7.2 GROUNDWATER HYDROLOGY AND QUALITY

7.2 GROUNDWATER HYDROLOGY AND QUALITY

7.2.1 INTRODUCTION

7.2.1.1 Content

Chapter 6 describes the changes in SWP and SWP contractor operations that are attributable to the Monterey Amendment and the Settlement Agreement. Some of the operational changes attributable to the proposed project could have effects on groundwater hydrology and quality. Elements of the proposed project that could potentially affect groundwater hydrology and quality are listed in Table 7.2-1.

TABLE 7.2-1

IMPACTS OF PROPOSED PROJECT ELEMENTS ON GROUNDWATER HYDROLOGY AND QUALITY

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Altered water allocation procedures	Groundwater levels	7.2-1
Permanent Table A transfers and retirements	Groundwater levels	7.2-1
Transfer of Kern Fan Element lands	Groundwater levels	7.2-1
Water supply management practices	Groundwater levels	7.2-1
Restructured financial arrangements	NA	NA
Settlement Agreement		
Substitute Table A amount for entitlement	NA	NA
Disclosure of SWP delivery capabilities	NA	NA
Guidelines on permanent transfers	NA	NA
Guideline for public participation	NA	NA
Restrictions on Kern Fan Element lands	NA	NA
Watershed forum in Plumas	NA	NA
Amendment of Plumas SWP contract water shortage provision	NA	NA
Funding for plaintiffs	NA	NA

Note:
NA – Not Applicable.

7.2.1.2 Analytical Method

Qualitative assessment of impacts to groundwater resources was conducted in accordance with standard professional practices for CEQA documents. Factors considered in the analysis include the past practice of groundwater banking activities in the San Joaquin Groundwater Basin. Historical records were examined to determine whether the proposed project had substantial effects on groundwater hydrology and quality between 1996 and 2003. The effects of the proposed project were separated from the effects of other unrelated groundwater storage projects developed during the same period.

7.2.1.3 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA guidelines. For the purposes of this EIR, impacts to groundwater would be judged to be potentially significant if the proposed project would:

- alter water quality in a groundwater basin sufficiently to substantially impair beneficial uses; or
- alter water levels in a groundwater basin sufficiently to substantially increase pumping costs or cause land subsidence.

Substantial changes are defined as changes beyond those normally observed in historical records, and that are disproportionate to any documented information on groundwater in the basin.

7.2.2 ENVIRONMENTAL SETTING

For planning and management purposes, the California Department of Water Resources (Department) has delineated 431 groundwater basins in California. Of these, 24 basins are further divided into 108 subbasins, giving a total of 515 distinct groundwater units.[1] Article 56 of the Monterey Amendment, which provides prior Department approval for SWP contractors to store SWP water outside their service areas for later use within their service areas, could theoretically affect groundwater basins anywhere in California. However, storage south of the Delta is more advantageous than storage north of the Delta. The following section includes a description of the groundwater basins that have been affected by the proposed project between 1995 and 2003 all of which lie in Kern County. Descriptions of other groundwater basins that could potentially be affected by the proposed project can be found on the Department's Bulletin 118.[2]

7.2.2.1 Physical Setting in 1995

The Department divides the Central Valley of California into two groundwater basins, the Sacramento Valley Groundwater Basin and the San Joaquin Valley Groundwater Basin. It further divides the San Joaquin Valley Groundwater Basin into subbasins, one of which, the Kern County Subbasin, would be affected by the proposed project. Kern County subbasin lies at the south end of the San Joaquin Groundwater Basin.

The San Joaquin Valley was formed by deposition of sediment in a north-northwestern trending trough. The aquifer system in the valley consists of continental and marine deposits several miles deep. The upper 2,000 feet generally contain fresh groundwater, with saline water at greater depths. The sediments that contain the aquifer system are primarily Tertiary– and Quaternary–aged continental sediments derived from the Coast Range to the west and the Sierra Nevada to the east. Overlying these formations are flood plain deposits. A significant hydrogeologic feature is the Corcoran Clay. This clay layer divides the aquifer system into two distinct aquifers, an unconfined to semi-confined upper aquifer above the clay layer and a confined aquifer below it.[3] However, the clay layer is not continuous, and is absent in portions of the Kern County Subbasin.

