected to recharge 2,112,000 AF of water while recharge by other banking projects in the model domain is projected to be 4,158,000 AF. AFO-BC recharge at the KWB and other banking facilities are higher than historical (1995–2014) recharge because increased pond areas under buildout conditions allow the water banks to recharge additional water (e.g., floodwater) that was available under hydrologic conditions similar to the 1995–2014 period. The KWB is projected to recover 1,614,000 AF during the AFO-BC simulation period while recovery at other projects is projected to be 2,029,000 AF. The total volume of water recovered from the KWB and other water banking projects is higher than the historical amount because of an additional year of pumping in 2015 and increased recovery wells under buildout conditions. This generates a balance of 498,000 AF of stored water for the KWB and 2,129,000 AF of stored water for other banking projects. The KWB annual recharge, recovery, and cumulative balance of stored water amounts are shown in Figure 3.4-1.

Note that there was an accumulated balance of 617,000 AF of stored water at the end of the 1995–2014 historical KWB operations period. When this prior balance is added to the additional 2015–2035 stored water, there is a cumulative balance of 1,115,000 AF of stored water in the aquifer at the end of 2035 under the AFO-BC scenario.

3.4.2 GROUNDWATER ELEVATION DIFFERENCE FOR WITH AND WITHOUT KERN WATER BANK OPERATIONS

As with the APO (see Section 3.2.2), groundwater elevation differences for the AFO-BC "With KWB Operations" and "Without KWB Operations" scenarios were evaluated by comparing simulated groundwater elevation hydrographs at several monitoring wells (Method No. 3 in Section 3.1) and developing groundwater elevation difference contour maps at the end of several representative recharge and recovery cycles (Method No. 2 in Section 3.1).

3.4.2.1 Hydrographs

Hydrographs of simulated groundwater levels for the "With KWB Operations" and "Without KWB Operations" scenarios were developed at 31 wells (14 wells inside the KWB boundary and 17 wells outside the KWB

boundary; Appendix 7-2F). The locations and hydrographs for three of these wells are shown in Figures 3.2-2 and 3.4-2a to 3.4-2c.

3.4.2.2 Contour Maps

The distribution of groundwater elevation differences between the “With KWB Operations” and “Without KWB Operations” scenarios after major KWB recharge and recovery cycles is shown in Figures 3.4-3 and 3.4-4. Figures 3.4-3a to 3.4-3c show groundwater elevation differences after the 1995–2000, 2005–2006, and 2011 recharge cycles, respectively. Figures 3.4-4a to 3.4-4c show groundwater elevation differences after the 2001–2004, 2007–2009, and 2012–2014 recovery cycles, respectively.

3.4.3 AFFECTED AREAS OUTSIDE THE KERN WATER BANK LANDS

The impacts of KWB operations on groundwater elevations outside KWB Lands for the AFO-BC “With KWB Operations” and “Without KWB Operations” scenarios are evaluated using time series charts showing areas affected by head differences of ±5 feet (Method No. 4 in Section 3.1), maps of the spatial extent of negatively and positively impacted areas (Method No. 5 in Section 3.1), and tables summarizing the acreage of impacted areas.

3.4.3.1 Time Series of Affected Area

At every time step of the simulation, the total area of the model with groundwater elevation difference greater than 5 feet and groundwater elevation difference less than -5 feet was calculated. Time series of these areas are shown in Figure 3.4-5. A detailed chart showing areas impacted by less than -5, -10, -20, -30, -45, and -60 feet is shown in Figure 3.4-6. Figure 3.4-7 shows areas impacted by groundwater levels greater than 5, 10, 20, 30, and 45 feet.

Negative elevation differences exceeding -5 feet continue to spread over a large area (52,000 acres in 2015) because of continued recovery in 2015 (the first year of the AFO-BC scenario), which was preceded by 3 consecutive years of recovery from 2012 to 2014 (the last 3 years of the APO scenario). Three consecutive years of recharge from 2016 through 2018 reduce the area with negative elevation differences exceeding -5 feet to zero. Areas with negative elevation differences reappear after periods of about 2 years of recovery (e.g., 2028–2029 and 2033–2034).

Figure 3.4-6 indicates that any negative differences exceeding -30 feet in areas outside KWB Lands are limited to years of groundwater recovery, affecting a maximum area of about 10,000 acres near KWB Lands in 2015 after 4 consecutive years of recovery (2012–2015).

3.4.3.2 Spatial Extent of Affected Area

Figure 3.4-8 shows the maximum spatial extent of negative elevation differences exceeding -60 feet, -45 feet, -30 feet, -20 feet, -10 feet, and -5 feet. This figure shows that negative elevation differences under the AFO-EC scenario spread about 4.5 miles outside the KWB boundary. Inside the Rosedale boundary, negative elevation differences exceeding -45 feet do not occur, but negative elevation differences between -5 feet and -45 feet do occur. The total area affected by negative elevation differences between -5 feet and -45 feet inside the Rosedale boundary is 16,562 acres of agricultural land.

TABLE 3.4-1

WATER BUDGET FOR ANALYSIS OF FUTURE OPERATIONS UNDER BUILDOUT CONDITIONS WITH KERN WATER BANK OPERATIONS, 2015-2035

Year	INFLOW Into Model						OUTFLOW from Model						Calculated Change in Storage
	Deep Percolation of Applied Water	KWB Recharge	Other Banking Projects Recharge	River and Canal Seepage	Boundary Inflow through DWR KWB Model Domain	Total Inflow	Agricultural Pumping	Urban Pumping	KWB Pumping	Other Banking Projects Pumping	Boundary Outflow through DWR KWB Model Domain	Total Outflow (Positive)	
	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY	AFY
2015	86,120	-	-	-	402,593	488,713	(381,757)	(82,673)	(163,306)	(280,776)	(258,335)	1,166,847	(678,134)
2016	70,062	248,404	561,186	179,029	390,276	1,448,957	(334,399)	(82,673)	-	(26,080)	(248,419)	691,571	757,386
2017	73,850	163,443	337,595	166,869	418,692	1,160,449	(328,524)	(82,673)	-	(25,761)	(231,863)	668,822	491,627
2018	72,679	105,526	282,490	164,725	455,582	1,081,002	(327,678)	(82,673)	-	(24,802)	(230,428)	665,581	415,421
2019	72,527	330,686	454,237	153,668	418,217	1,429,336	(334,699)	(82,673)	-	(24,027)	(245,012)	686,410	742,926
2020	82,645	34,548	90,420	146,220	422,018	775,850	(351,336)	(82,673)	-	(26,952)	(277,657)	738,618	37,232
2021	81,368	25,924	101,942	117,264	416,150	742,648	(358,232)	(82,673)	-	(31,548)	(270,994)	743,448	(800)
2022	84,840	9,428	15,239	83,336	305,560	498,403	(366,037)	(82,673)	(94,890)	(128,111)	(336,400)	1,008,112	(509,708)
2023	85,056	12,633	12,130	106,200	346,184	562,203	(366,596)	(82,673)	(30,381)	(64,024)	(311,367)	855,041	(292,837)
2024	83,799	37,952	62,887	140,967	383,405	709,011	(360,238)	(82,673)	(50,927)	(44,465)	(313,120)	851,423	(142,412)
2025	84,702	16,981	38,481	92,596	371,511	604,272	(366,720)	(82,673)	(52,071)	(71,338)	(321,803)	894,605	(290,333)
2026	70,938	367,533	678,089	187,847	396,810	1,701,217	(322,587)	(82,673)	-	(41,093)	(296,993)	743,346	957,871
2027	75,282	283,698	423,325	172,651	389,992	1,344,948	(328,761)	(82,673)	-	(38,687)	(289,054)	739,175	605,773
2028	85,653	15,724	33,840	57,508	321,008	513,734	(376,441)	(82,673)	(240,435)	(187,231)	(347,562)	1,234,343	(720,610)
2029	85,877	-	10,626	63,540	303,852	463,895	(357,337)	(82,673)	(243,528)	(223,716)	(390,279)	1,297,533	(833,637)
2030	85,306	-	14,575	63,858	328,436	492,176	(363,303)	(82,673)	(169,108)	(178,173)	(345,999)	1,139,256	(647,080)
2031	75,959	31,143	224,623	198,235	365,668	895,627	(329,505)	(82,673)	(53,022)	(68,150)	(313,341)	846,691	48,936
2032	69,119	420,319	742,715	262,648	427,089	1,921,890	(308,662)	(82,673)	-	(34,803)	(276,725)	702,863	1,219,026
2033	82,850	8,383	73,773	77,153	362,353	604,513	(358,544)	(82,673)	(115,228)	(62,853)	(316,757)	936,056	(331,543)
2034	86,120	-	-	54,142	323,419		(380,368)	(82,673)	(204,723)	(195,330)	(357,296)	1,220,389	(756,709)
2035	86,120	-	-	51,390	360,766	498,276	(381,757)	(82,673)	(196,616)	(251,427)	(317,946)	1,230,420	(732,144)
Total 2015–2035	1,680,874	2,112,325	4,158,176	2,539,847	7,909,579	17,937,120	(7,383,481)	(1,736,139)	(1,614,236)	(2,029,347)	(6,297,349)	19,060,552	

Notes: AFY = acre-feet per year; KWB = Kern Water Bank.

Figure 3.4-9 shows the maximum spatial extent of positive elevation differences exceeding +5 feet, +10 feet, +20 feet, +30 feet, +45 feet, and +60 feet. Positive differences in groundwater elevation attributable to KWB operations spread as far as 5.5 miles from the northern and eastern edges of KWB Lands and as far as 4 miles from the southern edge of KWB Lands.

3.4.3.3 Acreages of Affected Areas

The -30 feet elevation difference boundary line (see Figure 3.4-8) extends into agricultural area north and east of the KWB boundary. The negative differences in groundwater elevations between "With" and "Without" KWB operations spread into more agricultural areas as the specified levels change from -30 feet to -5 feet. Tables 3.4-2 and 3.4-3 show the area affected at different water level differences for the area outside KWB Lands and the entire model area. Tables 3.4-4 and 3.4-5 show the agricultural area affected by different levels of negative and positive differences, respectively.

3.4.4 FREQUENCY DISTRIBUTION OF GROUNDWATER ELEVATION DIFFERENCES

Maps were prepared to evaluate the location and frequency with which groundwater elevation differences between the AFO-BC "With KWB Operations" and "Without KWB Operations" scenarios exceeded selected values (Metric 6 of Section 3.1). Frequency distributions of negative groundwater elevation differences exceeding -45 feet, -30 feet, -20 feet, and -10 feet are shown in Figures 3.4-10a to 3.4-10d, respectively. Frequency distributions of groundwater elevation differences exceeding +10 feet, +30 feet, and +60 feet are shown in Figures 3.4-11a to 3.4-11c, respectively.

Figure 3.4-10a shows that negative elevation differences exceeding -45 feet are contained entirely within the KWB boundary at all times. Figure 3.4-10b shows that negative elevation differences exceeding -30 feet are contained entirely within the KWB boundary approximately 90 percent of the time during future (2015–2035) operations under the AFO-BC scenario.

Positive elevation differences exceeding +60 feet (Figure 3.3-11c) are mostly contained within the KWB boundary. Approximately 25 percent of the time such differences occur outside the KWB boundary, but in the immediate vicinity.

3.4.5 ZONAL AVERAGE GROUNDWATER ELEVATION HYDROGRAPHS

Average groundwater elevations outside KWB Lands (Metric 7 of Section 3.1) were evaluated at five 1-mile zones (Figure 3.2-14). Simulated head was averaged for each cell in a particular zone for each monthly time step of the simulation period. Average groundwater elevations for Zones 1–5 are shown in Figures 3.4-12a to 3.4-12e. Figure 3.4-13 shows the average elevation difference in each zone, which was calculated by subtracting the "Without KWB Operations" run from the "With KWB Operations" run data shown in Figures 3.4-12a to 3.4-12e. These figures indicate that the rise and fall of the groundwater mound follows KWB recharge and recovery cycles, and is correlated with the cumulative KWB storage balance. Impacts of consecutive years of pumping, such as the 4-year period of 2012–2015, are seen in the lowering of the average groundwater elevation in Zones 1–3 in the first few years of the AFO-EC scenario, until successive years of recharge in 2016–2017 (hydrologically similar to 1995–1996) result in an increase in the average groundwater level.

3.4.6 HIGH GROUNDWATER LEVELS AND IMPACT ON INFRASTRUCTURE

Future recharge operations at the KWB during the recharge periods of 2016–2019, 2026–2027, and 2032 under AFO-BC conditions (similar to 1995–1998, 2005–2006, and 2011 hydrologic conditions, respectively) could result in high groundwater elevations (<50 feet bgs) within KWB Lands and the surrounding areas.

AFO-BC has 1,090 acres of additional recharge ponds and could recharge more water during the years when Kern River flood water is available for recharge at KWB recharge facilities. This may cause the available water to exceed the total recharge capacity of the KWB and development of high groundwater elevations within the KWB area. Increased monitoring of groundwater elevations and recharge rates of KWB recharge ponds under AFO-BC conditions may be necessary to maintain the proposed recharge volumes.

High groundwater elevations could impact the existing infrastructure within and in the vicinity of KWB Lands. The CVC and residential areas on septic systems are the main infrastructure in the DWR KWB Model domain that might potentially be impacted by high water levels.

Results of AFO-BC model scenario were evaluated to determine the impact of high groundwater elevations on CVC and residential areas on septic systems.

Figures 3.4-14 to 3.4-16 show the spatial characteristics of the groundwater mound that form during recharge operations of 2019, 2027, and 2032 under AFO-BC "With KWB Operations" conditions. AFO-BC recharge operation includes recent recharge management improvements by KWBA to move more recharge to eastern ponds.

Figure 3.2-20 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 3.2-21 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 3.4-17 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 KWB Operations" and "Without KWB Operations" scenarios, 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.

Figure 3.4-18 shows the water level hydrographs at two locations near KWB Lands, as shown in Figure 3.2-21. The hydrographs show the water levels for the AFO-BC "With KWB Operations" and "Without KWB Operations" scenarios and the ground surface elevation. The impact on the KWB recharge operations on the septic systems is discussed below.

3.4.6.1 2016-2019 Recharge Operations

As shown in Figures 3.4-14 and 3.4-17, 2016-2019 recharge operations resulted in water levels lower than 50 feet from surface along the entire length of the CVC in the KWB area. As shown in Figure 3.4-18, depth to groundwater in residential areas on septic systems located northeast of KWB Lands exceeds 50 feet. Groundwater elevations are not high enough to impact the CVC and the septic systems.

3.4.6.2 2026-2027 Recharge Operations

As shown in Figures 3.4-15 and 3.4-17, similar to 2016-2019 conditions, 2026-2027 recharge operations resulted in water levels lower than 50 feet from surface along the entire length of the CVC in the KWB area. High groundwater levels would be limited to the area within KWB Lands and east of the CVC. As shown in Figure 3.4-18, depth to groundwater in residential areas using septic systems located northeast of KWB Lands would exceed 50 feet. Groundwater elevations are not high enough to impact the CVC and the septic systems.

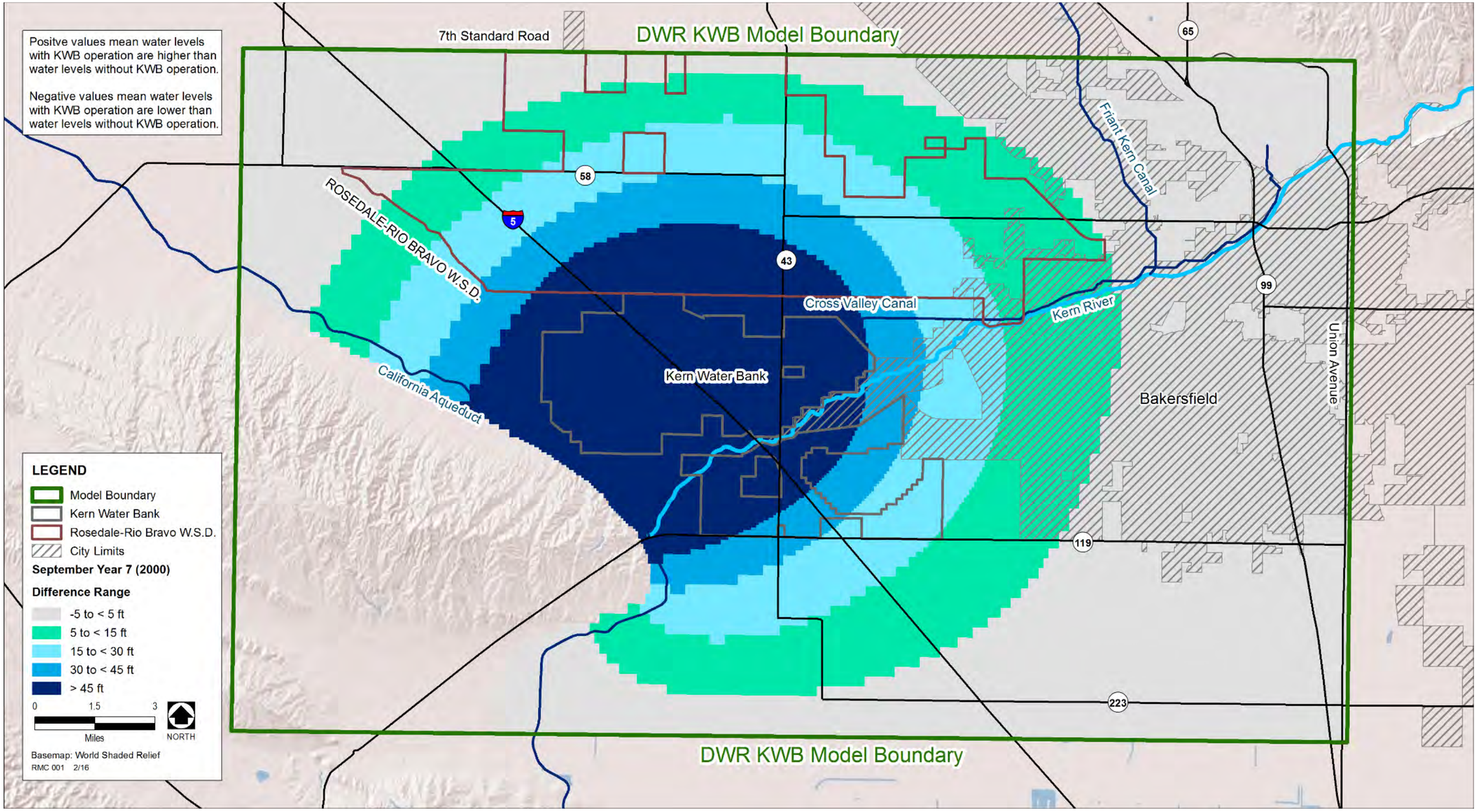


FIGURE 3.4-3a. Analysis of Future Operations under Buildout Conditions: Groundwater Elevation Difference Contour Map at the End of the 1995–2000 Equivalent Recharge Cycle

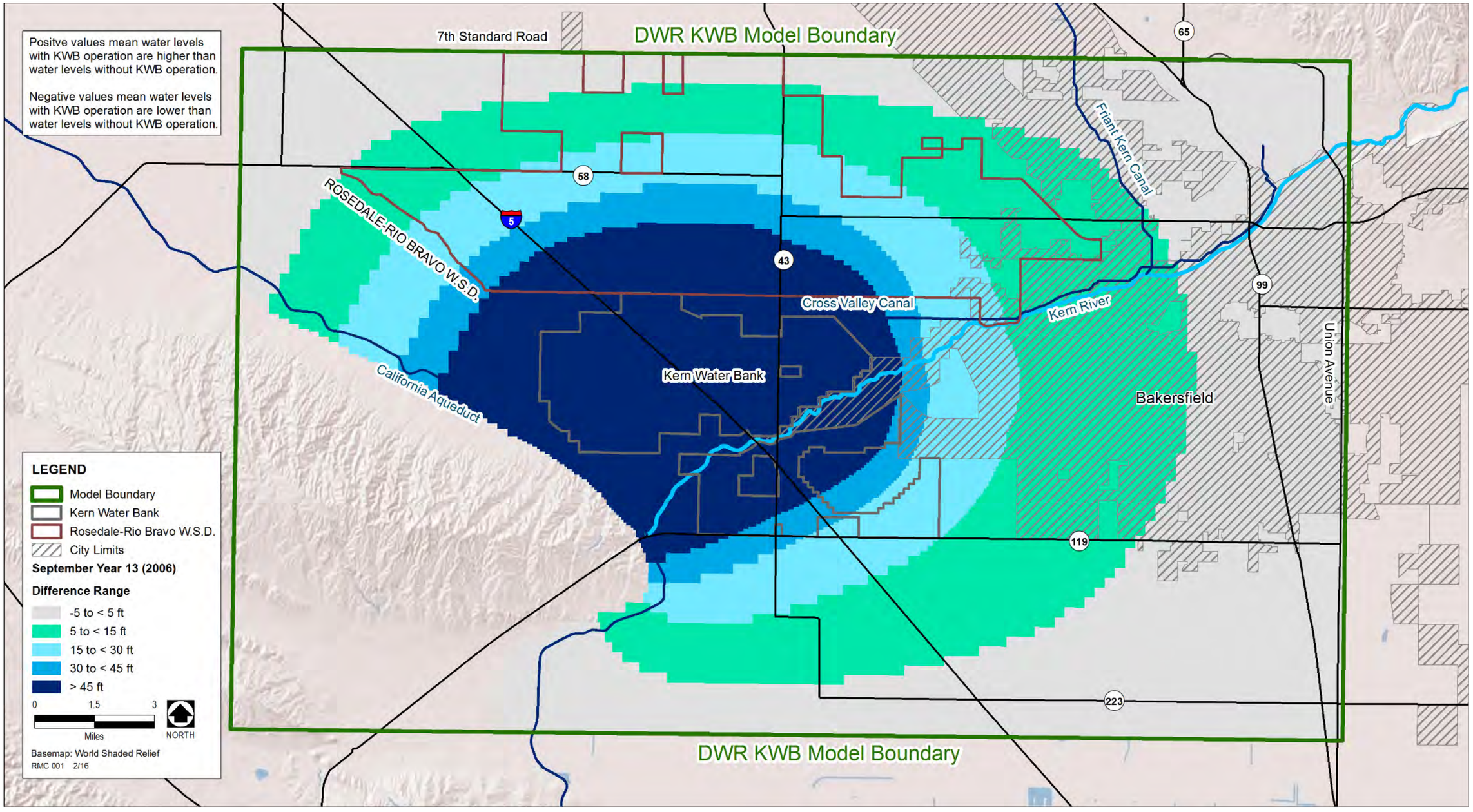


FIGURE 3.4-3b. Analysis of Future Operations under Buildout Conditions: Groundwater Elevation Difference Contour Map at the End of the 2006 Equivalent Recharge Cycle

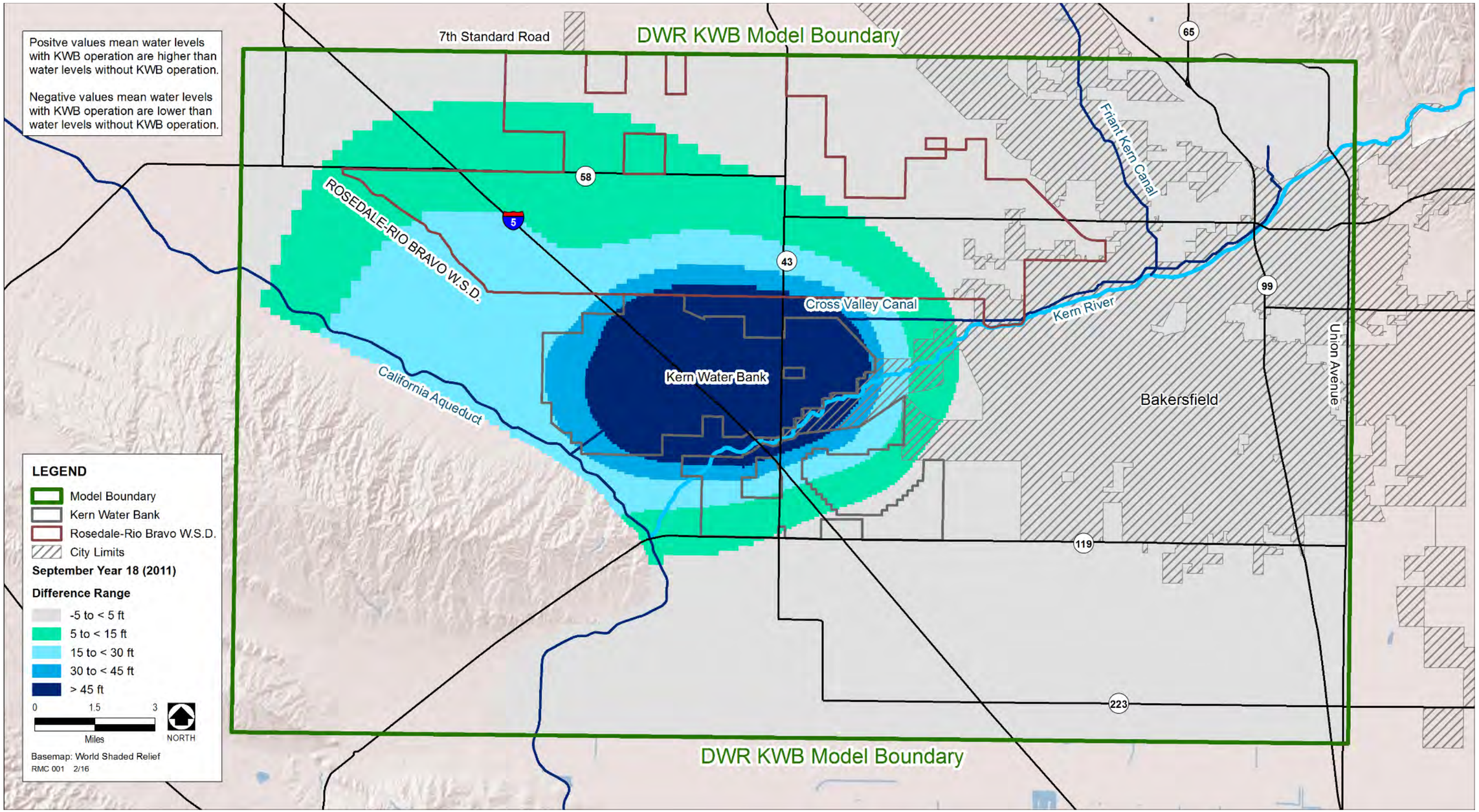


FIGURE 3.4-3c. Analysis of Future Operations under Buildout Conditions: Groundwater Elevation Difference Contour Map at the End of the 2011 Equivalent Recharge Cycle

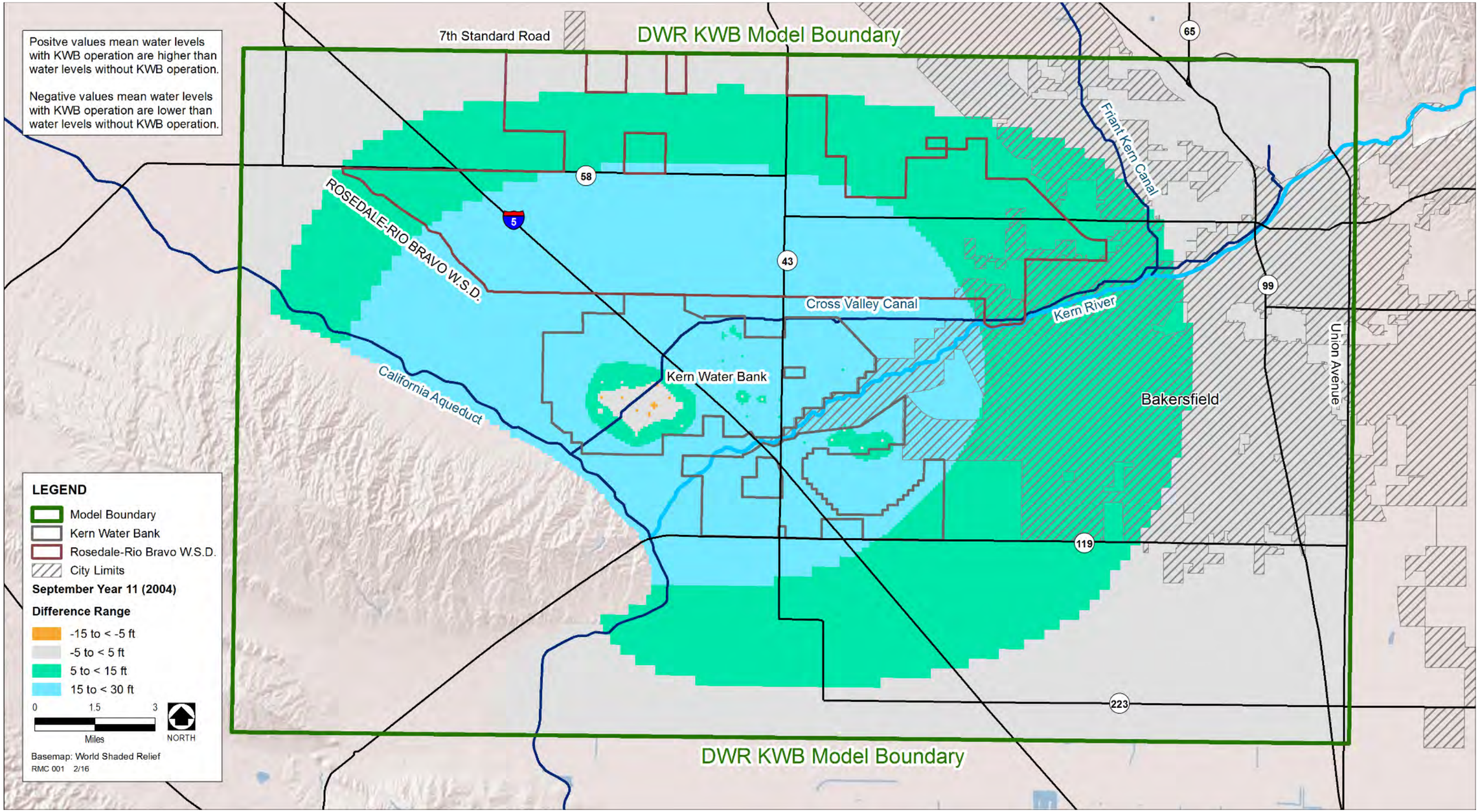


FIGURE 3.4-4a. Analysis of Future Operations under Buildout Conditions: Groundwater Elevation Difference Contour Map at the End of the 2001–2004 Equivalent Recovery Cycle

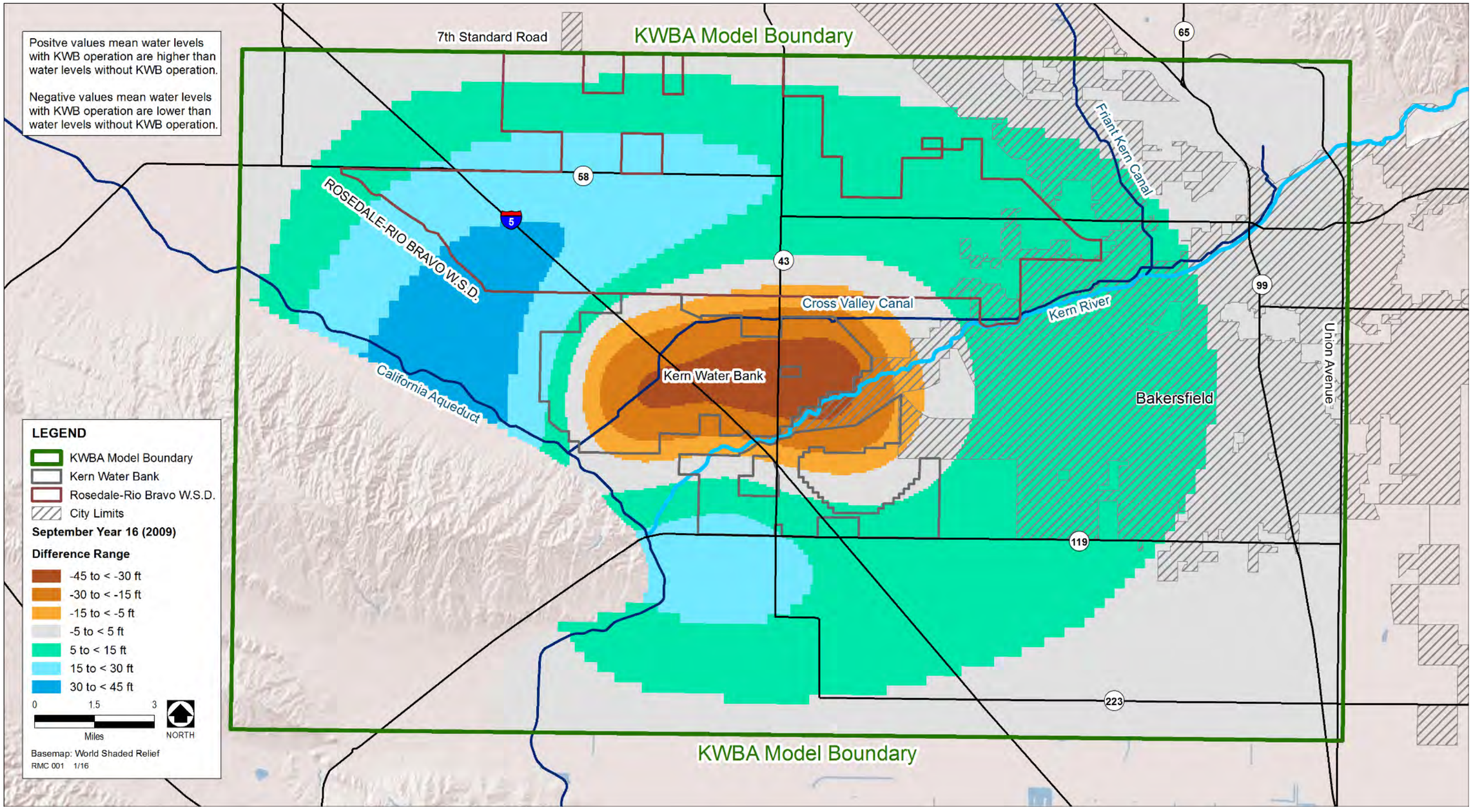


FIGURE 3.4-4b. Analysis of Future Operations under Buildout Conditions: Groundwater Elevation Difference Contour Map at the End of the 2009 Equivalent Recovery Cycle

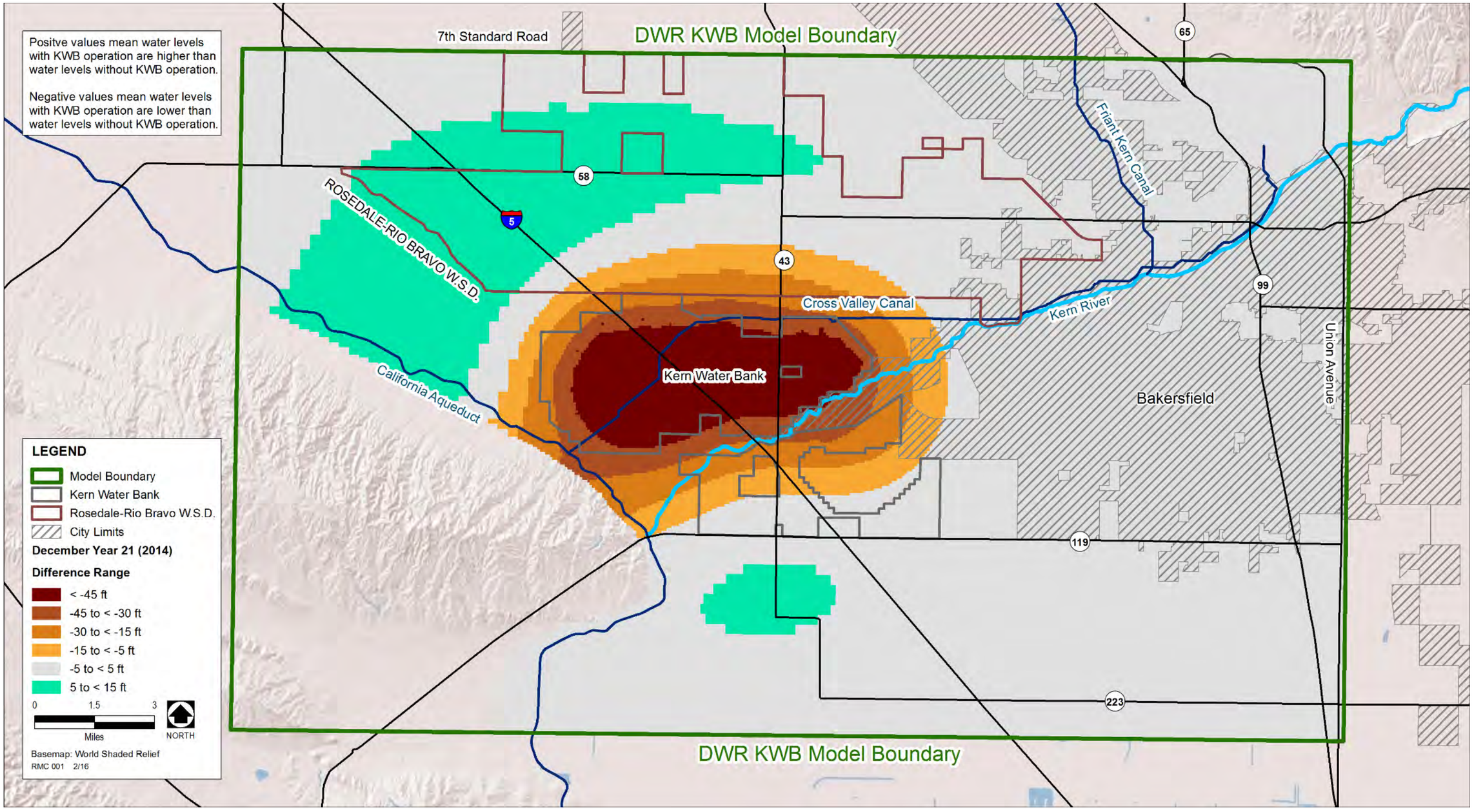


FIGURE 3.4-4c. Analysis of Future Operations under Buildout Conditions: Groundwater Elevation Difference Contour Map at the End of the 2014 Equivalent Recovery Cycle

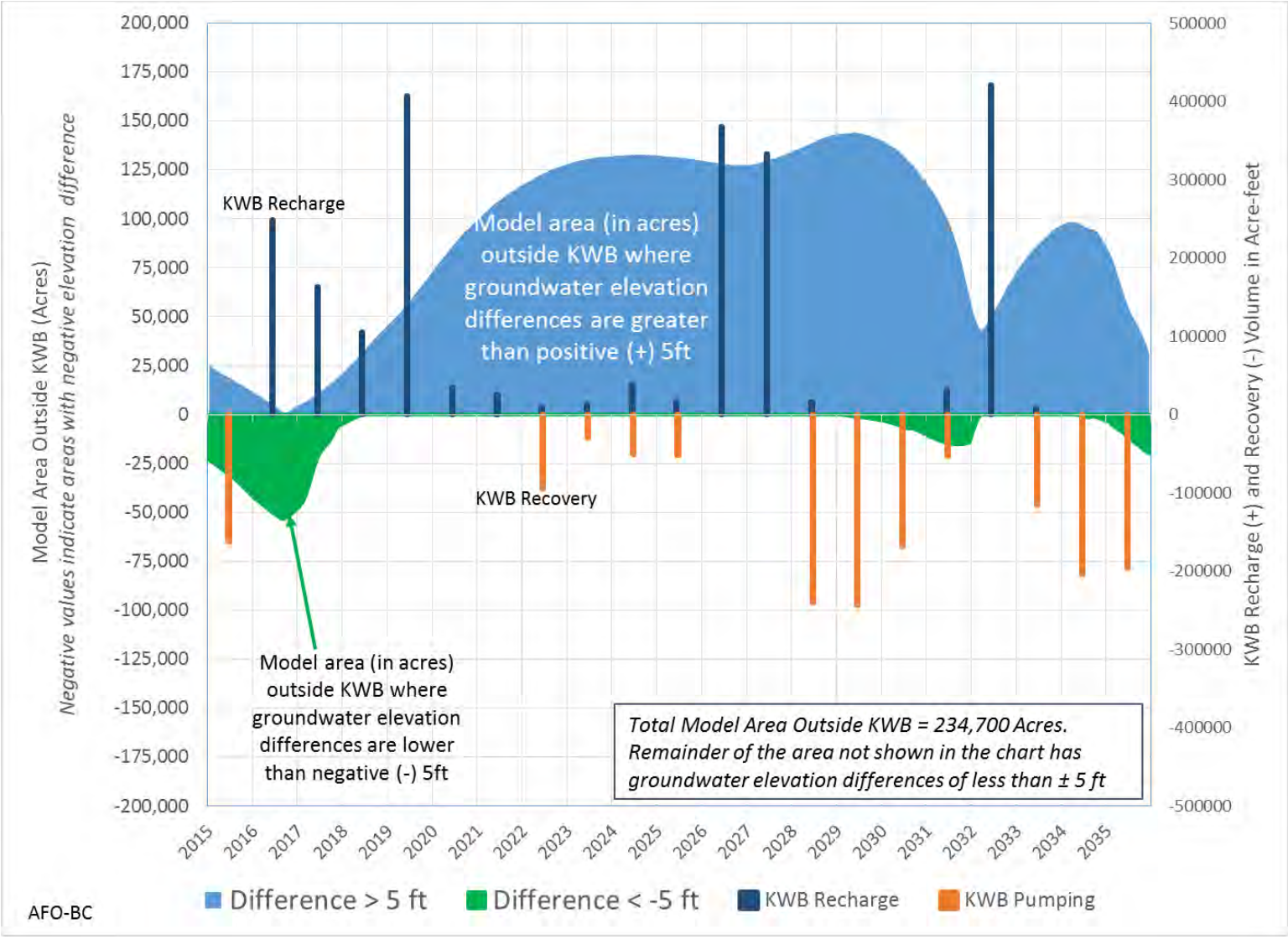


FIGURE 3.4-5. Analysis of Future Operations under Buildout Conditions: Time vs. Affected Area Outside Kern Water Bank Exceeding ± 5 Feet Differences in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

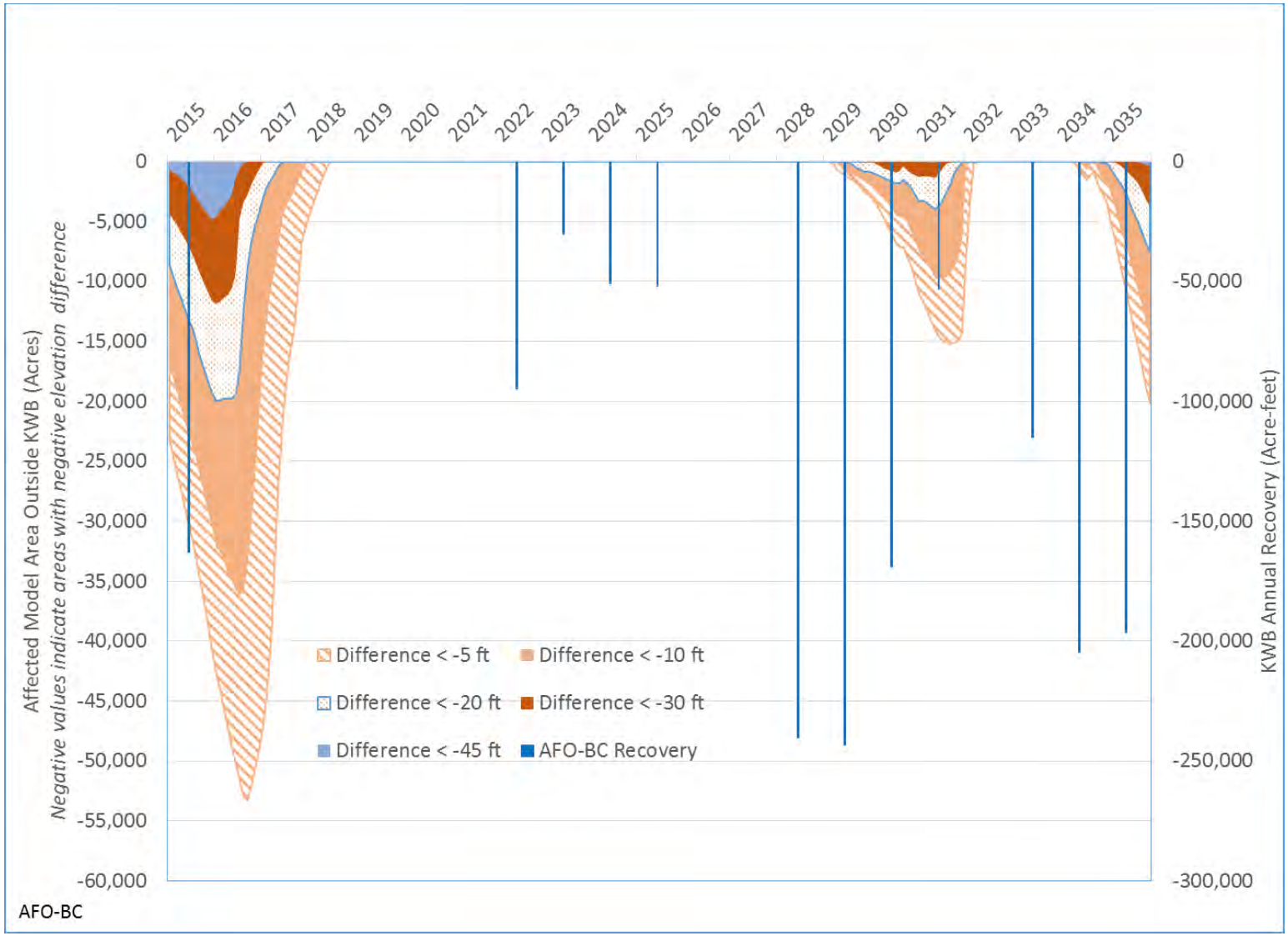


FIGURE 3.4-6. Analysis of Future Operations under Buildout Conditions: Time vs. Affected Area Outside Kern Water Bank at Various Levels of Negative Elevation Differences ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

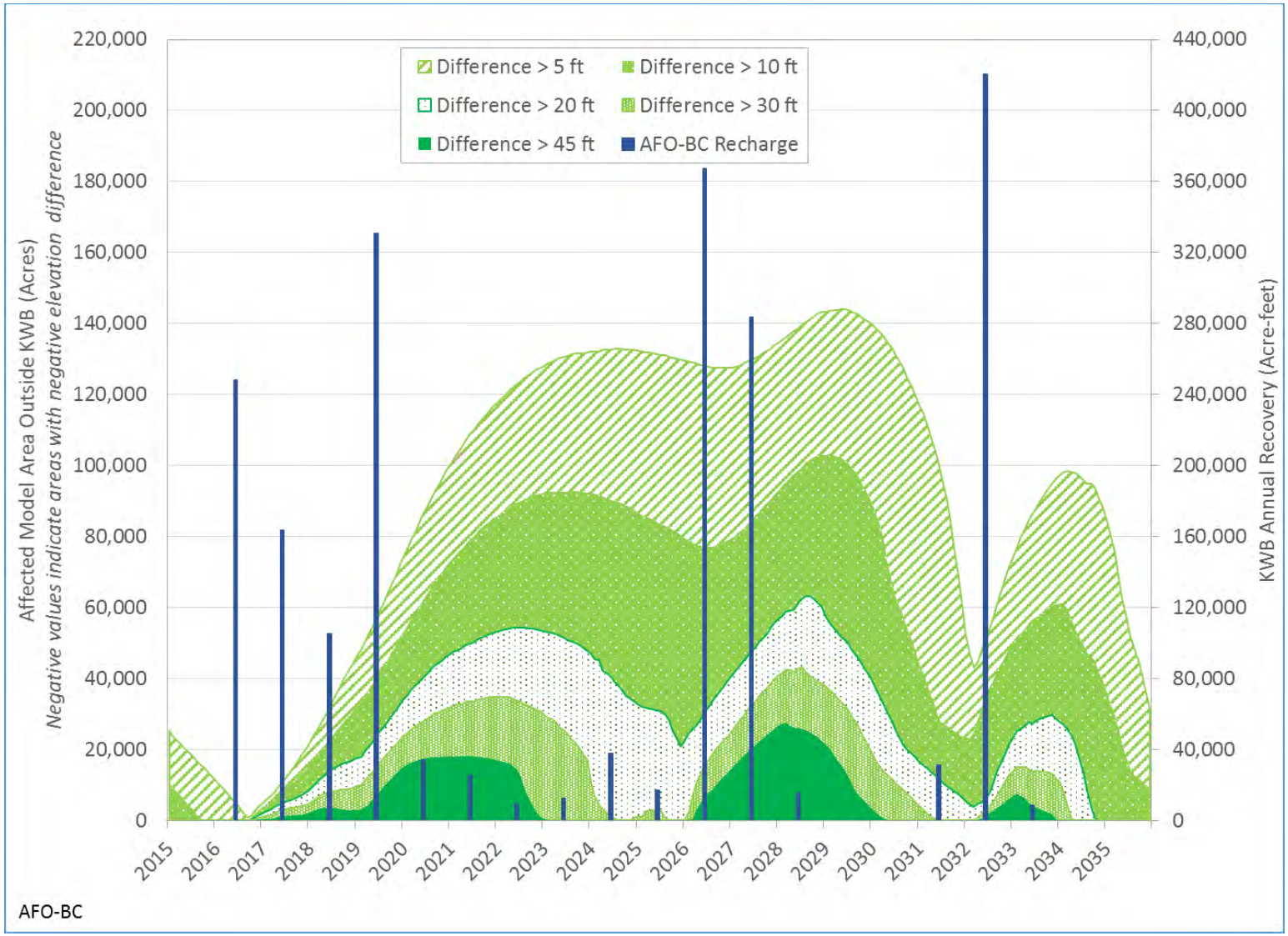


FIGURE 3.4-7. Analysis of Future Operations under Buildout Conditions: Time vs. Affected Area Outside Kern Water Bank at Various Levels of Positive Elevation Differences ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

3.4.6.3 2032 Recharge Operations

As shown in Figure 3.4-16 and 3.4-18, water levels would be lower than 50 feet from surface along the entire length of the CVC and within almost all of the KWB area. Water levels in 2032 would be generally lower than 2019 and 2027 levels due to 2032 being a single-year recharge period while the other two recharge periods are 4- and 2-year recharge periods, respectively. Also, a higher percentage of KWB recharge is shifted to eastern ponds to be consistent with current recharge management practices of the KWBA.

3.4.7 HIGH GROUNDWATER LEVELS AND IMPACT ON NEIGHBORING RECHARGE FACILITIES

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 AFO-BC conditions were evaluated by using water level hydrographs at the neighboring recharge facilities.

Figure 3.2-24 shows the locations of the selected water level hydrographs at the neighboring recharge facilities. Figure 3.4-19 shows the representative water level hydrographs at these locations. Table 3.4-6 shows the minimum depth to water under AFO-BC 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.

3.4.7.1 2016-2019 Recharge Operations

The water level analysis shows that at the adjacent recharge facilities, groundwater levels were lower than 40 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.

3.4.7.2 2026-2027 Recharge Operations

The water levels at the adjacent recharge facilities were generally higher than 2016-2019 conditions and lower than 15 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.

3.4.7.3 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 48 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.

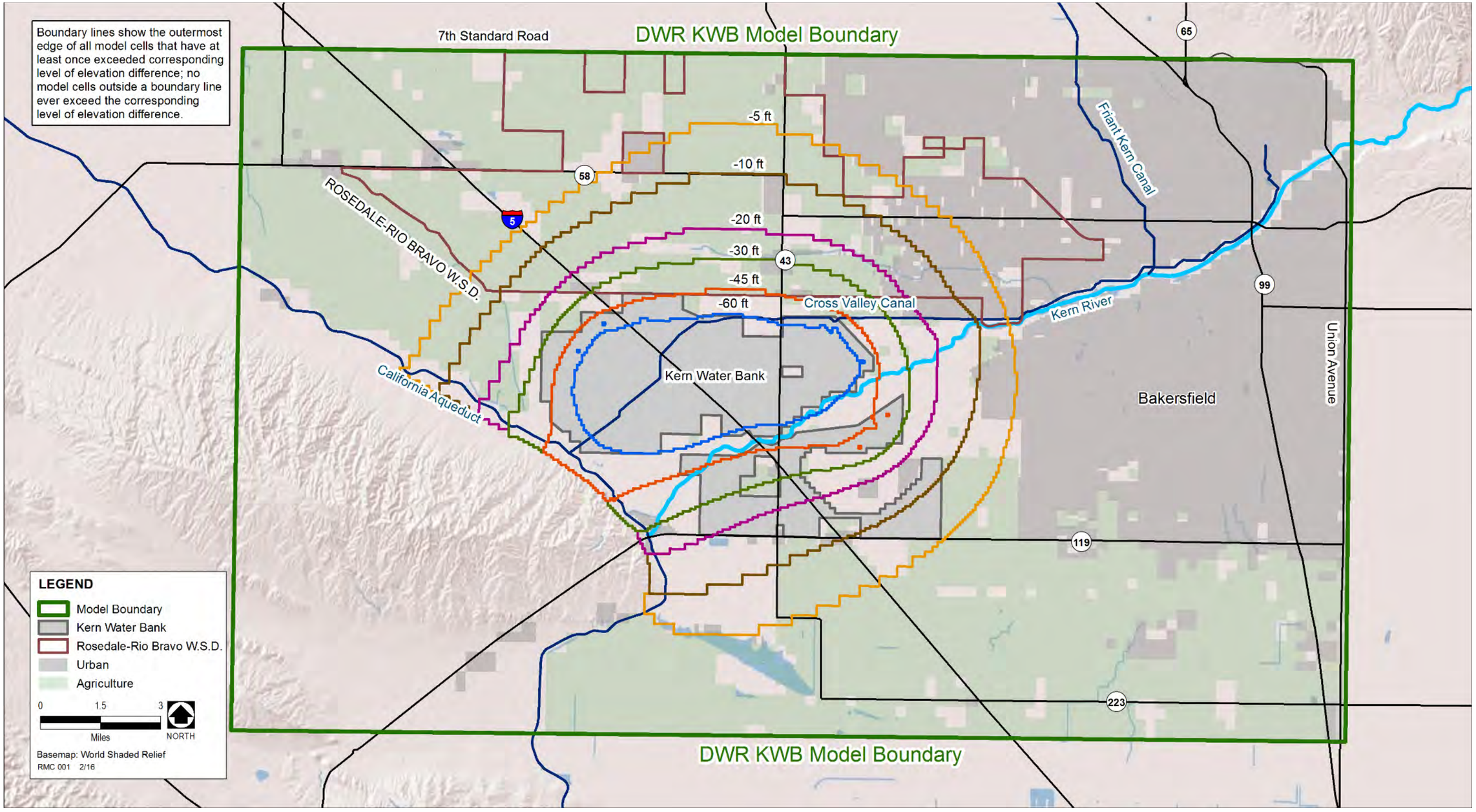


FIGURE 3.4-8. Analysis of Future Operations under Buildout Conditions: Contours of Negative Differences ("With" minus "Without"), 2015–2035

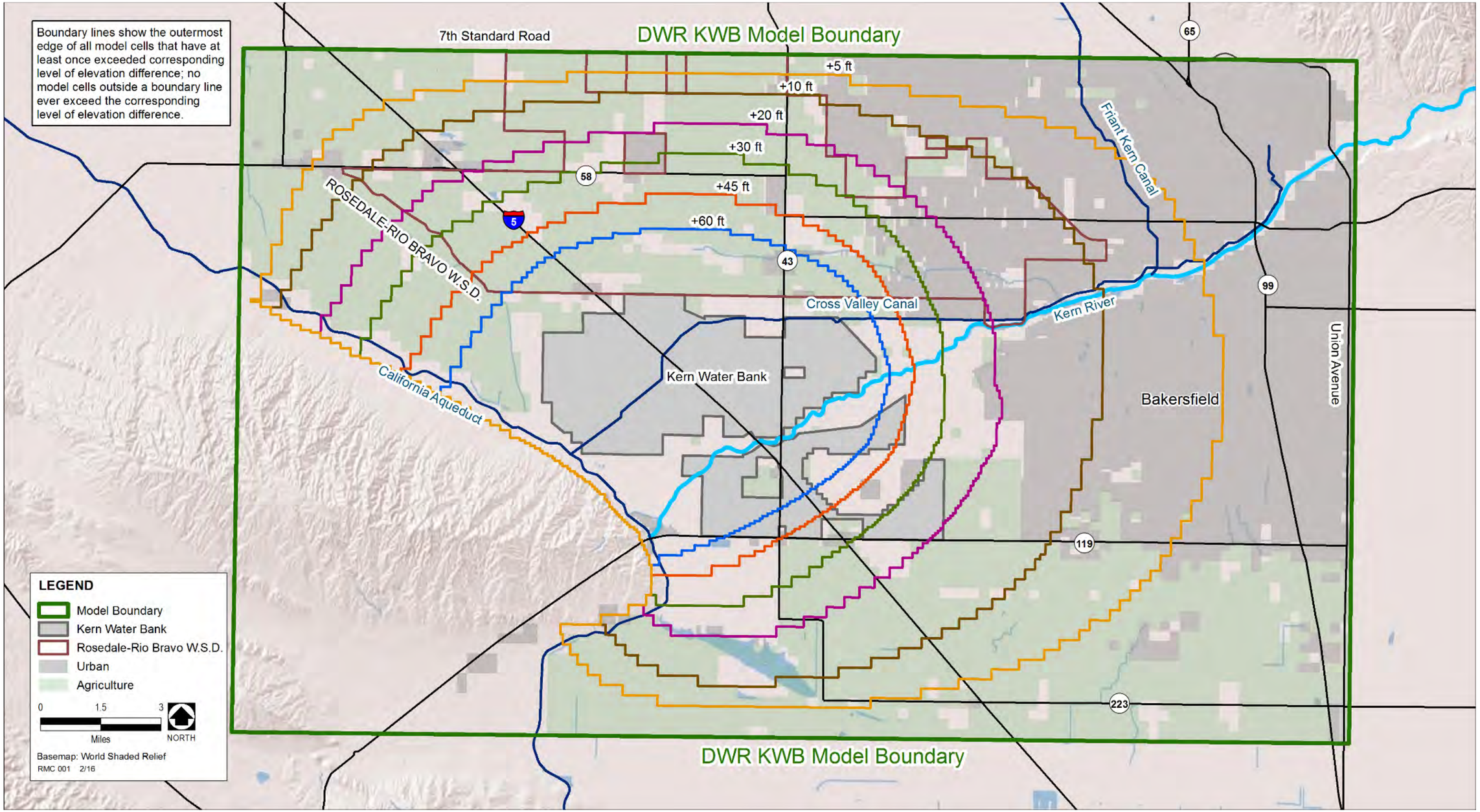


FIGURE 3.4-9. Analysis of Future Operations under Buildout Conditions: Contours of Positive Elevation Differences ("With" minus "Without"), 2015–2035

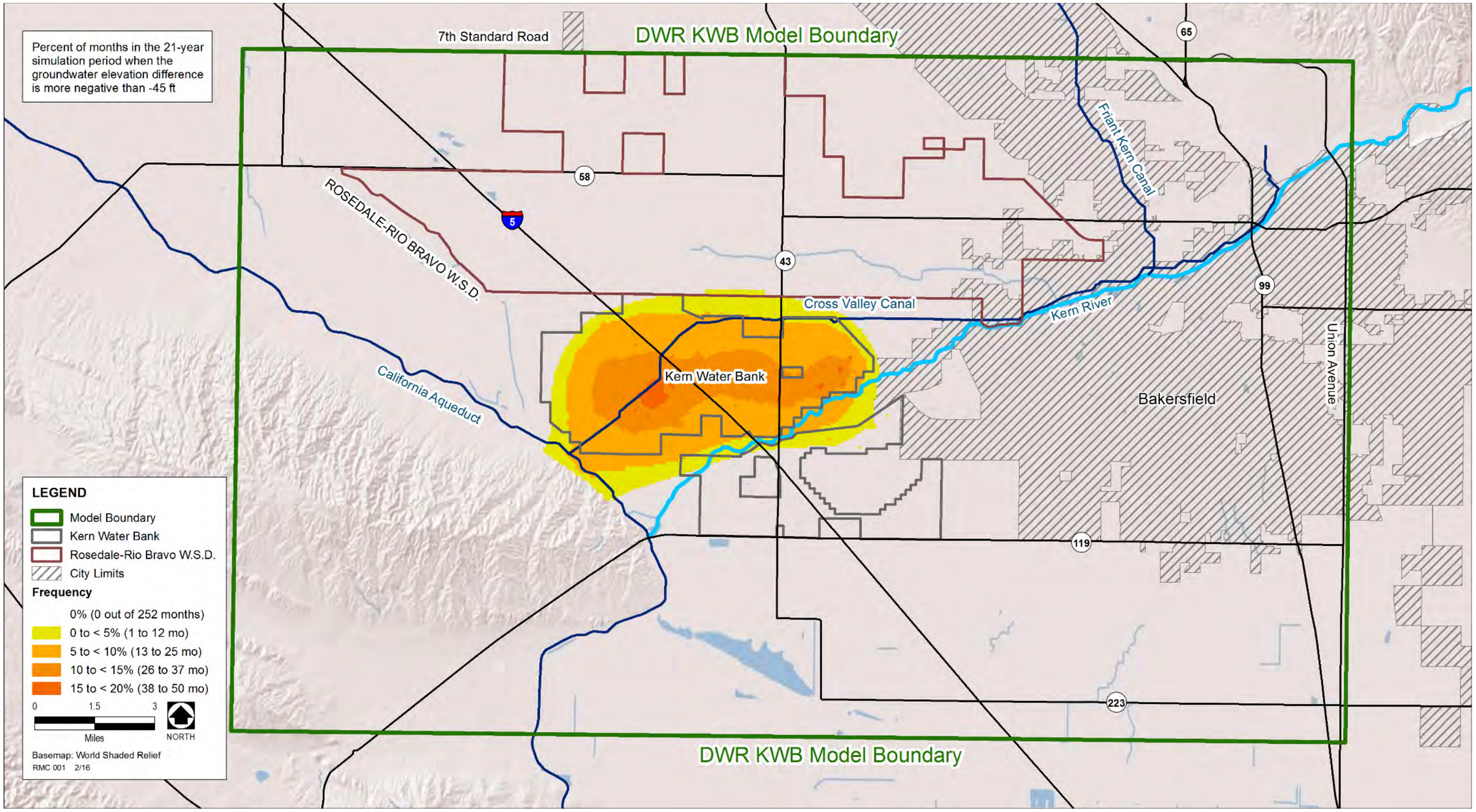


FIGURE 3.4-10a. Analysis of Future Operations under Buildout Conditions: Frequency Distribution (% of Months) of Areas with > -45 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

