

Appendix E

Kern Fan Water Banking Programs

Introduction

The Berrenda Mesa Spreading Grounds, Kern Water Bank, Pioneer Project, and West Kern Water District North Recharge and Recovery Project (Projects), located on the Kern River Alluvial Fan southwest of Bakersfield, have been operating for several decades (Figure 1.). These programs have been developed to help secure more reliable water supplies due to California's wet- and dry-year cycles. The Projects involve storing surface water in wet years for recovery in dry years for beneficial uses. The Projects comply with the Sustainable Management Criteria (SMCs) developed in Sections 11-13 of this Plan.

Description of the Projects

These direct recharge Projects all utilize the Kern River Alluvial Fan aquifer (Kern Fan) to temporarily store surface water underground for later recovery on behalf of specific project beneficiaries (participants) for municipal and industrial (M&I) and agricultural beneficial uses¹. These Projects are critical to the Kern County Subbasin's sustainability efforts – fully 73 percent by area of the Subbasin's water districts and agencies participate in one or more of these Projects. The Projects store participants available surface water from the State Water Project, the Kern River, and the Central Valley Project during wet years, and then recover the stored water in dry years to supplement the participants beneficial needs. The Projects do not store water for entities that are outside the Kern or Tulare Lake Subbasins. Instead, most of the recovered water is used within these Subbasins thereby reducing the participants reliance on Subbasin groundwater. In addition, there are no third-party beneficial groundwater users overlying the lands of any of the Projects.

Project Facilities

The projects occupy approximately 24,000 acres southwest of Bakersfield. With the exception of minor oil production, the lands are used exclusively for water banking. Recharge basins are developed on approximately 10,500 acres of the lands, and stored water is recovered with 149 recovery wells (Figure 1.).

Project Monitoring

The Kern Fan area has been monitored extensively since the late 1980's. California Department of Water Resources (DWR) installed a series of dedicated clustered monitoring wells throughout the area to evaluate the aquifer for water banking. The wells are used to monitor both water levels and groundwater quality. An extensometer located in the center of the Kern Water Bank and remote sensing tools are used to track subsidence.

¹ The M&I uses include the disadvantaged communities of Taft and others in the western portion of the basin.

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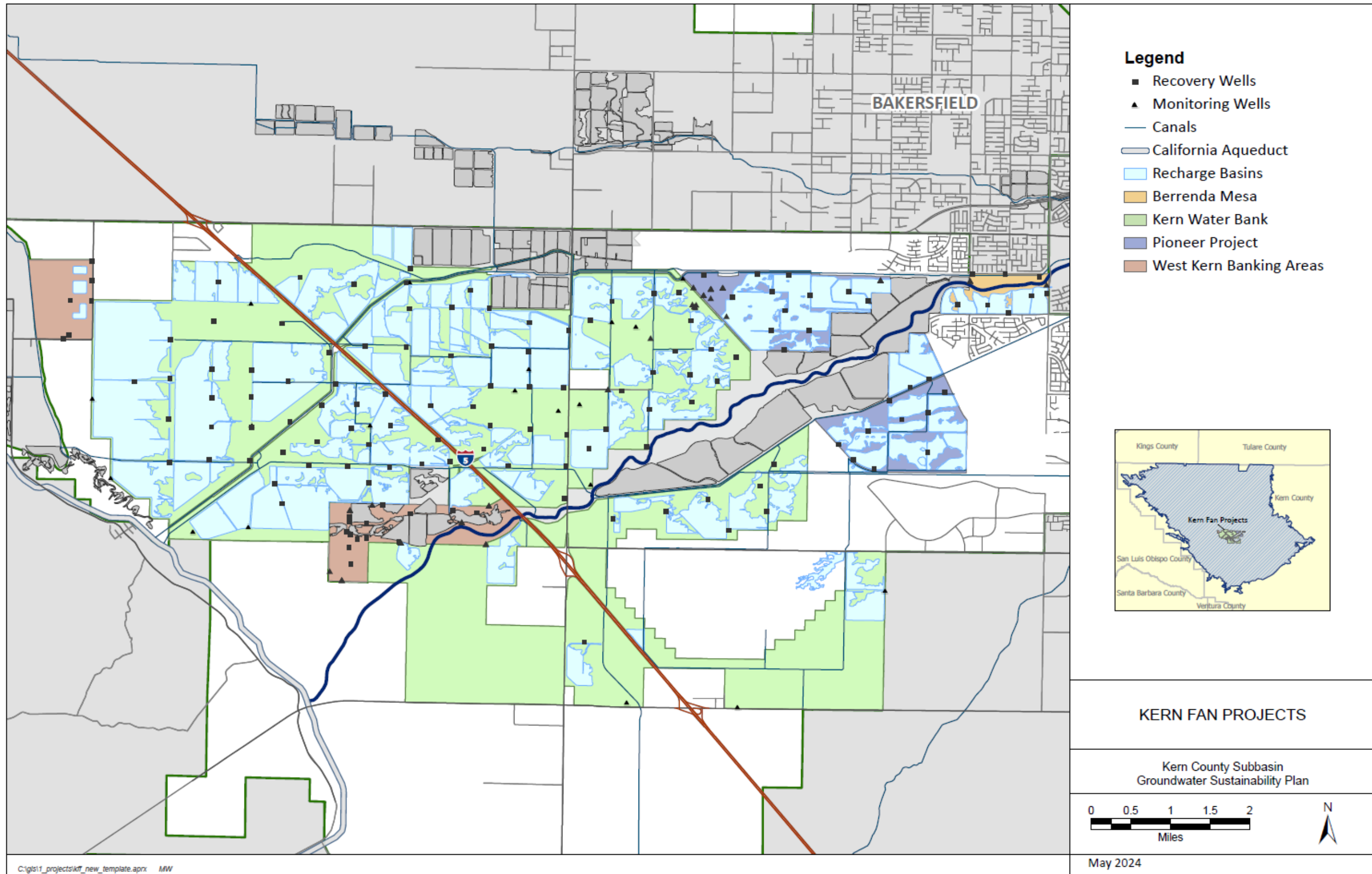