Historically, the upper aquifer system in the Kern County Subbasin was recharged by precipitation, infiltration from rivers and lakes and lateral inflow along the basin boundaries. The main surface water feature in the Kern County Subbasin is the Kern River. Before European

settlement the Kern River flowed to Kern and Buena Vista Lakes and extensive wetlands. During wet periods, the lakes overflowed to Tulare Lake to the north, which itself overflowed into the San Joaquin River watershed. Groundwater levels in the basin varied but reached artesian conditions in the lowest parts of the subbasin.

In the 1860s, ranchers raised livestock and dry farmed wheat in the San Joaquin Valley portion of Kern County. In the 1870s, farmers began diverting the waters of the Kern River to irrigate their crops. For two decades, irrigators relied almost exclusively on surface waters for their water supplies, but in the 1890s, some took advantage of improvements in pumping technology and began turning to more reliable groundwater supplies.[4] Increasing use of groundwater caused the water table in parts of Kern County to fall by as much as 400 feet by 1960. Groundwater extraction between 1926 and 1970 has caused the ground surface to subside by eight to nine feet in the central part of the Kern County Groundwater Subbasin.[5]

Surface water imports to the area began in 1949 with the completion of the CVP's Friant-Kern Canal and increased in the 1960s and 1970s, as water from the SWP became available. Many irrigators contracted for deliveries of imported surface water and were able to reduce their use of groundwater. As a result, groundwater levels in some parts of the southern San Joaquin Valley began to rise.

Kern County Water Agency (KCWA), the largest of the SWP's agricultural contractors, and other water agencies in Kern County, manage surface and groundwater in the San Joaquin Valley portion of Kern County. Their surface water sources include flood flows from the Kern River, CVP deliveries from the Friant-Kern Canal and SWP deliveries from the California Aqueduct. Their groundwater source is the aquifer that underlies much of the land within the KCWA boundaries.

For many years, water agencies in Kern County have practiced conjunctive use of their surface and groundwater sources; that is, they actively manage their surface and groundwater sources to take advantage of the unique characteristics of each type of water source. Kern County agencies utilize in-lieu recharge and direct recharge management practices. In-lieu recharge is a water management practice that modifies the irrigation practices of water users who have access to surface water supplies and groundwater supplies. It substitutes surface water for irrigation in-lieu of normal groundwater pumping to increase groundwater supplies and conserve groundwater for use in future years. Direct recharge (artificial recharge) is a water management practice that applies water to percolation ponds to increase groundwater recharge and store water in an aquifer for later extraction.

When surface waters are available from the Kern River, the CVP or the SWP, farmers use surface waters to irrigate crops. When surface water supplies are insufficient, farmers supplement their surface water supplies with groundwater. When surface water availability exceeds farmers' needs, KCWA and those other water agencies with groundwater recharge facilities percolate the surface water to recharge the groundwater basin. Other agencies that manage groundwater banks with in-lieu recharge will then use any excess surface water in lieu of pumped groundwater, with the objective of allowing the basin to recover.

Kern County water agencies manage groundwater banks for use by other agencies as well as their own in-county use. The agencies use direct and in-lieu recharge to bank groundwater for their own later recovery. Some Kern County agencies also offer groundwater banking, which is the storage of a non-Kern County agency's water in Kern County groundwater basins for later recovery. The agencies can recover the water for the non-Kern County agency by direct

pumping and conveyance of the water to the non-Kern County agency, or the Kern agencies can recover the water through an in-lieu exchange. Under an in-lieu exchange, the SWP or non-SWP surface water that would otherwise have been delivered to the Kern County agency would instead be delivered to the non-Kern County agency and the Kern County agency would pump a like amount of the non-Kern County agency's stored water.

Figure 7.2-1 shows total water supplies and water demand in the San Joaquin Valley portion of Kern County between 1970 and 1999. In years when total surface water supplies exceeded demand, groundwater storage increased as the excess supply was added to groundwater storage. In years when total surface water supplies were insufficient to meet demand, the deficit was made up groundwater pumping and groundwater storage decreased. Between 1970 and 1995, groundwater storage declined by 6.6 million acre-feet (AF), an average reduction in storage of 264,000 AF per year. Figure 7.2-2 shows cumulative groundwater storage for the period 1970 to 1995. During most of the 1970s, groundwater storage declined as a result of dry conditions and limited access to SWP water due to distribution system limitations. Groundwater storage increased from 1978 until the mid-1980s when a ten-year dry period began, resulting in a decline of approximately 7.3 million AF, compared to 1970 storage levels.[6]