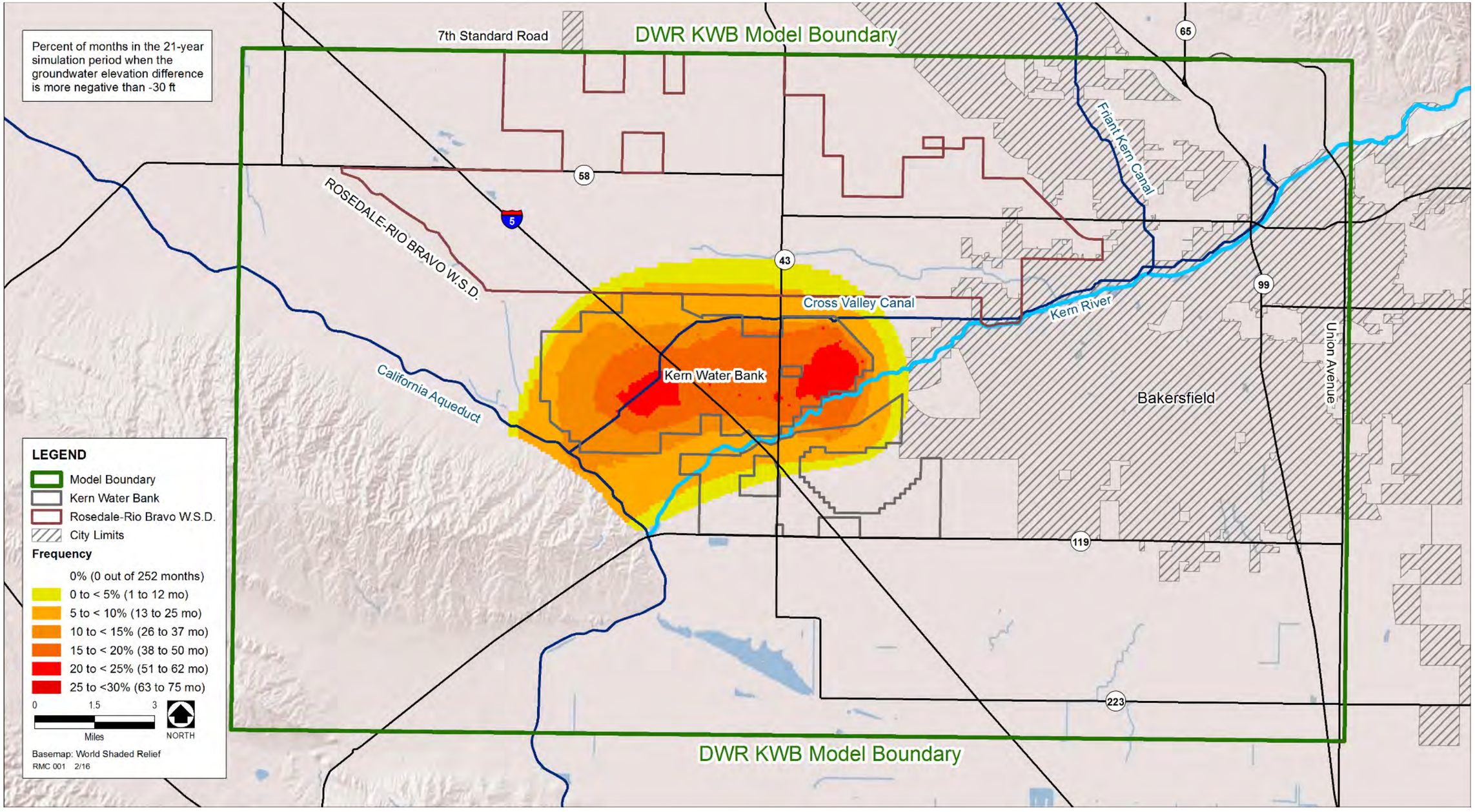


FIGURE 3.4-10b. Analysis of Future Operations under Buildout Conditions: Frequency Distribution (% of Months) of Areas with > -30 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

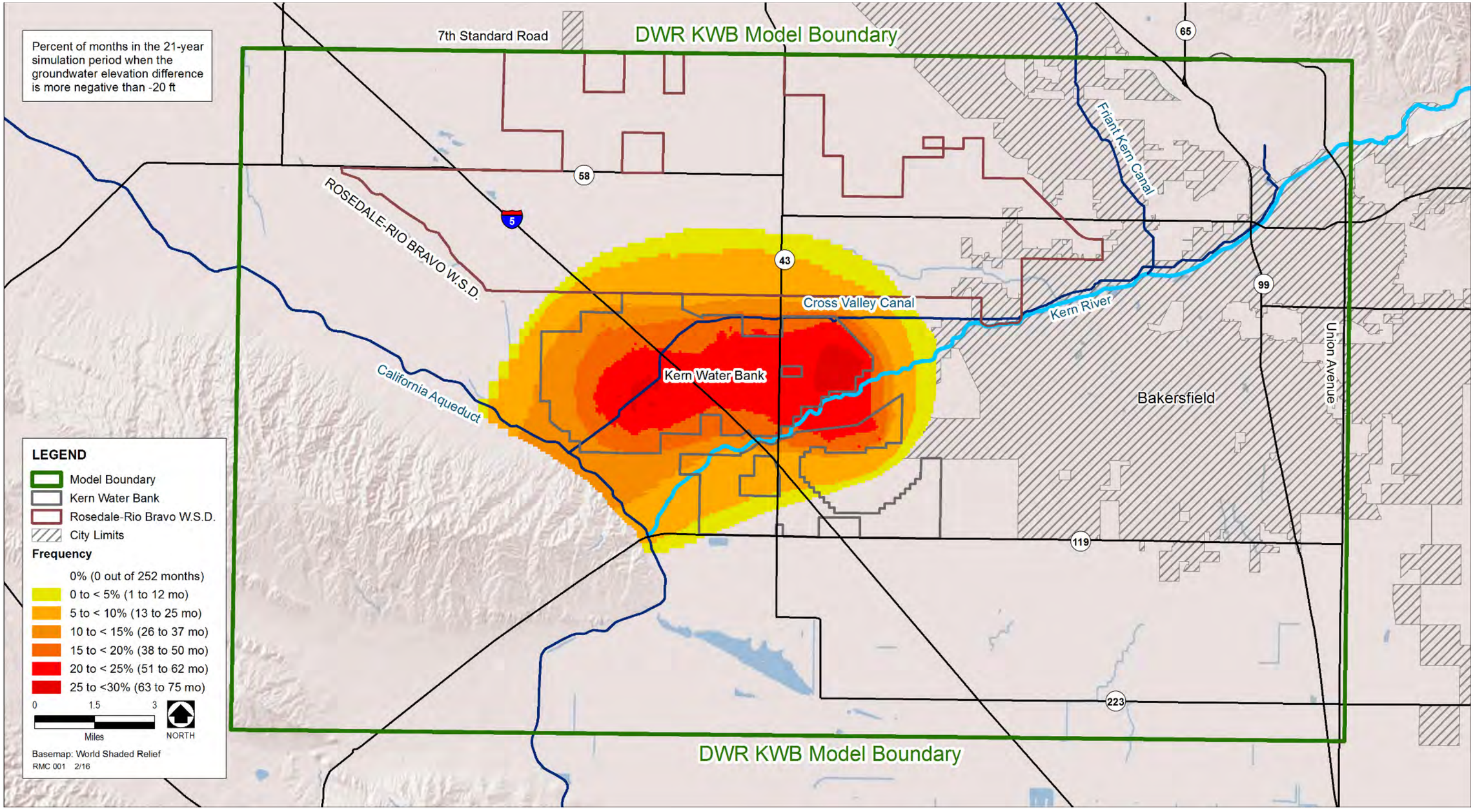


FIGURE 3.4-10c. Analysis of Future Operations under Buildout Conditions: Frequency Distribution (% of Months) of Areas with > -20 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

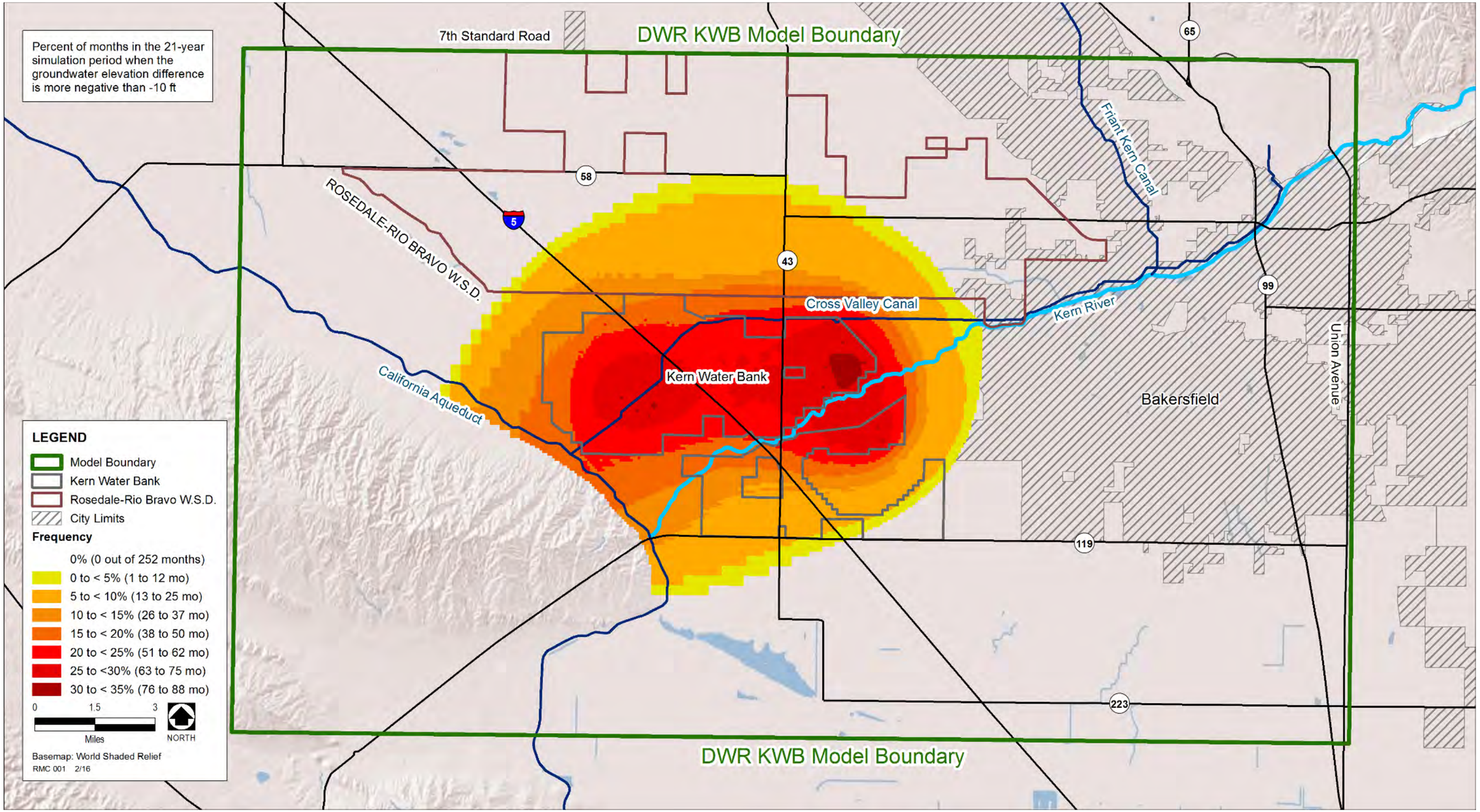


FIGURE 3.4-10d. Analysis of Future Operations under Buildout Conditions: Frequency Distribution (% of Months) of Areas with > -10 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

TABLE 3.4-2

AREA AFFECTED AT DIFFERENT LEVELS OF WATER LEVEL FOR AREA OUTSIDE THE KERN WATER BANK LANDS (ANALYSIS OF FUTURE OPERATIONS UNDER BUILDOUT CONDITIONS), 2015-2035

	Impacted Area Outside the Kern Water Bank Lands (acres)									
Frequency for 20-Year Simulation	**-60 Feet**	**-45 Feet**	**-30 Feet**	**-20 Feet**	**-10 Feet**	**+10 Feet**	**+20 Feet**	**+30 Feet**	**+45 Feet**	**+60 Feet**
Never Occurs	231,692	227,239	219,594	210,664	193,359	124,341	164,861	184,421	201,869	212,062
1–12 months	650	3,183	4,715	5,328	6,178	2,065	3,468	3,603	3,735	3,858
13–24 months	63	1,968	6,268	10,240	16,768	5,623	4,180	4,503	4,750	4,548
25–36 months	0	15	1,123	4,070	6,985	3,143	2,848	3,253	3,405	2,713
37–58 months	0	0	688	1,145	5,558	2,743	3,463	3,835	2,173	1,813
59–60 months	0	0	18	958	2,443	2,538	3,138	3,235	3,038	2,510
61–72 months	0	0	0	0	1,115	3,008	3,350	3,875	4,318	3,368
73–84 months	0	0	0	0	0	3,200	5,270	4,285	5,770	985
85–96 months	0	0	0	0	0	3,463	5,053	3,180	878	233
97–108 months	0	0	0	0	0	5,828	3,295	5,090	1,383	318
109–120 months	0	0	0	0	0	9,103	2,750	6,153	1,053	0
121–144 months	0	0	0	0	0	11,260	6,903	6,095	35	0
145–168 months	0	0	0	0	0	19,288	22,643	878	0	0
168 or more months	0	0	0	0	0	36,805	1,185	0	0	0

Table 3.4-3

Area Affected at Different Water Levels for the Entire Model Area (Analysis of Future Operations Under Buildout Conditions), 2015-2035

	Impacted Area in Model Domain (acres)									
Frequency for 20-Year Simulation	**-60 Feet**	**-45 Feet**	**-30 Feet**	**-20 Feet**	**-10 Feet**	**+10 Feet**	**+20 Feet**	**+30 Feet**	**+45 Feet**	**+60 Feet**
Never Occurs	242,487	234,139	223,752	213,429	194,371	124,341	164,916	185,944	203,917	215,494
1–12 months	5,363	5,610	5,618	6,150	6,590	2,065	3,645	3,738	4,475	4,885
13–24 months	6,440	9,428	10,435	12,715	19,170	5,623	4,558	4,530	5,313	5,343
25–36 months	160	4,970	5,830	7,078	8,310	3,143	3,048	3,295	3,600	3,193
37–58 months	0	303	7,023	5,970	8,608	2,743	3,690	4,053	2,728	2,493
59–60 months	0	0	1,783	8,160	9,513	2,538	3,425	3,765	3,923	3,568
61–72 months	0	0	10	948	7,498	3,008	3,628	4,425	5,233	9,490
73–84 months	0	0	0	0	390	3,200	5,358	5,083	10,998	2,915
85–96 months	0	0	0	0	0	3,463	5,195	3,668	2,723	1,388
97–108 months	0	0	0	0	0	5,828	3,700	5,778	3,698	3,373
109–120 months	0	0	0	0	0	9,653	3,135	10,288	5,465	2,310
121–144 months	0	0	0	0	0	12,665	10,085	13,908	2,380	0
145–168 months	0	0	0	0	0	28,845	38,460	5,978	0	0
168 or more months	0	0	0	0	0	47,338	1,608	0	0	0

TABLE 3.4-4 Analysis of Future Operations Under Buildout Conditions: Area Affected at Different Levels of Negative Differences ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035		
Level of Negative Difference	**Agricultural Area (Acres)**	**Urban Area (Acres)**
-45 feet	760	8
-30 feet	4,078	578
-20 feet	7,942	1,265
-10 feet	16,228	3,717
-5 feet	27,628	7,810

TABLE 3.4-5 Analysis of Future Operations Under Buildout Conditions: Area Affected at Different Levels of Positive Differences ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035		
Level of Positive Difference	**Agricultural Area (Acres)**	**Urban Area (Acres)**
5 feet	74,380	42,650
10 feet	55,780	21,850
20 feet	35,138	6,535
30 feet	24,840	3,170
45 feet	15,658	1,115

TABLE 3.4-6

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

Simulation Period	Recharge Facility			
	Rosedale	Pioneer	2800 Acre	West Kern Water District
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

3.4.8 ANALYSIS OF FUTURE OPERATIONS UNDER BUILDOUT CONDITIONS RESULTS SUMMARY

A summary of the evaluation of impacts on the groundwater table attributable to KWB future operations under the AFO-BC scenario is provided in Table 3.4-7. Consecutive years of recovery from future KWB operations under the buildout level of development may cause groundwater levels to fall such that existing wells in an area immediately outside the KWB boundary are impacted. In contrast, consecutive years of recharge may cause groundwater levels to rise and impact sections of the CVC within KWB Lands and residential areas on septic systems located north of KWB Lands.

TABLE 3.4-7 SUMMARY OF ANALYSIS OF FUTURE OPERATIONS UNDER BUILDOUT CONDITIONS MODEL SCENARIO RESULTS AFFECTING THE LOCAL GROUNDWATER TABLE, 2015-2035	
Evaluation Metric	**Conclusion**
Water Budget (Section 3.4.1)	The KWB has a balance of +498,000 AF stored water at the end of 2035. With the addition of APO balance of +617,000 AF, the KWB has a accumulated balance of +1,115,000 AF in aquifer volume of stored water at the end of 2035 under the AFO-BC scenario.
Groundwater Elevation Differences (Hydrographs and Contour Maps) (Section 3.4.2)	The positive groundwater elevation differences extend to almost all of the model domain. The negative groundwater elevation differences are limited to KWB Lands and the surrounding area.
Total Area of Negative and Positive Elevation Differences (Section 3.4.3)	Outside the KWB boundary, negative elevation differences occur in the first year of simulation because of the prior 3 years of recovery; thereafter, negative elevation differences occur after about 2 years of recovery following a recharge cycle.
Spatial Extent of Negative and Positive Elevation Differences (Section 3.4.3)	Outside the KWB boundary, negative elevation differences exceeding -30 feet are contained within 1 mile of the KWB boundary. Outside the KWB boundary, negative elevation differences exceeding -30 feet affect less than 5,000 acres of agricultural land in the immediate vicinity of KWB Lands, which represents less than five percent of the total agricultural area within the model domain. Outside the KWB boundary, positive elevation differences exceeding +60 feet (indicative of high water table) are contained within 1 mile of the KWB boundary.
Frequency Distribution of Negative and Positive Elevation Difference (Section 3.4.4)	Negative elevation differences exceeding -30 feet remain within the KWB boundary 90% of the time. Positive elevation differences exceeding +60 feet remain within the KWB boundary 75% of the time.
Average Elevation and Elevation Difference in Selected Zones (Section 3.4.5)	The average groundwater elevation of “With KWB Operations” in Zones 1–3 is lower than that of “Without KWB Operations” in 2015 and 2016, because of 4 consecutive years of recovery from 2012 through 2015.
High Groundwater Levels and Existing Infrastructure (Section 3.4.6)	Groundwater levels may impact sections of the CVC within KWB Lands. However, residential areas with septic systems located north of the KWB will not be impacted.
High Groundwater Levels and Neighboring Recharge Facilities (Section 3.4.7)	KWB operations, concomitant with the operations of other neighboring groundwater banks would not interfer with the recharge operations at neighboring groundwater banks.
Notes: AF = acre-feet; AFO-BC = Analysis of Future Operations under Buildout Conditions; APO = Analysis of Past Operations; KWB = Kern Water Bank; RRBWSD = Rosedale–Rio Bravo Water Service District	

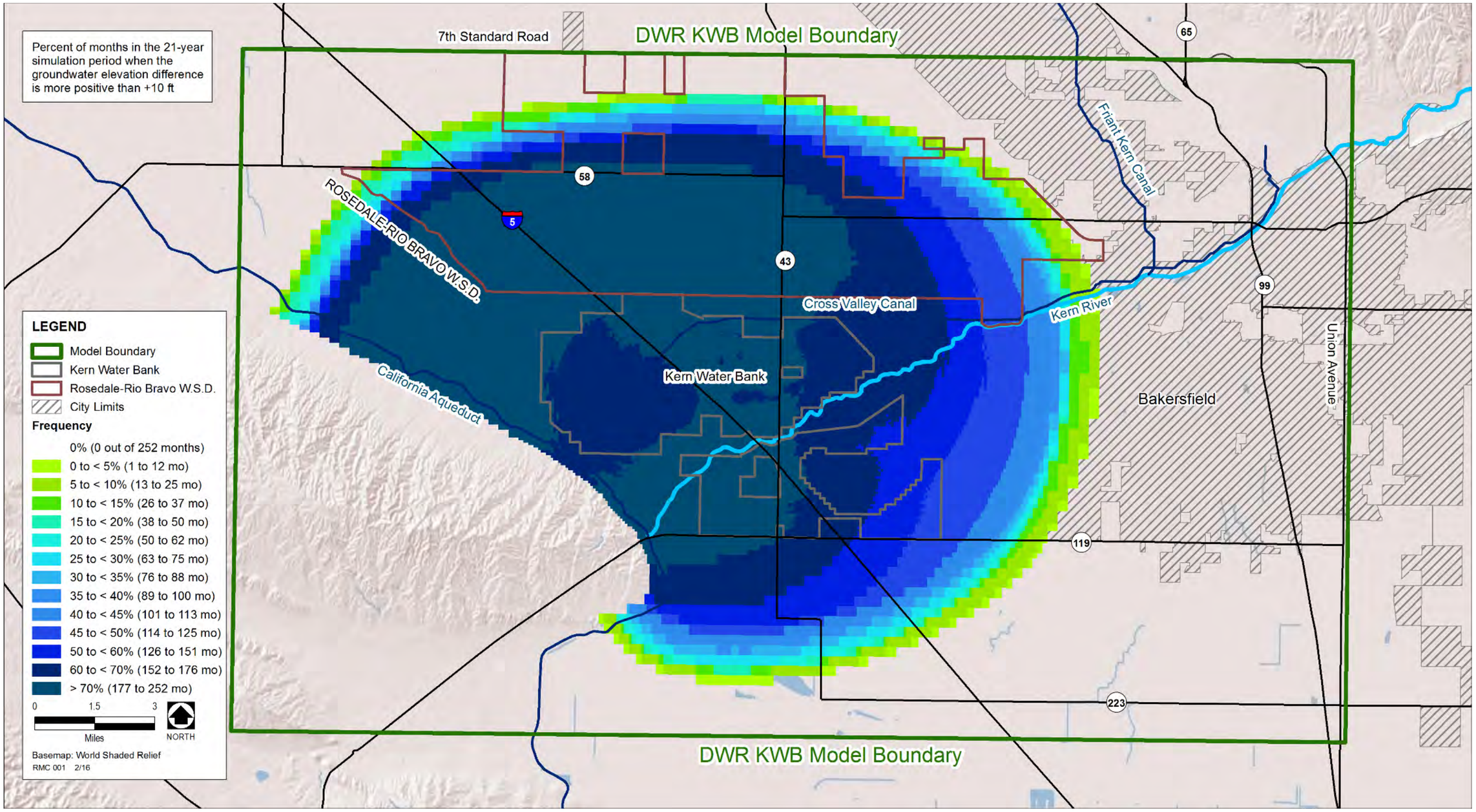


Figure 3.4-11a. Analysis of Future Operations under Buildout Conditions: Frequency Distribution (% of Months) of Areas with > +10 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

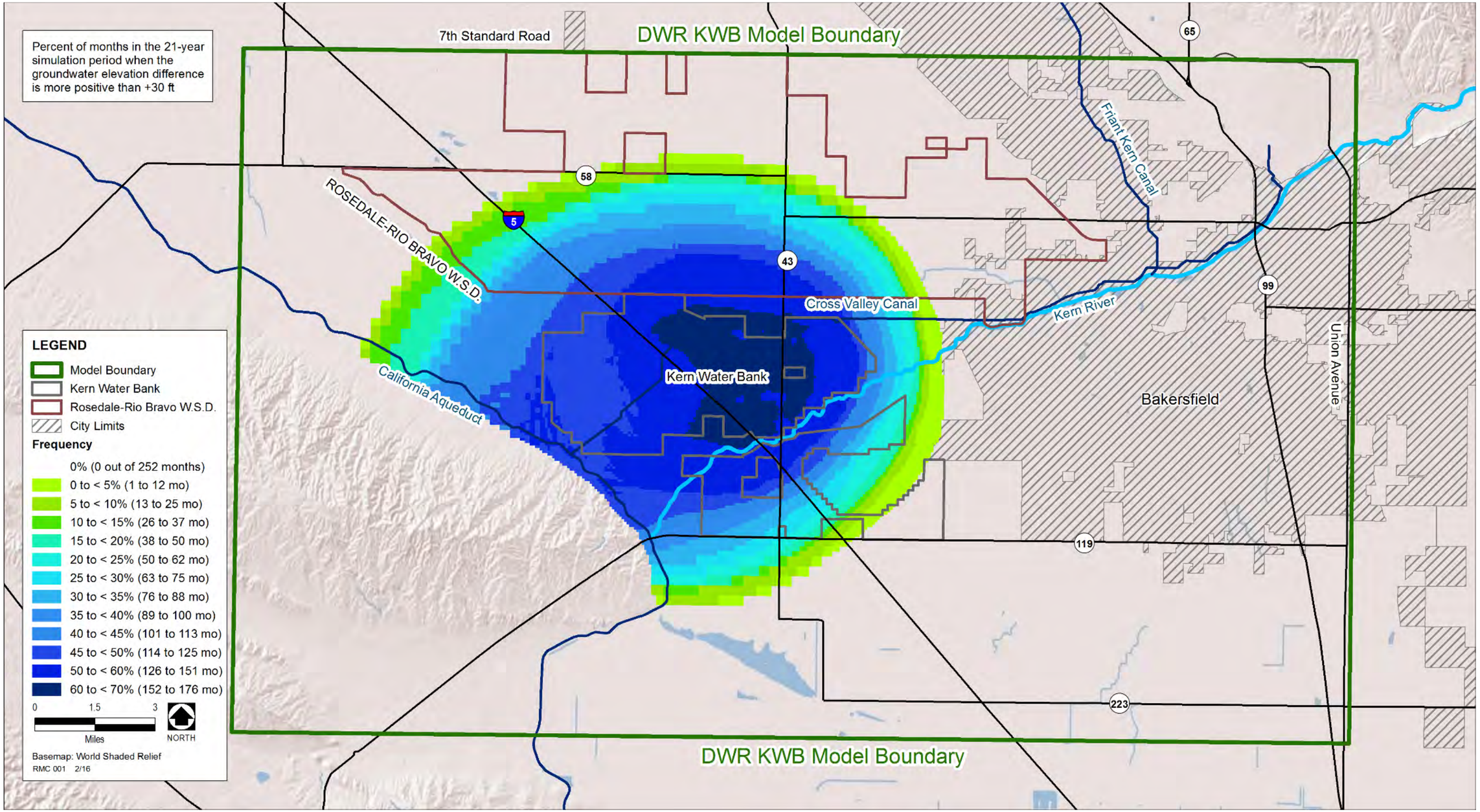


FIGURE 3.4-11b. Analysis of Future Operations under Buildout Conditions: Frequency Distribution (% of Months) of Areas with > +30 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

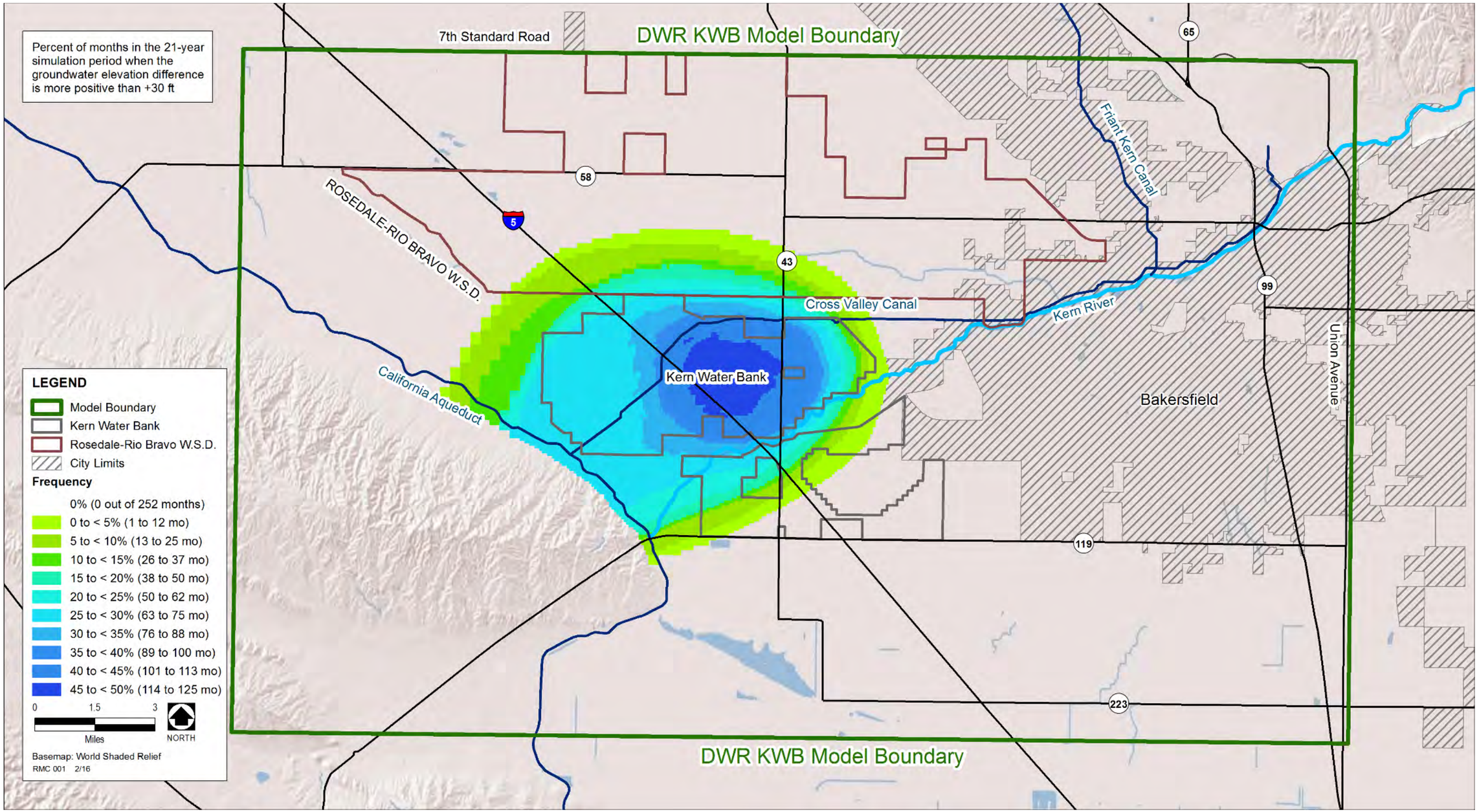


FIGURE 3.4-11c. Analysis of Future Operations under Buildout Conditions: Frequency Distribution (% of Months) of Areas with > +60 Feet Difference in Groundwater Elevations ("With Kern Water Bank Operations" Minus "Without Kern Water Bank Operations"), 2015-2035

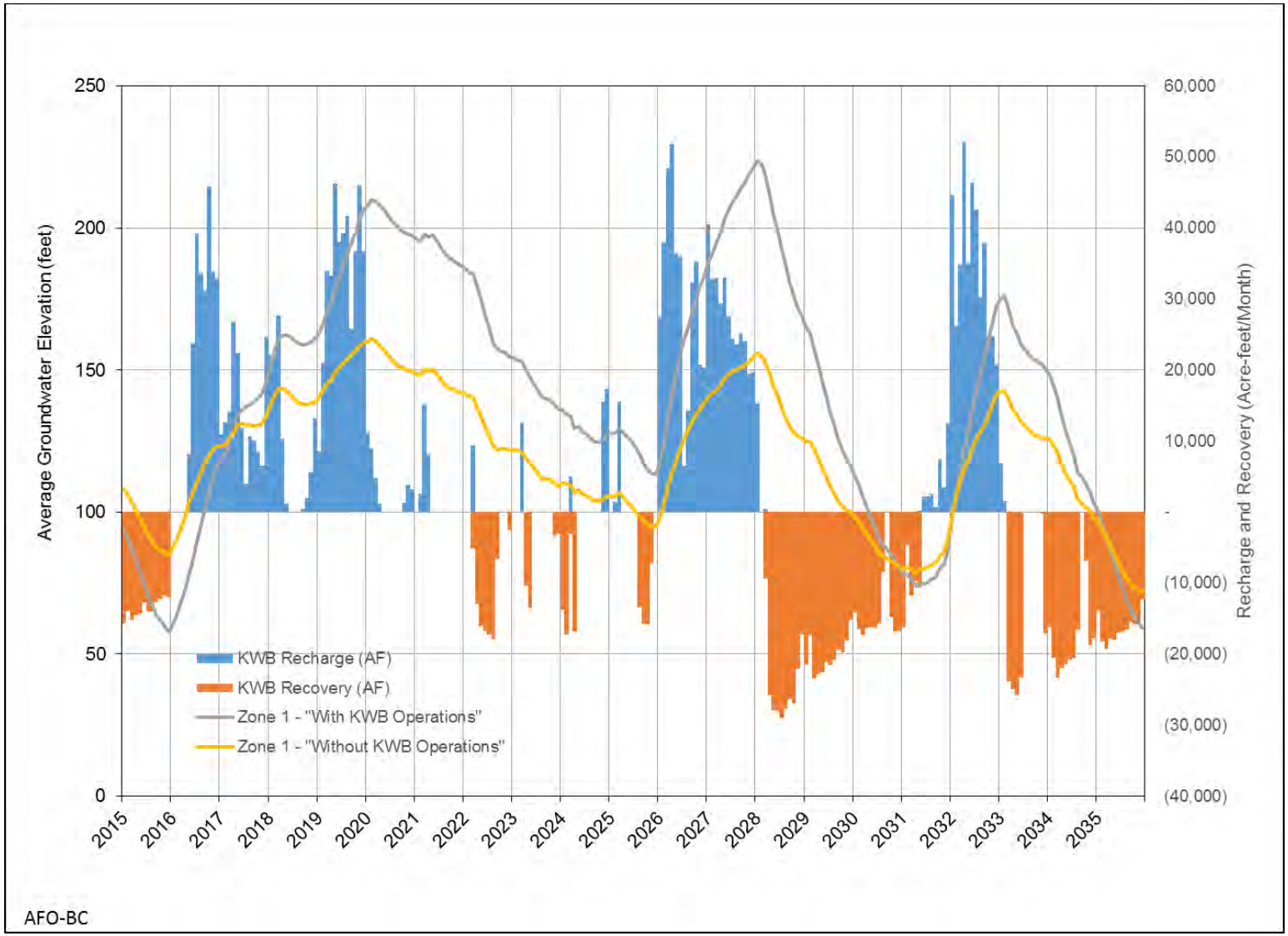


FIGURE 3.4-12a. Analysis of Future Operations under Buildout Conditions: Average Groundwater Elevation Over Zone 1 (0 to 1 Mile Outside the Kern Water Bank Boundary), 2015-2035

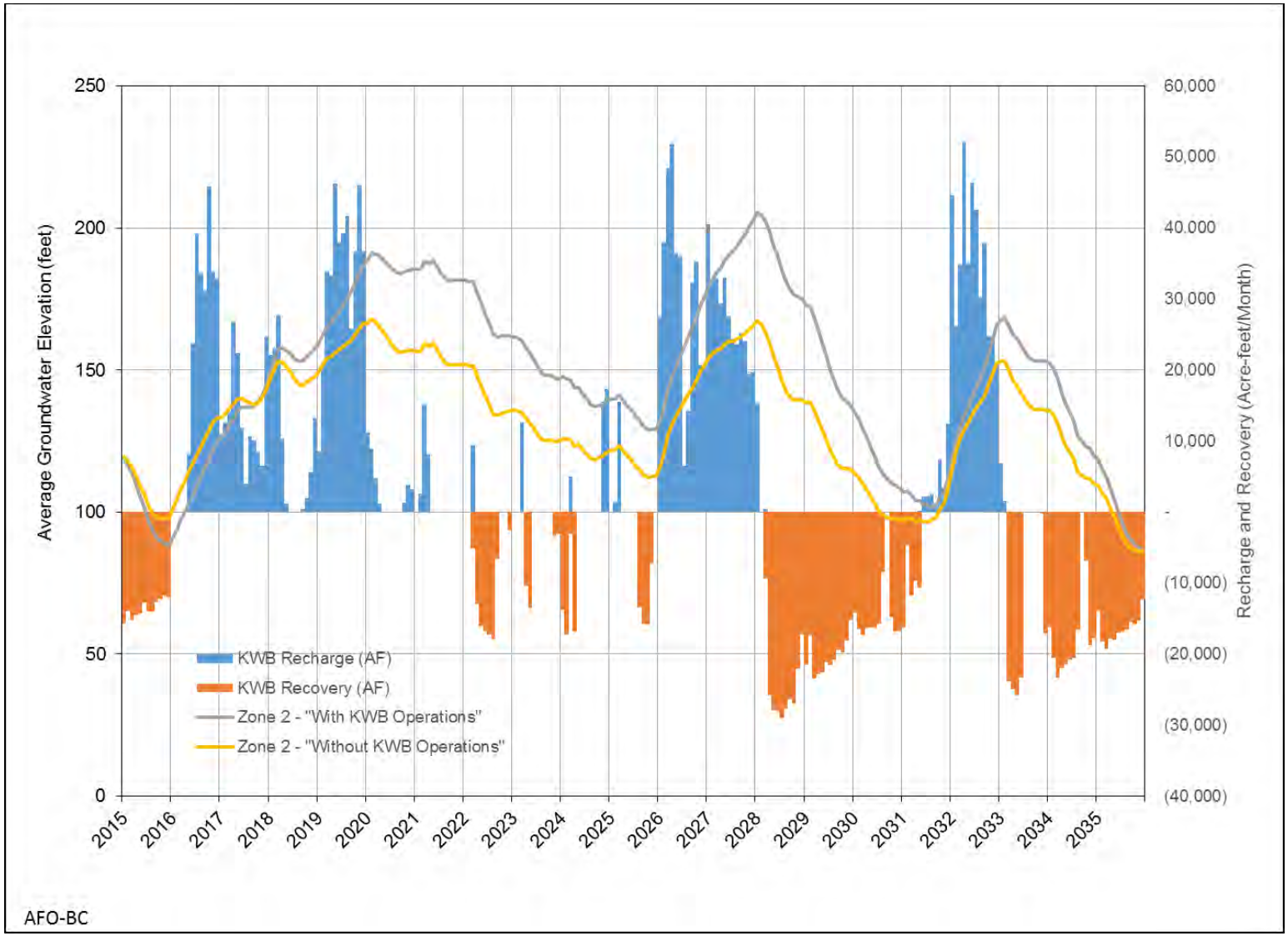


FIGURE 3.4-12b. Analysis of Future Operations under Buildout Conditions: Average Groundwater Elevation Over Zone 2 (1 to 2 Miles Outside the Kern Water Bank Boundary), 2015-2035

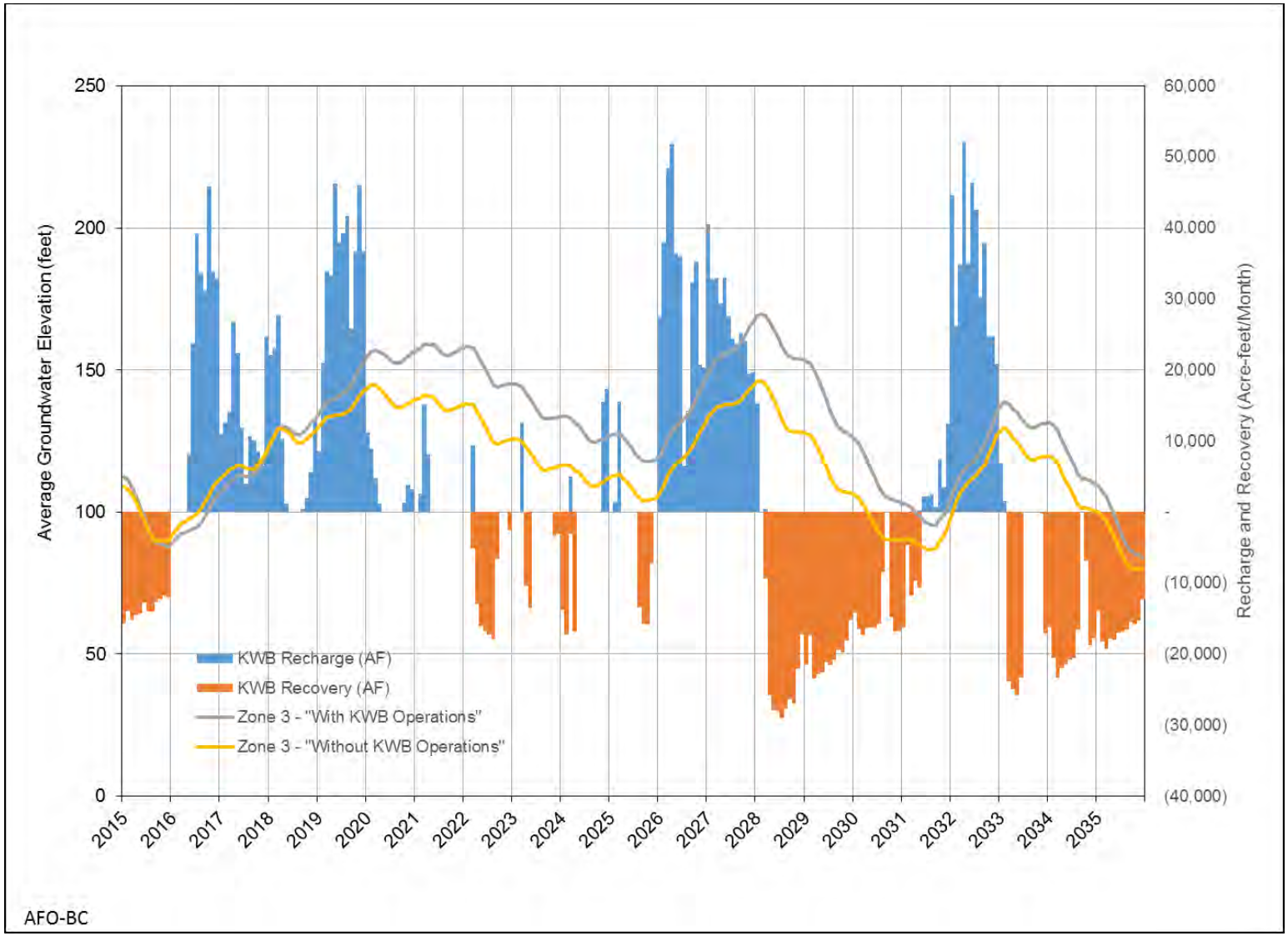


FIGURE 3.4-12c. Analysis of Future Operations under Buildout Conditions: Average Groundwater Elevation Over Zone 3 (2 to 3 Miles Outside the Kern Water Bank Boundary), 2015-2035

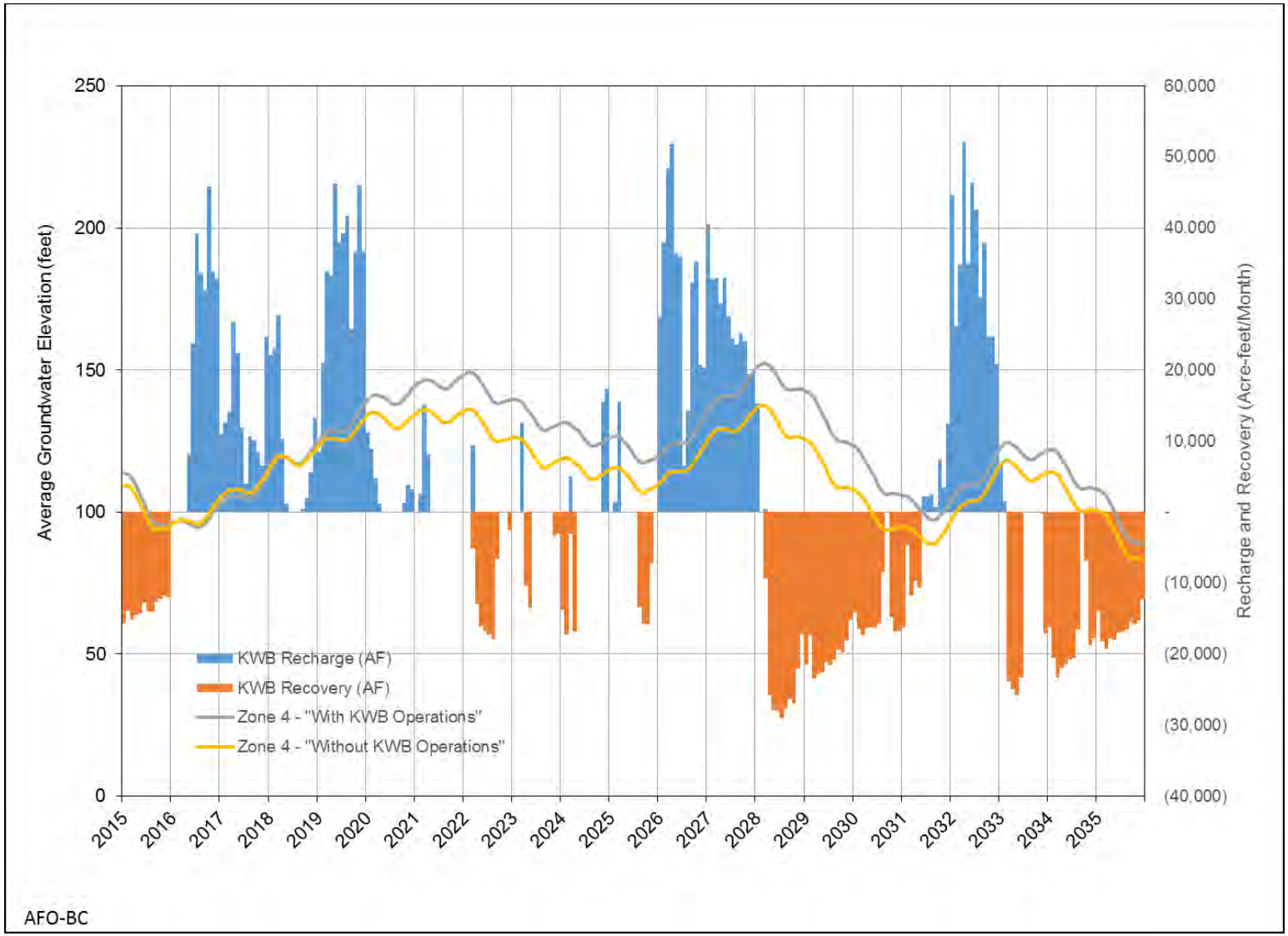


FIGURE 3.4-12d. Analysis of Future Operations under Buildout Conditions: Average Groundwater Elevation Over Zone 4 (3 to 4 Miles Outside the Kern Water Bank Boundary), 2015-2035

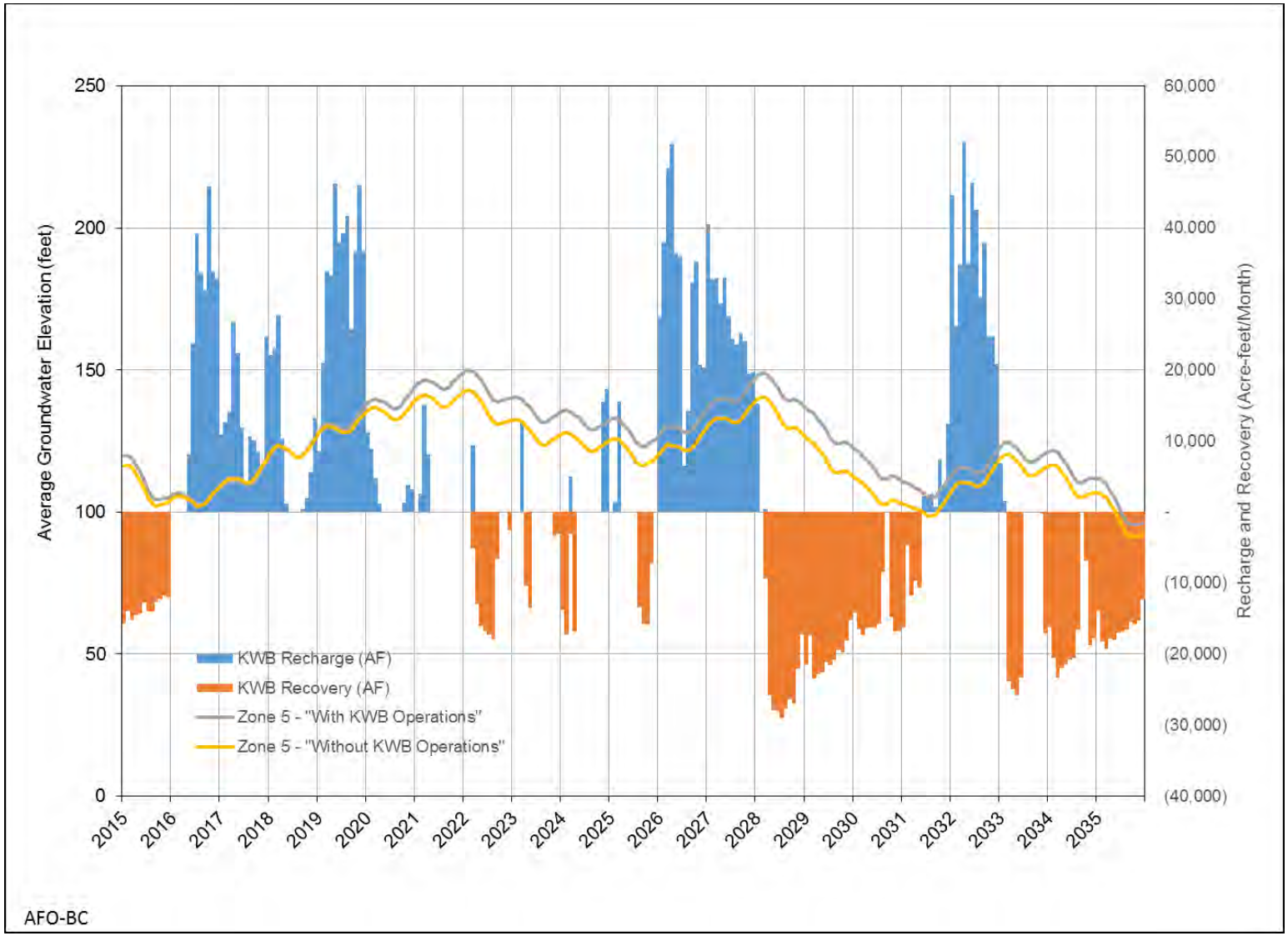


FIGURE 3.4-12e. Analysis of Future Operations under Buildout Conditions: Average Groundwater Elevation Over Zone 5 (4 to 5 Miles Outside the Kern Water Bank Boundary), 2015-2035

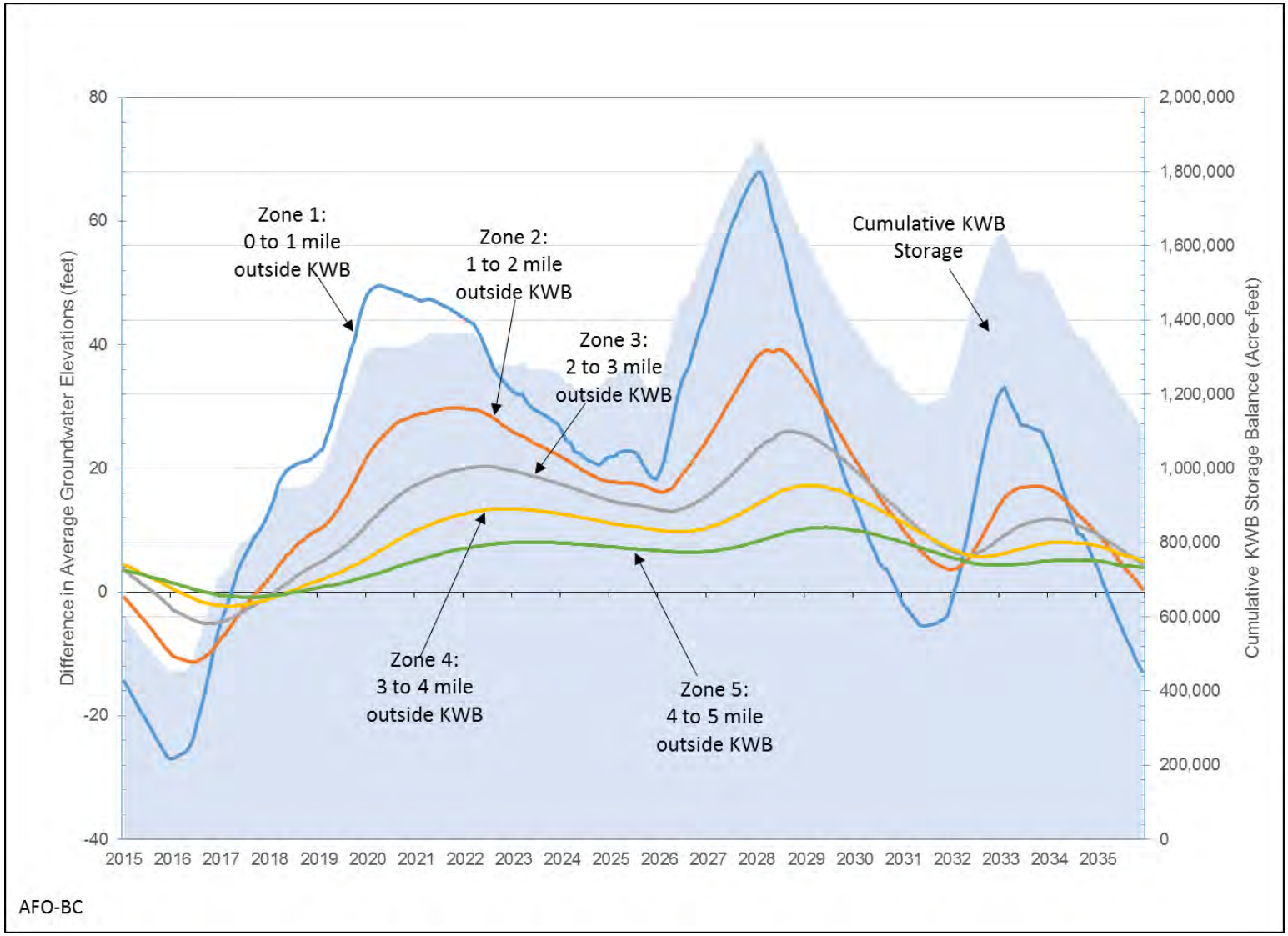


FIGURE 3.4-13. Analysis of Future Operations under Buildout Conditions: Groundwater Elevation Differences in Zones 1 to 5, 2015-2035

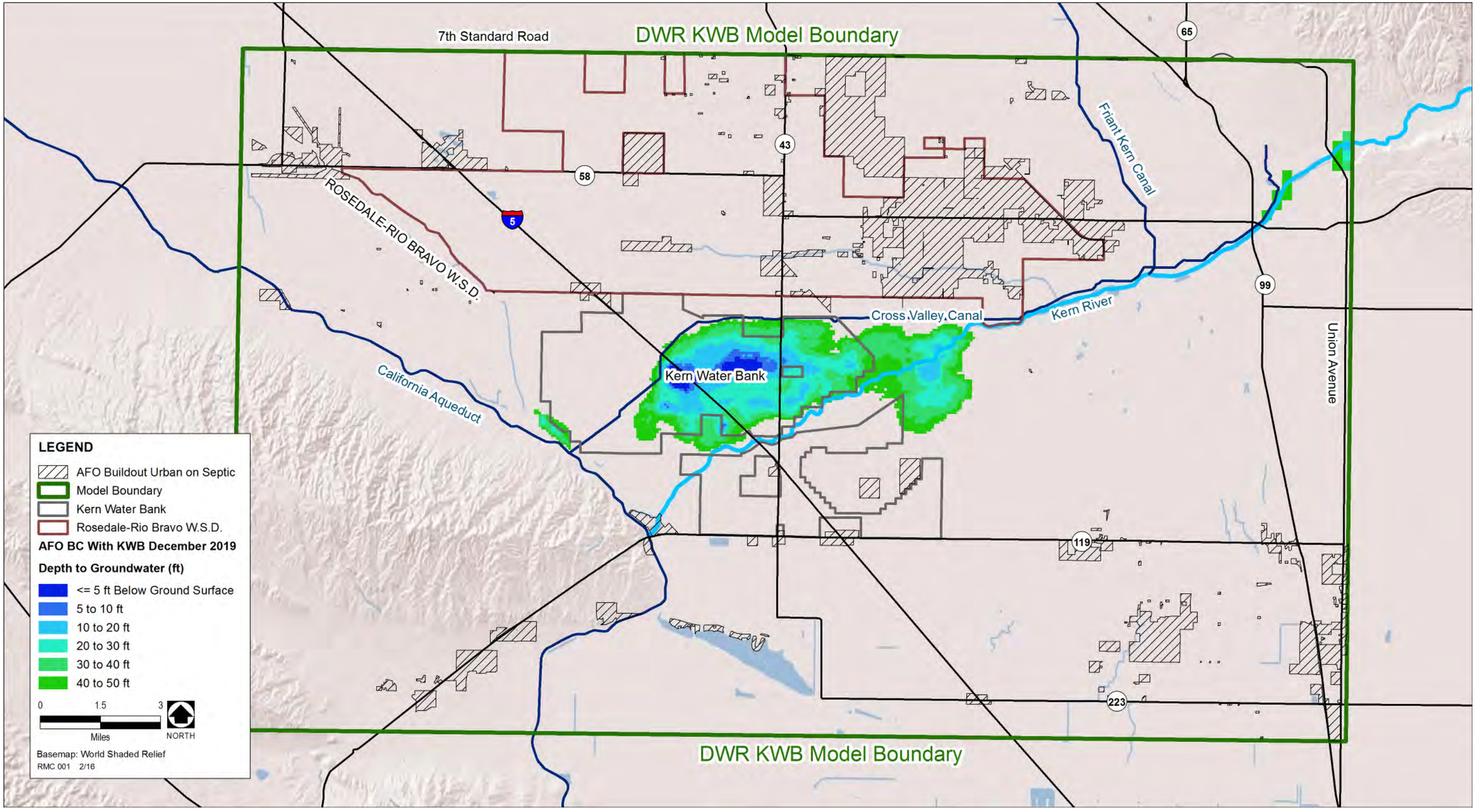


FIGURE 3.4-14. Analysis of Future Operations under Buildout Conditions: Depth-to-Groundwater Contour Map, December 2019

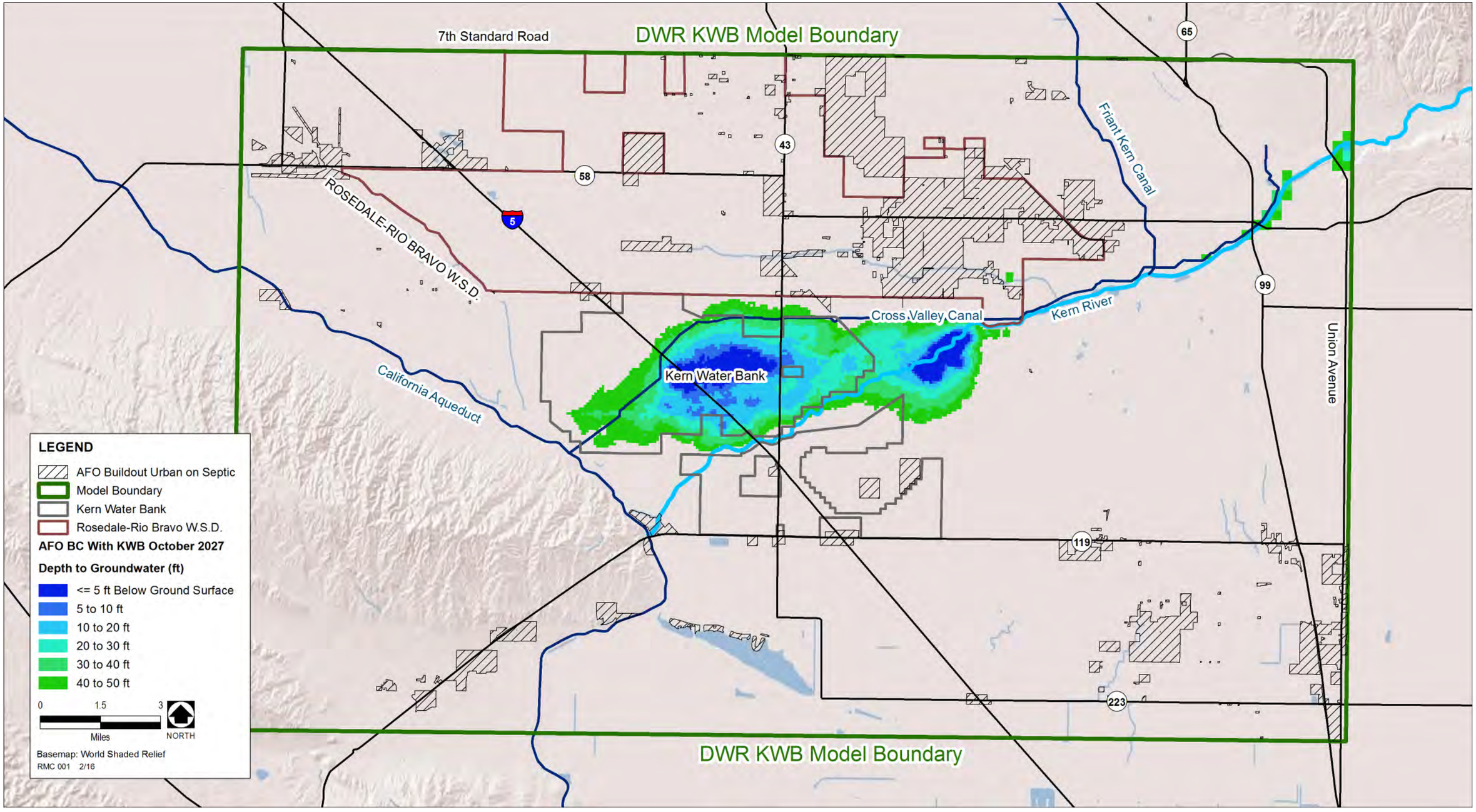


FIGURE 3.4-15. Analysis of Future Operations under Buildout Conditions: Depth-to-Groundwater Contour Map, October 2027