Figure 1. Kern Fan Projects

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Groundwater levels are monitored monthly in 85 clustered monitoring wells at 31 locations (Figure 1.). The wells are completed at various depth intervals so that water level information is also available vertically within the aquifer. Groundwater quality is determined in both dedicated monitoring wells (49 wells at 18 locations) and all wells used to recover stored water. The data is compiled and provided in operations reports available to the public that include hydrographs, groundwater depth and elevation maps, and water quality graphs.

Project Operations

Storage – Project storage operations are directed by each of the four agencies. Coordination between the agencies provides for water management benefits such as exchanges. The maximum annual volume of water recharged in any calendar year for the Projects is approximately 900 thousand acre-feet (TAF). The maximum storage capacity of the projects is approximately 2.4 million acre-feet (MAF).

Recovery – Recovered water is conveyed to the California Aqueduct and Cross Valley Canal (CVC) for direct delivery, exchange, and/or reregulation to accomplish deliveries to participants in the Subbasin. Prior to recovery operations, and at three-year intervals, Pump-in Proposals are submitted to DWR and stakeholders downstream in the California Aqueduct. Once the proposals are approved, recovery operations are coordinated through the Kern County Water Agency (KCWA) and DWR. During recovery programs, Kern County submits a blending model daily to DWR and the stakeholders that documents the expected quality of water delivered to the Aqueduct at the CVC and Kern Water Bank Canal. Status meetings are scheduled between the parties as needed. West Kern also recovers water to meet the demands of its M&I customers in the Disadvantaged Communities (DACs) it serves in western Kern County. The maximum annual volume of water recovered in any given year is just under 400 TAF. However, these rates decline significantly during extended droughts. For example, in 2015, the total volume of water recovered dropped 40 percent, to 240 TAF. Annual storage rates greatly exceed recovery rates, and the projects can only recover previously stored surface water.

Losses and Overdraft Correction – The Projects all deduct 6 percent of all water metered onto the projects to account for surface losses. In addition, adjoining districts can purchase 4 percent of the water stored for overdraft correction purposes. Finally, certain districts can store water for overdraft correction purposes in the Pioneer Project. Neither the 4 percent water nor the Pioneer ODC accounts are recovered by the Projects. The cumulative total of the 4 percent and ODC accounts through 2023 is approximately 650 TAF.

Accounting Methods and Current Account Status

The water delivered to and recovered from the Projects is measured with ultrasonic meters, propellor meters, rated gates, and/or weir structures. The volumes for the four Projects are reconciled with multiple public agencies, including DWR, the Kern County Water Agency (KCWA), Kern Water Bank, the City of Bakersfield, and Buena Vista WSD. Account records are maintained by KCWA for the Berrenda Mesa, Kern Water Bank, and Pioneer projects. West Kern maintains their own records and provides that information to the Kern Fan Monitoring Committee for reporting purposes. Project records are also audited annually by independent auditing firms for the participants. The approximate volume of water currently stored in the projects exceeds 1.9 MAF. This volume does not include approximately 650 TAF of water provided for overdraft correction (Figure 2).