7.2.2.2 Changes in Physical Setting between 1996 and 2003

Other than water level changes, there were no changes to the physical characteristics of the San Joaquin Valley Groundwater Basin, Kern County Subbasin after 1995. As shown in Figure 7.2-2, from 1996 to 1999, groundwater levels began to rebound after a long period of dry years. From 1996 to 1999, 1.58 million AF of water was delivered for banking within the San Joaquin Valley portion of Kern County, an average of about 395,000 AFY. Groundwater storage levels since then have continued to increase.

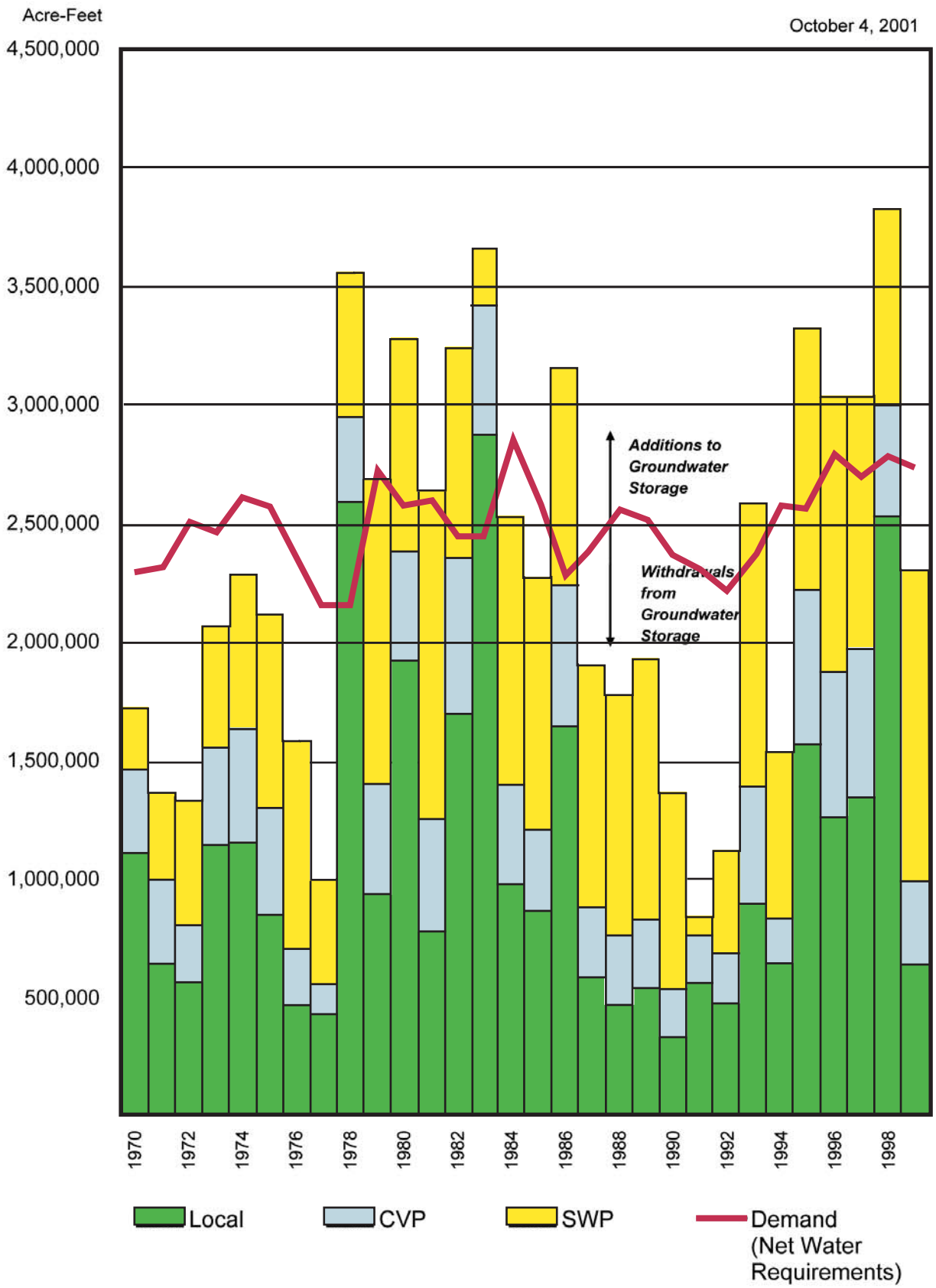
7.2.2.3 Regulatory Setting in 1995

<u>Groundwater Legislation</u>

In 1914, California created a system of appropriating surface water rights through a permitting process, but groundwater use has never been regulated by the State. Though the regulation of groundwater has been considered on several occasions, the California Legislature has repeatedly held that groundwater management should remain a local responsibility. Although they are treated differently legally, groundwater and surface water are