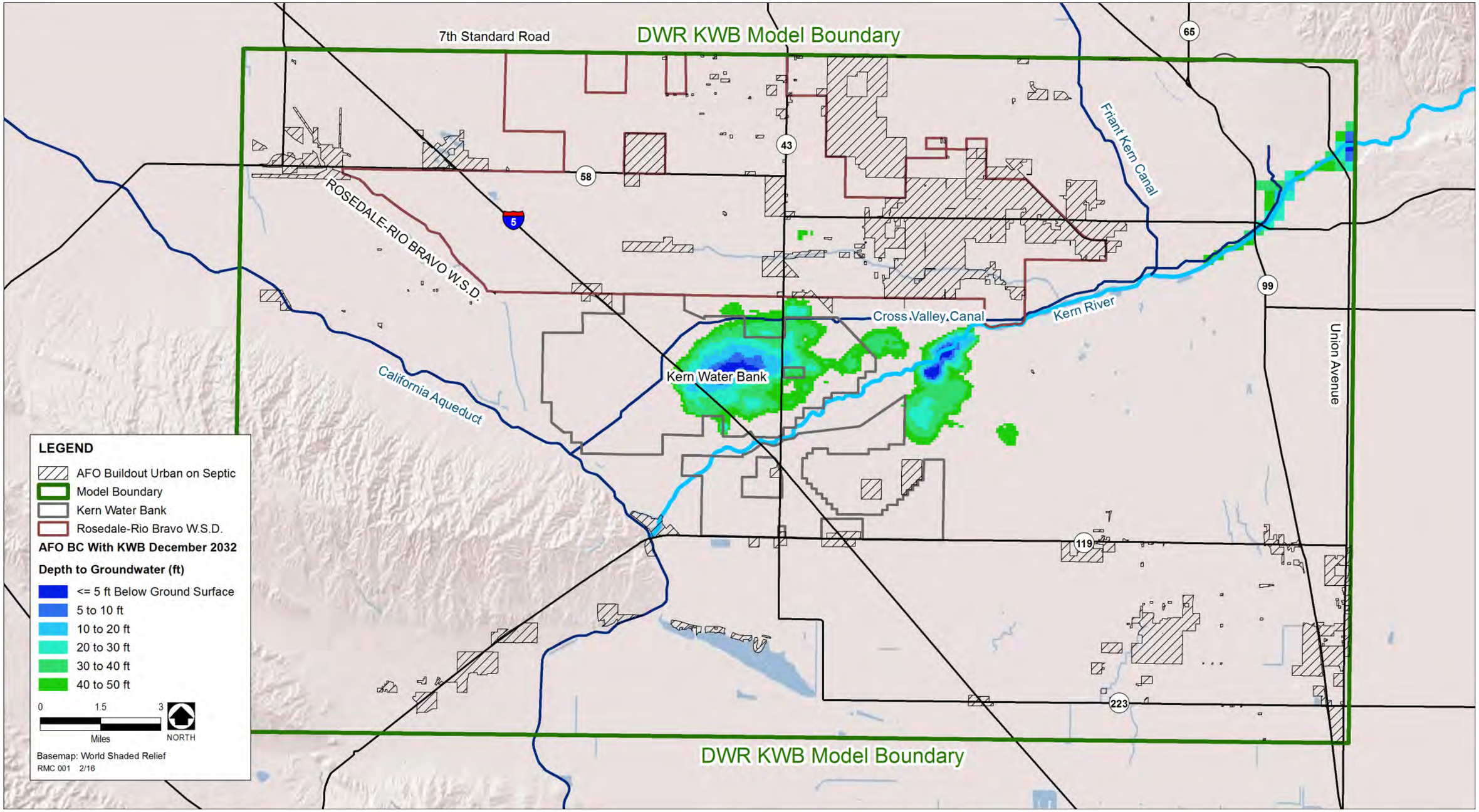
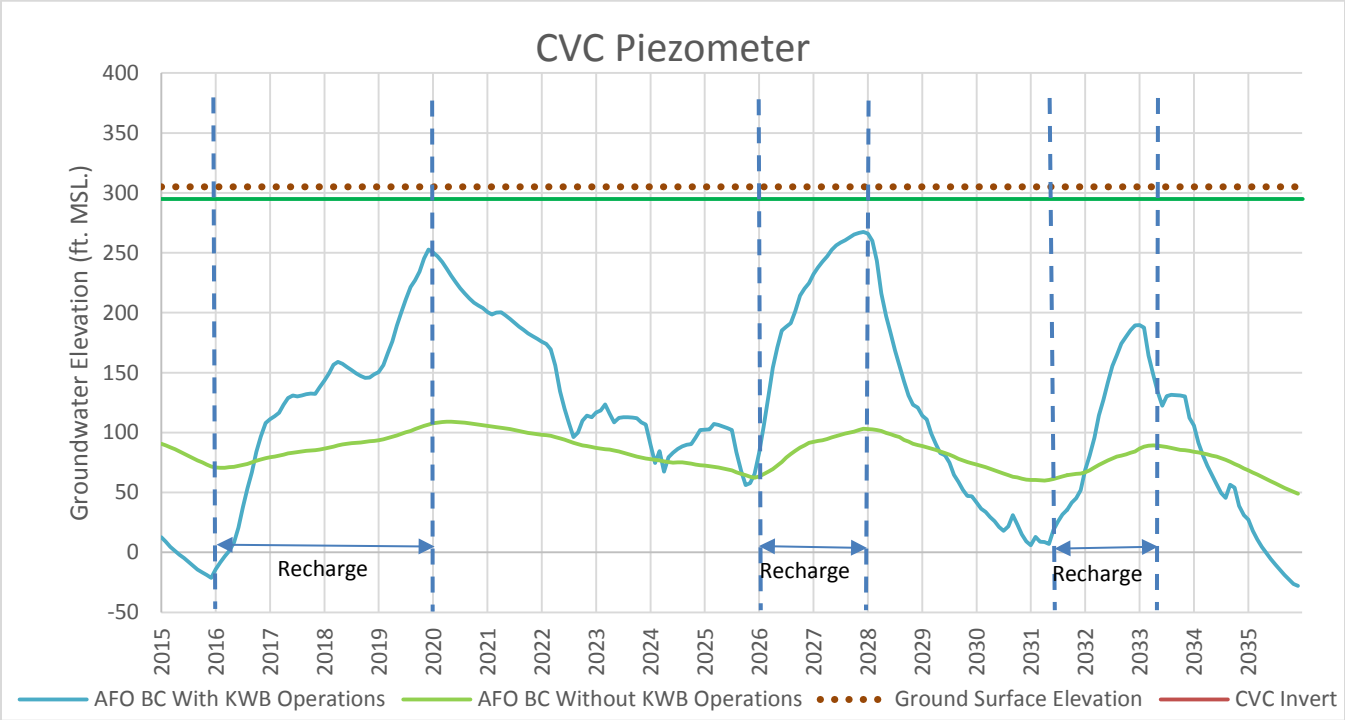


FIGURE 3.4-16. Analysis of Future Operations under Buildout Conditions: Depth- to-Groundwater Contour Map, December 2032



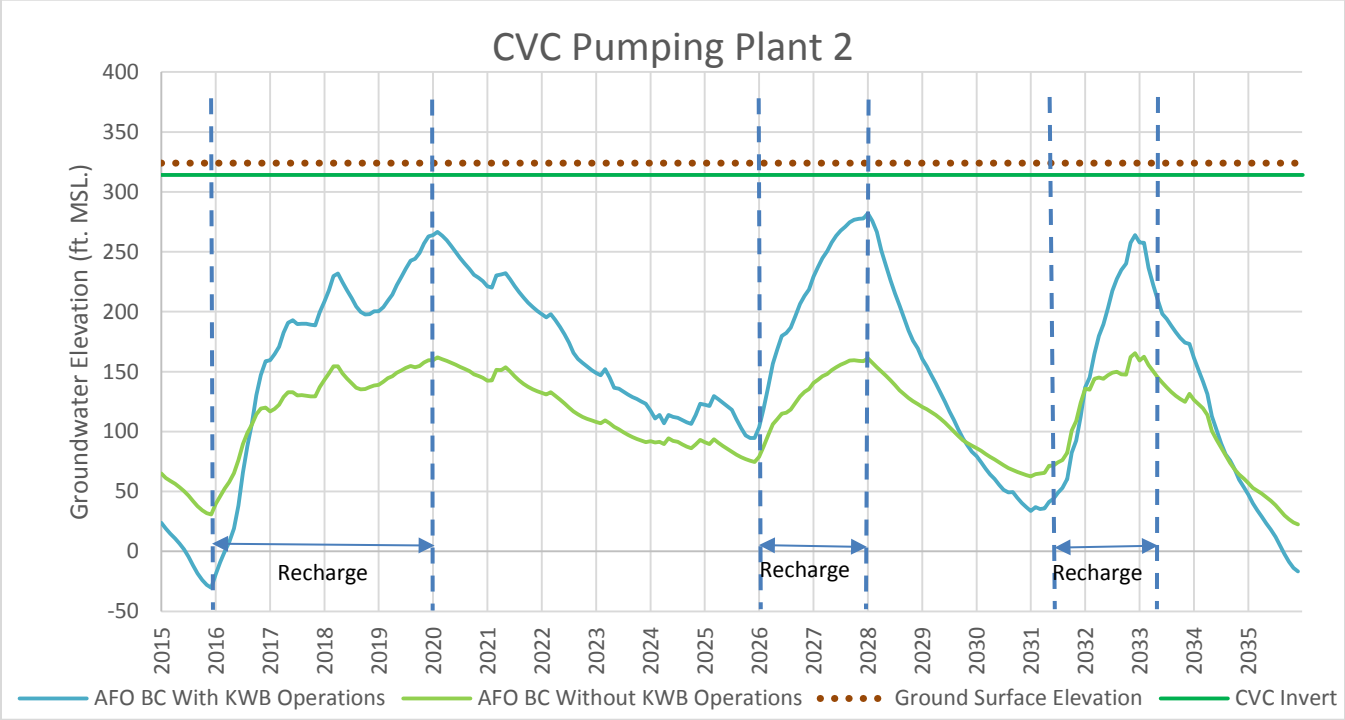
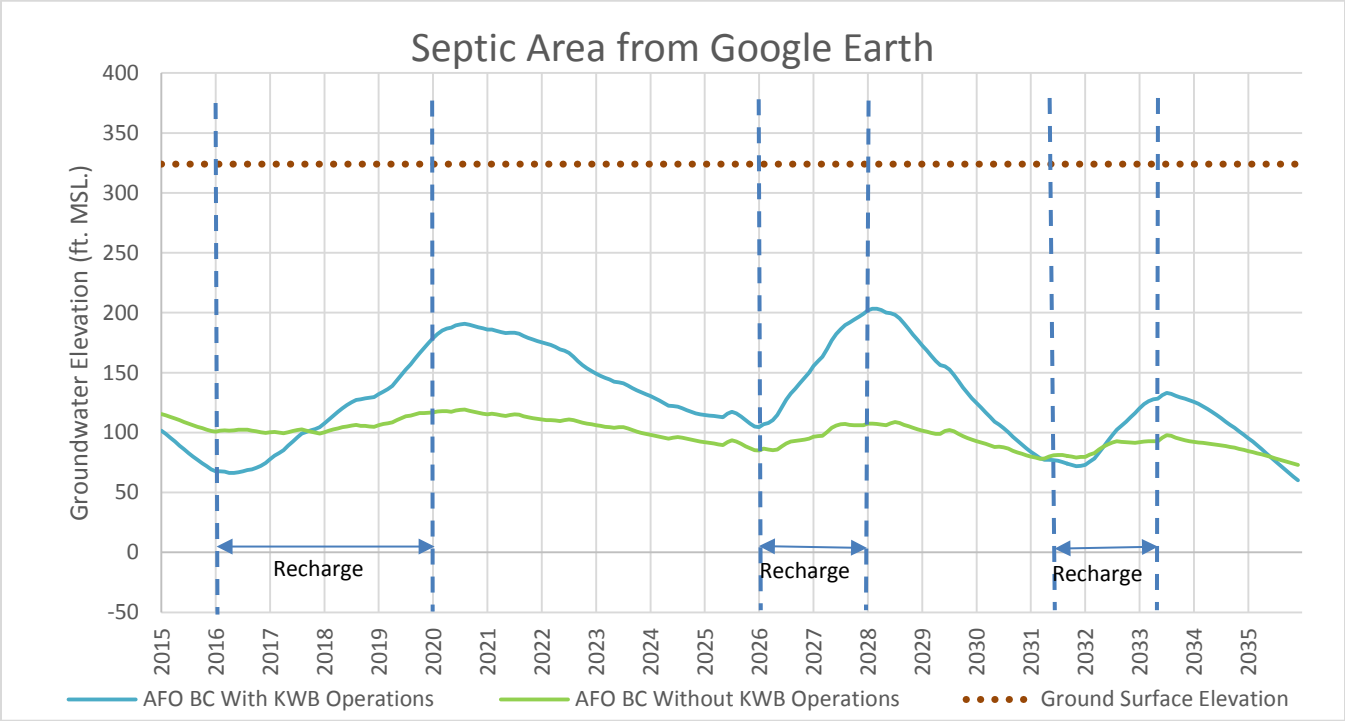


FIGURE 3.4-17. Groundwater Elevation Hydrographs at Selected Locations along the CVC for AFO-BC Scenario, 2015-2035



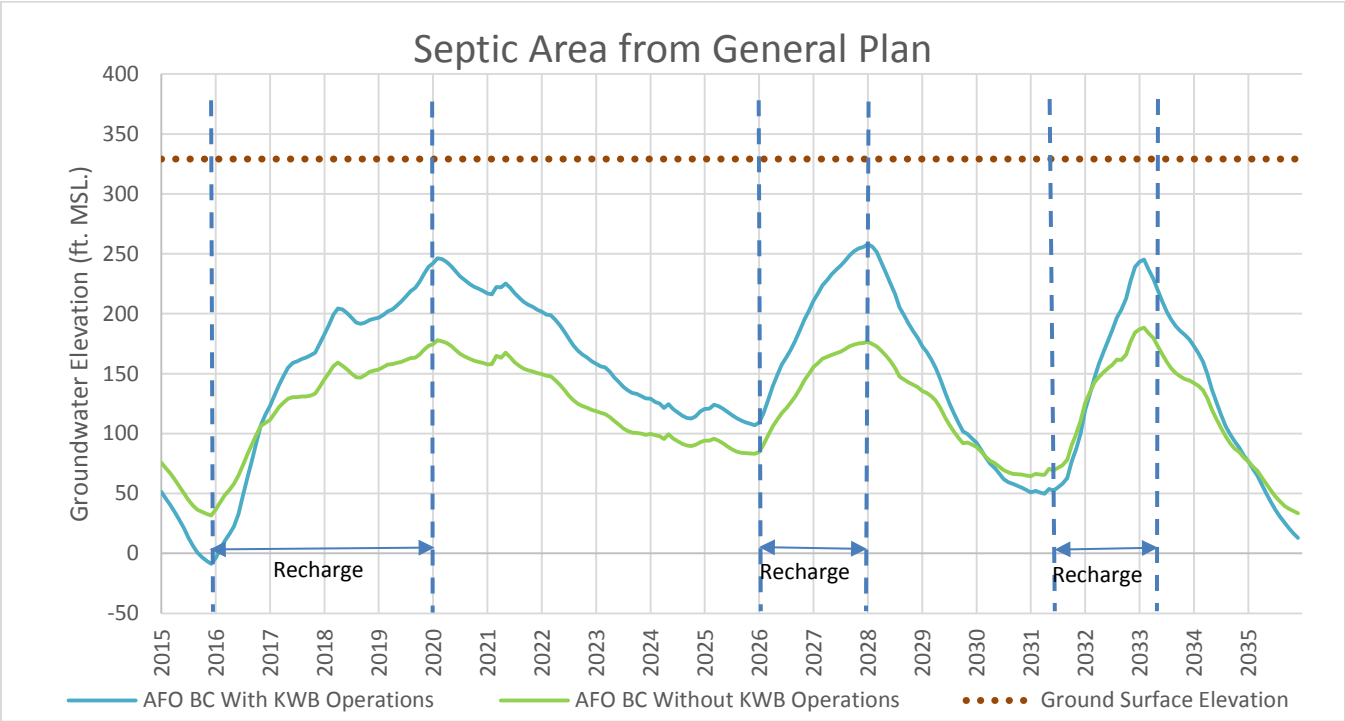


FIGURE 3.4-18. Groundwater Elevation Hydrographs at Selected Areas on Septic Systems for AFO-BC Scenario, 2015-2035

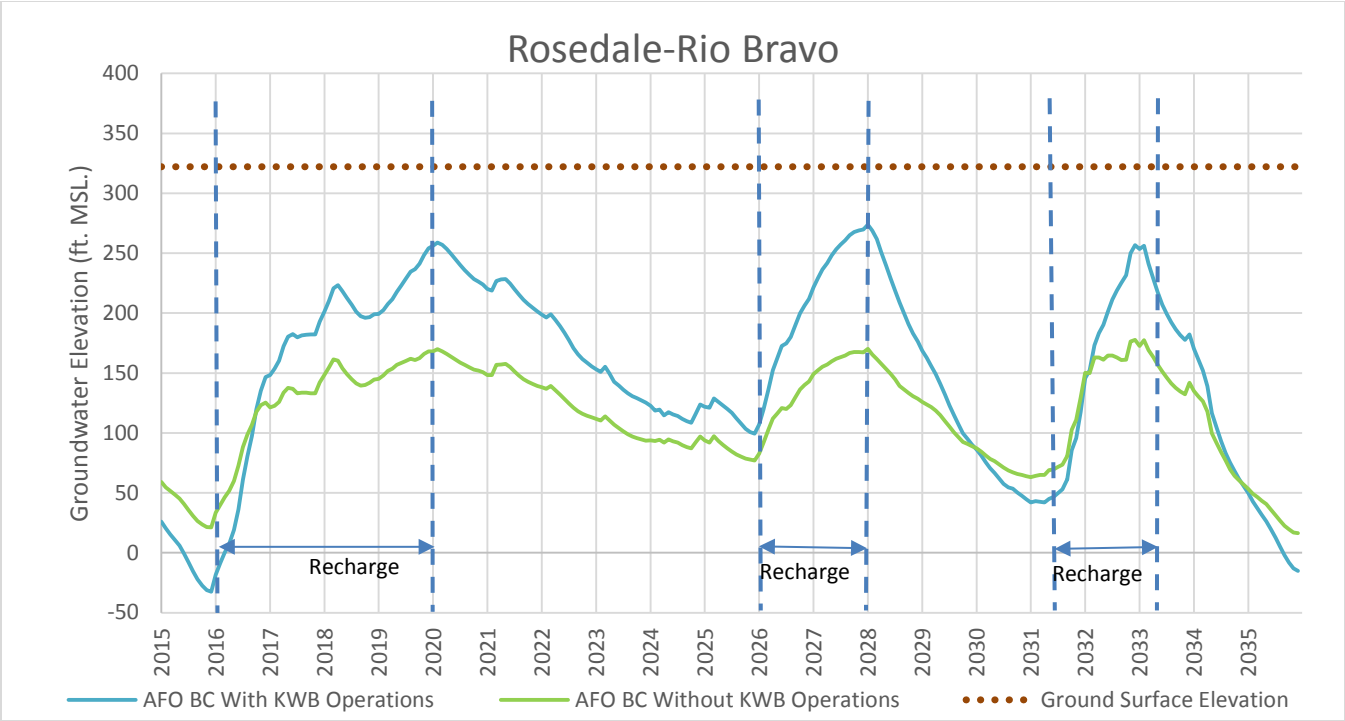


FIGURE 3.4-19a. Groundwater Elevation Hydrographs at Rosedale-Rio Bravo Recharge Pond for AFO-BC, 2015-2035

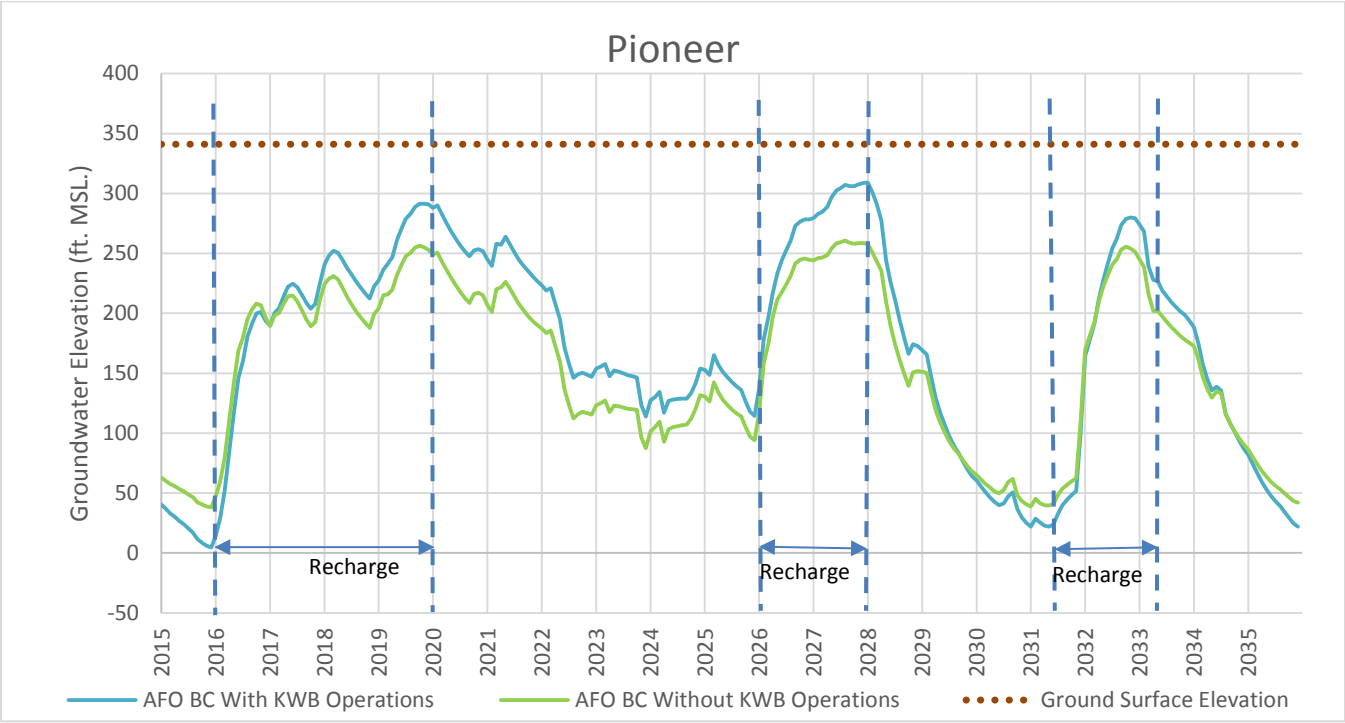


FIGURE 3.4-19b. Groundwater Elevation Hydrographs at Pioneer Recharge Pond for AFO-BC, 2015-2035

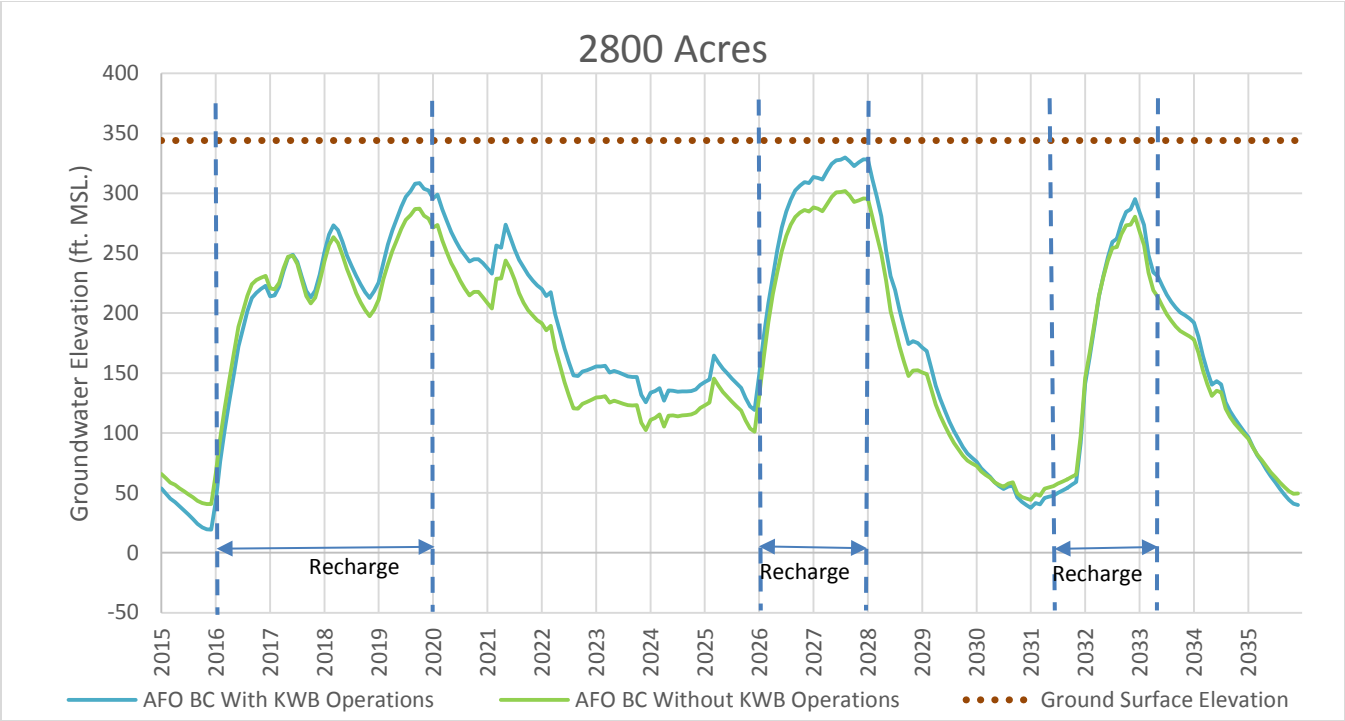


FIGURE 3.4-19c. Groundwater Elevation Hydrographs at 2800 Acres Recharge Pond for AFO-BC, 2015-2035

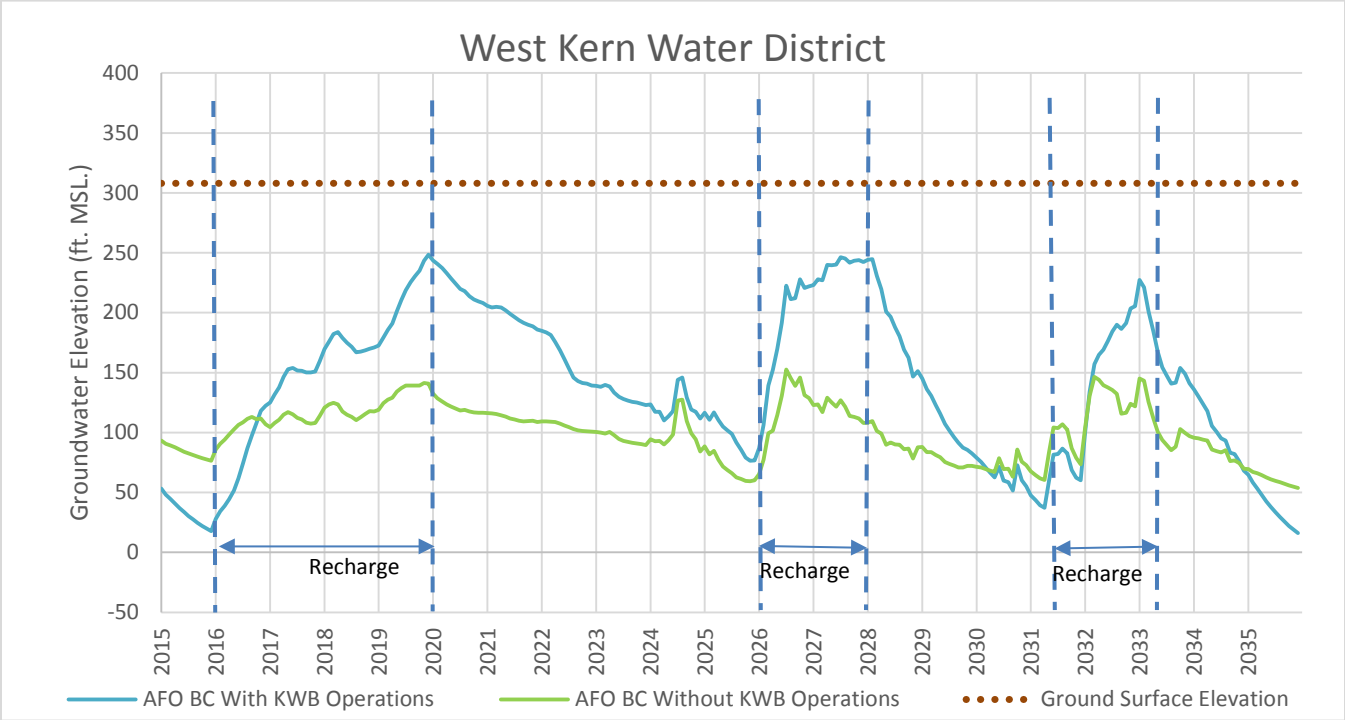


FIGURE 3.4-19d. Groundwater Elevation Hydrographs at West Kern Water District Recharge Pond for AFO-BC, 2015-2035

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APPENDIX 7-2
A. APO HYDROGRAPHS

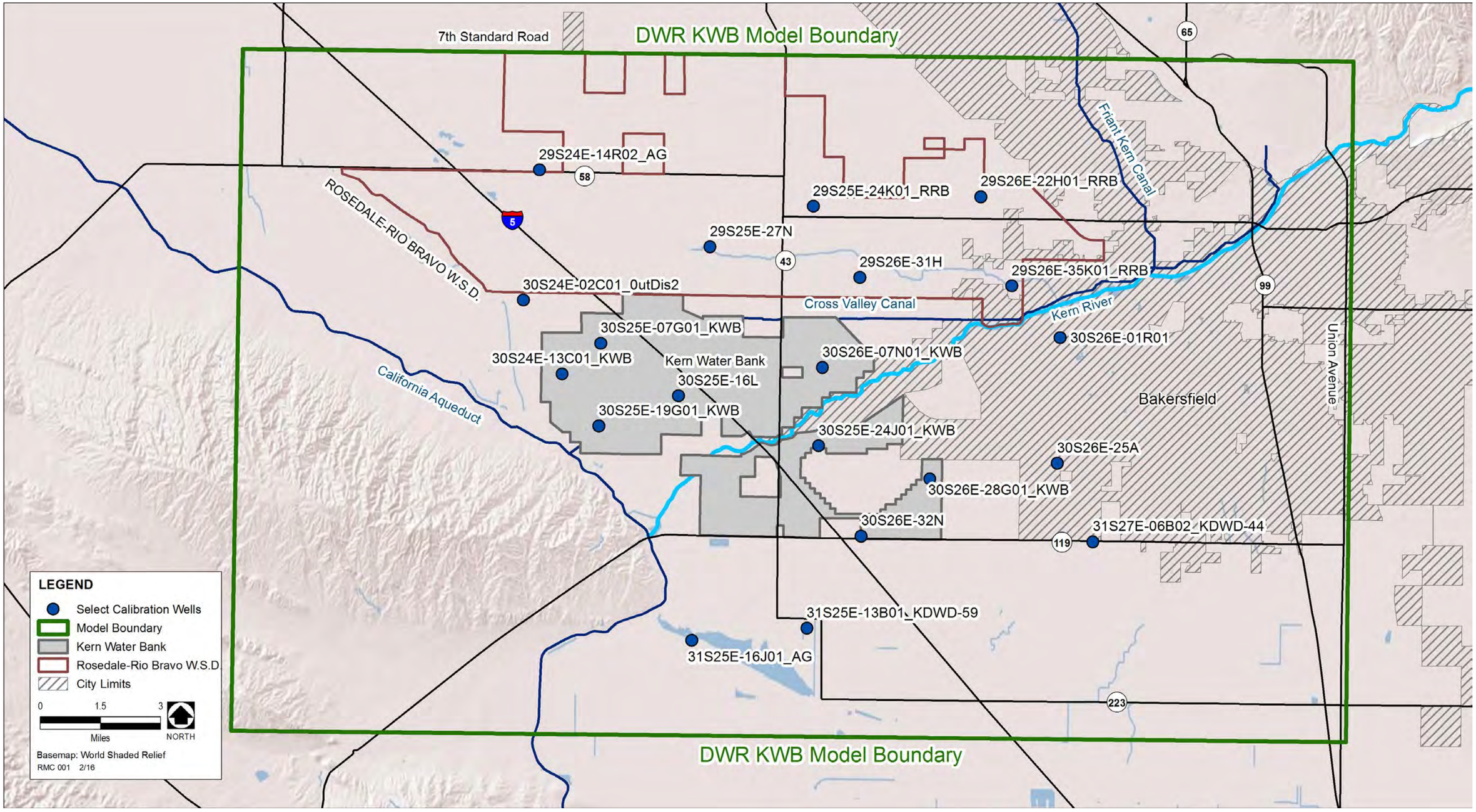

FIGURE 7-2 A.1. Location of Select Monitoring Wells Inside (14 Wells) and Outside (17 Wells) of Kern Water Bank

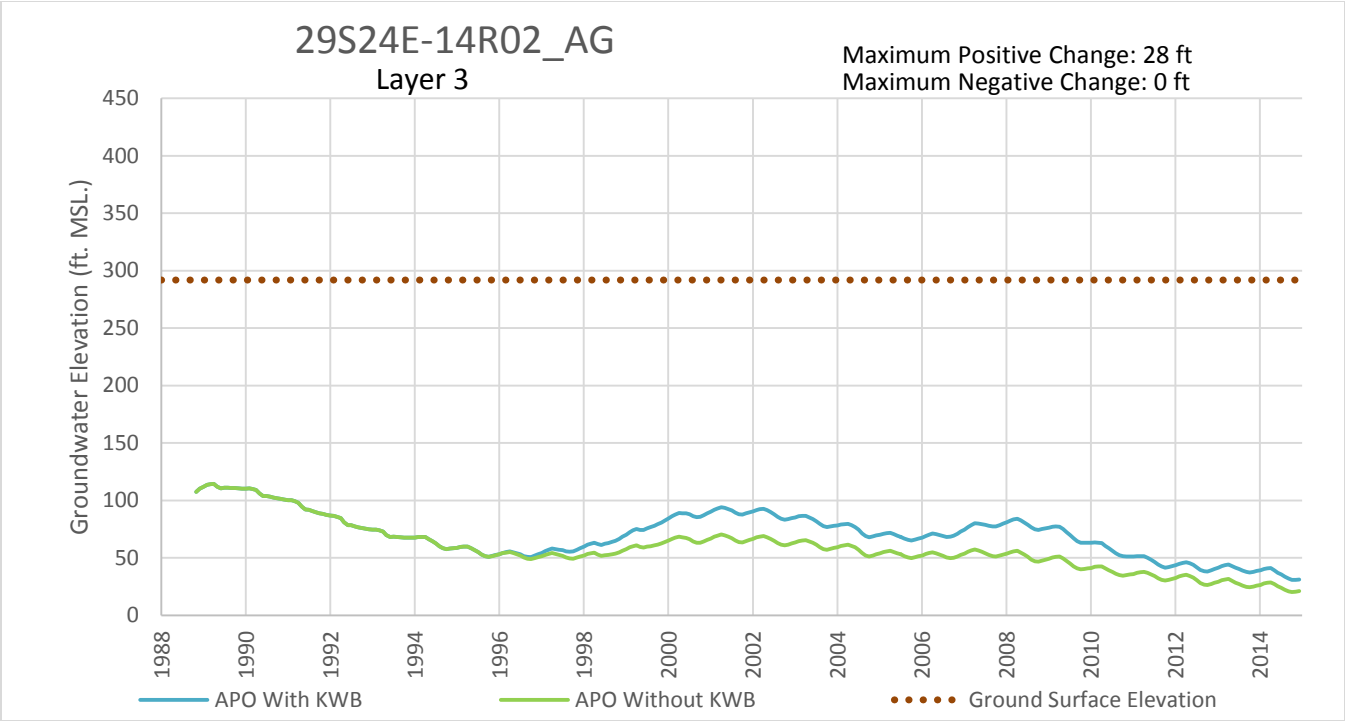

FIGURE 7-2 A.2 Hydrograph of Simulated Water Levels at Monitoring Well 29S24E14R02_Ag, 1988-2014

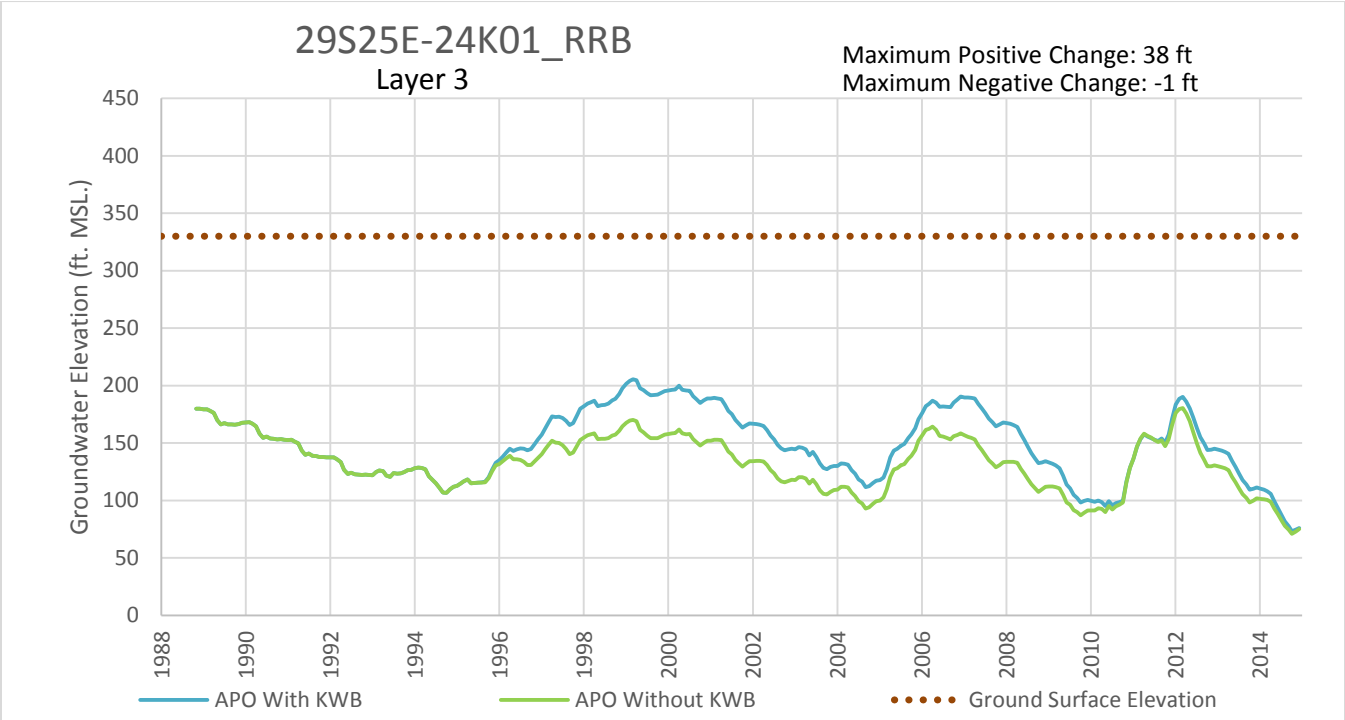

FIGURE 7-2 A.3. Hydrograph of Simulated Water Levels at Monitoring Well 29S257-24K01_RRB, 1988-2014

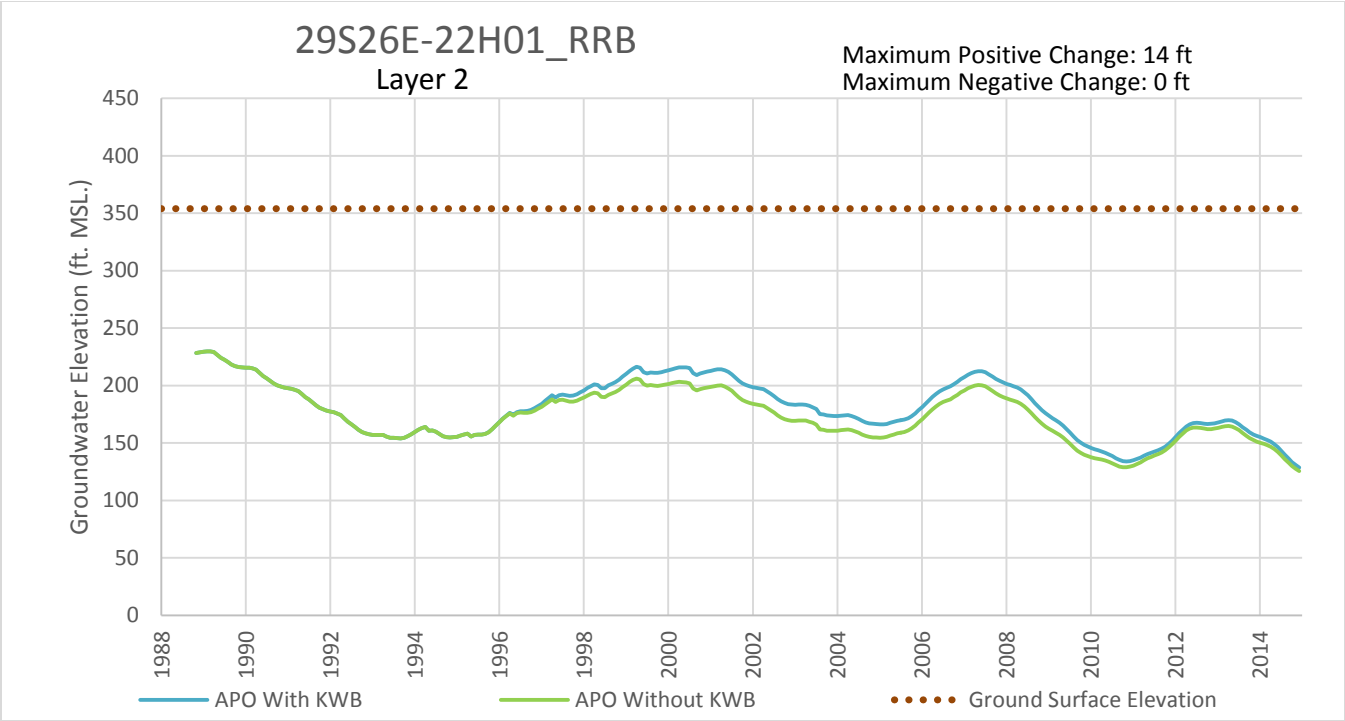

FIGURE 7-2 A.4. Hydrograph of Simulated Water Levels at Monitoring Well 29S267-22H01_RRB, 1988-2014

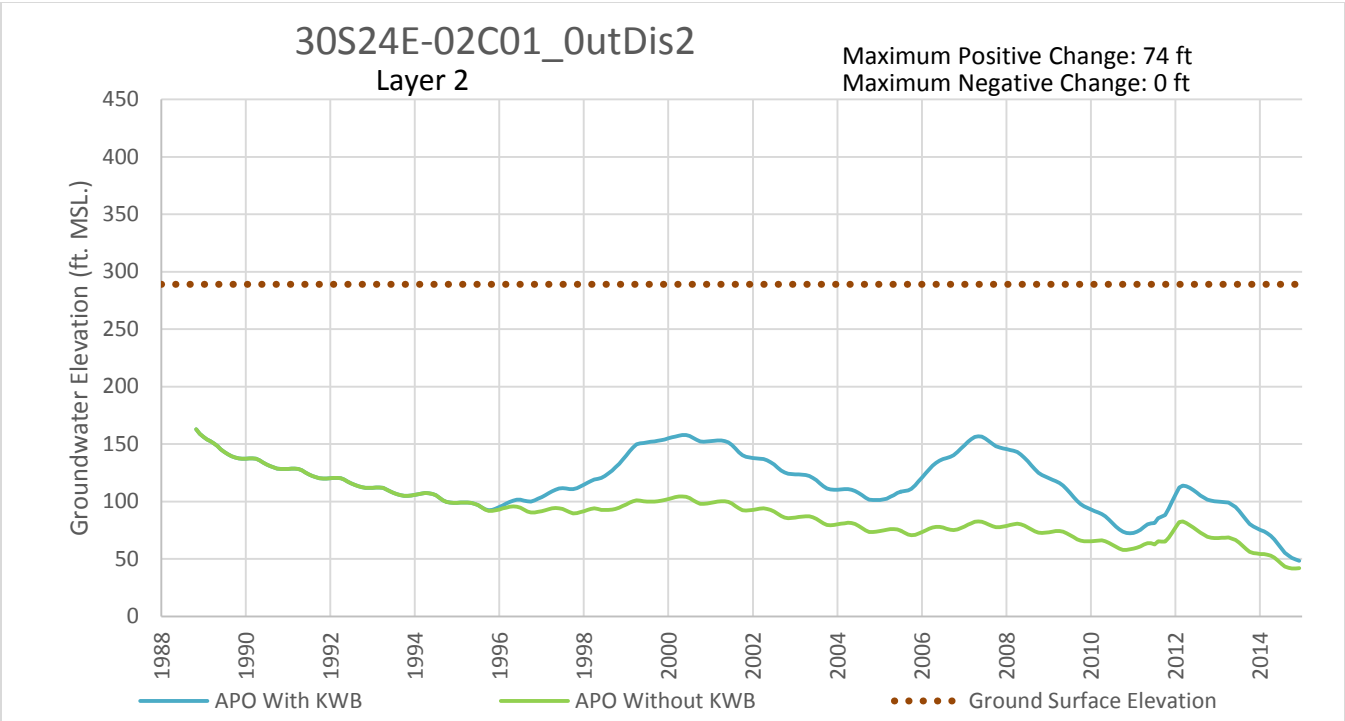

FIGURE 7-2 A.5. Hydrograph of Simulated Water Levels at Monitoring Well 30S24E-02C01_0utDis2, 1988-2014

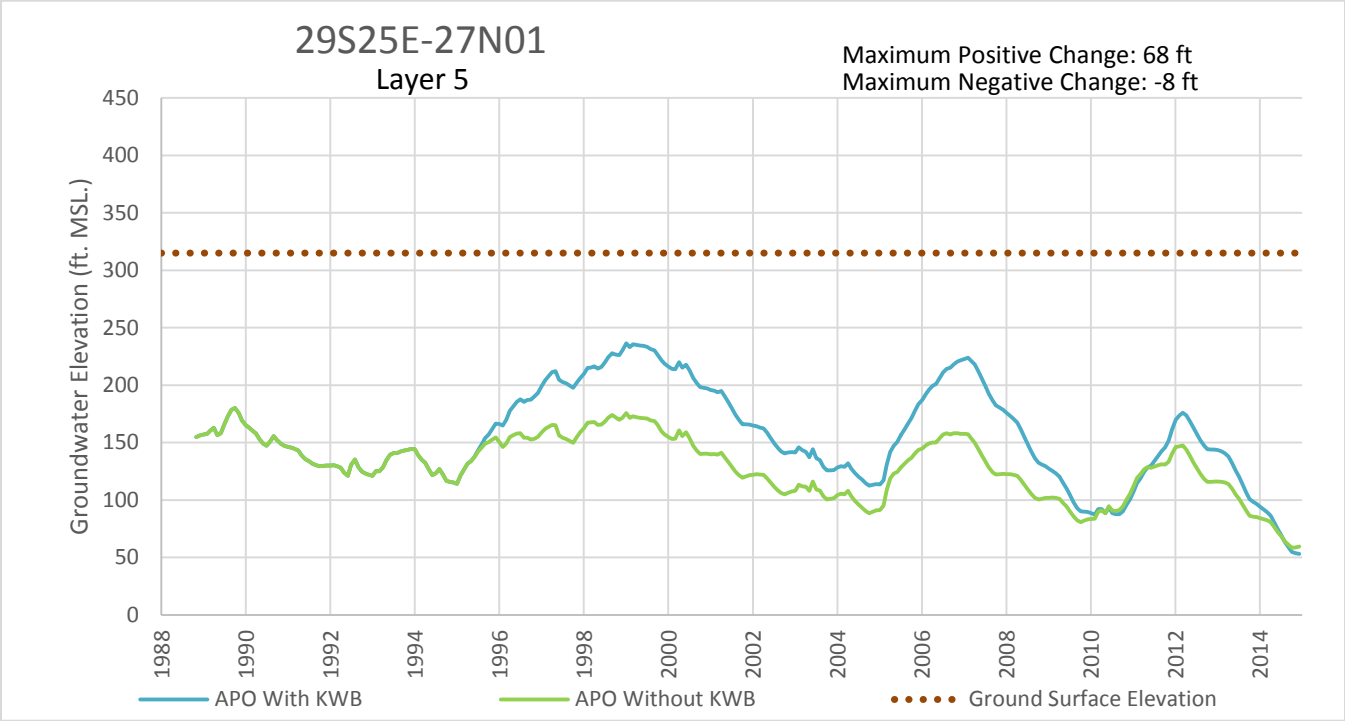

FIGURE 7-2 A.6. Hydrograph of Simulated Water Levels at Monitoring Well 29S257-27N01, 1988-2014

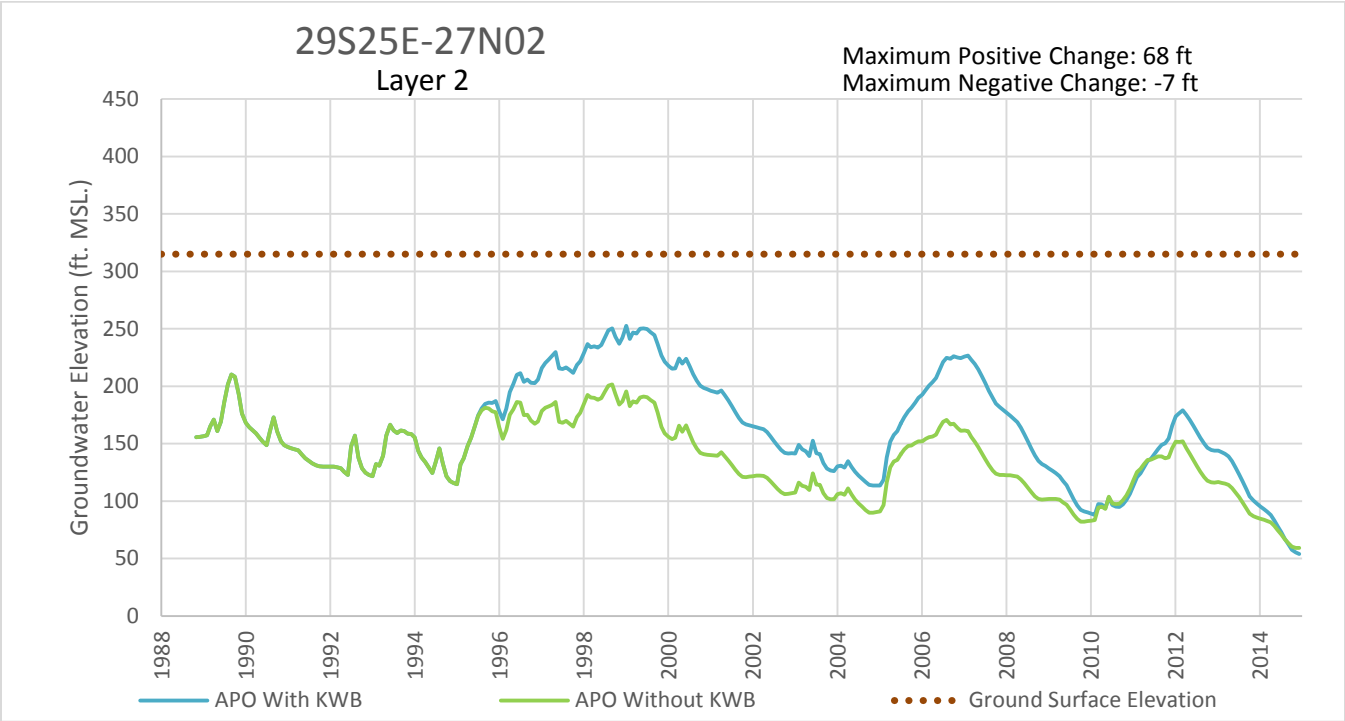

FIGURE 7-2 A.7. Hydrograph of Simulated Water Levels at Monitoring Well 29S257-27N02, 1988-2014

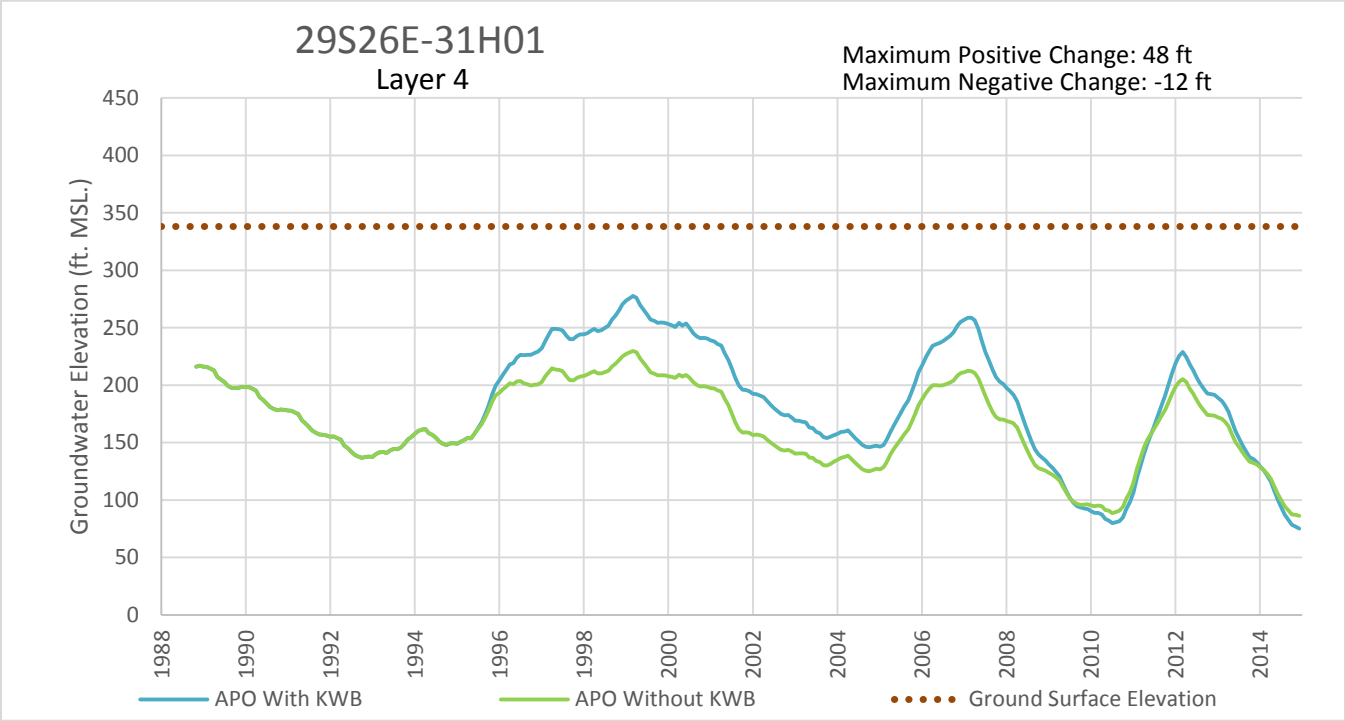

FIGURE 7-2 A.8. Hydrograph of Simulated Water Levels at Monitoring Well 29S26E-31H01, 1988-2014

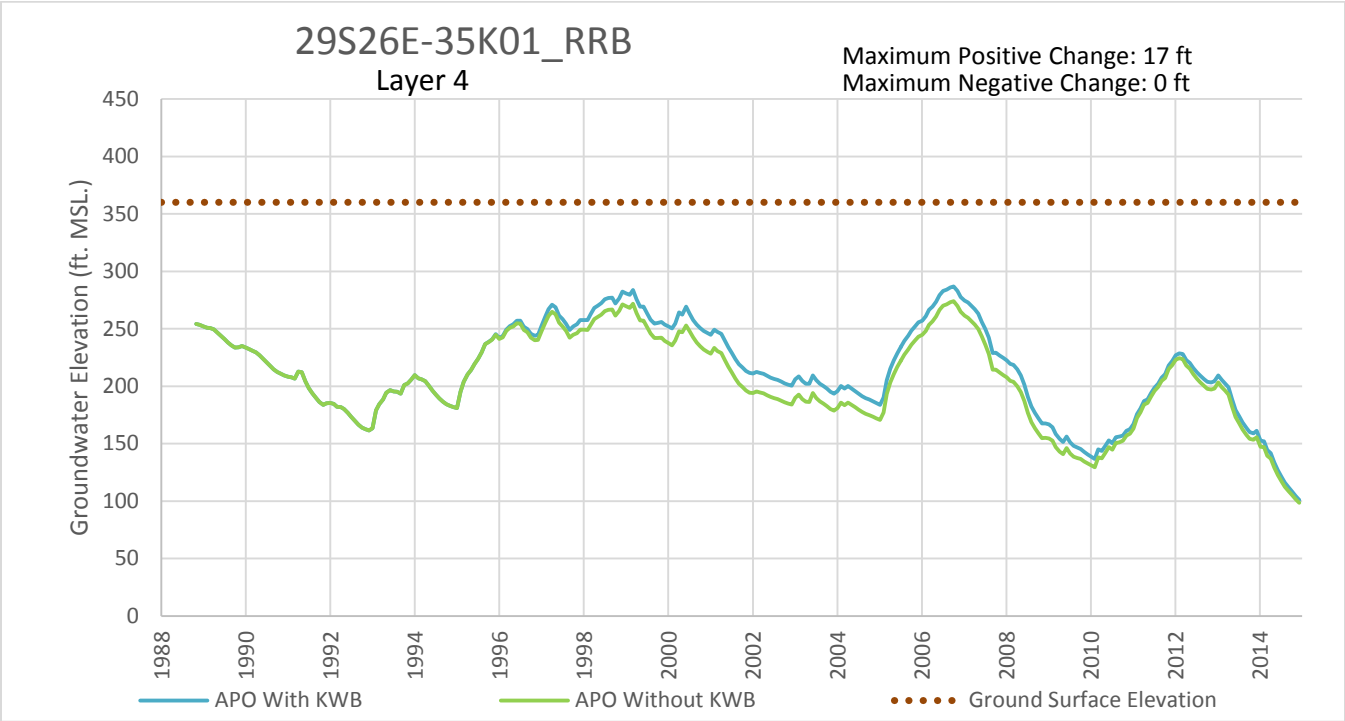

FIGURE 7-2 A.9. Hydrograph of Simulated Water Levels at Monitoring Well 29S26E-35K01_RRB, 1988-2014

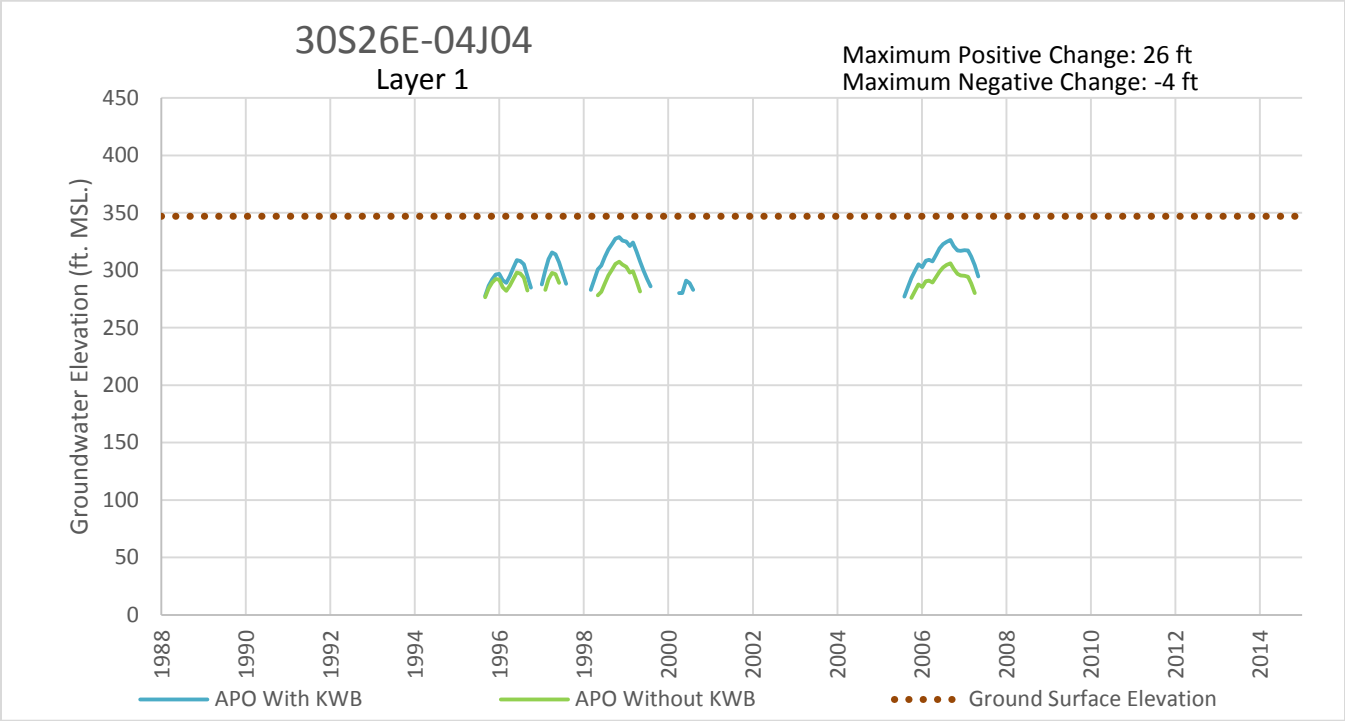

FIGURE 7-2 A.10. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-04J04, 1988-2014