Mitigation Measures

There are several documents that prescribe mitigation measures for the Projects. They include Memorandums of Understanding (MOUs), CEQA documents including mitigation and monitoring plans, and a Joint Operations Plan.

The MOUs provides for the establishment of a Monitoring Committee with banking participants and adjoining stakeholders, reports documenting operations and monitoring, mitigation measures for potential water level and quality impacts, and the establishment of loss factors.

The mitigation measures developed in several CEQA documents reduce potential impacts to less-than-significant for operations, water quality, and subsidence².

² DWR developed the mitigation measures for the KWB in a 2016 Revised EIR certified by DWR.

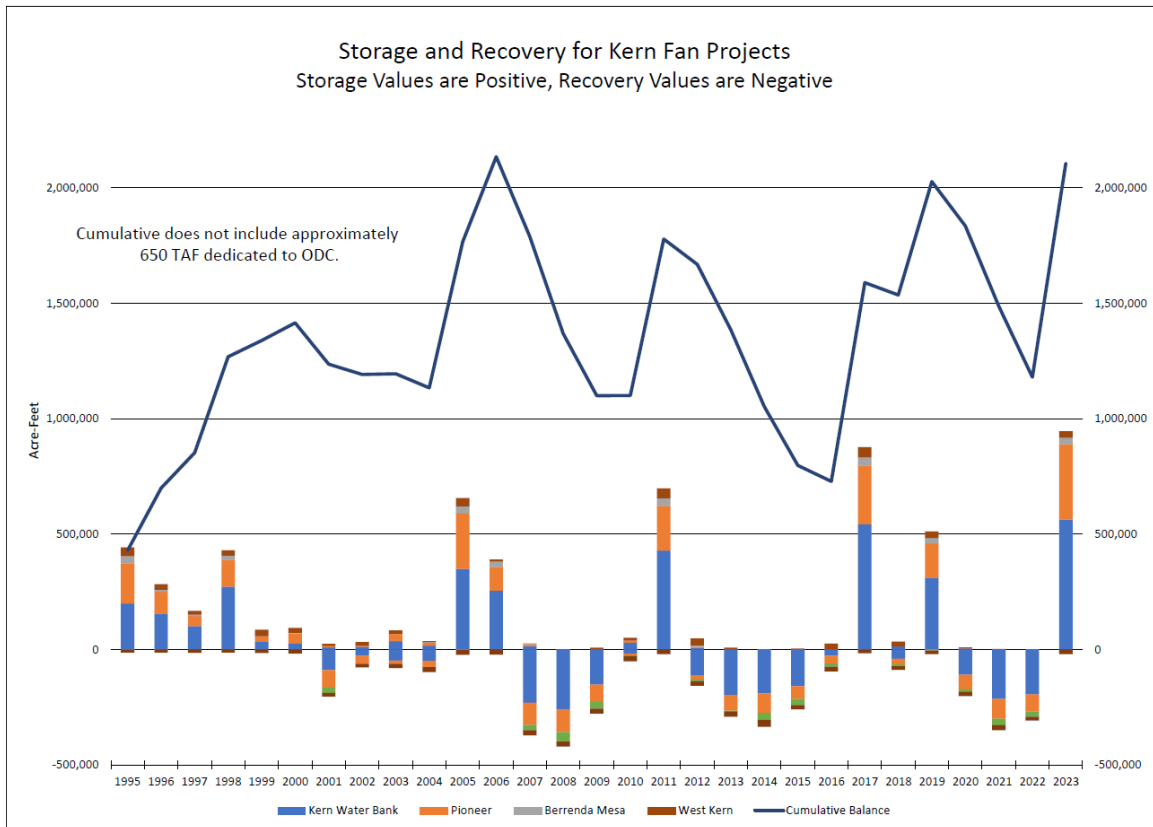


Figure 2

The Joint Operations Plan implements a well mitigation program for beneficial users. The Plan establishes a Joint Operations Committee (JOC) of the banking programs on the Kern Fan, establishes funding policies for mitigating short term/temporary water level impacts to domestic, small community, and agricultural wells related to banking operations, and provides for public outreach. Potential short term/temporary water level impacts are analyzed with two MODFLOW models to determine “with” and “without” project groundwater levels. Mitigation is triggered when the “with” project levels are deeper than the “without” project levels by 15 feet for domestic and small community wells and 45 feet for agricultural wells. Mitigation includes short-term water supplies and funds to lower a well pump, connect to an M&I provider, or replace the well with a deeper well. Since 2010, the JOC has assisted in funding 23 well replacements, 19 pump lowerings, and 6 connections to an M&I provider. Notably, the funds necessary to mitigate impacts since 2018 have been less than \$6,000.