closely interconnected in the hydrologic cycle. Because use of one resource will often affect the other, effective groundwater management must consider surface water supplies and uses.

Groundwater management needs are identified at the local water agency level and may be directly resolved at the local level. If groundwater management needs cannot be directly resolved at the local agency level, additional actions such as enactment of ordinances by local governments, passage of laws by the Legislature, or decisions by the courts may be necessary to resolve the issues. Upon implementation, local agencies evaluate program success and identify additional management needs. The State's role is to provide technical assistance to local agencies for their groundwater management efforts.

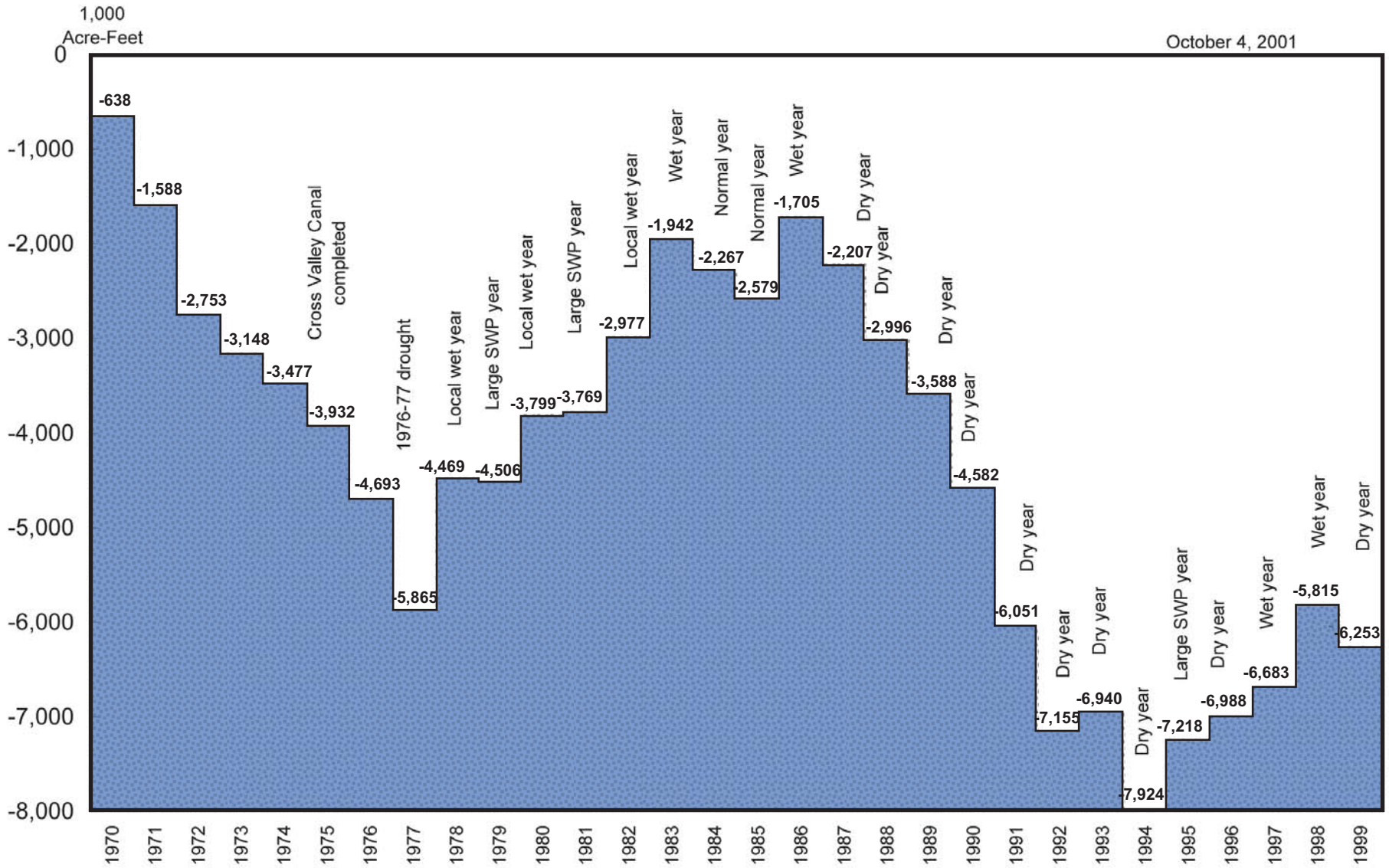
There are three basic methods available for managing groundwater resources in California: (1) management by local agencies under authority granted in the California Water Code or other applicable State statutes, (2) local government groundwater ordinances or joint powers