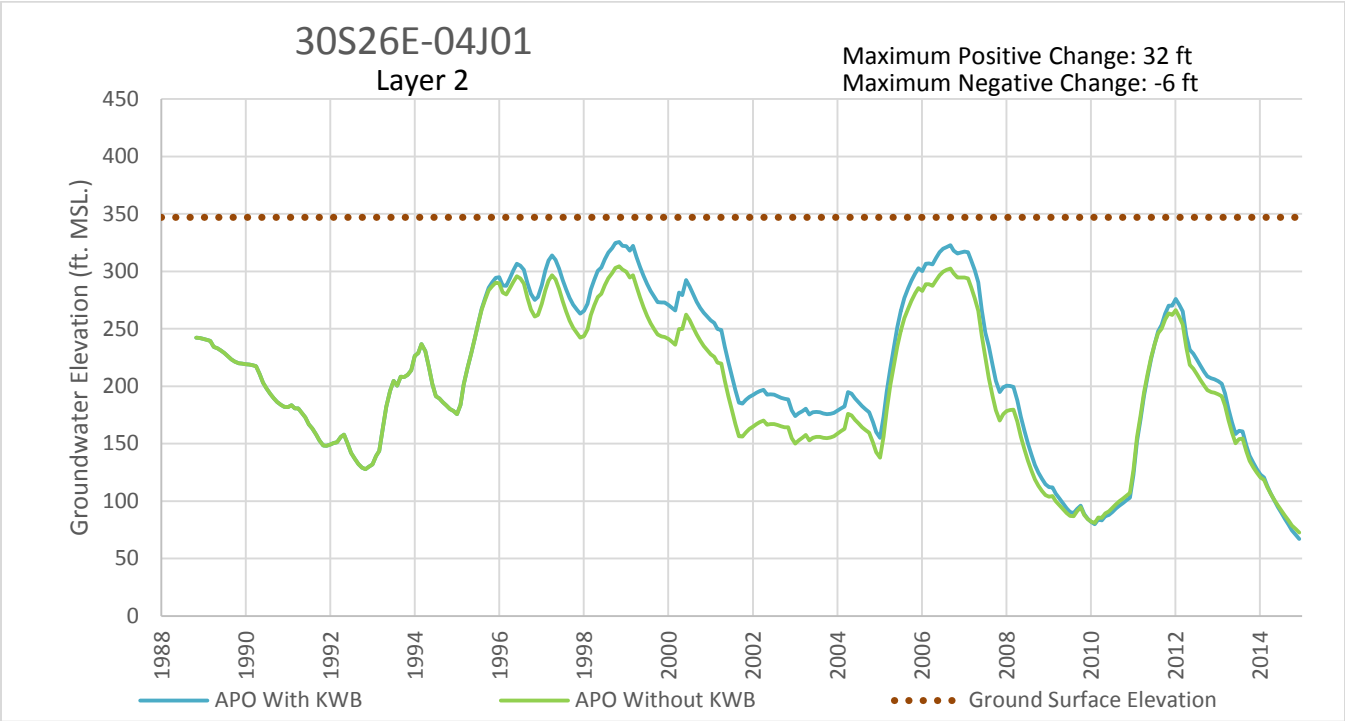

FIGURE 7-2 A.11. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-04J01, 1988-2014

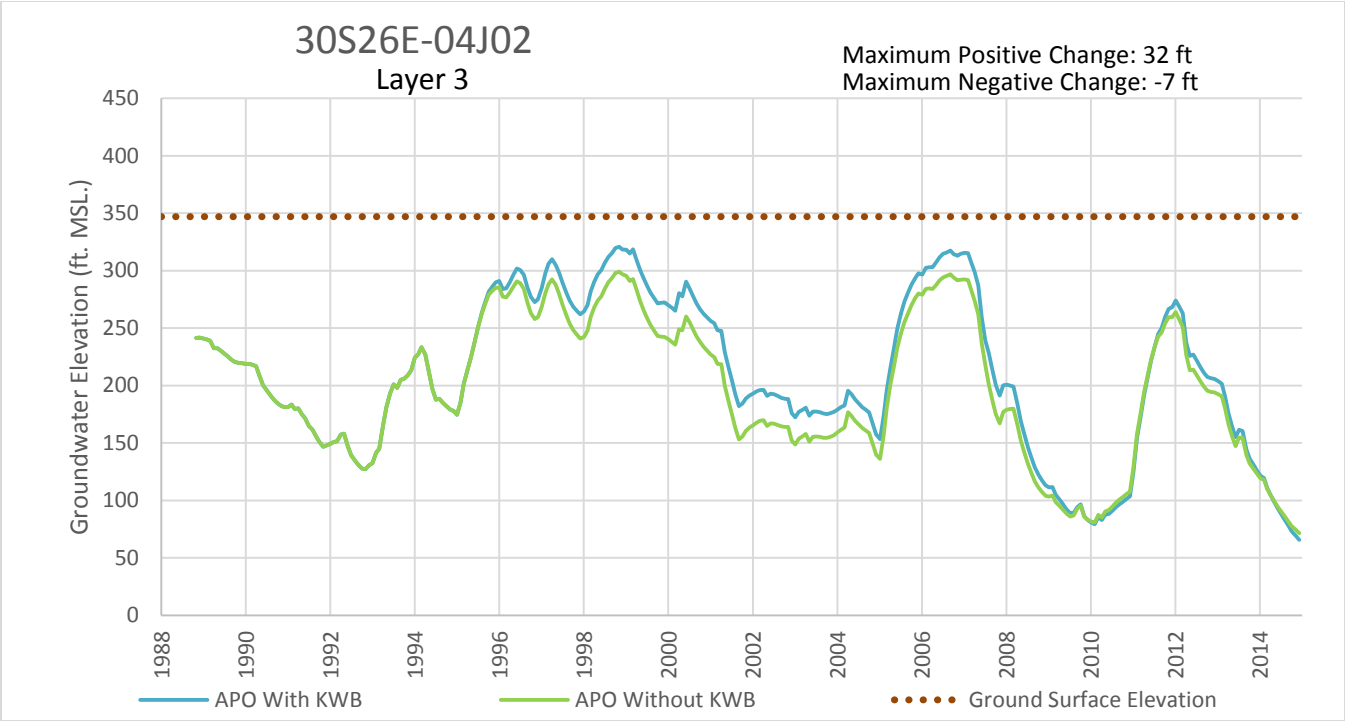

FIGURE 7-2 A.12. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-04J02, 1988-2014

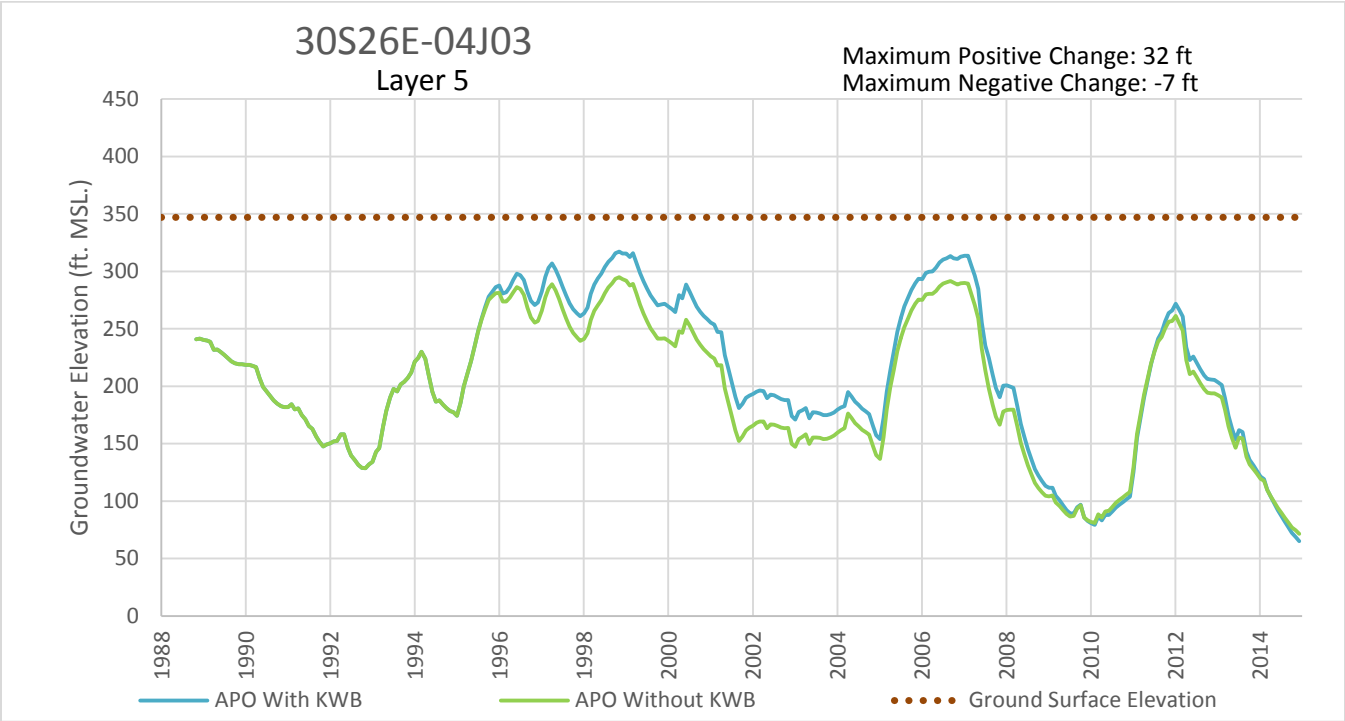

FIGURE 7-2 A.13. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-04J03, 1988-2014

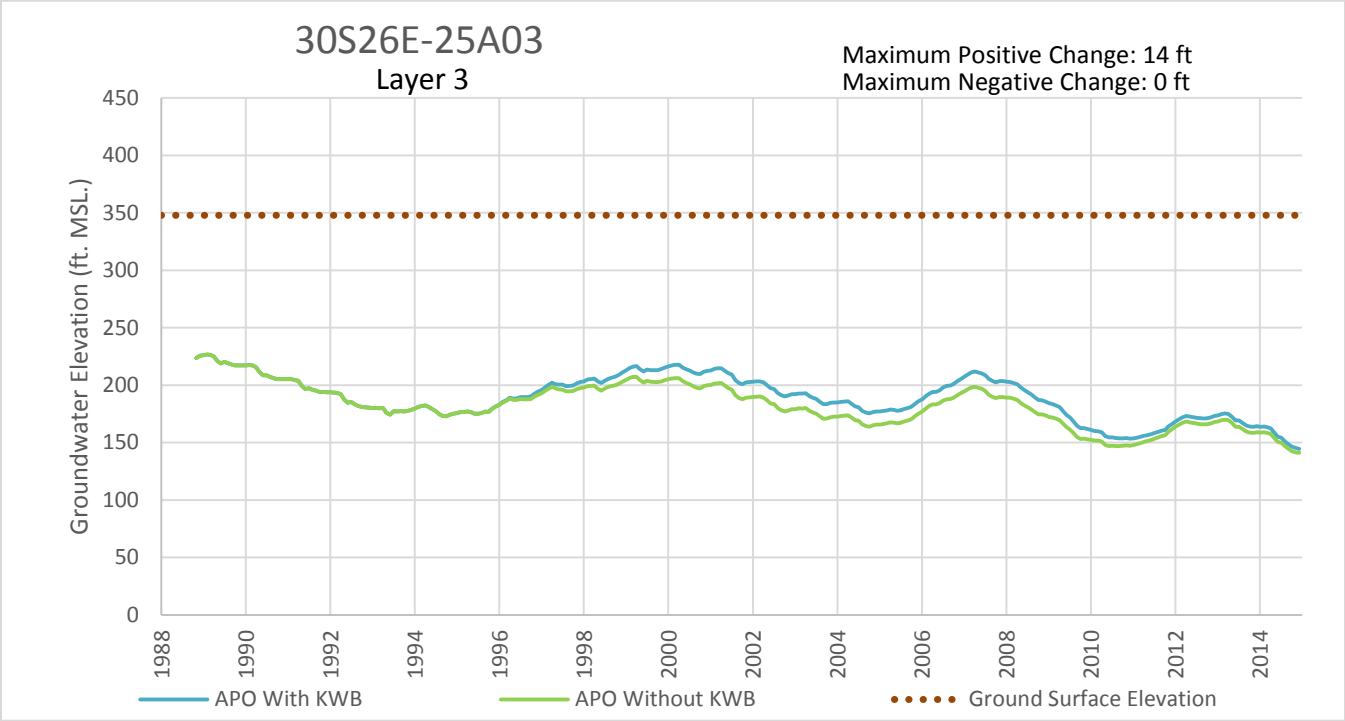

FIGURE 7-2 A.14. Hydrograph of Simulated Water Levels at Monitoring Well 30S267-25A03, 1988-2014

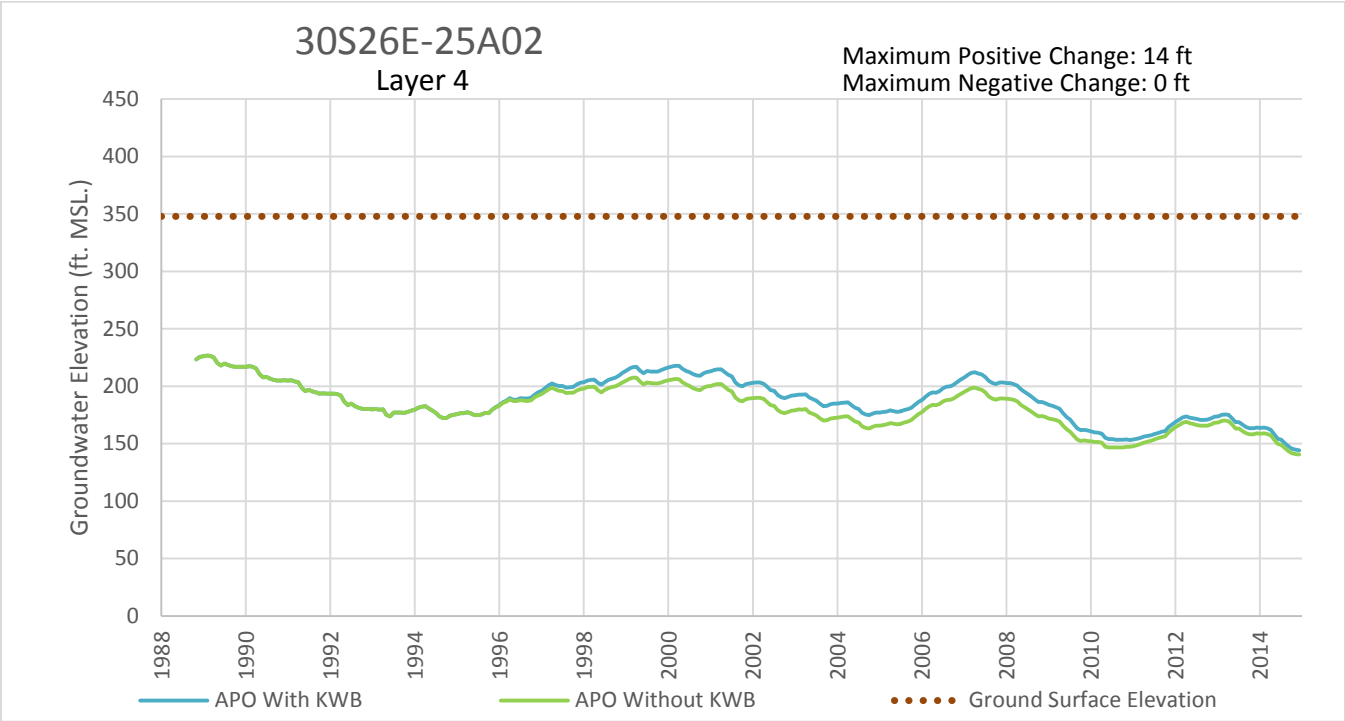

FIGURE 7-2 A.15. Hydrograph of Simulated Water Levels at Monitoring Well 30S267-25A02, 1988-2014

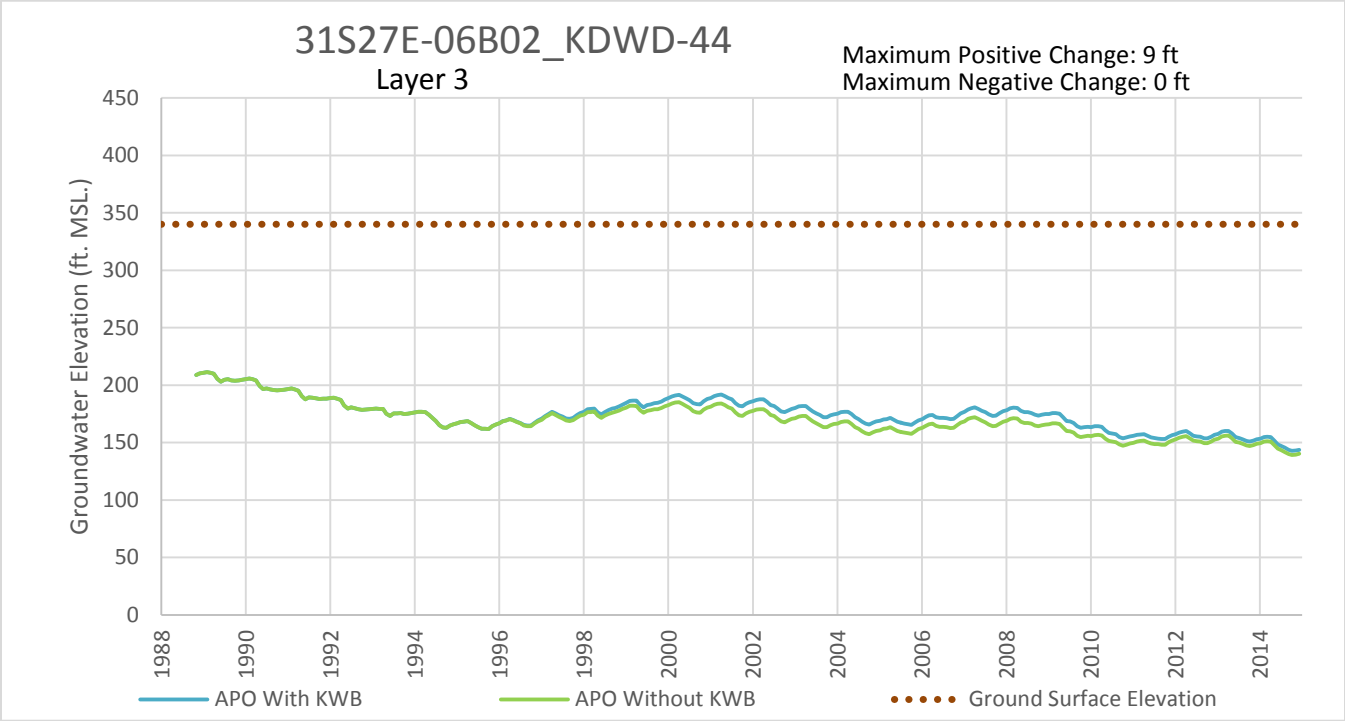

FIGURE 7-2 A.16. Hydrograph of Simulated Water Levels at Monitoring Well 31S27E-06B02_KDWD-44, 1988-2014

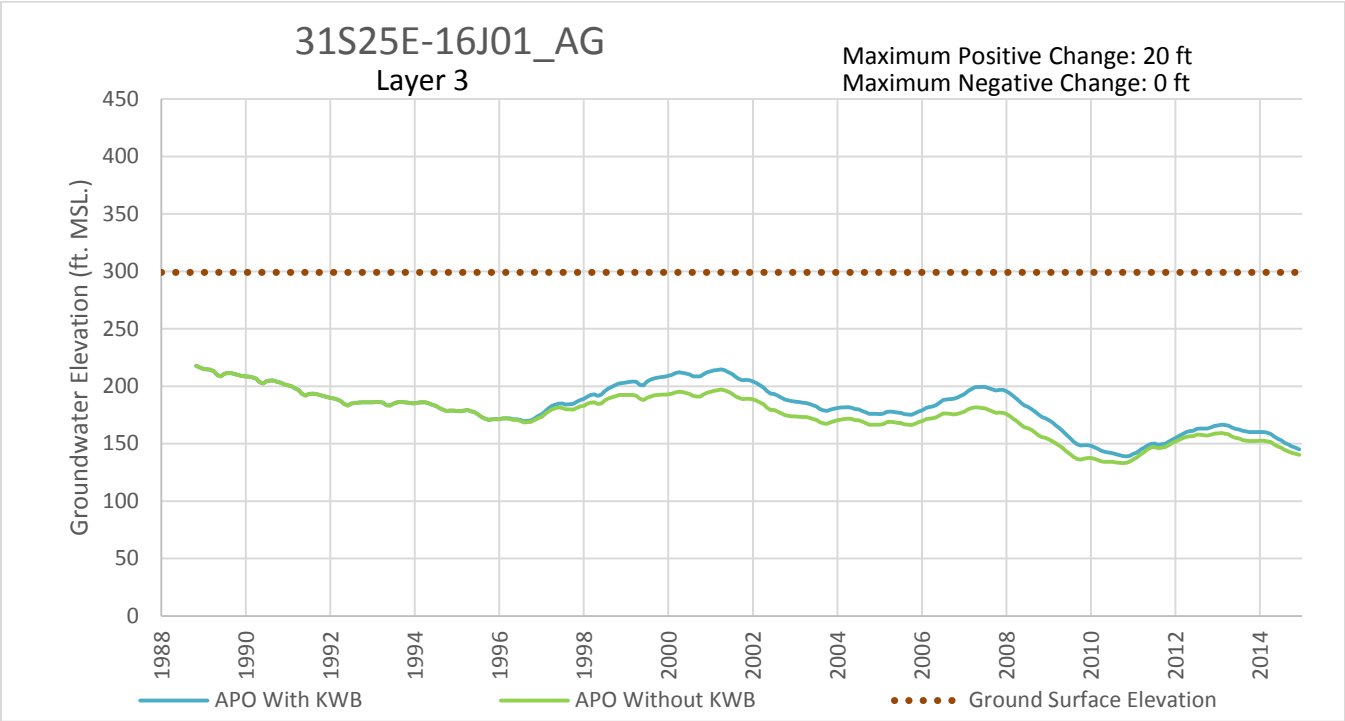

FIGURE 7-2 A.17. Hydrograph of Simulated Water Levels at Monitoring Well 31S25E-16J01_AG, 1988-2014

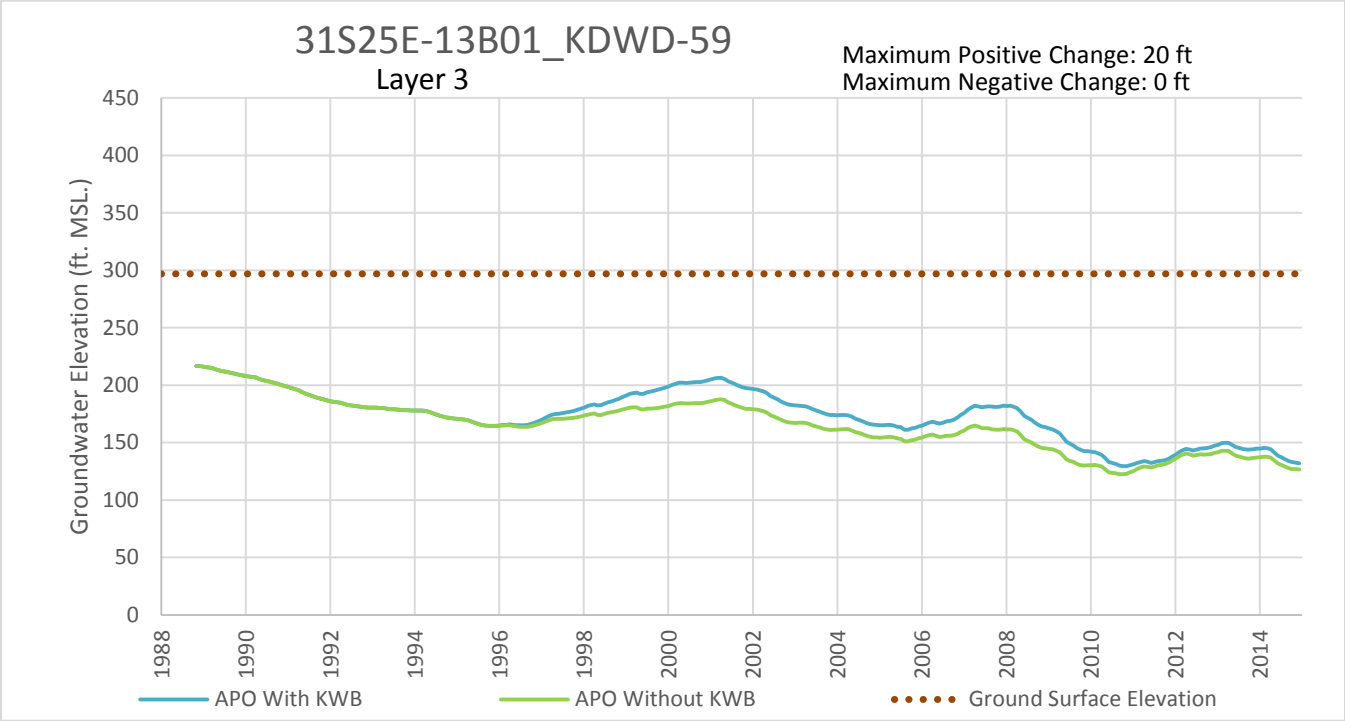

FIGURE 7-2 A.18. Hydrograph of Simulated Water Levels at Monitoring Well 31S25E-13B01_KDWD-59, 1998-2014

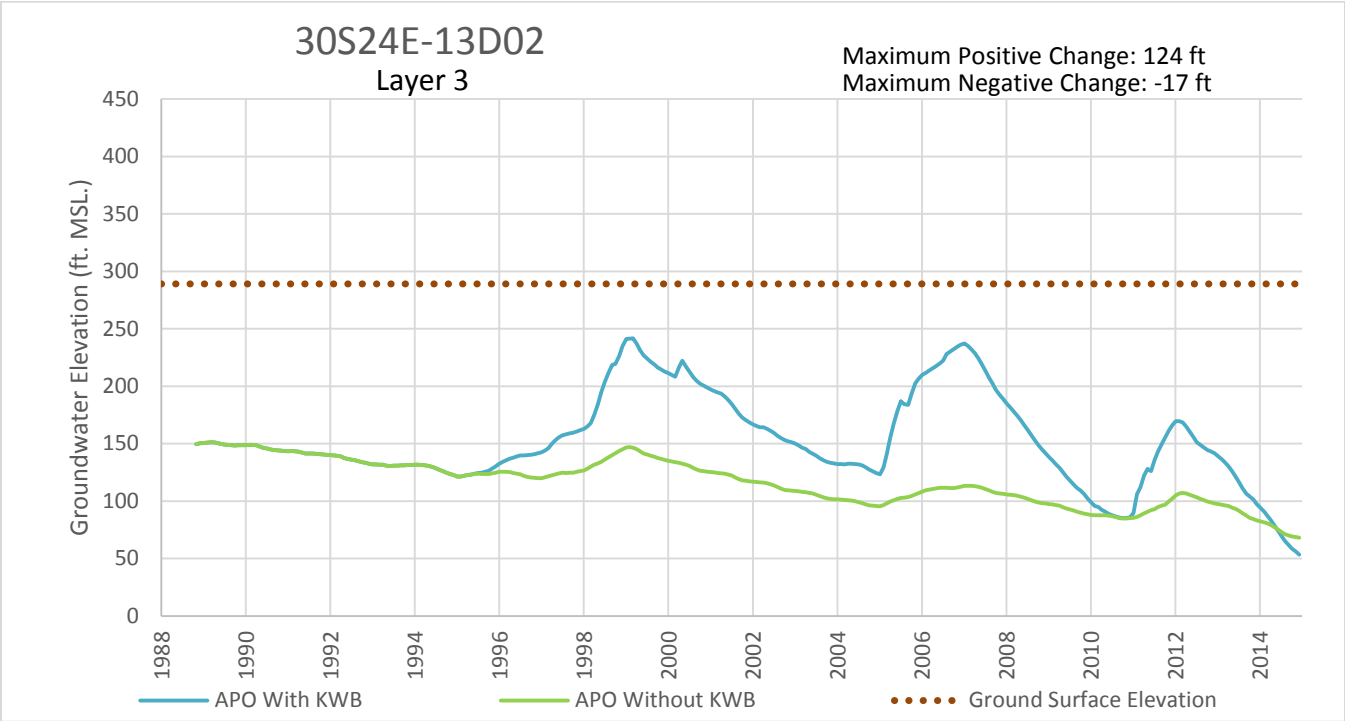

FIGURE 7-2 A.19. Hydrograph of Simulated Water Levels at Monitoring Well 30S24-13D02, 1988-2014.

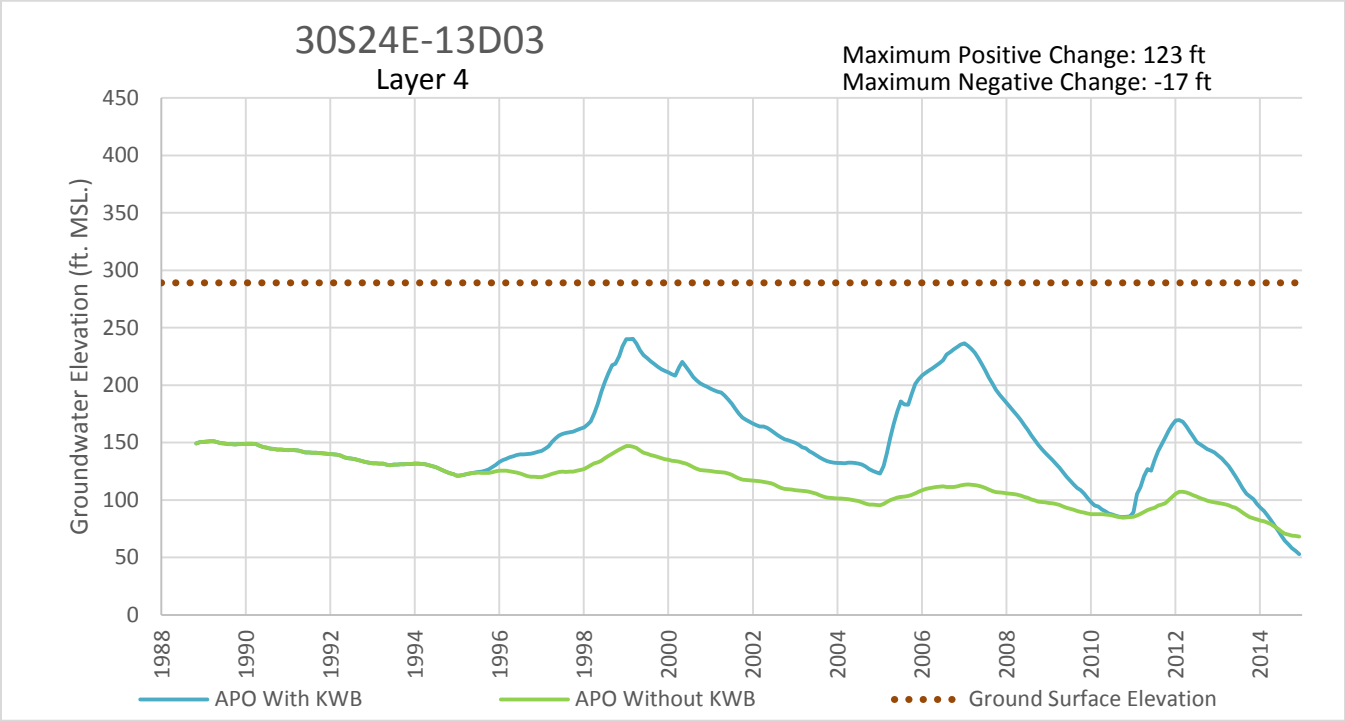

FIGURE 7-2 A.20. Hydrograph of Simulated Water Levels at Monitoring Well 30S24-13D03, 1988-2014

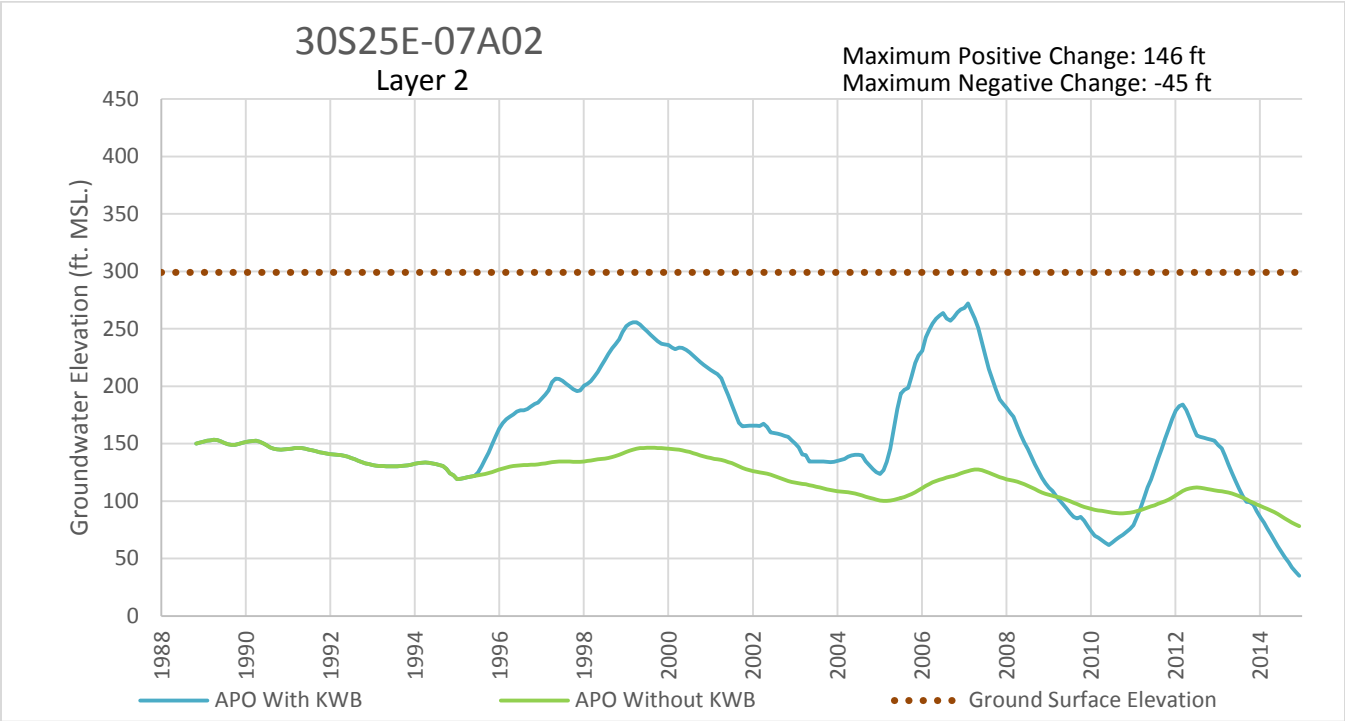

FIGURE 7-2 A.21. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-07A02, 1988-2014

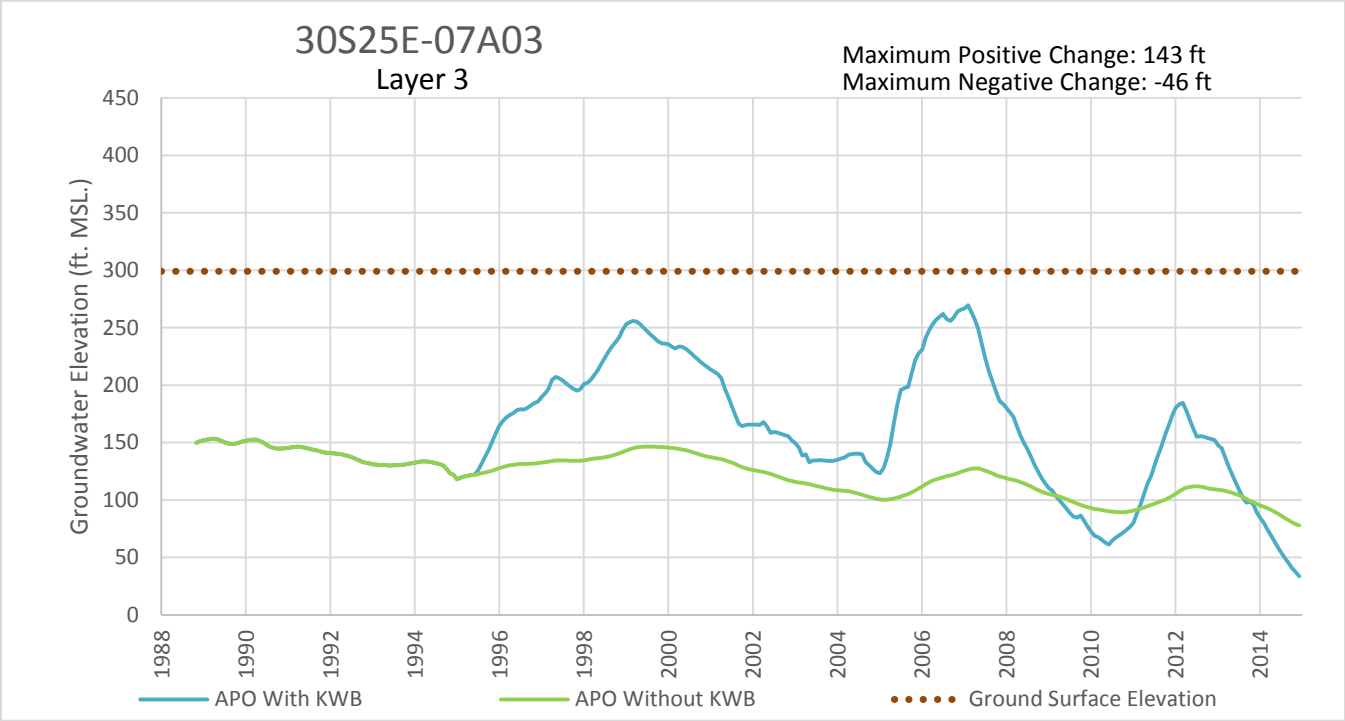

FIGURE 7-2 A.22. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-07A03, 1988-2014

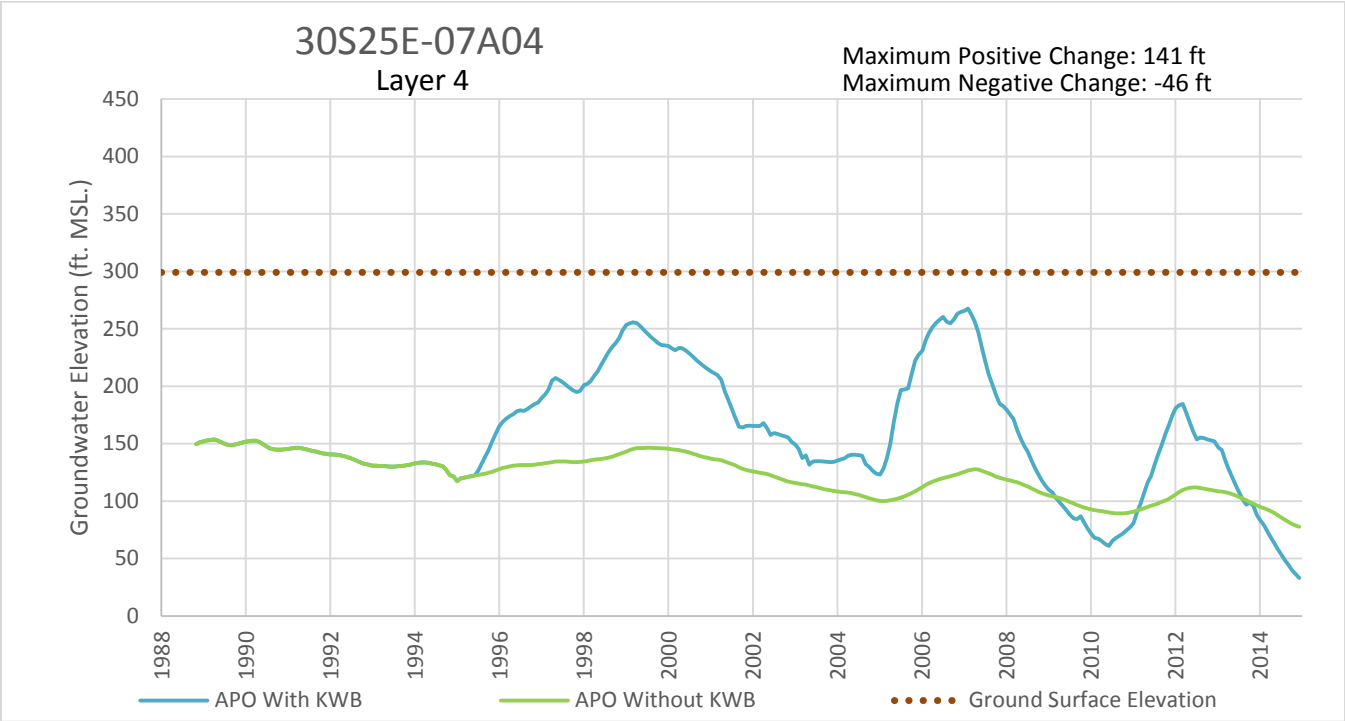

FIGURE 7-2 A.23. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-07A04, 1988-2014

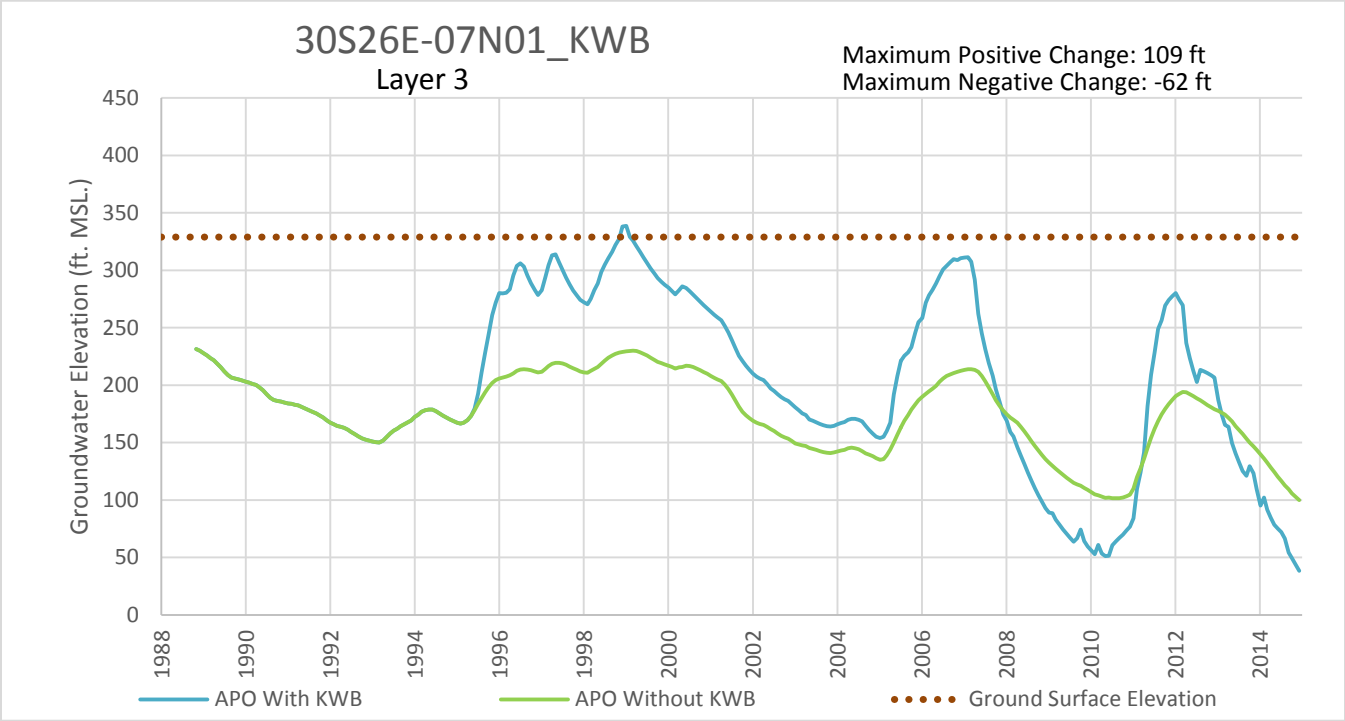

FIGURE 7-2 A.24. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-07N01_KWB, 1988-2014

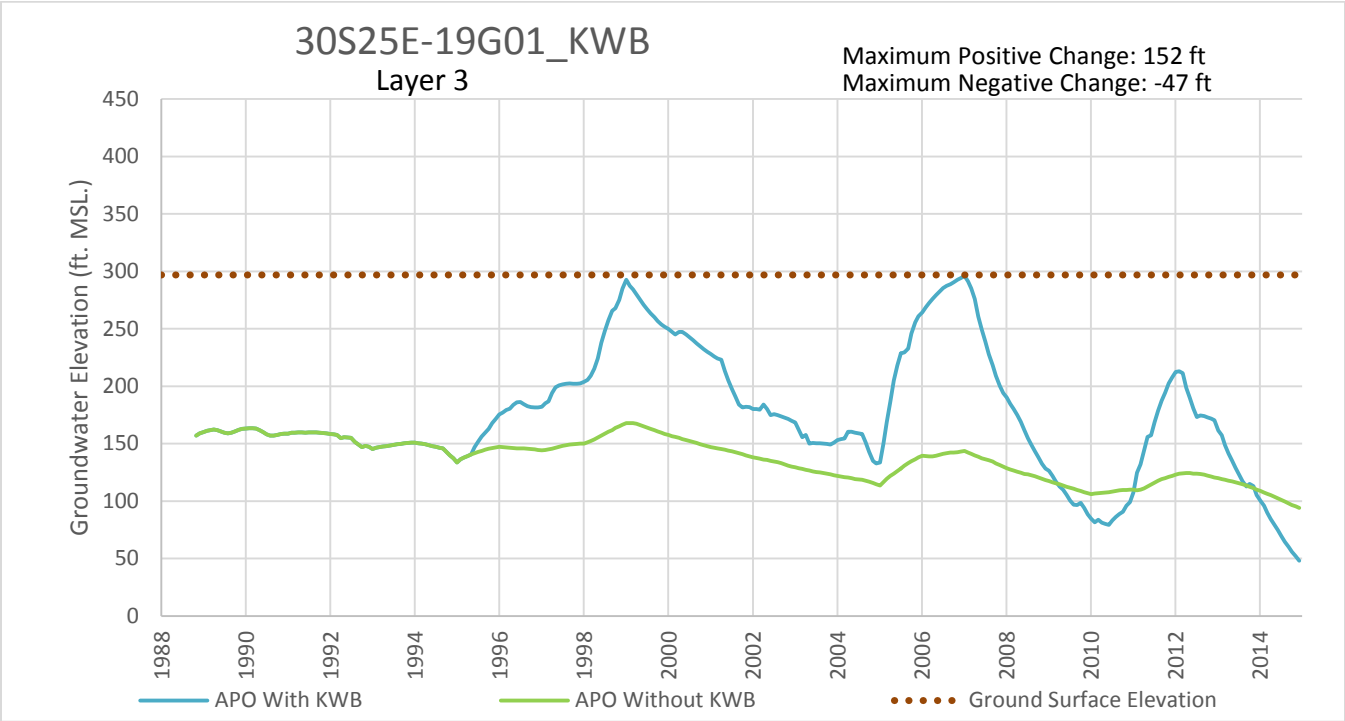

FIGURE 7-2 A.25. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-19G01_KWB, 1988-2014

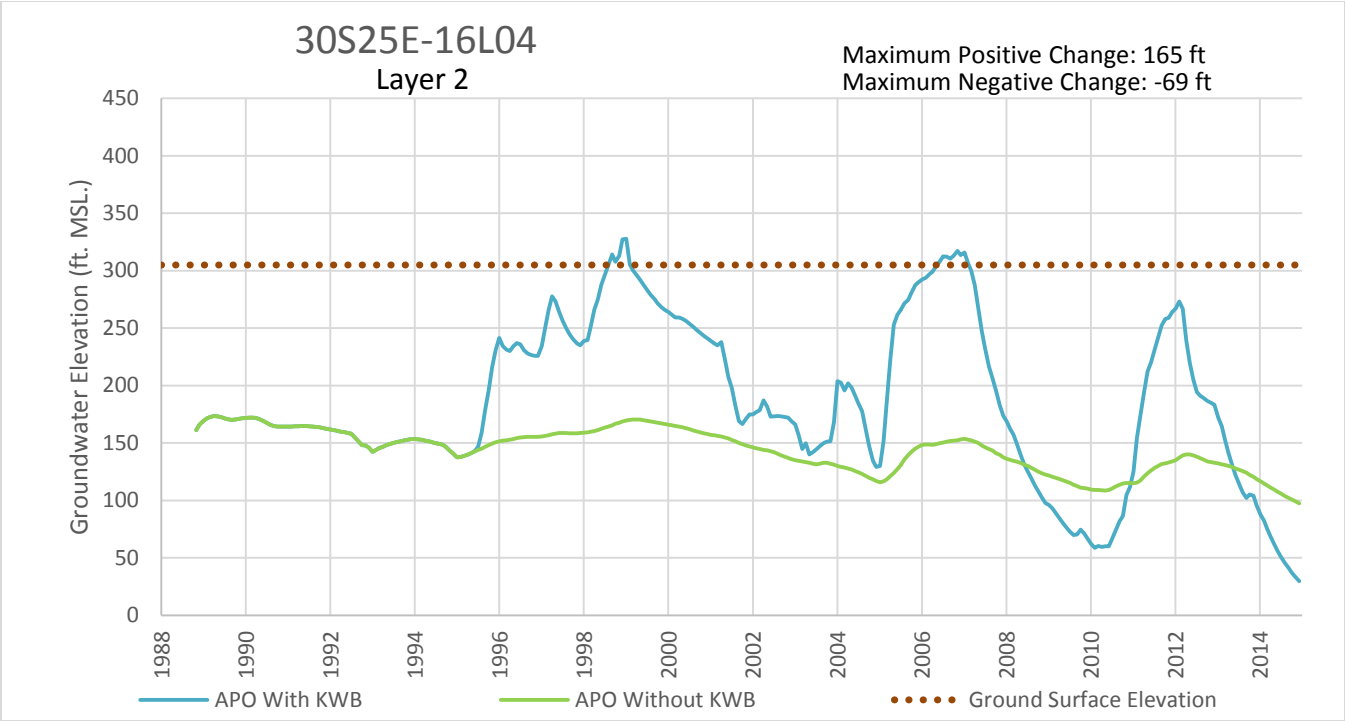

FIGURE 7-2 A.26. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-16L04, 1988-2014

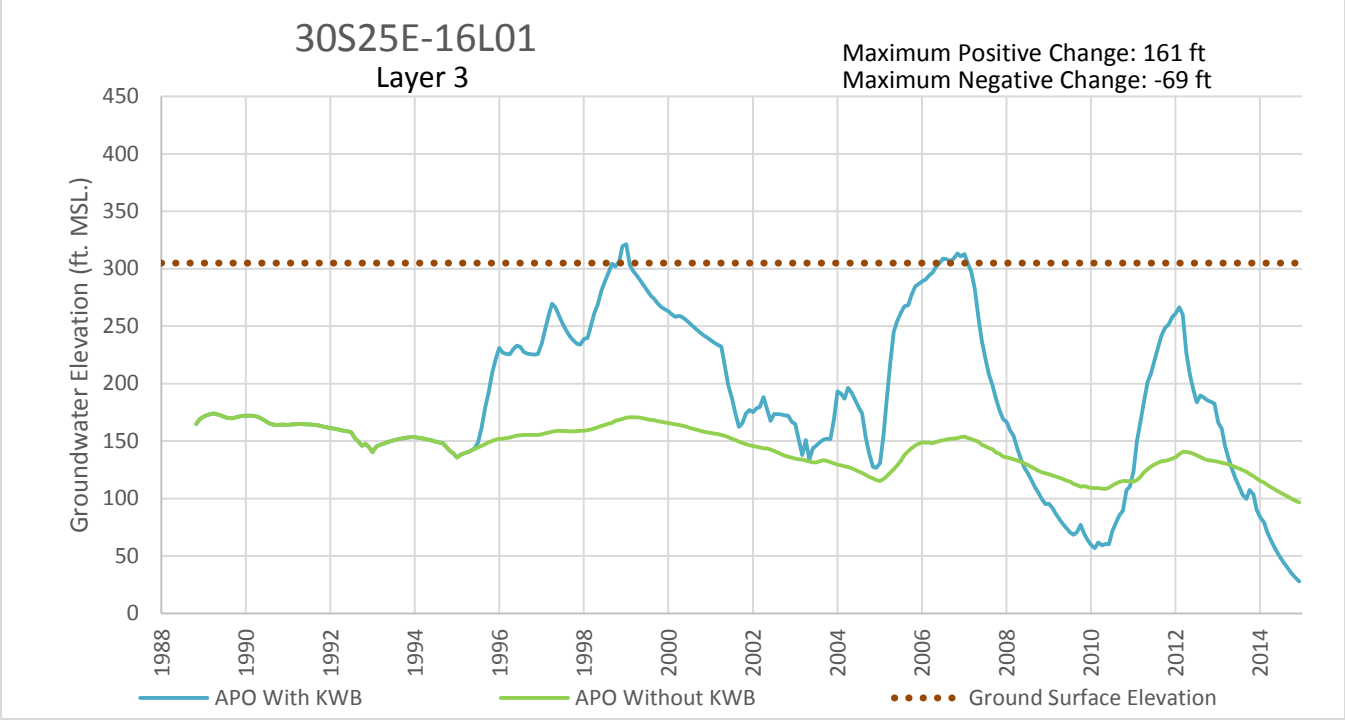

FIGURE 7-2 A.27. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-16L01, 1988-2014

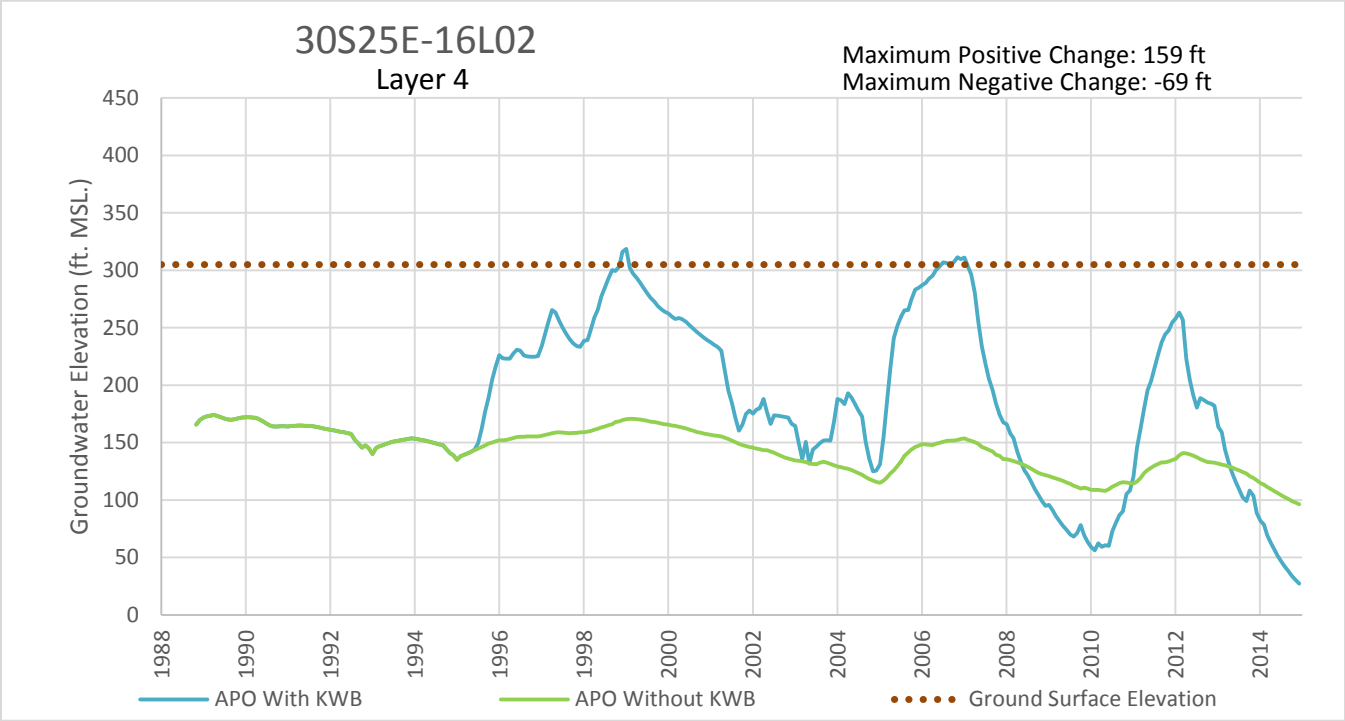

FIGURE 7-2 A.28. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-16L02, 1988-2014

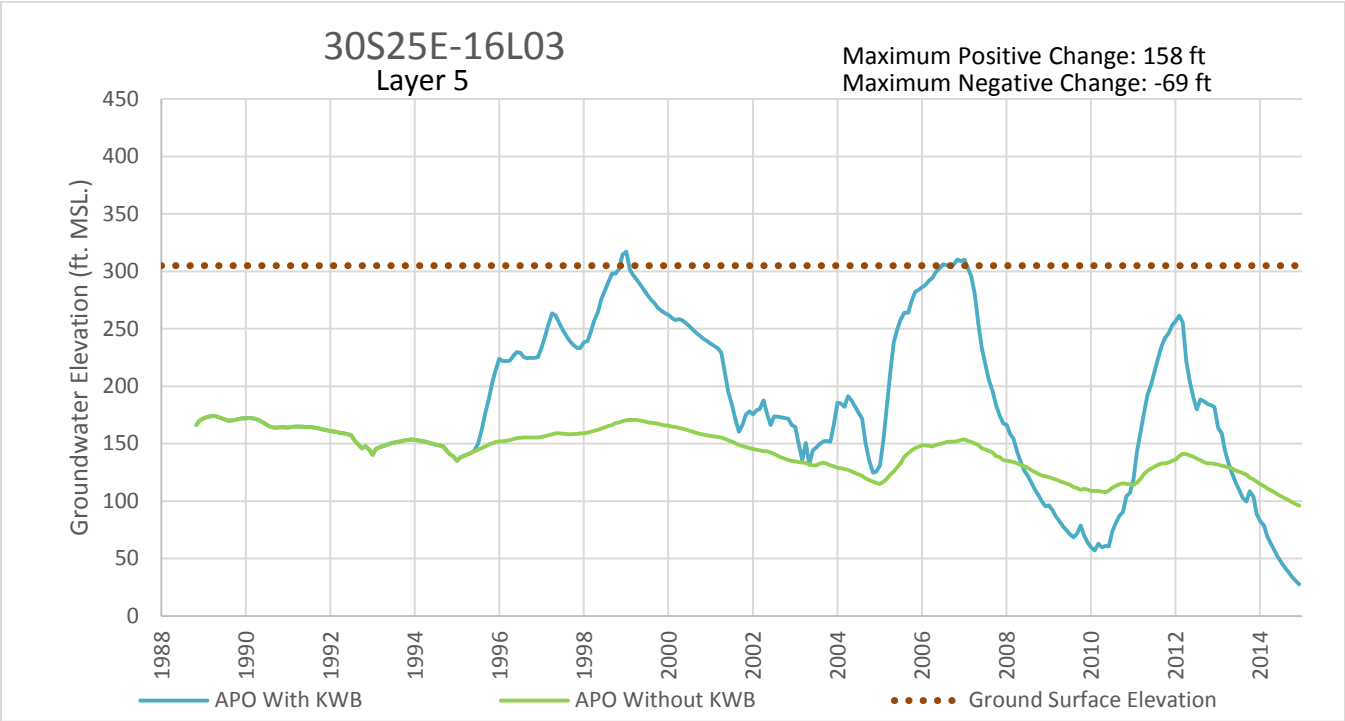

FIGURE 7-2 A.29. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-16L03, 1988-2014

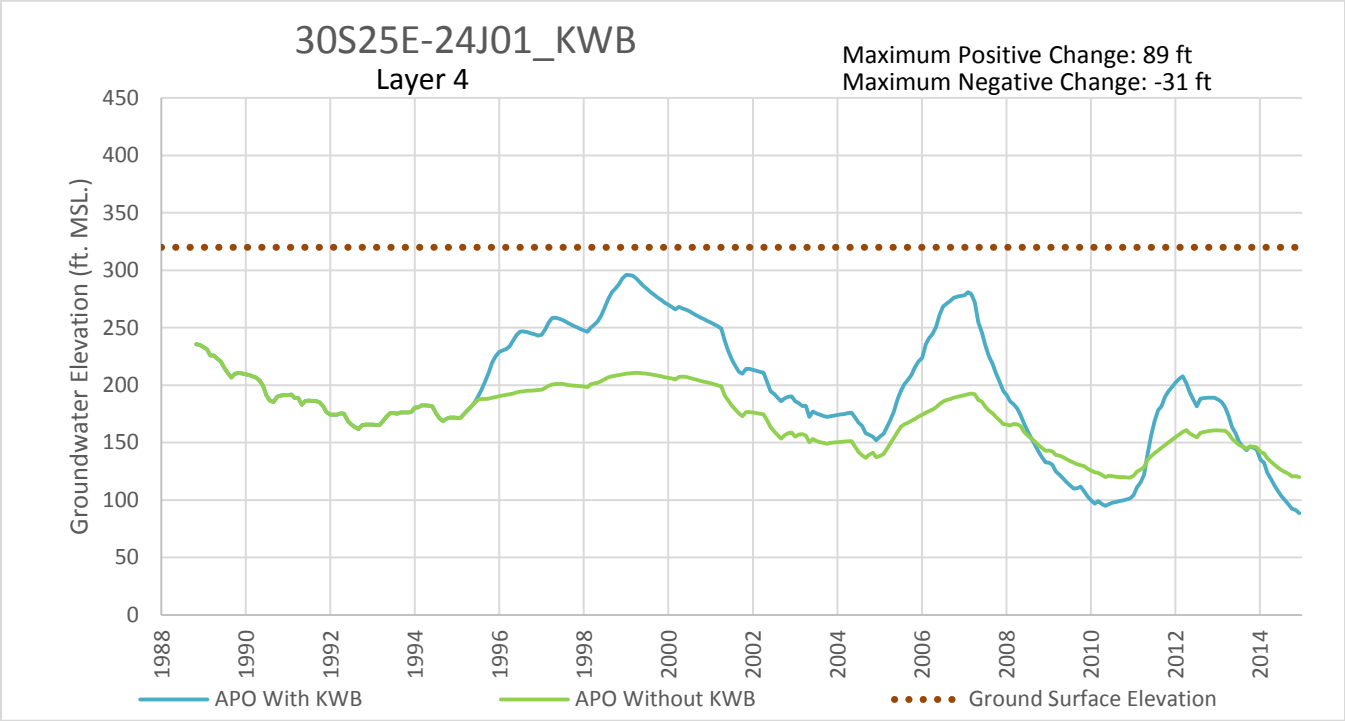

FIGURE 7-2 A.30. Hydrograph of Simulated Water Levels at Monitoring Well 30S257-24J01_KWB, 1988-2014