Sustainability Indicators

Chronic Lowering of Groundwater Levels and Reduction in Groundwater Storage – The Projects cannot cause a chronic lowering of groundwater levels or a reduction in groundwater storage because operating rules require that they only recover previously stored surface water from the aquifer after appropriate losses have been applied. If

these supplies are exhausted, recovery operations will cease³. Importantly, the recovery of stored water in the projects provides much needed water supplies in times of drought to reduce groundwater pumping from overdrafted aquifers elsewhere in the Subbasin. The supplies also help West Kern meet their M&I needs for disadvantaged communities. Nonetheless, the Projects utilize the SMC methodology developed by the Subbasin for these sustainability indicators (see Section 13.1 and 13.2 of the Plan).

Project operations can cause a temporary lowering of groundwater levels in adjacent areas toward the end of extended droughts. However, as described above, the Projects have developed a well mitigation program that mitigates any such impacts caused by those temporary conditions.

Water Quality Degradation - The monitoring committee discussed above samples and reviews the monitoring well groundwater quality data and has not identified any groundwater quality degradation concerns. Water quality sampling will align with subbasin sampling referenced in the Plan. The water recovered and delivered to the California Aqueduct by the Projects meets the water quality requirements provided for in the Pump-in Policy administered by DWR and, as such, surface water degradation does not occur. In fact, project recovery typically improves water quality in the Aqueduct for many constituents, including some with Maximum Contaminant Levels (MCLs). The water recovered by West Kern Water District for M&I uses only requires slight chlorination to meet water quality standards under its drinking water system permit.

The quality of surface water delivered to the Projects is monitored, as is the water recovered by the Projects and delivered to the Aqueduct. An analysis of this data indicates the ratio of exported salt to imported salt is 1.5:1. That is, 1.5 tons of salt are removed from the aquifer for every ton of salt imported in delivered surface water. At the same time, total dissolved solids (TDS) concentrations in the Aqueduct are typically reduced.

The SMC for Water Quality Degradation is described in Section 13.3 of the Plan.

Subsidence – Historic Project operations during five significant storage cycles and three significant recovery cycles where water levels have fluctuated over 250 feet have not caused any appreciable subsidence. An extensometer, maintained by DWR and located on the Kern Water Bank, records both minor subsidence and rebound indicating elastic conditions exist on the Kern Fan.

The Kern Subbasin has determined the California Aqueduct is critical infrastructure. Short portions of Aqueduct pools 28 and 29 (*i.e.*, Mile Posts 236.5 to 239.5) are near













³ If project supplies are exhausted, West Kern would rely on other banked surface water supplies to meet M&I demands for numerous DACs in its service area, as such, the project will not contribute to Subbasin overdraft.

the western end of some of the Projects. DWR data show that subsidence in this area over the last 48 years has been minimal. Changes have ranged from 0.3 feet of uplift to 0.35 feet of subsidence and are indicative of elastic subsidence and rebound. Available Aqueduct freeboard for most of the area adjacent to the western portion of the Projects is essentially unchanged from as-built conditions. The Projects also coordinate with operators of the CVC (Kern County Water Agency) and River Canal (City of Bakersfield) to monitor any impacts Project operations may cause to those facilities. None have been reported.

The SMC for Subsidence is described in Section 13.5 of the Plan.

Depletions of Interconnected Surface Water - With respect to interconnected surface-water depletions, the Kern River is a losing stream. Therefore, the Projects do not cause an impact related to this sustainability indicator.

The SMC for Depletions of Interconnected Surface Water is described in Section 13.6 of the Plan.

Chronic Lowering of Groundwater Levels	Reductions of Groundwater Storage	Seawater Intrusion	Degraded Water Quality	Land Subsidence	Depletions of Interconnected Surface Water
					
					
Improves	Improves	N/A	Improves	No impact	No impact

Project Benefits

With respect to water supplies and groundwater levels:

- The Projects have cumulatively stored 6 MAF of surface water in wet years and recovered 3.9 MAF of water for beneficial uses in the Kern and Southern Tulare Lake Subbasins. These supplies contribute significantly to meeting sustainability goals.
- The Projects raise groundwater levels in adjacent areas except toward the end of extended droughts. Overall, groundwater levels are higher with the Projects.

With respect to water quality:

- Extensive monitoring data reviewed by basin stakeholders has indicated no significant or unreasonable water quality issues.
- Kern Fan Project deliveries to the California Aqueduct meet pump-in guidelines and reduce Aqueduct background concentrations for many Constituents of Concern (COCs).
- Kern Fan Project storage and recovery results in a net removal of salts from the aquifer while reducing TDS in the California Aqueduct.

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