Source: Kern County Agency, Water Supply Report, 1999.

FIGURE **7.2-1**

Water Supplies and Use for San Joaquin Valley Portion of Kern County



Source: Kern County Water Agency, Water Supply Report, 1999.

FIGURE **7.2-2**

Cumulative Change in Groundwater Storage for San Joaquin Valley Portion of Kern County

agreements, and (3) court adjudications. No law requires that any of these forms of management be applied in a basin. Management is often instituted after local agencies or landowners recognize a specific groundwater problem. The level of groundwater management in any basin or subbasin is often dependent on water availability and demand.

Management by Local Agencies Under the California Water Code

More than 20 types of local agencies are authorized by statute to provide water for various beneficial uses. Many of these agencies also have statutory authority to institute some form of groundwater management. For example, a Water Replenishment District (Water Code, § 60000 et seq.) is authorized to establish groundwater replenishment programs and collect fees for that service. A Water Conservation District (Water Code, § 75500 et seq.) can levy groundwater extraction fees. Most of these agencies are identified in the Water Code, but their specific authority related to groundwater management varies. The Water Code does not require that the agencies report their activities to the Department.

In 1991, AB 255 (Stats. 1991, Ch. 903) was enacted authorizing local agencies overlying basins subject to critical conditions of overdraft, as defined in the Department's Bulletin 118-80, to establish programs for groundwater management within their service areas. Water Code section 10750 et seq. provided these agencies with the powers of a water replenishment district to raise revenue for facilities to manage the basin for the purposes of extraction, recharge, conveyance, and water quality. Seven local agencies in California adopted plans under this authority.

The provisions of AB 255 were repealed in 1992 with the passage of AB 3030 (Stats. 1992, Ch. 947). This legislation was significant in that it greatly increased the number of local agencies authorized to develop a groundwater management plan and set forth a common framework for management by local agencies throughout California. AB 3030, which is codified in Water Code section 10750 et seq., provides a systematic procedure to develop a groundwater management plan by local agencies overlying the groundwater basins defined by Bulletin 118-75 (DWR 1975) and updates. Upon adoption of a plan, these agencies could possess the same authority as a water replenishment district to "fix and collect fees and assessments for groundwater management" (Water Code, § 10754). However, the authority to fix and collect these fees and assessments is contingent on receiving a majority of votes in favor of the proposal in a local election (Water Code, § 10754.3). More than 200 agencies have adopted an AB 3030 groundwater management plan. None of these agencies is known to have exercised the authority of a Water Replenishment District.

Water Code section 10755.2 expands groundwater management opportunities by encouraging coordinated plans and by authorizing public agencies to enter into a joint powers agreement or memorandum of understanding with public or private entities that provide water service. At least 20 coordinated plans have been prepared to date involving nearly 120 agencies, including cities and private water companies.

Adjudicated Groundwater Basins

A second general form of groundwater management in California is court adjudication. In some California groundwater basins, as the demand for groundwater exceeded supply, landowners and other parties turned to the courts to determine how much groundwater can rightfully be extracted by each user. The courts study available data to arrive at a distribution of the groundwater that is available each year, usually based on the California law of overlying use

and appropriation. This court-directed process can be lengthy and costly. Many of these cases have been resolved with a court-approved negotiated settlement, called a stipulated judgment. Unlike overlying and non-overlying rights to groundwater, such decisions guarantee to each party a proportionate share of the groundwater that is available each year. The intense technical focus on the groundwater supply and restrictions on groundwater extraction for all parties make adjudications one of the strongest forms of groundwater management in California.