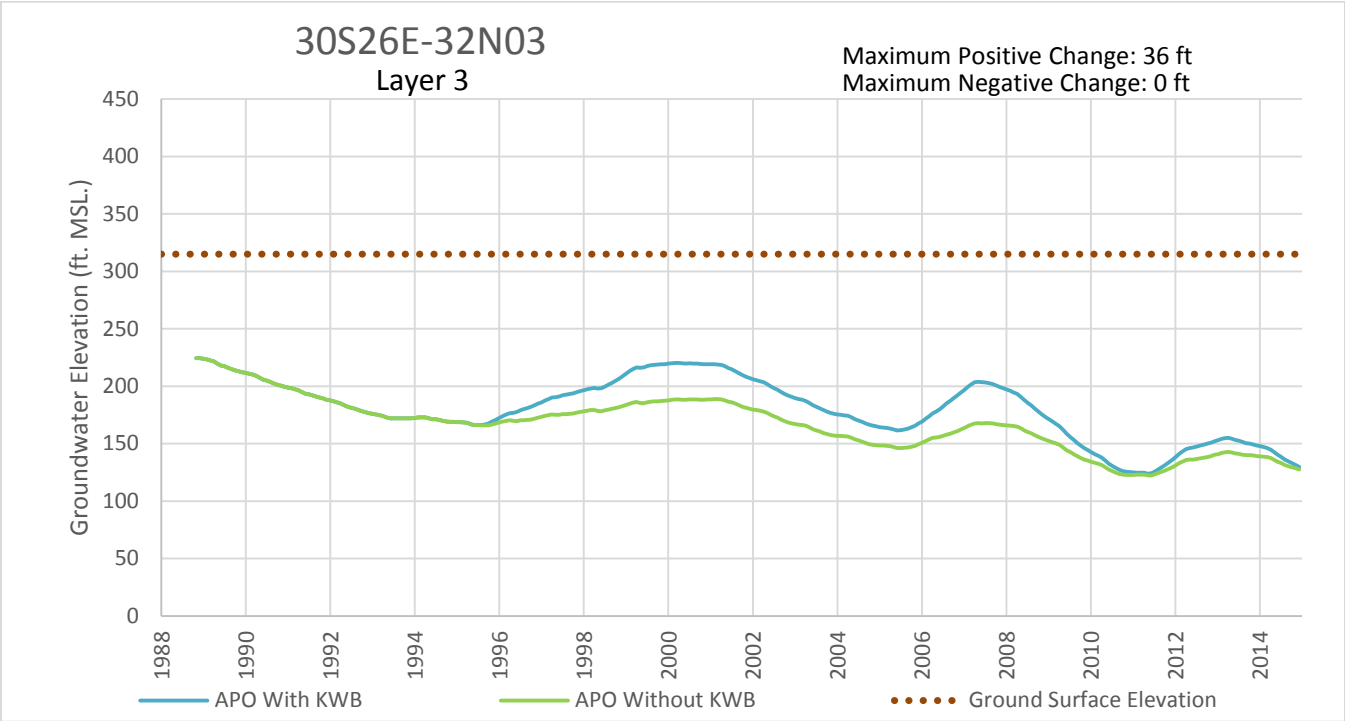

FIGURE 7-2 A.31. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-32N03, 1988-2014

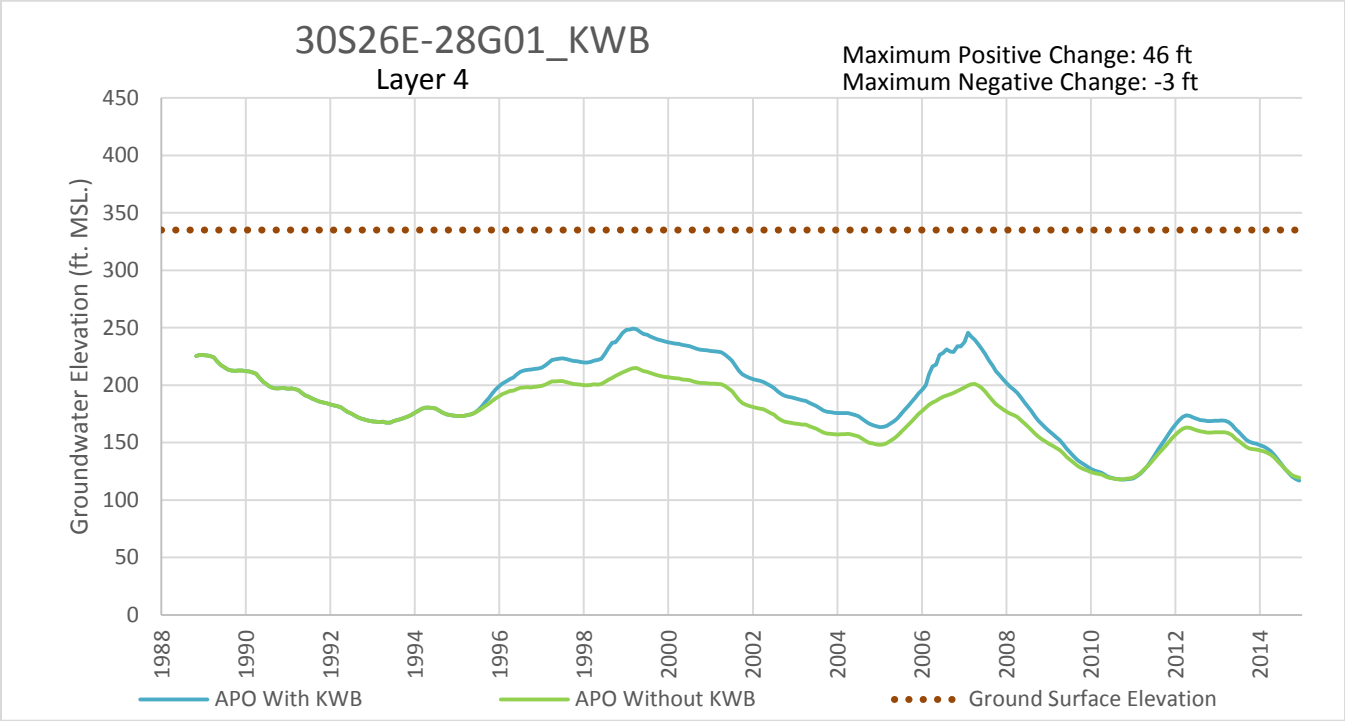

FIGURE 7-2 A.32. Hydrograph of Simulated Water Levels at Monitoring Well 30S267-28G01_KWB, 1988-2014

APPENDIX 7-2
B. AFO-EC HYDROGRAPHS

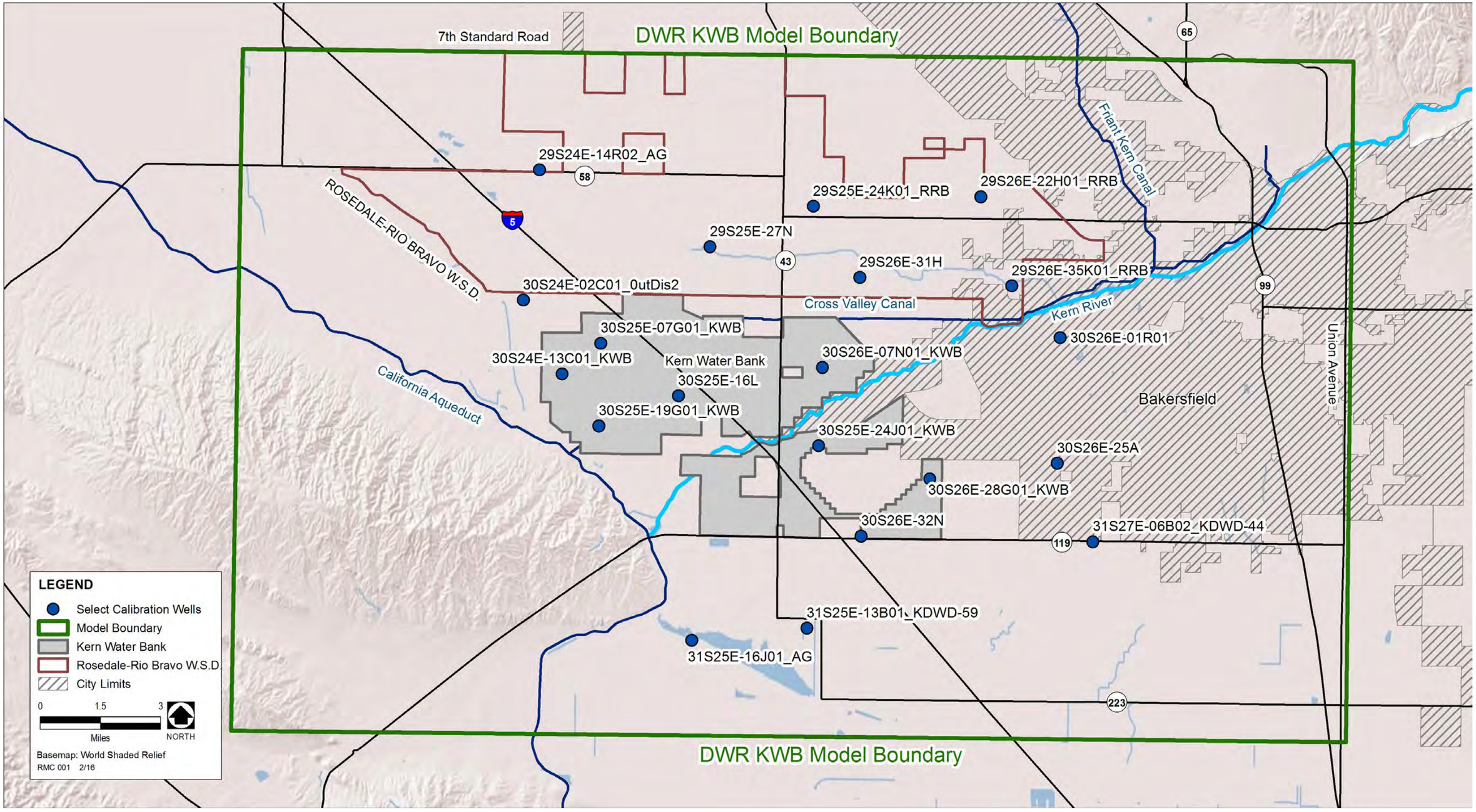

FIGURE 7-2 B.1. Location of Select Monitoring Wells Inside (14 Wells) and Outside (17 Wells) of Kern Water Bank

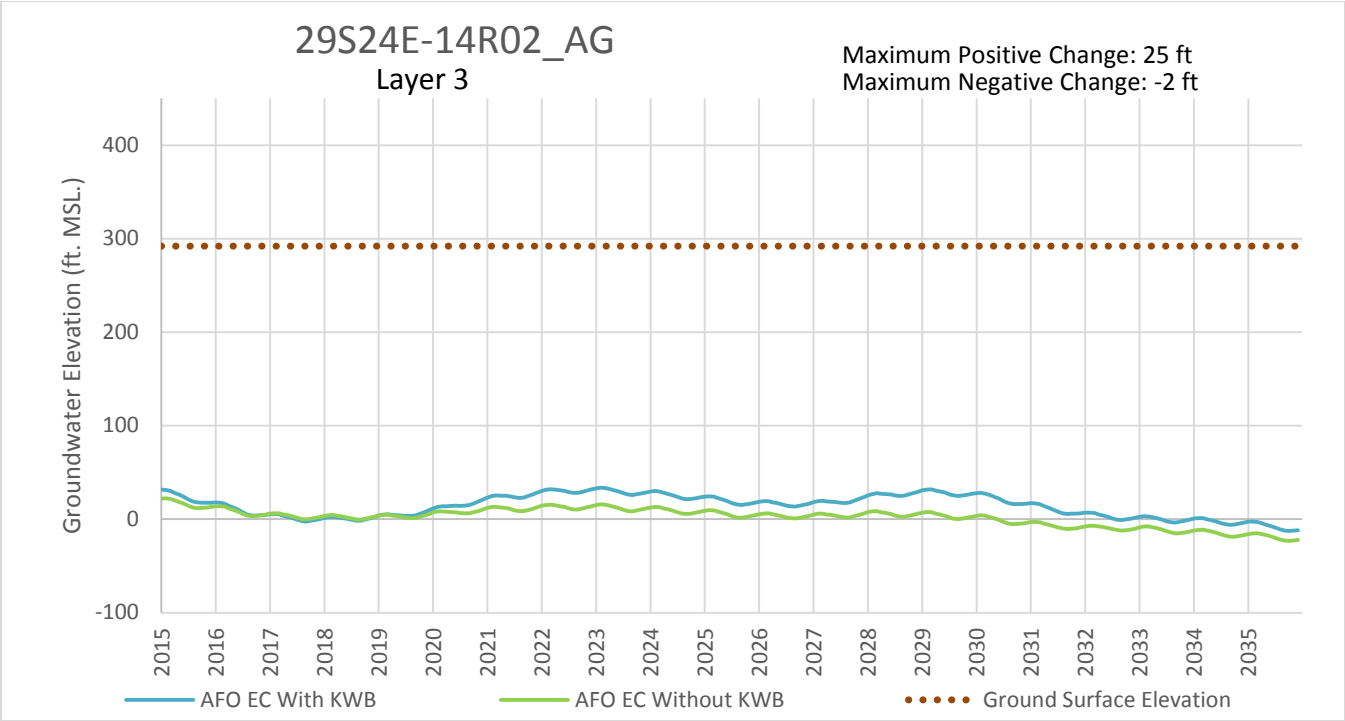

FIGURE 7-2 B.2. Hydrograph of Simulated Water Levels at Monitoring Well 29S24E14R02_Ag, 2015-2035

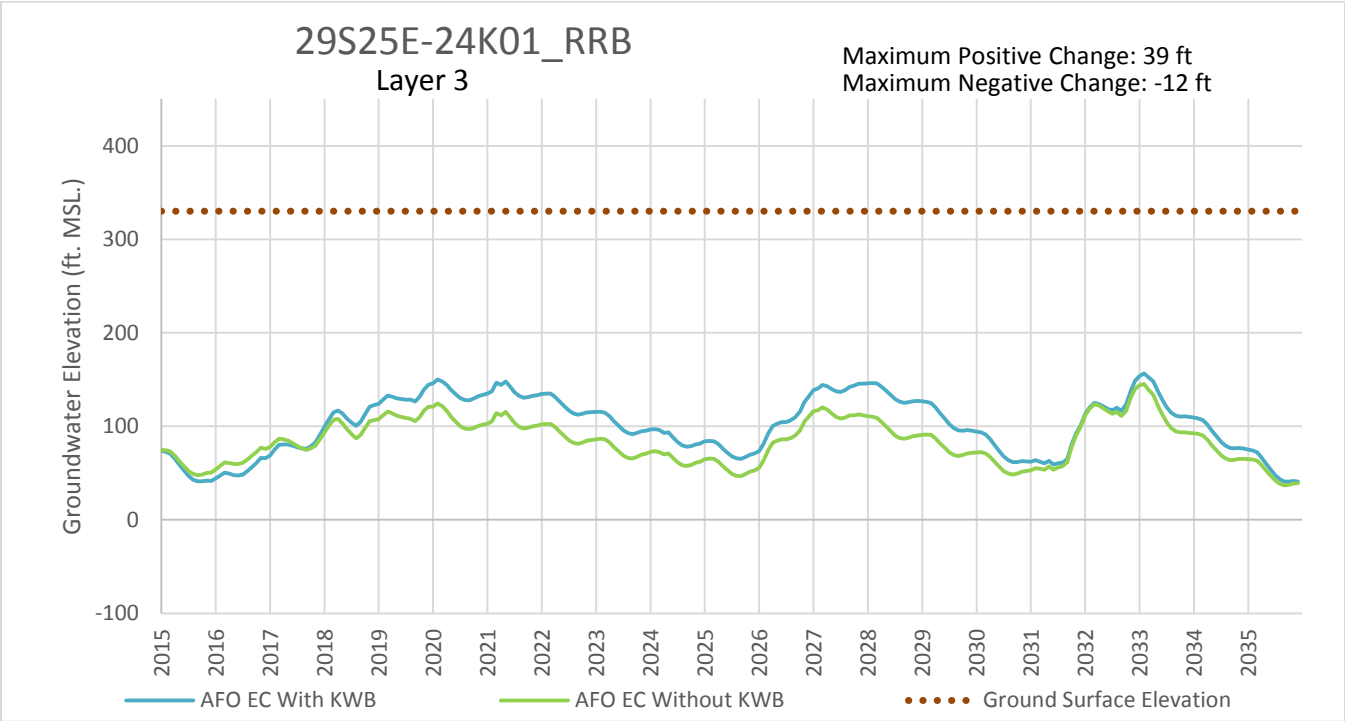

FIGURE 7-2 B.3. Hydrograph of Simulated Water Levels at Monitoring Well 29S257-24K01_RRB, 2015-2035

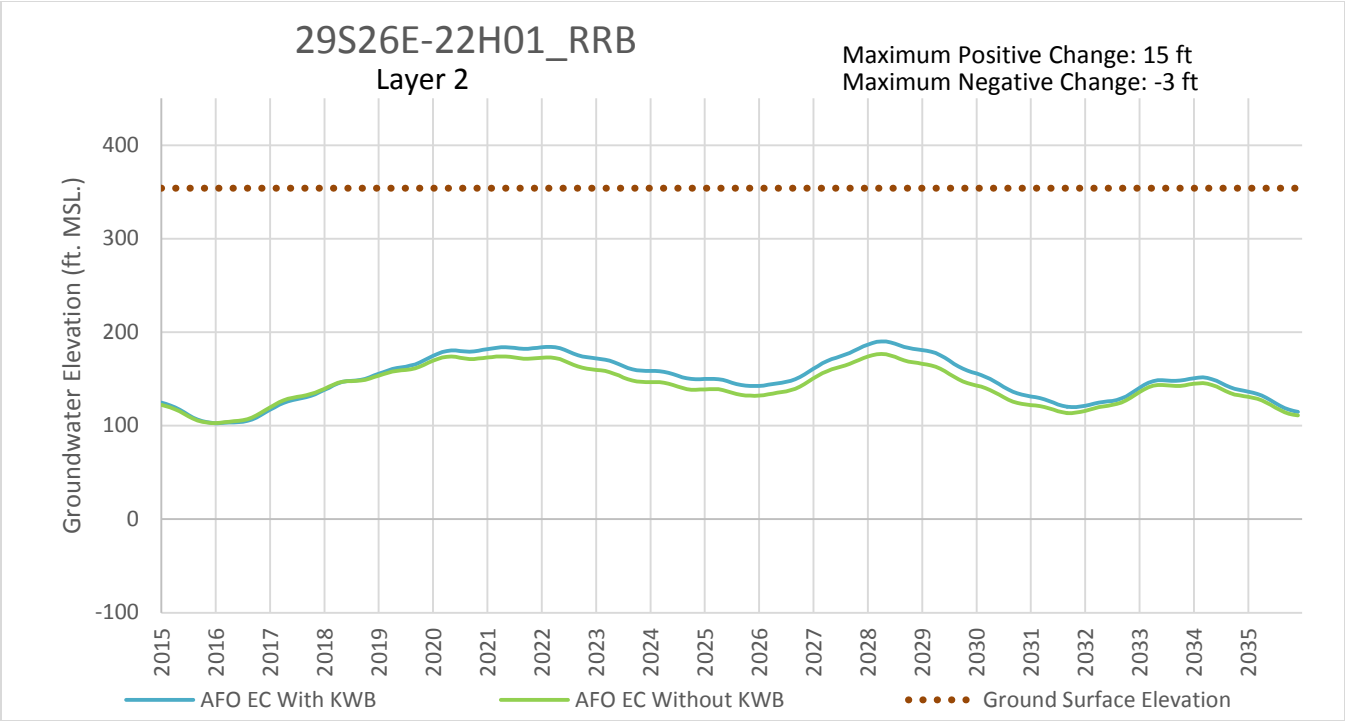

FIGURE 7-2 B.4. Hydrograph of Simulated Water Levels at Monitoring Well 29S267-22H01_RRB, 2015-2035

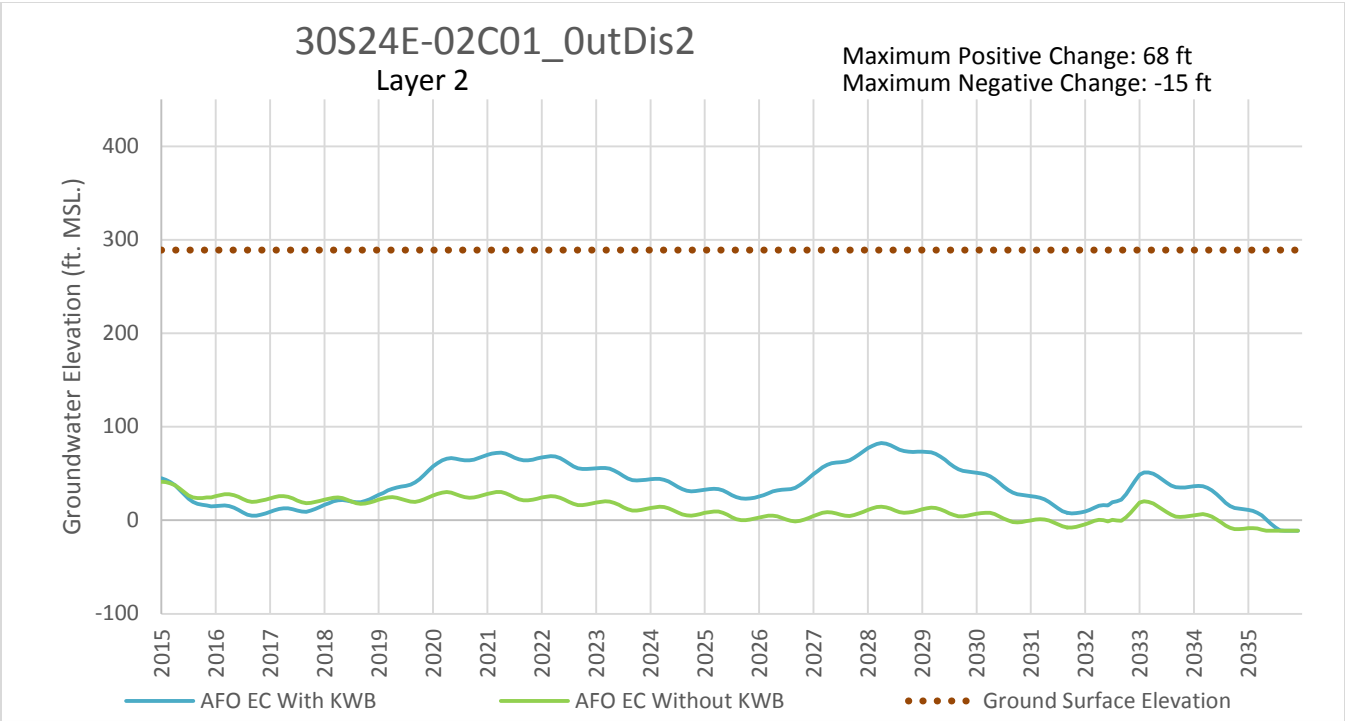

FIGURE 7-2 B.5. Hydrograph of Simulated Water Levels at Monitoring Well 30S24E-02C01_0utDis2, 2015-2035

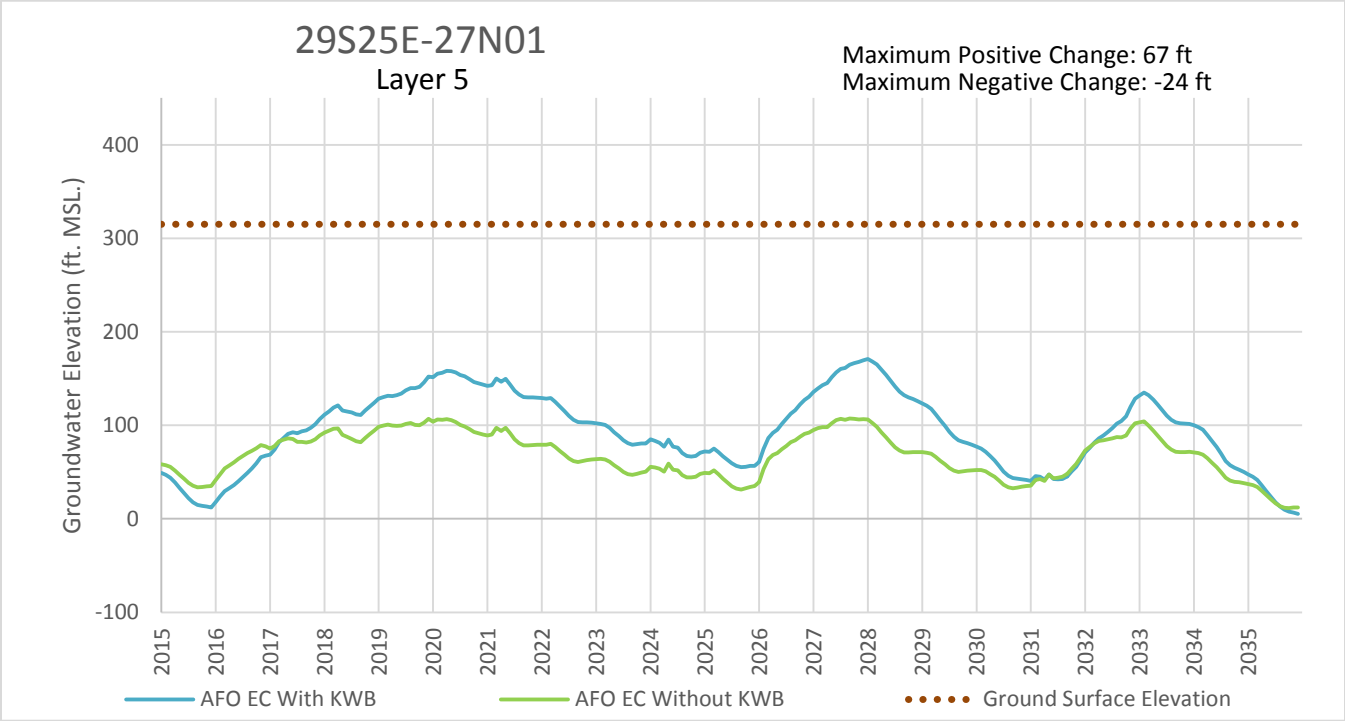

FIGURE 7-2 B.6. Hydrograph of Simulated Water Levels at Monitoring Well 29S257-27N01, 2015-2035

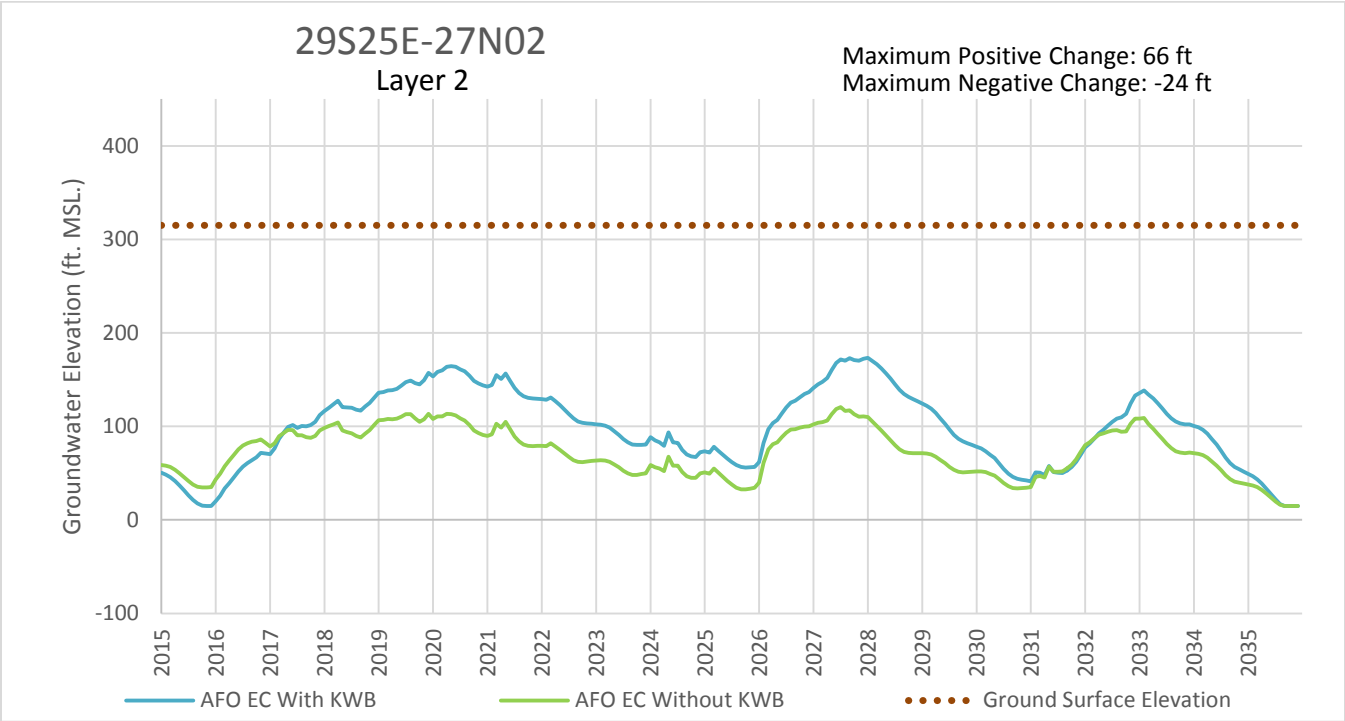

FIGURE 7-2 B.7. Hydrograph of Simulated Water Levels at Monitoring Well 29S257-27N02, 2015-2035

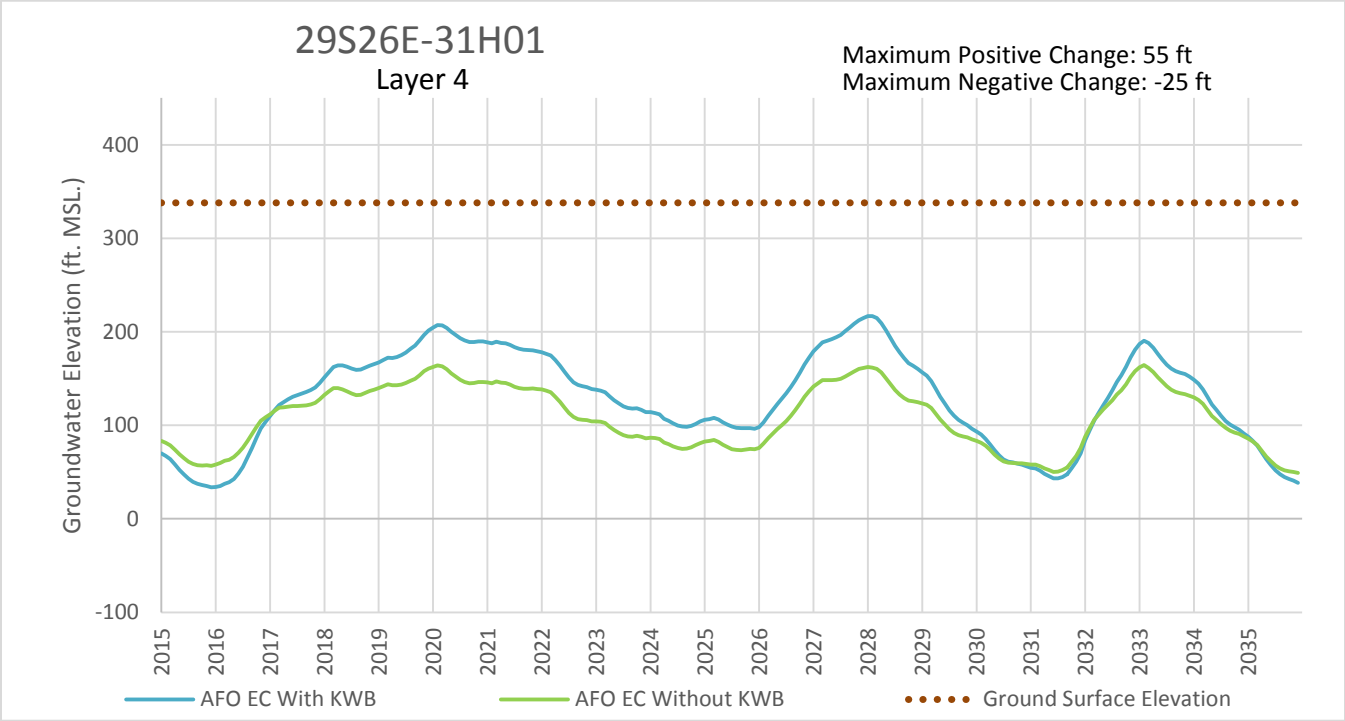

FIGURE 7-2 B.8. Hydrograph of Simulated Water Levels at Monitoring Well 29S26E-31H01, 2015-2035

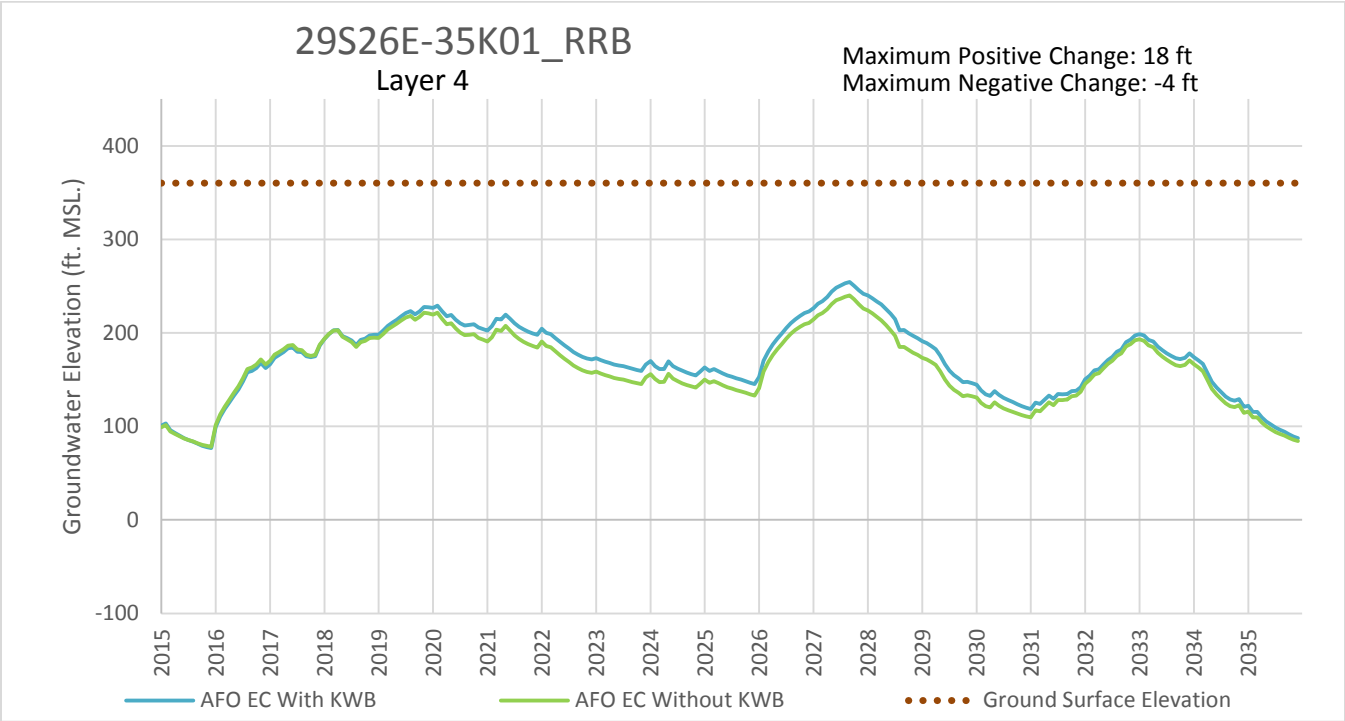

FIGURE 7-2 B.9. Hydrograph of Simulated Water Levels at Monitoring Well 29S26E-35K01_RRB, 2015-2035

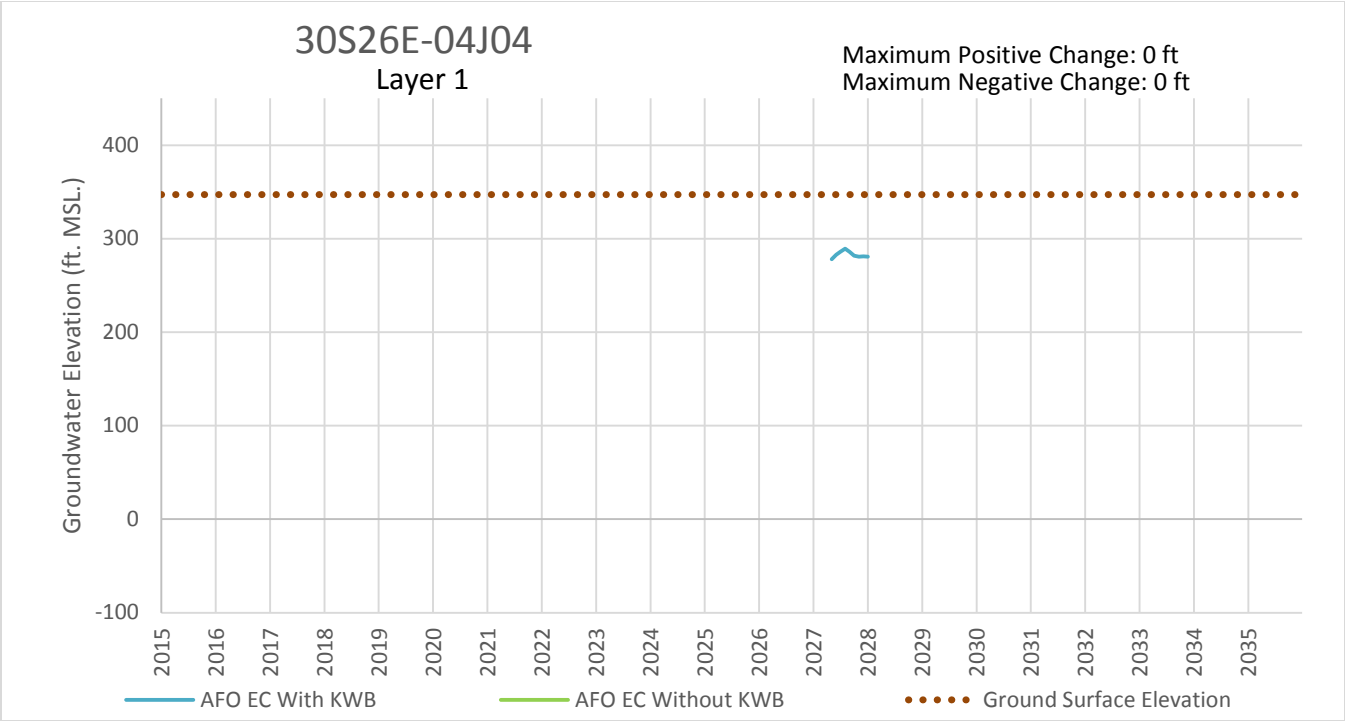

FIGURE 7-2 B.10. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-04J04, 2015-2035

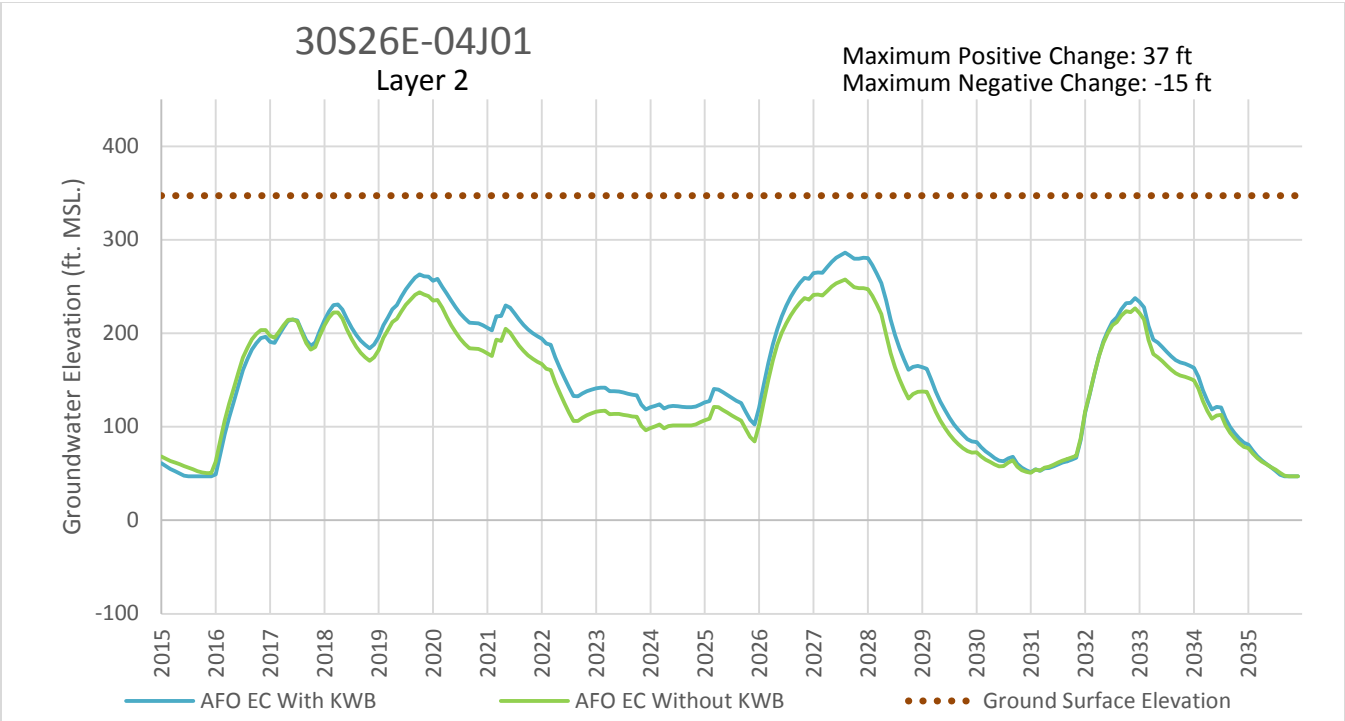

FIGURE 7-2 B.11. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-04J01, 2015-2035

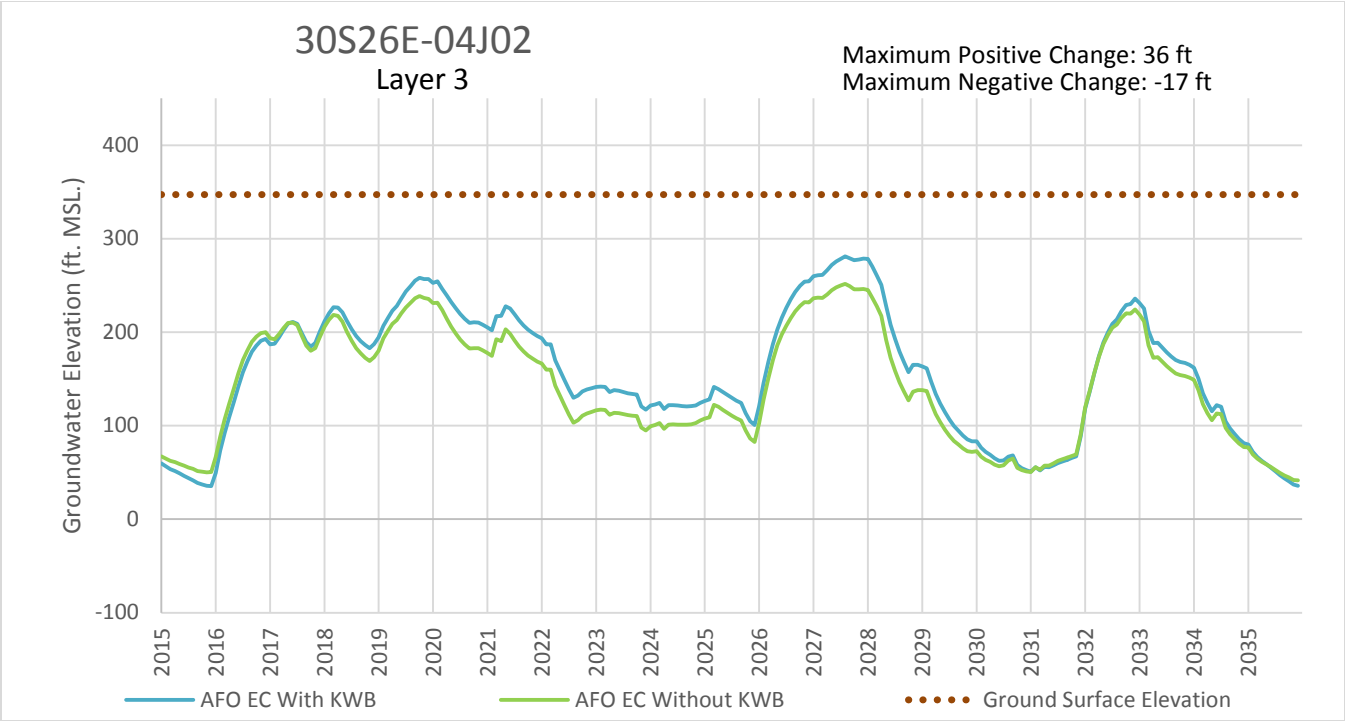

FIGURE 7-2 B.12. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-04J02, 2015-2035

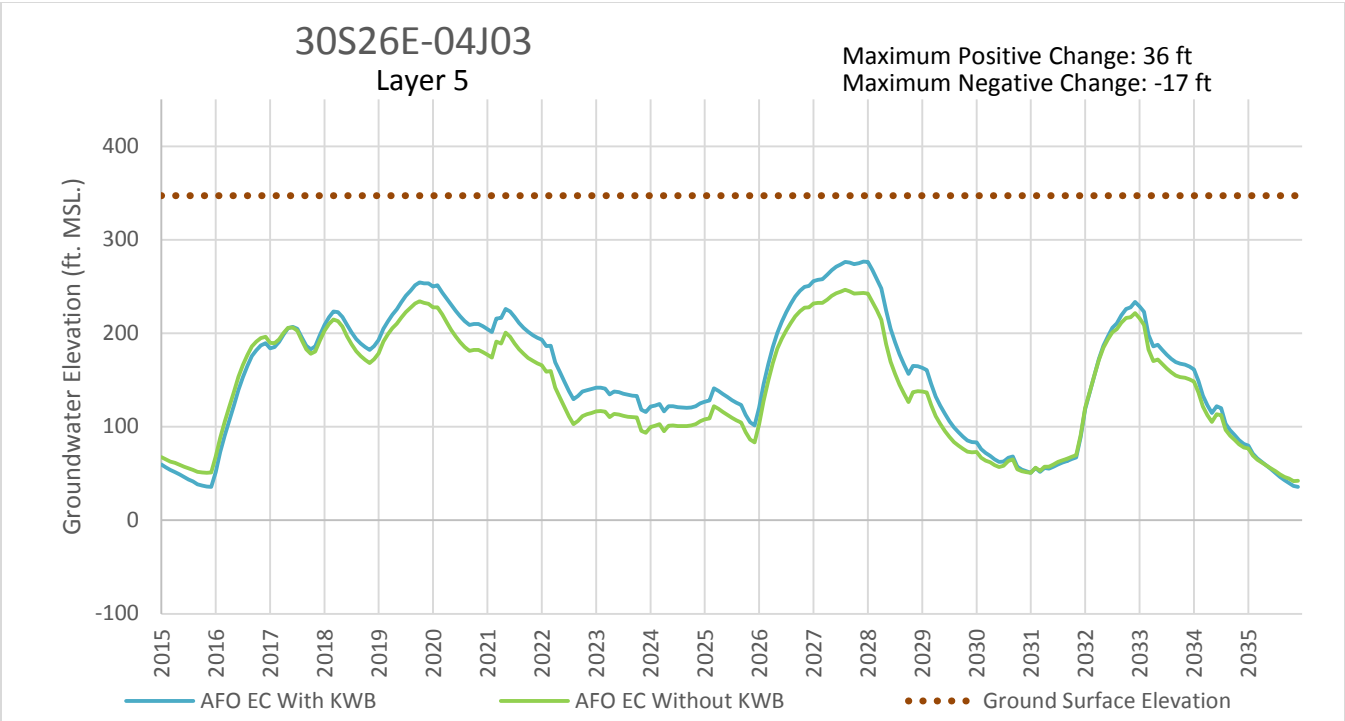

FIGURE 7-2 B.13. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-04J03, 2015-2035

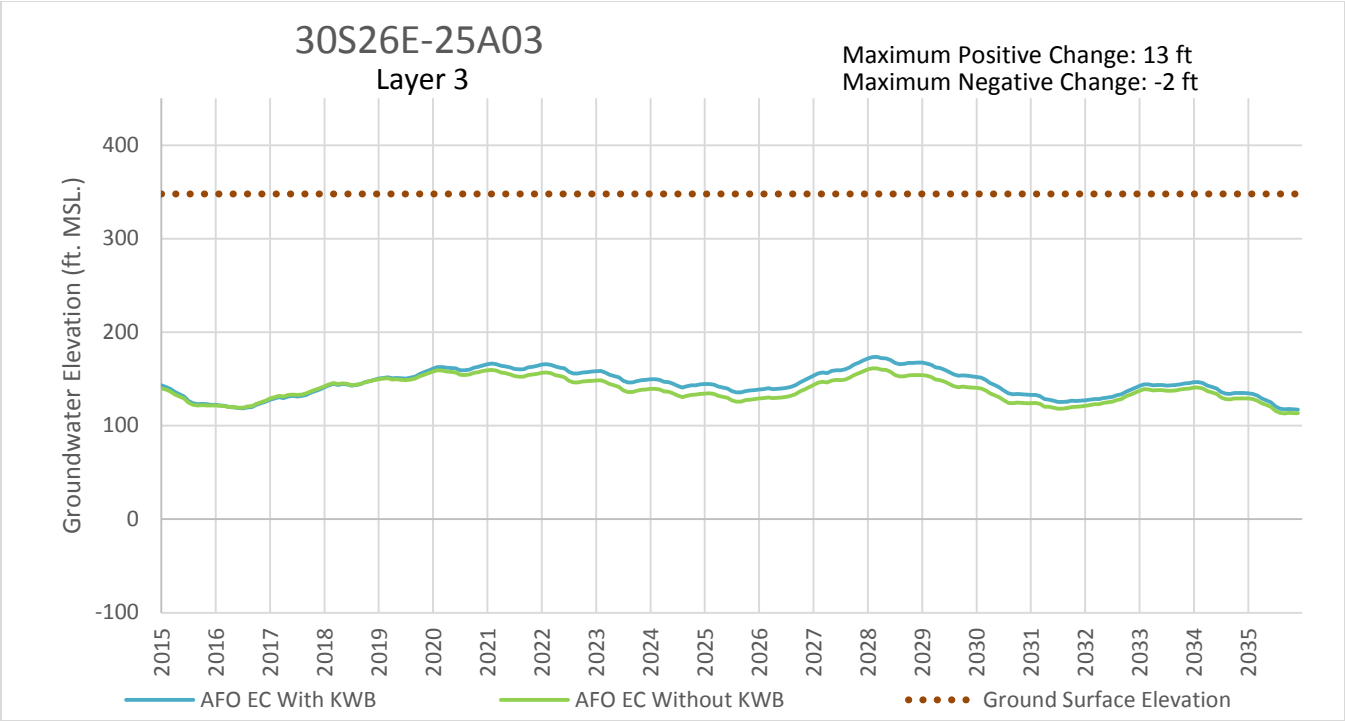

FIGURE 7-2 B.14. Hydrograph of Simulated Water Levels at Monitoring Well 30S267-25A03, 2015-2035

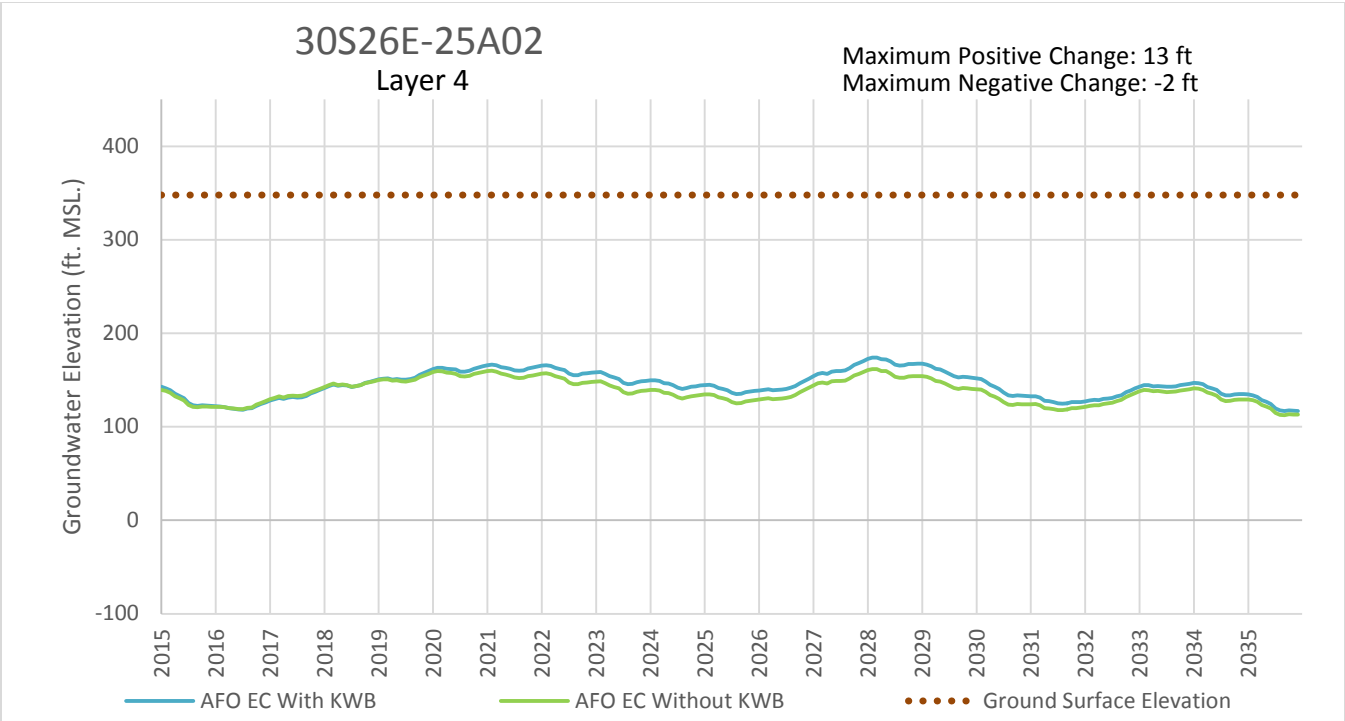

FIGURE 7-2 B.15. Hydrograph of Simulated Water Levels at Monitoring Well 30S267-25A02, 2015-2035

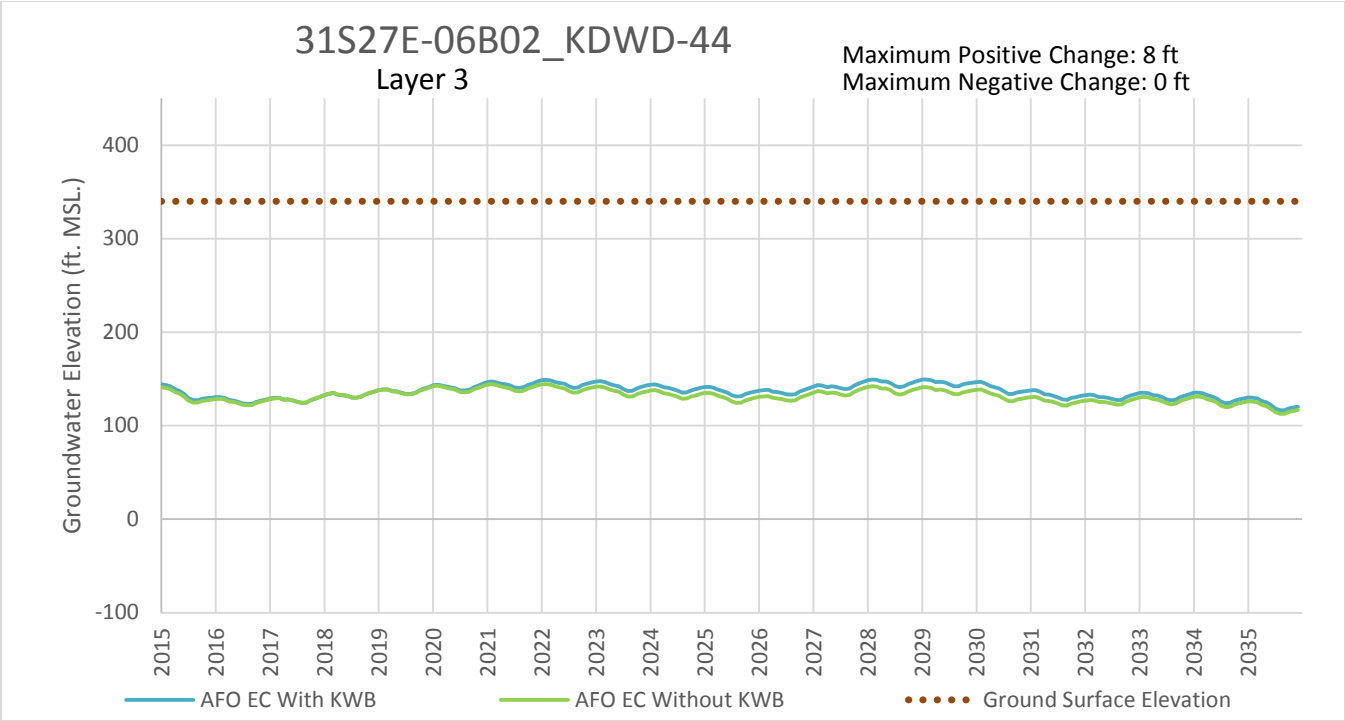

FIGURE 7-2 B.16. Hydrograph of Simulated Water Levels at Monitoring Well 31S27E-06B02_KDWD-44, 2015-2035

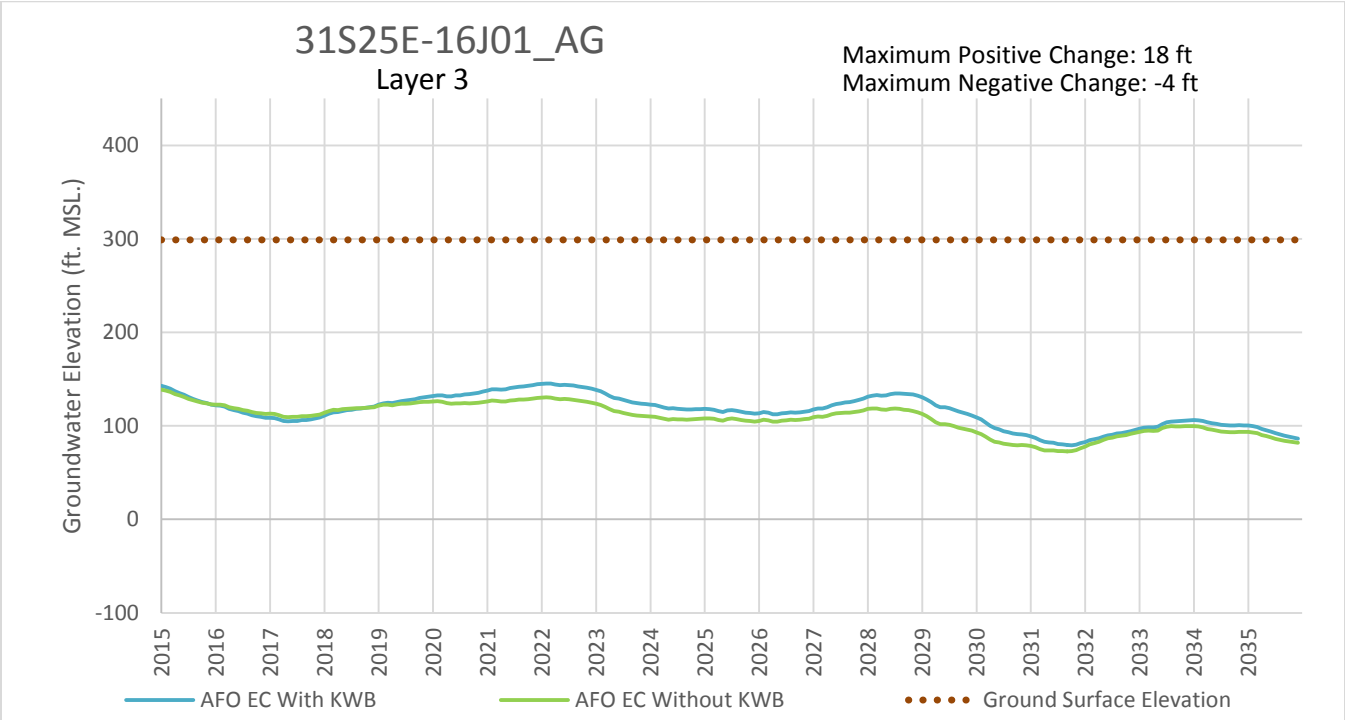

FIGURE 7-2 B.17. Hydrograph of Simulated Water Levels at Monitoring Well 31S25E-16J01_AG, 2015-2035