There are 19 court adjudications for groundwater basins in California, mostly in Southern California, including three in Kern County. Eighteen of the adjudications were undertaken in State Superior Court and one in federal court. For each adjudicated groundwater basin, the court usually appoints a watermaster to oversee the court judgment. In 15 of these adjudications, the court judgment limits the amount of groundwater that can be extracted by all parties based on a court-determined safe yield of the basin. The basin boundaries are also defined by the court.

Most basin adjudications have resulted in either a reduction or no increase in the amount of groundwater extracted. As a result, agencies often import surface water to meet increased demand. The original court decisions provided watermasters with the authority to regulate extraction of the quantity of groundwater; however, they omitted authority to regulate extraction to protect water quality or to prevent the spread of contaminants in the groundwater. Because water quantity and water quality are inseparable, watermasters are recognizing that they must also manage groundwater quality.

Local Ordinances

A third general method of managing groundwater in California is through ordinances adopted by local governments such as cities or counties. Twenty-seven counties have adopted groundwater ordinances, and others are being considered. The authority of counties to regulate groundwater has been challenged, but in 1995 the California Supreme Court declined to review an appeal of a lower court decision Baldwin v. County of Tehama (1994) that holds that State law does not occupy the field of groundwater management and does not prevent cities and counties from adopting ordinances to manage groundwater under their police powers. However, the precise nature and extent of the police power of cities and counties to regulate groundwater is uncertain.

Ordinances are mostly a recent trend in groundwater management, with 24 of the 27 ordinances enacted since 1990. Local ordinances passed during the 1990s have significantly increased the potential role of local governments in groundwater management. The intent of most ordinances has been to hold project proponents accountable for impacts that may occur as a result of proposed export projects. Because adoption of most of these ordinances is recent, their effect on local and regional groundwater management planning efforts is not yet fully known. However, it is likely that future groundwater development will take place within the constraints of local groundwater management ordinances.

7.2.2.4 Changes in Regulatory Setting between 1996 and 2003

The State Legislature recognized the need for groundwater data in making sound local management decisions. In 1999, the Legislature approved funding and directed the Department to update the inventory of groundwater basins contained in Bulletin 118 (1975), California's Ground Water and Bulletin 118-80 (1980), Ground Water Basins in California. In 2001, the

Legislature passed AB 599, requiring the State Water Resources Control Board to establish a comprehensive monitoring program to assess groundwater quality in each groundwater basin in the State and to increase coordination among agencies that collect groundwater contamination information. In 2002, the Legislature passed SB 1938, which contains new requirements for local agency groundwater management plans to be eligible for public funds for groundwater projects.

Additional progress in groundwater management is reflected by passage of amendments to the Water Code (§§ 10753.4 and 10795.4 as amended, §§ 10753.7, 10753.8, and 10753.9 as amended and renumbered, and §§ 10753.1 and 10753.7 as added) through SB 1938 of 2002. The amendments require that groundwater management plans include specific components for agencies to be eligible for some public funds for groundwater projects. Further, financial assistance, such as through the Local Groundwater Assistance grant program (see Chapter 4, Assembly Bill (AB) 303), was included in legislation after 1995 to assist local agencies in management of groundwater resources.

7.2.3 IMPACTS AND MITIGATION MEASURES

7.2-1 The proposed project could potentially alter groundwater levels in the Kern County Groundwater Subbasin.

1996 — 2003

For many years, Kern County farmers and water agencies have practiced conjunctive use of surface and groundwater sources. They also practice groundwater banking. Between 1971 and 1994, 1.15 million AF of water was delivered for banking in the San Joaquin Valley portion of Kern County, an average of about 48,000 AFY. Groundwater was banked for KCWA member agencies, with a few exceptions.

Groundwater banking in Kern County increased after 1995. Between 1996 and 1999, 1.58 million AF of water was delivered for banking within the San Joaquin Valley portion of Kern County, an average of about 395,000 AFY, using local, SWP and CVP supplies. There were four reasons for the increase in groundwater banking after 1995, two of them related to the Monterey Amendment.

A primary reason for increased groundwater banking was a growing recognition by contractors that they needed to take measures to improve the reliability of their water supplies. The extended drought of 1987 through 1992 illustrated how unfavorable hydrology could drastically reduce the availability of SWP water. At the same time, actions proposed to protect several Delta fish species, listed as threatened or endangered, would place operational constraints on the SWP and further reduce supply reliability. To improve water supply reliability, KCWA, its member agencies and other SWP contractors began groundwater banking programs which would enable them to store water available in wet years for later use in dry years.

A second reason for increased banking was the series of wet years that followed the drought of 1987 through 1992. Beginning in 1995 and continuing through the late 1990s, consecutive wet years provided abundant water for storage in groundwater banks in the San Joaquin Valley portion of Kern County.

The Monterey Amendment contributed to the increase in groundwater banking in two ways. First, it provided contractual assurance that contractors would be able to store SWP water outside their service areas. Second, it transferred ownership of the Kern Fan Element property to local interests and the Kern Water Bank Authority developed percolation ponds and wells on the property and made it available for groundwater banking by its member entities.

Between 1996 and 2003, contractors delivered about 981,000 AF more SWP water for out-of-service area groundwater storage in Kern County than they withdrew. Of this amount, about 616,000 AF was for storage programs that received approval after implementation of the Monterey Amendment. KCWA estimates that every 100,000 AF of water placed in storage causes a rise a one-foot rise in the groundwater level. Thus, out-of-service area storage of SWP water in Kern County groundwater banks as a result of the Monterey Amendment probably raised groundwater levels by about six feet between 1996 and 2004.

As noted above, the Monterey Amendment transferred ownership of Kern Fan Element property to local interests enabling development of a groundwater bank there by the Kern Water Bank Authority. Between 1996 and 2003, Kern Water Bank Authority member entities delivered about 502,000 AF more water for storage in the Kern Water Bank than they withdrew. But, an analysis conducted by KCWA indicated that if the Kern Water Bank had not existed, the Kern Water Bank Authority member entities had capacity in other water banks available to them and would have been able to store the water elsewhere in Kern County (see Appendix E for details). Consequently, the Monterey Amendment-related transfer of ownership of the Kern Fan Element property did not affect groundwater levels between 1996 and 2003.

During the late 1990s and early 2000s, contractors that stored SWP water in Kern County did so to set aside the stored water for use in dry periods rather than to use it to increase their average annual deliveries of SWP water. This operating practice would result in water remaining in storage for several years and only being drawn down occasionally. Overall, the effect of the additional groundwater banking facilitated by the Monterey Amendment was to raise groundwater levels in Kern County by several feet relative to the baseline scenario. Thus, the proposed project had a modestly ***beneficial effect*** on groundwater levels in Kern County between 1996 and 2003 relative to the baseline.

<u>Mitigation Measures</u>

None required.

Future Impacts

Between 1996 and 2003, contractors delivered about 616,000 AF more SWP water for storage in groundwater banks outside contractors' service areas than they withdrew than they would have under the baseline scenario. It is expected that contractors would continue to take advantage of the opportunity to store SWP water in Kern County groundwater banks in the future. Several new groundwater banks are planned in Kern County so total storage capacity is expected to increase in the future. As demand increases in their service areas between 2003 and 2020, contractors are expected to need their full Table A amounts to meet current needs in most years. However, water would likely still be available for storage in wet years. Consequently, contractors are likely to store volumes of water less than those stored between 1996 and 2003 in groundwater banks in the future in dryer years, but similar or larger amounts in wetter years.

As described for impacts between 1996 and 2003, above, storage of SWP water in groundwater banks as provided for by the Monterey Amendment has the potential to raise groundwater levels by approximately 1 foot for every 100,000 AF of water stored. The proposed project would increase groundwater levels in parts of Kern County by several feet compared to the baseline scenario and thus would have a modestly ***beneficial effect***.

Mitigation Measures

None required.

ENDNOTES

1. California Department of Water Resources, *California Groundwater, Update 2003*, Bulletin 118, 2003.

2. California Department of Water Resources, *California Groundwater, Update 2003*, Bulletin 118, 2003.

3. California Department of Water Resources and U.S. Bureau of Reclamation, *Draft Environmental Water Account EIS/EIR*, 2003.

4. Hundley, Jr., Norris, *The Great Thirst, Californians and Water: A history*, University of California Press, 2001.

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

6. Kern County Water Agency, *Water Supply Report 1999*, 2003.