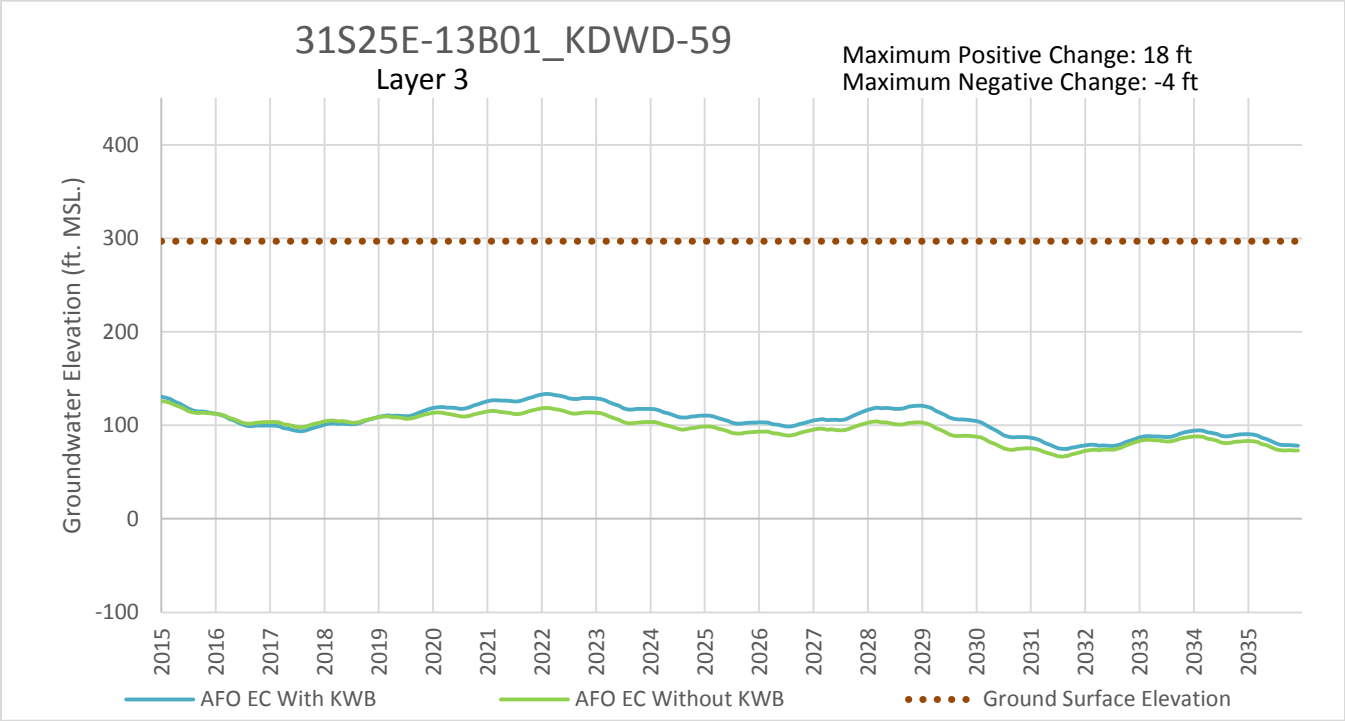

FIGURE 7-2 B.18. Hydrograph of Simulated Water Levels at Monitoring Well 31S25E-13B01_KDWD-59, 2015-2035

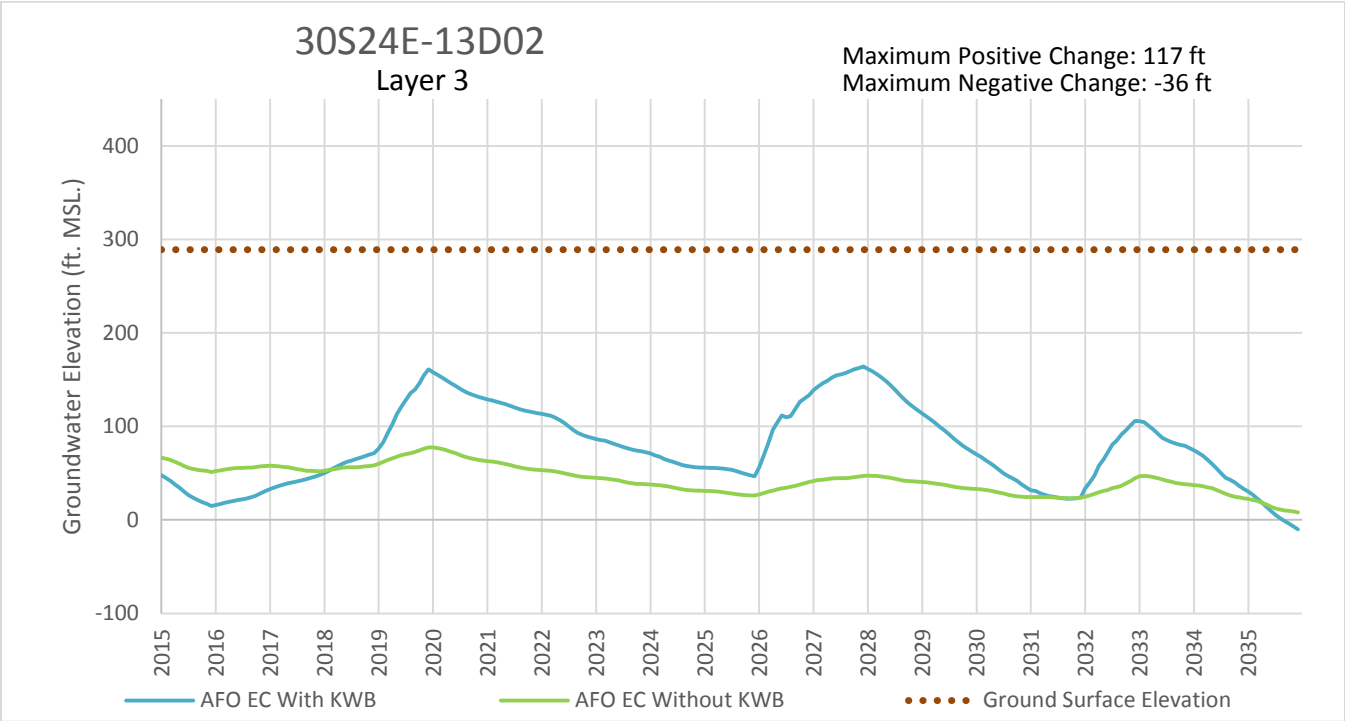

FIGURE 7-2 B.19. Hydrograph of Simulated Water Levels at Monitoring Well 30S24-13D02, 2015-2035

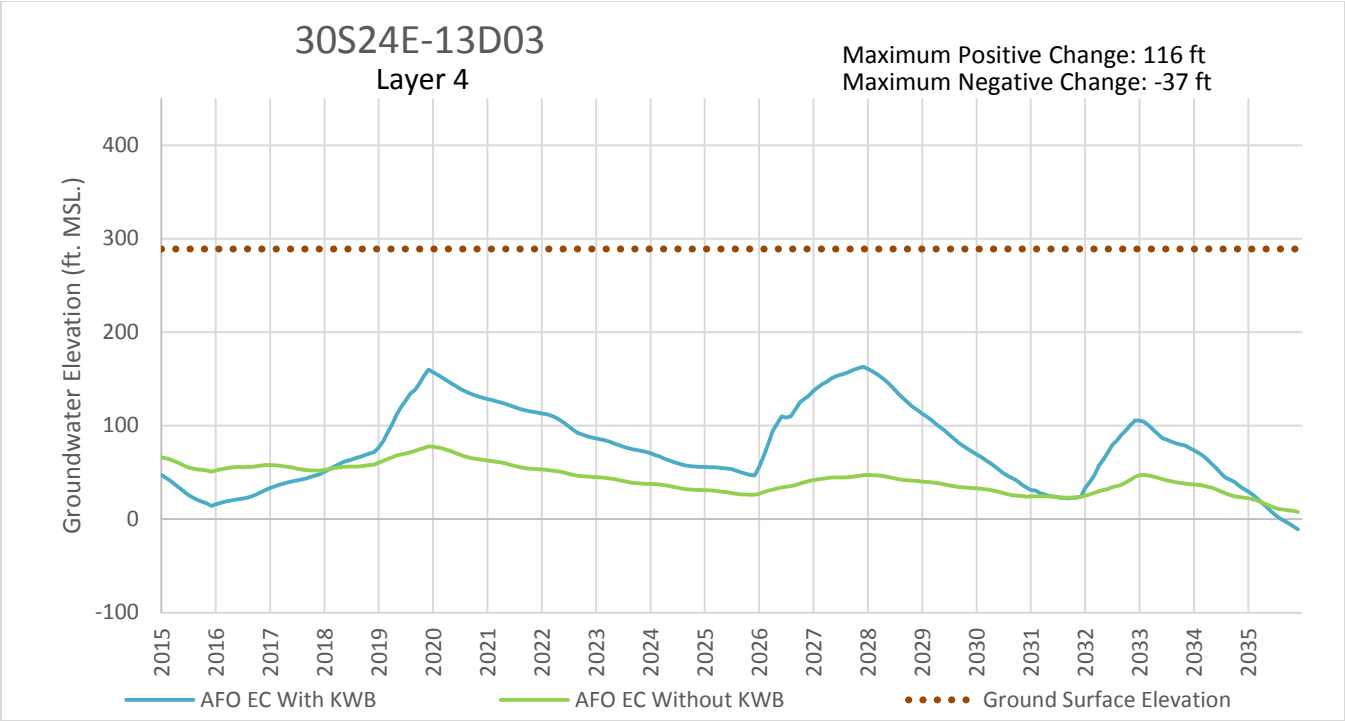

FIGURE 7-2 B.20. Hydrograph of Simulated Water Levels at Monitoring Well 30S24-13D03, 2015-2035

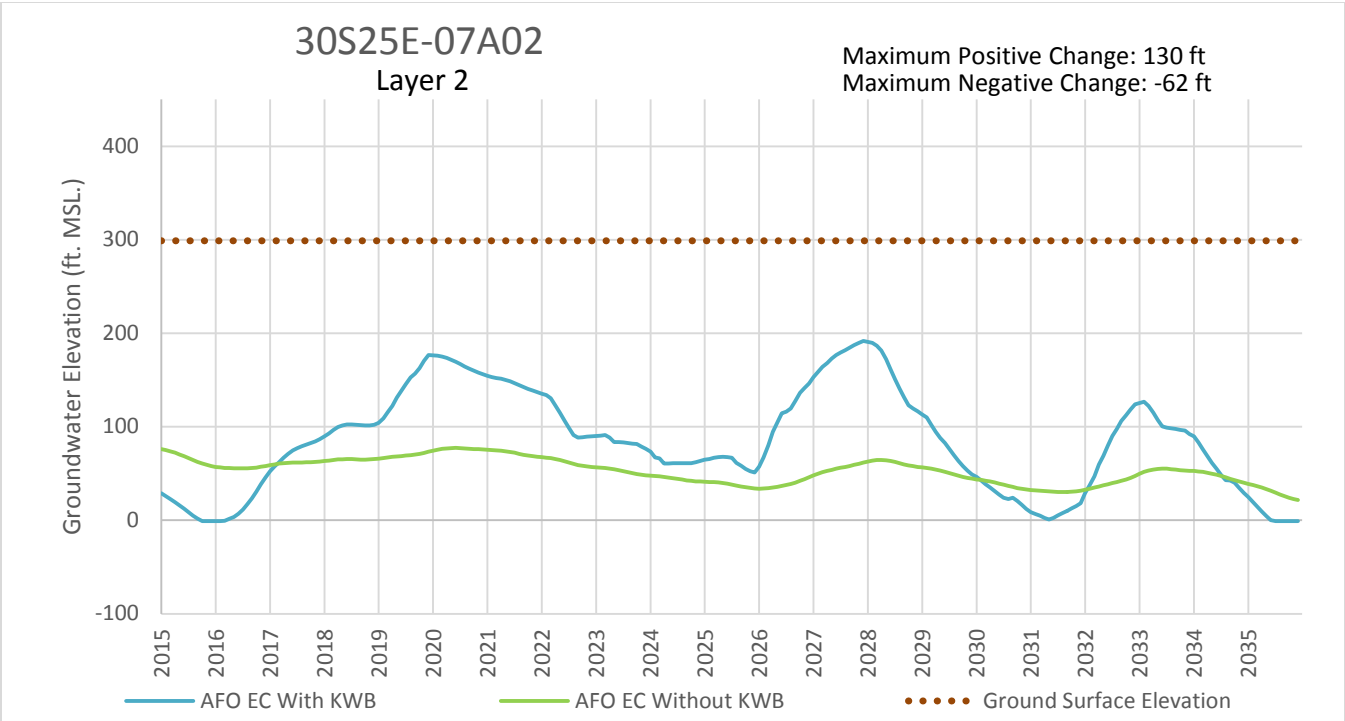

FIGURE 7-2 B.21. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-07A02, 2015-2035

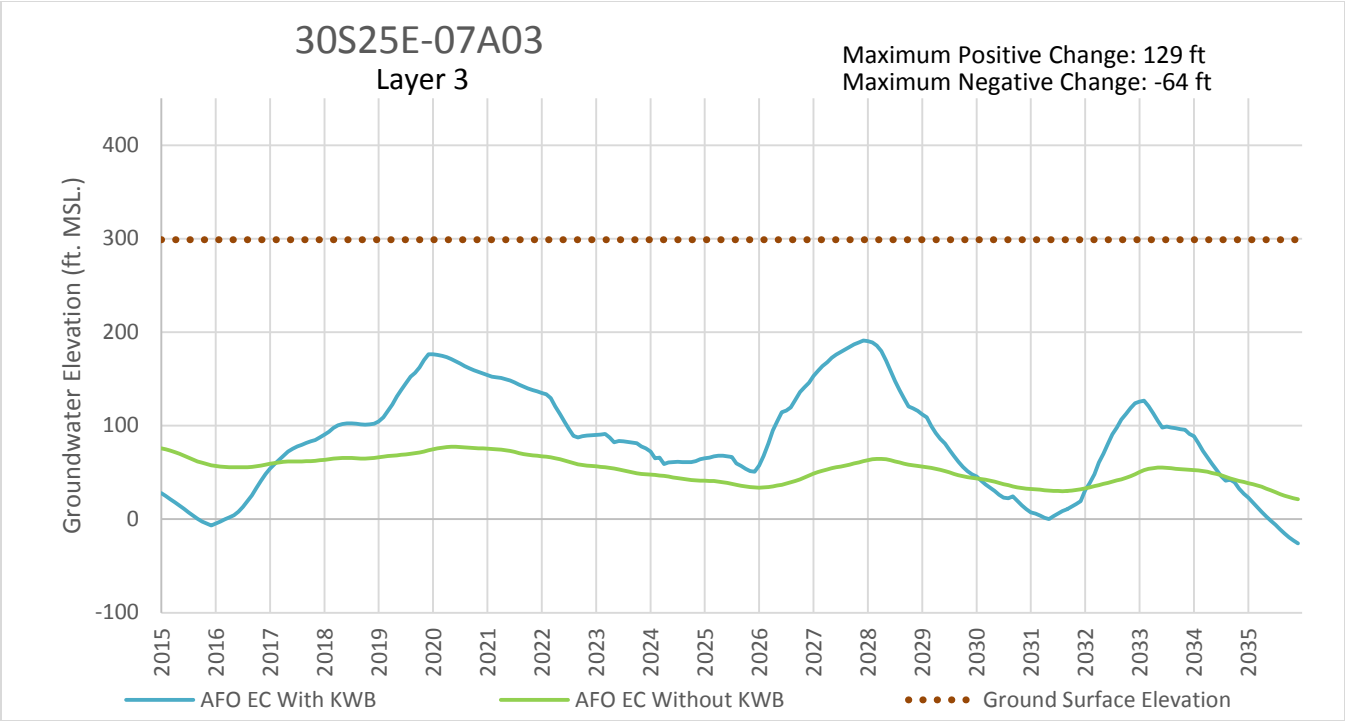

FIGURE 7-2 B.22. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-07A03, 2015-2035

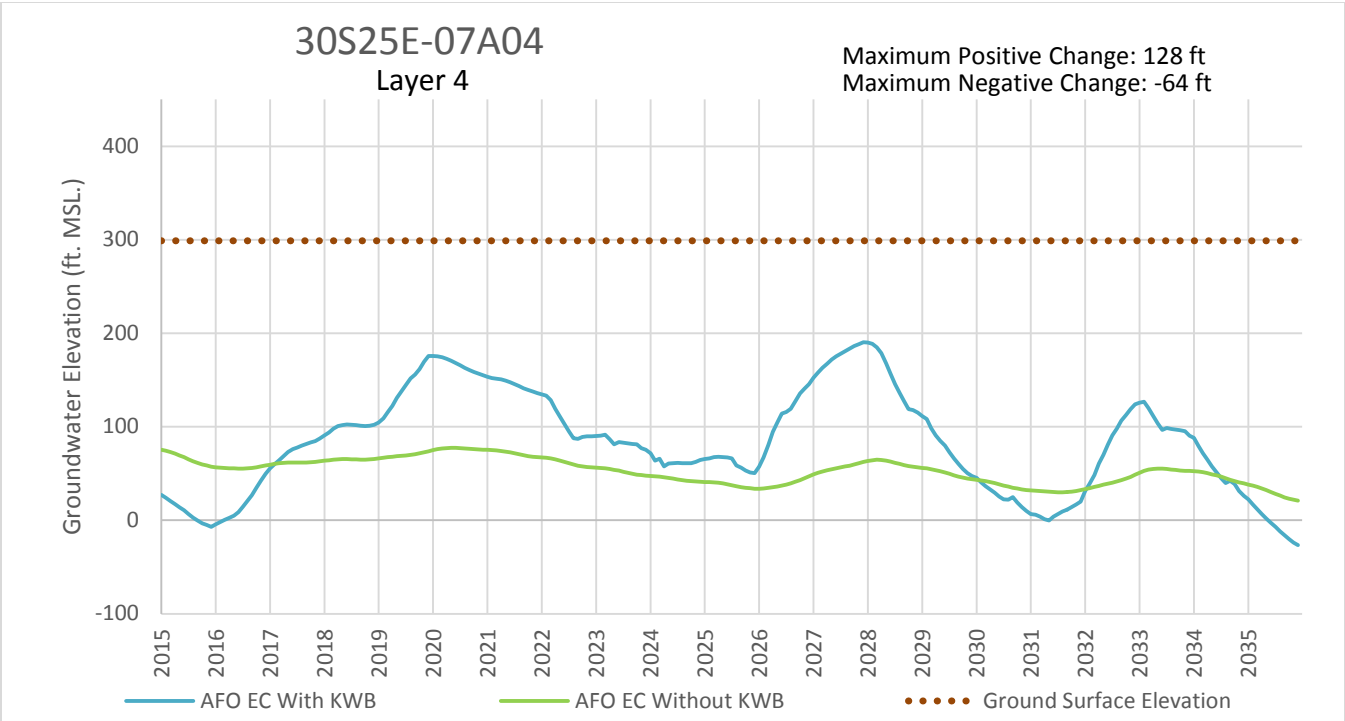

FIGURE 7-2 B.23. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-07A04, 2015-2035

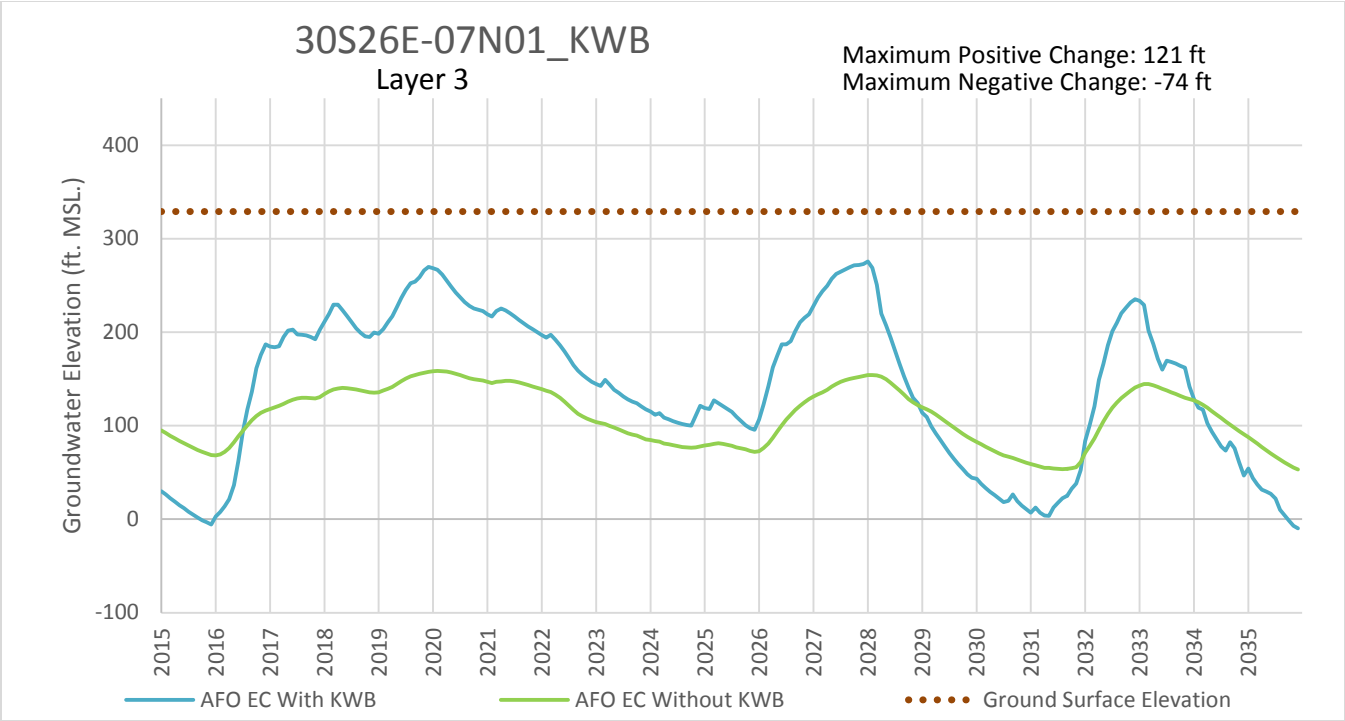

FIGURE 7-2 B.24. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-07N01_KWB, 2015-2035

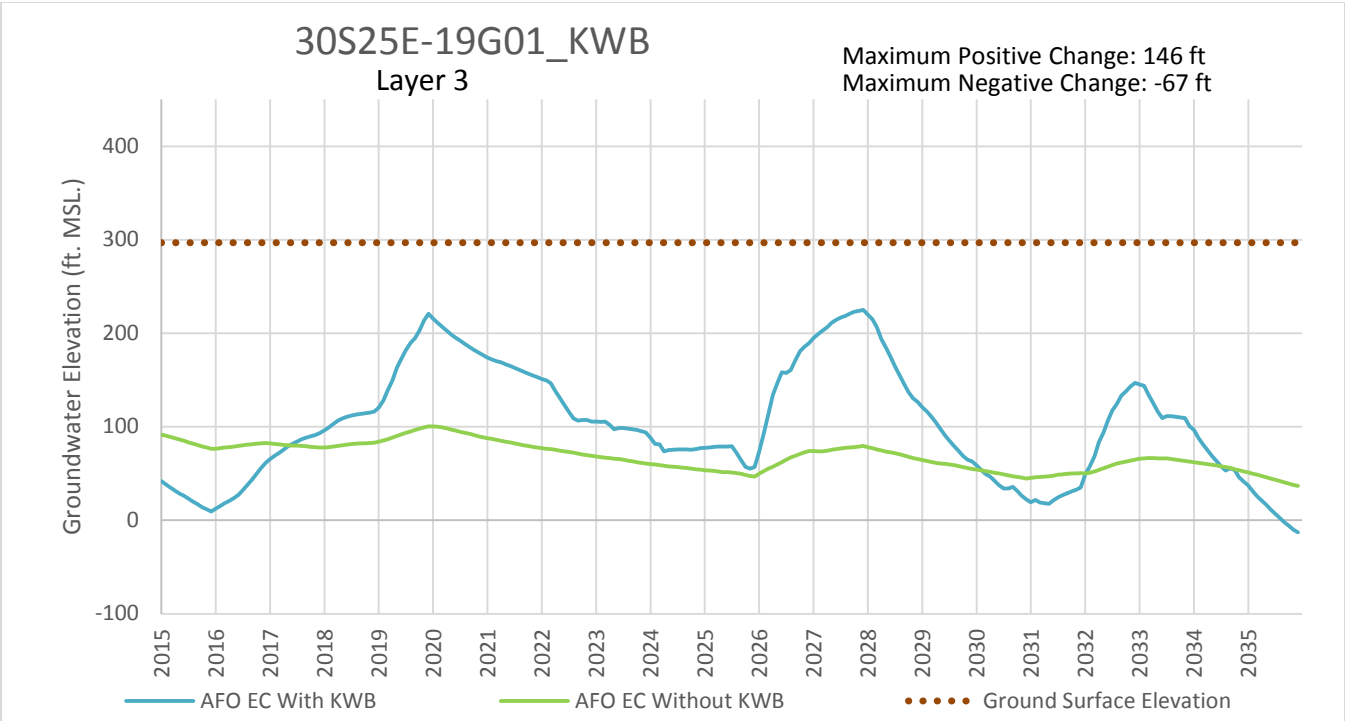

FIGURE 7-2 B.25. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-19G01_KWB, 2015-2035

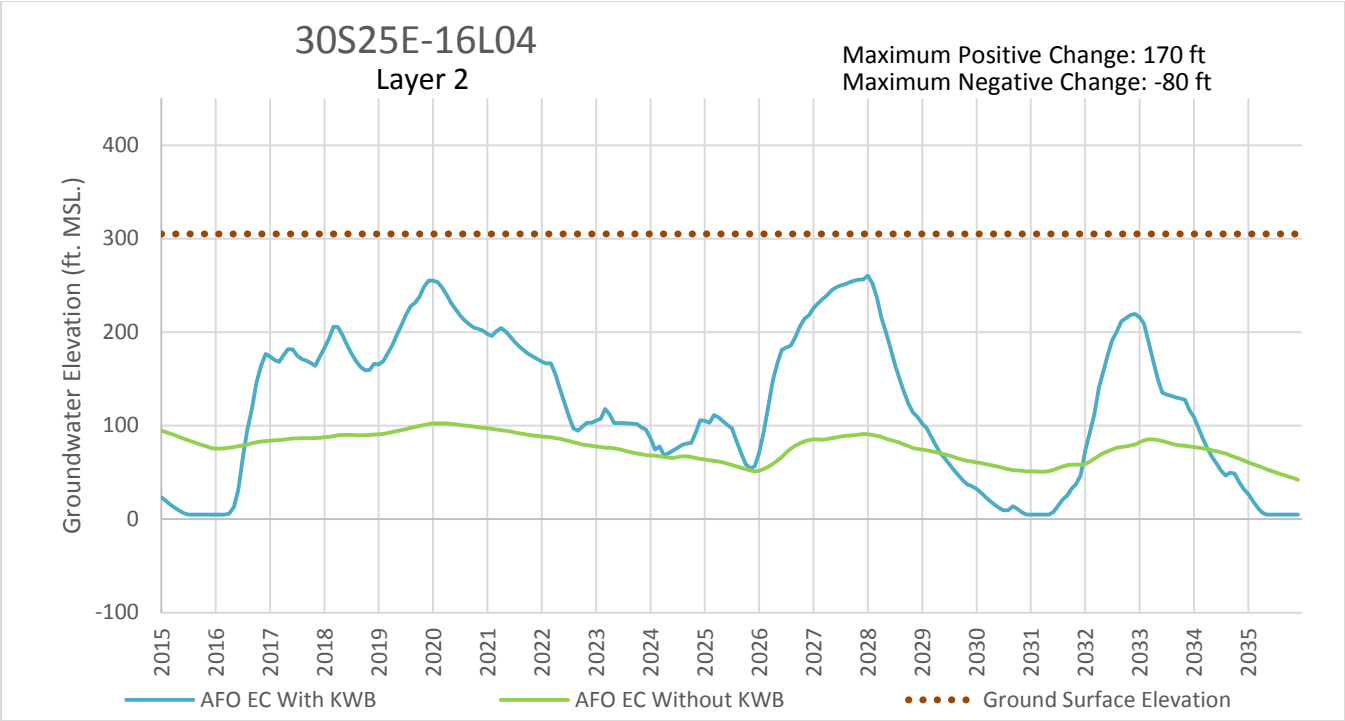

FIGURE 7-2 B.26. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-16L04, 2015-2035

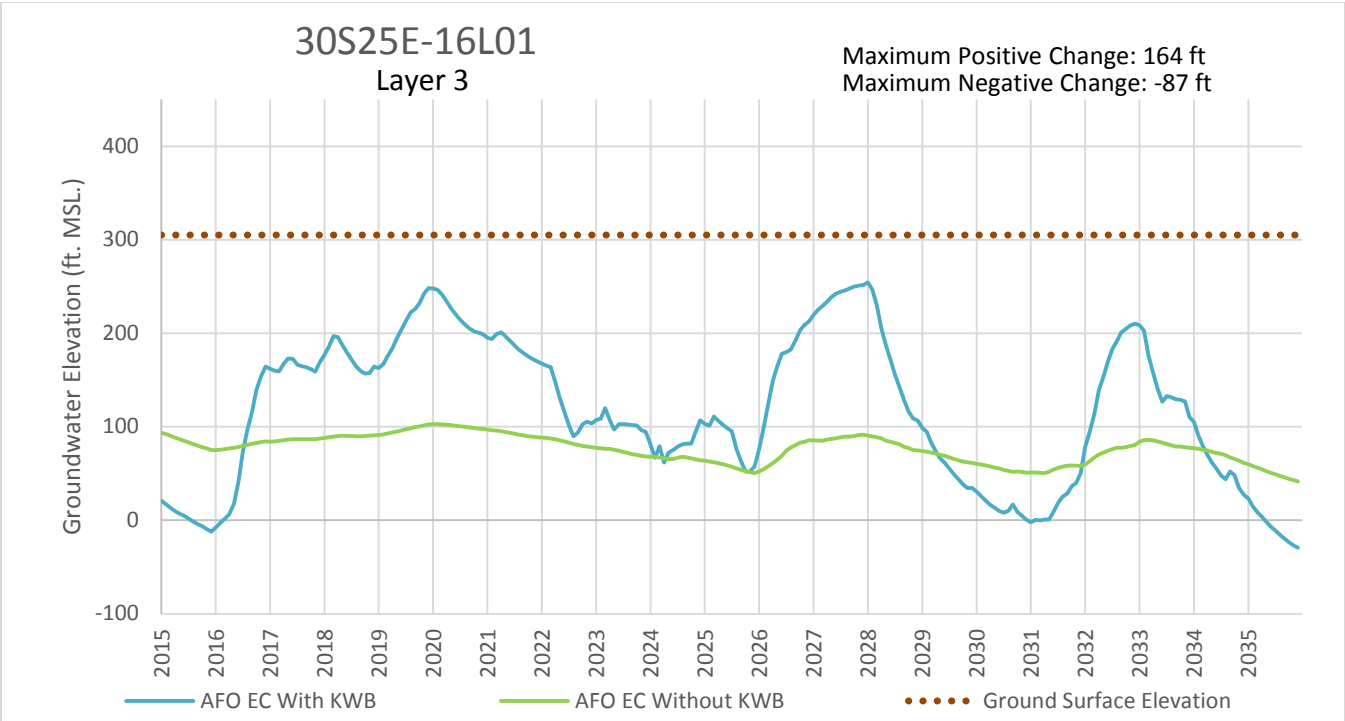

FIGURE 7-2 B.27. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-16L01, 2015-2035

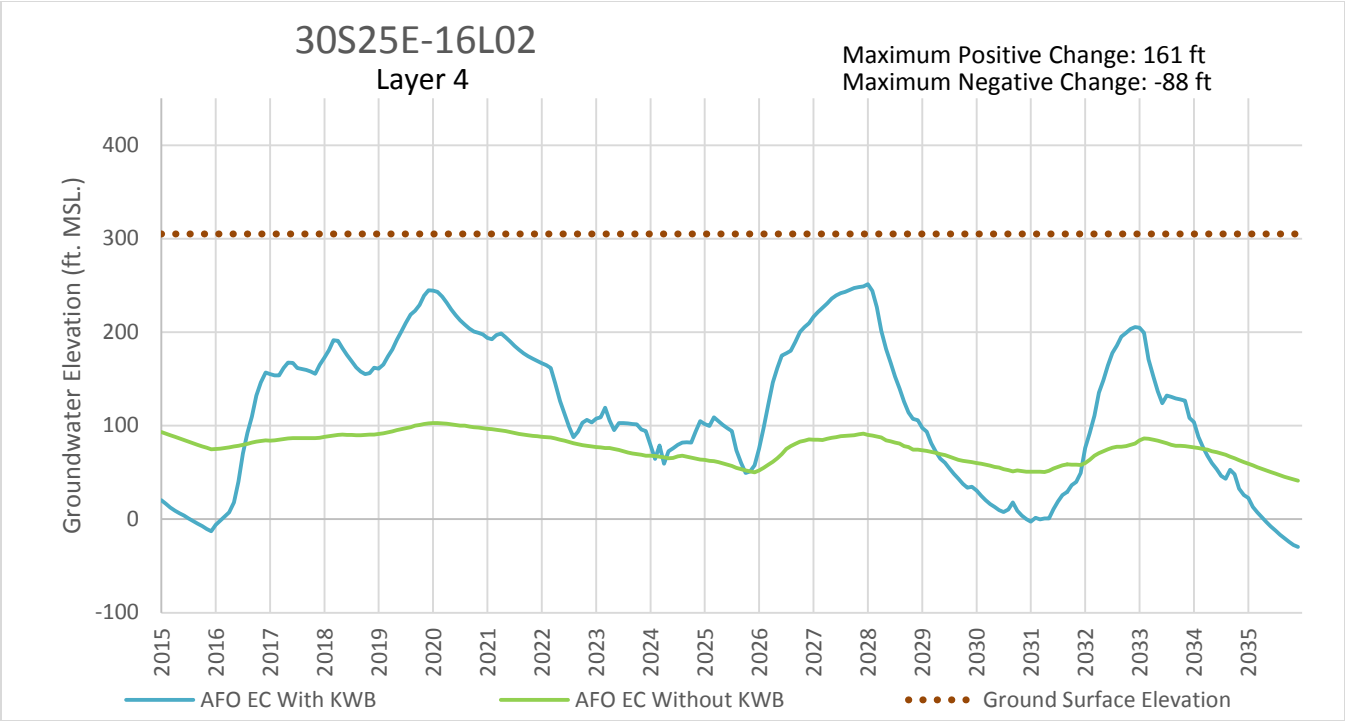

FIGURE 7-2 B.28. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-16L02, 2015-2035

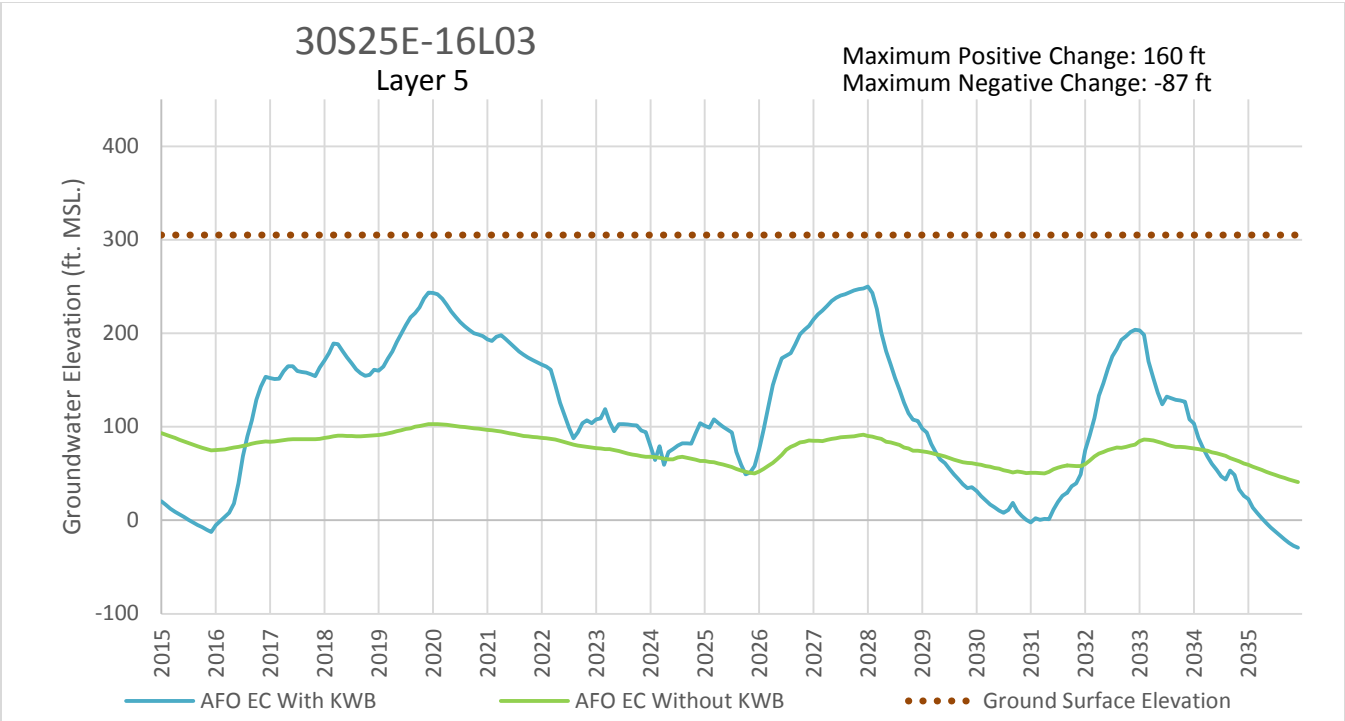

FIGURE 7-2 B.29. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-16L03, 2015-2035

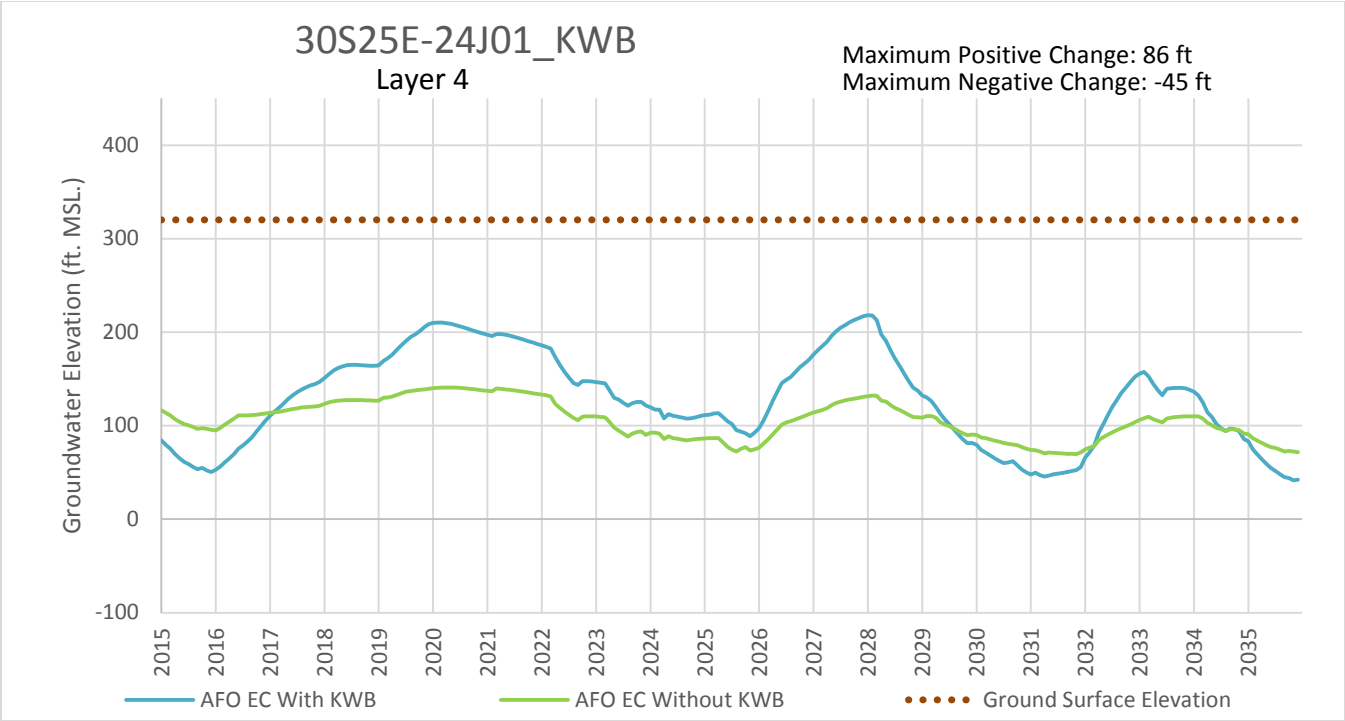

FIGURE 7-2 B.30. Hydrograph of Simulated Water Levels at Monitoring Well 30S257-24J01_KWB, 2015-2035

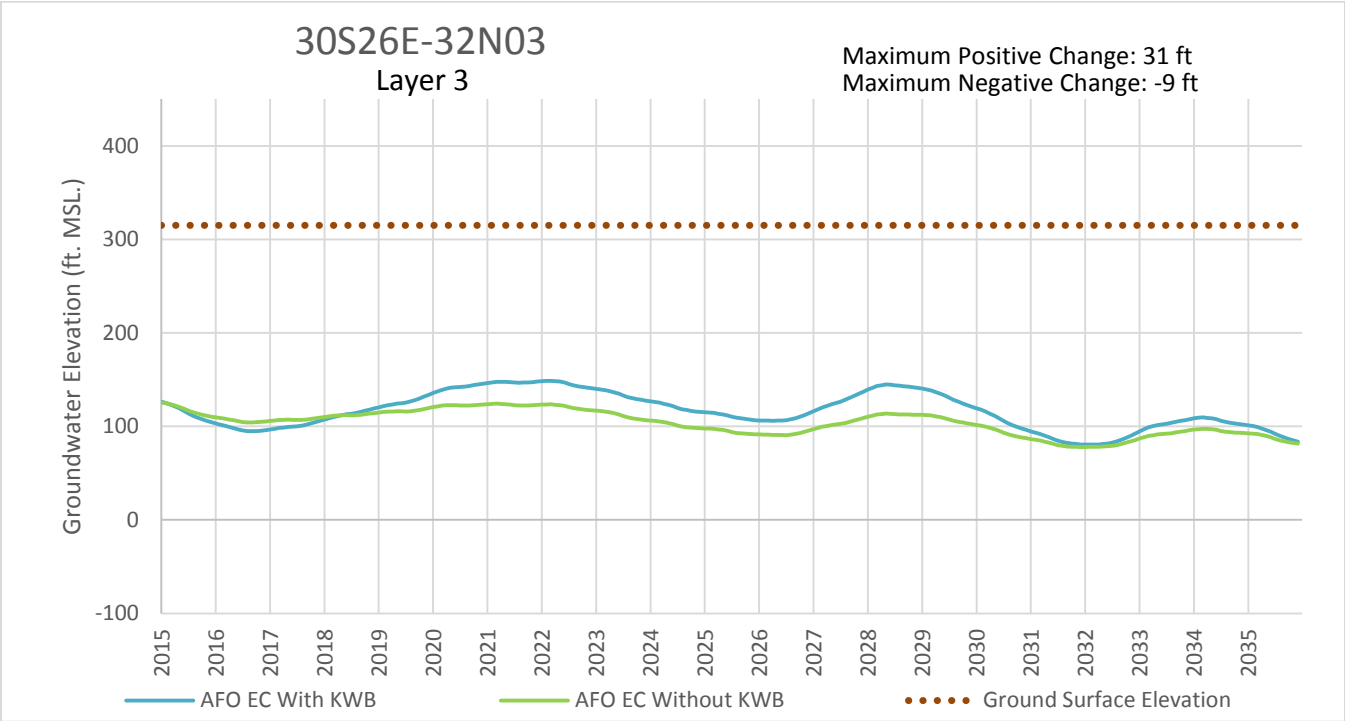

FIGURE 7-2 B.31. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-32N03, 2015-2035

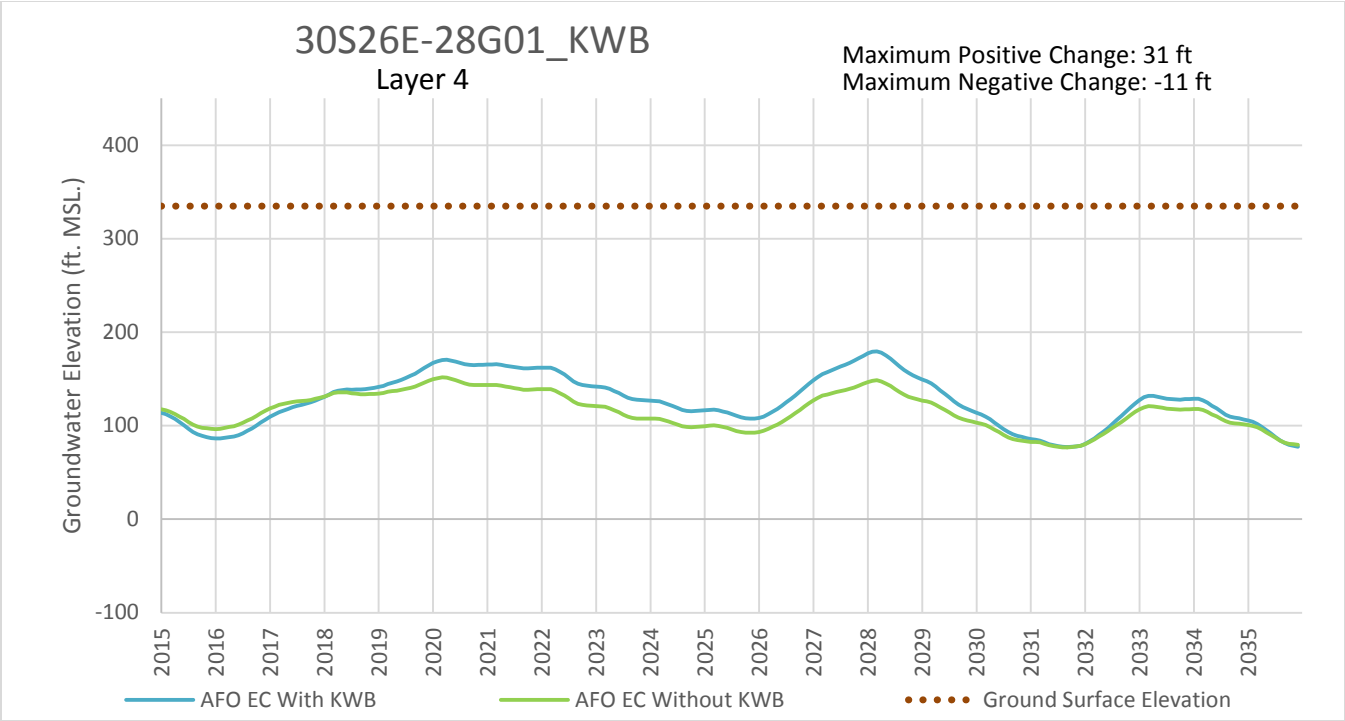

FIGURE 7-2 B.32. Hydrograph of Simulated Water Levels at Monitoring Well 30S267-28G01_KWB, 2015-2035

APPENDIX 7-2
C. AFO-BC HYDROGRAPHS

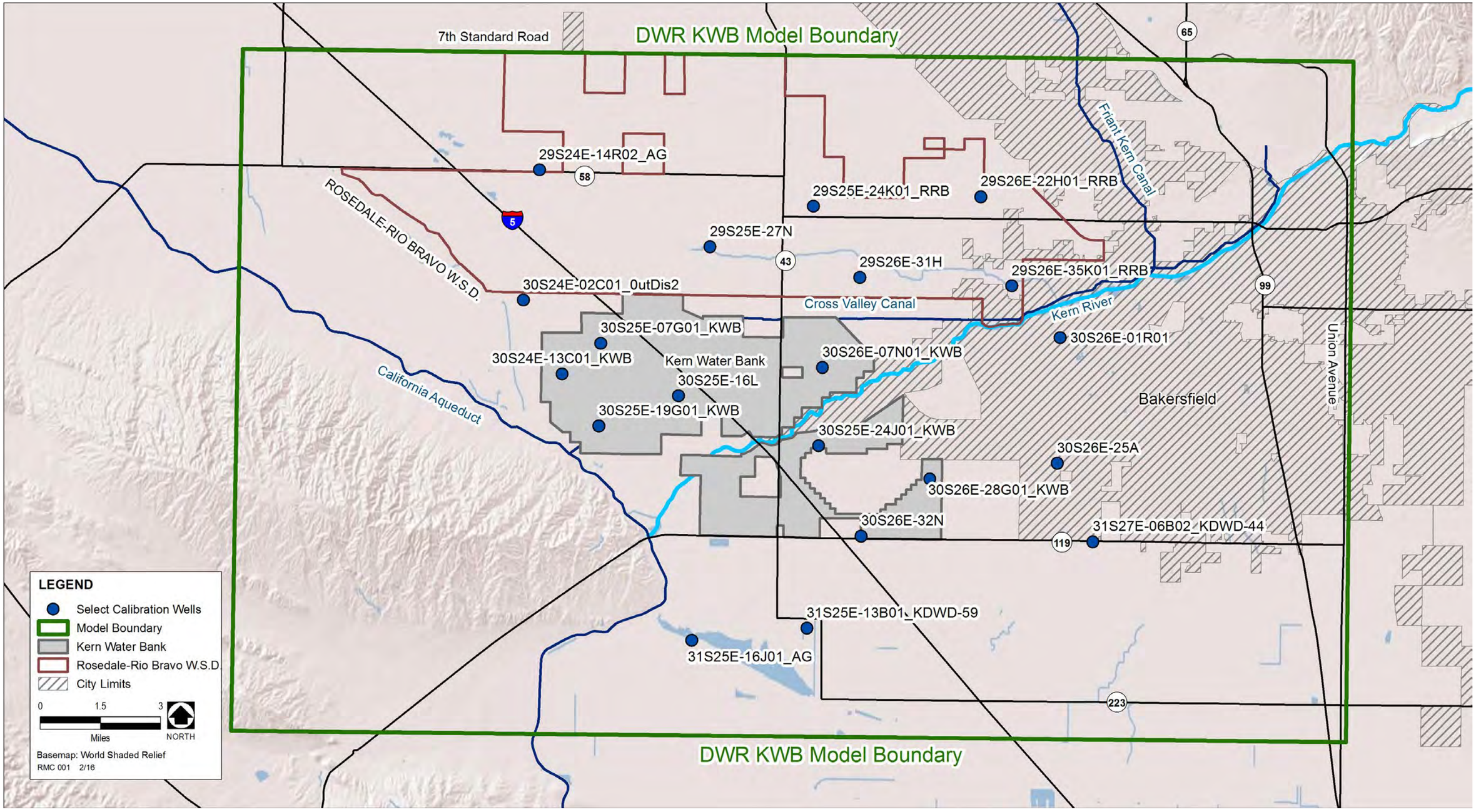

FIGURE 7-2 C.1. Location of Select Monitoring Wells Inside (14 Wells) and Outside (17 Wells) of Kern Water Bank

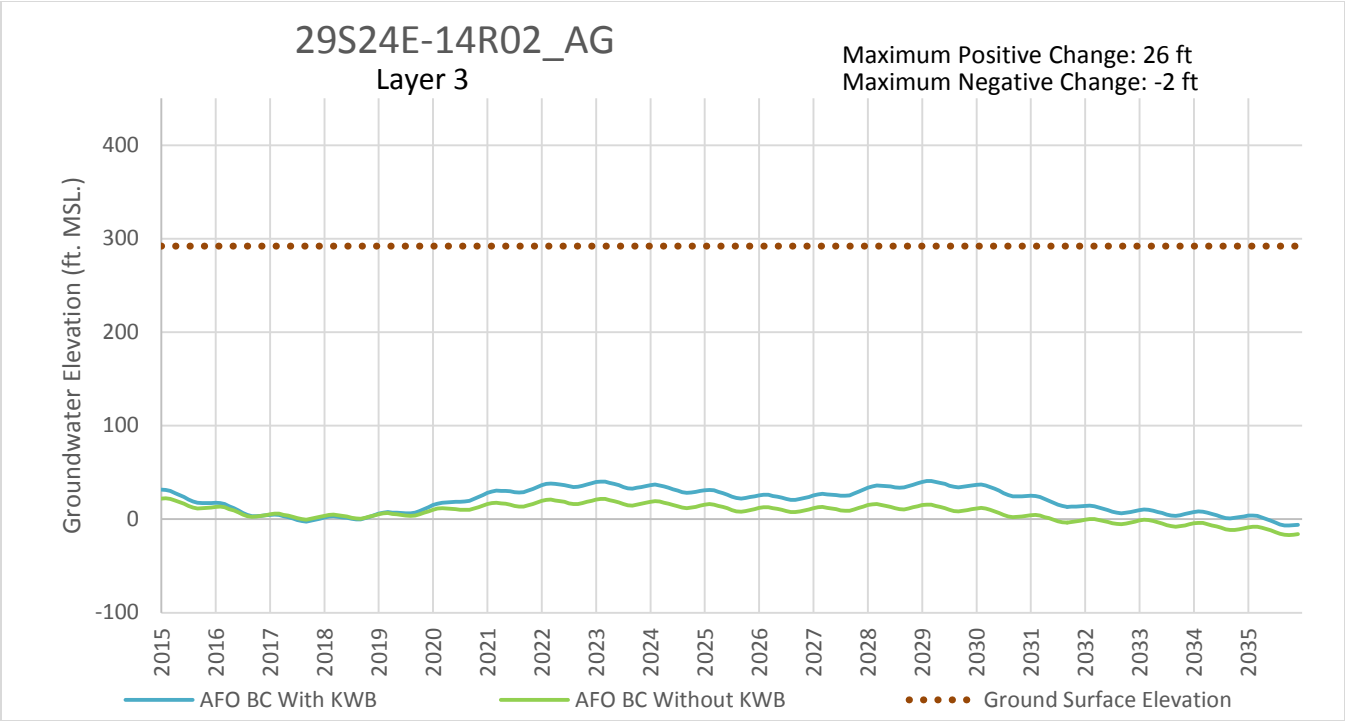

FIGURE 7-2 C.2. Hydrograph of Simulated Water Levels at Monitoring Well 29S24E14R02_Ag, 2015-2035

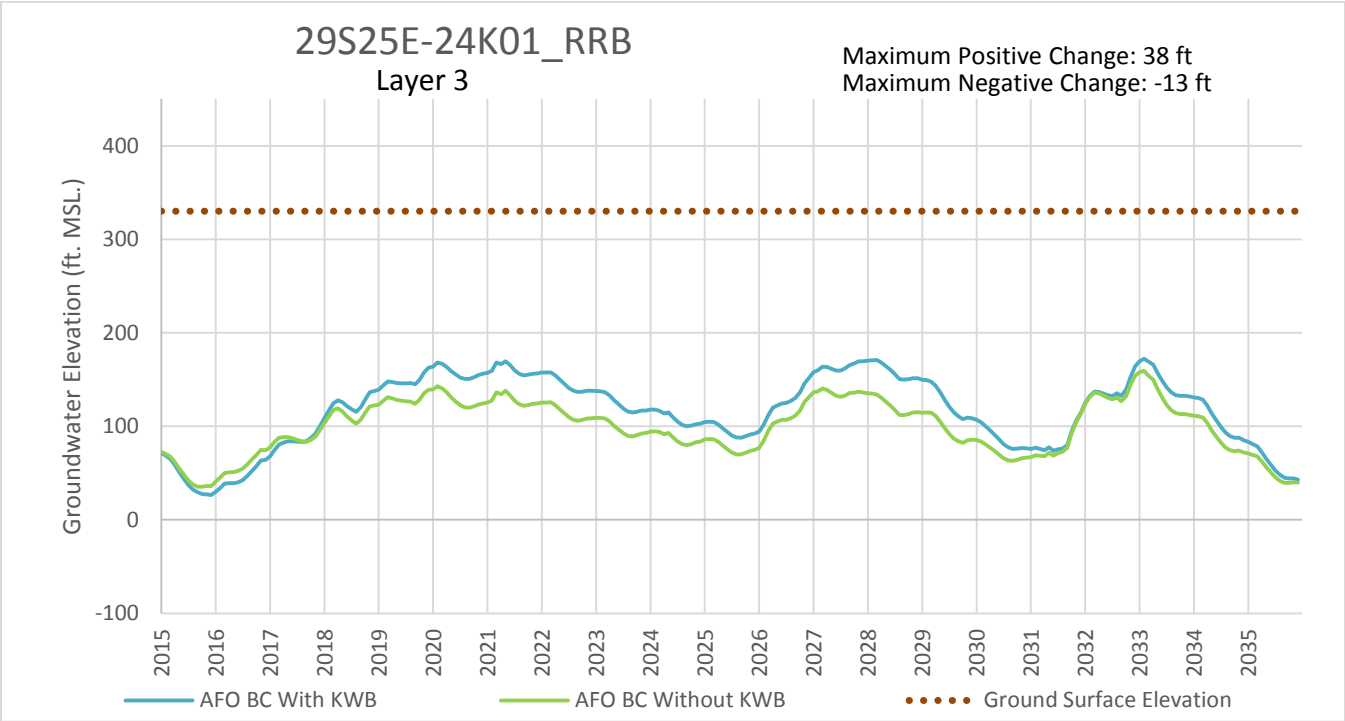

FIGURE 7-2 C.3. Hydrograph of Simulated Water Levels at Monitoring Well 29S257-24K01_RRB, 2015-2035

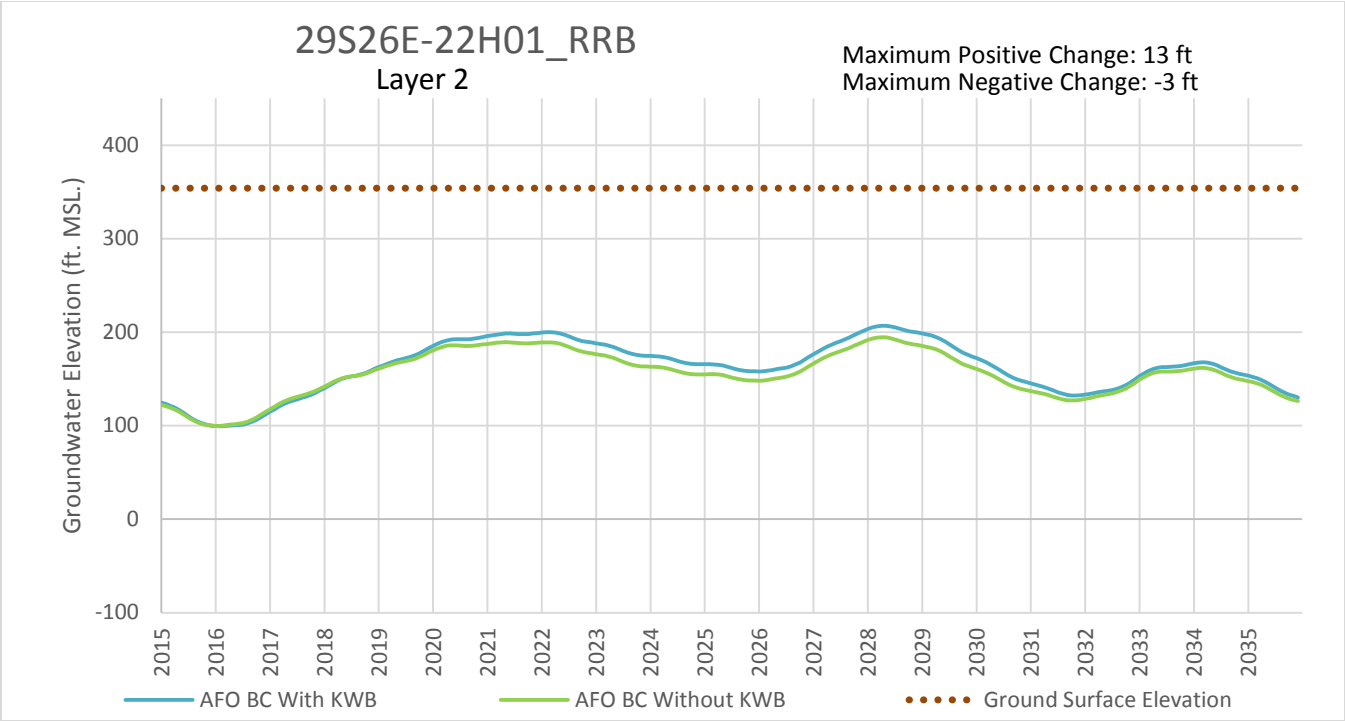

FIGURE 7-2 C.4. Hydrograph of Simulated Water Levels at Monitoring Well 29S267-22H01_RRB, 2015-2035

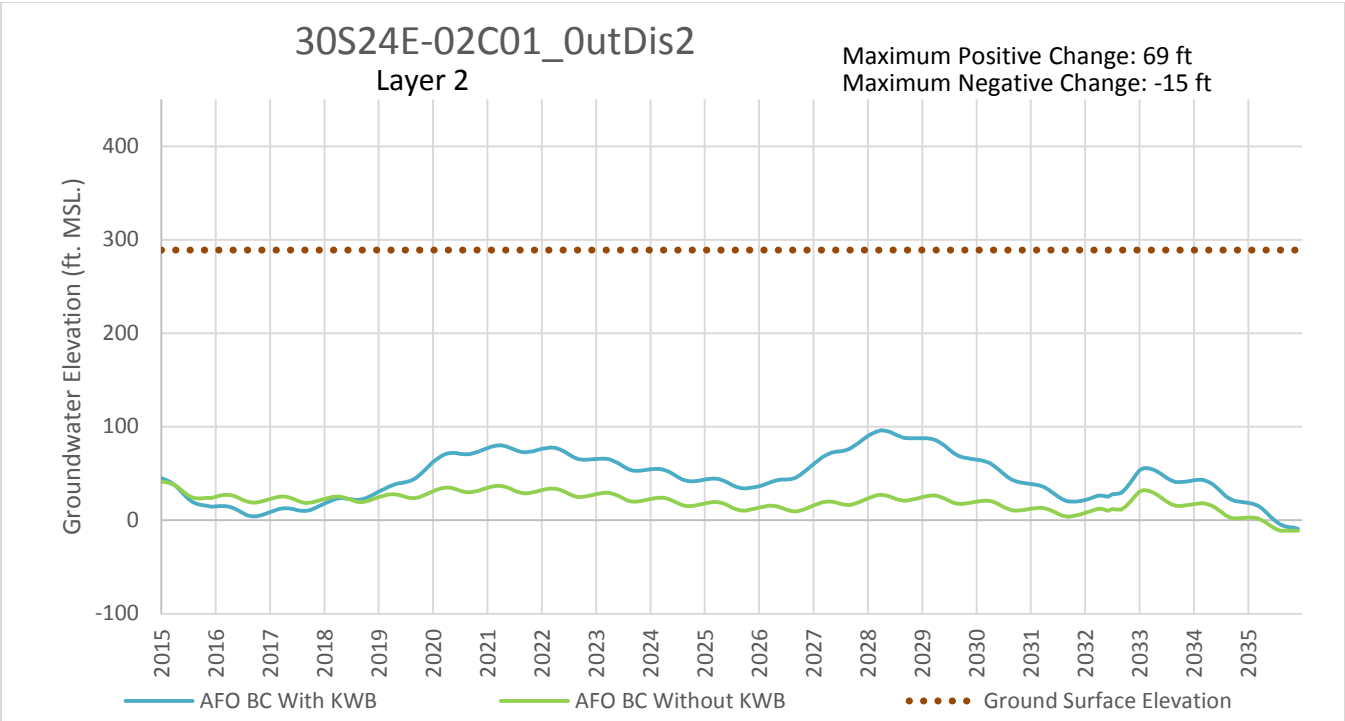

FIGURE 7-2 C.5. Hydrograph of Simulated Water levels at Monitoring Well 30S24E-02C01_0utDis2, 2015-2035

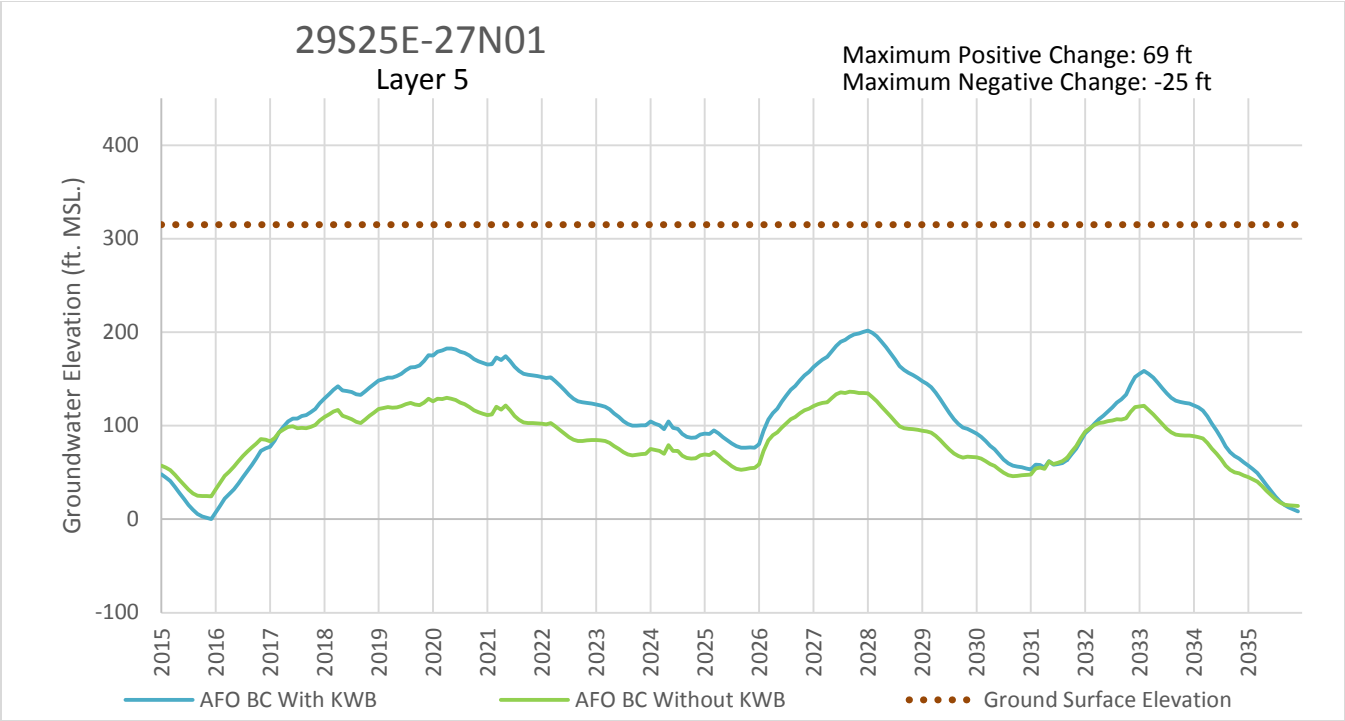

FIGURE 7-2 C.6. Hydrograph of Simulated Water Levels at Monitoring Well 29S257-27N01, 2015-2035

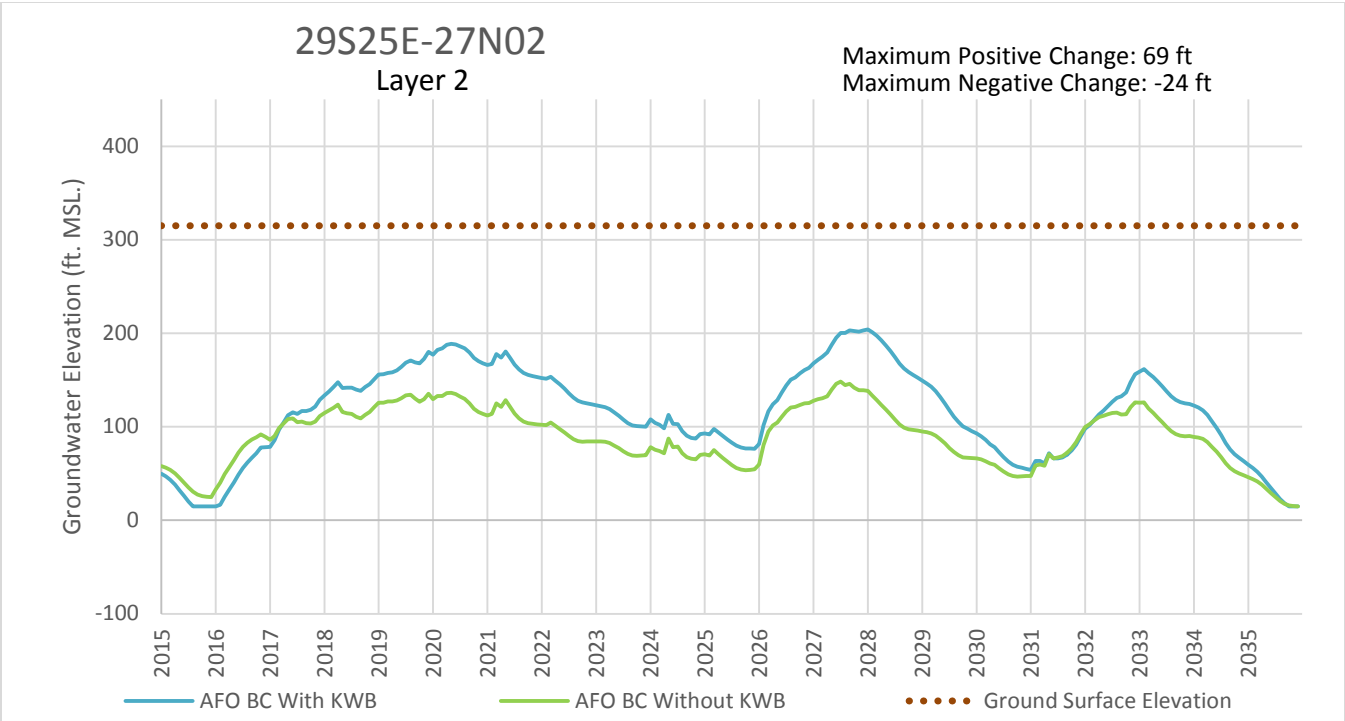

FIGURE 7-2 C.7. Hydrograph of Simulated Water Levels at Monitoring Well 29S257-27N02, 2015-2035

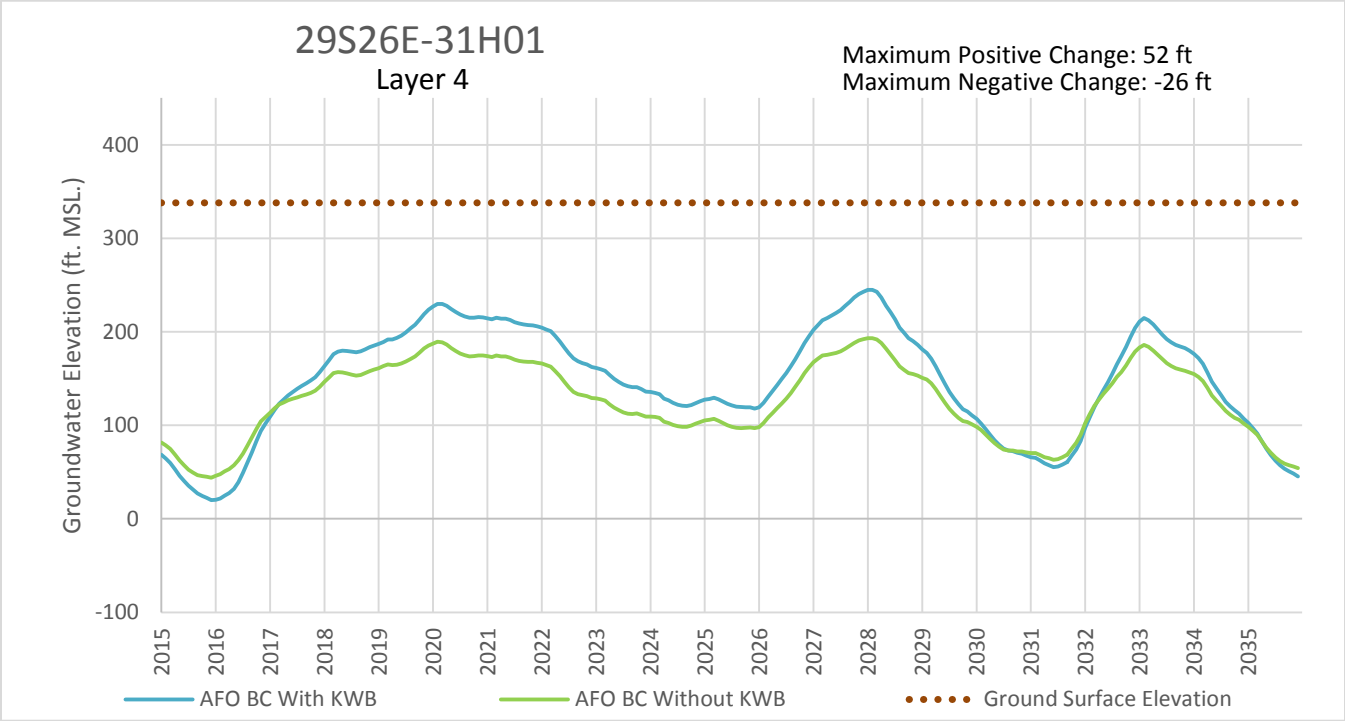

FIGURE 7-2 C.8. Hydrograph of Simulated Water Levels at Monitoring Well 29S26E-31H01, 2015-2035

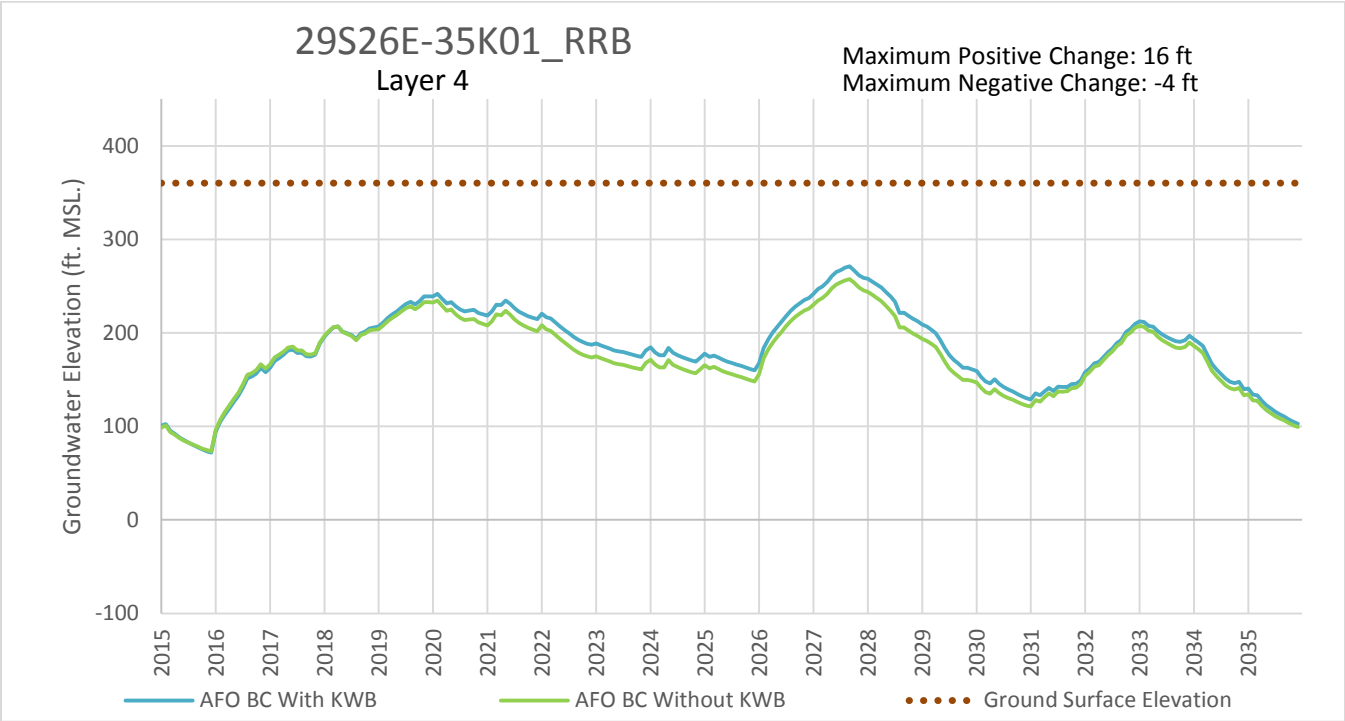

FIGURE 7-2 C.9. Hydrograph of Simulated Water Levels at Monitoring Well 29S26E-35K01_RRB, 2015-2035

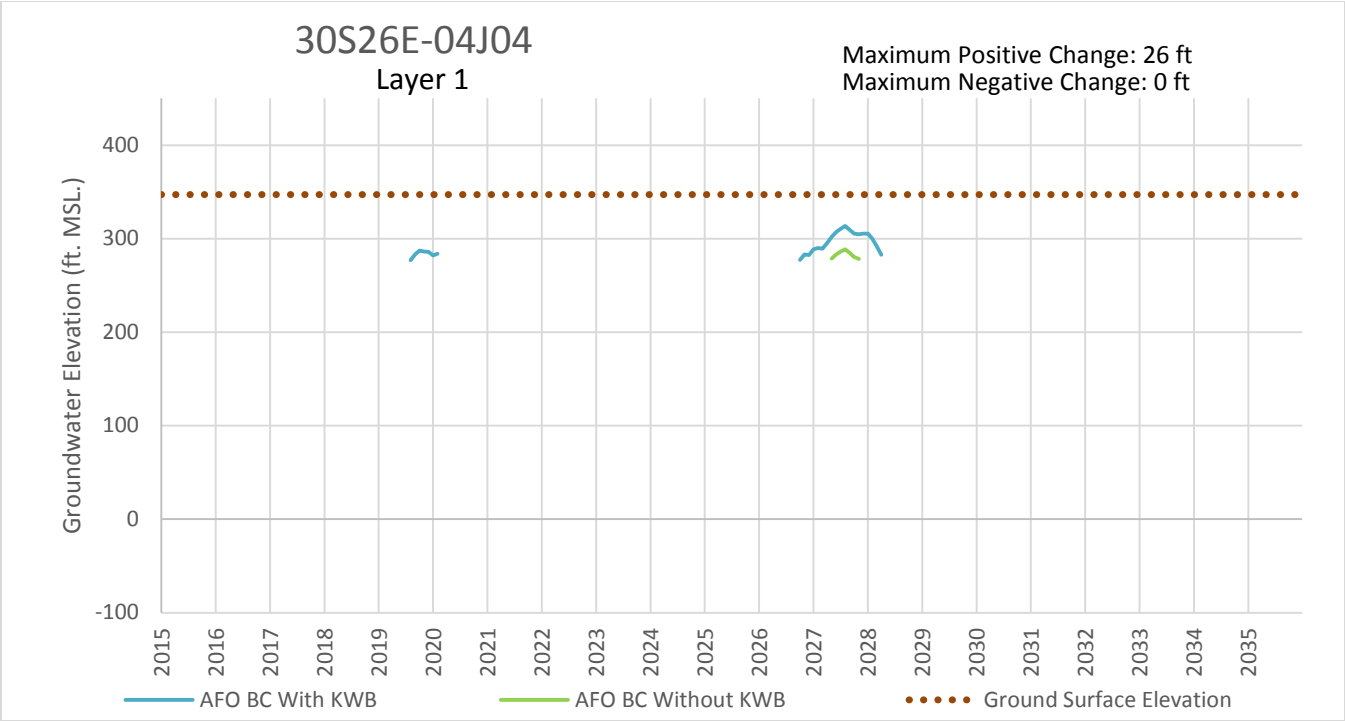

FIGURE 7-2 C.10. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-04J04, 2015-2035

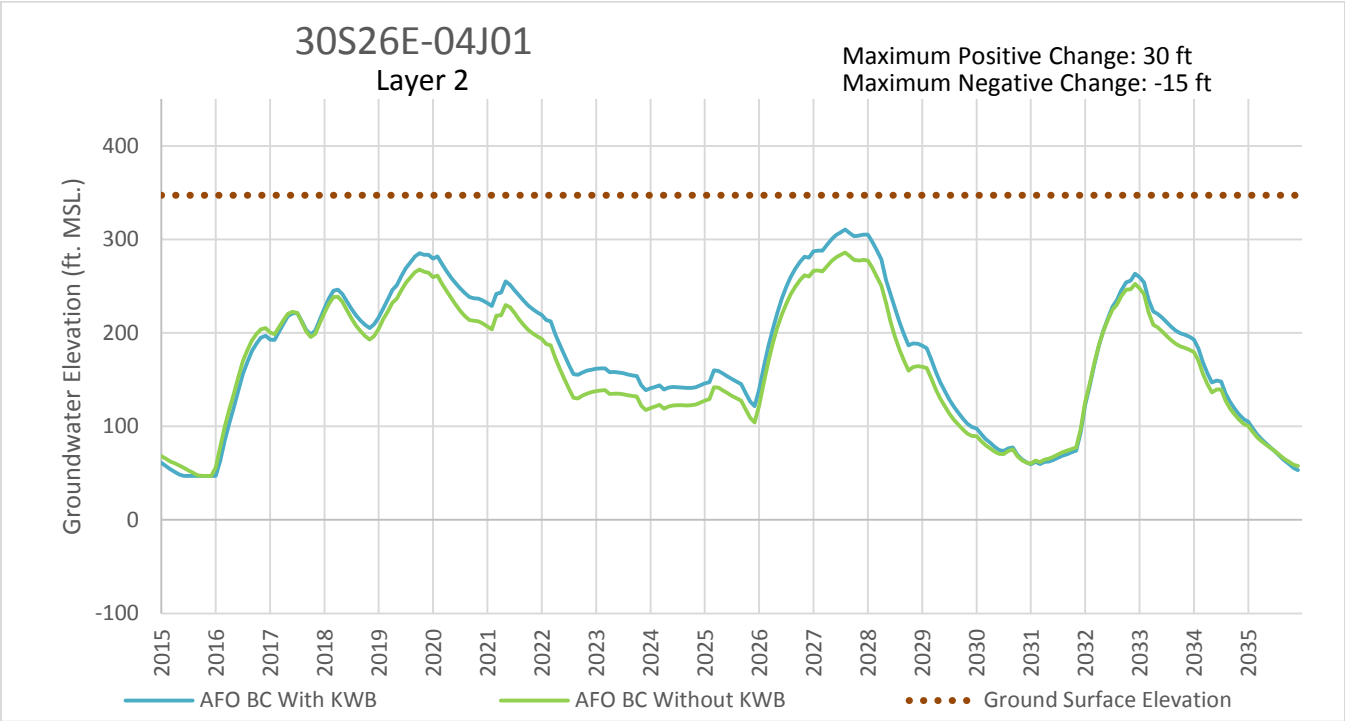

FIGURE 7-2 C.11. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-04J01, 2015-2035

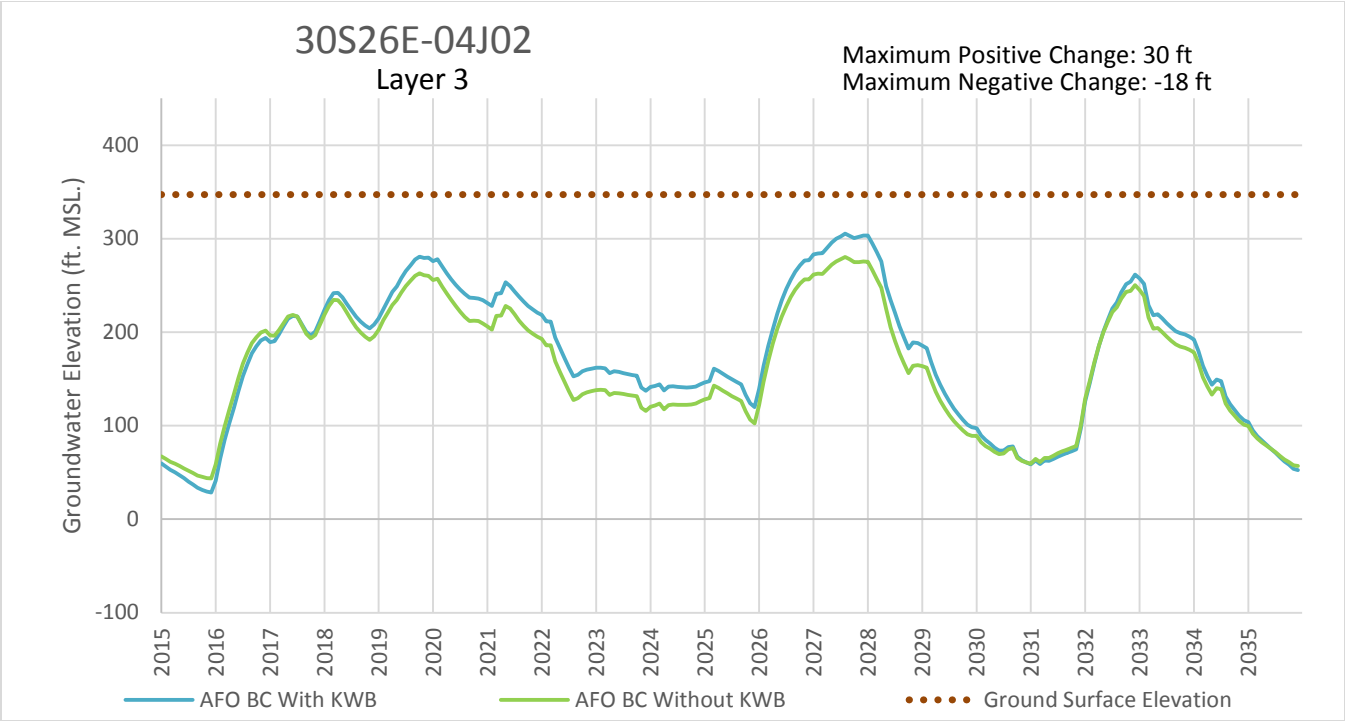

FIGURE 7-2 C.12. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-04J02, 2015-2035

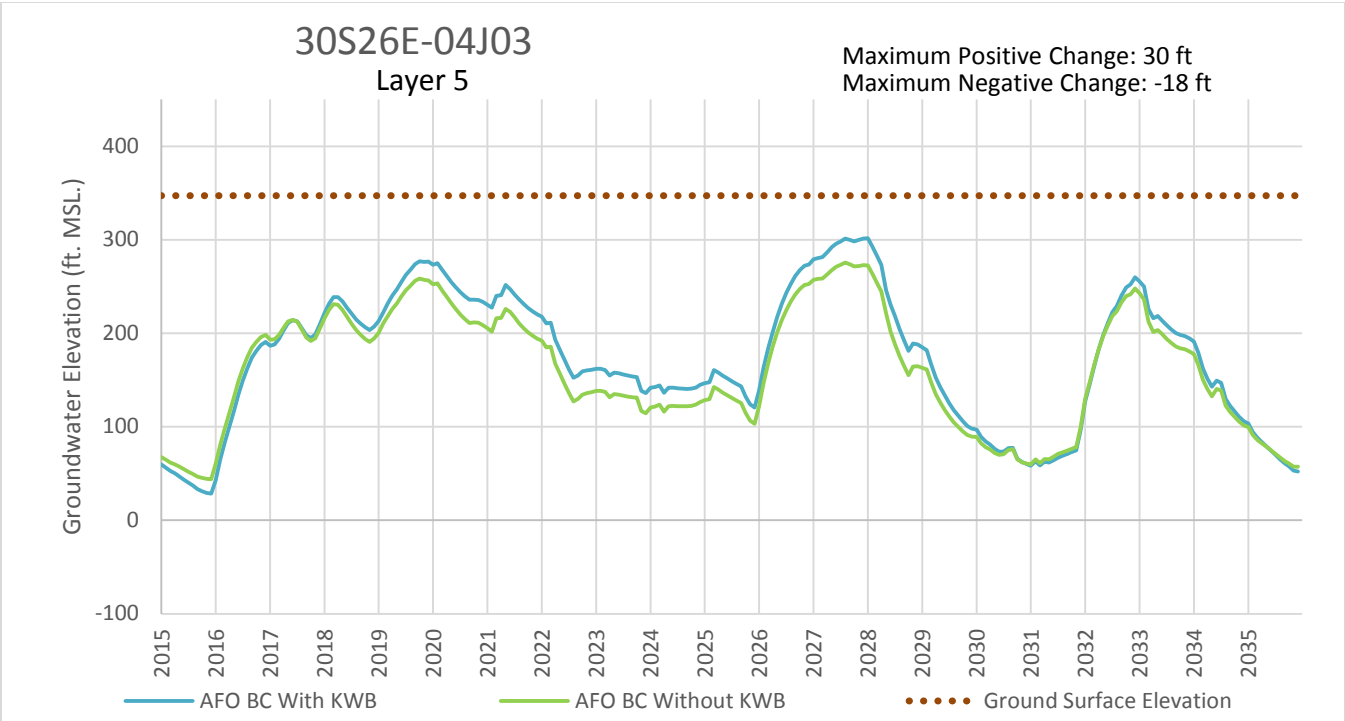

FIGURE 7-2 C.13. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-04J03, 2015-2035

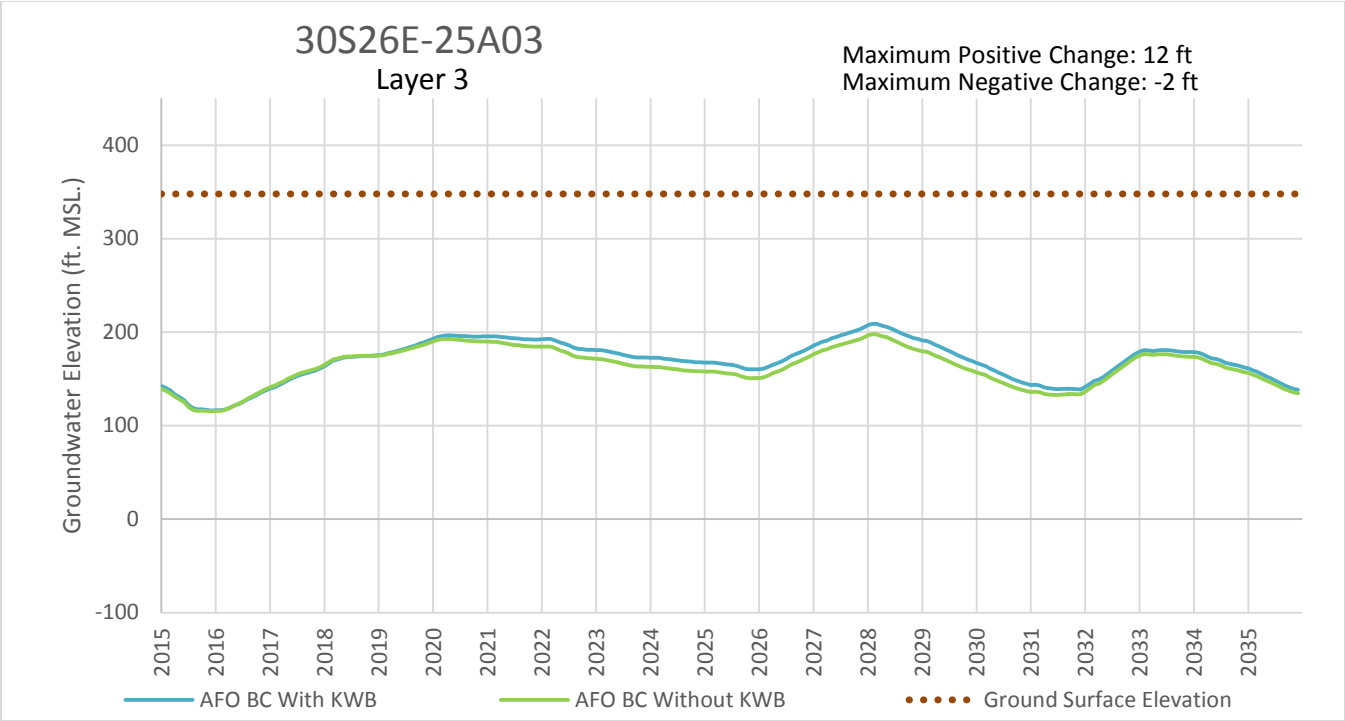

FIGURE 7-2 C.14. Hydrograph of Simulated Water Levels at Monitoring Well 30S267-25A03, 2015-2035

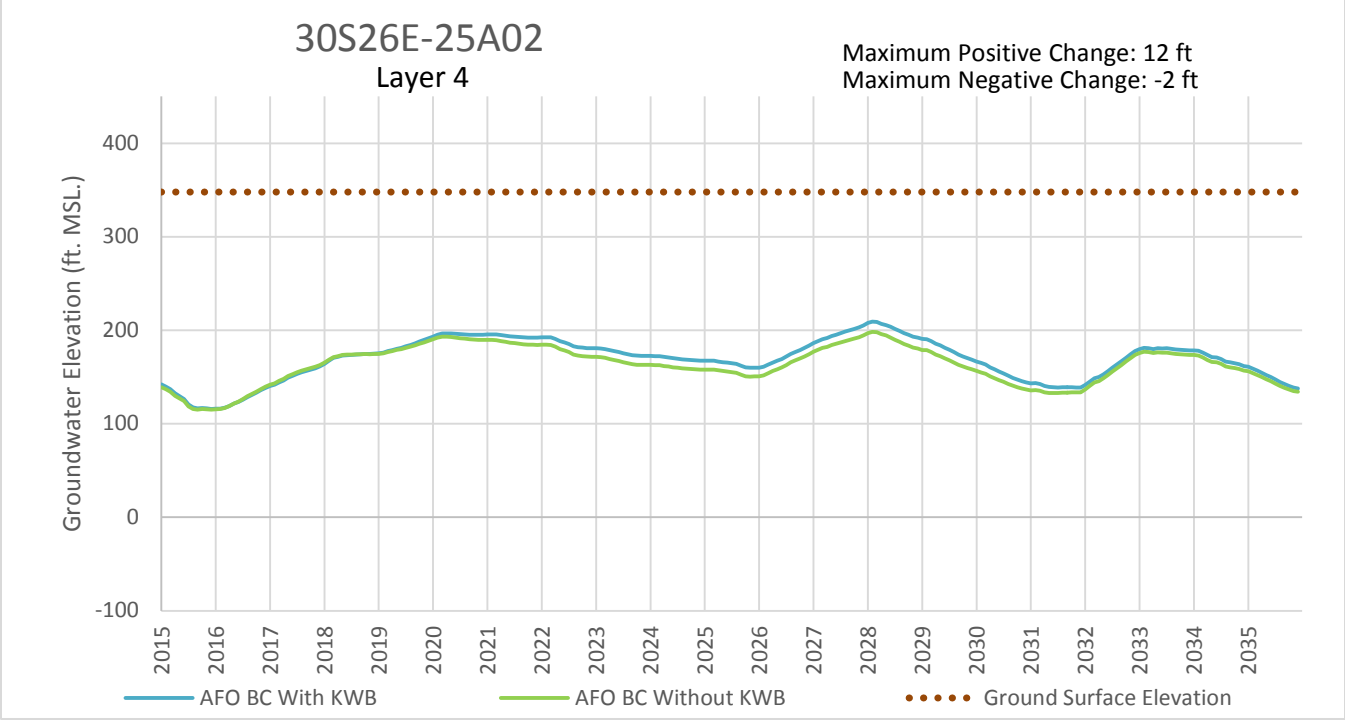

FIGURE 7-2 C.15. Hydrograph of Simulated Water Levels at Monitoring Well 30S267-25A02, 2015-2035

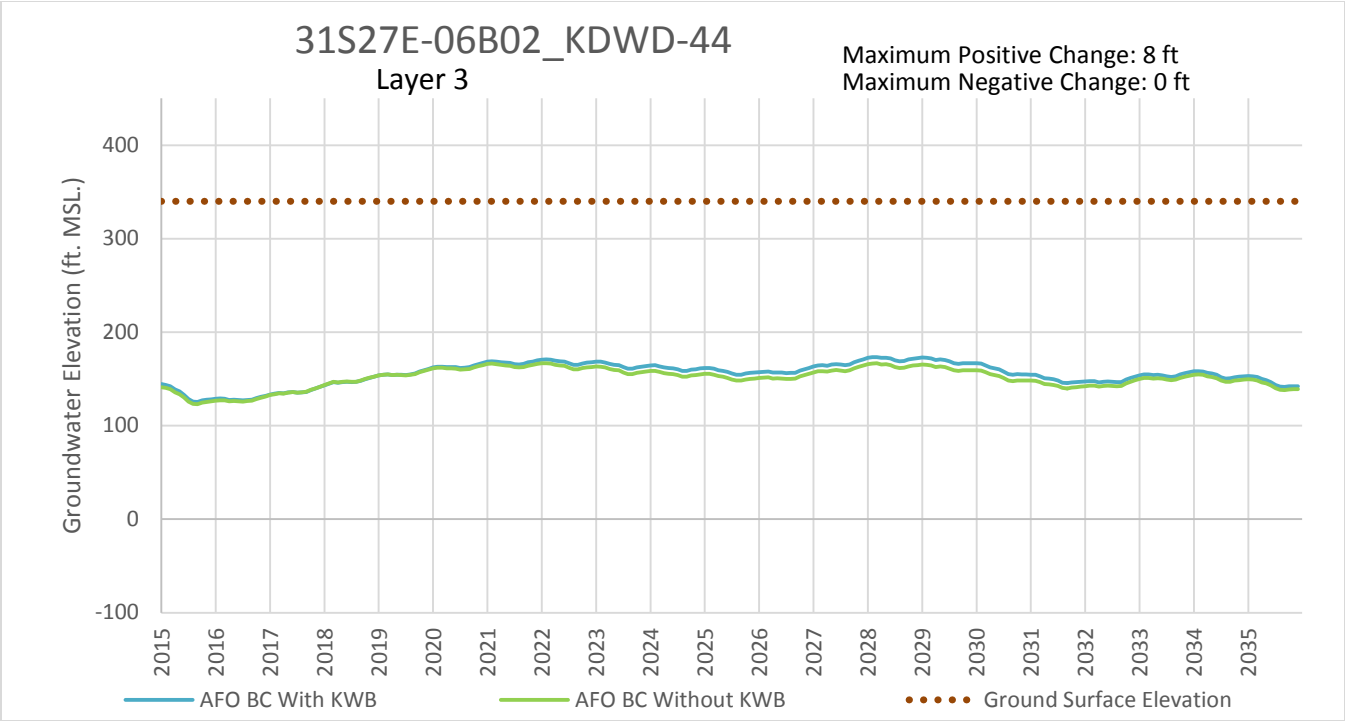

FIGURE 7-2 C.16. Hydrograph of Simulated Water Levels at Monitoring Well 31S27E-06B02_KDWD-44, 2015-2035

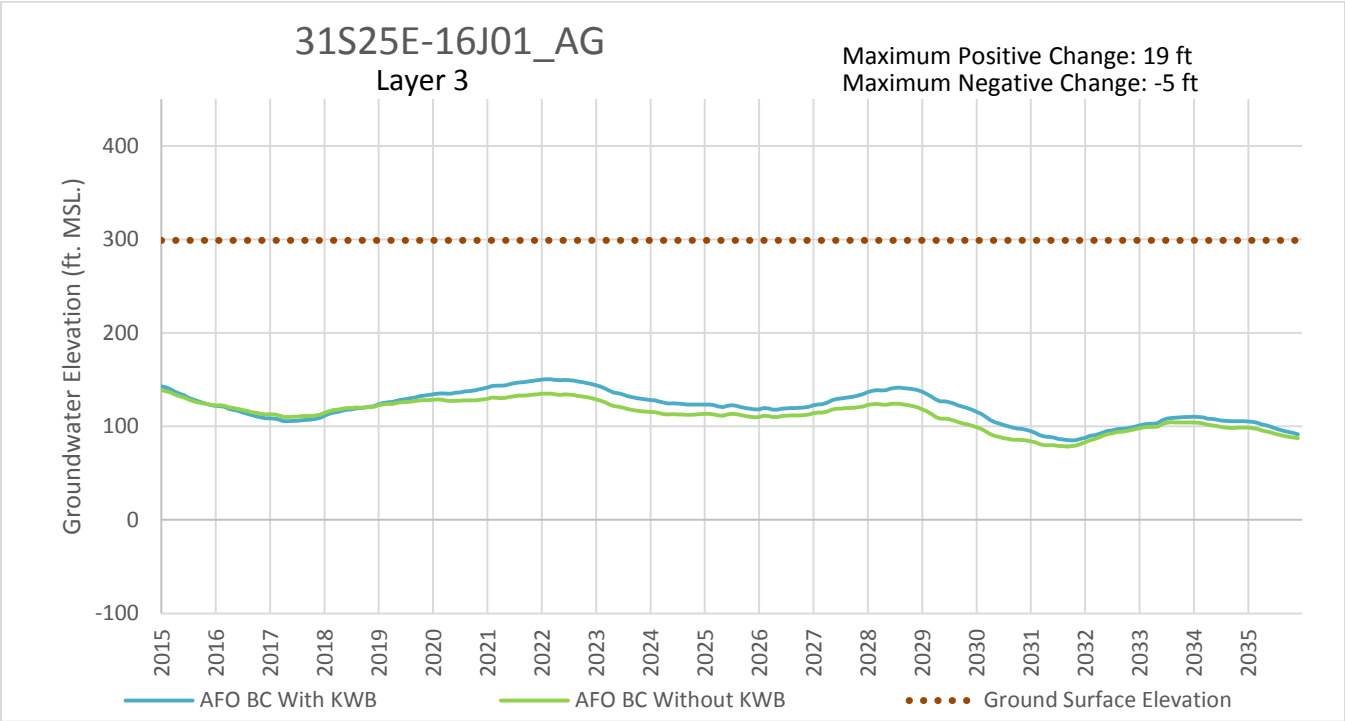

FIGURE 7-2 C.17. Hydrograph of Simulated Water Levels at Monitoring Well 31S25E-16J01_AG, 2015-2035

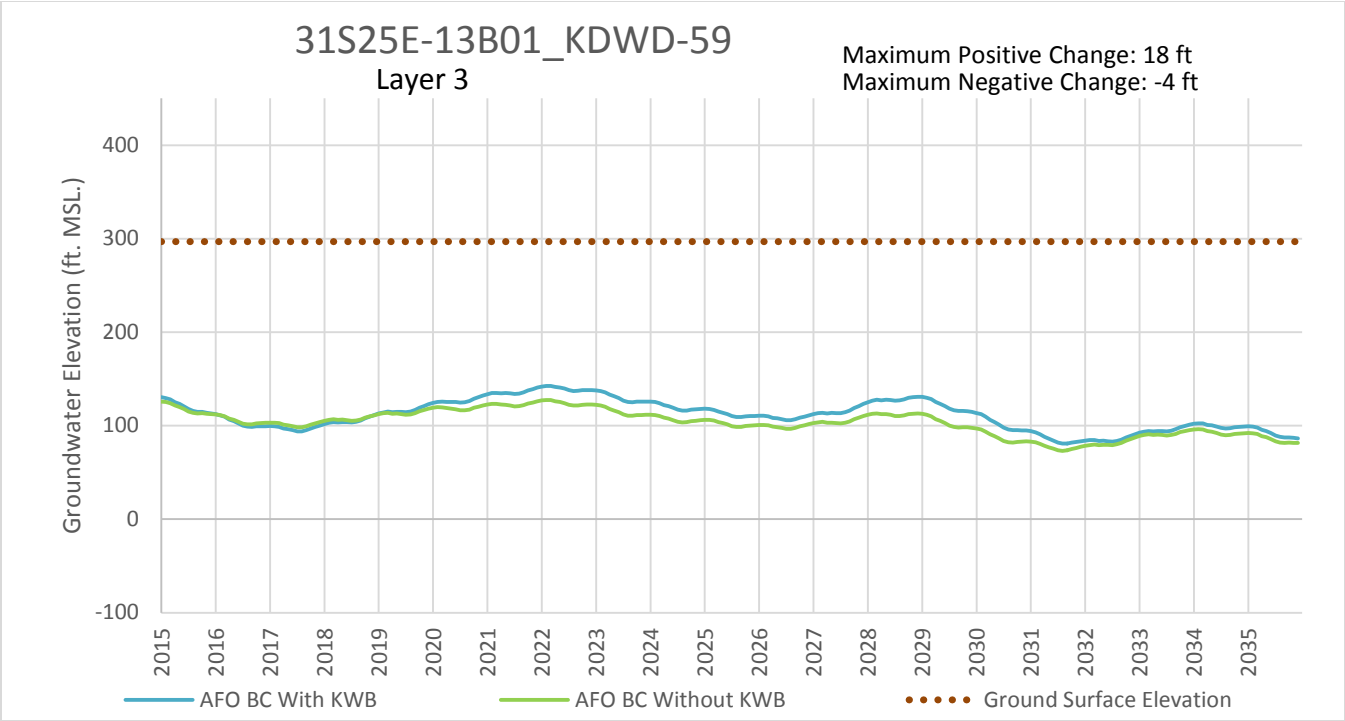

FIGURE 7-2 C.18. Hydrograph of Simulated Water Levels at Monitoring Well 31S25E-13B01_KDWD-59, 2015-2035

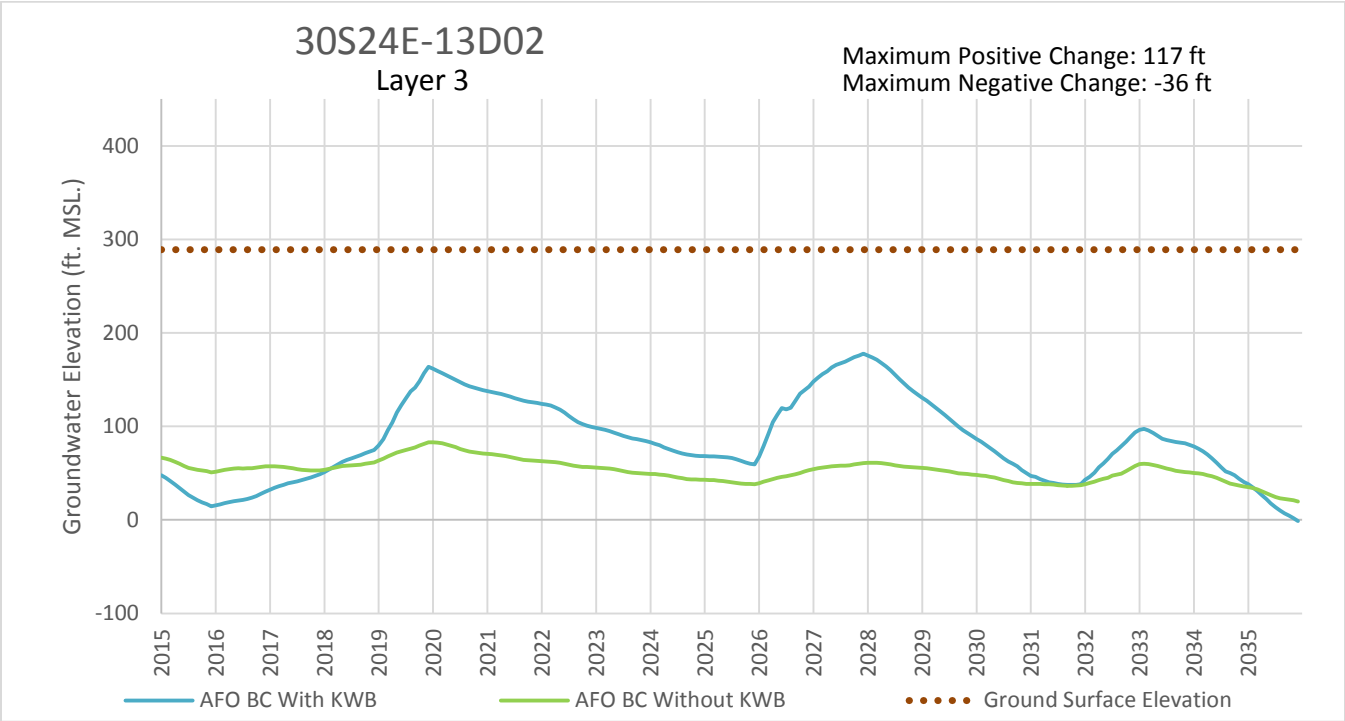

FIGURE 7-2 C.19. Hydrograph of Simulated Water Levels at Monitoring Well 30S24-13D02, 2015-2035

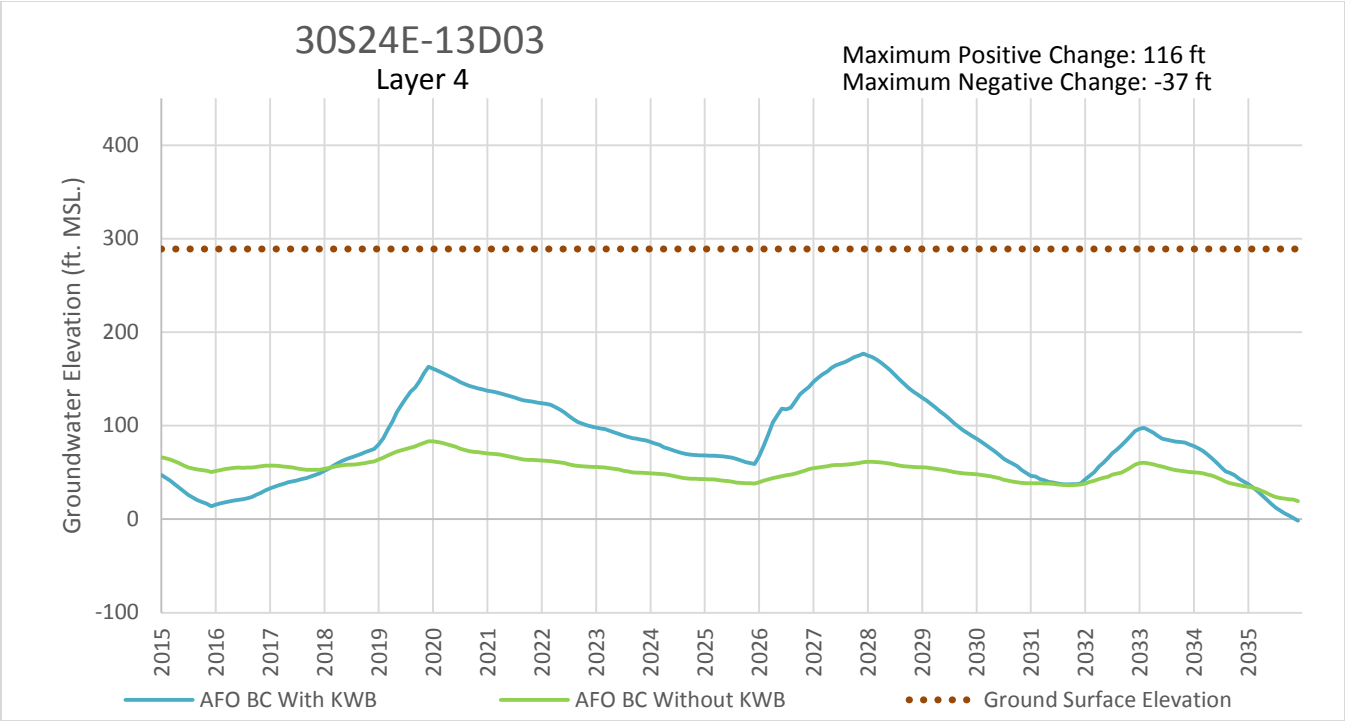

FIGURE 7-2 C.20. Hydrograph of Simulated Water Levels at Monitoring Well 30S24-13D03, 2015-2035

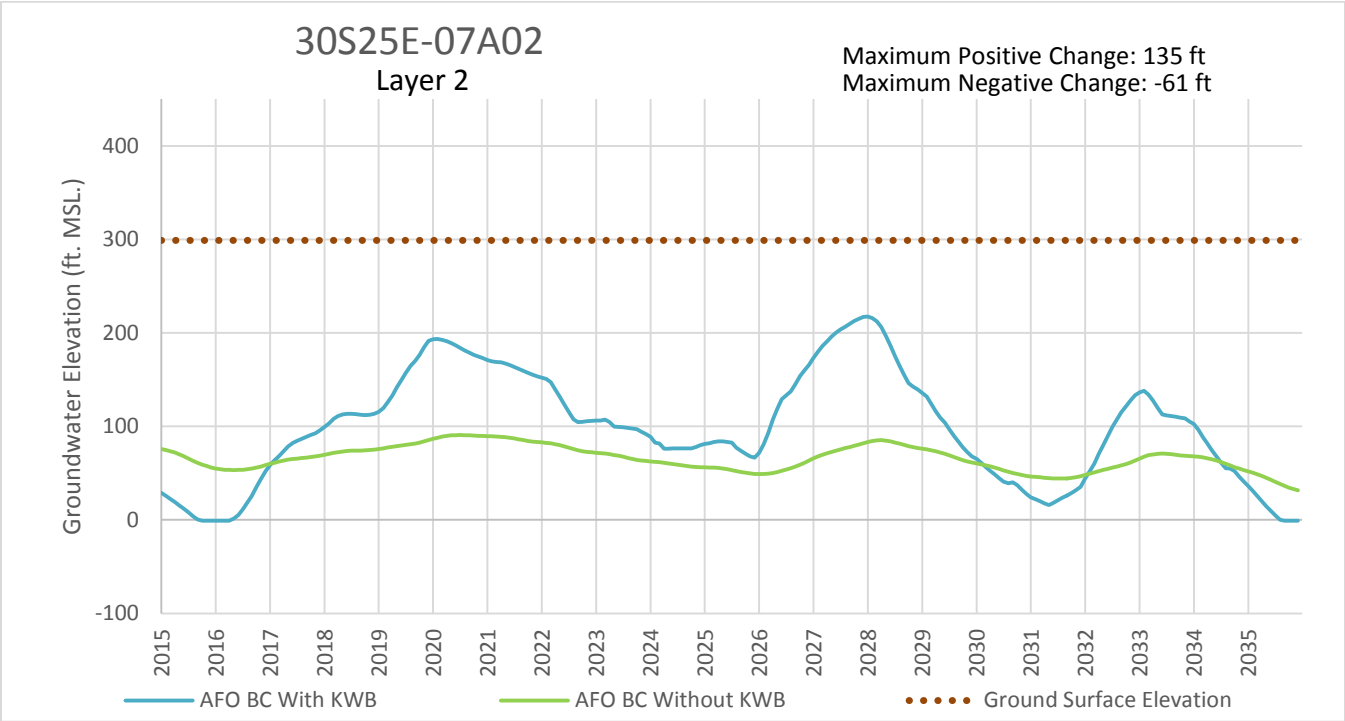

FIGURE 7-2 C.21. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-07A02, 2015-2035

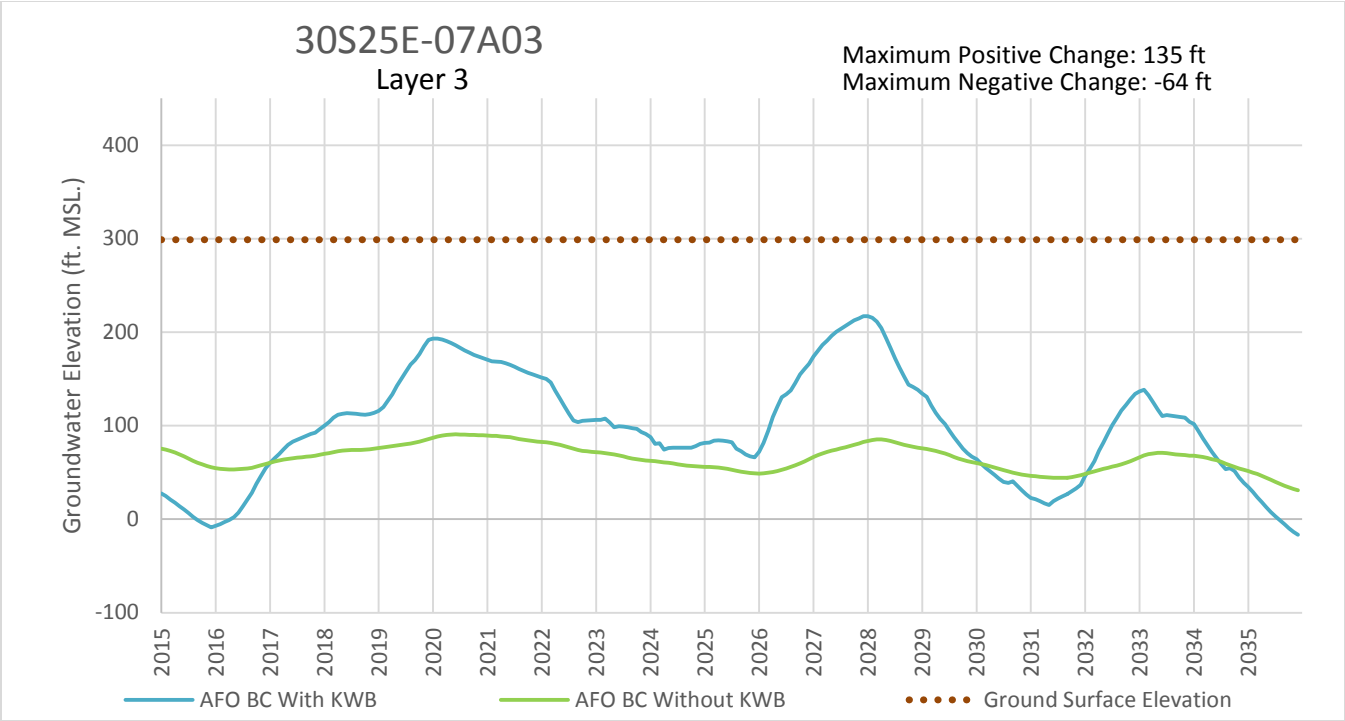

FIGURE 7-2 C.22. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-07A03, 2015-2035

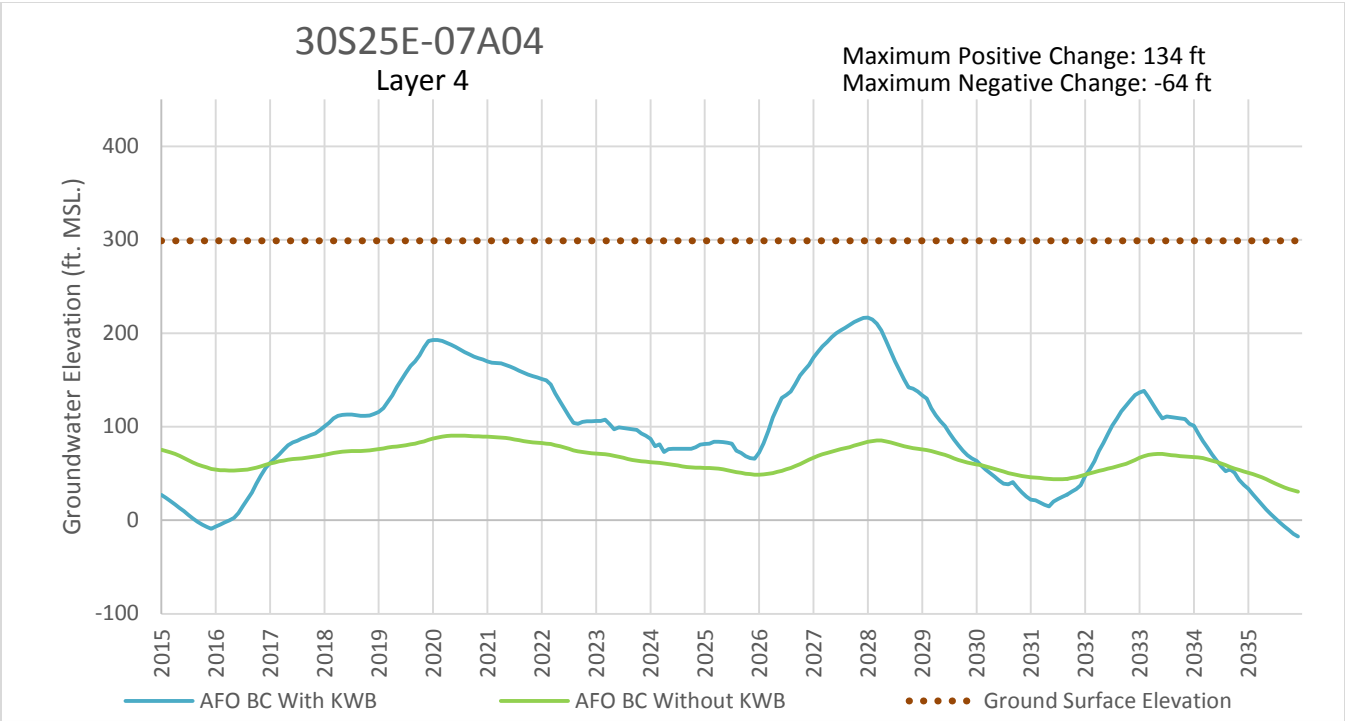

FIGURE 7-2 C.23. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-07A04, 2015-2035

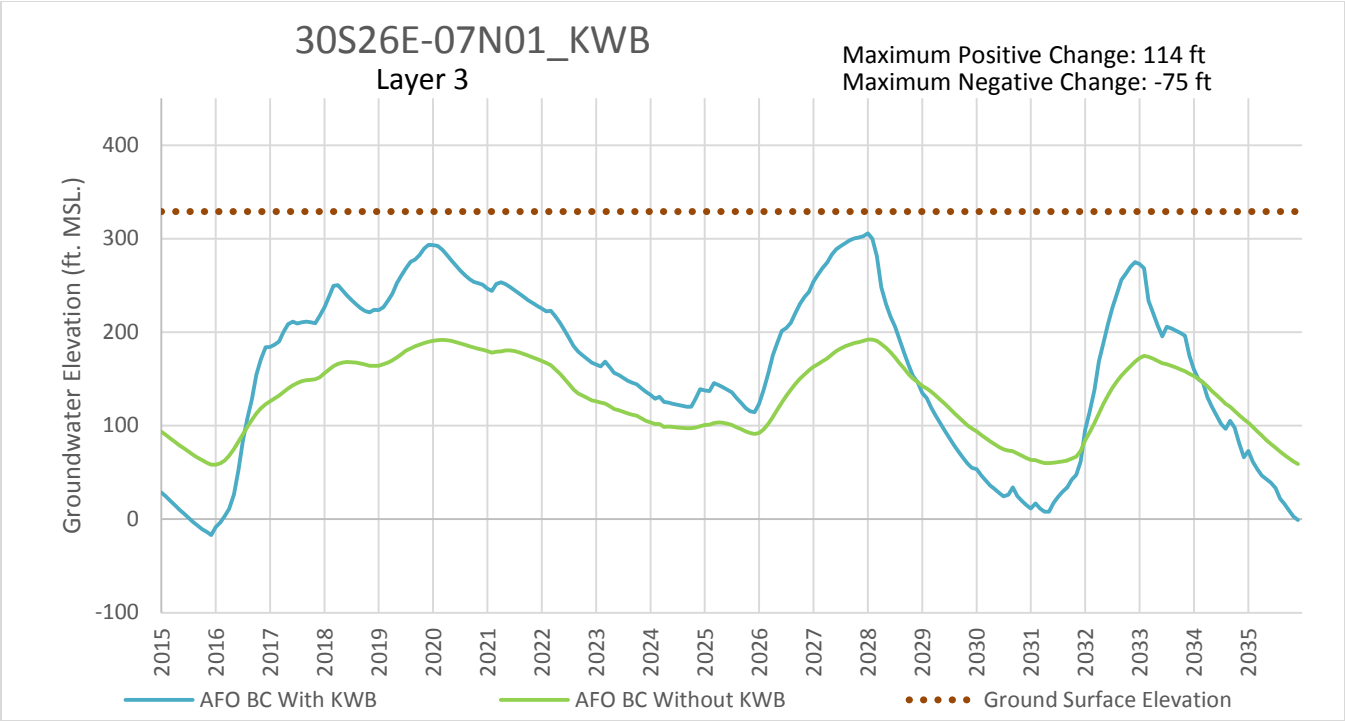

FIGURE 7-2 C.24. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-07N01_KWB, 2015-2035

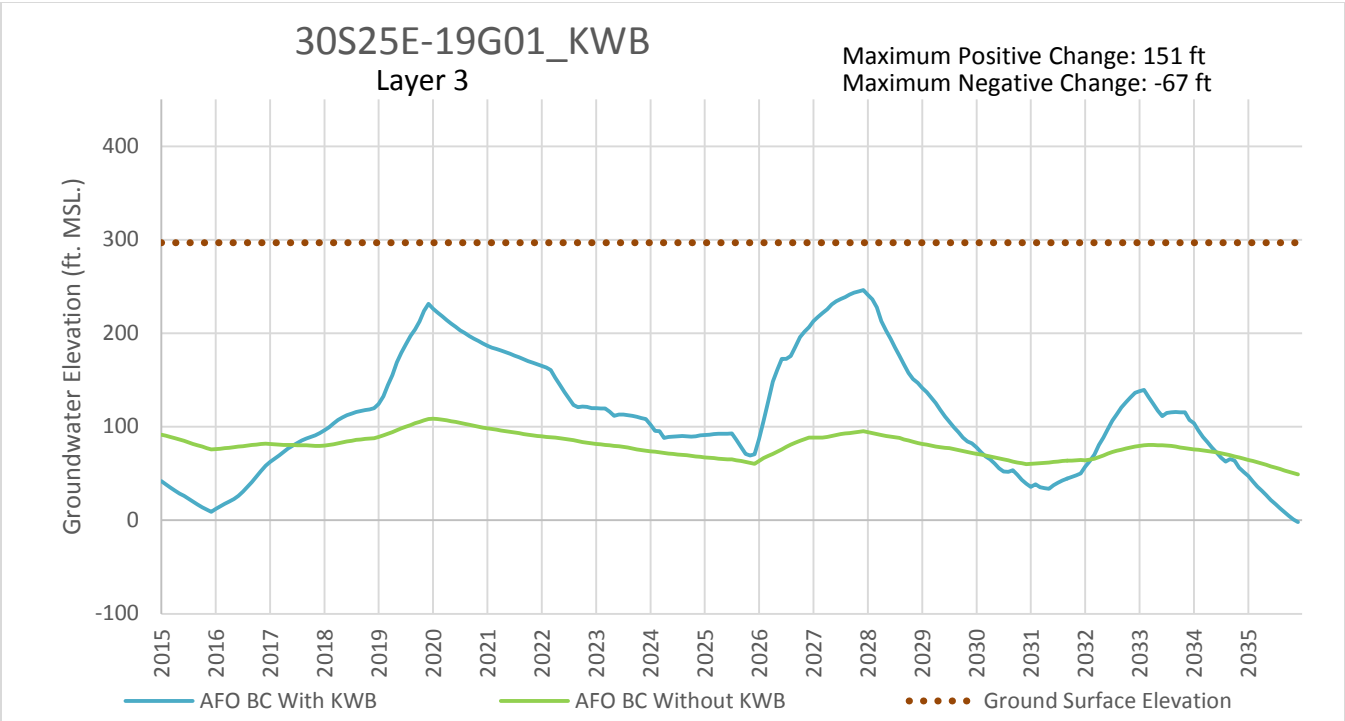

FIGURE 7-2 C.25. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-19G01_KWB, 2015-2035

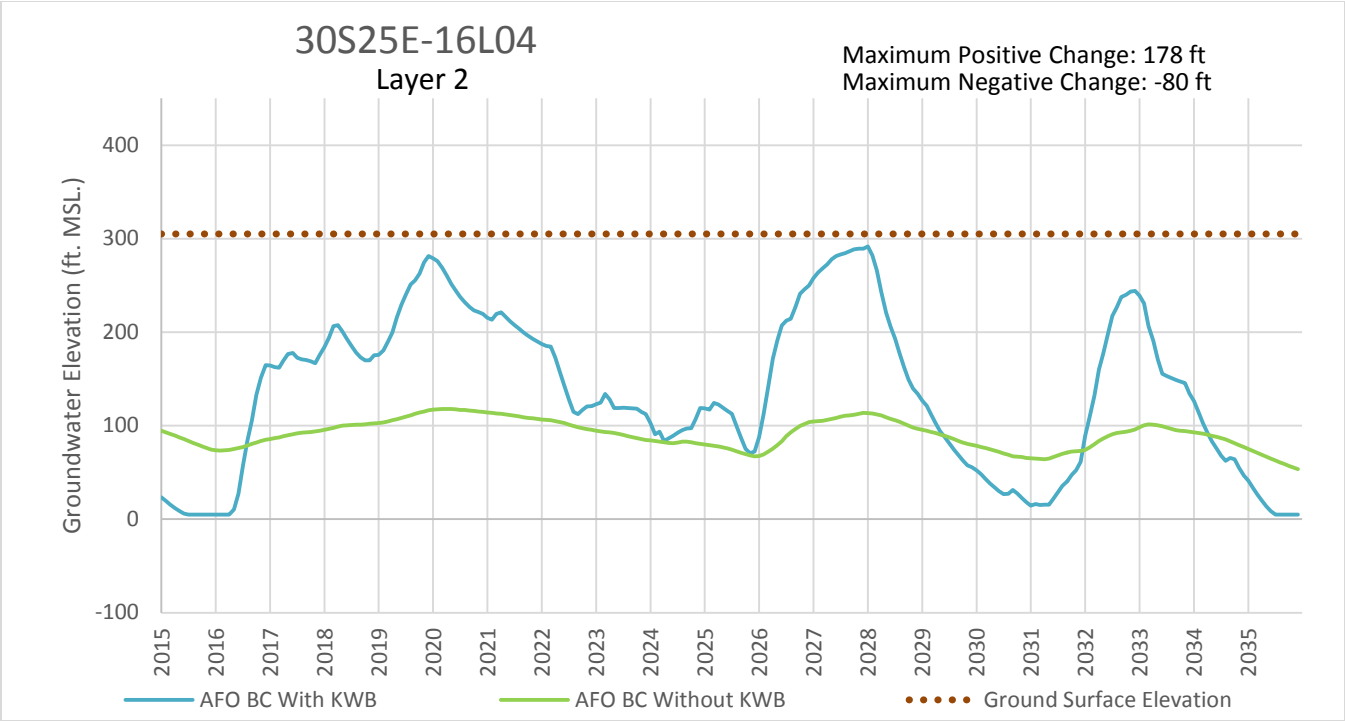

FIGURE 7-2 C.26. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-16L04, 2015-2035

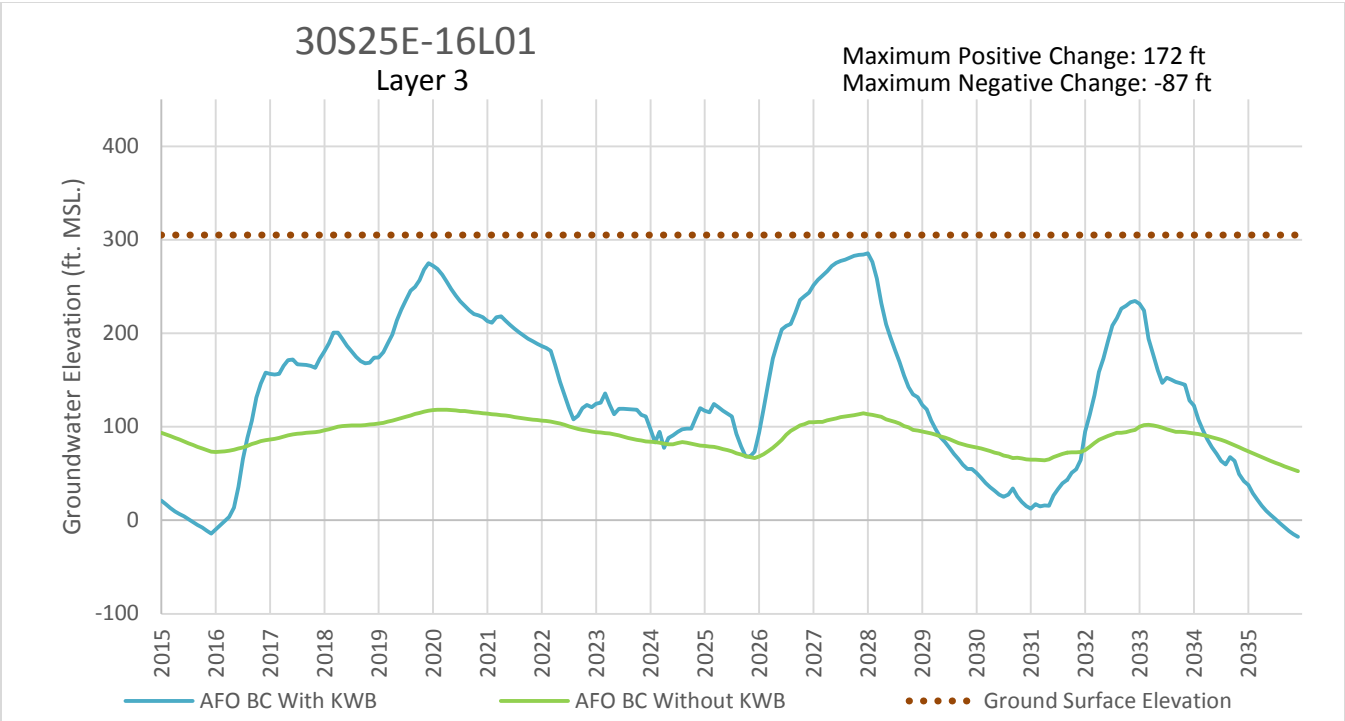

FIGURE 7-2 C.27. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-16L01, 2015-2035

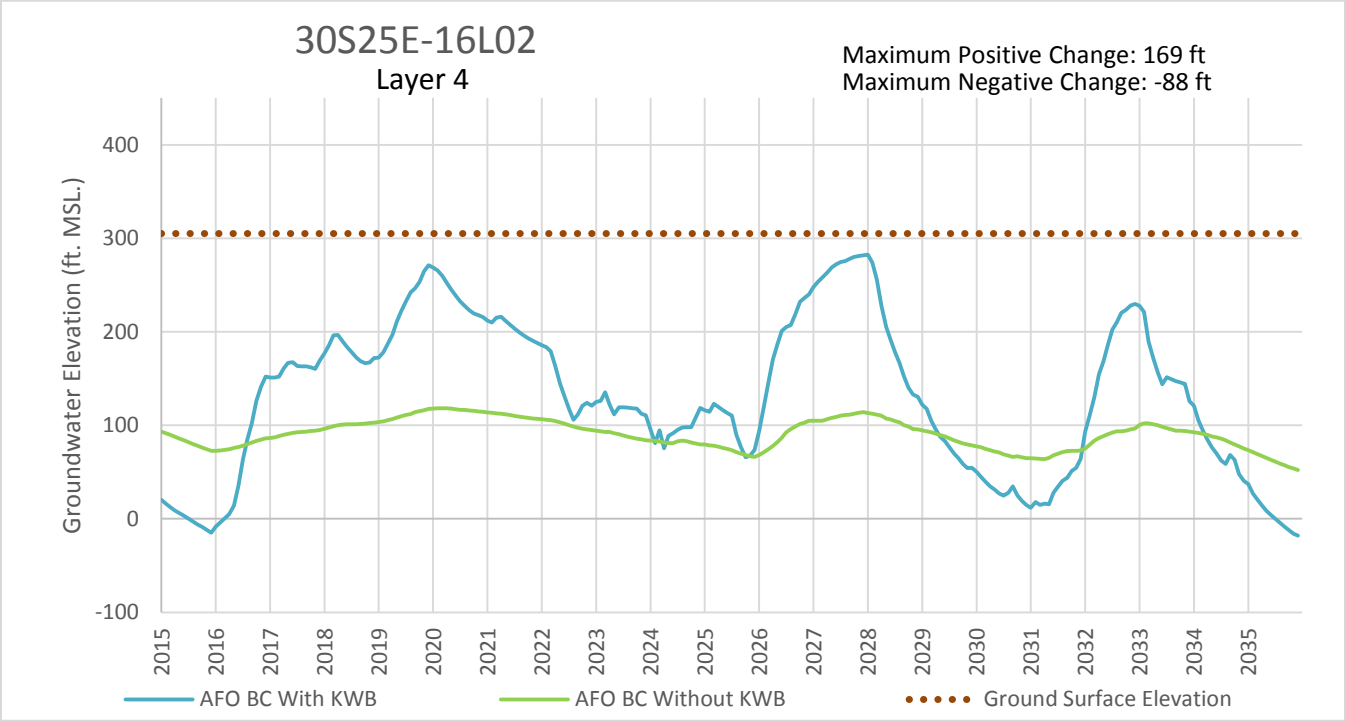

FIGURE 7-2 C.28. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-16L02, 2015-2035

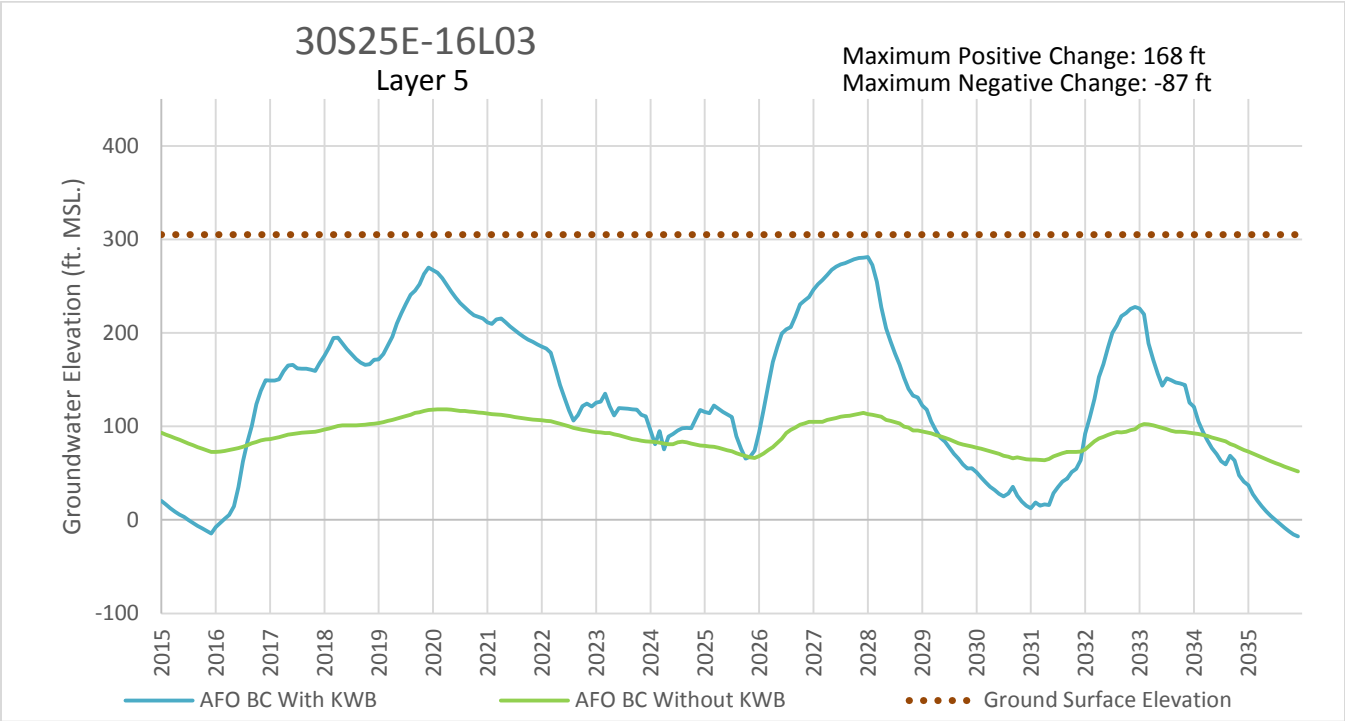

FIGURE 7-2 C.29. Hydrograph of Simulated Water Levels at Monitoring Well 30S25E-16L03, 2015-2035

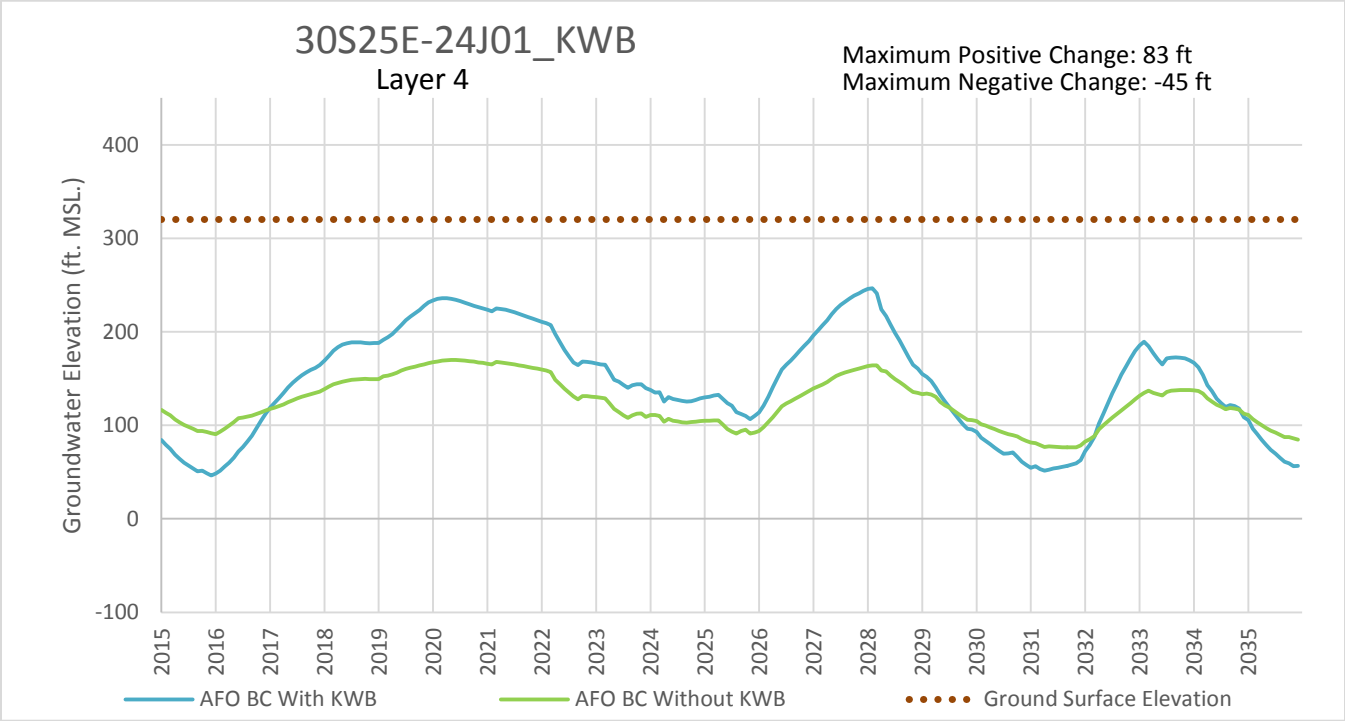

FIGURE 7-2 C.30. Hydrograph of Simulated Water Levels at Monitoring Well 30S257-24J01_KWB, 2015-2035

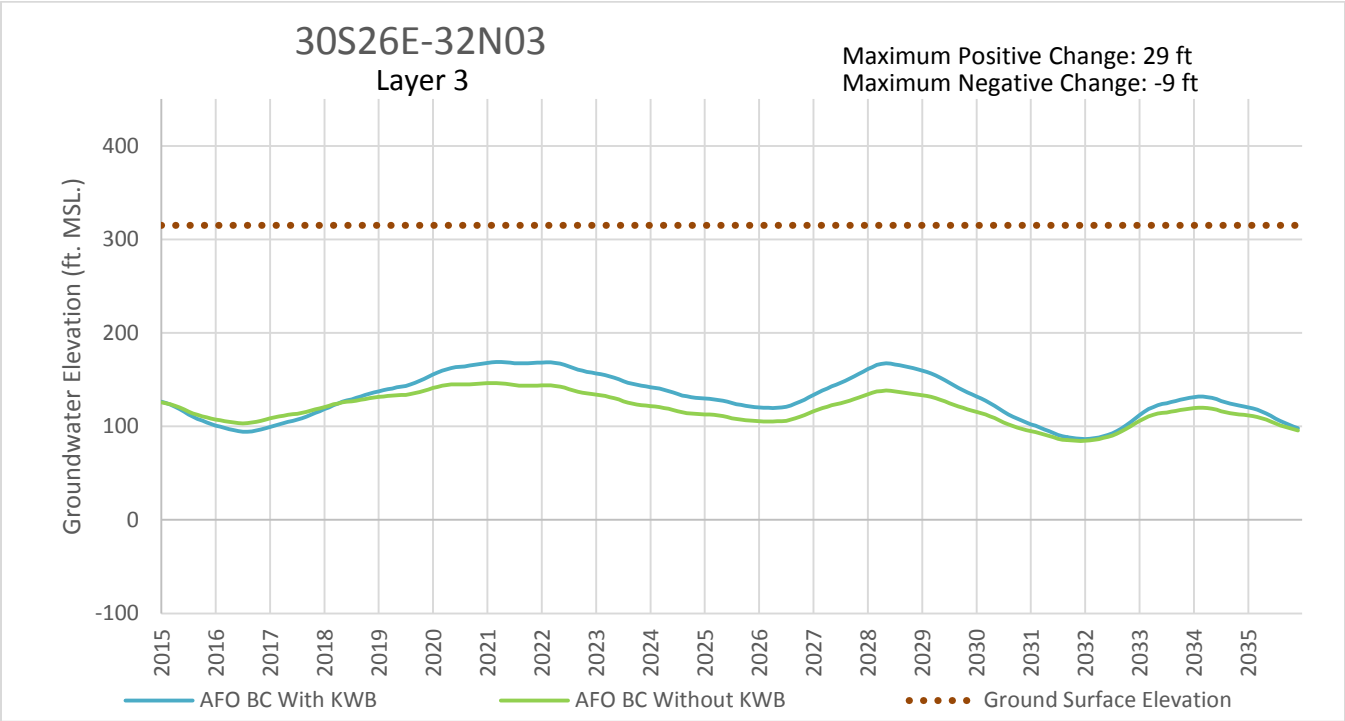

FIGURE 7-2 C.31. Hydrograph of Simulated Water Levels at Monitoring Well 30S26E-32N03, 2015-2035

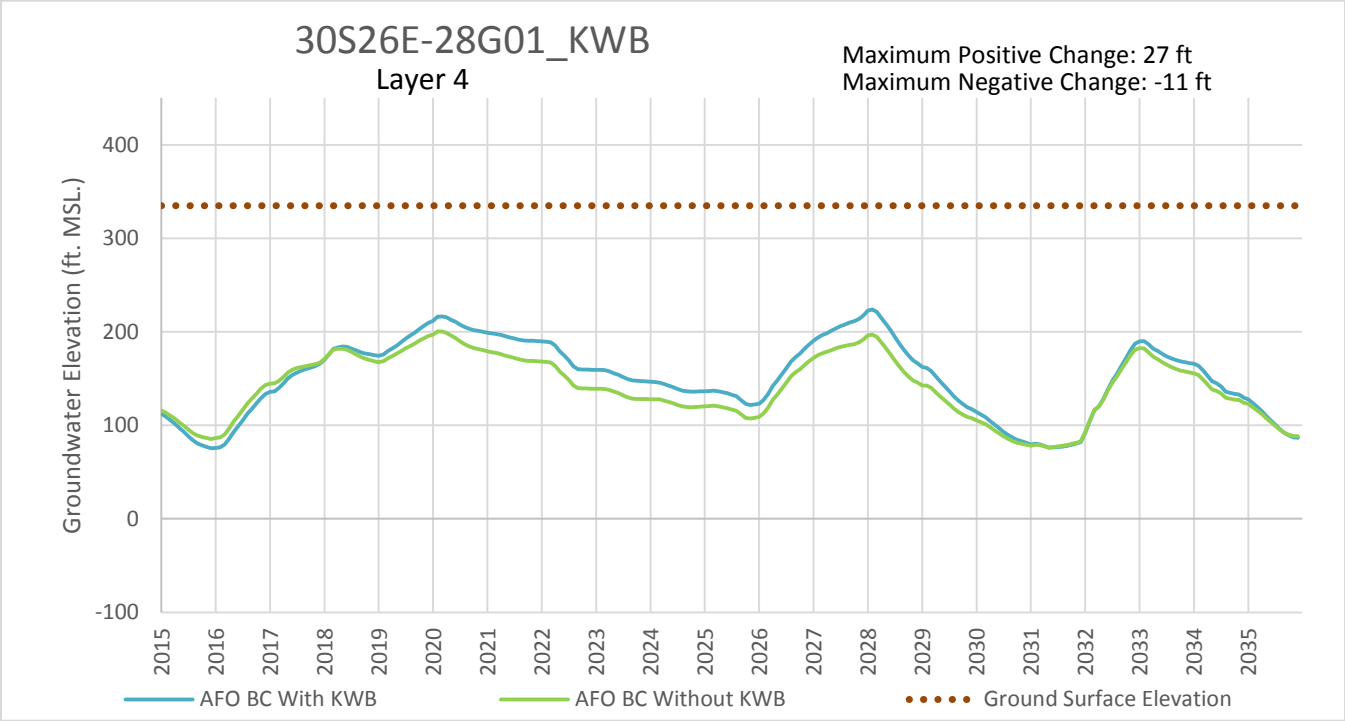

FIGURE 7-2 C.32. Hydrograph of Simulated Water Levels at Monitoring Well 30S267-28G01_KWB, 2015-2035

Appendix R

Well	As	Br	TCP	Cr+6	NO3	TDS	DOC	SO4	U	Cl	Well Sampling Dates				
	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l	pCi/l	mg/l					
30S/25E-36D01	10.0	510	NA	2.50	14.0	330	0.30	45	3.0	100	2/6/2012	2/6/2012	2/6/2012	2/6/2012	2/6/2012
30S/24E-24A01	< 0.7	100	< 0.002	0.27	7.7	480	0.89	130	30.0	36	3/8/2018	3/8/2018	3/8/2018	1/11/2012	3/8/2018
30S/25E-06K01	9.7	360	< 0.002	2.00	3.9	220	< 0.30	23	0.7	62	3/14/2018	3/14/2018	3/14/2018	12/12/2011	3/14/2018
30S/25E-07G01	1.7	340	< 0.002	1.60	7.2	310	0.32	86	1.1	72	1/12/2016	1/12/2016	4/28/2016	12/12/2011	1/12/2016
30S/25E-08F01	3.7	96	< 0.002	0.97	3.8	190	0.30	26	3.7	33	3/14/2018	3/14/2018	3/14/2018	12/19/2011	3/14/2018
30S/25E-08J02	48.0	500	< 0.002	0.80	1.7	320	< 0.30	24	1.2	110	3/14/2018	3/14/2018	3/14/2018	2/8/2012	3/14/2018
30S/25E-15B02	12.0	< 500	NA	0.61	4.8	220	< 0.30	45	9.7	44	10/17/2017	10/17/2017	10/17/2017	10/17/2017	10/17/2017
30S/25E-15C01	16.0	160	NA	1.70	3.6	180	0.32	25	2.6	58	1/5/2015	1/5/2015	1/5/2015	1/30/2012	1/5/2015
30S/25E-16B01	4.2	160	< 0.002	1.00	5.3	240	0.48	32	6.2	44	3/21/2018	3/21/2018	3/21/2018	1/4/2012	3/21/2018
30S/25E-16D01	26.0	86	< 0.002	1.30	2.4	160	0.34	20	4.8	28	3/21/2018	3/21/2018	3/21/2018	1/9/2012	3/21/2018
30S/25E-16F01	2.7	79	0.002	1.40	4.3	230	0.48	27	7.4	34	3/21/2018	3/21/2018	3/21/2018	1/9/2012	3/21/2018
30S/25E-04L02	44.0	< 500	NA	0.33	0.9	210	< 0.30	25	23.0	57	9/27/2017	9/27/2017	9/27/2017	9/27/2017	9/27/2017
30S/25E-05K01	1.9	120	0.004	0.63	4.3	240	0.45	28	4.3	38	4/18/2018	4/18/2018	4/18/2018	3/28/2012	4/18/2018
30S/25E-03L01	1.2	160	< 0.002	0.58	5.9	270	0.57	26	11.0	43	4/18/2018	4/18/2018	4/18/2018	1/16/2012	4/18/2018
30S/25E-09J01	2.5	160	< 0.002	1.00	4.0	270	0.54	35	11.0	41	3/18/2018	3/18/2018	3/18/2018	1/16/2012	3/18/2018
30S/25E-09L02	7.1	160	0.007	1.00	5.1	280	0.50	31	14.0	39	3/18/2018	3/18/2018	3/18/2018	idle	3/18/2018
30S/25E-12C01	< 1.0	610	NA	2.30	12.0	400	0.44	36	3.0	110	2/13/2012	2/13/2012	4/24/2016	2/13/2012	2/13/2012
30S/24E-12H01	< 0.7	< 58	< 0.002	0.76	10.0	400	0.44	130	14.0	49	3/8/2018	3/8/2018	3/8/2018	12/5/2011	3/8/2018
30S/24E-12R01	< 0.7	69	< 0.002	0.45	9.7	410	0.50	100	25.0	52	3/8/2018	3/8/2018	3/8/2018	12/5/2011	3/8/2018
30S/24E-13C01	< 0.7	93	< 0.002	0.35	5.9	520	0.62	160	26.0	52	3/8/2018	3/8/2018	3/8/2018	12/5/2011	3/8/2018
30S/24E-13H01	< 0.7	88	< 0.002	1.00	13.0	540	0.65	130	59.0	60	3/8/2018	3/8/2018	3/8/2018	12/5/2011	3/8/2018
30S/25E-01Q01	11.0	480	< 0.002	0.98	33.0	280	0.38	20	3.9	93	4/11/2018	4/11/2018	4/11/2018	2/13/2012	4/11/2018
30S/25E-03Q01	< 0.7	160	< 0.002	0.61	5.7	270	0.56	25	12.0	40	4/11/2018	4/11/2018	4/11/2018	1/18/2012	4/11/2018
30S/25E-03Q02	1.9	200	< 0.002	1.40	6.0	250	0.42	30	8.4	50	4/11/2018	4/11/2018	4/11/2018	2/8/2012	4/11/2018
30S/25E-03R01	0.8	120	< 0.002	0.71	3.5	250	0.66	20	14.0	29	4/11/2018	4/11/2018	4/11/2018	1/16/2012	4/11/2018
30S/25E-07P01	< 0.7	110	0.003	1.20	11.0	360	0.61	46	36.0	38	3/14/2018	3/14/2018	3/14/2018	12/12/2011	3/14/2018
30S/25E-07R01	1.0	130	0.003	1.40	9.6	320	0.38	77	7.8	39	3/14/2018	3/14/2018	3/14/2018	12/12/2011	3/14/2018
30S/25E-08P01	0.7	110	< 0.002	1.30	7.5	330	0.57	50	23.0	39	3/14/2018	3/14/2018	3/14/2018	12/19/2011	3/14/2018
30S/25E-09A01	0.8	200	0.010	1.10	6.5	280	0.42	31	9.6	45	4/11/2018	4/11/2018	4/11/2018	1/25/2012	4/11/2018
30S/25E-10K01	0.9	110	< 0.002	0.73	3.6	260	0.68	26	12.0	32	4/11/2018	4/11/2018	4/11/2018	1/16/2012	4/11/2018
30S/25E-11A01	0.8	210	< 0.002	1.90	8.2	230	0.33	24	3.0	49	4/11/2018	4/11/2018	4/11/2018		4/11/2018
30S/25E-11C02	< 0.7	150	< 0.002	1.20	6.9	310	0.49	28	16.0	43	4/11/2018	4/11/2018	4/11/2018	1/18/2012	4/11/2018
30S/25E-11E01	< 0.7	140	< 0.002	0.92	6.0	320	0.68	32	22.0	40	4/18/2018	4/18/2018	4/18/2018	1/16/2012	4/18/2018
30S/25E-11L02	73.0	200	NA	0.57	2.5	240	0.41	22	8.0	43	9/4/2015	9/4/2015	9/4/2015	9/4/2015	9/4/2015
30S/25E-11N01	1.0	230	< 0.002	1.90	6.8	280	0.48	37	7.2	56	4/12/2018	4/12/2018	4/12/2018	1/18/2012	4/12/2018
30S/25E-11Q01	0.9	340	< 0.002	2.40	8.4	310	0.48	31	7.8	69	4/11/2018	4/11/2018	4/11/2018	2/8/2012	4/11/2018
30S/25E-11R01	44.0	320	NA	1.90	4.7	220	0.52	26	4.8	59	11/5/2015	11/5/2015	11/5/2015	11/5/2015	11/5/2015
30S/25E-13B01	19.0	230	NA	1.70	9.8	250	0.95	44	6.7	58	7/16/2015	7/16/2015	7/16/2015	7/16/2015	7/16/2015
30S/25E-13F01	2.0	82	< 0.002	1.60	5.4	300	0.45	34	3.0	26	4/12/2018	4/12/2018	4/12/2018	2/8/2012	4/12/2018
30S/25E-13J01	3.6	59	< 0.002	1.10	1.5	160	0.48	15	4.1	18	4/12/2018	4/12/2018	4/12/2018	1/27/2012	12/22/2014
30S/25E-13L01	5.2	120	0.002	1.40	3.8	200	0.41	25	2.1	30	4/12/2018	4/12/2018	4/12/2018	1/25/2012	1/6/2015
30S/25E-14E01	0.9	140	< 0.002	0.89	3.0	260	0.72	25	11.0	25	4/11/2018	4/11/2018	4/11/2018	4/30/2012	1/6/2015
30S/25E-14J01	2.1	160	0.002	1.30	4.9	250	0.37	43	3.1	44	3/12/2018	3/12/2018	3/12/2018	1/25/2012	3/12/2018
30S/25E-14K01	1.6	270	NA	0.82	2.6	260	0.39	39	4.7	56	12/22/2014	12/22/2014	4/24/2016	1/25/2012	12/22/2014
30S/25E-14N01	1.6	79	< 0.002	0.77	3.4	250	0.49	40	6.4	36	3/21/2018	3/21/2018	3/21/2018	1/18/2012	3/21/2018
30S/25E-14R01	1.8	120	< 0.002	1.20	4.3	240	0.40	42	4.4	46	3/21/2018	3/21/2018	3/21/2018	4/30/2012	3/21/2018
30S/25E-15L01	3.4	77	< 0.002	0.91	2.7	240	0.52	32	7.5	36	3/21/2018	3/21/2018	3/21/2018	2/20/2013	3/21/2018
30S/25E-15N01	5.0	84	< 0.002	0.87	2.3	260	0.61	28	18.0	32	3/21/2018	3/21/2018	3/21/2018	1/11/2012	3/21/2018
30S/25E-15Q01	8.5	62	< 0.002	1.30	1.3	190	0.43	22	6.5	25	3/21/2018	3/21/2018	3/21/2018	12/21/2011	3/21/2018
30S/25E-15R01	0.8	110	< 0.002	0.99	4.0	270	0.43	44	9.1	41	3/21/2018	3/21/2018	3/21/2018	4/30/2012	3/21/2018
30S/25E-16J01	9.5	140	< 0.002	1.20	4.6	240	0.45	33	5.0	46	3/21/2018	3/21/2018	3/21/2018	1/4/2012	3/21/2018
30S/25E-16M01	1.9	150	< 0.002	0.49	4.7	290	0.74	32	20.0	45	4/18/2018	4/18/2018	4/18/2018	1/4/2012	4/18/2018
30S/25E-16P01	1.8	79	< 0.002	1.60	4.8	250	0.43	35	6.5	42	3/21/2018	3/21/2018	3/21/2018	1/9/2012	3/21/2018
30S/25E-17F01	1.6	150	< 0.002	0.71	4.9	270	0.50	29	16.0	34	3/14/2018	3/14/2018	3/14/2018	12/19/2011	3/14/2018
30S/25E-17H01	1.3	93	< 0.002	1.30	4.6	260	0.39	30	9.5	33	3/21/2018	3/21/2018	3/21/2018	1/4/2012	3/21/2018
30S/25E-17J01	1.7	100	< 0.002	0.48	3.7	260	0.56	25	15.0	33	3/21/2018	3/21/2018	3/21/2018	1/9/2012	3/21/2018
30S/25E-17M01	0.9	140	< 0.002	0.75	9.3	330	0.47	44	19.0	43	3/14/2018	3/14/2018	3/14/2018	12/7/2011	3/14/2018
30S/25E-17P01	1.6	110	< 0.002	0.55	5.2	260	0.44	33	14.0	40	3/21/2018	3/21/2018	3/21/2018	1/9/2012	3/21/2018
30S/25E-18A02	1.1	99	< 0.002	0.90	8.3	310	0.43	57	17.0	39	3/14/2018	3/14/2018	3/14/2018	1/11/2013	3/14/2018
30S/25E-18C01	1.3	140	< 0.002	0.48	11.0	410	0.49	95	22.0	52	3/14/2018	3/14/2018	3/14/2018	12/12/2011	3/14/2018
30S/25E-18K01	< 0.7	190	< 0.002	0.36	14.0	480	0.56	130	21.0	70	3/14/2018	3/14/2018	3/14/2018	12/7/2011	3/14/2018
30S/25E-18P01	< 0.7	88	< 0.002	0.65	5.2	490	0.58	130	31.0	63	3/8/2018	3/8/2018	3/8/2018	12/7/2011	3/8/2018
30S/25E-18R01	1.0	180	< 0.002	0.80	10.0	410	0.57	85	24.0	59	3/14/2018	3/14/2018	3/14/2018	12/7/2011	3/14/2018
30S/25E-20A01	1.4	140	0.002	0.72	4.7	260	0.43	45	14.0	46	4/12/2018	4/12/2018	4/12/2018	12/21/2011	4/12/2018
30S/25E-20C01	1.1	230	< 0.002	0.75	5.4	400	0.44	100	13.0	69	4/12/2018	4/12/2018	4/12/2018	12/21/2011	4/12/2018
30S/25E-20L01	1.6	290	< 0.002	0.97	6.5	470	0.52	140	14.0	78	4/12/2018	4/12/2018	4/12/2018	12/21/2011	4/12/2018
30S/25E-21A02	2.1	93	< 0.002	0.81	2.5	260	0.57	18	13.0	25	4/12/2018	4/12/2018	4/12/2018	12/21/2011	4/12/2018
30S/25E-21D01	1.5	71	< 0.002	1.30	2.7	220	0.46	21	7.2	28	4/12/2018	4/12/2018	4/12/2018	12/21/2011	4/12/2018
30S/25E-21G01	1.2	160	NA	0.93	3.4	260	0.42	32	11.0	45	idle	idle	idle	idle	idle
30S/25E-23H01	16.0	110	< 0.002	0.49	2.2	170	< 0.30	18	1.9	30	4/12/2018	4/12/2018	4/12/2018	3/21/2012	4/12/2018
30S/26E-06N01	2.1	260	< 0.002	0.95	4.3	250	0.41	22	7.6	50	4/11/2018	4/11/2018	4/11/2018	1/30/2012	4/11/2018
30S/26E-06P01	1.0	260	< 0.002	0.93	6.0	310	0.42	31	9.2	60	4/11/2018	4/11/2018	4/11/2018	1/30/2012	4/11/2018
30S/26E-07C01	1.3	530	< 0.002	1.70	8.3	320	0.41	28	4.7	98	4/11/2018	4/11/2018	4/11/2018	2/1/2012	4/11/2018
30S/26E-07J01	1.2	110	< 0.002	1.30	4.7	210	0.37	21	5.4	27	4/11/2018	4/11/2018	4/11/2018	2/1/2012	4/11/2018
30S/26E-07L01	52.0	220	NA	1.50	4.0	200	0.36	20	3.4	41	2/3/2015	2/3/2015	4/24/2016	1/30/2012	2/3/2015
30S/26E-07N01	0.9	100	< 0.002	2.30	8.2	240	0.48	28	5.2	31	4/11/2018	4/11/2018	4/11/2018	1/30/2012	4/11/2018
30S/26E-07Q01	1.5	83	< 0.002	1.40	4.6	200	0.49	23	6.1	25	4/12/2018	4/12/2018	4/12/2018	2/1/2012	4/12/2018
30S/26E-07R01	1.2	84	< 0.002	1.30	4.6	200	0.41	20	4.8	20	4/11/2018	4/11/2018	4/11/2018	2/1/2012	4/11/2018
30S/26E-08M01	4.6	99	< 0.002	1.60	2.8	160	0.50	17	3.3	17	4/12/2018	4/12/2018	4/12/2018	2/1/2012	4/12/2018
30S/26E-18B01	1.1	< 58	< 0.002	1.50	3.9	200	0.42	22	5.4	20	4/12/2018	4/12/2018	4/12/2018	2/1/2012	4/12/2018
30S/26E-18D01	1.5	77	< 0.002	1.40	4.2	220	0.44	25	6.5	24	4/12/2018	4/12/2018	4/12/2018	2/6/2012	4/12/2018
30S/25E-24K01	26.0	130	NA	0.62	4.6	220	0.30	34	5.0	39	1/12/2015	1/12/2015	4/24/2016	2/8/2012	1/12/2015
30S/26E-17Q01	12.0	62	NA	1.80	4.6	170	0.30	27	3.5	18	1/21/2015	1/21/2015	9/16/2015	2/8/2012	1/21/2015
30S/26E-19G01	3.0	74	NA	1.40	8.0	220	0.48	38	2.4	23	1/19/2015	1/19/2015	4/24/2016	2/6/2012	1/19/2015
30S/26E-19M01	3.6	78	NA	2.20	6.9	180	< 0.30	35	1.1	22	1/12/2015	1/12/2015	4/28/2016	2/6/2012	1/12/2015
30S/26E-20C01	1.1	66	NA	1.00	6.7	190	0.38	32	2.0	20	2/3/2015	2/3/2015	4/24/2016	2/13/2012	2/3/2015
30S/26E-20L01	5.3	61	NA	1.80	8.7	170	0.33	37	< 0.7	20	1/19/2015	1/19/2015	4/24/2016	3/28/2012	1/19/2015
30S/26E-20N02	21.0	99	NA	2.20	7.0	180	< 0.30	37	1.0	25	1/13/2015	1/13/2015	4/24/2016	3/28/2012	1/13/2015

Appendix S

Summary of Well Production - 6/1/2018 to 6/30/2018

Pool	Project	Well	6/1	6/2	6/3	6/4
Pool One	KWB	30S/25E-06K01	3.8	3.8	3.8	3.8
		30S/25E-07G01	7.7	7.7	7.7	7.7
		30S/25E-08F01	4.2	4.2	4.2	4.2
		30S/25E-08J02	2.2			
		30S/25E-16B01	5.0	5.0	5.0	5.1
		30S/25E-16D01	5.1	5.2	5.2	5.2
		30S/25E-16F01	3.7	3.7	3.7	3.7
		30S/24E-24A01	3.8	3.8	3.7	3.8
Pool 2	KWB	30S/25E-05K01	4.0	4.0	3.9	1.8
		30S/25E-09J01	1.8	1.8	1.8	1.8
		30S/25E-09L02	3.6	3.6	3.7	3.7
Pool 3	KWB	30S/25E-12C01	1.8			
West	KWB	30S/25E-17F01				
		30S/25E-17H01				
		30S/25E-17J01				
		30S/25E-17M01				
		30S/25E-17P01				
		30S/25E-18A02				
		30S/25E-18K01				
		30S/25E-18R01				
		30S/25E-20L01				
		CFS	46.7	42.8	42.7	40.7
		AF	93	85	85	81

Well Efficiency

From 06/01/2018 - 06/30/2018

Group	Name	Average from 06/01/2018 - 06/30/2018						6/1	6/2	6/3	6/4
		Totalizer Difference	PG&E Meter Difference	Meter Constant	kWh	kWh/AF	$/AF				
Main	30S/25E-16B01	105.37	652.63	80.00	52210.21	495.51	$70.29	502.45	500.35	497.14	496.50
	30S/25E-16D01	107.83	623.30	80.00	49864.29	462.44	$65.60	474.09	467.42	463.25	465.40
	30S/25E-16F01	62.62	315.67	120.00	37880.22	604.91	$85.81	599.94	593.69	596.36	599.17
	30S/25E-17H01	293.98	1222.45	120.00	146693.44	499.00	$70.78				
	30S/25E-17J01	325.20	1262.59	120.00	151510.20	465.90	$66.09				
	30S/25E-17P01	322.06	1339.50	80.00	107160.14	332.74	$47.20				
	30S/25E-20L01	302.11	1001.76	120.00	120211.20	397.91	$56.44				
North	30S/25E-05K01	36.35	238.57	80.00	19085.41	525.06	$74.48	519.21	514.53	508.79	508.73
Strand	30S/25E-09J01	37.18	147.36	40.00	5894.23	158.53	$22.49	158.17	153.80	153.67	160.00
	30S/25E-09L02	76.64	456.99	80.00	36559.36	477.01	$67.66	488.10	488.27	485.84	475.95
West	30S/24E-24A01	78.47	344.69	80.00	27575.49	351.39	$49.84	346.94	346.58	360.03	354.15
	30S/25E-06K01	78.66	540.71	80.00	43257.07	549.93	$78.01	552.00	549.86	547.72	548.15
	30S/25E-07G01	158.96	809.93	80.00	64794.74	407.61	$57.82	405.65	406.76	408.50	408.23
	30S/25E-08F01	87.52	219.62	80.00	17569.27	200.75	$28.48	199.51	199.94	204.74	201.62
	30S/25E-17F01	184.32	854.63	80.00	68370.07	370.94	$52.62				
	30S/25E-17M01	277.06	984.29	120.00	118115.06	426.31	$60.47				
	30S/25E-18A02	246.70	1305.15	80.00	104411.75	423.24	$60.04				
	30S/25E-18K01	307.25	1230.90	120.00	147707.52	480.74	$68.19				
	30S/25E-18R01	207.62	1020.92	80.00	81673.91	393.38	$55.80				

Appendix T

Article III. - Well Standards

14.08.190 - General location of well.
14.08.200 - Well casing material and installation.
14.08.210 - Well construction standards.
14.08.220 - Cathodic protection wells.
14.08.230 - Hazardous material monitoring well.
14.08.240 - Sealing the upper annular space.
14.08.250 - Sealing conditions.
14.08.260 - Annular seal—Sealing off strata.
14.08.270 - Well development or redevelopment.
14.08.280 - Surface construction features.
14.08.290 - Responsibility for compliance.
14.08.300 - Surface sealing.
14.08.310 - Disinfection of wells.
14.08.320 - Other sanitary requirements.
14.08.330 - Water quality testing.
14.08.340 - Approval by health officer.
14.08.350 - Well conversion.
14.08.360 - Well destruction.
14.08.370 - Out of service wells.
14.08.380 - Administrative variance.

14.08.190 - General location of well.

A. It shall be unlawful for any person to drill, dig, excavate or bore any well in any location in which sources of pollution or contamination are known to exist at such location whereby ground water may become contaminated or polluted even when the well is properly constructed and maintained.

B. It shall be unlawful to locate a well and utilize the well for future domestic purposes on lots in the residential or estate zone districts when a connection with a public water supply system willing and able to serve such development is available within the public water supply system service area or when a connection already exists.

C. All wells shall be located an adequate horizontal distance from potential sources of contamination and pollution, with due consideration given to local geological conditions and soil permeability. In any event, as a minimum, the following setback distances shall apply:

1. Septic tank or sewer line, one hundred (100) feet;

2. Subsurface sewage leaching field, one hundred (100) feet;

3. Cesspool, seepage pit or pit privy, one hundred fifty (150) feet;

4. Hazardous material site, two hundred (200) feet;

5. Animal enclosures, one hundred (100) feet;

6. Stormwater runoff sump or agricultural drainage sump, one hundred (100) feet;

7. Front property line (not including easements), twenty-five (25) feet;

8. Other property line (not including easements), five (5) feet;

9. Agricultural or industrial well, two hundred (200) feet;

10. Another well (except hard rock), one hundred (100) feet;

11. Class I, II, III waste disposal well, two hundred (200) feet.

D. The effect on surrounding properties must be considered when measuring setback distances. No approval by the department should limit or hinder the free and equal use of property by adjacent property owners, except where they have given their approval in writing to the applicant. Such written approval shall be in a form satisfactory to the department and may be required to be recorded with the county recorder.

E. Where extraordinary danger of degradation exists or special hazards are involved, the above distances shall be increased, or special means of protection particularly in the construction of the well, shall be provided as determined by the health officer. All wells shall be located up gradient from the specified source of contamination.

F. All wells drilled within an A (agricultural) zone district shall be set back a distance of seventy (70) feet from midsection lines and eighty (80) feet from section lines, except that where circumstances justify, an administrative variance may be granted pursuant to Section 14.08.380

G. The top of the well casing shall extend a minimum of one (1) foot above the 100-year (one hundred-year) base flood elevation as determined by the Federal Emergency Management Agency ("FEMA"), county engineering and survey services department or by any special flood study approved by representatives of the county. The proposed well site shall meet the minimum standards as provided in Chapter 17.48 of this code.

H. Where the proposed well is to be located near a building, such well shall be located far enough from the building so that it will be accessible for repair, maintenance, etc.

I. The proposed well may not be moved more than five (5) feet from the originally approved site location without a reinspection of the new site being performed by the health officer.

(Ord. G-7417 § 7, 2006; Ord. G-6906 § 8, 2002; Ord. G-6776 § 7, 2001; Ord. G-5356 § 4, 1990; Ord. G-5006 § 2 (part), 1989)

14.08.200 - Well casing material and installation.

Well casing shall be new with a minimum thickness of 3/16″ (0.188″). All other requirements for casing materials and installation shall be as outlined in Chapter II, Part II, Section 12 of Bulletin 74-81 "Water Well Standards"—State of California." Provided, however, that the use of fiberglass casing is not approved. PVC well casing must display the letters NSF-wc (National Sanitation Foundation well casing.)

(Ord. G-5006 § 2 (part), 1989)

14.08.210 - Well construction standards.

A. Except as otherwise specified, the standards for the construction, repair, reconstruction or destruction of wells shall be as set forth in:

1. Department of Water Resources Bulletin 74-81. The California Department of Water Resources Bulletin 74-81 "Water Well Standards, State of California" except as modified by subsequent revisions;

2. All Subsequent Supplements and Revisions. All subsequent Bulletin 74-81 supplements or revisions issued by the Department of Water Resources, once the revised standards have been reviewed at appropriate public hearing.

B. Drilling Fluids or Additives. The use of any used drilling fluids or additives for any purpose in the construction of a well is prohibited.

C. The use of any polluted or contaminated water in the actual drilling process or for flushing the well hole is prohibited.

D. It is unlawful to inject any pesticide or chemical into the discharge pipe of a well which is not equipped with an approved backflow protection device or methods as described in Section 14.08.280

(Ord. G-5356 § 6, 1990: Ord. G-5006 § 2 (part), 1989)

14.08.220 - Cathodic protection wells.

Cathodic protection wells shall be constructed and sealed in conformance with the cathodic well standards set forth in Bulletin 74-1, "Cathodic Protection Well Standards," including the latest revisions thereof, with the exception that the depth of the annular seal shall be as required in Section 14.08.240.

(Ord. G-5006 § 2 (part), 1989)

14.08.230 - Hazardous material monitoring well.

Hazardous material monitoring wells shall be constructed and sealed in conformance with the standards set forth in the county health department publication UT-50 or any successor publication.

(Ord. G-5006 § 2 (part), 1989)

(Ord. No. G-8035, § 43, 4-20-10)

14.08.240 - Sealing the upper annular space.

A. The area between the wall of the well bore and the well casing of the drilled hole (the annular space) shall be effectively sealed to protect it against contamination or pollution by entrance of surface and/or shallow, subsurface waters. The minimum depth of the upper annular seal shall be as specified in subsection (B) below.

B. The minimum depth of the upper annular seal shall be as follows:

1. Private domestic wells, fifty (50) feet;

2. Nonpublic domestic wells, fifty (50) feet;

3. Public domestic wells, fifty (50) feet;

4. Industrial wells, fifty (50) feet;

5. Observation and monitoring wells, twenty (20) feet;

6. Cathodic protection wells, fifty (50) feet;

7. Air conditioning wells, fifty (50) feet;

8. Agricultural wells, fifty (50) feet; and

9. State small water system wells, fifty (50) feet.

(Ord. G-6906 § 10, 2002; Ord. G-5006 § 2 (part), 1989)

14.08.250 - Sealing conditions.

The requirements for sealing a well shall be as specified in Part II, Chapter II, Section 9B of Bulletin 74-81.

(Ord. G-5006 § 2 (part), 1989)

14.08.260 - Annular seal—Sealing off strata.

A. When any well is to be constructed or reconstructed in such a manner that it will penetrate two (2) or more water bearing strata, one (1) or more of which has been determined by the health officer to contain groundwater of a quality which will cause the degradation of groundwater in the other strata if the waters are allowed to intermingle, the undesirable stratum shall be sealed off to prevent the flow of the poor quality water through the annular space from degrading water in the strata containing water of an acceptable quality.

B. Whenever an aquifer containing poor quality water is required to be sealed off as provided in subsection (A) above, an annular seal shall be placed from no less than ten (10) feet below the base of the confining formation separating the aquifer containing poor quality water from the aquifers containing acceptable quality water to the ground surface. An electrical geophysical log of the well shall be run to assist in the placement of the annular seal, and a copy made available to the department. Drill cuttings shall be made available at the request of the health officer. The sealing material shall fill the annular space in the interval to be sealed, and the surrounding void spaces which might absorb the sealing material.

C. Gravel chute shall extend through the annular seal at least two (2) feet into the gravel pack.

D. Sealing materials shall consist of neat cement, cement grout or cement. In areas of subsidence or under special conditions, the use of other approved sealing materials may be allowed with prior approval of the health officer.

E. In areas where deep subsidence may occur (as, for example, portions of the San Joaquin Valley), provision shall be made for maintaining the integrity of the annular seal in the event of subsidence. Such preventive measures may include the installation of a "sleeve" or "slip joint" in the casing, which will allow vertical movement in the casing without its collapse.

(Ord. G-7417 § 9, 2006; Ord. G-5006 § 2 (part), 1989)

14.08.270 - Well development or redevelopment.

Developing, redeveloping or conditioning of a well shall be done with care and by methods which will not cause damage to the well or cause adverse subsurface conditions that may destroy barriers to the vertical movement of water between aquifers. The following methods used in the developing, redeveloping or conditioning of a well when done with care are acceptable:

A. Overpumping;

B. Surging by use of a plunger;

C. Surging with compressed air;

D. Backwashing or surging by alternately starting and stopping the pump;

E. Jetting with water;

F. Introduction of chemicals designed for this purpose;

G. Bailing;

H. A combination of the above.

The use of explosives for development shall be only by persons licensed for that purpose. Special care shall be exercised when such explosives are employed in development of a well which penetrates two (2) or more distinct aquifers separated by a natural barrier.

The use of any chemicals for the purpose of development of a well, or any other purpose(s), shall be included on the well drillers log or, if performed by other than the driller, on a separate report. Where chemicals or explosives have been used, the well shall be pumped to remove residue from such chemicals and/or explosives to restore the water quality of any affected aquifer to the water quality conditions which existed prior to the use of such chemicals and/or explosives.

(Ord. G-5006 § 2 (part), 1989)

14.08.280 - Surface construction features.

Wells drilled for the purpose of producing water for any beneficial use shall be equipped with the following features, installed as outlined in Chapter II, Part II, Section 10 of Bulletin 74-81:

A. Disinfection access/sounding tube;

B. Screened air vent (optional for flowing artesian wells);

C. A backflow protection device or method approved by the department;

D. Unthreaded sample spigot.

(Ord. G-5006 § 2 (part), 1989)

14.08.290 - Responsibility for compliance.

It is the responsibility of the well contractor to construct the well in accordance with Article III of this

chapter, except for surface construction features.

It is the responsibility of the owner of the well to supply all surface construction features (i.e., slab, watertight sanitary seal, backflow protection device, vent, sounding tube and sample tap) and all required water quality analyses.

(Ord. G-5006 § 2 (part), 1989)

14.08.300 - Surface sealing.

A. All wells hereafter constructed, deepened or reconstructed shall, prior to being placed into service, be provided with: A watertight reinforced monolithic concrete slab a minimum thickness of six (6) inches, set a minimum of four (4) inches above ground level at the well site, and extending horizontally at least three (3) feet from the edge of the well casing in all directions, and covering the unsealed portion of the well excavation, except that monitoring wells, as defined in Section 14.08.074, shall have a minimum concrete slab two (2) foot by two (2) foot with a minimum thickness of six (6) inches. The concrete slab shall be constructed so as to adequately drain water away from the well casing. Where deviation from this pattern of construction would serve a practical purpose without lessening well protection, the health officer may approve such deviation. All wells shall be provided with a sanitary seal so as to prevent surface water from entering the well. Each slab (or well) shall be identified by the name of the owner on the well permit, or APN number, or other approved method.

B. In those cases where it is not possible to meet the horizontal setback distances from pollution sources described in Section 14.08.190, an alternative means of protection for the well may be to increase the depth of the upper annular seal. Where horizontal setback distances cannot be met or adverse or special hazards exist (such as perched water), the depth of the upper annular seal shall be increased as required by the health officer.

C. In hardrock formations, the minimum depth of seal shall be twenty (20) feet or one (1) foot into hardrock if encountered first. Sampled hardrock cuttings shall be collected and held at the site for inspection of the health officer.

D. Annular seals of one hundred (100) feet or less in dry formations may be poured. All other seals shall be posi-tively placed from the bottom upward using a pump or by air pressure.

E. All seals shall set forty-eight (48) hours after placement if an accelerator is not used. A twenty-four (24) hour set time may be allowed if the sealing material contains an accelerator.

F. During the pumping of sealing material for the annular seal, all standing water must be allowed to drain off and not incorporate into the annular seal nor into the slab.

(Ord. G-5006 § 2 (part), 1989)

14.08.310 - Disinfection of wells.

Every new, deepened, repaired or reconstructed individual domestic or community water supply well, after completion of construction, deepening, repair or reconstruction, and before being placed in service, shall be disinfected by a method approved by the health officer to produce water meeting bacteriological standards as set forth in applicable state laws and regulations.

(Ord. G-5006 § 2 (part), 1989)

14.08.320 - Other sanitary requirements.

The gravel used in gravel-packed wells, and lubricant mud, shall meet the sanitary requirements of Bulletin 74-81, Part II, Section 11.

(Ord. G-5006 § 2 (part), 1989)

14.08.330 - Water quality testing.

A. Water from all wells which provide water for any beneficial use shall be tested radiologically, bacteriologically and chemically as determined by the health officer by a state certified laboratory. The results of all such laboratory water testing shall be submitted to the health officer within ninety (90) days of pump installation.

B. Water from all wells that will be used in food processing or domestic water systems shall comply with the domestic water quality standards contained in California Code of Regulations, Title 22, Domestic Water Quality Monitoring Regulations, Sections 64401 et seq., or the latest revision thereof, or adequate treatment facilities to remove the constituent(s) that is in noncompliance shall be installed.

C. Water from reconstructed wells shall be tested bacteriologically and meet the same standard as new wells. When deemed necessary by the health officer, they shall meet the same chemical standards as new wells.

D. Chemical, radiological and bacteriological tests shall be the responsibility of the owner and if not completed within ninety (90) days may be performed by the health officer and related costs shall be the responsibility of the owner.

(Ord. G-7417 §§ 11, 12, 2006; Ord. G-6906 §§ 12—14, 2002; Ord. G-5006 § 2 (part), 1989)

14.08.340 - Approval by health officer.

No water from a new or reconstructed domestic well shall be used for domestic purposes until the well is given final approval by the health officer.

(Ord. G-5006 § 2 (part), 1989)

14.08.350 - Well conversion.

Before any nondomestic well can be converted to domestic use, it must first have department inspection and be brought into compliance with this chapter.

(Ord. G-5006 § 2 (part), 1989)

14.08.360 - Well destruction.

All abandoned wells shall be destroyed in such a way that they will not produce water or act as a channel for the interchange of water, or will present a hazard to the safety and well-being of people or animals. Destruction of a well shall consist of the complete filling of the well in accordance with the procedures prescribed in Section 23 of Chapter II of the California State Department of Water Resources Bulletin No. 74-81. Provided, however, at a minimum the top fifty (50) feet shall be sealed with concrete or other approved sealing material. Well destruction permits for wells located in areas which would require a deep annular seal for drilling new wells per Section 14.08.260 of this chapter

shall require filling the well with an approved sealing material from ten (10) feet below the base of the confining formation which separates the aquifer containing poor quality water from the aquifers containing acceptable quality water, to the ground surface. All abandoned wells shall be destroyed within ninety (90) days of abandonment. Applications for well destruction permits shall be submitted in accordance with Section 14.08.170. A copy of well destruction permit applications for the San Joaquin Valley area of the county shall be submitted to the Kern County Water Agency and the water district having jurisdiction over the land in which the well is located.

(Ord. G-7417 § 14, 2006: Ord. G-5006 § 2 (part), 1989)

14.08.370 - Out of service wells.

A. Any newly constructed well that has not been completed and given final approval of water quality and surface construction features within ninety (90) days of the cessation of drilling shall be declared out of service or properly destroyed. Any existing well that has not been used for a period of one (1) year shall be properly destroyed unless the owner has filed a "Notice of Intent" with the health officer declaring the well out of service, and declaring his intention to use the well again. As evidence of his intentions for future use, the owner shall properly maintain the well in such a way that:

1. The well has no defects which will impair quality of water in the well or in the water-bearing formations penetrated;

2. If the pump has been removed, the well shall be covered with a watertight seal to prevent injury to persons and the entrance of undesirable water, rodents or foreign matter;

3. The well is marked so that it can be clearly seen;

4. The area surrounding the well is kept clear of brush or debris;

5. Redeclaration of intent shall be made triennially to the health officer.

B. Additional evidence may be required by the health officer to demonstrate that the well is usable when placed out of service.

(Ord. G-7417 § 15, 2006: Ord. G-5006 § 2 (part), 1989)

14.08.380 - Administrative variance.

The health officer may grant an administrative variance to the provisions of this chapter where a determination has been made upon the basis of evidence submitted by the owner or his representative demonstrating that a modification of the well standards as provided herein will not endanger the health or safety of the consumer of the water, or the public generally, or contribute to groundwater degradation, and strict compliance would be unreasonable in view of all the circumstances.

(Ord. G-5006 § 2 (part), 1989)